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Gas cylinders — Transportable cylinders for dissolved acetylene — Periodic inspection and maintenance

Bouteilles à gaz — Bouteilles transportables pour acétylène dissous — Contrôles et entretien périodiques

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10462 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*.

This second edition cancels and replaces the first edition (ISO 10462:1994), which has been technically revised.

Introduction

Acetylene cylinders differ from all other cylinders transporting compressed or liquefied gases in that they contain a porous mass and normally a solvent in which the acetylene stored is dissolved. However, for special applications there is also a limited quantity of acetylene cylinders containing a porous mass and no solvent. For the periodic inspection cycle, due regard is to be given to the different types of porous masses. The remainder of this document should be read considering these differences.

The primary objective of the presence of the porous mass is to limit an acetylene decomposition, should it be initiated, and thus prevent a cylinder incident. If some porous mass 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 mass, then the decomposition could progress at a rate that could cause an explosion.

The requirements dealt with in this document are mainly those that are specific for acetylene cylinders; for more general requirements related to the periodic inspection of gas cylinders, reference is made to the relevant ISO documents.

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.

Due to the presence of a porous mass in the cylinder, neither a hydraulic or pneumatic pressure test, nor a visual inspection of the internal surface of the shell can be carried out.

Gas cylinders — Transportable cylinders for dissolved acetylene — Periodic inspection and maintenance

1 Scope

This International Standard specifies the requirements for periodic inspection of seamless and welded cylinders manufactured from steel or aluminium alloys intended for the transport of acetylene in cylinders of water capacity up to 150 l and the requirements for the periodic inspection and maintenance of acetylene cylinders, regardless of the method of manufacture of the shell.

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.

ISO 3807-1:2000, *Cylinders for acetylene — Basic requirements — Part 1: Cylinders without fusible plugs*

ISO 3807-2:2000, *Cylinders for acetylene — Basic requirements — Part 2: Cylinders with fusible plugs*

ISO 13341, *Transportable gas cylinders — Fitting of valves to gas cylinders*

ISO 13769, *Gas cylinders — Stamp marking*

3 Terms and definitions

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

3.1
acetylene bundle
transportable unit consisting of two or more acetylene cylinders manifolded together within a rigid frame, equipped with all necessary equipment for filling and emptying in the assembled state

3.2
acetylene cylinder
pressure vessel manufactured and suitable for transport of acetylene, containing a porous mass and solvent (where applicable) for acetylene with valve and other accessories fixed to the cylinder

NOTE 1 For solvent-free acetylene cylinders, see Clause 6 of ISO 3807-1:2000 or ISO 3807-2:2000.

NOTE 2 When there is no risk of ambiguity, the word “cylinder” is used.

3.3
acetylene/solvent ratio
ratio of the maximum acetylene content to the specified solvent content

3.4
competent authority
any national body or authority designated or otherwise recognized as such for any purpose in connection with this International Standard

3.5
competent person
person who by a combination of training, experience and supervision is able to make objective judgments on the subject

3.6
complete cylinder
cylinder shell ready to be charged with acetylene gas that is complete with porous mass, solvent (where applicable), saturation gas (where applicable), valve and any valve protection permanently fixed to the cylinder shell

3.7
cylinder shell
pressure vessel manufactured and suitable for receiving and containing a porous mass and to be filled as an acetylene cylinder

3.8
manufacturer
company responsible for filling the cylinder shell with porous mass and which generally prepares it for the first charge of acetylene

3.9
maximum acetylene content
specified maximum mass of acetylene the cylinder is designed to contain

NOTE 1 Maximum acetylene content is expressed in kilograms.

NOTE 2 When a solvent is used, it includes the saturation gas.

3.10
maximum permissible settled pressure
maximum permissible gauge pressure, at a uniform temperature of 15 °C, in a cylinder containing the maximum acetylene content and the specified solvent content

NOTE Maximum permissible settled pressure is expressed in bar.

3.11
porosity
ratio of the total volume (water capacity) of the cylinder shell minus the volume of the solid material of the porous mass, to the water capacity of the cylinder shell

NOTE Porosity is expressed as a percentage.

3.12
porous mass
porous substance
single or multi-component material introduced or formed in the cylinder shell in order to fill it and that, due to its porosity, allows the absorption of the solvent and acetylene gas solution

NOTE The porous mass may be monolithic or non-monolithic. Monolithic porous mass consists of a solid product typically obtained by reacting materials or by bonding materials together with a binder. Non-monolithic porous mass consists typically of granular, fibrous or similar materials without addition of a binder.

3.13
solvent
liquid that is absorbed by the porous mass and is capable of dissolving and releasing the acetylene

NOTE The following abbreviations are used:

— "A" for acetone;

— "DMF" for dimethylformamide.

