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Item 5 (a) of the provisional agenda

**Proposals for amendments to RID/ADR/ADN:
pending issues**

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}**

¹ In accordance with the programme of work of the Inland Transport Committee for 2014–2015 (ECE/TRANS/240, para. 100, ECE/TRANS/2014/23, cluster 9, para.9.2).

² Circulated by the Intergovernmental Organisation for International Carriage by Rail (OTIF) under the symbol OTIF/RID/RC/2014/48.

Summary

Executive summary:	Introduce into RID/ADR the possibility of using a specific procedure for periodic inspection and testing of over-moulded liquefied petroleum gas (LPG) cylinders.
Action to be taken:	To add a definition in 1.2.1, a special provision in 3.3.1 and a clause 6.2.3.5.3. To add EN16738 reference in table in clause 6.2.4.2 and to remove the exclusion of annex G for EN 1439 :2008 in the table in item 11) of P200.
Related documents:	Informal document INF.52/Rev.1 submitted at the spring 2014 session; ECE/TRANS/WP.15/AC.1/2014/31 and its informal document INF.4; Informal document INF.50 submitted by AEGPL and Informal document INF.45 submitted by Germany at the autumn 2013 session; ECE/TRANS/WP.15/AC.1/2013/43 and its informal document INF. 6; Informal document INF.39 submitted at the spring 2013 session; ECE/TRANS/WP.15/AC.1/2013/16; Multilateral agreement M247; prEN16728, LPG equipment and accessories - Transportable refillable LPG cylinders other than welded and brazed steel cylinders: periodic inspection; EN 1440:2008 + A1:2012, LPG equipment and accessories. Periodic inspection of transportable refillable LPG cylinders.

General

1. Protected over-moulded cylinders have a coated welded steel inner pressure receptacle over-moulded with a non porous material, which is fully bonded to the pressure receptacle and whose integrity ensures the integrity of the metallic inner pressure receptacle. They are designed for carriage of LPG (UN1011, UN1965, UN1969 and UN1975). Due to their specific design, the pressure test and the external check of the pressure receptacle required by RID/ADR in 6.2.1.6 for the periodic inspection are not relevant and an alternative way of inspecting the cylinders has been developed.

2. This subject has been already discussed during the three last joint meetings. It has been recorded in the Autumn 2013 Joint Meeting report (ECE/TRANS/WP.15/AC.1/132, para 66) that the Joint Meeting had no objection in principle to the texts proposed by

AEGPL in INF.50. During last Joint Meeting, it was decided to discuss further this item at next Joint Meeting in September 2014.

3. During the last Joint Meeting session, an informal document (INF.52/Rev.1) was issued to incorporate comments from other delegations. A key change has been made to the last AEGPL proposal (INF.52/Rev.1) to remove the general clause about periodic inspection of pressure receptacles (so not specific to LPG over-moulded cylinders) which was in proposal 3 in INF.52/Rev.1 due to the comments raised during the Joint Meeting.

The general information below has been already given in the previous working document.

4. Protected over-moulded cylinders have been manufactured since 1997 and the quantity of cylinders manufactured is over 3.6 million. They are in 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.

5. The cylinders capacity is 12.8lt so that the cylinders can be easily transported and handled. This capacity has been considered in the definition proposed in paragraph 13 of this document in order to be limited to cylinders of small capacity and be related to the concept of the note in ADR 6.2.3.5.1. This value is around 10% of the maximum capacity of a cylinder (as defined in chapter 1.2.1) and twice the capacity stated in the note of ADR 6.2.3.5.1 (which allows the replacement of the hydraulic pressure test by another test ensuring equivalent level of safety). This value can be discussed and increased if necessary.

6. Protected over-moulded cylinders have been introduced in the draft documents for revision of designing standards EN14140 and EN1442 in order to clearly define the requirements for designing and manufacturing this type of cylinder as it leads to a specific procedure for periodic inspection.

7. 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.

8. All 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;
- in case of an issue with a cylinder (detected at filling plant, at customer's, during periodic tests..), the electronic tag linked to the database allows cylinders from for the same batch to be automatically withdrawn to perform relevant tests and to assess if it is a batch issue or not. If necessary, the whole batch can be automatically withdrawn and disposed;
- 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.

9. The design lifetime of the protected over-moulded cylinder is set at present to 30 years. However, this lifetime can then be extended every 5 years, as long as the tests undertaken at the periodic inspection demonstrate that the polyurethane adhesion to the inner receptacle has retained its properties.

The electronic tag linked to the database enables a batch of cylinders to be withdrawn when it has reached its lifetime.

This concept of lifetime is to be added in prEN16728 as it is related to periodic inspection test results (see annex 1).

