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Battery voltage fault diagnosis mechanism of new energy vehicles based on electronic diagnosis technology

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Abstract: *The rapid development of the new energy automobile industry promotes the reform of the concept and method of automobile maintenance. In the context of the extensive application of information technology, intelligent diagnosis technology has been effectively promoted due to its advantages of accurate detection and low cost. The use of electronic diagnostic technology to diagnose and maintain the battery voltage faults of new energy vehicles has various advantages, which can realize the accurate investigation of voltage faults and provide effective information reference for fault maintenance. Clarifying the fault position in a short time and judging the degree of fault harm can greatly improve the effectiveness of battery voltage fault handling of new energy vehicles. This work mainly discusses the establishment of the battery voltage fault diagnosis mechanism of new energy vehicles using electronic diagnosis technology. Based on electronic diagnosis technology, this work clarified the specific application in automobile battery voltage fault diagnosis to guide the improvement of the diagnostic mechanisms.*

Keywords: *electronic diagnosis technology; new energy vehicles; battery voltage fault; diagnosis mechanism*

1. Introduction

New energy vehicles are innovative products in the field of clean energy application, which solves the problem of high energy consumption of vehicles using fuel to drive. New energy vehicles reduce energy consumption, reduce exhaust pollution, and promote the sustainable development of society. The new energy vehicle industry has bright development prospects and broad space for development, while it also puts forward new requirements for automobile maintenance technology [1]. We should explore the new technology of fault diagnosis and maintenance of new energy vehicles, especially the use of electronic diagnosis technology for the battery voltage fault diagnosis, to help the development of the new energy vehicle industry. Based on electronic diagnosis technology, the new energy vehicle battery voltage fault diagnosis can be analyzed by various kinds of electronic devices, which can help understand the running state of any components and parts in the battery, find out the abnormal situation in time, and achieve accurate positioning and processing of faults. Automobile maintenance technology can help complete diagnosis and maintenance in a short period to eliminate the use of new energy vehicles.

2. Maintenance challenges under the background of new energy vehicle application

China has a certain time and experience basis for the research of new energy vehicles. As early as 1980, China began to research this aspect. By the end of 2021, China's export volume of new energy vehicles has exceeded 10,000, accounting for 10.7% of the total export volume of all vehicles. In the continuous development, new energy vehicles have gradually become an important part of the development of automobiles, playing an important role in the domestic automobile manufacturing industry. At present, the use of new energy vehicles in China ranks relatively high in the world, which is expected to open up the international market of new energy vehicles. Compared with the total sales volume of new energy vehicles in 2021, the sales volume increased by 1.5 million units in 2022. With the wide application and development of new energy vehicles, the battery, as its core energy storage device, has higher and higher requirements for its performance and reliability. However, in the process of long use of the battery, there may be voltage failure, resulting in its performance decline or failure.

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This result can affect the endurance and reliability of new energy vehicles. To effectively solve this problem, electronic diagnosis technology has been introduced into the maintenance of battery voltage faults of new energy vehicles, providing maintenance personnel with more accurate, fast and reliable fault diagnosis and repair methods. From the perspective of practical application, electronic diagnostic technology will regard electronic equipment as the main carrier, and will directly inspect the interior of the car without any disassembly.

3. Overview and application advantages of electronic diagnostic technology

Information electronic diagnosis technology is a kind of use of computer, network and sensor information technology means to automobile fault diagnosis and repair technology. It connects the vehicle's Electronic Control Unit (ECU) to read the vehicle's fault code, sensor data, and real-time parameters, as well as provide fault descriptions and suggestions. Through diagnostic software and tools, technicians can conduct fault analysis, fault location and maintenance operations to improve maintenance efficiency and accuracy. Information technology and electronic diagnostic technology has many advantages in the maintenance of new energy vehicles. First, it can improve the accuracy of fault diagnosis. By reading the fault code and real-time data of the vehicle, diagnostic technicians can quickly and accurately determine the fault location and cause, avoid guessing and trial and error, and improve the accuracy of fault diagnosis. Second, it can improve maintenance efficiency [2]. Information electronic diagnosis technology can quickly obtain the relevant information of the vehicle, assist the technical personnel to conduct fault analysis and judgment, accelerate the speed of fault positioning and maintenance operation, and improve maintenance efficiency. Third, it can provide maintenance guidance and solutions. Diagnostic software and tools not only provide fault codes and data but also provide detailed repair guidance and fault solutions to help technicians better repair operations and reduce errors and omissions. Fourth, it can improve data recording and analysis. Information electronic diagnosis technology can record the fault data and maintenance records of vehicles, provide a reference and analysis basis for the subsequent maintenance work, and help improve the maintenance process and technology. Fifth, it can improve customer satisfaction. Through accurate fault diagnosis and efficient maintenance operation, information electronic diagnosis technology can provide high-quality after-sales service, improve customer satisfaction and enhance brand image [3].

