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## Economic Commission for Europe

### Inland Transport Committee

#### Working Party on the Transport of Dangerous Goods

##### Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods

Bern, 19-23 March 2012

Item 5(a) of the provisional agenda

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

### **Test periods for packing instruction P200**

**Transmitted by the European Industrial Gases Association<sup>1, 2</sup>**

#### **Introduction**

1. The European Industrial Gases Association (EIGA) submitted a proposal ECE/TRANS/WP.15/AC.1/2009/31 to the Joint Meeting at its session in September 2009. This document was discussed along with informal document INF.9 from the European Cylinder Makers Association (ECMA).

2. The result of the discussions, as recorded in the report of that joint meeting, ECE/TRANS/WP.15/AC.1/116 was that: "Those delegates who expressed a view did not support the idea of setting up an informal working group until EIGA provided more detailed justification and convincing evidence and until EIGA and ECMA had brought their respective positions closer together."

3. Following the above recommendation of the Joint Meeting there have been a number of meetings held between EIGA and the ECMA. EIGA now considers that it can provide the justification and evidence that was requested by the Joint Meeting. EIGA also believes that as a result of these meetings and subsequent work that has been carried out, that their respective positions concerning this issue are sufficiently understood so as to

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<sup>1</sup> 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)).

<sup>2</sup> Circulated by the Intergovernmental Organisation for International Carriage by Rail (OTIF) under the symbol OTIF/RID/RC/2012/14.

allow the formation of an informal working group, with all interested parties being able to contribute in a meaningful way.

4. EIGA would like to take this opportunity to thank the ECMA for their help in this matter.

5. This paper provides a brief summary of the work that has been carried out by EIGA who are submitting this for review by the Joint Meeting, with the request that an informal working group drawing on the experience of other members of the Joint Meeting is established to consider this proposal further.

6. This proposal applies similar requirements to those used to extend the periodicity of cylinders containing LPG with additional requirements to cover the specifics of the concerned gases.

## **Background**

7. This document only applies to cylinders as defined in ADR, ("*Cylinder*" means a transportable pressure receptacle of a water capacity not exceeding 150 litres).

8. Prior to the introduction of harmonised standards there had been requirements to carry out a periodic inspection and test of pressure receptacles including cylinders. The period between these periodic inspections and the type of tests required was determined and enforced by National Authorities and varied from country to country.

9. With the development of harmonized standards and the application of packing instruction P200 the methods of the periodic inspection and test as well as the intervals between those tests have become standardized across the contracting parties of ADR.

10. With the agreement of experts and as experience has developed over the life of pressure receptacles test periods have been extended through a number of carefully considered incremental steps. For example in a number of cases test periods have been extended from two years, to five years and eventually to ten years. At each incremental change, there has been a careful and considered review by all parties involved to ensure that any changes are managed in such a way to ensure that safety has not been compromised.

11. Cylinder test results are continuously reviewed by EIGA member companies to ensure that the testing periodicities in P200 remain applicable and that there have been no time dependant failure mechanisms initiated that could affect the on-going safety of cylinders in service.

12. EIGA is not aware that an increase in the test period has ever been revoked.

13. The testing frequency for cylinders has remained unchanged for a number of years but there have been changes to both the design of cylinders and cylinder valves. Cylinders will typically fail a periodic inspection for a number of reasons; these include external damage and internal corrosion. Internal corrosion occurs with certain gases when moisture is present in cylinders.

14. One of the significant developments in the industrial gases industry in the last twenty years for preventing internal corrosion of cylinders containing these gases is the possibility of using cylinder valves that incorporate an integral residual pressure valve 'cassette'. This device retains a minimum pressure in the cylinder and also prevents backflow of product from the customers' process, thereby removing the likelihood of internal contamination affecting the cylinder. The correct operation of this cassette and the presence of a positive pressure in the cylinder are verified prior to every fill.

15. There has also been the development of harmonized standards for the pre-fill inspection of cylinders and these have been incorporated into ADR. These standards specify the acceptance criteria a cylinder has to meet before it can be filled.

