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Working Party on the Transport of Dangerous Goods

Joint Meeting of the RID Safety Committee and the Working Party on the Transport of Dangerous Goods
(Bern, 28 May – 1 June 2001)

MINIMUM SHELL THICKNESS FOR SPHERICAL TANKS

Transmitted by the European Industrial Gases Association (EIGA) */

SUMMARY

Executive summary:	The proposal provides a formula for the calculation of the minimum wall thickness of spherical tanks.
Action to be taken:	Amend Chapter 6.8, paragraph 6.8.2.1.17
Relevant documents:	TRANS/WP.15/AC.1/80/Add.9.

Introduction

Spherical tanks are used for the transport of dangerous goods, but the formulae given in Chapter 6.8.2.1.17 are relevant to cylindrical shells only and not appropriate for spherical shells. Spherical shells are stiffer than cylindrical ones and the stresses due to pressure are lower.

National codes, such as CODAP 2000, and standards, give a specific formula for the calculation of spherical shells and the RID/ADR should include an appropriate calculation.

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*/ Circulated by the Central Office for International Carriage by Rail (OCTI) under the symbol OCTI/RID/GT/III/2001/17.

Proposal

The first sentence of paragraph 6.8.2.1.17 should be amended to read:

The thickness of the shell shall not be less than the greater of the values determined by the following formulae:

- *for cylindrical shells*

$$e = \frac{P_T D}{2 s\, l} \qquad \left| \qquad e = \frac{P_C D}{2 s}\right.$$

- *for spherical shells*

$$e = \frac{P_T D}{4 s\, l} \qquad \left| \qquad e = \frac{P_C D}{4 s}\right.$$

Justification

The formula proposed above for spheres is a standard engineering calculation. The spherical configuration results in the wall thickness being halved for a given stress value, as compared to a cylindrical shell.

Standardization work in CEN technical committees intended for reference in RID/ADR, will cover the design, fabrication, inspection and testing of transportable vessels and will include calculations for spherical shells. One example is a standard from CEN TC268 – Cryogenic Vessels, for the non-vacuum insulated tanks for refrigerated liquefied gases.

Safety

This proposal will allow the designer to take advantage of the extra stiffness and the reduced stress that a spherical configuration provides. The reduction in wall thickness will be limited by the requirements of 6.8.2.1.18 to 6.8.2.1.21.

Feasibility

The calculation is well known in pressure vessel codes and text books on stress calculations.

Enforceability

The thickness will be verified during the normal type approval process.

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