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Proposals of amendments to RID/ADR/ADN: reports of informal working groups

Report of the informal working group on test periods for packing instruction P200

Transmitted by the European Industrial Gases Association (EIGA)[1, 2]

1. The European Industrial Gases Association (EIGA) submitted document ECE/TRANS/WP.15/AC.1/2012/14 to the Joint Meeting (JM) at its session in March 2012. This document contained a proposal to extend the test interval for certain gases from 10 to 15 years and a request for an informal working group (IWG) to examine EIGA's proposal in detail. This proposal is the result of the work of the IWG after five sessions.

2. Initially EIGA had submitted document 2009/31 to the JM at its session of March 2009. EIGA was then asked to provide a more detailed justification and seek the support of the European Cylinder Makers Association (ECMA) who expressed disagreement with the idea of extending the test period.

3. All aspects of EIGA's proposal were looked at in detail by the IWG whose attendance was large enough to allow thorough debates related to regulatory, operational and technical issues. The sessions were attended by representatives from the Competent Authorities of France, Poland, Sweden, Switzerland and the United Kingdom. The German Competent Authority was represented by the Federal Institute for Materials Research and Testing (BAM). In addition there were representatives from the British Compressed Gases Association (BCGA), European Cylinder Makers Association (ECMA), the European

[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/2013/42.

Industrial Gases Association (EIGA) and German Industrial Gases Association, (IGV). The first session was chaired by Gregor Oberreuter who tragically passed away a few days after the first meeting. François Le Fort, former expert at the Swiss Federal Office of Transports, took over and chaired the subsequent meetings of the IWG with Andy Webb of EIGA acting as the meeting secretary.

4. This paper provides a brief summary of the outcome of the discussions held within the IWG and their conclusions.

5. 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.

6. This document only applies to cylinders as defined in RID/ADR, ("Cylinder" means a transportable pressure receptacle of a water capacity not exceeding 150 litres) and to bundles of such cylinders. UN cylinders and Multi Element Gas Containers, (MEGC) have been excluded as have seamless aluminium alloy cylinders produced from AA 6351. Cylinders made from this alloy have not been produced for many years, and the recommendation of the manufacturer who produced the majority of these cylinders was that their existing test interval of either five or ten years should remain.

Background

7. Prior to the introduction of harmonised standards the test interval and the type of tests required were determined and enforced by National Authorities and varied from country to country.

8. 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 RID/ADR.

9. 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.

10. EIGA advised the IWG that cylinder test results are continuously reviewed by EIGA member companies to ensure that the testing periodicities in P200 remain applicable.

11. The IWG is not aware that an increase in the test period has ever been revoked.

12. 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. For example, internal corrosion occurs with certain gases when moisture is present in cylinders.

13. 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 with an appropriate non-return function can also prevent backflow of product from the customers’ process, thereby removing the likelihood of internal contamination affecting the cylinder. The presence of a positive pressure in the cylinder is verified prior to every fill.

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

15. There is good experience in the gas industry of operating cylinders fitted with residual pressure valves over a period in excess of twenty years.

Principles

16. The IWG established a number of principles relating to this proposal, and these are summarised as below:

(a) The proposed increase in periodicity only applies to following gases having presently a retest period of ten years:

- Compressed gases: asphyxiant (A), oxidising (O) and flammable (F).

- Liquefied gases: limited to carbon dioxide (UN 1013), nitrous oxide (UN 1070) and sulphur hexafluoride (UN 1080). Other liquefied gases are usually filled in welded cylinders and therefore not concerned by this proposal.

- Toxic, corrosive and dissolved gases (T, TF, TC, TO, TFC TOC and 4F) are excluded.

(b) Cylinder filling facilities need to apply a documented and certified quality system which will be monitored by the competent authority. Filling shall only be carried out by these approved facilities.

(c) To prevent internal corrosion, only steel cylinders fitted with residual pressure valves will be allowed to operate under a 15 year test regime. Although internal corrosion is mainly an issue caused by moisture with oxidising and acidic gases such as oxygen and carbon dioxide filled in steel cylinders, this requirement applies in this proposal to all gases filled in steel cylinders. Aluminium alloy cylinders do not require to be fitted with residual pressure valves as they are less sensitive to such corrosion.

(d) For all cylinders operating under a fifteen year inspection regime the cylinder will be checked before filling for a positive pressure and the residual pressure valve shall be checked if there is no evidence of a residual pressure.

