GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 75.180.30

CCS N 13

GB/T 9081-2023

Replacing GB/T 9081-2008

Fuel dispensers for motor vehicles

机动车燃油加油机

Issued on: November 27, 2023 **Implemented on: June 01, 2024**

Issued by: State Administration for Market Regulation;

National Standardization Administration.

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Fuel dispensers for motor vehicles

1 Scope

This document specifies the technical requirements, inspection items and methods, inspection rules, requirements for marking, sealing, packaging, transportation and storage of fuel dispensers for motor vehicle (hereinafter referred to as dispensers).

This document applies to the design, manufacturing, and acceptance of fuel dispensers.

This document applies to gas dispensers used in fixed gas stations and gas stations with skid-mounted car refueling devices. Please refer to this document for gas dispensers used in mobile refueling trucks.

2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, for dated reference documents, only the edition corresponding to the date applies to this document; for undated reference documents, the latest edition (including all amendments) applies to this document.

GB/T 191 Packaging - Pictorial marking for handling of goods

GB/T 3836.1 Explosive atmospheres - Part 1: Equipment - General requirements

GB/T 3836.2 Explosive atmospheres - Part 2: Equipment protection by flameproof enclosures "d"

GB/T 3836.3 Explosive atmospheres - Part 3: Equipment protection by increased safety "e"

GB/T 3836.4 Explosive atmospheres - Part 4: Equipment protection by intrinsic safety "i"

GB/T 3836.9 Explosive atmospheres Part 9: Equipment protected by casting type "m"

GB/T 3836.15 Explosive atmospheres - Part 15: Electrical installations design, selection and erection

GB/T 3836.28 Explosive atmospheres - Part 28: Non-electrical equipment for explosive atmospheres - Basic method and requirements

4.3.3 Minimum specified volume quantity

The minimum specified volume quantity of the fuel dispenser shall be ≤ 0.01 L.

4.3.4 Maximum permissible error

The maximum permissible error of the fuel dispenser shall meet the following requirements.

- When Q_{max} ≤ 200 L/min, the maximum permissible error of the volume indication error of the fuel dispenser is ±0.30%; its repeatability is ≤ 0.10%.

- When Q_{max} > 200 L/min, the maximum permissible error of the volume indication error of the fuel dispenser is ±0.50%; its repeatability is ≤ 0.17%.

- The maximum permissible error of the minimum measured quantity is ±0.50%; its repeatability is ≤ 0.17%.

4.3.5 Payment amount error

The payment amount displayed by the fuel dispenser shall not be greater than the payment amount, which is calculated by multiplying the unit price and the volume indication value; the absolute value of the difference between the two shall not exceed the minimum specified price deviation.

4.3.6 Flow interruption indication error

If the oil circuit is suddenly closed during the refueling process, the volume indication error and payment amount indication error shall meet the requirements of 4.3.4 and 4.3.5, respectively.

4.3.7 Counting indication range

The range of counting indications shall meet the requirements of measurement accuracy. The requirements for the indication range are as follows:

- The payment amount and transaction volume shall be no less than 6 significant figures, including 2 digits after the decimal point and no less than 4 digits before the decimal point;

- The unit price must be no less than 4 significant figures, including 2 digits after the decimal point and no less than 2 digits before the decimal point;

- The electronic cumulative amount shall not be less than 10 significant figures.

4.3.8 Measuring endurance

After the fuel dispenser operates for 100 hours at 80% to 100% of the maximum flow

rate as shown on the nameplate, the average value of the indication error and measurement repeatability of each measurement point shall meet the requirements of 4.3.4. Compared with the indication error before 100 hours of operation, at the same flow point, the absolute value of the indication error change shall be ≤ 0.30%.

4.4 Electronic system security

4.4.1 General requirements

4.4.1.1 There shall be no circuit on the measurement controlling board, that can disconnect or attach the communication channel between the monitoring microprocessor and the security checking device.

4.4.1.2 There shall be no circuit on the measurement controlling board, that can disconnect or attach the communication channel between the monitoring microprocessor and the indicating device.

4.4.1.3 There shall be no circuit on the measurement controlling board, that can open the control valve alone. The control valve shall be opened jointly by the metering microprocessor and the monitoring microprocessor.

4.4.1.4 The monitoring microprocessor shall integrate the storage unit and real-time clock. The storage unit and real-time clock have no external access interface.

4.4.1.5 The measurement software shall be designed in accordance with the software requirements for category II metering instrument in Chapter 6 of GB/T 42555-2023 and the medium software protection level as specified in 5.1.1 of JJF 1182-2021. The overall design, detailed design, data protection mechanism, software interface, etc. of the software process shall be clearly described. Relevant software modules shall have online upgrade functions. The upgrade operation shall be carried out after online validation. The relevant information required for online validation shall be encrypted and stored in the storage medium. The software upgrade of the legal metrology part shall comply with the relevant provisions of 6.2.8.2 in GB/T 42555-2023.

