Thoughts and Methods of Compiling Automobile Maintenance Information

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Abstract. Automobile maintenance information can provide detailed and accurate guidance for diverse, intelligent and complicated automobile maintenance. This paper summarizes the idea of compiling automobile maintenance information. At the same time, it summarizes the 7 basic elements, and introduces the expression methods and requirements according to the elements. Which provides guidance for the preparation of maintenance information that is easy to check, easy to read, complete and can guide the depth of maintenance operations. Finally, it is beneficial to improve the quality and efficiency of information compilation.

Keywords: automobile, maintenance information, thought, method.

1. Introduction

China has a huge automobile market system and hundreds of automobile brand. Tens of thousands of new automobile model are added every year. There are some differences between different models in automobile structure and configuration. And automotive control system is also more and more intelligent leading to more complicated forms and phenomena, which brings great challenges to the conventional maintenance. If you can't update your thinking and master new processing methods, you will increase the difficulty of work and reduce work efficiency. Driven by the diversification, intelligence and complexity of faults of automobile , automobile maintenance information will have higher reference value, providing automotive fault diagnosis, parts dismantling, parts assembly and performance detection, which expressed through data, graphical representation and operation[1]. It is an important guarantee to guide technicians to carry out correct maintenance operation and improve maintenance efficiency.

2. Situation analysis

The <Administrative Measures for Disclosure of Automobile Maintenance Technical Information> had promulgated and implemented in 2015, which strengthened the requirements on the quality of the maintenance information compiled by whole automobile manufacturers. The in-use automobile are divided into three categories, included import, domestic parts joint venture production, independent research and development production[2]. Most of the foreign participants used the global automotive maintenance technology information disclosure system, which can reflect the characteristics of maintenance information compiled abroad. The maintenance information of independent research and development production represent the level of domestic maintenance information compilation.
2.1. **Europe and America**

Joint ventures with Europe and the United States, the maintenance information was divided according to the assembly, system, sorted according to the thought of the maintenance process. It was illustrate with the technical data, maintenance instructions, detection and replacement methods, special tools, and circuit connection and so on.

2.2. **Japan and Korea**

Joint ventures with Japan and Korea, writing the maintenance information of the train of thought according to the vehicle structure, are divided into assemblies, systems, components, according to the detachable maintenance system, parts and components to compile the relevant maintenance technical information of the structure. It also includes the technical data, maintenance instructions, detection and replacement methods, special tools, and circuit connection and so on.

2.3. **Domestic**

Most of the maintenance data established by domestic enterprises are also compiled according to above two ideas. In general, the earlier requirement of automotive maintenance technical information disclosure accumulated a lot of experience in Europe, United States, Japan, South Korea and other countries. The maintenance information of wholly foreign-owned enterprises and joint ventures is complete. But, because of varies level of maintenance data compiled in domestic enterprises, the maintenance information of some enterprises has these problems.

1. The data query does not match and correspond with the automobile model, which resulting in data selection is not easy, difficult to find and other phenomena.
2. The nonstandard terms and symbols, the indistinct words and pictures is not conducive for information retrieval, acquisition and use, which reduces the accuracy of information dissemination and the convenience of data use.
3. The unclear data structure and incomplete content failed to achieve the purpose of guiding the maintenance operation, and did not reflect the value of information.

3. **Compiling thoughts**

The quality of data compilation directly affects the frequency and efficiency of users. So, in order to guide users to find information quickly and accurately, the integrity information should be established with easy to find and read. Firstly, in order to facilitate the search, the maintenance data should be in accord with the specific models in the automobile market, which can be searched and located through the Vehicle Identification Number (VIN), model year configuration and other conditions. Secondly, the compilation of maintenance information can be decomposed by the maintenance work according to the maintenance process. It is need to be established the automobile maintenance train of thought according to the actual need of professional technicians and summarized the need to compile maintenance data, including maintenance work items, precautions, special tools, technical data, circuit information, fault diagnosis and troubleshooting, and maintenance operation methods. And then combined with the maintenance characteristics of parts and components, the maintenance information will be compiled.

4. **Compiling methods**

4.1. **Maintenance work items**

The determination of maintenance work items is mainly based on automobile structure and configuration, and determines the minimum repairable and replaceable assembly and components in the after-sales service parts. Due to the differences in the after-sales service system of different enterprises and different models, the classification forms and separation degrees of the substitutable parts are also different. So the parts given by the maintenance work items are also different. However, the assembly should be based on the automobile structure, including power unit (engine or drive system), chassis
4.2. Precautions
Precautions are written to remind the operator to avoid possible damage to dust, chemical materials, exhaust gas, noise, tools and equipment during the maintenance of the automobile, and how to operate correctly when there may be dangers such as electric shock, fire or some emergency. In order to cause the attention of the operator in advance to reduce the impact on personal safety and the environment, it can assist the way of graph and text to remind.

The different locations and different operation may cause the different dangers and injury to people and things, such as serious personnel casualty, personal injury, automobile damage or safety hidden danger, and reducing the automobile use performance. Therefore, enterprises can give tips according to the severity of the injury according to the actual situation. The text of the reminder should as conspicuous as possible near the dangerous operation in order to attract the reader's attention.

4.3. Special tools
Special tools are designed and developed for special parts or removal and installation of special parts. Without special tools, it will reduce work efficiency, increase maintenance difficulty, damage parts, or even make maintenance impossible. In order to comprehensive, centralized and sufficient prepare special tools before maintenance operations, it need to instruct name or number information of the special tools in maintenance information. For using the special tools correctly, it is required to describe clearly and include in the maintenance operation method, to ensure the correct use of special tools in specific maintenance steps.

