

Proposal for amendments to Regulation No. 67 (Equipment for liquefied petroleum gas (LPG))

The text reproduced below was prepared by the expert from The Netherlands in order to introduce the possibility for non-seamless gas tubes. The modifications to Regulation No. 67 are marked in bold for new characters and strikethrough for deleted characters.

I. Proposal

Regulation No. 67

Uniform provisions concerning:

- I. Approval of specific equipment of vehicles of categories M and N using liquefied petroleum gases in their propulsion system**
- II. Approval of vehicles of categories M and N fitted with specific equipment for the use of liquefied petroleum gases in their propulsion system with regard to the installation of such equipment**

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1. Scope

This Regulation applies to:

- 1.1. Part I Approval of specific equipment of vehicles of category M and N¹ using liquefied petroleum gases in their propulsion system;
- 1.2. Part II Approval of vehicles of category M and N¹ fitted with specific equipment for the use of liquefied petroleum gases in their propulsion system with regard to the installation of such equipment.

2. Definition and classification of components

LPG components for use in vehicles shall be classified with regard to the maximum operating pressure and function, according to Figure 1.

Class 0 High pressure parts including tubes and fittings containing liquid LPG with a pressure > 3,000 kPa.

Class 1 High pressure parts including tubes and fittings containing liquid LPG at vapour pressure or increased vapour pressure up to 3,000 kPa.

Class 2 Low pressure parts including tubes and fittings containing vaporized LPG with a maximum operating pressure below 450 kPa and over 20 kPa above atmospheric pressure.

Class 2A Low pressure parts for a limited pressure range including tubes and fittings containing vaporized LPG with a maximum operating pressure below 120 kPa and over 20 kPa above atmospheric pressure.

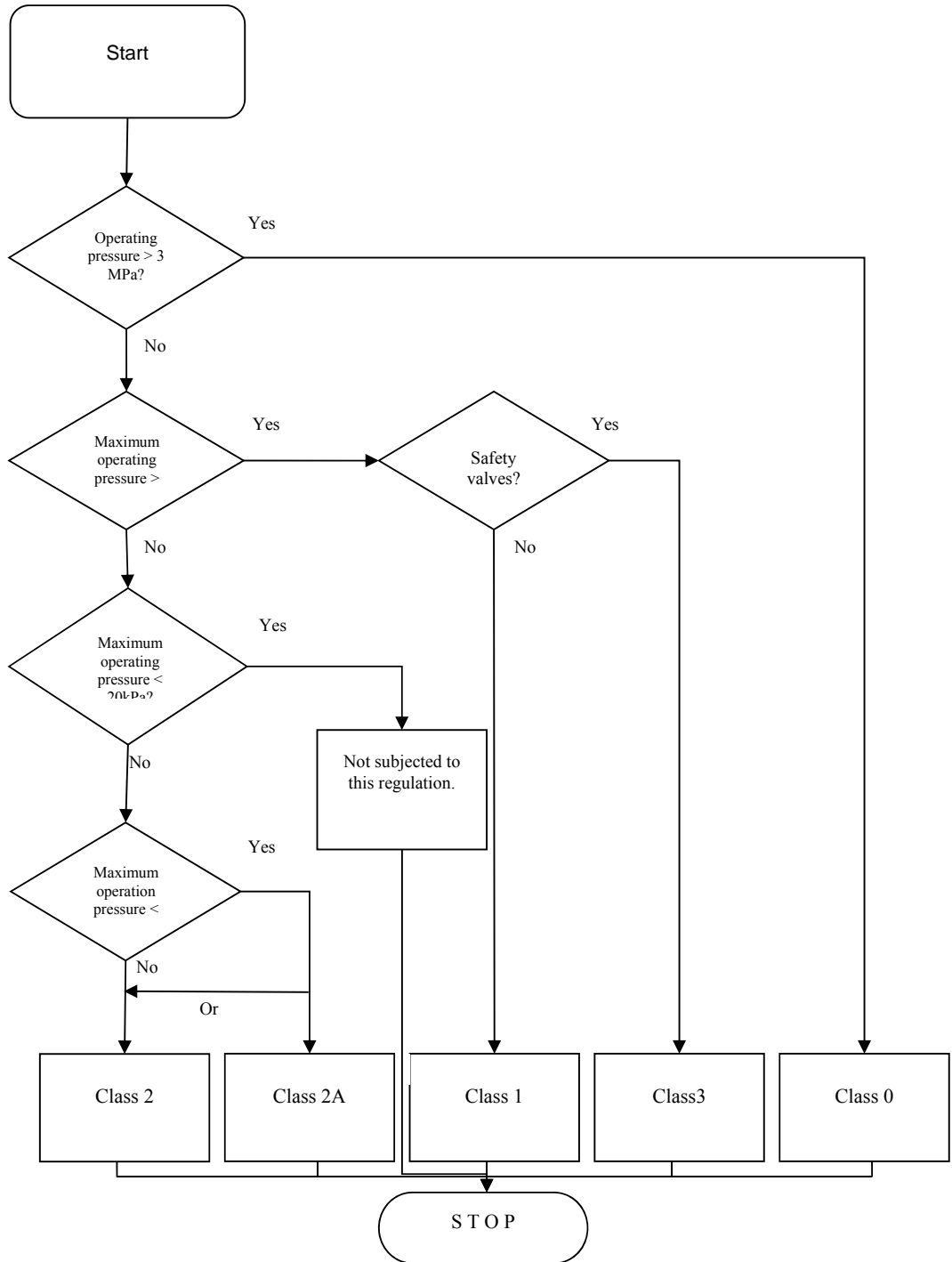
Class 3 Shut-off valves and pressure relief valves, when operating in the liquid phase.

LPG components designed for a maximum operating pressure below 20 kPa above atmospheric pressure are not subjected to this Regulation.

A component can consist of several parts, each part classified in his own class with regard to maximum operating pressure and function.

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2
<http://www.unece.org/trans/main/wp29/wgs/wp29gen/wp29resolutions.html>

Figure 1
Classification with regard to maximum operating pressure and function



- 2.1. "*Pressure*" means relative pressure versus atmospheric pressure, unless otherwise stated.
- 2.1.1. "*Service pressure*" means the settled pressure at a uniform gas temperature of 15 °C.
- 2.1.2. "*Test pressure*" means the pressure to which the component is subjected during the approval test.
- 2.1.3. "*Working pressure (WP)*" means the maximum pressure to which the component is designed to be subjected and on the basis of which its strength is determined.
- 2.1.4. "*Operating pressure*" means the pressure under normal operating conditions.
- 2.1.5. "*Maximum operating pressure*" means the maximum pressure in a component which might arise during operation.
- 2.1.6. "*Classification pressure*" means the maximum allowable operating pressure in a component according to its classification.
- 2.2. "*Specific equipment*" means:
 - (a) The container;
 - (b) The accessories fitted to the container;
 - (c) The vaporizer/pressure regulator;
 - (d) The shut-off valve;
 - (e) The gas injection device or injector or gas mixing piece;
 - (f) The gas dosage unit either separate or combined with the gas injection device;
 - (g) Flexible hoses;
 - (h) Filling unit;
 - (i) Non-return valve;
 - (j) Gas-tube pressure relief valve;
 - (k) Filter unit;
 - (l) Pressure or temperature sensor;
 - (m) Fuel pump;
 - (n) Service coupling;
 - (o) Electronic control unit;
 - (p) Fuel rail;
 - (q) Pressure relief device;
 - (r) Multi-component.
- 2.3. "*Container*" means any vessel used for the storage of liquefied petroleum gas.
- 2.3.1. A container can be:
 - (a) A standard cylindrical container with a cylindrical shell, two dished ends either torispherical or elliptical and the required openings;
 - (b) A special container: other containers than standard cylindrical containers. The dimensional characteristics are given in Annex 10, Appendix 5.

- 2.3.2. "*All-composite container*" means a container made only of composite materials with a non-metallic liner.
- 2.3.3. "*Batch of containers*" means a maximum of 200 containers of the same type produced consecutively on the same production line.
- 2.4. "*Type of container*" means containers which do not differ in respect to the following characteristics as specified in Annex 10:
- (a) The trade name(s) or trade mark(s);
 - (b) The shape (cylindrical, special shape);
 - (c) The openings (plate for accessories/metal ring);
 - (d) The material;
 - (e) The welding process (in case of metal containers);
 - (f) The heat treatment (in case of metal containers);
 - (g) The production line;
 - (h) The nominal wall thickness;
 - (i) The diameter;
 - (j) The height (in case of special containers).
- 2.5. "*Accessories fitted to the container*" means the following equipment which may be either separate or combined:
- (a) 80 per cent stop valve;
 - (b) Level indicator;
 - (c) Pressure relief valve;
 - (d) Remotely controlled service valve with excess flow valve;
 - (e) Fuel pump;
 - (f) Multivalve;
 - (g) Gas-tight housing;
 - (h) Power supply bushing;
 - (i) Non-return valve;
 - (j) Pressure relief device.
- 2.5.1. "*80 per cent stop valve*" means a device that limits the filling at maximum 80 per cent of the capacity of the container.
- 2.5.2. "*Level indicator*" means a device to verify the level of liquid in the container.
- 2.5.3. "*Pressure relief valve (discharge valve)*" means a device to limit the pressure build-up in the container.
- 2.5.3.1. "*Pressure relief device*" means a device aimed to protect the container from burst which can occur in case of fire, by venting the LPG contained.
- 2.5.4. "*Remotely controlled service valve with excess flow valve*" means a device which allows the establishment and interruption of LPG supply to the evaporator/pressure regulator; remotely controlled means that the service valve is controlled by the electronic control unit; when the engine of the vehicle is not running the valve is closed; an excess flow valve means a device to limit the flow of LPG.

- 2.5.5. "*Fuel pump*" means a device to establish the supply of liquid LPG to the engine by increasing the pressure of the container with the fuel pump supply pressure.
- 2.5.6. "*Multivalve*" means a device consisting of all or part of the accessories mentioned in paragraphs 2.5.1. to 2.5.3. and 2.5.8.
- 2.5.7. "*Gas-tight housing*" means a device to protect the accessories and to vent any leakages to the open air.
- 2.5.8. Power supply bushing (fuel pump/actuators/fuel level sensor).
- 2.5.9. "*Non-return valve*" means a device to allow the flow of liquid LPG in one direction and to prevent the flow of liquid LPG in the opposite direction.
- 2.6. "*Vaporizer*" means a device intended to vaporize LPG from a liquid to a gaseous state.
- 2.7. "*Pressure regulator*" means a device intended for reducing and regulating the pressure of liquefied petroleum gas.
- 2.8. "*Shut-off valve*" means a device to cut off the flow of LPG.
- 2.9. "*Gas-tube pressure relief valve*" means a device to prevent the pressure build up in the tubes above a pre-set value.
- 2.10. "*Gas injection device or injector or gas mixing piece*" means a device which establishes the liquid or vaporized LPG to enter the engine.
- 2.11. "*Gas dosage unit*" means a device which meters and/or distributes the gas flow to the engine and can be either combined with the gas injection device or separate.
- 2.12. "*Electronic control unit*" means a device which controls the LPG demand of the engine and cuts off automatically the power to the shut-off valves of the LPG system in case of a broken fuel supply pipe caused by an accident, or by stalling of the engine.
- 2.13. "*Pressure or temperature sensor*" means a device which measures pressure or temperature.
- 2.14. "*LPG filter unit*" means a device which filters the LPG, the filter can be integrated in other components.
- 2.15. "*Flexible hoses*" means hoses for conveying liquefied petroleum gas in either a liquid or vapour state at various pressures from one point to another.
- 2.16. "*Filling unit*" means a device to allow filling of the container; the filling unit can be realised by integration in the 80 per cent stop valve of the container or by a remote filling unit at the outside of the vehicle.
- 2.17. "*Service coupling*" means a coupling in the fuel line between the fuel container and the engine. If a mono-fuel vehicle is out of fuel the engine can be operated by means of a service fuel container which can be coupled to the service coupling.
- 2.18. "*Fuel rail*" means a pipe or duct that connects the fuel injection devices.
- 2.19. "*Liquefied petroleum gas (LPG)*" means any product essentially composed of the following hydrocarbons:
Propane, propene (propylene), normal butane, isobutane, isobutylene, butene (butylene) and ethane.

European Standard EN 589:1993 specifies requirements and methods of test for automotive LPG as marketed and delivered in the countries of the members of CEN (European Committee for Standardization).

- 2.20. "Hose assembly" means an assembly of a flexible hose and couplings.
- 2.21 "Non-seamless fuel line" means tubing which has been designed not to flex in normal operation and through which LPG flows.**
- 2.22 "Coupling" means a connector used in joining a piping, tubing or hose system.**
- 2.23 "Gas tube" means seamless fuel line made out of copper or stainless steel or steel with corrosion-resistant coating.**

Part I - Approval of specific equipment of vehicles of categories M and N using liquefied petroleum gases in their propulsion system

3. Application for approval

- 3.1. The application for approval of specific equipment shall be submitted by the holder of the trade name or mark or by his duly accredited representative.
- 3.2. It shall be accompanied by the under mentioned documents in triplicate and by the following particulars:
 - 3.2.1. A detailed description of the type of the specific equipment (as specified in Annex 1),
 - 3.2.2. A drawing of the specific equipment, sufficiently detailed and on an appropriate scale,
 - 3.2.3. Verification of compliance with the specifications prescribed in paragraph 6. of this Regulation.
- 3.3. At the request of the Technical Service responsible for conducting approval tests, samples of the specific equipment shall be provided.
Supplementary samples shall be supplied upon request.

