INTERNATIONAL STANDARD

ISO 19825

First edition
2018-11

Road vehicles — Liquefied petroleum gas (LPG) refuelling connector

Véhicules routiers — Connecteur de remplissage en gaz de pétrole liquéfié (GPL)

Reference number
ISO 19825:2018(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

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.

Introduction

This document was developed for the design, examination, testing and certification of newly produced Liquefied Petroleum Gas Vehicle fuelling nozzles and receptacles only.

A nozzle compliant with this document is functionally compatible from a safety and performance perspective with all listed receptacles of compatible profile and system pressure. Similarly, a receptacle compliant with this document is functionally compatible from a safety and performance perspective with all listed nozzles of compatible profile and system pressure.

These standard profiles incorporate the design specifications (mating materials, geometry and tolerances) which can be considered in the certification of a submitted nozzle or receptacle.

Road vehicles — Liquefied petroleum gas (LPG) refuelling connector

1 Scope

This document applies to Liquefied Petroleum Gas vehicle nozzles and receptacles, hereinafter referred to as devices, constructed entirely of new, unused parts and materials. Liquefied Petroleum Gas fuelling connectors consist of the following components, as applicable:

a) nozzle (mounted on dispenser side) (see Clause 5);

b) receptacle (mounted on vehicle) (see Clause 7).

This document applies to devices which have a gauge service pressure in the range of 110 kPa (Butane rich at 20 °C) and 840 kPa (Propane at 20 °C), hereinafter referred to as [see 9.1 c)]:

— J15;

— K15.

This document also applies to:

— devices with standardized mating components;

— connectors which prevent Liquefied Petroleum Gas vehicles from being fuelled by other gaseous fuels station dispensers; and

— Liquefied Petroleum Gas in accordance with ISO 9162.

NOTE All references to pressures (kPa) throughout this document are considered gauge pressures unless otherwise specified.

This document does not apply to the fuel system of vehicle, with the exception of the Liquefied Petroleum Gas receptacle.

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 188, *Rubber vulcanized — Accelerated ageing or heat-resistance tests*

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ASTM D4814, *Standard Specification for Automotive Spark-Ignition Engine Fuel*

3 Terms and definitions

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

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

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

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

3.1
dry air
air with moisture content such that the dew point of the air at the required test pressure is at least 11 °C below the ambient test temperature

3.2
working pressure
maximum pressure that a connector can be expected to withstand in actual service

3.3
Liquefied Petroleum Gas
LPG
autogas
low pressure gas composed of one or more light hydrocarbons which are assigned to UN 1011, UN 1075, UN 1965, UN 1969 or UN 1978 only and which consists mainly of propane, propene, butane, butane isomers, butene with traces of other hydrocarbon gases

3.4
nozzle
Liquefied Petroleum Gas refuelling nozzle
device which permits quick connection and disconnection of fuel supply hose to the *Liquefied Petroleum Gas receptacle* (3.5) in a safe manner

3.5
receptacle
Liquefied Petroleum Gas refuelling receptacle
device connected to a vehicle or storage system which receives the *Liquefied Petroleum Gas nozzle* (3.4) and permits safe transfer of fuel

3.6
connector
Liquefied Petroleum Gas refuelling connector
joined assembly of *Liquefied Petroleum Gas nozzle* (3.4) and *receptacle* (3.5)

3.7
non-sparking material
material that does not contain, by mass, more than 7,5 % in total of magnesium, titanium and zirconium

[SOURCE: IEC 60079-0:2017, 8.3]

3.8
service gasket
replaceable gasket ensuring tightness of the connection between the nozzle outlet and the receptacle inlet

3.9
cycle life
number of connections and disconnections between the *nozzle* (3.4) and the *receptacle* (3.5) required for testing purposes

3.10
service life
number of operations of the *receptacle* (3.5) required for testing purposes

4 General construction requirements

4.1 Nozzles and receptacles shall be designed in accordance with reasonable concepts of safety, durability and maintainability.

1) There are two different sizes of connectors, J15 and K15.

   The profile of the two different sizes is so different that no cross connection between the sizes is possible.

2) Working pressure. All nozzles and receptacles are designed to have a working pressure defined by the manufacturer and clearly marked on the device [see 9.1 d)].

3) Design life. All nozzles shall be tested at 100 000 connect/disconnect cycles and all receptacles at 20 000 connect/disconnect cycles for compliance with this document. The service gasket may be changed at a minimum of 20 000 cycles.

4.2 Nozzles and receptacles shall be manufactured to the dimensional requirements of this document and in accordance with good engineering practice. All construction requirements can be met by either the construction specified in this document or another construction that gives at least equivalent performance.

