



**Shaanxi Automobile Group Commercial Vehicle Co.,  
Ltd.**

## **After-Sales Service Three Standard Documents**

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# **Turnover Oil Pump Failure**

**Guidelines for Diagnosis, Inspection, and Maintenance Operations**

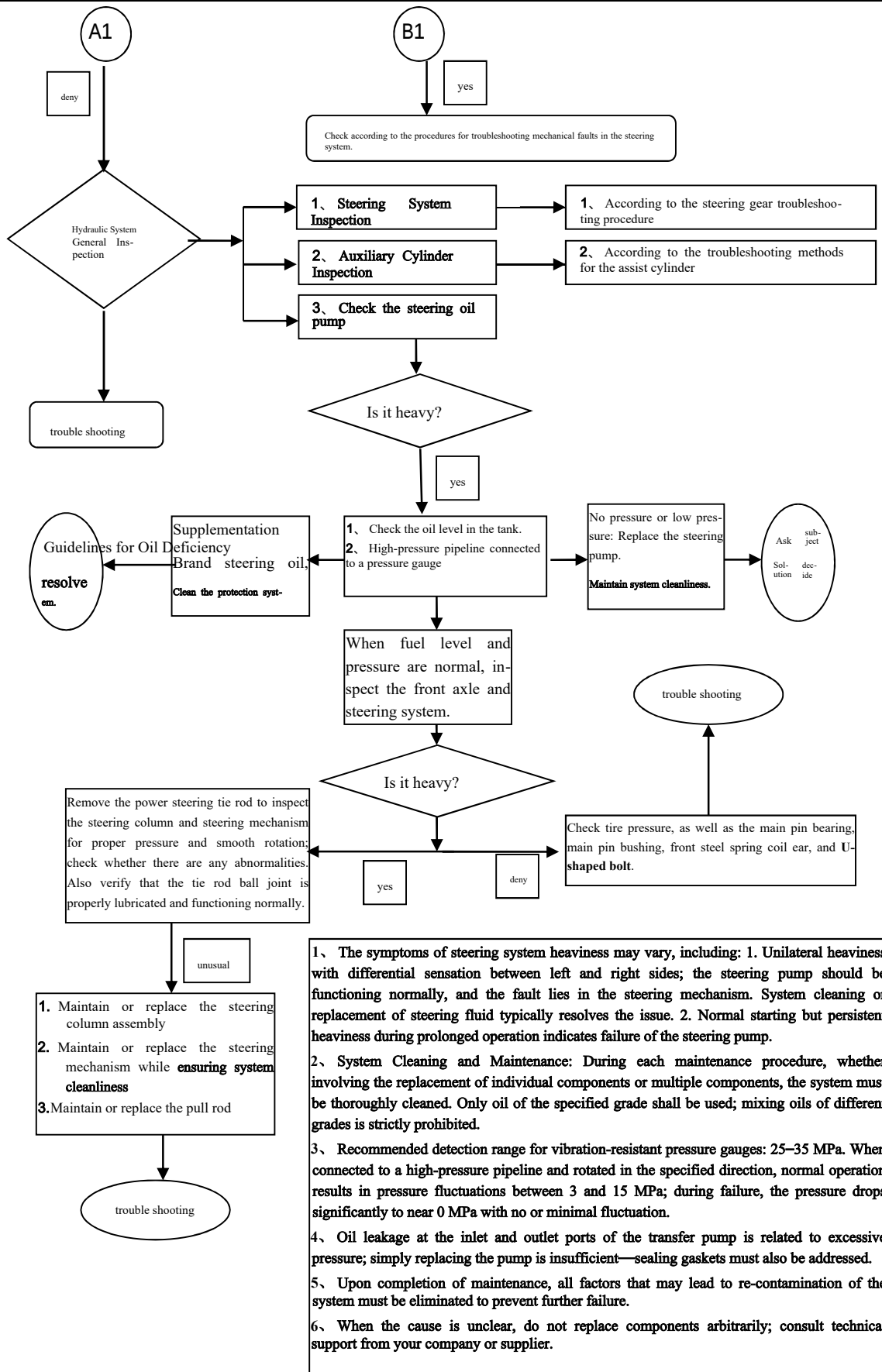
## Catalogue

|                                                                                       |    |
|---------------------------------------------------------------------------------------|----|
| I. Fault Diagnosis Process for Heavy Turning Resistance in the Steering Oil Pump----- | 3  |
| II. Fault Diagnosis Procedure for Oil Leakage from the Steering Oil Pump-----         | 7  |
| III. Diagnostic Procedure for Abnormal Sounds from the Steering Oil Pump-----         | 9  |
| IV. Diagnostic Criteria for Steering System Malfunctions-----                         | 10 |
| V. Testing Standards for Used Components of Steering Oil Pump-----                    | 11 |
| VI. Appendix: "Comparison Table of Technical Parameters for Steering Oil Pump"--      | 13 |

# I. Fault Diagnosis Process for Heavy Turning Resistance in the Steering Oil Pump

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| Fault-pattern     | <b>Hard steering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Fault Description | During normal vehicle operation and steering, a fault characterized by unilateral or bilateral heavy resistance or inability to turn the steering wheel may occur throughout the entire journey or in specific sections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Diagnosis Process | <p><b>1、 Basic diagnostic procedure for heavy steering oil pump operation:</b></p> <pre> graph TD     A[Confirm Use Household complaints] --&gt; B{is a non-steering SINK}     B --&gt; C[Rep cat]     A --&gt; D{Steering wheel handle Force Check}     D -- Yes --&gt; E[Non-steering heaviness]     D --&gt; F{Hydraulic tube Roads, Tires Basic examination procedures}     F --&gt; G[Oil Inspection]     F --&gt; H[Tank Inspection]     F --&gt; I[YouTube Check]     F --&gt; J[Tire Pressure Check]     F --&gt; K{Mechanical failure Problem Diagnosis}     K --&gt; L[Use a jack to lift the vehicle's front axle without starting the engine, then turn the steering wheel.]     