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Transportable gas cylinders — Cylinder bundles — Periodic inspection and testing

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National foreword

This British Standard is the UK implementation of EN 15888:2014.

The UK participation in its preparation was entrusted to Technical Committee PVE/3/7, Gas containers - Gas cylinder (receptacle) operations.

A list of organizations represented on this committee can be obtained on request to its secretary.

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

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Foreword

This document (EN 15888:2014) 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of an identical text or by endorsement, at the latest by October 2014, and conflicting national standards shall be withdrawn at the latest by October 2014.

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Introduction

The principal aim of a periodic inspection and testing procedure is that at the completion of the test the cylinder bundles may be reintroduced into service for a further period of time.

Experience of the inspection and testing of cylinder bundles which is specified in this European Standard is an important factor when determining whether a cylinder bundle should be returned into service.

Periodic inspection and testing of the bundle are carried out in line with the retest period of the cylinders within the bundle and are a legal requirement in order to comply with Directive 89/655/EEC as amended by Directive 95/63/EC as implemented into National Legislation within the European Union.

NOTE In this standard ‘retest’ is used as a synonym for ‘periodic inspection and test’.

1 Scope

This European Standard specifies the requirements for the periodic inspection and testing of cylinder bundles containing compressed, liquefied and dissolved gas. It is also applicable to cylinder bundles containing acetylene.

This European Standard includes information regarding the maintenance of cylinder bundles.

This European Standard does not cover the requirements for cylinder bundles when they are a part of a battery vehicle. For some specific application, e.g. offshore, additional requirements may apply.

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 1089-3, *Transportable gas cylinders - Gas cylinder identification (excluding LPG) - Part 3: Colour coding*

EN 1802, *Transportable gas cylinders - Periodic inspection and testing of seamless aluminium alloy gas cylinders*

EN 1968, *Transportable gas cylinders - Periodic inspection and testing of seamless steel gas cylinders*

EN ISO 7225, *Gas cylinders - Precautionary labels (ISO 7225)*

EN ISO 10462, *Gas cylinders - Acetylene cylinders - Periodic inspection and maintenance (ISO 10462)*

EN ISO 10961, *Gas cylinders - Cylinder bundles - Design, manufacture, testing and inspection (ISO 10961)*

EN ISO 11623, *Transportable gas cylinders - Periodic inspection and testing of composite gas cylinders (ISO 11623)*

EN ISO 15996, *Gas cylinders - Residual pressure valves - General requirements and type testing (ISO 15996)*

EN ISO 22434, *Transportable gas cylinders - Inspection and maintenance of cylinder valves (ISO 22434)*

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

3 Terms and definitions

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

3.1
compressed gas
gas which, when packaged under pressure, is entirely gaseous at −50 °C (including all gases with a critical temperature < −50 °C)

3.2
main valve
valve which is fitted to the manifold and which is used for the isolation of the bundle

3.3
cylinder bundles
transportable assembly which consists of a frame and two or more cylinders each of capacity up to 150 l and with a combined capacity of not more than 3 000 l, or 1 000 l in the case of toxic gases, connected to a manifold by cylinder valves or fittings such that the cylinders are filled, transported and emptied without disassembling

3.4
frame
structural and non-structural members of a bundle which combine all other components together, whilst providing protection for the bundle's cylinders, valves and manifold and which enable the bundle to be transported

3.5
cylinder valve
valve which is fitted into a cylinder and to which a manifold is connected in a bundle

3.6
cylinder fitting
component with no gas shut-off capability which serves as a method for connecting a bundle's manifold to its individual cylinders when cylinder valves are not fitted to the cylinders

3.7
manifold
piping system for connecting a bundle's cylinder valves or cylinder fittings to the main valve(s) or main connection(s)

3.8
main connection
means of making a gas connection to a bundle

3.9
tare weight
weight of the bundle including all permanent fittings, when empty of gas

Note 1 to entry: To be understood as “tare mass” as per RID/ADR.

3.10
maximum gross weight
sum of the tare weight of the bundle and the maximum permissible filling weight

Note 1 to entry: In International Standards, weight is equivalent to a force, expressed in Newtons. However, in common parlance (as used in terms defined in this European Standard), the word “weight” continues to be used to mean mass, although this practice is deprecated (see ISO 80000-4).

