# LG50HCGⅧ.00Ⅰ

Wheel loader

Repair Manual

Code：68000009355

# Foreword

Thank you for selecting the high-performance Lonking loader! The LG50HC Wheel Loader Repair Manual has been prepared to provide the dealers and service stations of Lonking with a better understanding of the Lonking LG50HC (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 the Machine

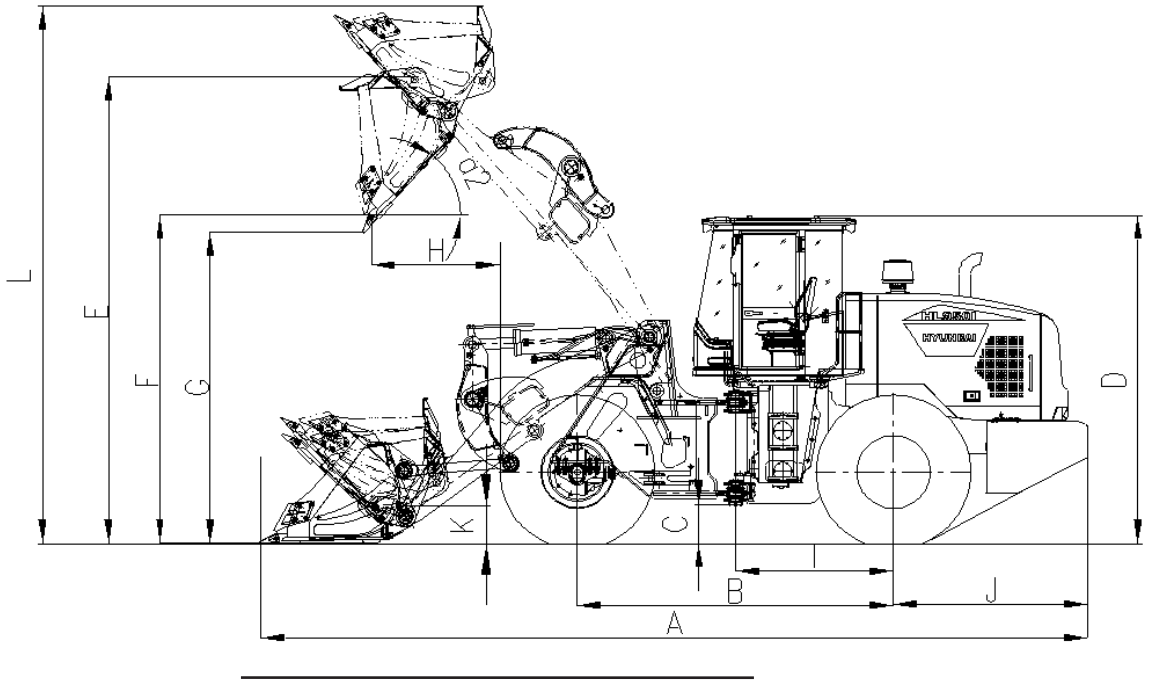



Fig. 2-01-01

**Overall dimensions:**

| Code | Description | Dimension |
|---|---|---|
| **A** | **Length of whole machine** | 8650 mm |
| **B** | **Wheel base** | 3300 mm |
| **C** | **Minimum ground clearance** | 398mm |
| **D** | **Maximum total height of main engine** | 3400mm |
| **E** | **Height of pin shaft at maximum lifting** | 4520mm |
| **F** | **Unloading height** | 3435mm |
| **G** | **Distance from bucket teeth to the ground during unloading** | 3250mm |
| **H** | **Rear dump distance** | 1280mm |
| **I** | **Spacing between rear axle and articulated point** | 1650mm |
| **J** | **Rear overhang length** | 2030mm |
| **K** | **Height of transport position** | 400mm |
| **L** | **Overall height at maximum lifting** | 5624mm |
| **a2** | **Unloading angle** | 45 ° |

| Standard specification | | | |
|---|---|---|---|
| **Item** | | | **Specification** |
| **Performance** | **Bucket capacity** | | 3.0 m |
| Performance | **Rated load** | | 5000kg |
| Performance | **Lift arm lifting time** | | ≤5.6s |
| Performance | **Sum of three items** | | ≤10.5s |
| Performance | **Maximum speed of** | **Forward gear I** | 11km/h |
| Performance | **Maximum speed of** | **Reverse gear I** | 14km/h |
| Performance | **Maximum speed of** | **Forward gear II** | 36km/h |
| Performance | **Traction** | | 175±5kN |
| Performance | **Maximum digging force (tilt)** | | 170±5kN |
| Performance | **Maximum gradeability** | | 28° |
| Performance | **Minimum turning** | **Outer side of bucket** | 7407mm |
| Performance | **Minimum turning** | **Tire center** | 6353mm |
| Performance | **Geometric dimensions** | **Vehicle length (bucket laid** | 8650±100mm |
| Performance | **Geometric parameters** | **Vehicle width (outer side of** | 2835±50mm |
| Performance | **Geometric parameters** | **Bucket width** | 3000±30mm |
| Performance | **Geometric parameters** | **Vehicle height (top of cab)** | 3400±30mm |
| Performance | **Geometric parameters** | **Wheel base** | 3300±30mm |
| Performance | **Geometric parameters** | **Wheel track** | 2240±10mm |
| Performance | **Geometric parameters** | **Minimum ground clearance** | 398±20mm |
| Performance | **Geometric parameters** | **Unloading height** | 3435±50mm |
| Performance | **Geometric parameters** | **Dump distance at maximum lift** | 1280±50mm |
| Performance | **Weight** | 17600±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 | | Nominal diameter of bolt (mm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bolt | | 22 | 24 | 27 | 30 | 33 | 36 | 39 |
| Bolt strength | Yield | 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 | Capacity |
|---|---|---|
| | -30 -20 -10 0 10 20 30 40 50 | Amount added |
| Engine oil | API Ck-4 and above<br>SAE 10W-30<br>SAE 15W-40<br>SAE 5W-40 | 17L |
| Hydraulic transmission oil | SAE 10W | 36L |
| Hydraulic oil | L-HM46<br>L-HV46 | 173L |
| Drive axle gear oil | SAE 85W-90<br>SAE 85W-90 | 37L |
| Grease | NO.2 | 1KG |
| Diesel oil | 0#<br>-10# | ——<br>—— |

**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<br>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

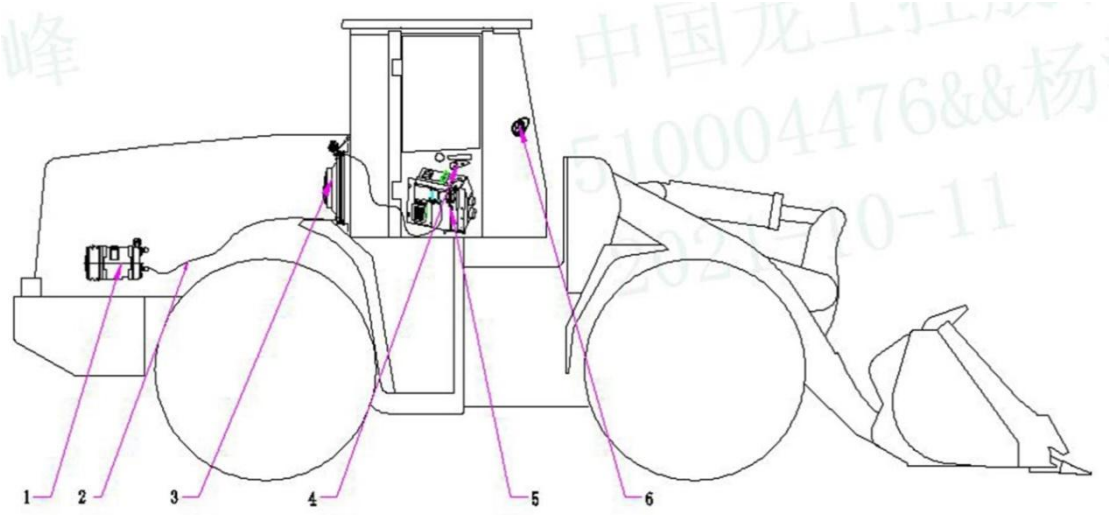
## Section 1 A/C System

**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**

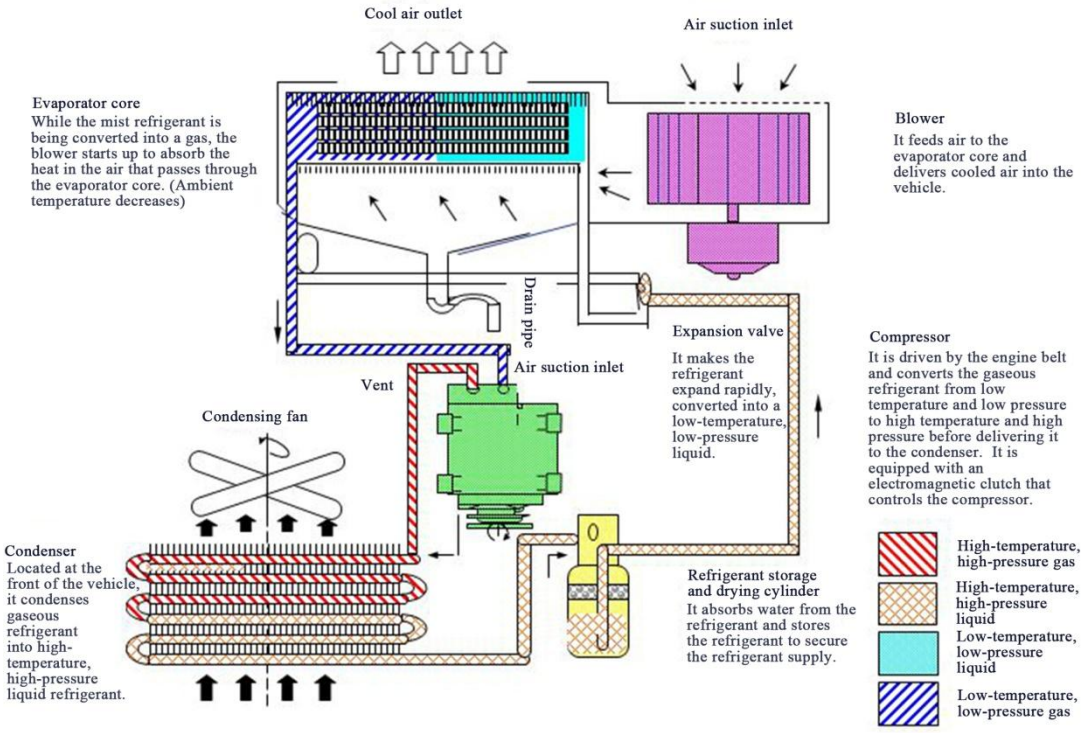



Fig. 5-01-02

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**

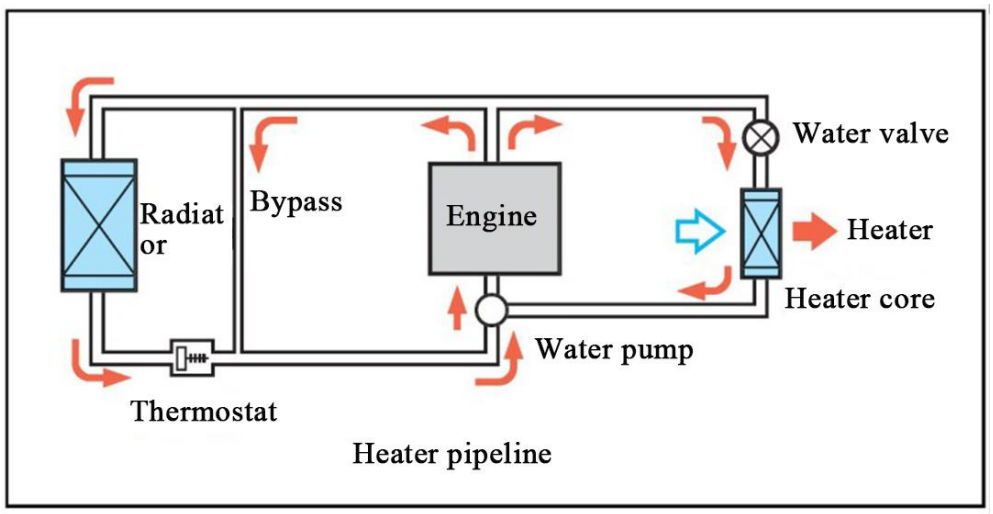



Fig. 5-01-03

### 5.1.3 Electrical Schematic Diagram of A/C

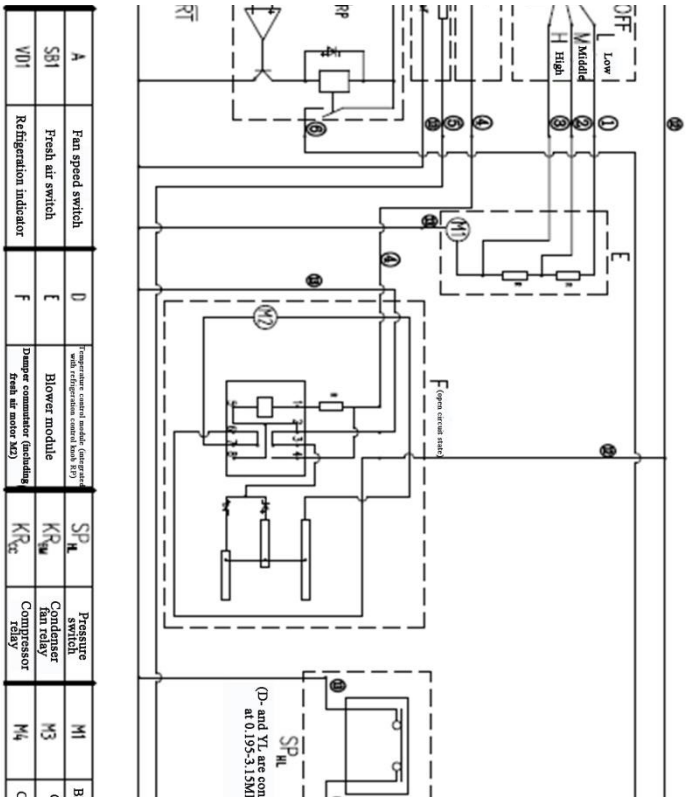



Fig. 5-01-04

### 5.1.4 Installation Guidelines 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 | 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.

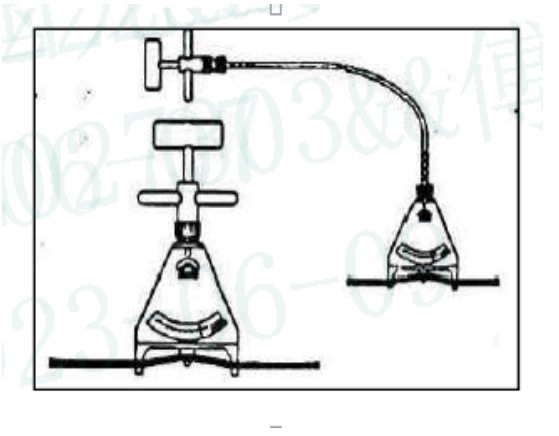


Fig. 5-01-05

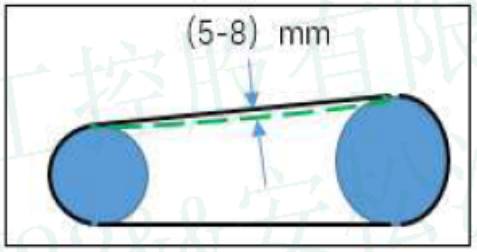



Fig. 5-01-06

| 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

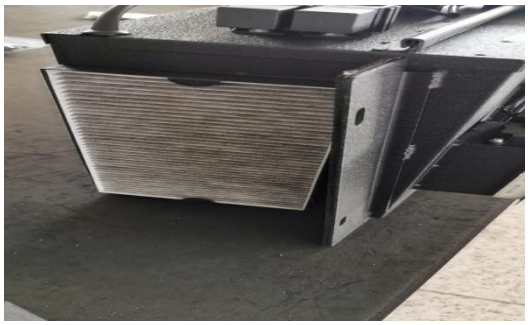


Fig. 5-01-08

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.**


**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.


**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**

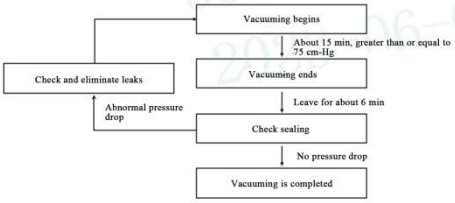



Fig. 5-01-12

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)

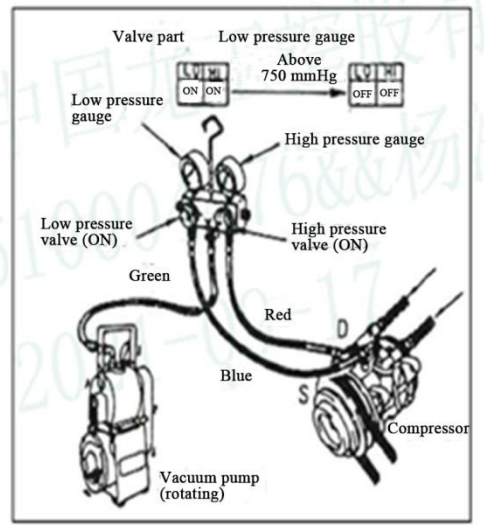



Fig. 5-01-13

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.

