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Cylinders for dissolved acetylene — Periodic inspection and maintenance

Bouteilles à acétylène dissous — Contrôles et essais périodiques

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Contents

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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.

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.

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

Annexes A to G of this International Standard are for information only.

Introduction

The primary object of periodic inspection and testing of gas cylinders is to ensure that at the completion of the test the cylinders may be reintroduced into service for a further period of time.

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

The requirements dealt with in this International Standard are mainly those which are specific for cylinders for acetylene; for more general requirements related to the periodic inspection of gas cylinders reference is made to the relevant International Standard.

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

The inspection and testing should be carried out only by persons who are competent in the subject, to assure all concerned that the cylinders are fit within the permissible limits for continued safe use.

Cylinders for dissolved acetylene — Periodic inspection and maintenance

1 Scope

This International Standard specifies the minimum requirements for periodic inspection and maintenance to verify the integrity of acetylene cylinders for further service, regardless of the method of manufacture of the shell. It does not exclude the application of additional national requirements.

This International Standard does not specify the requirements for initial approval and requalification of the porous mass and of the shell.

This International Standard does not exempt the filler of an acetylene cylinder from the obligation to carry out an external visual examination prior to each charging and to ensure that cylinders are suitable for refilling with acetylene.

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

Additional International Standards cover similar requirements for seamless steel, welded-steel and seamless aluminium cylinders and the inspection and tests to be carried out during normal filling procedures.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3807:1977, *Dissolved acetylene cylinders — Basic requirements.*

ISO 10297:—[1], *Gas cylinder valves — Specification and testing.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 cylinder shell: Pressure vessel manufactured for gas storage and transport, suitable for containing a porous mass, solvent for acetylene and acetylene.

3.2 complete cylinder: Cylinder shell, ready to be charged with acetylene, including porous mass, solvent, valve and other accessories permanently fixed to the cylinder.

3.3 porous mass: Single or multicomponent material, introduced or formed in the cylinder shell in order to completely fill it, whose porosity allows for the absorption of solvent and acetylene gas.

The porous mass may be of the following types:

3.3.1 non-monolithic porous mass: Porous mass consisting of granular, fibrous or similar materials without addition of a binder.

3.3.2 monolithic porous mass: Porous mass consisting of a solid product obtained by reacting materials or by materials connected together with a binder.

1) To be published.

3.4 porosity: Ratio, expressed as a percentage, of the total volume (water capacity) of the cylinder shell, minus the volume of the solid material of the porous mass, to the total volume (water capacity) of the cylinder shell, measured in accordance with ISO 3807.

3.5 solvent: Liquid, absorbed by the porous mass, capable of dissolving and releasing acetylene gas.

3.6 saturation gas: Mass of acetylene gas which is dissolved into a solvent in a cylinder at atmospheric pressure and remains dissolved when the cylinder is at zero gauge pressure.

3.7 requalification: Confirmation of the quality of previously approved porous mass for further service, based on testing according to ISO 3807, of cylinders manufactured during a particular year.

3.8 Tare

The mass of the cylinder, defined in one of the following two ways (see ISO 3807):

3.8.1 tare A: Mass of the vessel, including a valve and with or without safety devices, containing a porous mass, a solvent for the storage of dissolved acetylene and any valve protection permanently fixed directly to the cylinder.

3.8.2 tare S: Mass of the vessel, including a valve and with or without safety devices, containing a porous mass, a solvent for the storage of dissolved acetylene, the acetylene required to saturate the solvent at atmospheric pressure at a temperature of 15 °C and any valve protection permanently fixed directly to the cylinder.

4 Intervals between periodic inspections

The time intervals between periodic inspection of acetylene cylinders are specified below:

a) 5 years for cylinders containing non-monolithic porous masses;

   10 years for cylinders containing monolithic porous masses;

b) the time interval specified by national regulation if that period is different than the period specified in a);

c) the time interval specified by the cylinder manufacturer or owner if that period is less than the period specified in a) or b).