(e) The owner of cylinders that are eligible for a fifteen year inspection regime shall establish procedures to ensure that the cylinders are only filled in filling centres fulfilling the conditions under (b).

(f) The proposal only applies to seamless steel cylinders, aluminium alloy cylinders, and bundles of these cylinders. Aluminium alloy cylinders produced from AA 6351are excluded.

Data collection

17. 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 the IWG has carried out to ensure that there will be no reduction of the current high safety record of the industrial gases industry. The key points are that:

(a) In excess of two million EIGA representative cylinder test records were investigated over a five year period when the cylinders were tested hydraulically and visually inspected. The reasons for 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). Approximately 90% were seamless steel cylinders with the remainder being aluminium alloy.

(b) Of these two million EIGA cylinders, none failed the hydraulic test.

(c) Approximately 2% of the two million cylinders were rejected due to the following reasons:

External defects (detectable during pre-fill inspection) accounted for 83 to 84% of these rejected cylinders,

Internal corrosion or contamination accounted for the balance of the rejected cylinders.

(d) The very few cylinders rejected for internal corrosion showed signs of liquid ingress.

18. EIGA noted that the majority of cylinders are rejected at the stage when cylinders are returned for filling at a filling centre, and not at the periodic inspection test. 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.

19. 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 and performs a non-return function to prevent the backflow of contamination into the cylinder from the customers process. This measure has reduced the number of steel cylinders rejected 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.

20. The joint requirements for a pre-fill inspection and the equipping of cylinders with residual pressure valves (for the cylinders concerned) have resulted in a significant improvement in the overall cylinder package integrity.

21. Additional data provided to the IWG by BCGA revealed interesting figures:

(a) They concern more than 1.7 million cylinder inspections (steel and aluminium alloy, with and without RPV)

(b) Less than 3 % of inspected cylinders were rejected; and only about 0,4% of these rejected cylinders were rejected due to internal defects.

(c) The rate of rejection was 20 to 30 times lower for cylinders fitted with RPVs than those without RPVs fitted.

Risk Analysis Consideration

22. The IWG debated thoroughly about risk using Process Safety Methodology, which is used to evaluate risk in many industries. It recognized that there is a positive safety impact when requirements regarding the pre-fill checks are applied in the frame of a structured and approved quality system.

23. The reason for this conclusion is that the following requirements will be carried out under an approved quality system:-

(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.

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

(d) RPVs are technical devices that have been developed to ensure a high degree of reliability. Fitting cylinders with such valves to prevent moisture ingress increases the overall safety level of the cylinder package.

24. Industrial gases are produced to ensure that contamination and moisture content are minimised. This is because 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

Standard for RPV

25. There was a debate on whether EN ISO 15996 "Gas cylinders - Residual pressure valves - General requirements and type testing" should be made mandatory.

26. A reference to EN ISO 15996 in the RID/ADR seemed necessary to the IWG as it agreed that the fitting RPVs being a condition for an extension of the test period, requirements for such RPVs needed to be included in the regulation. The Residual Pressure Valve being relied upon to maintain a positive pressure within the cylinder, there was a need to have this standard as part of the requirements.

27. However, the RID/ADR being a transport regulation, a reference to a mandatory standard can be justified for a safety issue in transport. This aspect is already covered by the standard EN ISO 10297, "Transportable gas cylinders. Cylinder valves: Specification and type testing". This is a mandatory standard and applies to all cylinder valve closures including RPVs.

Bundles of cylinders

28. It was the intention of the original proposal to include bundles of cylinders for the extension of the test period but this point needed to be clarified in the text.

29. An inspection of the outer cylinders will indicate the overall condition of all cylinders within the assembly. Bundles of an inappropriate design where a contact between cylinders on the longitudinal axis may lead to external corrosion are excluded from this proposal. Moreover bundles can be fitted with main valve(s) with RPV device that perform the same functions as RPVs for cylinders.

RPVs for steel cylinders

30. The initial proposal was to fit RPVs only to steel cylinders in oxygen, carbon dioxide and mixtures containing these gases, (and fundamentally not for inert gases or when using aluminium alloy cylinders), however after further discussion it was agreed to fit RPVs to all steel cylinders.

31. There is no need to fit RPVs to aluminium alloy cylinders to gain a fifteen year test extension because the risks of internal corrosion are negligible for these cylinders.