4. Current status of new energy vehicle battery fault diagnosis

For electric vehicles, the degree of safety damage to the battery system determines the probability of operational failure. To ensure the accurate diagnosis of faults, the fault type needs to be identified in advance, and the safety failure of the battery system in actual use is mainly divided into two aspects: mechanical failure and electrical failure. In the process of operation, it is the main source of the mechanical failure of the battery system. After the mechanical failure of the battery system, the deformation of the battery makes the internal gas electrolyte overflow, leading to the bulging phenomenon of the battery. Meanwhile, the internal resistance of the battery increases the heat production. In this process, if the heat is not effectively distributed, fire and explosion accidents can occur; when the battery system is overcharged, internal short circuit and external short circuit cause electrical failure, the battery temperature triggers internal diaphragm melting, electrolyte decomposition, cathode material decomposition, and serious accidents such as battery leakage, fire and explosion. Fault diagnosis and positioning method based on battery-end voltage signal are usually divided into model-based method and data-driven method. Based on the model method, the battery equivalent circuit model is first established, and then analyzes the difference between the model output and the observed value. This method usually follows some basic principles. When battery failures occur, the internal resistance will always increase rapidly, or the terminal voltage will decrease rapidly, which is difficult to preset the appropriate failure threshold. The model-based fault diagnosis method relies on the sample data to avoid the online parameter update of the battery model. Electronic diagnostic technology is one of the model-based fault diagnosis methods. It uses intelligent detection methods to do a full range of detailed problem inspections of the car, which can help the technical repairman to quickly find the problems of the car according to the accurate data provided to make reliable maintenance decisions, which can ensure high efficiency and high quality of maintenance [4]. As a new maintenance detection technology, electronic diagnosis technology has achieved good promotion effect in maintenance engineering with its high-quality detection effect. By this, it turns traditional manual troubleshooting into electronic and accurate troubleshooting.

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5. Application of electronic diagnosis technology in battery fault diagnosis of new energy vehicles

For new energy vehicles, the key to promoting their normal operation is the power battery, and the operation efficiency and quality of power batteries will directly affect the operation efficiency and quality of new energy vehicles. In the new energy vehicle power battery, there are two main types, one is a storage battery, and the other is a fuel cell. Storage battery is more common, including lithium batteries, lead-acid batteries, nickel-based batteries, etc. Because the principle framework of power battery is more complex, the maintenance cost is relatively high, through the use of electronic diagnostic technology. Under the action of various intelligent equipment and systems, it can dynamically detect the overall situation of the power battery, find out the fault problem according to the obtained parameter information, and deal with it in time, for example, the sudden stalling of new energy vehicles. In general, the basic cause of the phenomenon cannot be ascertained in time. Through electronic diagnosis technology, the operation of the battery can be dynamically tracked. With its simulation function, the temperature change of the battery during the operation can be understood. If the temperature of the battery is abnormal, the cause of the fault is the battery. Through the maintenance treatment plan, the power battery in the operation of the fault problem in time to prevent the same problem from appearing. The power battery management system includes the battery management system, control module, display module, wireless communication module, etc. The detection sensor in the battery pack can monitor the internal temperature, voltage, internal resistance and other parameters of the vehicle battery in real time, and feedback the obtained data and information to the power battery management system. In vehicle maintenance processing, the use of electronic diagnostic technology, according to the data information obtained by the driving computer, to master the working environment temperature of the battery. Generally speaking, the battery temperature shall not exceed 50 ℃, and the minimum temperature shall not be less than 0 ℃. Therefore, to maintain the normal performance of the battery, it is necessary to monitor the temperature of the battery in real time.

6. Battery voltage fault diagnosis mechanism of new energy vehicles based on electronic diagnosis technology

Voltage fault diagnosis of new energy vehicle battery based on electronic diagnosis technology is mainly using electronic diagnosis technology from the distribution copper row, battery interior, voltage wire harness, circuit, battery daily maintenance for battery repair and maintenance. This is also the basic content of the construction of the battery voltage fault diagnosis mechanism of new energy vehicles based on electronic diagnosis technology.