5 Preparation for inspection

5.1 Identification

Cylinders due for periodic inspection may be identified by one of the following methods:

a) stamping/markings/labels located on the cylinder;

b) records maintained by the filler of the gas or by the owner of the cylinder.

NOTE 1 A test date ring located between the valve and the neck of the cylinder may be used for an initial sort. (See annex B.)

If there is any doubt as to the validity of the markings/records, then a periodic inspection shall be made.

5.2 Gas removal

Before proceeding with the inspection, cylinders shall be emptied of gas. A cylinder should be weighed and its pressure checked both before and after depressurization.

A positive pressure reading clearly indicates the presence of residual gas in the cylinder. The absence of a positive pressure reading does not clearly indicate the absence of gas because of the possibility of a blocked valve.

Weight greater than the tare weight stamped on the cylinder is not always a clear indication of the presence of residual gas. Some relevant factors which have to be considered include a possible excess of solvent, contamination with water, or the fixation of a new valve or cap without correction of the tare weight.

Weight lower than the stamped tare weight is not always a clear indication of the absence of gas under pressure. Possible causes include solvent shortage and corrosion resulting in a loss of shell weight. Also to be considered is the type of tare (A or S) (see 3.8).

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 a complete removal of all residual acetylene. The temperature at depressurization shall be essentially the same as that at inspection.

5.3 Preparation for external visual inspection

The cylinder shall have all loose coatings, corrosion products, tar, oil or other foreign matter, as well as any labels or transfers, removed from its external

surface by a suitable method, e.g. by steel wire brushing, shot blasting, water-jet abrasive cleaning, chemical cleaning, etc. Care shall be taken to avoid damage to the cylinder (and pressure relief devices where fitted.) The valve shall be closed during cleaning.

5.4 Valve removal

Before removing the valve from an acetylene cylinder it shall be verified that the cylinder has been completely depressurized according to 5.2.

If it is suspected that a cylinder valve is obstructed and that the cylinder may still contain residual gas pressure, checks shall be made to establish whether there is free passage through the valve or not, e.g. by introducing an inert gas at a pressure lower than 5 bar [2] and observing its discharge.

When a cylinder is found to have an obstructed gas passage in the valve, or a damaged/inoperable valve, then a suitable method shall be employed to remove the gas or the valve, taking into consideration the design of the valve. All necessary safety precautions shall be taken to ensure that no hazard results from an uncontrolled operation. (See annex C.)

The temperature of the cylinder when removing the valve should be as close as possible to the ambient temperature so as to avoid either sudden venting of residual gas or ingress of air.

It is undesirable to leave cylinders without valves, or with valves open, for protracted periods of time.

5.5 Removal of neck-core hole filters

Acetylene cylinders usually contain neck filters/core hole packing, consisting of screens and felt discs which are placed between the top of the porous mass and the base of the valve.

Depending of the type of porous mass, some packing material may also be placed between the top of the porous mass and the base of the valve or filling a possible core-hole. Neck filters and packing material shall be removed as appropriate, with due regard for the characteristics of these materials, to enable an adequate inspection of the porous mass in accordance with the manufacturer/owner's specifications.

WARNING: Special care shall be taken when removing filters or packing material in view of the possible presence of a restriction at the neck with residual pressure underneath, which, if suddenly released, can blow out the filter with some of the porous substance and cause injury.

6 Inspection and maintenance

6.1 External visual inspection

The external surface of the cylinder, particularly in the region of the welds, shall be carefully inspected for

a) dents, cuts, gouges, bulges, cracks, laminations or pinholes;

b) corrosion by giving special attention to areas where water may be trapped, to the base of the cylinder, and to the junction between the body and the foot ring and/or the shroud;

c) other defects such as illegible or unauthorized stamp markings, heat damage, electric arc or torch burns, unauthorized additions or modifications;

d) integrity of all permanent attachments.

Damaged valve guards, threaded neck rings and footrings may be repaired or replaced as appropriate. No welding or heat shall be applied to the pressure section of the cylinder.

Typical rejection limits are given for guidance in annex A.

