LG833HGⅤ.00Ⅰ

Wheel loader

Repair Manual

Code：68000009354

Foreword

Thank you for selecting the high-performance Lonking loader! The LG833H Wheel Loader Repair Manual has been prepared to provide the dealers and service stations of Lonking with a better understanding of the Lonking LG833H (China IV) wheel loaders.

This Manual focuses on structure and function, testing and adjustment, installation and removal, dismantling and repair, and troubleshooting, and hopefully covers the basics needed for the repair service.

The status of the machine may be influenced by factors such as the sales region, environmental condition, operating condition, operation skill, and the timeliness of routine maintenance. This Manual is based on information obtained at the time of its preparation, so it is not possible to include all possible situations. We hope that dealers and repair and service centers will feed back their comments and suggestions in a timely manner while using this Manual, so that it can be improved in the next edition. Always read carefully to understand the safety precautions before carrying out repairs on the machine strictly in a safe manner. Improper disassembly and repair of the machine is dangerous, which may lead to personal injury or death.

The pressure of some hydraulic components involved in parameter setting has been set before delivery. If these components need repairing, the assembly shall be replaced in principle (regardless of whether the dismantling and commissioning processes are introduced in this Manual). If the assembly is not available, the dismantling for repair and parameter setting of such components shall be carried out only after a written permission is obtained from Lonking and the component manufacturer, and the repair unit shall assume the responsibility for the quality and safety of such components after disassembly and adjustment.

We have been working hard to improve our products. We reserve the right to make changes to the parameters and configuration of the machine, which may result in changes to the contents of this Manual without notice. The technical parameters mentioned in this Manual shall not be used as a basis for delivery acceptance.

This Manual is the first edition.

Lonking Holdings Limited
August 2023

Contents

I. Safety Precautions

(I) Safety Precautions before Repair/Maintenance

1. Repair/maintenance shall be carried out on a level and solid ground or a specialized site, away from working machines and personnel;

2. Unauthorized personnel shall not approach the machine;

3. Place the gear control in the neutral position, and put the bucket horizontally on the ground. Make sure that the pilot control handle is in the return position, and pull up the hand brake;

4. Put the start electric lock on the steering column in the "OFF" position and remove the start key;

5. Switch off the main power supply, and remove the battery if necessary to prevent inter-pole short circuit;

6. Put a "Do Not Operate" sign at the position of the main power supply switch to inform the others that someone is working on this machine;

7. Apply the parking brake and place wedges at the front or rear wheels;

8. Depress the brake pedal repeatedly to release pressure in the brake system;

9. Move the pilot operating lever in a full stroke to relieve all pressure in the hydraulic system of the work tool. Place the lift arm control lever and tilt control lever in the "HOLD" position;

10. Turn the steering wheel several times in both directions to release pressure from the steering system;

11. Confirm that the rim locks of four tires are firmly installed in the slots and the tire pressures are within the specified range;

12. When necessary, discharge the water or antifreeze in the water tank to prevent scalding hands, faces or skin of other parts;

13. When removing any oil storage space or related oil line, drain the hydraulic oil and fuel in the box first and contain them with a proper container;

14. Dispose of all fluids in accordance with local regulations and ordinances;

15. Assemble and connect the front and rear frame fixing rods to avoid casualties caused by machine swing;

16. After the repair/maintenance, loosen the front and rear frame fixing rods before starting the machine and fix them in the storage position; otherwise, the machine will not be able to turn.

(I) Safety Precautions during Repair/Maintenance

1. Set up a repair sign during repair/maintenance of the machine, and prohibit non-relevant personnel from approaching the repair/maintenance site;

2. Before removing any component or pipeline, confirm that the oil has cooled down. Do not remove the oil filler cap until the engine has stopped and the oil filler cap is cool enough to be touched by hand;

3. Avoid burning hands or skin when addressing faults around the engine. Do not make repairs until the water, air pipeline, muffler, smoke pipe, engine body, etc. have cooled down;

4. Disassemble threaded or fastened parts with special tools. Unauthorized alteration of tools is strictly prohibited. Maintenance personnel shall not perform repairs until they stand steadily to prevent slipping off;

5. In case of large-scale repair, disassembly will be carried out in the following order: pipes and lines - engine hood - cab - hydraulic components and pipelines - bucket - lift arm - water tank - drive shaft - engine and torque converter & transmission assembly - frame assembly - drive axle - tires;

6. Select lifting appliances and lifting equipment with a safety factor greater than 1.5 according to the component weight reference table;

7. When lifting, the design lifting points shall be selected first, and then the assembly holes on the component shall be selected. Lifting shall be symmetrical in front and back, and left and right. The hook shall be equipped with anti-detachment mechanism. No personnel are allowed under the hanging object. The removed workpiece shall be placed stably;

8. Before repairing the tire assembly or replacing the inner tube, release the internal air pressure of the tire first, using a protective frame;

9. When removing the lock ring, use a protective frame or net to prevent personal injury when the lock ring is elastically released;

10. When the tire is inflated, use a protective frame to prevent the lock ring and retainer ring from popping up or tire burst due to excessive air pressure;

11. After inflation, detect the tire pressure with a barometer and release excess air pressure;

12. When working under the lift arm, lift the lift arm onto a protective frame or assemble a special cylinder protective frame;

13. Follow operating specifications strictly when using pneumatic or electric tools;

14. When disassemble the engine and torque converter & transmission assembly, the core components of the torque converter may fall off and hurt people, so protective measures shall be taken;

15. The disassembled drive shaft and the intermediate spline shaft may disengage and injure people, so protective measures shall be taken;

16. Workpieces in the hands with residual oil may slip and injure people, so protective measures shall be taken;

17. Spilled oil on the ground may make people slip, so protective measures shall be taken;

18. When welding is conducted directly on the machine body, make sure that the grounding is good and close to the welding point. Otherwise, lines, tires or other non-metallic components of the machine may be burnt out or fire maybe caused;

19. High-pressure fluid leakage, even pinhole-sized leakage, can penetrate human tissues and cause serious injury or even death. If the fluid penetrates the skin, it must be treated immediately by a physician familiar with this type of injury.

20. When checking for leakage, use a wooden board or thick plate to block it.

(III) Safety Precautions for Commissioning

1. Before starting the machine, make sure that the gear is in the neutral position, the hand brake is released, and all kinds of oil, grease, water or antifreeze are filled. Make sure no extraneous personnel around the machine, and sound the horn;

2. The flexible control shaft of each part of the machine shall be adjusted accurately and reliably, and the service brake and parking brake systems shall be modulated reliably first;

3. Confirm that the overpressure protection switch of air reservoir operates normally;

4. Verify that the display of each instrument and reversing alarm device work normally;

5. Verify that the turn signals and work lights work normally;

6. Adjust the indication direction of rearview mirror to be correct;

7. Check the original safety signs on the machine and if any fall off, affix new ones;

8. Idle until brake air pressure is established before driving.

II. Pictures and Parameters of Whole Machine

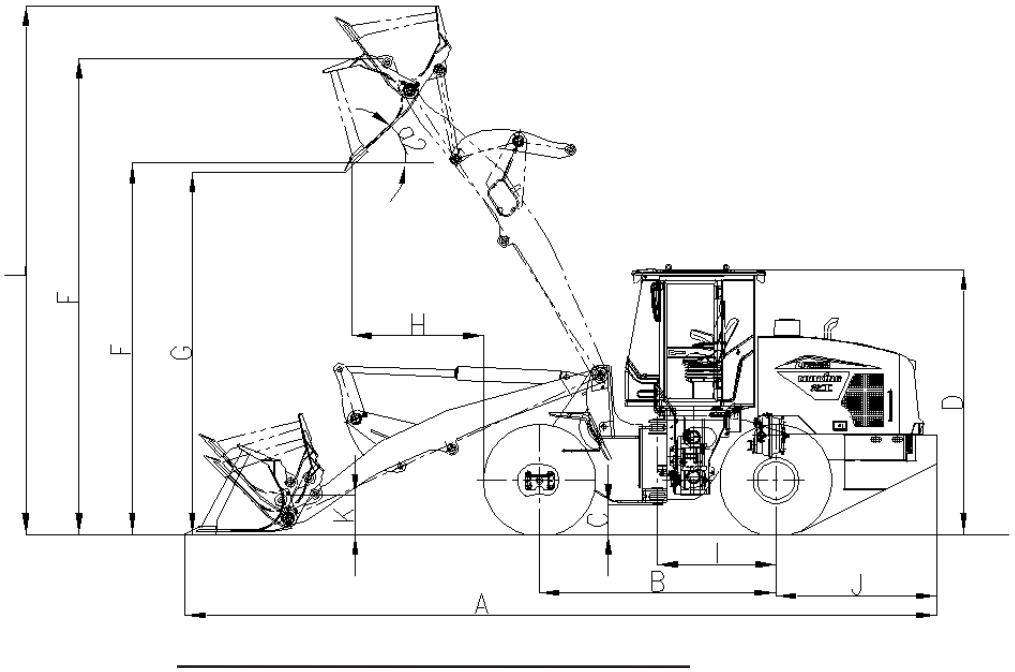


Fig. 2-01-01

Overall dimensions:

Code	Description	Dimension
A	**Length of whole machine**	7450mm
B	**Wheel base**	2850mm
C	**Minimum ground clearance**	355 mm
D	**Maximum total height of main engine**	3180mm
E	**Height of pin shaft at maximum lifting**	4040mm
F	**Unloading height**	3250mm
G	**Distance from bucket teeth to the ground during unloading**	3105mm
H	**Rear dump distance**	1000mm
I	**Spacing between rear axle and articulated point**	1425mm
J	**Rear overhang length**	1940mm
K	**Height of transport position**	400mm
L	**Overall height at maximum lifting**	5060mm
a2	**Unloading angle**	45 °

Standard specification			
Item			**Specification**
Performance	**Bucket capacity**		1.7 m^3
	Rated load		3000kg
	Lift arm lifting time		≤5.0s
	Sum of three items		≤9.0s
	Maximum speed of each gear	**Forward gear I**	8km/h
		Reverse gear I	9.5km/h
		Forward gear II	13.5km/h
		Reverse gear II	40km/h
		Forward gear III	24km/h
		Forward gear IV	40km/h
	Traction		97±3kN
	Maximum digging force (tilt)		95±3kN
	Maximum gradeability		26°
	Minimum turning radius	**Outer side of bucket**	6250mm
		Tire center	5450mm
	Geometric dimensions	**Vehicle length (bucket laid flat on the ground)**	7450±100mm
		Vehicle width (outer side of wheel)	2320±50mm
		Bucket width	2430±30mm
		Vehicle height (top of cab)	3180±30mm
		Wheel base	2850±30mm
		Wheel track	1850±10mm
		Minimum ground clearance (at hinge)	355±20mm
		Unloading height	3250±50mm
		Dump distance at maximum lift	1000±50mm
	Weight	10200±300kg	

III. Maintenance Schedule of Whole Machine

Maintenance Schedule of Loader												
Maintenance Parts	Maintenance Contents	Maintenance Cycle							Specification and Model	Quantity	Replacement Period	Remarks
		50H	100H	250H	500H	1000H	1500H	2000H				
Engine	Engine oil	*		*	*	*	*	*	CK-4 15W/40 (ordinary) CK-4 5W/40 (low temperature)	17L	First 50h, every 250h	Note the brand of oil used in winter and summer
	Oil filter element	*		*	*	*	*	*	1000491060	2		
Fuel system	Fuel filter element (fine filter)	*			*	*	*	*	1001120353	1	First 50h, every 500h	
	Fuel system protector (coarse filter)	*			*	*	*	*	1003308082	1		
Air filter	Air filter element				*	*	*	*	1001847111	1	Every 500h	Replace according to the operating conditions
Cooling system	Coolant							*	-25℃, -35℃, -40℃		Every 2000h or one year	
Transmission system	Hydraulic transmission oil		*		*	*	*	*	8D hydraulic transmission oil	48L	First 100h, every 500h	
	Fine filter of torque converter and transmission		*		*	*	*	*	60308000048	1		
	Transmission oil suction filter element		*		*	*	*	*	36201100054	1		
Drive axle system	Gear oil				*	*		*	GL-5 80W/90 (ordinary) GL-5 85W/90 (low temperature)	28L*2	First 500h, every 1000h	
Hydraulic system	Hydraulic oil				*	*		*	L-HM 46 L-HV 46	265L	First 500h, every 1000h	
	Oil suction and return filter element of hydraulic oil tank				*	*		*	60308000038	1		
Brake system	Brake fluid				*	*	*	*	DOT3	2.7L	Every 500h	
A/C	Fresh air filter screen					*		*		1	Every 1000h	
	Air inlet filter screen					*		*		1		
After-treatment parts	Urea solution								AUS-32	20L		Daily inspection
	Urea pump filter element				*				612640130438	1	Every 500h or 6 months	
	Filter screen of urea tank sensor suction port				*				1003316424	1	Every 500h or 6 months	
	Clean the urea pump, nozzle and tank				*						Every 500h or 6 months	The urea nozzle gasket needs to be replaced every time the urea nozzle is removed

Note: 1. The oil filling amount and oil grade in the table are only for reference. For the actual oil filling amount and oil grade, please refer to the oil dipstick and local ambient temperature;
2. Refer to the Engine Maintenance Manual for engine maintenance time;
3. The maintenance cycle and inspection cycle under special working conditions need to be shortened accordingly;

IV. Data Sheet

1. Tightening torque of ordinary bolts

Bolt strength grade	Yield strength (N/mm)	Nominal diameter of bolt (mm)							
		6	8	10	12	14	16	18	20
		Tightening torque (N.m)							
4.6	240	4~5	10~12	20~25	36~45	55~70	90~110	120~150	170~210
5.6	300	5~7	12~15	25~32	45~55	70~90	110~140	150~190	210~270
6.8	480	7~9	17~23	33~45	58~78	93~124	145~193	199~264	282~376
8.8	640	9~12	22~30	45~59	78~104	124~165	193~257	264~354	376~502
10.9	900	13~16	30~36	65~78	110~130	180~210	280~330	380~450	540~650
12.9	1080	16~21	38~51	75~100	131~175	209~278	326~434	448~597	635~847

Bolt strength grade	Yield strength (N/mm)	Nominal diameter of bolt (mm)						
		22	24	27	30	33	36	39
		Tightening torque (N.m)						
4.6	240	230~290	300~377	450~530	540~680	670~880	900~1100	928~1273
5.6	300	290~350	370~450	550~700	680~850	825~1100	1120~1400	1160~1546
6.8	480	384~512	488~650	714~952	969~1932	1319~1759	1694~2259	1559~2079
8.8	640	512~683	651~868	952~1269	1293~1723	1759~2345	2259~3012	2932~3898
10.9	900	740~880	940~1120	1400~1650	1700~2000	2743~3298	2800~3350	4111~5481
12.9	1080	864~1152	1089~1464	1606~2142	2181~2908	2968~3958	3812~5084	4933~6577

2. Recommended grades, prescribed amounts and filling amounts (in international grades and units of measurement) of engine oil, transmission oil, hydraulic oil, drive axle oil, pin grease, diesel, antifreeze for the smaller temperature ranges within the general range of -30 to +50 ℃

Oil type	Ambient temperature -30 -20 -10 0 10 20 30 40 50	Capacity Amount added
Engine oil	API Ck-4 and above SAE 10W-30 SAE 15W-40 SAE 5W-40	17L
Hydraulic transmission oil	SAE 10W	36L
Hydraulic oil	L-HM46 L-HV46	173L
Drive axle gear oil	SAE 85W-90 SAE 85W-90	37L
Grease	NO.2	1KG
Diesel oil	0# -10#	—— ——

3. Comparison of domestic and foreign oil products

S/N	Oil product name		China Models	International Models
1	Engine oil	Engine oil	General CK-4 15W/40 China IV	CK-4 15W-40 Diesel engine oil
			Low temperature CK-4 5W/40 or CK-4 OW/40 China IV	CK-4 5W-40 Diesel engine oil
		Diesel oil	General 0#	0#
			Low temperature -10#	Low Temperature -10#
2	Hydraulic torque converter oil		8 or 8D hydraulic transmission oil	8# Hydraulic transmission oil
3	Gear oil		General GL-5 80W/90	80W/90 GL-5 Heavy duty automobile gear oil
			Low temperature GL-5 85W/90	GL-5 85W/90 Heavy Duty Automotive Gear Oil
4	Hydraulic oil		General L-HM46#	L-HM 46 Anti-wear hydraulic oil
			Low temperature L-HV46# or L-HS46#	L-HV46 Low Temperature Hydraulic Oil
5	Grease		General 2# or 3# lithium-based grease	Multipurpose Lithium Grease (Natural) NLGI 2
6	Brake fluid		XILIAN 719# (i.e. DOT4)	BRAKE FLUID DOT 4
7	A/C refrigerant		R134a	R134a
8	Urea solution		AUS-32	/

4. Pressure values of the machine

Pressure Value Table of the Machine	
Shift pressure range: 1.2~1.5 Mpa	Oil pressure range: 100~600 kpa
Brake air pressure range: 0.7~0.8 Mpa	Steering system pressure: 15MPa
Working system pressure: 19Mpa	

5. Definition of VDO instrument pins

[Connector-Pins assignment]

Functional Description

Blue Connector：

Pin	Define	Remark
1	Glow Input	Digital Input 1
2	Neutral Gear Input	Digital Input 2
3	Chassis Ground	KL31
4	Sensor Ground	All Analogue Inputs Negative Pole
5	Back To Oil Filter Warning Input	Digital Input 3
6	Back To Oil Filter Warning Input	-
7	Transmission Oil Temperature Input	PR [AI 3-Transmission Oil Temperature Input]
8	Engine Speed Signal Input	PR [FI 1-Tachometer Input]
9	Battery Voltage Input	Kl.30
10	Little Lamp Input	Digital Input 5
11	Ignition	Kl.15 Digital Input 6
12	Air filter blocked	N.A
13	Diagnostic	K line
14	Oil-water separation	Digital Input 7
15	Transmission Oil Pressure Warning Input	Digital Input 8
16	Park Brake Input	Digital Input 9
17	Low engine coolant level	N.A
18	Fuel Level Input	PR [AI 1-Fuel Level Input]
19	Turning Right Input	Digital Input 10
20	Water Temperature Sensor Input	PR [AI 2-Engine Coolant Temperature Input]

21	Turning Left Input	Digital Input 11
22	High Beam Input	Digital Input 12
23	Engine operating condition	Digital Input 13
24	Speed Signal Input	PR [FI 2-Speedometer Input]
25	Engine Oil Pressure Input	PR [AI 4-Engine Oil Pressure Input]
26	Air Pressure Input	PR [AI 5- Air Pressure Input]
27	CAN-L PR [CAN Circuit] Product requirements	[CAN Circuit]
28	CAN-H PR [CAN Circuit] Product requirements	[CAN Circuit]

V. Main Components

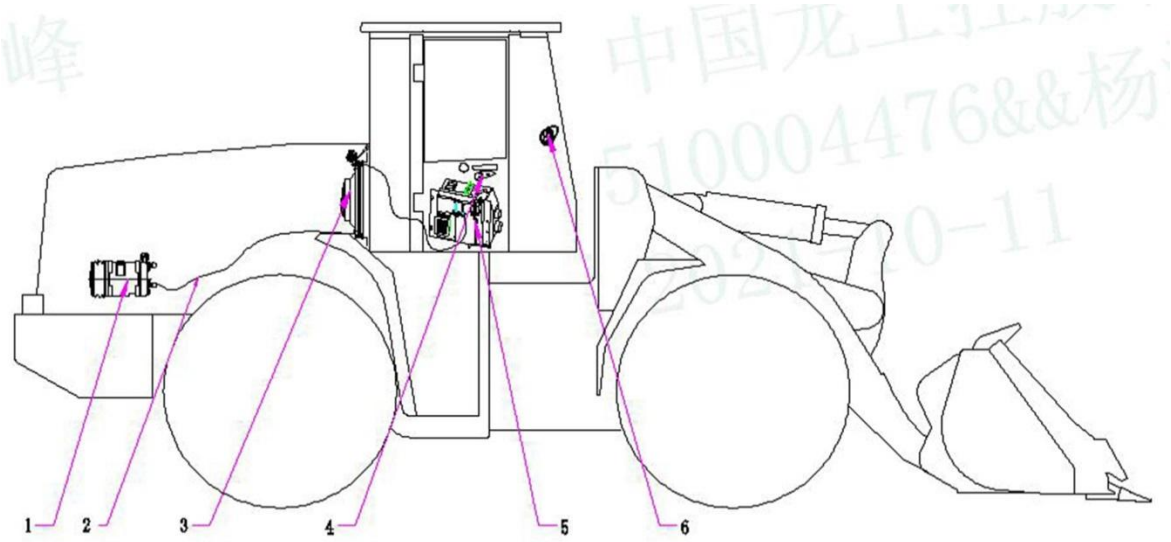
Section 1 A/C System

Contents

5.1 A/C System

5.1.1 Main Composition and Parameters

Main components of A/C: The A/C is mainly composed of condensing unit, air vent, switch panel, evaporation unit, compressor and refrigeration pipeline. The following is a schematic diagram of the main components of the A/C on the loader.



1. Compressor 2. Refrigeration pipeline 3. Condensing unit 4. Switch panel 5. Evaporation unit (with water heating) 6. Air vent

Fig. 5-01-01

Technical parameters	
Refrigerating capacity: 4.5kW±5%	Heating capacity: 6.0kW±5%
Air volume: 450m3/h	Rated voltage: DC 24V
Refrigerant: R134a	Refrigerant oil: PAG100
Total power consumption: ≤360 W	
Filling amount of system refrigerant: 950±50 g*	

*** The filling amount varies according to the length of A/C pipeline**

5.1.2 Principle and Schematic Diagram of Cooling and Heating

1. Overview of refrigeration principle

① Compression process (compressor): The compressor operates to suck low-temperature and low-pressure gaseous refrigerant in the evaporator, compress it into high-temperature and high-pressure gaseous refrigerant and discharge it;

② Condensation process (condenser): The high-temperature and high-pressure gaseous refrigerant from the compressor enters the condenser for heat exchange and becomes a high-temperature and high-pressure liquid refrigerant;

③ Throttling expansion process (expansion valve): The high-temperature and high-pressure liquid refrigerant is filtered by the receiver-drier and then enters the expansion valve. After throttling expansion, its pressure and temperature drop sharply, and it enters the evaporator in the form of small mist droplets;

④ Evaporation process (evaporator): The mist refrigerant with a boiling point far lower than the temperature in the evaporator absorbs heat and vaporizes in the evaporator, then turns into low-temperature and low-pressure gas and enters the compressor for the next cycle. The cooled air around the evaporator is blown out by a blower to achieve refrigeration.

Schematic Diagram of Refrigeration Cycle

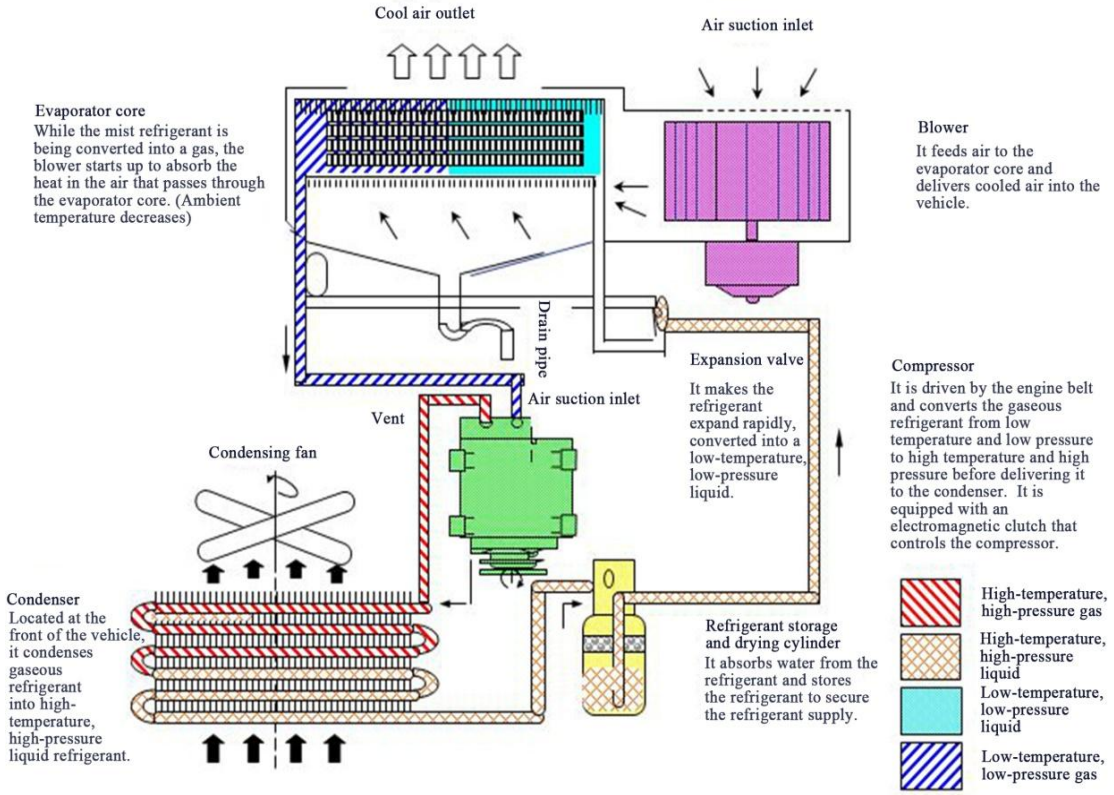


Fig. 5-01-02

2. Overview of heating principle

The heating system of the A/C is water-heating type, using engine coolant as heat source. This system has a simple structure and is environmentally friendly and economical. The coolant generated by the engine enters the heater core through the warm water pipe. Through the opening and closing of the water valve and the operation of the blower, the sucked cold air is heated by the heater core to become warm air. The warm air, via the air duct and air outlet, is blown to an appropriate position under the action of the blower, so that the driver can work in a warm and comfortable environment in winter.

Schematic Diagram of Heating Cycle

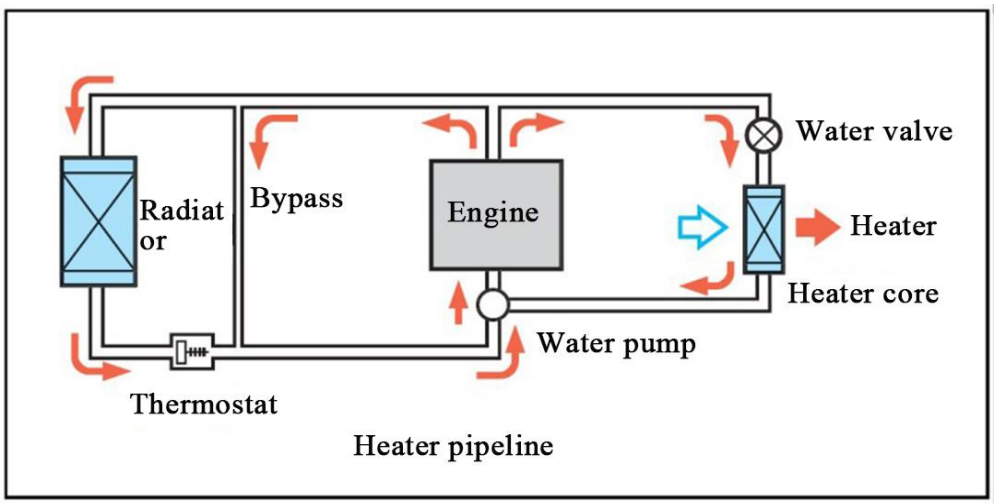


Fig. 5-01-03

5.1.3 Electrical Schematic Diagram of A/C

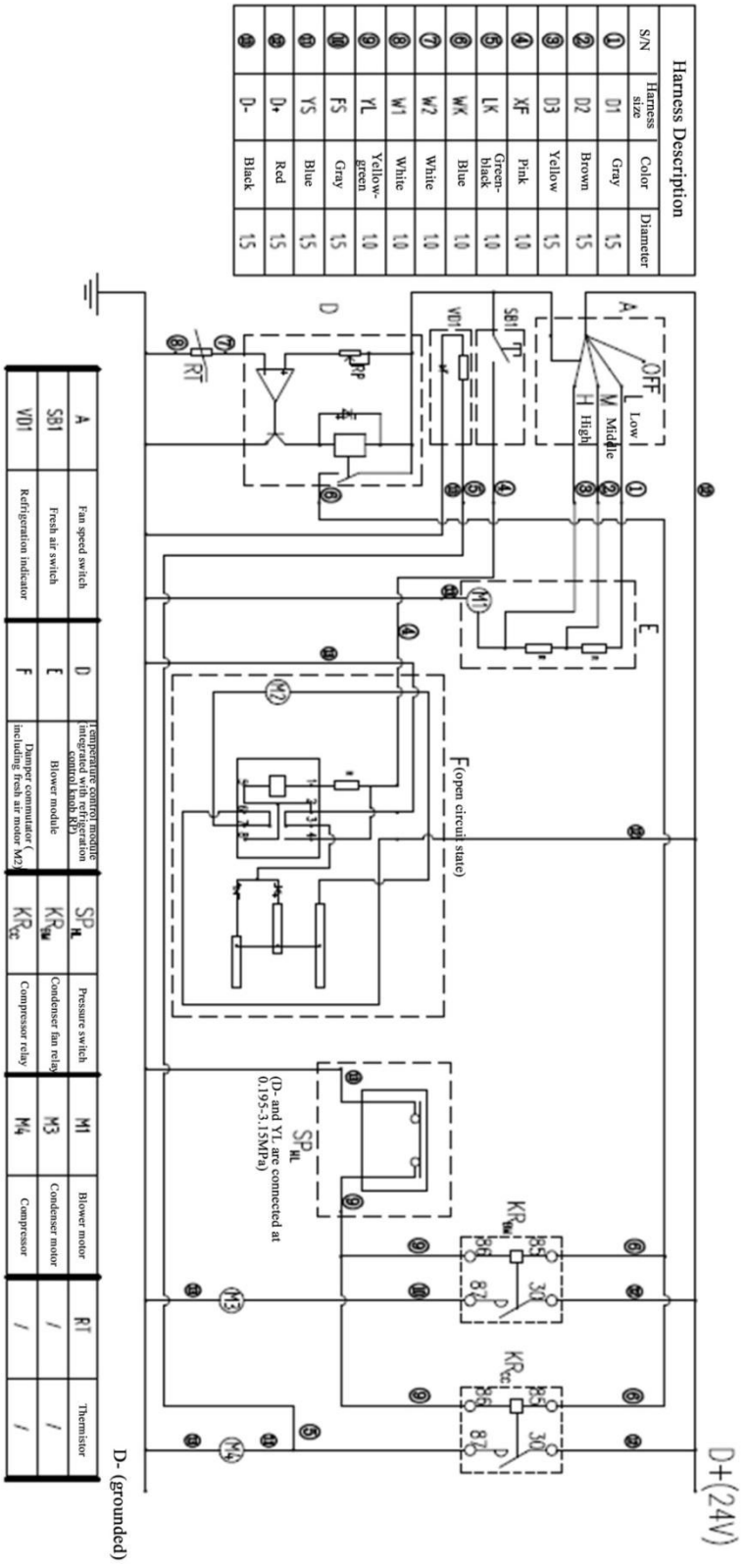


Fig. 5-01-04

5.1.4 Installation Guide and Precautions

(I) Filling amount of compressor oil

A certain amount of oil shall be injected into the A/C system for lubrication. The compressor oil is dissolved in the refrigerant and circulates throughout the system. When the A/C system is turned off, the compressor oil will stay in various components of the system. If an appropriate amount of oil is not supplemented to the system when main components are replaced, the lubrication will be insufficient. The amount of oil to be replenished when main components are replaced is shown in the following table:

Details	Compressor
Filling amount (CC)	180ml ±10ml
Compressor oil model	PAG100

Warning

The filling of compressor oil must be completed by personnel with specialized training;

The new compressor has been filled with the oil required by the circulation system. When replacing the compressor, the excess oil in this compressor shall be drained;

Improper quantity of compressor oil injected: If excessive compressor oil is injected into the A/C system, the refrigeration capacity will decrease; if there is too little compressor oil in the system, the compressor will be abnormally worn and stuck;

When removing the compressor, please protect the cleanliness of pipeline joints and O-rings.

(II) Installation of compressor assembly (and belt)

1. The tightening torque of 4 fixing bolts of the compressor is (24.5-29.4 N ·m).

2. Inspection of pulley.

3. Manual inspection: Apply a downward pressure of about 6 Kgf (58.8 N) at the midpoint of the centerline through the driving pulley and the compressor wheel, and this point shall drop between 5-8 mm.

4. Inspection with tension meter: Inspect the tension of compressor belt with a tension meter.

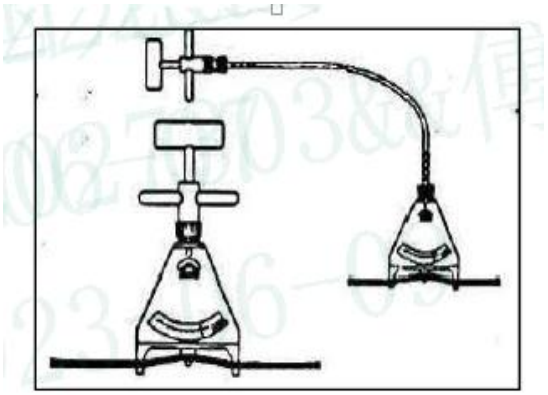


Fig. 5-01-05

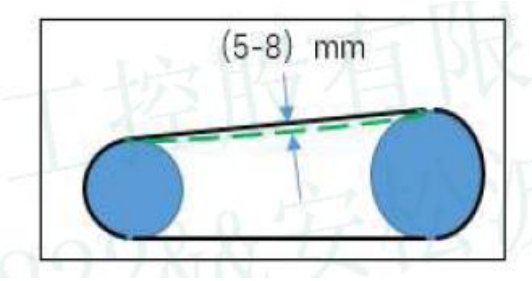


Fig. 5-01-06

Belt model	New belt	Used belt
V-belt A-1219	488 ±98N	340 ±48N

Fig. 5-01-07

Precautions for test run of compressor

1. The test run shall be carried out when the engine is idling (at a speed of 750 rpm), and the A/C shall run for more than 10 min;

2. During the test run, it is absolutely forbidden to increase the speed halfway;

3. In winter or when the A/C is not used for a long time (more than one week), it shall be regularly turned on and run for more than 10 minutes to prevent the A/C compressor from being stuck due to lack of oil.