L --&gt; M{Is it heavy?}     M --&gt; N((B1))     K --&gt; O((A1))     </pre> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Confirm the customer's complaint</p> <ol style="list-style-type: none"> <li>1. Listen: The customer's complaint;</li> <li>2. Question: What are the significant phenomena?<br/><br/>When did it start appearing?<br/><br/>Where/under what conditions did it occur?</li> <li>3. Test: Conduct a field driving test based on the above information;</li> <li>4. The following operating conditions are considered normal: turning in place under full load; driving normally under overload conditions.<br/><br/>Driving on poor road conditions such as gravel, dirt, or uneven surfaces;<br/><br/>When operating at full load and idling with steering, during downhill driving;<br/><br/>During initial cold start, steering feels heavy until oil temperature rises and performance returns to normal.<br/><br/>When cargo is loaded incorrectly—e.g., positioned too far forward, resulting in excessive load on the front axle;<br/><br/>Judgment criteria: The above 6 situations are normal phenomena and do not constitute heavy steering.</li> </ol> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px; text-align: center;"> <p><b>When rated, the steering wheel torque is less than 10 Nm; when stationary, the torque is less than 8 Nm.</b></p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Mechanical break-down :</p> <ol style="list-style-type: none"> <li>1. Are any components interfering with the steering column, potentially causing damage to it?</li> <li>2. The ball joint of the lever rod is damaged; the bearing of the steering arm is damaged; the connecting rod mechanism is deformed.</li> <li>3. The main bearing is damaged.</li> </ol> </div> |

