

COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS AND ON THE GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS

Sub-Committee of Experts on the
Transport of Dangerous Goods

Thirty-fifth session
Geneva, 22-26 June 2009
Item 5 of the provisional agenda

MISCELLANEOUS PROPOSALS OF AMENDMENTS TO THE MODEL REGULATIONS ON THE TRANSPORT OF DANGEROUS GOODS

Life of Gas Cylinders of Composite Construction Bearing the UN Mark

Comments on ST/SG/AC.10/C.3/2009/7 (ISO) and INF. 7 (EIGA)

Transmitted by the experts from Canada and the United States of America

1. The Sub-Committee's "work group on gases" discussed the issue of the service life of UN gas cylinders of composite construction in detail in 2002, in advance of the adoption of the current provisions into the UN Model Regulations. The experts from Canada and the United States believe that the conclusions were based on technical considerations that are still valid.
2. Whereas the current ISO 11119 standards have specified tests to address various performance characteristics of these cylinders, the permitted "design life" is based only on the "ambient pressure cycling test". However, in the opinion of Canada and the United States cycle testing alone is not sufficient to adequately characterize the safe service life of gas cylinders of composite construction. Such cylinders are also subject to "stress rupture"; a failure mode that can, over time, decrease the strength of composite fiber materials under service stress and that, therefore, may limit the safe service life of these cylinders. The potential for loss of strength over time due to stress rupture increases with the stress to which fiber material is exposed. At this time, there is no effective non-destructive method of detecting the degree of strength loss due to stress rupture for a composite cylinder in use. The stress rupture failure mode is not addressed in the current ISO 11119 standards.
3. Amending Note 1 as proposed by ISO would reduce the factor of safety now required for UN composite gas cylinders. The ISO 11119-1, 2 & 3 allow cylinders to be designed for various service life increments (e.g. 10, 12, 15, 30, 48 years), each of which has a different pressure cycling requirement. A cylinder designed for a 15 year cycle life is required by ISO 11119 to be tested to only 7500 test pressure cycles compared to the 12000 cycles now required under the Model Regulations by Note 1. Such a "15 year design" cylinder would have less fiber composite material that would, in turn, be exposed to higher stress. If the ISO proposal were to be accepted, manufacturers would be allowed the option of selecting any service life

based on cycling from between 10 years and ‘unlimited’, and the attendant number of cycles applied for the ambient pressure cycle test from between 5000 to 12000 cycles. These design requirements differ from the other ISO cylinder standards that are referenced in UN Model Regulations; such as ISO 9809-1, 2, 3 and 7866. The result will be UN marked composite cylinders with different design criteria. Additionally, the proposal requires marking for cylinders with a “limited life”, but does not require a marking for those of “unlimited life”, even though the later is limited to 15 years under Note 2. This will result in an impractical enforcement situation for competent authorities.

4. When the Sub-Committee considered adopting the ISO 11119 standards into the UN Model Regulations in 2002, the Sub-Committee’s gases work group agreed that the 15 year life limit should be imposed (Note 2 under 6.2.2.1). In addition, the work group agreed to require type testing to 12000 test pressure cycles as required for unlimited cycle life by ISO 11119 (Note 1 under 6.2.2.1) to address the potential for failure due to gradual weakening by stress rupture. Some members of the work group were of the view that the aramid fibers and carbon fibers were not affected by stress rupture and wanted the opportunity for longer life. Others indicated that, while anecdotally those newer materials were thought to be less affected than glass fiber, no conclusive data similar to what had been generated for glass fibers to that effect had been presented. Given that the 12000 test pressure cycle requirement allowed for unlimited life in terms of pressure cycling in accordance with ISO 11119, the Model Regulations in Note 2 give the opportunity for composite cylinder manufacturers to substantiate requests for life extension to competent authorities upon presentation of data in relation to the other failure mode of concern, namely stress rupture. It should be noted that collection of persuasive stress rupture data must be done over time and, therefore, data collection must be planned and implemented by cylinder manufacturers early during the initial 15 year service period, if the data is generated from actual cylinders. The United States has granted a number of special permits that allow design, manufacture and sale of gas cylinders of composite construction with 30 years service life, based on such considerations.

5. The ISO 11119 standards are currently undergoing revision. The new editions are in draft stage. The draft revised standards have a stress rupture test included but it is only applicable to glass fiber composite cylinders. Numerous comments have been submitted in recent voting. Some comments submitted request eliminating from the standards the manufacturer’s option of selecting any service life based on varied levels of pressure cycle testing. If the future revised ISO 11119 standards address the safety concerns raised in this paper, consideration could be given at that time to amending or deleting these notes. Consequently, in the opinion of the Experts from Canada and the United States, the ISO proposal in 2009/7 to replace the current text of Note 1 under clause 6.2.2.1 should not be adopted.

6. In relation to the EIGA proposal for a correspondence group, we believe that a correspondence group or a work group may be necessary to consider eventual adoption of a revised ISO 11119 standard within the UN Model Regulations, including consideration of the necessity of additional provisions or notes. Such consideration should be made once the revised standards have been fully developed and published. A revision to Note 2 could be considered at that time provided the necessary safety conditions have been incorporated into the revised ISO 11119 standards.
