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Installation Specification for Gas System of Gas Vehicles

燃气汽车燃气系统安装规范

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Installation Specification for Gas System of Gas Vehicles

1 Scope

This document specifies the installation requirements, test methods, inspection rules and implementation transition period of the gas system of gas vehicles.

This document is applicable to gas vehicles that can use compressed natural gas (hereinafter referred to as CNG) / liquefied natural gas (hereinafter referred to as LNG) / liquefied petroleum gas (hereinafter referred to as LPG) as fuel.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in this text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB 8410 Flammability of Automotive Interior Materials

GB/T 13005 Terminology of Gas Cylinders

GB/T 17676 Natural Gas Vehicle and Liquefied Petroleum Gas Vehicle - Identification Marks

GB/T 17895 Natural Gas Vehicle and Liquefied Petroleum Gas Vehicle - Vocabulary

GB/T 34510 Liquefied Natural Gas Cylinders for Vehicles

GB/T 36123-2018 Technical Requirements for Gas Leakage Alarm Device of Gas Vehicle

QC/T 245-2017 Technology Requirements of Fuel-gas System for CNG Vehicles

QC/T 247-2017 Technology Requirements of Fuel-gas System for LPG Vehicles

QC/T 755-2020 Technical Requirements of Fuel-gas System for LNG Vehicles

ISO 6487:2015 Road Vehicles - Measurement Techniques in Impact Tests - Instrumentation

3 Terms and Definitions

What is defined in GB/T 17895, GB/T 13005 and GB/T 34510, and the following terms and definitions are applicable to this document.

3.1 Refueling Device

Refueling device refers to a component connected with the gas (liquid) refueling gun or gas (liquid) returning gun when refueling gas (liquid).

4 Installation Requirements

4.1 General Requirements

4.1.1 The gas system for CNG vehicles shall satisfy the requirements of Chapter 4 in QC/T 245-2017. The gas system for LPG vehicles shall satisfy the requirements of Chapter 4 in QC/T 247-2017. The gas system for LNG vehicles shall satisfy the requirements of Chapter 5 in QC/T 755-2020.

4.1.2 The installation of the gas system of gas vehicles shall comply with the requirements of the design documents of finished vehicles, and shall be assembled in accordance with the product drawings and technical documents approved by the prescribed procedures.

4.1.3 The installation of the gas system of gas vehicles shall satisfy the requirements of the strength and rigidity of the vehicle bearing parts and other relevant safety components. Installation methods that may result in a reduction in the strength and rigidity of the vehicle bearing parts shall not be adopted. The gas system shall not be used as a bearing part.

4.1.4 The gas vehicles shall be marked with signs in accordance with the stipulations of GB/T 17676 in a prominent position.

4.1.5 After installation, the gas system of gas vehicles shall satisfy the following requirements:

- the gas cylinder shall not be deformed or worn;
- all components shall have anti-loosening measures, and there shall be no loosening or falling off;
- After the system is tested in accordance with the method specified in 5.1, there shall be no leakage. When the LNG gas system is tested, the cold test shall be carried out first;
- The various components of the gas system shall not be installed within a range of 100 mm from heat sources, such as: exhaust pipe and exhaust after-treatment tank, etc. When the distance between relevant components and heat sources is between 100 mm and 200 mm, fixed and reliable heat insulation devices shall be set up.

4.2 Gas Cylinder

4.2.1 The gas cylinder shall be installed away from heat sources, and shall be effectively separated from the driver's cab or passenger compartment. When the gas cylinder cannot be effectively separated from the driver's cab or passenger compartment, sealing boxes (sealing parts around the gas cylinder accessories), corrugated pipes and ventilation ports shall be used to discharge the gas that may leak out of the vehicle. The exhaust direction of the ventilation port shall be within the range of 45° cone with the ground. The distance from the ventilation

specified in 5.3.2, the relative displacement between the gas cylinder or gas cylinder set and the fixed point of its fixing seat shall not be greater than 13 mm. Among them, the single gas cylinder and the single gas cylinder fixing seat in the gas cylinder set shall be tested in accordance with the method specified in 5.3.2.2; the installation of the fixing seat for the vertical arrangement of the gas cylinder set shall be tested in accordance with the method specified in 5.3.2.3. If the gas cylinder set is horizontally arranged and multiple gas cylinders are fixed by one fastening belt, the installation of the fixing seat shall be tested in accordance with the method specified in 5.3.2.4; if the gas cylinder fastening belt only fixes one gas cylinder, it shall be tested in accordance with the method specified in 5.3.2.2.

4.3 Refueling Device

4.3.1 The refueling device shall be installed with a dust cover and additional protective measures. The protective measures include additional protective fences, partitions, protective covers or the protective mechanism of the vehicle itself.

4.3.2 The refueling device shall be arranged at a position that is easy to operate and shall not exceed the outline of the vehicle.