(III) Maintenance of A/C filter element

1. The filter element shall be cleaned or replaced regularly according to the working conditions. It is recommended that the filter element be dusted once a week, and if the working conditions are harsh, such as in coal yards, quarries and other dusty places, it shall be dusted once every 2-3 days.

2. The fresh air circulation (external circulation) is normally turned off during the operation of A/C. If necessary, the external circulation can be turned on for ventilation. If the fresh air circulation is often turned on, it is necessary to regularly maintain the external circulation filter element.

3. It is forbidden to use the A/C without a filter screen; otherwise, dust will accumulate in the evaporator blower and air duct, affecting normal use.

4. The A/C cotton paper filter screen can only be maintained by air blowing with a dust gun or soft brush, and it is forbidden to wash it with water.

Fig. 5-01-09

Fig. 5-01-10

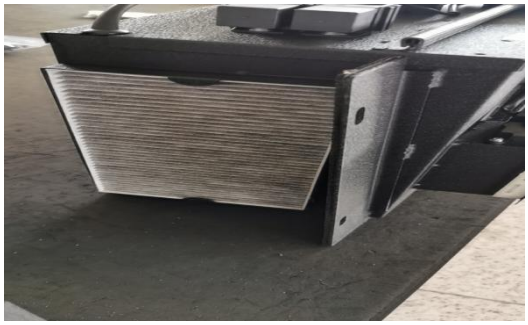


Fig. 5-01-08

Fig. 5-01-11

(IV) Precautions for pipeline connection

1. The dust cover on the pipe joint must be removed during installation to prevent moisture and other impurities from entering;

2. Before connecting the pipe joints, check whether the sealing O-ring is damaged. If there is no abnormality, drip 2-3 drops of refrigerant oil on the O-ring before assembly, then press the pipe joint into the end face by hand and tighten the threads;

3. When threaded pipe joints are connected, two wrenches must be used to lock them with reverse force to avoid damage to the pipeline;

4. In addition to two wrenches used to connect the pipeline, since it is made of aluminum, its tightening torque shall meet the requirements in the following table. Qualified torque wrenches shall be selected.

Pipe diameter (mm)	Φ8 (3 points)	Φ12.7 (4 points)	Φ15.88 (5 points)
Tightening torque (N.m)	13-16	23-28	33-38

Precautions for seal ring installation

1. O-rings cannot be reused;

2. Only O-rings suitable for R134a A/C system can be used;

3. Only PAG100 compressor oil can be used for O-ring assembly on R134a system;

4. Do not use other oil, lubricating oil or silicone lubricant;

5. If oil is filled into the oil reservoir before use, the oil reservoir must be of the R134a system. To avoid confusion, the oil reservoir shall be labeled.

Warning

1. Take care not to damage the pipeline when removing the O-ring.

2. If parts or pipes are not covered when components are replaced, moisture may easily enter the refrigeration system and cause internal corrosion of components. Therefore, do not leave uncovered parts or pipes for a long time.

3. Apply a small amount of compressor oil on the O-ring when connecting pipes.

(V) Use of antifreeze

The heating principle of the A/C system is that the engine coolant goes through the pipeline and the heater water tank to form a warm air circulation system, thus providing heating for the cab. As this heater water tank is made of pure aluminum, antifreeze that does not corrode aluminum is required.

1. Three functions of antifreeze:

Anti-boiling in summer, anti-freezing in winter, and anti-corrosion and scaling.

2. Replacement cycle of antifreeze:

Generally, the replacement cycle is ≤ every 2 years or every 4000 H, whichever comes first.

(For reference only, see the antifreeze instructions or vehicle maintenance manual for specific replacement cycle)

3. Type of antifreeze for use

Please use antifreeze not containing amine-phosphate series.

※ Antifreeze containing amine-phosphate series will corrode the heater water tank and is strictly prohibited.

4. Concentration and filling method of antifreeze:

Please refer to the vehicle maintenance manual for the concentration and filling method of antifreeze.

Warning

1. When the engine shows a lack of coolant, be sure to add antifreeze of the same brand or use purified water temporarily (note that when the ambient temperature is lower than zero, be sure to supplement antifreeze of the same brand as that of the vehicle to prevent freezing and cracking of the engine water tank);

2. It is absolutely forbidden to use tap water, river water, seawater and other water containing minerals.

(VI) Vacuumizing

There shall be no moisture inside the A/C unit. The refrigerant used in the A/C is easily soluble in water. If a very small amount of moisture remains in the unit, it will cause faults such as icing of expansion valve hole and rusting of compressor valve during use. Therefore, before filling the refrigerant, remove the moisture in the cooling system as much as possible. In order to minimize the residual moisture in the cooling system, the unit is vacuumized so that the moisture is removed by boiling and vaporization.

Vacuumizing steps

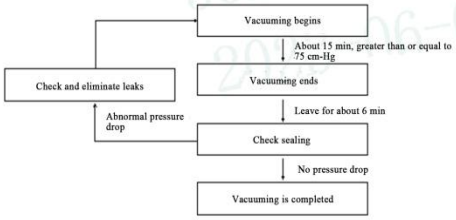


Fig. 5-01-12

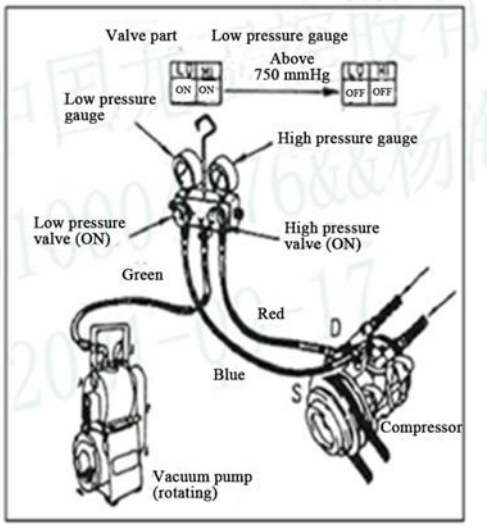


Fig. 5-01-13

Vacuumizing operation I: connection of manifold pressure gauge

1. Shut off the high-pressure valve and low-pressure valve of the manifold pressure gauge.

2. Connect the inflation hoses (red and blue) to the auxiliary valve ports of the compressor. The red hose is connected to the valve port on the high pressure side, and the blue hose is connected to the valve port on the low pressure side.

3. Connect the inflation hose (green) in the middle of manifold pressure gauge to the vacuum pump.

Note: The valve port marked with "HI" is on the high-pressure side; the valve port marked with "LO" is on the low-pressure side; the red hose is a high-pressure pipe, the blue hose is a low-pressure pipe, and the yellow hose is an external connecting pipe (to vacuum pump or refrigerant tank).

Vacuumizing operation II: vacuumizing

1. Switch on the high pressure valve (HI) and low pressure valve (LO) of the manifold pressure gauge.

2. Switch on the vacuum pump to carry out vacuumizing operation (about 15-20 min).

3. When the pointer of pressure gauge returns to the lowest scale (generally -1 bar), shut off the high-pressure valve and low-pressure valve of the manifold pressure gauge. Then switch off the vacuum pump. (Do not confuse the above two steps, otherwise air will flow back)

Vacuumizing operation III: sealing inspection

1. Leave the manifold pressure gauge with its high and low pressure valves off for 5-10 min until the pressure reading remains unchanged.

2. When the pointer of the pressure gauge changes, it indicates leakage somewhere. Check all connections of the pipe, and vacuumize it again after tightening the nut at each interface until there is no leakage found.

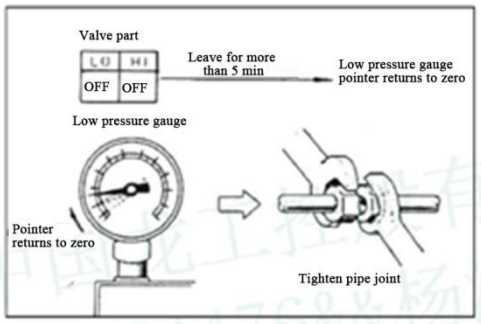


Fig. 5-01-14

(VII) Refrigerant filling

Note: Refrigerant must be filled by personnel with specialized training.

1. Filling method and amount of refrigerant:

Confirm the type of refrigerant to be filled: R134a

Filling quantity of refrigerant: 950±50g

If the filling fails and re-operation is needed, the filled refrigerant must be discharged before refilling.

2. Check the flow state of refrigerant in the A/C system through the observation window: The observation window is usually installed on the upper part of the reservoir or its connecting pipeline. Proper amount of injection: Almost no bubbles can be seen when the refrigerant flows. When the engine is gradually accelerated from idle speed to 1500 rpm, bubbles disappear and the refrigerant becomes transparent.

Excessive injection: No bubbles can be seen when the refrigerant flows.

Insufficient injection: Bubbles can be seen frequently when refrigerant flows.

Filling steps at low-pressure side

1. Connect the refrigerant cylinder to the middle joint of the filling gauge (yellow hose) using a cylinder opener.

2. Rotate the cylinder opener to open the refrigerant cylinder, and keep it upright.

3. Exhaust the air in the connecting pipe from the exhaust interface of the filling gauge.

4. Invert the refrigerant cylinder and switch on the low pressure gauge valve (no high pressure gauge valve can be switched on, as it may easily cause explosion of the refrigerant cylinder).

5. Start the engine and turn on the control panel (adjust the air speed switch and temperature control switch to the maximum).

6. When the pointer of the low pressure gauge drops stably, shut off the low pressure gauge valve to complete the filling of the first cylinder (at this point, the pressure of the low-pressure gauge shall be < 1.5 bar and that of the high-pressure gauge shall be 4-6 bar).

7. Repeat the above steps to fill the remaining two cylinders (at this pint, the pressure of low pressure gauge shall be 1.0-2.5 bar and that of the high pressure gauge shall be 12-16 bar)

8. After the filling is completed, operate for more than 15 min and observe whether each component operates normally.

Refrigerant Filling

Charge refrigerant from the low-pressure side:

The low-pressure side of the refrigeration system can be charged with gaseous refrigerant by means of a manual low-pressure valve on the manifold pressure gauge as follows:

1. Connect the yellow hose on the manifold pressure gauge to the refrigerant tank.

2. Open the refrigerant tank, put it upright, loosen the nut of the intermediate injection hose on the manifold pressure gauge until a sound of refrigerant vapor flowing is heard, and then tighten the nut. The purpose is to drive away the air injected into the hose.

3. Switch on the manual low-pressure valve to allow refrigerant to enter the refrigeration system. When the pressure value of the system reaches saturation pressure (the saturation pressure varies with ambient temperature), switch off the manual low-pressure valve.

4. Start the engine, switch on the A/C, and adjust the fan switch and temperature control switch to the maximum (Note: After the engine is started, do not switch on the manual high-pressure valve on the manifold pressure gauge to avoid explosion of the refrigerant tank caused by high pressure, resulting in personal injury).

5. Switch on the manual low-pressure valve on the manifold pressure gauge to allow refrigerant to continue entering the refrigeration system until the charge amount reaches the specified value (950 g±50 g).

6. After charging the system with specified amount of refrigerant, observe from the sight glass window to confirm that there are no too many bubbles or excessive refrigerant in the system. Then adjust the engine speed to 1800-2000 r/min, and turn the blower to the highest position. If the temperature is 25-35 ℃, the pressure on the low-pressure side of the system shall be 1.0-2.5 kgf/cm ², and the pressure on the high-pressure side shall be 10-16 kgf/cm ².

7. After charging, shut off the manual low-pressure valve on the manifold pressure gauge and the injection valve installed on the refrigerant tank to stop the engine. Unscrew the high- and low-pressure pipe heads first, and then remove the manifold pressure gauge from the compressor.

Check the A/C duct for leakage
Preparation for inspection:

1. Start the engine

2. Open all doors, turn the A/C switch to "ON", the blower switch to "MAX" and the temperature control switch to "COOL".

3. Keep the compressor speed at 1800rpm.

Check the refrigerant charge with naked eyes according to the refrigerant flow rate through the observation window.

Refrigerant amount	Refrigerant state in observation window
Excessive	The reading of the low pressure gauge is greater than 2.5 kgf/cm², and occasional or no bubbles are found.
Appropriate	The reading of the low pressure gauge is 1.0-2.5 kgf/cm², and a small amount of bubbles are found.
Insufficient	When the reading of low pressure gauge is below 1.0kgf/cm², continuous bubbles can be seen.

(The reading of the high pressure gauge is 12~16 kgf/cm², and the intake temperature of the cooling device is 25-35 ℃)

After the check, operate for more than 15 min and observe whether each component operates normally.

5.1.5 Maintenance Guide and Precautions

(I) Routine check of A/C

1. Check and clean the A/C condenser. The cooling fins shall be clean and free of blockage. Cold water or compressed air shall be used for cleaning, not hot water or hot gas;

2. Check the tension of compressor drive belt;

3. Check whether the hose appearance is normal and whether each joint flange is firm;

4. Check whether the power supply of refrigeration system is firmly connected and whether there is short circuit or open circuit.

(II) Maintenance cycle of A/C

S/N	Item	Contents	Maintenance cycle		
			Weekly	Monthly	Quarterly
1	Evaporation unit	Whether the blower operates abnormally		√	
		Whether the core surface is dirty and blocked		√	
		Whether the drainage is smooth	√		
2	Compressor	Whether the fastening bolts are loose		√	
		Whether the belt tightness is appropriate		√	
		Whether the clutch is engaged normally			√
3	Condensing unit	Whether the core surface is dirty and blocked		√	
		Whether the fan rotates normally		√	
4	Pipeline	Whether the joint is loose or leaks			√
		Whether the hose is damaged		√	
5	Switch	Whether the gears are normal	√		
6	Electrical plug-in	Whether there is falling off or poor connection			√
7	Temperature control switch	Whether the indicator lights up normally	√		
8	Air filter screen	Whether the surface is dirty and blocked		√	

5.1.6 Analysis and Troubleshooting of Common Faults

(I) Troubleshooting of A/C

The A/C system in use may suffer refrigeration faults. One is failure of refrigeration, and the other is insufficient refrigeration or poor refrigeration effect;

Failure of refrigeration: The A/C compressor does not work and there is no cool air blown out from the air outlet;

Insufficient refrigeration or poor refrigeration effect: Cool air is blown out from the air outlet of the A/C but the effect is not good, or cool air is blown out from time to time;

There are various causes of failure of refrigeration. The most prominent one is that there is no refrigerant in the A/C system, and the compressor can not work (when the low pressure in the system is below 1 kg, or the high pressure is above 21 kg, the A/C pressure switch does not conduct, and the compressor stops working). Do not start the machine when checking the system pressure. Connect the high- and low-pressure connectors of the pressure gauge to the

system and test the pressure value. The normal pressure range is 6-8 kg in summer and 4-6 kg in winter, and the pressure varies with the outside temperature.

(II) The troubleshooting methods are as follows: asking, listening, looking and touching. The specific contents are as follows:

Asking: When maintaining the A/C, first ask the owner whether there are abnormalities found or heard during use.

Listening: Start the engine until it stabilizes at about 1800 r/min, turn on the A/C refrigeration function, listen to the working sound of the compressor, and judge its operation. If a sharp "hissing" is heard, it indicates that the belt is too loose, which causes abnormal sliding sound; if a jitter sound is heard, it generally indicates that the compressor frame bolts are loose.

Looking: Observe whether the condenser surface is clean.

Touching: Touch and feel the temperature of the operating A/C system pipeline and parts with the hand. The pipe at the evaporator outlet shall be cold, while the pipe at the condenser shall be hot. If the temperature is abnormal, it indicates that there is a fault here.

Fault	Cause analysis	Fault phenomenon	Check methods and tools	Treatment
Refrigeration of A/C does not work	Whether the system refrigerant leaks	Normal pressure values: Low pressure: 1.0~2.5 kgf/cm ², high pressure: 10~16 kgf/cm ²(Note: The pressure varies with the change of ambient temperature)	Check the pressure state with a pressure gauge	Find out the cause of leakage
		There is no pressure display, and the pressure value is "0"	Pressurize the system and gradually check the pipeline joints and components with soapy water. If bubbles are blown out, there is a leakage point	Check, repair or replace the leakage point or component, and refill refrigerant
	Whether the electrical appliances work normally (e.g. compressor, blower)	When the pressure is normal	Turn on the windshield switch and refrigeration switch, and observe whether the blower and electronic fan work normally; whether there is a "tick" suction sound of the compressor; watch/touch/listen	Handle or replace the faulty parts
	Clutch does not engage/lines failures	Start the A/C, and there is no change in system	Test it with a pressure gauge and observe the pressure;	Handle or replace the faulty parts

	Broken or no belt	pressure	watch/listen	
	Compressor does not compress or seizes due to internal damage			
	Loose connectors	Controlled electrical appliances do not work	Check the circuit with a multimeter or test pencil	Handle or replace the faulty parts
	Fuse damage	All electrical appliances do not work		
	Windshield switch fault	All electrical appliances do not work		
	Faulted temperature detect switch	Electrical appliances other than blower do not work		
	Relay fault	Controlled electrical appliances do not work		
	Pressure switch fault	Electrical appliances other than blower do not work		
	Other line faults	Controlled electrical appliances do not work		

Fault	**Cause analysis**	**Fault phenomenon**	**Check methods and tools**	**Treatment**
	The air outlet pipe of the evaporator is damaged or not connected properly	The air speed at the air outlet is low or no air blows out	Visual inspection/hand feeling	Correct or replace the air outlet pipe
	The heater water valve is not closed or leaks	The heater hose is hot and hot air blows out of the air outlet	Touch the heater water pipe by hand, or feel the air outlet temperature; or test it with a	Close the water valve or replace it

			thermometer	
	Insufficient refrigerant	The high and low pressures are relatively low, and there are many bubbles in the sight glass on the drying bottle	Test it with a pressure gauge and observe the pressure	Check the system for leakage, repair or replace it, and fill an appropriate amount of refrigerant
	Excessive refrigerant	The low pressure is relatively high, the high pressure exceeds the normal value and is unstable, and the compressor trips frequently	Test it with a pressure gauge and observe the pressure	Discharge a proper amount of refrigerant
Refrigeration of A/C does not work	There are other gases (such as air) in the system	The high and low pressures are relatively high, and the air outlet temperature cannot be reduced	Use a pressure gauge to test it and observe the pressure, and the high-pressure pointer is unstable	Drain the system refrigerant, re-vacuumize it and add refrigerant
	Dirty blockage of evaporator air inlet/dirty blockage in core	Muddy surface, thick dirt/sundries blocking the air outlet	Visual inspection	Clear sundries or clean soil
	The A/C filter element is dirty and blocked	There are many sundries on the surface, and the air volume at the air outlet is small	Visual inspection/hand feeling	Clean or replace the filter element
	The condenser surface is dirty and blocked	The surface has a lot of mud, thick dirt, the system pressure is high and the heat dissipation is not good	Check the pressure visually/with a pressure gauge	Clean the condenser to ensure good heat dissipation
	The inlet air temperature of the condenser is too high or the exhaust air dissipates poorly	The air inlet temperature is higher than 40 ℃, and the air inlet is blocked and the air outlet is blocked by foreign matters	Check the pressure visually/with a pressure gauge	The air inlet has enough natural wind to blow in. Clean up sundries to allow smooth air discharge, so that the backflow is not re-inhaled by the condenser to affect the effect of heat dissipation
	Loose belt	Harsh noise is heard and the rotating speed of the compressor does not rise	Watch/listen	Adjust the belt

	The expansion valve is blocked	The system does not cool down after working for a period of time, with low negative pressure and no change when the accelerator pedal is increased	Test it with a pressure gauge and observe the pressure	Replace the expansion valve and drying bottle, vacuumize it again and fill refrigerant
	The expansion valve is damaged	There is no temperature difference between the inlet and outlet of expansion valve	Test it with a pressure gauge and observe the pressure/touch	Replace the expansion valve and drying bottle, vacuumize it again and fill refrigerant
	Clogging of drying bottle	The low pressure is zero, which is not normal, and obvious temperature difference is present between both sides of the drying bottle	Test it with a pressure gauge and observe the pressure; watch/touch	Replace the expansion valve and drying bottle, vacuumize it again and fill refrigerant
	Poor compression of compressor	The low pressure is relatively high and the high pressure is relatively low at idle speed, and the high and low pressures are normal when accelerator is increased	Test it with a pressure gauge and observe the pressure	Replace the compressor and drying bottle, vacuumize it again and fill refrigerant
	Excessive opening of expansion valve	The low pressure is relatively high, and the high pressure is lower than the normal value	Test it with a pressure gauge and observe the pressure	Replace the expansion valve and drying bottle, vacuumize it again and fill refrigerant
	Switch the A/C to external circulation	Outside hot air is sucked in from the evaporator air inlet	Visual inspection/hand feeling	Turn off the external circulation and switch to internal circulation

5.1.7 Fault Detection Method

Manifold pressure gauge method

After the engine is warmed up, read the pressure value of manifold pressure gauge under the following specific conditions.

The temperature at the air inlet is 30~35 ℃.

The engine speed is 1800 rpm (reference).

Set the fan speed to the high position and the temperature control to the coldest position.

1. Refrigeration system in normal state

Meter reading:

Low-pressure side 1.0-2.5 kgf/cm ²

High-pressure side 10-16 kgf/cm ²

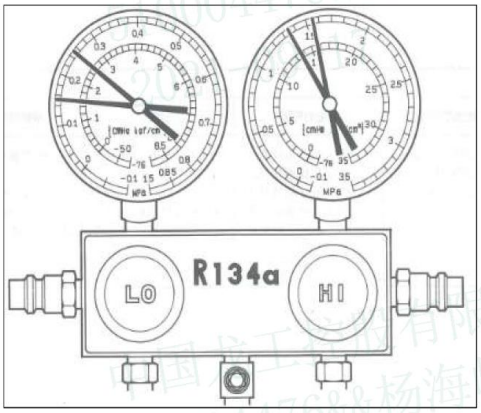


Fig. 5-01-15

2. Moisture in the refrigeration system

Condition: intermittent refrigeration, and finally no refrigeration

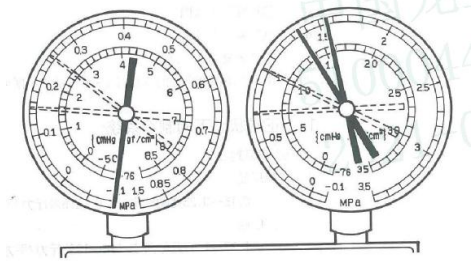


Fig. 5-01-16

Symptoms of refrigeration system	Cause analysis	Diagnosis	Troubleshooting
When the system is running, sometimes the pressure at the low-pressure side is vacuum and sometimes it is normal.	The water entering the refrigeration system freezes in the expansion valve, causing a temporary stop of circulation. However, when the ice melts, the system resumes.	The drier is oversaturated. The water entering the refrigeration system freezes in the expansion valve, hindering the circulation of the refrigeration system.	Replace the drier. Water is removed from the system by air extraction. Replenish an appropriate amount of refrigerant.

3. Poor circulation of refrigerant

Condition: Insufficient refrigeration

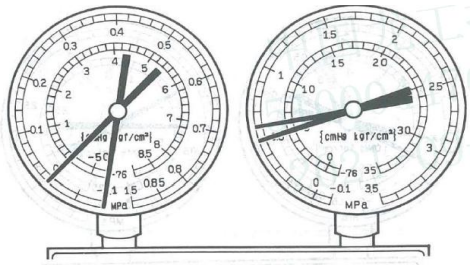


Fig. 5-01-17

Symptoms of refrigeration system	Cause analysis	Diagnosis	Troubleshooting
Pressure is low at both the high- and low-pressure sides. The pipes from the component to the reservoir are frosted.	Dirt in the reservoir hinders refrigerant flow.	The reservoir is blocked.	Replace the reservoir.

4. Refrigerant does not circulate

Condition: no refrigeration (intermittent refrigeration in some cases)

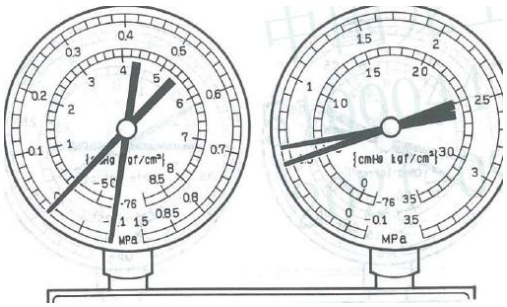


Fig. 5-01-18

Symptoms of refrigeration system	Cause analysis	Diagnosis	Troubleshooting
Vacuum is present at the low-pressure side and the pressure is extremely low at the high-pressure side. Frost or condensation forms on the pipes in front of and behind the expansion valve or receiver-drier.	Water and dirt in the refrigerant hinder refrigerant flow. The gas leakage at the thermosensitive pipe of the expansion valve hinders refrigerant flow .	The refrigerant does not circulate.	Check the expansion valve. Remove dirt in the expansion valve by blowing air, and if necessary, replace the reservoir. Pump out air and fill an appropriate amount of refrigerant. If air leaks from the thermosensitive pipe, replace it Expansion valve.

5. Excessive refrigerant charging or insufficient condensation

Condition: insufficient refrigeration

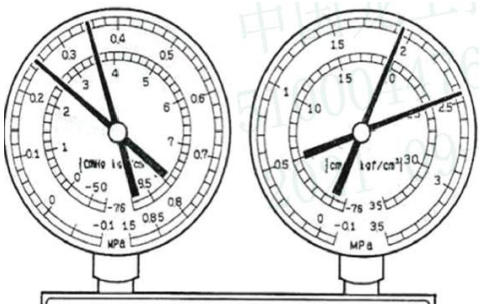


Fig. 5-01-19

Symptoms of refrigeration system	Cause analysis	Diagnosis	Troubleshooting
Pressure is too high at the high- and low-pressure sides When the engine speed drops, no bubbles can be seen through the sight glass.	Refrigerant is excessive in the system, and the refrigeration effect cannot be fully achieved. Refrigeration is inadequate.	Excessive refrigerant in the system: excessive charging of refrigerant. Refrigeration with insufficient condensation: The cooling fin of the condenser is blocked or the fan motor fails.	Clean the condenser and check the operation of fan motor. If the first two conditions are normal, check the amount of refrigerant. Release an appropriate amount of refrigerant.

6. Mechanical fault of compressor

Condition: not cold

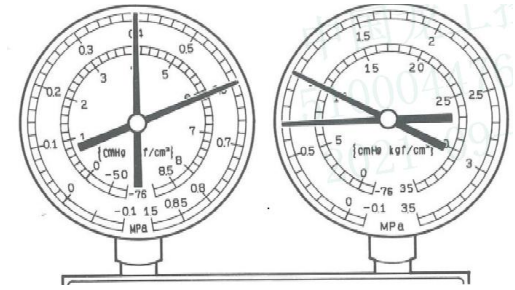


Fig. 5-01-20

Symptoms of refrigeration system	Cause analysis	Diagnosis	Troubleshooting
The pressure at the low-pressure side is too high while that at the high-pressure side is too low.	The compressor is leaking internally.	Compressor fault The valve leaks or is damaged, and the part slips.	Repair or replace the compressor.

V. Main Components

Section 2 Pilot Valve

Contents

5.2 Pilot Valve

CRV Pilot Valve Parts Brochure and Exploded View Diagrams			
S/N	**Figure No.**	**Description**	**Qty.**
1	DXS-01y-00a	Handle assembly	1
2	GB/T6170-2000	Nut M12	1
3	CRV-12	Dust cover	1
4	CRV-11	Thick nut	1
5	CRV-09	Pad disc	n
6	GB/T6170-2000	Nut M6	4
7	XDF3-28	Gasket	4
8	CRV-08	Ejector rod head assembly	1
9	XDF3-20	Gasket	n
10	CRV-10	Universal joint assembly	1
11	GB/T70.1-2000	Screw M6X45	2
12	GB/T93-1987	Washer 6	2
13	CRV-07	Cover plate	1
14	XDF3-25	Screw plug	1
15	GB/T3452.1-2005	O-ring 11.8X2.1	2
16	CRV-01-P	Valve body	1
17	CRV-15	Spring 1.5X8X34.5	1
18	CRV-14	Sequence valve element	1
19	DXS-18-04	Screw plug	1
20	ZLF25A-10	Screw plug	6
21	GB/T3452.1-2005	O-ring 8X1.8	6
22	CRV-19	Return spring 1.6X19X31	3
23	4THF5-03	Return spring 1.3X11.6X54	4
24	XDF3-07	Locating sleeve	3
25	CRV-02	Valve element	4
26	CRV-17	Gasket	4
27	CRV-18	Pressure regulating spring 1.2X7.7X30.8	4
28	CRV-03a	Spring seat	4
29	WYX-U06-08a	Clip	4
30	WYX-U06-10a-00	Sleeve assembly	4
31	GB/T895.2-1986	Steel wire retainer ring for shaft 10	4
32	CRV-04	Contact	4
33	GB/T70.1-2000	Screw M5X25	2
34	CRV-05	Transition plate	1
35	XDEF-21y	Electromagnet	3

36	XDF3-13	Shaft sleeve	1
37	CRV-06y1	Mounting plate	1

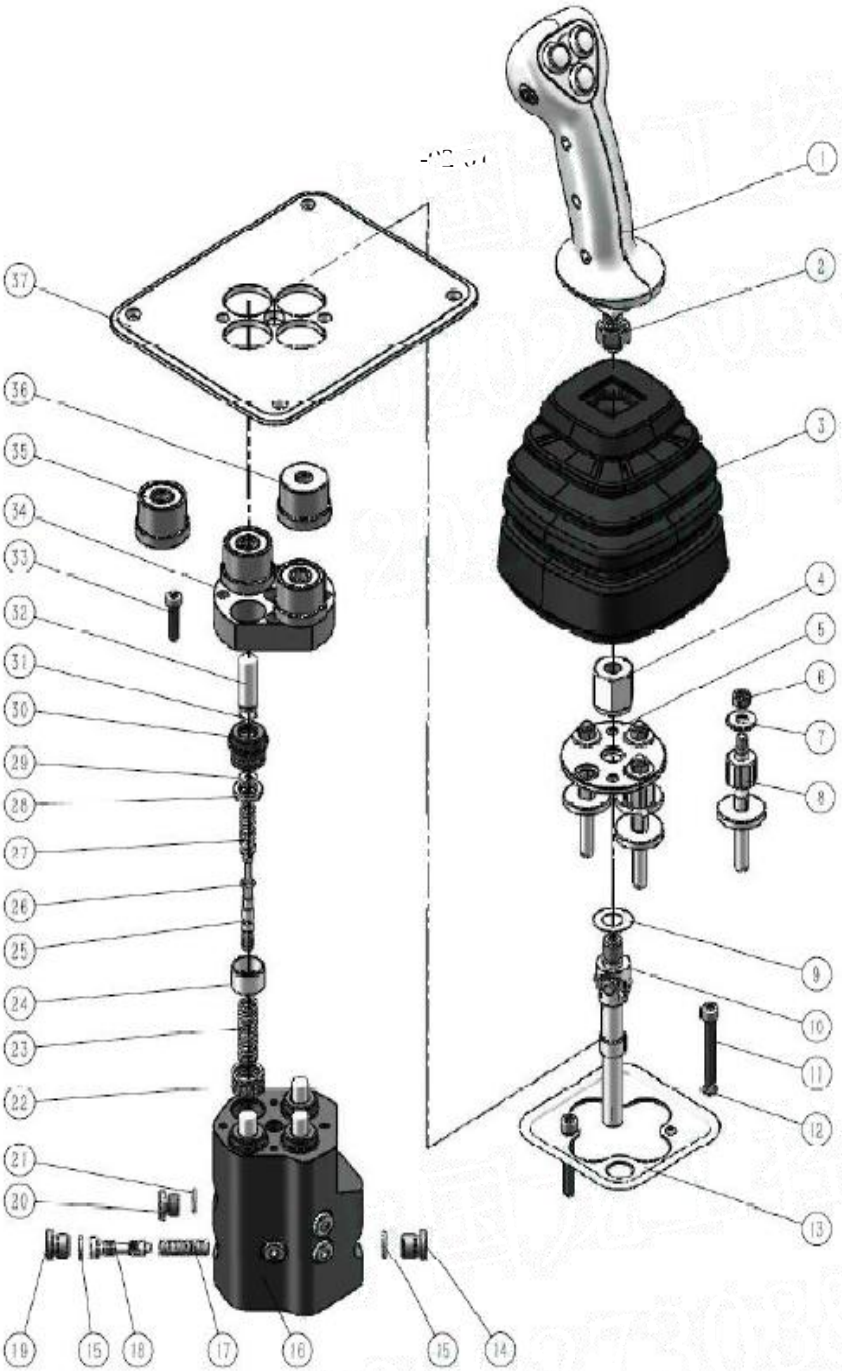


Fig. 5-02-01

Technical parameters	
Maximum pressure: 5MPa	Nominal flow: 10L/min
Oil return back pressure: MAX≤0.3 MPa	Electromagnet resistance: 117±10 Ω
Working voltage of electromagnet: DC24 V	Rated attraction force of electromagnet: 320±20 N
Working current of electromagnet: 0.19-0.23 A	Operating temperature of electromagnet: -40 - 121 ℃
Control pressure range: tilt joint: 0.5-1.9 MPa Lift arm joint: 0.5-1.9 MPa	

5.2.1 Schematic Diagram of Pilot Valve

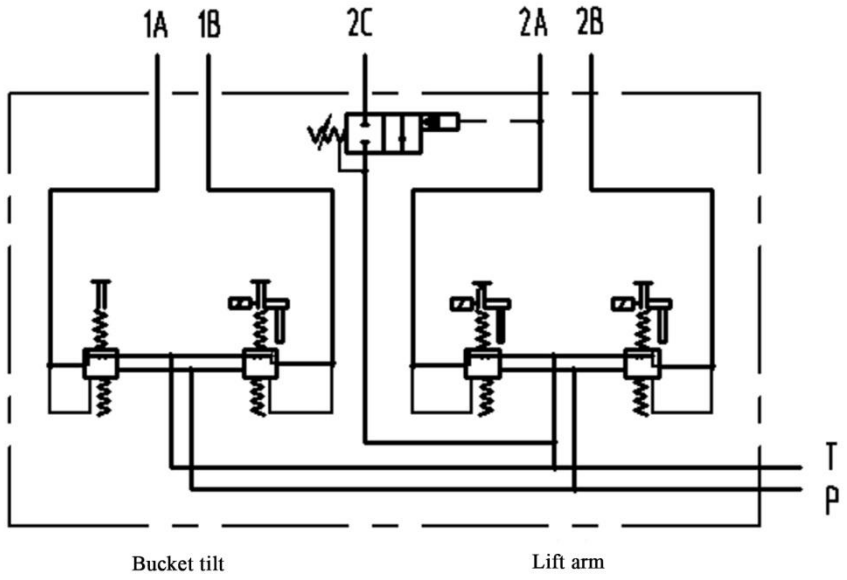


Fig. 5-02-02

5.2.2. Introduction to Working Principle

The tilt control lever and lift arm control lever are set in the pilot valve. There are three tilting positions: forward tilting, neutral and backward tilting. The lift arm control lever has four positions: lifting, neutral, lowering and floating. Generally, electromagnet positioning is provided at the lift arm lifting, floating and bucket backward tilting positions.