4.3 Nozzles and receptacles shall be:

— designed to minimize the possibility of incorrect assembly;

— designed to be secure against displacement, distortion, warping or other damage under normal and anticipated abnormal conditions;

— designed to release less than 1 cm^3 of liquid LPG during disconnection; and

— constructed to maintain operational integrity under normal and anticipated abnormal conditions of handling and usage;

— manufactured and produced according to a test plan as described in Annex B.

4.4 Nozzles and receptacles shall be manufactured of materials suitable and compatible for use with Liquefied Petroleum Gas in accordance with ISO 9162, at the pressure and the temperature ranges to which they will be subjected.

4.4.1 The temperature range shall be:

For the receptacle:

— Moderate operating conditions: −20 °C to +85 °C

— Cold operating conditions: −40 °C to +85 °C

For the nozzle:

— Moderate operating conditions: −20 °C to +65 °C

— Cold operating conditions: −40 °C to +65 °C

For specific regions, the temperature range specified may not be sufficient. In such a case, a wider temperature range, representative of that specific region, shall be considered.

4.5 Nozzles and receptacles shall be operated either to connect or disconnect without the use of tools and with one hand operation.

4.6 Jointing components shall provide gas-tight sealing performance.

5 Nozzles

The design of the nozzle shall ensure that:

— it is compatible with the relevant receptacle as specified in Clause 6;

— entrapment of fingers and/or cold burns are not possible;

— the maximum push-on force during connection is 100 N at any pressure up to 1 500 kPa in the nozzle;

— the maximum pull-off force during disconnection is 50 N at 1 500 kPa;

— the force on the lever, if any, to open the valve applied at the centre of the grip area of the lever, is 100 N maximum at any pressure up to 1 500 kPa in the nozzle;

— where a latch is provided and in use, it shall be capable of being normally disarmed by the user;

— provision is made to enable the lever or the whole nozzle to freely rotate over an angle of 360° around the longitudinal axis of the nozzle or the filling hose; the requirement can be met by the integration of a swivel between nozzle and hose with provision of UL 567 requirements;

— it is not possible to open the valve in the nozzle if the nozzle is not properly locked and sealed on the receptacle;

— a locking mechanism is incorporated that locks in the connected position;

— it is not possible to unlock the nozzle from the receptacle unless the nozzle valve is closed;

— internal blocking due to freezing does not occur under intended operating conditions;

— it will withstand a torque of 150 % of the mounting torque specified by the manufacturer without damage;

— the external surfaces of the filling nozzle are corrosion resistant or protected against corrosion and are made of materials (non-sparking materials) that do not cause sparks when dropped on a surface;

— changing the service gasket shall not result in any Liquefied Petroleum Gas release;

— the minimum cycle life of the service gasket is 20 000 cycles;

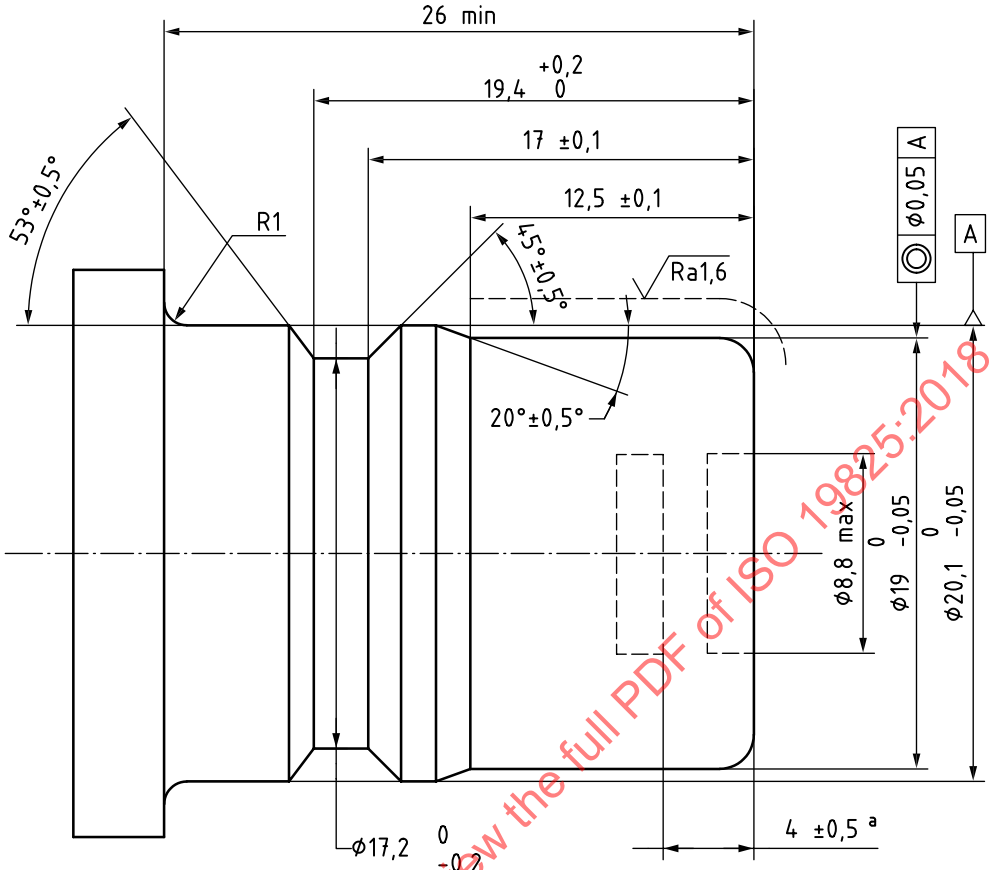
— the nozzle is provided with a means to attach it to the delivery hose;

— the nozzle shall comply with the performance requirements of Clause 10 to ensure interchangeability.

6 Standard receptacle dimensions J15 and K15

A receptacle shall comply with the design specifications detailed in Figures 1 and 2.

Dimensions in millimetres



Key

A reference for geometrical tolerances

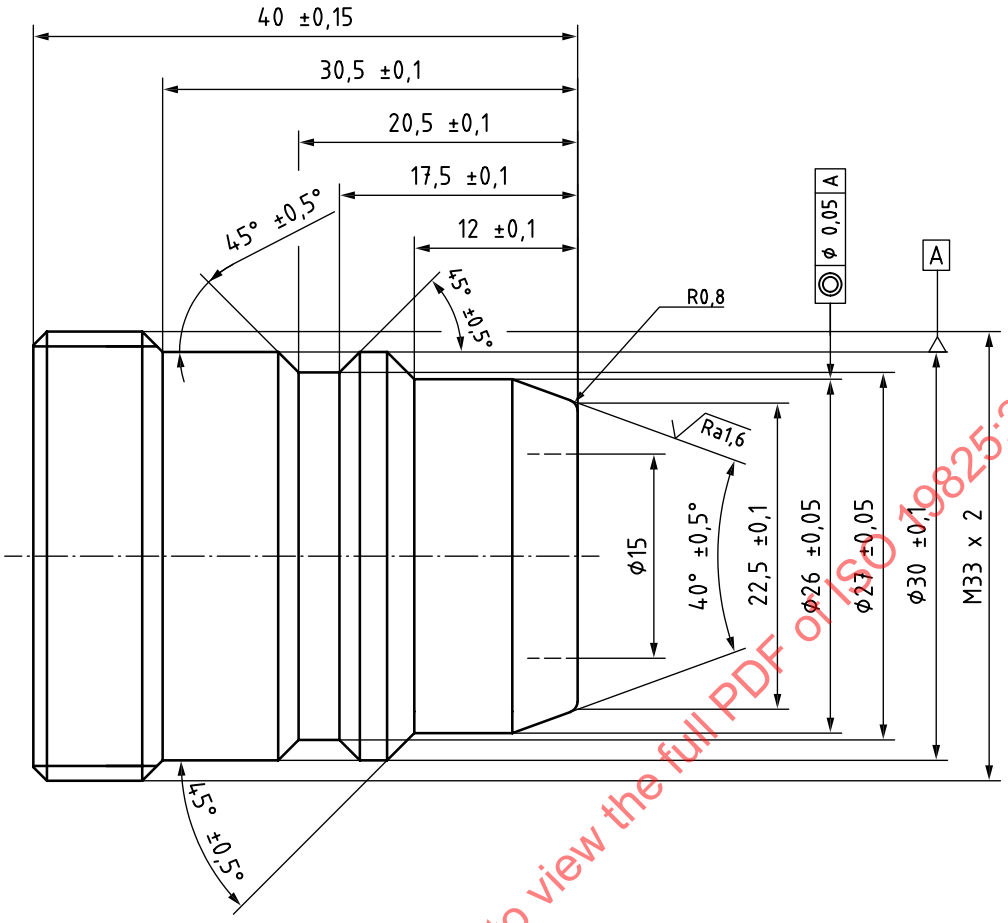
Ra surface roughness

*R*1 radius

[a] Stroke.

Figure 1 — J15 Receptacle

Dimensions in millimetres



Key

A reference for geometrical tolerances

Ra surface roughness

R radius

Figure 2 — K15 Receptacle

7 Receptacles

7.1 Receptacles shall comply with Clauses 4, 6 and 10 and shall be evaluated with a test nozzle which is already certified to this document.

The failure of any test conducted with the receptacle and nozzle test samples shall constitute a failure of the submitted receptacle, unless the manufacturer can prove the problem was caused by the test nozzle.