6.2 Examination of the porous mass

The main reason for the presence of the porous mass in an acetylene cylinder is to suppress acetylene decomposition, should it be initiated, in an attempt to avoid cylinder failure. Insufficient porous mass, or a defect, e.g. a cavity, crack or void of significant size, present as a result of breakdown or subsidence of the porous mass, could allow decomposition to progress at a rate which could cause violent failure of the cylinder.

Thus examination of the porous mass is the most important and delicate operation, as the safety of an acetylene cylinder relies mainly on the good quality and condition of the porous mass it contains.

It is not possible to specify a procedure for the examination of the porous mass and establish rejection criteria, as there are different types of masses for cylinders and also different gas capacities approved for the country of use. The procedure and rejection criteria applied will depend on the particular type of mass and cylinder under examination. (See annex E.)

2) 1 bar = 10^5 Pa = 10^5 N/m^2

In particular, comparison is made with the original characteristics of the porous mass, e.g. the consistency, the presence or absence of a gap between the top of the mass and the interior surface of the shell, the colour, etc., as defined when the porous mass and the cylinder were submitted to test for approval in accordance with ISO 3807. For cylinders not manufactured in accordance with ISO 3807, characteristics of the porous mass are as defined by national standards or by the manufacturer, ensuring that the top clearance shall in no case exceed 3 mm.

The primary object of the visual inspection of the porous mass through the valve opening shall be that of verifying that the porous mass has maintained its original characteristics and that the porous mass does not shift (move) in the cylinder.

Special spark-resistant tools are required, such as metal wire probes, feelers, rods, clearance gauges, etc. to check the firmness of the porous mass and for the presence of voids and defects. (See annex D.)

Attention shall be paid also to the presence of contamination with, for example, water, oil or tar which may lead to rejection of the cylinder.

The presence of carbon or other contaminants in the neck/core hole filters or packing (indicative of a flashback having occurred) means that extra care is necessary when examining the porous mass.

The presence of significant quantities of fine powdery carbon indicates acetylene decomposition; this is sufficient cause for rejection of the porous mass.

6.3 Repair of non-monolithic porous mass

Repair of non-monolithic porous mass is permissible, provided that excessive quantities of material are not added to a cylinder without due consideration for effects on porosity and safety.

Repair of the non-monolithic porous mass shall be performed in accordance with the manufacturer/owner's instructions.

Any addition of material should be recorded and the tare weight of the cylinder adjusted appropriately.

The porous mass and the repair method employed shall be verified by testing the porous mass in accordance with ISO 3807.

6.4 Replacement of porous mass

If the porous mass is found to be no longer acceptable and the external shell is found satisfactory, then the existing porous mass may be removed and replaced with a new porous mass.

The removal of the existing porous mass and of the solvent shall be carried out in a safe manner and the cylinder thoroughly cleaned and inspected, and hydraulically tested if necessary. The internal surface of the cylinder shall be examined and if the shell is found to be satisfactory (see annex A), it is permissible to introduce a new porous mass.

If a different porous mass is employed, the identification mark of the original porous mass manufacturer shall be removed and the identity of the manufacturer of the new porous mass stamped onto the cylinder. The porous mass shall be type-tested in accordance with ISO 3807.

6.5 Pressure relief devices, including fusible plugs

Where fusible plugs or other pressure relief devices are used, they shall be examined for damage. Where such damage is found the device shall be replaced.

6.6 Valves

If the cylinder is to be reintroduced into service, each valve shall be inspected and maintained so that it will perform satisfactorily and close without leakage, according to ISO 10297 (see annex F). Particular care should be taken to ensure valve threads are in adequate condition, and gauges should be used as appropriate.

Any damaged or defective part shall be replaced.

6.7 Cylinder threads

The internal neck threads of the cylinder shall be examined to ensure that they are:

— clean and of full form;

— free of damage;

— free of burrs;

— free of cracks;

— free of other imperfections.

