Analysis and Research on the Test Technology of Electric Vehicle Running Performance

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Abstract: The gradual popularization and development of new energy electric vehicles brings not only opportunities but also challenges, such as new requirements for the technical analysis of running performance test. This paper first describes the evaluation index of the operation performance of electric vehicles, and then, based on the key index factors in the detection test of electric vehicles, analyzes the detection test technology and scheme of the operation performance of electric vehicles.

1. Introduction
With the gradual popularization and development of new energy electric vehicles, it has great potential as a future land transportation tool. However, although the current research on electric vehicle technology and specifications has been gradually launched and in-depth, it still needs time to further improve. Modern vehicle inspection and test technology for traditional fossil fuel vehicles has been basically mature, but also produced significant environmental protection and economic benefits. Relatively speaking, the analysis and research of EV operation test technology still need to be further deepened. Therefore, the technical analysis of EV operation performance test is not only the verification of vehicle performance and operation safety after being offline, but also helps to improve the technical level of EV test and promote the further development of the industry.

2. Operation performance evaluation index of electric vehicle
Among many performance indexes of electric vehicle, the most concerned indexes of consumers are shown in Figure 1. However, in order to comprehensively analyze the comprehensive performance of electric vehicles, it is necessary to comprehensively analyze the performance test and evaluation indexes of the whole vehicle.

Figure 1. Most concerned performance indexes of consumers
2.1 Dynamic performance evaluation parameters

As one of the most basic and important performance indexes of electric vehicles including traditional fuel vehicles, the power performance mainly includes the maximum vehicle speed, acceleration ability, torque and other power indexes. Different from the traditional fuel vehicles, the power of the electric vehicle comes from the driving motor, and the power indicators of the electric vehicle, such as acceleration ability, torque and other capabilities directly depend on the output power of the driving motor. Therefore, for the detection of the power performance of the electric vehicle, the evaluation standard of its power performance can be directly determined according to the percentage of the output power of the driving wheel and the rated power of the corresponding power system.

2.2 Factors affecting driving mileage

At present, the short driving range is one of the main factors limiting the development and application of electric vehicles, so it is necessary to analyze the factors of driving range of electric vehicles. Because of the difference of motor efficiency, this difference is not only caused by motor power, but also by different working conditions. Therefore, many factors need to be considered to analyze the influence index of electric vehicle driving range, which will make the analysis abnormal complex. In order to turn the theory into the executable test and detection, it is necessary to simplify the analysis model, eliminate the unimportant interference factors, and retain the core factors such as battery capacity and voltage, so as to carry out the evaluation and analysis.

3. Test scheme for the operation performance of electric vehicle

3.1 Test plan of power performance bench

The output power of the electric vehicle is tested by the bench equipment, and the speed of the power system at the rated power is taken as the test condition. When the driving motor works under the rated parameters, the output power of the driving wheel can be obtained through the measurement and calculation of the parameters. When the vehicle is tested on the bench, the output power of the driving wheel is equal to the sum of all the lost power. By measuring the calculation formula, we can get the mechanical transmission efficiency, that is, the ratio of the output power under the rated working condition to the rated power of the motor. Taking vehicle speed as an example, the relationship between vehicle speed and time based on bench test results is shown in Figure 2.

![Figure 2. Relationship between vehicle speed and time](image)

3.2 Test scheme of drive motor characteristic bench

The core evaluation indexes of the drive motor include speed, torque and efficiency. These indexes can be used to draw the performance curve of the motor through the bench test. In the curve, the ordinate is three core parameters and the abscissa is the motor current. As shown in Figure 3, the
performances curve of the relationship between speed and current. In the test process, the data of vehicle speed, wheel power and other parameters are obtained by chassis dynamometer, and the data of battery discharge current are obtained by battery monitoring system. At the end of each cycle, gradually increase the load, record and process the data, and finally obtain the performance curve.

![Figure3. Performances curve of the relationship between speed and current](image)

3.3 Test plan for influencing factors of driving range
The test of the influence factors of endurance mileage is based on the selection of key indicators such as voltage, capacity, and speed and so on. Thus, the influencing factors of endurance mileage are analyzed and evaluated. For example, by analyzing the relationship between battery voltage and electric vehicle mileage, the battery discharge data can be recorded under different battery voltage conditions by connecting the same single battery in series. The same method can be used to test the relationship between total battery capacity and endurance mileage. Figure 4 below shows the relation curve between electric vehicle mileage and speed.

![Figure4. Relation curve of vehicle mileage and speed](image)

4. Conclusions
As an indispensable part of the electric vehicle operation life cycle, the test and analysis of the operation performance of the electric vehicle is an important support to promote the development of the electric vehicle industry and technology. The test of the running performance of electric vehicles
should be carried out based on scientific methods and means. The test technology exists in the same place of traditional vehicles, but also has the unique method of electric vehicles. This paper discusses and analyzes the key indicators of the operation performance of electric vehicles, such as power performance, energy consumption efficiency and endurance mileage, and makes corresponding test plans.

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