On-line Intelligent Detection Device of Automobile Fuel Pump Valve

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Abstract: During the specific operation of automotive fuel pumps, various types of valves, such as safety relief valves and one-way valves, will be involved. In the actual application process, if these valves cannot guarantee the normal operation status, it will have an impact on the operation effect of the automobile fuel pump. Therefore, the on-line intelligent detection device of automobile fuel pump valves is analyzed, which is conducive to timely discovery of hidden problems in the valves, and can propose targeted solutions to provide effective protection for the application effect of the valves.

1. Introduction
In the practical application of automobile fuel pump, it is generally composed of pump body, permanent magnet motor and other components [1]. In the normal operation of automobile fuel pump, safety relief valve has a very important influence and role [2]. In the actual application process, the fundamental role of the valve is to avoid the problem of excessive oil pressure in the operation process of oil supply pipeline [3]. At the same time, in the actual application process of one-way valve, its main purpose is to promote the fuel pipeline to maintain a stable oil pressure when the fuel pump stops working [4]. The basic purpose of this method is to meet the demand of oil pressure in time and facilitate start-up and operation when starting again. It can be seen that for automotive fuel pump, various types of valves have a very important impact and role. Therefore, the actual situation should be considered, and whether these valves are in the normal working state should be detected effectively [5]. This can not only discover the hidden problems in time, but also ensure the safety and stability of each valve in the working process [6].

2. Feasibility analysis of developing intelligent testing device for working characteristics of automobile fuel pump valve
When analyzing the working characteristics of automotive fuel pump valves, the main purpose is to determine whether their working characteristics can meet the personalized needs of intelligent testing devices in the development and application process [7]. Therefore, its feasibility needs to be analyzed. Generally, when the feasibility is analyzed, technology, organization and economy will be involved [8]. When analyzing the technical feasibility of automobile fuel pump valves, the on-line intelligent detection device should be studied according to the actual situation.

In the specific application process of the device, it is necessary to control the hardware equipment, and also involves pressure sensors, solenoid valves and other different types of equipment, all of which are sold in the market [9]. When collecting and utilizing test data, data acquisition card is
usually needed, which can not only ensure the validity of data acquisition, but also realize the storage of data. Especially in the context of the continuous progress and rapid development of Internet science and technology, there are abundant system tools that have been developed and used in the market [10]. In this context, through the rational use of these new technical means and software systems, the development and utilization of intelligent testing devices can be realized, so that the working characteristics of automotive fuel pump valves can be specifically analyzed.

### 3. Analysis of working characteristics of automotive fuel pump valves

In the specific application process of automotive fuel pump, no matter in any working state, the fuel pump supply must ensure to provide all the fuel required for the engine. In this way, it can ensure as much as possible to meet the individualized fuel demand of the engine in the normal operation process [11]. In the specific analysis process, through the investigation and study of the actual situation, it is found that in the actual application process of fuel pump, the fuel is usually directly sucked out from the tank in a continuous state. After suction, it will be directly transported to the electromagnetic injector through various different equipment such as fuel filter, distributor and so on. In the whole operation process, it is necessary to ensure that the operation process is followed. When entering the injector, the injector will directly determine the amount of fuel to be transferred in a very precise way, and inject the prescribed amount of fuel directly into the internal airway of the engine [12]. After injection, if there is any remaining fuel, the fuel can be directly returned to the tank according to the influence and function of the pressure regulator.