4. Markings

- 4.1. All components submitted for approval shall bear the trade name or mark of the manufacturer and the type; and for non-metallic components also the manufacturing month and year; this marking shall be clearly legible and indelible.
- 4.2. All equipment shall have a space large enough to accommodate the approval mark including the classification of the component (see Annex 2A) and in case of components of Class 0 also the working pressure (WP); this space shall be shown on the drawings referred to in paragraph 3.2.2. above.
- 4.3. Every container shall also bear a marking plate, welded to it, with the following data clearly legible and indelible:
 - (a) A serial number

- (b) The capacity in litres;
 - (c) The marking "LPG";
 - (d) Test pressure [kPa];
 - (e) The wording: "maximum degree of filling: 80 %";
 - (f) Year and month of approval (e.g. 99/01);
 - (g) Approval mark according to paragraph 5.4;
 - (h) The marking "PUMP INSIDE" and a marking identifying the pump when a pump is mounted in the container.
- 4.4. In addition to provisions of paragraphs 4.1. and 4.2., one of the following additional marks shall be used for remotely controlled service valves and remotely controlled shut-off valves which comply respectively with paragraph 4.7. of Annex 3 or with paragraph 1.7. of Annex 7:
- (a) "H₁"
 - (b) "H₂"
 - (c) "H₃"

5. Approval

- 5.1. If the equipment samples submitted for approval meet the requirements of paragraphs 6.1. to 6.13. of this Regulation, approval of the type of equipment shall be granted.
- 5.2. An approval number shall be assigned to each type of equipment approved. Its first two digits (at present 01 corresponding to the 01 series of amendments which entered into force on 13 November 1999) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign this alphanumeric code to another type of equipment.
- 5.3. Notice of approval or of refusal or of extension of approval of an LPG equipment type/part pursuant to this Regulation shall be communicated to the Parties to the Agreement applying this Regulation, by means of a form conforming to the model in Annex 2B to this Regulation. If it concerns a container, Annex 2B - Appendix shall be added.
- 5.4. There shall be affixed, conspicuously and in the space referred to in paragraph 4.2. above, to all equipment conforming to a type approved under this Regulation, in addition to the mark prescribed in paragraphs 4.1. and 4.3. above, an international approval mark consisting of:
- 5.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval².
- ⁵4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 5.4.1. above. This approval number consists of the component type approval

²

The distinguish numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.3. <http://www.unece.org/trans/main/wp29/wgs/wp29gen/wp29resolutions.html>

number which appears on the certificate completed for this type (see paragraph 5.2. above and Annex 2B) preceded by two figures indicating the sequence of the latest series of amendments to this Regulation.

- 5.5. The approval mark shall be clearly legible and be indelible.
- 5.6. Annex 2A to this Regulation gives examples of the arrangement of the aforesaid approval mark.
- 5.7. In case of a Class 0 component also the working pressure shall be marked in the vicinity of the approval mark mentioned in paragraph 5.4. above.

6. Specifications regarding the various components of the LPG equipment

6.1. General provisions

The specific equipment of vehicles using LPG in their propulsion system shall function in a correct and safe way.

The materials of the equipment which are in contact with LPG shall be compatible with it.

Those parts of equipment whose correct and safe functioning is liable to be influenced by LPG, high pressure or vibrations has to be submitted to relevant test procedures described in the annexes to this Regulation. In particular the provisions of paragraphs 6.2. to 6.13. below are to be fulfilled.

The installation of LPG equipment approved by this Regulation shall comply with relevant electromagnetic compatibility (EMC) requirements according to Regulation No. 10, 02 series of amendments, or equivalent.

6.2. Provisions regarding containers

The LPG containers shall be type approved pursuant to the provisions laid down in Annex 10 to this Regulation.

6.3. Provisions regarding accessories fitted to the container

6.3.1. The container shall be equipped with the following accessories, which may be either separate or combined (multivalve(s)):

6.3.1.1. 80 per cent stop valve;

6.3.1.2. Level indicator;

6.3.1.3. Pressure relief valve (discharge valve);

6.3.1.4. Remotely controlled service valve with excess flow valve.

6.3.2. The container may be equipped with a gas-tight housing, if necessary.

6.3.3. The container may be equipped with a power supply bushing for the sake of actuators/LPG fuel pump.

6.3.4. The container may be equipped with a LPG fuel pump inside the container.

6.3.5. The container may be equipped with a non-return valve.

6.3.6. The container shall be equipped with a pressure relief device (PRD). Devices or functions may be approved as PRD being:

- (a) A fusible plug (temperature triggered) (fuse), or

- (b) A pressure relief valve provided that it complies to paragraph 6.15.8.3. below, or
 - (c) A combination of the two above devices, or
 - (d) Any other equivalent technical solution provided that it ensures the same degree of performance.
- 6.3.7. The accessories mentioned in paragraphs 6.3.1. to 6.3.6. above shall be type approved pursuant to the provisions laid down in:
- (a) Annex 3 to this Regulation for accessories mentioned in paragraphs 6.3.1., 6.3.2., 6.3.3. and 6.3.6. above;
 - (b) Annex 4 to this Regulation for accessories mentioned in paragraph 6.3.4. above;
 - (c) Annex 7 to this Regulation for accessories mentioned in paragraph 6.3.5. above.
- 6.4. - 6.14. Provisions regarding other components
- The other components, which are shown in Table 1, shall be type approved pursuant to the provisions laid down in the annexes which can be determined from the table.

Table 1

<i>Paragraph</i>	<i>Component</i>	<i>Annex</i>
6.4.	Fuel pump	4
6.5.	Vaporizer ¹ Pressure regulator ¹	6
6.6.	Shut-off valves Non-return valves Gas-tube pressure relief valves Service couplings	7
6.7.	Flexible hoses	8
6.8.	Filling unit	9
6.9.	Gas injection devices/Gas mixing piece ³ or Injectors	11
6.10.	Gas dosage units ²	12
6.11.	Pressure sensors Temperature sensors	13
6.12.	Electronic control unit	14
6.13.	LPG filter units	5
6.14.	Pressure relief device	3
6.15	Non-seamless fuel lines and couplings¹	15

¹ Either combined or separate

² Only applicable when the gas dosage actuator is not integrated in the gas injection device.

³ Applicable only when the operating pressure of the gas mixing piece exceeds 20 kPa (Class 2).

- 6.15. General design rules regarding components
 - 6.15.1. Provisions regarding the 80 per cent stop valve
 - 6.15.1.1. The connection between the float and the closing unit of the 80 per cent stop valve shall not be deformed under normal conditions of use.
 - 6.15.1.2. If the 80 per cent stop valve of the container comprises a float, the latter shall withstand an outside pressure of 4,500 kPa.
 - 6.15.1.3. The closing unit of the device that limits the filling at 80 per cent ± 5 per cent of the capacity of the container, for which the 80 per cent stop valve is designed, shall withstand a pressure of 6,750 kPa. At the cut-off position, the filling rate at a differential pressure of 700 kPa shall not exceed 500 cm³/minute. The valve shall be tested with all the containers on which it is intended to be fitted or the manufacturer shall declare by calculation for which container types this valve is suitable.
 - 6.15.1.4. When the 80 per cent stop valve does not comprise any float, it shall not be possible to continue filling, after closing-off, at a rate exceeding 500 cm³/minute.
 - 6.15.1.5. The device shall bear a permanent marking, indicating the container-type for which it has been designed, diameter and angle, and if applicable mounting indication.
 - 6.15.2. Electrical operated devices containing LPG shall, in order to prevent in case of fracture of the component electric sparks on the surface of fracture:
 - (a) Be insulated in a manner that no current is lead through LPG containing parts;
 - (b) Have the electrical system of the device isolated:
 - (i) From the body;
 - (ii) From the container for the fuel pump.
- Isolation resistance shall be $> 10 \text{ M}\Omega$.
- 6.15.2.1. The electrical connections inside the boot and passengers compartment shall comply with protection degree class IP 40 according to IEC Standard 60529-1989+A1:1999.
 - 6.15.2.2. All other electrical connections shall comply with protection degree class IP 54 according to IEC Standard 60529-1989+A1:1999.
 - 6.15.2.3. The power supply bushing (fuel pump/actuators/fuel level sensor) to establish an isolated and tight electrical connection shall be of a hermetic sealed type.
 - 6.15.3. Specific provisions on valves activated by an electric/external (hydraulic, pneumatic) power
 - 6.15.3.1. In the case of valves activated by an electric/external power (e.g. 80 per cent stop valve, service valve, shut-off valves, non-return valves, gas tube pressure relief valve, service coupling), those valves shall be in "closed" position when their power is switched off.
 - 6.15.3.2. The power of the fuel pump shall be switched off when the electronic control unit becomes defective or loses power.

- 6.15.4. Heat exchange medium (compatibility and pressure requirements)
- 6.15.4.1. The materials constituting a device which are in contact with the heat exchange medium of a device when operating shall be compatible with that fluid and shall be designed to withstand a pressure of 200 kPa of the heat exchange medium. The material shall meet the prescriptions laid down in Annex 156, paragraph 17.
- 6.15.4.2. The compartment containing the heat exchange medium of the vaporizer/pressure regulator shall be leak proof at a pressure of 200 kPa.
- 6.15.5. A component consisting of both high pressure and low pressure parts shall be so designed to prevent a pressure build up in the low pressure part above 2.25 times the maximum working pressure for which it has been tested. Components connected directly to the tank pressure shall be designed for the classification pressure of 3,000 kPa. Venting to the motor compartment or outside of the vehicle is not allowed.
- 6.15.6. Specific provisions to prevent any gas flow
- 6.15.6.1. Pumps of Class 1 shall be so designed that the outlet pressure never exceeds 3,000 kPa, when there is e.g. blocking of the tubing or not opening of a shut-off valve. This can be realized by switching off the pump or by recirculating to the container.
- Pumps of Class 0 shall be so designed that the outlet pressure never exceeds the WP of the components downstream of the pump, when there is, e.g. blocking of the tubing or not opening of a shut-off valve. This can be realized by switching off the pump or by recirculation to the container.
- 6.15.6.2. The pressure regulator/vaporizer shall be so designed as to prevent any gas flow when the regulator/vaporizer unit is supplied with LPG at a pressure $\leq 4,500$ kPa when the regulator is not operating.
- 6.15.7. Provisions regarding the gas tube relief valve
- 6.15.7.1. Gas-tube pressure relief valves of Class 1 shall be so designed as to open at a pressure of $3,200 \pm 100$ kPa.
- Gas-tube pressure relief valves of Class 0 shall be so designed as to open at a pressure of 1.07 WP of the pipe ± 100 kPa (if needed).
- 6.15.7.2. Gas-tube pressure relief valves of Class 1 shall not have internal leakage up to 3,000 kPa.
- Gas-tube pressure relief valves of Class 0 shall not have internal leakage up to WP of the pipe.
- 6.15.8. Provisions regarding the pressure relief valve (discharge valve)
- 6.15.8.1. The pressure relief valve shall be mounted inside the container or on the container, in the area where the fuel is in gaseous state.
- 6.15.8.2. The pressure relief valve shall be so designed as to open at a pressure of $2,700 \pm 100$ kPa.
- 6.15.8.3. The flow capacity of the pressure relief valve, determined with compressed air at a pressure which is 20 per cent higher than the normal operating-pressure shall be at least
- $$Q \geq 10.66 \cdot A^{0.82}$$

In which:

Q = flow of air in standard m^3/min (100 kPa absolute and temperature of 15°C)

A = exterior surface of the container in m^2 .

The flow test results shall be corrected to standard conditions:

Air pressure of 100 kPa absolute and temperature of 15°C .

When the pressure relief valve is considered as a pressure relief device, the flow shall be at least 17.7 standard m^3/min .

- 6.15.8.4. The pressure relief valve shall not have internal leakage up to 2,600 kPa.
- 6.15.8.5. The pressure relief device (fuse) shall be designed to open at a temperature of $120 \pm 10^\circ\text{C}$.
- 6.15.8.6. The pressure relief device (fuse) shall be designed to have, when opened, a flow capacity of:

$$Q \geq 2.73 \cdot A$$

In which:

Q = flow of air in standard m^3/min (100 kPa absolute and temperature of 15°C)

A = exterior surface of the container in m^2 .

The flow test shall be carried out at an upstream air pressure of 200 kPa absolute, and at temperature of 15°C .

The flow test results shall be corrected to standard conditions:

Air pressure of 100 kPa absolute, and temperature of 15°C .

- 6.15.8.7. The pressure relief device shall be mounted on the container in the gaseous zone.
- 6.15.8.8. The pressure relief device shall be fitted to the container in such a manner that it can discharge into the gas tight housing, when its presence is prescribed.
- 6.15.8.9. The pressure relief device (fuse) shall be tested according to the provisions described in Annex 3, paragraph 7.
- 6.15.9. Power dissipation of the fuel pump
At minimum fuel level whereby the engine is still operating the heat build-up by the fuel pump(s) should never cause the pressure relief valve to open.
- 6.15.10. Provisions regarding the filling unit
- 6.15.10.1. The filling unit shall be equipped with at least one soft-seated non-return valve, and it shall not be dismountable by design.
- 6.15.10.2. The filling unit shall be protected against contamination.
- 6.15.10.3. The design and dimensions of the connecting area of the filling unit shall comply with those in the figures in Annex 9.

The filling unit shown in Figure 5 is only applicable for motor vehicles of categories M_2 , M_3 , N_2 , N_3 and M_1 having a maximum total mass $> 3,500$ kg.

- 6.15.10.4. The filling unit shown in Figure 4 may also apply for motor vehicles of categories M₂, M₃, N₂, N₃ and M₁ having a maximum total mass > 3,500 kg.³
- 6.15.10.5. The outside filling unit is connected to the container by a hose or pipe.
- 6.15.10.6. Specific provisions regarding the light vehicle Euro filling unit (Annex 9 – Figure 3):
 - 6.15.10.6.1. The dead volume between the front sealing surface and the front of the non-return valve shall not exceed 0.1 cm³;
 - 6.15.10.6.2. The flow through the connector at a pressure difference of 30 kPa shall be at least 60 litres/min, if tested with water.
- 6.15.10.7. Specific provisions regarding the heavy-duty vehicle Euro filling unit (Annex 9 – Figure 5):
 - 6.15.10.7.1. The dead volume between the front sealing surface and the front of the non-return valve shall not exceed 0.5 cm³;
 - 6.15.10.7.2. The flow through the filling unit, with the non-return valve mechanically opened, at a pressure difference of 50 kPa shall be at least 200 litres/min, when tested with water.
 - 6.15.10.7.3. The Euro filling unit shall comply with the impact test as described in Annex 9, paragraph 7.4.
- 6.15.11. Provisions regarding the level indicator
 - 6.15.11.1. The device to verify the level of liquid in the container shall be of an indirect type (for example magnetic) between the inside and outside of the container. If the device to verify the level of liquid in the container is of a direct type, the electric power connections should meet IP54 specifications according to IEC EN 60529:1997-06.
 - 6.15.11.2. If the level indicator of the container comprises a float, the latter shall withstand an outside pressure of 3,000 kPa.
- 6.15.12. Provisions regarding the gas tight housing of the container.
 - 6.15.12.1. The gas-tight housing outlet shall have a total free cross-section of at least 450 mm².
 - 6.15.12.2. The gas-tight housing shall be leak-proof at a pressure of 10 kPa with the aperture(s) closed off, maximum allowed leak rate of 100 cm³/h vapour and show no permanent deformation.
 - 6.15.12.3. The gas-tight housing shall be designed to withstand a pressure of 50 kPa.
- 6.15.13. Provisions regarding the remotely controlled service valve with excess flow valve.
 - 6.15.13.1. Provisions regarding the service valve
 - 6.15.13.1.1. In case of the service valve is combined with a 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

³ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2. <http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html>

IEC Standard 60529-1989+A1:1999.

