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**Road Vehicles – Liquefied Natural Gas (LNG) Refueling
Connector – 3.1MPa Connector**

(ISO 12617:2015, MOD)

道路车辆 液化天然气（LNG）加注连接器 3.1MPa 连接器

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Table of Contents

Foreword.....	3
1 Scope	5
2 Normative References	5
3 Terms and Definitions	5
4 General Structural Requirements	7
5 Refueling Nozzle	9
6 Standard Size of Refueling Receptacle	9
7 Refueling Receptacle	10
8 Instructions for Use.....	11
9 Markings	11
10 Test Methods	13
Bibliography	19

Foreword

This Document was drafted as per the rules specified in GB/T 1.1-2020 *Directives for Standardization – Part 1: Rules for the Structure and Drafting of Standardizing Documents*.

This Document modified and adopted ISO 12617:2015 *Road Vehicles – Liquefied Natural Gas (LNG) Refueling Connector – 3.1MPa Connector*.

Compared with ISO 12617:2015, this Document made the following structural adjustments:

- 3.3, 3.4~3.8, 3.9~3.13 correspond to 3.4, 3.6~3.10, 3.12~3.16 in ISO 12617:2015;
- Add the numbers of 4.1~4.3;
- 7.3 corresponds to 7.3 and 10.4 in ISO 12617:2015;
- 9.2~9.4 corresponds to 9.2~9.5 in ISO 12617:2015; and add the numbers of 9.2.1~9.2.3;
- 10.4~10.10 corresponds to 10.5~10.11 in ISO 12617:2015; and add the numbers of 10.9.1~10.9.4.

The technical differences and the causes between this Document and ISO 12617:2015 are as follows:

- Replace ISO 14469 (see 10.10) with normatively quoted GB/T 43408 to comply with China's technical situation;
- Delete 3.3 in ISO 12617:2015, which is likely to cause confusion. Delete 3.5 in ISO 12617:2015, the hydrostatic strength is clearly specified and explained in this Document, and there is no need to define it. Delete the second half of the NOTE of 3.7 in ISO 12617:2015, there shall be no requirements in NOTE. Delete the NOTE of 3.9 in ISO 12617:2015, which is already confirmed in 3.1. Delete 3.11 in ISO 12617:2015, and it only appears once in the document;
- Delete the prerequisite for international certification in 4.1 of ISO 12617:2015, and international certification cannot be carried out through this Document. Delete the operator training requirements in 4.1c) of ISO 12617:2015, which comply with national requirements, and there are clear regulatory requirements for operators. Delete the filling port shall be installed outside the engine compartment in 4.8 of ISO 12617:2015, and there shall be no installation requirements in the product technical requirements standard;
- Delete that the filling port should not be installed in areas where the temperature exceeds 85 °C in 7.5 of ISO12617:2015; and there shall be no installation requirements in the product technical requirements standard;
- Change 9.3 and 9.4 in ISO 12617:2015; merge 9.3 and 9.4; and do not produce

Road Vehicles – Liquefied Natural Gas (LNG) Refueling Connector – 3.1MPa Connector

1 Scope

This Document specifies the general construction requirements, refueling nozzle, refueling receptacle, instructions for use, markings and test methods for new and unused 3.1MPa connectors for road vehicle liquefied natural gas (LNG) filling connectors.

This Document applies to connectors with a working pressure of 3.4MPa.

NOTE: Unless otherwise specified, pressures in MPa mentioned in this Document are considered gauge pressures.

2 Normative References

The provisions in following documents become the essential provisions of this Document through reference in this Document. For the dated documents, only the versions with the dates indicated are applicable to this Document; for the undated documents, only the latest version (including all the amendments) is applicable to this Document.

GB/T 43408 Road vehicles - Compressed natural gas (CNG) refueling connector (GB/T 43408-2023, ISO 14469:2017, MOD)

ISO 15500-2 Road vehicles – Compressed natural gas (CNG) fuel system components – Part 2: Performance and general test methods

3 Terms and Definitions

For the purposes of this Document, the following terms and definitions apply.

3.1 Check valve

A component installed inside the refueling receptacle or refueling gun to prevent fuel backflow or discharge after the refueling nozzle is disconnected from the refueling receptacle.