7.2 The receptacle shall be equipped with an internal check valve to prevent the escape of gas. Regardless of whether the check valve is opened mechanically or by differential pressure, the flow through the receptacle, when tested with water, at a differential pressure of 30 kPa, shall be at least 3 l/min.

The dead volume between the front sealing surface and the front of the internal check valve shall not exceed 0,1 cm^3.

7.3 The method for attaching the receptacle to the vehicle fuel system shall not rely on the joint between the male and female threads for sealing, such as conical threads.

7.4 The interfacing surface of the receptacle shall be constructed of material that does not cause sparks (non-sparking) and ensures electrical continuity (see 10.8.8).

7.5 The receptacle shall have provisions to be firmly attached to the vehicle and shall comply with applicable abnormal load tests (see 10.4).

7.6 The receptacle shall be mounted on the vehicle in compliance with Annex A.

7.7 The receptacle shall not be installed in an area that exceeds a temperature of 85 °C.

7.8 Receptacles shall have a cycle life of more than 10 000 cycles, but a service life of more than 100 000 cycles

8 Instructions

Information required for instructions and provisions shall be in an easily understood form.

Special tools required for connection of receptacles to tubing shall be clearly identified in the instructions.

Manufacturers of receptacles and nozzles shall provide clear and concise printed instruction and diagrams in a form that can be easily understood and adequate for:

— proper field assembly;

— installation;

— maintenance;

— replacement of components as appropriate;

— for safe operation by all users;

— suitability and use; and

— storage and handling.

9 Marking

9.1 Information required for marking and provisions shall be in an easily understood form. Marking should be embossed, cast, stamped or otherwise formed in the part. This includes markings baked into an enamelled surface.

Nozzles and receptacles shall bear the following information:

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

b) the model designation;

c) J15 or K15;

d) the working pressure;

e) the minimum design temperature;

f) the manufacturer code to ensure traceability; and

g) if required, a certification mark.

9.2 A marking to identify this document (i.e. ISO 19825) shall be provided for each system. This marking may be located on the package or on a notice placed inside the package in which the device is shipped.

10 Tests

10.1 General requirements

A nozzle and receptacle shall be tested with receptacle and nozzle designs specified in Clauses 4 to 9.

Unless otherwise stated:

a) tests shall be conducted at room temperature (20 ± 5) °C;

b) all pressure or leak tests shall be conducted with dry air, nitrogen, or any other suitable gas; and

c) devices shall be conditioned to attain equilibrium conditions.

The tolerances for test temperatures and pressures shall be:

— for low temperatures: $\binom{+0}{-5}$ °C;

— for high temperatures: $\binom{+5}{-0}$ °C;

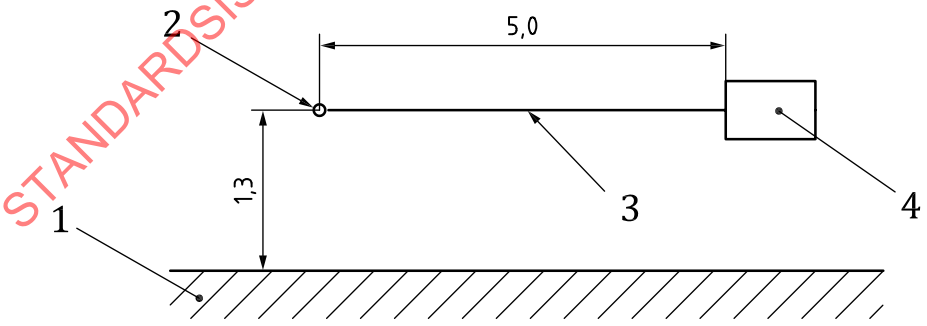
— test pressures: ±10 % of the stated value with a maximum of 100 kPa.

10.2 Impact resistance

10.2.1 Nozzle test

A nozzle conditioned for 4 h at −20 °C for moderate operating conditions or −40 °C for cold operating conditions shall be connected to a 5 m length of 19 mm internal diameter refuelling hose at room temperature, and then dropped 1,3 m onto a concrete floor as shown in Figure 3. The nozzle shall be dropped ten times at room temperature, then pressurized at the working pressure and subjected to ten additional drops. Following the above drops, the nozzle shall be capable of normal connection and disconnection to the receptacle. In addition, the nozzle shall comply with leakage tests specified in 10.3.

Dimensions in metres



Key

1 horizontal concrete floor
2 solid fixing point
3 hose
4 nozzle

Figure 3 — Impact resistance test arrangement

10.2.2 Receptacle test

The receptacle shall be subjected to an impact test of 10 J. A hardened steel mass of 1 kg shall be dropped from a height of 1 m so as to deliver the impact velocity 4,4 m/s. This shall be achieved by mounting the mass in a pendulum. The receptacle shall be installed horizontally on a solid object. The impact of the mass shall be on the centre of the protruding part of the receptacle (see Figure A.1). Following the above impact test, the receptacle shall comply with leakage tests specified in 10.3.

