Research on Methods of Detecting Failure of Automotive Electrical Components

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Abstract: With the rapid development of China's economy and science and technology, the automotive industry has also made great progress, and has improved the rhythm and quality of people's daily life. With the increasing use of automobiles, the automotive maintenance industry has put forward higher requirements. Modern vehicles have generally realized the characteristics of electrical and automation. After the statistics of relevant industries, the probability of occurrence of electrical faults in daily vehicle maintenance problems is relatively high. The paper starts with the characteristics of automotive electrical systems, and analyzes the characteristics and maintenance of automotive electrical faults.

1. Introduction

With the development of automotive electronics technology, automotive electrical systems have become an important part of automobiles, and their performance has a great impact on the use of automobiles. The new structure and electronic devices of the car have emerged one after another, and the comprehensive performance of the car has been greatly improved. At the same time, fundamental changes have taken place, which has led to the development of automobile faults in an increasingly diversified and complicated direction. At the same time, the fault diagnosis and maintenance of electronic appliances the problem is increasingly prominent. This puts new demands on car driving and maintenance personnel, and it is more and more important to master certain use and maintenance techniques. The fault analysis of automotive electrical systems helps car users and maintenance personnel to systematically master the principles of faults in modern automotive electrical appliances. This paper passes on automotive generators and regulators, automotive batteries and starters, automotive engine ignition systems and electronically controlled fuel injection. Systems, automotive electronic circuits and meters analyze the common faults of modern vehicles, so that we can better grasp the faults of modern automotive electrical appliances.

2. Characteristics of automotive electrical faults

Automotive electrical system faults are characterized by strong concealment and diversification and complexity. Therefore, it is difficult to quickly determine the cause of the fault and find the location where the fault occurred. In general, automotive electrical system faults have the characteristics of faults such as the breakdown of the original parts, the overheating of the automotive electrical system, the overvoltage, the overcurrent causing the breakdown of the original, the breakdown of the short circuit or the open circuit. Circuit failures can easily lead to overvoltage or overcurrent breakdown. However, once this phenomenon occurs, it will not recover well. In the process of using automotive electrical systems, the phenomenon of aging of the original parts will inevitably occur. If the capacitance is reduced, the transistor will be used to measure electricity. When the resistance value of the resistor changes, the resistance of the insulator will also decrease. The aging of the original component will lead to poor contact of the automotive electrical system, so that the fault of the line occurs, but the fault of the line has nothing to do with the components of the device.

In addition to faults caused by component aging, line faults in automotive electrical systems are divided into two categories: progressive faults and sudden faults. The period of the progressive fault is relatively long, which is an increasing degree of line fault. Most of the faults are caused by the

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friction time of the parts. The period of sudden failure is relatively short and is an unforeseen failure, mostly due to short circuit and open circuit of the system line. Line faults in automotive electrical systems are also classified into functional faults and destructive faults. Functional fault refers to non-destructive faults in which electrical equipment functions are not completely zombies. Destructive faults refer to line faults in which electrical equipment functions are completely lost. The causes of line faults are as long as the power supply is damaged, the lines are not smooth, and the electrical appliances are improperly used. Improper system design, environmental impact, etc.

3. New methods for automotive electrical component testing

Based on years of maintenance experience, a new method for detecting the above-mentioned second type of electrical components (hereinafter referred to as electrical components refers to such electrical components) has been developed. The basic "theory" of the method is as follows: This type of electrical components are mainly composed of resistors, capacitors, diodes, transistors, field effect transistors, integrated circuits, chips, microcontrollers, CPUs and other components. People do not know which components are composed, and they do not know the structural relationship and performance parameters of each component. However, for a styling product, its structural and performance parameters have been determined. Then, there is a certain resistance value between every two terminals of the electrical component (although it is not clear why this resistor is this value). Then, if the electrical component fails, it can be confirmed that one of the internal components (or several) components or the connection has failed, which inevitably causes a change in the resistance value between two or some of the terminals of the electrical component. Based on such considerations, the resistance value between the respective terminals of the new electrical components can be measured as a "standard value". If an electrical component is suspected to be faulty, the terminal resistance value can be measured and compared with the "standard value". In comparison, if they are consistent, it can be concluded that the electrical component is not faulty, otherwise the component is faulty.

A Santana 2000, which was delivered in August 2004, is equipped with an AJR engine and uses M3.8.2 electronically controlled fuel injection system with a mileage of about 48,000 km. The fault phenomenon is that the vehicle power is seriously insufficient, the fuel is exhausted, the exhaust gas is “stunned”, and the idle speed is severely shaken. After testing: no fault code; 1, 4 cylinder high pressure no fire; 2, 3 cylinder high pressure fire is normal. Further detecting the spark plug, the cylinder line, the line connected to the ignition coil N152, and its control signal (waveform) related to the ignition of the 1 and 4 cylinders are normal. It is preliminarily concluded that the ignition coil N152 or its 4-terminal connector is in poor contact. Santana 2000 ignition system line. The connector contact can't be measured, it can only be observed, it feels no problem, but it is not sure. Finally, the resistance value between the four terminals of the faulty vehicle ignition coil N152 is measured, as shown in Table 1. Measure the resistance between the four terminals of the new ignition coil of the same model. By comparing the values of Table 1 and Table 2, it can be found that the resistance values of the terminals 3 and 4 of the ignition coil N152 do not match. The new resistor value is 4.3 kΩ; the faulty resistor value is 0.1 Ω. It is certain that the ignition coil N152 of the faulty vehicle has failed. Replace with a new one, troubleshooting.