Methodology of how to extend 10 to 15 years

32. Many owners of gas cylinders already have the cylinders, residual pressure valves and quality systems in place that will be required to extend test intervals. Based on this, it would appear to be appropriate to implement the extended test interval for such cylinders from the date of the last periodic inspection, if the requirements for the extended period have already been met since then. In this case it should not be necessary to wait for the next periodic inspection; the next inspection is due 15 years after the last inspection, even if it was done prior to the new regulation .The majority of the IWG considered that if owners were to be in this situation, then it would be their responsibility to make an application to their competent authority that the test interval should be extended with immediate effect.

Safety

33. Enhanced visual checks at the pre-fill stage and the use of RPVs for steel cylinders contribute towards achieving a higher level of safety.

Enforceability

34. The IWG is not aware of any difficulties with the 15 year regime granted to the LPG cylinders applicable from the 2011 version of RID/ADR and would not anticipate difficulties in applying this to other gases.

Proposal for changes to P200

35. Add to para (10) packing instruction P200 of chapter 4.1.4.1 with the following:

"(10) Periodic inspection

Insert after “u”

ua: The interval between periodic tests may be extended to 15 years for aluminium alloy cylinders and bundles of such cylinders if the provisions of paragraph (13) of this packing instruction are applied. This shall not apply to cylinders made from aluminium alloy AA 6351.

Insert after “v”

va: For seamless steel cylinders which are equipped with RPVs (see note below) that have been designed and tested in accordance with EN ISO 15996 and for bundles of seamless steel cylinders equipped with main valve(s) with a residual pressure device, tested in accordance with EN ISO 15996, the interval between periodic tests may be extended to 15 years if the provisions of paragraph (13) of this packing instruction are applied.

"NOTE: "Residual Pressure Valve" (RPV) means a closure which incorporates a residual pressure device that prevents moisture ingress by maintaining a positive differential between the pressure within the cylinder and the valve outlet. In order to prevent back-flow of fluids into the cylinder from a higher pressure source a "Non-Return Valve" (NRV) function shall either be incorporated into the residual pressure device or be a discrete additional device in the cylinder valve, e.g. a regulator.

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 seamless steel and aluminium alloy cylinders and bundles of such cylinders may be granted in accordance with special packing provision (ua, va) 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 one of 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[a] and 84/526/EEC[a]

as applicable according to the table in 6.2.4 of RID/ADR.

Other cylinders manufactured before 1 January 2009 in conformity with RID/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 RID/ADR as applicable at the time of application.

NOTE: This provision is considered to be fulfilled if the cylinder has been reassessed according to the procedure for the reassessment of conformity described in Annex III of the Directive 2010/35/EU of 16 June 2010.

1.4 Bundles of cylinders shall be constructed such that contact between cylinders along the longitudinal axis of the cylinders does not result in external corrosion.

1.5 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.

1.6 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 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 RID/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 RID/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.*

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

[a] *Council directive on the approximation of the laws of the Member States relating to seamless steel and aluminium alloy gas cylinders, published in the Official Journal of the European Communities No. L 300 of 19.11.1984.*

2. Operational provisions

2.1 Cylinders or bundles of such cylinders having been granted a 15 year interval for periodic inspection shall only be filled in filling centres applying a documented and certified quality system to ensure that all the provisions of paragraph (7) of this packing instruction and the requirements and responsibilities of EN 1919, EN 1920 or EN 13365 as applicable are fulfilled and correctly applied. The Quality System, according to the ISO 9000 (series) or equivalent, shall be certified by an accredited independent body acceptable to the competent authority. This includes procedures for pre- and post-fill inspections and filling process for cylinders, bundles of such cylinders and valves.

2.2 Aluminium alloy cylinders and bundles of such cylinders without RPVs having been granted a 15 year interval for periodic inspection shall be checked prior to every fill in accordance with a documented procedure which shall at least include the following:

- Open the cylinder valve or bundle main valve to check for residual pressure;
- If gas is emitted, the cylinder or bundle may be filled;
- If no gas is emitted, the internal condition of the cylinder or bundle shall be checked for contamination;
- If no contamination is detected, the cylinder or bundle may be filled;
- If contamination is detected corrective action is to be carried out.

2.3 Seamless steel cylinders fitted with RPVs and bundles equipped with main valve(s) with a residual pressure device having been granted a 15 year interval for periodic inspection shall be checked prior to every fill in accordance with a documented procedure which shall at least include the following:

- Open the cylinder valve or bundle main valve to check for residual pressure;
- If gas is emitted, the cylinder or bundle may be filled;
- If no gas is emitted the functioning of the residual pressure device shall be checked;
- If the check shows that the residual pressure device has retained pressure the cylinder or bundle may be filled
- If the check shows that the residual pressure device has not retained pressure, a corrective action shall be carried out.

