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Road vehicles — Liquefied petroleum gas (LPG) fuel system components — Part 7: Remotely controlled service valve with excess flow valve

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 41, *Specific aspects for gaseous fuels*.

A list of all parts in the ISO 20766 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Road vehicles — Liquefied petroleum gas (LPG) fuel system components — Part 7: Remotely controlled service valve with excess flow valve

1 Scope

This document specifies general requirements and definitions of the liquefied petroleum gas fuel component: remotely -controlled service valve with excess flow valve. This component ~~of liquefied petroleum gas fuel,~~is intended for use on the types of motor vehicles as defined in ISO 3833. It also provides general design principles and specifies requirements for instructions and marking.

This document is applicable to vehicles (mono-fuel, bi-fuel or dual-fuel applications) using gaseous fuels in accordance with ISO 9162. It is not applicable to the following:

a) fuel containers;

b) stationary gas engines;

c) container mounting hardware;

d) electronic fuel management;

e) refuelling receptacles.

It is recognized that miscellaneous components not specifically addressed herein can be examined for compliance with the criteria of any applicable part of the ISO 20766 series, including testing to the appropriate functional tests.

All references to pressure in this document are considered gauge pressures unless otherwise specified.

This document applies to device which have a service pressure in the range of 110 kPa (butane rich at 20 °C) and 840 kPa (propane rich at 20 °C), hereinafter referred to in this document. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20766-~~-~~1:2018, *Road vehicles — Liquefied petroleum gas (LPG) fuel systems components — Part 1: General requirements and definitions*

ISO 20766-~~-~~2, *Road vehicles — Liquefied petroleum gas (LPG) fuel systems components — Part 2: Performance and general test methods*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in in ISO 20766-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
commanded stop
period of time during which the combustion engine is switched off automatically for fuel saving and is allowed to start again automatically

4 Markings

The remotely controlled service valve with excess flow valve shall bear, the following clearly legible and indelible identification markings consisting of characters, figures or symbols:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the working pressure and temperature range;

d) the year and month of fabrication;

e) the rated closing flow capacity.

The following additional markings are recommended:

— the direction of flow (when necessary for correct installation);

— the type of fuel;

— electrical ratings (if applicable);

— the symbol of the certification agency;

— the type approval number;

— the serial number or date code;

— a reference to this document, i.e. ISO 20766-7.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

In addition to the markings specified above, if the valve is compatible with start/stop systems, one of the following additional marks shall be used for automatic cylinder valves:

— "H1" if the valve is to be used with an engine that shuts off automatically when the vehicle comes to a halt;

— "H2" if the valve is to be used with an engine that, in addition to a), it also shuts off automatically when the vehicle drives with an electric motor only;

— "H3" if the valve is to be used with an engine that, in addition to a) or b), it also shuts off automatically when the accelerator pedal is released.

5 Construction and assembly

5.1 The remotely controlled service valve with excess flow valve shall be designed to withstand the maximum operating pressure as applicable.

5.2 The remotely controlled service valve with excess flow valve shall be designed to withstand a temperature between the minimum operating temperature and maximum operating temperature in ISO 20766-1:2018, Table 1.

5.3 In order to prevent electrical sparking in case of fracture of the component, the electrically operated remotely controlled service valve with excess flow valve shall:

a) be insulated in a manner that no current is lead through LPG containing parts;

b) have the electrical system of the device isolated from the body.

~~Isolation~~The isolation resistance shall be >~~10MΩ~~10 MΩ.

5.4 In the case where a remotely controlled service valve with excess flow valve is activated by an electric/external power, the valve shall be in “closed” position when its power is switched off.

5.5 The remotely controlled service valve with excess flow valve shall be installed directly on the fuel container, without any intervening fittings.

5.6 The remotely controlled service valve with excess flow valve shall be controlled such that it is automatically closed when the engine is not running, irrespective of the position of the ignition switch, and shall remain closed as long as the engine is not running.

