GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 43.060.50

CCS R 16

GB/T 19910-2022

Replacing GB/T 19910-2005

Technical requirements for repair of automotive engine electronic control system

汽车发动机电子控制系统修理技术要求

Issued on: October 12, 2022 **Implemented on: May 01, 2023**

Issued by: State Administration for Market Regulation;
Standardization Administration of the People's Republic of China.

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Technical requirements for repair of automotive engine electronic control system

1 Scope

This document specifies the general requirements, operation procedures, pre-maintenance inspection, technical requirements for operation, completion inspection, and warranty period for repair of automotive engine electronic control system.

This document applies to the repair of automotive engine electronic control systems; it can be used as a reference for the repair of engine electronic control systems of other types of vehicles.

2 Normative references

The following documents are normatively referenced in this document and are indispensable for its application. For dated references, only the version corresponding to that date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB/T 5624, Motor vehicle maintenance and repair terms

JT/T 816, Motor vehicle maintenance service specification

QC/T 29106, Technical specification of automobile wire harness

3 Terms and definitions

Terms and definitions determined by GB/T 5624 and the following ones are applicable to this document.

3.1 Engine electronic control system

System that analyzes and processes various parameters in the engine operation, and controls the engine working condition precisely according to the information of each sensor.

3.2 Over-the-air upgrade

Technology of wirelessly downloading and updating the automobile software that needs to be upgraded or modifying the corresponding automobile settings through the mobile network terminal equipment.

3.3 Freeze data

Instantaneous operation data of the engine, when the fault indicator light is on, which is recorded by the electronic control unit (ECU).

3.4 Signal wave form

A graph of signal parameters over time.

3.5 On vehicle status

The status in which components are not removed from the vehicle.

3.6 Off vehicle status

The status in which components are removed from the vehicle.

4 Abbreviations

The following abbreviations apply to this document.

ECU: electronic control unit

KOEO: key on engine off

KOER: key on engine run

OBD: on board diagnostics

OTA: over-the-air technology

5 General requirements

5.1 When repairing the engine electronic control system, the technical requirements of the maintenance and repair manual of the vehicle under repair shall be followed.

5.2 When repairing, repair technicians shall take anti-static measures, and at the same time do a good job in the safety protection of personnel and vehicles.

5.3 Before repairing the engine electronic control system, self-calibration of the testing instruments and equipment shall be carried out.

5.4 When removing the battery negative cable, first read and record the fault code information and personalized settings of the to-be-repaired vehicle.

5.5 When disconnecting the ECU wire connector, turn off the ignition switch first, and then disconnect the battery negative cable.

7 Pre-maintenance inspection

The pre-maintenance inspection shall meet the requirements of JT/T 816. The vehicle shall be subject to the pre-maintenance inspection based on the vehicle failure description, a “pre-maintenance inspection record” (see Appendix A) shall be filled in, and a “repair construction sheet” (see Appendix B) shall be issued.

8 Technical requirements for operation

8.1 Engine inspection

8.1.1 The connection of the battery shall be firm; the voltage of the battery shall meet the technical requirements of the vehicle.

8.1.2 The engine oil shall be free from emulsification and deterioration; the oil level shall meet the technical requirements of the vehicle.

8.1.3 The liquid level of coolant, brake fluid, power steering fluid, etc. shall be between the highest scale and the lowest scale. Where the liquid level does not meet the requirements, find out the reason and adjust the liquid level to the specified height.

8.1.4 Vacuum pipelines and fuel pipelines shall be connected correctly and reliably without spillage or leakage.

8.1.5 Lines shall be free from interference, aging or damage; wire connectors shall be connected reliably without loosening.

8.1.6 The appearance of sensors, actuators, ECU, etc. shall be intact, without obvious damage; the installation shall be firm.

8.1.7 Fill the engine inspection results and repair handling suggestion into the “Repair operation and process inspection record” (see Appendix C).

8.2 Engine basic inspection

8.2.1 Test engine cylinder pressure, fuel pressure, intake pipe vacuum degree, exhaust back pressure, etc. All parameters shall meet the requirements of the maintenance and repair manual of the vehicle under repair. If the test results are abnormal, the fault location shall be determined according to the test results and repair shall be carried out accordingly.

8.2.2 Check the ignition or injection timing, which shall meet the requirements of the maintenance and repair manual of the vehicle under repair; otherwise, it shall be repaired.

8.2.3 Fill each inspection data and repair handling suggestion of the basic inspection of the engine in the “Repair operation and process inspection record” (see Appendix C).

8.3 Fault verification

8.3.1 The fault shall be tested and verified under the vehicle failure status stated by the requesting party. If necessary, the fault shall be tested and verified with the company of the requesting party.

8.3.2 During the process of testing and verifying the fault, the fault phenomenon shall be observed and confirmed; the tested and verified faults shall be filled in the “Repair operation and process inspection record” (see Appendix C).

