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Gas cylinders — Acetylene cylinders — Basic requirements and type testing

Bouteilles à gaz — Bouteilles d'acétylène — Exigences fondamentales et essais type

(Revision of first edition of ISO 3807-1:2000 and ISO 3807-2:2000)

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This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO-lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five-month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

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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 3807 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*.

This second edition cancels and replaces the first edition of both ISO 3807-1 and ISO 3807-2.

The main technical modifications are the following:

- a) ISO 3807-1 and ISO 3807-2 were revised and the according requirements were merged into one standard ISO 3807.
- b) A test for the compressive strength of the porous material was added.
- c) A calculation method as an alternative to the elevated temperature test was added.
- d) The impact stability test was removed.
- e) The procedure for establishing permissible acetylene/solvent concentrations for bundles was removed and is now included in ISO 13088.

Introduction

There are two types of acetylene cylinders operated in certain parts of the world:

- acetylene cylinders with a test pressure of at least 60 bar and without fusible plugs;
- acetylene cylinders with a test pressure of at least 52 bar, fitted with fusible plugs which release the gas and hence reduce the pressure if the cylinder temperature increases unintentionally.

This International standard covers the requirements for both types of acetylene cylinders and specifies specific requirements in separate annexes.

ISO 3807 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 the UN Model Regulations [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.

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), the word “weight” continues to be used to mean “mass”, but this practice is deprecated (ISO 80000-4).

In this standard the unit bar is used, due to its universal use in the field of technical gases. It should, however, be noted that bar is not an SI unit, and that the according SI unit for pressure is Pa.

Pressure values given in this standard are given as gauge pressure (pressure exceeding atmospheric pressure) unless noted otherwise.

Gas cylinders — Acetylene cylinders — Basic requirements and type testing

1 Scope

This document specifies the basic and type testing requirements for acetylene cylinders with and without fusible plugs with a maximum nominal water capacity of 150 l and requirements regarding production/batch test procedures for manufacturing of acetylene cylinders with porous material.

It does not include details of the design of the cylinder shell; these are specified e.g. in ISO 9809-1, ISO 9809-3, ISO 4706 or ISO 7866.

NOTE The limitation to 150 l is derived from the standards for the cylinder shells. However, in practice acetylene cylinders in general have lower water capacities than 150 l.

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 10297, *Transportable gas cylinders — Cylinder valves — Specification and type testing*

ISO 11117, *Gas cylinders — Valve protection caps and valve guards — Design, construction and tests*

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 cylinder

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

Note 1 to entry: For solvent-free acetylene cylinders, see Clause 7.

Note 2 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 and to be fitted as part of an *acetylene cylinder* (3.1)

3.3

fusible plug

non-reclosing pressure relief device designed to function by the yielding or melting of a plug of fusible material at a predetermined temperature

**3.4
manufacturer**

<acetylene cylinders> company responsible for filling the *cylinder shell* (3.2) with *porous material* (3.6) and which generally prepares it for the first charge of acetylene

**3.5
maximum acetylene content**

<acetylene cylinders> specified maximum weight of acetylene including *saturation gas* (3.8) in the cylinder

Note 1 to entry: When using tare S, the maximum acetylene charge may be used. The maximum acetylene charge is the maximum acetylene content minus the saturation gas.

**3.6
porous material**

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

Note 1 to entry: The porous material may be either:

- monolithic, consisting of a solid product typically obtained by reacting materials connected together with a binder; or
- non-monolithic, consisting of granular, fibrous or similar materials without addition of a binder.

**3.7
porosity**

<acetylene cylinders> ratio of the total volume (*water capacity* (3.12)) of the *cylinder shell* (3.2) minus the volume of the solid material of the *porous material* (3.6), to the *water capacity* (3.12) of the *cylinder shell* (3.2)

Note 1 to entry: For the determination of the porosity see Annex A or Annex B

**3.8
saturation gas**

<acetylene cylinders> acetylene dissolved in the *solvent* (3.9) in the cylinder 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 abbreviations are used:

- "A" for acetone;
- "DMF" for dimethylformamide.

**3.10
specified solvent content**

<acetylene cylinders> weight of *solvent* (3.9) that the *acetylene cylinder* (3.1) shall contain that is established during prototype testing

**3.11
tare**

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

Note 1 to entry: The tare is further specified in accordance with 3.11.1 to 3.11.3.

Note 2 to entry: For 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 cylinders in bundles, see ISO 13088.

3.11.1**tare A**

<acetylene cylinders> sum of the weights of the empty *cylinder shell* (3.2), the *porous material* (3.6), the *specified solvent content* (3.10), the valve, the coating and the valve guard, where applicable, and all other parts which 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.

3.11.2**tare S**

<acetylene cylinders> *tare A* (3.11.1) plus the weight of the *saturation gas* (3.8)

3.11.3**tare F**

<acetylene cylinders> *tare A* minus the *specified solvent content* (3.10)

3.12**water capacity**

<acetylene cylinders> actual capacity of the *cylinder shell* (3.2) measured by filling the *cylinder shell* (3.2) with water

Note 1 to entry: The cylinder shell is defined as being empty of any porous material, see 3.2.