Port P is the oil inlet and port T is the oil return port. Among the control ports, 1A is for tilting downward, 1B is for leveling, 2A is for lowering, 2B is for lifting, and 2C is for floating, which are connected to the corresponding control ports b1, a1, b2, a2, and k of the hydraulic multi-way valve.

When the control lever is in the neutral position, the slide valve is in the initial position, the oil inlet chamber and the

oil return chamber are not connected, the control port is connected with the oil return chamber, and the multi-way valve is in the neutral position.

When the control lever is pulled, it pushes the contact to move downward, so that the pressure regulating spring pushes the valve element to move downward to cut off the passage between the control chamber and the oil return chamber, and connect the oil inlet chamber with the control oil chamber. In this way, the pilot pressure oil can be output to the multi-way valve control port, and pushes the multi-way valve stem to move, thus realizing direction switching action.

At the same time, the oil pressure in the control chamber acts on the lower end of the valve element and balances with the force of the pressure regulating spring. When the control lever is kept at a position, the spring force and the corresponding pressure of the control chamber are constant, similar to the action process of the fixed pressure reducing valve. The spring force varies with the swing angle of the control lever: If the swing angle is large, the spring force will be large, and the pressure in the control chamber will be high. The thrust on the multi-way valve stem will also increase accordingly, that is, the stroke of the main valve stem is proportional to the operating angle of the pilot valve handle, thus realizing proportional pilot control.

When the pilot valve control lever moves to the full lifting or full retracting position, the magnetic attraction of the coil assembly fixes the control lever in the lifting or retracting position, and the pilot valve will be locked (positioned) until the bucket reaches the limited lifting height or limited bucket angle. The bucket limiter circuit is disconnected, the coil is de-energized, and the return spring pushes the compression rod up to make the control lever return to the neutral position.

When the control lever continues to be pulled from the lowering position to the floating position, the pilot valve will be locked due to the electromagnet positioning at this position. At this point, the pressure of the control port increases, so that the sequence valve in the pilot valve opens and the oil pressure in the drain port 2C is released back to the oil tank. When the pilot valve is pulled out of the floating position and released, the return spring pushes the compression rod to rise, and the control lever will return to the neutral position.

5.2.3 Faults and Troubleshooting

S/N	Fault	Cause	Troubleshooting method
1	Failure of pilot valve control	The valve element is stuck or fails to move	Check the cleanliness of oil, and clean the valve element and valve hole
		Deformation of p**ressure relief spring**	Replace the spring
		Insufficient control flow or pressure	Check whether the pilot oil supply system works normally
		Inflexible universal joint	Add grease to the joint
		Poor contact in the circuit	Inspection and repair of circuits
		Low power supply voltage	Replace the battery
		The dust cover is damaged, and dust enters the electromagnet, resulting	Remove the dirt on the joint surface of pure iron pressing plate

2	Unreliable positioning of electromagnet	in insufficient suction	and electromagnet, apply a small amount of anti-rust oil or hydraulic oil, and replace the dust cover.
		The electromagnet is damaged	Replace the electromagnet
3	Floating function failure	The valve element is stuck	Clean the parts
		Spring deformation	Replace the spring
4	External leakage	O-ring is damaged	Replace the seal
		Oil leakage of dynamic seal	Replace the dynamic seal sleeve assembly

List of Wearing Parts		
S/N	**Description**	**Quantity per unit**
WYX-U06-10a-00	Dynamic seal sleeve assembly	**4**
CRV-12	Dust cover	**1**

5.2.4 Precautions for Installation and Use

1. During handling, installation and storage, avoid impacting or damaging the machined surface;
2. Do not remove the plastic plugs of each oil port before installation to prevent foreign matters from entering;
3. The mounting plate and bracket shall be flat, and the tightening force of mounting screws shall be uniform without distorting the mounting plate;
4. The working oil shall be clean, and the cleanliness of oil and system shall not be higher than Grade 19/16 in ISO4406 or Grade 10 in NAS1638;
5. Correctly connect the pilot valve and each working oil port of the multi-way valve.

Replace the copper sleeve

① Disengage the upper end of the dust cover from the handle positioning groove, and remove the handle and dust cover with S18 and S24 open-end wrenches.

② Loosen and remove the thick nut with an S22 wrench, loosen the universal joint with an S5 Allen wrench, and remove the ejector rod assembly and other parts.

③ Loosen the M6 bolts with an S5 Allen wrench, and remove the mounting plate, cover plate, electromagnet, etc.

④ Loosen the M5 bolts with an S4 Allen wrench and remove the transition block.

⑤ Replace the copper sleeve assembly.

Replace the valve element

① Disengage the upper end of the dust cover from the handle positioning groove, and remove the handle and dust cover with S18 and S24 open-end wrenches

② Loosen and remove the thick nut with an S22 wrench, loosen the universal joint with an S5 Allen wrench, and remove the ejector rod assembly and other parts

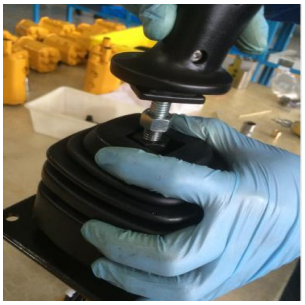
③ Loosen the M6 bolts with an S5 Allen wrench, and remove the mounting plate, cover plate, electromagnet, etc.

④ Loosen the M5 bolts with an S4 Allen wrench and remove the transition block.

⑤ Take out the copper sleeve, spring and valve element assembly and clean them as well as the valve body, and then reinstall the parts into the valve

Replace the ejector rod assembly

① Disengage the upper end of the dust cover from the handle positioning groove, and remove the handle and dust cover with S18 and S24 open-end wrenches.

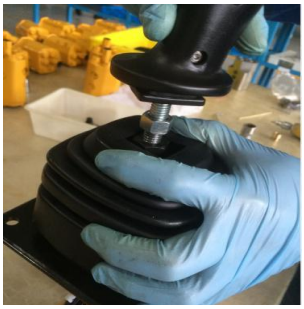


② Loosen and remove the thick nut with an S22 wrench, remove three M6 nuts with S10 and S17 wrenches, loosen the universal joint with an S5 Allen wrench, and take out the disc and universal joint.

③ Replace the ejector rod assembly.

Replace the handle

① Disengage the upper end of the dust cover from the handle positioning groove, and remove the handle with S18 and S24 open-end wrenches.



② Install the new handle into the pilot valve and tighten it with S18 and S24 open-end wrenches.

Clean the electromagnet

① Disengage the upper end of the dust cover from the handle positioning groove, remove the handle with S18 and S24 open-end wrenches, and take out the dust cover.

② Check the joint surface between pressing plate and electromagnet for rust and dirt, and if any, clean it up.

③ In the dust cover, install the new handle into the pilot valve, and tighten the handle with S18 and S24 open-end wrenches; finally, clamp the upper and lower ends of the dust cover into the cover plate and the handle positioning groove respectively.

V. Main Components

Section 3 Multi-way Valve

Contents

5.3 Multi-way Valve

5.3.1 Parts Catalog and Exploded View

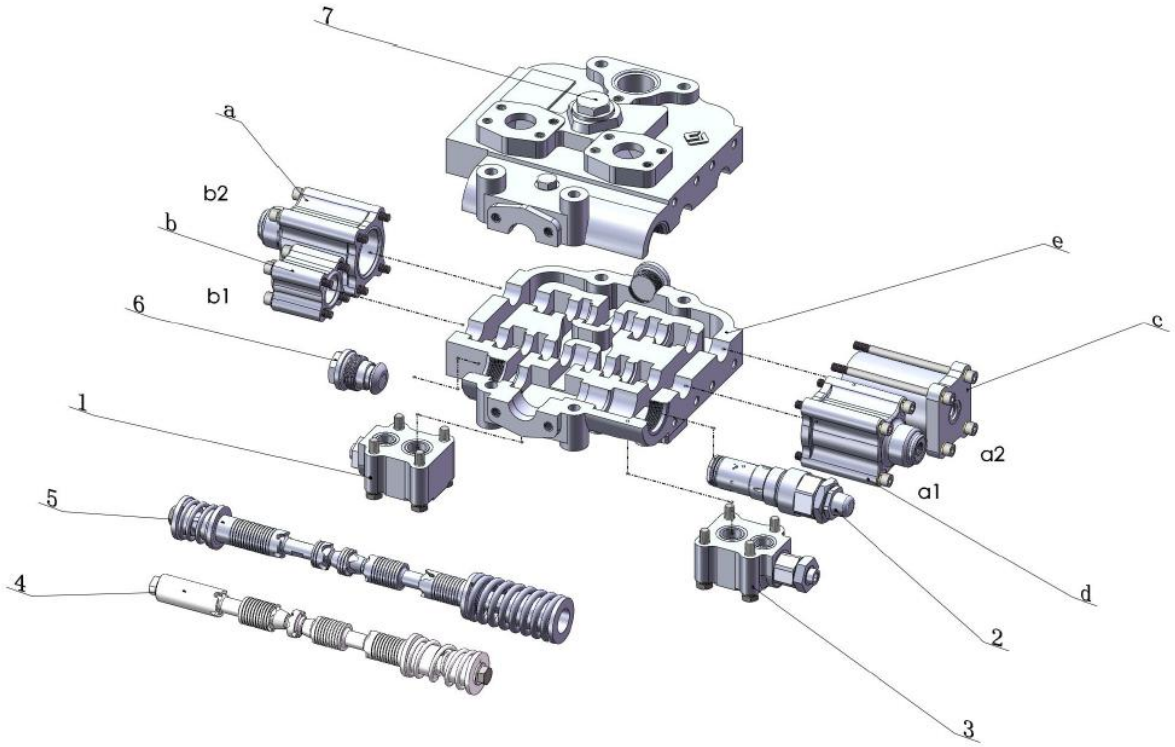


Fig. 5-03-01

Parts Catalog of Multi-way Valve	
P: From oil cylinder	1: Overload oil makeup valve (assembly)
A1: To large cavity of tilt cylinder	2: Safety valve (assembly)
B1: To small cavity of tilt cylinder	3: Overload valve (assembly)
A2: To large cavity of lift arm cylinder	4: Tilt valve stem
B2: To small cavity of lift arm cylinder	5: Lift arm valve stem
T: Oil return tank	6: Tilt check valve
a1, b1: Tilt pilot control oil port	7: Lift arm check valve
a2, b2: Lift arm pilot control oil port	b, d: Tilt end cover
a, c: Lift arm end cover	YGDF-32-01C multi-way valve body

5.3.2 Structural Schematic Diagram

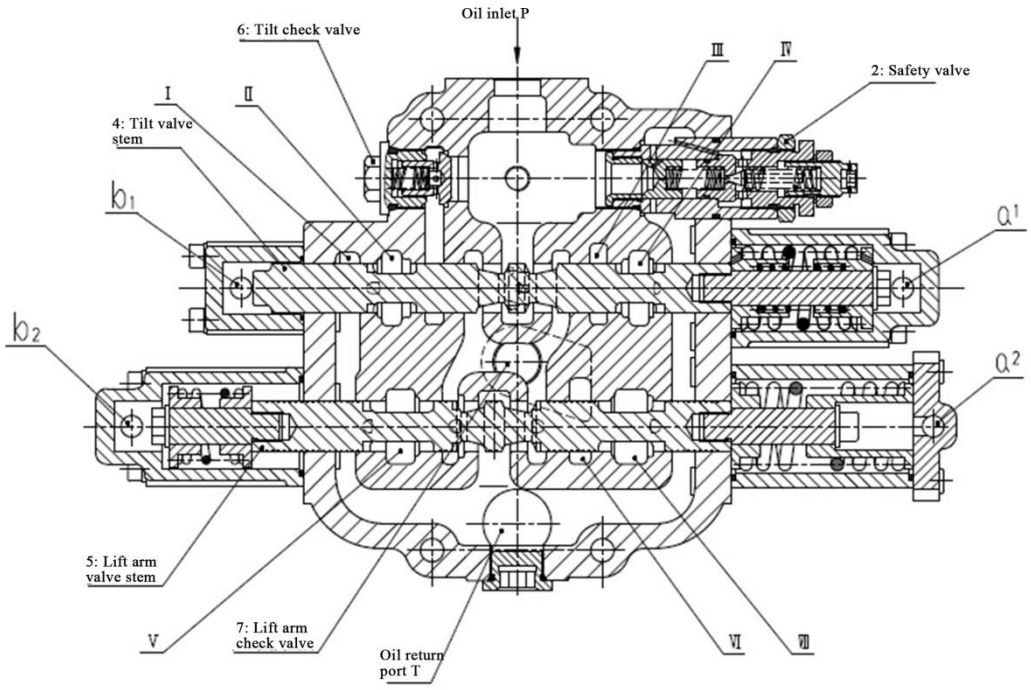


Fig. 5-03-02

5.3.3 Schematic Diagram of Working Principle

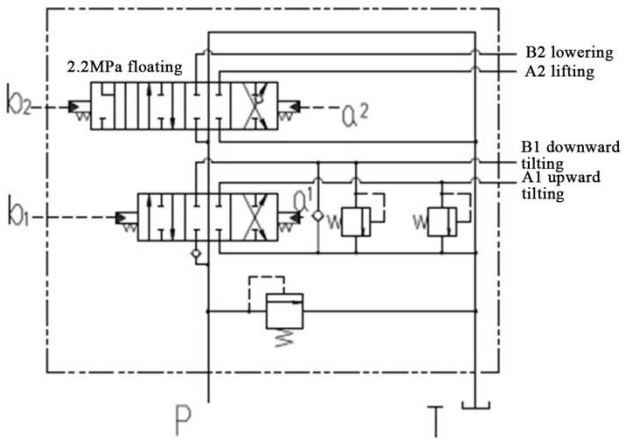


Fig. 5-03-03

In the hydraulic multi-way valve, port P is the oil inlet, T is the oil return port, ports A1 and B1 are connected with the large cavity and small cavity of the tilt cylinder respectively, ports A2 and B2 are connected with the large cavity and small cavity of the lift arm cylinder respectively, a1 and b1 are the control oil ports of the tilt pilot valve, and a2, b2 and k are the control oil ports of the lift arm pilot valve; external check valves [tilt check valve (6) and lift arm check valve (7)] prevent pressure oil from flowing back into the tank during reversing, thus overcoming "nodding" phenomenon in the working process. The safety valve (2) controls the system pressure. When the system pressure exceeds the rated pressure, the safety valve opens and the pressure oil returns to the oil tank to protect the hydraulic system from damage caused by excessive pressure.

(I) The tilt reversing valve is a three-position six-way valve. For the tilt, it can control the upward tilting, downward tilting and neutral position of the tilt.

1. Neutral position: When the tilt valve stem (4) is in the middle position, the oil from the working oil pump passes through the oil passage from the oil inlet "P" and returns to the oil tank through the oil return port "T".

2. Upward tilting of bucket: The pilot oil enters from port a1, and the tilt valve stem (4) is pushed out to close ports "P" to "T". The hydraulic oil enters from the "P" port, pushes the tilt check valve (6) to open, passes through oil passages II, III (oil passages II and III are straight-through) and IV (at this time, oil passages III and IV are connected) to port A1, and then enters the large cavity of the cylinder to make the bucket tilt upward. At this time, the oil passage I is connected with port "T", and the hydraulic oil in the small cavity of the cylinder returns to the oil tank through port "B1" and port "T".

3. Downward tilting of bucket: The pilot oil enters from port b1, pushes the tilt valve stem (4) to close ports "P" to "T". The hydraulic oil enters from the "P" port, pushes the tilt check valve (6) to open, passes through oil passage II and oil passage I to port B1, and then enters the small cavity of the cylinder to make the bucket tilt downward. At this time, the hydraulic oil in the large cavity of the cylinder connected by oil passage IV and port "T" returns to the oil tank through port "A1" and port "T".

When the external force of the tilt valve stem (4) is canceled, the valve stem automatically returns to the middle (closed) position by the elasticity of the return spring.

4. Overload oil makeup valve

Install one for oil line of the front and rear cavities of the tilt cylinder respectively (which can also be increased or decreased at will according to user's needs), and its function is to eliminate the trapped oil or negative pressure in the oil cylinder when the bucket is interfered by external impact load or other mechanisms.

(II) The lift arm reversing valve is a four-position six-way valve, which can control the lifting, closing, lowering and floating of the lift arm.

1. Neutral position:

When the lift arm valve stem (5) is in the middle position, the oil from the working oil pump enters from the oil inlet "P", flows through the oil passage and returns to the oil tank through the oil return port "T".

2. Lift arm lifting:

The pilot oil enters from port a2, pushes the lift arm valve stem (5) to the lifting position, so that ports "P" to "T" are closed. The hydraulic oil enters from the "P" port, pushes the lift arm check valve (7) to open, passes through oil passage VI to oil passage VII, and then enters the large cavity of the cylinder from port A2 to lift the lift arm. At this time, the oil passage V is connected with port "T", and the hydraulic oil in the small cavity of the cylinder returns to the oil tank through port "B2" and port "T".

3. Lift arm lowering:

The pilot oil enters from port b2 to push the lift arm valve stem (5) to the lowering position, so that ports "P" and "T" are closed. The hydraulic oil enters the small cavity of the cylinder from port P through oil passage V and then enters B2 to lower the lift arm; at this time, oil passage VII is connected with port "T", and the hydraulic oil in the large cavity of the cylinder returns to the oil tank through port "A2" and port "T".

4. Lift arm floating:

The pilot oil enters from ports a2 and b2 according to the designed pressure balance, and the lift arm valve stem (5) is pushed to the floating position. At this time, ports "A2", "B2" and "P" are connected with port "T", the upper and lower cavities of the lift arm cylinder are connected and in a low-pressure state, and the cylinder is in a free floating state under the mass of the working device and ground force.

5.3.4 Faults and Handling Methods

S/N	Fault	Cause	Troubleshooting method
1	Insufficient working pressure	1. Low pressure adjustment of the safety valve (33) 2. The main valve element 11 of the safety valve (33) is stuck. 3. The pressure regulating spring 6 of the safety valve (33) is damaged 4. System line pressure loss is too much	1. Adjust the pressure of safety valve (33) 2. Disassemble, clean and reassemble it 3. Replace the pressure regulating spring 6 4. Repair the system pipeline
2	Insufficient working flow	1. Insufficient system oil supply 2. Large leakage in the valve a. The oil temperature is too high and the viscosity decreases b. Improper oil is selected c. The fit clearance between valve stem and valve body is too large	1. Check the oil source a. Take measures to lower the oil temperature b. Replace the oil c. Replace the valve stem according to appropriate clearance
3	Reset fails	1. The return springs (31, 32) are damaged or deformed 2. The components at the return part are not coaxial 3. There are foreign matters between the valve body hole and the valve stem	1. Replace the return springs (31, 32) 2. Reassemble and keep them coaxial 3. Clean the parts
4	Bucket drop	1. The overload valve (34) and the overload oil makeup valve (43) are stuck by dirt 2. The oil is not clean enough. 3. Internal leakage of oil cylinder	1. Disassemble, clean and reassemble it 2. Replace the oil 3. Repair the oil cylinder
5	External leakage	1. The O-rings (22, 27 and 45) of end cover are damaged 2. Poor sealing of oil port safety flange surface 3. The fastening bolts on each joint surface are loose or the back cap of pressure regulating screw is loose	1. Replace with a new one 2. Check the fastening and sealing of corresponding components 3. Tightening of corresponding components

The part number is based on the structural diagram of multi-way valve and safety valve.

V. Main Components

Section 4 Booster Pump

Contents

5.4 Booster Pump

5.4.1 Pump Purpose

The air booster pump is suitable for the air-over-hydraulic brake systems of the engineering machinery loader, bulldozer, excavator and heavy-duty vehicle to convert the low pressure from the air brake valve into the high hydraulic pressure required by the brake.

5.4.2 Working Principle

1. The brake fluid from the oil storage cup assembly enters chamber C through the inclined hole of the hydraulic cylinder block, passes the side clearance between the push rod seat assembly and the hydraulic piston, and then enters chamber B through the filling hole in the hydraulic piston.

2. Compressed air from the air brake valve outlet enters chamber A through the air inlet of booster pump to push the air piston assembly forward. The push rod pushes the push rod seat assembly to seal the filling hole in the hydraulic piston assembly, forming a closed space in chamber B of the hydraulic cylinder block to generate high hydraulic pressure. The output pressure is 90% times the pressurization ratio of input air pressure. When the air pressure is released, under the action of return spring, the filling hole opens and the hydraulic oil returns to the oil storage cup assembly through the filling hole.

Structural Diagram of Air Booster Pump

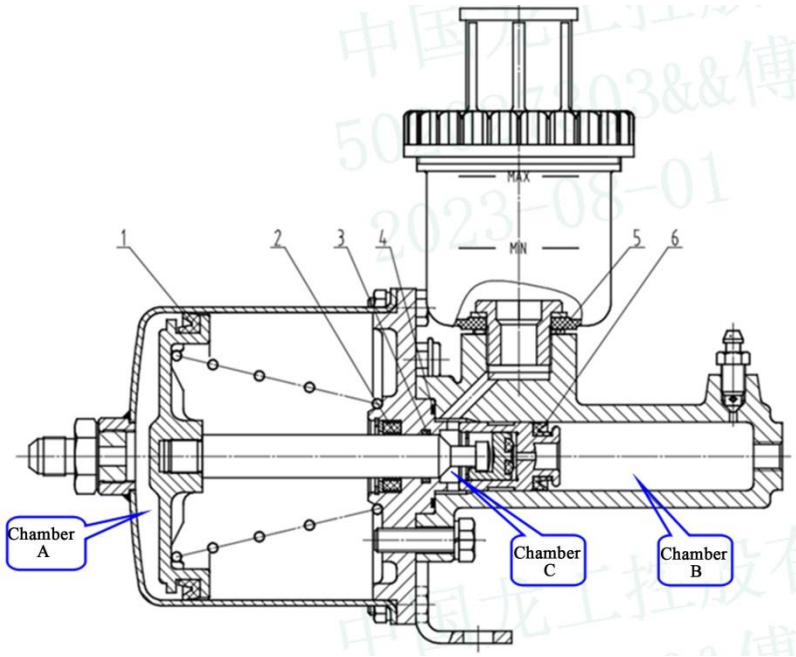


Fig. 5-04-01

List of Wearing Parts			
S/N	**Description**	**Figure No.**	**Qty.**
1	Air piston rubber ring	LYG209B-35100023	1
2	Central seal ring	ZL20A-3510031	1
3	O-ring 17×2.65	GB/3452.1	1
4	O-ring	JN162-3515025	1
5	Combined sealing washer 27	JB/T 982	1
6	Hydraulic rubber ring	SL209-3510041	1

Main technical parameters	
Rated working air pressure: 784kPa	Pressure ratio: 1: 15*90%
Operating temperature: -30～+80℃	Displacement: 44mL
Working medium: air, high-temperature resistant synthetic brake fluid	

Warning

Remove the protective plugs of each air (liquid) inlet and outlet before installation;

Fasten the product to the engineering machinery, and ensure that the height of the oil storage cup is higher than the hydraulic pipeline in the system;

Before commissioning, inject brake fluid into the oil storage cup and open the bleed screw (including the bleed screw of the brake actuator) at the same time. During the bleeding process, continuously replenish brake fluid. After confirming that all air is released, close the bleed screw quickly, keep the brake fluid in the oil storage cup at the specified required height, and finally tighten the oil storage cup cover;

The specified brake fluid must be used for the product to ensure cleanliness. It is strictly prohibited to mix different types of brake fluid;

Check the fluid level in the oil cup frequently during use of the product, and always keep sufficient brake fluid. It is strictly prohibited to work without or with little fluid.

Precautions for maintenance

① The brake fluid used shall conform to national standards and shall not be adulterated. If it works in a low-temperature environment, antifreeze brake fluid shall be selected.

② During the installation and commissioning of the product, the air in the hydraulic pipeline shall be discharged through the bleed screw so that there is no gas in the hydraulic system; otherwise, it is not allowed to run.

③ There are water discharge and filtering devices in the air circuit to ensure the cleanliness of the air source. The air reservoir shall be drained regularly.

④ Replace the brake fluid regularly and ensure that the brake fluid level is within the specified range.

⑤ If wearing parts are found to be seriously worn, with insufficient pressure or weak brake, the wearing parts shall be replaced immediately.

⑥ When replacing wearing parts, they shall be replaced according to the physical objects of wearing parts. The fasteners (retainer rings and bolts) damaged during replacement must be replaced, and it shall be ensured that they are installed in place, firm and reliable without damaging other components. After replacement, they shall not be installed without passing the test.

⑦ Clean the breather filter screen assembly regularly according to actual working conditions.

5.4.3 Fault Diagnosis

1. Use special oil pressure and air pressure gauges to measure the air pressure and oil pressure at both ends of the booster pump. When the air pressure is 0.4-0.78MPa, the oil pressure is 8.5-11MP, indicating that the air booster pump is in good condition; otherwise, the booster pump fails.

2. When the air pressure of booster pump is abnormal, it indicates that there is a fault in the air circuit. First check whether the oil-water separator leaks or the gas circuit is blocked.

3. When the air pressure of booster pump is normal but the oil pressure is abnormal, it indicates that there is a fault in the oil line. Firstly, check whether there is oil leakage at the brake caliper. If so, the piston oil seal of brake caliper is damaged; if not, the hydraulic chamber seal of the booster pump is damaged.

4. The brake fluid filled in the air booster pump must be special and of the same brand, and cannot be mixed for use. In addition, it is strictly prohibited to add other fluids into the booster pump, so as to avoid erosion of the booster pump and brake caliper piston seal (other fluids will cause expansion deformation of the booster pump and brake caliper seal), resulting in deformation of the seal and damage to the booster pump.

5. If the ratio of pressure value between hydraulic gauge and barometer reaches 90% of pressurization ratio, it indicates that the performance of booster is normal.

6. If the ratio of pressure value between hydraulic gauge and barometer is less than 90% of the pressurization ratio, it indicates that the performance of booster has been attenuated.

7. When there is no pressure value on the hydraulic gauge, a. the piston may be stuck; b. the hydraulic rubber ring or oil inlet valve assembly may be damaged; c. no oil enters due to expansion of the hydraulic rubber ring and push rod seat.

8. The pressure values of the barometer and hydraulic gauge drop synchronously, indicating that there is air leakage in the air chamber.

9. If the pressure value of the barometer does not drop, but that of the hydraulic gauge drops, it indicates that there is oil leakage in the hydraulic chamber of the booster pump.

S/N	Common faults	Fault analysis	Troubleshooting and Treatment Measures	Remarks
1	Air leakage of air chamber	1. The edge of air piston rubber ring is worn 2. There are foreign matters on the edge of air piston rubber ring 3. The inner surface of the cylinder block is not clean 4. There is no or little grease on the surface of cylinder block	1. Replace the air piston rubber ring 2. Clean the edge of air piston 3. Clean the inner surface of cylinder block 4. Apply an appropriate amount of grease to the inner surface of cylinder block	
2	No oil pressure	1. The seal is damaged 2. Piston jamming	1. Replace the seal 2. Replace the product assembly	
3	Oil leakage at the joint between hydraulic cylinder block and connecting cover	1. Loose oil storage cup assembly 2. The O-ring is damaged	1. Re-tighten the oil storage cup assembly to 25+5 N·m 2. Replace the O-ring	
4	Oil leakage at the joint between oil cup and hydraulic cylinder block	O-ring is deformed or damaged	Replace the O-ring	
5	Oil spreading of connecting cover	1. The Y-ring inside the connecting cover is damaged or falls off 2. The dust ring inside the connecting cover is damaged or falls off	1. Replace the Y-ring 2. Replace the dust ring	

Note: If the inner surface of cylinder block is rusted or the piston gets stuck, it is recommended to replace the assembly

V. Main Components

Section V Air Brake Valve

Contents

5.5. Air Brake Valve

5.5.1 Working Principle

When the driver depresses the brake pedal, a certain pressure is applied to the balance spring through the ejector rod, so as to push the piston to move downward to open the air intake valve. Compressed air is then output from the air inlet to the air outlet. When the air pressure at the air outlet rises to 20 ~ 80 kPa, the power supply is turned on and the brake lamp lights up. When the pedal is released, the return spring pushes the piston upward to return the air intake valve and close the channel between the air inlet and the air outlet. The residual air pressure at the air outlet is discharged from the exhaust port. When the air pressure at the air outlet drops to 80 ~ 20 kPa, the power supply is cut off and the brake lamp goes out.

5.5.2 Purpose

This product is suitable for the brake systems of the engineering machinery loader, bulldozer and road roller. It is a valve controlled by the driver's foot.

Structural Diagram of Air Brake Valve

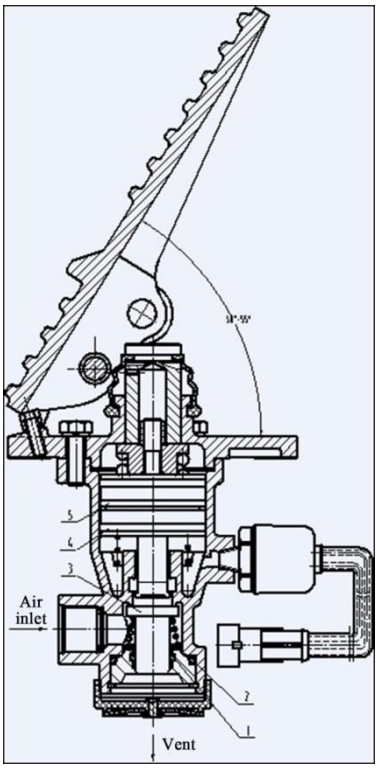


Fig. 5-05-01

List of Wearing Parts			
S/N	**Description**	**Figure No.**	**Qty.**
1	Lower valve stem seal ring	CA141-3514021	1
2	O-ring	XM60C-3514054	1
3	Lower valve assembly	CA141-3514030C	1
4	Split guide ring	XM60C(LGA)-3514012A	2
5	O-ring	XM60C-3514053A	1

Main technical parameters	
Rated working air pressure	784kPa
Working medium	Air
Operating temperature	-30～+80℃

Precautions for use

Before installation, remove the protective plugs of each air inlet and outlet to ensure that the pedal is firmly connected with the valve body. Adjust the valve clearance with adjusting screws (ensure that the margin of the ejector rod pressed down by the roller is not more than 0.5 mm), and lock the nuts.

M8 bolts are firmly connected through 4-φ9 holes.

The air inlet and outlet shall be distinguished when the gas circuit is connected.

Precautions for maintenance

There shall be water discharge and filtering devices in the air circuit to ensure the cleanliness of the air source.

The pipelines and air reservoirs of the air brake system shall be subject to anti-rust treatment.

The use space shall ensure that the foot pedal can move freely.

When replacing wearing parts, they shall be replaced according to the physical objects of wearing parts. The fasteners (retainer rings and bolts) damaged during replacement must be replaced, and it shall be ensured that they are installed in place, firm and reliable without damaging other components. After replacement, it shall not be used unless passing the test;

The moving parts of the air brake valve shall be maintained with grease. If the brake is ineffective or weak, check the wearing parts of the brake system and air brake valve.

Warning

When it is suspected that there is air leakage in a non-braking state, there is no need to remove the air brake valve. When about 800kPa of air pressure is charged into the air inlet, immerse the exhaust port of the valve in water:

When no bubbles or occasional bubbles appear in the water, it indicates that the non-braking performance of the air brake valve is normal.

When there are continuous bubbles in the water, it indicates that the air brake valve leaks in a non-braking state.

Fig. 5-05-02

5.5.3 Analysis and Troubleshooting of Non-braking Air Leakage

① Unscrew the dust cover assembly

② Remove the retainer ring with retainer pliers

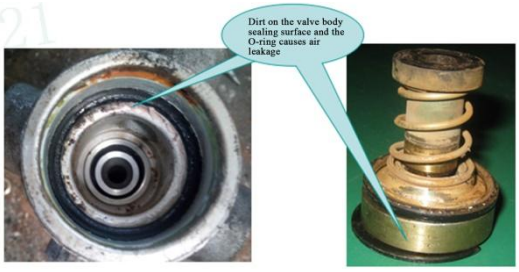
③ Remove the parts at the non-braking end, clean the interior of the valve body and its components, and replace the wearing parts.

Failure mode of non-braking air leakage of air brake valve (I)

Repair method: Disassemble the valve and check whether the valve plane is damaged. If not, clean it with clear water or cleaning agent that has no impact on rubber. Avoid damaging the rubber plane during cleaning.

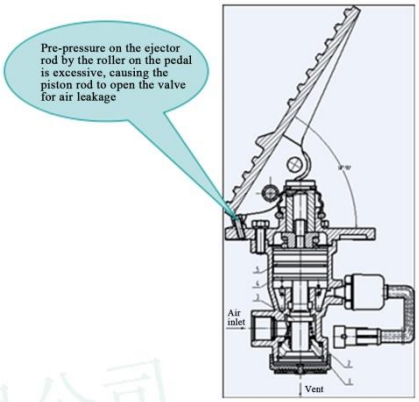
Failure mode of non-braking air leakage of air brake valve (II)

Repair method: Clean the dirt on the sealing surface and O-ring of the valve body, and take protective measures during cleaning. If the sealing surface of the valve body is damaged, replace the product; if the O-ring is damaged, go to a 4S store to replace the O-ring or replace the product.



Failure mode of non-braking air leakage of air brake valve (III)

Repair method: Adjust the M6 bolt at the bottom of the pedal with a solid wrench 8-10 to ensure that the roller is in contact with the ejector rod and can be rotated by hand, and then lock the nut.