When combined with the actual situation, it is found that if the overall pressure of the fuel pump exceeds the rated value at the time of output pressure, the safety relief valve will be opened in an automatic way. In this context, high-pressure fuel can be directly returned to the fuel pump intake chamber. At the same time, during the normal operation of fuel pump and motor, internal circulation can be realized directly. The basic purpose of doing this is to avoid serious blockage of the oil pipeline. Once the blockage occurs, it will inevitably lead to high oil pressure of the pipeline, which will directly lead to serious rupture of the pipeline, and even lead to serious damage to the fuel pump. Therefore, in the specific application process of relief valve, the requirement of this type of valve is to ensure the constant expansion of pressure regulation range, and also to ensure that the action has a certain sensitivity, which can not only achieve effective noise control, but also ensure the effectiveness of the whole operation process. In the analysis and research of this problem, the fuel pump of an auto parts factory can be taken as the object of analysis. Based on the analysis of the actual situation, it is found that the rated flow $Q = 1$L/min corresponds to the 12V operating voltage. At the same time, the corresponding impulse pressure $P = 0.45-0.63$ MPa. Combining with the actual situation, the final test data is shown in figure 1. The content shown in figure 1 is the opening and closing characteristics of the relief valve, and also includes the dynamic characteristics of the relief valve.
Through the analysis of the current situation of the actual work, it is found that overflow valves and one-way valves are very important types of valves for automotive fuel pump valves. However, if the two are compared and analyzed from the point of view of working performance, the overall openness of one-way valve in the actual application process, that is, the circulation is better than the relief valve. When the one-way valve is used, it can make the pumping in the pipeline achieve rapid and effective flow, and the requirement of sealing is relatively high. In application, if the leakage of one-way valve itself has reached the required value or standard value, it means that there is not enough oil in the pipeline, which will have a serious impact on the next start of the car. Leakage of relief valve has always been regarded as an index with comprehensive characteristics. In the process of formulation and application, the index can not only directly rely on the manufacturing process and assembly level of manufacturers, but also directly affect the static and dynamic performance of relief valve.

4. Analysis of on-line intelligent detection device for automobile fuel pump valve

4.1 Principle analysis of online intelligent detection system

In the detection of automobile fuel pump valves, the actual situation should be effectively combined with advanced scientific and technological means, which is not only conducive to improving the detection efficiency, but also to ensure the accuracy and effectiveness of the detection. In this context, an on-line intelligent detection system is proposed. In the process of construction and application, the system needs to be composed of five solenoid valves, one negative pressure generator and one sensor, as shown in figure 2A. Combining with the content in figure 2A, it is found that solenoid valve 1 is a one-way valve in the practical application process, and its main function is to control the oil outlet. At the same time, solenoid valves 1 and 2 are effective control of the positive pressure source, while solenoid valves 3 and 4 are effective control of the negative pressure generator and sensor respectively.
so as to ensure that the effect of the detection system can be effectively played in the practical application process.

Figure. 2 Schematic diagram of online intelligent detection system

In the specific application process of the system, if the workpiece is positioned and the sealing is good, it can directly start from the bottom of the workpiece and use the method of electric pressure regulating valve to pressurize the workpiece according to the actual situation. When using this method, once the given pressure is reached, the safety overflow valve will automatically open, and it will also be treated in practice. At the same time, the computer will also achieve automatic timing at this time. In the whole process of holding pressure, the importance of judging the sealing of the relief valve should be realized. Once the pressure holding is over, in general, the solenoid valve 1 controlled directly by computer is used to realize the pressure relief treatment. At this time, the one-way valve will gradually be in the open state. In this context, it is necessary to test whether the one-way valve has good sealing by means of vacuum detection. When using this method, the limitation and simplicity of the traditional method should be broken, and the way of gas path detection should also be used, so as to replace the use of oil in it. If it is analyzed from a theoretical point of view, then the valve pressure curve of the tested workpiece itself can be shown with reference to the content in figure 2B.

4.2 Design of mechanical part of workbench of on-line intelligent detection system for automobile fuel pump valve

In order to ensure the effect of the detection system in the practical application, it is necessary to take pertinent measures to design the test system reasonably according to the actual situation when on-line intelligent detection is carried out for the fuel pump valves of automobiles. In the design process, the design of the mechanical part of the worktable plays an irreplaceable role. In the specific design process, the importance of the design of the mechanical fixture worktable need to be realized. In
addition, it also needs to be realized that the design of the gas path detection system, system control circuit and so on plays a very important role, as shown in figure 3.