4.3.3 After the gas (liquid) refueling port is installed, there shall be no leakage after being inspected in accordance with the test method specified in 5.4.

4.4 Piping

4.4.1 Rigid piping shall be neatly and reasonably arranged, and shall not interfere with adjacent components. The fixed spacing shall not be greater than 600 mm. If the piping is in contact with adjacent components, or passes through holes, protective measures shall be taken to ensure that the piping is not worn. When two components are connected by rigid connection piping, it shall be designed as an “O”, “S” or “U” shape, which can eliminate the effects of thermal expansion and contraction, and vibration; the radius of curvature of the piping center shall not be less than 5 times the outer diameter of the piping.

4.4.2 Components that can generate relative displacement shall be connected by flexible piping, and the others shall be connected by rigid piping. Flexible piping shall be fixed by resilient clips before and after each bend. The fixed spacing of flexible piping shall be not greater than 300 mm; when fixing, vibration reduction and anti-wear measures shall be considered. The direction of the piping shall be smooth, and there shall be no interference or discount.

4.4.3 The pipe joints shall not pass through or be installed in the driver’s cab and passenger compartment, and shall not be installed in places with high heat sources, easy wear or impact; the distance from the transmission shaft shall not be less than 100 mm.

4.4.4 The pipe joints shall be installed within the visible range or at a position that is easy for the operator to operate. When disassembling the piping, release the pressure first, then disassemble it. After reassembly, conduct an air-tight test in accordance with different working pressures; the test method shall comply with the stipulations of 5.1.

4.4.5 When the distance between the liquid supply piping between the LNG cylinder and the carburetor, and the wiring harness, water circuit, gas circuit, oil circuit and other components that are not resistant to low temperature is less than 15 mm, temperature insulation measures shall be taken.

4.4.6 The venting port of the LNG cylinder vent piping shall be located at the top or rear of the vehicle, and a structure shall be set up to prevent rainwater and dust from entering and accumulating. When the vent piping is installed at the rear of the vehicle, measures shall be taken to prevent natural gas from entering or accumulating in the compartment or under the vehicle. In addition, it shall also be separated from devices and components that are prone to sparks, such as: exhaust pipes, batteries and relays of the vehicle.

4.5 Pressure, Temperature and Liquid Level Display Device

The pressure gauge shall be installed in a shock-proof place that is easy to observe and can avoid damage. It shall be firmly installed and shall not be installed in the driver's cab. When installation is exposed on the outside of the vehicle, a protective cover shall be installed for the pressure gauge. The devices for displaying pressure, temperature and liquid level signals in the driver's cab shall be arranged at positions that can be easily observed by the driver.

4.6 Manual Globe Valve

The manual globe valve shall be installed in a position that is easy to operate. The valve body shall not be directly installed in the driver's cab or in the passenger compartment.

4.7 Pressure Reducing Regulator (CNG), Carburetor (LNG) and Evaporating Pressure Regulator (LPG)

When the pressure reducing regulator, carburetor and evaporating pressure regulator are heated by the engine circulating water, their installation heights shall be lower than the top of the engine radiator or the lowest water level of the expansion tank.

4.8 Fuel Switch

The fuel switch that performs the fuel switching function shall be installed at a position that is convenient for the driver to operate. The gear marking of the fuel switch shall be obvious. After installation, it shall be able to correctly control all the states.

4.9 Electrical System

4.9.1 The layout and direction of the wiring harness shall be reasonable, and well fixed. In addition, it shall not rub against adjacent components. An overcurrent protection device shall be installed in the line.

4.9.2 An electromagnetic shut-off valve shall be installed between the gas cylinder and the engine. The installation position of the electromagnetic shut-off valve shall be far away from electrical equipment, and the installation bracket shall not be in direct contact with the

During the test, a neutral foaming liquid shall be used; the foaming liquid shall be applied to the entire surface of the detected part, and observed for at least 1 min; there shall be no air bubbles in the detected area. After the test, the foaming liquid on the detected part shall be cleaned.

5.1.5 Detection with leak detector

5.1.5.1 Before the detection, remove the residual oil or sealant from the detected part. During the detection, the wind speed shall be less than 3 m/s.

5.1.5.2 An explosion-proof digital display detection instrument with an accuracy of not lower than $\pm 5\%$ and an alarm point of 0.025% shall be used to detect the connections of each port, and there shall be no leakage alarm. The detection time shall not be less than the reaction time of the explosion-proof instrument.

5.2 Air-tight Test with Air-tight Box

Bring the compressed air into any orifice of the test piece and seal the other orifices. The gas pressure is 0.01 MPa. Check in accordance with the method specified in 5.1.4.

5.3 Cylinder Installation Strength Test

5.3.1 Dynamic test

5.3.1.1 In accordance with the size and structure of the entire body or part of the body with the gas cylinder installed (hereinafter referred to as the test piece) and the actual installation mode of the original vehicle, fix the test piece on the test bench. The installation method shall not increase the installation strength of the gas cylinder.

