INTERNATIONAL STANDARD

ISO 23876

First edition
2022-06

Gas cylinders — Cylinders and tubes of composite construction — Acoustic emission examination (AT) for periodic inspection and testing

Bouteilles à gaz — Bouteilles et tubes composites — Essai par émission acoustique (EA) pour les contrôles et les essais périodiques

Reference number
ISO 23876:2022(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

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

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

This AT method for Type 1 cylinders is described in ISO 16148, which allows pneumatic pressurization to a value of at least 110 % of the cylinder's normal working pressure or hydraulic pressurization to a value equal to the cylinder's test pressure. ISO 16148 was developed for periodic inspection and testing of monolithic materials (seamless steel and aluminium-alloy cylinders [Type 1]) and includes modal acoustic emission. ISO 16148 is not adapted to test composite cylinders. For composite cylinders, further details on the use of modal acoustic emission are described in ISO/TS 19016.

ISO 11623 provides requirements for the periodic inspection of composite cylinders based on the hydraulic test and visual inspection.

AT was used recently (HyPactor Project[10]) to detect loss of performance of composite cylinders due to mechanical impact. These tests have shown that this method can be used successfully to detect defects in composite cylinders, provided that appropriate verification criteria using performance tests and pressurization tests for cylinders and tubes with or without damage are used as outlined in Annex A.

This document also gives other requirements concerning preparation, finishing and maintenance of composite cylinders and tubes as well as the safety precautions for the personnel performing this work. These requirements can be mandatory under other regulations.

Gas cylinders — Cylinders and tubes of composite construction — Acoustic emission examination (AT) for periodic inspection and testing

CAUTION — Some of the tests specified in this document involve the use of processes that could lead to a hazardous situation.

1 Scope

This document specifies the use of acoustic emission examination (AT) during periodic inspection and testing of hoop wrapped (Type 2) and fully wrapped (Types 3 and 4) composite transportable gas cylinders and tubes of water capacity up to 3 000 l, with aluminium-alloy, steel or non-metallic liner or of linerless construction (Type 5), intended for compressed and liquefied gases under pressure.

It is applicable to only the verification of the composite material. Additional inspection such as internal visual inspection of the liner does not apply to this document (see ISO 11623).

NOTE Unless noted by exception, the use of the word "cylinder" in this document refers to both cylinders and tubes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 10286, *Gas cylinders — Vocabulary*

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

ASTM E1106-12, *Standard Test Method for Primary Calibration of Acoustic Emission Sensors*

EN 13477 (all parts), *Non-destructive testing — Acoustic emission — Equipment characterisation*

EN 13554, *Non-destructive testing — Acoustic emission testing — General principles*

EN 14584, *Non-destructive testing — Acoustic emission testing — Examination of metallic pressure equipment during proof testing — Planar location of AE sources*

EN 15495, *Non Destructive testing — Acoustic emission — Examination of metallic pressure equipment during proof testing — Zone location of AE sources*

EN 15857, *Non-destructive testing — Acoustic emission — Testing of fibre-reinforced polymers — Specific methodology and general evaluation criteria*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10286 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp