

# Fault Diagnosis and Maintenance of the Front Lighting System of Volkswagen Magotan

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## Abstract

Study the front lighting system of the Volkswagen Magotan B8L model, analyze the composition and control principle of high beam, low beam, and side marker lights in the front lighting system. Introduce typical fault cases of high beam, low beam, and side marker lights, analyze fault phenomena, conduct fault diagnosis, and achieve fault elimination.

## Keywords

Volkswagen Magotan; Fault Diagnosis; Maintenance; Front Lighting System.

## 1. Introduction

The lighting system is one of the important components of a car, and various lights with different functions in the lighting system can play a decorative, lighting, reminder, and warning role, which is crucial for the normal driving and driving safety of the car. The Volkswagen Magotan is a best-selling flagship B-class car with a high market share. Its lighting system is relatively complex, and diagnosing and repairing common lighting faults is of universal significance. This article selects the front lighting system of the Volkswagen Magotan B8L for research.

## 2. Composition and Control Principle of the Front Lighting System

The front lights of the Volkswagen Magotan mainly include high beam lights, low beam lights, and side marker lights.

### 2.1. Composition and Control Principle of High Beam Headlights

In order to save energy and increase the brightness of high beam and overtaking lights, the Volkswagen Magotan adopts LED unit lighting for both left and right high beam and overtaking lights.

The Volkswagen Magotan high beam control system is centrally controlled by the on-board power grid control unit J519. The system includes components such as the light rotary switch, light dimmer switch, left headlight assembly, right headlight assembly, steering column electronic device control unit J527, data bus diagnostic interface J533, combination meter control unit J285, and on-board power grid control unit J519.

Under normal circumstances, the light rotary switch is turned to the low beam position, and the dimmer switch is pressed down, as shown in Fig. 1. The switch is internally connected to the high beam control contact, and then the steering column electronic device control unit J527 receives an analog signal to turn on the high beam. The control unit J527 converts this analog signal into a digital signal, and sends the data to the onboard power grid control unit J519 and the combination instrument control unit J285 through the comfort system CAN bus, J519 turns on the high beam lights, and J285 turns on the indicator light of the high beam lights (the actual measured indicator light of the high beam lights on J285 is blue).



**Fig.1** Composition of Dimmer Switch

## **2.2. Composition and Control Principle of Low Beam Headlights**

The Volkswagen Magotan low beam control system is centrally controlled through the vehicle power grid control unit J519, which mainly includes the following components: light rotary switch, vehicle power grid control unit J519, left headlight assembly, right headlight assembly, data bus diagnostic interface J533, and combination instrument control unit J285.

From the Volkswagen Magotan low beam control circuit, it can be seen that when the light rotary switch is turned to the low beam position, the light rotary switch unit receives a signal to turn on the low beam. The unit converts the received analog voltage signal into a digital signal, and sends this signal to the vehicle power grid control unit J519 through the switch LIN bus. After receiving this signal, the control unit J519 switches on the left front and right front low beam control signals respectively, and all low beams light up.

## **2.3. Composition and Control Principle of Side Marker Lights**

The side marker lights control system of the Volkswagen Magotan is centrally controlled through the vehicle power grid control unit J519. The system mainly includes a light rotary switch, the vehicle power grid control unit J519, the side marker lights in the left and right headlight assemblies, the side marker lights in the left and right rear taillight assemblies, the data bus diagnostic interface J533, the combination instrument control unit J285, and the indicator lights for various operation switches in the car.

The side marker light in the headlamp assembly, also known as daytime side marker light, is installed at the bottom of the headlamp assembly. The side marker light is made of LED, and the dual color LED light is used for daytime side marker lights, parking lights, and turn signal lights. Under the "daytime side marker light" function, the white part of the 13.5V LED is controlled through a 100% PWM signal. When the turn signal light is activated, the daytime side marker light will be turned off.

The control circuit of the Volkswagen Magotan external side marker light shows that when the light rotary switch is turned to the side marker light position, the light rotary switch unit receives a signal to turn on the side marker light. The unit converts the received analog voltage signal into a digital signal, and sends this signal to the vehicle power grid control unit J519 through the switch LIN bus. After receiving this signal, the control unit J519 connects the left front, right front, left rear, and right rear side marker light control circuits respectively, all side marker lights are on.

# **3. Fault Diagnosis and Maintenance of the Front Lighting System**

## **3.1. High Beam System Fault Diagnosis and Maintenance**

Case analysis:

Fault symptom:

Turn on the ignition switch, the instrument panel prompts "Please check the left high beam light" and the light fault indicator light is on; When the light rotary switch is placed in the side marker position, the side marker lights will light up normally. By operating the front and rear

fog light switches, the front and rear fog lights will light up normally; But when the light rotary switch is placed in the low beam position, the low beam lights will turn on normally. By operating the front and rear fog light switches, the front and rear fog lights will turn on normally, and the EX1 background light will turn on. When operating the high beam headlight, the left front high beam headlight always does not light up, while the right front high beam headlight lights up normally.

Fault analysis:

Opening the car door, the EX1 background light is on, indicating that the EX1 power supply and grounding are normal;

Turn on the ignition switch and operate the lights. The left front high beam light remains off, while the other lights are controlled normally, indicating that the EX1 switch function is normal. Possible cause: Abnormal power supply and grounding of the left front high beam lamp; The left front high beam control circuit is abnormal; J519 is partially damaged.

Diagnostic process:

Step 1: Turn on the ignition switch, use a decoder, and read fault code 07175: Left high beam light bulb short circuit to ground.