Note 2 to entry: To be understood as “maximum gross mass” as per RID/ADR.

3.11
liquefied gas
gas which when packaged under pressure for transport is partially liquid at temperatures above –50 °C

Note 1 to entry: A distinction is made between:

a) high pressure liquefied gas; a gas with a critical temperature between –50 °C and +65 °C; and

b) low pressure liquefied gas; a gas with a critical temperature above +65 °C.

3.12
proof test pressure
hydraulic or pneumatically applied pressure which demonstrates the structural integrity of the manifold

3.13
working pressure
settled pressure at a uniform temperature of 288 K (15 °C) for a full bundle

3.14
competent person
someone who has the necessary technical knowledge, experience and authority to assess and approve repair processes and to define any special conditions of use that are necessary

Note 1 to entry: Such people will also normally be formally qualified in an appropriate technical discipline.

3.15
helium test gas
leak testing gas mixture containing not less than 2 % helium

4 List of procedures for periodic inspections and tests

Each bundle shall be submitted to periodic inspections and tests. The procedures shown in a) to f), where applicable, form the requirements for such inspections and tests and are explained more fully in later clauses:

a) identification of cylinders/bundles and preparation for inspection and tests;

b) depressurization of manifold and individual cylinders;

c) disassembly of the bundle including safe de-valving and removal of cylinder fittings;

d) cylinder periodic inspection and test (see EN 1802, EN 1968, EN ISO 11623 or EN ISO 10462);

e) assessment of the cylinder bundle frame, manifold and valve condition (including cylinder and main valves);

f) bundle assembly and testing.

5 Inspection and tests

5.1 General

Depending upon the nature of the operation, an existing cylinder bundle may, upon dismantling, be reassembled using the same frame, cylinders and components. Alternatively, frames, cylinders and components may be interchanged for ease of operation during the periodic inspection and testing.

If at any stage, replacement of any part of the bundle (frame, cylinders or components) takes place, the new parts shall be compatible with the original design type specification.

5.2 Identification of cylinders/bundles and preparation for inspection and tests

On receipt for inspection, the gas content within the bundle shall be identified.

Before any work is carried out, the relevant cylinder data and ownership shall be identified.

5.3 Depressurization of manifold and individual cylinders

Cylinders, and any pressure retaining accessories, shall be depressurized and emptied in a safe, controlled manner before carrying out any inspection or test work.

Particular attention shall be given to cylinders containing flammable, oxidizing, corrosive or toxic gases to eliminate risks at the internal inspection stage (e.g. by purging the cylinders and associated fittings prior to de-valving).

Before removing any pressure retaining accessory (e.g. a valve or flange) a positive check shall be performed to ensure that the cylinder and associated fittings do not contain gas under pressure. This may be performed as described in Annex A.

Main or cylinders valves which are found to be inoperative or blocked shall be treated as described in Annex A.

In the case of cylinders disassembled from bundles and not equipped with cylinder valves, the connecting T-junctions shall be checked to determine whether the gas is able to pass freely from the cylinders (e.g. using the device shown in Figure A.1).

NOTE Provided the requirements described in this clause have been met, the manifold and cylinders can be depressurized safely and the corresponding valve can be removed.

5.4 Disassembly of the bundle including safe de-valving/removal of cylinder fittings

The main valve and manifold shall be safely removed from the cylinders/frame (see 5.3).

The cylinders, manifold and frame shall be segregated (see 5.1).

5.5 Cylinder periodic inspection and test

Cylinders shall be subjected to a periodic inspection and test as specified for the particular cylinder type (as described in EN 1968, EN 1802, EN ISO 11623 and EN ISO 10462. New cylinders provided they are within the test period need not be retested.

5.6 Assessment of the cylinder bundle frame, manifold and valve condition (including cylinder and main valves)

If any of the existing frame, manifold and valves are intended to be reused, the relevant equipment shall be inspected in accordance with the following requirements.

Whenever valves are reused, they shall be inspected and maintained in accordance with the requirements of EN ISO 22434. If new valves are fitted they shall conform to the original type approval of the bundle.