4.4.1.6 The encryption algorithm used by the system shall be one or more of the symmetric encryption algorithm (3DES, AES), the asymmetric encryption algorithm (RAS) or the national secret algorithm (SM1, SM2). It shall have the function of online key update.

4.4.1.7 The fuel dispenser used for domestic oil trade settlement shall have self-locking and validation functions.

4.4.2 Self-locking function

4.4.2.1 The fuel dispenser shall be able to activate the self-locking function through special equipment.

realize closed-loop control and automatically adjust the air-liquid ratio, to meet the requirements of 5.3 in GB 20952-2020.

4.6 Climate and environmental adaptability

Under the following environmental conditions, the fuel dispenser shall perform normally and meet the requirements of 4.3.4.

- Temperature: -25 °C ~ +55 °C.

- Relative humidity: ≤ 95%.

- Atmospheric pressure: 86 kPa ~ 106 kPa.

4.7 Power supply adaptability

The fuel dispenser shall perform normally in a power supply environment, which has a nominal voltage (allowed fluctuation range is -15% ~ +10%) and maximum frequency variation of ±1 Hz (except DC power supply), meanwhile meet the requirements of 4.3.4.

4.8 Electrical safety

4.8.1 The conductive parts in contact with the protective grounding terminal and connecting end of the fuel dispenser shall be selected according to Appendix N in GB 4943.1-2022, so that the potential difference between any two different metals is equal to or less than 0.6 V.

4.8.2 The connection resistance -- between the protective grounding terminal or grounding contact of the fuel dispenser and the components that need to be grounded -- shall not be greater than 0.1 Ω.

4.8.3 The contact current of the fuel dispenser shall not be greater than 5 mA.

4.8.4 The fuel dispenser shall meet the electrical strength requirements of category I overvoltage equipment. An AC test voltage, which has an effective value of 1500 V and a frequency of 50 Hz, shall be applied between the primary circuit and the fuel dispenser or between the primary circuit and the secondary circuit for 60 seconds. There shall be no insulation breakdown during the test. The test voltage of the electric strength test for exit-factory inspection can be reduced by 10%; the duration shall be 1 s ~ 4 s.

4.8.5 The resistance value of the refueling nozzle and the anti-static grounding to the ground shall be less than 1×10^6 Ω.

4.9 Adaptability to electromagnetic environment

4.9.1 General requirements

The entire fuel dispenser shall be tested for electrostatic discharge immunity, radio frequency electromagnetic field radiation immunity, electrical fast transient pulse group immunity, voltage sag, short interruption and voltage change immunity, surge (shock) immunity test. During the above test process and after the test is completed, the function of the fuel dispenser shall be normal; the following phenomena shall not occur:

- Device failure or unexpected action;

- Change or loss of stored data;

- Restore to factory settings;

- Change of operating mode;

- Confusion or errors in data display;

- Keyboard operation failure.

Note: Normal functions refer to normal functions such as start and stop of the fuel dispenser, unit price setting, zero return.

4.9.2 Electrostatic discharge immunity

The electrostatic discharge immunity's severity level shall reach the Level 3 test level specified in GB/T 17626.2-2018:

- Air discharge: Test voltage ±8 kV;

- Contact discharge: Test voltage ±6 kV.

4.9.3 Radio frequency electromagnetic field radiation immunity

The severity level of radio frequency electromagnetic field radiation immunity shall reach the Level 3 test level specified in GB/T 17626.3-2016:

- Frequency range: 80 MHz ~ 1000 MHz;

- Test field strength: 10 V/m.

4.9.4 Electrical fast transient burst immunity

The severity level of electrical fast transient burst immunity shall reach the Level 3 test level specified in GB/T 17626.4-2018:

the factory; the test results shall meet the following requirements.

- All parts are not loose and work normally, flexibly, harmoniously, reliably.

- There is no leakage or abnormal noise in the hydraulic oil circuit during operation.

5 Component requirements

5.1 Flow measurement transducer

5.1.1 The appearance shall be subject to good surface treatment; it shall be free of visible burrs, scratches, cracks, rust or mildew and other defects.

5.1.2 A flow direction mark shall be marked on an obvious part of the shell.

5.1.3 There shall be a nameplate on the exterior; the nameplate shall indicate:

- Manufacturer name;

- Flow measurement transducer model;

- Measuring range;

- Maximum permissible error;

- Nominal pressure;

- Exit-factory number.

5.1.4 The maximum permissible error is ±0.20%; the repeatability error shall be ≤ 0.07%.

5.1.5 The ratio -- of the maximum flow rate Q_{max} to the minimum flow rate Q_{min} -- shall not be less than 10:1.

5.1.6 No leakage when withstanding oil pressure 1.5 times the pump outlet pressure.

5.1.7 A mechanical adjustment device can be equipped to adjust the flow meter so that the indication error is close to zero. The adjustment device and the shell shall have a reliable sealing mechanism, to prevent components from being adjusted or replaced at will.