2.4 The competent authority shall verify that the requirements of 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 2.1, 2.2 and 2.3.

2.6 If a filling centre is situated in a different RID Contracting State/Contracting Party to ADR, the owner shall provide additional documentary evidence that the filling centre is monitored accordingly by the competent authority of that RID Contracting State/ 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 cylinders or bundles. 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 or equivalent.

3. Provisions for qualification and periodic inspection

3.1 Cylinders and bundles of such cylinders already in use, for which the conditions of sub paragraph 2 have been met from the date of the last periodic inspection to the satisfaction of the competent authority, may have their inspection period extended to 15 years from the date of the last periodic inspection. Otherwise the change of test period from ten to fifteen years shall be made at the time of periodic inspection.

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 a 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 RID/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 or bundles of such cylinders having been granted a 15 year interval shall only be fitted with valves designed and tested according to EN 849 or EN ISO 10297. After a periodic inspection a new valve shall be fitted, except that valves which have been refurbished or inspected according to EN ISO 22434 may be re-fitted.

4. Marking

Cylinders and bundles of such 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 5.2.1.6 (c) updated and at the same time additionally be marked clearly and legibly with "P15Y". This marking shall be removed if the cylinder or bundle of such cylinders is no longer authorised for a 15 year interval.

36. Complete “Table 1: Compressed gases” and “Table 2: Liquefied and dissolved gases” of PACKING INSTRUCTION P200 as follows (new text underlined)

P200	PACKING INSTRUCTION *(cont'd)*										P200
Table 1: COMPRESSED GASES											
UN No.	**Name and description**	**Classification code**	**LC_{50} ml/m^3**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**Test period, years [a]**	**Test pressure, bar [b]**	**Maximum working pressure, bar [b]**	**Special packing Provisions**
1002	AIR, COMPRESSED	1A		X	X	X	X	10			ua, va
1006	ARGON, COMPRESSED	1A		X	X	X	X	10			ua, va
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
1072	OXYGEN, COMPRESSED	1O		X	X	X	X	10			s, ua, va
1954	COMPRESSED GAS, FLAMMABLE, N.O.S	1F		X	X	X	X	10			z, ua, va
1956	COMPRESSED GAS, N.O.S.	1A		X	X	X	X	10			z, ua, va
1957	DEUTERIUM, COMPRESSED	1F		X	X	X	X	10			d, ua, va
1964	HYDROCARBON GAS MIXTURE, COMPRESSED, N.O.S.	1F		X	X	X	X	10			z, ua, va
1971	METHANE, COMPRESSED or NATURAL GAS, COMPRESSED with high methane content	1F		X	X	X	X	10			ua, va
2034	HYDROGEN AND METHANE MIXTURE, COMPRESSED	1F		X	X	X	X	10			d, ua, va

P200	PACKING INSTRUCTION *(cont'd)*										P200
Table 1: COMPRESSED GASES											
UN No.	**Name and description**	**Classification code**	**LC_{50} ml/m^3**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**Test period, years [a]**	**Test pressure, bar [b]**	**Maximum working pressure, bar [b]**	**Special packing Provisions**
3156	COMPRESSED GAS, OXIDIZING, N.O.S.	1O		X	X	X	X	10			z, ua, va

[a] *Not applicable for pressure receptacles made of composite materials.*

[b] *Where the entries are blank, the working pressure shall not exceed two thirds of the test pressure.*

P200	PACKING INSTRUCTION *(cont'd)*										P200
Table 2: LIQUEFIED GASES AND DISSOLVED GASES											
UN No.	**Name and description**	**Classification code**	**LC_{50} ml/m³**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**Test period, years [a]**	**Test pressure, bar**	**Filling ratio**	**Special packing provisions**
1013	CARBON DIOXIDE	2A		X	X	X	X	10	190	0.68	ra, ua, va
									250	0.76	ra, ua, va
1070	NITROUS OXIDE	2O		X	X	X	X	10	180	0.68	ua, va
									225	0.74	ua, va
									250	0.75	ua, va
1080	SULPHUR HEXAFLUORIDE	2A		X	X	X	X	10	70	1.06	Ra, ua, va
									140	1.34	Ra, ua, va
									160	1.38	Ra, ua, va

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