
**Gas cylinders — Refillable seamless
steel gas cylinders and tubes —
Acoustic emission examination (AT)
and follow-up ultrasonic examination
(UT) for periodic inspection and testing**

*Bouteilles à gaz — Bouteilles à gaz rechargeables en acier sans
soudure et tubes — Essais d'émission acoustique et examen
ultrasonique complémentaire pour l'inspection périodique et l'essai*

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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.

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).

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).

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 4, *Operational requirements for gas cylinders*.

This second edition cancels and replaces the first edition (ISO 16148:2006), which has been technically revised. The changes include

- a) expansion of the scope to include tubes of water capacity up to 3 000 l used for compressed and liquefied gases, and
- b) addition of procedures for ultrasonic examination (UT) follow-up during periodic inspection, as described in the new [Annex A](#).

Introduction

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

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

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

The pressurization medium can 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. One of the alternative NDE methods used as a follow-up to AT is ultrasonic examination (UT), which has proved to be an acceptable testing method applied during periodic inspection and testing. The purpose of this International Standard is to provide a procedure for locating, detecting and evaluating the relevance of AE indications such as those from longitudinally oriented crack-like discontinuities. The shear wave (angle beam) UT method is intended to be used immediately following AT to evaluate the significance of AE indications.

This International Standard describes two methods of AT, defined as Method A and Method B, and a method of follow-up UT.

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 can be replaced by an equivalent AT/UT Method A or B.

This International Standard is intended to be used under a variety of national regulatory regimes, but has been written so that it is suitable for the application of Reference.^[1] Attention is drawn to requirements in the specified relevant national regulations of the country (countries) where the cylinders are intended to be used that might override the requirements given in this International Standard. Where there is any conflict between this International Standard and any applicable regulation, the regulation always takes precedence.

Gas cylinders — Refillable seamless steel gas cylinders and tubes — Acoustic emission examination (AT) and follow-up ultrasonic examination (UT) for periodic inspection and testing

1 Scope

This International Standard gives procedures for the use of acoustic emission examination (AT) and ultrasonic examination (UT) follow-up during the periodic inspection and testing of seamless steel cylinders and tubes with a water capacity of up to 3 000 l used for compressed and liquefied gases. This examination provides acoustic emission (AE) indications and locations that are evaluated by a secondary examination using UT for a possible flaw in the cylinder or tube. Methods other than UT for the secondary examination are not covered by this International Standard.

This International Standard does not cover composite cylinders.

CAUTION — Some of the tests specified in this International Standard involve the use of processes which could lead to a hazardous situation.

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 5577, *Non-destructive testing — Ultrasonic inspection — Vocabulary*

ISO 6406, *Gas cylinders — Seamless steel gas cylinders — Periodic inspection and testing*

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

ISO 12716, *Non-destructive testing — Acoustic emission inspection — Vocabulary*

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

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*

ASTM E1419, *Standard Practice for Examination of Seamless, Gas-Filled, Pressure Vessels using Acoustic Emission*

ASNT SNT-TC-1A, *Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5577, ISO 12716 and the following apply.