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agenda item 8.)

PROPOSAL FOR DRAFT AMENDMENTS TO THE NEW DRAFT REGULATION ON

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF:

- I. SPECIFIC COMPONENTS OF MOTOR VEHICLES USING LIQUID HYDROGEN
- II. VEHICLE WITH REGARD TO THE INSTALLATION OF SPECIFIC COMPONENTS FOR THE USE OF LIQUID HYDROGEN

Transmitted by the members of the informal group "hydrogen / fuel cell – vehicles"

Note: The text reproduced below was prepared by the members of the informal group on "hydrogen / fuel cell - vehicles" proposing some editorial amendments to the new draft Regulation introducing provisions for the type approval of hydrogen vehicles. The modifications to the current text of TRANS/WP.29/GRPE/2003/14 are marked in **bold** characters.

Note: This document is distributed to the Experts on Pollution and Energy only.

A. PROPOSAL

Paragraph 2.19., amend to read:

"2.19. "Impermissible fault range" of a process variable means the range within which an unwanted event is to be expected, e.g. the corresponding pressure where from plastic deformation or bursting of the inner tank occurs as shown in Figure 1. In the case of steel inner tanks, the lower limit of the impermissible fault range corresponds to a pressure higher than 136 per cent of the Maximum Allowable Working Pressure (MAWP) of the inner tank **if a safety valve is used as second pressure relief device. In case of steel inner tanks, the lower limit of the impermissible fault range corresponds to a pressure higher than 150 per cent of the Maximum Allowable Working Pressure (MAWP) of the inner tank if a burst disk is used as second pressure relief device.** For other materials an equivalent level of safety is to be applied.

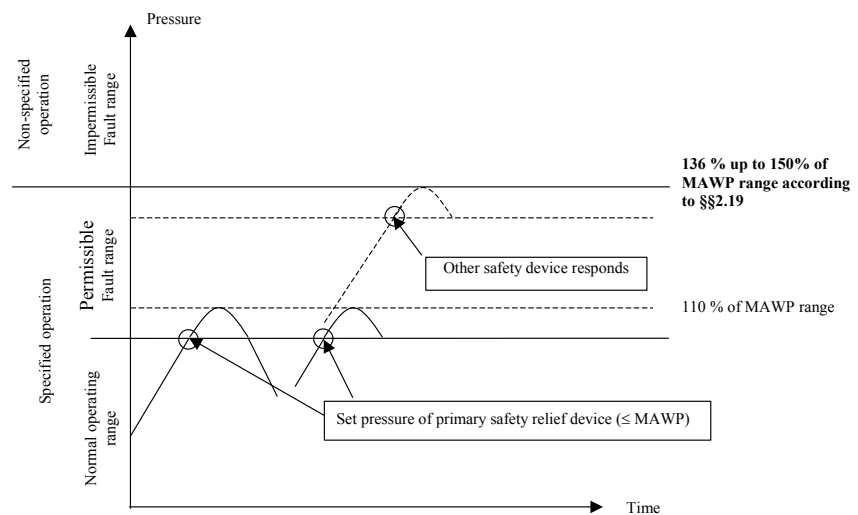


Figure 1 – Ranges of a steel inner tank

Paragraph 6.2.1., amend to read (square brackets to be deleted including the text).

"6.2.1. The hydrogen container(s) shall be type-approved pursuant to the provisions laid down in annexes 7A of this Regulation."

Paragraph 6.4.1.1., amend to read:

"6.4.1.1. The primary pressure relief device for the inner tank shall limit the pressure inside the tank to not more than 110 per cent of the Maximum Allowable Working Pressure (MAWP), **even in case of a sudden vacuum loss.** This device shall be a safety valve or equivalent **and shall be connected directly to the gaseous part under normal operating conditions.**"

Paragraph 6.4.1.2., amend to read:

