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**Committee of Experts on the Transport of Dangerous Goods  
and on the Globally Harmonized System of Classification  
and Labelling of Chemicals****Sub-Committee of Experts on the Transport of Dangerous Goods****Forty-fourth session**

Geneva, 25 November – 4 December 2013

Item 4 (c) of the provisional agenda

**Transport of gases: miscellaneous****References to ISO Standards – Section 6.2.2****Submitted by the International Organization for Standardisation (ISO)<sup>1</sup>****Introduction**

1. This paper proposes to introduce three revised standard for the design construction and testing of UN composite cylinders and one revised standard for the porous material of acetylene cylinders.

The standards concerned are:

- ISO 11119-1:2012 Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 l
- ISO 11119-2:2012 Gas cylinders – Refillable composite gas cylinders and tubes -- Design, construction and testing – Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with load-sharing metal liners
- ISO 11119-3:2013 Gas cylinders - Refillable composite gas cylinders and tubes – Design, construction and testing – Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with non-load-sharing metallic or non-metallic liners
- ISO 3807:2013 Gas cylinders – Acetylene cylinders – Basic requirements and type testing

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<sup>1</sup> In accordance with the programme of work of the Sub-Committee for 2013–2014 approved by the Committee at its sixth session (see ST/SG/AC.10/C.3/84, para. 86 and ST/SG/AC.10/40, para. 14).

If accepted, these standards will replace the existing references to the earlier versions subject to the transition arrangements agreed in the last biennium.

2. It is apparent from the title of the composite cylinder standards that their scope extends to 450 litres water capacity which means that they can be used to make small tubes. Therefore a second proposal adds these three standards to paragraph 6.2.2.1.2 which lists standards applicable to tubes.

3. The definition of tubes describes them as seamless pressure receptacles and to remove doubt as to whether this includes composite cylinders an amendment of the definition is proposed.

4. The existing referenced standard for acetylene cylinders is in two parts. The revised version has combined the requirements into one standard and this is proposed as a replacement.

## Proposal 1

5. Insert three new rows in the table in 6.2.2.1.1 and add the end date for manufacture to the existing references as shown below with new text underlined.

Reference	Title	Applicable for manufacture
ISO 11119-1:2002	Gas cylinders of composite construction – Specification and test methods – Part 1: Hoop wrapped composite gas cylinders	<u>Until 31 December 2020</u>
<u>ISO 11119-1:2012</u>	<u>Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 l</u>	<u>Until further notice</u>
ISO 11119-2:2002	Gas cylinders of composite construction – Specification and test methods – Part 2: Fully wrapped fibre reinforced composite gas cylinders with load-sharing metal liners	<u>Until 31 December 2020</u>
<u>ISO 11119-2:2012</u>	<u>Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with load-sharing metal liners</u>	<u>Until further notice</u>
ISO 11119-3:2002	Gas cylinders of composite construction – Specification and test methods – Part 3: Fully wrapped fibre reinforced composite gas cylinders with non-load-sharing metallic or non-metallic liners	<u>Until 31 December 2020</u>
<u>ISO 11119-3:2013</u>	<u>Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with non-load-sharing metallic or non-metallic liners</u>	<u>Until further notice</u>

## Justification

6. The following is a summary of the technical changes introduced in these revised standards.

- (a) The following changed requirements apply to all cylinders:
- A minimum water capacity of 0.5 l is introduced;

- The upper pressure limit of 650 bar is removed;
- The minimum design life is increased from 10 to 15 years;
- The High Temperature Creep Test has been renamed the Environmentally Assisted Stress Rupture Test; the acceptance criteria are unchanged, but the humidity has been raised from 50% maximum to 95% minimum.

(b) For hoop wrapped cylinders (Part 1) reinforced with glass or aramid fibre the acceptance criterion for the burst test pressure has been raised from 1.67 x test pressure to 2 x test pressure. Carbon fibre is unchanged at 1.67 x test pressure.

(c) For fully wrapped cylinders (Parts 2 and 3) the burst test minimum acceptance criterion was 2 x test pressure for all cylinders but is now 2 x for carbon fibre, 2.2 x for aramid 2.4 x for glass reinforcement.

(d) The minimum acceptance criteria for the burst test at the end of the Environmental Cycle Test (Parts 2 and 3) have been changed from 1.4 x test pressure to:

- 85% of design burst pressure; and
- 1.7 x test pressure for carbon fibre; or
- 1.9 x test pressure for aramid fibre; or
- 2.2 x test pressure for glass fibre reinforcement.