3.13**working pressure**

<acetylene cylinders> settled pressure at a uniform reference temperature of 15 °C in a cylinder containing the *specified solvent content* (3.10) and the *maximum acetylene content* (3.5)

Note 1 to entry: For the determination of the working pressure see Annex C.

4 Basic requirements**4.1 Cylinder shell**

The acetylene cylinder shell shall conform to the requirements of the relevant International Standard for design and construction of the cylinders, e.g.

- for seamless steel, ISO 9809-1, ISO 9809-3;
- for welded steel, ISO 4706;
- for seamless aluminium alloy, ISO 7866.

NOTE Other standards for the design and construction of cylinders are in preparation and appropriate standards should be conformed to when published.

The minimum test pressure for acetylene cylinders without fusible plugs shall be 60 bar.

The minimum test pressure for acetylene cylinders with fusible plugs shall be 52 bar.

4.2 Porous material

The maximum specified porosity shall not exceed the minimum specified porosity by more than 3 %.

$$P_{\max} - P_{\min} \leq 3 \% \quad (1)$$

where

P Porosity of the porous material, in %.

The compressive strength shall be at least 2 MPa (20 bar).

For safety reasons, the porous material shall be able to prevent the propagation of an acetylene decomposition within the cylinder.

The porous material in each cylinder shall be of such quality that it enables the acetylene cylinder to pass the tests described in Annex D and Annex E.

Acetylene cylinders equipped with fusible plugs shall pass the fire test described in Annex F in addition.

Where cylinder shells with joggle welds are used, it shall be verified that the welds do not damage the porous material in accordance with Annex G.

To ensure the quality of the porous material and the solvent, production/batch test procedures for manufacturing of the porous material shall be established by the manufacturer in accordance with Annex I.

4.3 Solvent content and acetylene content

The specified solvent content and the maximum acetylene content for an acetylene cylinder shall be such that the cylinder will meet the requirements specified in Annex D and Annex E.

The specified solvent content and the maximum acetylene content for an acetylene cylinder equipped with fusible plugs shall be such that the cylinder will meet the requirements specified in Annex F in addition.

4.4 Working pressure

When the cylinder has been filled with the specified solvent content and the maximum acetylene content, and the pressure has reached equilibrium at a uniform reference temperature of 15 °C, the gauge pressure in the cylinder shall not exceed the working pressure as calculated using the equation in Annex C.

4.5 Cylinder identification

The stamp marking of acetylene cylinders shall be in accordance with ISO 13769.

In addition, solvent free acetylene cylinders shall bear the words “solvent-free” painted in a clear and visible manner.

NOTE Attention is drawn to requirements for marking in relevant regulations that might override the requirements given in this International standard.

4.6 Fusible plugs

For acetylene cylinders equipped with fusible plugs the fusible plugs shall be sized and selected as to location and quantity so that the fusible plug(s) are capable of preventing rupture of the normally filled cylinder when subjected to a fire test in accordance with Annex F.

The fusible plug shall utilize a fusible alloy having a yield temperature of no more than 107 °C and no less than 98 °C. The nominal yield temperature shall be 100 °C. The yield temperature is the temperature at which the fusible alloy becomes sufficiently soft to extrude from its holder to permit discharge of acetylene.

The fusible alloy may be installed in a threaded steel or brass plug or in the cylinder valve. The threaded plug shall be fitted into a boss or pad preferably on the cylinder top. Bottom plugs are not permitted for cylinders used in bundles.

The fusible plugs shall be sample tested for yield temperature and for resistance to extrusion and leakage as a quality control procedure during manufacture prior to installation into the cylinder. Detailed test procedures are given in Annex H.

4.7 Accessories

Valves for use with acetylene cylinders shall conform to the requirements of ISO 10297. Valve guards and caps for use with acetylene cylinders shall conform to the requirements of ISO 11117.

NOTE Other accessories should conform to the requirements of appropriate International Standards, when available.

5 Type approval

5.1 General requirements

Representative cylinders, selected according to 5.3.1 by, or on behalf of the approving body shall successfully withstand the type tests as required in 5.3.2 prior to type approval being granted to the manufacturer of the porous material.

5.2 Request for approval

5.2.1 Range of an approval

A request for approval of acetylene cylinders may cover a range of different cylinder water capacities provided that:

- a) the cylinder shells are made from the same type of material (steel or aluminium alloy);
- b) the construction of the cylinders is similar (either seamless cylinders or cylinders with circumferential joggle welds or cylinders with butt welds only);
- c) the nominal outside diameter of the cylinders falls within the range of either:
 - ≤ 270 mm, or
 - > 270 mm;
- d) the cylinders contain the same porous material from the same factory and the same solvent;
- e) the specified solvent content per litre water capacity of the cylinder shell is the same;
- f) the maximum acetylene content per litre water capacity of the cylinder shell is the same.

NOTE The maximum acetylene content per litre water capacity may be lower than the value approved, provided the solvent content is not changed.