5.7 Notwithstanding the provision of 5.6, in case of liquid injection system, if a fuel recirculation is required to reach the system equilibrium (avoid vapour lock), it is allowed to keep the remotely controlled service valve with excess flow valve open for a period not longer than necessary to reach the system equilibrium (avoid vapour lock) before starting the engine in LPG running mode.

5.8 Notwithstanding the provisions of 5.6, the remotely controlled service valve may stay in an open position during the commanded stop phases.

5.9 In case the service valve is combined with an LPG fuel supply pump, identification of the pump shall be realised by the marking “PUMP INSIDE” and the identification of the pump either on the marking plate of the LPG container or on the multivalve if present. Electrical connections inside the LPG container shall comply with protection degree class IP 40 according to IEC 60529.

5.10 Service valve with liquid LPG at a pressure ≤3 000 kPa shall withstand a pressure of 6 750 kPa in the open and closed position. Service valves with liquid LPG at a pressure >3 000 kPa shall withstand a pressure of 2,25 ~~WP~~the working pressure (WP) in the open and closed position.

5.11 The service valve shall not, at the shut-off position, allow an internal leak rate in the flow direction. There may be leak in the back-flow direction.

5.12 The excess flow valve shall be mounted inside the container.

5.13 The excess flow valve shall be designed with a bypass to allow for equalization of pressures. Where a manual or automated reset is provided, a bypass is not necessary.

5.14 The excess flow valve shall cut off at a pressure difference over the valve of 90 kPa. At this pressure difference the flow shall not exceed 8 000 cm^3/min. For larger engines the value of 8 000 cm^3/min may not be adequate for engine performance. In this case the system designer shall specify a maximum excess flow rate for the engine.

5.15 When the excess flow valve is at cut-off position, the flow through the by-pass shall not exceed 500 cm^3/min at a difference pressure of 700 kPa.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Applicable tests

Test	Applicable	Test procedure as required by ISO 20766-2	Specific test requirements of this document
Hydrostatic strength	X	X	X (see 6.2)
External leakage	X	X	
High temperature	X		X (see 6.3)
Low temperature	X		X (see 6.4)
Seat leakage	X		X (see 6.5)
Continued operation (endurance test)	X	X	X (see 6.6)
Operational test	X		X (see 6.7)
Non-metallic material immersion (LPG compatibility)	X[a]	X	
Corrosion resistance	X[a]	X	
Resistance to dry heat	X[a]	X	
Ozone ageing	X[a]	X	
Creep	X[a]	X	
Temperature cycle	X[a]	X	

[a] Only if applicable.

6.2 Hydrostatic strength

Test the remotely controlled service valve with excess flow valve according to the procedure for testing hydrostatic strength specified in ISO 20766-2. The test pressure shall be 2,25 times the working pressure.

6.3 High temperature

The remotely controlled service valve with excess flow valve shall not leak more than 15 cm^3/h at normal conditions when subjected to the leakage test specified in ISO 20766-2 at the maximum operating temperature (65 °C or 85 °C or 120 °C as applicable) and pressure equal to 150 % of the working pressure. The component shall be conditioned for at least 8 h at this temperature.

6.4 Low temperature

The remotely controlled service valve with excess flow valve shall not leak more than 15 cm^3/h at normal conditions when subjected to the leakage test specified in ISO 20766-2 at the minimum operating temperature (-40 °C or -20 °C as applicable) and pressure equal to 150 % of the working pressure. The component shall be conditioned for at least 8 ~~hours~~h at this temperature.

6.5 Seat leakage test

6.5.1 The following tests for seat leakage shall be conducted on samples of a service valve which has previously been subjected to the external leak test according to the procedure specified in ISO 20766-2.

