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Gas cylinders — Acetylene cylinders — Periodic inspection and maintenance

Bouteilles à gaz — Bouteilles d'acétylène — Contrôle et entretien périodiques

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Foreword

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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. www.iso.org/directives

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The committee responsible for this document is ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*.

This third edition cancels and replaces the second edition (ISO 10462:2005), which has been technically revised.

The following are the main technical modifications.

a) The second edition (ISO 10462:2005) has been revised taking EN 12863 into account; EN 12863 has been superseded by this third edition.

b) Periodic inspection periods are based on the relevant regulations and do not have to be repeated in this International Standard, thus also avoiding possible inconsistencies in case periodic inspection periods are changed in the regulations. Consequently, the former Annex A has been deleted and relevant information is covered in 4.1.

c) For the removal of the valve, reference to ISO 25760 is included and, consequently, the former Annex B has been deleted.

d) The external visual inspection has been revised; 6.1 and Annex B (which was Annex C in the second edition) have been updated accordingly.

e) The inspection of monolithic porous materials with regard to cracking, crumbling or cavitation is given in greater detail for better clarity. A new Annex C for the determination of the top clearance has been added.

f) For the inspection of the valve, reference to ISO 22434 is included and, consequently, the former Annex F has been deleted.

Introduction

Acetylene cylinders differ from all other cylinders transporting compressed or liquefied gases in that they contain a porous material and, normally, a solvent in which the acetylene is dissolved. Acetylene cylinders that contain a porous material but no solvent are only used for special applications. For periodic inspections, it is intended that due regard be given to the different types of construction of cylinders and porous materials. This International Standard should be read considering these differences.

The primary objective of the porous material is to limit an acetylene decomposition, if it is initiated, and thus prevent a cylinder incident. If some porous material is missing, or if a defect (e.g. a cavity, crack or void of significant size) exists as a result of breakdown or subsidence of the porous material, the decomposition could progress at a rate that can cause violent failure of the cylinder accompanied by an explosion.

The requirements in this International Standard are mainly those specific to acetylene cylinders. The periodic inspection of acetylene cylinders is to be performed only by competent persons and, in those jurisdictions requiring it, persons authorized by the regulatory authority.

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.

In International Standards, "weight" is equivalent to a force, expressed in Newton. However, in common parlance (as used in terms defined in this International Standard), "weight" is used as an equivalent of "mass", but this practice is deprecated (see ISO 80000-4).

Similarly, the unit "bar"[1)], which is not an SI unit and is deprecated by ISO, is used as an equivalent of Pascal, the SI unit for pressure. This is because of its universal use in the field of technical gases. Pressure values in this International Standard are given as gauge pressure (pressure exceeding atmospheric pressure), unless noted otherwise.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

Gas cylinders — Acetylene cylinders — Periodic inspection and maintenance

1 Scope

This International Standard specifies requirements for the periodic inspection of acetylene cylinders as required for the transport of dangerous goods and for maintenance in connection with periodic inspection. It applies to acetylene cylinders with and without solvent and with a maximum nominal water capacity of 150 l.

NOTE The limitation of 150 l is derived from the definition of cylinder in Reference [1].

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 13341, *Gas cylinders — Fitting of valves to gas cylinders*

ISO 22434, *Transportable gas cylinders — Inspection and maintenance of cylinder valves*

3 Terms and definitions

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

3.1
acetylene cylinder
cylinder manufactured and suitable for the transport of acetylene, containing a *porous material* (3.6) and *solvent* (3.9) (where applicable) for acetylene with a valve and other accessories affixed to the cylinder

Note 1 to entry: When there is no risk of ambiguity, the word “cylinder” is used.