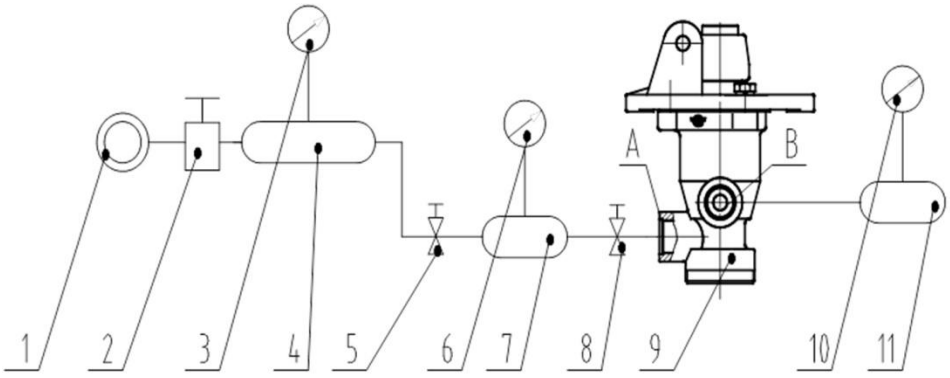
When it is suspected that there is air leakage in the full braking state, remove the air brake valve and verify it with a type test bench. When about 800kPa of air pressure is charged into the air inlet, press down the tappet. When the air outlet pressures are about 400 kPa and 800 kPa respectively, check the exhaust port of the valve with soap solution:

1. When no bubbles or occasional bubbles appear at the exhaust port, it indicates that the full braking performance of the air brake valve is normal.

2. When there are continuous bubbles coming out of the exhaust port, it indicates that the air brake valve leaks in a full braking state.

Method for testing the performance of air brake valve

Schematic Diagram of Test Device:



1 - Air source; 2 - Pressure regulating valve; 3, 6, 10 - Standard pressure gauge (with an accuracy not less than Grade 0.4); 4 - 30 L air reservoir; 5, 8 - Stop valve; 7, 11 - 1 L air reservoir; 9 - Air brake valve (part under test)

Fig. 5-05-03

Input 784±20 kPa air pressure into the air inlet A, press down the tappet. When the air pressure at the air outlet B is 400±20 kPa and 784±20 kPa respectively, close the stop valve 5. Check with soap solution, and there shall be no

leakage. (In case of leakage, observe Table 6 and the determined tightness index is not more than 20 kPa.)

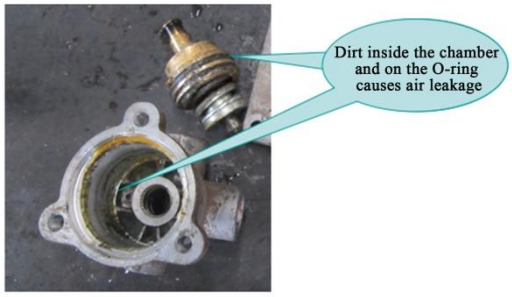
5.5.4 Analysis and Troubleshooting of Full Braking Air Leakage

① Remove the three M8 bolts with a pneumatic impact wrench.

② Remove the parts at the full braking end, clean the interior of the valve body and its components, and replace the wearing parts.

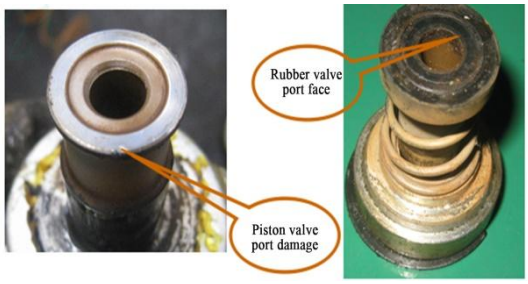
Failure mode of full braking air leakage of air brake valve (I)

Repair method: Clean the dirt on the sealing surface of the internal hole of the valve body, piston and O-ring. Take protective measures during cleaning. If the sealing surface of the internal hole of the valve body is damaged, replace the product; if the O-ring is damaged, replace the O-ring or replace the product.



Failure mode of full braking air leakage of air brake valve (II)

Repair method: Disassemble the product, check whether the piston valve port and valve plane are damaged. If the piston valve port is damaged, replace the product. If the piston valve port and valve plane are not damaged, clean them with clear water or cleaning agent that has no impact on rubber. Avoid damaging the rubber plane during cleaning. If the valve plane is damaged, replace the product or replace the components of the lower valve.



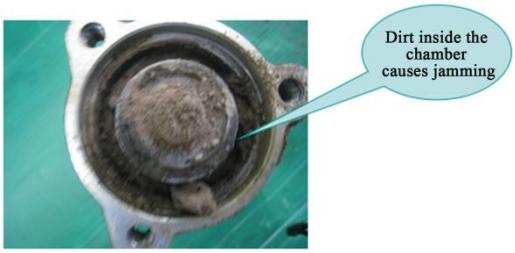
5.5.5 Analysis and Troubleshooting of Jamming

1. When the air brake valve is jammed, if the pedal cannot return automatically or cannot be depressed with foot, it indicates that the piston is jammed.

2. When the air brake valve charge air to the air inlet in a non-braking state, if the air is quickly discharged from the exhaust port, it indicates that the lower valve is jammed.

Failure mode of air brake valve jamming (I)

Repair method: Disassemble the product. If the piston chamber is blocked by dust, remove the dust without damaging components.



Failure mode of air brake valve jamming (II)

Repair method: Disassemble the product. If jamming is caused by the guide ring on the piston, replace the product.

V. Main Components

Section VI Unloading Valve

Contents

5.6 Unloading Valve

5.6.1 Purpose

The unloading valve is suitable for the brake system of engineering vehicles and automobiles, which is used to automatically adjust the working pressure in the brake system and can automatically discharge the filtered oil, water and other impurities through unloading.

5.6.2 Working Principle

The compressed air from the air compressor enters the valve body through the air inlet. The moisture and impurities in the air condense at the exhaust port, and the compressed air reaches the air outlet through the check valve to inflate the air reservoir.

When the air pressure of the air reservoir reaches the cut-off pressure, the gas entering the upper cover chamber overcomes the acting force of the pressure regulating spring, pushes the diaphragm assembly upward, and opens the lower exhaust valve to discharge compressed air in the valve body together with water and impurities at the exhaust port into the atmosphere through the exhaust port, so that the air compressor is in no-load operation. When the air pressure of the air reservoir drops to the stop exhaust pressure value and the air pressure in the upper cover chamber is insufficient to overcome the pressure of the pressure regulating spring, The diaphragm assembly moves down, and the exhaust valve moves up under the action of the spring to close the exhaust valve port, so that the valve continues to supply air to the air reservoir. When the air pressure of the air reservoir reaches the cut-off pressure, the exhaust valve below is opened, and the cycle repeats.

Main technical parameters	
Cut-off pressure	784kPa±20kPa
Pressure drop	60～130kPa
Operating temperature	-30～+100℃
Weight	0.8kg

Wearing parts			
S/N	**Description**	**Figure No.**	**Qty.**
1	Check valve	SLKJ-3512019	1
2	Exhaust valve	WSL-1109038 A	1
3	O-ring	EQ153-3512028	1
4	Diaphragm	EQ153-3512032	1

5.6.3 Correct Use and Maintenance Methods

1. Precautions for use

① Remove the protective plugs of each air inlet and outlet before installation.

② The product shall be installed on the mounting plates with a spacing of 70, and the exhaust port shall face downward.

③ The air pressure adjusting screw has been set before leaving the factory, and users are not allowed to adjust or remove it.

2. Precautions for maintenance

① The valve pipe from the air compressor can fully cool the hot air, condense and precipitate moisture in the air, give full play to the function of the valve and prolong its service life.

② If the wearing parts are found to be seriously worn or have serious air leakage, they shall be replaced immediately.

③ When replacing wearing parts, they shall be replaced according to the physical objects of wearing parts. The fasteners (bolts and nuts) damaged during replacement must be replaced, and it shall be ensured that they are installed in place, firm and reliable without damaging other components. After replacement, they shall not be installed without passing the test.

5.6.4 Common Faults, Fault Analysis and Troubleshooting Methods

S/N	Common faults	Fault analysis	Troubleshooting
1	Air leakage at the exhaust port	O-ring on the exhaust valve stem is damaged	Replace the O-ring on the exhaust valve stem
		Exhaust valve is damaged	Replace the exhaust valve
		Iron filings on the exhaust valve	Clean the pipeline
2	Air leakage from the exhaust hole of the body	Diaphragm damage	Replace the diaphragm

V. Main Components

Section VII Drive Axle

Contents

5.7 Drive Axle

5.7.1 Structure and Function

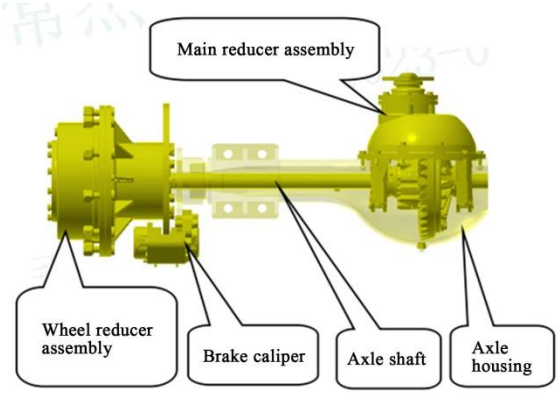


Fig. 5-07-01

(I) Functions of drive axle

1. Power transmission function: After the power input by the transmission and drive shaft is reduced in speed and increased in torque, it changes the transmission direction (driving and driven gears), and then drives the left and right tires to rotate via the axle shaft, thus making the vehicle move forward or backward. The left and right driving wheels are allowed to rotate at different speeds.

2. Function of supporting the vehicle: The front and rear drive axles support the weight of the vehicle through the frame.

3. Steering function: It implements the steering of the vehicle (except for the overall steering of the whole axle).

4. Differential function: It realizes vehicle turning and other functions.

(II) Drive axle structure

The drive axle of a wheel loader is mainly composed of 5 parts: axle housing, main reducer assembly, axle shaft, wheel reducer assembly and brake caliper. The main reducer assembly contains the differential assembly. The power from the engine passes through the transmission components and is input into the main reducer for one-stage deceleration, then transmitted to the wheel reducer through the axle shaft for deceleration, and finally output through the rim and tire. The driving spiral bevel gear is right-handed, and the driven spiral bevel gear is left-handed.

Total oil filling capacity of drive axle: 36L, 10L for intermediate axle pack, and 4L for wheel hubs on both sides.

(III) Structure and principle of wheel reducer

Fig. 5-07-02

The wheel reducer is mainly composed of sun gear, planetary gear, planetary gear bracket and ring gear. Planetary transmission principle of wheel reducer assembly: The axle shaft drives the sun gear with spline integrated into it to rotate at a speed and direction of n sun, while the planetary gear meshed with the sun gear rotates in the opposite direction. Since the ring gear is fixed, the planetary carrier rotates in the same direction as the sun gear at a speed of n frame. As the n frame is less than n sun, deceleration is achieved.

(IV) Structure and principle of differential

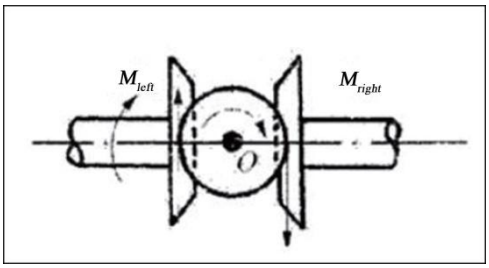


Fig. 5-07-03

The differential is mainly composed of four bevel planet gears, four bevel gear gaskets, cross shaft, two axle shaft gears, two axle shaft gear gaskets and left and right housings of the differential. Working principle of differential: When the driving wheel is running on the road, if the resistance torque acting on the axle shaft axis at the contact between the left and right wheels and the ground is not equal, and if the difference between the resistance torques of the two wheels is greater than the torque of the internal resistance to be overcome for the rotation of the planetary gear, the planetary gear will rotate around its own axis, so that the left axle shaft gear and the right axle shaft gear rotate in opposite directions. As long as the difference between the resistance torques of the left and right wheels is a torque to overcome the rotating friction inside the differential, the left axle shaft and the right axle shaft can rotate at their respective speeds, which plays the role of differential.

5.7.2 Removal and Repair

Tools used:

1. Two 10t traveling	7. 46 sleeves;
2. Special lifting	8. 1-inch and 2-inch
3. Special bracket for	9. 16-18 open-end wrench;
4. Special extended	10. 19-22 open-end wrench;
5. K50 air ejector	11. 27-30 open-end wrench;
6. 46 anti-rotation wrench;	12. 500N.m and 1200N.m torque wrenches;

(I) Introduction to the position of drive axle on the product

1. The drive axle is divided into front and rear axles. The front axle is directly fixed on the front frame, and the flange surface of the front axle is connected with the front drive shaft. The rear axle is fixed on the oscillating suspension and connected with the rear drive shaft. One tire is installed at each wheel hub.

2. Assemble eight M24×280 bolts and eight M24 washers for connecting the front drive axle with the front frame, and assemble eight M24×240 bolts and eight M24 washers for connecting the rear drive axle with the oscillating suspension;

3. Assemble the steel pipe assembly and tee joint connected to the drive axle.

(II) Disassembly steps

1. Remove the connecting bolts between the drive axle and the drive shaft to separate the drive axle from the drive shaft.

2. Disconnect the steel pipe assembly connected to the drive axle from the tee joint.

3. Remove the eight M24×280 bolts and eight M24 nuts connecting the front drive axle to the front frame. Remove the eight M24×240 bolts and eight M24 nuts connecting the rear drive axle to the oscillating suspension. Lift the frame with two 10t overhead cranes and push away the drive axle.

4. Fix the drive axle on a special bracket, remove the rim nut connecting the front drive axle and the tire, lift down the tire with a special lifting appliance, mark it and place it on the tire rack.

(III) Commissioning requirements

If commissioning is required, it shall be carried out by designated personnel.

(IV) Installation

1. Installation sequence: First assemble the frame system with the front and rear drive axles; connect the tee joint steel pipe assembly on the axle; connect the flange surface of the axle with the drive shaft; finally, install the tire on the drive axle.

2. Maintain cleanliness during assembly. Pay attention to the direction of drive axle flange when lifting the drive axle.

3. The assembling torque shall be as specified in the torque table.

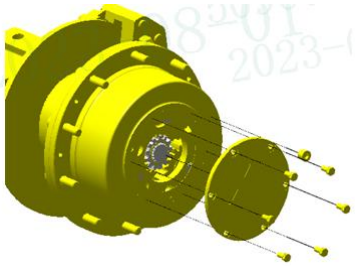
5.7.3 Disassembly and Repair

(I) Disassembly of drive axle

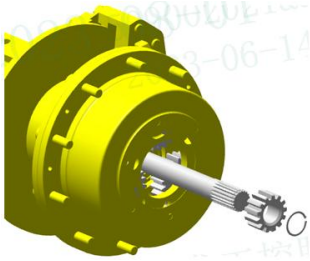
1. Disassembly of wheel reducer assembly

① Place the drive axle horizontally on the tooling rack, rotate the gear brackets on both sides to make the two wheel-hub screw plugs at the lowest point of the circumference, and place two oil collecting devices right below the wheel-hub screw plugs.

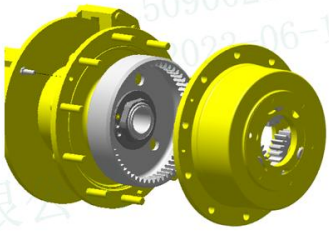
② Remove the screw plug and introduce oil into the oil holding device; remove the 6-bolt M12×1.5×25 on the wheel-hub end cover with a wrench or other tools, install two long bolts into the screw holes of the wheel-hub end cover, and hold the long bolts to remove the wheel-hub end cover.



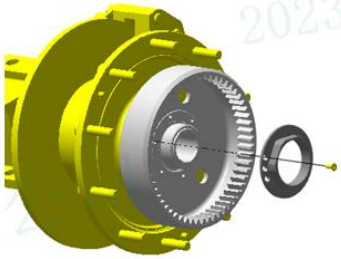
③ After the gear oil is drained completely, knock the end of the axle shaft with a copper rod to make it pop out. Remove the axle shaft snap spring and take off the sun gear. Pull out the axle shaft carefully.



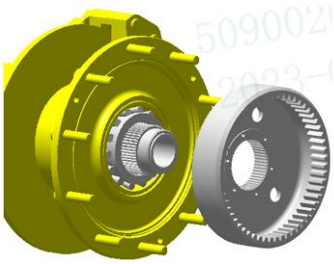
④ Loosen the three M12×35 tension bolts on the back of the wheel housing, and then screw them into the two threaded jackscrew holes on the gear bracket. When the gear bracket is separated from the joint surface of the wheel housing, use the hook of the lifting appliance to pass it through the bolt hole, and remove the planetary gear bracket assembly.



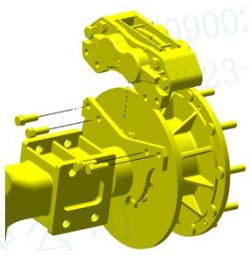
⑤ Remove the hexagon socket screw of the round nut with an Allen wrench, put a thin iron rod (long bolt, etc.) on the screw hole of the round nut, and then remove the round nut along the loosening direction of the round nut with the iron rod.



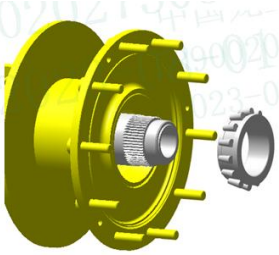
⑥ Remove the inner gear ring.



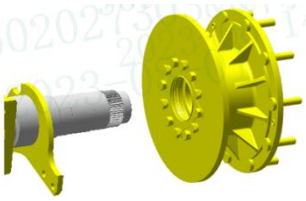
⑦ Unscrew the four M20×1.5×56 fixing bolts and washers of brake caliper with a wrench. Remove the brake caliper carefully.



⑧ Remove the inner ring of bearing 32221.

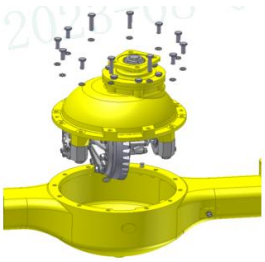


⑨ Hook the threaded hole of the wheel housing with a lifting appliance, and slowly remove the wheel housing assembly.



2. Disassembly of main reducer assembly

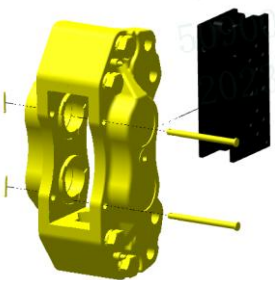
Use a wrench to remove 8-bolts M12×35 and 4-bolts M12×60 (12 in total) which combine the main reducer assembly with the axle housing and gaskets.



3. Disassembly of brake caliper

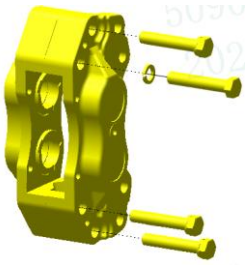
① Place the brake caliper on the workbench with the outer caliper body facing upward.

② Remove the two cotter pins from the key-bolt with needle-nose pliers, then remove the key-bolt, and finally remove the two brake pads and put them aside.



③ Unscrew the deflating valves on the two inner calipers with a wrench, and then take out the two Φ9 steel balls in the deflating valve holes and put them aside.

④ Loosen the four bolts M22×120 and washers on the inner caliper body with a wrench



⑤ Carefully pick up the inner caliper body and turn it over by 180°, place it on the workbench, and then take out two O-rings 20×2.4.

⑥ Clamp the piston removal tooling on the groove in the piston, and then remove the piston from the caliper body with a jackhammer and tooling.

⑦ Take out the seal removal tooling, and remove the rectangular seal ring and dust cover in the caliper body.

(II) Repair of drive axle

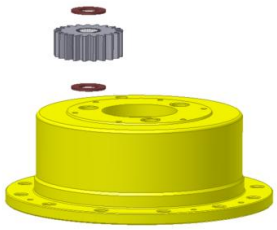
Warning

Before assembling, all disassembled components shall be cleaned; worn or damaged parts, especially sealing parts, shall be replaced; for the positions sealed with sealant, such as the joint between axle housing and bracket flange surface, the sealant shall be scraped clean.

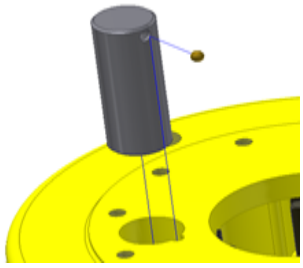
1.Repair of planetary gear bracket assembly

① Put 28 needle rollers coated with grease into the planetary gear, and seal both ends of the inner hole of the planetary gear with spacer bushes.

② Put the three assembled planetary gear assemblies and planetary gear gaskets into the planetary gear bracket as shown in the figure.

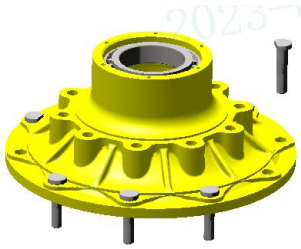


③ Align the planetary gear shaft and steel balls with the planetary gear shaft hole and ball positions on the planetary gear bracket, and knock them into the planetary gear bracket.



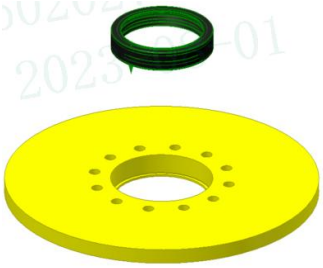
2. Repair of wheel housing assembly

① Knock 10 rim bolts into the bolt holes with a copper rod, and then press the bearing 32022 outer ring into the wheel housing. Apply grease to the bearing inner ring during assembly.



② Press the outer ring of bearing 32221 into the wheel housing, and apply grease to the bearing inner ring during assembly.

③ Install the seal ring ZD120×150×24 into the brake disc with special tooling.

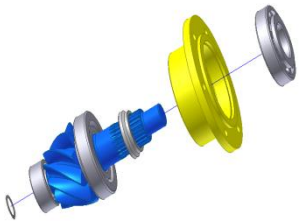


④ Assemble the brake disc equipped with O-ring 165×3.55 to the wheel housing assembly with 12 bolts M16×45 and 12 spring washers of 16. At the same time, assemble the dust cover on the brake disc with the above bolts.

3. Repair of main reducer assembly

① Press-fit the inner ring of bearing 30310 and bearing NUP2305E onto the driving spiral bevel gear with an oil press.

② Install the retainer ring 25, press the outer ring of bearing 30310 and the outer ring of bearing 30309 onto the bearing pedestal with an oil press, and then install the stepped sleeve and bearing pedestal assembly and the inner ring of bearing 30309 on the driving spiral bevel gear in turn.

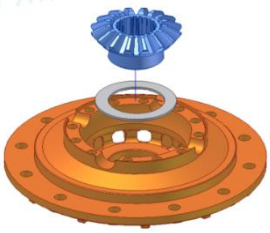


③ Press the seal ring of seal ZD65×90×20.5 into the sealing cover with an oil press, and assemble the paper pad and sealing cover assembly onto the driving spiral bevel gear assembly.

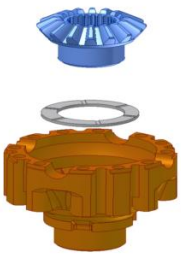
④ Assemble the input flange welded part, washer and lock nut to the driving gear assembly. The torque is 480N.m.

⑤ Assemble the assembled driving gear assembly on the bracket with 6-bolts M12X55. Note that gaskets shall be used to adjust the tooth surface mark in the middle of the bracket and bearing sleeve. The adjustment method is shown in Fig. C-16, and the tightening torque of M12×55 bolts is 90N.m. 598 plane sealant shall be applied on the joint surface of bracket and bearing sleeve for sealing.

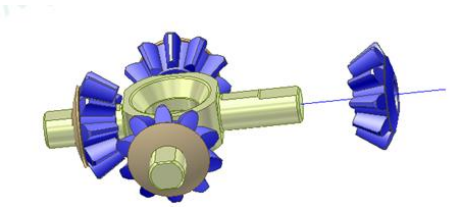
⑥ Put the axle shaft gear gasket and axle shaft gear into the right housing of the differential in turn. Note that there shall be no jamming of the gears when rotating the axle shaft.



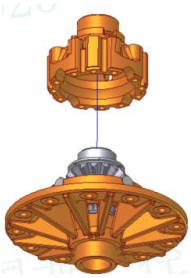
⑦ Put the axle shaft gear gasket and the axle shaft gear into the left housing of the differential in turn. Note that there shall be no jamming of the gears when rotating the axle shaft.



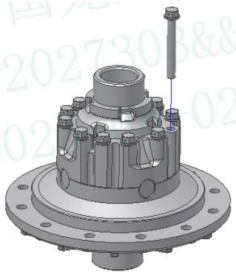
⑧ Assemble the bevel gear and bevel gear gasket onto the cross shaft in turn.



⑨ Place the assembled cross shaft on the right housing of the differential, and assemble the left and right housings in pairs.

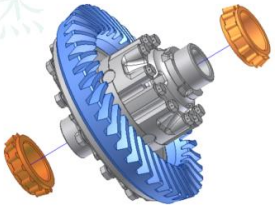


⑩ Lock it with 8-M12×1.25×80 differential bolts, and tie them together crosswise with iron wires (three bolts as a group) to prevent loosening. The tightening torque of M12×1.25×80 bolt is 135N.m.

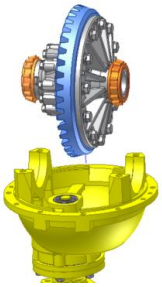


⑪ The driven spiral bevel gear is matched with the differential right housing and connected by 12-M14×1.5×40 driven spiral bevel bolts and spring washers. The tightening torque of M14×1.5×40 bolts is 230N.m.

⑫ Shrink-fit the inner rings of two bearings (32214) to the left and right differential housings.

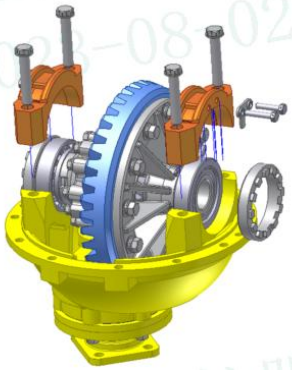


⑬ Assemble the assembled differential assembly onto the bracket assembly.



⑭ Assemble the outer rings of two bearings (32214) on the bracket 32214 bearing position.

⑮ Cover the bearing cap, and adjust the meshing clearance and bearing play of driving and driven spiral bevel gears with adjusting nuts. It needs to be adjusted to 0.2 ~ 0.35, and the clearance between two 32214 bearings is 0.03 ~ 0.08. After adjusting the clearance, tighten four M16×1.5×94 bolts with a tightening torque of 330N.m. Clamp the locking piece on the adjusting nut to prevent it from loosening. Lock the locking piece with four M10×1×20 bolts, with a tightening torque of 50N.m. Four M16×1.5×94 bolts are tied with iron wires in a figure-eight knot for locking, and the locking wire crosses around the M10 bolt.



⑯ The meshing clearance between driving and driven spiral bevel gears is adjusted by applying red lead powder on the tooth surface of driven spiral bevel gear first, and then rotating the gear to observe the meshing marks. If the mark is ≥40% in the direction of tooth height and ≥50% in the direction of tooth length, it is qualified.

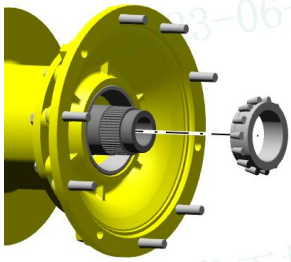
Schematic diagram of the adjustment method:

Location of contact marks on driven gear surface		Adjustment method	Gear moving direction
Forward	Reverse		
		Move the driven gear closer to the driving gear, and if the backlash is too small as a result, move the driving gear outward.	
		Move the driven gear away from the driving gear, and if the backlash is too large as a result, move the driving gear inward.	
		Move the driving gear closer to the driven gear,and if the backlash is too small as a result, move the driven gear outward.	
		Move the driving gear away from the driven gear,and if the backlash is too large as a result,move the driven gear inward.	

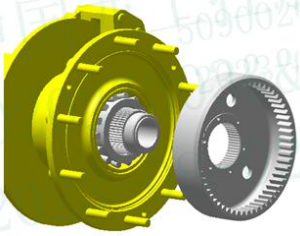
4. Repair of drive axle assembly

① Lift the assembled wheel housing assembly onto the axle housing assembly with a lifting appliance. Avoid the damage caused by collision between the oil seal position and the supporting shaft.

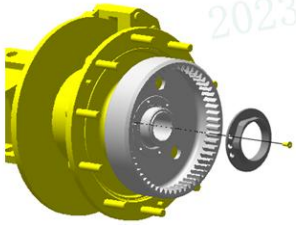
② Install the 32221 bearing inner ring. During installation, apply a layer of grease to the 32221 bearing outer ring to ensure lubrication of the bearing.



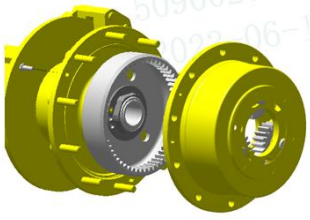
③ Install the inner gear ring.



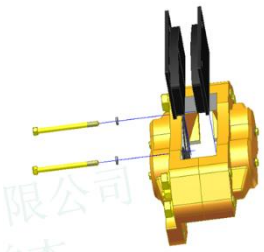
④ Install the round nut. When adjusting the wheel hub pre-tightening force, tighten the round nut until the wheel hub assembly can only be barely rotated, and then rotate the round nut for 1/10 turn. After the pre-tightening force is adjusted, align the round nut screw hole with the ring gear screw hole, and tighten it with two hexagon socket screws M10×25 using an Allen wrench. Apply 2~3 threads of 262 thread locking agent to the two hexagon socket screws M10×25.



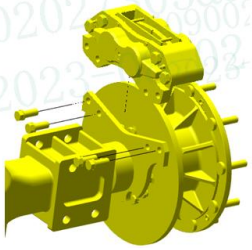
⑤ Assemble the installed planetary gear bracket assembly, and check whether the inside of the planetary gear bracket is clean and free of foreign matters. Then, Install the O-ring 335×3.55 on the rabbet of the planetary gear bracket, hang it in the rim bolt hole with a lifting appliance, align it with the rim bolt and install it into the planetary gear bracket assembly. Finally, install it onto the back of the wheel housing with 3-bolts M12x35.



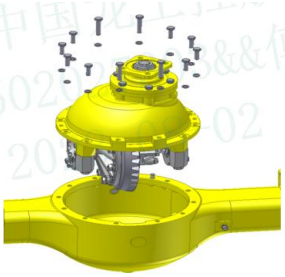
⑥ Put the two friction discs on the brake caliper assembly with the friction surface facing inward. Tighten two M10×116 bolt pins threaded with M10 elastic washers, with a tightening torque of 40N.m



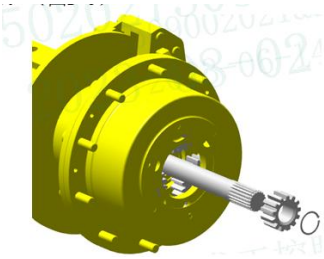
⑦ Install the assembled brake assembly. The connecting bolts between the brake assembly and the brake caliper bracket are 4-M20×1.5×56 bolts, with a tightening torque of 370 ~ 450 N.m.



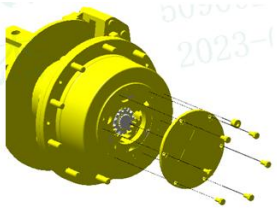
⑧ Check whether there is any foreign matter in the inner chamber of the axle housing. Apply 598 plane sealant evenly on the large flange surface of the axle housing with a glue gun, and pay attention to that it shall be uniform without gaps. The 598 plane sealant forms a closed loop. Connect the main reducer assembly and axle housing assembly with 8-M12×35 and 4-M12×60 bolts (12 in total). The tightening torque of the 12 bolts is 320 ~ 330 N.m. Bolts are tightened diagonally. Tighten the screw plug at the bottom of the axle housing with an Allen wrench, and the number of exposed threads of the screw plug is 3 ~ 5.



⑨ Install the cleaned axle shaft, sun gear and retainer ring 48.



⑩ Six M12×1.5×25 bolts are inserted into the wheel-hub end cover assembly and aligned with the bolt holes of planetary gear bracket. The tightening torque of bolts is 80 ~ 86 N.m, and the bolts are tightened diagonally. Tighten the screw plug with an Allen wrench.



5. Repair of brake caliper

Warning

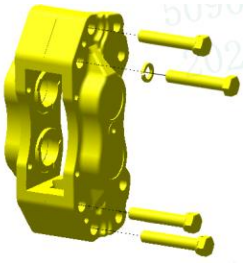
Before assembly, all disassembled parts shall be cleaned; worn or damaged parts, especially sealing parts, shall be replaced; the parts with seals, such as two seal grooves inside the caliper body, shall be cleaned.

① Install the rectangular seal ring into the sealing groove below the caliper body inner hole, and install the dust cover into the groove above the caliper body inner hole.

② Evenly apply silicone grease to the dust cover and inner holes of rectangular seal ring for a full circle, so as to ensure that there is silicone grease on the surfaces of dust cover and rectangular seal ring. Then lay the piston flat on the piston hole of the caliper body, and press the piston into the piston hole with tooling.

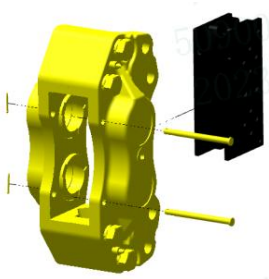
③ Install qualified O-rings into the counterbore at both ends of the outer caliper body, with one each on the left and right sides of each outer caliper body, and press them flat by hand. Then lift the inner caliper and turn it over by 180°, align it with the bolt holes of the inner and outer calipers, and gently place the inner caliper on the outer caliper. When placing, align the outer edges of the inner and outer calipers.

④ Align the inner and outer caliper bolt holes, screw in four spring washers Φ22 and bolts M22×120, and lock them with a wrench. The torque value is 550 N·m.



⑤ Put the steel balls Φ9 into the holes at both ends of the inner caliper body, with one each on the left and right sides of each brake, and then screw one deflating valve in each threaded hole after putting in the steel ball Φ9. The tightening torque is 20 N·m ~ 30 N·m.

⑥ Put the two friction discs on the brake caliper assembly with the friction surface facing inward. Insert two bolt pins φ10×125 and lock them with two pins 3.2×26.



6. Gas test

Air pressure: 0.1~0.15Mpa. Tighten the screw plug after injecting gear oil, and apply 567 pipe thread sealant to the screw plug. Conduct test run, which shall be in accordance with the test run outline.

Attachment: Tools, equipment and supplies for disassembly and repair of drive axle

1. Place the drive axle assembly rack;	2. Wheel hub bearing press-fitting tooling;
3. Pneumatic wrench;	4. Oil press;
5. Iron rod (diameter slightly smaller than the screw hole of planetary gear bracket, length about 300mm);	6. Copper rod (diameter 40~50mm, length about 300mm);
7. Crane, hook and chain;	8. No.0 fine mesh gauze;
9. Allen wrench (for removal and installation of round nut and screw plug);	10. Press-fitting tooling for driving gear bearing;
11. Hammer and chisel;	12. Fixing tooling of driving spiral bevel gear pair;
13. 46 anti-reverse wrenches;	14. Dial indicator
15. 46 sleeves;	16. Red lead powder;
17. 1-inch and 2-inch adjustable wrenches;	18. Input flange installation tool;
19. 16-18 open-end wrench;	20. 262 thread locker, 598 plane sealant and 567 pipe thread sealant;
21. 19-22 open-end wrench;	22. Iron wire 16#×500;
23. 27-30 open-end wrench;	24. Socket wrench;
25. Gas test equipment.	