7. The above technical changes have been made to reflect the experience gained in the last ten years. The transition proposed with these standards is the usual six year period in accordance with the principle agreed at the forty first session of the Sub Committee.

## Proposal 2

8. Add three new rows to the table in 6.2.2.1.2 below the entry for ISO 11120 and add the notes 1 and 2 of 6.2.2.1 specifying restrictions on composite cylinders as (agreed the forty third session), suitably amended to apply to tubes. Amend the new marking requirements to apply to tubes. Amendments are shown underlined>.

Reference	Title	Applicable for manufacture
ISO 11119-1:2012	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 l	Until further notice
ISO 11119-2:2012	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with load-sharing metal liners	Until further notice
ISO 11119-3:2013	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with non-load-sharing metallic or non-metallic liners	Until further notice

**NOTE 1:** In the above referenced standards composite tubes shall be shall be designed for a design life of not less than 15 years.

**NOTE 2:** Composite tubes with a design life longer than 15 years shall not be filled after 15 years from the date of manufacture, unless the design has successfully passed a service life test programme. The programme shall be part of the initial design type approval and shall specify inspections and tests to demonstrate that tubes manufactured accordingly remain safe to the end of their design life. The service life test programme and the results shall be approved by the competent authority of the country of approval that is responsible for the initial approval of the tube design. The service life of a composite tube shall not be extended beyond its initial approved design life.

In 6.2.2.7.4 amend the following subparagraphs and note as shown:

- “(q) For composite cylinders and tubes having a limited design life, the letters “FINAL” followed by the design life shown as the year (four digits) followed by the month (two digits) separated by a slash (i.e. “/”).
- (r) For composite cylinders and tubes having a limited design life greater than 15 years and for composite cylinders having non-limited design life, the letters “SERVICE” followed by the date 15 years from the date of manufacture (initial inspection) shown as the year (four digits) followed by the month (two digits) separated by a slash (i.e. “/”).

**NOTE:** Once the initial design type has passed the service life test programme requirements in accordance with 6.2.2.1.1 NOTE 2 or 6.2.2.1.2 NOTE 2 future production no longer requires this initial service life mark. The initial service life mark shall be made unreadable on cylinders and tubes of a design type that has met the service life test programme requirements.

### **Justification**

9. The original editions of these standards had a scope extending to 450 litres water capacity and experience using the standard has been satisfactory. The new versions have more stringent burst pressure requirements for glass and aramid fibres that should give confidence in these larger pressure receptacles.

### **Proposal 3**

10. Amend the definition of tubes in 1.2.1 to include composite construction.

*"Tube"* means a ~~seamless~~ transportable pressure receptacle of seamless or composite construction having a water capacity exceeding 150 litres and of not more than 3 000 litres;

### **Justification**

11. Composite cylinders consist of fibres wrapped around a liner and bonded to it and to each other with a polymeric matrix. It is open to question whether this falls within the meaning of seamless in the definition of a tube. Seamless is normally taken to mean a homogeneous metal without welds or other form of joining. Adding ‘composite construction’ to the definition removes doubt.

## Proposal 4

12. Insert a new line in the second table of 6.2.2.1.3 referencing ISO 3708:2013 and insert “Until 31 December 2020” in the third column of the first and second rows as shown below with new text underlined.

Reference	Title	Applicable for Manufacture
ISO 3807-1:2000	Cylinders for acetylene – Basic requirements – Part 1: Cylinders without fusible plugs	<u>Until 31 December 2020</u>
ISO 3807-2:2000	Cylinders for acetylene – Basic requirements – Part 2: Cylinders with fusible plugs	<u>Until 31 December 2020</u>
<u>ISO 3807:2013</u>	<u>Gas cylinders – Acetylene cylinders – Basic requirements and type testing</u>	<u>Until further notice</u>

## Justification

13. The main technical changes are:

- The requirements for fusible plugs have been included, but their fitting remains optional;
- A test for the compressive strength of the porous material was added;
- A calculation method as an alternative to the elevated temperature test was added;
- The procedure for establishing permissible acetylene/solvent concentrations for bundles was removed and is now included in ISO 13088:2011 *Gas cylinders – Acetylene cylinder bundles – Filling conditions and filling inspection*.

These are incremental changes in a mature technology and ISO proposes that the usual six years transition is appropriate.