

# EMISSIONGUARD™ TR<sup>2</sup> Rings Give 3.5 years Running Life in Lubricated High Pressure Hydrogen Application



## The Challenge

A Thomassen three-stage, lubricated hydrogen compressor in a major European refinery is a critical asset, but it was unable to align with the site's four-year maintenance interval. Packing ring life was typically ~3 years, so the objective was to extend ring life to match the four-year schedule.

Based on strong results achieved on other compressors at the site, the customer implemented CPI's EMISSIONGUARD™ TR<sup>2</sup> rings on this machine to improve lifetime and reliability.

After four years of continuous operation, overall ring wear with EMISSIONGUARD™ TR<sup>2</sup> was very low. However, inspections revealed ring deformation and breakage, along with excessive oil accumulation within the packing case cups.

A consistent wear/failure pattern was identified in the first EMISSIONGUARD™ TR<sup>2</sup> sealing ring group positioned in the cup immediately after the pressure breaker, affecting almost all 12 packing cases. The deformation and breakage were most pronounced in the third stage packing cases operating at 220 bar.

The condition is consistent with hydraulic pulsing of the packing rings caused by excessive oil accumulation in the packing area, which increases loading on both the rings and the garter springs. Notably, the tangent gaps of the EMISSIONGUARD™ TR<sup>2</sup> rings remained close to their original dimensions—an extremely positive outcome—yet garter spring failures still occurred, suggesting an additional contributing failure mechanism.

Overall, the customer is satisfied with the performance improvements but remains concerned about spring failures and the potential for spring fragments to damage other packing rings.



## The Solution

The most likely cause is hydraulic constraint resulting from liquid accumulation in the packing area. The following actions are recommended:

- **Confirm lubrication rate** against field settings and actual consumption data.
- **Verify lubrication distribution** by inspecting check valves, filters, and lubrication lines for restrictions or blockages.
- **Assess liquid carryover from the process side** and confirm drains and level control are functioning correctly.
- **Review operating practices** to minimize extended unloaded operation where possible and to prevent excess oil during reloading.
- **Verify inlet water temperature** and maintain it at least **5°C above the gas inlet temperature**, in accordance with **API 618**.

Based on four years of operation, the observed condition was assessed as consistent with expected wear and failure behaviour for the application. The customer was very satisfied with the overall results. The packing case ring set was replaced with a new set of **EMISSIONGUARD™ TR<sup>2</sup>** rings, restoring the compressor to service. CPI believes that implementation of the above recommendations could enable up to four years of operation, delivering an approximate 33% increase in service life in this demanding application. The customer confirmed satisfaction with the level of technical support provided, and we are pleased to have contributed to the measurable gains in running life achieved to date.