5.7.4 Faults and Troubleshooting

(I) Insufficient driving force

Fault characteristics: The loader has normal pressure response in all gears, with sudden weakness during operation, but it runs normally on the road.

Possible cause: The axle shaft of the front or rear axle is twisted off, resulting in insufficient driving force.

Inspection steps or handling methods:

1. Remove the rear drive shaft first, and then start the engine and engage the first gear. If it cannot run, the front axle shaft is twisted off.

2. If it can still run after the rear drive shaft is removed, install the rear drive shaft and remove the front drive shaft. At this point, if the loader cannot run, the rear axle shaft is twisted off.

3. Alternatively, directly remove the front and rear axle wheel-hub end covers to check whether the axle shaft is twisted off.

Note: If the axle shaft is twisted off, clean the inside of the drive axle before replacing it.

(II) Abnormal noise from wheel hub during driving

Fault characteristics: When driving, the tires swing significantly from side to side,

and in severe cases, the loader shakes and even cannot travel.

Possible causes:

1. Excessive clearance or burn of wheel-hub bearing.

2. The wheel-hub gear has broken teeth.

3. The wheel-hub round nut is loose.

Inspection steps or handling methods: Disassemble the wheel hub for inspection and repair.

(III) Abnormal noise from main drive

Fault characteristics: The noise is more obvious when the machine runs in a straight line at high speed during deceleration.

Possible causes: loose bearing; excessive clearance or irregular meshing between driving gear and driven gear.

Inspection steps or handling methods:

1. Remove the drive shaft, grasp the input flange of the main drive with both hands, push and pull it up and down to see whether it swings obviously, or push and pull it in and out to check whether

there is obvious travel, so as to determine the noise is from the front or rear main drive.

2. Remove the main drive and check the bearing clearance on the driving spiral bevel gear, as well as the clearance between the support bearings of the left and right housing journals.

3. Check the meshing surface and clearance between driving spiral bevel gear and driven spiral bevel gear.

4. Disassemble the differential and check the bevel gear clearance.

Note: The installation must be carried out in strict accordance with the drive axle requirements corresponding to each model.

(IV) Abnormal noise when the loader turns

Fault characteristics: The noise is more obvious when turning, and the steering is hard.

Possible cause: The differential is damaged.

Inspection steps or handling methods: Remove the main drive and disassemble it for repair.

V. Main Components

Section VIII Torque Converter

Contents

5.8 Torque Converter

5.8.1 Structure and Function

The torque converter is connected with the diesel engine. It can automatically adjust the output torque and speed, so that the loader can automatically change its speed and traction according to road conditions and resistance to adapt to changing working conditions. After the gear is engaged, automatic stepless speed change can be realized from starting to the maximum speed of the highest gear, with stable start and good acceleration performance. In case of a steep slope or a sudden obstacle, the loader can decelerate automatically with gear shift to increase traction force and can go over the obstacle at any low speed. After the external resistance is reduced, it can automatically increase speed quickly to improve operation efficiency. When shoveling materials, it can stretch the bucket into the material pile at a high speed and, as the resistance increases, automatically decelerate to increase the wheel-hub traction force to ensure deep shoveling.

The hydraulic torque converter is a non-rigidly connected transmission device, which is mainly composed of several impellers. It is transmitted by liquid and has good vibration isolation and damping effects, making the transmission stable and prolonging the service life of equipment. Its power is transferred by the change of momentum of liquid, and it has good automatic adaptability of speed and torque, improving the working efficiency of operation machinery and the passing capacity of traveling vehicles.

The hydraulic torque converter is directly fixed and installed on the engine flywheel housing, with elastic disc power input, coaxial output and flange output end.

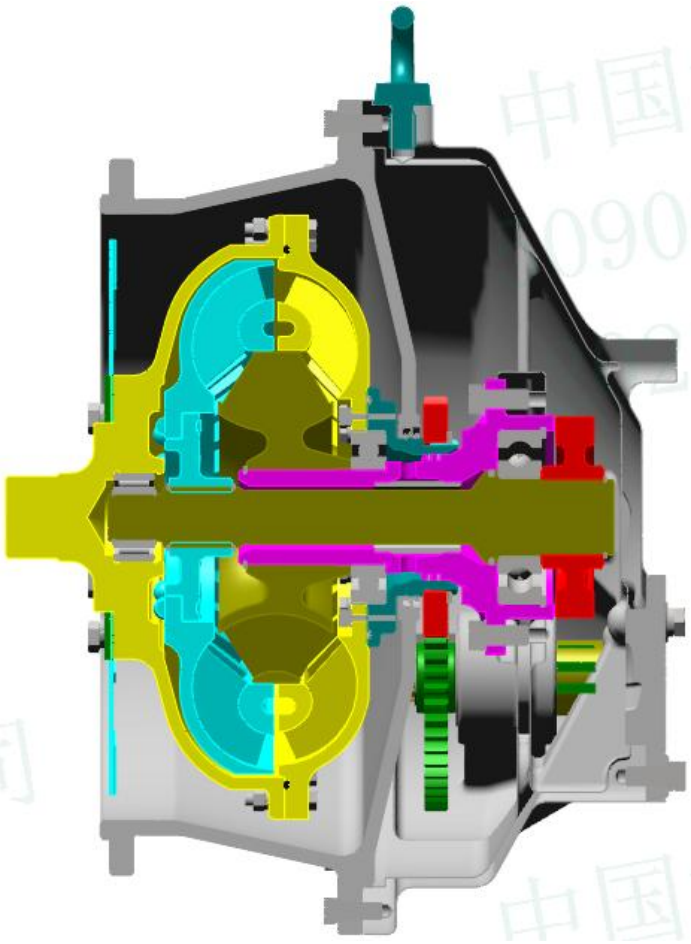


Fig. 5-08-01

Item		
Type of hydraulic torque converter		Single-stage single-phase centripetal turbine
Direction of rotation (viewed from the input end)		Clockwise
Maximum input speed		2400r/min
Input power		38～105kW
Working fluid		No.6 or No. 8 hydraulic transmission oil
Outlet oil temperature	Common	80～110℃
	Short-time	120℃
Inlet oil pressure		0.45～0.65Mpa
Outlet oil pressure		0.25～0.5Mpa
性能参数		
Effective diameter D		315mm
Maximum efficiency ηmax		≥0.82
Zero-speed torque conversion coefficient K0		3.45±5%
Nominal torque MBgη		69.16±5% N.m

The hydraulic torque converter consists of the flow passages of pump pulley, turbine and guide wheel to form a space for liquid circulation, thus forming a closed body together with the pump pulley cover.

The power of the engine is transmitted to the pump pulley through the elastic disc and the pump pulley cover.

Under the action of centrifugal force, the pump pulley converts the mechanical energy of the engine into kinetic and pressure energy of the working fluid to drive the turbine to rotate. The turbine then converts the liquid energy into mechanical energy.

The liquid flowing out of the turbine passes through the fixed guide wheel, converting part of pressure energy into kinetic energy, increasing the rotation degree of the liquid and then returning to the inlet of the pump pulley. The liquid circulates like this, forming the normal operation of the hydraulic torque converter.

The action of the guide wheel increases the velocity circulation of liquid at the inlet of the pump pulley, thus increasing the output torque of the hydraulic torque converter and "converting the torque". The degree to which the output torque increases depends on the outlet conditions of the turbine, that is, this change occurs automatically with changes of load. That is, when the load increases, the output speed automatically decreases, the velocity circulation of liquid at the turbine outlet decreases, the velocity circulation of liquid at the pump pulley inlet increased by the guide wheel increases, and the torque output by the turbine also increases. On the contrary, when the load decreases, the output speed automatically increases, and the output torque also decreases. This characteristic is the automatic adaptability of speed and torque to external loads.

The guide wheel is fixed on the torque converter housing 5 with the guide wheel base. The pump pulley is connected with the pump hub as a whole, and the driving gear 22 of the driving oil pump is installed on the pump hub. Two driven gears 4 of the driving oil pump are meshed with it, driving the working pump and the transmission pump through the spline oil pump shaft 8 and the single-key oil pump shaft 9 respectively. The transmission pump provides oil source for the gearshift valve and hydraulic torque converter of the transmission.

The oil entering the hydraulic torque converter enters the circulation circle of the hydraulic torque converter from the pump pulley inlet through the oil inlet cavity of the guide wheel base and the ball clearance of the bearing, then is discharged from the housing through the clearance between the turbine outlet and the guide wheel inlet, the clearance between the turbine shaft 23 and the guide wheel base, and finally through the oil outlet cavity of the guide wheel base.

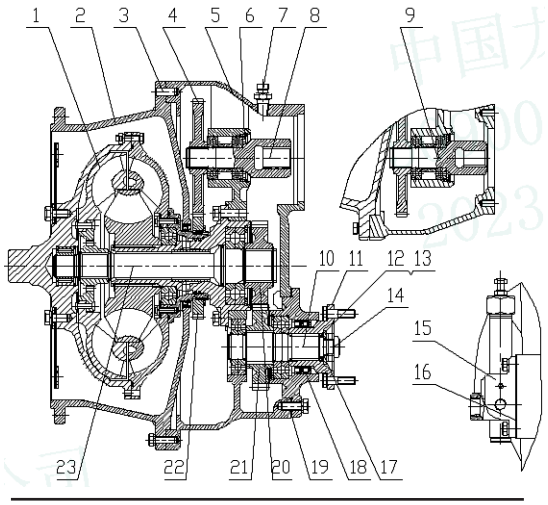


Fig. 5-08-02

Parts Catalog		
S/N	**Figure No.**	**Description**
1	LGJ125AA.01	Core assembly
2	LGJ125AA-001A	Front housing
3	GB/T119.2	Pin 10×30
4	LGJ830DC-004	Driven gear of driving oil pump
5	LGJ830DC-003A	Rear housing
6	LGJ830DC-007	Washer of power take-off port
7	LGJ830DC-024	Joint
8	LGJ830DC-025A	Spline oil pump shaft
9	LGJ830DC-006A	Single-key oil pump shaft
10	LGJ830DC-019	Output shaft
11	LGJ830DC-014	Output connecting flange
12	LGJ830DC-018	Output shaft washer
13	LGJ830DC-017	Output shaft sealing gasket
14	LGJ830DC-032	Nylon self-locking nut
15	LGJ830DC.02	Pressure reducing valve assembly
16	LGJ830DC-029	Pressure reducing valve sealing gasket
17	LGJ830DC-016	Lock washer
18	LGJ830DC-033	Combined oil seal 55×78×24
19	LGJ830DC-012	Oil seal seat sealing gasket
20	LGJ830DC-010	Driving gear
21	LGJ830DC-020	Driven gear
22	LGJ830DC-021	Driving gear of driving oil pump
23	LGJ830DC-011B	Turbine shaft

Bearings and Wearing Parts Used				
Description	**Code**	**Specification**	**Qty.**	**Installation Position**
Bearing	GB/T276	6206（62×30×16）	2	Driving oil pump shaft
		6206N（62×30×16）	2	Driving oil pump shaft
		6308（90×40×23）	1	Output shaft
		6307（80×35×21）	1	Output shaft
		6310（110×50×27）	1	Turbine shaft
		6212（110×60×22）	1	Pump pulley assembly
	JB/T3588	NAV4006（55×3025）	1	Turbine shaft front end
Sealing ring	LGJ830DC-009	—	1	Turbine shaft
	ZL30D-11-19	Sealing ring φ80	2	Guide wheel base
Rotation axis	LGJ830DC-034	—	1	Front housing
Framework oil seal	LGJ830DC-033	55×78×24	2	Oil seal seat

Torque converter pressure measuring port

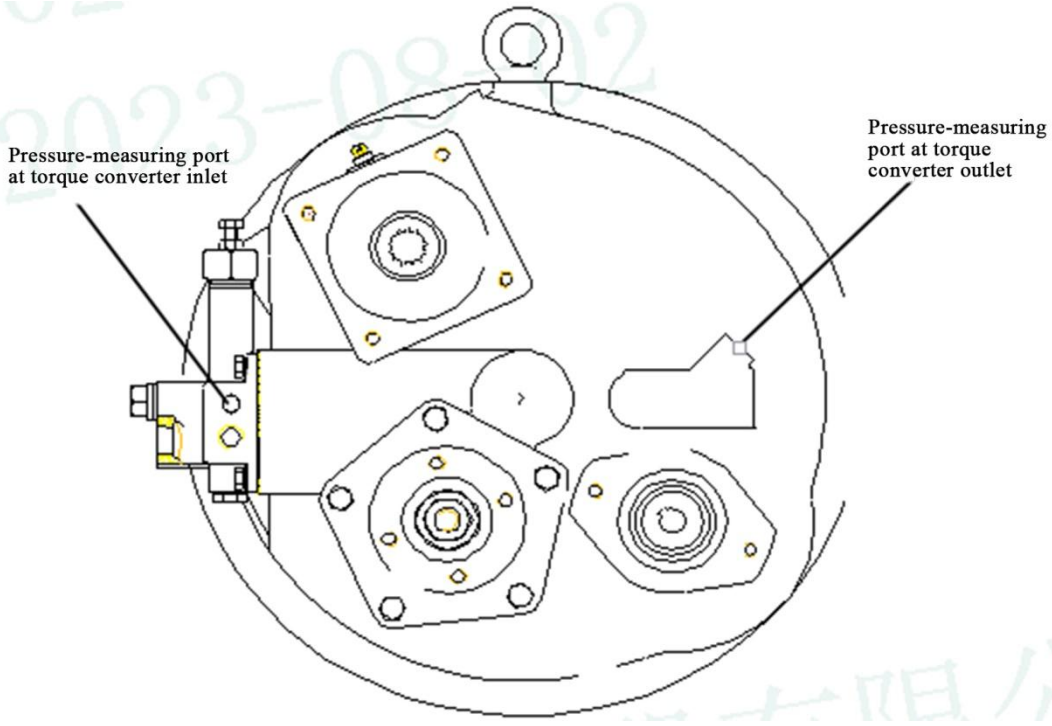


Fig. 5-09-01

5.8.2 Test and Adjustment

(I) Management of working oil

1. The torque converter shall use 6# or 8# hydraulic transmission oil as working oil and lubricating oil, and the oil shall be kept clean during use and shall not be mixed with other oils.

2. When a new machine is used, the engine must run at low speed for several minutes to fill all pipes and accessories with oil. Check the transmission oil level before daily operation. Insufficient oil will cause oil pressure reduction, powerless output or overheating of working oil.

3. In the initial use stage, check and clean the oil filter every day. After 60 hours of first use, replace with new oil. Thereafter, replace the oil every 1000 hours and check the oil filter every 100 hours. If there is too much water, metal powder or impurities in the oil, replace the oil.

4. When replacing with new oil, all oil filters and pipe fittings of the system shall be cleaned, and those that fail shall be replaced.

(II) Oil pressure inspection

Set the engine speed to 1800r/min and run it under braking condition. When the oil temperature reaches 80~100 ℃, the outlet pressure of torque converter shall be 0.25~0.31MPa.

(III) Check the oil seal of torque converter, pipe connection parts and valve fitting surfaces. No external leakage is allowed.

(IV) Oil temperature used

During normal operation, the outlet oil temperature of torque converter is 80 ~ 110 ℃, which is allowed to reach 120 ℃ in a short time. If the oil temperature continues to be above 120 ℃, stop operation and make the engine run at idle speed. After the oil temperature drops below 80 ℃, shut down for inspection.

(V) Overhaul

1. It is recommended to carry out overhaul every 3,000 hours or one year (whichever comes first).

2. Before repair, carefully read and understand the disassembly and assembly procedures.

3.Vulnerable parts such as oil seals, O-rings and sealing rings must be replaced with new ones even if no damage is found after inspection. Parts shall be prepared before removal.

5.8.3 Removal and Installation

1. The torque converter is connected to the engine by hoisting. That is, lift the torque converter, align the centering shaft head at the left end of the pump pulley cover with the central hole of the engine flywheel and slowly push it in, then locate it with the rabbet on the front housing 2, and fix the front housing on the engine flywheel cover with 12 bolts. Then fasten the elastic plate and flywheel through the window on the front housing. Prevent any sundries from falling into the housing during installation. Once sundries fall in, disassemble the housing to remove sundries and reinstall it.

2. Install the hydraulic system of the machine and connect all accessories and pipe fittings.

3. Fill the transmission with specified amount of 6# or 8# hydraulic transmission oil. The two oils shall not be mixed.

4. Start the engine, check the oil quantity under idling, and replenish it in time when insufficient.

5. Check whether the oil pressure is normal, whether there is oil leakage and whether there is any abnormality.

6. Cleaning, inspection and replacement.

① Clean all metal parts with gasoline or volatile industrial alcohol, and do not use caustic soda solution.

② The cleaned metal parts shall be coated with the hydraulic transmission oil actually used immediately after drying.

③ Check that the mounting surface is free of notches, burrs, scratches and inclusions. Remove burrs and foreign matters with abrasive cloth or grinding stone, and replace the damaged parts with large and deep scratches.

④ The castings with cracks shall be replaced.

⑤ Check the bearing race for nicks, pits, cracks, debris and excessive wear of balls. If any defect is found, replace it.

⑥ Check whether the bearing is flexible. If there is still jamming in the presence of lubricating oil, it must be replaced.

⑦ Check the gear tooth profile for wear and deformation, and replace the gear if such defects are found.

⑧ Check the gear tooth surface for streaks, burrs and damage. If the damage cannot be removed with a grinding stone, replace the gear.

⑨ Check the spline for peeling, scratches, distortion and burrs. Burrs can be removed with a grinding stone, and the spline should be replaced in case of other damage.

⑩ The wear limit size of the contact part of oil seal lip is nominal size 100 minus 0.2 mm.

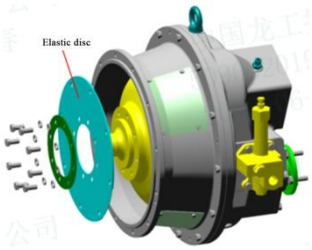
5.8.4 Disassembly and Repair

Warning

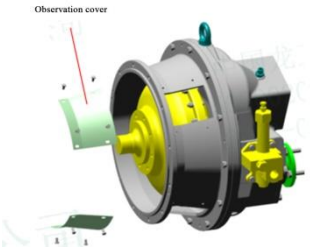
During disassembly and assembly, the parts must be kept clean on a workbench in a workplace free of dust and sand.

1. Disassembly of torque converter

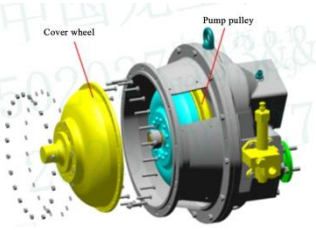
① Remove the bolts connecting the elastic disc, and then remove the elastic disc.



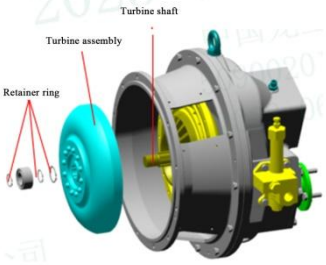
② Remove the two observation covers on the front housing.



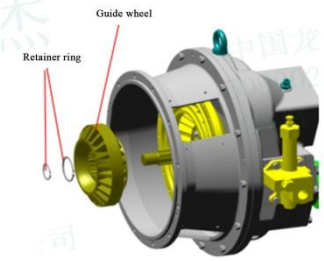
③ Remove the connecting bolts between the cover pulley and the pump pulley, and remove the cover pulley through jackscrew holes.



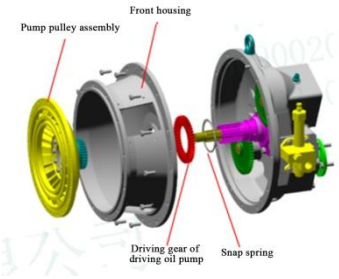
④ Remove the bearing snap ring at the left end of the turbine shaft, and remove the support bearing of the cover pulley; remove the snap spring on the left side of the turbine, and remove the turbine assembly from the turbine shaft.



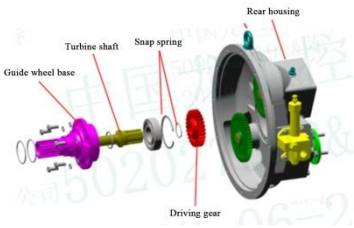
⑤ Remove the retainer ring and guide wheel.



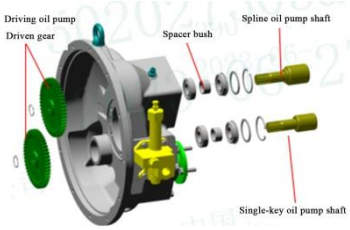
⑥ Remove the front housing and pump pulley assembly through the jackscrew hole on the front housing, and then remove the snap spring on the right side of the driving gear of the driving oil pump.



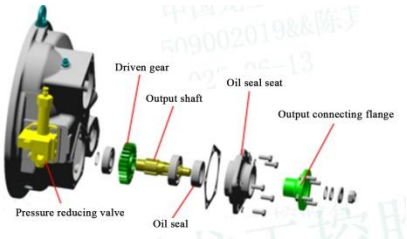
⑦ Remove the connecting bolts between the guide wheel base and the housing, and separate the guide wheel base from the rear housing with jackscrew; remove the snap springs on the right sides of the guide wheel base and turbine shaft, and then remove the bearing and driving gear respectively.



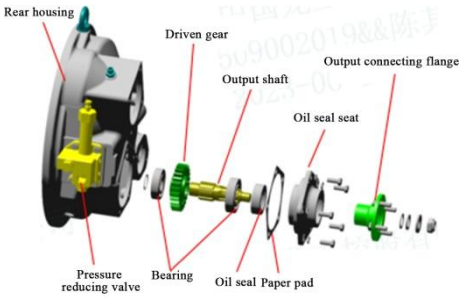
⑧ Remove the snap spring, pump shaft, spacer bush and driven gear of driving oil pump.



⑨ Remove the connecting bolts of oil seal seat and rear housing, and then remove such parts as oil seal seat, driven gear, output connecting flange, bearing, oil seal and pressure reducing valve.



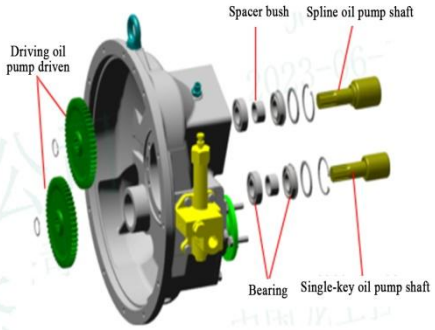
① Install the oil seal, 6308 bearing and retainer ring 90 on the oil seal seat, insert the output shaft and knock it in place, install the driven gear with its short end facing the direction of the oil seal seat, install the 6307 bearing at the end of the output shaft, and install the shaft retainer ring 35. Thread four M12×40-10.9 bolts (blue-white zinc) into the output connecting flange and put them onto the output shaft, and then install the iron washer, rubber washer and lock washer into the output connecting flange in turn. Screw in the nylon self-locking nut and then lock it with a jackhammer;



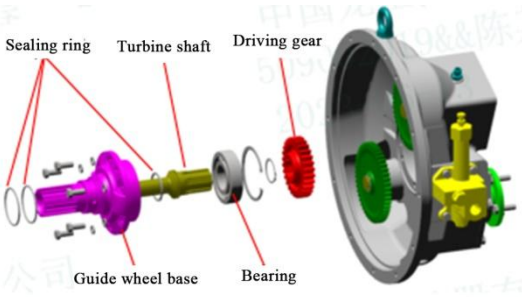
Assemble the above assembled output shaft assembly to the rear housing, and connect and lock the output shaft assembly with the rear housing with 5 bolts; place a paper

pad on the pressure reducing valve, align it with the hole position on the rear housing, and tighten 4 bolts diagonally.

② Install the bearing 6206, spacer bush, bearing 6206N (with snap ring), power take-off washer and retainer ring 68 in turn on the back of the rear housing; install the spline oil pump shaft on the "square" power take-off port and the single-key oil pump shaft on the other power take-off port; install the driven gear of the driving oil pump at the other end of the two power take-off shafts and install the retainer ring 30.

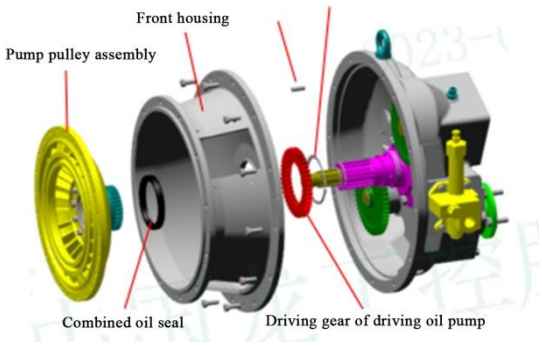


③ Install the sealing ring in the sealing groove of turbine shaft, and install the turbine shaft into the guide wheel; pass the 6310 bearing through the turbine shaft and install it on the guide wheel base, and install the hole retainer ring 110; install the driving gear (28 teeth, with the long end facing the direction of the guide wheel base), and install the shaft retainer ring 48 at the right end of the turbine shaft;



Install the sealing ring into the groove of the guide wheel base, assemble the guide wheel base assembly assembled in the above steps to the rear housing. Note that the oil inlet (with "INT" mark) on the guide wheel base faces the pressure reducing valve side, and lock the bolts.

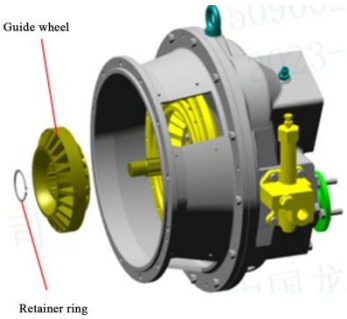
④ Assemble the combined oil seal at the oil seal position of the front housing, sleeve the pump pulley assembly on the front housing, pay attention not to damage the oil seal, assemble the driving gear of the driving oil pump on the spline on the right side of the pump pulley assembly, and install the retainer ring 100;



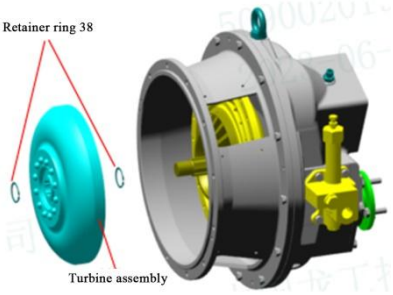
Install the locating pin on the pin hole of the rear housing, and install the above assembled front housing assembly on the rear housing. Align the pin hole on the front housing with the locating pin. When installing the front housing assembly, knock the special tooling while slightly rotating the pump pulley by hand to install it in place;

Use 12 bolts M10×30 with spring washers to assemble and lock the front housing and rear housing.

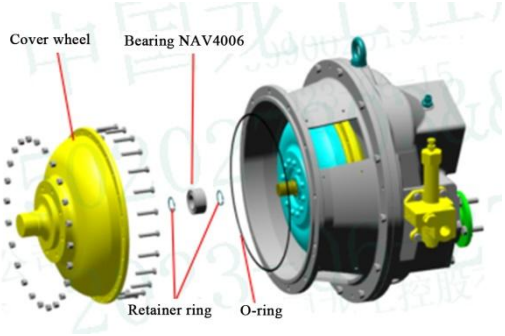
⑤ Align the guide wheel with the spline on the guide wheel base and install it in place, and assemble the retainer ring 60 into the corresponding retainer ring groove.



⑥ Assemble one retainer ring 38 into the right retainer ring groove of turbine shaft, align the turbine assembly with the spline of turbine shaft and install it in place, and then assemble another retainer ring 38 into the left retainer ring groove of turbine shaft.



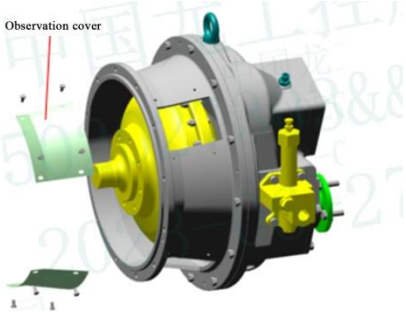
⑦ Install the retainer ring 30 in the right retainer ring groove at the end of the turbine shaft, assemble the inner ring of bearing NAV4006 on the left side of the turbine shaft, and then install another retainer ring 30 on the left side of the turbine shaft;



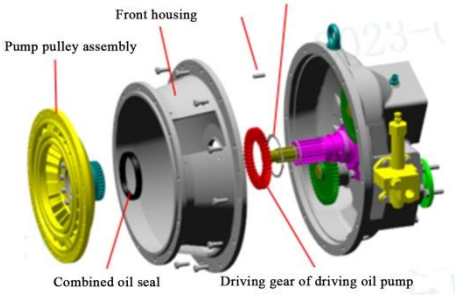
Apply grease to the needle roller to prevent it from falling off from the outer ring during assembly. Assemble the outer ring into the inner hole of the cover pulley with special tooling, and assemble the hole retainer ring 55 into the retainer ring groove in the inner hole of the cover pulley;

Put the O-ring into the O-ring groove of the pump pulley, align it with the turbine shaft and assemble the cover pulley in place; use 24 bolts M8×35 and nuts and spring washers to assemble and lock the cover pulley and the pump pulley.

⑧ Observe the cover at the corresponding position of the front housing and tighten the bolts.



⑨ Measure the height difference between the mounting end face of the cover pulley elastic plate and the flange end face connecting the front housing and the engine, and ensure that the upper surface of the installed elastic plate is at the same height as the flange end face of the front housing;



Put adjusting shims of appropriate thickness under the elastic plate, and then assemble the elastic plate on the cover pulley. Note that the one with crescent plate shall be placed below and locked on the cover pulley with bolts and spring washers.

5.8.5 Faults and Troubleshooting

Fault	S/N	Cause	Troubleshooting method
Low output torque	1	Low engine output speed	Check and adjust the engine
	2	Low oil supply pressure of torque converter	See the low oil supply pressure item
	3	High oil temperature	See high oil temperature item
	4	Use of unsuitable oil	Replace with specified oil
High oil temperature	1	Insufficient oil filling	Supplement to the specified value
	2	High oil level	Drain the oil to a proper level
	3	Oil filter jammed	Check and clean the oil filter
	4	Radiator and pipeline blocked	Check and clean the radiator and check and fasten the pipeline.
	5	Cooling system fault	Check the cooling system
	6	Loose connection of oil suction pipeline	Adjust the operation cycle and reduce the operation load
	7	Full acceleration and long operating time at low speed	Damaged inlet valve or low adjusting pressure
Low oil supply pressure	1	Insufficient oil	Supplement to the specified amount
	2	Insufficient oil supply of transmission pump or damaged transmission pump	Check the wear of oil pump
	3	Excessive internal leakage	Check the sealing ring coupling for wear Replace the sealing ring
	4	Damaged inlet valve or low adjusting pressure	Check, replace or adjust the spring
	5	Unsmooth or unsealed oil suction pipeline	Check the pipeline system
Oil leakage	1	Damaged oil seal, paper pad and O-ring	Check and replace it
	2	Loose connecting threads	Check and fasten them
Excessive noise	1	Bearing failure	Check and replace it
	2	Wear of gear and spline	Check and replace it
	3	Retainer ring on turbine shaft or guide wheel base is cracked	Check and replace it

V. Main Components

Section IX Transmission

Contents

5.9 Transmission

5.9.1 Structure and Function

The transmission is mainly composed of main components such as box body, large end cover, input shaft assembly, reverse gear shaft assembly, countershaft assembly, output shaft assembly, high and low gears shifting fork mechanism and operating valve. Each gear clutch assembly consists of multiple inner friction discs and outer friction discs, piston assembly, gear, shaft, sealing ring, return spring, etc. When a certain gear needs to be engaged, a speed ratio is formed by the operating valve and the high/low gear shifting fork mechanism respectively to transmit torque. When the operating valve shifts, the inner friction disc and outer friction disc of the clutch in corresponding gear push the piston tightly under the axial working oil pressure. When the inner friction disc and outer friction disc of the clutch are released, the piston returns under the action of the return spring; When shifting between high and low gears, the shifting fork mechanism pushes the sliding gear sleeve of high and low gears to mesh with the high gear and low gear of output shaft respectively, so as to switch between high and low gears of the transmission.

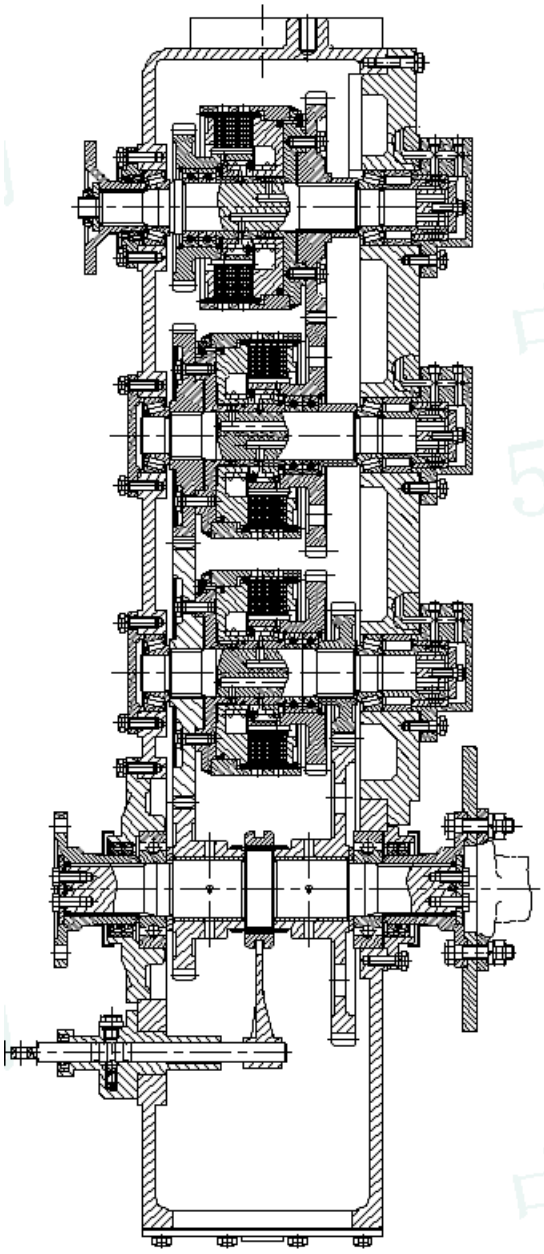


Fig. 5-09-01

5.9.2 Test and Adjustment

Main technical parameters	
Maximum input speed	2500r/min
Maximum input power	92KW
Zero-speed pitch ratio of supporting torque converter	3.0～3.6
Type of transmission	Fixed shaft, normally meshed, hydraulic fork shift
Drive ratio of transmission	Forward gear I 3.82 gear II 2.08 gear III 1.09 gear IV 0.59 Reverse gear I 3.05 gear II 0.87
Transmission oil	8# hydraulic drive oil
Operating pressure	1.1MPa～1.5MPa
Allowable oil temperature of oil pan	100℃

(I) Working principle of transmission system

The transmission has four shafts, three shift clutches and one shifting fork. When the reverse gear shaft clutch (Part 15) is engaged and the high/low-speed gear sliding sleeve (Part 17) is turned to the left, the power from the torque converter is transmitted through the following route: 1-15-7-9-3-11-13-17-4 to the forward gear I.

