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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

Geneva, 19–23 September 2016

Item 5 (a) of the provisional agenda

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

### **Alternative methods for periodic inspection of refillable pressure receptacles**

**Transmitted by the European Liquefied Petroleum Gas Association  
(AEGPL) on behalf of the informal working group on alternative  
methods for periodic inspections<sup>1, 2</sup>**

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<sup>1</sup> In accordance with the programme of work of the Inland Transport Committee for 2016-2017, (ECE/TRANS/2016/28/Add.1 (9.2)).

<sup>2</sup> Circulated by the Intergovernmental Organisation for International Carriage by Rail (OTIF) under the symbol OTIF/RID/RC/2016/22.

*Summary*

- Executive summary:** This submission is the outcome of work of the “Working group on alternative methods for periodic inspections of refillable cylinders”. It requests to introduce into RID/ADR:
- A general provision, split in 3 proposals, describing the requirements to create and propose an alternative method for periodic inspection of pressure receptacles.
- proposal 1 – General rules  
 proposal 2 – Non-destructive testing as a first substitute  
 proposal 3 – Destructive testing when non-destructive testing is inappropriate
- Action to be taken:** To add a new sub-section 6.2.3.5.3  
 To add a new sub-section 6.2.3.5.3.1  
 To add a new sub-section 6.2.3.5.3.2
- Reference documents:** ECE/TRANS/WP.15/AC.1/2015/48 and informal documents INF.20 and INF 30 submitted at the autumn 2015 session  
 ECE/TRANS/WP.15/AC.1/138 and informal document INF.23 submitted at the spring 2015 session;  
 ECE/TRANS/WP.15/AC.1/2014/48 and informal documents INF.5 and INF.52 submitted at the autumn 2014 session;  
 ECE/TRANS/WP.15/AC.1/2014/31 and informal document INF.4 submitted at the spring 2014 session;  
 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 submitted at the autumn 2013 session;  
 Informal document INF.39 submitted at the spring 2013 session;  
 ECE/TRANS/WP.15/AC.1/2013/16.

**General**

1. As agreed at the last Joint Meeting in Bern (March 2016), a new session took place in Paris on 3 and 4 May 2016, in physical presence of Austria, Germany, Switzerland, Belgium, Sweden, the European Industrial Gases Association (EIGA), the European Cylinder Makers Association (ECMA) and AEGPL.
2. During the session, AEGPL recalled the subject to new participants, as the enlargement of the scope to other types of gases and cylinders had been agreed, by the Joint Meeting.

3. It has been agreed by the participants to answer to the different questions raised on the subject during the September 2015 session of the Joint Meeting, such as:

- Spanish concerns (informal document INF.30);
- Questions about statistics (Switzerland, Luxemburg, Belgium) raised during the informal lunch session;

either by commenting each point, or adapting the proposals.

Dealing more precisely with informal document INF.30, here below are precisions from the working group, given for each section of informal document INF.30:

#### **General comments**

*The general approach is to create a step by step process as guideline for necessary modifications of the ADR with respect to periodic inspection and testing.*

*This approach means to insist on priorities of decisions, e. g. the general provision has been split into 3 proposals. Especially, proposal 2 requires as a first priority, for any alternatives, to look for individual non-destructive testing (NDT) for 100% of the receptacles to replace the current required ADR tests, if not appropriate.*

*An independent expert, experienced in statistics and pressure receptacles, shall validate the safety level of any alternative statistical method (which only can be applied if there is no 100% NDT possible). This analysis shall assess the distribution function and take into account potential modifications of the distribution function, caused for example by service degradation. Worst degradation cases are also part of the samples.*

*In proposal 1, it is clearly required that any alternative method shall be specified in the relevant paragraph of 6.2.3 and detailed in a special provision or in a referenced standard. Hence the alternative method will have to be submitted to the Joint Meeting and finally agreed.*

#### **Designing methods**

*Answer has already been given by the Joint Meeting in September 2015, regulations can be adapted along with technology evolutions.*

*The safety along the life of any type of pressure recipient is a mixture of robust:*

- *design properties, manufacturing performances;*
- *controls at filling (operations); and*
- *periodic controls.*

*In other words, global safety is the result of the mastery of all steps, and, as an example, in order to keep an equivalent safety level, periodic controls can be adapted according to specific performances or innovations from design.*