Diag-  
nosis  
Process

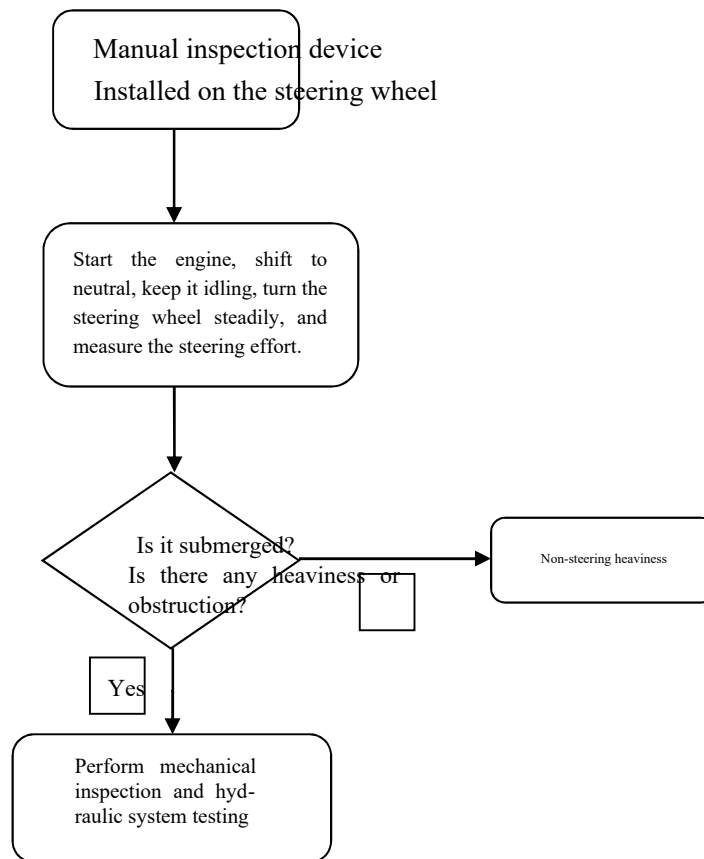


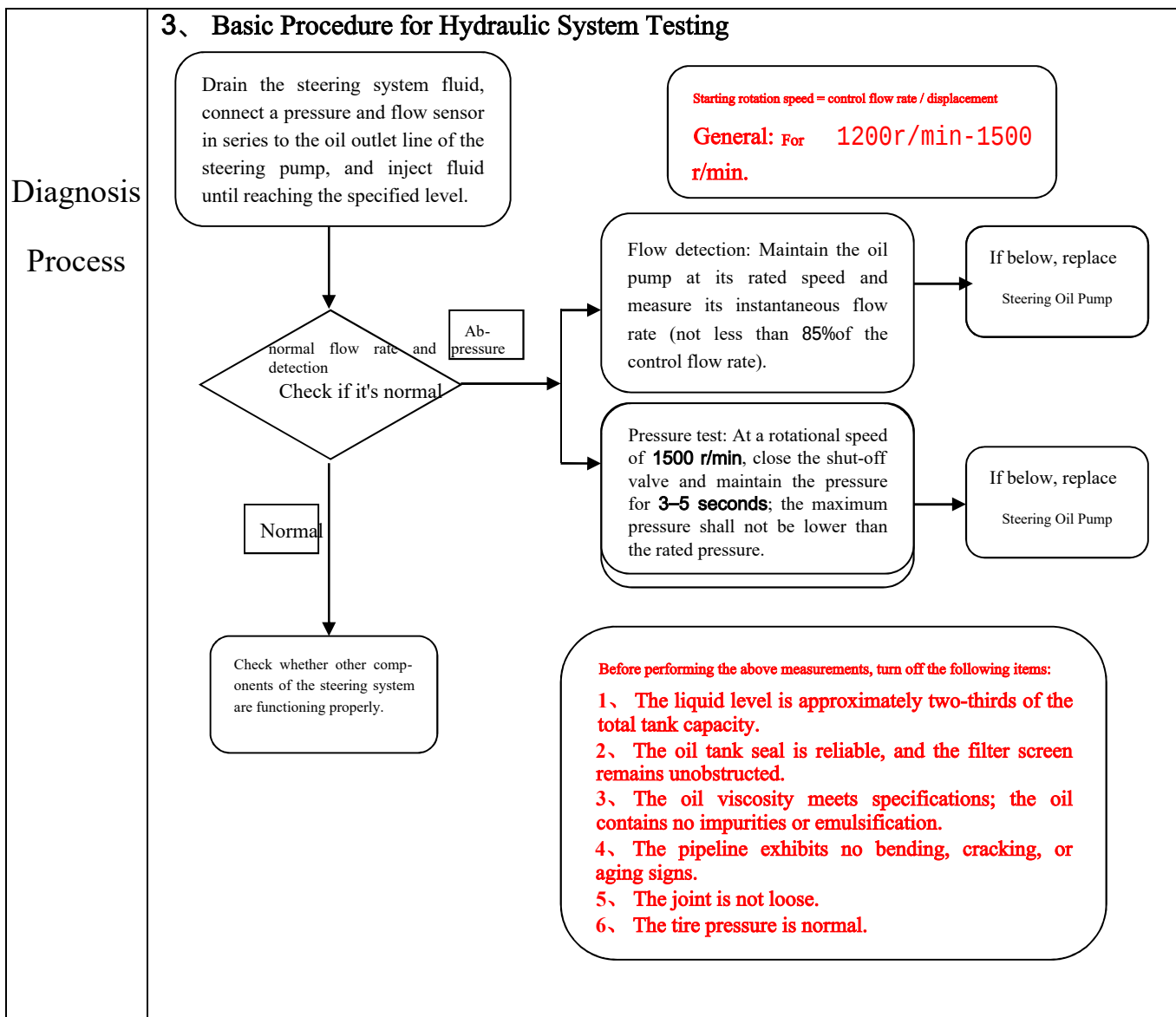
## 2、 Basic Process for Steering Wheel Force Detection