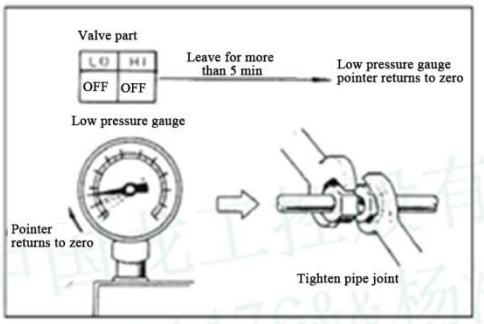



Fig. 5-01-14

## (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 Guidelines 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 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; | Handle or replace the faulty parts |

| | | | | |
|---|---|---|---|---|
| | | | watch/touch/listen | |
| | Clutch does not engage/lines failures | Start the A/C, and there is no change in system pressure | Test it with a pressure gauge and observe the pressure; watch/listen | Handle or replace the faulty parts |
| | Broken or no belt | | | |
| | 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 |

| | | | | |
|---|---|---|---|---|
| **Refrigeration of A/C does not work** | 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 thermometer | Close the water valve or replace it |
| | 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 |
| | 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.

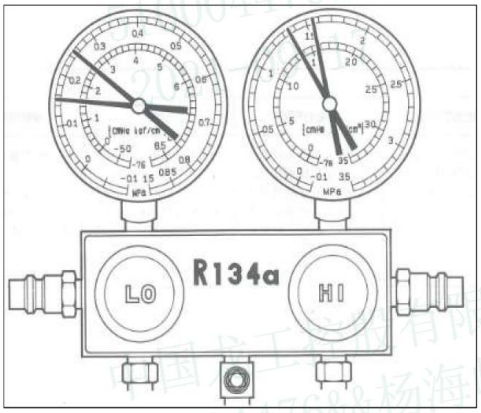



Fig. 5-01-15

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

2. Moisture in the refrigeration system

Condition: intermittent refrigeration, and finally no refrigeration

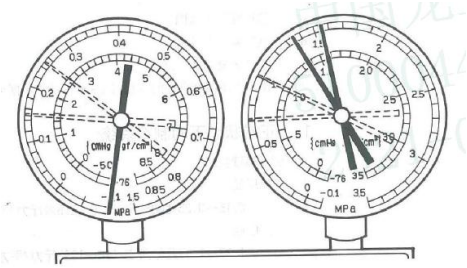


Fig. 5-01-16

| 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

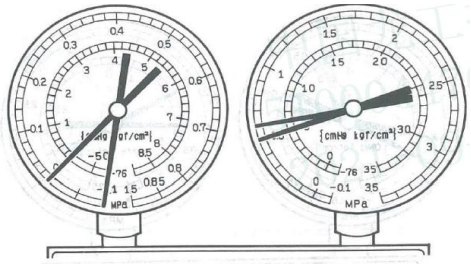


Fig. 5-01-17

| 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)

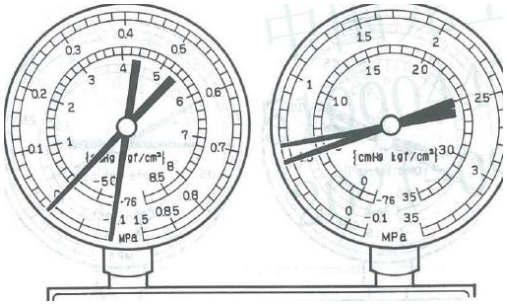


Fig. 5-01-18

| 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. | Dirt in the refrigerant impedes the flow of the refrigerant. 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

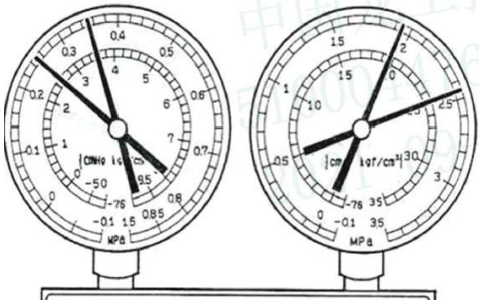


Fig. 5-01-19

| 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

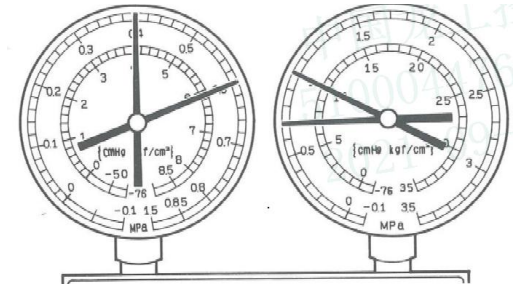


Fig. 5-01-20

| 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 |

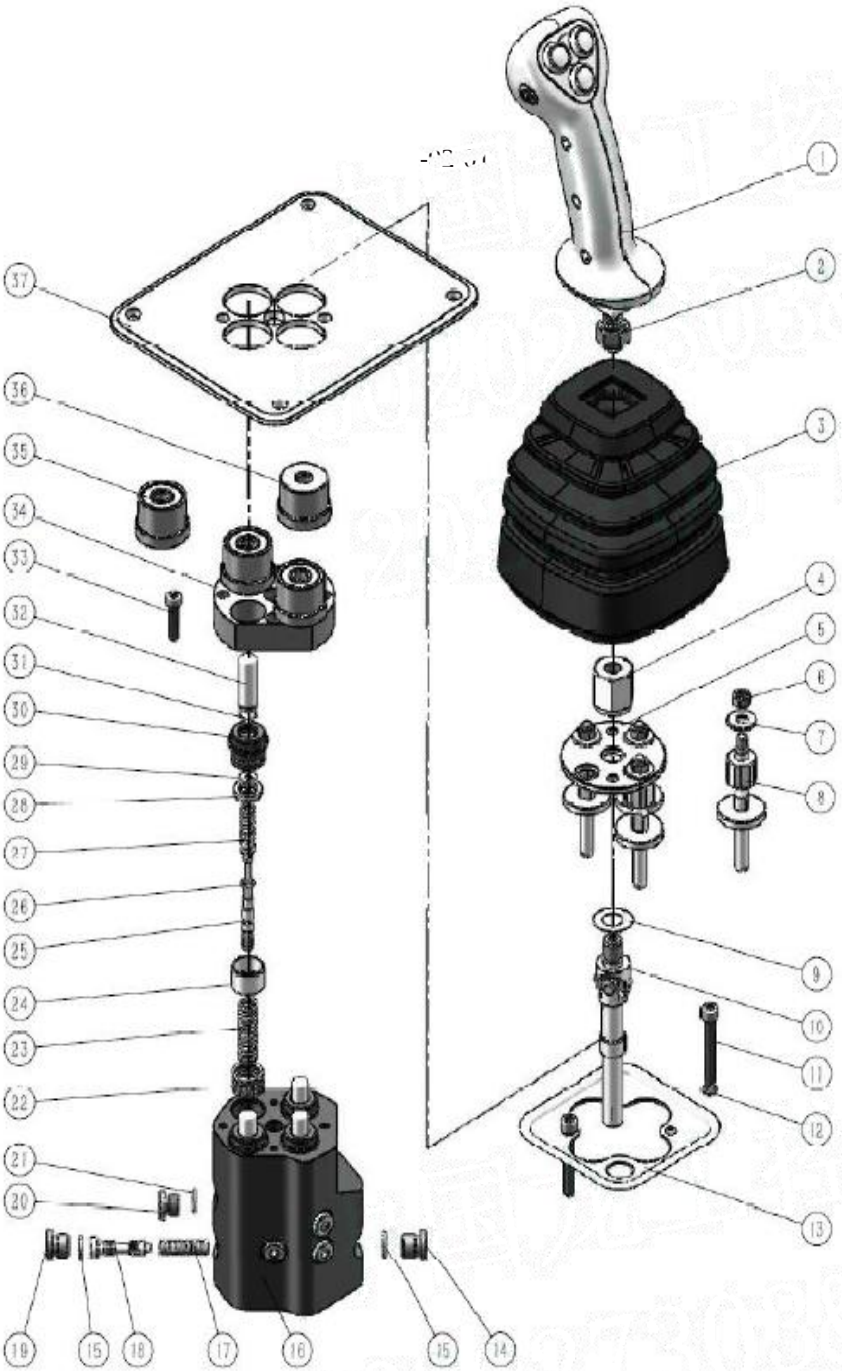


Fig. 5-02-01

| 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<br>Lift arm joint: 0.5-1.9 MPa | |

### 5.2.1 Schematic Diagram of Pilot Valve

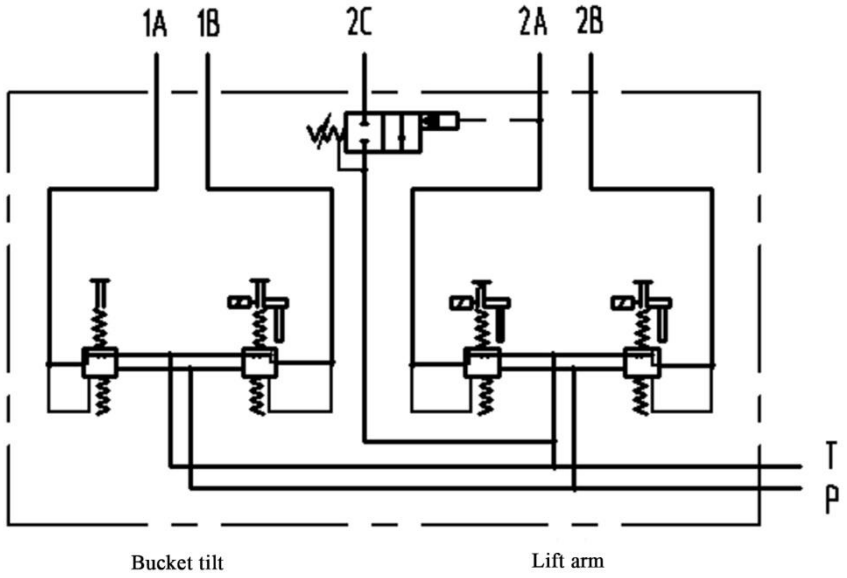



Fig. 5-02-02

### 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 Fault 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 |
| **2** | Unreliable positioning of electromagnet | 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 in insufficient suction | Remove the dirt on the joint surface of pure iron pressing plate 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

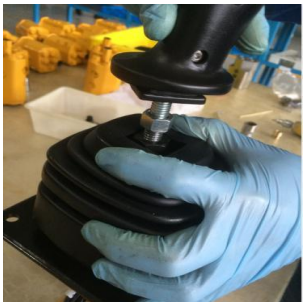
③ Loosen the M6 bolts with an S5 Allen wrench, and remove the mounting plate, cover plate, electromagnet, etc.

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.

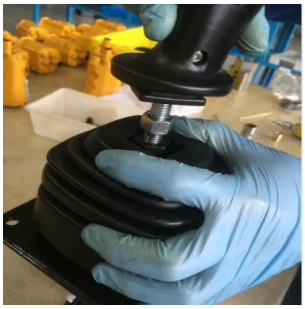


② Loosen and remove the thick nut with an S22 wrench, remove three M6 nuts with S10 and S17 wrenches, loosen the universal joint with an S5 Allen wrench, and take out the disc and universal joint.

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

| Technical parameters | |
|---|---|
| Nominal pressure: 25 MPa, nominal diameter: 32 mm; | Oil makeup nominal diameter: 25 mm; |
| Nominal flow: 250L/min; | Oil makeup opening pressure: ≤0.3 bar; |
| Maximum set pressure of overload valve: 31.5 MPa; | |

### 5.3.1 Structural Diagram

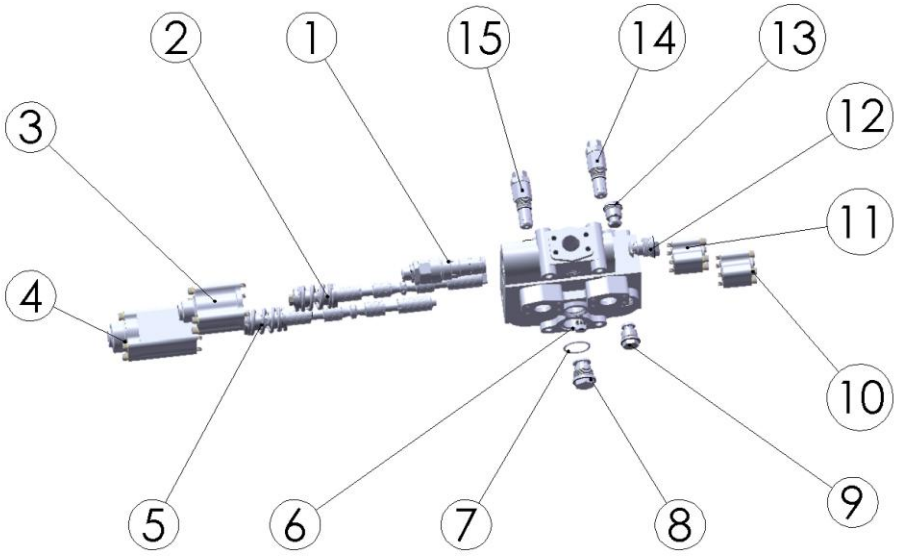



Fig. 5-03-01

| Parts Catalog | |
|---|---|
| 1: Main overflow valve (assembly) | 9: Lift arm makeup valve (assembly) |
| 2: Tilt valve stem (assembly) | 10: Small end cover of lift arm (assembly) |
| 3: Tilt large end cover (assembly) | 11: Tilt small end cover (assembly) |
| 4: Large end cover of lift arm (assembly) | 12: Tilt oil inlet check valve (assembly) |
| 5: Lift arm valve stem (assembly) | 13: Tilt oil makeup valve (assembly) |
| 6: Pressure measuring port plug (assembly) | 14: Low-pressure overload valve (assembly) |
| 7: Oil return port seal ring | 15: High pressure overload valve (assembly) |
| 8: Lift arm oil inlet check valve | |

### 5.3.2 Schematic Diagram

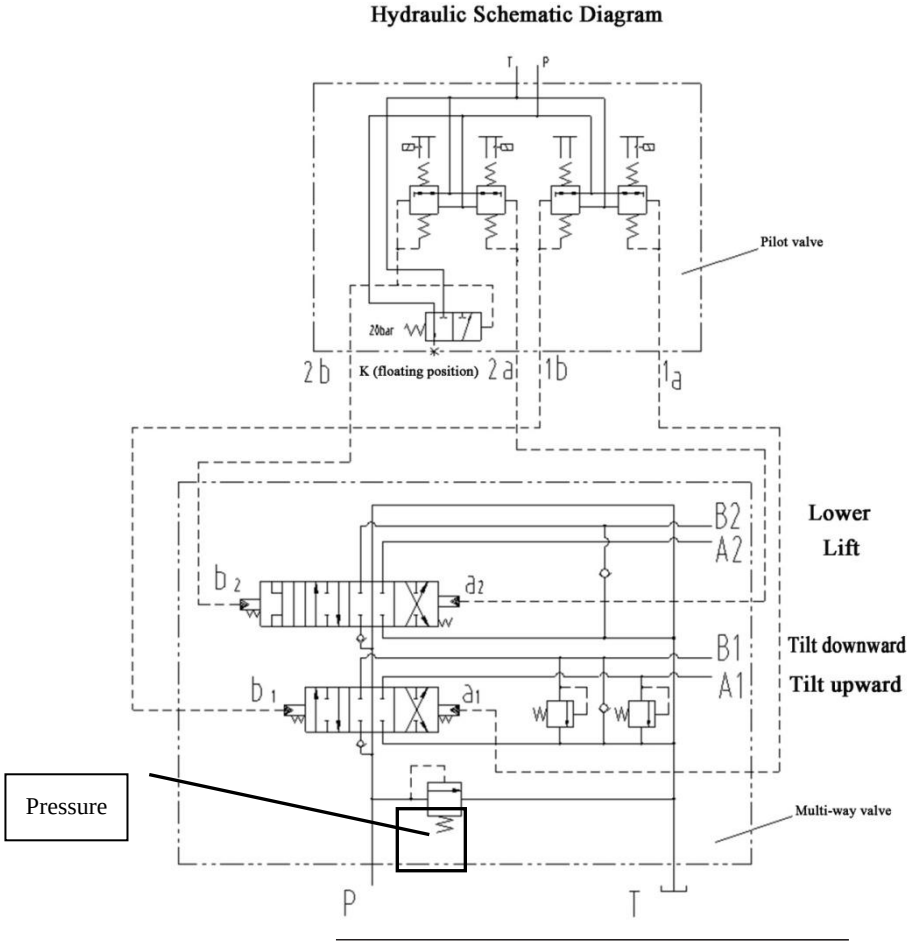



Fig. 5-03-02

| Parts Catalog | |
|---|---|
| P: Oil outlet connected to oil pump | B2: To small cavity of lift arm cylinder |
| A1: To large cavity of tilt cylinder | T: To oil return tank |
| B1: To small cavity of tilt cylinder | a1, b1: Tilt pilot control oil port |
| A2: To large cavity of lift arm cylinder | a2, b2: Lift arm pilot control oil port |

### 5.3.3 Introduction to Working Principle

In the 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 and b2 are the control oil ports of the lift arm pilot valve; external tilt check valve 12 and lift arm check valve 8 prevent pressure oil from flowing back into the oil tank during direction switching, thus overcoming "nodding" phenomenon in the working process. The safety valve 1 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 2 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. Upward tilting of bucket

The pilot oil enters from port a1, and the tilt valve stem 2 is pushed out to close ports "P" to "T". The hydraulic oil enters from port "P" to open the tilt check valve 12, flows through the oil passage in the valve body to port A1 and then enters the large cavity of the cylinder. At this time, the hydraulic oil in the small cavity of the cylinder passes port "B1" and returns to the oil tank through port "T", so that the bucket rotates upward.

