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**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-eighth session**

Geneva, 29 November–7 December 2010

Item 4 of the provisional agenda

**Listing, classification and packing****4.1.4.1 P200 Materials compatibility requirements for gases  
in pressure receptacles****Amendment to P200****Transmitted by the International Organization for Standardization  
(ISO)<sup>1</sup>**

1. At the thirty-sixth session of Sub-Committee of Experts on the Transport of Dangerous Goods the following papers on the compatibility of gases with pressure receptacles constructed from aluminium alloy were considered; ST/SG/AC.10/C.3/2009/30 (United Kingdom), informal document INF.29 (United Kingdom) and informal document INF.48 (EIGA).

2. The proposals were referred to a lunchtime working group which reported back with informal document INF.53. The proposals of the report were adopted with the exception of the list in paragraph 5 which was placed in square bracket in view of the on-going discussions in the ISO working group currently revising ISO 11114-1 "Transportable gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 1: Metallic materials". Also, EIGA's paper raised doubts concerning the designation of UN 1911 Diborane as incompatible with aluminium alloy in the ISO draft standard.

3. The ISO working group met on 11 and 12 March 2010 and completed its review of the compatibility of gases with metals. As a result, the square brackets should be deleted from the list concerning P200 in Annex I of the meeting report (see page 23 of

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<sup>1</sup> In accordance with the programme of work of the Sub-Committee for 2009-2010 approved by the Committee at its fourth session (refer to ST/SG/AC.10/C.3/68, para. 118 (a) and ST/SG/AC.10/36, para. 14).

ST/SG/AC.10/C.3/72). Also, UN 1911 Diborane should be removed from that list since it was deemed by the ISO experts to be compatible with aluminium alloy, based on 50 years operational experience of safely transporting this gas in aluminium alloy pressure receptacles.

4. The amendment to the regulations should read:

Packing Instruction **P200**, Table 2:

For UN Nos. 1008, 1076, 1741, 1859, 2189 and 2418, insert "a" in column "Special packing provisions".

Packing Instruction **P200**, Table 3:

For UN No. 1052, insert "a" in column "Special packing provisions".

## **Compatibility of chlorinated hydrocarbon solvents with aluminium gas cylinders**

5. Experts will recall from the thirty-sixth session that informal document INF.29 (United Kingdom) provided new information concerning the failure of the aluminium alloy cylinder in Dubai. The new finding was that the small concentrations of 1,1,1-trichloroethane and trichloroethylene in the mixture had caused a vigorous exothermic chemical reaction inside the cylinder. From studying the literature, it was evident that other halogenated hydrocarbons could also trigger a similar reaction in aluminium alloy cylinders when very dilute or when mixed together.

6. The ISO working group revising ISO 11114-1 was asked to consider how to avoid a repetition of this dangerous reaction and was given a draft text on this subject to consider as an addition to the standard.

7. The background to the discussion is that ethyl chloride is classed as incompatible with aluminium because it reacts with it. However, the reaction proceeds very slowly and damage sufficient to cause failure of a cylinder would take several years to emerge and would require some impurity such as water vapour to be present.

8. The working group concluded that the vigorous exothermic reaction which led to the failure of the aluminium alloy cylinder in Dubai would not have occurred if the gases present had been only:

(a) Ethyl chloride and the inert pressurising gas; or

(b) The trace additions of 1,1,1-trichloroethane and trichloroethylene pressurised by an inert gas.

9. In other words, it was necessary for there to be both the trace additions of the two chlorinated hydrocarbon solvents and ethyl chloride. It is known that small concentrations of mixed chlorinated hydrocarbons can be safely packed in aluminium alloy cylinders with an inert gas since a major Japanese speciality gas supplier has been successfully supplying such calibration mixtures for many years in gas cylinders made from aluminium alloy AA6061.

10. Thus the exothermic reaction leading to the failure of the cylinder can only take place in very specific circumstances and it is believed that forbidding the use of ethyl chloride in the regulations (and in the standard) closes the route to initiating such a reaction.

11. The literature suggests that the reaction is specific to ethyl chloride. Even if the reaction could be supported by other chemical species, the potential candidates in Class 2, e.g. methyl chloride, methyl bromide and vinyl chloride, are also forbidden for use with aluminium alloy.

12. The decision of the ISO working group therefore, is not to include a specific warning about chlorinated hydrocarbon solvents in the standard ISO 11114-1 and it also recommends that with the changes of wording adopted at the thirty-sixth session and the current application of special packing provision "a" in P200, the risks of a repeat incident are already addressed satisfactorily in the Model Regulations.

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