16. EIGA believes that its members have sufficient experience of operating cylinders fitted with residual pressure valves have robust inspection data for cylinders that have been tested, have records of the number of cylinders that have failed and understand the reasons why such failures occurred.

## Proposal

17. EIGA wishes to create an informal working group to explore the options to increase the periodicities of cylinder testing, for certain gases of division 2.2 and asks the members of the Joint Meeting for their support.

## Principles

18. EIGA has established a number of principles relating to this proposal, and these are summarised as below:

- (a) Any proposed increase in periodicity would only apply to certain gases of division 2.2.
- (b) Only cylinders that comply with the technical requirements of ADR will be allowed to change to the 15 year test regime.
- (c) Cylinder filling facilities would need to apply a documented quality system.
- (d) For oxidising gases and acidic gases such as oxygen and carbon dioxide, to prevent internal corrosion, only cylinders fitted with residual pressure valves will be allowed to operate under a 15 year test regime.
- (e) For all cylinders operating under a fifteen year inspection regime the cylinder and or valve will undergo a positive pressure and a functionality check at each filling.

## Justification

19. Any change to an existing test regime will raise concerns about the equivalence of safety, and this has been at the heart of the work EIGA has carried out to ensure that there will be no reduction of the current high safety record of the industrial gases industry. The work carried out by EIGA has included a review of the rate of cylinder rejections at both the pre-fill and inspection stages. From this work a fuller understanding has been developed of where the rejection of a cylinder occurs in its life cycle. The key points are that:

- (a) In excess of two million representative cylinder test records were investigated over a five year period when the cylinders were tested hydraulically and visually inspected. The reasons of failure were identified (*Note: Over this same period, it is estimated that EIGA member companies have tested in excess of 20 million cylinders either hydraulically or ultrasonically.*)
- (b) Of these two million cylinders, none failed the hydraulic test; approximately 90% were seamless steel cylinders with the remainder being aluminium alloy.

There was a visual rejection rate of 0.6% of cylinders inspected. Of this 0.5%, (2000 per year) had been rejected at the time of filling at a filling centre, (between periodic

inspections) on external condition. The remaining 0.1%, (200 per year) were rejected at the time of periodic inspection, the very few cylinders rejected for internal corrosion showed signs of liquid ingress.

(c) The majority of cylinders are therefore rejected at the stage when cylinders are returned for filling at a filling centre, and not at the periodic inspection test.

(d) It is recognised that the pre-fill stage is critical, which is why the gas industry has worked on developing standards for the pre-fill inspection of cylinders.

20. It should be noted that since the last extension to the interval for the periodic inspection and test period for cylinders, EIGA members have worked to develop residual pressure valves (RPV). This initiative means that many cylinders are now equipped with a residual pressure valve which maintains a positive pressure in the cylinder as well as performing a non return function to prevent the backflow of contamination into the cylinder from the customers process. This measure has reduced the number of cylinder failures due to internal corrosion which occurs, when carbon dioxide and oxygen cylinders are not equipped with a residual pressure valve. Internal corrosion occurs as soon as moisture is introduced, which is why fitting a residual pressure valve to these gases and their mixtures is important.

21. In conjunction with the requirements for a pre-fill inspection and the equipping of cylinders with residual pressure valves (for the gases concerned) has resulted in a significant improvement in the overall cylinder package integrity.

22. In order to support this proposal, a risk analysis has been carried out using Process Safety methodology which is used to evaluate risk in many industries.

23. The result of the risk analysis has showed that by adopting the pre-fill regime as required by ADR and the checking for the presence of a residual pressure in the cylinder prior to filling there is a significant and important increase in the overall safety of the cylinder package.

24. The reasons for this are:-

(a) The prefill check on the external condition of the cylinder remains a critical part of the overall filling process to ensure the safety of the cylinder.

(i) This is important as cylinders are filled a number of times between the periodic inspections.

(ii) The majority of damage to cylinders is from external influences.

(iii) The most hazardous part of a cylinder's life is during filling, when it is subjected to the highest stress due to internal pressure.