3. Downward tilting of bucket:

The pilot oil enters from port b1, and the tilt valve stem 2 is pushed in to close ports "P" to "T". The hydraulic oil enters from port "P" to open the tilt check valve 12, flows through the oil passage in the valve body to port B1 and then enters the small cavity of the cylinder. At this time, the hydraulic oil in the large cavity of the cylinder passes port "A1" and returns to the oil tank through port "T", so that the bucket rotates downward;

When the external force of the tilt valve stem 2 is canceled, the valve stem automatically returns to the middle (closed) position by the elasticity of the return spring.

4. Overload oil makeup valve

There is an overload valve (which can also be increased or decreased arbitrarily according to the user's needs) on the oil line of the front and rear cavities of the tilt cylinder respectively, which is used to eliminate the trapped oil or negative pressure in the cylinder when the bucket is subjected to external impact load or other mechanism interference.

(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 through port P to open the lift arm check valve 8, passes the oil passage inside the valve body, and then enters the large cavity of the cylinder through port A2. At this time, the hydraulic oil in the small cavity of the cylinder passes port "T" and returns to the oil tank through port "B2", so that the lift arm is lifted.

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 passes port P, flows through the passage to port B2, and then enters the small cavity of the cylinder. At this time, the hydraulic oil in the large cavity of the cylinder passes port "A2" and returns to the oil tank through port "T", so that the lift arm is lowered.

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 gravity of the work tool and ground force.

### 5.3.4 Installation and Use

1. During handling, installation and storage, avoid impacting or damaging the machined surface and the oil port surface.

2. Before installation, do not remove the plastic plugs of the oil ports. Do not perform disassembly and assembly in dusty places to prevent dirt from entering.

3. The mounting plate and bracket shall be flat, and the tightening force of mounting screws shall be uniform without distorting the valve body.

4. Correctly connect all oil ports, and the pipeline should not be too long.

5. The working oil shall be clean, and the cleanliness of oil and system shall not be lower than Grade 18/15 in ISO4406 or Grade 9 in NAS1638.

6. It is recommended to use hydraulic oil N32 (in winter), N46 (in summer) or other hydraulic oil with similar viscosity.

7. The allowable operating temperature of hydraulic oil is -20 ℃ ~ +100 ℃.

### 5.3.5 Fault and Troubleshooting

| S/N | Fault | Cause | Solutions | Remarks |
|---|---|---|---|---|
| 1 | Automatic tipping, falling or weak retracting of bucket | The high-pressure overload valve element is jammed | Remove and clean or replace the high-pressure overload valve | |
| | | Excessive leakage in the tilt cylinder | Consult the cylinder manufacturer for details | |
| 2 | Bucket tilting is weak or the machine cannot be jacked by the bucket | The low-pressure overload valve element is jammed | Remove and clean or replace the low-pressure overload valve | |
| | | Excessive leakage in the tilt cylinder | Consult the cylinder manufacturer for details | |
| 3 | Weak and slow lifting and automatic sinking of the boom | The safety valve element is locked | Remove and clean the safety valve or replace it | |
| | | Low pressure of safety valve | Properly increase the pressure of safety valve | |
| 4 | Large lift arm sinking | Excessive leakage in lift arm cylinder | Consult the cylinder manufacturer for details | |
| | | Relatively large leakage at the middle position of the valve body | Replace the whole valve body | |
| 5 | Valve stem is jammed | Oil is too dirty | Remove and clean the valve stem and replace the oil | |
| 6 | Oil leakage at positioning end cover and screw plug | Damaged O-ring | Replace the corresponding O-ring | |

| List of Wearing Parts | | | | | |
|---|---|---|---|---|---|
| S/N | Code | Name and specification | Quantity/set | Material | Remarks |
| 1 | XDY32G02-00A | Safety valve | 1 | Insert | |
| 2 | Y10G03-00A | High-pressure overload valve | 1 | Insert | |
| 3 | Y10G03-00 | Low-pressure overload valve | 1 | Insert | |
| 4 | GB/T3452.1-2005 | O-ring 31.5*2.65 | 2 | Nitrile rubber | |
| 5 | GB/T3452.1-2005 | O-ring 55*3.1 | 2 | Nitrile rubber | |
| 6 | GB1235-1976 | O-ring 50*3.1 | 1 | Nitrile rubber | |

**Outline schematic diagram**

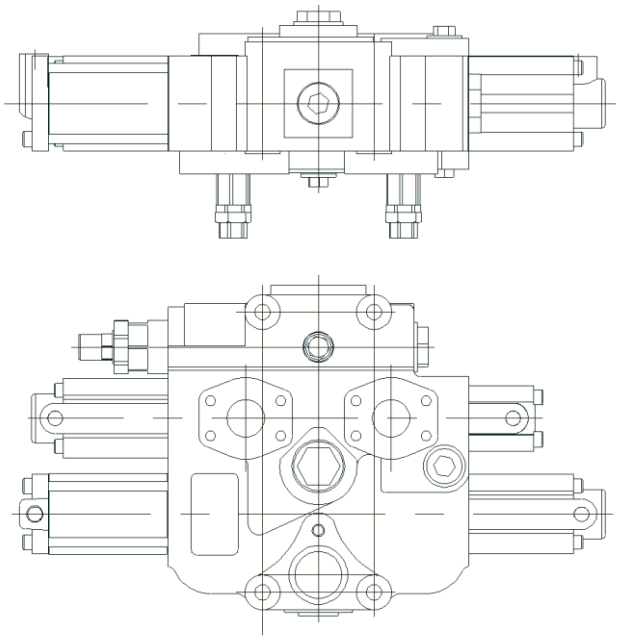


Fig. 5-03-03

# V. Main Components

## Section 4 Booster Pump

**Contents**

## 5.4 Booster Pump

### 5.4.1 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**

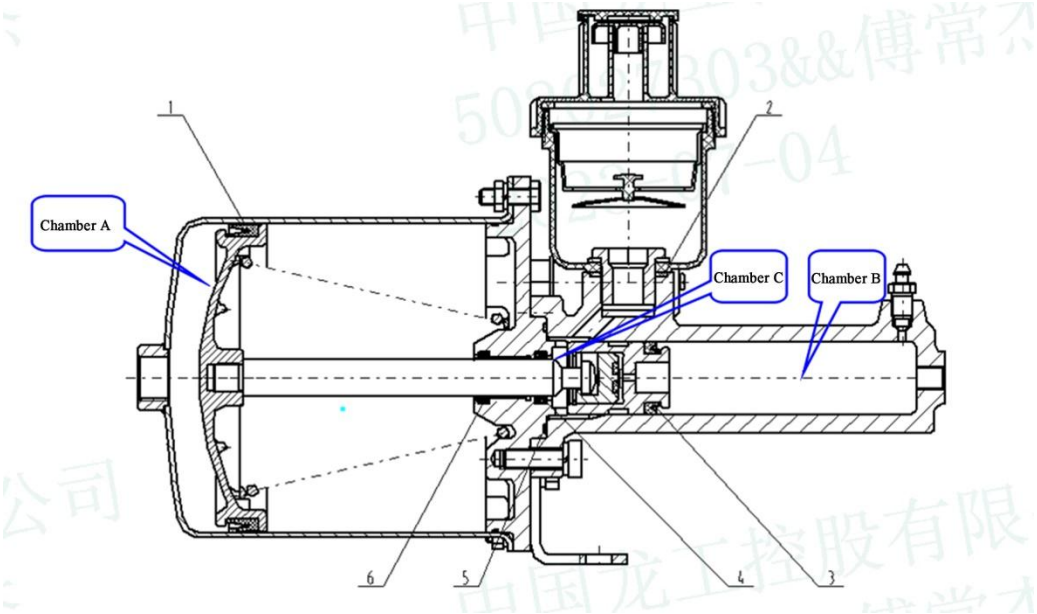



Fig. 5-04-01

| List of Wearing Parts | | | |
|---|---|---|---|
| **S/N** | **Description** | **Figure No.** | **Qty.** |
| 1 | Air piston rubber ring | SL409-35100023C | 1 |
| 2 | O-ring | SG509-3510011 | 1 |
| 3 | Hydraulic rubber ring | SL409-3510052MF | 1 |
| 4 | Y-ring | SL409XG-3510024A | - |
| 5 | O-ring | ZL20A-3510034 | 1 |
| 6 | Dust ring | SL409XG-3510026A | 1 |

| Main technical parameters | |
|---|---|
| Rated working air pressure: 784kPa | Pressure ratio: 1 : 18*90% |
| Operating temperature: -30～+80℃ | Displacement: 90 mL |
| 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 a special oil pressure and air pressure gauge to measure the air pressure and oil pressure at both ends of the booster pump. When the air pressure is 0.4 - 0.78 MPa, the oil pressure is 10-13 MP, it indicates 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<br>2. There are foreign matters on the edge of air piston rubber ring<br>3. The inner surface of the cylinder block is not clean<br>4. There is no or little grease on the surface of cylinder block | 1. Replace the air piston rubber ring<br>2. Clean the edge of air piston<br>3. Clean the inner surface of cylinder block<br>4. Apply an appropriate amount of grease to the inner surface of cylinder block | |
| 2 | No oil pressure | 1. The seal is damaged<br>2. Piston jamming | 1. Replace the seal<br>2. Replace the product assembly | |
| 3 | Oil leakage at | 1. Loose oil storage cup assembly | 1. Re-tighten the oil storage cup | |

| | | | | |
|---|---|---|---|---|
| | the joint between hydraulic cylinder block and connecting cover | 2. The O-ring is damaged | assembly to 25+5 N·m<br>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<br>2. The dust ring inside the connecting cover is damaged or falls off | 1. Replace the Y-ring<br>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.

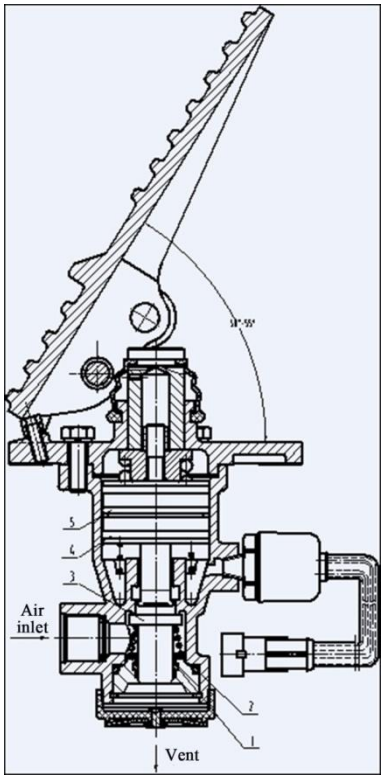



Fig. 5-05-01

**Structural Diagram of Air Brake Valve**

| 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 idle stroke 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

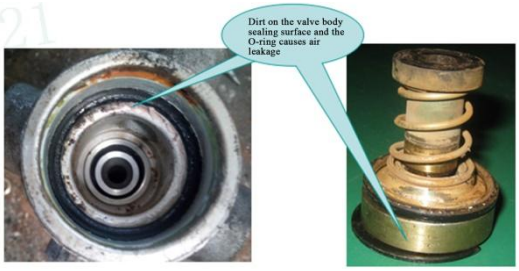
③ Remove the parts at the non-braking end, clean the interior of the valve body and its components, and replace the wearing parts.

**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.

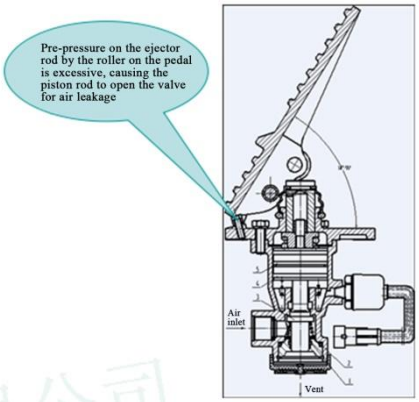

**Failure mode of non-braking air leakage of air brake valve (II)**

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.

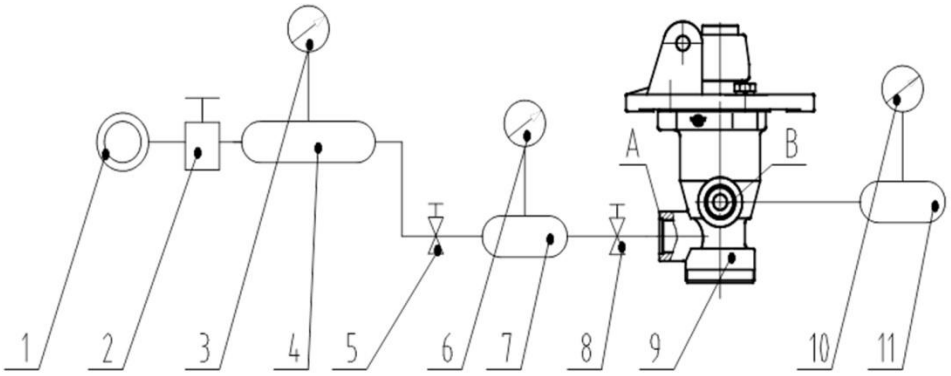



When it is suspected that there is air leakage in the full braking state, remove the air brake valve and verify it with a type test bench. When about 800kPa of air pressure is charged into the air inlet, press down the tappet. When the air outlet pressures are about 400 kPa and 800 kPa respectively,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

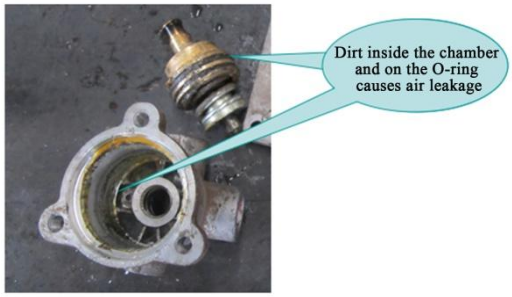
### 5.5.4 Analysis and Troubleshooting of Full Brake Air Leakage

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.