Use a dedicated tool to lock the steering wheel. Apply torque with a torque wrench to the hexagon on the tool's head. With the transmission in neutral and the brake released, keep the engine idling while turning the steering wheel left and right (at a speed not exceeding 1 revolution per second; avoid reaching dead center), as shown in the figure, until the wheels rotate in place, then measure the steering wheel rotation force.

Diagnosis  
Process





## II. Fault Diagnosis Procedure for Oil Leakage from the Steering Oil Pump

|                                                                                                  |                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>hitch</div> <div>description</div>                                                          | <p>Vehicle oil leakage or oil leakage from the power steering pump was repaired by adding lubricant, after which the fault was resolved. The service station diagnosed oil leakage in the power steering pump; alternatively, users reported oil leakage in their vehicles.... etc.</p> |
| <div>turn</div> <div>oil pump</div> <div>oil leak</div> <div>diagnose</div> <div>flow path</div> | <div>1、 Basic diagnostic procedure for oil leakage from the steering pump:</div> <div></div>                                                                                                                                                                                            |

## 2、Precautions for oil leakage from the steering pump:

When oil leakage is detected in the steering system: It is recommended to thoroughly inspect the source of the leak. Leaks at joints are generally not caused by issues with the steering pump or steering mechanism; handle this matter with care to avoid misdiagnosis.

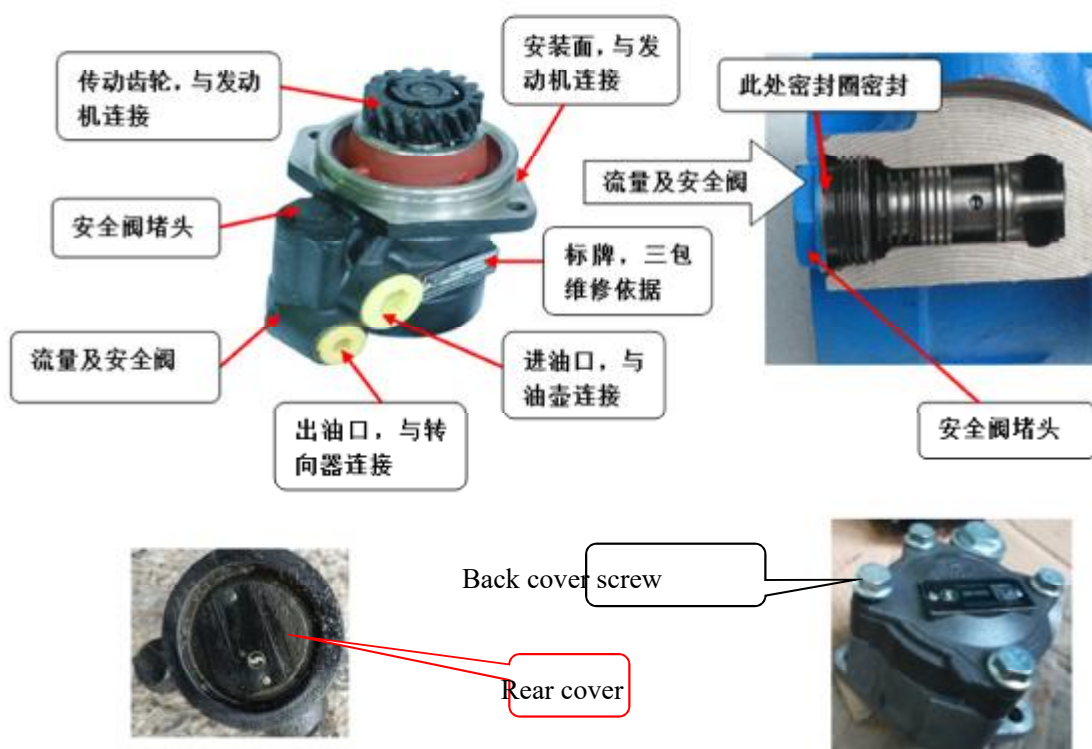
- 1) All hollow bolts with purple copper washers are designed for single-use; they must be replaced upon disassembly.
- 2) Oil leakage caused by improper tightening is not due to a pump fault.
- 3) Oil leakage caused by joint/tube quality issues, not due to pump malfunction.

