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**Gas cylinders — Refillable composite  
gas cylinders and tubes — Design,  
construction and testing —**

Part 2:

**Fully wrapped fibre reinforced composite  
gas cylinders and tubes up to 450 l with  
load-sharing metal liners**

*Bouteilles à gaz — Bouteilles à gaz rechargeables en matériau  
composite et tubes — Conception, construction et essais —*

*Partie 2: Bouteilles à gaz composites entièrement bobinées renforcées  
par des fibres et tubes d'une contenance allant jusqu'à 450 l avec liners  
métalliques transmettant la charge*



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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 11119-2 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 3, *Cylinder design*.

This edition cancels and replaces ISO 11119-2:2002.

ISO 11119 consists of the following parts, under the general title *Gas cylinders — Refillable composite gas cylinders and tubes — Design, construction and testing*:

- *Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 l*
- *Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with load-sharing metal liners*
- *Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with non-load-sharing metallic or non-metallic liners*

The following part is under preparation:

- *Part 4: Fully wrapped fibre reinforced composite gas cylinders with load-sharing welded metal liners*

## Introduction

The purpose of this International Standard is to provide a specification for the design, manufacture, inspection and testing of cylinders for worldwide usage. The objective is to balance design and economic efficiency against international acceptance and universal utility.

This International Standard aims to eliminate the concern about climate, duplicate inspection and restrictions currently existing because of lack of definitive International Standards and is not to be construed as reflecting on the suitability of the practice of any nation or region.

This part of ISO 11119 addresses the general requirements on design, construction and initial inspection and testing of pressure receptacles of the *Recommendations on the transport of dangerous goods: Model regulations* developed by the United Nations (Reference [16]).



# Gas cylinders — Refillable composite gas cylinders and tubes — Design, construction and testing —

## Part 2:

## Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with load-sharing metal liners

### 1 Scope

This part of ISO 11119 specifies requirements for composite gas cylinders and tubes between 0,5 l and 450 l water capacity, for the storage and conveyance of compressed or liquefied gases.

This part of ISO 11119 applies to type 3 fully wrapped cylinders or tubes with a load-sharing metal liner and composite reinforcement on both the cylindrical portion and the dome ends.

This part of ISO 11119 is limited to cylinders and tubes with composite reinforcement of carbon fibre, aramid fibre or glass fibre (or a mixture thereof) within a matrix.

Cylinders complying with this part of ISO 11119 have a minimum design life of 15 years.

This part of ISO 11119 does not address the design, fitting, and performance of removable protective sleeves.

This part of ISO 11119 does not apply to cylinders with welded liners.

NOTE ISO 11439<sup>[6]</sup> applies to cylinders intended for use as fuel containers on natural gas vehicles and ISO 11623<sup>[7]</sup> covers periodic inspection and re-testing of composite cylinders.

### 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 3341, *Textile glass — Yarns — Determination of breaking force and breaking elongation*

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

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 7225, *Gas cylinders — Precautionary labels*

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

ISO 9809-1, *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, *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, *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 3: Normalized steel cylinders*

ISO 10618, *Carbon fibre — Determination of tensile properties of resin-impregnated yarn*

ISO 11114-1, *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials*

ISO 13341, *Gas cylinders — Fitting of valves to gas cylinders*

ISO 13769, *Gas cylinders — Stamp marking*

EN 1964-3, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0,5 litre up to and including 150 litres — Part 3: Cylinders made of seamless stainless steel with an  $R_m$  value of less than 1 100 MPa*

ASTM D7269, *Standard test methods for tensile testing of aramid yarns*

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. References to cylinders are to include composite tubes as appropriate

#### 3.1

##### **aramid fibre**

continuous filaments of aramid laid up in tow form

#### 3.2

##### **autofrettage**

pressure application procedure which strains the metal liner past its yield point sufficient to cause permanent plastic deformation, and results in the liner having compressive stresses and the fibres having tensile stresses when at zero internal gauge pressure

#### 3.3

##### **batch**

set of homogeneous items or material

NOTE The number of items in a batch can vary according to the context in which the term is used.

#### 3.4

##### **batch of liners**

production quantity of up to 200 finished liners successively produced (plus units required for destructive testing) of the same nominal diameter, length, thickness and design, from the same material cast and heat treated to the same conditions of temperature and time

#### 3.5

##### **batch of finished cylinders**

production quantity of up to 200 finished cylinders successively produced by the same manufacturing process plus finished cylinders required for destructive testing, of the same nominal diameter, length, thickness and design

#### 3.6

##### **burst pressure**

highest pressure reached in a cylinder during a burst test

#### 3.7

##### **carbon fibre**

continuous filaments of carbon laid up in tow form

#### 3.8

##### **composite overwrap**

combination of fibres and matrix

#### 3.9

##### **dedicated gas service**

service in which a cylinder is to be used only with a specified gas or gases