The manifold shall be visually inspected and where necessary cleaned and degreased. Where repairs are necessary, they shall be carried out by a competent person in accordance with a written procedure in line with the requirements of EN ISO 10961.

If the original manifold is reused, it shall be subjected to a pressure retest and leak checked in accordance with the requirements of EN ISO 10961 or the original, applicable design code. If a new manifold is used, provided it has been pressure tested after manufacturing it does not have to be retested at time of periodic inspection.

The frame shall be visually inspected for any signs of corrosion, contamination, deformation or fracture which may be structurally significant. If the frame fails the visual inspection, it shall be either cleaned or repaired, as appropriate. Following any lifting attachment repairs, the frame shall be proof load tested to twice its maximum

gross weight (in accordance with the requirements of EN ISO 10961). The full and free movement of any panels/covers shall be checked.

5.7 Bundle assembly and testing

The recommended steps for assembling the bundle are as follows (other different orders can be used depending on the bundle design).

a) Usually newly retested cylinders are assembled in the bundle in order to maximize the period before the next retest is required.

   If cylinders, still within the test period are placed in the bundle, the next retest date of the bundle shall be that of the earliest cylinder retest period. At all times the original type approval shall be maintained for the bundle, by ensuring gas cylinder compatibility.

   Except for acetylene bundles, the use of colour coding is not required for cylinders assembled into a bundle or for the bundle frame itself.

b) All pressure retaining accessories maybe reused if the threads pass a visual examination. Valves may be reused if they meet the requirements of EN ISO 22434. Where repairs or replacement are necessary, they shall be carried out by a competent person in accordance with a written procedure in line with the requirements of EN ISO 10961.

c) Before torque tightening the valve/fitting into the cylinder, a final internal examination of the cylinder shall be undertaken to ensure that no contamination is present.

d) The manifold has to be attached to the cylinder valves/fittings on the cylinders, one by one. Appropriate torque values shall be used depending on the type of seal used between the fitting and manifold. Any sealing materials shall be new.

e) Depending on the bundle design, the main valve(s) may be preassembled to the manifold, or assembled after the manifold has been installed onto the cylinders. The main valve(s) outlet connection shall be compatible with the gas and the test pressure of the intended product and shall not protrude from the cylinder/frame.

f) A pneumatic leak test at the working pressure using dry, oil-free air, nitrogen or helium test gas shall be performed. This test may be performed at time of the first fill with the intended gas after the retest of the bundle. For liquefied gases, the pressure may be the normal filling pressure.

   When helium test gas is used a leak detector shall be employed.

g) If applicable, the manifold shall be protected using an appropriate manifold cover.

h) For the bundle, if any replacement is necessary, see 5.1.

6 Stamp marking

After satisfactory completion of the periodic inspection and test, the plate (e.g. as specified in EN ISO 10961:2012, 6.3.1) shall be permanently stamp marked with the present test date (yy/mm) (see 5.7a) followed by the symbol of the inspection body.

If at the time of the periodic inspection testing of the bundle it has undergone a reassessment in accordance with the requirements of 2010/35/EU (TPED) the new markings for the bundle, cylinder and valves shall follow the requirements of RID/ADR.

The next retest date shall be marked on the bundle by either the retester or the filler at the time of first fill. This shall be referenced to the shortest cylinder retest date and not that of the bundle.

NOTE The marking of bundles of cylinders is regulated by RID/ADR which take precedence. Directive 2010/35/EU includes additional marking requirements (Pi marking).

7 Product and hazard identification

Individual cylinders in bundles are not required to have labels attached.

The appropriate precautionary labels and other information e.g. in accordance with EN ISO 7225 shall be attached to the bundle adjacent to the main connection.

The minimum size of the side of the hazard label(s) shall be 100 mm x 100 mm.

NOTE The labelling of bundles of cylinders is regulated by RID/ADR which take precedence.

8 Colour coding

For colour coding cylinders see 5.7(a). There are no requirements to colour code bundles.

9 Documentation

Records of the components used to assemble a bundle and of the history of how and where the bundle was assembled and tested shall be maintained for every retested and reassembled bundle.

The bundle documentation (see EN ISO 10961:2012, Clause 8) shall be modified with the data of the made up new cylinders or other components incorporated into the bundle.

