

---

---

**Gas cylinders — Refillable seamless  
steel gas cylinders — Design,  
construction and testing —**

**Part 4:  
Stainless steel cylinders with an  $R_m$   
value of less than 1 100 MPa**

*Bouteilles à gaz — Bouteilles à gaz rechargeables en acier sans  
soudure — Conception, construction et essais —*

*Partie 4: Bouteilles en acier inoxydable avec une valeur  $R_m$  inférieure  
à 1 100 MPa*



This document is a preview generated by EBS



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2014

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

<b>Foreword</b>	<b>v</b>
<b>Introduction</b>	<b>vi</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms and definitions</b>	<b>1</b>
<b>4 Symbols</b>	<b>2</b>
<b>5 Inspection and testing</b>	<b>3</b>
<b>6 Materials</b>	<b>4</b>
6.1 General requirements	4
6.2 Controls on chemical composition	4
6.3 Heat treatment	5
6.4 Cold working or cryoforming	5
6.5 Failure to meet test requirements	5
<b>7 Design</b>	<b>6</b>
7.1 General requirements	6
7.2 Calculation of cylindrical shell thickness	6
7.3 Calculation of convex ends (heads and bases)	6
7.4 Calculation of the concave base ends	9
7.5 Neck design	9
7.6 Foot rings	10
7.7 Neck rings	10
7.8 Design drawing	10
<b>8 Construction and workmanship</b>	<b>10</b>
8.1 General	10
8.2 Wall thickness	10
8.3 Surface imperfections	10
8.4 Ultrasonic examination	11
8.5 Out-of-roundness	11
8.6 Mean diameter	11
8.7 Straightness	11
8.8 Verticality and stability	11
8.9 Neck threads	12
<b>9 Type approval procedure</b>	<b>12</b>
9.1 General requirements	12
9.2 Prototype test	13
9.3 Type approval certificate	14
<b>10 Batch tests</b>	<b>15</b>
10.1 General requirements	15
10.2 Tensile test	16
10.3 Bend test and flattening test	17
10.4 Impact test	18
10.5 Hydraulic burst test	20
10.6 Intergranular corrosion test	23
<b>11 Tests/examinations on every cylinder</b>	<b>23</b>
11.1 General	23
11.2 Hydraulic test	24
11.3 Hardness test	24
11.4 Leak test	24
11.5 Capacity check	25

<b>12</b>	<b>Certification</b> .....	<b>25</b>
<b>13</b>	<b>Marking</b> .....	<b>25</b>
<b>Annex A</b> (informative)	<b>Description and evaluation of manufacturing imperfections and conditions for rejection of seamless steel gas cylinders at the time of final inspection by the manufacturer</b> .....	<b>26</b>
<b>Annex B</b> (normative)	<b>Ultrasonic examination</b> .....	<b>32</b>
<b>Annex C</b> (informative)	<b>Type approval certificate</b> .....	<b>38</b>
<b>Annex D</b> (informative)	<b>Acceptance certificate</b> .....	<b>39</b>
<b>Bibliography</b>	.....	<b>42</b>

## 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 58, *Gas cylinders*, Subcommittee SC 3, *Cylinder design*.

ISO 9809 consists of the following parts, under the general title *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*
- *Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa*
- *Part 3: Normalized steel cylinders*
- *Part 4: Stainless steel cylinders with tensile strength less than 1 100 MPa*

## Introduction

The purpose of ISO 9809 is to provide a specification for the design, manufacture, inspection, and testing of a seamless stainless steel cylinder for worldwide usage. The objective is to balance the design and economic efficiency against international acceptance and universal utility.

ISO 9809 aims to eliminate the concern about climate, duplicate inspections, and restrictions currently existing because of the lack of definitive International Standards. This International Standard should not be construed as reflecting on the suitability of the practice of any nation or region.

This part of ISO 9809 has been prepared to address the general requirements on the design, construction, and initial inspection and test of pressure receptacles of the UN model regulations for the transportation of dangerous goods.<sup>[6]</sup>

It is intended to be used under a variety of regulatory regimes but has been written so that it is suitable for use with the conformity assessment system in paragraph 6.2.2.5 of the above mentioned model regulations.

# Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing —

## Part 4:

## Stainless steel cylinders with an $R_m$ value of less than 1 100 MPa

### 1 Scope

This part of ISO 9809 specifies the minimum requirements for the material, design, construction and workmanship, manufacturing processes, examinations, and tests at manufacture of refillable seamless stainless steel gas cylinders of water capacities from 0,5 l up to and including 150 l for compressed, liquefied, and dissolved gases. This part of ISO 9809 is applicable to cylinders with a maximum actual tensile strength,  $R_{ma}$ , of less than 1 100 MPa.

NOTE If so desired, cylinders of water capacity less than 0,5 l and between 150 l and 500 l can be manufactured to be in full compliance with this part of ISO 9809.

### 2 Normative references

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

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 3651-2, *Determination of resistance to intergranular corrosion of stainless steels — Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid*

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

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

ISO 7438, *Metallic materials — Bend test*

ISO 9329-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steels with specified room temperature properties*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 13769, *Gas cylinders — Stamp marking*

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1

##### yield strength

stress value corresponding to the 0,2 % proof stress or for austenitic steels in the solution-annealed condition, 1 % proof stress