(b) The presence of a positive pressure is checked prior to every fill thereby ensuring that outside contamination will not have entered into the cylinder during customer use.

*Note: In carrying out (b), which is not presently required by the pre-fill inspection standards, an additional step is put in place to ensure that the internal condition of the cylinder is maintained.*

If the cylinder fails either of the above checks, that is a pre-fill external inspection or residual pressure check for internal condition, it is sent to an authorised facility for a more detailed examination.

(c) The above points will be reinforced by only allowing cylinder filling stations that have been accredited to fill cylinders with the extended test interval.

(d) Only cylinders that comply with the technical requirements of ADR will be allowed to benefit from the 15 year retest. A cylinder which has passed a periodic inspection will have a new or refurbished cylinder valve fitted.

25. The majority of industrial gases including carbon dioxide are produced as cryogenic liquids thus ensuring that contamination and moisture content are minimised. Other gases are produced from a variety of different sources, all of which have requirements for minimum levels of moisture and contamination for their applications. Typical maximum permissible product contamination levels are given in Table 4 EN 14175 Welding consumables – Gases and gas mixtures for fusion welding and allied processes.

26. The formation of an inter-session working group to look at this subject in depth will allow all interested parties to contribute and ensure that an objective view is obtained on this matter, without any reduction of safety.

## **Safety**

27. EIGA has carried out an analysis of the impact of extending the test period, and this does not present any reduction in safety.

## **Feasibility**

28. The potential change to fifteen year periodic inspection periods is considered to be technically feasible.

## **Enforceability**

29. No compliance issues are foreseen.

## Annex

### **Draft for Extended retest period for high pressure compressed gases**

Replace para (10) regarding periodic inspection of packing instruction P200 of chapter 4.1.4.1 with the following

"(10) Periodic inspection

u: The interval between periodic tests may be extended to 10 years for aluminium alloy pressure receptacles. This derogation may only be applied to UN pressure receptacles if the alloy of the pressure receptacle has been subjected to stress corrosion testing as specified in ISO 7866:1999

[Note: the text of 2nd sentence is misleading and not needed, because ISO 7866 which includes the stress corrosion test shall be followed for UN pressure receptacles]

v: (1) The interval between inspections for steel cylinders, other than refillable welded steel cylinders for UN Nos. 1011, 1075, 1965, 1969 or 1978, may be extended to 15 years:

(a) with the agreement of the competent authority (authorities) of the country (countries) where the periodic inspection and the carriage take place; and

(b) in accordance with the requirements of a technical code or a standard recognised by the competent authority

(2) For refillable welded steel cylinders for UN Nos. 1011, 1075, 1965, 1969 or 1978, the interval may be extended to 15 years, if the provisions of paragraph (12) of this packing instruction are applied.

[Note: the text of 1<sup>st</sup> sentence can be misunderstood. The wording should be

For Steel cylinders , other than refillable welded steel cylinders, the interval between inspections for UN Nos. 1011, 1075, 1965, 1969 or 1978, may be extended to 15 years:]

ua: The interval between periodic tests may be extended to 15 years for aluminium alloy pressure receptacles if the provisions of paragraph (13) of this packing instruction are applied.

This derogation shall not apply to breathing apparatus cylinders in accordance with special provision 655 of 3.3.1.

va: For refillable seamless steel cylinders the interval between periodic tests may be extended to 15 years if the provisions of paragraph (13) of this packing instruction are applied.

This derogation shall not apply to breathing apparatus cylinders in accordance with special provision 655 of 3.3.1

vb: For refillable seamless steel cylinders the interval between periodic tests may be extended to 15 years for seamless steel cylinders equipped with residual pressure valves (RPV) if the provisions of paragraph (13) of this packing instruction are applied.

vc: For refillable seamless steel cylinders for gas mixtures UN No 1956 containing more than 1% carbon dioxide the interval between periodic tests may be extended to 15 years for seamless steel cylinders equipped with residual pressure valves (RPV) if the provisions of paragraph (13) of this packing instruction are applied.

vd: For refillable seamless steel cylinders for gas mixture UN No 1956 containing less than 1% carbon dioxide the interval between periodic tests may be extended to 15 years for seamless steel cylinders if the provisions of paragraph (13) of this packing instruction are applied."