5.3.1.2 The test shall be carried out in accordance with the following methods:

- a) Fill the gas cylinder or gas cylinder set with water or nitrogen equivalent to the rated filling mass. Alternatively, the test tooling of the mass of the gas cylinder plus the rated filling mass can also be used as replacement;
- b) The acceleration of the test device shall be measured in accordance with the CFC60 frequency level characteristics in ISO 6487:2015;
- c) The acceleration shall be maintained for at least 30 ms in accordance with the stipulations of 5.3.1.3.

5.3.1.3 The requirements for the acceleration of Category-M1, Category-M2, Category-M3, Category-N1, Category-N2 and Category-N3 vehicles are as follows.

- a) Category-M1 and Category-N1 vehicles shall withstand:

---longitudinal acceleration of 20g forward;

---longitudinal acceleration of 20g backward;

---lateral acceleration of 8g in both directions;

---if the gas cylinder is installed on the side or under the frame, or under the floor of the vehicle body, then, the acceleration in the vertical downward direction is 5g.

b) Category-M2 and Category-N2 vehicles shall withstand:

---longitudinal acceleration of 10g forward;

---longitudinal acceleration of 10g backward;

---lateral acceleration of 5g in both directions;

---if the gas cylinder is installed on the side or under the frame, or under the floor of the vehicle body, then, the acceleration in the vertical downward direction is 5g.

c) Category-M3 and Category-N3 vehicles shall withstand:

---longitudinal acceleration of 6.6g forward;

---longitudinal acceleration of 6.6g backward;

---lateral acceleration of 5g in both directions;

---if the gas cylinder is installed on the side or under the frame, or under the floor of the vehicle body, then, the acceleration in the vertical downward direction is 5g.

5.3.2 Static test

5.3.2.1 Requirements for test device

5.3.2.1.1 The test device shall have a facility to effectively control the force application. Meanwhile, the height of the horizontal force applying mechanism in the vertical direction shall be steplessly adjustable.

5.3.2.1.2 The test device shall be suitable for different vehicle models and different installation forms of various gas cylinders.

5.3.2.1.3 The test device shall be able to record and automatically display the force and displacement data, and can automatically draw the “force-displacement” relation curve.

5.3.2.1.4 The force application process shall be gentle and without impact.

5.3.2.1.5 The gas cylinder can be replaced by a tooling gas cylinder with the same outer diameter as the gas cylinder, so as to ensure that the gas cylinder will not be deformed when force is applied.

5.3.2.2 Test method of single gas cylinder

5.3.2.2.1 In accordance with the size and structure of the test piece and the actual installation mode of the original vehicle, fix the test piece on the test device. The installation method shall not increase the installation strength of the gas cylinder.

5.3.2.2.2 Adjust the force applying mechanism, so that the force applying point passes through the center of the gas cylinder. The direction of force application is respectively the forward direction, the vertical upward direction, and the left or right direction of the vehicle. The applied force is 8 times the mass of the gas cylinder after it is full.

5.3.2.2.3 Apply a force to the test piece: when it reaches the set value, automatically stop the force application, and record the force and displacement data in real time; draw the “force-displacement” relation curve.

5.3.2.3 Test method of vertically arranged gas cylinder set

5.3.2.3.1 In accordance with the size and structure of the test piece and the actual installation mode of the original vehicle, and the measurement requirements of the forward direction of the vehicle, fix the test piece on the test piece. The installation method shall not increase the installation strength of the fixing seat of the gas cylinder set, and shall ensure that the test piece is firmly fixed.

5.3.2.3.2 The force applying point shall be on the fixing seat of the gas cylinder set. The direction of force application is the forward direction of the vehicle, and passes through the center of gravity of the gas cylinder set. The applied force is 8 times the mass of the gas cylinder after it is full.

5.3.2.3.3 When carrying out the test of the fixing seat of the gas cylinder set, in order to prevent deformation of the force-bearing part of the fixing seat, an additional reinforcing plate can be added to the force-applying part.

5.3.2.3.4 Adjust the force applying mechanism; in accordance with the stipulations of 5.3.2.3.2, apply a force to the fixing seat of the gas cylinder set. When reaching the set value, automatically stop the force application, and record the force and displacement data in real time; draw the “force-displacement” relation curve.

5.3.2.4 Test method of horizontally arranged gas cylinder set

5.3.2.4.1 In accordance with the size and structure of the test piece and the actual installation mode of the original vehicle, fix the test piece on the test bench. The installation method shall not increase the installation strength of the fixing seat of the gas cylinder set, and shall ensure that the test piece is firmly fixed.

5.3.2.4.2 The force applying point shall be at the end of each gas cylinder; the direction of force application shall be the axial direction of each gas cylinder; the applied force is 8 times the mass of the gas cylinder after it is full.

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