The Santana 2000, which was produced in December 2002, is equipped with an AJR engine and uses M3.8.2 electronically controlled fuel injection system. The mileage of the car is more than 120,000 km. The phenomenon of failure is accelerated response. After testing: No fault code, fuel supply system, ignition system, etc.; View data flow, idling speed fluctuates between 760~820 r /min, throttle opening varies between 3 ° ~ 4 °, intake The amount is 1.5 g/s, the injection pulse width is 1.65 ms, and the oxygen sensor signal is 0.2 V. It can be seen from the above data that only the throttle position signal is correct, other signals deviate from the standard range, and the intake air amount is significantly lower (standard value is 2 to 4 g/s). Finally, the air flow meter G70 is suspected. failure. The Santana 2000 is equipped with a hot film air flow meter G70 (marked on the part: BOSCH 0 280 217 121, Made in Germany). The dynamic signal voltage is measured at the signal end of the plug. At idle speed, the standard voltage is 0.8 to 1.4 V. When accelerating to full load, the voltage signal can approach 4 V. The measured value of this car is 0.6 V at idle speed and only 3.2 V when accelerating to full load. It can be confirmed that the signal voltage is low overall, there are many reasons for the failure: 1 air flow meter has problems; 2 bad connector contact; 3 air flow meter dirty; 4 engine electronic control unit failure.

The Audi A4 sedan, which was launched in January 2005 by FAW-Volkswagen Automotive Co., Ltd., is equipped with a 1.8T engine and travels about 51,000 km. It uses ME7.5 electronically controlled fuel injection system. Suddenly turned off during driving and could no longer be started. After testing, there is no sign of fire at the start; check with the decoder, no fault code; during the starting process, the oil pump does not work, the spark plug does not jump; test the actuator with the decoder: oil pump operation, injector action, spark plug Jumping, other actuators also act. Preliminary analysis, the oil pump, oil pump relay, ignition system and other related devices and lines are not faulty. Check the data flow, the intake air temperature and the coolant temperature are all displayed at about 38 °C, normal; measure the cylinder pressure, normal. Through the above detection and analysis, it is considered that the possibility of failure of devices and lines related to the engine speed sensor is large. Check out the Audi A4 Service Manual, which electronically controls the circuit associated with the speed sensor in the fuel injection system circuit diagram.

Through the above waveform analysis, the fault range is as follows: 1T3 /3 pin and the motor electronic control unit terminal 82 wire break; 2 engine electronic control unit connector terminal 82 bad contact; 3 engine electronic control unit failure. After testing, the wire between the T3 /3 pin and the engine ECU terminal 82 is normal. It is not good to judge whether the connector of the engine ECU is in good contact. The connector can only be seen by the naked eye. By observation, it is considered that the terminal 82 of the connector of the engine ECU is unlikely to be in contact with each other, but it is not certain. When the fault is detected, it is considered that the possibility of damage to the engine electronic control unit is very large. But this is only an inference, there is no theoretical basis. As we all know, this type of car can't diagnose the engine ECU by the replacement method, because the engine ECU has already entered the password and can no longer be used in other vehicles. In fact, many cars are currently being produced (especially in mid- to high-end cars). Finally, it was decided to find the same engine of the same model, the engine ECU model and version (the ECU marked: 480 906018 CQ; BENZIN ME7.5001; BOSCH 0 261 207 557Made in Germany) engine ECU. The resistance between the terminals (62, 3, 1, 82, 90, etc.) related to the engine speed sensor G28 on the engine ECU is measured by a multimeter by means of the vehicle circuit diagram and the like.

The oil supply timing of the injector (fuel timing) depends on the energization timing of the injector solenoid valve, and the energization timing of the solenoid valve is controlled by the ECU; in addition, since the return spring force of the needle valve in the injector is Certainly, the pressure (closed valve pressure) in the injector oil chamber is also fixed when the fuel injection is stopped. Therefore, when the fuel injection timing is constant, the fuel injection time of the injector is also fixed. The injector nozzle has a certain size and the injection time is constant, so the injection pressure can be controlled to control the fuel injection amount. When the booster piston and the plunger are of a certain size, the injection pressure (boost pressure) depends on the high pressure common rail. The oil pressure in the high pressure common rail is controlled by the ECU through the rail pressure regulating valve according to various sensor signals. Therefore, the ECU calculates the fuel injection amount and the injection timing according to the signal input of various sensors and the program in the memory, and controls the fuel supply timing by controlling the coil of the injector solenoid valve, by controlling the high pressure rail pressure regulating valve. To control the oil pressure of the high pressure rail, and thus control the fuel injection amount, fuel injection rate and injection pressure of the injector, the fuel pressure sensor located on the fuel rail is used for closed-loop control of the fuel injection amount.

4. Conclusion

With the increasing number of automotive electrical appliances, electrical faults are gradually becoming more complicated. In the process of maintenance, technicians must understand the basic principles of electrical equipment and the characteristics of faults. On this basis, maintenance personnel should be familiar with the mastery of the vehicle. The principle and method of electrical maintenance, and the flexible use of the knowledge learned, and the selection of appropriate solutions, can effectively repair automotive electrical appliances and ensure the service life of automotive electrical appliances.

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