6.1. Power distribution copper exhaust fault maintenance

New energy vehicles use positioning bolts to fix the battery pack and power distribution copper row for fault maintenance. The distribution copper row obtains the single battery voltage in a crossway, which is transmitted to the power controller by a single or more channels. The positioning bolt will follow the resonance of the vehicle in driving, fall off, or the force impact causes the bolt to skew. This can not play a fixed role, causing the multi-cell battery voltage jump and the battery voltage imbalance when the power is directly interrupted. In the detection process, the cloud electronic file information can be analyzed to clearly check the last operation and maintenance time of the vehicle, and check whether there is a major impact accident. If there is a fault, even if the detection equipment does not send alarm information, the staff needs to check the bolt for loosening one by one [5].

6.2. Internal fault maintenance of storage battery

Because the battery is assembled by multiple single batteries in series and parallel, the small impurities between individuals and individuals will also cause the internal resistance failure of the cell, resulting in abnormal voltage. At the same time, if the vehicle does not start for a long time, the battery will discharge slowly with time, and the voltage value will be abnormal. If the electronic diagnosis results show that the voltage of any block is too low or too high, the single battery is recharged. If the voltage remains abnormal after charging, then the abnormal phenomenon is caused by small impurities, and the battery module should be replaced. If it can be restored to normal, the abnormal phenomenon is caused by the self-discharge, and the battery can be recharged slowly. It should be noted that the new energy vehicles should be placed in the correct charging position of more than 0℃ for charging. If the charging pile temperature is too low, it will not be able to transport energy to the vehicle, so the owners

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in the areas where the temperature is lower than 0℃ in winter should charge the car immediately after parking.

6.3. Pressure harness fault repair

The voltage wiring harness serves as a battery temperature and residual power information collection tool. If the fault occurs, the vehicle itself detection system will not be able to carry out dynamic transportation and inspection of the internal situation, which is easy to cause safety accidents. The main causes of voltage failure caused by abnormal voltage wire harnesses are: lax contact between the wire harness and the battery pack, short circuit, open circuit or series connection [6]. At the same time, compared with the normal automotive electronic components, the number and precision of new energy electronic components are much higher, but the voltage is very small. When there is a fault in the voltage wiring harness, there will be problems with the overall circuit. For this reason, the fault detection device of electronic diagnosis technology can be used to insert the two ends of the wire harness to determine whether the port has return needles. The short circuit, open circuit or series problems of the wire harness itself are usually due to the unreasonable arrangement of copper wire in the line, so the wire compression shall be replaced.

6.4. Circuit fault maintenance

In order to optimize the function of the vehicle, users of new energy vehicles will add other electronic devices, which increases the burden of batteries and is easy to cause faults. Therefore, it is necessary to insert the circuit detection system into the detector. If the ABS alarm lamp flashes constantly, there is a circuit fault. The maintenance personnel need to record the current voltage of the battery through the universal meter, compare with the flashing frequency of the alarm light, get the fault code, and find out the electronic device that causes the voltage fault. After removing the device, it needs to insert the detection system again to check if the ABS alarm light flashes or not.

6.5. Daily maintenance of the storage battery

Maintenance personnel should guide the user to charge and use electricity correctly. If the voltage is too low or excessive charging, the battery life will be lost. Focus on checking whether the low SOC warning lamp can work normally. When the vehicle is near the low SOC, it can timely alarm to remind the user to find the charging device. It needs to inform the owner to adjust the interval between of battery maintenance through the fault alarm instrument panel and braking power force and carry out charge and discharge training every 3 months. If the power consumption is higher than the last test, it will need to go to the nearest logistics maintenance shop for electronic diagnosis to check the battery voltage fault. If the vehicle is not used for a long time, the owner needs to charge on time to ensure that the battery is always in a state of non-power loss. In the process of repair and maintenance, the staff must cut off the power supply. After repairing the voltage fault, the original voltage wiring harness and power distribution copper row position should be restored. When the installation is completed, the plug part should be slightly pulled to prevent the occurrence of bad contact problems. At the same time, maintenance personnel also needs to do a good job of waterproofing and dust prevention, to avoid external impurities and water vapor infiltration into the battery. In this way, all the work of battery voltage fault detection and maintenance is completed and uploaded to the cloud to provide a data basis for the next operation and maintenance.

7. Conclusions

Differential fault detection and maintenance technology based on electronic diagnosis technology is a necessary means for the operation and maintenance of new energy vehicle batteries. Through real-time monitoring and diagnosis of battery voltage combined with advanced electronic technology and fault positioning algorithm, it can accurately determine the cause and location of voltage fault, and provide the corresponding maintenance scheme. Electronic diagnostic technology can not only improve the efficiency and accuracy of new energy vehicle battery fault diagnosis and maintenance but also reduce the maintenance cost and improve the reliability and market competitiveness of new energy vehicles.

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