- 6.15.13.1.2. Service valves of Class 1 shall withstand a pressure of 6,750 kPa in the open and closed position. Service valves of Class 0 shall withstand a pressure of 2.25 WP in the open and closed position.
- 6.15.13.1.3. 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.
- 6.15.13.2. Provisions regarding the excess flow valve
 - 6.15.13.2.1. The excess flow valve shall be mounted inside the container.
 - 6.15.13.2.2. The excess flow valve shall be designed with a bypass to allow for equalization of pressures.
 - 6.15.13.2.3. 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 cm³/min.
 - 6.15.13.2.4. When the excess flow valve is at cut-off position, the flow through the by-pass shall not exceed 500 cm³/min. at a differential pressure of 700 kPa.

7. Modifications of a type of LPG equipment and extension of approval

- 7.1. Every modification of a type of LPG equipment shall be notified to the Type Approval Authority which granted the type approval. The Type Approval Authority may then either:
 - 7.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect, and that the equipment still complies with the requirements; or
 - 7.1.2. Consider whether retesting will be partial or complete.
- 7.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 5.3. above to the Parties to the Agreement which apply this Regulation.
- 7.3. The Type Approval Authority issuing the extension of approval shall assign a series number to each communication form drawn up for such an extension.

8. (Not allocated)

9. Conformity of production

The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324-E/ECE/TRANS/505/Rev.2), with the following requirements:

- 9.1. All equipment approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements of paragraph 6. above.
- 9.2. In order to verify that the requirements of paragraph 9.1. are met, suitable controls of production shall be carried out.
- 9.3. The minimum requirements for conformity of production control tests set forth in Annexes 8, 10 and 156 to this Regulation shall be complied with.

- 9.4. The Type Approval Authority which has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be once every year.
- 9.5. Moreover, each container shall be tested at a minimum pressure of 3,000 kPa in conformity with the prescriptions of paragraph 2.3. of Annex 10 to this Regulation.
- 9.6. Every hose assembly which is applied in the high pressure class (Class 1) according to the classification as prescribed in paragraph 2. of this Regulation, shall, during half a minute, be subjected to a test with gas under a pressure of 3,000 kPa by the approval holder.
- 9.6.1. Every hose assembly which is applied in the high pressure class (Class 0) according to the classification as prescribed in paragraph 2. of this Regulation, shall, during half a minute, be subjected to a test with gas under a pressure of the declared WP by the approval holder.
- 9.7. For welded containers at least 1 per 200 containers and one of the remaining number has to be subjected to the radiographic examination according to Annex 10, paragraph 2.4.1.
- 9.8. During production 1 of 200 containers and 1 of the remaining number has to be subjected to the above-mentioned mechanical tests as described in Annex 10, paragraph 2.1.2.

10. Penalties for non-conformity of production

- 10.1. The approval granted in respect of a type of equipment pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 9. above are not complied with.
- 10.2. If a Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex 2B to this Regulation.

11. Transitional provisions regarding the various components of the LPG equipment

- 11.1. As from the official date of entry into force of the 01 series of amendments to this Regulation, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by the 01 series of amendments.
- 11.2. As from 3 months after the official date of entry into force of the 01 series of amendments to this Regulation, Contracting Parties applying this Regulation shall grant approvals only if the type of component to be approved meets the requirements of this Regulation as amended by the 01 series of amendments.
- 11.3. No Contracting Party applying this Regulation shall refuse a type of component approved to the 01 series of amendments to this Regulation.

- 11.4. Until 12 months after the date of entry into force of the 01 series of amendments to this Regulation, no Contracting Party applying this Regulation shall refuse a type of component approved to this Regulation in its original form.
- 11.5. Upon the expiration of a period of 12 months after the date of entry into force of the 01 series of amendments, Contracting Parties applying this Regulation may refuse the sale of a type of component which does not meet the requirements of the 01 series of amendments to this Regulation, unless the component is intended as a replacement for fitting on vehicles in use.

12. Production definitively discontinued

If the holder of the approval completely ceases to manufacture a type of equipment approved in accordance with this Regulation, he shall so inform the Type Approval Authority which granted the approval. Upon receiving the relevant communication, that Authority shall inform thereof the other Contracting Parties to the Agreement applying this Regulation by means of a communication form conforming to the model in Annex 2B to this Regulation.

13. Names and addresses of Technical Services responsible for conducting approval tests, and of Type Approval Authorities

The Contracting Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

Part II - Approval of vehicles of categories M and N fitted with specific equipment for the use of liquefied petroleum gases in their propulsion system with regard to the installation of such equipment

14. Definitions

- 14.1. For the purposes of Part II of this Regulation:
- 14.1.1. "*Approval of a vehicle*" means the approval of a vehicle type with regard to the installation of its specific equipment for the use of liquefied petroleum gases in its propulsion system;
- 14.1.2. "*Vehicle type*" means a vehicle or a family of vehicles fitted with specific equipment for the use of LPG in its propulsion system, which do not differ with respect to the following conditions:
- 14.1.2.1. The manufacturer;
- 14.1.2.2. The type designation established by the manufacturer;
- 14.1.2.3. The essential aspects of design and construction;

- 14.1.2.3.1. Chassis/floor pan (obvious and fundamental differences);
- 14.1.2.3.2. Installation of the LPG equipment (obvious and fundamental differences).
- 14.1.3. "*Commanded stop phase*" defines the period of time during which the combustion engine is switched off automatically for fuel saving and is allowed to start again automatically.

15. Application for approval

- 15.1. The application for approval of a vehicle type with regard to the installation of specific equipment for the use of liquefied petroleum gases in its propulsion system shall be submitted by the vehicle manufacturer or by his duly accredited representative.
- 15.2. It shall be accompanied by the undermentioned documents in triplicate: description of the vehicle comprising all the relevant particulars referred to in Annex 1 to this Regulation.
- 15.3. A vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service conducting the approval tests.

16. Approval

- 16.1. If the vehicle submitted for approval pursuant to this Regulation is provided with all the necessary specific equipment for the use of liquefied petroleum gases in its propulsion system and meets the requirements of paragraph 17. below, approval of that vehicle type shall be granted.
- 16.2. An approval number shall be assigned to each type of vehicle approved. Its first two digits shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval.
- 16.3. Notice of approval or of refusal or of extension of approval of an LPG vehicle type pursuant to this Regulation shall be communicated to the Parties to the Agreement applying this Regulation, by means of a form conforming to the model in Annex 2D to this Regulation.
- 16.4. There shall be affixed, conspicuously and in a readily accessible space specified on the approval form referred to in paragraph 16.3. above, to every vehicle type approved under this Regulation an international approval mark consisting of:
 - 16.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval.⁴
 - 16.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 16.4.1. above.
- 16.5. If the vehicle conforms to a vehicle approved, under one or more other Regulations annexed to the Agreement, in the country which has granted

⁴ The distinguish numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.3
<http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html>

approval under this Regulation, the symbol prescribed in paragraph 16.4.1. above need not be repeated; in such case, the Regulation and approval numbers and the additional symbols of all the Regulations under which approval has been granted in the country which has granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 16.4.1. above.

- 16.6. The approval mark shall be clearly legible and be indelible.
- 16.7. The approval mark shall be placed close to or on the vehicle data plate.
- 16.8. Annex 2C to this Regulation gives examples of the arrangement of the aforesaid approval mark.

17. Requirements for the installation of specific equipment for the use of liquefied petroleum gases in the propulsion system of a vehicle

- 17.1. General
 - 17.1.1. The LPG equipment as installed in the vehicle shall function in such a manner that the working pressure for which it has been designed and approved cannot be exceeded.
 - 17.1.2. All parts of the system shall be type approved for individual parts pursuant to Part I of this Regulation.
 - 17.1.2.1. Notwithstanding the provisions of paragraph 17.1.2. above, if the LPG electronic control unit is integrated into the engine electronic control unit and is covered with a vehicle installation type approval according to Part II of this Regulation and to Regulation No. 10, no separate type approval of the LPG electronic control unit is necessary. The vehicle type approval shall also be approved pursuant to the applicable provisions laid down in Annex 14 to this Regulation.
 - 17.1.3. The materials used in the system shall be suitable for use with LPG.
 - 17.1.4. All parts of the system shall be fastened in a proper way.
 - 17.1.5. The LPG system shall show no leaks.
 - 17.1.6. The LPG system shall be installed such that it has the best possible protection against damage, such as damage due to moving vehicle components, collision, grit or due to the loading or unloading of the vehicle or the shifting of those loads.
 - 17.1.7. No appliances shall be connected to the LPG system other than those strictly required for the proper operation of the engine of the motor vehicle.
 - 17.1.7.1. Notwithstanding the provisions of paragraph 17.1.7. above, motor vehicles of categories M₂, M₃, N₂, N₃ and M₁ having either a maximum total mass > 3500 kg or a body type SA^{1 5}, may be fitted with a heating system to heat the passenger compartment which is connected to the LPG system.
 - 17.1.7.2. The heating system referred to in paragraph 17.1.7.1. above shall be

⁵ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2. <http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html>

- permitted if, in the view of the Technical Services responsible for conducting type approval, the heating system is adequately protected and the required operation of the normal LPG system is not affected.
- 17.1.7.3. Notwithstanding the provisions of paragraph 17.1.7. above, a mono-fuel vehicle without limp-home system may be equipped with a service coupling in the LPG system.
- 17.1.7.4. The service coupling referred to in paragraph 17.1.7.3. above shall be permitted if, in the view of the Technical Services responsible for conducting type approval, the service coupling is adequately protected and the required operation of the normal LPG system is not affected. The service coupling shall be combined with a separate gas-tight non-return valve whereby it is only possible to operate the engine.
- 17.1.7.5. Mono-fuel vehicles installed with a service coupling shall carry a sticker near the service coupling as specified in Annex 178 to this Regulation.
- 17.1.8. Identification of LPG-fuelled M₂ and M₃ category vehicles.
- 17.1.8.1. Vehicles of category M₂ and M₃ shall carry a plate as specified in Annex 167 to this Regulation.
- 17.1.8.2. The plate shall be installed on the front and rear of the M₂ or M₃ category vehicle and on the outside of the doors on the left-hand side for the right hand drive vehicles and on the right-hand side for the left hand drive vehicles.
- 17.2. Further requirements
- 17.2.1. No component of the LPG system, including any protective materials which form part of such components, shall project beyond the external surface of the vehicle, with the exception of the filling unit if this does not project more than 10 mm beyond the nominal line of the body panel.
- 17.2.2. With the exception of the LPG fuel container, in no cross section of the vehicle any component of the LPG system, including any protective material which forms part of such components, may extend beyond the lower edge of the vehicle unless another part of the vehicle, within a radius of 150 mm is situated lower.
- 17.2.3. No component of the LPG system shall be located within 100 mm of the exhaust or similar heat source, unless such components are adequately shielded against heat.
- 17.3. The LPG system
- 17.3.1. An LPG system shall contain at least the following components:
- 17.3.1.1. Fuel container;
- 17.3.1.2. 80 per cent stop valve;
- 17.3.1.3. Level indicator;
- 17.3.1.4. Pressure relief valve;
- 17.3.1.5. Remotely controlled service valve with excess flow valve;
- 17.3.1.6. Pressure regulator and vaporizer, which may be combined;⁶
- 17.3.1.7. Remotely controlled shut-off valve;

⁶ These components might not be necessary in case of liquid LPG injection.

- 17.3.1.8. Filling unit;
- 17.3.1.9. Gas tubes, **non-seamless fuel line** and/or hoses;
- 17.3.1.10. Gas-carrying connections between the LPG system components;
- 17.3.1.11. Injector or gas injection device or gas mixing piece;
- 17.3.1.12. Electronic control unit;
- 17.3.1.13. Pressure relief device (fuse).
- 17.3.2. The system may also include the following components:
- 17.3.2.1. Gas-tight housing, covering the accessories fitted to the fuel container;
- 17.3.2.2. Non-return valve;
- 17.3.2.3. Gas tube pressure relief valve;
- 17.3.2.4. Gas dosage unit;
- 17.3.2.5. LPG filter unit;
- 17.3.2.6. Pressure or temperature sensor;
- 17.3.2.7. LPG fuel pump;
- 17.3.2.8. Power supply bushing for the container (actuators/fuel pump/fuel level sensor);
- 17.3.2.9. Service coupling (mono-fuel vehicles only & no limp-home system);
- 17.3.2.10. Fuel selection system and electrical system;
- 17.3.2.11. Fuel rail.
- 17.3.3. The container fittings referred to in paragraphs 17.3.1.2. to 17.3.1.5. above may be combined.
- 17.3.4. The remotely controlled shut-off valve referred to in paragraph 17.3.1.7. above may be combined with the pressure regulator/vaporizer.
- 17.3.5. Additional components required for the effective operation of the engine may be installed in that part of the LPG system where the pressure is less than 20 kPa.
- 17.4. Installation of the fuel container
- 17.4.1. The fuel container shall be permanently installed in the vehicle and shall not be installed in the engine compartment.
- 17.4.2. The fuel container shall be installed in the correct position, according to the instructions from the container manufacturer.
- 17.4.3. The fuel container shall be installed such that there is no metal to metal contact, other than at the permanent fixing points of the container.
- 17.4.4. The fuel container shall have permanent fixing points to secure it to the motor vehicle or the container shall be secured to the motor vehicle by a container frame and container straps.
- 17.4.5. When the vehicle is ready for use the fuel container shall not be less than 200 mm above the road surface.
- 17.4.5.1. The provisions of paragraph 17.4.5. above shall not apply if the container is adequately protected, at the front and the sides and no part of the container is

located lower than this protective structure.

- 17.4.6. The fuel container(s) shall be mounted and fixed so that the following accelerations can be absorbed (without damage occurring) when the containers are full:

Vehicles of categories M₁ and N₁:

- (a) 20 g in the direction of travel;
- (b) 8 g horizontally perpendicular to the direction of travel.

Vehicles of categories M₂ and N₂:

- (a) 10 g in the direction of travel;
- (b) 5 g horizontally perpendicular to the direction of travel.

Vehicles of categories M₃ and N₃:

- (a) 6.6 g in the direction of travel;
- (b) 5 g horizontally perpendicular to the direction of travel.

A calculation method can be used instead of practical testing if its equivalence can be demonstrated by the applicant for approval to the satisfaction of the Technical Service.

- 17.5. Further requirements to the fuel container

- 17.5.1. If more than one LPG container is connected to a single delivery tube each container shall be fitted with a non-return valve installed downstream of the remotely controlled service valve and a tube pressure relief valve shall be installed in the delivery tube, downstream of the non-return valve. An adequate filter system has to be placed upstream of the non-return valve(s) to prevent fouling of the non-return valve(s).

- 17.5.2. A non-return valve and tube pressure relief valve shall not be required if the backflow pressure of the remotely controlled service valve in the closed position exceeds 500 kPa.