Step 2: Operate EX1 to the low beam position, dim the switch to the high beam position, and measure the output signal of the left front high beam J519 end. Turn on the ignition switch and use a voltmeter to measure the ground voltage of J519 terminal T46b/23 at 12.6V, which is normal in actual measurement.

Step 3: Test the input signal of the left front high beam lamp terminal M30. Turn on the ignition switch and use a voltmeter to measure the voltage between the T14af/14 terminal of M30 and the ground as 0V. The voltage is abnormal.

Preliminary analysis shows that the left high beam control circuit is short circuited to ground. Disconnect the negative terminal of the battery, check the continuity of the circuit, and measure a resistance of 0.02 ohms to ground at the T14af/14 terminal. The result is that the M30 control circuit is short circuited to ground.

Finally, troubleshoot the problem, turn on the ignition switch to clear the fault code, operate the high beam lights again, and check if the problem still exists.

### **3.2. Low Beam System Fault Diagnosis and Maintenance**

Case analysis:

Fault symptom:

Turn on the ignition switch, the instrument panel prompts "Please check the left headlight" and the light fault indicator light is on. When the light rotary switch is placed in the side marker position, the side marker lights will light up normally. By operating the front and rear fog light switches, the front and rear fog lights will light up normally. But when the light rotary switch is placed in the low beam position, the left front headlight always does not light up. Operate the front and rear fog light switches, the front and rear fog lights are turned on normally, and the EX1 background light is on.

Fault analysis:

Opening the car door, the EX1 background light is on, indicating that the EX1 power supply and grounding are normal;

Turn on the ignition switch and operate the lights. The left front headlight remains off, while the right front headlight and fog light are controlled normally, indicating that the EX1 switch function is normal. Possible cause: Abnormal power supply and grounding of the left front headlight; The control circuit of the left front headlight is abnormal; J519 is partially damaged.

Diagnostic process:

Step 1: Turn on the ignition switch, use a decoder, and read fault code 21772: There is an electrical fault in the left LED headlight power module.

Step 2: Operate EX1 to the low beam position and measure the output signal of the left headlight J519 end. Turn on the ignition switch and use a voltmeter to measure the ground voltage of J519 terminal T73c/5 at 12.6V, which is normal.

Step 3: Operate EX1 to the low beam position and measure the input signal of M29 on the left headlight end. Turn on the ignition switch and use a voltmeter to measure the voltage between terminal T14af/6 of M29 and ground as 0V, indicating an abnormal voltage.

Combining step two, there is a voltage drop between J519 and the lamp terminal. It is preliminarily determined that T14af/6 of M29 and T73c/5 of J519 are open circuited. Disconnect the negative electrode of the battery, check the continuity of the circuit, and obtain an infinite resistance. The result is that T14af/6 of M29 and T73c/5 of J519 are open circuited. Finally, troubleshoot the problem, turn on the ignition switch to clear the fault code, operate EX1 again, and check if the problem still exists.

### 3.3. Fault Diagnosis and Maintenance of Side Marker Lamp System

Case analysis:

Fault symptom:

Turn on the ignition switch, the instrument panel prompts "Please check the left daytime running light" and the light fault indicator light is on. When the light rotary switch is placed in the side marker position, the right side marker light will light up normally, while the left side marker light will not light up. Operate the front and rear fog lamp switches, and the front and rear fog lights up normally. When the light rotary switch is placed in the low beam position, the low beam lights will turn on normally. By operating the front and rear fog light switches, the front and rear fog lights will turn on normally, and the EX1 background light will turn on. Operate the high beam headlights and they will light up normally.

Fault analysis:

Opening the car door, the EX1 background light is on, indicating that the EX1 power supply and grounding are normal;

Turn on the ignition switch and operate the lights. The left front side marker light remains off, while the other lights are controlled normally, indicating that the EX1 switch function is normal. Possible cause: Abnormal power supply and grounding of the left front side marker lamp; The left front high beam control circuit is abnormal; J519 is partially damaged.

Diagnostic process:

Step 1: Turn on the ignition switch, use a decoder, and read fault code 18698: Left daytime running light (DRL) and parking light LED module power supply open circuit/short circuit to positive pole.

Step 2: Operate EX1 to the side marker position and measure the output signal of the left front side marker J519 end. Turn on the ignition switch and use a voltmeter to measure the ground voltage of J519 terminal T46b/10 at 12.6V, which is normal in actual measurement.

Step 3: Test the input signal of the left front side marker lamp terminal M1. Turn on the ignition switch and use a voltmeter to measure the voltage between terminal T14af/10 of M1 and ground as 0V, indicating an abnormal voltage.

Based on Step 2, there is a voltage drop at both ends of the M1 power supply line, and it is preliminarily determined that the M1 power supply line is open circuit. Disconnect the negative electrode of the battery and check the continuity of the circuit. It is found that the resistance from T14af/10 of M1 to T46b/10 of J519 is infinite, resulting in an open circuit in the M1 power supply line.

Finally, troubleshoot the problem, turn on the ignition switch to clear the fault code, operate EX1 again, and check if the problem still exists.

#### **4. Conclusion**

The lighting system of the Volkswagen Magotan B8L model is relatively complex, and EX1 is an important part of the Magotan lighting system. The on-board power grid control unit J519, which supplies power to the lights on the Magotan vehicle, is even more important. In the lighting system, the composition and control of the high beam, low beam, and side marker lights in the front lighting are closely related to EX1 and J519. Preliminary analysis and identification of possible problems can be carried out through fault phenomena. Combined with the operation of decoder fault codes, test signals, etc., the cause of the fault can be identified and fault repair can be achieved.

#### **References**

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