6.5.2 Seat leakage tests are conducted with the inlet of the sample valve connected to a source of aerostatic pressure, the valve in the closed position, and with the outlet open. A positive shut-off valve and a pressure gauge having a pressure range not less than 1,5 times nor more than 2 times the test pressures shall be installed in the pressure supply piping. The pressure gauge shall be installed between the positive shut-off valve and the sample under test. While under the applied test pressure, observations for leakage are to be made with the open outlet submerged in water unless otherwise indicated.

6.5.3 Conformance with 6.5.5 shall be determined by connecting a length of tubing to the valve outlet. The open end of this outlet tube shall be located within an inverted graduated cylinder which is calibrated in cubic centimetres. The inverted cylinder shall be closed by a water seal. The apparatus shall be adjusted so that:

a) the end of the outlet tube is located approximately 13 mm above the water level within the inverted graduated cylinder, and

b) the water within and exterior to the graduated cylinder is at the same level. With these adjustments made, the water level within the graduated cylinder shall be recorded. With the valve in closed position assumed as the result of normal operation, air or nitrogen at the specified test pressure shall be applied to the valve inlet for a test period of not less than 2 min. During this time, the vertical position of the graduated cylinder shall be adjusted, if necessary, to maintain same water level within and exterior to it.

At the end of the test period and with the water within and exterior to the graduated cylinder at the same level, the level of water within the graduated cylinder is again recorded. From the change of volume within the graduated cylinder, the leakage rate shall be calculated according to the following formula:

$$V_1 = V_t * \frac{60}{t} * \left(\frac{273}{T} * \frac{P}{101,3} \right)$$

~~Where:~~

where

V_1 is the leakage rate, cubic centimetres of air or nitrogen per hour;

V_t is the increase in volume within graduated cylinder during test;

t is the time of the test, in minutes;

P is the barometric pressure during test, in kPa;

T is the ambient temperature during test, in K.

6.5.4 Instead of the method described in 6.5.3, leakage may be measured by a flowmeter installed on the inlet side of the valve under test. The flowmeter shall be capable of indicating accurately, for the test fluid employed, the maximum leakage flow rates permitted.

6.5.5 The seat of a service valve, when in the closed position, shall be free from leakage at any aerostatic pressure between 0 to 3 000 kPa or from 0 to the working pressure (WP) in accordance with working pressure of service valve.

6.6 Continued operation (endurance test)

6.6.1 Test the remotely controlled service valve in accordance with the procedure for testing continued operation given in ISO 20766-2, for 50 000 cycles, but lower the downstream pressure of the test fixture to less than 2 % of the working pressure, and perform the leakage test in accordance with 6.3, 6.4 and 6.5. The valve shall continue to operate according to the manufacturer's specifications.

6.6.2 Following cycling and leakage testing, perform the hydrostatic strength test in accordance with 6.2.

6.6.3 If the remotely controlled service valve is to be used in vehicles with start-stop systems, and closed during commanded stop phases, the valve shall be submitted to the following numbers of operations during test:

a) 200 000 cycles (mark “H1”) if the engine shuts off automatically when the vehicle comes to a halt;

b) 500 000 cycles (mark “H2”) if, in addition to a), the engine also shuts off automatically when the vehicle drives with the electric motor only;

c) 1 000 000 cycles (mark “H3”) if, in addition to a) or b), the engine also shuts off automatically when the accelerator pedal is released.

6.7 Operation test for excess flow valve

6.7.1 An excess flow valve shall operate at not more than 10 % above, nor less than 20 % below the rated closing flow capacity specified by the manufacturer, and shall close automatically at a pressure differential across the valve of not more than 100 kPa during the operation tests described below.

6.7.2 Three samples of each size and style of valve are to be subjected to these tests. A valve intended for use only with liquid shall be tested with water, otherwise the tests are to be made both with air and with water. Except as indicated in 6.7.3, separate tests are to be run with each sample installed in vertical, horizontal and inverted positions. The tests with air ~~to~~shall be made without piping or other ~~restriction~~restrictions connected to the outlet of the tests sample.