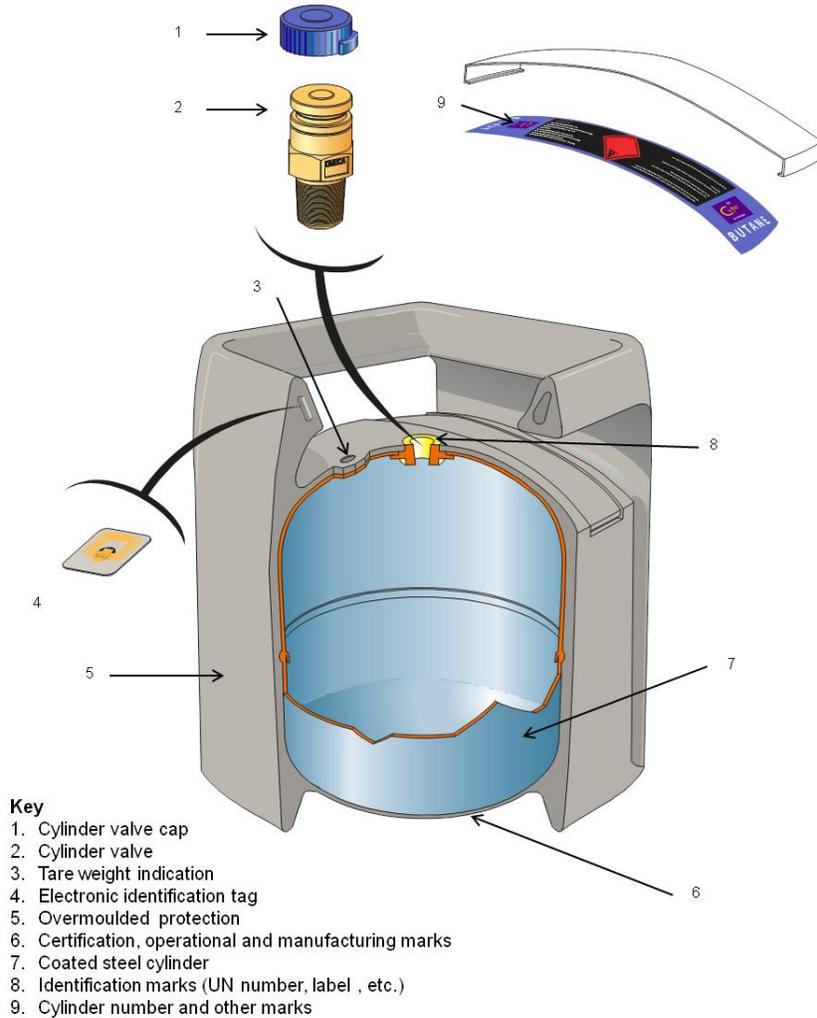
10. The over-moulding case does not cover the cylinder number. Other permanent markings which are covered are reproduced on the PU case. The date of the last periodic inspection is marked on each cylinder (of the same series) during the next filling process, subject to the successful completion of the periodic inspection.

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

12. 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 (destructive test).

13. At each fill, the protected over-moulded cylinders are externally visually inspected and leak tested according to EN1439.

14. A specific periodic inspection protocol has been developed step by step with an independent competent expert (see annex 6). 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.



Example of protected over-moulded cylinder

Proposal

15. Add the following definition in 1.2.1 :

“Over-moulded cylinder, means a cylinder intended for the carriage of LPG of a water capacity not exceeding 13 litres made of a coated steel inner pressure receptacle with an over-moulded protective case made from cellular plastic which is non removable and bonded to the outer surface of the inner receptacle wall”.

16. Add “over-moulded cylinders” in the existing definition of “Pressure receptacle” under 1.2.1.
17. Insert ‘6XY’ in column (6) of the Dangerous Goods list for the entries for UN numbers 1011, 1075, 1965, 1969 and 1978.
18. Add elementary design information in 6.2.3.5.3:

Add a paragraph 6.2.3.5.3 *additional requirement for the construction of over-moulded cylinders*

Over-moulded cylinders shall be produced serially based on steel cylinders in accordance with EN1442, EN14140 or annex I, parts 1 to 3 to Council Directive 84/527/EEC. Each cylinder shall be fitted with an individual resilient identification electronic tag or an equivalent device linked to an electronic database. The design of the over-moulding case shall prevent water penetrating to the inner steel cylinder. The conversion of the base steel cylinder to an over-moulded cylinder shall conform to the relevant requirements of EN1442 and EN14140.

19. Insert the following special provision in 3.3.1

6XY This entry applies to over-moulded cylinders as defined in 1.2.1.

The owner shall demonstrate to the satisfaction of the competent authority that the over-moulded cylinders are only filled in filling centres applying a documented quality system and that the requirements of EN1439:2008 are fulfilled and correctly applied. The filling centre shall have the facility to read the electronic tag. The owner shall provide documentary evidence to the competent authority that the filling centre complies with these requirements.

If during the visual external prefill inspection, the outer surface of an over-moulded cylinder is not free from material gouges, cuts or cracks that may harm the protection against corrosion of the inner steel pressure receptacle as defined in EN1439:2008 annex G, the over-moulded cylinder shall be removed from service. Prior to any reuse of the inner receptacle for over-moulding, the over-moulding case shall be removed and a hydraulic test shall be carried out.

Notwithstanding P200 periodic inspection shall be performed by sampling of an annual production group of cylinders after 3 years in service and thereafter every 5 years.

