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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
(Twentieth session, 3-12 December 2001, agenda item 3 (b))

TANKS

Miscellaneous proposals

Requirements for the design, construction and testing of safety devices for portable tanks

Transmitted by the expert from Spain

1. When a bursting disc fails, the discharge area is less than the total area of the disc and this affects the discharge relief flow. ASME VIII provides some guidance on this issue. It is also important that when a bursting disc is combined with a safety relief device it is correctly sized to allow for the maximum discharge flow rate of the valve and that the combined discharges rates of valve and disc are taken into account when designing the assembly. It is then necessary, that the designer and manufacturer are aware of this potential to reduce the relief capacity of the assembly. In order to ensure the correct flow rate and capacity of the combined relief devices, it is proposed to add a new paragraph at 6.7.2.12.1:

> "In the case of a combined spring loaded pressure-relief device preceded by a bursting disc device, the discharge flow through the bursting disc device shall not be less than the discharge flow rate through the spring loaded pressure-relief device.
> This information should also be in the construction technical codes for the spring loaded pressure-relief devices and disc devices".

2. The existing text in paragraph 6.7.2.12.2 reads: "The combined delivery capacity of the relief devices in condition of complete fire engulfment of the portable tank shall be sufficient to limit the pressure in the shell to 20% above the start-to-discharge pressure of the pressure limiting device". It is also stated that "The total capacity of the relief devices may be determined using the formula in 6.7.2.12.2.1 or the table in 6.7.2.12.2.3". But in reality the manufacturers of relief devices, obtain the flow capacities through independent tests. Example:

Consider a tank-container with a test pressure of 4 bar.

1. If a valve Perolo multi-superventix 2 ½" is used in a portable-tank lateral surface S=70m^2 there are, depending on pressure, differents flow capacities obtained by tests.
   At 4'4 bar 16.127 m^3/h.
   4 bar 15.090 m^3/h.

2. The same happens if a Fort Valve of 2 ½" is used in a portable-tank of S=65 m^2 of lateral surface.
   At 4'4 bar 14.996 m^3/h.
   4 bar 13.816 m^3/h.

In both cases, looking at the capacities obtained for theses valves according (for example) to table 6.7.2.12.2.3 or the IMDG Code, the following may be observed:

Table	Lateral surface	Capacity
Case 1	70 m^2	15.249 m^3/h
Case 2	65 m^2	14.353 m^3/h

So depending on the pressure used (4 bar or 4'4 bar), 1 or 2 valves or a valve of higher capacity than 2 ½" for the portable tank would be necessary.

The normal method is to take a relief valve with a nominal setting of the test pressure but not higher than 20% above the test pressure of the tank. If manufacturers take the setting as 20% above the test pressure (to allow for the rated discharge capacity of the valve), and this is then a tolerance of another +20% in the accuracy of the relief pressure setting, then the valve would be oversized and fail to relieve until possibly 40% above the test pressure. This would affect the integrity of the tank in a fire situation. In other words, the tank could reach its burst pressure and explode before the relief valve operated due to the yielding effects of fire on the material.

If the valve is not sized correctly, a higher pressure could take the tank material beyond its yield limit at high temperatures such as under fire conditions.

Consequently a new paragraph 6.7.2.12.2.5 is proposed as follows:

"In the case of using spring-loaded pressure devices, in order to ensure that the test pressure of the tank is not exceeded, the discharge flow rate of the spring-loaded pressure devices, calculated according to ISO 4126-1:1991 "Safety valves - Part 1 - General requirements" should accommodate the maximum discharge of fluid at the test pressure of the tank, and this discharge flow rate should be equal or higher for each tank, than the theoretical capacity determined in table 6.7.2.12.2.3. or the formula of paragraph 6.7.2.12.1.