SLOVENSKI STANDARD
SIST EN 16753:2016

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Plinske jeklenke - Periodični pregledi in preskusi ponovno polnjivih velikih jeklenk iz celega iz jekla za stisnjene pline s prostornino od 150 do 3000 l na mestu obratovanja (brez demontaže)

Gas cylinders - Periodic inspection and testing, in situ (without dismantling) of refillable seamless steel tubes of water capacity between 150 l and 3 000 l, used for compressed gases

Gasflaschen - Wiederkehrende Inspektion und Prüfung, im Einbauzustand (ohne Demontage), von wiederbefüllbaren nahtlosen Großflaschen aus Stahl mit einem Fassungsraum zwischen 150 l und 3 000 l für verdichtete Gase

Bouteilles à gaz - Contrôles et essais périodiques sur site (sans démontage) des tubes en acier sans soudure rechargeables d'une contenance en eau de 150 l à 3 000 l, utilisés pour les gaz comprimés

Ta slovenski standard je istoveten z: EN 16753:2016

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23.020.35 Plinske jeklenke Gas cylinders

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EUROPEAN STANDARD
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English Version

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This European Standard was approved by CEN on 15 April 2016.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 16753:2016) has been prepared by Technical Committee CEN/TC 23 "Transportable gas cylinders", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2016, and conflicting national standards shall be withdrawn at the latest by December 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

A number of seamless steel pressure vessels designed and manufactured in a similar way as tubes, as referred to in ADR are used for applications other than the transport of gases, e.g. Ice Breaking Emergency Evacuation Vessels (IBEEV), Diving Support Vessels (DSV), power generation, hospitals, advanced research applications and marine installations such as heave compensation systems on semi-submersible drilling rigs, etc.

This European Standard is applicable only to seamless steel pressure vessels installed in locations where attempting any removal from their containing superstructure would be hazardous or difficult or where the downtime required to remove the tube would hinder a continuous operation of a plant or service.

This European Standard provides information and procedures for the periodic inspection and testing of such refillable seamless steel vessels (tubes). Many of these vessels installed in various installations are certified by the manufacturer to meet the requirements of EN ISO 11120 and are designed to store compressed and liquefied gases. Other design standards are also in use.

An example of a similar approach to that adopted in this standard is that for compressed natural gas (CNG) cylinders installed on-board automobile vehicles which is described in ISO 19078.

This standard is intended to be used under a variety of regulatory regimes. In case of conflict, the applicable regulation takes precedence.

1 Scope

This European Standard specifies requirements for using a combination of appropriate *in situ* (without dismantling), non-destructive examination (NDE) techniques, for example visual examination, acoustic emission testing [AT] and ultrasonic testing [UT] when periodically inspecting and testing seamless steel pressure vessels (tubes) with a water capacity between 150 l and 3 000 l, used for compressed and liquefied gases for a further period of service.

This European Standard is applicable only to pressure vessels (tubes) installed in locations where attempting any removal from their containing superstructure would be hazardous, or where the downtime required to remove them would hinder a continuous operation of a plant or service.

This European Standard does not apply to pressure receptacles used for the transport of gases as described under the TPED.

This European Standard only applies to pressure vessel (tube) assemblies where the designs permit all necessary inspections stipulated.

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.

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

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

EN ISO 13769, *Gas cylinders — Stamp marking (ISO 13769)*

EN ISO 16148, *Gas cylinders — Refillable seamless steel gas cylinders and tubes — Acoustic emission examination (AT) and follow-up ultrasonic examination (UT) for periodic inspection and testing (ISO 16148)*

EN ISO 25760, *Gas cylinders — Operational procedures for the safe removal of valves from gas cylinders (ISO 25760)*

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

3 Terms and definitions

For the purposes of this document, 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 1 to entry: This can be reduced by slowing the fill rate and/or filtering out such emissions electronically within the AE recording equipment.

3.3
acoustic emission test pressure
maximum pressure at which acoustic testing is performed

3.4
working pressure
settled pressure of a compressed gas at a uniform reference temperature of 15 °C in a full gas cylinder

Note 1 to entry: See EN ISO 10286.

3.5
Kaiser effect
absence of detectable acoustic emission until the previous maximum applied load level has been exceeded

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 should be as stipulated in the national regulations for the gas concerned. In the absence of such regulations, the time intervals for the gas concerned are given in Annex C. 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.

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

a) hydraulic pressure testing (see EN 1968);

b) acoustic emission testing (see EN ISO 16148);

c) internal and external visual examination (see EN 1968);

d) ultrasonic thickness survey (see EN 1968);

e) ultrasonic flaw detection (see EN 1968);

f) magnetic particle testing (see EN ISO 9934-1);

g) radiographic testing (see EN ISO 5579);

h) eddy current testing (see EN ISO 15548 (all parts));

i) hardness testing (see EN ISO 9809-1).