In that case the control of the remotely controlled service valves shall be constructed such that it is impossible for more than one remotely controlled valve to be open at any time. The overlap time to allow switching is limited to two minutes.

- 17.6. Accessories to the fuel container

- 17.6.1. Remotely controlled service valve with excess flow valve on the container

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

- 17.6.1.2. 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.

- 17.6.1.3. Notwithstanding the provision of paragraph 17.6.1.2.above, in case of liquid injection systems, if a fuel recirculation is required to purge the system from gas bubbles (vapour lock), it is allowed to keep the remotely controlled service valve with excess flow valve open for a period not longer than 10 seconds before starting the engine in LPG running mode.

- 17.6.1.4. Notwithstanding the provisions of paragraph 17.6.1.2. above, the remotely controlled service valve may stay in an open position during the commanded stop phases.
- 17.6.1.5. If the remotely controlled service valve is closed during commanded stop phases, the valve shall comply with paragraph 4.7. of Annex 3.
- 17.6.2. Spring-loaded pressure relief valve in the container
 - 17.6.2.1. The spring-loaded pressure relief valve shall be installed in the fuel container in such a manner that it is connected to the vapour space and can discharge to the surrounding atmosphere. The spring-loaded pressure relief valve may discharge into the gas-tight housing if that gas-tight housing fulfils the requirements of paragraph 17.6.5. below.
- 17.6.3. 80 per cent stop valve
 - 17.6.3.1. The automatic filling level limiter shall be suitable for the fuel container it is fitted to and shall be installed in the appropriate position to ensure that the container cannot be filled to more than 80 per cent.
- 17.6.4. Level indicator
 - 17.6.4.1. The level indicator shall be suitable for the fuel container it is fitted to and shall be installed in the appropriate position.
- 17.6.5. Gas-tight housing on the container
 - 17.6.5.1. A gas-tight housing over the container fittings, which fulfils the requirements of paragraphs 17.6.5.2. to 17.6.5.5. below shall be fitted to the fuel container, unless the container is installed outside the vehicle and the container fittings are protected against dirt and water.
 - 17.6.5.2. The gas-tight housing shall be in open connection with the atmosphere, where necessary through a connecting hose and a lead-through.
 - 17.6.5.3. The ventilation opening of the gas-tight housing shall point downwards at the point of exit from the motor vehicle. However, it shall not discharge into a wheel arch, nor shall it be aimed at a heat source such as the exhaust.
 - 17.6.5.4. Any connecting hose and lead-through in the bottom of the bodywork of the motor vehicle for ventilation of the gas-tight housing shall have a minimum clear opening of 450 mm². If a gas tube, other tube or any electrical wiring is installed in the connecting hose and lead-through, the clear opening shall also be at least 450 mm².
 - 17.6.5.5. The gas-tight housing and connecting hoses shall be gas-tight at a pressure of 10 kPa with the apertures closed off, and show no permanent deformation, with a maximum allowed leak rate of 100 cm³/h.
 - 17.6.5.6. The connecting hose shall be secured in a proper way to the gas-tight housing and the lead-through to ensure that a gas-tight joint is formed.
- 17.7. Gas tubes and gas hoses
 - 17.7.1. Gas tubes shall be made of ~~seamless material~~; either copper or stainless steel or steel with corrosion-resistant coating **of:**
 - (a) Seamless material; or**
 - (b) Non-seamless material, complying with the applicable test according to Annex 15 provisions regarding the approval of non-seamless fuel**

line and/or couplings.

- 17.7.2. If seamless copper is used the tube shall be protected by a rubber or plastic sleeve.
- 17.7.3. The outer diameter of gas tubes made of copper shall not exceed 12 mm with a wall thickness of at least 0.8 mm, gas tubes from steel and stainless steel shall not exceed 25 mm with, for gas services, an appropriate wall thickness.
- 17.7.4. The gas tube may be made of a non-metallic material if the tube fulfils the requirements of this Regulation, paragraph 6.7.
- 17.7.5. The gas tube may be replaced by a gas hose if this hose fulfils the requirement of this Regulation, paragraph 6.7.
- 17.7.6. Gas tubes, other than non-metallic gas tubes, shall be secured such that they shall not be subjected to vibration or stresses.
- 17.7.7. Gas hoses and non-metallic gas tubes shall be secured such that they shall not be subjected to stresses.
- 17.7.8. At the fixing point the gas tube or hose shall be fitted with a protective material.
- 17.7.9. Gas tubes or hoses shall not be located at jacking points.
- 17.7.10. At passages the gas tubes or hoses, whether or not fitted with a protective sleeve, shall be fitted with protective material.
- 17.8. Gas connections between the components of the LPG system
 - 17.8.1. Soldered or welded joints and bite-type compression joints are not permitted. Soldering or welding can be permitted for connecting the individual parts of detachable couplings to the gas tube or component.
 - 17.8.2. Gas tubes shall only be connected by compatible fittings with regard to corrosion.
 - 17.8.3. Stainless steel tubes shall only be joined by stainless steel fittings.
 - 17.8.4. Distributing-blocks shall be made of corrosion-resistant material.
 - 17.8.5. Gas tubes shall be connected by appropriate joints, for example, two-part compression joints in steel tubes and joints with olives tapered on both sides or two flanges in copper tubes. Gas tubes shall be connected with appropriate connections. Under no circumstances couplings may be used whereby the tube will be damaged. The burst pressure of the mounted couplings shall be the same or higher as specified for the tube.
 - 17.8.6. The number of joints shall be limited to a minimum.
 - 17.8.7. Any joints shall be made in locations where access is possible for inspection.
 - 17.8.8. In a passenger compartment or enclosed luggage compartment the gas tube or hose shall be no longer than reasonably required; this provision is fulfilled when the gas tube or hose does not extend further than from the fuel container to the side of vehicle.
 - 17.8.8.1. There shall be no gas-conveying connections in the passenger compartment or enclosed luggage compartment with the exception of:
 - (a) The connections on the gas-tight housing; and

- (b) The connection between the gas tube or hose and the filling unit if this connection is fitted with a sleeve which is resistant against LPG and any leaking gas will be discharged directly into the atmosphere.
- 17.8.8.2. The provisions of paragraph 17.8.8. and paragraph 17.8.8.1. above shall not apply for M₂ or M₃ category vehicles if the gas tubes or hoses and connections are fitted with a sleeve which is resistant against LPG and which has an open connection to the atmosphere. The open end of the sleeve or ducting shall be situated at the lowest point.
- 17.9. Remotely controlled shut-off valve
 - 17.9.1. A remotely controlled shut-off valve shall be installed in the gas tube from the LPG container to the pressure regulator/vaporizer, as close as possible to the pressure regulator/vaporizer.
 - 17.9.2. The remotely controlled shut-off valve may be incorporated into the pressure regulator/vaporizer.
 - 17.9.3. Notwithstanding the provisions of paragraph 17.9.1. above, the remotely controlled shut-off valve may be installed at a location in the engine bay specified by the manufacturer of the LPG system if a fuel return system is provided between the pressure regulator and the LPG container.
 - 17.9.4. The remotely controlled shut-off valve shall be installed such that the fuel supply is cut off when the engine is not running or, if the vehicle is also equipped with another fuel system, when the other fuel is selected. A delay of 2 seconds is permitted for diagnostic purposes.
 - 17.9.5. Notwithstanding the provision of paragraph 17.9.4. above, in case of liquid injection systems, if a fuel recirculation is required to purge the system from gas bubbles (vapour lock), it is allowed to keep the remotely controlled shut-off valve open for a period not longer than 10 seconds before starting the engine in LPG running mode and during the fuel switching-over.
 - 17.9.6. Notwithstanding the provisions of paragraph 17.9.4. above, the remotely controlled shut-off valve may stay in an open position during the commanded stop phases.
 - 17.9.7. If the remotely controlled shut-off valve is closed during commanded stop phases, the valve shall comply with paragraph 1.7. of Annex 7.17.10. Filling unit
- 17.10.1. The filling unit shall be secured against rotation and shall be protected against dirt and water.
- 17.10.2. When the LPG container is installed in the passenger compartment or an enclosed (luggage) compartment, the filling unit shall be located at the outside of the vehicle.
- 17.11. Fuel selection system and electrical installation
 - 17.11.1. The electrical components of the LPG system shall be protected against overloads and at least one separate fuse shall be provided in the supply cable.
 - 17.11.1.1. The fuse shall be installed in a known location where it can be reached without the use of tools.
 - 17.11.2. The electrical power to LPG system components which also carry gas may not be conducted by a gas tube.

- 17.11.3. All electrical components installed in a part of the LPG system where the pressure exceeds 20 kPa shall be connected and insulated in a manner that no current is led through LPG containing parts.
- 17.11.4. Electrical cables shall be adequately protected against damage. The electrical connections inside the boot and passengers compartment shall comply with protection degree class IP 40 according to IEC Standard 60529-1989+A1:1999. All other electrical connections shall comply with protection degree class IP 54 according to IEC Standard 60529-1989+A1:1999.
- 17.11.5. Vehicles with more than one fuel system shall have a fuel selection system
- 17.11.6. The electrical connections and components in the gas-tight housing shall be constructed such that no sparks are generated.
- 17.12. Pressure relief device
- 17.12.1. The pressure relief device shall be fitted to the fuel container(s) in such a manner that it can discharge into the gas tight housing, when its presence is prescribed, if that gas tight housing fulfils the requirements of paragraph 17.6.5. above.

18. Conformity of production

The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324-E/ECE/TRANS/505/Rev.2) with the following requirements:

- 18.1. All vehicles approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements of paragraph 17. above.
- 18.2. In order to verify that the requirements of paragraph 18.1. above are met, suitable controls of the production shall be carried out.
- 18.3. The Type Approval Authority which has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be once every year.

19. Penalties for non-conformity of production

- 19.1. The approval granted in respect of a type of vehicle pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 18. above are not complied with.
- 19.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex 2D to this Regulation.

20. Modification and extension of approval of a vehicle type

- 20.1. Every modification of the installation of the specific equipment for the use of liquefied petroleum gases in the propulsion system of the vehicle shall be notified to the Type Approval Authority which approved the vehicle type. That Type Approval Authority may then either:
- 20.1.1. Consider that the modifications made are unlikely to have an appreciably adverse effect and that in any case the vehicle still complies with the requirements; or
- 20.1.2. Require a further test report from the Technical Service responsible for conducting the tests.
- 20.2. Confirmation or refusal of approval, specifying the alteration, shall be communicated by the procedure specified in paragraph 16.3. above to the Parties to the Agreement applying this Regulation.
- 20.3. The Type Approval Authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Contracting Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 2D to this Regulation.

21. Production definitively discontinued

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall so inform the Type Approval Authority which granted the approval. Upon receiving the relevant communication, that Authority shall inform thereof the other Contracting Parties to the Agreement applying this Regulation by means of a communication form conforming to the model in Annex 2D to this Regulation.

22. Transitional provisions regarding the installation of various components of the LPG equipment and the type approval of a vehicle fitted with specific equipment for the use of liquefied petroleum gas in its propulsion system with regard to the installation of such equipment

- 22.1. As from the official date of entry into force of the 01 series of amendments to this Regulation, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by the 01 series of amendments.
- 22.2. As from the official date of entry into force of the 01 series of amendments to this Regulation, no Contracting Party applying this Regulation shall prohibit the fitting on a vehicle and the use as first equipment of a component approved under this Regulation as amended by the 01 series of amendments.

- 22.3. During the period of 12 months after the date of entry into force of the 01 series of amendments to this Regulation, Contracting Parties applying this Regulation may allow the use of as first equipment of a type of component approved to this Regulation in its original form, when fitted on a vehicle transformed for LPG propulsion.
- 22.4. Upon the expiration of a period of 12 months after the date of entry into force of the 01 series of amendments to this Regulation, Contracting Parties applying this Regulation shall prohibit the use as first equipment of a component which does not meet the requirements of this Regulation as amended by the 01 series of amendments, when fitted on a vehicle transformed for LPG propulsion.
- 22.5. Upon the expiration of a period of 12 months after the date of entry into force of the 01 series of amendments to this Regulation, Contracting Parties applying this Regulation may refuse first National Registration (first entry into service) of a vehicle which does not meet the requirements of this Regulation as amended by the 01 series of amendments.

23. Names and addresses of Technical Services responsible for conducting approval tests, and of Type Approval Authorities

The Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

Annex 1

Essential characteristics of the vehicle, engine and LPG related equipment

Description of the vehicle(s)

Make:

Type(s):

Name and address of the manufacturer:

1. Description of the engine(s)
 - 1.1. Manufacturer:
 - 1.1.1. Manufacturer's engine code(s) (as marked on the engine or other means of identification):
 - 1.2. Internal combustion engine
 - 1.2.1.-1.2.4.4. Not used
 - 1.2.4.5. Description of the LPG fuelling equipment:
 - 1.2.4.5.1. System description:
 - 1.2.4.5.1.1. Make(s):
 - 1.2.4.5.1.2. Type(s):
 - 1.2.4.5.1.3. Drawings/flow charts of the installation in the vehicle(s):
 - 1.2.4.5.2. Vaporizer/pressure regulator(s):
 - 1.2.4.5.2.1. Make(s):
 - 1.2.4.5.2.2. Type(s):
 - 1.2.4.5.2.3. Certification number:
 - 1.2.4.5.2.4. Not used
 - 1.2.4.5.2.5. Drawings:
 - 1.2.4.5.2.6. Number of main adjustment points:
 - 1.2.4.5.2.7. Description of principle of adjustment through main adjustment points:
.....
 - 1.2.4.5.2.8. Number of idle adjustment points:
 - 1.2.4.5.2.9. Description of principles of adjustment through idle adjustment points:
.....
 - 1.2.4.5.2.10. Other adjustment possibilities: if so and which (description and drawings):

- 1.2.4.5.2.11. Operating pressure(s):¹ kPa
- 1.2.4.5.3. Mixing piece: yes/no²
- 1.2.4.5.3.1. Number:
- 1.2.4.5.3.2. Make(s):
- 1.2.4.5.3.3. Type(s):
- 1.2.4.5.3.4. Drawings:
- 1.2.4.5.3.5. Place of installation (include drawing(s)):
- 1.2.4.5.3.6. Adjustment possibilities:
- 1.2.4.5.3.7. Operating pressure(s):¹ kPa
- 1.2.4.5.4. Gas dosage unit: yes/no²
- 1.2.4.5.4.1. Number:
- 1.2.4.5.4.2. Make(s):
- 1.2.4.5.4.3. Type(s):
- 1.2.4.5.4.4. Drawings:
- 1.2.4.5.4.5. Place of installation (include drawing(s)):
- 1.2.4.5.4.6. Adjustment possibilities (description)
- 1.2.4.5.4.7. Operating pressure(s):¹ kPa
- 1.2.4.5.5. Gas injection device (s) or Injector(s): yes/no²
- 1.2.4.5.5.1. Make(s):
- 1.2.4.5.5.2. Type(s):
- 1.2.4.5.5.3. (Not used)
- 1.2.4.5.5.4. Operating pressure(s):¹ kPa
- 1.2.4.5.5.5. Drawings of installation: kPa
- 1.2.4.5.6. Electronic Control Unit LPG-fuelling:
- 1.2.4.5.6.1. Make(s):
- 1.2.4.5.6.2. Type(s):
- 1.2.4.5.6.3. Place of installation:
- 1.2.4.5.6.4. Adjustment possibilities:
- 1.2.4.5.7. LPG container:
- 1.2.4.5.7.1. Make(s):
- 1.2.4.5.7.2. Type(s) (include drawings):
- 1.2.4.5.7.3. Number of containers:
- 1.2.4.5.7.4. Capacity: litres
- 1.2.4.5.7.5. LPG fuel pump in container: yes/no²

¹ Specify the tolerance.
² Strike out what does not apply.