4) **P10/WD12/WP12NG** Oil leakage at the connection bolt between the oil pump and the engine; not due to a pump fault.

If oil leakage is detected at the joint of the steering gear, steering oil pump, or power steering cylinder oil line, do not replace the steering gear or oil pump. Instead, check whether the joint is loose or replace the combined sealing gasket (joint bolt torque: **70–90 N·m**; sleeve-type joint bolt torque: **90–110 N·m**). After tightening, clean the leaking area and start the vehicle for 5 minutes. If leakage persists, then determine whether the oil pump is leaking and decide whether to replace it.

5) When oil leakage occurs at the interface between the oil pump and the engine or air compressor, do not replace the entire oil pump assembly immediately. First, replace the sealing ring or gasket, or apply sealant to the contact surface (making sure it is applied evenly). During reinstallation, ensure the oil pump interface aligns flush with the engine or compressor surface. Clean the leaking area thoroughly, then run the vehicle for 5 minutes. If leakage persists, determine whether the oil pump is indeed leaking and decide whether replacement is necessary.

## 3、Schematic diagram of the steering oil pump structure



### III. Diagnostic Procedure for Abnormal Sounds from the Steering Oil Pump

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fault-pattern     | Abnormal sound                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Fault Description | Noisy steering oil pump: replaced with a new component to resolve the issue; alternatively, the steering oil pump assembly was replaced on the vehicle and hydraulic oil added before troubleshooting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Diagnosis Process | <p><b>1、 Basic Procedure for Detecting Sounds from the Steering Oil Pump</b></p> <pre> graph TD     A{Confirm Use Household complaints} -- Unusual --&gt; B[Abnormal noise from a non-oil pump]     A -- Yes --&gt; C[Abnormal noise from the oil pump]     C -- Yes --&gt; D[Replace the oil pump. Abnormal Sound Elimination]     D --&gt; E[Trouble shooting]     D --&gt; B     </pre> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p>Confirm the customer's complaint</p> <ol style="list-style-type: none"> <li>1、 Listen: The customer's complaint;</li> <li>2、 Question: What is the phenomenon of abnormal sounds?             <ol style="list-style-type: none"> <li>1) When did it start appearing?</li> <li>2) Where/under what conditions did it occur?</li> </ol> </li> <li>3、 Check for bubbles inside the oil tank and any oil leakage at the joints.</li> <li>4、 Test: Based on the above information, conduct an on-site driving test. The following operating conditions may cause abnormal noises.             <ol style="list-style-type: none"> <li>1) The oil tank is low on oil.</li> <li>2) The oil viscosity is too high.</li> <li>3) The oil temperature is too low (usually in winter).</li> <li>4) The oil suction line of the oil pump is bent, flattened, or cracked.</li> <li>5) The seal of the oil suction pipeline joint is inadequate, and the joint is loose.</li> </ol> </li> </ol> </div> <div style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p>If the aforementioned inspections and troubleshooting measures still fail to eliminate the fault, both the steering oil pump and the steering gear must be replaced separately. Issues such as stuck steering valve or damaged oil pump can also cause abnormal noise in the steering system.</p> </div> |