#### **Normal statistical distribution**

*Normal distribution, as any other distribution, permits a very high percentage of assurance, if it fits with the behavior of the basic population. If a population or a sub group is deviating from the normal distribution function, another type of distribution has to be followed to best fit the population or the sub group.*

*There are cases where individual tests although compulsory do not allow to set aside worst cases.*

**Grouping for statistical purposes**

*Proposal 3 has been specifically set up and reworked to take comments into account. (as follows: In case of any modification to a design, material, production process or any other changes affecting the mechanical properties of the product, even though allowed within the same type approval, a new population group shall be defined)*

**Representation of the samples**

*Population representativeness is to be taken into account in the method and its assessment. It is assured by using adequate existing statistical standards. Samples have to contain also the worst cases (extreme conditions, etc....).*

*Parallelism with the car industry example is not totally accurate, because it doesn't reflect the reality of the tests described for example for over-moulded cylinders (OMC). Indeed, the paragraph forgets the individual controls done. The alternative method for pressure recipients (like the OMCs) are a combination of individual tests and statistical destructive tests. As far as we know, there is no destructive tests done by sampling along the life of vehicles.*

**Test failure**

*Again, the example of the brake failure is not as straightforward as written in the text. Before any customer recall, many investigations and statistical tests are done to assess whether it is an isolated case or could impact other vehicles. If it could impact other vehicles, very accurate measures and tests are further decided to define the potential affected population. In any European country, we all have heard about some vehicle recalls, but limited to a certain type of vehicle, of one period of production or from one serial number to another.*

**Hydraulic test**

*The object is not to skip yet hydraulic tests from the ADR when it is meaningful, but when it is not meaningful, and it seems to be the case for some new types of cylinders (composites for examples), other methods which would give an equivalent safety level have to be developed, assessed and at some stage be recognized by the authorities.*

*If no individual test, even NDT, is available to replace hydraulic test, representative sampling, destructive tests and statistical analysis is a way forward that can give additional higher reliable information on the materials factors (exact remaining mechanical and protection properties at regular times) than the hydraulic individual test.*

*As recalled during the September 2015 session, the economical factor is not a Joint Meeting subject.*

*New types of cylinders may require more meaningful tests than those currently required in the ADR, in order to get at least an equivalent safety level.*

*Globally an equivalent safety level for pressure receptacle goes beyond periodic controls requirements; it is a combination of:*

- *Robust design properties, manufacturing performances*

- *Robust controls at filling (operations), and*
- *fit for purpose periodic controls.*

4. Dealing with all remarks given before, and always keeping in mind the compulsory equivalent level of safety to be respected for any alternative method for periodic inspection, the working group has then written the following general provision, split into 3 proposals.

### **Proposal 1 – General Provision – General Rules**

5. Add a new sub-section 6.2.3.5.3 to read as follows:

“6.2.3.5.3 *General rules for the substitution of a periodic inspection method required in 6.2.3.5.1*

This subsection applies to pressure receptacles designed and manufactured in accordance with standards referred to in 6.2.4.1 or a technical code in accordance with 6.2.5, and for which the inherent properties of the design type prevent the successful performance or a meaningful interpretation of one or more of the inspections and tests required in 6.2.1.6.1 (a) to (e).

For such pressure receptacles, those inspections or tests shall be replaced by an alternative method. The method shall be specified in the relevant paragraph of 6.2.3 and detailed in a special provision or in a referenced standard. This alternative method shall state which inspections or tests according to 6.2.1.6.1 (a) to (e) are substituted.

The alternative method shall ensure that an equivalent level of safety is maintained.”.

### **Proposal 2 – General Provision – Non-destructive testing**

6. Add a new sub-section 6.2.3.5.3.1 to read as follows:

“6.2.3.5.3.1 *Non-destructive testing as an alternative method*

The relevant inspections or tests for each individual pressure receptacle shall be substituted by a non-destructive test method.”.

### **Proposal 3 – General Provision - Destructive testing**

Add a new sub-section 6.2.3.5.3.2 to read as follows:

“6.2.3.5.3.2 *Destructive testing in combination with statistical assessment as an alternative method*

If no non-destructive method is appropriate to assess the safety of individual pressure receptacles, an alternative method, using destructive testing in combination with a statistical evaluation, shall be developed.

