



**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****Forty-fourth session**

Geneva, 25 November – 4 December 2013

Item 4 (c) of the provisional agenda

Transport of gases: miscellaneous**Packing instructions P200 and P206 for collective entries****Transmitted by the expert from Germany¹****Background**

1. For the collective entries

- UN 1058 “LIQUEFIED GASES, non-flammable, charged with nitrogen, carbon dioxide or air”
- UN 3157, 3160, 3161, 3162, 3163, 3307, 3308, 3309, 3310 “LIQUEFIED GAS, XXXX, N.O.S.”,
- UN 3500, 3501, 3502, 3503, 3504, 3505 “CHEMICAL UNDER PRESSURE, XXXX, N.O.S.”

P200 (3) or P206 (3), respectively, is applicable for the calculation of the filling ratio and the test pressure.

2. For cases where a liquid phase of a fluid is charged with a compressed gas, the above packing instructions do not include instructions on how to calculate the filling ratio and test pressure. In these cases, both components – the liquid phase and the compressed gas – have to be taken into consideration in the calculation of the internal pressure in the pressure receptacle.

¹ In accordance with the programme of work of the Sub-Committee for 2013–2014 approved by the Committee at its sixth session (see ST/SG/AC.10/C.3/84, para. 86 and ST/SG/AC.10/40, para. 14).

This is shown in Figure 1:

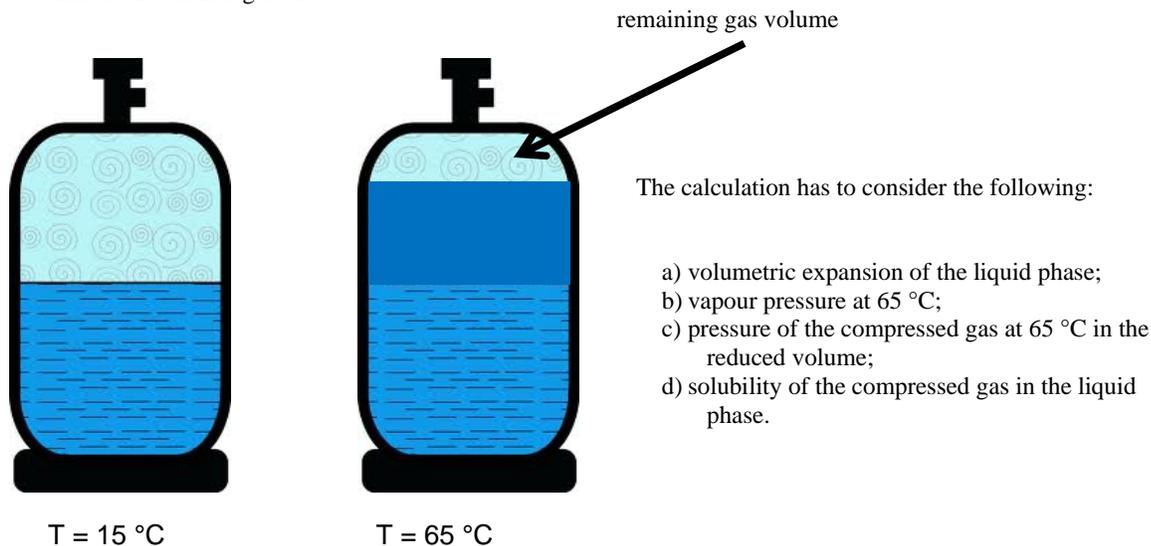


Fig. 1: Schematic presentation of the volumetric expansion for the calculation of the internal pressure in pressure receptacles containing liquid phases and compressed gas

3. If only the compressed gas is considered in accordance with P200 (3) (a), this results in calculated pressures which are too low and not acceptable from the point of view of safety. If only the vapour pressure of the liquefied component at 65 °C is considered in accordance with P200 (3) (c) and/or P206 (3), this also result in calculated pressures which are too low and not acceptable from the point of view of safety.
4. A complete calculation formula is not given in P200 and P206. Experimental values are often also not available.
5. A similar approach to calculating test pressures taking into account both the compressed gas and the liquid phase for tanks is given under 6.7.2.1 and 6.7.3.1.

Proposal

6. The following amendments to P200 and P206 are proposed:

P200 (5) (e): Amend to read:

“(e) For pressure liquefied gases or liquids charged with compressed gases, the maximum mass of contents per litre of water capacity shall equal 0.95 times the density of the liquid phase at 50 °C; in addition, the liquid phase shall not fill the pressure receptacle at any temperature up to 60 °C.

When full, the internal pressure at 65 °C shall not exceed the test pressure of the pressure receptacles. The vapour pressures and volumetric expansions of all substances in the pressure receptacles shall be considered. The following steps shall be carried out:

- a. Calculation of the vapour pressure of the liquid component and of the partial pressure of the compressed gas at 15 °C (filling temperature);
- b. Calculation of the volumetric expansion of the liquid phase resulting from the heating from 15 °C to 65 °C and calculation of the remaining volume for the gaseous phase;

- c. Calculation of the partial pressure of the compressed gas at 65 °C considering the volumetric expansion of the liquid phase;
- d. Calculation of the vapour pressure of the liquid component at 65 °C;
- e. The total pressure is the sum of the vapour pressure of the liquid component and the partial pressure of the compressed gas at 65 °C;
- f. Consideration of the solubility of the compressed gas at 65 °C in the liquid phase;

The test pressure of the pressure receptacle shall be not less than the calculated pressure minus 100 kPa (1bar).

If the solubility of the compressed gas in the liquid component is not known for the calculation, the test pressure can be calculated without taking the gas solubility (paragraph (f)) into account.

If reliable pressure-temperature-curves have been experimentally determined for certain systems, these data may be used.”.

At the end of P206 (3), add the following paragraph:

“The following steps shall be carried out:

- a. Calculation of the vapour pressure of the liquid component and of the partial pressure of the compressed gas at 15 °C (filling temperature);
- b. Calculation of the volumetric expansion of the liquid phase resulting from the heating from 15 °C to 65 °C and calculation of the remaining volume for the gaseous phase;
- c. Calculation of the partial pressure of the compressed gas at 65 °C considering the volumetric expansion of the liquid phase;
- d. Calculation of the vapour pressure of the liquid component at 65 °C;
- e. The total pressure is the sum of the vapour pressure of the liquid component and the partial pressure of the compressed gas at 65 °C;
- f. Consideration of the solubility of the compressed gas at 65 °C in the liquid phase.

The test pressure of the cylinders or pressure drums shall be not less than the calculated pressure minus 100 kPa (1bar).

If the solubility of the compressed gas in the liquid component is not known for the calculation, the test pressure can be calculated without taking the gas solubility (paragraph (f)) into account.

If reliable pressure-temperature-curves have been experimentally determined for certain systems, these data may be used.”.

Correction for UN 1058, P200, Table 2:

In the entry for UN 1058 LIQUEFIED GAS, non-flammable, charged with nitrogen, carbon dioxide or air, delete “1.5 x working pressure” in the columns for test pressure and filling ratio.