Where necessary, and where the cylinder manufacturer confirms that the design of the neck permits, threads may be retapped to provide the appropriate number of effective threads. Retapping shall be carried out with special equipment and tools, and by qualified persons only. After retapping, the threads shall be checked with the appropriate thread gauge.

6.8 Reassembling

Every cylinder judged satisfactory after inspection shall be reassembled by replacing as appropriate any packing materials to the neck end and fitting new

filters so as to ensure that when the valve is fitted, contact is made between the base of the valve stem/shank and the filters/packings.

New or reconditioned valves shall be fitted to the cylinder using a suitable jointing material and the optimum torque necessary to ensure a seal between the valve and the cylinder. If a valve different from the original valve is used, the new tare weight shall be stamped on the cylinder [see 7 a)].

When applying torque, consideration shall be taken of the size, form and taper of the threads, the material of the valve and of the cylinder and the type of jointing material used. The torque must be sufficient to obtain engagement of the required minimum number of threads between the valve and the cylinder.

Before being recharged, the complete cylinder shall be repainted and the solvent for the acetylene replenished as required.

The next test date may be indicated on the cylinder using an appropriate method. A code, using a disc fitted between the valve and the cylinder, which indicates the date (year) of the next periodic inspection and tests, is proposed in annex B.

7 Markings

After satisfactory completion of the periodic inspection and maintenance and the revalving of the cylinder, each cylinder shall undergo the following:

a) The tare shall be established, taking into account the possible loss in mass of the cylinder with the attached parts and the possible difference in mass of the valve. If it differs from the marked tare significantly, the latter shall be lined out, but so that it is still readable, and the correct tare shall be marked in a permanent and legible fashion.

b) The cylinder shall be stamped, adjacent to the previous inspection/test mark, according to national requirements or with

   — the symbol of the inspection body or test station;

   — the date of the test (this date may be indicated by the month and year or by the year followed by a number within a circle to denote the quarter of the year).

The markings should preferably be not less than 6 mm in height but in any case shall be not less than 3 mm in height.

The marking shall be stamped on the shoulder of the cylinder, or the top boss or foot ring, or on a metal plate permanently secured to the cylinder.

The tare actually stamped on the cylinder shall be a number followed by the units of mass used, followed by either the letter A or the letter S in accordance with the definition in 3.8.1 or 3.8.2.

8 Records

An inspection record shall be retained by the inspection station for not less than the period between inspections. It shall record sufficient information to identify positively the cylinder and the results of the inspection. Where national regulations require certain information to be recorded, this shall be complied with. For an example of an inspection record, see annex G.

In any case the following shall be recorded:

— type and mass of porous filler added, if any;

— any replacement of cylinder attachments by a different model;

— the cylinder mass/tare as tested, if applicable.

9 Rejection and destruction of unserviceable cylinders

The decision to reject a cylinder may be taken at any stage during the inspection procedure. A rejected cylinder shall not under any circumstances be re-issued into service. It shall be destroyed either by the inspection station, after agreement with the owner, or by the owner. In case of any disagreement, ensure the legal implications of contemplated action are fully understood.

The markings on the cylinder shall be obliterated.

Consideration shall be given to the fact that acetylene cylinders contain residual acetylene, solvent and porous mass, and that the porous mass may contain asbestos, and suitable precautions taken.

Annex A
(informative)

Description and evaluation of defects in the cylinder shell and conditions for rejection of cylinders for dissolved acetylene at the time of visual inspection

A.1 General

Gas cylinder defects may be physical, material or due to corrosion as a result of the environmental or service conditions to which the cylinder has been subjected during its life.

The objective in this annex is to provide general guidelines for acetylene gas cylinder users on the application of rejection criteria. It is intended, in particular, for acetylene gas cylinder users with limited practical experience.

When applying the rejection criteria, the minimum allowable calculated wall thickness for the type of cylinder under consideration shall be used. When unknown, the minimum allowable thickness shall be calculated using the formulae given in the relevant ISO documents, e.g. ISO 4705 for seamless steel or ISO 4706 for welded steel.