## IV. Diagnostic Criteria for Steering System Malfunctions

| Order number | Fault Status                                   | Identification Status | Compare with the photo                                                              | State description                                                                                                                                                                      | Liability judgment                          |
|--------------|------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 1            | Turning down                                   | Available Stage       |    | When marking, the steering torque is less than <b>10 Nm</b> , which is a normal phenomenon.                                                                                            | No maintenance required                     |
|              |                                                | Scrap Phase           |                                                                                     | When marking, the steering force exceeds <b>10 Nm</b> , indicating heavy steering.                                                                                                     | Check the mechanical and hydraulic systems. |
| 2            | Oil pump is damaged                            | Available Stage       |    | The instantaneous flow rate of the oil pump shall not be less than <b>85%</b> of its control flow rate; the maximum pressure shall not be lower than <b>85%</b> of the rated pressure. | No replacement required                     |
|              |                                                | Scrap Phase           |                                                                                     | The instantaneous flow rate of the oil pump is below <b>85%</b> of its control flow rate; the maximum pressure is below <b>85%</b> of the rated pressure.                              | Change the oil pump                         |
| 3            | Oil leakage from the oil pump rear cover 1     | Available Stage       |   | After cleaning, start the vehicle and turn the steering wheel left and right for <b>5 minutes</b> to check for any oil leakage.                                                        | Examine other parts of the pipeline.        |
|              |                                                | Scrap Phase           |                                                                                     | After cleaning, start the vehicle and turn the steering wheel left and right for <b>5 minutes</b> , then check for oil leakage.                                                        | Change the oil pump                         |
| 4            | Oil leakage from the oil pump rear cover 2     | Available Stage       |  | Wipe clean, tighten the screws, start the vehicle, and turn the steering wheel left and right for <b>5 minutes</b> . No oil leakage should be observed.                                | Examine other parts of the pipeline.        |
|              |                                                | Scrap Phase           |                                                                                     | After cleaning and tightening the screws, start the vehicle and turn the steering wheel left and right for <b>5 minutes</b> . Oil leakage is still present.                            | Change the oil pump                         |
| 5            | The oil pump safety valve plug is leaking oil. | Available Stage       |  | Clean the area, tighten the plug, start the vehicle, and turn the steering wheel left and right for <b>5 minutes</b> . No oil leakage should be observed.                              | Examine other parts of the pipeline.        |
|              |                                                | Scrap Phase           |                                                                                     | After cleaning, tighten the plug, start the vehicle, and turn the steering wheel left and right for <b>5 minutes</b> , then check for oil leakage.                                     | Change the oil pump                         |

## V. Testing Standards for Used Components of Steering Oil Pump

### 1、 Process for returning used parts to the factory for testing:

The return-to-factory testing and verification of defective components generally follows the following procedure.

- 1) Information organization: Organize information on faulty components, determine the number of oil pumps to be verified, and exclude oil pumps not manufactured by our factory.
- 2) Surface Cleaning: Clean the oil sludge from the exterior of the oil pump before testing.
- 3) Internal cleaning: This procedure is required for steering oil pumps whose inlet and outlet ports show visible contamination or impurities.
- 4) Product Testing: Conduct tests in accordance with factory testing requirements, focusing on fault mode testing.



### 2、 Test Process for Steering Oil Pump Products

#### 2.1 Air tightness test: Detection of oil pump faults caused by oil leakage

##### 1) Dry detection method:

Seal the oil outlet of the oil pump, install it on a gas-tight test bench, apply a gas pressure of **190 KPa** to **220 KPa**, inflate for **8 seconds**, allow equilibrium for **8 seconds**, and measure the oil pump pressure drop for **11 seconds** to verify whether it is  $\leq 0.15$  KPa. The industry standard QC/T299-2014 specifies a gas pressure of **100 KPa**, a testing duration of **10 seconds**, and a pressure drop value of **0.18 KPa**.