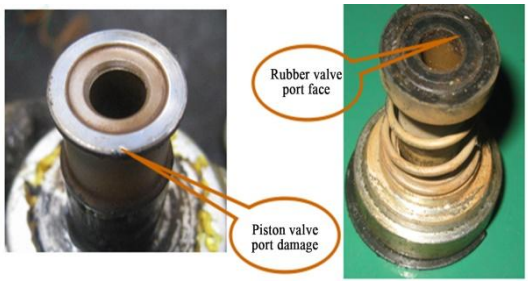
**Failure mode of full braking air leakage of air brake valve (I)**

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.



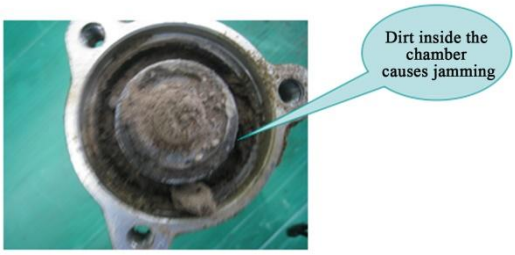
### 5.5.5 Analysis and Troubleshooting of Jamming

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-1109038A | 1 |
| 3 | O-ring | EQ153-351202 | 1 |
| 4 | Diaphragm | EQ153-351203 | 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 steel wire pipe from the air compressor to the unloading valve can fully cool the hot air, give full play to the function of the valve and prolong the service life of the unloading valve.

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 method |
|---|---|---|---|
| 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

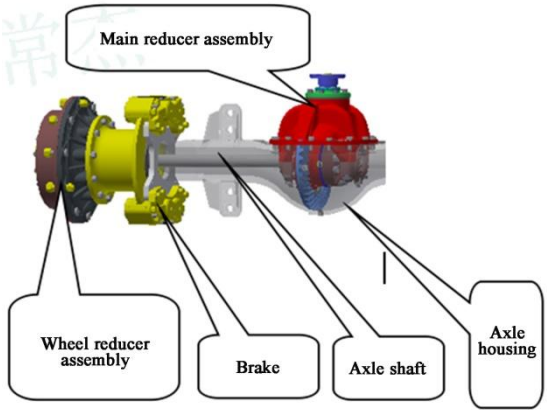



Fig. 5-07-01

(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: 56 L, 16.2 L for intermediate axle pack, and 5.9 L for wheel hubs on both sides.

### 5.7.2 Removal and Repair

(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 integrated with spline to rotate at the speed and direction of the sun gear, 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. The speed of the planetary carrier is less than that of the sun gear, so it is decelerated.

(IV) Structure and principle of differential

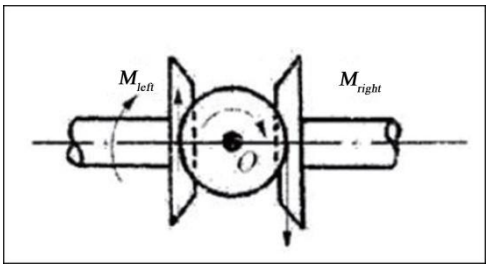



Fig. 5-07-03

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.

(IV) Installation

1. Installation sequence: First assemble the frame system

Tools used:

| | |
|---|---|
| 1. Two 10t traveling | 7. Sleeve 46 |
| 2. Special lifting tools | 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-reverse wrench | 12. 500 N·m and 1200 N·m torque wrenches |

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

1. The front axle is directly fixed on the front frame; the rear axle is fixed on the oscillating suspension of the rear frame and connected with the drive shaft. One tire is installed at each wheel hub.

2. Assemble 8×M30×2×110 bolts and 8×M30X2 nuts 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 8×M30×2×145 bolts from the front drive axle, and remove 8×M30×2×110 connecting bolts and 8×M30 nuts from the rear drive axle and 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.

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.

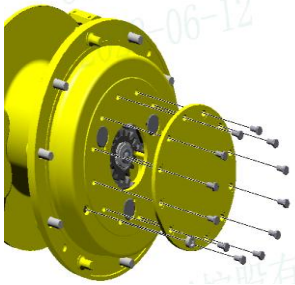
### 5.7.3 Disassembly and Repair

(I) Disassembly of drive axle

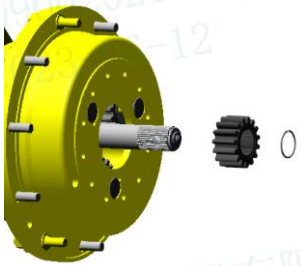
**1. Disassembly of wheel reducer assembly**

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.

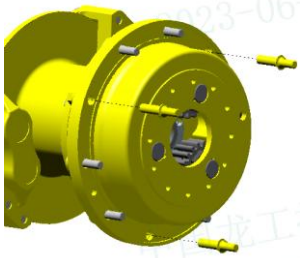
② Remove the screw plugs and introduce oil into the oil collecting device; remove 12 bolts M12×30 on the wheel-hub end cover with a wrench or other tools, install two long bolts into the screw holes of the wheel-hub end cover, and hold the long bolts by hand to remove the wheel-hub end cover.



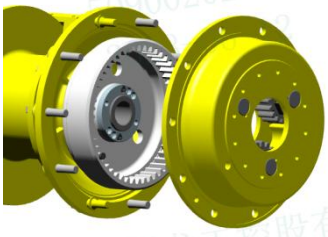
③ After the gear oil is drained completely, knock the end of the axle shaft with a copper rod to make it pop out. Remove the axle shaft snap spring and take off the sun gear. Pull out the axle shaft carefully.



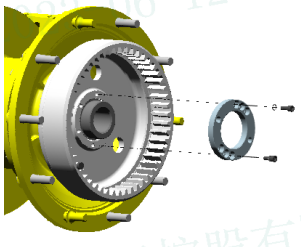
④ Screw out 3 nuts M22×1.5 and washers with a wrench or other tools, and then remove the 3 tension bolts from the planetary gear bracket assembly.



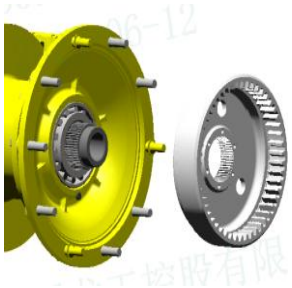
⑤ Screw M16×35 bolts into the two threaded jackscrew holes in the gear bracket. When the gear bracket is separated from the joint surface of the wheel housing, use the hook of the lifting appliance to pass through the bolt hole of the gear bracket, and move out and remove the planetary gear bracket assembly.



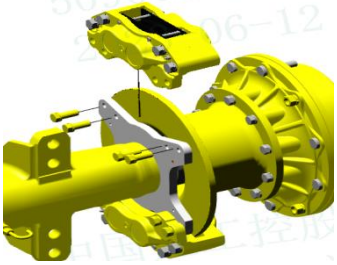
⑥ Remove the hexagon socket screw of the round nut with an Allen wrench, put a thin iron rod (long bolt, etc.) on the screw hole of the round nut, and then remove the round nut along the loosening direction of the round nut with the iron rod.



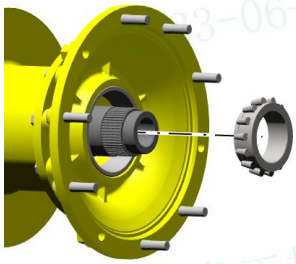
⑦ Remove the ring gear.



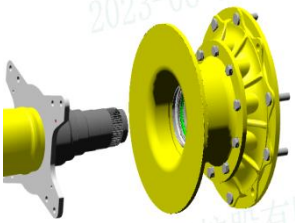
⑧ Unscrew the 8 fixing bolts M20×1.5×56 of brake caliper with a wrench, and remove 4×20 spring washers. Remove the brake caliper carefully.



⑨ Remove the inner ring of bearing 32221.



⑩ Hook the bolt hole of the wheel housing with a lifting appliance and slowly remove the wheel housing assembly.



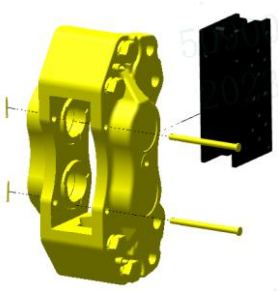
**2. Disassembly of main reducer assembly**

Remove 14 bolts M16×40 and washers connecting the main reducer assembly to the axle housing with a wrench.

**3. Disassembly of brake caliper**

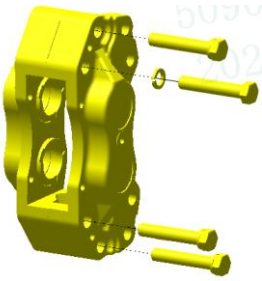
① Place the brake caliper on the workbench with the outer caliper body facing upward.

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**

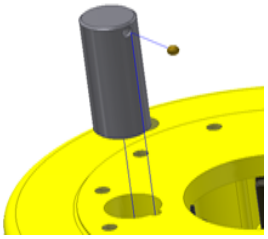
**Before assembling, all disassembled components shall be cleaned; worn or damaged parts, especially sealing parts, shall be replaced; for the positions sealed with sealant, such as the joint between axle housing and bracket flange surface, the sealant shall be scraped clean.**

**1.Repair of planetary gear bracket assembly**

① Put 31 needle rollers φ5×45 coated with grease into the planetary gear, and seal both ends of the inner hole of the planetary gear with spacer bushes.

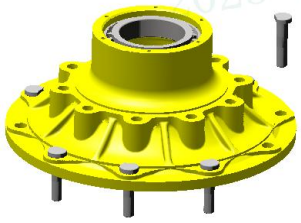
② Put the three assembled planetary gear assemblies and planetary gear gaskets into the planetary gear bracket as shown in the figure.

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.



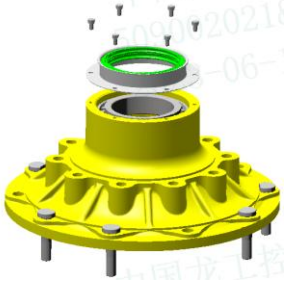
**2. Repair of wheel housing assembly**

① Knock 14 rim bolts into the bolt holes with a copper rod, and then press the bearing 32024 outer ring into the wheel housing. Apply grease to the bearing inner ring during assembly.



② Install the oil seal assembly into the wheel housing with 6 bolts M8×16 and washers.

③ Install the oil seal assembly into the wheel housing with 6 bolts M8×16 and washers.

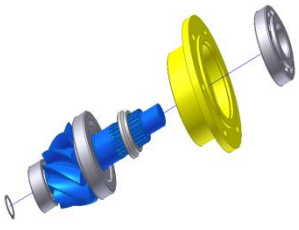


④ Assemble the brake disc onto the wheel housing assembly with 20 bolts M20×1.5×50 and spring washers.

**3. Repair of main reducer assembly**

① Press-fit the inner ring of bearing 31311 and bearing NUP2306E onto the driving spiral bevel gear with an oil press.

② Install the retainer ring 30, press the outer ring of bearing 31311 and the outer ring of bearing 31310 onto the bearing pedestal with an oil press, and then install the stepped sleeve and bearing pedestal assembly and the inner ring of bearing 31310 on the driving spiral bevel gear in turn.

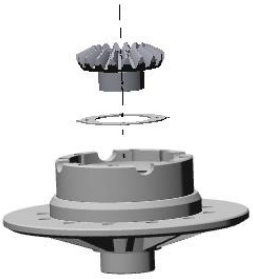


③ Press the double combined oil seal 62×93×20.5 into the sealing cover with an oil press, and assemble the paper pad and sealing cover assembly onto the driving spiral bevel gear assembly.

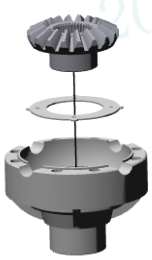
④ Assemble the input flange welded part, washer and lock nut to the driving gear assembly. The torque is 650 N·m.

⑤ Assemble the assembled driving gear assembly on the bracket using 1 bolt M12×55, washer and 7 bolts M14×55. Note that gaskets shall be used to adjust the tooth surface mark between the bracket and bearing sleeve. The adjustment method is shown in Fig. C-16. The tightening torque of M12×55 bolt is 100 N·m, and that of M14×55 bolt is 140 N·m. 598 plane sealant shall be applied on the joint surface of bracket and bearing sleeve for sealing.

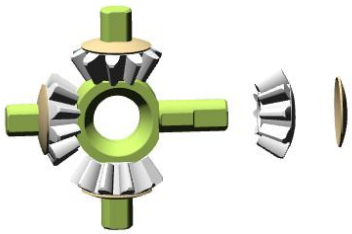
⑥ Put the axle shaft gear gasket and axle shaft gear into the right housing of the differential in turn. Note that there shall be no jamming of the gears when rotating the axle shaft.



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.



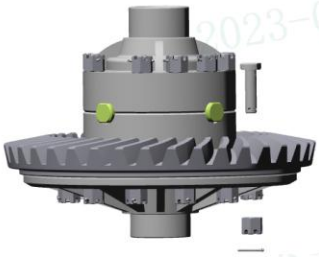
⑧ Assemble the bevel gear and bevel gear gasket onto the cross shaft in turn.



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

⑩ Tighten it with the 8 differential bolts M14×1.5×139 and nuts M14×1.5, and use 3×30 cotter pin for locking. The tightening torque of M14×1.5 nut is 180 N·m.

⑪ The driven spiral bevel gear is matched with the right housing of the differential, connected by 12 passive spiral bevel bolts M16×1.5×54 and nuts, and locked with cotter pin 3×30. The tightening torque of M16×1.5 nut is 270 N·m.



⑫ Shrink-fit the two bearings 32215 to the left and right housings of the differential.

⑬ Assemble the assembled differential assembly onto the bracket assembly.

⑭ Cover the bearing cap, and adjust the meshing clearance and bearing play of driving and driven spiral bevel gears with adjusting nuts. The adjustment requirement is 0.2 ~ 0.35, and the clearance between two 32215 bearings shall be 0.08 ~ 0.012. After adjusting the clearance, tighten 4 bolts M22×2.5×105 to a tightening torque of 500 N·m.

Clamp the locking piece on the adjusting nut to prevent it from loosening. Lock the locking piece with 2 bolts M10×1×20 to a tightening torque of 50 N·m. Tie 4 bolts M22×2.5×105 with iron wires in a 8-shaped knot to prevent loosening, and the locking wire crosses around the M10 bolt.

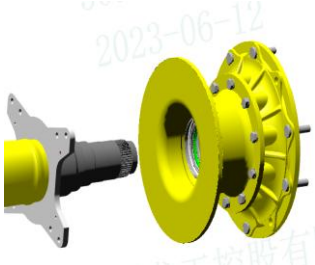
⑮ The meshing clearance of the driving and driven spiral bevel gears is adjusted by applying red lead powder on the tooth surface of driven spiral bevel gear first, and then rotating the gear to observe the meshing marks. If the mark is ≥40% in the direction of tooth height and ≥50% in the direction of tooth length, it is qualified.

Schematic diagram of the adjustment method:

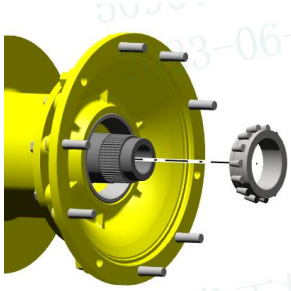
| Location of contact marks on driven gear surface | | Adjustment method | Gear moving direction |
|---|---|---|---|
| Forward | Reverse | | |
| | | Move the driven gear closer to the driving gear, and if the backlash is too small as a result, move the driving gear outward. | |
| | | Move the driven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

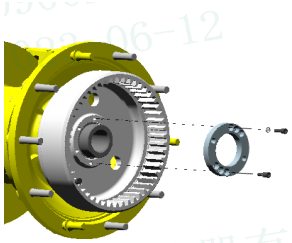
① Lift the assembled wheel housing assembly onto the axle housing assembly with a lifting appliance. Avoid the damage caused by collision between the oil seal position and the supporting shaft.



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.

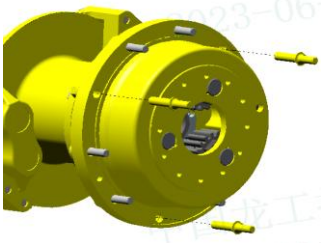


③ Sleeve the ring gear into the support shaft first, and then install the round nut. When adjusting the wheel hub pre-tightening force, tighten the round nut until the wheel hub assembly can only be barely rotated, and then rotate the round nut for 1/10 turn. After the pre-tightening force is adjusted, 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.