- 1.2.4.5.7.6. (Not used)
- 1.2.4.5.7.7. Drawings of the installation of the container:
- 1.2.4.5.8. LPG container accessories
- 1.2.4.5.8.1. 80 per cent stop valve:
 - 1.2.4.5.8.1.1. Make(s):
 - 1.2.4.5.8.1.2. Type(s):
 - 1.2.4.5.8.1.3. Operating principle: float/other² (include description or drawings):
.....
- 1.2.4.5.8.2. Level indicator:
 - 1.2.4.5.8.2.1. Make(s):
 - 1.2.4.5.8.2.2. Type(s):
 - 1.2.4.5.8.2.3. Operating principle: float/other² (include description or drawings):
.....
- 1.2.4.5.8.3. Pressure relief valve (discharge valve):
 - 1.2.4.5.8.3.1. Make(s):
 - 1.2.4.5.8.3.2. Type(s):
 - 1.2.4.5.8.3.3. Flow rate in standard conditions:
- 1.2.4.5.8.4. Pressure relief device
 - 1.2.4.5.8.4.1. Make(s):
 - 1.2.4.5.8.4.2. Type(s):
 - 1.2.4.5.8.4.3. Description and drawings:
 - 1.2.4.5.8.4.4. Operating temperature:
 - 1.2.4.5.8.4.5. Material:
 - 1.2.4.5.8.4.6. Flow rate in standard condition:
- 1.2.4.5.8.5. Remotely controlled service valve with excess flow valve:
 - 1.2.4.5.8.5.1. Make(s):
 - 1.2.4.5.8.5.2. Type(s):
- 1.2.4.5.8.6. Multivalve: yes/no²
 - 1.2.4.5.8.6.1. Make(s):
 - 1.2.4.5.8.6.2. Type(s):
 - 1.2.4.5.8.6.3. Multivalve description (include drawings):
- 1.2.4.5.8.7. Gas-tight housing:
 - 1.2.4.5.8.7.1. Make(s):
 - 1.2.4.5.8.7.2. Type(s):
- 1.2.4.5.8.8. Power supply bushing (fuel pump/actuators):
 - 1.2.4.5.8.8.1. Make(s):

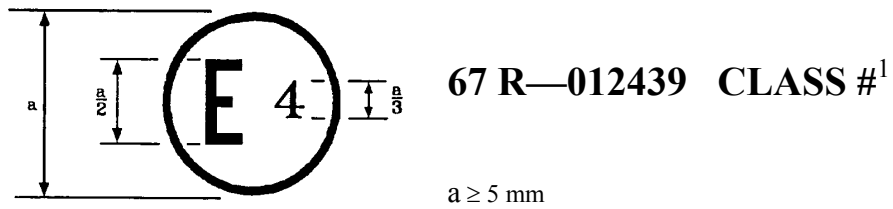
- 1.2.4.5.8.8.2. Type(s):
- 1.2.4.5.8.8.3. Drawings:
- 1.2.4.5.9. Fuel pump (LPG): yes/no²
- 1.2.4.5.9.1. Make(s):
- 1.2.4.5.9.2. Type(s):
- 1.2.4.5.9.3. Pump mounted in LPG container: yes/no²
- 1.2.4.5.9.4. Operating pressure(s):¹ kPa
- 1.2.4.5.10. Shut-off valve/Non-return valve/Gas tube pressure relief valve:
yes/no²
- 1.2.4.5.10.1. Make(s):
- 1.2.4.5.10.2. Type(s):
- 1.2.4.5.10.3. Description and drawings:
- 1.2.4.5.10.4. Operating pressure(s):¹ kPa
- 1.2.4.5.11. Remote filling unit:²
- 1.2.4.5.11.1. Make(s):
- 1.2.4.5.11.2. Type(s):
- 1.2.4.5.11.3. Description and drawings:
- 1.2.4.5.12. Flexible fuel hose(s)/pipes:
- 1.2.4.5.12.1. Make(s):
- 1.2.4.5.12.2. Type(s):
- 1.2.4.5.12.3. Description:
- 1.2.4.5.12.4. Operating pressure(s):¹ kPa
- 1.2.4.5.13. Pressure and Temperature sensor(s):²
- 1.2.4.5.13.1. Make(s):
- 1.2.4.5.13.2. Type(s):
- 1.2.4.5.13.3. Description:
- 1.2.4.5.13.4. Operating pressure(s):¹ kPa
- 1.2.4.5.14. LPG filter unit(s):²
- 1.2.4.5.14.1. Make(s):
- 1.2.4.5.14.2. Type(s):
- 1.2.4.5.14.3. Description:
- 1.2.4.5.14.4. Operating pressure(s):¹ kPa
- 1.2.4.5.15. Service coupling(s) (mono-fuel vehicles without limp-home system):²
- 1.2.4.5.15.1. Make(s):
- 1.2.4.5.15.2. Type(s):
- 1.2.4.5.15.3. Description and drawings of installation:

- 1.2.4.5.16. Connection to LPG system for heating system: yes/no²
- 1.2.4.5.16.1. Make(s):
- 1.2.4.5.16.2. Type(s):
- 1.2.4.5.16.3. Description and drawings of installation:
- 1.2.4.5.17. Fuel rail:²
- 1.2.4.5.17.1. Make(s):
- 1.2.4.5.17.2. Type(s):
- 1.2.4.5.17.3. Description and drawings of installation:
- 1.2.4.5.17.4. Operating pressure(s):¹ kPa
- 1.2.4.5.18. Multi-component:²
- 1.2.4.5.18.1. Make(s):
- 1.2.4.5.18.2. Type(s):
- 1.2.4.5.18.3. Description and drawings:
- 1.2.4.5.18.4. Operating pressure(s):¹ kPa
- 1.2.4.5.19 Non-seamless fuel line**
- 1.2.4.5.19.1 Make(s):**
- 1.2.4.5.19.2 Type(s):**
- 1.2.4.5.19.3 Description and drawings:**
- 1.2.4.5.20 Coupling(s)**
- 1.2.4.5.20.1 Make(s):**
- 1.2.4.5.20.2 Type(s):**
- 1.2.4.5.20.3 Description and drawings:**
- 1.2.4.5.~~4921~~. Further documentation:
- 1.2.4.5.~~4921~~.1. Description of the LPG equipment and the physical safeguarding of the catalyst at switch-over from petrol to LPG or back
- 1.2.4.5.~~4921~~.2. System lay-out (electrical connections, vacuum connections compensation hoses, etc.)
- 1.2.4.5.~~4921~~.3. Drawing of the symbol:
- 1.2.4.5.~~4921~~.4. Adjustment data:
- 1.2.4.5.~~4921~~.5. Certificate of the vehicle on petrol, if already granted:
- 1.2.5. Cooling system: (liquid/air)²
- 1.2.5.1. System description/drawings with regard to the LPG equipment

Annex 2A

Arrangement of the LPG equipment type approval mark

(See paragraph 5.4. of this Regulation)



¹ Class 0, 1, 2, 2A or 3

The above approval mark affixed to the LPG equipment shows that this equipment has been approved in the Netherlands (E 4), pursuant to Regulation No. 67 under approval number 012439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. 67 as amended by the 01 series of amendments.

Annex 2B

Communication

(Maximum format: A4 (210 x 297 mm))



Concerning:² Approval granted
Approval extended
Approval refused
Approval withdrawn
Production definitively discontinued

of a type of LPG equipment pursuant to Regulation No. 67

Approval No.: Extension No.:

1. LPG equipment considered:²

Container including the configuration of accessories fitted to the container, as laid down in Appendix 1 to this annex.

80 per cent stop valve

Level indicator

Pressure relief valve (discharge valve)

Pressure relief device

Remotely controlled service valve with excess flow valve

Multivalve, including the following accessories:

.....

Gas-tight housing

Power supply bushing (pump/actuators)

Fuel pump

Vaporizer/pressure regulator

Shut-off valve

Non-return valve

Gas-tube pressure relief valve

¹ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation.)

² Strike out what does not apply.

Service coupling
Flexible hose
Remote filling unit
Gas injection device or injector
Fuel rail
Gas dosage unit
Gas mixing piece
Electronic control unit
Pressure/temperature sensor
LPG filter unit

Non-seamless fuel line

Coupling

Multi-component

2. Trade name or mark:
3. Manufacturer's name and address:
4. If applicable, name and address of manufacturer's representative:
5. Submitted for approval on:
6. Technical Service responsible for conducting approval tests:
7. Date of report issued by that Service:
8. No. of report issued by that Service:
9. Approval granted/refused/extended/withdrawn:²
10. Reason(s) of extension (if applicable):
11. Place:
12. Date:
13. Signature:
14. The documents filed with the application or extension of approval can be obtained upon request.

Annex 2B - Appendix

Containers only

1. Container characteristics from the parent container (configuration 00):
 - (a) Trade name or mark:
 - (b) Shape:
 - (c) Material:
 - (d) Openings: see drawing
 - (e) Wall thickness: mm
 - (f) Diameter (cylindrical container): mm
 - (g) Height (special container shape): mm
 - (h) External surface: cm²
 - (i) Configuration of accessories fitted to container: see Table 1.

Table 1

<i>No.</i>	<i>Item</i>	<i>Type</i>	<i>Approval No.</i>	<i>Extension No.</i>
a	80 per cent stop valve			
b	Level indicator			
c	Pressure relief valve			
d	Remotely controlled service valve with excess valve			
e	Fuel pump			
f	Multi-valve			
g	Gas-tight housing			
h	Power supply bushing			
i	Non return valve			
j	Pressure relief device			
K	Coupling			

2. Lists of the container family

The lists of the container family indicate the diameter, capacity, external surface and the possible configuration(s) of the accessories fitted to the container.

Table 2

<i>No.</i>	<i>Type</i>	<i>Diameter/height [mm]</i>	<i>Capacity [L]</i>	<i>External surface [cm²]</i>	<i>Configuration of accessories [codes]¹</i>
01					
02					

¹ Code 00 and, if applicable, same code(s) from Table 3.

3. Lists of the possible configurations of accessories fitted to the container

Specify a list of the possible accessories, which differ from the tested configuration of accessories (code 00) and which may be fitted to the type of container. Specify for all accessories, type, approval number and extension number, indicating its own configuration code.

Table 3

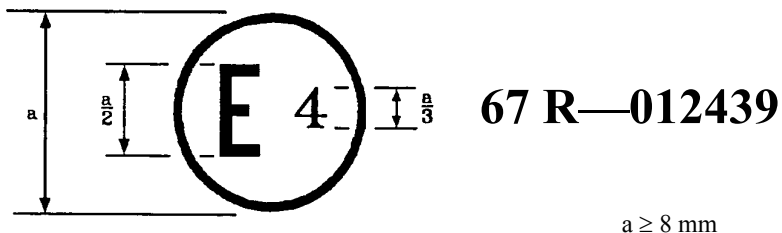
<i>No.</i>	<i>Accessories</i>	<i>Type</i>	<i>Approval No.</i>	<i>Extension No.</i>	<i>Configuration of accessories [code]</i>
a					
b					
c					
d					

Annex 2C

Arrangement of approval marks

Model A

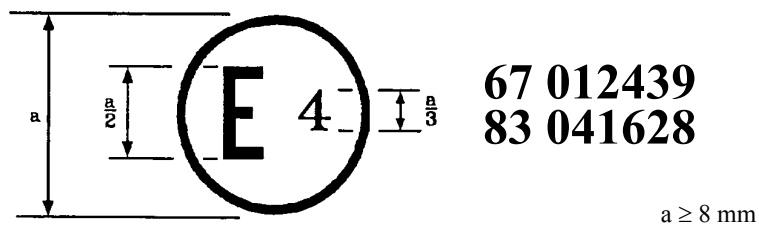
(See paragraph 16.4. of this Regulation)



The above approval mark affixed to a vehicle shows that the vehicle has, with regard to the installation of specific equipment for the use of LPG for propulsion, been approved in the Netherlands (E 4), pursuant to Regulation No. 67 under approval number 012439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. 67 as amended by the 01 series of amendments.

Model B

(See paragraph 16.4. of this Regulation)



The above approval mark affixed to a vehicle shows that the vehicle has, with regard to the installation of specific equipment for the use of LPG for propulsion, been approved in the Netherlands (E 4), pursuant to Regulation No. 67 under approval number 012439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. 67 as amended by the 01 series of amendments and that Regulation No. 83 included the 04 series of amendments.

Annex 2D

Communication

(Maximum format: A4 (210 x 297 mm))



Concerning:² Approval granted
Approval extended
Approval refused
Approval withdrawn
Production definitively discontinued

of a vehicle type with regard to the installation of LPG systems pursuant to Regulation No. 67

Approval No: Extension No:
.....

1. Trade name or mark of vehicle:.....
2. Vehicle type:
3. Vehicle category:
4. Manufacturer's name and address:
5. If applicable, name and address of manufacturer's representative:
.....
.....
6. Description of the vehicle (drawings, etc.)
7. Test results:
8. Submitted for approval on:
9. Technical Service responsible for conducting approval tests:.....
10. Date of report issued by that Service:
11. No. of report issued by that Service:
12. Approval granted/refused/extended/withdrawn:²
13. Reason(s) of extension (if applicable):
14. Place:

¹ Distinguishing number of the country which has granted/extended/refused/withdrawn approval provisions in the Regulation.)

approval (see

² Strike out what does not apply.

15. Date:
16. Signature:
17. The following documents filed with the application or extension of approval can be obtained upon request.

Drawings, diagrams and scheme plans regarding the components and the installation of the LPG equipment considered to be of importance for the purpose of this Regulation;

Where applicable drawings of the various equipment and their position in the vehicle.