It shall be based on the following elements:

- Random sampling of a quantified population of pressure receptacles;
- Procedure for destructive testing;
- Procedure for statistical evaluation of test results; and
- Procedure for the application of the not replaced inspections and tests to 100% of the population.

Specification of rejection criteria, determination of the periodicity of retest checks, alternative test method, substituting inspection method(s), and the following elements shall be fulfilled.

(a) Assessment of the method

The safety level of this alternative method of destructive testing combined with statistical assessment shall be validated by an independent expert, experienced in statistics and pressure receptacles. This analysis shall assess the distribution function and take into account potential modifications of the distribution function, caused by service degradation.

*Note: Meaning of distribution function: Strength and all other safety related properties are randomly distributed. For an appropriate safety assessment, the distributions of a relevant strength property must be known and described by a function (distribution function) and the relevant parameters of this function (e. g. mean value and scatter value).*

(b) Dividing the population of a design type into groups for statistical purposes

The population of a pressure receptacle design type, considered for statistical assessment, shall be separated into clearly defined population groups. Each group is limited to the population of a dedicated year of production per manufacturer of the design type, owned/operated by one company. In case of any modification to the design, material, production process or any other changes affecting the mechanical properties of the product, even though within the same type approval, a new population group shall be defined. Deviating from this, grouping annual production can be organized by more than one owner/operator under the following conditions:

- Duties and responsibilities shall be regulated in a contract that also includes each filling center involved,
- The filling centers shall work under the supervision of at least one of the owners or operators; and
- In the event of a change in ownership, the population concerned shall be transferred to the new owner with its design, manufacture, inspection and operational documentation and its full database.

(c) Traceability

Measures shall be taken to ensure traceability of each pressure receptacle to its population group and production batch. The owner shall collect all relevant data on filling, retesting and maintenance, correlation with a population group, selection for sampling and other issues in a database. The owner shall update data on a regular basis.

The owner shall give access to the database. All filling centers and inspection bodies shall have relevant access in order to check individual pressure receptacles concerning their relationship with rejected population groups. The complete set of data shall be made available to the competent authority upon request. Before filling or periodic inspection of a pressure receptacle, the database system shall automatically cross-check the data of the relevant population group concerning upcoming measures. If the database cannot be accessed, related pressure receptacles shall not be offered for service.

(d) Sampling for statistical assessment

The procedure for random sampling must be detailed clearly to ensure high reproducibility of sampling and finally of interpretation of statistical assessment. Essentials of this procedure are:

- A determined number of individuals from each population group shall be sampled randomly to create a lot for destructive testing;
- The sampling procedure shall ensure that the lot is representative of its own population group, and be representative for each owner;
- The minimum size of a lot is to be determined.

(e) Test method for destructive testing

The procedure(s) for destructive testing must be clearly detailed to ensure high reproducibility of test conditions. All results of testing must be monitored, collected independently from its value and made available for the entire lifetime of a population group.

(f) Statistical evaluation of test results

The procedure for statistical evaluation of test results shall be described in a clear and understandable manner. It shall provide data on the requested reliability level, the minimum unilateral confidence level of a sample and the value of the rejection criteria for the relevant test. To determine the requested reliability level, the potential consequences of an in-service failure of the pressure receptacle design type shall be considered. All test results of destructive tests specified in (e) and in no case less than the minimum amount of pressure receptacles, determined in (d) for sampling, shall be evaluated for the relevant population group.

(g) Measures if requirements are not met

If the statistical assessment of test results representing a population group shows insufficient properties, the affected population group shall not be made available for filling or use and shall be taken out of service.

The reasons for not meeting the statistical acceptance criteria shall be analyzed. It shall be assessed whether other population groups are affected and if they have to be taken out of service.

If an X(a) body, in accordance with 6.2.3.6.1, can demonstrate that defined parts of the population group are not affected, the competent authority or its delegate may permit further use of unaffected parts of the population group.

(h) Filling center

Centers filling pressure receptacles according to 6.2.3.5.3 shall apply a documented quality system to ensure that:

- all the provisions of paragraph (7) of packing instruction P200; and
- all the requirements and responsibilities of the alternative retest method;

are fulfilled and correctly applied.

The quality system, according to the ISO 9000 (series) or equivalent, shall be certified by an accredited independent body recognized by the competent authority.”.