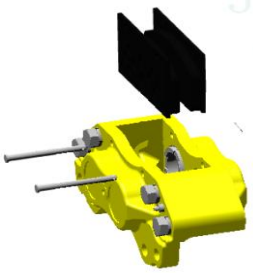


④ Assemble the installed planetary gear bracket assembly, and check whether the inside of the planetary gear bracket is clean and free of foreign matters. Then install the O-ring 425×3.55 on the rabbet of the planetary gear bracket, hang it in the rim bolt hole with a lifting appliance, and align it with the rim bolt and install it into the planetary gear bracket assembly.

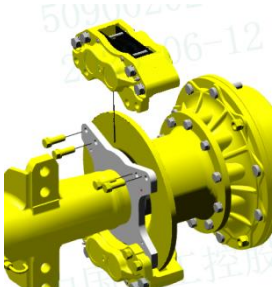
⑤ Connect 3 tension bolts to the planetary gear bracket assembly and wheel housing, screw 3 nuts M22×1.5 and washers into the back of the wheel housing, and then lock them with a wrench or other tools. The torque value is 500 N m.



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.

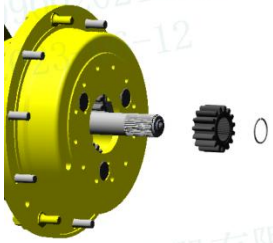


⑦ Install the assembled brake assembly. The brake assembly and the brake caliper bracket are connected with 8 bolts M20×1.5×56 to a tightening torque of 370 ~ 450 N·m.

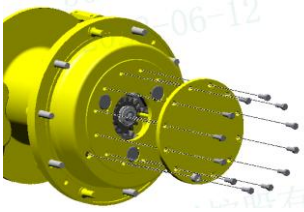


⑧ Check whether there is any foreign matter in the inner chamber of the axle housing. Apply 598 plane sealant evenly on the large flange surface of the axle housing with a glue gun, and pay attention to that it shall be uniform without gaps. The 598 plane sealant forms a closed loop. After the main drive is leveled, knock in two cylindrical pins φ12×30. Connect the main reducer assembly and axle housing assembly with 14 bolts M16×40 and washers. The tightening torque of the 14 bolts is 230 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 52.



⑩ Insert 12 bolts M12×30 into the wheel-hub end cover assembly and align them with the bolt hole positions of planetary gear bracket. The tightening torque of bolts is 100 N·m, and the bolts are tightened diagonally. Tighten the screw plug with an Allen wrench.



**5. Repair of brake caliper**

**Warning**

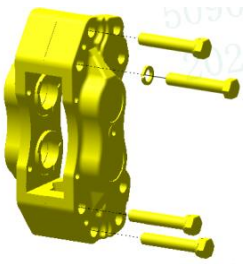
**Before assembly, all disassembled parts shall be cleaned; worn or damaged parts, especially sealing parts, shall be replaced; the parts with seals, such as two seal grooves inside the caliper body, shall be cleaned.**

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.

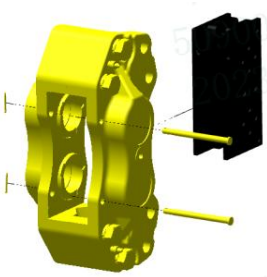
③ Install qualified O-rings into the counterbore at both ends of the outer caliper body, with one each on the left and right sides of each outer caliper body, and press them flat by hand. Then lift the inner caliper and turn it over by 180°, align it with the bolt holes of the inner and outer calipers, 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. Air test, air pressure 0.2~0.3 Mpa**

Air pressure: 0.2~0.3 Mpa; tighten the screw plug after injecting gear oil, and apply 567 pipe thread sealant onto 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. Drive axle assembly placement rack | 14. Wheel-hub bearing press-fitting tooling |
| 2. Pneumatic wrench | 15. Oil press |
| 3. Iron rod (with a diameter slightly smaller than the screw hole of planetary gear bracket and a length about 300 mm) | 16. Copper rod (with a diameter of 40~50mm and length of about 300 mm) |
| 4. Crane, hook and chain | 17. No.0 fine mesh gauze |
| 5. Allen wrench (for removal and installation of round nuts and screw plugs) | 18. Driving gear bearing press-fitting tooling |
| 6. Hammer and chisel | 19. Fixing tooling of driving spiral bevel gear pair |
| 7. 46 anti-reverse wrenches | 20. Dial indicator |
| 8. 46 sleeves | 21. Red lead powder |
| 9. 1-inch and 2-inch adjustable wrenches | 22. Input flange installation tool |
| 10. 16~18 open-end wrench | 23. 262 thread locker, 598 plane sealant and 567 pipe thread sealant |
| 11. 19～22 open-end wrench | 24. Iron wire 16#×500 |
| 12. 27~30 open-end wrench | 25. Socket wrench |
| 13. Air 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 slope or sudden road obstacles, it can automatically decelerate without shifting gears to increase traction and drive at any low speed and cross the obstacles. 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.

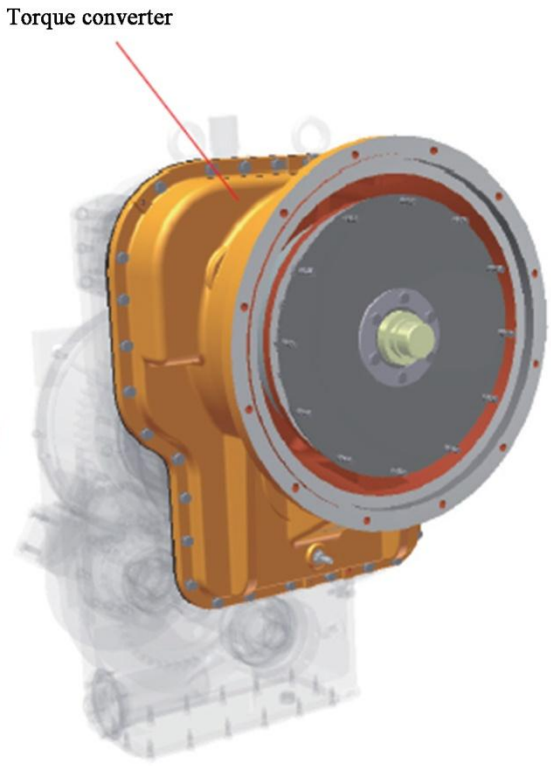



Fig. 5-08-01

The torque converter is mainly composed of four working impellers: impeller, first-stage turbine, second-stage turbine and guide wheel. Its working chamber is filled with working oil. The function of the impeller is to convert the mechanical energy generated by the engine into liquid kinetic energy. It is driven by the engine and rotates at the same speed, forcing the oil in the chamber to impact the turbine at a huge speed and pressure. The two turbines absorb the kinetic energy of the fluid flow and reduce it to mechanical energy, rotating at n1 and n2 respectively to transmit power to the large overrunning clutch through gears. The guide wheel is fixed and does not rotate. The liquid flow impacts the blade of the guide wheel with a torque. Because the guide wheel is fixed, it generates an equal counter-torque in the opposite direction and reflect it to the turbine through the liquid, so that the torque value output by the turbine changes. The blades of the four impellers have certain shapes and inlet and outlet angles, so that liquid flows in and out of each impeller according to the specified flow channel and direction.

However, as the speed of the pump pulley is controlled by the accelerator, the turbine speed changes with the change of external load (feedback through axle and transmission) applied to the output shaft, which is faster or slower or even does not rotate (e.g. under starting or braking conditions, the wheels do not move), so that the speed, pressure and relative angle of attack of liquid entering each working wheel are constantly changing, and the torque emitted by the pump pulley and the torque reflected by the guide wheel are also changing. When the pump pulley torque obtained by the turbine through liquid is positive, the output torque of the turbine increases, and decreases in reverse.

The torque converter impeller and cover pulley are integrated with the diesel engine flywheel through elastic plates, and run at the same speed as the diesel engine. The power of the diesel engine is transmitted to the impeller and then to the first-stage turbine and second-stage turbine through oil. The power of the second-stage turbine of the torque converter is transmitted to the intermediate input shaft through the input second-stage gear, and the power of the first-stage turbine of the torque converter is transmitted to the input first-stage gear and then to the outer ring gear of the large overrunning clutch. When the external load is small, because the speed of the transmission intermediate input shaft is higher than that of the outer ring gear of the large overrunning clutch, the rollers of the large overrunning clutch are released, and the outer ring gear of the large overrunning clutch idles. At this time, the second-stage turbine works alone. When the external load increases, the speed of the intermediate input shaft of the transmission is forced to gradually decrease. If the speed of the intermediate input shaft is less than that of the outer ring gear of the large overrunning clutch, the rollers are tightened, and the power transmitted by the first-stage turbine is transmitted to the cam of the large overrunning clutch through the rollers. Since the cam and the intermediate input shaft are bolted together, the first-stage turbine and the second-stage turbine work at the same time.

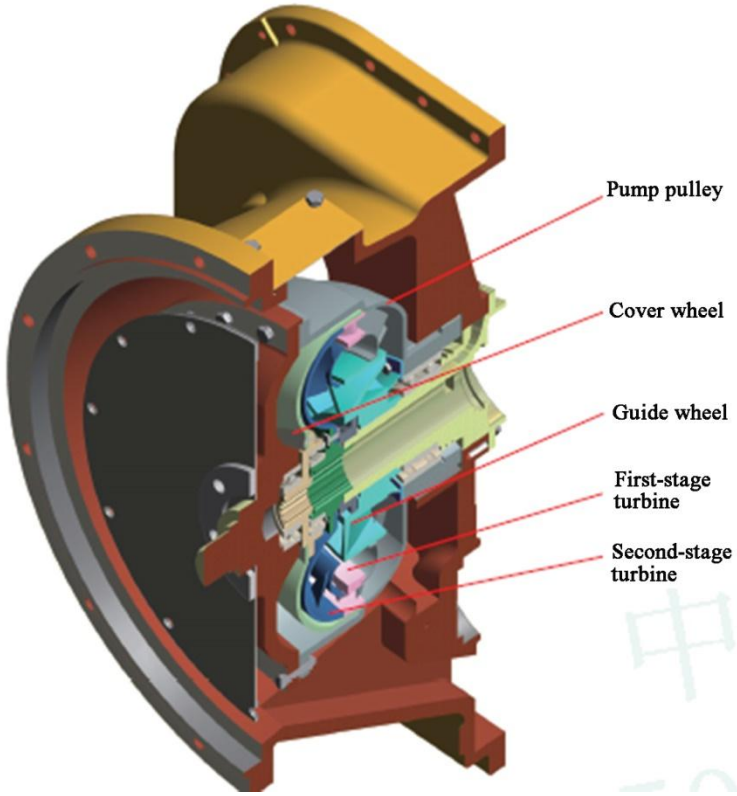



Fig. 5-08-02

Torque converter pressure measuring port:

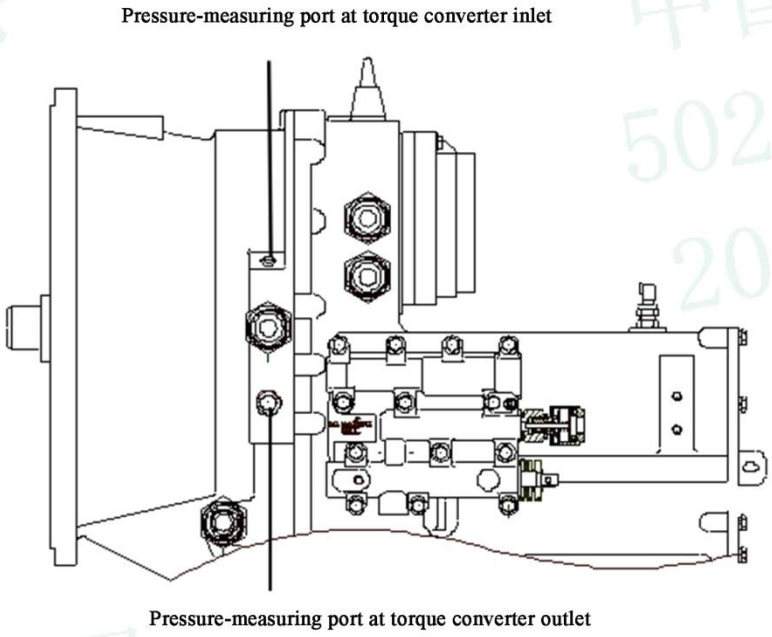



Fig. 5-08-03

### 5.8.2 Test and Adjustment

The torque converter and the transmission are installed on the machine as a whole, so the "Testing and Adjustment" of the torque converter after installation is incorporated into the "Testing and Adjustment" section for the transmission. Refer to the "Transmission Testing and Adjustment" page.

### 5.8.3 Removal and Installation

When the torque converter is installed on and removed from the machine, it is integrated with the transmission as a whole, so the contents of "Removal and Installation" of the torque converter are incorporated into the description page of the transmission. Refer to "Transmission Removal and Installation" page.

### 5.8.4 Disassembly and Repair

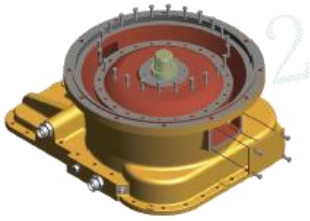
| List of Tools, Supplies and Equipment | | |
|---|---|---|
| 1. Allen wrench | 5. Puller | 9. Inner and outer snap ring pliers |
| 2. Socket wrench | 6. Pinch bar | 10. Grease |
| 3. Pneumatic wrench | 7. Hammer | 11. Copper rod (diameter 10mm, length 400mm) |
| 4. Iron rod (diameter 8mm, length 150mm) | 8. Containers, brushes and cleaning fluids for cleaning parts | |

**Disassembly of torque converter**

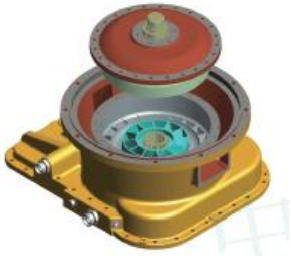
## (I) Disassembly of torque converter assembly

① Remove the six fastening bolts from the housing with a wrench, and remove the gasket and elastic plate.

② Remove the connecting bolts and nuts between the cover pulley and the pump pulley with a wrench.



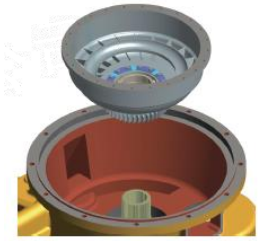
③ Remove the cover pulley and first-stage and second-stage turbines.



④ Then, use a snap ring plier to remove the retainer ring of guide wheel.

⑤ Take out the guide wheel by hand.

⑥ Remove the pump pulley with a puller.



⑦ Erect the housing, remove the fixing screws of the guide wheel base, and take out the guide wheel base from the housing.

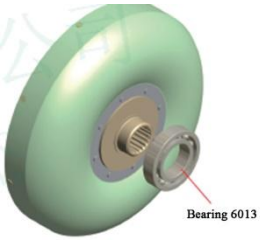
⑧ Remove the rotating oil seal on the guide wheel base and check whether the oil seal is damaged. Replace the oil seal if it is damaged or worn.

## (II) Disassembly of cover pulley and first-stage and second-stage turbine components

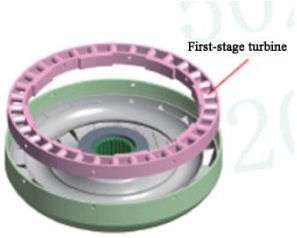
① Remove the first-stage and second-stage turbines and cover pulley.

② Remove the O-ring from the cover pulley.

③ Remove the bearing from the first-stage turbine cover with a pinch bar.

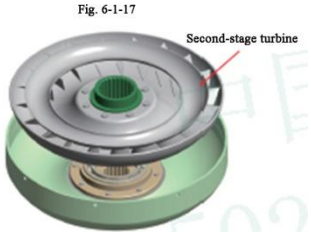


④ Use a hammer and a special iron rod to knock out the 8 elastic pins connecting the first-stage turbine with the turbine cover, and take out the first-stage turbine.

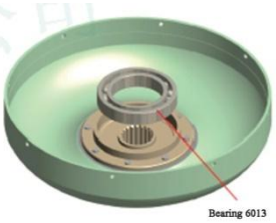



⑤ Remove the second-stage turbine with a thin iron rod.

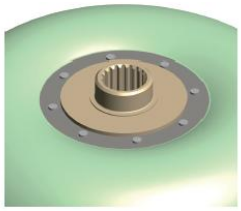
Fig. 6-1-17




⑥ Take out the bearing from the turbine cover.




⑦ Remove the snap ring on the second-stage turbine with a snap ring plier.



## (III) Disassembly of pump pulley and transfer gear assembly

① First beat out the locking gasket with a pinch bar, and then loosen the fastening bolts of pump pulley and transfer gear.

