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Item 5(b) of the provisional agenda

**Proposals for amendments to RID/ADR/ADN:
new proposals**

Periodic inspection and test of some transportable refillable LPG steel cylinders in RID/ADR

**Transmitted by the European Liquefied Petroleum Gas Association
(AEGPL)^{1, 2}**

Summary

Executive summary:	Introduce into RID/ADR the possibility of using a specific procedure for periodic inspection and testing of protected over-moulded liquefied petroleum gas (LPG) cylinders.
Action to be taken:	Add a definition in 1.2.1 and a note in 6.2.3.5.1.
Related documents:	Multilateral agreement M247; EN 1440:2008/A1:2012, LPG equipment and accessories. Periodic inspection of transportable refillable LPG cylinders; EN 1439:2008, LPG equipment and accessories. Procedure for checking LPG cylinders before, during and after filling; PrEN14140:2012, Transportable refillable welded steel cylinders for liquefied petroleum gas (LPG). Alternative design and construction.

¹ In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106, ECE/TRANS/2010/8, programme activity 02.7 (c)).

² Circulated by the Intergovernmental Organisation for International Carriage by Rail (OTIF) under the symbol OTIF/RID/RC/2013/16.

General

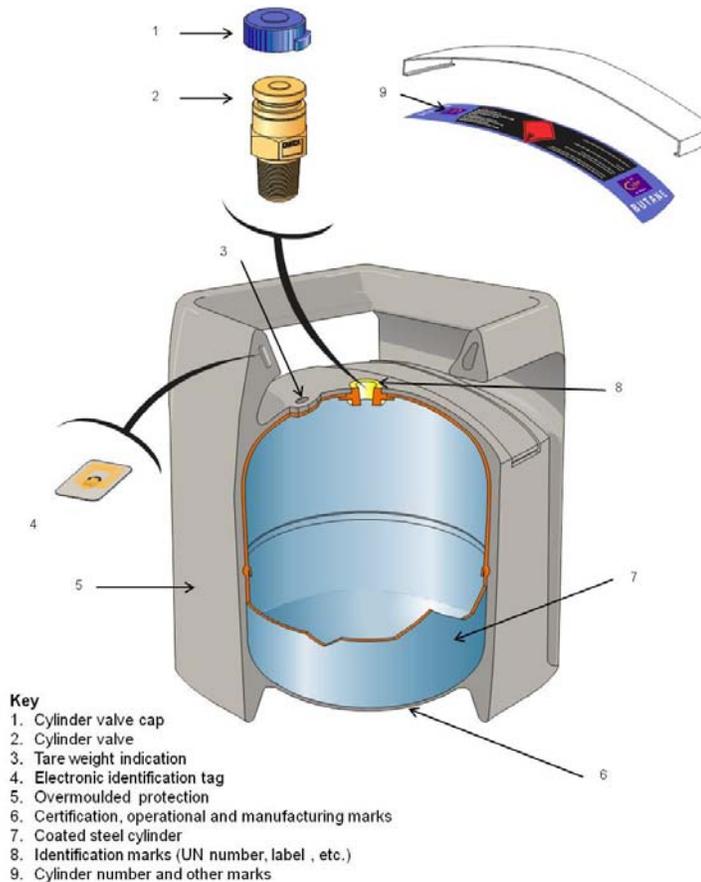
1. Protected over-moulded cylinders have a coated welded steel inner pressure receptacle over-moulded with a non porous material, which is full bonded to the pressure receptacle and whose integrity ensures the integrity of the metallic inner pressure receptacle. They are designed for carriage of LPG, UN No. 1965.

2. Protected over-moulded cylinders have been manufactured since 1997 and the number manufactured is over 3.2 million. They are commercial use in at least two European countries (France and Belgium). The steel pressure receptacle is manufactured in accordance with directive 84/527/EEC, directive 1999/36/EC or directive 2010/35/EU. Since 2003, the pressure receptacles have been manufactured according to the relevant parts of EN 1442 or EN 14140.

3. The inner pressure receptacle is coated (painted), which is the first protection against external corrosion of the pressure receptacle; there is no possibility of water ingress between the receptacle and the layer of paint. The protective case in polyurethane material is over-moulded to the coated inner pressure receptacle, which is the second protection against external corrosion; it has adequate adhesion to the coating to prevent water ingress between the coating of the pressure receptacle and the over-moulded protective case during the cylinder life and it provides mechanical protection of the pressure receptacle.