3.2
cylinder shell
<acetylene cylinders> empty cylinder manufactured and suitable for receiving and containing a *porous material* (3.6) for use as part of an *acetylene cylinder* (3.1)

3.3
maximum acetylene content
<acetylene cylinders> specified maximum weight of acetylene including *saturation acetylene* (3.8) in an *acetylene cylinder* (3.1)

3.4
maximum acetylene charge
<acetylene cylinders> *maximum acetylene content* (3.3) minus the *saturation acetylene* (3.8)

3.5
periodic inspection body
<acetylene cylinders> body responsible for the periodic inspection of *acetylene cylinders* (3.1)

3.6
porous material
<acetylene cylinders> single or multiple component material introduced to or formed in the *cylinder shell* (3.2) that, due to its porosity, allows the absorption of a solvent/acetylene solution

Note 1 to entry: The porous material can be either

— monolithic, consisting of a solid product obtained by reacting materials or by materials connected together with a binder, or

— non-monolithic, consisting of granular, fibrous or similar materials without the addition of a binder.

3.7
residual gas
<acetylene cylinders> weight of acetylene including the *saturation acetylene* (3.8) contained in an *acetylene cylinder* (3.1) returned for filling

3.8
saturation acetylene
<acetylene cylinders> acetylene dissolved in the *solvent* (3.9) in the *acetylene cylinder* (3.1) at atmospheric pressure (1,013 bar) and at a temperature of 15 °C

3.9
solvent
<acetylene cylinders> liquid that is absorbed by the *porous material* (3.6) and is capable of dissolving and releasing acetylene

Note 1 to entry: The following abbreviated terms are used:

— "A" for acetone;

— "DMF" for dimethylformamide.

3.10
tare
<acetylene cylinders> reference weight of the *acetylene cylinder* (3.1) including the specified solvent content

Note 1 to entry: The tare is further specified in accordance with the following subclauses.

Note 2 to entry: For acetylene cylinders with solvent, the tare is expressed by indicating either tare S or both, tare A and tare S. For solvent-free acetylene cylinders, the tare is expressed by indicating tare F. For the tare used for acetylene cylinders in bundles, see ISO 13088.

3.10.1
tare A
<acetylene cylinders> sum of the weights of the empty *cylinder shell* (3.2), the *porous material* (3.6), the specified solvent content, the valve, the coating and the valve guard, where applicable, and all other parts that are permanently attached to the cylinder when it is presented to be filled

Note 1 to entry: Generally, valve guards are included in the tare and are considered to be permanently attached (and are not removed when the cylinder is filled). This, however, might not always be the case.

3.10.2
tare S
<acetylene cylinders> *tare A* (3.10.1) plus the weight of the *saturation acetylene* (3.8)

3.10.3
tare F
<acetylene cylinders> *tare A* (3.10.1) minus the specified solvent content

3.11
top clearance
<acetylene cylinders> gap between the inside of the cylinder shoulder and the monolithic porous material

3.12
working pressure
<acetylene cylinders> settled pressure at a uniform reference temperature of 15 °C in an *acetylene cylinder (3.1)* containing the specified solvent content and the *maximum acetylene content* (3.3)

4 General

4.1 Intervals between periodic inspections

A cylinder is due for periodic inspection when the periodic inspection interval has elapsed. After that time the cylinder shall not be filled with acetylene. The regular periodic inspection intervals are given in the Reference [1], Section 4.1.4, Packing instruction P200, or are specified by national or international authorities.

However, for acetylene cylinders that are newly filled with porous material, it is recommended to carry out the first periodic inspection earlier. This first periodic inspection interval is recommended as follows:

a) non-monolithic porous material: two years;

b) monolithic porous material: three years.

After the first periodic inspection according to either a) or b), the regular periodic inspection interval as stated in the first paragraph of this subclause applies.

Provided the cylinder has been subjected to normal conditions of use and has not been subjected to abusive or abnormal conditions rendering the cylinder unsafe, there is no general requirement for the user to return an acetylene cylinder before the content has been used, even when the periodic inspection interval has elapsed.

4.2 Requirements for inspection

Before any work is carried out, the relevant information on the acetylene cylinder and its ownership shall be identified (e.g. from its marking and labelling). Cylinders with illegible or incorrect markings shall be set aside for further investigation.

Due to the presence of a porous material in the cylinder, neither a pressure test (hydraulic or pneumatic) nor a visual inspection of the internal surface of the cylinder shell is required by this International Standard.

