INTERNATIONAL STANDARD

ISO 11439

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

Bouteilles à gaz — Bouteilles haute pression pour le stockage de gaz naturel utilisé comme carburant à bord des véhicules automobiles

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

International Standard ISO 11439 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 3, *Cylinder design*.

Annexes A and B form a normative part of this International Standard. Annexes C to H are for information only.

Introduction

Cylinders for the on-board storage of fuel for natural gas vehicle service are required to be light-weight, at the same time maintaining or improving on the level of safety currently existing for other pressure vessels. These requirements are achieved by:

a) specifying service conditions precisely and comprehensively as a firm basis for both cylinder design and use;

b) using an appropriate method to assess cyclic pressure fatigue life and to establish allowable defect sizes in metal cylinders or liners;

c) requiring design qualification tests;

d) requiring non-destructive testing and inspection of all production cylinders;

e) requiring destructive tests on cylinders and cylinder material taken from each batch of cylinders produced;

f) requiring manufacturers to have a comprehensive quality system documented and implemented;

g) requiring periodic re-inspection and, if necessary, retesting in accordance with the manufacturer's instructions;

h) requiring manufacturers to specify as part of their design, the safe service life of their cylinders.

Cylinder designs that meet the requirements of this International Standard:

a) will have a fatigue life which exceeds the specified service life;

b) when pressure cycled to failure, will leak but not rupture;

c) when subject to hydrostatic burst tests, will have factors of "stress at burst pressure" over "stress at working pressure" that exceed the values specified for the type of design and the materials used.

Owners or users of cylinders designed to this International Standard should note that the cylinders are designed to operate safely if used in accordance with specified service conditions for a specified finite service life only. The expiry date is marked on each cylinder and it is the responsibility of owners and users to ensure that cylinders are not used after that date, and that they are inspected in accordance with the manufacturer's instructions.

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

1 Scope

This International Standard specifies minimum requirements for serially produced light-weight refillable gas cylinders intended only for the on-board storage of high pressure compressed natural gas as a fuel for automotive vehicles to which the cylinders are to be fixed. The service conditions do not cover external loadings which may arise from vehicle collisions, etc.

This International Standard covers cylinders of any steel, aluminium or non-metallic material construction, using any design or method of manufacture suitable for the specified service conditions. This International Standard does not cover cylinders of stainless steel or of welded construction.

Cylinders covered by this International Standard are designated as follows:

CNG-1 Metal

CNG-2 Metal liner reinforced with resin impregnated continuous filament (hoop wrapped)

CNG-3 Metal liner reinforced with resin impregnated continuous filament (fully wrapped)

CNG-4 Resin impregnated continuous filament with a non-metallic liner (all composite)

NOTE Cylinders designed in accordance with ISO 9809-1, ISO 9809-2, ISO 9809-3 and ISO 7866 can be used for this service provided these designs meet additional requirements as specified in this International Standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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.

ISO 148:1983, *Steel — Charpy impact test (V-notch)*.

ISO 306:1994, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*.

ISO 527-2:1993, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (incorporating Technical Corrigendum 1:1994)*.

ISO 2808:1997, *Paints and varnishes — Determination of film thickness*.

ISO 4624:—[1], *Paints and varnishes — Pull-off test for adhesion*.

ISO 6506-1:1999, *Metallic materials — Brinell hardness test — Part 1: Test method*.

ISO 6892:1998, *Metallic materials — Tensile testing at ambient temperature*.

ISO 7225, *Gas cylinders — Precautionary labels*.

ISO 7866:1999, *Gas cylinders — Refillable seamless aluminium alloy gas cylinders — Design, construction and testing*.

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests*.

ISO 9712:1999, *Non-destructive testing — Qualification and certification of personnel*.

ISO 9809-1:1999, *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa.*

ISO 9809-2:2000, *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa*.

ISO 9809-3:—[2], *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 3: Normalized steel cylinders*.

ISO 14130:1997, *Fibre-reinforced plastic composites — Determination of apparent interlaminar shear strength by short-beam method*.

ASTM D522-93a, *Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings*.

ASTM D1308-87(1998), *Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes*.

ASTM D2794-93(1999)e1, *Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)*.

ASTM D3170-87(1996)e1, *Standard Test Method for Chipping Resistance of Coatings*.

ASTM D3418-99, *Standard Test Method for Transition Temperatures of Polymers by Differential Scanning Calorimetry*.

ASTM G53-93[3], *Standard Practice for Operating Light and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials*.

NACE TM0177-96[4], *Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking and Stress Corrosion Cracking in H_2S Environments*.

3 Terms and definitions

For the purposes of this International Standard the following terms and definitions shall apply:

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1) To be published. (Revision of ISO 4624:1978)

2) To be published

3) To be discontinued in 2000 and replaced by G154.

4) NACE standards are available from NACE International, PO Box 218340, Houston, Texas 77218-8340, U.S.A.