10.3 Leakage at room temperature

Tests shall be conducted at 2 different pressures: 20 kPa and 1,5 times the working pressure.

Pressurized air or nitrogen shall be applied to the coupled (and uncoupled) device. The external body shall then be checked for bubble leakage using immersion in room temperature water.

Nozzles and receptacles, coupled and uncoupled, shall be either bubble free on the leak test for 2 min or have a leak rate less than 15 cm^3/h (normal). The leak rate shall be determined according to the following method or any other equivalent method.

A graduated cylinder that is calibrated in cubic centimetres, filled with the test liquid, shall be placed inverted above the component.

At the end of the test period, the liquid displacement in the graduated cylinder is recorded.

The leakage rate is then calculated using Formula (1):

$$V_l = V_t \frac{60}{t}\left(\frac{273P}{101,6T}\right) \quad (1)$$

where

V_l is the leakage rate, cm^3/h of air or nitrogen;

V_t is the liquid displacement during the test in cm^3;

t is the time of test, minutes;

P is the atmospheric pressure during test in kPa;

T is the ambient temperature during test in K.

10.4 Abnormal loads

10.4.1 General

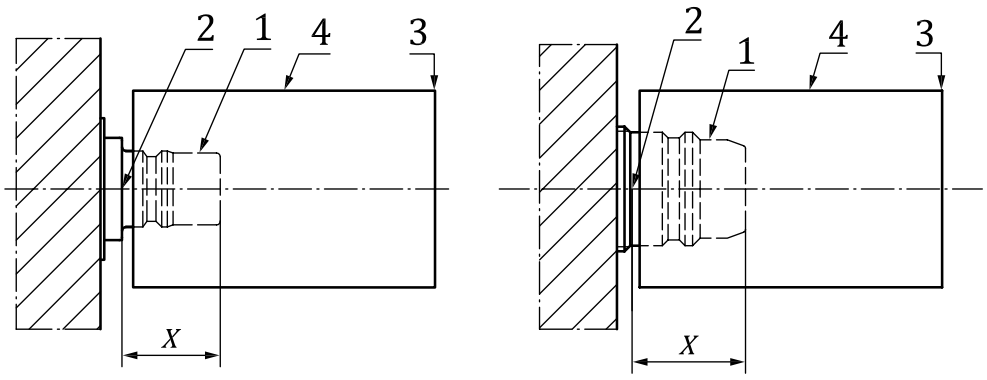
The connected nozzle and receptacle shall be subjected to the following abnormal loads for a period of 5 min in service. These tests shall conducted separately:

a) pulls along the nozzle or receptacle's longitudinal axis;

b) moments applied in a worst case manner.

The nozzle and receptacle shall be able to withstand abnormal loads of (a = 1 350 N; b = 120 Nm) without distortion or damage and (a = 2 000 N; b = 240 Nm) without becoming so damaged as to leak. The load and moment arm shall be measured about a point X = 26 mm (for J15) and 30 mm (for K15) from the front of the receptacle to the hose inlet of the nozzle (see Figure 4).

After completing these tests, the receptacle shall comply with 10.3.



J15 K15

Key

1 receptacle
2 abnormal load reference
3 moment
4 nozzle
X distance as described

Figure 4 — Abnormal load test

10.4.2 Testing the unpressurised condition

The receptacle and nozzle shall not be pressurized during the abnormal load tests.

The receptacle shall be mounted as a cantilever to a supporting member in accordance with the manufacturer's instructions. For the purposes of this test, the supporting member shall be capable of withstanding the specified loads without displacement or deflection.

The loads applied and the device's ability to resist damage shall be as specified in 10.4. After completing the tests, the receptacle shall comply with 10.3.

10.4.3 Testing the pressurised condition

The receptacle and nozzle shall be pressurized with air, nitrogen, water or any adequate liquid to the working pressure during the abnormal load tests.

The receptacle shall be mounted as a cantilever to a supporting member in accordance with the manufacturer's instructions. For the purposes of this test, the supporting member shall be capable of withstanding the specified loads without displacement or deflection. The nozzle shall be properly connected to the receptacle.

The loads applied and the devices ability to resist damage shall be as specified in 10.4. After completing the tests, the receptacle shall comply with 10.3.

10.5 Mounting hardware torque

The receptacle and mounting hardware shall withstand, without damage, a turning force equal to 150 % of the manufacturer's recommended mounting hardware fastening torque.

10.6 Leakage at low and high temperatures

All tests shall be conducted while the nozzles and receptacles are continuing to be exposed to the minimum and maximum test temperatures as defined in 4.4.1.