Figure 7 Air-Tightness Testing Instrument



Figure 8 System for Testing Operation on the Performance Test Bench



## 2) Immersed Testing Method:

Seal the oil outlet of the oil pump, immerse the oil pump in diesel oil, apply a gas pressure of **0.2 MPa**, maintain the pressure for **30 seconds**, and observe whether bubbles form on the parts and all assembly surfaces.

2.2 Factory Performance Testing: Install the faulty component on a performance test bench and conduct the following tests according to factory specifications. Detailed technical parameters for each oil pump are listed in the attached Table "Technical Parameters Comparison Table for Steering Oil Pumps".

① Run-in test: Start the steering oil pump under no-load pressure, increase it to the maximum speed and maintain for **30 seconds**; then adjust the speed to **1500 r/min**, and increase the pressure from no-load to **0.5P<sub>max</sub>** and **0.85P<sub>max</sub>** working pressures respectively, maintaining each for **30 seconds**.

② Safety pressure test: Start the steering oil pump under no-load pressure, increase the speed to **1500 r/min**, quickly close the output oil circuit to reduce the output flow rate to near zero, maintain this condition for 2 to **3 seconds**, and record the pressure value at this time.

③ Flow measurement: Test using the flow parameters specified or converted according to the "Technical Parameter Comparison Table for Steering Oil Pump".

④ External leakage test: Operating speed **1500 r/min**, pressure **0.85 P<sub>max</sub>**(working pressure), running for **30s**, no leakage.

⑤ Volume efficiency test: At a rotational speed of **600 r/min**, measure the ratio of flow rate under **0.5P<sub>max</sub>** operating pressure to flow rate under no-load pressure, requiring a value  $\geq 80\%$ .

Note: Throughout the entire oil pump inspection process for oil leakage faults, external leaks must be observed.

2.2.1 When evaluating the test data results of used components, the maximum pressure attenuation under flow and safety conditions shall not exceed 7%(refer to 5.3 of **QC/T299.1-2014**, which specifies a maximum attenuation of 10%).

2.3 For verification purposes, disassemble and inspect the faulty oil pump: remove the defective component and carefully examine all parts of the oil pump core for any abnormalities.

