



BSI Standards Publication

Gas cylinders – In situ, non-destructive examination and testing of refillable seamless steel tubes of water capacity between 150 L and 3 000 L, used for compressed gases – Specification

Publishing and copyright information

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 March 2011. It was prepared by Subcommittee PVE/3/7, *Gas containers – Gas cylinder (receptacle) operations*, under the authority of Technical Committee PVE/3, *Gas containers*. A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

This British Standard is intended to ensure that seamless steel tubes, that are inaccessible after installation are satisfactorily periodically inspected and tested prior to continued service.

An example of an in situ examination standard is that for Compressed Natural Gas (CNG) cylinders installed on-board automotive vehicles (BS ISO 19078).

The inspection and test programme has to be carried out only by competent persons.

NOTE A competent person has the necessary technical knowledge, experience and authority to assess and approve materials for use with gases and to define any special conditions of use that are necessary. Such a person will normally be formally qualified in an appropriate technical discipline. A competent person has to be impartial and free of any pressures that could influence the independence of their judgement.

Product certification/inspection/testing. Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of tubes to check conformity with the requirements of this British Standard, preferably by an authorized inspection body recognized by the competent authority responsible for the application of the tubes being assessed.

Users of this British Standard are advised to use equipment for measurement, testing and examination of tubes in accordance with the requirements of this standard that is maintained and calibrated within a documented quality management system.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Tubes covered by this standard come under the Pressure System Safety Regulations (PSSR) [1, 2], and so need to have a Written Scheme of Examination when used onshore, and under the Offshore Installations (Safety Case) Regulations [3, 4] when used offshore.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard specifies requirements for using a combination of appropriate in situ, Non-Destructive Examination (NDE) techniques [e.g. visual examination, Acoustic emission Testing (AT) and Ultrasonic Examination (UE)] when periodically inspecting and testing tubes of seamless steel construction and water capacity between 150 L and 3 000 L, used for compressed gases for a further period of service.

This British Standard is applicable only to tubes installed in locations where attempting any removal from their containing superstructure would be hazardous or impossible (e.g. offshore oil installations), or where the downtime required to remove the tube would hinder safe operation of a plant or service (e.g. power generation, hospitals, advanced research applications and marine installations such as heave compensation systems on semi-submersible drilling rigs).

Indication of any anomaly in the tube(s) under test that are revealed at the time of in situ inspection have to be evaluated using a different technique to be able to quantify (location and frequency) and size any possible imperfection.

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.

BS EN 473, *Non-destructive testing – Qualification and certification of NDT personnel – General principles*

BS EN 1968:2002, *Transportable gas cylinders – Periodic inspection and testing of seamless steel gas cylinders*

BS EN ISO 13769, *Gas cylinders – Stamp marking*

BS EN ISO 16148, *Gas cylinders – Refillable seamless steel gas cylinders – Acoustic emission testing (AT) for periodic inspection*

BS ISO 25760, *Gas cylinders – Operational procedures for the safe removal of valves from gas cylinders*

ISO 6406:2005, *Gas cylinders – Seamless steel gas cylinders – Periodic inspection and testing*

3 Terms and definitions

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

3.1 acoustic emission (AE) activity

number of bursts (or events if the appropriate conditions are fulfilled) detected during a test or part test

3.2 flow noise

acoustic emission events caused by the action of pressurizing the vessel and not by any structural flaws within it

NOTE This can be reduced by slowing the fill rate and/or filtering out such emissions electronically within the AE recording equipment.

3.3 total test pressure

pressure that is 110% of the working pressure

3.4 working pressure

settled pressure of a compressed gas at a uniform reference temperature of 15 °C in a full gas cylinder.

NOTE See ISO 10286.

4 Operational principles

4.1 General

The periodic inspection and test shall comprise a pre-inspection site visit followed by an on-site inspection.

The maximum time interval for the periodic inspection shall be as stipulated in P200 of the current version of the ADR [5] (in force at the time of the inspection) for the gas concerned. Where other organizations/institutions stipulate a shorter time interval, this shall be complied with. The applicable time interval shall be included in the written scheme of examination.

At all times the safety of all personnel in the vicinity of the installation shall be taken into account.

NOTE 1 The techniques used to evaluate the tube condition within the installation may include:

- a) hydraulic pressure testing;
- b) acoustic emission testing;
- c) internal and external visual examination;
- d) ultrasonic thickness survey;
- e) ultrasonic flaw detection;
- f) magnetic particle inspection;
- g) dye penetrant inspection;
- h) radiography;
- i) eddy current inspection;
- j) hardness testing.

NOTE 2 At the discretion of the competent person other appropriate test techniques may be used.

4.2 Pre-inspection site visit

Prior to any tests taking place, a pre-inspection visit to the site of the tube installation shall be undertaken to gather all the necessary information to ensure that an appropriate set of tests are performed for the installation and the suitability of the tube to be examined in situ.

To ensure that the installation itself and any areas of concern related to it are understood, the site owner/operator shall be asked to complete