② Tap the pump pulley gently with a hammer to remove the transfer gear and bearing.

③ Gently knock out the bearings in the pump pulley and transfer gear with a copper rod.

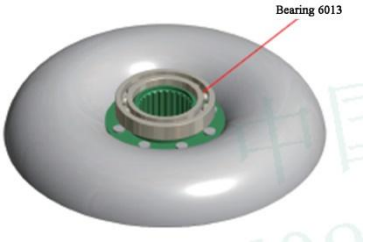

**Repair of torque converter**

## (I) Cleaning of parts

Clean all parts of the torque converter with a brush in cleaning fluid. Replace any worn or damaged parts with new ones.

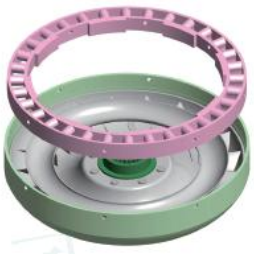
## (II) Component assembly

① Assemble the second-stage turbine assembly. Install the snap ring into the second-stage turbine with a snap ring plier, and then install the bearing.

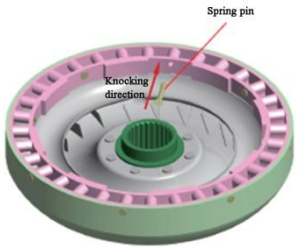



② Assemble the first-stage turbine assembly and second-stage turbine assembly: Install the second-stage turbine into the turbine cover, and tap it gently with a copper rod to make it contact evenly.

③ Install the first-stage turbine.



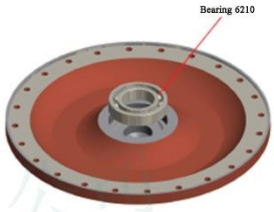
④ Align the first-stage turbine with the pin hole on the turbine cover, and then hammer in 8 elastic pins.



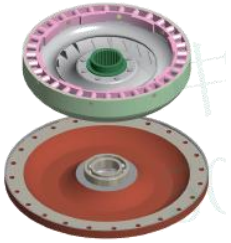

⑤ Check the rotation of the second-stage turbine.

⑦ Assemble the cover pulley and first-stage turbine assembly and second-stage turbine assembly: Install the O-ring into the groove on the end face of the cover pulley.

⑧ Install the bearing into the hole in the middle of the cover pulley, and tap it gently with a copper rod to make it contact evenly.

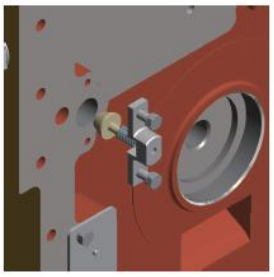



⑨ Install the turbine cover assembly into the cover pulley.

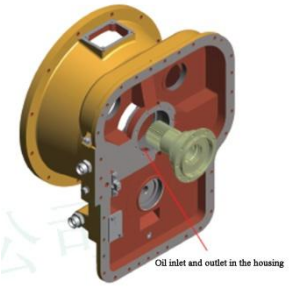


## (III) Assembly of torque converter assembly

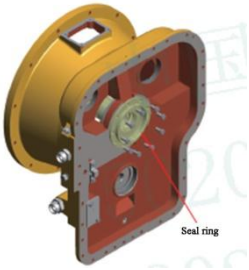
① Install the oil inlet and outlet valve, and control it between 0.45 MPa and 0.8 MPa.



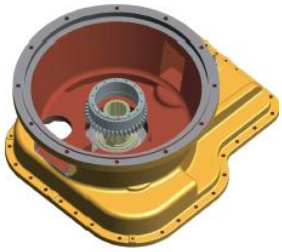
② Check the quality of rotating oil seal, and pay special attention to whether the interface is firm. Install the rotating oil seal on the guide wheel base and check whether it is flexible. Then install the guide wheel base, and align the oil inlet and outlet of the guide wheel base with the corresponding oil inlet and outlet on the housing. Install bolts on the guide wheel base to fasten it to the housing.



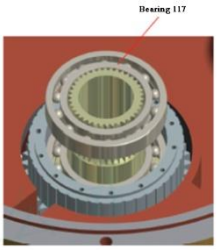

③ Install the seal ring into the guide wheel base. Note that the lip of the seal ring faces inward and apply a little grease to the seal ring.



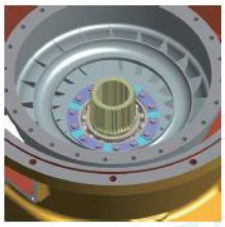

④ Lay the housing flat, press the transfer gear into the guide wheel base and rotate it to see if it is flexible.



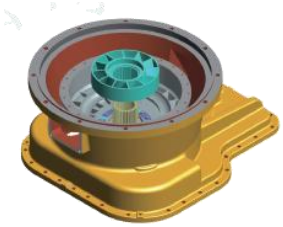
⑤ Install two 117 bearings and tap them in place with a copper rod.



⑥ Install the pump pulley, gasket and locking gasket. Tighten the hexagon bolt with a wrench and put away the locking gasket wrap angle.

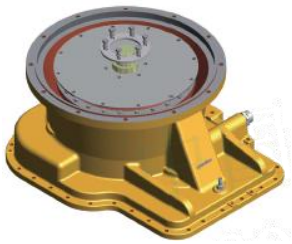


⑦ Install the guide wheel, and then install the check ring to fix it

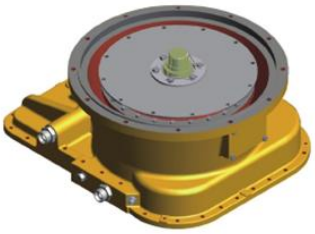


⑧ Turn over the cover pulley by 180 °, install two lifting bolts into the screw holes of the cover pulley, hold the lifting bolts with hands to install the cover pulley and first-stage turbine assembly and second-stage turbine assembly into the torque converter housing, and tighten them with bolts.

⑨ Install the gasket, elastic plate and gasket, and fasten them with hexagon socket bolts.



⑩ The torque converter is assembled.



# V. Main Components

## Section IX Transmission

**Contents**

## 5.9 Transmission

### 5.9.1 Structure and Function

The transmission is composed of main parts such as box body, overrunning clutch, planetary transmission mechanism, friction disc clutch, cylinder piston, transmission pump, transmission operating valve, oil filter, shaft and gear.

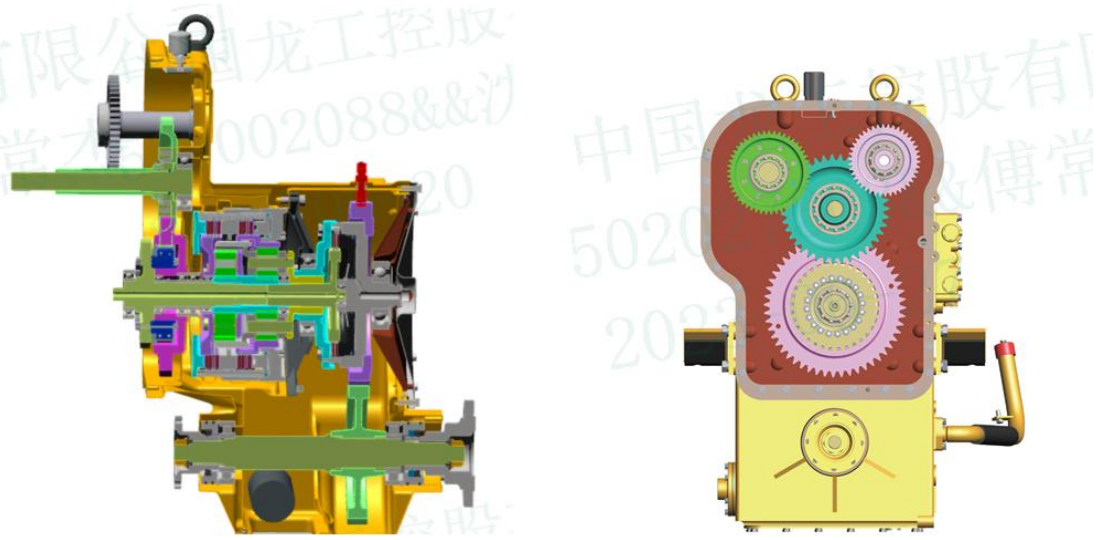


Fig. 5-09-01

This transmission is a hydraulic shift transmission with two forward gears and one reverse gear.

1. Forward gear I: Under the action of oil pressure, the first-gear piston moves left, the first-gear friction disc engages and the first-gear inner gear ring brakes. The power is transmitted from the input gear to the first-gear planetary gear through the sun gear. As the first-gear inner gear ring is braked, the first-gear planetary carrier rotates, and then it is transmitted to the direct gear pressure plate through the direct gear connecting plate, and then to the intermediate output gear as the first-gear power output through the direct gear oil cylinder.

2. Forward gear II (direct gear): The piston of the direct gear moves left under the action of oil pressure, and the friction disc of the direct gear is engaged. Power is transmitted from the input gear to the shaft of the direct gear through the sun gear. Due to the engagement of the friction disc of the direct gear, power is transmitted to the direct pressure plate, and then to the intermediate output gear through the direct gear oil cylinder as the second-gear (direct gear) power output.

3. Reverse gear: Under the action of oil pressure, the reverse piston moves right, and the reverse friction disc engages to brake the reverse planetary carrier. The power is transmitted from the input gear to the reverse planetary gear through the sun gear. As the reverse planetary carrier is braked, the power is transmitted from the reverse gear ring to the first-gear planetary carrier by reversing, and then transmitted to the direct gear pressure plate through the direct gear connecting plate, and then transmitted to the intermediate output gear through the direct gear oil cylinder as the reverse gear power output.

The transmission is equipped with three oil pumps. As the torque converter pump pulley is connected to the transfer gear, which in turn meshes with the variable-speed oil pump shaft gear and the steering oil pump drive gear, the working pump and the transmission pump are driven by the variable-speed oil pump shaft gear, while the steering oil pump is driven by the steering oil pump drive gear.

### 5.9.2 Test and Adjustment

As the torque converter and transmission are installed on the machine as a whole, the contents of "Test and Adjustment" of the transmission described in this chapter have included the contents of the torque converter.

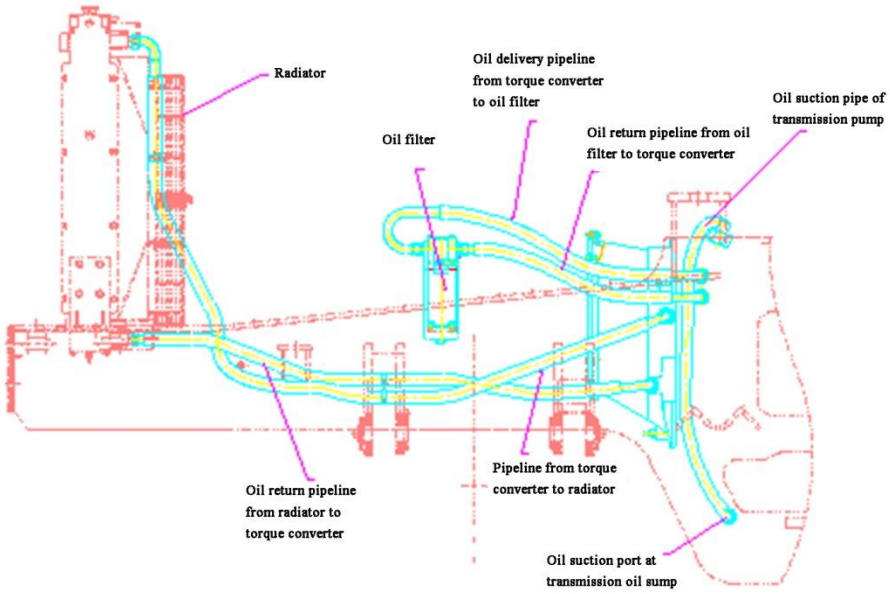



Fig. 5-09-02

1. During the operation of the whole machine, check the tightness of each oil line interface every day. If any oil leakage is found, repair it in time.

2. The arrow in the figure above shows the torque converter observation window. When the machine is shut down, open the window cover to check the internal conditions or whether fasteners are loose. There must be no foreign sundries inside the machine. The machine can only be started after the window cover and sealing gasket are reassembled and confirmed to be normal.

3. The oil filter 1 is equipped with a signal transmitter. Once the internal filter screen is blocked, it will automatically give an alarm. When there is an alarm prompt, stop the machine and replace accessories or assemblies.

4. Monitor the oil pressure and temperature of torque converter through instruments. If there is any abnormality, check the oil filter 2 first and replace the filter screen or assembly. If the fault still cannot be eliminated, repair other parts.

5. Adjust the working oil level of torque converter and transmission: Before starting the engine, check the two drain screw plugs on the right side of the transmission. The upper screw plug is at the highest oil level and the lower screw plug is at the lowest oil level. Under normal conditions, the oil shall be between the upper and lower oil levels. If there is too much oil, a certain amount of oil shall be released from the oil drain port at the transmission oil sump, and if there is too little oil, a certain amount of oil shall be added from the oil filler nozzle of the transmission.

6. Monitor and adjust the working oil pressure of torque converter and transmission: The inlet and outlet pressures of the torque converter have been adjusted in the manufacturer. After the engine works, the working oil pressure of the transmission showed on the pressure gauge shall be within the range of 1.2 ~ 1.5 MPa. If it is abnormal, check it.

7. Adjust the working oil temperature of torque converter and transmission: The maximum oil temperature during general operation and driving shall not exceed 120℃. If it exceeds, stop the vehicle for cooling and inspection. After the running-in period of the transmission, it is generally necessary to replace with new oil after 600 hours. However, if the oil deteriorates or is mixed with impurities during inspection, it should be cleaned and checked and replaced with new oil of the specified grade.

| **Normal pressure value of transmission** | |
|---|---|
| Working oil pressure: 1.2~1.5MPa | Inlet oil pressure of torque converter: 0.4~0.55 MPa |
| Lubricating oil pressure: 0.10~0.20 MPa | Outlet oil pressure of torque converter: 0.30~0.45 MPa |

**Schematic Diagram of Assembly Transmission**

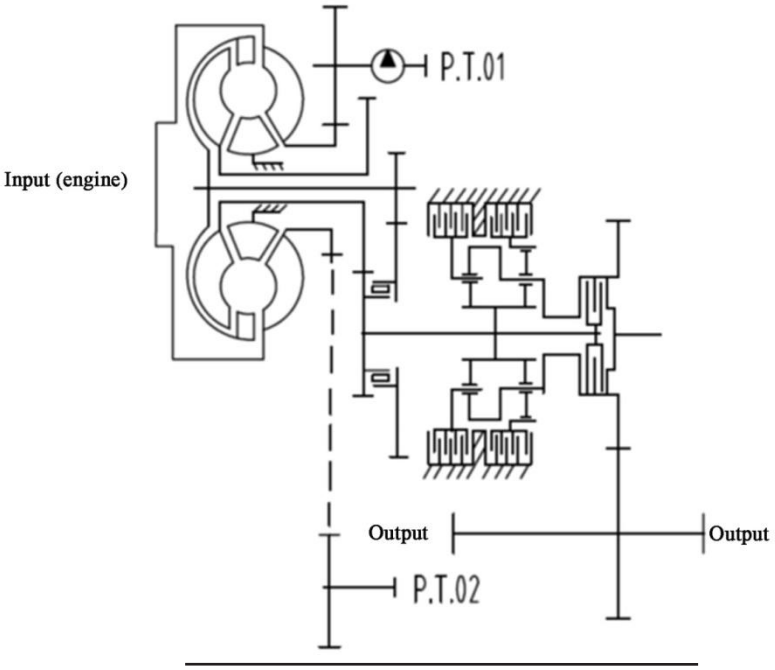



Fig. 5-09-03

### 5.9.3 Removal and Installation

As the torque converter and transmission are installed on the machine as a whole, the removal and installation of the transmission described here already includes the torque converter.

The specific details of removal and installation of transmission (including torque converter) are as follows:

(I) Introduction to position of torque converter & transmission assembly on product

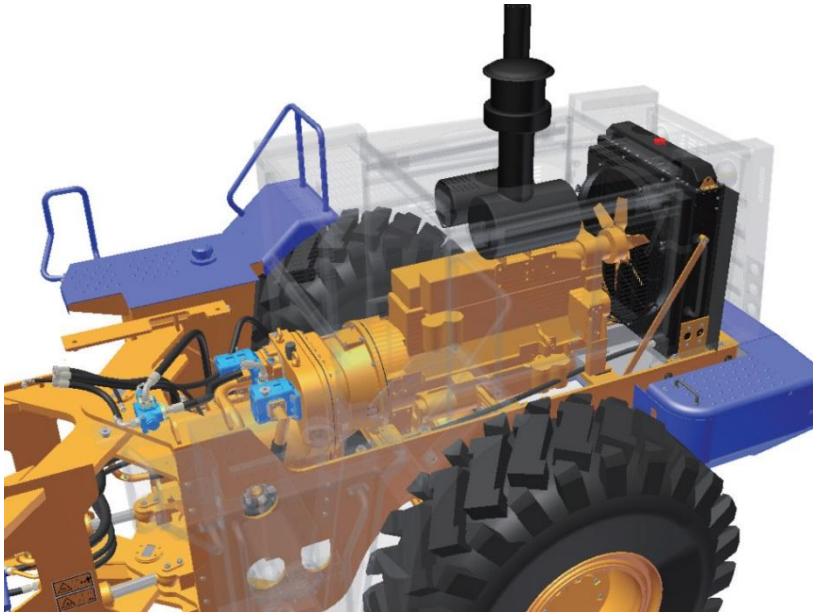


Fig. 5-09-04

The torque converter & transmission assembly is connected with the front and rear drive axles through the front drive shaft and the rear drive shaft. The torque converter is connected with the diesel engine by internal hinge and external hinge.

## (II) Disassembly steps

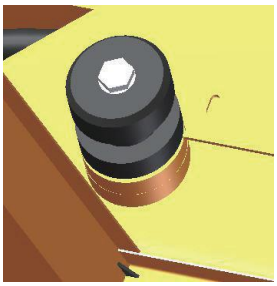
**1. Remove the cab according to the following steps**

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.



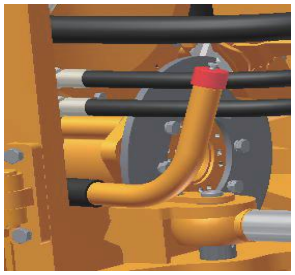
**Warning**

**Safety tips for hoisting:**

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

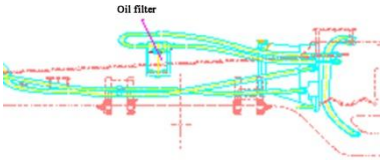
**2. Hoist smoothly, and note that whether the surrounding personnel are within the safe range.**

① Remove the two M8×25 bolts, Φ8 enlarged flat washers and spring washers connecting the fuel filler pipe assembly bracket to the frame with a wrench.

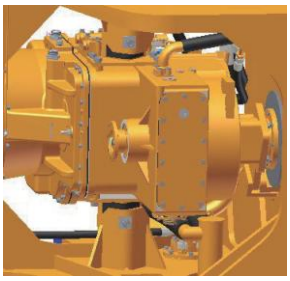


② Remove the rubber hose and oil tank steel pipe connected to the working pump and steering pump with a wrench (Note: Before removal, please open the oil drain plug at the bottom of the transmission to completely discharge the transmission oil, then loosen the steel pipe and rubber hose joint to be removed, 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).

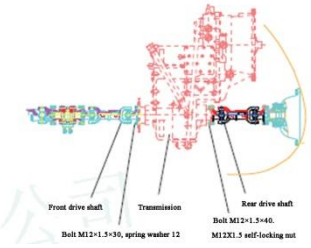
③ Remove the rubber hose connected to the oil filter and diesel engine water tank on the torque converter with a wrench.



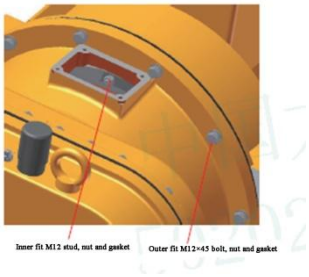

④ Remove the two M18 bolts, nuts and gaskets (Φ18 enlarged flat washer and arc washer) connecting the transmission to the transmission support seat on the rear frame with a jackhammer and supporting sleeve.



⑤ Remove the eight M12×1.5×30 bolts and Φ12 spring washers used to connect the transmission with the front drive shaft using a jackhammer and supporting sleeve; remove the eight M12×1.5×45 bolts and M12×1.5 self-locking nuts used to connect the transmission with the rear drive shaft.



⑥ Remove the twelve M10×1 nuts used for inner hinge of torque converter and engine with a wrench; remove the M12 ×45 bolts, nuts and flat washers used for outer hinge of torque converter and engine with a wrench.




⑦ Lift the torque converter & 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 torque converter & transmission assembly in the following order:

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

② The torque converter & transmission assembly shall be hinged with the inside and outside of the engine;

③ Assemble the bolts and nuts connecting the front and rear drive shafts to the transmission;

④ Fix the torque converter & transmission assembly on the transmission support seat with bolts.

Fig. 5-09-06

**Warning**

**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. Assemble the damping pad assembly (upper assembly) on the cab support, and align with the holes.

Fig. 5-09-05

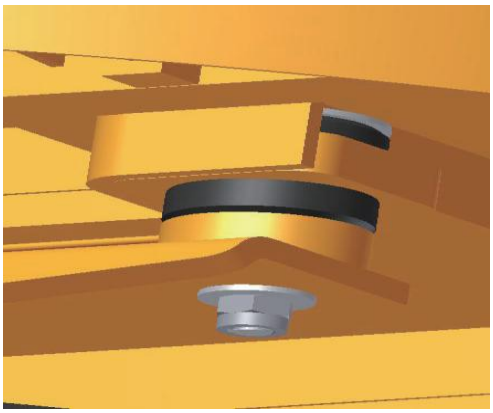


Fig. 5-09-07

③ Lift the cab to the top of the frame with special lifting appliance and traveling crane, slowly adjust the height from the frame, insert the upper shock absorber, gasket and bolt into the cab bracket, then steadily place the cab on the cab support seat, align the holes, and lock the shock absorber with the lower shock absorber, large gasket and nut.

**Parts used for cab installation**

| S/N | Material name | Material code | Quantity of material | Remarks |
|---|---|---|---|---|
| 1 | Cab weldment | 30812116480 | 1 | |
| 2 | Base plate | 30812115784 | 4 | |
| 3 | Shock absorber | 30812013457 | 4 | |
| 4 | Bolt | 51210172914 | 4 | |
| 5 | Nylon self-locking (nut) | 51342001119 | 4 | |

| **Equipment and tools used** | |
|---|---|
| 1. One 10t traveling crane; | 5. 5044 jackhammer; |
| 2. Special lifting tools | 6. Sleeve 12; |
| 3. Bracket | 7. 1-inch and 2-inch adjustable wrenches; |
| 4. 16 open-end wrench, 18 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

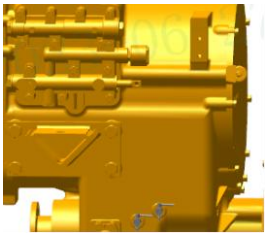
| **Equipment List** | | |
|---|---|---|
| 1. Wrench (install and remove the oil level check valve, etc.) | 8. Copper bar | 15. Special gripper (remove the bearing on the second gear assembly) |
| 2. Pneumatic wrench (install and remove the oil pan bolts, transmission distribution valve fixing bolts, transmission oil pump bolts, rear end cover screws, etc.) | 9. Snap ring pliers | 16. Lifting appliance (lift the second gear assembly, reverse planetary carrier assembly, rear output shaft, transmission assembly, etc.) |
| 3. Hammer | 10. Pliers (install and remove the cotter pin) | 17. Screwdriver (remove the second gear rotating bearing, remove the frame oil seal in the hole beside the rear output shaft and the bearing on |

| | | |
|---|---|---|
| | | the intermediate output shaft) |
| 4. Puller | 11. Socket wrench | 18. Lifting bolt and iron wire (lift the reverse planetary carrier assembly) |
| 5. Jackscrew (jack out the rear end cover) | 12. Hexagon socket (install and remove the rear output flange fastening nut) | 19. Box wrench (install and remove the second gear friction disc screw, reverse planetary shaft screw, etc.) |
| 6. Special tool (install the cover sleeve of the second gear piston) | 13. Gauge block (check the piston bearing hole of the second gear) | 20. Front and rear output shaft jackets (not required for new transmission without separate front and rear output shafts) |
| 7. Transmission assembly disassembly and assembly fixing bracket | 14. Lifting screw (lift the reverse piston, etc.) | 21. Dial indicator (check the perpendicularity of box end face and transmission pump output shaft) |
| 22. Scraper (finish the mounting surface of transmission pump on the box) | | |

**1. Disassembly of transmission**

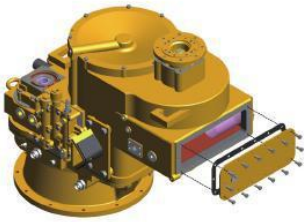
①

② Remove the oil level check valve with a wrench.



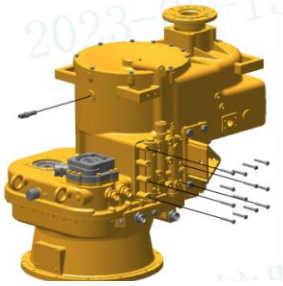
③ Remove the fixing bolt of fuel filler pipe, and then remove the fuel filler pipe.

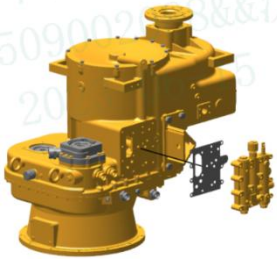
④ Unscrew the fixing bolts of oil pan with a wrench, remove the oil pan and gasket, and take down the filter.

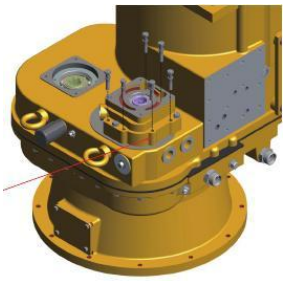


⑤ Unscrew the fixing bolts of transmission distribution valve and speed sensor with a wrench.

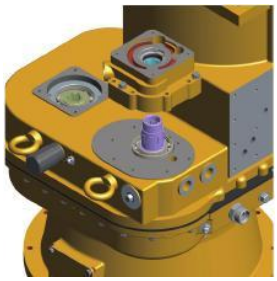
Remove the transmission distribution valve and take down the gasket.



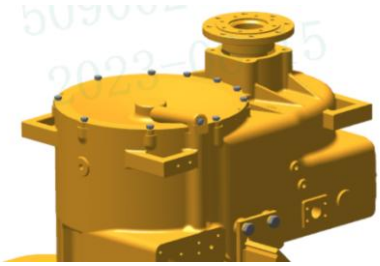




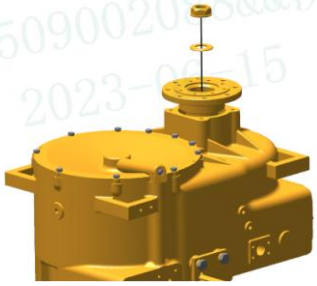
⑥ Unscrew the fixing bolt of the transmission oil pump with a wrench, gently knock the flange beside the transmission oil pump bolt hole with a hammer and copper rod to loosen it, and then remove the transmission.

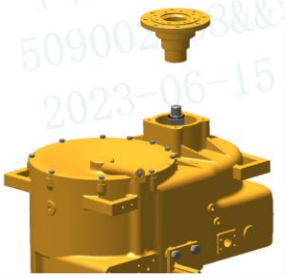


⑦ Remove the cotter pin with pliers.



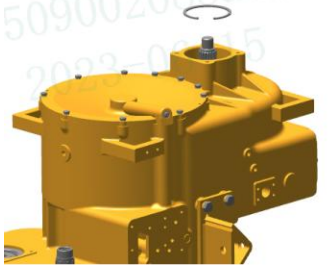
⑧ Remove the fastening nut and gasket with a wrench, and take out the front output flange.





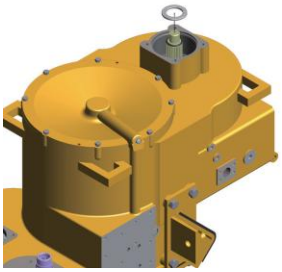
⑨ Remove the oil seal seat and frame oil seal with a

puller.



⑩ Remove the snap ring, frame oil seal and O-ring with a snap ring plier.

⑪ Take out the gasket and check ring with a snap ring plier.



### 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 0.05MPa in general areas and 0.07MPa 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.

2. As the first and third gears are used frequently during

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. 5-09-8

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 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.

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

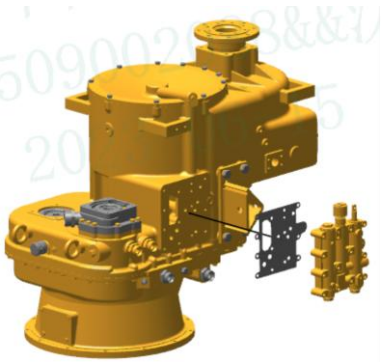


Fig. 5-09-9

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

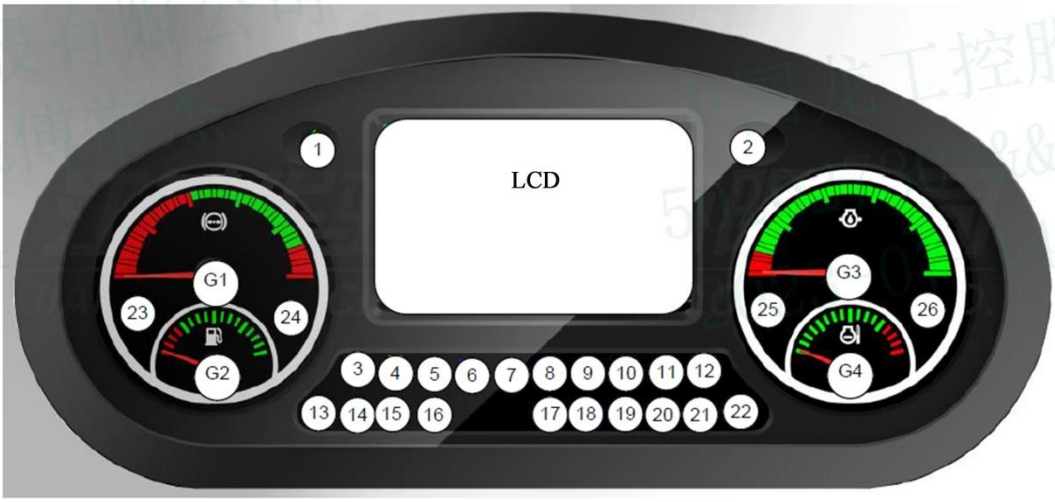
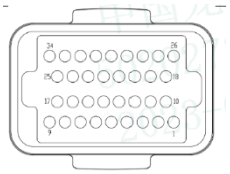



Fig. 5-10-02

### 5.10.2 Function Description

| S/N | Functional description | V1.0 |
|---|---|---|
| 1 | Pointer gauge | Pointer gauge 1 (G1): brake air pressure gauge<br>Pointer gauge 2 (G2): fuel gauge<br>Pointer gauge 3 (G3): oil pressure gauge<br>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.<br>  |
| 5 | Instrument lighting | Scale light: white<br>Pointer light: red<br>Turn signal light: green |
| 6 | Alarm light | Number of alarm lights: 26 |
| | | List of analog input signals:<br>1. Hydraulic oil temperature sensor signal (reserved)<br>2. Fuel quantity sensor signal<br>3. Transmission oil pressure sensor signal<br>4. Brake air pressure sensor signal<br>5. Transmission oil temperature sensor signal<br>6. Charging indication<br>7. Low oil pressure alarm<br>8. High coolant temperature alarm<br>9. Preheating<br>10. DPF regeneration state (reserved)<br>11. DPF regeneration disabled (reserved)<br>12. Driver alarm indication (reserved)<br>13. Driver performance limit (reserved)<br>14. SVS fault indicator<br>15. Oil-water separation<br>16. Vehicle speed sensor signal |

| | | |
|---|---|---|
| 7 | Input signal | List of digital input signal:<br>1. Hydraulic oil cleanliness fault alarm<br>2. Neutral<br>3. Parking brake<br>4. Preheating (reserved)<br>5. Clearance lamp<br>6. Air filter blockage fault alarm (reserved)<br>7. Low coolant level alarm (reserved)<br>8. Hazard indicator (reserved)<br>9. Left turn signal<br>10. Right turn signal<br>11. Low transmission oil pressure alarm<br>12. Oil cleanliness fault alarm of torque converter and transmission<br>13. High beam<br>14. 3t/5t identification signal |
| 8 | Output signal | Digital signal output<br>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<br>  |
| 10 | Voltage | Normal voltage: 24V DC<br>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]<br>Dustproof and waterproof: front: IP65<br>Whole gauge: IP30 |
| 13 | Temperature requirements | Operating temperature: -30～+75℃<br>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<br>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<br>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.