Annex 3

Provisions regarding the approval of LPG container accessories

- 1 80 per cent stop valve
 - 1.1. Definition: See paragraph 2.5.1. of this Regulation.
 - 1.2. Component classification (according to Figure 1, para. 2.): Class 3.
 - 1.3. Classification pressure: 3,000 kPa.
 - 1.4. Design temperatures:
-20 °C to 65 °C
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
 - 1.5. General design rules:
Paragraph 6.15.1., Provisions regarding 80 per cent stop valve.
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.3.1., Provisions on valves activated by electrical power.
 - 1.6. Applicable test procedures:

Overpressure test	Annex 156, para. 4.
External leakage	Annex 156, para. 5.
High temperature	Annex 156, para. 6.
Low temperature	Annex 156, para. 7.
Seat leakage	Annex 156, para. 8.
Endurance	Annex 156, para. 9.
Operational tests	Annex 156, para. 10.
LPG compatibility	Annex 156, para. 11.*
Corrosion resistance	Annex 156, para. 12.*
Resistance to dry heat	Annex 156, para. 13.**
Ozone ageing	Annex 156, para. 14.**
Creep	Annex 156, para. 15.**
Temperature cycle	Annex 156, para. 16.**
2. Level indicator
 - 2.1. Definition: see paragraph 2.5.2. of this Regulation.
 - 2.2. Component classification (according to Figure 1, para. 2.): Class 1.
 - 2.3. Classification pressure: 3,000 kPa.

- 2.4. Design temperatures:
-20 °C to 65 °C
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
- 2.5. General design rules:
Paragraph 6.15.11., Provisions regarding the level indicator.
Paragraph 6.15.2., Provisions regarding the electrical insulation.
- 2.6. Applicable test procedures:
- | | |
|------------------------|------------------------|
| Overpressure test | Annex 156, para. 4. |
| External leakage | Annex 156, para. 5. |
| High temperature | Annex 156, para. 6. |
| Low temperature | Annex 156, para. 7. |
| LPG compatibility | Annex 156, para. 11.** |
| Corrosion resistance | Annex 156, para. 12.* |
| Resistance to dry heat | Annex 156, para. 13.** |
| Ozone ageing | Annex 156, para. 14.** |
| Creep | Annex 156, para. 15.** |
| Temperature cycle | Annex 156, para. 16.** |
3. Pressure relief valve (discharge valve)
- 3.1. Definition: See paragraph 2.5.3. of this Regulation.
- 3.2. Component classification (according to Figure 1, para. 2.): Class 3.
- 3.3. Classification pressure: 3,000 kPa.
- 3.4. Design temperatures:
-20 °C to 65 °C
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
- 3.5. General design rules:
Paragraph 6.15.8., Provisions regarding the pressure relief valve (discharge valve)
- 3.6. Applicable test procedures:
- | | |
|--|----------------------|
| Overpressure test | Annex 156, para. 4. |
| External leakage | Annex 156, para. 5. |
| High temperature | Annex 156, para. 6. |
| Low temperature | Annex 156, para. 7. |
| Seat leakage | Annex 156, para. 8. |
| Endurance
(with 200 operation cycles) | Annex 156, para. 9. |
| Operational test | Annex 156, para. 10. |

- | | | |
|------|--|------------------------|
| | LPG compatibility | Annex 156, para. 11.** |
| | Corrosion resistance | Annex 156, para. 12.* |
| | Resistance to dry heat | Annex 156, para. 13.** |
| | Ozone ageing | Annex 156, para. 14.** |
| | Creep | Annex 156, para. 15.** |
| | Temperature cycle | Annex 156, para. 16.** |
| 4. | Remotely controlled service valve with excess flow valve | |
| 4.1. | Definition: see paragraph 2.5.4. of this Regulation. | |
| 4.2. | Component classification (according to Figure 1, para.2.): Class 3 or Class 0 if WP declared. | |
| 4.3. | Classification pressure: 3,000 kPa or WP declared if $\geq 3,000$ kPa. | |
| 4.4. | Design temperatures: | |
| | -20 °C to 65 °C | |
| | For temperatures exceeding the above-mentioned values, special tests conditions are applicable. | |
| 4.5. | General design rules: | |
| | Paragraph 6.15.2., Provisions regarding the electrical insulation. | |
| | Paragraph 6.15.3.1., Provisions on valves activated by an electrical/external power. | |
| | Paragraph 6.15.13., Provisions regarding the remotely controlled service valve with excess flow valve. | |
| 4.6. | Applicable test procedures: | |
| | Overpressure test | Annex 156, para. 4. |
| | External leakage | Annex 156, para. 5. |
| | High temperature | Annex 156, para. 6. |
| | Low temperature | Annex 156, para. 7. |
| | Seat leakage | Annex 156, para. 8. |
| | Endurance | Annex 156, para. 9. |
| | Operational test | Annex 156, para. 10 |
| | LPG compatibility | Annex 156, para. 11.** |
| | Corrosion resistance | Annex 156, para. 12.* |
| | Resistance to dry heat | Annex 156, para. 13.** |
| | Ozone ageing | Annex 156, para. 14.** |
| | Creep | Annex 156, para. 15.** |
| | Temperature cycle | Annex 156, para. 16.** |

- 4.7. If the remotely controlled service valve is closed during commanded stop phases, the valve shall be submitted to the following numbers of operations during the endurance test of paragraph 9. of Annex 156:
- (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.

Notwithstanding the above-mentioned provisions, the valve complying with (b) shall be deemed to satisfy (a), and the valve complying with (c) shall be deemed to satisfy (a) and (b).

5. Power supply bushing

5.1. Definition: see paragraph 2.5.8. of this Regulation.

5.2. Component classification (according to Figure 1, para. 2.):

Class 0 for the part which is in contact with liquid LPG at a pressure > 3,000 kPa;

Class 1 for the part which is in contact with liquid LPG at a pressure ≤ 3,000 kPa.

5.3. Classification pressure:

Parts of Class 0 WP declared

Parts of Class 1 3,000 kPa

5.4. Design temperatures: -20 °C to 65 °C

For temperatures exceeding the above-mentioned values, special tests conditions are applicable.

5.5. General design rules:

Paragraph 6.15.2., Provisions regarding the electrical insulation.

Paragraph 6.15.2.3., Provisions regarding the power supply bushing.

5.6. Applicable test procedures:

Overpressure test	Annex 156, para. 4.
External leakage	Annex 156, para. 5.
High temperature	Annex 156, para. 6.
Low temperature	Annex 156, para. 7.
LPG compatibility	Annex 156, para. 11.**
Corrosion resistance	Annex 156, para. 12.*
Resistance to dry heat	Annex 156, para. 13.**
Ozone ageing	Annex 156, para. 14.**
Creep	Annex 156, para. 15.**
Temperature cycle	Annex 156, para. 16.**

6. Gas-tight housing
- 6.1. Definition: See paragraph 2.5.7. of this Regulation.
- 6.2. Component classification (according to Figure 1, para. 2.):
Not applicable.
- 6.3. Classification pressure: Not applicable.
- 6.4. Design temperatures:
-20 °C to 65 °C

For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
- 6.5. General design rules:
Paragraph 6.15.12., Provisions regarding the gas-tight housing.
- 6.6. Applicable test procedures:
- | | |
|-------------------|---------------------------------|
| Overpressure test | Annex 156, para. 4. (at 50 kPa) |
| External leakage | Annex 156, para. 5. (at 10 kPa) |
| High temperature | Annex 156, para. 6. |
| Low temperature | Annex 156, para. 7. |
7. Provisions regarding the approval of the pressure relief device (fuse)
- 7.1. Definition: see paragraph 2.5.3.1. of this Regulation.
- 7.2. Component classification (according to Figure 1, paragraph 2.): Class 3.
- 7.3. Classification pressure: 3,000 kPa.
- 7.4. Design temperature:
The fuse has to be designed to open at a temperature of 120 ± 10 °C
- 7.5. General design rules
Paragraph 6.15.2., Provisions regarding the electrical insulation
Paragraph 6.15.3.1., Provisions on valves activated by electrical power
Paragraph 6.15.7., Provisions regarding the gas tube pressure relief valve
- 7.6. Test procedures to be applied:
- | | |
|------------------------|------------------------|
| Overpressure test | Annex 156, para. 4. |
| External leakage | Annex 156, para. 5. |
| High temperature | Annex 156, para. 6. |
| Low temperature | Annex 156, para. 7. |
| Seat (if any) leakage | Annex 156, para. 8. |
| LPG compatibility | Annex 156, para. 11.** |
| Corrosion resistance | Annex 156, para. 12.* |
| Resistance to dry heat | Annex 156, para. 13.** |
| Ozone ageing | Annex 156, para. 14.** |

Creep Annex 156, para. 15.**

Temperature cycles Annex 156, para. 16.**

7.7. Pressure relief device (fuse) requirements

Pressure relief device (fuse) specified by the manufacturer shall be shown to be compatible with the service conditions by means of the following tests:

- (a) One specimen shall be held at a controlled temperature of not less than 90 °C and a pressure not less than test pressure (3,000 kPa) for 24 hours. At the end of this test there shall be no leakage or visible sign of extrusion of any fusible metal used in the design.
- (b) One specimen shall be fatigue tested at a pressure cycling rate not to exceed 4 cycles per minute as follows:
 - (i) Held at 82 °C while pressured for 10,000 cycles between 300 and 3,000 kPa;
 - (ii) Held at -20 °C while pressured for 10,000 cycles between 300 and 3,000 kPa.

At the end of this test there shall be no leakage, or any visible sign of extrusion of any fusible metal used in the design.

- (c) Exposed brass pressure retaining components of pressure relief device shall withstand, without stress corrosion cracking, a mercurous nitrate test as described in ASTM B154***. The pressure relief device shall be immersed for 30 minutes in an aqueous mercurous nitrate solution containing 10 g of mercurous nitrate and 10 ml of nitric acid per litre of solution. Following the immersion, the pressure relief device shall be leak tested by applying an aerostatic pressure of 3,000 kPa for one minute during which time the component shall be checked for external leakage. Any leakage shall not exceed 200 cm³/h.
- (d) Exposed stainless steel pressure retaining components of pressure relief device shall be made of an alloy type resistant to chloride induced stress corrosion cracking.

* Only for metallic parts.

** Only for non-metallic parts.

*** This procedure, or other equivalent, is allowed until an international standard will be available.

Annex 4

Provisions regarding the approval of the fuel pump

- 1 Definition: See paragraph 2.5.5. of this Regulation.
2. Component classification (according to Figure 1, para. 2):-
Class 0 for the part which is in contact with liquid LPG at a pressure > 3,000 kPa;
Class 1 for the part which is in contact with liquid LPG at a pressure ≤ 3,000 kPa.
3. Classification pressure:

Parts of Class 0	WP declared
Parts of Class 1	3,000 kPa
4. Design temperatures:
-20 °C to 65 °C, when the fuel pump is mounted inside the container.
-20 °C to 120 °C, when the fuel pump is mounted outside the container.
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.2.1., Provisions regarding the insulation class.
Paragraph 6.15.3.2., Provisions when the power is switched off.
Paragraph 6.15.6.1., Provisions to prevent pressure build-up.
6. Applicable test procedures:
 - 6.1. Fuel pump mounted inside the container:

LPG compatibility	Annex 156, para. 11.**
-------------------	------------------------
 - 6.2. Fuel pump mounted outside the container:

Overpressure test	Annex 156, para. 4.
External leakage	Annex 156, para. 5.
High temperature	Annex 156, para. 6.
Low temperature	Annex 156, para. 7.
LPG compatibility	Annex 156, para. 11.**
Corrosion resistance	Annex 156, para. 12.*
Resistance to dry heat	Annex 156, para. 13.**
Ozone ageing	Annex 156, para. 14.**
Creep	Annex 156, para. 15.**
Temperature cycle	Annex 156, para. 16.**

* Only for metallic parts.

** Only for non-metallic parts.

Annex 5

Provisions regarding the approval of the LPG filter unit

1. Definition: See paragraph 2.14. of this Regulation.
2. Component classification (according to Figure 1, para. 2.):
Filter units can be Class 0, 1, 2 or 2A.
3. Classification pressure:
Components of Class 0: WP declared
Components of Class 1: 3,000 kPa.
Components of Class 2: 450 kPa.
Components of Class 2A: 120 kPa.
4. Design temperatures:
-20 °C to 120 °C

For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
5. General design rules: (not used)
6. Applicable test procedures:
 - 6.1. For parts of Class 1:

Overpressure test	Annex 156, para. 4.
External leakage	Annex 156, para. 5.
High temperature	Annex 156, para. 6.
Low temperature	Annex 156, para. 7.
LPG compatibility	Annex 156, para. 11.**
Corrosion resistance	Annex 156, para. 12.*
Resistance to dry heat	Annex 156, para. 13.**
Ozone ageing	Annex 156, para. 14.**
Creep	Annex 156, para. 15.**
Temperature cycle	Annex 156, para. 16.**
 - 6.2. For parts of Class 2 and/or 2A:

Overpressure test	Annex 156, para. 4.
External leakage	Annex 156, para. 5.
High temperature	Annex 156, para. 6.
Low temperature	Annex 156, para. 7.
LPG compatibility	Annex 156, para. 11.**
Corrosion resistance	Annex 156, para. 12.**

* Only for metallic parts.

** Only for non-metallic parts.

Annex 6

Provisions regarding the approval of the pressure regulator and the vaporizer

1. Definition:
Vaporizer: See paragraph 2.6. of this Regulation.
Pressure regulator: see paragraph 2.7. of this Regulation.
2. Component classification (according to Figure 1, para. 2.):
Class 0: for the part which is in contact with LPG at a pressure $> 3,000$ kPa.
Class 1: for the part which is in contact with the pressure $\leq 3,000$ kPa.
Class 2: for the part which is in contact with the regulated pressure and with a maximum regulated pressure during operation of 450 kPa.
Class 2A: for the part which is in contact with the regulated pressure and with a maximum regulated pressure during operation of 120 kPa.
3. Classification pressure:
Parts of Class 0: WP declared
Parts of Class 1: 3,000 kPa.
Parts of Class 2: 450 kPa.
Parts of Class 2A: 120 kPa.
4. Design temperatures:
-20 °C to 120 °C
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.3.1., Provisions on valves activated by external power.
Paragraph 6.15.4., Heat exchange medium (compatibility and pressure requirements).
Paragraph 6.15.5., Overpressure bypass security.
Paragraph 6.15.6.2., Gas flow prevention.
6. Applicable test procedures:
 - 6.1. For parts of Class 1:
Overpressure test Annex 156, para. 4.
External leakage Annex 156, para. 5.
High temperature Annex 156, para. 6.
Low temperature Annex 156, para. 7.