Action: Add a new definition in 1.2:

"*Residual Pressure Valve*" (RPV) means a closure which incorporates a device that prevents moisture ingress by maintaining a positive differential between the pressure within the cylinder and the valve outlet."

Insert a new paragraph (13) in packing instruction P200 of 4.1.4.1

"(13) An interval of 15 years for the periodic inspection of refillable seamless steel and aluminium alloy cylinders may be granted in accordance with special packing provision (ua, va, vb, vc, vd) of paragraph (10), if the following provisions are applied.

### **1. General provisions**

1.1 For the application of this section, the competent authority shall not delegate its tasks and duties to Xb bodies (inspection bodies of type B) or IS bodies (in-house inspection services).

1.2 The owner of the cylinders shall apply to the competent authority for granting the 15 year interval, and shall demonstrate that the requirements of sub-paragraphs 2, 3 and 4 are met.

1.3 Cylinders manufactured since 1 January 1999 shall have been manufactured in conformity with the following standards:

- EN 1964-1 or [EN 1964-2]; or
- EN 1975; or
- ISO 9809-1; or [ISO 9809-2]; or
- ISO 7866; or
- Annex I, parts 1 to 3 to Council Directive 84/525/EEC<sup>a</sup> and 84/526/EEC<sup>a</sup> those with Rm < 1100MPa

as applicable according to the table in 6.2.4 of ADR.

Other cylinders manufactured before 1 January 2009 in conformity with ADR in accordance with a technical code accepted by the national competent authority may be accepted for a 15 year interval, if they are of equivalent safety to the provisions of ADR as applicable at the time of application.

*[A harmonized conformity assessment process/procedure shall be developed and agreed to ensure cylinders are in conformity with ADR and having an equivalent level of safety.]*

<sup>a</sup>

Council directive on the approximation of the laws of the Member States relating to welded unalloyed steel gas cylinders, published in the Official Journal of the European Communities No. L300 of 19.11.1984.

1.4 The owner shall submit documentary evidence to the competent authority demonstrating that the cylinders comply with the provisions of sub-paragraph 1.3. The competent authority shall verify that these conditions are met.

1.5 The competent authority shall check whether the provisions of sub-paragraphs 2 and 3 are fulfilled and correctly applied. If all provisions are fulfilled, it shall authorise the 15-year interval for the cylinders. In this authorisation, the type of cylinder (as specified in the type approval) or a group of cylinders (see Note) covered shall be clearly identified. The authorisation shall be delivered to the owner; the competent authority shall keep a copy. The owner shall keep the documents for as long as the cylinders are authorised for a 15 year interval.

*NOTE: A group of cylinders is defined by the production dates of identical cylinders for a period, during which the applicable provisions of ADR and of the technical code accepted by the competent authority have not changed in their technical content. Example: Cylinders of identical design and volume having been manufactured according to the provisions of ADR as applicable between 1 January 1985 and 31 December 1988 in combination with a technical code accepted by the competent authority applicable for the same period, form one group in terms of the provisions of this paragraph.*

1.6 The competent authority shall monitor the owner of the cylinders for compliance with the provisions of ADR and the authorisation given as appropriate, but at least every three years or when changes to the procedures are introduced.

## **2. Operational provisions**

2.1 Cylinders having been granted a 15 year interval for periodic inspection shall only be filled in filling centres applying a documented quality system to ensure that all the provisions of paragraph (7) of this packing instruction and the requirements and responsibilities of EN 1919 or EN 1920 or EN 13365 as applicable are fulfilled and correctly applied. In particular the visual inspection shall be carried out as required by the standards mentioned.

2.2 Cylinders having been granted a 15 year interval for periodic inspection following provisions (ua, va and vd) shall have the presence of a positive pressure checked prior to every filling. This check shall be carried out in accordance with an appropriate procedure. In the case of no positive pressure being present a verification of the internal condition of the cylinder shall be carried out.