When the countershaft clutch (Part 16) is engaged and the high/low-speed gear sliding sleeve (Part 17) is turned to the left, the power is transmitted through the route 1-8-10-16-3-11-13-17-4 to the gear II.

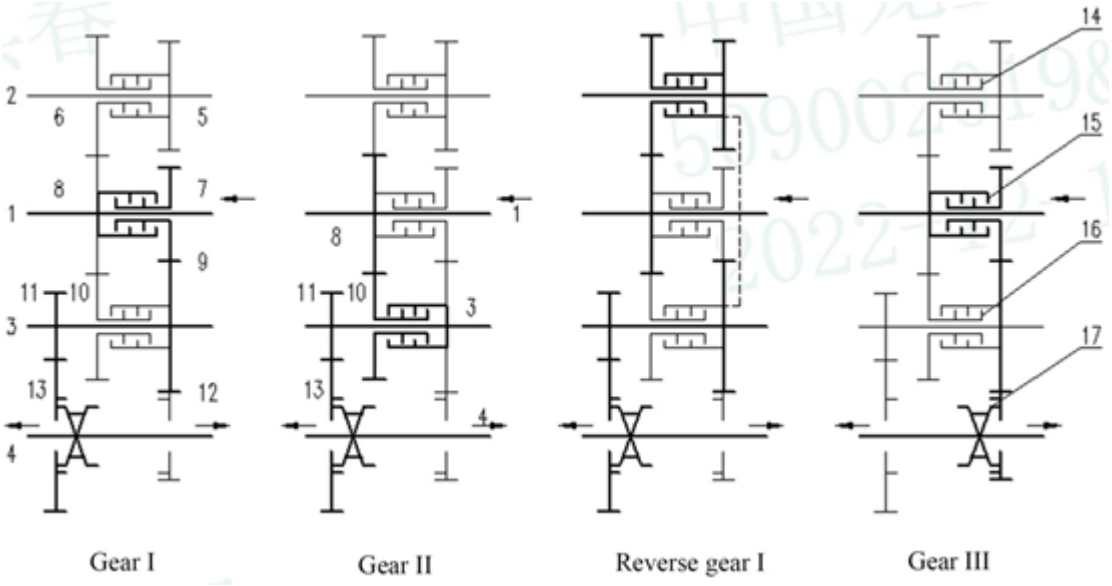


Fig. 5-09-02

1. Input shaft	2. Reverse gear shaft	3. Countershaft	4. Output shaft
5. Reverse gear shaft bull gear	6. Reverse gear shaft pinion	7. Input shaft gears I and III	8. Input shaft gears III and IV
9. Countershaft gears I and III	10. Countershaft gears II and IV	11. Countershaft low-speed gear	12. Output shaft high-speed gear
13. Output shaft low-speed gear	14. Input shaft clutch	15. Reverse gear shaft clutch	16. Countershaft clutch
17. High and low-speed gear sliding sleeves			

Control lever / Gear	I	II	III	Shifting fork
Forward gear I	√			←
Forward gear II		√		←
Forward gear III	√			→
Forward gear IV		√		→
Reverse gear I			√	←
Reverse gear II			√	→

Fig. 5-09-03

(II) High and low gears

When the sliding sleeve of high and low-speed gears is on the left side in Figure 6-2-02, it is a low-speed gear, i.e., forward gear I, forward gear III and reverse gear I. When it is on the right side, it is a high-speed gear, i.e., forward gear II, forward gear IV and reverse gear II. There is no output in the middle.

Shifting with the high or low-speed gear sliding sleeve must be carried out when the neutral gear is engaged and after the vehicle stops, otherwise impact may occur.

(III) Principle and composition of hydraulic control system

The principle of the hydraulic control system of the hydraulic transmission device is shown in Figure 2. The elements in the right half of the two-dot chain line in the figure are configured by the torque converter. The left half part is composed of transmission operating valve, oil cylinder (clutch), filter, oil tank (consisting of oil pan and box body).

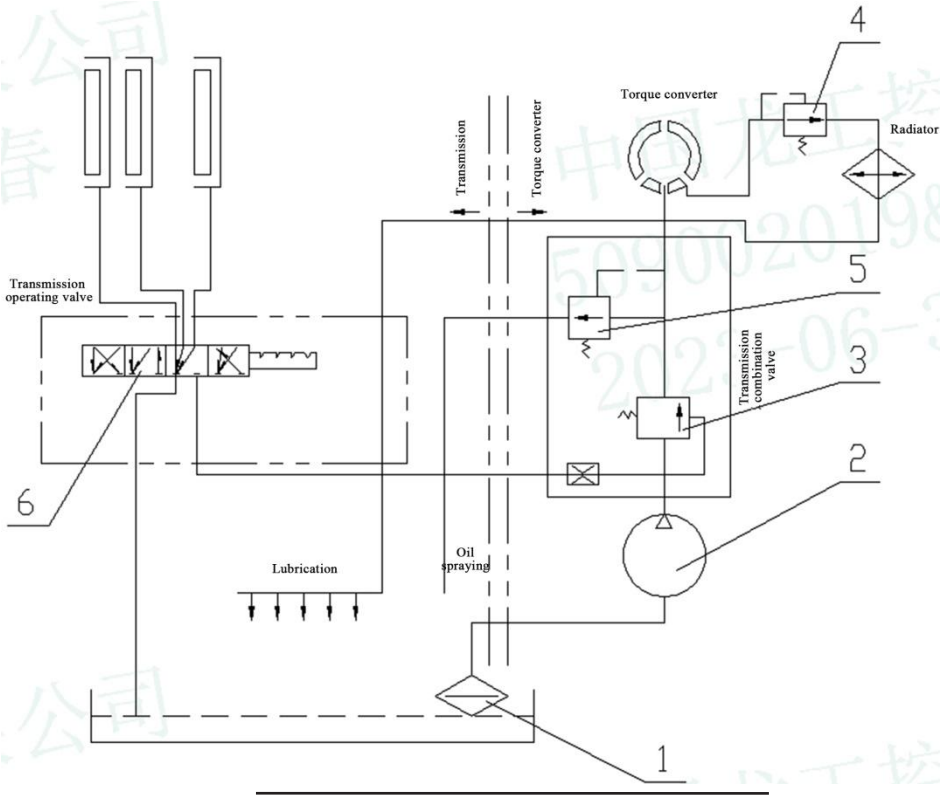


Fig. 5-09-04

1. Oil suction filter	2. Main oil pump	3. Transmission pressure valve	4. Oil outlet pressure valve
5. Oil inlet pressure valve	6. Transmission valve	7. Brake safety valve	

When the torque converter pump pulley is running, the transmission gear drives the oil pump 2 to run to suck oil from the oil tank and output pressure oil into the torque converter combination valve. The torque converter combination valve consists of a transmission pressure valve (3), an inlet pressure valve (5) and a restrictor. Under the action of the transmission pressure valve (3), the working oil entering the combination valve first ensures the operating oil, and then is transmitted to the torque converter through the transmission pressure valve (3). The transmission control oil pressure and the torque converter inlet oil pressure are controlled by the transmission pressure valve (3) and the inlet pressure valve (5) respectively. The oil pressures are 1.1-1.5 MPa and 0.3-0.6 MPa respectively (the torque converter inlet pressure is 0.1-0.2 MPa during transmission). When the inlet oil pressure of the torque converter exceeds the set value of the inlet pressure valve (5), the valve port is opened, and the oil flows out to the transmission and torque converter for oil spraying. The outlet pressure valve (4) of the torque converter controls the outlet pressure of the torque converter within the range of 0.05-0.15 MPa. The oil flowing out from the outlet pressure valve (4) flows through the radiator to the transmission lubrication system.

5.9.3 Removal and Installation

The specific details of transmission removal and installation are as follows:

(I) Position of transmission on the product

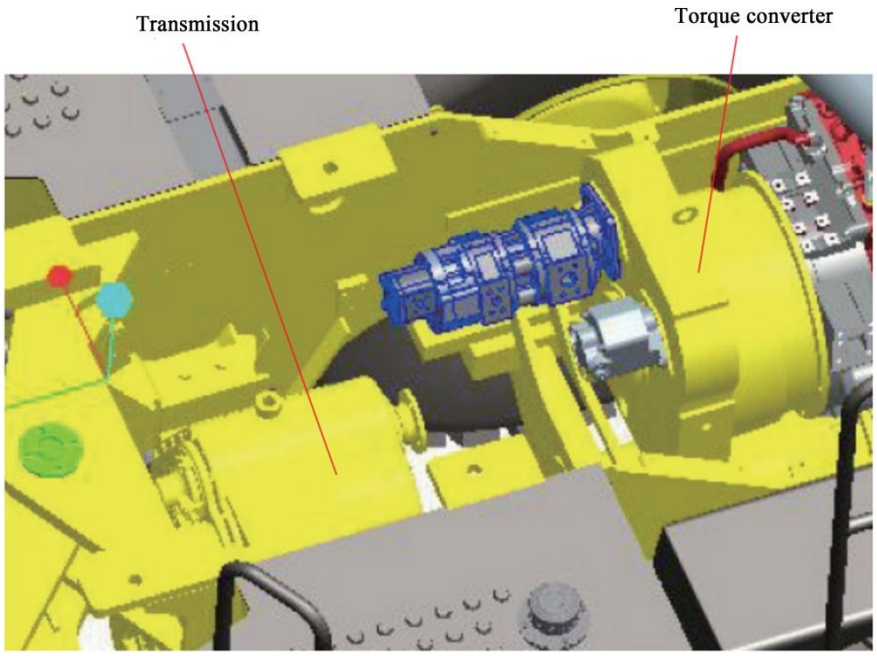


Fig. 5-09-05

The torque converter assembly and transmission assembly are connected through the upper drive shaft, and the front and rear output flanges of the transmission are connected with the front and rear drive axles through the drive shaft; the torque converter is connected to the diesel engine by internal hinge and external hinge.

(II) Disassembly steps

1. Remove the cab according to the following steps:

① Lift the cab with the traveling crane and lifting appliance. The rope shall be straightened, but not tightened.

② Remove the nylon self-locking nut, pin and washer.

③ Lift the cab and place it in a safe place.

④ Take out the damping pad assembly.

Warning

Safety tips for hoisting:

① When lifting the cab, the lifting appliance must be hung in a reasonable position to avoid overturning;

② Hoist smoothly, and note that whether the surrounding personnel are within the safe range.

2. Remove the transmission assembly

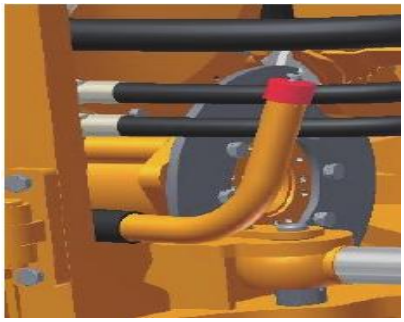


Fig. 5-09-06

① Remove the bolts and washers connecting the fuel filler pipe assembly bracket to the frame with a wrench.

② Remove the rubber hose and steel pipe connected to the transmission pump with a wrench (note that before removal, please open the oil drain plug at the bottom of the transmission to completely discharge the transmission oil, then loosen the steel pipe and rubber hose joint to be removed, place cotton cloth at the removal joint, gently knock the steel pipe or rubber hose joint to be removed to release the pressure, and then remove the steel pipe or rubber hose).

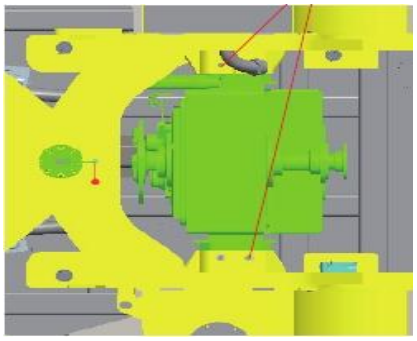


Fig. 5-09-07

③ Remove the four M16×110 bolts, nuts and gaskets (M16 flat washers and self-locking nuts) connecting the transmission to the transmission support seat on the rear frame with a jackhammer and supporting sleeve.

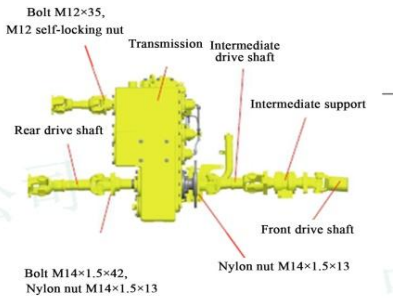


Fig. 5-09-08

④ Remove the four M14×1.5×13 nylon nuts and self-locking nuts used to connect the transmission with the middle drive shaft using a jackhammer and supporting sleeve; remove the four M14×1.5×42 bolts and self-locking nuts used to connect the transmission with the rear drive shaft.

⑤ Remove the M12×35 bolts and self-locking nuts connecting the transmission to the upper drive shaft with a jackhammer and supporting sleeve.

⑥ Lift the transmission assembly to the designated bracket with a special lifting appliance.

(III) Commissioning requirements

Commissioning shall be carried out by designated personnel (if required);

(IV) Installation

1. Install the transmission in the following sequence

① Lift the transmission onto the frame with a special lifting appliance;

② Install the bolts and nuts connecting the upper drive shaft, front and rear drive shafts and transmission;

③ Fix the transmission on the transmission support seat with bolts.

Warning

Note: Keep it clean during assembly;

2. Install the cab in the following sequence

① Check whether all interior trims of the cab assembly are in good condition before hoisting;

② Pre-install the base plate and damping pad. Install the damping pad assembly (upper assembly)

to the cab support seat, and align it with holes, as shown in the following figure.

③ Lift the cab to the top of the frame at a constant speed with special lifting appliance and traveling crane, slowly adjust its height from the frame, finally place the cab stably on the cab support seat, align with the holes, and connect them with pins.

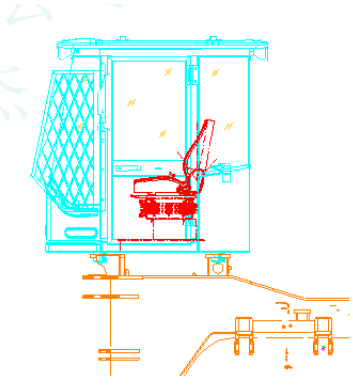


Fig. 5-09-09

④ Parts used for cab installation

S/N	Material name	Material code	Quantity of material	Remarks
1	Cab weldment	30812116471	1	
2	Shock absorber assembly	30812013457	4	
3	Bolt M24×2×130	51210172914	4	
4	Base plate	30812115784	4	
5	Nut M24×2	51342001119	4	

(V) Equipment and tools used			
1. One 10t traveling crane;	2. Special lifting tools	3. Bracket;	4. 5044 Jackhammer
5. 16 open-end wrench, 18 open-end wrench	6. 12 Sleeves	7. 1-inch and 2-inch adjustable wrenches;	8. 22-24 open-end wrench

Warning

Safety tips for hoisting:

(1) During hoisting, the lifting appliance must be hung in a reasonable position to avoid overturning;

(2) Hoist smoothly, and note that whether the surrounding personnel are within the safe range.

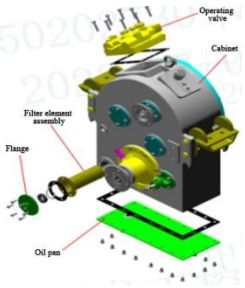
5.9.4 Disassembly and Repair

List of Tools, Supplies and Equipment			
1. Open-end wrench	2. Allen wrench	3. Electric jackhammer	4. Iron rod
5. Copper rod	6. Pliers (removal and	7. Sleeve	8. Puller
9. One set of snap ring	10. Vice	11. Scraper	12. Bearing knocking
13. Torque wrench			

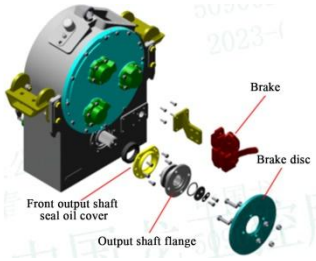
(I) Disassembly of transmission

1. Disassembling of transmission assembly

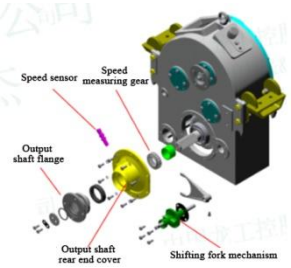
① Place the transmission assembly horizontally on the assembling and disassembling tooling, and remove the fastening bolts of the operating valve, filter element assembly and oil pan with a wrench or electric jackhammer.



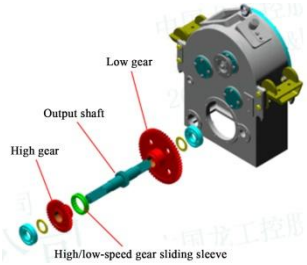
② Remove the fastening bolts of hand brake, brake disc, output shaft flange and front output shaft oil seal cover with a wrench or electric jackhammer.



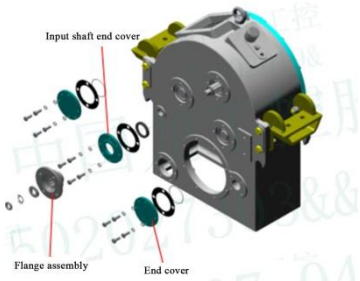
③ Remove the high/low gear shifting fork mechanism, output shaft flange, rear end cover of output shaft, speed measuring gear and speed sensor.



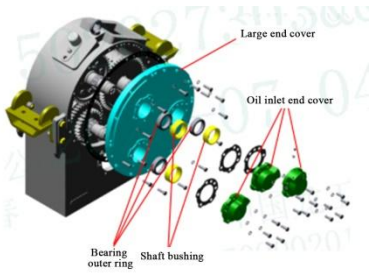
④ Knock out the output shaft with a copper rod, and remove relevant parts of the output shaft assembly such as high gear, sliding sleeves for high/low gears, low gear and output shaft.



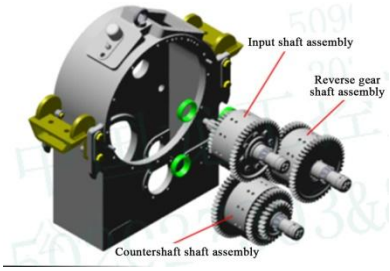
⑤ Remove the flange assembly, input shaft end cover, reverse gear shaft and countershaft end covers with a wrench or pneumatic jackhammer.



⑥ Remove the oil inlet end cover I, II and large end cover with a wrench or jackhammer, then remove the plug and 32207 bearing outer ring, and take out the shaft sleeve. (



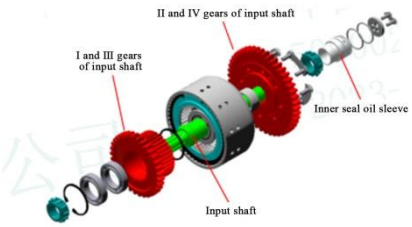
⑦ Take out the input shaft assembly, reverse gear shaft assembly and countershaft assembly from the box body, and then knock out the 32207 bearing outer ring.



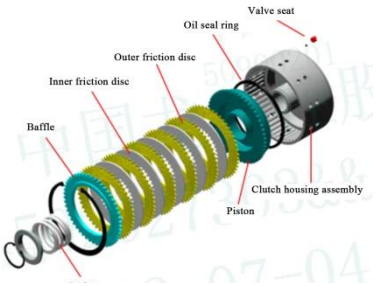
⑧ Remove the breather cap, oil baffle and transmission bracket with a wrench or electric jackhammer.

2. Disassembly of input shaft assembly

① Remove the II and IV gears of input shaft and inner oil seal sleeve with a wrench or electric jackhammer, knock out the input shaft with a copper rod, remove the inner retainer ring of I and III gears of input shaft with snap ring pliers, and then knock out the bearing 6009.



② Remove the snap ring in the clutch housing assembly with snap ring pliers, and remove all parts.



3. Disassembly of reverse gear shaft assembly

The disassembling steps are similar to those of the input shaft assembly.

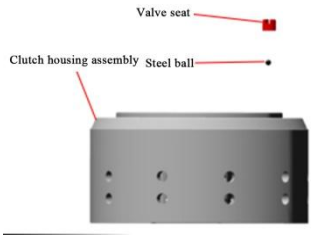
4. Disassembly of countershaft assembly

The disassembling steps are similar to those of the input shaft assembly.

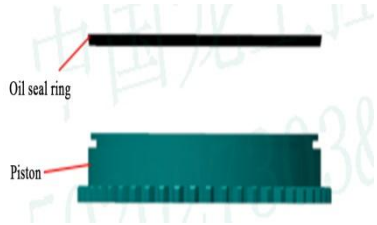
(II) Repair of transmission

1. Repair of input shaft assembly

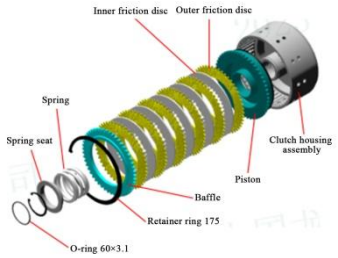
① Assemble the steel ball and valve seat into corresponding holes of clutch housing assembly with iron rod.



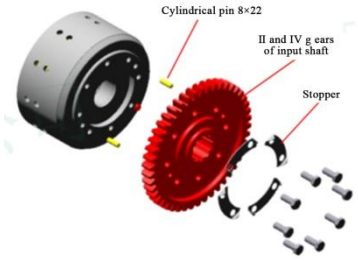
② Assemble the oil seal ring into the corresponding groove of piston.



③ Install the O-ring 60×3.1 into the O-ring groove in the clutch housing assembly. Install the piston, outer friction disc, inner friction disc, baffle and retainer ring 175 into the clutch housing assembly in turn. (Note: When assembling the inner and outer friction discs, put 1 outer friction disc first and then 1 inner friction disc alternately in turn (5 inner friction discs and 6 outer friction discs), and install the spring, spring seat and retainer ring 60 into the clutch housing assembly in turn.

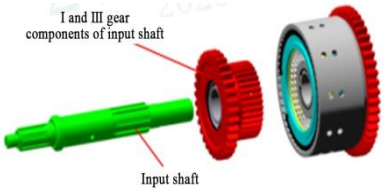


④ Assemble two cylindrical pins 8×22 on the clutch housing assembly, align the cylindrical pins to assemble the II and IV gears of input shaft onto the clutch housing assembly; fasten the gear and the clutch housing with stoppers and bolts M10×25 (torque: 55N.m), and then flange the stopper to prevent loosening after the bolt is locked.



⑤ First install the retainer ring 75 in the left retainer ring groove of I and III gears of input shaft, then install 2 bearings 6009 in the bearing hole, and finally install the other retainer ring in the right retainer ring groove.

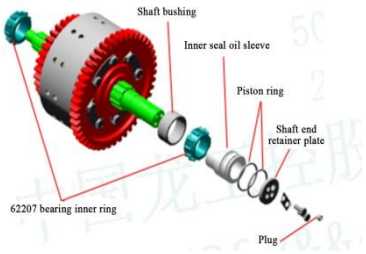
⑥ Install the I and III gear assembly of input shaft and the input shaft into the clutch housing assembly.



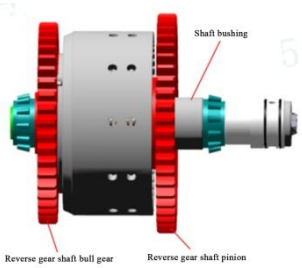
⑦ Assemble the left 32207 bearing inner ring on the left side of the input shaft, and then assemble the shaft sleeve, 32207 bearing inner ring, inner oil seal sleeve, axle end baffle, stop washer (knock and flange it to prevent looseness) and bolts on the right side of the input shaft in turn;

Assemble the piston ring into the oil groove of inner oil seal sleeve;

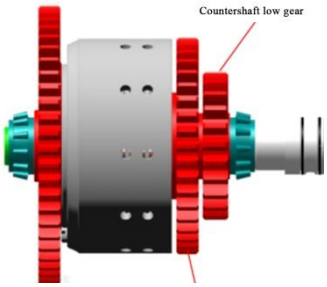
Finally, evenly apply an appropriate amount of thread locker to the plug and assemble it on the right shaft end.



2. The repair of reverse gear shaft assembly is similar to that of input shaft assembly.



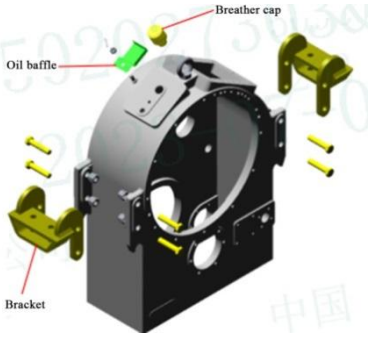
3. The repair of the countershaft assembly is similar to that of the input shaft assembly, with the main differences as follows: ① There is a spline structure in the middle part of the countershaft; ② The countershaft assembly has 3 gear parts, and the longer end of the internal spline of the countershaft low gear faces the inner side;



(III) Repair of transmission assembly

① Assemble the bracket on the bolt holes on the left and right sides of the box body, and lock the bolts;

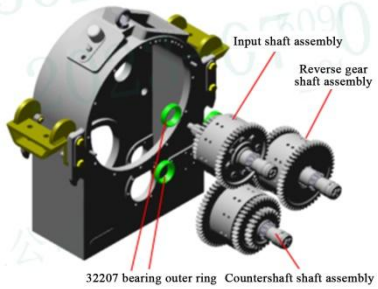
Align the oil baffle inside the box with the threaded hole on the box, lock one M10×25 bolt with a screw hole with a jackhammer, lock the M10 slotted nut outside the box, insert a cotter pin of 2.5×20, and bend the opening (Note: The center of the oil baffle shall face the breather cap hole);



Apply thread locker to the front 2~3 teeth of breather valve. Tighten the breather valve with an open-end wrench;

② Install the 32207 bearing outer ring in the bearing holes of transmission input shaft, reverse gear shaft and countershaft;

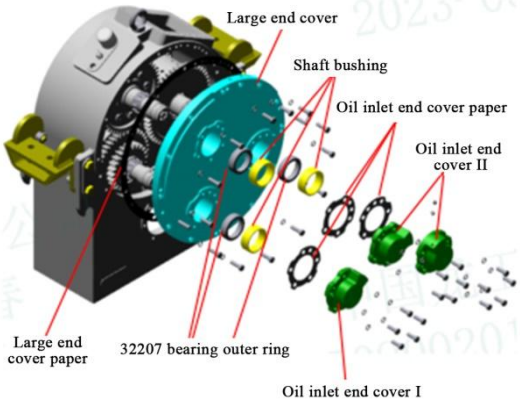
Put the input shaft assembly, reverse gear shaft assembly and countershaft assembly gently in place from top to bottom corresponding to the positions of the three bearing holes;



③ Use an iron rod to gently knock 2 pins (φ10×40) into the box pin holes;

Align the cylindrical pin with the threaded hole, and put in the paper pad of large end cover;

Align the cylindrical pin, assemble the large end cover in place with an iron rod, and tighten it with bolts M10×35 equipped with spring washers (torque: 55N.m);



Assemble the 32207 bearing outer ring in place with special tooling;

Assemble the outer seal shaft sleeve on the oil inlet end cover I and II. Note that the end with large chamfer of inner ring faces outward;

Put shaft sleeves in the three shaft assemblies, put oil inlet end cover paper pad on the boss surface of large end cover, assemble oil inlet end cover II on the input shaft and reverse gear shaft, assemble oil inlet end cover I on the countershaft, and lock the oil inlet end cover on the large end cover with bolts M10×20 equipped with spring washers (torque: 55N.m);

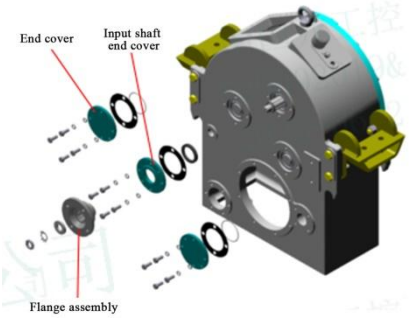
Install plugs on the plug holes of oil inlet end cover I, oil inlet end cover II and large end cover, and apply 567 pipe

thread sealant evenly to the plugs during assembly;

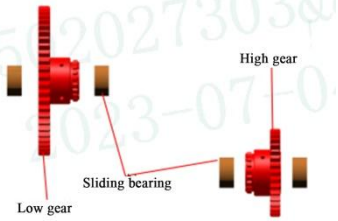
④ Put the removed adjusting washers into each shaft hole in turn, and be careful not to mix them;

Put a paper pad on the boss of each bearing hole of the box body, and lock each axle end cover on the box body with bolts M10×25 equipped with spring washers (torque: 55N.m);

Assemble the flange assembly, O-ring 28×5.3, washer 20, anti-rotation washer and nut M20×1.5 on the input shaft in turn. Use special tooling to flange the anti-rotation washer and attach it closely to the nut groove.



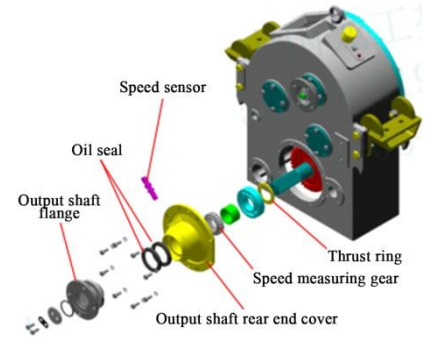
⑤ Press-fit 1 sliding bearing on the left and right ends of the output shaft low gear and high gear respectively. Be careful not to block the lubricating oil hole on the gear.



⑥ Place the low gear assembly on the box body, align its center with the output shaft hole of the box body, and make sure that the longer end of the step exceeds the center of the box body. Pay attention to the meshing between the low gear and the low gear of the countershaft; place the high/low sliding gear sleeve on the low gear, insert the output shaft in alignment with the gear sleeve and the low gear, and then assemble the high gear assembly onto the output shaft.

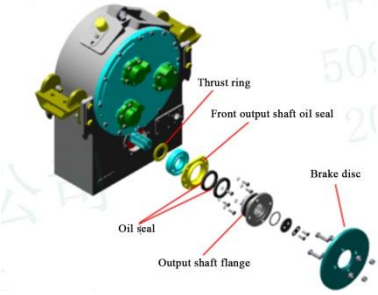
⑦ Assemble the thrust ring, bearing 6310, shaft sleeve and speed measuring gear onto the output shaft in turn. Note that the copper surface of the thrust ring faces inward;

Press-fit 2 oil seals on the oil seal position of output shaft rear end cover with special tooling; assemble the rear end cover of output shaft on the box body and lock it with M10×30 bolts equipped with spring washers; assemble and lock the output shaft flange, O-ring 52×5.7, pressure plate, stop washer and bolts in turn. Rotate the output shaft so that the tooth top of the speed measuring gear is aligned



with the center of the threaded hole of the speed sensor on the rear end cover of the output shaft, and apply an appropriate amount of 567 pipe thread sealant to the speed sensor. Screw the threads of the rear end cover of the output shaft to the bottom, and then back out by 0.8 turn, and tighten the nut.

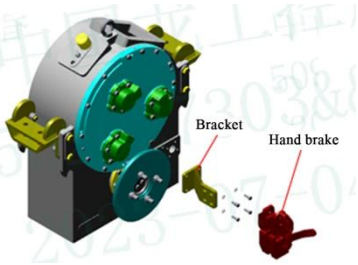
⑧ Assemble the thrust ring, bearing 6310, shaft sleeve and speed measuring gear onto the output shaft in turn. Note that the copper surface of the thrust ring faces inward;



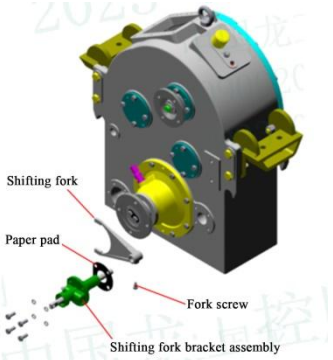
Press-fit 2 oil seals on the oil seal position of front output shaft oil seal cover with special tooling; assemble the front output shaft oil seal cover on the box body and tighten it with M10×30 bolts equipped with spring washers (torque: 55N.m);

Assemble and lock the output shaft flange, O-ring 52×5.7, pressure plate, stop washer, brake disc and bolts in turn.

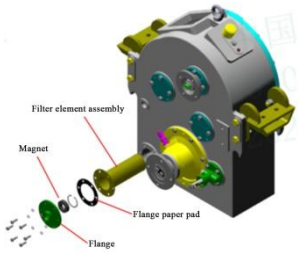
⑨ Assemble the hand brake and bracket on the transmission, and lock the bolt and spring washer.



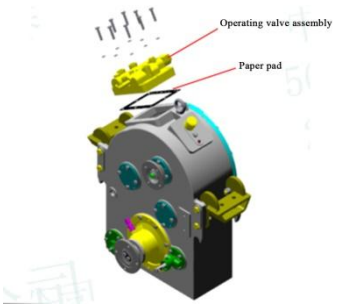
⑩ Put a paper pad on the shifting fork bracket assembly and assemble it on the box body, and tighten it with M10×30 bolts equipped with spring washers (torque: 55N.m). Insert the shifting fork into the slot of high/low-speed gear sliding sleeve of output shaft, and assemble the shaft hole on the shifting fork with the fork shaft in place. Note that the screw threaded hole shall face downward after assembly. Apply a proper amount of thread locker evenly on the fork screw, align it with the threaded hole on the shift fork, tighten the screw and torque to 30N.m; thread the iron wire into the fork and fixing bolt hole by hand. Pull the wire tightly and straightly with a vice, then tighten it clockwise, and cut off the excess part at the end.