5.1.8 For discontinuous manual adjustment devices, the adjustment range of the indication error shall be ≤ 0.05%/grid.

5.1.9 After running for 100 hours at 80% ~ 100% of the maximum flow rate shown on the nameplate, the average value and repeatability of the indication errors at each

measurement point shall meet the requirements of 4.3.4.

5.1.10 There shall be a unique code or label on an obvious part of the shell.

5.2 Coding device

5.2.1 The coding device shall use a special customized chip; the sensor and microprocessor shall be integrated and packaged together. It shall have a unique serial number and cannot be changed; the output signal shall be an encrypted digital signal and shall not be output in plain text or pulse output. The encryption algorithm shall meet the requirements of 4.4.1.6.

5.2.2 The coding device shall be able to identify the rotation direction of the flow measurement transducer.

5.2.3 There shall be a unique code or label on the visible part of the coding device shell.

5.3 Measurement controlling board

5.3.1 The measurement controlling board shall have a unique serial number which cannot be changed.

5.3.2 The metering microprocessor of the measurement controlling board shall be a 32-bit or above microprocessor; special customized chips can be used.

5.3.3 Metering microprocessors, monitoring microprocessors, intelligent control valves shall use encrypted communication; the encryption algorithm shall meet the requirements of 4.4.1.6.

5.3.4 The monitoring microprocessor shall use a special customized chip. The storage unit, real-time clock, monitoring microprocessor shall be integrated and packaged together, have a unique serial number, have hardware encryption and decryption functions.

5.3.5 The storage unit of the monitoring microprocessor shall store relevant data for at least 7 years.

5.4 Indicating devices

5.4.1 The indicating device shall use a special customized encrypted display chip with a unique serial number that cannot be changed.

5.4.2 There shall be no additional circuits or devices on the indicating device, that can change the display content. The display content is solely controlled by the monitoring

disassembly key.

5.6 Pump (excluding submersible pump)

5.6.1 The flow range shall meet the requirements of 4.3.1.

5.6.2 The absolute value of vacuum at the pump inlet shall be ≥ 54 kPa; the outlet pressure shall be ≤ 300 kPa.

5.6.3 There will be no leakage when withstanding a pressure 1.5 times the pump outlet pressure.

5.6.4 The noise during operation shall be ≤ 80 dB(A).

5.6.5 It shall have the ability to separate oil and gas and meet the following requirements.

a) When the fuel dispenser operates at the maximum flow rate and minimum pressure, it can eliminate gas mixed in the oil, meanwhile the maximum permissible error and repeatability of the fuel dispenser meet the requirements of 4.3.4.

b) For oil with a viscosity lower than or equal to 1 mPa·s, the volume ratio of gas to oil shall not exceed 20%; for oil with a viscosity higher than 1 mPa·s, the volume ratio of gas to oil shall not exceed 10%.

5.7 Control valve

5.7.1 The control valve shall have a flow adjustment function and a sealing mechanism.

5.7.2 Intelligent control valves with microprocessors shall have a unique serial number that cannot be changed.

5.7.3 The intelligent control valve shall pass online validation before receiving the opening command; the opening command control shall meet the requirements of 4.4.1.3.

5.7.4 The intelligent control valve shall be able to save abnormal opening records and report them to the measurement controlling board and security checking device; the electromagnetic intelligent control valve shall also have a magnetic field detection function.

5.8 Oil hose

5.8.1 For fuel dispensers with a maximum flow rate greater than 60 L/min and without a hose reel, the change in the internal volume of the hose shall not exceed 40 mL.

5.8.2 For oil dispensers with a maximum flow rate greater than 60 L/min and equipped with a hose reel, the change in the internal volume of the hose caused by the transition from unpressurized curled state to the pressurized uncurled state without any flow shall not exceed 80 mL.

5.8.3 For fuel dispensers with a maximum flow rate not exceeding 60 L/min and without a hose reel, the change in the internal volume of the hose shall not exceed 20 mL.

5.8.4 For oil dispensers with a maximum flow rate of no more than 60 L/min and equipped with a hose reel, the change in the internal volume of the hose caused by the transition from the unpressurized curled state to the pressurized uncurled state without any flow shall not exceed 40 mL.

5.8.5 Oil delivery hoses, oil and gas hoses (when applicable) and components shall have good electrostatic conductivity; the conductivity shall comply with the relevant requirements of 6.2.2.1.9 in GB/T 32476-2016.

5.9 Pull-off valve

The performance of the pull-off valve assembly shall comply with the relevant requirements of GB/T 22380.2.

5.10 Nozzle

5.10.1 The flow rate of the refueling nozzle shall meet the flow requirements of the fuel dispenser.

5.10.2 The refueling nozzle shall be flexible to operate, well sealed, have no leakage under the working pressure of the fuel dispenser.

5.11 Refueling vapor recovery system

5.11.1 Measurement controlling board for vapor recovery

The vapor recovery measurement controlling board shall meet the following requirements.

a) If a 32-bit or above microprocessor is used, the motherboard shall have a unique serial number that cannot be changed.

b) Use digital communication to obtain refueling volume data from the measurement controlling board.

c) Online verification can be performed through the security checking device; the

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