2.3 Cylinders having been granted a 15 year interval for periodic inspection following provision (vb,vc) shall have the function of the RPV device checked prior to every filling. The functionality tests shall be carried out in accordance with an approved procedure. In case of malfunction the RPV the cylinder shall be internally inspected and the valve shall be replaced or repaired.

2.4 The competent authority shall verify that these requirements (2.1, 2.2 and 2.3) are fulfilled and check this as appropriate, but at least every three years or when changes to the procedures are introduced.

2.5 The owner shall provide documentary evidence to the competent authority that the filling centre complies with the provisions of sub-paragraph 2.1, 2.2 and 2.3.

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<sup>a</sup> Council directive on the approximation of the laws of the Member States relating to welded unalloyed steel gas cylinders, published in the Official Journal of the European Communities No. L300 of 19.11.1984.



2.6 If a filling centre is situated in a different Contracting Party to ADR, the owner shall provide additional documentary evidence that the filling centre is monitored accordingly by the competent authority of that Contracting Party to ADR. See also 1.2

2.7 To prevent internal corrosion, only gases of high quality with very low potential contamination shall be filled into the cylinders. This is deemed to be fulfilled, if the compatibility of gases/material is acceptable in accordance with EN ISO 11114 series, and the gas quality meets the specifications in EN 14175.

[2.8 several other applications e.g. trailer etc need special provision ]

### **3. Provisions for qualification and periodic inspection**

3.1 Cylinders of a type or group already in use, for which a 15 year interval has been granted and to which the 15 year interval has been applied, shall be subject to a periodic inspection according to 6.2.3.5.

NOTE: For the definition of a group of cylinders, see Note to sub-paragraph 1.5.

3.2 If a cylinder with a 15-year interval fails the pressure test by bursting or leakage or if a severe defect is detected by the non-destructive test (NDT) during a periodic inspection the owner shall investigate and produce a report on the cause of the failure and if other cylinders (e.g. of the same type or group) are affected. In the latter case, the owner shall inform the competent authority. The competent authority shall then decide on appropriate measures and inform the competent authorities of all other Contracting Parties to ADR accordingly.

3.3 If internal corrosion and other defects as defined in the periodic inspection standards referenced in 6.2.4 have been detected, the cylinder shall be withdrawn from use and shall not be granted any further period for filling and carriage.

3.4 Cylinders having been granted a 15 year interval shall only be fitted with valves designed and manufactured according to EN 849 or ISO 10297. After a periodic inspection, a new valve shall be fitted to the cylinder, except that manually operated valves, which have been refurbished or inspected according to EN 14189 or ISO 22434 may be re-fitted. Refurbishment processing shall only be carried out by the manufacturer of the valves or according to his technical instruction by an enterprise qualified for such work and operating under a documented quality system.

### **4. Marking**

Cylinders having been granted a 15 year interval for periodic inspection in accordance with this paragraph shall have the date (year) of the next periodic inspection as required in section 5.2.6 modified and at the same time additionally be marked clearly and legibly with "P15Y". This marking shall be removed if the cylinder is no longer authorised for a 15 year interval."