An annual production group of over-moulded cylinders is defined as the production of cylinders from a single over-moulding company using inner cylinders manufactured by one manufacturer within one calendar year.

Following failure of an annual production group to meet the requirements of its periodic inspection further use of parts of the group (sub-groups) can be allowed by the competent authority authorizing the original type approval if it has been demonstrated without doubt that the cause of the periodic inspection failure is known and not valid for the other parts of the group (sub-groups).

The following procedures shall replace the requirements of 6.2.1.6 a) and d).

(a) Destructive adhesion tests and peeling tests shall be performed on two samples per group to check that there is no external corrosion on the inner receptacle wall and the cellular plastic case keeps its adhesive properties with time using the method specified in annex F of EN16728. The minimum size of the sampling shall be 5 cylinders for the adhesion test and 10 cylinders for the peeling test.

(b) The hydraulic pressure test of 6.2.1.6.1 (d) shall be substituted by a burst test on one sample per group in accordance with annex F of EN16728. The minimum size of the sampling shall be 20 cylinders. The result of burst tests shall be in accordance with the unilateral statistical tolerance interval of ISO 16269-6:2005 for a confidence level of 95% and a fraction of population equal to 99% as described in annex F of EN16728.

(c) If a burst test or peeling test fails, additional tests can be performed to demonstrate that the cause of periodic failure is delimited to (a) specific sub-group(s). The defective annual production group or sub-group(s) shall be withdrawn immediately after detection using the electronic tag.

(d) If a result of the adhesion test does not comply with the criteria for at least one test, additional tests can be performed to demonstrate that the cause of periodic failure is delimited to (a) specific sub-group(s). The defective annual production group or sub-group(s) shall be withdrawn immediately after detection using the electronic tag.

(e) The test results shall be recorded and kept available by the owner of the over-moulded cylinders for 30 years.

All other provisions of RID/ADR shall apply.

20. Remove the exclusion of clause 3.5 and of annex G for EN 1439:2008 in the table in point 11 in P200.

21. To add EN16728 reference in table in clause 6.2.4.2

Justification

22. As well as the pressure test, the burst test can demonstrate that the mechanical and structural integrity of the inner receptacle is maintained.

As well as the external check of the pressure receptacle, the adhesion test and the peeling test can show that there is no external corrosion on the inner receptacle wall. The adhesion test demonstrates that the over-moulded case keeps its adhesive properties along time and so continues to protect the anti-corrosion coating of the inner receptacle. It has been demonstrated that good adhesion of the over-moulded case means that there is no corrosion on the inner receptacle (external corrosion): (see annex 6). An adhesion test and characteristics of the cellular plastic case have been added in the design standard prEN14140 and prEN1442. The peeling test allows visual external check of the pressure receptacle.

The details of these tests are described in the multilateral agreement M247 and in : Annex F of prEN 16728 (sent to Public Enquiry in May 2014). (see annex 1)

23. In case of an unsuccessful periodic inspection, the group of cylinders can be easily withdrawn at the filling plant when the cylinders are returned using the electronic tag and database.

Enforcement

24. Regarding the experience, the proposed method has been used since 2000. No issue or lack of efficiency has been found. The burst test method (with the statistical assessment) is used since 1966 for French national LPG cylinders to have a 15 years period for periodic inspection.

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

List of referred standards:

- prEN 1442:[2016], LPG equipment and accessories - Transportable refillable welded steel cylinders for LPG - Design and construction;

- EN 1439:2008, LPG equipment and accessories. Procedure for checking LPG cylinders before, during and after filling;
- prEN 14140 [2014], LPG equipment and accessories. Transportable refillable welded steel cylinders for LPG - Alternative design and construction;
- prEN16728: [2015]., LPG equipment and accessories. Transportable refillable LPG cylinders other than welded and brazed steel cylinders: periodic inspection.

Annexes:

- **Annex 1:** Annex F of prEN 16728 , LPG equipment and accessories - Transportable refillable LPG cylinders other than welded and brazed steel cylinders: periodic inspection. These extracts are from the document sent to Public Enquiry in May 2014 (public enquiry is up to 22nd October 2014);
- **Annex 2:** Extracts from prEN 14140 [2014], LPG equipment and accessories. Transportable refillable welded steel cylinders for LPG - Alternative design and construction. This document will be sent to formal vote in Summer 2014.
- **Annex 3:** Extracts from prEN 1442 : LPG equipment and accessories - Transportable refillable welded steel cylinders for LPG - Design and construction. These extracts are from the 2014 April draft document made by TC 286 WG1 for the public enquiry;
- **Annex 4:** Extracts from EN1439:2008, LPG equipment and accessories. Procedure for checking LPG cylinders before, during and after filling. A revision of EN1439 has been started by TC286 WG7 but a draft is not yet available.
- **Annex 5:** Example on application of periodic inspection method
- **Annex 6:** Document displayed at ESOPE 2004 – Periodic Inspection Procedure (Study)

These annexes are reproduced in informal document INF.5.