The records shall contain at least the following:

a) unique serial number of bundle;

b) unique serial number of frame, where applicable;

c) type of main outlet valve(s);

d) gas service for which the bundle is intended;

e) working pressure of the cylinders in the bundle;

f) cylinder test pressure and previous re-test date(s);

g) cylinder serial numbers;

h) symbol (or number) of the inspection body, name and address of re-tester plus date of re-test;

i) confirmation that post-assembly leak tests were passed satisfactorily.

Test records of individual or batches of components shall be maintained such that they may be cross-referenced to individual bundle records. These test records shall cover the original manufacture, repair and retest.

All records shall be maintained at least for as long as required by current legislation.

Annex A
(normative)

Procedure to be adopted when a cylinder valve is suspected to be obstructed

A.1 Check for obstructed valve

The procedures described in Annex A shall be carried out only by trained personnel. These are inline with those described in ISO 25760. In view of the potential hazards in handling pressurized cylinders (e.g. injury from stored energy release, fire and toxic hazards), personnel shall take such precautions as deemed necessary for the work to be performed safely.

As indicated in 5.3, a systematic check shall be made to establish that the gas passage through the valve is unobstructed. The method adopted shall be a recognized procedure or one that provides equivalent safeguards such as:

a) by introducing a gas, non-reactive to the gas stored in the cylinder, at a pressure up to 5 bar and checking its discharge;

b) by using the device shown in Figure A.1 to hand-pump air into the cylinder;

c) for a cylinder of liquefied gas, first check to establish that the total tare weight of the cylinder is the same as the tare weight stamped on the cylinder. If there is a positive difference, the cylinder may contain either liquefied gas under pressure or contaminants. Lack of a positive difference does not rule out the presence of a gas under pressure;

d) for a valve incorporating a residual pressure device (see EN ISO 15996), use a specific adapter to release the remaining pressure and verify the absence of pressure using one of the methods described previously.

A.2 Valve unobstructed

When the gas, if any, has been released and the pressure within the cylinder reduced to atmospheric, and, in the case of liquefied gases, when there is no frost or dew on the outside of the cylinder, the valve may be removed after an additional check is made to establish that there is free passage through it.

Only when it is established that there is no obstruction to gas flow through the cylinder valve, may the valve be removed.

The personal protection during de-valving shall be assessed.

A.3 Valve obstructed

For cylinders containing non-toxic, non-flammable and non-chlorofluorocarbon (non-CFC) gases, appropriate safety precautions shall be taken to ensure that no hazard results from the uncontrolled discharge of any residual gas.

When a cylinder is found to have an obstructed gas passage in the valve, the cylinder shall be set aside and only handled by specially trained personnel.

The obstructed cylinder valve may be removed by:

a) sawing or drilling the valve body until interception is made with the gas passage between the valve body / stem and valve spindle seat. The operation shall be properly cooled particularly when handling oxidizing gases; or

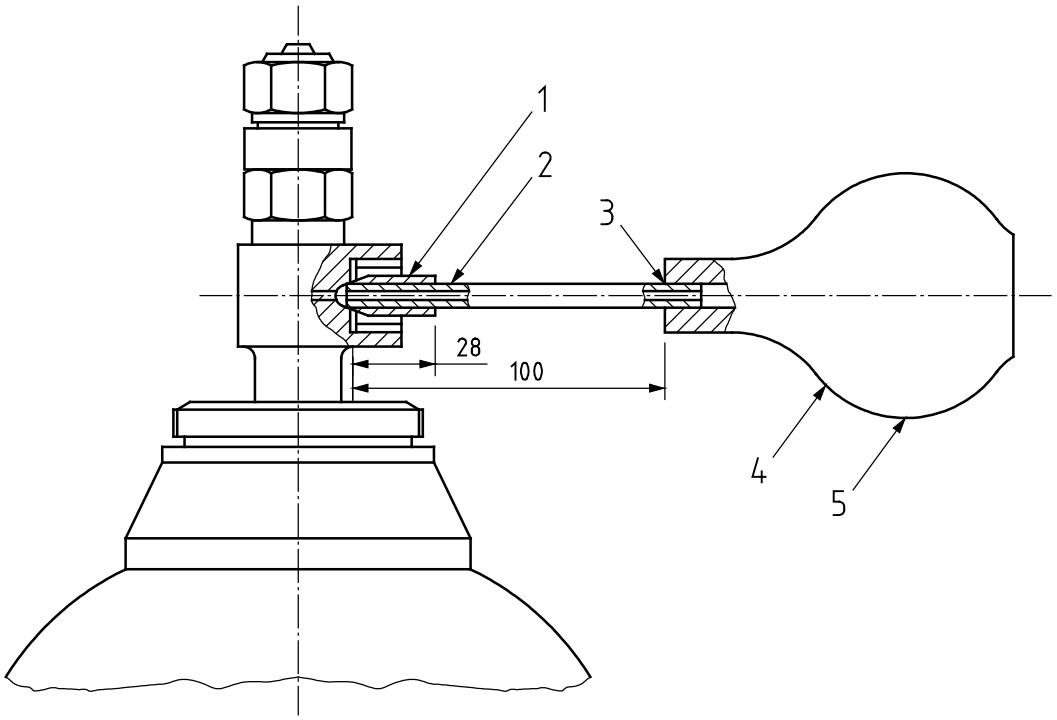
b) loosening or piercing the pressure relief device in a controlled manner.