	Seat leakage	Annex 156, para. 8.
	Endurance (Number of cycles shall be 50,000 cycles)	Annex 156, para. 9.
	LPG compatibility	Annex 156, para. 11.**
	Corrosion resistance	Annex 156, para. 12.*
	Resistance to dry heat	Annex 156, para. 13.**
	Ozone ageing	Annex 156, para. 14.**
	Creep	Annex 156, para. 15.**
	Temperature cycle	Annex 156, para. 16.**
6.2.	For parts of Class 2 and/or 2A:	
	Overpressure test	Annex 156, para. 4.
	External leakage	Annex 156, para. 5.
	High temperature	Annex 156, para. 6.
	Low temperature	Annex 156, para. 7.
	LPG compatibility	Annex 156, para. 11.**
	Corrosion resistance	Annex 156, para. 12.*
	Remarks:	
	The shut-off valve can be integrated in the vaporizer, regulator, in this case Annex 7 is also applicable.	
	The parts of the pressure regulator/vaporizer (Class 1, 2 or 2A) shall be leak proof with the outlet(s) of that part closed off.	
	For the overpressure test all the outlets including those of the coolant compartment shall be closed off.	

* Only for metallic parts.

** Only for non-metallic parts.

Annex 7

Provisions regarding the approval of the shut-off valve, the non-return valve, the gas-tube pressure relief valve and the service coupling

1. Provisions regarding the approval of the shut-off valve
 - 1.1. Definition: See paragraph 2.8. of this Regulation.
 - 1.2. Component classification (according to Figure 1, para. 2.): Class 3.
 - 1.3. Classification pressure: 3,000 kPa or WP declared if > 3,000 kPa.
 - 1.4. Design temperatures:
-20 °C to 120 °C

For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
 - 1.5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.3.1., Provisions on valves activated by electrical power.
 - 1.6. Applicable test procedures:

Overpressure test	Annex 156 , para. 4.
External leakage	Annex 156 , para. 5.
High temperature	Annex 156 , para. 6.
Low temperature	Annex 156 , para. 7.
Seat leakage	Annex 156 , para. 8.
Endurance	Annex 156 , para. 9.
LPG compatibility	Annex 156 , para. 11.**
Corrosion resistance	Annex 156 , para. 12.*
Resistance to dry heat	Annex 156 , para. 13.**
Ozone ageing	Annex 156 , para. 14.**
Creep	Annex 156 , para. 15.**
Temperature cycle	Annex 156 , para. 16.**
 - 1.7. If the remotely controlled shut-off valve is closed during commanded stop phases, the valve shall be submitted to the numbers of operations according to paragraph 4.7. of Annex 3 during the endurance test of paragraph 9. of Annex ~~156~~.
2. Provisions regarding the approval of the non-return valve
 - 2.1. Definition: See paragraph 2.5.9. of this Regulation.
 - 2.2. Component classification (according to Figure 1, para. 2.): Class 1.

- 2.3. Classification pressure: 3,000 kPa.
- 2.4. Design temperatures:
-20 °C to 120 °C
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
- 2.5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.3.1., Provisions on valves activated by electrical power.
- 2.6. Applicable test procedures:
- | | |
|------------------------|------------------------|
| Overpressure test | Annex 156, para. 4. |
| External leakage | Annex 156, para. 5. |
| High temperature | Annex 156, para. 6. |
| Low temperature | Annex 156, para. 7. |
| Seat leakage | Annex 156, para. 8. |
| Endurance | Annex 156, para. 9. |
| LPG compatibility | Annex 156, para. 11.** |
| Corrosion resistance | Annex 156, para. 12.* |
| Resistance to dry heat | Annex 156, para. 13.** |
| Ozone ageing | Annex 156, para. 14.** |
| Creep | Annex 156, para. 15.** |
| Temperature cycle | Annex 156, para. 16.** |
3. Provisions regarding the approval of the gas-tube relief valve
- 3.1. Definition: See paragraph 2.9. of this Regulation.
- 3.2. Component classification (according to Figure 1, para. 2.): Class 3.
- 3.3. Classification pressure: 3,000 kPa or WP declared if > 3,000 kPa.
- 3.4. Design temperatures:
-20 °C to 120 °C
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
- 3.5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.3.1., Provisions on valves activated by electrical power.
Paragraph 6.15.7., Provisions regarding the gas-tube pressure relief valve.
- 3.6. Applicable test procedures:
- | | |
|-------------------|---------------------|
| Overpressure test | Annex 156, para. 4. |
| External leakage | Annex 156, para. 5. |
| High temperature | Annex 156, para. 6. |

	Low temperature	Annex 156, para. 7.
	Seat leakage	Annex 156, para. 8.
	Endurance (with 200 operation cycles)	Annex 156, para. 9.
	LPG compatibility	Annex 156, para. 11.**
	Corrosion resistance	Annex 156, para. 12.*
	Resistance to dry heat	Annex 156, para. 13.**
	Ozone ageing	Annex 156, para. 14.**
	Creep	Annex 156, para. 15.**
	Temperature cycle	Annex 156, para. 16.**
4.	Provisions regarding the approval of the service coupling	
4.1.	Definition: See paragraph 2.17. of this Regulation.	
4.2.	Component classification (according to Figure 1, para. 2.): Class 1.	
4.3.	Classification pressure: 3,000 kPa.	
4.4.	Design temperatures: -20 °C to 120 °C For temperatures exceeding the above-mentioned values, special tests conditions are applicable.	
4.5.	General design rules: Paragraph 6.15.2., Provisions regarding the electrical insulation. Paragraph 6.15.3.1., Provisions on valves activated by electrical power.	
4.6.	Applicable test procedures:	
	Overpressure test	Annex 156, para. 4.
	External leakage	Annex 156, para. 5.
	High temperature	Annex 156, para. 6.
	Low temperature	Annex 156, para. 7.
	Seat leakage	Annex 156, para. 8.
	Endurance (with 6,000 operation cycles)	Annex 156, para. 9.
	LPG compatibility	Annex 156, para. 11.**
	Corrosion resistance	Annex 156, para. 12.*
	Resistance to dry heat	Annex 156, para. 13.**
	Ozone ageing	Annex 156, para. 14.**
	Creep	Annex 156, para. 15.**
	Temperature cycle	Annex 156, para. 16.**

* Only for metallic parts.

** Only for non-metallic parts.

Annex 8

No changes.

Annex 9

Provisions regarding the approval of the filling unit

1. Definition: See paragraph 2.16. of this Regulation.
2. Component classification (according to Figure 1, para. 2. of this Regulation):
Filling unit: Class 3
Non-return valve: Class 3
3. Classification pressure: 3,000 kPa.
4. Design temperatures:
-20 °C to 65 °C
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.10., Provisions regarding the filling unit.
6. Applicable test procedures:

Overpressure test	Annex 156 , para. 4.
External leakage	Annex 156 , para. 5.
High temperature	Annex 156 , para. 6.
Low temperature	Annex 156 , para. 7.
Seat leakage test	Annex 156 , para. 8.
Endurance (with 6,000 operation cycles)	Annex 156 , para. 9.
LPG compatibility	Annex 156 , para. 11.**
Corrosion resistance	Annex 156 , para. 12.*
Resistance to dry heat	Annex 156 , para. 13.
Ozone ageing	Annex 156 , para. 14.
Creep	Annex 156 , para. 15.**
Temperature cycle	Annex 156 , para. 16.**
Impact test	paragraph 7. of this annex
7. Impact test requirements for the Euro filling unit
- 7.1. General requirements

The filling unit shall be subjected to an impact test of 10 J.

7.2. Test procedure

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 filling unit shall be installed horizontally on a solid object. The impact of the mass shall be on the centre of the protruding part of the filling unit.

7.3. Test interpretation

The filling unit shall comply with the external leak test and seat leak test at ambient temperature.

7.4. Re-testing

If the filling unit fails the test, 2 samples of the same component shall be submitted to the impact test. If both samples pass the test, the first test shall be ignored. In the event where one or both fail the re-test, the component shall not be approved.

Remarks:

- (a) The overpressure test has to be performed on each non-return valve.
- (b) The endurance test shall be carried out with a nozzle specifically intended for the filling unit under test. 6,000 cycles shall be applied according to the following procedure:
 - (i) Connect the nozzle to the connector and open the filling unit system;
 - (ii) Leave in open situation for at least 3 seconds;
 - (iii) Close the filling unit and disconnect the nozzle.

Figure 1
Connecting area of the bayonet filling unit

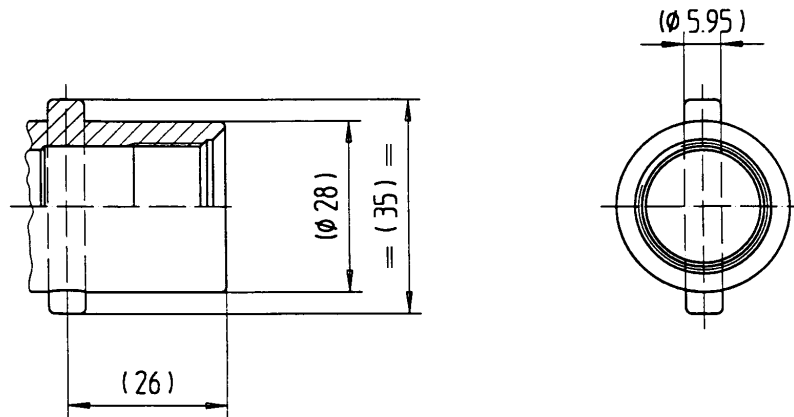


Figure 2
Connecting area of the Dish filling unit

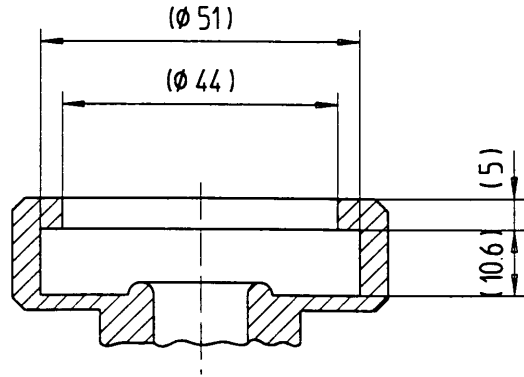


Figure 3
Connecting area of the light vehicle Euro filling unit

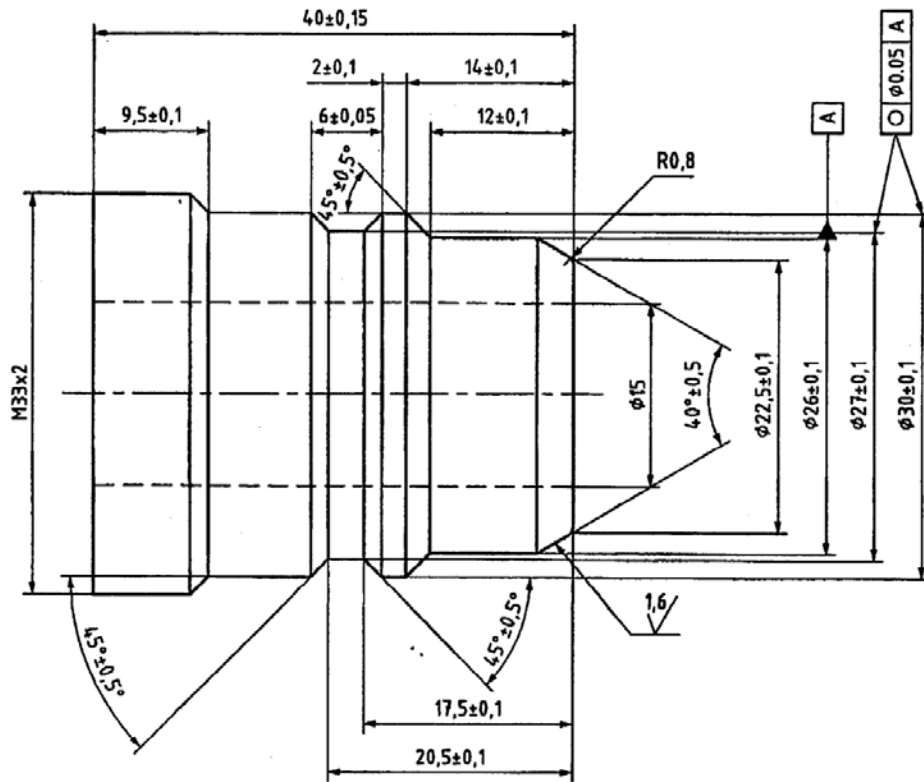


Figure 4
Connecting area of the ACME filling unit

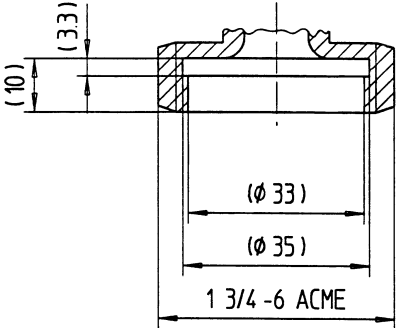
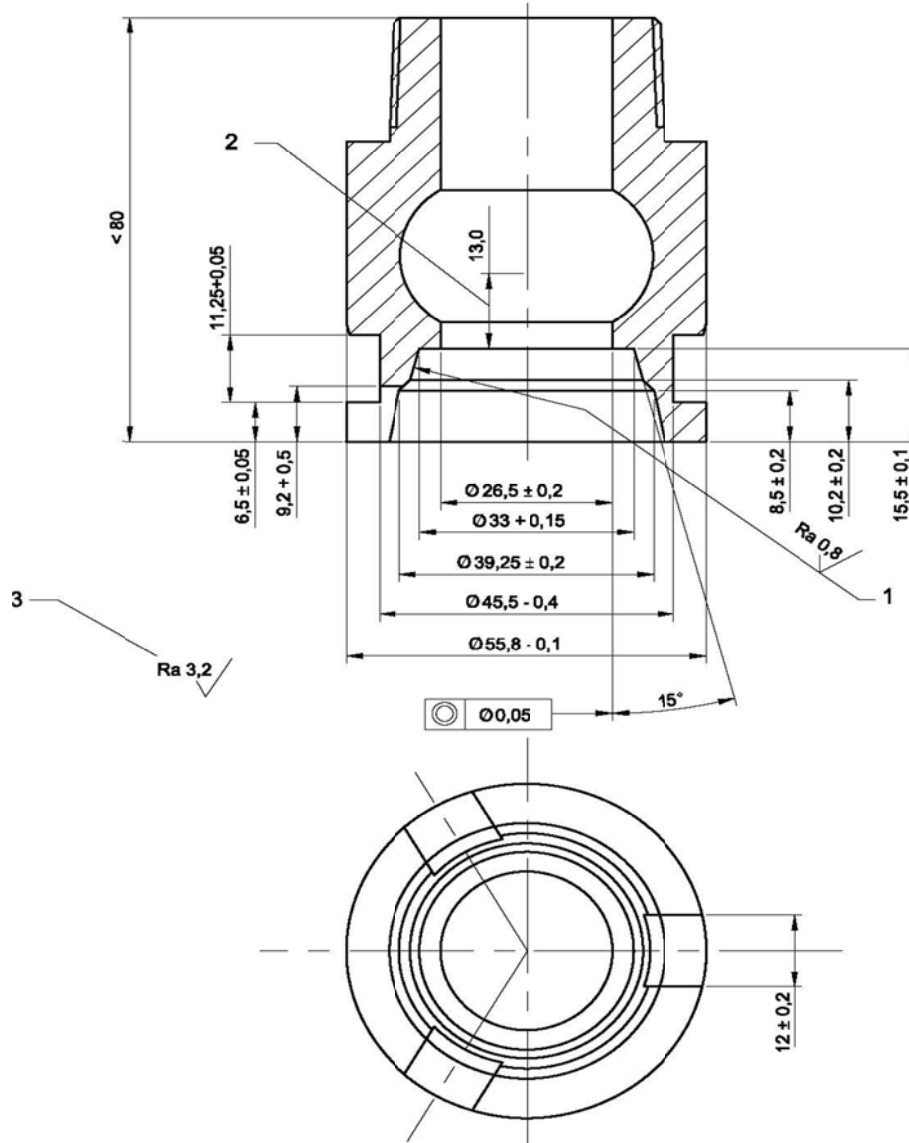


Figure 5
Connecting area of the heavy-duty vehicle Euro filling unit

Dimensions in millimetres



Keys:

- 1 Nozzle sealing surface
- 2 Minimum valve travel
- 3 General tolerance

* Only for metallic parts.
** Only for non-metallic parts.