Ultrasonic detectors may be used to check the remaining wall thickness of the cylinder at the bottom of the defect.

A.2 Physical or material defects

The evaluation of physical and material defects in the cylinder shall be carried out in accordance with table A.1.

A.3 Corrosion

A.3.1 General

Extensive experience and judgement are necessary to evaluate whether acetylene cylinders which have corroded externally are safe and suitable for return to service.

It is important that the surface of the metal is completely cleaned of corrosion products prior to the inspection of the cylinder.

A.3.2 Evaluation of corrosion

If the bottom of the defect cannot be seen, or when its extent cannot be evaluated using special equipment, the cylinder shall be rejected.

The corrosion on the cylinder wall shall be evaluated in accordance with table A.2.

Table A.1 — Physical and material defects in the cylinder shell

Defect	Description	Conditions for rejection
Bulge (see figure A.1)	Visible swelling of the cylinder.	All cylinders with such a defect.
Dent (see figure A.2)	A depression in the cylinder that has neither penetrated nor removed metal, and is greater than 2 % of the external cylinder diameter.	When the depth of any dent exceeds 10 % of its width at any point with a maximum deflection of 10 mm[1]. Where denting occurs so that any part of the deformation includes a weld, the cylinder shall be removed from service if the depth of the dent is greater than 6 mm.
Cut or gouge (see figure A.3)	A sharp impression where metal has been removed or redistributed.	When the length of any cut or gouge exceeds 2 % of the cylinder length or the depth exceeds 10 % of the minimum design wall thickness.
Dent containing cut or gouge (see figure A.4)	A depression in the surface within which there is a cut or gouge.	When the size of the dent or gouge is greater than 50 % of the dimension for its rejection as an individual defect.
Crack (see figure A.5)	A split or rift (fissure) in the metal.	All cylinders with such a defect.
Lamination (laps or folds) (see figure A.6)	Laminations are layerings of the material within the cylinder wall and sometimes show up as a discontinuity, crack or bulge at the surface.	All cylinders with such a defect in excess of that permitted by the construction specification.
Fire damage	Excessive general or localized heating of a cylinder, usually indicated by a) burning or charring of paint; b) burning or sintering of metal; c) distortion of the cylinder; d) melting of metallic valve or plug parts.	When the fire damage is of type b) or c). If only fire damage of type a) or d) is evident, see note. NOTE — If paint is only superficially charred, a cylinder may be accepted, but if paint has been removed by heat, or if metallic parts of a valve or plug have been melted, the decision to accept, refurbish or reject shall be made the responsibility of a competent person. When so decided by a competent person, and after removal of the solvent and porous substance, reheat treatment and retest may be carried out in accordance with the specification to which the cylinder was made.
Plug or neck insert	Additional metal inserts fitted in the cylinder neck, base or wall.	Any cylinder that has had a plug or neck insert fitted, unless it can be ascertained that the plug or neck insert is part of the approved design of the cylinder. Plugs in the cylinder wall are cause for rejection.
Incorrect stamping	Marking by means of a metal punch, or absence of identity marks on the cylinder.	Any cylinder with stamping on the cylindrical wall of the pressure vessel, or when stamping is illegible, inadequate or has been altered. NOTE — When it can be clearly established from records or otherwise that the cylinder fully complies with the requirements of the appropriate manufacturing specification, an altered marking may be accepted and illegible or inadequate marking may be corrected.
Arc or torch burns (see figure A.7)	Burning of the cylinder metal, a hardened heat-affected zone, the addition of weld metal or the removal of metal by scarifying or cratering.	All cylinders presenting such a defect.
Boss damage	The boss is a metal attachment welded to the cylinder for receiving a valve or other fitment.	If the boss is depressed or misaligned.

1) The figures given are based on cylinders of 40 litres to 50 litres water capacity with diameters ranging between 200 mm and 270 mm. For small cylinders below 200 mm diameter these general limits will have to be adjusted in accordance with wall thickness and diameter. Consideration of appearance also plays a part in the evaluation of dents, especially in the case of small cylinders.