"6.4.1.2. The secondary pressure relief device for the inner tank shall be installed to ensure that the pressure in the tank cannot under any circumstances exceed the permissible fault range of the inner tank. In the case of steel inner tanks, the secondary pressure relief device shall limit the pressure in the tank to 136 per cent of the Maximum Allowable Working Pressure (MAWP) of the inner tank, **if a safety valve is used as second PRD. In case of steel inner tanks, the secondary pressure relief device shall limit the pressure in the tank to 150 per cent of the Maximum Allowable Working Pressure (MAWP) of the inner tank, if a burst disk is used outside the vacuum area as second PRD. In case of steel inner tanks, the secondary pressure relief device shall limit the pressure in the tank to 150 per cent of the Maximum Allowable Working Pressure plus 0.1 MPa (MAWP + 0.1 MPa) of the inner tank, if a burst disk is used inside the vacuum area as second PRD.** For other materials, an equivalent level of safety shall be applied. The secondary pressure relief device shall not operate below 110 per cent of the set pressure of the primary pressure relief device."

Paragraph 6.5.1., to be deleted.

Paragraph 6.5.2. (former), renumber as paragraph 6.5.1.

Paragraph 6.5.3. (former), renumber as paragraph 6.5.2.

Paragraph 6.7.3., correct to read:

"6.7.3. A safety system shall be provided to **prevent** failure of the heat exchanger and prevent any cryogenic liquid or gas from entering the other circuit and the system located downstream of it, if it has not been designed for this."

Paragraphs 13.4. to 13.8., remove the square brackets (the text in the square bracket should be maintained).

Paragraph 14.1.6., correct to read:

"14.1.6. The hydrogen system shall be installed such that it is protected against damage **so far as is reasonably practical**, such as damage due to moving vehicle components, **impacts**, grit or due to the loading or unloading of the vehicle or the shifting of those loads."

Paragraph 14.4.2.1., correct to read:

"14.4.2.1. The pressure relief devices (pressure triggered) shall be fitted to the hydrogen container(s) in such a manner that **they** must discharge into an atmospheric outlet line that vents outside the vehicle. **They** shall not discharge at a heat source such as the exhaust. Additionally **they** shall discharge such that hydrogen cannot enter the inside of the vehicle and/or accumulate in an enclosed **space**. **Additionally the first PRD shall not discharge into a partially enclosed space.** In case the secondary pressure relief

device is a burst disc and is installed within the inner tank, an appropriate exhaust vent in the outer jacket is required."

Annex 7A,

Paragraph 3.3., amend to read:

"... paragraphs 3.1. and 3.2. of this annex are fulfilled. The inspection shall be performed according to CEOC – specification, e.g. R 97/CEOC/CP 96 def - **"Supplementary Quality Management System Requirements for Manufacturers of Metallic Materials for Pressure Equipment"**. Existing certificates of notified bodies according to pressure equipment **EU-Directive 97/23/EC** or equivalent shall be accepted."

Paragraph 3.5.1., amend to read:

"... the technical service shall issue a certificate for the materials. The inspection shall be performed according to CEOC – specification R 77/CEOC/CP 90 def - **"Appraisal of Materials for Pressure Equipment"** (and following numbers of the specifications). Existing certificates of notified bodies according to the pressure equipment **EU-Directive 97/23/EC** or equivalent shall be accepted."

Paragraph 5.4.1., amend to read:

"5.4.1. A system shall be provided for preventing the container from being overfilled. This system may work in conjunction with the refuelling station. **This system shall bear a permanent marking, indicating the container-type for which it has been designed and if applicable the mounting position and orientation.**"

Paragraph 5.4.2., correct to read:

"5.4.2. **The filling process shall not lead to any pressure relief device coming into operation irrespective of time passed during/after the filling process. The filling process shall not lead to operating conditions the BMS (boil-off management system) is not designed for and therefore cannot handle.**"

Annex 7C,

Paragraph 1., correct to read:

"1. The design, manufacturing and **checking of the cryogenic hydrogen valves** shall be in accordance with EN 13648-1:2002 and EN 13648-2:2002."

