

---

---

**Gas cylinders — Refillable seamless steel  
gas cylinders — Acoustic emission  
testing (AT) for periodic inspection**

*Bouteilles à gaz — Bouteilles à gaz rechargeables sans soudure —  
Essais d'émission acoustique pour contrôle périodique*



**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

This document is a preview generated by EVS

© ISO 2006

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing 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

<b>1</b>	<b>Scope .....</b>	<b>1</b>
<b>2</b>	<b>Normative references .....</b>	<b>1</b>
<b>3</b>	<b>Terms and definitions .....</b>	<b>1</b>
<b>4</b>	<b>Operational principles .....</b>	<b>2</b>
<b>5</b>	<b>Personnel qualification .....</b>	<b>3</b>
<b>6</b>	<b>Special considerations to ensure valid tests.....</b>	<b>3</b>
<b>7</b>	<b>Apparatus .....</b>	<b>4</b>
<b>8</b>	<b>Calibration and equipment verification .....</b>	<b>6</b>
<b>9</b>	<b>Overall procedure .....</b>	<b>6</b>
<b>10</b>	<b>Real-time evaluation criteria .....</b>	<b>7</b>
<b>11</b>	<b>Test report .....</b>	<b>8</b>
<b>Annex A</b>	<b>(normative) Instrumentation specifications.....</b>	<b>10</b>
<b>Annex B</b>	<b>(informative) Alternative method for source location.....</b>	<b>12</b>
<b>Annex C</b>	<b>(informative) Example instrument settings, examination methods and rejection criteria for modal acoustic emission (MAE).....</b>	<b>15</b>
<b>Annex D</b>	<b>(informative) Distance amplitude correction procedures.....</b>	<b>18</b>
<b>Bibliography</b>	<b>.....</b>	<b>21</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.

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 16148 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*, in collaboration with Technical Committee CEN/TC 23, *Transportable gas cylinders*, of the European Committee for Standardization.

## Introduction

In recent years, new non-destructive examination (NDE) techniques have been successfully introduced as an alternative to the conventional re-testing procedures of gas cylinders, tubes and other cylinders.

One of the alternative NDE methods for certain applications is acoustic emission testing (AT), which has proved to be an acceptable testing method applied during periodic inspection in some countries.

The test method requires pressurization to a level greater than the normal filling pressure.

The pressurization medium may be either gas or liquid.

Acoustic emission (AE) measurements are used to detect and locate emission sources. Other NDE methods are needed to evaluate the significance of AE detected sources. Procedures for other NDE techniques are beyond the scope of this International Standard. For example, shear wave, angle beam ultrasonic inspection is commonly used to establish the exact position and dimensions of flaws that produce AE.

This International Standard includes two methods of AT and, for the purpose of differentiation, the methods are addressed as Method A and Method B (see Clause 3).

With the agreement of the testing and certifying body approved by the competent authority of the country of approval, the hydraulic pressure test of cylinders and tubes may be replaced by an equivalent method based on acoustic emission.

This document is a preview generated by EVS

# Gas cylinders — Refillable seamless steel gas cylinders — Acoustic emission testing (AT) for periodic inspection

## 1 Scope

This International Standard is a guideline for using acoustic emission testing (AT) during re-qualification of seamless steel cylinders and tubes of water capacity up to 3 000 l used for compressed and liquefied gases. For cylinders below 20 l additional precautions may be taken due to the potential reflections from the ends. This examination provides indications and locations that should be evaluated by another examination for a possible flaw in the cylinder. This International Standard covers monolithic steel 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 6406, *Gas cylinders — Seamless steel gas cylinders — Periodic inspection and testing*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

EN 1330-9, *Non-destructive testing — Terminology — Part 9: Terms used in acoustic emission testing*

EN 13477-1, *Non-destructive testing — Acoustic emission — Equipment characterisation — Part 1: Equipment description*

EN 13477-2, *Non-destructive testing — Acoustic emission — Equipment characterisation — Part 2: Verification of operating characteristic*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1330-9 and the following apply.

### 3.1

#### **fracture critical flaw**

defect that is large enough to exhibit unstable crack growth under certain service conditions

### 3.2

#### **working pressure**

settled pressure at a uniform temperature of 288 K (15 °C) for a full gas cylinder with the maximum permissible charge of compressed gas

NOTE 1 In North America service pressure is often used to indicate a similar condition, usually at 21,1 °C (70 °F).

NOTE 2 For compressed gases, this value is usually stamped on the cylinder.