3.2 Cycle life

The number of refueling that can be withstood by the components without leakage or other malfunctions.

3.3 Dry air

Air with a dew point temperature at the test pressure that is at least 11°C lower than the ambient test temperature.

3.4 Liquefied natural gas (LNG)

A colorless, cryogenic liquid fluid that is composed primarily of methane and may contain small amounts of ethane, propane, butane, nitrogen, or other components commonly found in natural gas.

[SOURCE: GB/T 8423.3-2018, 2.1.14]

3.5 Refueling connector; LNG refueling connector

The connecting assembly of the LNG refueling nozzle (3.6) and the LNG refueling receptacle (3.7).

NOTE: There are check valves (3.1) in the refueling nozzle and the refueling receptacle that can be opened mechanically by mutual operation.

3.6 Refueling nozzle; LNG refueling nozzle

The component that is safely and quickly connecting and disconnecting the fuel supply from the LNG refueling receptacle (3.7).

3.7 Refueling receptacle; LNG refueling receptacle

The component that is installed on the vehicle to connect to the LNG storage system and dock with the LNG refueling nozzle (3.6) for safe fuel transferring.

3.8 Maximum service pressure

The maximum pressure that the refueling station provides the fuel.

3.9 Poppet

The moving part within the check valve (3.1) that has the function of closing and opening the valve body.

3.10 Positive locking means

Measures that are required to activate the interlocking mechanism to achieve safe connection or disconnection of the refueling nozzle (3.6) and the refueling receptacle (3.7).

--- Under normal handling and use conditions, the product structure can maintain normal operation;

--- vapor spillage space is less than 25cm³.

4.4 Pressure level

4.4.1 Working pressure (maximum allowable pressure)

The working pressure of the connector is 3.4MPa.

4.4.2 Maximum service pressure

The maximum service pressure of the connector is 3.1MPa.

4.4.3 Hydrostatic strength

The hydrostatic strength test pressure of components is 2.5 times the working pressure.

4.4.4 Working temperature

4.4.4.1 The working temperature range of the refueling receptacle is -196°C~85°C.

4.4.4.2 The refueling nozzle shall be able to deliver fuel at -196°C and can operate normally within the ambient temperature range of -40°C to 85°C.

4.5 Materials

4.5.1 Corrosion resistance

Corrosion-resistant materials shall be used (see 10.9). Different metals shall be protected against electrochemical corrosion before they can be used in contact.

4.5.2 LNG refueling nozzle and LNG refueling receptacle

The materials of the LNG refueling nozzle and the LNG refueling receptacle shall be compatible with LNG within the working pressure and temperature range; and the manufacturer shall declare the compliance of its materials in the documents delivered with the product.

4.5.3 Body materials of refueling nozzle and refueling receptacle

The body materials of the refueling nozzle and the refueling receptacle shall:

- a) Adapt to the operating temperature range of the product;
- b) Be able to conduct electricity (see 10.7);
- c) Do not generate sparks (see 10.10).

4.6 Manual operation

The LNG refueling nozzle and the LNG refueling receptacle shall be able to be connected and disconnected without using tools.

4.7 Replacement of seal component

The seal design of check valve of the refueling nozzle and the refueling receptacle shall ensure that the seal component is replaced from the front using special tools on the fixture.

5 Refueling Nozzle

5.1 Exhaust and pressure relief

Before disconnecting, the refueling nozzle shall be vented and depressurized. Disconnection of the refueling nozzle shall be completed in accordance with 10.2.

5.2 Identification

The refueling nozzle shall be marked in accordance with Clause 9. If necessary, there may be operating direction markings indicating the opening and closing of the actuator.

5.3 Internal check valve

There is a check valve inside the refueling nozzle to prevent gas leakage. During the connection process, after the poppet surface of the refueling nozzle check valve comes into contact with the poppet surface of refueling receptacle check valve. The check valve poppet of the refueling receptacle is pushed to the open position to achieve stable flow. When in the fully open position, the force on the check valve poppet of the refueling nozzle shall be greater than the reaction force from the check valve of the refueling receptacle. The movement stroke of the refueling nozzle probe in the refueling receptacle is not limited by the mechanical part of the refueling receptacle.

