

## 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

10 November 2015

### Forty-eight session

Geneva, 30 November-9 December 2015

Item 6 (c) of the provisional agenda

### Miscellaneous proposals for amendments to the Model Regulations on the Transport of Dangerous Goods: packagings

## **Water temperature during internal pressure (hydraulic) test with plastics packagings, composite packagings (plastics receptacles), plastics IBCs and composite IBCs (plastic inner receptacles)**

### **Transmitted by the expert from Germany**

1. As already noted in document ST/SG/AC.1/C.3/2015/15 there are no rules in the Model Regulations regarding the internal (hydraulic) pressure which prescribe that the water temperature must be kept within a certain range during the test. Nevertheless, there are several investigations which show that temperature has a big influence on the mechanical behaviour of plastics material.
2. In 2008 the SP Technical Research Institute of Sweden did an investigation on internal pressure tests regarding the burst pressure at different temperatures. The tests were performed with three different jerricans made of PE at 3, 20, 40 and 55 °C. The results showed a decrease in the burst pressure with rising temperature. For instance, for jerrican A the burst pressure was 234 kPa at 3 °C, 175 kPa at 20 °C, 151 kPa at 40 °C and 114 kPa at 55 °C.
3. BAM (Federal Institute for Materials Research and Testing, Germany) has also performed internal pressure tests to failure with plastics jerricans at different temperatures (10 °C, 15 °C, 21 °C) as already described in document ST/SG/AC.1/C.3/2015/15. In this case the time to failure was measured with a constant pressure of 3 bar. The times to failure ranged at 21 °C from 20 minutes to 1 hour, at 15 °C from 1 hour 20 minutes to 3 hours and at 10 °C from 2 hours 40 minutes to 8 hours 20 minutes. These results show that the same design type passes the test in accordance with 6.1.5.5 at 10 °C and 15 °C but fails at 21 °C.
4. The results of all investigations concerning the water temperature during internal pressure tests show clearly that a higher temperature leads to an earlier failure of the plastics packaging. Furthermore tests with different water temperatures applied to one design type can produce different test results (pass or failure). To make the test results more comparable the German expert proposes introducing a lower water temperature limit of 12 °C when testing plastics packagings, composite packagings (plastics receptacles), plastics IBCs and composite IBCs (plastic inner receptacles). Water with a temperature above 12 °C would be permitted but not water with a temperature below 12°C. It can be assumed that most of the test laboratories are using water with temperatures exceeding 12 °C due to the normal conditions in the test labs.
5. At the last session, different opinions were expressed on the proposals in ST/SG/AC.1/C.3/2015/15 and INF.46. The sub-committee agreed that this question could

be further considered at the next session on the basis of a new proposal which would address the issues raised.

6. German experts have reviewed the issue again. The current provisions on the level on the internal test pressure without connection to the temperature are technically incomplete, and thus provide a limited informative value on the safety level of the packages. Different practices have developed which cause competitive disadvantages and are contrary to the intention to have harmonized provisions as a basis for the worldwide acceptance of UN approved packagings. The insertion of a requirement for a minimum temperature of 12 °C is still considered as an appropriate solution. The choice of 12°C is justified by the existing practice and it can be assumed that most of the existing packagings are capable to meet this test level. This approach is presented as proposal 1.

7. Additionally, an alternative proposal 2 has been developed, taking into account the views of several experts which were in favour of the possibility to use a correction factor. Tables with correction factors should be inserted in the Model Regulations instead of referring to ISO 16495:2013 as proposed in UN/SCETDG/47/INF.46.

8. The Sub-Committee is invited to discuss the proposals below and depending on the outcome of the discussion a formal document could be submitted to the next session of the UN Sub-Committee.

## Proposal 1

9. Amend the text of 6.1.5.5.3 to read as follows (new added text in bold):

*“Special preparation of packagings for testing: either vented closures shall be replaced by similar non-vented closures or the vent shall be sealed. **Plastics packagings and composite packagings (plastics receptacles) shall be filled with water at room temperature. The water temperature shall not be below 12 °C and shall be measured and documented before testing.**”*

Amend the text of 6.5.6.8.2 to read as follows:

*“Preparation of the IBC for test*

The test shall be carried out before the fitting of any thermal insulation equipment. Pressure-relief devices shall be removed and their apertures plugged, or shall be rendered inoperative. **Rigid plastics IBCs and composite IBCs (plastic inner receptacles) shall be filled with water at room temperature. The water temperature shall not be below 12 °C and shall be measured and documented before testing.**”

## Alternative proposal

10. Amend 6.1.5.5.3 to read as follows (new added text in bold):

*“Special preparation of packagings for testing: either vented closures shall be replaced by similar non-vented closures or the vent shall be sealed. **Plastics packagings and composite packagings (plastics receptacles) shall be filled with water at room temperature. The water temperature shall not be below 12 °C and shall be measured and documented before testing. If the measured water temperature is above 12 °C the internal pressure to be applied may be reduced with a correction factor according to the table below:**”*

**Water temperature adjustment factors for plastics packagings and composite**

Water temperature °C	Correction factor
12 + 2	1.000
≥14	0.976
15	0.964
16	0.952
17	0.940
18	0.928
19	0.917
≥	0.906

**packagings (plastics receptacles)**

Amend 6.5.6.8.2 to read as follows:

*“Preparation of the IBC for test*

The test shall be carried out before the fitting of any thermal insulation equipment. Pressure-relief devices shall be removed and their apertures plugged, or shall be rendered inoperative. **Rigid plastics IBCs and composite IBCs (plastic inner receptacles) shall be filled with water at room temperature. The water temperature shall not be below 12 °C and shall be measured and documented before testing. If the measured water temperature is above 12 °C the internal pressure to be applied may be reduced with a correction factor according to the table below:**

**Water temperature adjustment factors for plastics IBCs and composite IBCs (plastic inner receptacles)**

<b>Water temperature °C</b>	<b>Correction factor</b>
<b>12 + 2</b>	<b>1.000</b>
<b>≥14</b>	<b>0.976</b>
<b>15</b>	<b>0.964</b>
<b>16</b>	<b>0.952</b>
<b>17</b>	<b>0.940</b>
<b>18</b>	<b>0.928</b>
<b>19</b>	<b>0.917</b>
<b>≥</b>	<b>0.906</b>

**Consequential amendments**

11. If these tables are applied for the internal (hydraulic) pressure test, further provisions have to be reviewed, as follows:

- 6.1.5.5.4 (b) and (c) and 6.5.6.8.4.2 (b) (ii) and (iii) require a minimum test pressure of 100 kPa, but the application of the correction factor implies that the test pressure may be below the minimum level required. Consequentially it has to be decided how the minimum test level requirement should be drafted.
  - P620 and P650 contain capability requirements concerning the internal pressure which should be reviewed accordingly.
  - It should be clarified how the marking of the hydraulic test pressure which the packaging was shown to withstand (see 6.1.3.1 (d), 6.5.2.2.1) should be applied.
-