
**Road vehicles — Compressed natural gas
(CNG) fuel system components —**

**Part 17:
Flexible fuel line**

*Véhicules routiers — Composants des systèmes de combustible gaz
naturel comprimé (GNC) —
Partie 17: Tuyauterie flexible pour combustible*

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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 3.

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 part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-17 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

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ISO 15500-17:2001(E)

- *Part 15: Gas-tight housing and ventilation hose*
- *Part 16: Rigid fuel line*
- *Part 17: Flexible fuel line*
- *Part 18: Filter*
- *Part 19: Fittings*

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Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 17: Flexible fuel line

1 Scope

This part of ISO 15500 specifies tests and requirements for the flexible fuel line, a compressed natural gas fuel system component in accordance with SAE J 517 (100R-8 hose) or JIS B 8362 intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

- a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;
- b) fuel containers;
- c) stationary gas engines;
- d) container mounting hardware;
- e) electronic fuel management;
- f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar¹⁾] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

1) 1 bar = 0,1 MPa = 10⁵ Pa; 1 MPa = 1 N/mm²

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ISO 3833, *Road vehicles — Types — Terms and definitions.*

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles.*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions.*

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

SAE J 517, *Hydraulic hose.*

JIS B 8362, *Textile reinforced thermoplastic hose assemblies for hydraulic use.*

3 Terms and definitions

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

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

- a) the manufacturer's or agent's name, trademark or symbol;
- b) the model designation (part number);
- c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

- d) the direction of flow (when necessary for correct installation);
- e) the type of fuel;
- f) electrical ratings;
- g) the symbol of the certification agency;
- h) the type approval number;
- i) the serial number or date code;
- j) reference to this part of ISO 15500.

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

5 Construction and assembly

The flexible fuel line shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

6 Tests

6.1 Applicability

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

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	
Excess torque resistance	X ^a	X	
Bending moment			
Continued operation	X	X	X (see 6.3)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical over-voltages	X	X	
Non-metallic synthetic immersion	X	X	
Vibration resistance			
Brass material compatibility	X	X	
Bending	X		X (see 6.4)
Pull-off	X		X (see 6.5)
Conductivity	X		X (see 6.6)
Permeability	X		X (see 6.7)

^a Applicable to the fittings.

6.2 Hydrostatic strength

The flexible fuel line shall be tested according to the procedure for testing hydrostatic strength specified in ISO 15500-2.

Test pressure upstream of the first stage of the pressure reduction shall be 100 MPa (1 000 bar). Test pressure downstream of the first stage of the pressure reduction shall be four times its working pressure.

6.3 Continued operation

The flexible fuel line shall be subjected to the continued operation test for a total of 20 000 cycles.

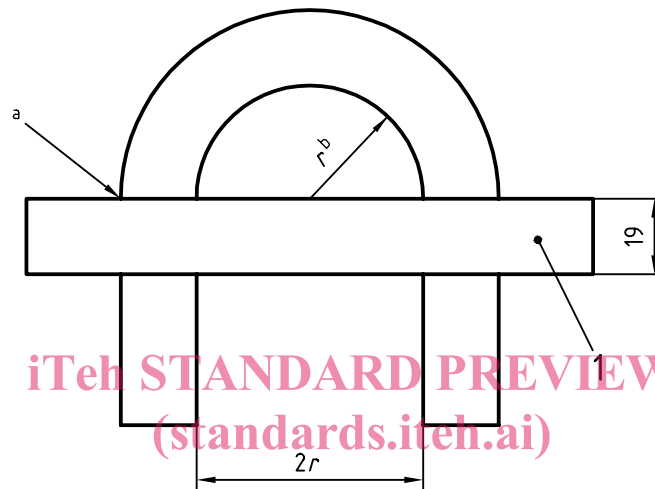
6.4 Bending

Test the flexible fuel line using a suitable length of hose with no end fittings according to the following procedure and acceptance criteria.

- a) Carefully bend the hose and place it in a fixture as shown in Figure 1.
- b) After the hose has been left in this position for 5 min, insert into one end of the hose a steel ball having a diameter equal to half the hose's nominal inside diameter.

The fuel line shall not kink and the ball shall pass freely from one end of the hose to the other.

Dimension in millimetres



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Key

- 1 Board
- a Hole size as necessary to fit hose outside diameter.
- b $r = 10$ times the nominal hose inside diameter, or the hose manufacturer's specified minimum bend radius, whichever is less.

Figure 1 — Bending test

6.5 Pull-off

Test the flexible fuel line, attached to its fitting or fittings 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 flexible fuel line axis at a maximum rate of 250 N/min until the flexible fuel line separates from its fitting.

The force (F), in newtons, required to pull apart the fuel line from its fitting shall be that calculated as:

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

where

- d is the inside diameter, in millimetres;
- P is the pressure, in bar.

6.6 Electrical conductivity

Conduct the test with the hose depressurized and at the specified working pressure. Check the hose resistance using an applied potential of up to 500 V DC and measuring the current.

Electrical resistance between couplings at each end of the hose shall be $< 1 \text{ M}\Omega/\text{m}$, in order to dissipate static electricity.

6.7 Permeability

Fill a suitable length of hose with CNG to service or working pressure, place it in an enclosed sealed chamber at ambient temperature and monitor it for leakage for 14 d.

The hourly permeation rate shall be less than $20 \text{ cm}^3/\text{m}$. Section the hose and inspect the internal surfaces for any evidence of cracking or deterioration.

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