At each test condition the nozzles and receptacles shall be maintained at the specified temperature for at least 4 h.

Tests shall be conducted at 2 different pressures for each temperature: 100 kPa and 1,5 times the working pressure.

Pressurized air or nitrogen shall be applied to the coupled (and uncoupled) device. The external body shall then be checked for bubble leakage using:

a) at –20 °C for moderate operating conditions or –40 °C for cold operating conditions, immersion in alcohol or another adequate liquid;

b) at 65 °C (nozzles) or 85 °C (receptacles), immersion in water or another adequate liquid.

Nozzles and receptacles, coupled and uncoupled, shall be either bubble free on the leak test for 2 min or have a leak rate less than 15 cm^3/h. The leak rate shall be determined according to 10.3.

10.7 Nozzle freezing

The test shall be carried out as follows:

a) connect the nozzle to a receptacle for which it is designed;

b) plug the outlet of the receptacle;

c) fill the nozzle with pentane to which 200 mg/kg of water is added and plug the inlet of the nozzle;

d) condition the assembly to –20 °C for moderate operating conditions or –40 °C for cold operating conditions, for 4 h;

e) hold the nozzle and the receptacle in the upright position with the receptacle at the bottom;

f) remove the pentane from the nozzle by disconnecting the receptacle from the nozzle and remove the plug from the inlet of the nozzle;

g) carry out an external leak test, according to 10.6, of the unconnected nozzle at –20 °C for moderate operating conditions or –40 °C for cold operating conditions, without warming up the nozzle during the procedure.

The nozzle shall pass the test if it passes the external leak test at –20 °C for moderate operating conditions or –40 °C for cold operating conditions.

10.8 Durability

10.8.1 Endurance

10.8.1.1 General

A durability cycle test shall be carried out at the working pressure and at 20 °C with air, nitrogen, water or any adequate liquid.

10.8.1.2 Nozzle test

All nozzles shall be capable of withstanding a number of 100 000 cycles as follows.

For the purposes of this test, one cycle of operation shall be:

1) properly connecting the pressurized nozzle to a receptacle for which the nozzle has been designed;

2) idling a minimum of 3 s between connecting and disconnecting; and

3) disconnecting the nozzle.

Precautions shall be taken to avoid large temperature variations of the nozzle.

The service gasket replacement after 20 000 cycles shall be acceptable.

Before and after changing the service gasket and at the end of the test, an external leak test of the coupled nozzle shall be performed according to 10.3.

At the end of the test, an external leak test of the uncoupled nozzle shall also be performed according to 10.3.

NOTE Replacement of the receptacle is permitted every 10 000 cycles.

The release volume at disconnection shall be measured at the end of the test.

After the test, a visual examination of all components of the nozzle shall be carried out.

The nozzle shall pass the test if:

a) it shows no deformation or excessive wear likely to indicate an early failure of any component of the nozzle;

b) it complies with requirements of 10.3; and

c) it does not have a release volume greater than 1 cm^3 liquid.

10.8.1.3 Receptacle test

A receptacle shall be capable of withstanding a number of 10 000 cycles of operation as follows.

For the purposes of this test, one cycle of operation shall be:

1) properly connecting a pressurized nozzle for which the receptacle has been designed, to the receptacle;

2) idling a minimum of 3 s between connecting and disconnecting; and

3) disconnecting the receptacle from the nozzle.

The receptacle shall pass the test if:

a) it shows no deformation or excessive wear likely to indicate an early failure of any component of the receptacle,

b) it complies with requirements of 10.3.

10.8.1.4 Receptacle check valve test

The receptacle check valve shall be bubble free on the leak test for 1 min and be capable of withstanding 100 000 cycles of operation and 24 h of the flow conditions that cause the most severe chatter.

The receptacle shall be connected to a nozzle test fixture. The working pressure shall be applied to the nozzle and receptacle. Pressure shall then be vented from the upstream side of the receptacle check valve. Pressure on the downstream side of the receptacle check valve shall be lowered to between 0 and a maximum of half of the working pressure prior to the next cycle.

Following 100 000 cycles of operation, the receptacle check valve shall be subjected to 24 h of flow at the inlet/outlet flow conditions that cause the most severe chatter. The receptacle shall then be tested for compliance with requirements of 10.3.

10.8.2 Corrosion resistance

10.8.2.1 Nozzle test

Any metallic part of a nozzle, subject to Liquefied Petroleum Gas pressure and exposed to corrosive conditions during its normal life, shall be submitted to 144 hours salt spray test in accordance with ISO 9227.

