

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

(Twenty-second session, 2-6 December 2002, agenda item 2)

ADDITIONAL PROVISIONS FOR THE TRANSPORT OF GASES

Section 6.2.1.1.8

Electronic earthing of pressure receptacles carrying flammable gas. Earth straps.

Transmitted by the Expert from the United Kingdom

Background

1. The expert from the United Kingdom has some observations on the above paragraph which he feels should be considered by the Sub-Committee and the Gases working group.
2. The requirement to fit earth straps to pressure receptacles for flammable liquefied gases was discussed at the July 2002 Sub-Committee meeting with no agreement reached on the suitability of the clause for composite cylinders. Section 6.2.1.1.8 is still in square brackets therefore.
3. Composite cylinders can be made of materials such as carbon composites or glass reinforced plastic (GRP). The cylinders may be lined or unlined with conductive or non-conductive materials. Static electricity can build up by means of friction, including flow through a hose and valve and by 'splash filling' of containers. Electrostatic discharges vary in type (e.g. spark or brush) and incendivity. It should be noted that an electro static charge could exist in the liquid phase, in the vapour phase and on the cylinder components.
4. In LPG filling plants the LPG is handled in a closed system with the LPG concentration well above the upper explosion limit (UEL) so the risk from an electrostatic discharge is not within the cylinder itself but outside the cylinder in the filling area (3). **See references at the end of this paper.**
5. In the UK it is recommended that cylinder filling buildings are classified as hazardous Zone 1 (a flammable atmosphere is likely to occur in normal operation) and all electrical equipment should be suitable for use in a Zone 1 area. In addition there shall be no sources of ignition within the area (5).
6. The need for electrical continuity to prevent the build up of static is discussed in UK industry guidance (1, 5), British Standards (3, 4) and European guidance (2).
7. European guidance (2) states that for Zone 1 areas non-conductive solid materials should only be used if charging mechanisms capable of generating hazardous potentials will not occur either during normal operation (including maintenance and cleaning) or in the case of likely malfunctions. Dissipative solid materials (with surface resistance not exceeding 10^{11} ohms at 30% humidity and 10^9 ohms at 50% humidity) if connected to earth do not require further protective measures. It is good practice to minimise the use of non-conductive materials in hazardous areas. Many materials which are non-conductive (e.g. plastics) are now available in grades which are dissipative, e.g. by the addition of carbon black into the resin.

8. European Guidance (2) gives restrictions on the size of chargeable surfaces depending on the ignitability of the gases and vapours and the classification of the hazardous area: for a Zone 1 area for LPG (gas ignition category Group IIA; or Group IIB if substantial butane is present) the maximum area is given as 100 cm². If this restriction on size cannot be met incendive brush discharges can be avoided by incorporating an earthed mesh or metal frame into the non-conductive solid or on its surface, for LPG the mesh should be within 2mm of the surface of the material and have a mesh size less than 400cm². *Note: An internal mesh does not protect against propagating brush discharges.*
9. A number of other methods may be used to reduce the surface resistivity of non-conductive materials to dissipative levels in some, but not all situations. These include increased humidity or ionising the air. Conductive or dissipative coatings are yet to be proven for use in Zone 0 or Zone 1 areas, and in any case they should be properly earthed.

Proposals

With the above in mind the expert from the United Kingdom makes the following suggestions for consideration by the gases working group.

1. Discourage the use of composite cylinders for flammable liquefied gases unless they are made of a conductive or dissipative material.
2. Cylinders made of dissipative materials with surface resistance not exceeding 10¹¹ ohms at 30% humidity and 10⁹ ohms at 50% humidity must have a suitable earthing point.
3. Continuity and earth bonding of all conductive and dissipative parts of the cylinder and associated system must be possible for operations such as filling.
4. Non-conductive cylinders (which are not dissipative) should be avoided for flammable liquefied gases unless it can be shown that they do not retain an electro static charge.

References

1. Guidelines for the control of hazards arising from static electricity. The Institute of Petroleum, Model Safe Code of Practice Part 21.
 2. Safety of machinery Guidance and recommendations for the avoidance of hazards due to static electricity. CENELEC report R044-001, February 1999.
 3. BS5958-1: 1991, Code of Practice for Control of undesirable static electricity – Part 1: General Considerations.
 4. BS5958-2: 1991, Code of Practice for Control of undesirable static electricity – Part 2: Recommendations for particular industrial situations.
 5. Recommendations for the safe filling of LPG cylinders at depots. LP Gas Association Code of Practice 12: 1998.
-