Annex 10

No changes.

Annex 11

Provisions regarding the approval of gas injection devices, or gas mixing pieces, or injectors and the fuel rail

1. Gas injection device or injector
 - 1.1. Definition: See paragraph 2.10. of this Regulation.
 - 1.2. Component classification (according to Figure 1, para. 2.): Class 1 or Class 0.
 - 1.3. Classification pressure:
Class 0: WP declared
Class 1: 3,000 kPa.
 - 1.4. Design temperatures:
-20 °C to 120 °C

For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
 - 1.5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.2.1., Provisions regarding the insulation class.
Paragraph 6.15.3.1., Provisions when the power is switched off.
Paragraph 6.15.4.1., Heat exchange medium (compatibility and pressure requirements).
 - 1.6. Applicable test procedures:

Overpressure test	Annex 156, para. 4.
External leakage	Annex 156, para. 5.
High temperature	Annex 156, para. 6.
Low temperature	Annex 156, para. 7.
LPG compatibility	Annex 156, para. 11.**
Corrosion resistance	Annex 156, para. 12.*
Resistance to dry heat	Annex 156, para. 13.**
Ozone ageing	Annex 156, para. 14.**
Creep	Annex 156, para. 15.**
Temperature cycle	Annex 156, para. 16.**
2. Gas injection device or gas mixing piece

- 2.1. Definition: See paragraph 2.10. of this Regulation.
- 2.2. Component classification (according to Figure 1, para. 2.):
 Class 2: for the part with a maximum regulated pressure during operation of 450 kPa.
 Class 2A: for the part with a maximum regulated pressure during operation of 120 kPa.
- 2.3. Classification pressure:
 Parts of Class 2: 450 kPa.
 Parts of Class 2A: 120 kPa.
- 2.4. Design temperatures:
 -20 °C to 120 °C, when the fuel pump is mounted outside the container.
 For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
- 2.5. General design rules:
 Paragraph 6.15.2., Provisions regarding the electrical insulation.
 Paragraph 6.15.2.1., Provisions regarding the insulation class.
 Paragraph 6.15.3.1., Provisions when the power is switched off.
 Paragraph 6.15.4.1., Heat exchange medium (compatibility and pressure requirements).
- 2.6. Applicable test procedures:
- | | |
|----------------------|------------------------------------|
| Overpressure test | Annex 156 , para. 4. |
| External leakage | Annex 156 , para. 5. |
| High temperature | Annex 156 , para. 6. |
| Low temperature | Annex 156 , para. 7. |
| LPG compatibility | Annex 156 , para. 11.** |
| Corrosion resistance | Annex 156 , para. 12.* |
3. Fuel rail
- 3.1. Definition: See paragraph 2.18. of this Regulation.
- 3.2. Component classification (according to Figure 1, para. 2.):
 Fuel rails can be of Class 0, 1, 2 or 2A.
- 3.3. Classification pressure:
 Parts of Class 0 WP declared
 Parts of Class 1: 3,000 kPa.
 Parts of Class 2: 450 kPa.
 Parts of Class 2A: 120 kPa.
- 3.4. Design temperatures:
 -20 °C to 120 °C

For temperatures exceeding the above-mentioned values, special tests conditions are applicable.

- 3.5. General design rules: (not used)
- 3.6. Applicable test procedures:
 - 3.6.1. For fuel rails of Class 0 and 1:
 - Overpressure test Annex 156, para. 4.
 - External leakage Annex 156, para. 5.
 - High temperature Annex 156, para. 6.
 - Low temperature Annex 156, para. 7.
 - LPG compatibility Annex 156, para. 11. **
 - Corrosion resistance Annex 156, para. 12. *
 - Resistance to dry heat Annex 156, para. 13. **
 - Ozone ageing Annex 156, para. 14. **
 - Creep Annex 156, para. 15. **
 - Temperature cycle Annex 156, para. 16. **
 - 3.6.2. For fuel rails of Class 2 and/or 2A:
 - Overpressure test Annex 156, para. 4.
 - External leakage Annex 156, para. 5.
 - High temperature Annex 156, para. 6.
 - Low temperature Annex 156, para. 7.
 - LPG compatibility Annex 156, para. 11. **
 - Corrosion resistance Annex 156, para. 12. *

* Only for metallic parts.

** Only for non-metallic parts.

Annex 12

Provisions regarding the approval of the gas dosage unit when not combined with the gas injection device(s)

1. Definition: See paragraph 2.11. of this Regulation.
2. Component classification (according to Figure 1, para. 2.):
Class 2: for the part with a maximum regulated pressure during operation of 450 kPa.
Class 2A: for the part with a maximum regulated pressure during operation of 120 kPa.
3. Classification pressure:
Parts of Class 2: 450 kPa.
Parts of Class 2A: 120 kPa.
4. Design temperatures:
-20 °C to 120 °C

For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.3.1., Provisions on valves activated by electrical power.
Paragraph 6.15.4., Heat exchange medium (compatibility and pressure requirements).
Paragraph 6.15.5., Overpressure bypass security.
6. Applicable test procedures:

Overpressure test	Annex 156 , para. 4.
External leakage	Annex 156 , para. 5.
High temperature	Annex 156 , para. 6.
Low temperature	Annex 156 , para. 7.
LPG compatibility	Annex 156 , para. 11. ^{**}
Corrosion resistance	Annex 156 , para. 12. [*]

Remarks:
The parts of the gas dosage unit (Class 2 or 2A) shall be leakproof with the outlet(s) of that part closed.

For the overpressure test all the outlets including those of the coolant compartment shall be closed off.

* Only for metallic parts.

** Only for non-metallic parts.

Annex 13

Provisions regarding the approval of the pressure and/or temperature sensor

1. Definition:
Pressure sensor: See paragraph 2.13. of this Regulation.
Temperature sensor: See paragraph 2.13. of this Regulation.
2. Component classification (according to Figure 1, para. 2.):
Pressure and temperature sensors can be of Class 0, 1, 2 or 2A.
3. Classification pressure:
Parts of Class 0: WP declared
Parts of Class 1: 3,000 kPa.
Parts of Class 2: 450 kPa.
Parts of Class 2A: 120 kPa.
4. Design temperatures:
-20 °C to 120 °C
For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
5. General design rules:
Paragraph 6.15.2., Provisions regarding the electrical insulation.
Paragraph 6.15.4.1., Heat exchange medium (compatibility and pressure requirements).
Paragraph 6.15.6.2., Gas flow prevention.
6. Applicable test procedures:
 - 6.1. For parts of Class 0 and 1:

Overpressure test	Annex 156, para. 4.
External leakage	Annex 156, para. 5.
High temperature	Annex 156, para. 6.
Low temperature	Annex 156, para. 7.
LPG compatibility	Annex 156, para. 11.**
Corrosion resistance	Annex 156, para. 12.*
Resistance to dry heat	Annex 156, para. 13.**
Ozone ageing	Annex 156, para. 14.**
Creep	Annex 156, para. 15.**
Temperature cycle	Annex 156, para. 16.**

6.2.	For parts of Class 2 or 2A:	
	Overpressure test	Annex 156, para. 4.
	External leakage	Annex 156, para. 5.
	High temperature	Annex 156, para. 6.
	Low temperature	Annex 156, para. 7.
	LPG compatibility	Annex 156, para. 11.**
	Corrosion resistance	Annex 156, para. 12.*

* Only for metallic parts.

** Only for non-metallic parts.

Annex 14

No changes.

Annex 15

Provisions regarding the approval of the non-seamless fuel line and/or couplings

1. **Definitions:**
 - Fuel line: See paragraph 2.21. of this Regulation.
 - Coupling: See paragraph 2.22. of this Regulation.
2. **Component classification (according to Paragraph 2 Figure 1):**
 - Fuel line and coupling can be of Class 0, 1, 2 or 2A.
3. **Classification pressure:**
 - Parts of Class 0: WP declared
 - Parts of Class 1: 3,000 kPa.
 - Parts of Class 2: 450 kPa.
 - Parts of Class 2A: 120 kPa.
4. **Design temperatures:**
 - 20 °C to 120 °C
 - For temperatures exceeding the above-mentioned values, special tests conditions are applicable.
5. **General design rules:**
 - The couplings shall be compatible with the fuel line.
 - Specific care shall be taken against galvanic corrosion.
 - Stainless steel fuel line shall only be used in combination with stainless steel couplings.
6. **Applicable test procedures:**
 - 6.1. **For parts of Class 0 and 1:**
 - Overpressure test Annex 16, para. 4.
 - External leakage Annex 16, para. 5.
 - High temperature Annex 16, para. 6.
 - Low temperature Annex 16, para. 7.
 - LPG compatibility Annex 16, para. 11.**
 - Resistance to dry heat Annex 16, para. 13.**
 - Ozone ageing Annex 16, para. 14.**
 - 6.2. **For parts of Class 2 or 2A:**
 - Overpressure test Annex 16, para. 4.
 - External leakage Annex 16, para. 5.
 - High temperature Annex 16, para. 6.
 - Low temperature Annex 16, para. 7.
 - LPG compatibility Annex 16, para. 11.**

Corrosion resistance Annex 16, para. 12.*

6.3 Specific requirements on the fuel line and/or couplings or combination:

6.3.1 The fuel line and/or coupling shall be tested for an endurance test consisting out of 100.000 cycles.

1 Cycle consist out of pressure ramp from 0 up to WP.

The coupling shall only be tested using a compatible fuel line.

After the endurance test the fuel line and or coupling need to comply with the test from Annex 16 paragraph 4, 5, 6 and 7.

6.3.2 Bending test on the fuel line

Test the rigid fuel line according to the following procedure and acceptance criterion.

a) Select a mandrel with an external diameter from the below table:

External diameter	Mandrel diameter
< 8 mm	3 x external fuel line diameter
≥ 8 mm	5x external fuel line diameter

b) Bend the rigid fuel line over this mandrel once, forming a “U” shape.

c) Close the ends of the rigid fuel line and subject it to the overpressure test according to Annex 16 paragraph 4.

At the completion of the overpressure test, the rigid fuel line shall be tested according to the leakage testing of Annex 16 paragraph 5, 6 and 7.

6.3.3 Excess torque resistance

A coupling designed to be connected directly to threaded fittings shall be capable of withstanding, without deformation, breakage or leakage, a torque effort of 150% of the rated installation value delivered by the manufacturer, according to the following test procedure:

a) Test an unused component, applying the torque adjacent to the fitting.

b) For a component having a threaded connection or threaded connections, apply the turning effort for 15 minutes, release the turning effort, then remove the component and examine it for deformation and breakage.

c) Perform the leakage test according to Annex 16 paragraphs 5, 6 and 7.

d) Perform the overpressure test according to Annex 16 paragraph 4.

6.3.5 Vibration test

Vibrate the coupling connected according to the manufacturer’s specification to a compatible fuel line using the test described in Annex 16, paragraph 10.5.4., procedure A.

After this test the tested sample shall comply with the test described in Annex 16 paragraphs 4, 5, 6 and 7.

6.3.6 Pull-off

Test the coupling, attached to compatible fuel line and coupled to its mating part or parts, according to the following procedure and acceptance criterion.

Secure the subject specimen in an appropriate test fixture, then statically apply a tensile load along the fuel line axis at a maximum rate of 250 N/min until the fuel line separates from the coupling.

The force (F), in newton’s, required to pull apart the fuel line from its coupling shall be that calculated as:

$$F = (\pi d^2 P) / 10$$

where

d is the internal diameter, in millimetres;

P is the maximum working pressure, in bar.

- 6.3.7 Brass material compatibility**
All fuel line and couplings having brass components shall be subjected to the brass material compatibility test according to ISO15500-2:2012.
After this test the fuel line and couplings shall comply with the Annex 16 paragraph 4, 5, 6 and 7 tests.

* Only for metallic parts.

** Only for non-metallic parts.

Annex 156

Annex 167

Annex 178

II. Justification

This proposal aims at adapting the provisions of UN Regulation No. 67 (R67) to the technical progress. Non-seamless double and single wall tubes are already known in brake and fuel tubing applications and allow the whole variety of end forms and coupling techniques. Due to their usage they have to withstand high pressure and a high resistance for pressure pulses. R67 should allow this well-known technology, as long the tube can withstand the applicable tests according to Annex 15. Paragraph 17.7.1. is modified accordingly.

This proposal aims for more flexibility in the Regulation and comprise a rapid commercialization process of LPG. Pre-qualification testing made by GM shows positive results.

The technical information behind this proposal was presented during the previous GRSG session (GRSG-109-14e page 11-21).

During its 110th session, GRSG discussed the preference that fuel lines and couplings were part of the certification process instead of complying with the general definitions as currently.

This proposal is implementing the general test program for the fuel lines and couplings based on R67. The specific added tests for the fuel line and couplings are based on the experience for fuel lines used in CNG (ISO15500) having a higher pressure as used in the LPG.

Annexes 15, 16 and 17, and the references to these Annexes, have been renumbered respectively Annexes 16, 17 and 18.