## Extract and example of modified packing instruction P200

P200	PACKING INSTRUCTION										P200
Table 1: COMPRESSED GASES											
UN No.	Name and description	Classification code	LC <sub>50</sub> ml/m <sup>3</sup>	Cylinders	Tubes	Pressure drums	Bundles of cylinders	Test period, years <sup>a</sup>	Test pressure, bar <sup>b</sup>	Maximum working pressure, bar <sup>b</sup>	Special packing provisions
1002	AIR, COMPRESSED	1A		X	X	X	X	10			ua, vb
1006	ARGON, COMPRESSED	1A		X	X	X	X	10			ua, va
1016	CARBON MONOXIDE, COMPRESSED	1TF	3760	X	X	X	X	5			u
1023	COAL GAS, COMPRESSED	1TF		X	X	X	X	5			
1045	FLUORINE, COMPRESSED	1TOC	185	X			X	5	200	30	a, k, n, o
1046	HELIUM, COMPRESSED	1A		X	X	X	X	10			ua, va
1049	HYDROGEN, COMPRESSED	1F		X	X	X	X	10			d, ua, va
1056	KRYPTON, COMPRESSED	1A		X	X	X	X	10			ua, va
1065	NEON, COMPRESSED	1A		X	X	X	X	10			ua, va
1066	NITROGEN, COMPRESSED	1A		X	X	X	X	10			ua, va
1071	OIL GAS, COMPRESSED	1TF		X	X	X	X	5			
1072	OXYGEN, COMPRESSED	1O		X	X	X	X	10			s, ua, vb
1612	HEXAETHYL TETRAPHOSPHATE AND COMPRESSED GAS MIXTURE	1T		X	X	X	X	5			z
1660	NITRIC OXIDE, COMPRESSED	1TOC	115	X			X	5	225	33	k, o
1953	COMPRESSED GAS, TOXIC, FLAMMABLE, N.O.S.	1TF	≤ 5000	X	X	X	X	5			z
1954	COMPRESSED GAS, FLAMMABLE, N.O.S	1F		X	X	X	X	10			z
1955	COMPRESSED GAS, TOXIC, N.O.S.	1T	≤ 5000	X	X	X	X	5			z
1956	COMPRESSED GAS, N.O.S.	1A		X	X	X	X	10			vc, vd
1957	DEUTERIUM, COMPRESSED	1F		X	X	X	X	10			d
1964	HYDROCARBON GAS MIXTURE, COMPRESSED, N.O.S.	1F		X	X	X	X	10			z

P200	PACKING INSTRUCTION										P200
Table 1: COMPRESSED GASES											
UN No.	Name and description	Classification code	LC <sub>50</sub> ml/m <sup>3</sup>	Cylinders	Tubes	Pressure drums	Bundles of cylinders	Test period, years <sup>a</sup>	Test pressure, bar <sup>b</sup>	Maximum working pressure, bar <sup>b</sup>	Special packing provisions
1971	METHANE, COMPRESSED or NATURAL GAS, COMPRESSED with high methane content	1F		X	X	X	X	10			
2034	HYDROGEN AND METHANE MIXTURE, COMPRESSED	1F		X	X	X	X	10			d
2190	OXYGEN DIFLUORIDE, COMPRESSED	1TOC	2.6	X			X	5	200	30	a, k, n, o
3156	COMPRESSED GAS, OXIDIZING, N.O.S.	1O		X	X	X	X	10			z
3303	COMPRESSED GAS, TOXIC, OXIDIZING, N.O.S.	1TO	≤ 5000	X	X	X	X	5			z
3304	COMPRESSED GAS, TOXIC, CORROSIVE, N.O.S.	1TC	≤ 5000	X	X	X	X	5			z
3305	COMPRESSED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.	1TFC	≤ 5000	X	X	X	X	5			z
3306	COMPRESSED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.	1TOC	≤ 5000	X	X	X	X	5			z

<sup>a</sup> Not applicable for pressure receptacles made of composite materials.

P200		PACKING INSTRUCTION (cont'd)								P200	
Table 2: LIQUEFIED GASES AND DESSOLVED COMPRESSED GASES											
UN No.	Name and description	Classification code	LC <sub>50</sub> ml/m <sup>3</sup>	Cylinders	Tubes	Pressure drums	Bundles of cylinders	Test period, years <sup>a</sup>	Test pressure, bar <sup>b</sup>	Filling ratio	Special packing provisions
1013	CARBON DIOXIDE	2A		X	X	X	X	10	190 250	0,68 0,75	ua, va
1070	NITROUS OXIDE	2O		X	X	X	X	10	180 225 250	0,68 0,74 0,75	ua, vb

<sup>a</sup> Not applicable for pressure receptacles made of composite materials.

<sup>b</sup> For mixtures of UN No. 1965, the maximum permissible filling mass per litre of capacity is as follows:

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