3.14
tare weight
reference mass of the acetylene cylinder with the specified amount of solvent

NOTE 1 Tare weight is expressed in kilograms.

NOTE 2 This is further specified in accordance with 3.14.1, 3.14.2 or 3.14.3.

NOTE 3 For cylinders with solvent, the tare weight is expressed by indicating either one or both of the masses corresponding to tare A and tare S. For solvent-free acetylene cylinders, the tare weight is expressed by indicating a tare F. For the tare weight used for cylinders in bundles, see ISO 3807-1 or ISO 3807-2, 7.5.3.

3.14.1
tare A
sum of empty mass of the cylinder shell, the mass of the porous substance (see 3.12), the specified mass of solvent, the mass of any coating (e.g. paint) used in service, the mass of the valve including thermocouple where fitted, any fixed valve guard and the mass of all other parts that are permanently attached (e.g. by clamping or bolt fixing) to the cylinder when it is presented for filling

3.14.2
tare S
tare A plus the acetylene mass required to saturate the solvent at normal atmospheric pressure (1,013 bar) and at a temperature of 15 °C (saturation gas)

NOTE Tare S is expressed in kilograms.

3.14.3
tare F
tare A minus the specified mass of solvent

3.15
total weight
total mass equal to tare A (or tare F for solvent-free cylinders) plus the maximum acetylene content

NOTE Total weight is expressed in kilograms.

3.16
water capacity (cylinder shell volume)
actual capacity of the cylinder shell, measured by filling the shell with water

NOTE 1 Water capacity is expressed in litres.

NOTE 2 The cylinder shell is defined as being empty of any porous mass, see 3.7.

4 Intervals between periodic inspections

A cylinder shall be due for periodic inspection on its first receipt by a filler after the expiry of the interval in accordance with the requirements of the United Nations *Recommendations on the Transport of Dangerous Goods, Model Regulations* or as specified by national or international authorities (see examples in Annex A).

Provided the cylinder has been subjected to normal conditions of use and has not been subjected to abusive and abnormal conditions rendering the cylinder unsafe, there is no general requirement for the user to return a gas cylinder before the contents have been used even though the inspection interval may have lapsed.

It is the responsibility of the owner or user to submit the cylinder for a periodic inspection and test within the interval specified by national or international authorities, or as specified in the relevant cylinder design standard if this is shorter.

5 Preparation of gas cylinder

5.1 Removal of gas

Before proceeding with the inspection, cylinders shall be depressurized of gas. Cylinders shall be checked for pressure both before and after depressurization. Depressurization shall be carried out in a safe manner having 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 gas. Precautions shall be taken because variations in temperature influence the quantity of acetylene in the form of saturation gas.

The absence of a positive pressure reading does not clearly indicate the absence of excess gas due to the possibility of a blocked valve (see Annex B).

In case of any doubts regarding the efficiency of the depressurization cycle, the cylinder should be weighed.

A cylinder weighing more than the tare weight (see 3.14) stamped on the cylinder is not always a clear indication of the presence of excess gas. Some relevant factors that have to be considered include a possible excess of solvent or contamination with water, etc.

A cylinder weighing less than or equal to the stamped tare weight is not always a clear indication of the absence of gas under pressure. Some relevant factors that have to be considered include a possible solvent shortage and external corrosion causing a loss of shell weight.

5.2 Preparation for external visual inspection

When necessary, the 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 or other suitable methods. The method used to clean the cylinder shall be a validated, controlled process. 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 (See Annex C).

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

NOTE 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, which should not be used.

5.3 Valve removal

Before removing the valve from an acetylene cylinder, it shall be determined that the cylinder has been completely depressurized as described in 5.1. If there is any reason to believe that a valve is blocked, e.g. the lack of an audible release of gas when opening the valve, and that the cylinder may still contain residual gas under pressure, checks shall be made, e.g. by introducing an inert gas at a pressure lower than 5 bar and observing its discharge.

If it is found that the valve is obstructed, then a suitable method shall be employed to remove the gas or the valve, taking into consideration the design of the valve and taking all necessary precautions having due regard to the hazards that can result from an uncontrolled operation (see Annex B). De-valving shall take place in the

open or in a ventilated area. The temperature of the cylinder when removing the valve should be close to the ambient temperature to avoid either excess venting of residual gas from the cylinder or ingress of air into the cylinder.

NOTE 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 packing consisting of filter/gauze and felts. Neck filters and packing materials placed between the top of the porous mass and the base of the valve stem shall be removed, as appropriate, to enable an adequate inspection of the porous mass in accordance with the inspection requirements of the porous mass manufacturer. When the inspection requirements cannot be established, a competent person shall define such inspection requirements. For various types of neck/core hole filters see Annex D.