At the discretion of the competent person employed for the task, other appropriate test techniques may be used, e.g. dye penetrant.

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

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 without dismantling.

To ensure that the installation itself and any areas of concern related to it are understood, the site owner/operator shall complete a questionnaire before the pre-inspection visit. The pre-inspection visit shall, as a minimum, identify and record:

a) the application of the tube to be examined/tested (e.g. submersible, a static storage service [offshore or on-shore], used in a diving application);

b) the manufacturing standard/specification of the tube to be examined;

c) details of the tube installation including at least:

   1) the feasibility of conducting an *in situ* test at the desired location without dismantling e.g. post hydraulic testing to ensure that all water can be eliminated (see Annex D);

   2) a listing of any applicable local regulations that apply to the *in situ* installation;

   3) the nature of the gas contained;

   4) the pressure rating(s) of the tube(s) to be examined;

   5) the pipework configuration, and its pressure rating, leading to and from the tube (if relevant);

   6) the type of any valve, pressure control device, ancillary item (e.g. pressure gauge) and their pressure ratings fitted to the tube or its pipework (if relevant);

   7) the pressure rating and relief valve setting of the compressor (if relevant);

   8) the design characteristics of the pressure vessel (tube) and associated installation to be inspected to withstand the acoustic emission test pressure/hydraulic test pressure;

   9) the environmental conditions at the test site (e.g. noise and vibration levels); and

   10) a location-based risk analysis (see Annex D).

If the collected information does not allow the use of this European Standard, such tube(s) shall not be tested and the owner informed accordingly.

4.3 On-site inspection

4.3.1 General

Having gathered and analysed the data from the pre-inspection site visit (see 4.2), the most suitable test method(s) for the particular tube installation under consideration shall be selected. The selected methods shall form the basis of a written scheme of examination for the installation being inspected.

At all times the inspection work shall be carried out in accordance with the appropriate written procedures(s) for the test(s) to be performed.

Periodic inspection and testing shall comprise, as a minimum, of:

a) a visual examination (see 4.3.2) of all accessible external surfaces, internal surfaces and an acoustic emission test (see 4.3.3) coupled with any other tests deemed necessary; or

b) a visual examination (see 4.3.2) of all accessible external surfaces, internal surfaces and a hydraulic test (see 4.3.4) coupled with any other tests deemed necessary.

If it is found that the tube surface coating is unsatisfactory for a further period of use, it shall be brought to the attention of the tube owner for further appropriate action to remedy the situation.

Once the tube(s) has failed one of the above mentioned tests, none of the other test methods shall be applied to approve the tube(s).

If at any stage of the inspection process the valve/plug/adaptor/pressure control device within the tube needs to be removed, this shall be done in accordance with the requirements of EN ISO 25760.

4.3.2 Visual examination

All external visual examinations (see Annex A) shall be performed in accordance with the requirements of EN 1968:2002, Annex C (additional information can be found in ISO/TR 16115).

All internal visual examinations shall be performed in accordance with the requirements of EN 1968:2002, Annex C (additional information can be found in ISO/TR 16115).

All signs of corrosion and any form of mechanical damage shall be carefully investigated.

Where necessary, additional equipment (e.g. a video camera or an endoscope) shall be used to help clarify and interpret the initial observations.

4.3.3 Acoustic emission testing

AT shall be carried out in accordance with the requirements of EN ISO 16148 (an examination procedure using AT is described in Annex B).

4.3.4 Hydraulic testing

Hydraulic testing shall be carried out in accordance with the requirements of EN 1968:2002, 10.2.

4.3.5 Supplementary tests

Where there is doubt about the type and/or severity of any imperfection identified by the tests in 4.3.2 to 4.3.4, additional test(s) shall be conducted to supplement or clarify the results obtained (e.g. UT, magnetic particle testing, radiographic testing, eddy current testing, hardness testing).

Where particular parts of the tube are inspected using UT, the relevant requirements of ISO 6406:2005, 11.4 shall be met. Corrosion mapping or flaw detection may be used to further evaluate imperfection distribution.

NOTE Corrosion mapping is a pulse-echo ultrasonic technique that produces a colour graphic image of the area scanned. It involves scanning with one or more straight beam probes using a prescribed, dual axis scan pattern over the tube surface whilst taking thickness measurements. The measurements are converted into digital values, which are colour-coded to create a topographic map of the tube wall thickness profile. Images (C-scans) from individual scan areas can be assembled together to create a composite image covering large areas of the tube surface. The thickness profile of the corroded area can be evaluated at the time of the test and/or can be stored and used to monitor future surface degradation.

Eddy current testing (ET) may be used as part of the overall programme for tube examination and verification. The requirements for the examination, verification and equipment used for this technique are specified in EN ISO 15548 (all parts).