The methods described in A.3 c), d) and e) are applicable to cylinders containing toxic, flammable, air reactive, water reactive, oxidizing and CFC gases. After release, containment and subsequent disposal shall be carried out safely and without impact to the environment by:

c) partially unscrewing the valve within a glanded cap, secured and joined to the cylinder and vented to a safe discharge point. The principles of a suitable device are shown in Figure A.2. This procedure shall be performed in a controlled manner in such a way as to avoid personal injury; or

d) mechanically remove the valve using an enclosed, automatic device that will contain the release of gas and release the stored energy safely; or

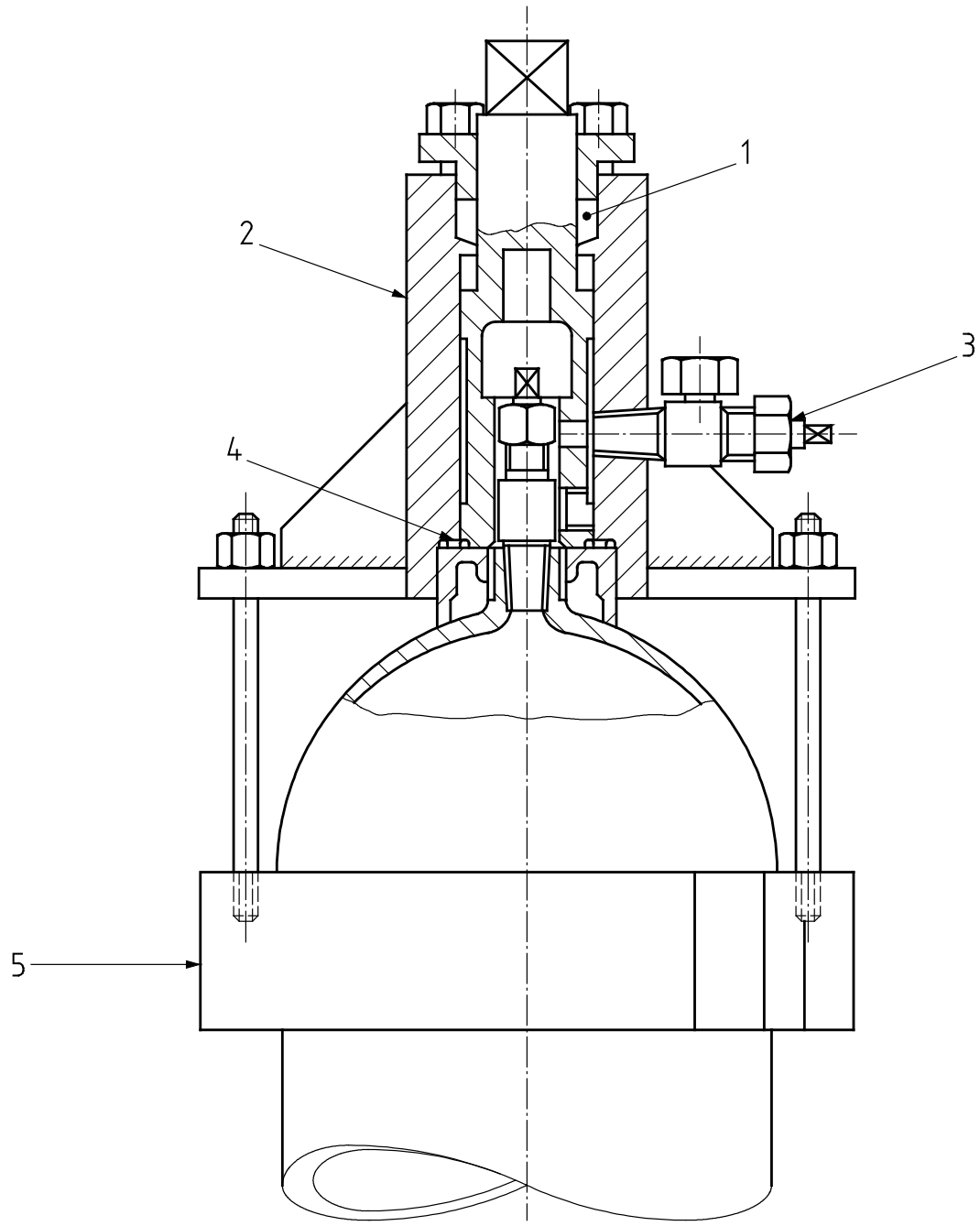
e) placing the cylinder in a suitable container able to contain the release of gas and gas energy, and crushing or puncturing the cylinder to release the gas under pressure.