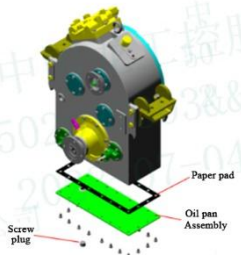
⑪ Assemble the magnet into the flange, install the retainer ring 50, and align it with the hole on the box to assemble and lock the filter element assembly, flange paper pad, flange, bolt and spring washer in turn.



⑫ Align with the mounting surface of the box operating valve, assemble the paper pad and the operating valve assembly on the box in turn, and fasten them with bolts M10×50 equipped with spring washers (torque: 55N.m).



⑬ Align with the mounting surface of oil pan of box body, and lock the paper pad, oil pan assembly, bolt M10×20 and spring washer assembly on the box body in turn (bolt locking torque: 55N.m). Evenly apply an appropriate amount of 567 sealant to the screw plug and lock it on the oil pan assembly.



5.9.5 Faults and Troubleshooting

(I) Transmission oil temperature and water temperature rise too fast

Fault description:

Under normal use of the loader, the transmission oil temperature will exceed 120 ℃ in a short time. The engine coolant temperature will reach above 95 ℃. After shutdown and cooling, the loader can continue to work.

Possible causes: This phenomenon rarely occurs. Generally speaking, the main factors leading to this phenomenon include working conditions, use methods, altitude, heat dissipation effect, machine failure, etc.

Engine part:

1. Special working conditions.

2. Improper use.

3. The instrument is electrically damaged.

4. The coolant is insufficient and the water return pipe is blocked.

5. The thermostat is damaged or the working efficiency of water pump decreases.

6. The engine accelerator control cable or flameout cable is stuck and cannot be in place.

7. The fan belt is too loose, the water tank is too dirty or the installation spacing of air deflector does not meet the requirements.

8. The air filter element is too dirty.

9. The heat dissipation effect of oil radiator is poor or the cylinder head leaks air and water.

10. The fuel injector pressure is set too high.

Torque converter & transmission:

1. Sensors and instruments are damaged.

2. The oil is improperly used or deteriorated, and the filter screen is blocked.

3. The heat dissipation effect of the torque converter & transformer cooler is poor or the return oil pressure is too high.

4. The oil suction pipe of the transmission pump is flattened or the transmission pump leaks internally.

Inspection steps or handling methods

Premise I: Confirm the working condition. Or special working environment such as paper mill.

Premise II: Confirm the operation method. It is not advisable to operate under heavy load for a long time or continuously climb up a long slope with a gradient of no more than 30 °. The operation shall be carried out in the first gear, and the engine accelerator control shall be adjusted reasonably according to the working load.

Premise 3: Confirm whether the high temperature area generated by operation is in the engine or transmission. If it is caused by high engine temperature, please check according to the inspection steps for high engine water temperature; if it is caused by high transmission oil temperature, please check according to the inspection steps for excessively high transmission oil temperature.

Inspection steps for high water temperature of engine part:

1. Check whether the water temperature sensor and instrument are damaged.

2. Check whether the coolant is sufficient and whether the water return pipe of the water tank is blocked.

Check whether the water tank cover is in good condition.

The starting pressure is 0.09MPa in general areas and 0.11MPa in plateau areas.

3. Check whether the engine thermostat is opened normally.

4. Check whether the water pump works normally. At this time, check whether the inner layer of the water pump suction

hose falls off, flat or small in diameter.

5. Check whether the engine accelerator cable and flameout cable are stuck.

6. Check the tightness of fan belt and clean the water tank.

7. Confirm the distance between fan and air deflector.

8. Check the air filter element.

9. Check whether the engine cooler is blocked.

10. Check the cylinder head for water and air leakage.

11. Test whether the opening pressure of fuel injector is too high.

Inspection steps of transmission parts:

1. Check whether the oil temperature gauge and sensor are accurate.

2. Check whether the torque converter oil (adding amount and oil quality) meets the requirements.

3. Transmission oil sump filter screen and oil filter. As shown in the figure below

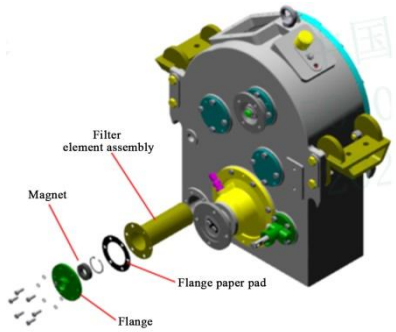


Fig. 5-09-10

4. Check the transmission oil radiator.

5. Check whether the oil return pressure of torque converter is too high, resulting in rapid rise of oil temperature due to excessive liquid resistance of oil return system.

6. Check whether the oil suction hose of transmission pump is flattened or blocked.

7. Check whether the internal leakage of transmission pump is abnormal.

8. Check the internal fault of torque converter & transmission.

(II) After the first or third gear is engaged, wait for a few seconds before the loader can run.

Fault description:

After each gear shift, the transmission pressure rises slowly and the oil temperature rises relatively quickly. The pressure will drop after warming up, but the second gear works normally.

Possible causes:

1. The clutches of all gears share the same oil. The normal working of the second gear indicates that the oil itself is not the main cause for the equal speed of the first and third gears.

2. As the first and third gears are used frequently during operation, the main reason is the first gear clutch itself.

3. The transmission operating valve has internal leakage or the valve element and spring are stuck.

4. The end cover bolts are loose or the first gear clutch seal is damaged.

5. The fixing locking plate of the isolation frame is bent and deformed or the stroke of the first-gear piston is too large.

6. The first gear oil pipe cracks, or the end cover clearance is improperly adjusted.

Inspection steps or handling methods:

1. Check whether the transmission control system is properly connected to avoid inaccurate or incomplete gear engagement.

2. To facilitate fault diagnosis, please confirm the transmission oil consumption first. Check whether the addition amount and oil specification meet the requirements.

3. Remove the transmission oil sump filter screen and oil filter to check whether they are blocked. At this time, carefully observe the oil and filter screen to confirm whether the oil deteriorates. After deterioration, the oil will turn black and smelly. Check whether there is aluminum powder, copper powder or other impurities. Copper powder is obvious under light (it is not easy to see copper powder in the oil in the workshop). When observing the oil in the sun, we can clearly see that the copper powder is glittering in the sun. This step is conducive to preliminarily determining the fault location in the box.

4. Remove the transmission operating valve, and pay special attention to whether the inclined small hole of pressure reducing valve stem is blocked. As shown in the figure

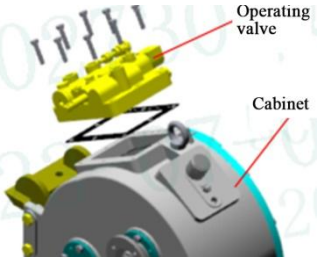


Fig. 5-09-11

5. After taking out the clutch, check whether the end cover bolts are loose. Then disassemble the second gear clutch and check whether the piston returns. If it does not return completely, the speed of the first gear and third gear will be equal.

6. Remove the transmission middle cover, and check whether the O-ring between the oil inlet of the first gear cylinder block and the box body is misaligned or damaged. Misalignment or damage to the O-ring will cause oil leakage into the first gear cylinder block, resulting in prolonged engagement time of the first gear.

7. Check the piston stroke, which should be controlled between 3.63 and 5.5 mm. When the friction disc is worn seriously, the piston stroke will increase, resulting in prolonged engagement time of the piston or deflection, and equal speed of different gears. Piston stroke control can usually be calculated by measuring the friction disc thickness. Thickness requirement of friction disc: The total thickness of 6 driving discs and 6 driven discs shall be controlled between 25.5-26.1 mm, with the maximum not exceeding 26.3 mm.

(III) After the second gear is engaged, wait for a few seconds before the loader can run.

Fault description:

After each gear shift, the transmission pressure rises slowly, and the pressure will drop after warming up, but the first and third gears work normally.

Possible causes: The clutches of all gears share the same oil. The normal working of the first and third gears indicates that the oil itself is not the main cause for the equal speed of the second gear and other gears.

1. The engine idle speed is too low.

2. The transmission control lever system is misaligned after loosening.

3. There are many impurities in the oil.

4. The seal on the transmission end cover is damaged.

5. The seal on the second gear clutch piston is damaged.

6. Sand hole or fracture of piston body.

Inspection steps or handling methods:

1. Check whether the engine idle speed is too low and whether the driver's operation is correct.

2. Check whether the transmission control system is poorly connected, resulting in inaccurate or incomplete gear engagement.

3. Check the oil line system. Remove the transmission oil sump filter screen and check whether the oil filter is blocked. At this time, carefully observe the oil and filter screen and check whether there are abnormal impurities in the oil or oil pan filter screen, such as seals and bolts.

4. Remove the transmission operating valve, and focus on checking whether the oil line of the second gear is blocked or the paper pad is damaged.

5. Remove the transmission end cover and check whether the O-ring and oil seal of the end cover are damaged.

6. Disassemble the second gear clutch, and check whether the piston guide pin is broken, whether the friction disc is worn, and whether the piston ring is stuck.

(IV) The pressure value cannot reach the normal value after gear engagement

Fault description:

After the loader is started, the pressure value at each gear of the transmission cannot reach the normal value (1.2MPa). Although the pressure of each gear is abnormal, driving and operation are normal.

Possible cause: According to the characteristics that the pressure value of each gear of the transmission cannot reach the normal value, but the driving and operation are normal, it can be preliminarily diagnosed that there is no fault inside the torque converter and transmission, and the fault is between the transmission controller and the pressure gauge. Therefore, this fault can be quickly eliminated by checking according to the following steps.

Inspection steps or handling methods:

1. Check whether the pressure gauge is normal. If it is damaged, please replace it. If it is normal, please go to step 2.

2. Check whether the connecting pipe and joint of pressure gauge are blocked. If so, clean them with diesel or gasoline.

3. Check whether the pressure regulating spring of transmission operating valve is deformed (short, bent or broken).

(V) Insufficient pressure at each gear, weak driving and operation

Fault description:

After the loader is started, the pressure value of each gear engaged in the transmission cannot reach 1.2MPa, and driving and operation are abnormal at the same time.

Possible cause: According to the fault phenomenon, it can be preliminarily analyzed that it is caused by insufficient oil supply of the fuel supply system, resulting in insufficient pressure at each gear and abnormal driving and operation at each gear.

1. Insufficient or improper oil.

2. The transmission control lever is loose or misaligned.

3. The pressure regulating spring of the transmission operating valve is broken or the pressure reducing rod is stuck.

4. The cut-off valve stem of the transmission operating valve does not return completely.

5. Internal leakage of transmission operating valve.

6. The oil suction pipe of the transmission pump is blocked or the working efficiency of the transmission pump decreases.

Inspection steps or handling methods:

1. Check whether the transmission oil is sufficient. In case of insufficiency, please add hydraulic transmission oil of the same brand and model. If the oil quantity is normal, please go to the next step.

2. Check whether the transmission control lever is misaligned. If so, the oil inlet of each gear cannot be fully opened, resulting in insufficient gear pressure. The fault can be eliminated after adjustment. If the transmission control lever is not misaligned, please go to the next step.

3. Check whether the transmission control pressure regulating spring is broken. If so, please replace it. If it is normal, please go to the next step.

4. Check whether the pressure reducing and regulating valve stem of transmission control is stuck. If it is stuck and cannot be returned, clean it with diesel or gasoline. If it is normal, go to the next step.

5. Check whether the transmission control cut-off valve stem is stuck. If so, part of the pressure oil will directly flow back to the oil pool, resulting in insufficient pressure at each gear and weak driving and operation. If the cut-off valve stem is not stuck, go to the next step.

6. Check whether the paper pad at the main oil passage of transmission control is cracked. When the paper pad at the main oil passage is cracked, the oil entering the transmission operating valve will flow back to the oil tank through the oil port. The fault can be eliminated by replacing the paper pad. If the paper pad is intact, please go to the next step.

7. Check whether the oil pan filter screen is blocked. If it is blocked, please replace the filter screen, filter element and transmission fluid. If the oil and filter screen are clean, go to the next step.

8. Check whether the inner layer of oil suction hose of transmission pump falls off or is blocked. Falling off or blocking of the inner layer of the oil suction hose will lead to oil suction difficulties. The fault can be eliminated by replacing the oil suction hose. If the hose is normal, please go to the next step.

9. Check the transmission pump for internal leakage or burn. If any, oil supply of the transmission system will be insufficient, so the transmission pump needs to be replaced. If the oil supply of transmission pump is normal, please go to the next step.

10. Check whether there are sand holes or cracks on the joint surface between the transmission housing and the transmission operating valve. If any, a large amount of pressure oil from the transmission pump will directly flow back to the oil pool, resulting in insufficient system pressure.

(VI) Under normal use of the loader, the transmission oil temperature will exceed 120℃ in a short time

Fault description:

The oil temperature rises rapidly, the transmission pressure, driving and operation are basically normal, and the engine water temperature is also normal. Possible causes: The oil temperature rise is mainly influenced by working conditions and improper use, such as long-term overload operation, insufficient oil supply of the fuel supply system, poor heat dissipation effect, etc.

1. Special working conditions or application methods. (e.g. paper mills, uphill operations, etc.)

2. The instrument is electrically damaged.

3. Improper oil use.

4. The engine accelerator or flameout cable is stuck.

5. The return oil pressure of torque converter is too high.

Inspection steps or handling methods:

1. Confirm the working condition and operation method (It is not advisable to operate under heavy load for a long time or continuously climb up a long slope with a gradient of no more than 30 °), check whether the operation method is correct, operate in the first gear, and adjust the engine accelerator control reasonably according to the working load.

2. Check whether the oil temperature sensor and oil temperature gauge are damaged.

3. Check whether the oil for torque converter & transmission meets the requirements. Replace the transmission filter element and clean the transmission oil radiator.

4. Check whether the engine accelerator cable and flameout cable are stuck.

5. Check whether the oil return pressure of torque converter is too high, resulting in rapid rise of oil temperature due to excessive liquid resistance of oil return system.

(VII) Do not run when the engine is cooled down; run when the engine is warmed up (after the loader is started, it cannot run when the gear is engaged. After a period of warming up, the loader starts to run)

Fault description:

When the engine is cooled down, the loader cannot run in any gear, but all gears can be used normally when the transmission oil temperature reaches above 50 ℃.

Possible causes:

1. The pipeline joint is loose.

2. Improper oil use.

3. Bad air flow.

4. The oil inlet valve of torque converter is damaged or the adjusting pressure is relatively high.

5. The cut-off valve of the transmission operating valve does not return completely.

6. Internal leakage of transmission pump.

7. The fit clearance between the transmission operating valve element and the valve body is interfered, and the tightening torque of the fixing bolt of the operating valve is uneven.

2. Check whether the oil is too thick. If it is too thick, it will make it difficult for the transmission pump to absorb oil when the engine is cooled down.

3. Check whether the transmission breather cap is blocked.

4. Check, replace or adjust the spring pressure.

5. Check whether the cut-off valve stem of transmission operating valve is stuck. In winter, attention shall be paid to the possible moisture freezing caused by compressed air.

6. Remove the transmission pump and check it for internal leakage, and check the wear of the transmission pump spline.

(VIII) Run when the engine is cooled down; do not run when the engine is warmed up (stop-and-go)

Fault description:

After the loader is started, it runs normally in any gear. After the engine is warmed up, its driving ability will decrease with the increase of oil temperature, and the pressure of each gear will also decrease. In severe cases, the pressure will drop to zero and the loader cannot run. However, after stopping for a period of time, the loader will start to walk again, and the same phenomenon will appear repeatedly. It should be noted that the pressure will also drop when in neutral.

Possible causes:

The fault and its characteristics show that the decrease of traveling ability is caused by the increase of oil temperature with the decrease of pressure. There are many reasons for the increase of oil temperature, but the cause of pressure drop is mainly in the oil supply system. In addition, the failure of oil supply system will inevitably lead to the increase of oil temperature, so the main reason lies in the oil supply system.

1. Improper maintenance.

2. The oil suction pipe of the transmission pump is flattened or blocked.

Inspection steps or handling methods:

1. Check the cleanliness of transmission oil. There is too much oil dirt. During oil suction, the dirt will gather at the oil outlet of the oil pan, blocking the oil outlet and affecting the oil suction of the transmission pump, resulting in pressure drop and reduced traveling ability. However, after shutdown for a period of time, the dirt will be dispersed into the oil again, and the loader will travel again when it is started again, so the same phenomenon will occur repeatedly.

2. Check the oil suction pipe of transmission pump. The inner layer of the oil suction hose of the transmission pump will become softer with the increase of oil temperature after falling off. At this time, under the action of oil suction of the transmission pump, the space of inner diameter of the oil suction hose may be blocked, making it difficult for the transmission pump to suck oil. When the falling-off area is large, the oil suction pipe may be completely blocked, resulting in insufficient oil supply and difficulty in establishing system pressure or even no pressure.

V. Main Components

Section X Instrument Cluster

Contents

5.10 Instrument Cluster

All monitoring instruments, alarm and steering indication systems of the loader are integrated in the instrument assembly under the steering wheel. The instrument system displays multiple items such as engine coolant temperature, engine oil pressure, engine speed, brake air pressure, fuel quantity, transmission oil temperature, system voltage, charging indicator, low braking pressure alarm, low transmission oil pressure alarm, working hour meter of the whole machine, left and right turn signal indicators, high beam indicator, etc.

5.10.1 Instrument Assembly

Fig. 5-10-01

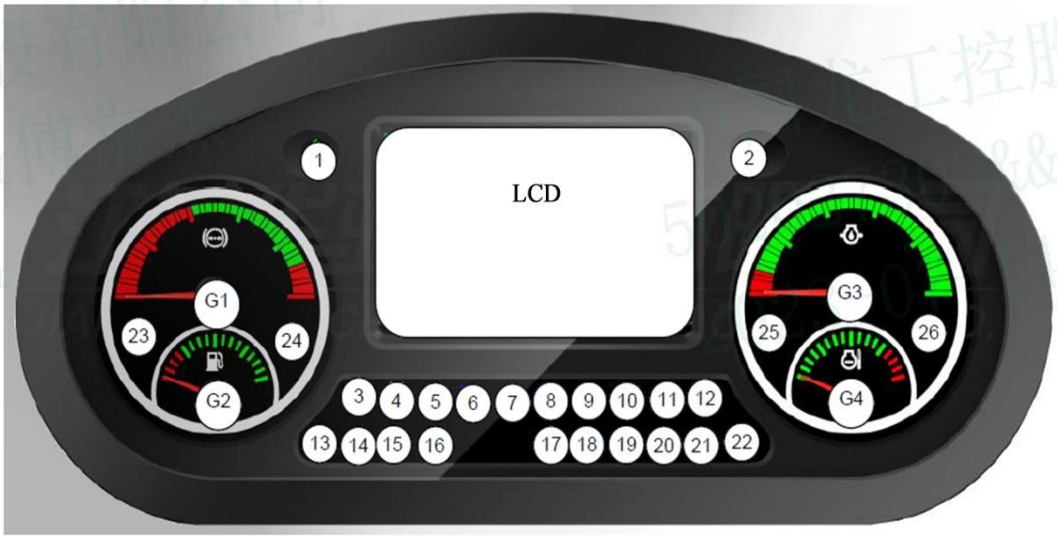
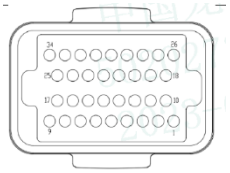


Fig. 5-10-02

5.10.2 Function Description

S/N	Functional description	V1.0
1	Pointer gauge	Pointer gauge 1 (G1): brake air pressure gauge Pointer gauge 2 (G2): fuel gauge Pointer gauge 3 (G3): oil pressure gauge Pointer gauge 4 (G4): engine coolant temperature gauge
2	LCD	See details below
3	Sound	Sound emitting device: buzzer
4	Button	There are 4 buttons on the instrument, namely Up, Down, Mute/Return and Menu/OK. The Menu/OK button can switch the display interface. When there is an alarm sound, press the Mute/Return button to mute the buzzer. 
5	Instrument lighting	Scale light: white Pointer light: red Turn signal light: green
6	Alarm light	Number of alarm lights: 26
7	Input signal	List of analog input signals: 1. Hydraulic oil temperature sensor signal (reserved) 2. Fuel quantity sensor signal 3. Transmission oil pressure sensor signal 4. Brake air pressure sensor signal 5. Transmission oil temperature sensor signal 6. Charging indication 7. Low oil pressure alarm 8. High coolant temperature alarm 9. Preheating 10. DPF regeneration state (reserved) 11. DPF regeneration disabled (reserved) 12. Driver alarm indication (reserved) 13. Driver performance limit (reserved) 14. SVS fault indicator 15. Oil-water separation 16. Vehicle speed sensor signal
		List of digital input signal: 1. Hydraulic oil cleanliness fault alarm 2. Neutral

		3. Parking brake 4. Preheating (reserved) 5. Clearance lamp 6. Air filter blockage fault alarm (reserved) 7. Low coolant level alarm (reserved) 8. Hazard indicator (reserved) 9. Left turn signal 10. Right turn signal 11. Low transmission oil pressure alarm 12. Oil cleanliness fault alarm of torque converter and transmission 13. High beam 14. 3t/5t identification signal
8	Output signal	Digital signal output Analog signal output
9	Connector	Number of connectors: 1
		Connector information: 34-core socket: 2-6447232-3 Corresponding harness end sheath: 4-1437290-0
		Connector Diagram 
10	Voltage	Normal voltage: 24V DC Power supply voltage: 10~36V DC
11	Current consumption	Quiescent current: The maximum quiescent current of the instrument is IQ ≤ 3mA
		Test method: The quiescent current value is measured when 24.0V ±0.2V is added between the instrument battery voltage input and GND, and other ports are suspended.
12	Mechanical characteristics	Dimensions: refer to product requirements [mechanical dimensions] Dustproof and waterproof: front: IP65 Whole gauge: IP30
13	Temperature requirements	Operating temperature: -30～+75℃ Storage temperature: -40～+85℃

5.10.3 Instrument Display Indicator

S/N	Description	Symbol	Color	Input signal
1	Left turn		Green	+24V
2	Right turn		Green	+24V
3	Low fuel level alarm		Yellow	Sensor
4	Preheating		Yellow	CAN
5	Clearance lamp		Green	+24V
6	High beam		Blue	+24V
7	Hazard indicator		Red	+24V, reserved
8	SVS fault indicator		Yellow	CAN
9	OBD lamp		Yellow	Reserved
10	Parking brake		Red	+24V

11	Charging indication		Red	Analog quantity
12	High water temperature alarm		Red	CAN
13	Neutral		Green	+24V, GND dual control
14	Air filter blockage fault alarm		Red	+24V
15	Fault alarm for cleanliness of hydraulic oil filter		Red	GND
16	Fault alarm for cleanliness of oil filter of torque converter and transmission		Red	GND
17	Driver performance limit		Red	CAN
18	Driver alarm indication		Yellow	CAN
19	DPF regeneration state		Yellow/Red	CAN
20	DPF regeneration disabled		Red	CAN
21	Low transmission oil pressure alarm		Red	Sensor/+24V
22	High transmission oil temperature alarm		Red	Sensor

23	Low coolant level alarm		Red	GND
24	Brake air pressure fault alarm		Red	Sensor
25	Low oil pressure alarm		Red	CAN
26	Oil-water separation fault alarm		Red	CAN

Liquid crystal – LCD layout

Fig. 5-10-03

If there is an alarm, the alarm and text prompt area will display the alarm text, which will alternately display the alarm of analog quantity and switching value during operation; under normal circumstances, it will display "Normal Operation".

1. Alarm and text prompt

❖ **Display conditions and corresponding text: as shown in the following table**

Alarm Index	Alarm Conditions	Alarm text
1	CAN signal cannot be received within 10s	Communication with engine ECU failed!
2	Fuel quantity <20%	Low fuel level, please check!
3	Transmission oil pressure < 1.0 Mpa, speed ≥ 100 rpm and parking brake is not activated or Connector assembly pin 21 input is +24V, speed ≥100rpm and parking brake is not activated	Transmission oil pressure too low, please check!
4	Brake air pressure < 0.4Mpa and speed > 650rpm	Low brake air pressure, please check!
5	Brake air pressure > 0.9 Mpa and speed > 650 rpm	High brake air pressure, please check!
6	Transmission oil temperature ≥120°C	Transmission oil temperature is too high, please check!
7	Connector pin 2 input is GND	Hydraulic oil filter is blocked, please check!
8	Byte3 of received message 0x18FEE400 is 01 Connector pin 5 input is +24V (reserved)	Preheating is in progress!
9	Connector pin 11 input is +24V (reserved)	Air filter blocked, please check!
10	Connector pin 12 input is GND (reserved)	Coolant level is too low, please check!
11	Connector pin 28 input is GND	Oil filter of torque converter and transmission is blocked, please check!
12	Coolant temperature ≥ 110°C	Engine coolant temperature is too high, please check!
13	Voltage < 26V and speed > 650rpm	Abnormal charging, please check!
14	Oil pressure < 0.07 Mpa and speed > 650 rpm	Engine oil pressure is too low, please check!
15	Byte0 of received message 0x18FD7C00 is 01 (reserved)	The vehicle is currently being regenerated. Please operate normally and pay attention to the components around the after-treatment device to avoid fire.
16	Byte0 of received message 0x18FD7C00 is 04 (reserved)	Move the vehicle to a safe area and park it for parking regeneration.
17	Byte0 of received message 0x18FD7C00 is 02 (reserved)	Move the vehicle to a safe area, park it and contact 400 for after-sales service.
18	Byte 0 of received message 0x18FEFF00 is 01	Abnormal oil-water separation, please check!
19	Byte1 of received message 0x18FEFF00 is 04 (reserved)	The urea level is low. Please stop the vehicle to add urea.
20	Byte1 of received message 0x18FEFF00 is 10 (reserved)	Limit the torque of the whole vehicle after parking and flameout.
21	Byte1 of received message 0x18FEFF00 is 18 (reserved)	At present, the vehicle torque has been limited.
22	Byte1 of received message 0x18FEFF00 is 20 (reserved)	The torque and speed of the vehicle have been limited after parking and flameout.
23	Byte1 of received message 0x18FEFF00 is 28 (reserved)	At present, the torque and speed of the vehicle have been limited.

24	Urea level ≤10%	The level of urea solution is too low, please check!
25	Urea temperature ≥100°C	The temperature of urea solution is too high, please check!

2. Digital signal input

S/N	Description	Activation signal	Connector pin
1	Hydraulic oil cleanliness fault alarm	GND	A2
2	Neutral	+24V	A3 to +24V, A1 to GND
3	Parking brake	+24V	A4
4	Preheating	+24V	A5 (reserved)
5	Clearance lamp	+24V	A6
6	Air filter blockage fault alarm	+24V	A11 (reserved)
7	Low coolant level alarm	GND	A12 (reserved)
8	**3t/5t identification signal**	Connected to GND: 3t; suspended: 5t	A13
9	Hazard indicator	+24V	A16 (reserved)
10	Left turn	+24V	A19
11	Right turn	+24V	A20
12	Low transmission oil pressure alarm	+24V, speed ≥100rpm and parking brake is not activated	A21

13	Oil cleanliness fault alarm of torque converter and transmission	GND	A28
14	High beam	+24V	A29

3. Analog signal input

S/N	Description	Activation signal	Connector pin
1	Hydraulic oil temperature sensor signal	/	A8 (reserved)
2	Fuel quantity sensor signal	Fuel quantity <20%	A15
3	Transmission oil pressure sensor signal (and low transmission oil pressure alarm)	Transmission oil pressure < 1.0 Mpa, speed ≥ 100 rpm and parking brake not activated	A21
4	Vehicle speed sensor signal	/	A23
5	Brake air pressure sensor signal	/	A30
6	Transmission oil temperature sensor signal	/	A31
7	Charging indication	Voltage < 26V	/
8	Low oil pressure alarm	Oil pressure < 0.07 Mpa	/
9	High water temperature alarm	Coolant temperature ≥ 110°C	/
10	Preheating	Byte3 of received message 0x18FEE400 is 01	/

11	DPF regeneration state	Bits 0 ~ 2 of Byte 0 of message 0x18FD7C00 received	Reserved
12	DPF regeneration disabled	Bits 0 ~ 1 of Byte 2 of message 0x18FD7C00 received	Reserved
13	Driver alarm indication	Bits 0 ~ 2 of Byte 1 of message 0x18FEFF00 received	Reserved
14	Driver performance limit	Bits 3~5 of Byte 1 of message 0x18FEFF00 received	Reserved
15	SVS fault indicator	Bits 0 ~ 1 of Byte 0 of message 0x18FECA00 received are 01	/
16	Oil-water separation	Bits 0 ~ 1 of Byte 0 of message 0x18FEFF00 received are 01	/

(I) Press F2 key to enter the main menu interface. The main menu has 6 submenus, namely: engine DTC, operating parameters, main machine information, user settings, instrument information and system settings, which will be introduced separately below. The F3 key is used to select up and the F4 key is used to select down.

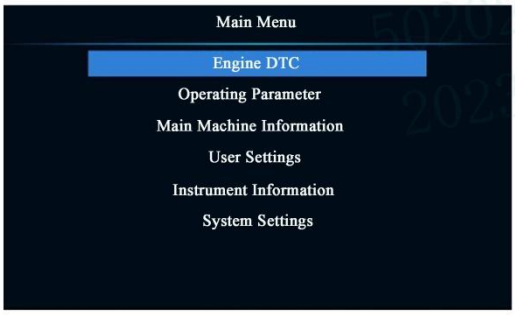


Fig. 5-10-04

① Engine DTC

Press F2 in the main menu to enter the 1st menu of the main menu interface. If the engine DTC appears, it can be seen in this menu; if there is no fault, it indicates that there is no fault. After entering the menu, press F1 or F2 to exit the main menu.

Fig. 5-10-05

If a DTC appears, press F2 to view the specific code, as shown in the following figure:

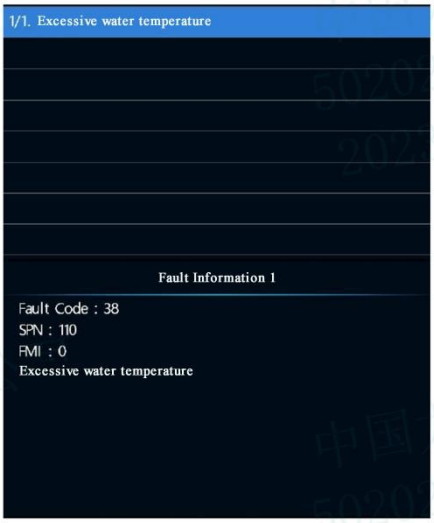


Fig. 5-10-06

② Operating parameters

Press F2 in the main menu to enter the 2nd menu of the main menu interface. Information about vehicle operating parameters can be found in this menu. After entering the menu, press F1 or F2 to exit the main menu. Press F3 to page up and F4 to page down.

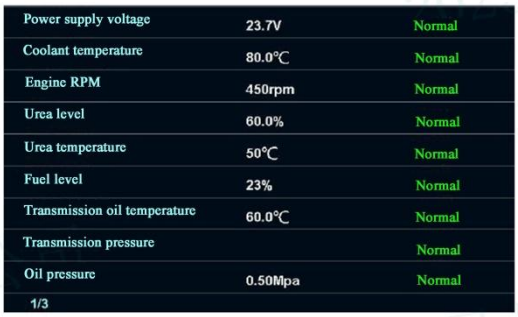


Fig. 5-10-07

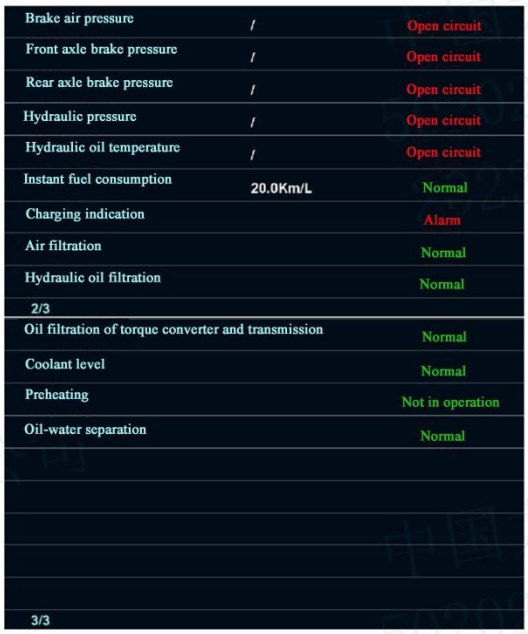


Fig. 5-10-08

③ Main machine information

Press F2 in the main menu to enter the 3rd menu of the main menu interface. Information about the OEM can be found in this menu. After entering the menu, press F1 to exit the main menu.

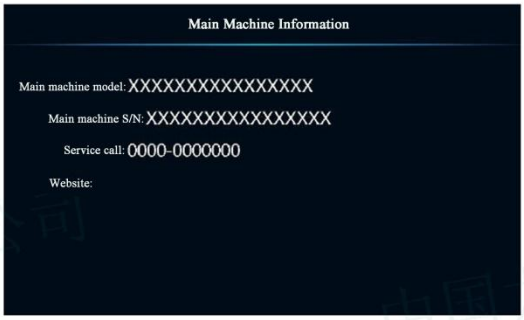


Fig. 5-10-09

④ User settings

Press F2 in the main menu to enter the 4th menu of the main menu interface. There are 2 submenus in this menu: language setting and brightness setting, as shown in the figure below. After entering the menu, press F1 to exit the main menu.

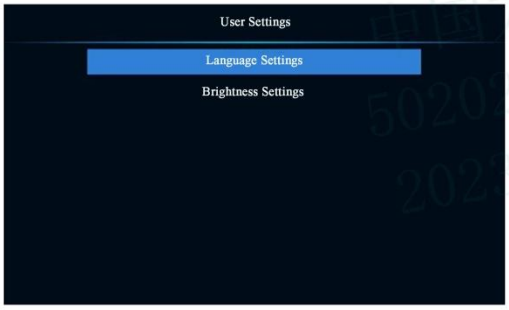


Fig. 5-10-10

In the user settings menu, press F2 to enter the 1st submenu - language settings. After entering, Simplified Chinese and English are available for selection. Press F3 to select up and F4 to select down, and press F2 to select the required language. After that, "Operation Succeeded!" will be displayed.

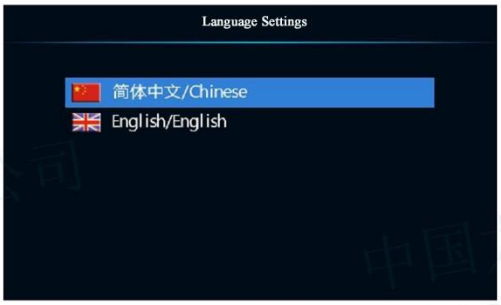


Fig. 5-10-11

⑤ Instrument Information

Press F2 in the main menu to enter the 5th menu of the main menu interface. Information about the instrument can be found in this menu. After entering the menu, press F1 to exit the main menu.