5 Preparation of the acetylene cylinder

5.1 Depressurization of the acetylene cylinder

SAFETY PRECAUTIONS — Emptying of the cylinder should be carried out slowly; a typical rate would be 1/8 of the maximum acetylene content per hour.

Before the periodic inspection, cylinders shall be emptied of gas and depressurized. Cylinders shall be checked for pressure, both before and after depressurization. Depressurization shall be carried out in a safe manner with due regard to the characteristics of acetylene. Depressurization shall be carried out over a period long enough to ensure removal of all acetylene, except saturation acetylene. Precautions shall be taken because variations in temperature influence the quantity of acetylene that remains dissolved in the solvent.

The absence of a positive pressure reading does not clearly indicate the absence of gas under pressure due to the possibility of a blocked valve (for information, see ISO 25760). In case of any doubt regarding the efficiency of the depressurization, the cylinder shall be weighed.

If a cylinder weighs more than the tare stamped on the cylinder, it is not always a clear indication of the presence of gas under pressure. Some relevant factors that should be considered are a possible excess of solvent or contamination with water, etc.

If a cylinder weighs less than or equal to the stamped tare, it is not always a clear indication of the absence of gas under pressure. Some relevant factors that should be considered are a possible solvent shortage or external corrosion causing a loss of cylinder shell.

5.2 Preparation for external visual inspection

Each cylinder shall be cleaned and have all loose coatings, corrosion products, tar, oil or other foreign matter removed from its external surface by a suitable method, e.g. by brushing, shot blasting (under closely controlled conditions to ensure that there is no leakage of acetylene into the brushing or shot-blasting cabinet), water jet abrasive cleaning, chemical cleaning. Care shall be taken at all times to avoid damaging the cylinder and pressure relief devices (where fitted) or removing excess amounts of cylinder wall.

Shot blasting is a process utilizing iron shot of various sizes. It is not to be confused with or referred to as sand blasting, grit blasting or other more aggressive processes that remove a significant amount of the base metal or metallic coatings. These more aggressive processes should not be used.

The external visual inspection in accordance with 6.1 may be carried out at this stage.

5.3 Removal of the valve

The valve shall be removed safely. For information, see ISO 25760.

The cylinders should not be left open or without valves longer than necessary for the inspection.

5.4 Removal of neck/core hole filters

Acetylene cylinders usually contain neck filters/core hole packings consisting of filter or metallic gauze and felts. Neck filters and packing materials placed between the top of the porous material and the base of the valve stem shall be removed, as appropriate, to enable an adequate inspection of the porous material in accordance with the inspection requirements of the porous material manufacturer. For various types of neck filters/core hole packings, see Annex A.

Some porous material manufacturers equip acetylene cylinders containing a monolithic porous material with wooden plugs, which form an integral part of the porous material. These plugs, which are situated below the neck filter or gauze arrangement, shall be left intact and not removed for the purpose of the visual inspection provided the wooden plug is in the correct position permitting the measurement of the top clearance in accordance with the manufacturer's instructions. If during a previous inspection the wooden plug was tampered with, removed by mistake or is not in the correct position, it shall be replaced with a new one in accordance with the porous material manufacturer's specification.

Special care shall be taken when removing filters or packing material. Some restrictions at the neck can hold residual pressure that, if suddenly released, can blow the filter out with some of the porous material and cause injury.

NOTE The presence of soot on the filters or packing material indicates that a flashback might have occurred.

6 Inspection and maintenance

6.1 External visual inspection

The external surface of each cylinder shall be inspected for

a) illegible, incorrect, unauthorized or incorrectly located stamp markings, or unauthorized additions or modifications,

b) plug or neck inserts, vertical stability, bulges, dents, cracks, cuts, gouges, laminations and excessive removal of material from the cylinder base,

c) fire and heat damage, torch or electric-arc burns,

d) corrosion. Special attention shall be given to areas where water can be trapped. These include the entire base area, the junction between the cylinder shell and the footring and the junction between the cylinder shell and the valve and the neckring (if applicable), and

e) integrity of all permanent attachments.

The external visual inspection shall be carried out in accordance with Annex B. Cylinders no longer suitable for future service shall be rendered unserviceable (see Clause 9).