8.4 ECU inspection and confirmation

8.4.1 Use the fault detector to establish a communication connection with the engine electronic control unit. If communication is unavailable, troubleshoot the communication failure according to the maintenance and repair manual of the vehicle under repair.

8.4.2 Use the fault detector to read the software version of the ECU. If there is a new version upgrade, the ECU software version shall be subject to over-the-air upgrade.

8.4.3 After the over-the-air upgrade of the ECU software version, a test run shall be carried out to verify and confirm the troubleshooting of the vehicle under repair, and the over-the-air upgrade status of the ECU software version shall be filled in the “Repair operation and process inspection record” (see Appendix C).

8.5 Fault code diagnosis

8.5.1 Read and record the fault code of the engine electronic control system under KOEO.

8.5.2 Check whether there is freeze data of the relevant fault code, read and record the corresponding data.

8.5.3 Use the fault detector to clear the fault code and record the clearing results of the fault code.

8.5.4 Start the engine and simulate the failure occurrence conditions to run the engine.

8.5.5 Use the fault detector again to read and record the fault code and freeze data of the engine electronic control system under KOEO or KOER.

8.5.6 Carry out fault diagnosis according to the fault guidance function or the maintenance and repair manual, and record the diagnosis results.

8.8 Component Inspection

8.8.1 When the suspicious components are under the on vehicle status, use a fault detector to read their dynamic data flow, or use an oscilloscope to detect the signal wave form of the sensor, the driving waveform of the actuator or the input and output signal waveform of the ECU, and detect and judge the performance of the suspicious components; record the inspection results.

8.8.2 When the suspicious components are under the off vehicle status, use a multimeter or similar equipment to detect and judge the performance of the suspicious components according to the requirements of the maintenance and repair manual of the vehicle under repair, and record the inspection results.

8.8.3 When necessary, it is allowed to determine the performance of suspicious components according to the test method by replacing the components.

8.8.4 Traceable spare parts that meet the technical requirements of the original manufacturer shall be used to repair, and the relevant information of the spare parts shall be recorded.

8.8.5 The installation of spare parts shall comply with the requirements of the maintenance and repair manual of the vehicle under repair.

8.8.6 After the repair, the test run shall be carried out by simulating the failure occurrence conditions; there shall be no fault phenomenon in the verification, and the verification results shall be recorded. Fill the component inspection result into the “Repair operation and process inspection record” (see Appendix C).

8.9 System recovery

8.9.1 Install the components or lines that have been disassembled during the restoration and repair process according to the operating specifications in the maintenance and repair manual of the vehicle under repair.

8.9.2 Use a fault detector or similar equipment to complete the necessary programming and setting work, and record relevant coding information.

8.9.3 Restore the requesting party’s personalized settings of the vehicle.

8.10 Fault repair and confirmation

8.10.1 Use a fault detector to clear the fault memory, and perform a test run under the failure occurrence condition, to confirm that the failure reported by the requesting party has been eliminated and no other new failures have occurred.

8.10.2 After the test run, use a fault detector to read the fault code, and confirm that the system is normal and no fault code is stored.

8.10.3 After the test run, use a fault detector to read the dynamic data flow of the system, and confirm that the operating parameters of the system meet the requirements of the maintenance and repair manual of the vehicle under repair, and there is no abnormal data.

8.10.4 If the vehicle still has faults after the test run, rework shall be carried out until the engine electronic control system returns to normal. Fill the fault result confirmed in the test run into the "Repair operation and process inspection record" (see Appendix C).

9 Completion inspection

9.1 After the repair of the engine electronic control system is completed, the quality inspection personnel shall check the completion of the repair items according to the "construction sheet".

9.2 Quality inspectors shall check the repair items in accordance with JT/T 816, vehicle maintenance and repair manuals or instructions, and the inspection results shall meet the standards or technical requirements of the maintenance and repair manual of the vehicle under repair.

9.3 Check the oil level, coolant level, line connection status, etc. The liquid level of the repair completed vehicle shall be normal, and the line connection shall be reliable.

9.4 Under the two statuses of KOEO and KOER, check the indications of the instruments of the repair completed vehicle, and all instruments shall work normally.

9.5 Use the fault detector to read the fault codes of the repair completed vehicle in the two statuses of KOEO and KOER, and there shall be no fault code storage related to the fault phenomenon.

9.6 Use the fault detector to read the dynamic data flow of the repair completed vehicle in the two statuses of KOEO and KOER, and all data shall meet the requirements of the maintenance and repair manual.

9.7 Check the restoration of the requesting party's personalized settings of the vehicle, which shall be fully restored.

9.8 Carry out test run verification for the repair completed vehicle; check the starting, idling, acceleration, deceleration and other working conditions, which shall be normal; there shall be no abnormal sound or smell during the driving process of the vehicle.

9.9 Use the fault detector to detect fault codes and related data flow information in the engine electronic control unit through the OBD interface, and the status information related to the emission control device shall be normal. Fill the above inspection results into the "Repair completed inspection record" (see Appendix D).

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