6 Standard Size of Refueling Receptacle

The refueling receptacle shall conform to the dimensions shown in Figure 1.

the refueling receptacle; and to prevent dust from entering through the ventilation holes. The dust cover shall ensure the discharge of gas caused by small leakage of the refueling receptacle check valve (see 10.4.2) or a small amount of air caused by the increase in internal air pressure caused by the temperature rise of the refueling receptacle after refueling. The dust cover shall be permanently marked with the word of "Only for LNG use ". The refueling receptacle manufacturer or vehicle manufacturer shall provide a report on the dust cover's suitability for at least 2000 opening/closing operations and 5 years of aging.

7.4 Installing accessories

The refueling receptacle shall be equipped with installing accessories that can be firmly installed on the vehicle and shall meet the requirements of 10.5 abnormal load test.

8 Instructions for Use

8.1 Instruction manual

Suppliers of refueling nozzle and refueling receptacle shall provide easy-to-understand, printable instruction documents and diagrams. It shall contain at least the following contents:

- Correct on-site component assembly and assembly installation;
- Maintenance and regular inspection;
- Parts replacement;
- Safe operation;
- Suitability and use;
- Storage and handling.

8.2 Tool list

The special tools required for the connection between the refueling nozzle, the refueling receptacle and the pipeline, and the assembly and disassembly of components shall be indicated in the instruction manual.

9 Markings

9.1 Markings

The required markings on the refueling receptacle and refuel nozzle shall be clear and easy to understand. The markings should be embossed, cast, stamped or otherwise permanently displayed on the surface of the part.

9.2 Information

The refueling nozzle and the refueling receptacle shall have the following information:

- Manufacturer's name;
- Trademark or marking;
- Model or part number;
- Manufacture date;
- Identification of this Document.

9.3 Date of manufacture

9.3.1 The refueling nozzle and the refueling receptacle shall be marked with a date code. The 4-digit date code mark shall consist of at least 4 adjacent digits of the following:

- The first and second digits shall indicate the calendar year in which the refueling nozzle, the refueling receptacle and three-way valve were manufactured (for example: 11 represents 2011, 21 represents 2021);
- The third and fourth numbers shall indicate the specific week in which the refueling nozzle and the refueling receptacle were manufactured (for example: 03 represents the third week of the year).

9.3.2 A week shall start at 00:01 on Sunday and end at 24:00 on Saturday. Date codes can be used for more than one week; however, consecutive periods shall not be used for more than four weeks or for more than two weeks in the next calendar year.

9.3.3 When a 4-digit date code is not feasible, the manufacturer shall submit a plan acceptable to the certification body, which shall outline the method for determining the date of manufacture so that it can be traced back to the purchaser.

9.4 Optional Markings

Optional marking numbers, letters or symbols follow the 4-digit number. If extra digits are used, they shall be separated from the date code.

Optional markings include:

- Body material;
- Traceability number.

c) 0.5MPa.

When conducting a leakage rate test, the maximum allowable leakage rates under 0.5MPa and working pressure are 30cm³/h and 60cm³/h, respectively.

After filling air or nitrogen into the inlet of a connected or unconnected refueling nozzle, it shall be immersed in water at room temperature and inspect the shell for bubbles.

All connections shall be observed for 5 min after completion of connection and before disconnection to see if there is any leakage. If there are no bubbles within 1 min, the sample passes the test; if bubbles are detected, the leakage rate test shall be performed by collecting the amount of gas leaked underwater.

Other leak detection methods with equivalent or better sensitivity may also be used.

10.4.2 Refueling receptacle

Fill the check valve at the refueling receptacle with air or nitrogen at 0.5MPa and working pressure. The leakage rate of the check valve shall not exceed 30cm³/h and 60cm³/h, respectively, or there shall be no bubbles within 5 min.

10.5 Abnormal loads

10.5.1 General requirements

The connected refueling nozzle and the refueling receptacle shall withstand a 5-min abnormal load test. The tests shall be conducted separately according to the following methods (see Figure 3):

- a) Apply a pulling force F_a along the axial direction of the refueling nozzle or the refueling receptacle;
- b) Apply torque M_b in the direction of Figure 3.