Key

1 rubber tube ground to olive form and bonded
2 copper tube
3 bond
4 rubber bulb
5 hand pressure

Figure A.1 — Device for detecting obstructed cylinder valve



Key

1 rubber packing gland
2 extractor casing
3 control valve
4 joint ring
5 clamp

Figure A.2 — Typical device for the removal of a damaged gas cylinder valve

Whenever a Residual Pressure Valve (RPV) is present a special tool shall be used to overcome the RPV device ensuring a correct procedure for this blocked valve test.

Annex B
(normative)

Requirements for the periodic inspection and test of acetylene cylinder bundles

When dismantled for periodic inspection, the acetylene cylinders in the bundle shall be retested in accordance with the requirements of this standard and additionally, if any of them are intended to be used, each manifold, including all pipework or flexible hoses except safety devices, shall be tested for strength and leaks using a pressure of 300 bar. The pressure test of the manifold shall be carried out when the manifold is disconnected from the cylinders.

Each acetylene cylinder in the bundle shall be re-examined and maintained in accordance with the requirements of EN ISO 10462 Whenever a failed cylinder has to be replaced, in the bundle, it shall be replaced by a cylinder of the same type approval, size and with the same porous material and solvent as the original cylinders.

When an existing hose is reused after the periodic inspection, its electrical resistance between the connecting ends shall be $\leq 10^6$ Ω.

All existing flashback arrestors intended to be reused shall be visually inspected for signs of damage in accordance with the manufacturer's recommendations. If damaged they shall be replaced.

All acetylene cylinders in bundles shall be colour coded in accordance with EN 1089-3.

Bibliography

[1] Use of Work Equipment Directive 89/655/EEC as amended by Directive 95/63/EC

[2] Transportable Pressure Equipment Directive, 2010/35/EU

[3] DNV 2.7-1, *Offshore Containers (April 2006)*

[4] EN 13365, *Transportable gas cylinders - Cylinder bundles for permanent and liquefied gases (excluding acetylene) - Inspection at time of filling*

[5] ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road)/RID (Regulations concerning the International Carriage of Dangerous Goods by Rail)

[6] EN 12079-3, *Offshore containers and associated lifting sets — Part 3: Periodic inspection, examination and testing*

[7] EN ISO 17638, *Non-destructive testing of welds - Magnetic particle testing (ISO 17638)*

[8] EN ISO 23278, *Non-destructive testing of welds - Magnetic particle testing of welds - Acceptance levels (ISO 23278)*

[9] EN ISO 13769, *Gas cylinders - Stamp marking (ISO 13769)*

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