As option to the salt spray test described in this document, the metal LPG component shall comply with the following. Before the test, the part shall be degreased. Subsequently, the part shall be sprayed for 2 h with a salt solution containing 5 % NaCl (by mass) with less than 0,3 % contamination and 95 % distilled or demineralized water, at a temperature of 20 °C. After spraying, the part shall be stored at a temperature of 40 °C and 90 % to 95 % relative humidity for 168 h.

This spray and hold sequence shall be repeated 4 times.

Following this, the part shall be cleaned and dried for 1 h at 55 °C.

The part shall be conditioned to 20 °C for 4 h.

The tested part shall be reinstalled in the device and the device shall be subjected to the test of 10.3.

The part shall pass the test if the device complies with requirements of 10.3.

10.8.2.2 Receptacle test

Receptacles shall perform safely and in compliance with 10.3 and 10.6 following exposure to salt spray according to one of the following test methods, at choice of the manufacturer. AISI series 300 Austenitic stainless steels are exempt from corrosion resistance testing.

With the receptacle supported in its normal installed position, expose it for 144 h to a salt spray (fog) test as specified in ISO 9227. If the component is expected to operate in vehicle underbody service conditions, and not protected, then it shall be exposed for 500 h to the salt spray (fog) test.

Maintain the temperature within the fog chamber at between 33 °C and 36 °C.

The saline solution shall consist of 5 % sodium chloride and 95 % distilled water, by weight.

After the corrosion test, immediately rinse the sample and gently clean it of salt deposits; then subject it to the test according to 10.3 and 10.6.

After leakage re-testing, immediately subject it to the test according to 10.9.

As option to the salt spray test described in this document, the metal LPG component shall comply with the test procedure specified in 10.8.2.3.

10.8.2.3 Test procedure

Before the test the component shall be cleaned according to the instructions of the manufacturer. All the connections shall be closed off. The component shall not be operated during the test.

Subsequently, the component shall be submitted during 2 h to spraying with a solution of salt, containing 5 % NaCl (mass %) with less than 0,3 % contamination and 95 % distilled or demineralized water, at a temperature of 20 °C. After the spraying the component is stored at temperature of 40 °C and 90 % to 95 % relative humidity for 168 h. This sequence shall be repeated 4 times.

After the test the component shall be cleaned and dried during 1 h at 55 °C. The component shall be conditioned to reference conditions during 4 h, before submitting it to further testing.

After the corrosion resistance test, immediately rinse the sample and gently clean it of salt deposits; then subject it to the leakage test according to Clause 6.

After the leakage test, immediately subject the sample to the hydrostatic strength test according to Clause 5.

10.8.3 Brass material compatibility

Any brass part subject to Liquefied Petroleum Gas pressure for which a satisfactory declaration of properties is not submitted by the applicant shall be tested according to the following procedure (part manufacturers able to provide documentation attesting to the field-worthiness of their products are exempted from this requirement).

a) Subject each test sample to the physical stresses normally imposed on, or within, a part as a result of assembly with other parts. Apply these stresses to the sample prior to the test, and maintain them during it. Samples with thread, intended to be used for installing the product in the field, shall have the threads engaged and tightened to the torque specified in the instruction manual of the sample. PolyTetraFluorEthylene (PTFE) tape or pipe compounds shall not be used on the threads.

b) Degrease three samples and continuously expose them for 10 days at a set position to a moist, ammonia-air mixture maintained in a glass chamber of approximately 30 l capacity and with a glass cover. Aqueous ammonia having a specific gravity of 0,94 shall be maintained at the bottom of the glass chamber below the samples at a concentration of 21,2 ml per litre of chamber volume. Maintain approximately 600 cm^3 of aqueous ammonia, with a relative density (specific gravity) of 0,94, at the bottom of the glass chamber, below the samples. Position the samples 40 mm above the aqueous ammonia solution, supported by an inert tray. Maintain the moist ammonia-air mixture in the chamber at atmospheric pressure and at a temperature of 34 °C ± 2 °C.

After being subjected to the conditions of this procedure, samples shall show no evidence of cracking when examined at 25× magnification.

10.8.4 Resistance to dry heat

Any non-metallic part subject to Liquefied Petroleum Gas pressure and to atmospheric conditions, shall be submitted to the resistance to dry heat test.

The test shall be carried out in accordance with ISO 188. The test piece shall be exposed to air at 65 °C for 168 h.

The part shall pass the test if the loss of tensile strength does not exceed 25 % and the change in ultimate elongation does not exceed the following values:

— maximum increase: 10 %, and

— maximum decrease: 30 %.

10.8.5 Ozone ageing

Any non-metallic part subject to Liquefied Petroleum Gas pressure and to atmospheric conditions, shall be listed and rated by the manufacturer as being resistant to ozone ageing. Otherwise, they shall not crack or show visible evidence of deterioration subsequent to ozone ageing as specified herein.