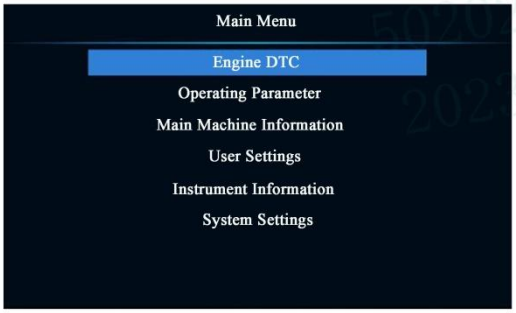



Fig. 5-10-04

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:

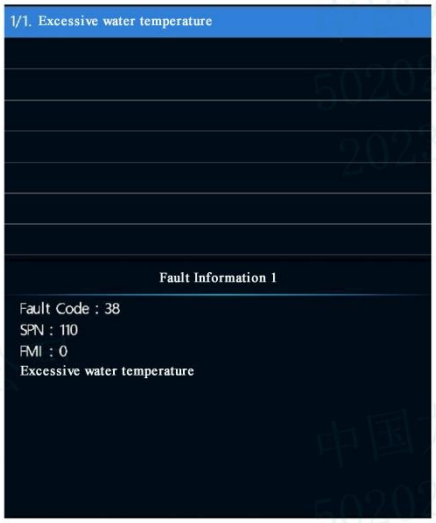



Fig. 5-10-06

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.

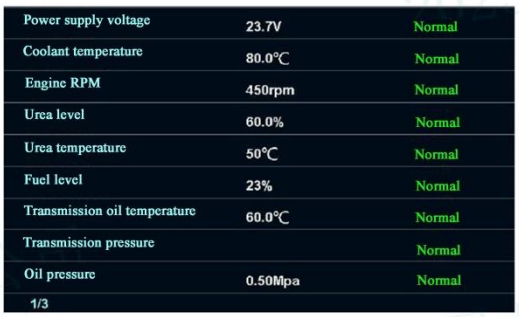



Fig. 5-10-07

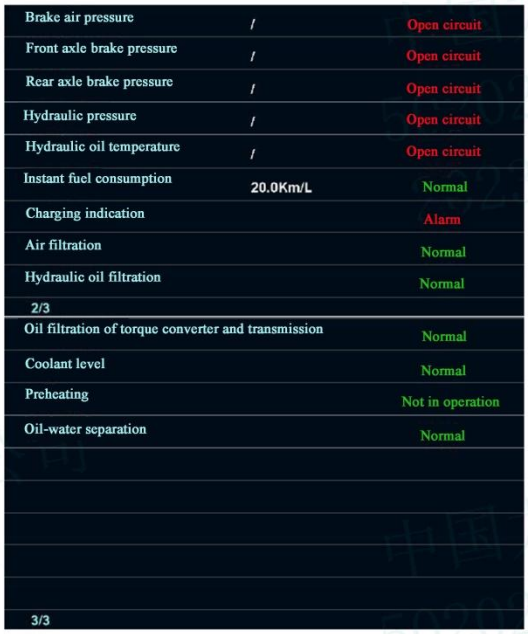



Fig. 5-10-08

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.

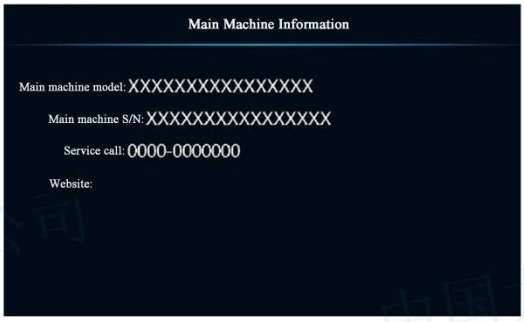



Fig. 5-10-09

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.

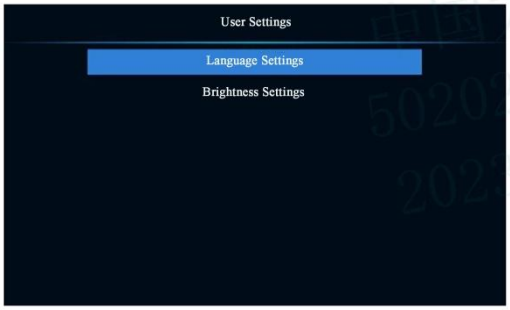



Fig. 5-10-10

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.

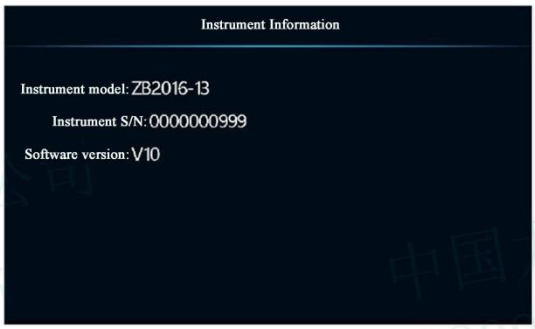



Fig. 5-10-12

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:

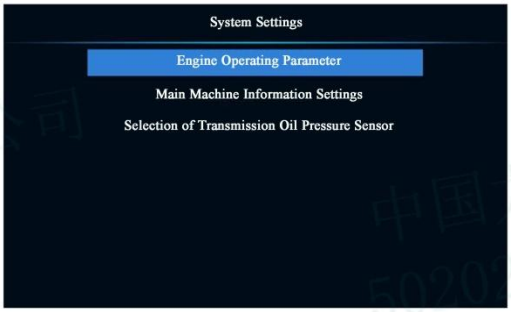



Fig. 5-10-14

(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:

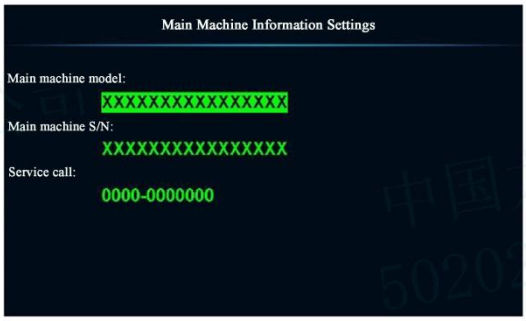



Fig. 5-10-16

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 Steering Gear

**Contents**

## 5.11 Steering Gear

### 5.11.1 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.

### 5.11.2 Removal and Installation

1. Introduction to the position of steering gear on product

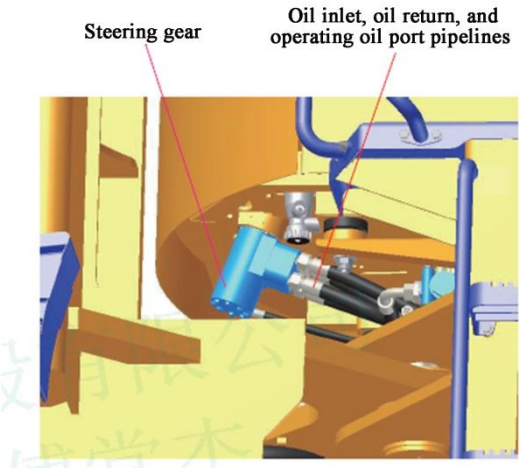



Fig. 5-11-01

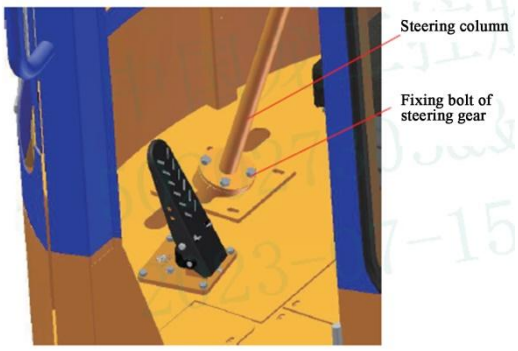



Fig. 5-11-02

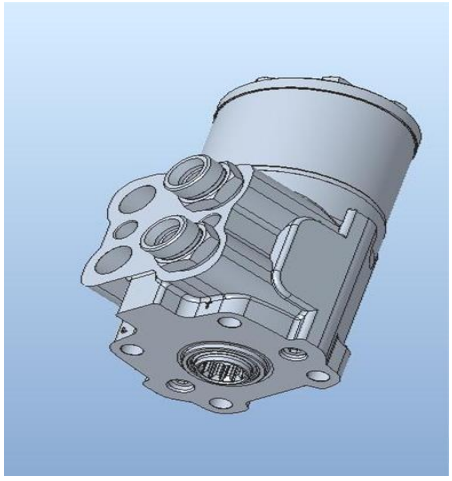


Fig. 5-11-03

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 5-11-01. 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 5-11-02. Meanwhile, cooperate with personnel outside to drag the steering gear (as shown in Figure 5-11-03);

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 5-11-02;

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 5-11-01. 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.**

### 5.11.3 Disassembly and Repair

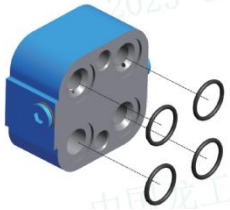
**1. Disassembly process**

① Place the steering gear on the workbench

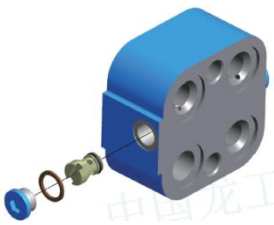
② Remove the two bolts of the joint seat

③ Remove the joint seat.

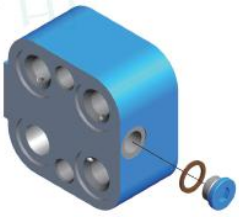
④ Remove the four seal rings on the joint seat



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



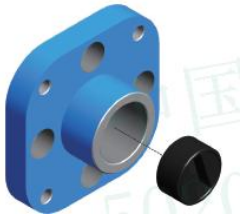
⑥ Remove the plug and copper gasket on the other side.



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

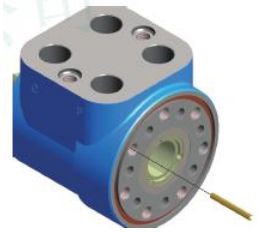
⑭ Remove the gear and jacking pipe in the gear

⑮ Remove the seal ring assembly from the gear

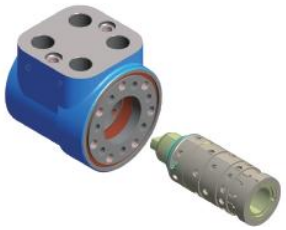
⑯ Remove the universal joint shaft, oil distribution disc and steel balls on the oil distribution disc

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

**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

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

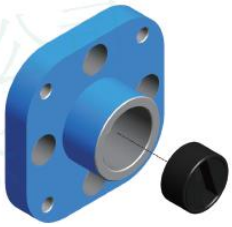
⑪ Install the gear ring and seal ring

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

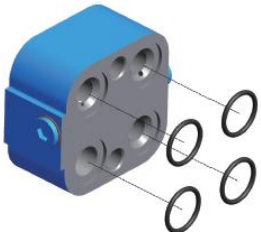
⑭ Install the two seal rings on the upper end cover

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 XII Gear Pump

**Contents**

## 5.12 Gear Pump

### 5.12.1 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.

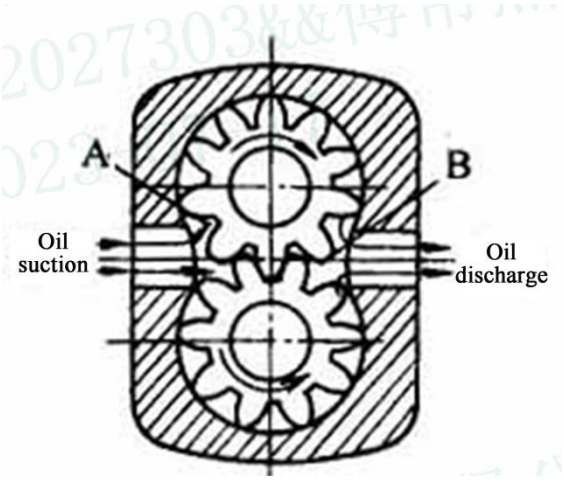



Fig. 5-12-01

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.

### 5.12.2 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 XIII Hydraulic Cylinder

**Contents**

# 5.13 Hydraulic Cylinder

## 5.13.1 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.

## 5.13.2 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.

## 5.13.3 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

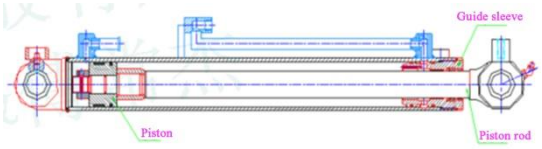



Fig. 5-13-01

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 | |

### 5.13.4 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;

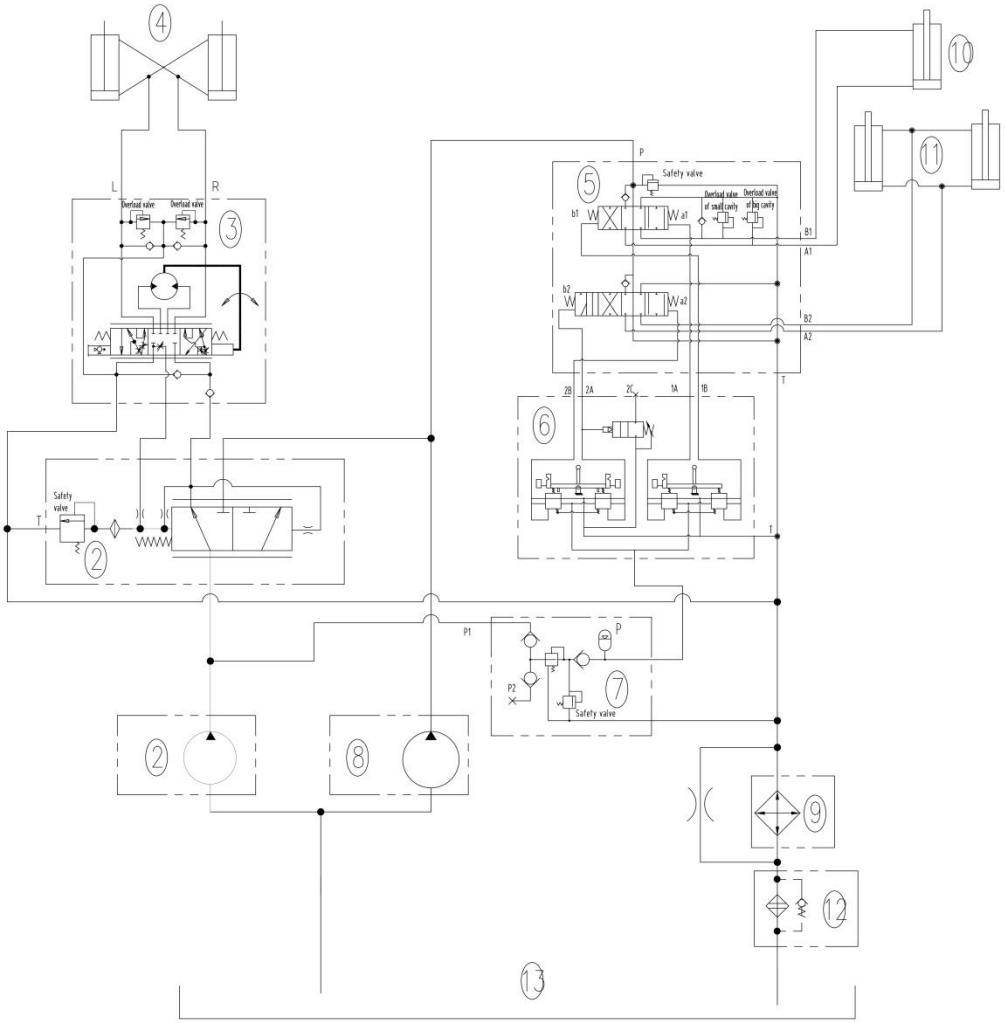
⑪ Do not use fiber or adhesive as sealant to avoid entering the cylinder and polluting the system or damaging the seal;

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

# VI. Hydraulic Schematic Diagram



# VII. Electrical Schematic Diagram