

## **Proposal to amend Regulation No. 110 (CNG/LNG vehicles)**

The modifications to the current text of the Regulation are marked in bold for new or strikethrough for deleted characters.

### **Proposal**

Annex 3A, paragraph 4.1.4 (periodic requalification), the second sentence is amended to read:

"Each cylinder shall be visually inspected at least every 48 months after the date of its entry into service on the vehicle (vehicle registration) and at the time of any reinstallation to verify the absence of damage and deterioration, including under the support straps **and under any ogive protective covers.**"

Annex 3A, add a new paragraph 10.7.5, to read:

#### **"10.7.5 Impact damage test**

**One or more finished cylinders must be subjected to an impact damage test according to paragraph Appendix A, paragraph A.20.**

**When ogive protective covers are fitted on the cylinder, this test shall be carried out in the absence of such covers."**

Annex 3A, paragraph 10.7.1, amend to read:

#### **"10.7.1. General**

Cylinder design qualification tests shall be in accordance with the requirements of paragraphs 8.6., 10.7.2., 10.7.3., ~~and~~ 10.7.4. **and 10.7.5** of this annex, except that the LBB performance in paragraph 8.6.10. above is not required."

Annex 3A, appendix A, paragraph A20, amend to read:

#### **"A.20. Impact damage test**

One or more finished cylinders shall be drop tested at ambient temperature without internal pressurization, without **ogive protection covers or** attached valves."

### **Justification**

In Italy, two cases of structural failure were recorded in CNG-4 cylinders, fitted on in-use vehicles. In both cases the failure occurred during normal refueling operations. The cylinders were provided with covers protecting the ogives, glued on the ogives so as to cover them completely. The failure was produced on the ogive side valve, in the center of the area hidden by the protective cover.

The thickness of the cylinder wall, in that area, was much reduced, about half of that of the cylindrical portion.

UN ECE R 110, requires, in Annex 3, paragraph 4.1.4 that cylinders should be checked by visual inspection to enable the detection of any damage. This requirement is even more compelling in the case that the manufacturer does not foresee any test to be carried out for this purpose during the cylinder service life.

For CNG-4 cylinders it is in fact known that any damage, especially in correspondence with the ogive, may also affect only the fibers which are internally placed in the cylinder wall thickness, thus being identifiable from color variations of the ogive itself (see, for example point 7.6.3 of ISO 19078).

It is evident that any protective ogive cap, if glued, as in the case of the occurred failure, would prevent the conduct of the inspection of the ogive, as instead expressly required by R110 and absolutely indispensable, especially in the absence of specific tests prescribed by the manufacturer.

Therefore, any protective cap intended to protect the cylinder during the handling phases, should be removed at the time of fitting on the vehicle. Otherwise, any protective cap provided by the manufacturer should, however, be easily removable, to allow the inspection of the ogives, and the manufacturer should specify the need of removing it at the occasion of inspection, indicating the mode of execution, as required by Annex 3, paragraph 6.12.

The material of the protective cylinder covers that shown structural failure seems to present the characteristic of cracking after a short time of use, due to aging and deformation cycles resulting from normal refueling operations, therefore reducing the resistance capacity of the cylinder to shocks in correspondence of ogives or leading to the scrapping of cylinders that have not been subjected to any impact or damage.

Regulation UN ECE R110, for obvious safety reasons, requires, in section 6.13., Table 6.4 of Annex 3, that CNG-3 and CNG-4 cylinders are able to withstand shocks and falls; to this end specific drop tests are to be carried out according to the procedures described in a very precise manner in Annex 3, Appendix A, point A.20.

While this requirement is reiterated for CNG-3-type cylinders, (see paragraph 9.6), this is not the case for CNG-4 type cylinders, in paragraph 10.7.

Since it is not possible to exclude that any bumps on the ogives may take place when the protective caps have been removed or when they show reduced efficiency conditions due to the presence of cracks, we can conclude that in order to ensure the safety conditions laid down in R 110 CNG-4 cylinders, should be able to pass the prescribed drop tests, mentioned above, without the presence of the ogive protective covers.

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