![Schematic diagram of mechanical fixture](image)

Figure. 3 Schematic diagrams of mechanical fixture

In the specific design of mechanical fixture, it is necessary to design different links and parts of the fixture according to the actual situation, so as to give full play to the role and value of the testing system in the specific application process. Firstly, the workpiece should be positioned. Secondly, the cylinder should be selected and utilized scientifically and reasonably. When locating the workpiece, the distance between the workpiece and the cylinder must be ensured. At the same time, positive pressure should be gradually introduced into the workpiece in practice, which is conducive to the realization of targeted detection.

In the specific implementation process, it is necessary to reasonably calculate the pressing force required by the workpiece itself in the operation process in accordance with the actual situation. The fundamental purpose of this is to ensure that the individualized requirements of the testing device in the actual application process are met. After the selection of the cylinder, the bracket that can support the cylinder should be designed reasonably, and the geometric size of the bracket should be determined. This can not only calculate the strength and reliability of the bracket, but also fundamentally guarantee the safety and stability of the on-line intelligent detection system.

4.3 Intelligent realization of on-line intelligent detection system for automobile fuel pump valve

Through the analysis of the actual operation of valve manufacturers at this stage, it is found that many manufacturers will still carry out oil detection through manual operation when testing the fuel pump valves of automobiles. In the practical application of this method, not only its overall application efficiency is relatively low, but also the errors between them are relatively large. At the same time, when using this method to detect, generally only static performance can be detected, and dynamic testing cannot be achieved. Under the background of the continuous progress and rapid development of science and technology, the requirements for different types of components are getting higher and higher, especially for dynamic and static performance.
In this context, in order to achieve accurate and effective detection of automotive fuel pump valves, it is necessary to effectively integrate with advanced science and technology and systems, and truly realize online intelligent detection. In the specific application process of the system platform, the high-speed A/D conversion device can be reasonably applied among them, while ensuring that the processing equipment has good high precision computing ability in the specific application process. In this way, not only the static characteristics of the components can be calculated accurately and effectively, but also the dynamic performance of the components can be calculated and controlled reasonably. This can not only fundamentally promote all the performance of the characterization elements and some information related to them to achieve targeted control, but also provide accurate and effective data and information for product design as a basis.

After combining with the actual situation, it is found that in the specific application process of the test system, the corresponding control chart is shown in figure 4. After analyzing the actual application of the test system, it is found that the use of computers will be involved in the construction and application of the test system, in which computers play a very important role. In the practical application process, the main purpose of I/O interface is to receive the digital signal output from the computer, at the same time, to combine with the actual instructions and output the analog signal directly to the relay module. In addition, the fundamental purpose of A/D signal in practical application is to apply it to the analog signal receiving process of the conditioner, and also to output digital signals to the computer. In addition, the D/A converter mainly receives analog signals in practical application, and at the same time, it can effectively control the pressure of the gas source.

Figure. 4 Schematic diagram of test system control

Through the investigation and study of the actual situation, it is found D/A converter or I/O interface, is basically directly set on the interface card of the computer, and it is directly set inside the host computer. In this way, not only the effective connection between interface and computer can be realized, but also the intelligent operation of detection can be realized.

5. Conclusion

In the analysis and research of on-line intelligent detection device for automobile fuel pump valves, it is necessary to combine with the characteristics of fuel pump valves in the actual application process, and at the same time to realize the reasonable benefit of computers. Reasonable use of on-line intelligent detection device can not only improve the reliability of control program, but also ensure the effective improvement of detection efficiency. This method can not only realize on-line detection, but
also ensure the accuracy and validity of the test results, and provide guarantee for the safety and stability of automotive fuel pump valves in the actual application process.

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