4. All the protected over-moulded cylinders are fitted with an individual resilient identification electronic tag. Their detailed characteristics are recorded in an information technology database. The record in the data base means that:

- the specific technical characteristics of the cylinders are easily available;
- cylinders can be safely filled/tested;
- cylinders can be monitored for mandatory tests;
- a batch of cylinders can be automatically withdrawn to perform periodic tests;
- cylinders which have to be marked to indicate the successful completion of the periodic inspection can be identified and marked;
- the history of all the events in the life of a cylinder can be reviewed.



Example of protected over-moulded cylinder

5. The quality of LPG used to fill the cylinders has always complied with the corrosion contaminants level specified in ISO 9162:1989.

6. At manufacturing, before over-moulding of the polyurethane material, the steel receptacles are individually hydraulically tested. After over-moulding, the adherence of the polyurethane to the receptacle is tested on a sampling basis.

7. At each filling, the protected over-moulded cylinders are externally visually inspected and leak tested according to EN 1439.

8. A specific periodic inspection protocol has been developed step by step with an independent competent expert. It has been agreed with an external competent body and validated by the French authorities in 2002. A multilateral agreement (M247) has been signed in 2011 regarding this periodic inspection protocol.

Proposal

9. Add the following definition in 1.2:

“*Protected over-moulded cylinder*, means a cylinder made of a coated steel inner pressure receptacle with an over-moulded protective case in polyurethane or material with equivalent properties, which is non removable and bonded to the inner receptacle wall giving mechanical protection against corrosion”.

10. Add the following note in 6.2.3.5.1 after the current note, which should be numbered as Note 1,

“NOTE 2: With the agreement of the competent authority of the country that issued the type approval, the check of the external conditions, the check of the internal conditions and the hydraulic pressure test of each protected over-moulded cylinder with a capacity below 12.8 l, intended for the carriage of gases of UN No. 1965, hydrocarbon gas mixture liquefied, n.o.s, may be replaced by another periodic control procedure ensuring an equivalent level of safety. The competent authority in charge of the periodic inspection shall not delegate its tasks and duties to Xb bodies or IS bodies. The competent authority shall verify that the cylinders are only filled in filling centres applying a documented quality system and that the requirements of EN1439:2008 are fulfilled.”.

Justification

11. Due to polyurethane material, a hydraulic test is not relevant as it will not be possible to detect small leaks and a check of the external conditions of the pressure receptacle is not possible as the steel external surface is not visible. Due to stringent requirements applied to this type of cylinder, visual inspection of the over-moulding ensures the integrity of the metallic inner receptacle wall. This inspection is done at each filling for every cylinder. Cylinders are produced serially.

12. Instead of an individual check of the cylinder for periodic inspection, an alternative way has been developed. It is based on regular sampling and destructive testing. Some burst test, peeling and corrosion tests and adhesion tests are done after three years of service and every five years after the first tests on a sampling basis. These tests demonstrate that:

- the polyurethane material retains its adhesive properties;
- there is no corrosion;
- the mechanical and structural integrity of the pressure receptacle is maintained.

The details of these tests are described in the multilateral agreement M247 and in appendix G of EN 1440:2008 + A1:2012.

13. The internal check is not necessary as the LPG is non corrosive.

14. So far more than 10 000 burst tests, 5 200 peeling tests and 2 000 adhesion tests (5 tests per cylinder) have been performed. No trace of corrosion, no issues with the polyurethane material or degradation of the pressure receptacle have been detected.

15. The date of the last periodic inspection is marked on each cylinder (of the same series) during the next filling process, provided the successful completion of the periodic inspection.

16. In case of non-successful periodic inspection, the batch can be easily withdrawn at the filling plant when the cylinders are returned by the customer's using the electronic tag and database.



Example of burst test



Example of adhesion test

Adhesion test block are glued to the over-moulded material. A tensile stress, increasing at a rate not greater than 1 MPa/s, perpendicular to the plane of the substrate is applied.



Example of blocks with polyurethane material layer extracted (adhesion test).



Example of peeling test: the over-moulded material is peeled and the steel surface is inspected.
This test is done on a cylinder previously submitted to a burst test.

Enforcement

17. No difficulties with enforcement are foreseen. A multilateral agreement, M247, has been signed by several countries and is valid until the 31 December 2016.

18. Protected over-moulded cylinders have been introduced in the draft documents for revision of design standards: EN 14140 and EN 1442 to clearly explain the requirements for designing and manufacturing this type of cylinders as it leads to a specific procedure for periodic inspection.

