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Accidents and risk management

Incidents with 2-piece EN 12245 Composite LPG Cylinders and Corrective Actions

Transmitted by the European LPG Association (AEGPL)

Introduction/Background

This document aims to bring clarity to the recent incidents in Denmark related to “fully wrapped composite gas cylinders” without liner manufactured from two parts joined together intended for LPG, made to the requirements in EN 12245:2002.

The events and incidents are not limited to the incidents in the Danish market, but also incorporate discussion around design standards for composite gas cylinders, such as e.g. EN 12245, EN 14427 and ISO 11119-3.

Composite gas cylinders in various forms were introduced into the market as early as the 1970's, at that time mainly for military and for high pressure applications (i.e. with service pressure around 200 bar or more). Since then millions of medium and high pressure cylinders have been put into service. The mass production of LPG cylinders manufactured from composite materials started in 1994. Since their introduction cylinder design and technology has developed to meet new requirements, both from the market and new/revised manufacturing standards. Currently there are several different cylinder models available from a number of different manufactures. The main manufacturers are located in Europe, while some manufacturers have established manufacturing facilities outside Europe.

Fully wrapped composite cylinders have been in use to transport LPG on the European market since 1994. The first 6 years there were only one type of cylinders available from one manufacturer, producing cylinders from two cylinder half-shells that were joined together to form the pressure vessel. There is no internal plastic liner in these cylinders. In year 2000 a new cylinder design entered the market, based on a one-piece cylinder without joints with an internal plastic liner.

The total numbers of composite cylinders in LPG service on the European market is estimated to be close to 1,5 million 2-piece cylinders and 10 million one-piece cylinders.

Composite LPG cylinders are designed to be durable; however, they must be treated with care and be correctly maintained.

Recently, The Danish Working Environment Authority (DWEA) have registered a number of incidents on the Danish market, involving the 2-piece LPG cylinder. Investigations showed that while DWEA found the 2-piece cylinders fulfilling the requirements in the type approval (based on EN 12245, 2002 edition), this was not deemed enough to provide sufficient safety

to the user. The investigation also involved one-piece cylinders which showed satisfactory results. This led to the Danish Working Environment Authority issuing a nationwide recall for Compolite CS 6 and CS 10, and a RAPEX report to the EU commission.

The halves of the cylinders manufactured without liner from two parts joined together are joined using a 2-component polymer adhesive. It is shown in the testing by DWEA that when overheated, the strength in the seam decreases and at some point it will fail, and the two parts will separate, releasing the cylinder contents as a result.

The vast majority of 2-piece cylinders have been equipped with valves incorporating a fusible plug that is set to melt at a temperature above 100°C, so that if exposed to fire, the fusible plug will melt and release the contents in a controlled manner. However, when tested by DWEA, the cylinder valve was shielded by a steel tube, which interferes with the operation of the fusible plug (it shields the fusible plug from the heat of the fire). This is identified as a possible cause of the failure for the fusible plug to release the contents before the seam of the cylinder failed.

This issue is not directly related to LPG, but could happen to any 2-piece cylinder of similar construction, used with other types of gases, e.g. refrigerants, CO₂ etc. Cylinders without liner manufactured from two parts joined together using a polymer adhesive would exhibit the same performance in fire no matter what type of gas it contained.

The issue has been discussed in recent plenary meetings of CEN TC 23, ISO TC 58 and ISO TC 58/SC 3 where it was identified a need to update and clarify the fire test requirements for 2-piece cylinders. Work has already been initiated to prepare a process for revision of the EN 12245. A similar process is being initiated for the ISO 11119-3. The subject has also been discussed within the RID/ADR/ADN Joint Meeting Standards Working group. The proposed actions and ADR change proposal in this INF. paper reflect these discussions.

Proposed actions

Review EN 12245 with respect to requirements for cylinders without liner manufactured from two parts joined together.

Change proposal

Insert Note for EN 12245:2009+A1:2011 in column 2 of the table in section 6.2.4.1

Add note in column 2:

“NOTE: This standard shall not be used for cylinders and tubes without a liner, manufactured from two parts joined together.”

Withdrawal of type approvals in column 5 of the table in section 6.2.4.1

Add text in column 5 for EN 12245:2002 and EN 12245:2009+A1:2011:

“31 December 2019, only for cylinders and tubes without a liner, manufactured in two parts joined together.”