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Item 4 of the provisional agenda
Interpretation of RID/ADR/ADN

Hydraulic pressure testing of pressure receptacles

Transmitted by the International Organisation for Standardisation (ISO), The European Cylinder Makers Association (ECMA), The European Industrial Gases Association (EIGA), and the European Committee for Standardisation (CEN) [1, 2]

Summary

Executive summary: The expression 'design specification' in 6.2.1.5.1 (g) has lead to a misunderstanding of the intention of the regulations in relation to pressure testing. This paper seeks to establish the meaning of this expression and consequentially clarify when the volumetric expansion test and the proof pressure test shall be used and specify acceptance criteria for the latter test.

Action to be taken: Interpret the meaning of 'design specification' and modify the text in 6.2.3.4.1 and 6.2.3.5.1 to clarify the acceptance criteria.

Related documents: ECE/TRANS/WP.15/AC.1/2010/15

[1] In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94, ECE/TRANS/2012/12, programme activity 02.7 (A1c)).

[2] Circulated by the Intergovernmental Organisation for International Carriage by Rail (OTIF) under the symbol OTIF/RID/RC/2014/17.

Introduction

1. During its March 2010 session, the Joint Meeting adopted a proposal made by ECMA, EIGA and CEN in ECE/TRANS/WP.15/AC.1/2010/15 to harmonise the requirements for pressure testing during the initial inspection and test. The purpose of this proposal is summarised in ECE/TRANS/WP.15/AC.1/2010/15 as follows.

"The initial inspection and test for UN pressure receptacles specified in 6.2.1.5.1 (g) effectively permits either the classical European proof pressure test with no visible permanent expansion or the water jacket test which measures volumetric expansion and detects any permanent expansion. Limits are set on such expansion in the construction standards. Paragraph 6.2.3.4.1 does not allow a permanent deformation and thus implicitly excludes the use of this latter test for RID/ADR/ADN pressure receptacles. This proposal seeks to allow the use of the water jacket test where its use and failure criteria are specified in the design and construction standards.".

2. Unfortunately, this intention has been misinterpreted because the text of 6.2.1.5.1 (g) reads: "Pressure receptacles shall withstand the test pressure without expansion greater than that allowed in the design specification.". The understanding of the proposers of the adoption of this provision was that "design specification" meant the design standard listed in 6.2.2 for UN pressure receptacles, in 6.2.4 for RID/ADR pressure receptacles or the technical code approved in accordance with 6.2.5. However, the word "specification" appears in the preceding sub-section 6.1.2.4 *Approval of pressure receptacles* in the sentence "The technical documentation shall include full specifications on design and construction, and full documentation on the manufacturing and testing.". This specification may also be described more fully as the "design type specification". Therefore, 6.2.1.5.1 (g) is being taken to mean that the design type specification shall include a limit for the permissible expansion. Establishing such a limit for expansion requires the use of the water jacket test (also known as the volumetric expansion test) for the type approval and not the traditional proof pressure test almost universally used in Europe. Furthermore, each pressure receptacle needs to be subjected to this test to verify its expansion.

3. Two members of the working group of the of the UN Sub-Committee of Experts on the Transport of Dangerous Goods that was responsible for drafting the text of 6.2.1.5.1 (g) have confirmed that the working group's intention was that "design specification" would mean the design standard or the technical code. This issue arose too late to be the subject of a document at the recent meeting of the UN Sub-Committee of Experts on the Transport of Dangerous Goods, but it is ISO's intention to bring this to the attention of the next session of the Sub-Committee. The purpose of this document is for action to be taken now to enable a clarification of the 2015 edition of RID/ADR.

Interpretation

4. The Joint Meeting is asked to confirm that the "design specification" in 6.2.1.5.1 (g) shall be taken to mean "design standard or technical code".

5. The Joint Meeting is also asked to confirm that the proof pressure test and the volumetric expansion test have equal validity and safety. It was not the intention of the amended text of 6.2.3.4.1 in RID/ADR 2011 to introduce the Volumetric Expansion Test as a preferred technique.

Modifications to the text of RID/ADR 2015

6. Given an affirmative answer the above interpretation, the sentence "Pressure receptacles shall withstand the test pressure without expansion greater than that allowed in

the design specification." means that which ever test is used the pressure receptacle shall meet the acceptance criteria stated in the design standard or technical code. However, there is a remaining problem with the Proof Pressure Test in that european familiarity with the technique has lead to a lack of precision in the acceptance criteria expressed in the standards. For example the 1984 Council Directives relating to cylinders (Cylinder Directives) require that "… the cylinder must show no deformation". Indeed, RID/ADR 2009 stated "Pressure receptacles shall withstand the test pressure without undergoing permanent deformation or exhibiting cracks." It is explained in ECE/TRANS/WP.15/AC.1/2010/15 that while in theory an adequately designed pressure receptacle will never exhibit a permanent expansion during the pressure test there may be small but measurable deformations such as correction of ovality, which are not considered a safety issue. Since, by simple visual inspection it is impossible to verify the criterion of no deformation, it is necessary to qualify the acceptance criteria to state that there shall be "no visible deformation". This phrase is used in more recent standards, but some do not. The Volumetric Expansion Test does not have such a problem and the acceptance criteria expressed in the standards are accurate and appropriate. For the avoidance of doubt, it is also proposed to include new text in the requirements for periodic inspection and test. Also, the limitations in the use of the Volumetric Expansion Test are included.

Proposal

7. Amend the text of 6.2.3.4.1 to read as follows (new text underlined).

6.2.3.4.1 New pressure receptacles shall be subjected to testing and inspection during and after manufacture in accordance with the requirements of 6.2.1.5 <u>except that 6.2.1.5.1 (g) shall be replaced by the following:</u>

(g) The hydraulic pressure test.<u> Pressure receptacles subjected to the proof pressure test shall be held at test pressure for 30s and there shall be no visible leakage or visible permanent deformation. Pressure receptacles may alternatively be subjected to the volumetric expansion test only if acceptance criteria for this test are provided in the design standard or technical code.</u>

8. Amend the text of 6.2.3.5.1 to read as follows (new text underlined):

6.2.3.5.1 Periodic inspection and test shall be in accordance with 6.2.1.6 <u>except that 6.2.1.6.1 (d) shall be replaced by the following:</u>

(d) A hydraulic pressure test and if necessary, verification of the characteristics of the material by suitable tests<u>. Pressure receptacles subjected to the proof pressure test shall be held at test pressure for 30s and there shall be no visible leakage or visible permanent deformation. Pressure receptacles may alternatively be subjected to the volumetric expansion test only if acceptance criteria for this test are provided in the design standard or technical code</u>;

Justification

9. This proposal is intended to establish uniform practice in the conduct of the hydraulic pressure test and restore it to that existing for many decades before the intent of the text modifications of 2011 were misinterpreted. The limitations of the role of the volumetric expansion test are explained.