4.4. Technical data
Maintenance technical data is a theoretical guide for maintenance personnel to perform detection, analysis, and judgment. Technical data is the basic information for understanding the technical status of the assembly or system. It is the reference basis for checking and judging the performance of parts, relative position, bearing capacity, and automobile performance, and it is also the basis for fault diagnosis. Therefore, various types of technical parameter information such as inspection, adjustment, assembly, and fastening need to be given according to the maintenance requirements.

In addition, the quality, stability and anti-aging property of different types of oils vary with different brands and models, and the mixed different brands and models of antifreeze, those may affect the performance of the car. So it is necessary to provide the applicable oil specifications and dosages for the automobile model to help users choose the right oil.

4.5. Circuit information
Circuit information is the basis of automobile electrical maintenance. Circuit diagrams are used to analyze the principle of electric circuit, device position, wiring method, etc, so as to eliminate actual automobile circuit faults. Since the standards for drawing circuit diagrams are not unified, the meanings of different signs also varies. The composition items and identification information of the circuit diagram is the primary key to understand the circuit diagram. In order to identify the circuit diagram more accurately, you must first grasp the meaning of each graphical symbol, wiring harness representation and drawing rules information. The maintenance of circuit mainly involves the wear of the wiring harness, the damage of the connector, the distribution box, etc. Therefore, the wiring harness with matching performance and the components with matching shape and functions are selected for replacement. At present, most companies can provide a separate circuit schematic diagram to briefly explain the connection relationship of components, but the lack of information about the location of the components, the shape and location of the connector, and so on, affect the selection of components and connectors.
In addition, poor grounding and grounding failure will also cause automotive electronic fault, and its location and maintenance matters must be determined during maintenance. So the circuit information is not only to understand the circuit principle and the location of electrical appliances, but also to ensure the safety of maintenance and provides the necessary information to find the real automobile fault.

4.6. Fault diagnosis and troubleshooting
Faults can be divided into common faults and electronic faults according to the types. The common fault is the phenomenon fault which the enterprise has summarized according to previous models malfunction’s experience. Assembly or auto parts occur natural wear deformation, aging, damage, fatigue and corrosion, all of these will cause the automobile failure. The main features are abnormal vibration, abnormal noise, abnormal temperature, leak and peculiar smell. According to the location of the fault, the fault characteristics are different. The whole automobile manufacturers have a full understanding of its own model structure and performance, who can grasp more fault cases, so solutions can be provided based on foreseen or summarized based on experience.

The data of electronic control system fault is read by the ECU analysis. Fault information of electronic faults can be recorded by OBD. Different faults will correspond to different fault codes. Part of the currently formed fault codes are a unified fault code that complies with the OBD-II standard specification formulated by the American Society of Automotive Engineers (SAE), and other is the enterprise custom fault code. Based on specific fault codes and definitions, maintenance personnel can quickly and accurately determine the nature and location of the fault. Therefore, fault codes and definitions should be given in the maintenance information.

No matter what kind of fault, it is necessary to determine the fault location first, common faults are analyzed according to the description of the fault phenomenon. If there is a fault identification signal, the type and location of the fault can be determined according to the characteristic signal of the mechanical fault. Such as angular interval, free stroke, working stroke and other geometric signals, cylinder compression pressure, oil pressure, tire pressure and other pressure signals, voltage, current, frequency, phase and other electrical signals, oil viscosity, metal impurity content and other material content signals. The electronic fault is identified according to the fault code reported by the electronic control system. The same fault may be caused by different parts, the suspicious parts where the fault may occur are given, and a recommended troubleshooting sequence is provided for easy maintenance personnel to eliminate one by one. So the solution of troubleshooting, such as technical data of fault detection and diagnosis, troubleshooting methods and specific steps of maintenance, should be provided in the maintenance information.

4.7. Maintenance operation method
The maintenance operation method is the core content of the maintenance information, it is the key information to guide the completion of the maintenance operation and restore the original performance of the automobile.

In the process of automobile maintenance, the assembly and parts are mainly involved in the disassembly, cleaning, inspection, decomposition, assembly and installation. The degree of disassembly and decomposition, the methods of cleaning and inspection depend on the structure of the automobile. In order to avoid the degradation of automobile performance due to the wrong maintenance sequence or maintenance method, the maintenance work content, steps, operation points and technical requirements of the assembly and parts should be given. In order to explain the operation position more intuitively, the key steps can be given a diagram to help explain. After some parts were disassembled, it needs to be inspected to judge their performance. So the maintenance information should include its detection method to determine whether the parts need to be restored through maintenance adjustment or whether they need to be replaced.

The procedure and method of electronic control system component maintenance is different from that of mechanical system. The electronic control system mainly involves electronic components
control module and other electronic components. It may realize their functions after reinstalling, matching, setting and programming some electronic components such as ECM and TCU. If the ECM memory is not set and programmed, it may cause the engine starting system and control system failure. Therefore, if the original electronic control systems are involved in the above operations, the operating conditions and methods should be given.

The repair technology and method of body repair are quite different from that of parts, it mainly involving sheet metal and coating. So the maintenance information shall include the body size, sheet metal coating process, etc. to guide the body repair, correction, bonding, welding and coating operations, it also need include the determination of the body recovery location, the disassembly, cutting, welding and replacement requirements of sheet metal parts, the technical requirements of coating, work flow and other information.

5. Summary
Faced with the problem that the maintenance information cannot reach the depth of the maintenance operation, this paper gives the compilation method of each elements content according to the idea of dividing basic elements, and guides the formation of complete maintenance technical data of basic models. It is the key to improve the efficiency of compiling data to master the effective compiling ideas and methods.

References