## VI. Appendix: "Comparison Table of Technical Parameters for Steering Oil Pump"

| Part Number   | Part name                                                 | Nominal<br>displac-<br>ement<br>(ml/r) | Control<br>Flow Rate<br>(L/min) | Flow indicator               |                              |                       |                              |                      | Safety valve pre-<br>essure (MPa) | Volume effie-<br>ncy (L/min) |
|---------------|-----------------------------------------------------------|----------------------------------------|---------------------------------|------------------------------|------------------------------|-----------------------|------------------------------|----------------------|-----------------------------------|------------------------------|
|               |                                                           |                                        |                                 | 600r/min                     | 1200 r/min                   |                       | 2000 r/min                   |                      |                                   |                              |
|               |                                                           |                                        |                                 | No-load flow rate<br>(L/min) | No-load flow<br>rate (L/min) | Load Flow (L/<br>min) | No-load flow<br>rate (L/min) | Load Flow<br>(L/min) |                                   |                              |
| DZ96319470702 | Control Oil Pump<br>(WP7/Reduce Speed)                    | 25                                     | 22                              | 14.2-16.5                    | 21-24                        | 20-24                 | 20-26                        | 22-27                | 14-16                             | ≥80%                         |
| DZ93319130002 | Steering Oil Pump                                         | 22                                     | 25                              | 12.5-14.5                    | 22-26                        | 23-27                 | 23-28                        | 24-30                | 14-16                             | ≥80%                         |
| BZ34071140    | Steering Oil Pump                                         | 18                                     | 16                              | 10-12                        | 14.5-17.5                    | 15-18                 | 16-19                        | 16-20                | 15-17                             | ≥80%                         |
| DZ96189470761 | Steering Oil Pump (WP7/<br>Single Front Shaft)            | 20                                     | 18                              | 12-14                        | 16.5-19.5                    | 16-20                 | 18-21                        | 19-22                | 17<br>(No relief valve)           | ≥80%                         |
| DZ97319470108 | Steering Oil Pump<br>Assembly (ISM/1.25s)                 | 25                                     | 25                              | 14.2-16.5                    | 22-26                        | 23-27                 | 23-28                        | 24-30                | 14-16                             | ≥80%                         |
| BZ96259470006 | Steering Oil Pump                                         | 20                                     | 18                              | 11.4-13.2                    | 16.5-19.5                    | 16-20                 | 18-21                        | 19-22                | 14-16                             | ≥80%                         |
| DZ97189470213 | Steering Oil Pump<br>Assembly (WP12/15<br>Mpa<br>/1.25/s) | 20                                     | 18                              | 11.4-13.2                    | 16.5-19.5                    | 16-20                 | 18-21                        | 19-22                | 17<br>(No relief valve)           | ≥80%                         |
| DZ96319470984 | Steering Oil Pump<br>(WP9H/No safety valve)               | 25                                     | 25                              | 14.25-16.5                   | 22-26                        | 23-27                 | 23-28                        | 24-30                | 15<br>(No relief valve)           | ≥80%                         |
| DZ9M319470101 | Steering Oil Pump                                         | 25                                     | 25                              | 14.25-16.5                   | 22-26                        | 23-27                 | 23-28                        | 24-30                | 17+1.5<br>(No relief valve)       | ≥80%                         |
| BZ93109471001 | Steering Oil Pump                                         | 14                                     | 13                              | 9.4-10.5                     | 11.5-14                      | 11.5-14.5             | 12-16                        | 13-17                | 13-15                             | ≥80%                         |
| DZ95189470133 | Steering Oil Pump<br>(X12/17 MPa)                         | 17                                     | 18                              | 9.6-11.22                    | 16.5-19.5                    | 16-20                 | 18-21                        | 19-22                | 17<br>(No relief valve)           | ≥80%                         |

|               |                                                |       |      |            |           |       |           |       |                         |      |
|---------------|------------------------------------------------|-------|------|------------|-----------|-------|-----------|-------|-------------------------|------|
| DZ96189470929 | Steering Oil Pump<br>(WP9H/No safety valve)    | 20    | 18   | 11.4-13.2  | 16.5-19.5 | 16-20 | 18-21     | 19-22 | 15<br>(No relief valve) | ≥80% |
| DZ97189470215 | Steering Oil Pump As-<br>sembly (WP12/15/1.25) | 20    | 16   | 11.4-13.2  | 14.5-17.5 | 14-18 | 14.5-19.5 | 15-21 | 14-16                   | ≥80% |
| BZ96609470001 | Steering Oil Pump<br>(WP15/1.25)               | 25    | 25   | 14.25-16.5 | 22-26     | 23-27 | 23-28     | 24-30 | 17<br>(No relief valve) | ≥80% |
| DZ9H319470103 | Steering Oil Pump<br>(WP15/1.25)               | 25    | 25   | 14.25-16.5 | 22-26     | 23-27 | 23-28     | 24-30 | 17<br>(No relief valve) | ≥80% |
| BZ93189470014 | Steering Oil Pump                              | 14    | 12   | 7.5-9.5    | 10.5-13.5 | 10-14 | 13-15     | 14-17 | 11.2-13                 | ≥80% |
| BZ34071020    | Power Steering Oil Pump                        | 8.5   | 6-8  | ≥5         | 7-9       |       | 7.5-9.5   |       | 9.3-11                  | ≥80% |
| DZ9100130044  | Steering Oil Pump                              | 21    | 16   | 11.5-13.5  | 14.5-17.5 | 14-18 | 14.5-19.5 | 15-21 | 14-16                   | ≥80% |
| BZ93189470101 | Steering Oil Pump                              | 16    | 20   | 9.12-10.56 | 18-21     | 17-21 | 20-23     | 20-24 | 14-16                   | ≥80% |
| DZ91259470708 | Steering Oil Pump                              | 15.77 | 15.8 | 9.12-10.56 | 14.5-17.5 | 14-18 | 14.5-19.5 | 15-21 | 14-16                   | ≥80% |