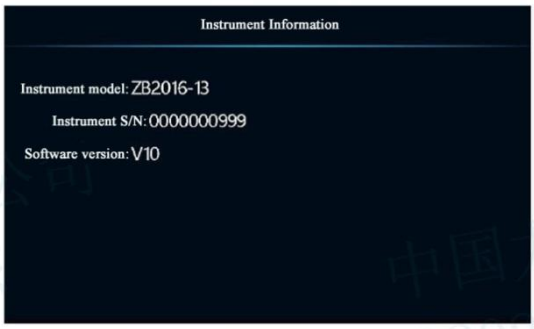


Fig. 5-10-12

⑥ System settings

Press F2 in the main menu to enter the 6th menu of the main menu interface. Password is required to enter this menu.

The password is 1111, as shown in the following figure:

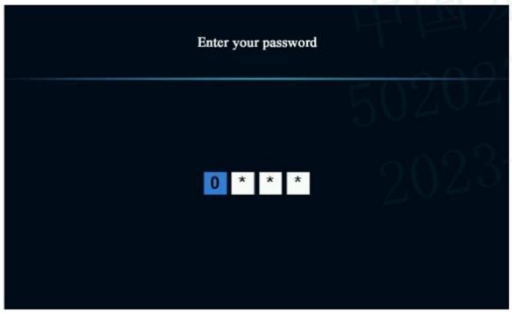


Fig. 5-10-13

The password has 4 digits. Press F3 to get the number +1, and press F4 to get the number -1. Enter from the 1st digit in turn and press F2 to confirm. If the password is wrong, return to the main menu interface; if the password is correct, enter the system setting menu, as shown in the following figure:

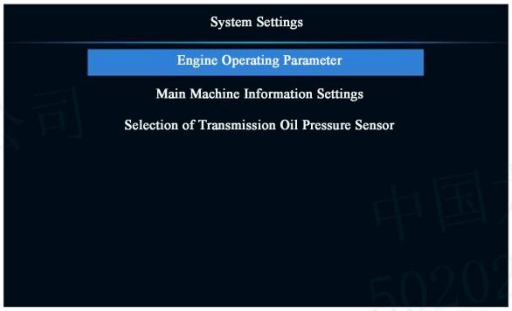


Fig. 5-10-14

(II) There are 3 submenus in the system settings, namely: engine operating parameters, main machine information setting and transmission oil pressure sensor selection. Press F3 to select up, F4 to select down, and F2 to confirm the entry.

① Engine operating parameters

This submenu contains detailed engine-related parameters, as shown in the following figure:

Fig. 5-10-15

② Main machine information settings

Main machine information can be modified in this submenu, as shown in the following figure:

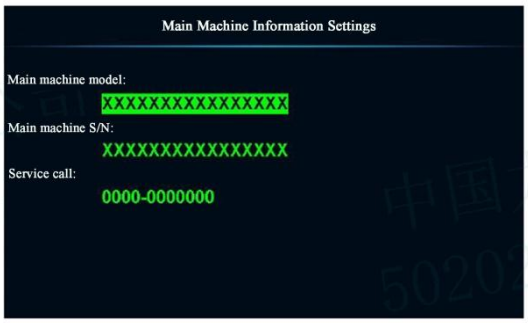


Fig. 5-10-16

Press F3 to select up, F4 to select down and F2 to confirm the selection.

Note: If you press F1 to exit after modification, it will be saved automatically.

③ Selection of transmission oil pressure sensor

This submenu allows you to select the sensor type of transmission oil pressure, as shown in the figure below:

Fig. 5-10-17

The identification of transmission oil pressure sensor can be set to 3 modes: automatic identification, analog sensor and switching sensor.

Press F3 to select up, F4 to select down and F2 to confirm the selection. After confirmation, "Operation Succeeded!" will be displayed and you will return to the

system setting menu.

V. Main Components

Section XI Hand Brake Flexible Shaft Assembly

Contents

5.11 Hand Brake Flexible Shaft Assembly

5.11.1 Outline Diagram

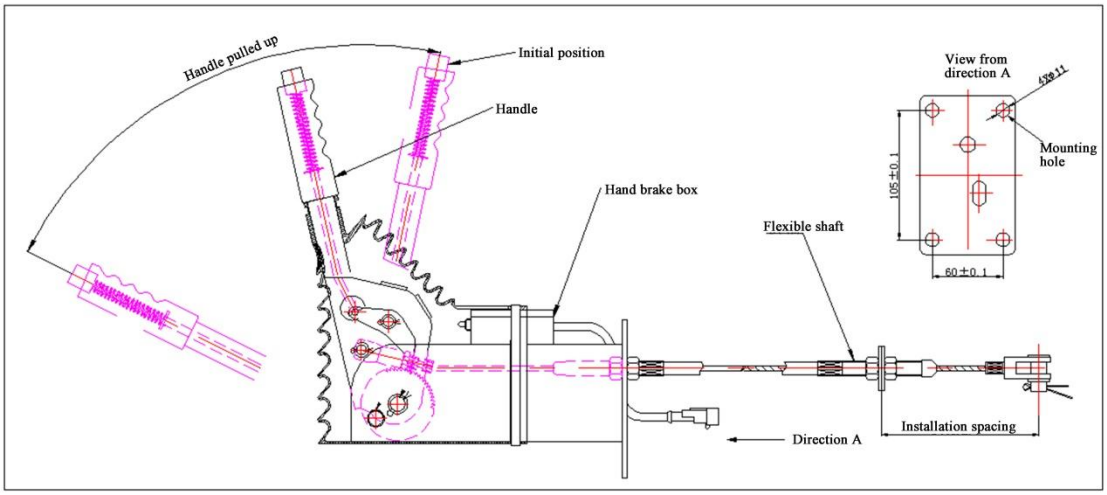


Fig. 5-11-01

5.11.2 Structure Description

The hand brake flexible shaft assembly is mainly composed of the following three parts: 1. handle; 2. hand brake box; 3. flexible shaft

5.11.3 Installation and Operation Instructions

As shown in the figure above, the hand brake assembly is fixed through 4 mounting holes on the bottom plate of the hand brake box, and the handle is pulled up for braking.

5.11.4 Adjustment and Maintenance

When the braking effect is poor during assembly or use of a new vehicle, it can be adjusted by adjusting the "installation spacing", specifically by adjusting the two nuts on the flexible shaft, so as to adjust the braking effect.

V. Main Components

Section XII Steering Gear

Contents

5.12 Steering Gear

5.12.1 Structure and Function

(I) Function

The control element of the vehicle steering system realizes the steering function of the vehicle through the steering wheel.

(II) Working Principle

The control/amplification rotary valve composed of the valve element, valve sleeve and valve body plays a dual role in controlling the oil flow direction and amplifying the flow. The cycloidal pin gear meshing pair composed of rotor and stator acts as a metering motor, which can ensure that the outlet oil quantity is directly proportional to the steering wheel angle. The pull pin and linkage shaft connect with the control/amplification rotary valve and rotor of cycloidal pin gear meshing pair, forming a mechanical feedback link. The return spring enables the valve element and valve sleeve of the control/amplification rotary valve to be strictly centered beyond the dead zone.

When the steering gear is in the middle position, the oil from the priority valve directly returns to the oil tank from the oil return port. When the steering gear deviates from the middle position with the rotation of the steering wheel, the oil from the priority valve is divided into two ways: part of oil (a small amount) flows through the control/amplification rotary valve to the cycloidal pin gear meshing pair to push the rotor to rotate with the steering wheel. The flow passing through the cycloidal pin gear meshing pair is proportional to the speed of the steering wheel. When the steering wheel rotates fast, the flow passing through the cycloidal pin gear meshing pair is large, and vice versa. Other oil flows directly to the steering cylinder through the control/amplification rotary valve to push the frame for steering. Its flow is controlled by a mechanical feedback link, which is formed by pull pin, linkage shaft connecting control/amplification rotary valve and rotor of cycloidal pin gear meshing pair. i.e., it is proportional to the speed of the steering wheel. When the steering wheel rotates faster, its flow will be larger and the steering will be faster, and vice versa.

5.12.2 Removal and Installation

1. Introduction to the position of steering gear on product

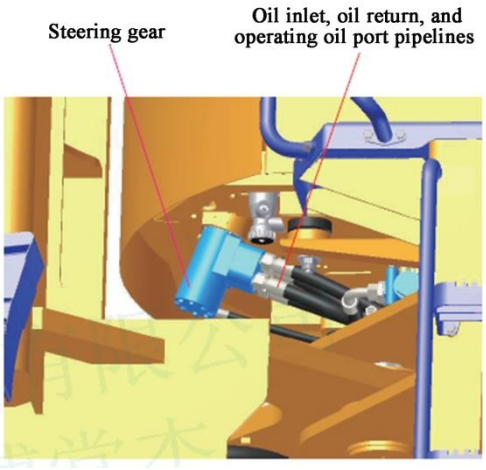


Fig. 5-12-01

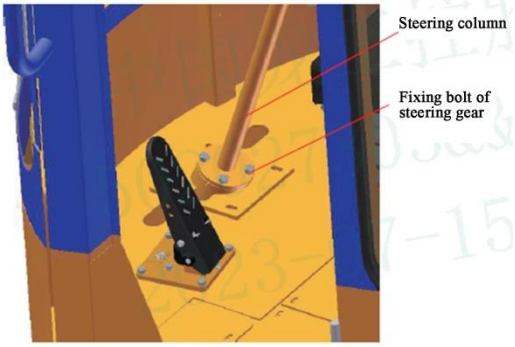


Fig. 5-12-02

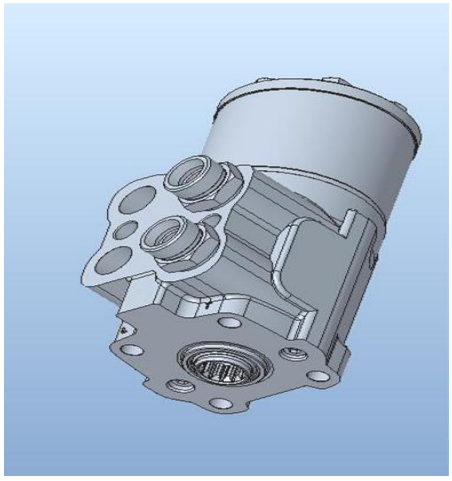


Fig. 5-11-03

① The steering gear is installed under the cab floor and connected with the column tube assembly inside the cab through the pipe seat installed on the cab floor.

② Four M10×85 mounting bolts with spring washers;

2. Removal steps:

① Release the pressure before removal, and then remove the connecting pipelines of 5 interfaces as indicated in Figure 5-12-01. The one with smaller diameter is the feedback pipeline on the side of steering gear;

② In case of oil leakage during removal, prepare an oil pan for standby; protect the oil port and mark it for reassembly;

③ Operate inside the cab in the following process: first remove the steering column cover, and then remove four M10×35 fasteners as shown in Figure 5-12-02. Meanwhile, cooperate with personnel outside to drag the steering gear (as shown in Figure 5-12-03);

3. Inspection instructions

① Check whether there are foreign matters in the inner cavity of each oil port;

② The screw plug and pressure regulating fastening end on the steering gear shall not be loosened without permission;

Commissioning shall be carried out by designated personnel (if required);

4. Installation

① Pay attention to the assembling direction of steering gear during installation, with 4 sets of oil port ends pointing to the rear side of vehicle body;

② Check whether the connecting paper pad is in good condition, and replace it if damaged;

③ Check whether the cross connecting sleeve is installed and assembled with the flat square under the steering shaft;

④ Assemble four M10×85 bolts (with spring washers) as shown in Figure 5-12-02;

⑤ Install the steering column cover;

⑥ The following operations shall be carried out outside the cab: Install the connecting pipelines with 5 interfaces according to the instructions in Figure 5-12-01. The one with smaller diameter is the feedback pipeline on the side of the steering gear.

Warning

Note: ① During assembly, check the sealing surface and sealing elements of the pipeline, and keep them clean;

② The assembling torque shall be as specified in the torque table. The list of required tools is as follows:

① 16-18 open-end wrench;

② 16-18 open-end torque wrench;

③ 1-inch and 2-inch adjustable wrenches;

④ 27-30 open-end wrench;

⑤ 350N m torque wrench.

5.12.3 Disassembly and Repair

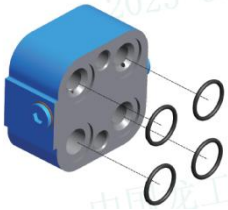
1. Disassembly process

① Place the steering gear on the workbench

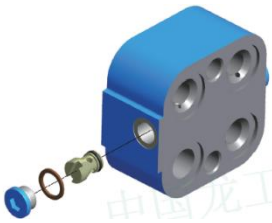
② Remove the two bolts of the joint seat

③ Remove the joint seat.

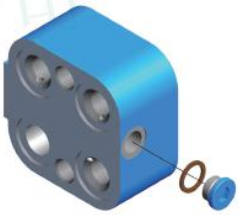
④ Remove the four seal rings on the joint seat



⑤ Remove the outer plug, copper gasket and inner plug on the joint seat



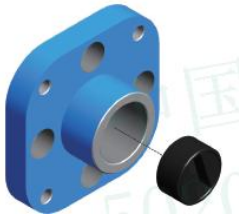
⑥ Remove the plug and copper gasket on the other side.



⑦ Remove the four bolts of upper end cover.

⑧ Remove the upper end cover

⑨ Remove the joint connecting the steering column in the upper end cover.



⑩ Remove the two seal rings on the upper end cover

⑪ Remove the seven bolts on the lower end cover

⑫ Remove the lower end cover, seal ring and gear washer

⑬ Remove the gear ring and seal ring

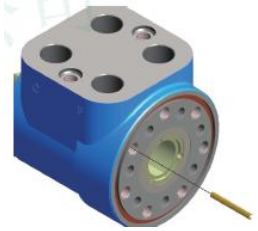
⑭ Remove the gear and jacking pipe in the gear

⑮ Remove the seal ring assembly from the gear

⑯ Remove the universal joint shaft, oil distribution disc and steel balls on the oil distribution disc

⑰ Remove the seal ring

⑱ Take out the small pipe in the valve body



⑲ Take out the valve element assembly from the valve body

⑳ Remove the seal ring assembly, axial bearing and its two gaskets on the valve element

Gasket

2. Repair process

Clean all parts and check whether they are damaged. If any, replace them with new ones. However, rubber seals, whether damaged or not, shall be replaced with new ones after removal.

① Assemble the valve element and valve sleeve

② Align the hole position of valve sleeve and transverse pin of valve element, and insert the transverse pin

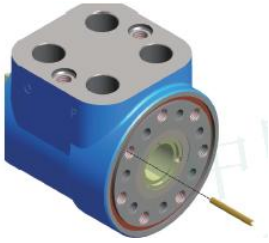
③ Install the middle spring assembly

④ Install the seal ring assembly, axial bearing and its two two gaskets on the valve element

Gasket

⑤ Install the valve element assembly into the valve body

⑥ Install the small pipe into the valve body



⑦ Install the seal ring

⑧ Install the universal joint shaft, oil distribution disc and steel balls on the oil distribution disc

⑨ Install the seal ring assembly on the gear

⑩ Install the gear and jacking pipe in the gear

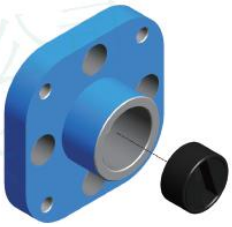
⑪ Install the gear ring and seal ring

⑫ Install the upper and lower end covers, seal rings and gear washers

⑬ Install the seven bolts on the upper and lower end covers

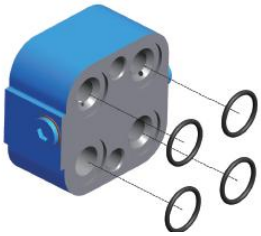
⑭ Install the two seal rings on the upper end cover

⑮ Install the joint connected to steering column



⑯ Install the upper end cover and its four bolts

⑰ Install the outer plug, copper gasket, inner plug and four seal rings on the other side of the joint seat onto the joint seat.



⑱ Install the joint seat and its two bolts

⑲ Assembly completed

V. Main Components

Section XIII Gear Pump

Contents

5.13 Gear Pump

5.13.1 Working Principle

The closed volume formed by the gear and pump housing is changed to complete the function of the pump. The flow distribution device is not required, so it is invariant, with the simplest structure, low price, and large radial load.

When the gear rotates, in cavity A, the volume gradually increases due to the disengagement of gear teeth, forming a vacuum to suck oil from the oil tank. With the rotation of the gear, the oil filled in the tooth groove is brought to cavity B, where the volume gradually decreases due to the meshing of gear teeth, and hydraulic oil is discharged.

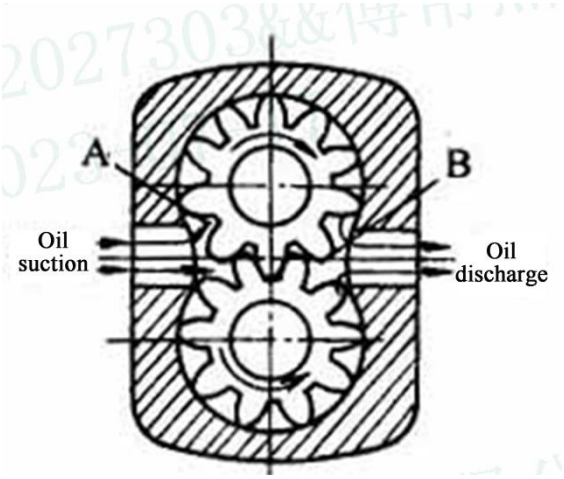


Fig. 5-13-01

Oil trapping:

When one pair of gears has not been disengaged, but the other pair of gears have entered into meshing, there will be a moment when two pairs of gears are meshed at the same time, forming a closed volume between the tooth meshing lines of the two pairs of gears, and part of oil is trapped in this closed volume, resulting in oil trapping. There is abnormal noise and high temperature in the pump.

Two oil trap unloading grooves are milled on the pump cover of the gear pump. When the oil trap cavity changes from large to small, it can be connected with the pressure oil cavity through the unloading groove, and when the oil trap cavity changes from small to large, it can be connected with the oil suction cavity through another unloading groove.

5.13.2 Analysis of Common Faults

S/N	Fault	Cause	Troubleshooting method
1	Reduced hydraulic oil and increased transmission oil	Damaged oil seal	Pressure measurement, replacement of oil seal or working pump
2	Increased hydraulic oil and decreased transmission oil	Damaged oil seal	Pressure measurement, replacement of oil seal or transmission pump
3	Oil leakage at the joint surface of pump body	Loose O-ring or bolt	Replace the O-ring or fastening bolt
4	Oil leakage of pump body	Cracking of pump body	Pressure measurement and pump replacement
5	Abnormal sound of pump	Excessive wear of spline shaft	Replace the spline shaft or pump
		Excessive wear of side plates	Replace the side plate or pump
		Out-of-tolerance dimension of spline shaft, jacking shaft	Replace the spline shaft or pump
		damaged bearing	Replace the bearing or pump
6	Slow lifting caused by insufficient pump flow	Excessive wear of gears or side plates	Replace the corresponding parts

V. Main Components

Section XIV Hydraulic Cylinder

Contents

5.14 Hydraulic Cylinder

5.14.1 Storage and Handling

When storing hydraulic cylinders, it is necessary to distinguish between short-term storage and long-term storage. Short-term storage is understood as storage for up to three months after arrival, and other conditions are regarded as long-term storage.

(I) Storage conditions

The hydraulic cylinder shall be stored in a dry and well-ventilated place, which shall not be affected by weather changes during storage to prevent moisture condensation and corrosive gases.

(II) Short-term storage

No special measures are required for short-term storage not exceeding three months, but the storage conditions listed in 1.1 must be met.

(III) Long-term storage

In case of long-term storage, in addition to meeting the storage conditions specified in 1.1, the user shall fill the inside of the hydraulic cylinder with corresponding working medium, which should not affect the sealing and hydraulic system medium.

The cleanliness of the medium filled in the hydraulic cylinder shall meet the cleanliness requirements of the working medium of the hydraulic system;

Unprotected parts, such as assembly surfaces or machined surfaces, shall be protected with special grease.

The spherical hinge bearing and shaft sleeve shall be coated with special grease, protected with sealing tape, and then wrapped in plastic packaging to prevent moisture and rust.

Requirements for best condition after storage

In order to ensure that the hydraulic cylinder remains in the best condition during storage, annual inspection must be carried out according to the following requirements:

① Rust prevention: Check the appearance for damage and rust;

② Working medium: Check the oxidation or acidification degree of working medium;

③ Check and add grease to the spherical hinge bearing and shaft sleeve;

④ Move the hydraulic cylinder back and forth to prevent the seals from sticking;

⑤ Correct any improprieties found immediately.

Availability validation

If the hydraulic cylinder is stored for more than one year, or if the actual storage conditions cannot meet the requirements given above, a comprehensive inspection shall be carried out before the hydraulic cylinder is put into use, and its availability shall be confirmed by functional tests.

Functional tests include:

Apply corresponding pressure for a certain period of time with no load to check whether there is leakage inside and outside the hydraulic cylinder;

Move the hydraulic cylinder back and forth to check whether there is creeping or runout.

Loading, unloading and handling

The following precautions must be observed when transporting and lifting the hydraulic cylinder:

① The hydraulic cylinder shall be transported horizontally and placed on a wooden pad. If possible, it is better to use the original package;

② No impact or collision is allowed during storage and transportation, and the exposed piston rod surface and other assembly parts must be properly protected;

③ Use soft slings to prevent damage to the surface coating. Iron chains and hooks can only be used to hook special lifting lugs on hydraulic cylinders;

④ The distribution of hooks shall ensure stable lifting, and if necessary, a balance device can be used.

5.14.2 Use of Hydraulic Cylinder

(I) Field installation of hydraulic cylinder

The following should be considered when preparing for on-line installation of hydraulic cylinders:

① Check the model of hydraulic cylinder, remove relevant protective articles, and no dirt is allowed in the oil port of hydraulic cylinder;

② Check the actual working pressure of the hydraulic cylinder. The pressure given by the system shall not exceed the rated pressure specified for the cylinder;

③ Check whether the hydraulic medium and operating temperature meet the requirements of this cylinder;

④ Check the surface of piston rod. No tape, paint or concrete is allowed to stick on the surface of piston rod to avoid damaging the seal.

⑤ The connecting bolts for installing the hydraulic cylinder and its accessories must be selected according to the strength grade required by the design;

⑥ Welding on the hydraulic cylinder is not allowed;

⑦ Reliable lifting equipment shall be used to meet the weight requirements of hydraulic cylinders and accessories. Multiple hoisting points shall be used as much as possible, and slings and lifting rings that meet the hoisting requirements must be used. Lifting rings are not allowed to bear shear force;

⑧ After the hydraulic cylinder is installed, it shall not be subjected to abnormal stress and unnecessary load;

⑨ The pipeline installed on the hydraulic cylinder must also be stress-free and meet the requirements of cleanliness.

(II) Putting into operation

After confirming that the hydraulic cylinder is installed correctly, the hydraulic system must be filled with working medium through a suitable filter. The cleanliness of the medium shall meet the design requirements before it can be put into use.

(III) Regular maintenance of hydraulic cylinder

In addition to regularly adding grease to the swing shaft, hinge point and pin shaft, the hydraulic cylinder is basically maintenance-free under normal circumstances. However, in order to ensure the normal function of the hydraulic cylinder, regular inspection shall be carried out according to the following requirements:

① Check whether there is oil leakage at the oil port;

② Check the surface of piston rod for damage and cleanliness;

③ Check the protective coating for damage;

④ Check whether there is internal leakage or external leakage. If the oil leakage exceeds the allowable value, replace the seal;

⑤ Check whether the pin shaft, swing shaft and hinge point at the connection part are abnormal, whether the fastening bolt is loose. If any, lock or replace it in time.

5.14.3 Replacement of Spare Parts

(I) Overview

Please take the following measures before starting operation:

① Make sure that you have an installation drawing of the hydraulic cylinder;

② Make sure that you have special tools for cleaning and the working area has been cleaned;

③ Use reliable lifting equipment and soft slings that can bear the weight of hydraulic cylinder. Make sure that the distribution of hoist points is reasonable and hoisting is stable;

④ When disassembling and assembling the hydraulic cylinder, no dirt is allowed to enter the hydraulic cylinder, and the oil port must be sealed and protected by a reliable method;

⑤ Take care to ensure that the exposed part of the piston rod of the hydraulic cylinder is not damaged.

(II) Empty the working medium

The working medium must be emptied before disassembling the hydraulic cylinder. It is necessary to consider the pressure increase in the hydraulic cylinder caused by temperature rise or sun exposure, and the damage to personnel caused by the temperature rise of the working medium.

(III) Removal of hydraulic cylinder

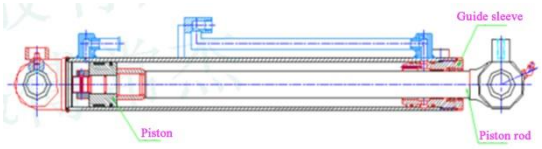


Fig. 5-14-01

The removal sequence is as follows:

① Remove the guide sleeve of the hydraulic cylinder. The structural modes of the guide sleeve include flange bolt fastening, snap ring fixing and guide sleeve thread fixing, etc. Special tools must be selected for removal;

② Pull the piston rod, guide sleeve and piston out of the cylinder barrel together and place them in a clean area to avoid damage to the piston rod and other internal components;

③ Remove the lock screw on the piston. The lock screw is located on the lock nut if there is a lock nut, and on the piston if there is no lock nut. The lock screws of some hydraulic cylinders are under the support ring on the piston. Remove the support ring before removing the lock screw, and then pour out a steel ball at the bottom of the lock screw;

④ Remove the piston. The structural modes of the piston include nut fixing and direct thread locking on the piston. In the nut fixing mode, the piston can be directly disengaged after the nut is removed; in the piston threaded mode, the piston can be directly removed;

⑤ Remove the guide sleeve, and then slide it out directly from the piston rod. When reaching the piston thread, the guide sleeve shall be slid out stably to avoid the seal inside the guide sleeve being scratched by the thread;

⑥ After the components are disassembled, take out the seals and then clean all parts with degreasing medium;

(IV) General guidance on installation process

The cleanliness of all parts and the correctness of installation tools must be ensured during installation. Installation shall be carried out in the reverse order of removal steps specified in 4.3, and the installation requirements are as follows:

① Install seals. According to different sealing forms, adopt corresponding special installation methods for seals, and pay attention to the installation direction of seals. If you have any objection, please consult the manufacturer;

② During installation, working medium shall be added to the contact surface between the seal and piston rod or cylinder barrel to ensure lubrication of the seal;

③ The guide sleeve must be smoothly inserted into the piston rod to prevent the piston rod thread from scratching the seal;

④ The piston must be fastened according to the torque value on the installation drawing, and special installation tools shall be used;

⑤ Tighten the lock screw, apply threadlocker to the screw, and knock the locking point on the threaded hole of the lock screw;

(V) Necessary tools and resources

The following tools and materials are required for replacement of spare parts and easily worn parts. It is necessary to ensure the inventory of these items, so as not to delay the construction period or replace them with other tools and materials by mistake.

Tools	**Material**
Allen wrench	Grease
Pneumatic wrench	Thread fastening agent
Torque wrench with sufficient capacity	Plane sealant
HAMMER	Polishing paper
Copper bar	Working medium
Adjustable hook wrench	Degreasing cleaning medium
Heaters for heating the seals	Snap spring pliers
Slings	

5.14.4 Troubleshooting for Maintenance and Repair of Oil Cylinder

① Only professionally trained personnel can maintain the hydraulic cylinder;

② Only professional manufacturers can repair the hydraulic cylinder;

③ Check whether there is leakage at the joint of oil port, piston rod, rod head, cylinder head and guide sleeve, and whether the mounting bolts and connecting parts of the cylinder are loose due to impact load;

④ Frequently check whether the hydraulic cylinder works normally, whether there is abnormal sound, and whether external parts such as piston rod, cylinder head, rod head and cylinder assembly are damaged;

⑤ Replace or clean the working medium oil filter frequently at least once a month;

⑥ The hydraulic medium must be replaced regularly according to its working characteristics and aging degree;

⑦ When the hydraulic cylinder cannot work normally due to leakage and component damage, wear parts shall be replaced immediately for repair;

⑧ During repair, the surface of each moving part shall be checked, and worn parts shall be replaced and repaired. The worn or broken seals shall also be replaced with new spare parts;

⑨ When assembling the hydraulic cylinder, ensure that the processed parts are free of burrs and sharp edges and cleaned, and grease shall be used for installation;

⑩ Pay attention to the correct installation direction of the seal to prevent it from being extruded and tightened. If the seal needs to cross the thread, auxiliary installation tools shall be used;

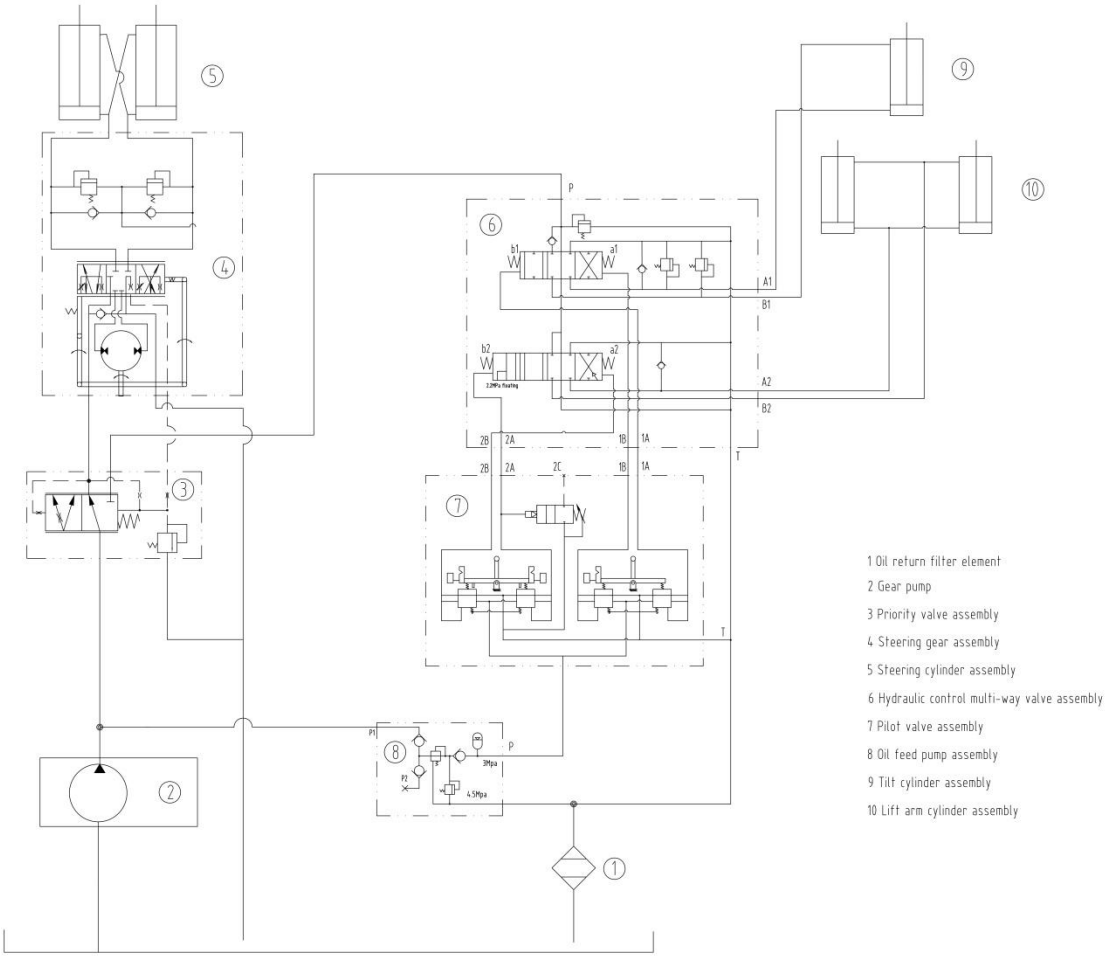
⑪ Do not use fiber or adhesive as sealant to avoid entering the cylinder and polluting the system or damaging the seal;

⑫ Oily waste parts, waste grease and waste hydraulic oil shall be recycled uniformly.

Troubleshooting

Fault phenomenon	Causes	Troubleshooting method
The hydraulic cylinder does not work.	1. The oil line is blocked or has serious leakage 2. The overflow valve is opened due to dirt. 3. Serious leakage caused by damaged seals or movement fit	1. Clean the pipeline and block leakage 2. Clean or replace the overflow valve 3. Replace or repair the seals and replace moving parts
Hydraulic cylinder underspeed	1. Internal leakage 2. The load is greater than the rated value. 3. The cylinder wall expands, resulting in internal leakage.	1. Replace the seal 2. Reset the overflow valve or update the selection 3. Re-select the cylinder with proper cylinder wall thickness.
Noise or abnormal vibration	1. The oil film on the moving surface is broken or the surface pressure is too high 2. The seal is over-compressed, resulting in operation with dry surface. 3. Serious leakage caused by damaged seals	1. Enhance the lubrication of kinematic pair surface 2. Correctly adjust and add high temperature grease 3. Replace the seal.
Creeping	1. Abnormal strength caused by improper assembly. 2. The speed is too low 3. The surface of the kinematic pair is dry and free from lubrication motion 4. Oil aging or poor lubrication performance 5. Excessive compression of seals 6. Air mixing 7. The surface contact pressure is too large, resulting in oil cut-off on the moving surface 8. Increased working resistance caused by sintering of moving parts	1. Correct installation 2. Correct selection of sealing materials and forms 3. Add grease to increase lubricity 4. Replace with lubricating oil with good lubricity 5. Adjust carefully and press evenly 6. Exhaust the gas in hydraulic oil 7. Reduce lateral load 8. Repair the moving surface
Poor buffering	1. Buffer mating surface is worn 2. Excessive inertia force	1. Replace the guide sleeve or buffer sleeve 2. Select appropriate buffer mechanism
Leakage	1. Wear or damage of seals 2. The seal is not pressed tightly 3. The surface of piston rod or cylinder block is worn, forming deep marks and pits	1. Replace the seal 2. Readjust the pressing force 3. Repair or replace the piston rod and cylinder block

VI. Hydraulic Schematic Diagram



VII. Electrical Schematic Diagram