Annex 8A,

Paragraph 2.1.2., amend to read:

"2.1.2. The tank shall not burst and the pressure inside the inner tank shall not exceed the permissible fault range of the inner tank. In case of steel inner tanks, **the secondary pressure relief device shall limit the pressure inside the tank to 136 per cent of the Maximum Allowable Working Pressure (MAWP) of the inner tank, if a safety valve is used as second PRD.**
In case of steel inner tanks, the secondary pressure relief device shall limit the pressure inside the tank to 150 per cent of the Maximum Allowable Working Pressure (MAWP) of the inner tank, if a burst disk is used outside the vacuum area as second PRD.
In case of steel inner tanks, the secondary pressure relief device shall limit the pressure inside the tank to 150 per cent of the Maximum Allowable Working Pressure plus 0.1 MPa (MAWP + 0.1 MPa) of the inner tank, if a burst disk is used inside the vacuum area as second PRD.
For other materials, an equivalent level of safety shall be applied.
The secondary pressure relief device shall not operate below 110 per cent of the set pressure of the primary pressure relief device."

Paragraph 2.2.2., amend to read:

"2.2.2. Its manufacturing is completely finished and it is mounted with all its equipment ~~and particularly the level gauge.~~"

Paragraph 2.2.3., to be deleted

Paragraphs 2.2.4. to 2.2.4.5. (former), renumber as paragraphs 2.2.3. to 2.2.3.5.

Annex 9, paragraph 1., correct to read:

"1. ...
This annex may also be **applied**, by special paragraphs ...
..."

* * *

B. JUSTIFICATION

1. Ad paragraph 2.19.:

General requirement:

Safety requires that no plastic deformation of the inner tank occurs.

Current Problem:

The tolerance fields of first PRD (safety valve) and second PRD (burst disc) do partly cover. As a result, in some cases the second PRD came into operation before the first and therefore the first PRD did not come into operation at all.

Solution:

Moving the set pressure of first and second PRD away from each other would improve the situation. Since ISO 13985-1 requests an operating pressure for burst discs between 120 per cent and 150 per cent of MAWP, a set pressure of 150 per cent would still be suitable.

Furthermore, in case the burst disc is located inside the vacuum, the set pressure of the burst disc can be set to MAWP+0.1MPa, since the calculation is based on overpressure.

Remark:

If the second PRD would be a safety valve, the draft should not be changed, i.e. stay at 136 per cent MAWP of inner tank, as safety valves are made up by many more individual parts and therefore overall safety is less.

2. Ad paragraph 6.4.1.1.:

This change details the function of first and second PRD. The first PRD handles all normal operating situations including a sudden vacuum loss, the second PRD handles also situations where additionally temperature is raising drastically (fire outside/underneath the tank).

3. Ad paragraph 6.4.1.2.:

See item 1., the justification for paragraph 2.19

4. Ad paragraph 6.5.1.:

Content of paragraph 6.5.1. has been moved to 6.4.1.1., see paragraph 2. above.

5. Ad paragraph 6.7.3.:

The emphasis here lies on prevention of failure. Detection would imply an additional system just for detection of a failure, a system for prevention must be implemented anyway.

6. Ad paragraph 14.1.6.:

The wording of this paragraph has been changed and is now in line with the relevant paragraph of the document for gaseous hydrogen (GRPE Informal Group: Hydrogen/Fuel Cell Vehicles, Draft ECE Compressed Gaseous Hydrogen Regulation, Revision 12b, date: 12.10.03).

7. Ad paragraph 14.4.2.1.:

If the second PRD needs to start operation, the amount of hydrogen is such that partially enclosed spaces (wheel houses) do not matter anymore. The main focus lies on prevention of bursting of the tank.

However, the first PRD should not discharge hydrogen into wheel houses.

8. Ad annex 7A, paragraph 5.4.1.:

Current wording is design restrictive. New wording does not lead to any loss of safety, neither with current design details nor with future design changes.

9. Ad annex 7A, paragraph 5.4.2.:

See item 8., the justification for paragraph 5.4.1.

10. Ad annex 8A, paragraph 2.1.2.:

See items 1. and 3., justification for paragraphs 2.1.9. and 6.4.1.2.

11. Ad annex 8A, paragraph 2.2.2.:

The level gauge is not necessary since the amount of hydrogen used for the test is defined and must get weighed by a mass measurement system.

12. Ad annex 8A, paragraph 2.2.3.:

Paragraph 2.2.3. is contradicting to paragraph 2.2.1., since the replacement of the second safety device would make the container non-representative of the container to be homologated.