The test shall be in compliance with ISO 1431-1.

The test piece, stretched by 20 % in elongation shall be exposed to air at 40 °C with an ozone concentration of 50 parts per hundred million during 72 h.

The part shall pass the test if no cracks are visible in the elongated position.

10.8.6 Temperature cycle

Any non-metallic part subject to Liquefied Petroleum Gas pressure shall be submitted to a 120 min temperature cycle test, from the minimum design temperature up to the maximum design temperature, at the working pressure, for 96 h.

After this test, the part shall be fitted in the device, which shall be subjected to 10.3.

The part shall pass the test when the device, with the tested part, passes the external leak tests.

10.8.7 Compatibility with Liquefied Petroleum Gas

Sealing materials subject to Liquefied Petroleum Gas pressure shall be submitted to an immersion test carried out with pentane or any alternative representative fluid that has the same characteristics as propene in accordance with ISO 1817.

The material shall pass the test if the maximum increase in volume measured immediately after the immersion test in accordance with ISO 1817 does not exceed 20 % and the loss of weight after drying does not exceed 5 %.

10.8.8 Electrical continuity

The tests shall be conducted prior to and after endurance cycling of the nozzle (see 10.8.1.1).

The electrical continuity through the body of the nozzle shall be measured as follows:

a) connect the nozzle to a receptacle for which it has been designed;

b) connect one probe of an Ohm meter with a range of at least 100 Ω to 10 kΩ, to the nozzle inlet;

c) connect the other probe to a point of the receptacle;

d) measure and record the resistance in ohms;

e) repeat for four other points on the nozzle inlet.

The nozzle shall pass the test if all five electrical resistance measurements do not exceed 1 kΩ.

10.9 Overpressure

The tests shall be conducted after endurance cycling test (see 10.8.1).

The test pressure shall be 2,25 times the working pressure.

The test shall be performed at 20 °C.

The outlet of the nozzle shall be connected to the receptacle, for which the devices are designed. The outlet of the receptacle shall be plugged.

The test medium shall be water or any other suitable liquid.

The pressure shall be raised at a maximum rate of 1 000 kPa per minute until the test pressure is reached.

The test pressure shall then be maintained for at least 1 min.

The device shall withstand the overpressure test without any visible evidence of rupture or permanent distortion.

10.10 Oxygen ageing

No synthetic or non-metallic parts of components that provide a fuel containing seal shall crack or show visible evidence of deterioration after oxygen ageing when tested in accordance with the following procedure.

Expose representative samples to oxygen for a minimum of 96 h at a temperature of 70 °C ± 5 °C and a pressure of at least 2 MPa, in accordance with ISO 188.

10.11 Non-metallic material immersion

10.11.1 Non-metallic material used in a component shall be subjected by the test agency to the tests described in 10.11.2 and 10.11.3, except where the applicant submits a test result declaration for tests carried out on the material provided by the manufacturer.

10.11.2 A part made of non-metallic material in contact with LPG shall not show excessive change in volume or weight when tested with n-pentane or any alternative representative fluid that has the same characteristics as propene according to ISO 1817 with the following conditions:

a) Temperature: 23 °C ± 2 °C for temperate countries or 27 °C ± 2 °C for tropical and subtropical countries;

b) Immersion period: 72 h.

   — Prepare, measure, and weigh a representative sample or samples of each non-metallic synthetic material used in a component. Immerse the sample or samples according to the conditions above.

   — Maximum change in volume: 20 %.

   — After storage in air with a temperature of 40 °C for a period of 48 h the mass compared to the original value may not decrease more than 5 %.

10.11.3 A part made of non-metallic material in contact with LPG shall not show excessive change in volume or weight when tested in accordance with the following procedure.

a) Prepare, measure and weigh one or more representative samples of each non-metallic material used in a component, then immerse the sample or samples at room temperature in LPG, at a pressure equal to its working pressure, but not less than 100 kPa, for a minimum of 70 h.

b) Rapidly reduce the test pressure to atmospheric pressure without causing shredding or disintegration.

No tested sample shall exhibit swelling greater than 25 % or shrinkage greater than 1 %. The weight change shall not exceed 10 %.

10.11.4 Non-metallic material used in a component that is likely to be exposed to ester-based or alpha-olefin- based synthetic compressor oils, including non-synthetic compressor oils, shall not show excessive change in volume or weight when tested in accordance with ISO 1817 or the following procedure.

a) Prepare, measure and weigh one or more representative samples of each non-metallic material used in a component, then immerse the sample or samples at room temperature in holders, each containing one of the test fluids, for a minimum of 70 h.

b) Remove and measure the test samples, within 1 h.

No sample shall exhibit swelling greater than 25 % or shrinkage greater than 1 %. The weight change shall not exceed 10 %