Some porous mass manufacturers equip monolithic mass acetylene cylinders with wooden plugs, which form an integral part of the porous mass. These plugs, which are situated below the neck filter/gauze arrangement, shall be left intact and not removed for the purpose of the visual examination if the wooden plug is in the right position permitting the measurement of the gap in accordance with the manufacturer's instruction. If on a previous inspection the wooden plug has been tampered with or removed by mistake, this plug shall be replaced in accordance with the porous mass manufacturer's instructions.

Special care shall always be taken when removing filters or packing material in view of the possibility of some restrictions at the neck with residual pressure underneath, which, if suddenly released, might blow the filter out with some of the porous substance and cause injury. The presence of fine carbon powder on the filters or packing material could indicate a flashback has occurred.

6 Inspection and maintenance

6.1 External visual inspection

The external surface of each cylinder shall be inspected for

a) dents, cuts, gouges, bulges, cracks, laminations (see Table C.1) and excessive removal of material from the cylinder base;

b) heat damage, torch or electric-arc burns (see Table C.1);

c) corrosion (see Table C.2);

d) other defects such as illegible, incorrect or unauthorized stamp markings, or unauthorized additions or modifications (see Table C.1); and

e) integrity of all permanent attachments (see Table C.2).

Damaged valve guards, threaded neck rings and footrings can be repaired or replaced as appropriate. No welding or any heat shall be directly applied to the pressure containing part of the cylinder.

For rejection criteria, see Annex C. Cylinders no longer suitable for future service shall be rendered unserviceable (see Clause 10).

6.2 Examination of the porous mass

Subject to the requirements of 5.4, the porous mass shall be examined for the presence of visible contamination or other defects that could affect the suppression of an acetylene decomposition. The examination shall be performed by appropriate use of special spark resistant 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 mass

(see Annex E). Subclauses 6.2.1 to 6.2.3 give the rejection criteria. Care shall be taken to ensure that the porous mass is not damaged by the inspection tools. See Table C.1, flash back.

6.2.1 Contamination

The porous mass shall be checked visually for contamination such as the presence of significant fine carbon powder (see 5.4), water, or oil deposits or whether there has been a discoloration of the porous mass. Depending on the level of contamination for any of those listed above, the competent person shall decide if the porous mass is to be rejected.

6.2.2 Monolithic masses – cracking or crumbling

The visual inspection shall verify that the porous mass shows no excessive top clearance (gap between the top of the cylinder and the monolithic porous mass), and no excessive cracking or crumbling.

Cylinders with masses that show cracking or crumbling less than 1 mm width when they do not incorporate break outs or dislodging of the mass are acceptable. Small break outs in the top of the cylinder neck/shoulder area are acceptable as long as the maximum gap is not exceeded at any point. See examples in Annex E in Figure E.1 a) and Figure E.1 b).

6.2.3 Cavitation or compaction

The maximum gap between the top of the cylinder and the monolithic porous mass shall not exceed that specified in the type approval for that cylinder. Only those gaps up to the maximum used in the type approval tests shall apply. If such data is unavailable for cylinders manufactured with monolithic asbestos-containing mass, the gap shall not exceed 5 mm and for cylinders with monolithic asbestos-free porous mass, the gap shall not exceed 2 mm. If at a later stage, cylinders with other gap sizes pass the requirements of the flashback test and are approved, then these gap sizes may also apply.

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 significant lateral movement.

Additionally, the porous mass shall be checked to ensure that there is no significant lateral movement. Cylinders showing cavitation or significant lateral movement shall be rejected.

Non-monolithic porous masses that show cavitation or compaction, or a loss of compaction shall be rejected or repaired in accordance with 6.3.

6.3 Repair of non-monolithic porous mass

A non-monolithic mass that has been rejected due to cavitation shall only be repaired if the repair does not impair the safety of the cylinder.

The repair of a non-monolithic mass shall be performed according to the instructions of the porous mass manufacturer or according to the instructions of a competent person, and the method to be used shall be verified by testing in accordance with ISO 3807-1 or ISO 3807-2. The quantity of material added shall be recorded, the tare weight of the cylinder adjusted as appropriate and the stamp marking adjusted accordingly.

A cylinder that contains a rejected porous mass that is not suitable for repair in accordance with this clause shall be rendered unserviceable or its porous mass shall be replaced according to 6.4.

6.4 Replacement of porous mass

If the porous mass is no longer acceptable but the external condition of the shell is satisfactory, then either the existing porous mass shall be replaced and the shell reused or the complete cylinder shall be made unserviceable.