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SAES Getters Spa, Lainate (MI): getter materials and impurity control solutions for vacuum systems

Bolognini
GAS SOLUTIONS

Bolognini Srl, Treviolo (BG): recommissioning of cryogenic storage vessels, production and maintenance of gas handling systems



Effect of Lothar+® application on thermal insulation integrity in recommissioned cryogenic vacuum-insulated vessels

Introduction

Vacuum-insulated vessels are designed to store liquefied gases at cryogenic temperatures. Their thermal performance relies on a high-quality vacuum gap between the inner and outer shells, which minimizes heat transfer. Any degradation of the vacuum results in increased product boil-off, reduced storage efficiency, energy consumption, increased costs for refilling and maintenance. Due to vacuum degradation, over time cryogenic vessels may require recommissioning by vacuum restoration to recover thermal performance.

A key aspect during production and recommissioning of vessels is to minimize the outgassing of impurities that lead to pressure rise in the vacuum gap. Besides water, whose effect is mitigated by cryo-pumping and the use of molecular sieve absorbers, **Hydrogen** is the most detrimental contaminant: its high thermal conductivity (0.18 W/mK at room temperature) causes loss of thermal insulation properties even at low concentration, while its low liquefaction point (-253°C) makes it difficult to condense by cryo-pumping.

The mitigation of hydrogen effects is achieved by combining vacuum baking processes with the addition of a **hydrogen getter**. This application note presents a comparative evaluation of vacuum integrity in repaired cryogenic vessels with and without the installation of **SAES Lothar+ hydrogen getter**, based on their insulation performance over a 12-month observation period.

NER (Normal Evaporation Rate) Test

Standardized method used to quantify the boil-off mass loss of stored liquid gas in a vacuum-insulated container. It is an indirect but highly sensitive indicator of vacuum insulation quality.

Procedure: measurement of weight loss happening in 24 hours after the vessel has been filled with liquid gas.

Test Population and Methodology

- N.12 identical cryogenic liquid oxygen (LOX) containers that were collected from the field and failed the NRE test
- Container size: Ø 37 cm – h. 82 cm – empty weight 23 kg – filling capacity 31 L
- Standard vacuum restoration process and leak test
- Group A (n.6 vessels): Vacuum restored only
- Group B (n.6 vessels): Vacuum restored with the installation of a **LOTHAR+ bag containing 1.4 g of getter powder**
- The bag was introduced through the vacuum port onto the internal vessel wall before the vacuuming process
- Nominal weight of containers filled with LOX: 57 kg
- Pass/Fail NER test criteria: passed with NER loss < 1 kg (1,75% of the weight of filled vessel); failed if NER loss > 1 kg (1,75%)

Application Note

Key observations:

The graphs below show the results of NER tests for vessels of Group A and Group B at time zero from recommissioning, after 4 months and after 12 months. Each dot represents a NER measurement.

Group A containers, recommissioned without the addition of Lothar+ , show greater drift in NER weight loss values and higher sensitivity to vacuum degradation. Two vessels out of six failed the NER test after 12 months, with weight losses of 3% and up to 6%.

Group B containers, equipped with Lothar+ , demonstrate stable and uniform NER results, suggesting that LOTHAR+ acts as an effective getter, removing any outgassed hydrogen. The complete absence of vacuum failures in Group B over a year of testing further supports the positive influence of LOTHAR+.



Conclusions

- Vacuum restoration alone does not always ensure stable thermal performance over time.
- The application of SAES LOTHAR+ hydrogen getter significantly enhances long-term vacuum retention.
- Vessels with LOTHAR+ consistently passed the NER test and maintain a constant, non-degrading evaporation rate after 12 months.
- LOTHAR+ provides a practical and low-impact improvement to reliability, reducing risk of early vacuum degradation.

For both newly-manufactured and recommissioned cryogenic vacuum-insulated vessels, the installation of SAES LOTHAR+ is strongly recommended to ensure insulation efficiency, stable performance and reduce maintenance interventions.

The SAES manufacturing companies are ISO9001 certified, the Asian and Italian companies are also ISO14001 certified.

Full information about our certifications for each company of the Group are available on our website at:

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