The refueling nozzle and the refueling receptacle shall withstand the abnormal load of $F_a=1350\text{N}$ and $M_b=120\text{N}\cdot\text{m}$ without deformation or damage; they shall withstand the abnormal load of $F_a=2700\text{N}$ and $M_b=240\text{N}\cdot\text{m}$ without being damaged and causing leakage. The position 0.048m away from the front-end face of the refueling receptacle is the base plane of the force moment M_b arm. The length L of the force moment M_b arm is measured from the base plane. The load of the force moment M_b is $F_b=M_b/L$. After completing these tests, carry out the tests specified in 10.4.

The cycle test meets the following requirements:

- a) During the test, the fluid pressure of the refueling nozzle shall be maintained at 1.4MPa;
- b) In order to maintain the required flow rate, the pressure of the refueling receptacle shall be allowed to fluctuate as needed;
- c) The refueling nozzle shall be connected to the refueling receptacle;
- d) The cryogenic fluid shall be transported to a stable flow rate;
- e) The flow of cryogenic fluid shall be cut off;
- f) The refueling nozzle and the refueling receptacle shall be disconnected.

During the test, defrosting operations can be performed according to the manufacturer's requirements.

10.6.3 Continuous test

10.6.3.1 The number of cycles for each continuous test should be determined based on the life of seal component provided by the manufacturer, but shall be no less than 1000 cycles.

10.6.3.2 No visible cryogenic fluid leakage shall be observed during the test.

10.6.3.3 After each complete cycle, a leak test may be carried out according to the provisions of 10.4.

10.6.3.4 During the cycle test, each leakage test failure shall be regarded as a cycle test failure. If the leakage problem can be solved by replacing the seal component, the cycle test can be continued.

10.6.4 Replacement of seal component

Seal component can be replaced according to the manufacturer's instructions after each cycle of leak test failure or in the event of seal failure. If the seal component is replaced, it shall be noted in the test report.

10.7 Resistance test

In pressurized and non-pressurized states, the resistance, after the refueling receptacle and the refueling nozzle are connected, is no greater than 1000Ω. The resistance test shall be carried out before and after the cycle test.

10.8 Hydrostatic strength test

10.8.1 Test configuration

Warning: The hydrostatic strength test is the final test and samples shall not be used for any other tests after this test.

Water and other suitable liquids can be used as test fluids.

The following components shall be subjected to hydrostatic strength tests, respectively:

- a) Inlet side of unconnected refueling nozzle (check valve closed);
- b) Outlet side of unconnected refueling nozzle (check valve closed);
- c) Connected refueling nozzle and refueling receptacle (check valve open).

10.8.2 Test procedures and judgments

10.8.2.1 Block the outlets of components a) ~ c) in 10.8.1, and keep the valve seat or internal valve block in the open position.

10.8.2.2 Hydrostatic pressure shall be applied to the components for at least 3 min in accordance with the provisions of 4.4.3.

10.8.2.3 The refueling nozzle and refueling receptacle should not be broken when completing the test.

10.9 Corrosion resistance

10.9.1 The refueling nozzle and the refueling receptacle shall not show corrosion or loss of metal coating after the salt spray test. The refueling nozzle and the refueling receptacle shall pass the subsequent test.

10.9.2 New samples shall be used for testing, the dust cover shall be installed in place, and the exhaust hole shall not be blocked. Components shall be supported to a horizontal position and salt spray test shall be performed in accordance with ISO15500-2.

10.9.3 0.5MPa air shall be continuously applied to the inlet of the refueling nozzle. During the first 8 h of the test, the refueling nozzle shall be operated every hour to transfer air to the atmosphere.

10.9.4 After flushing and carefully removing salt deposits, the refueling nozzle and the refueling receptacle shall comply with the provisions of the leak test at room temperature in 10.4.

10.10 Non-flammability assessment

Materials that are proven to be non-sparking are considered non-flammable materials. Otherwise, the materials shall be evaluated for non-flammability test in accordance with GB/T 43408.

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