Damaged valve guards, threaded neckrings and footrings may be repaired or replaced as appropriate. No welding or any heat shall be directly applied to the pressure-containing part of the cylinder. If welding is performed on a non-pressure-containing part of the cylinder, due care shall be taken with regard to the presence of acetylene and solvent.

SAFETY PRECAUTIONS — Acetylene cylinders cannot be completely emptied. They will always contain some residual gas and solvent (except for solvent-free acetylene cylinders). Therefore, special care should be taken when repairing acetylene cylinders using methods that can be a source of ignition (e.g. through heat or sparks).

6.2 Inspection of the porous material

6.2.1 General

After the removal of neck/core hole filters in accordance with 5.4, the porous material shall be inspected for the presence of visible contamination or other defects that could affect the ability to suppress an acetylene decomposition. The inspection shall be performed by the appropriate use of special non-sparking tools such as metal wire probes, rods, feeler or clearance gauges to check the firmness and the presence of voids or other defects in the porous material. Rejection criteria are given in 6.2.2 to 6.2.4. Care shall be taken to ensure that the porous material is not damaged by the inspection tools.

6.2.2 Contamination

The porous material shall be checked visually for contamination such as the presence of soot, water or oil deposits, or if there has been a discoloration of the porous material. The following guidelines shall apply:

a) cylinders in which any soot is visible shall be rejected;

b) cylinders in which water or oil deposits are visible shall be rejected depending on the level of such contamination. For monolithic porous materials, this is often visible through greying of the porous material.

6.2.3 Monolithic porous materials — Cracking, crumbling or cavitation

The visual inspection shall verify that the porous material shows:

a) no top clearance above the maximum allowed top clearance;

The top clearance as determined in accordance with Annex C shall not exceed that in the type approval, if specified.

If a top clearance specification does not exist for a given cylinder, the top clearance shall not exceed

— 2 mm for asbestos-free porous materials, or

— 5 mm for all other monolithic porous materials.

If at a later stage cylinders with other top clearance sizes pass the requirements of the backfire test as described in ISO 3807 and are approved, then these maximum top clearances apply.

b) no excessive cracking;

Only small cracks without visible side walls are acceptable for all porous materials, provided they do not incorporate breakouts and do not allow the material to get dislodged. This can be checked by applying a gentle lateral load with a gloved finger. Porous materials with cracks having visible side walls are not acceptable and shall be rejected (for examples, see Annex D).

c) no excessive crumbling;

Crumbling of the porous material is acceptable if it arises from the collar of the porous material only and if it is so little that the maximum allowed top clearance is not exceeded at any point. Small breakouts in the top of the cylinder neck/shoulder area are acceptable and may be repaired by a procedure validated and endorsed by the porous material manufacturer, e.g. by backfire testing. Cylinders with porous materials that show crumbling in excess of the allowable shall be rejected.

d) no voids or cavities.

The porous material shall be checked to ensure that there are no voids or cavities between the porous material and the cylinder wall by verifying there is no detectable lateral movement (e.g. by applying a gentle lateral load with a gloved finger). A cylinder that demonstrates lateral movement of the porous material shall be rejected.

If the cylinder is equipped with a wooden plug (see 5.4), it shall be checked by applying a gentle load that the plug is firmly fixed in its position and there is no lateral movement of the wooden plug. The wooden plug shall not be removed during the inspection except if there is a lateral movement of the plug. In this case, it shall be replaced with a new one in accordance with the porous material manufacturer's specification.

6.2.4 Non-monolithic porous material — Compaction

Acetylene cylinders containing non-monolithic porous material that shows compaction either shall be rejected or porous material shall be added in accordance with 6.3.

6.3 Addition of non-monolithic porous material

An acetylene cylinder containing non-monolithic porous material that has been rejected due to compaction shall have porous material added only if this does not impair the safety of the cylinder. The porous material used shall be in accordance with the specifications of the porous material manufacturer and the addition of non-monolithic porous material shall be performed by or on behalf of the porous material manufacturer.

The quantity of porous material that may be added at each periodic inspection shall not exceed 50 g. The cumulative total quantity of porous material added to the acetylene cylinder shall be limited so that

