
**Road vehicles — Compressed natural
gas (CNG) fuel systems —**

**Part 1:
Safety requirements**

*Véhicules routiers — Systèmes d'alimentation en gaz naturel
comprimé (GNC) —*

Partie 1: Exigences de sécurité

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ISO 15501-1:2012

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Published in Switzerland

Contents	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Requirements	3
4.1 Design	3
4.2 Refuelling connection	5
4.3 Leakage control	5
4.4 Mounting of the cylinder(s)	5
4.5 Heat protection	6
4.6 Minimizing risk of gas ignition	6
4.7 Venting system	6
5 Instructions for use	7
6 Marking	7
Annex A (informative) Technical solutions to functional requirements	8
Annex B (informative) Examples of compressed natural gas (CNG) on-board fuel systems	9
Bibliography	11

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Foreword

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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15501-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Vehicles using gaseous fuels*.

This second edition cancels and replaces the first edition (ISO 15501-1:2001), which has been technically revised.

ISO 15501 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel systems*:

- *Part 1: Safety requirements*
- *Part 2: Test methods*

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Introduction

For the purposes of this part of ISO 15501, all fuel system components in contact with natural gas have been considered suitable for natural gas as defined in ISO 15403.

When applying this part of ISO 15501, it is to be understood that a safety device that prevents overfilling of the vehicle's fuel system is part of the refuelling station. The pressure gauge is not considered a safety component.

Where necessary, technical solutions to functional requirements are given in Annex A.

This part of ISO 15501 makes reference to a service pressure of 20 MPa¹⁾ [200 bar²⁾] for natural gas used as fuel, settled at 15 °C. It is possible to accommodate other service pressures by adjusting the pressure using the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

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1) 1 MPa = 1 N/mm².

2) 1 bar = 0,1 MPa = 10⁵ Pa.

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Road vehicles — Compressed natural gas (CNG) fuel systems —

Part 1: Safety requirements

1 Scope

This part of ISO 15501 specifies the minimum safety requirements applicable to compressed natural gas (CNG) on-board fuel systems intended for use on the types of motor vehicles defined in ISO 3833. This part of ISO 15501 is applicable to vehicles using compressed natural gas as defined in ISO 15403, including bi-fuel, original-production and converted vehicles.

Matters relating to the skills of installers and converters are outside the scope of this part of ISO 15501.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 11439, *Gas cylinders — High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles*

ISO 14469-1, *Road vehicles — Compressed natural gas (CNG) refuelling connector — Part 1: 20 MPa (200 bar) connector*

ISO 14469-2, *Road vehicles — Compressed natural gas (CNG) refuelling connector — Part 2: 20 MPa (200 bar) connector, size 2*

ISO 14469-3, *Road vehicles — Compressed natural gas (CNG) refuelling connector — Part 3: 25 MPa (250 bar) connector*

ISO 15500 (all parts), *Road vehicles — Compressed natural gas (CNG) fuel system components*

ISO 15501-2, *Road vehicles — Compressed natural gas (CNG) fuel systems — Part 2: Test methods*

IEC 60079-10-1, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15500-1, ISO 1176, and the following apply.

3.1

service pressure

settled pressure of vehicle fuel system at a uniform natural gas temperature of 15 °C

3.2

CNG on-board fuel system

compressed natural gas fuel system comprising a cylinder, or cylinders, mounting hardware, a refuelling receptacle or more than one of each of these, in accordance with ISO 14469, and the components described in ISO 15500-3 to ISO 15500-20

3.3

main shut-off valve

automatic valve designed to isolate a high-pressure source

3.4. Vehicle mass

3.4.1

kerb mass

complete shipping mass of a vehicle fitted with all equipment necessary for normal operation plus the mass of the following elements for categories M1, N1 and M2 whose maximum authorized mass does not exceed 3 500 kg:

- lubricants, coolant (if needed), washer fluid;
- fuel (tank filled to at least 90 % of the capacity specified by the manufacturer);
- other equipment if included as basic parts for the vehicle, such as spare wheel(s), wheel chocks, fire extinguisher(s), spare parts and tool kit

NOTE The definition of kerb mass can vary from country to country, but in this part of ISO 15501, it refers to the definition given in ISO 1176.

3.4.2

maximum authorized mass

kerb mass plus the maximum allowable payload

3.5 Vehicle categories

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3.5.1

category M

power-driven vehicles having at least four wheels and used for the carriage of passengers

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3.5.1.1

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category M1

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vehicles used for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat

3.5.1.2

category M2

vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat and having a maximum authorized mass not exceeding 5 000 kg

3.5.1.3

category M3

vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat and having a maximum authorized mass exceeding 5 000 kg

3.5.2

category N

power-driven vehicles having at least four wheels and used for the carriage of goods

3.5.2.1

category N1

vehicles used for the carriage of goods and having a maximum authorized mass not exceeding 3 500 kg

3.5.2.2

category N2

vehicles used for the carriage of goods and having a maximum authorized mass exceeding 3 500 kg but not exceeding 12 000 kg

3.5.2.3

category N3

vehicles used for the carriage of goods and having a maximum authorized mass exceeding 12 000 kg

4 Requirements

4.1 Design

4.1.1 General

4.1.1.1 The CNG on-board fuel system components shall comply with ISO 11439, ISO 14469 and ISO 15500, as applicable.

4.1.1.2 For bi-fuel vehicles, provision shall be made to avoid accelerated deterioration of the non-CNG fuel system as a result of sustained operation on natural gas. Such measures shall be as recommended by the original vehicle manufacturer (with regard to fuel hoses for example).

4.1.1.3 All fuel system components shall fulfil the following conditions.

- a) They shall withstand the environmental temperatures and other environmental conditions safely during their operational life.
- b) They shall be located with full regard for anticipated damage liable to occur while the vehicle is being used safely.

NOTE Such damage can be caused by the vehicle itself, by extraneous factors such as heat, road debris, automotive chemical splash (brake liquid, oil, petrol, cooling liquid, etc.), or by rust, etc.

- c) They shall be fitted so that they are not the outermost, highest or lowest parts of the vehicle; otherwise they shall be protected.
- d) They shall be fitted so as not to affect the ground clearance, approach angle, ramp (break-over) angle or departure angles defined by the vehicle manufacturer.
- e) They shall be located so as not to suffer corrosion damage through accumulation of water or cargo chemicals.
- f) They shall ensure proper electrical conductivity throughout the fuel system in order to avoid electrostatic charges. This provision does not apply to gas-tight housing and ventilation hoses.

4.1.1.4 The CNG system [including the gas cylinder valve(s), pressure-relief device(s) (PRDs) and one or more automatic valves designed to close when the engine is not running on CNG and to be opened or closed manually in the event of automated failure (see Annex B)] shall be installed in such a way that it is suitably protected against damage, such as that arising from moving vehicle components, collision and grit or that due to loading or unloading of the vehicle or the shifting of those loads.

4.1.1.5 The CNG on-board fuel system shall include

- a) a main shut-off valve that remains closed when the engine is not running on CNG,
- b) a manual or automatic override valve located on each gas cylinder,
- c) a PRD installed on each cylinder, which is functionally independent from any other component, and
- d) a device located inside the cylinder, or a functionally equivalent system, to control gas leakage in the event of an abnormal flow (see Annex A).

4.1.1.6 The main shut-off valve shall only be open when

- a) CNG operation has been selected, either manually or automatically, and
- b) the engine is cranking or running.