



EMISSIONGUARD™ TR² Product Brief

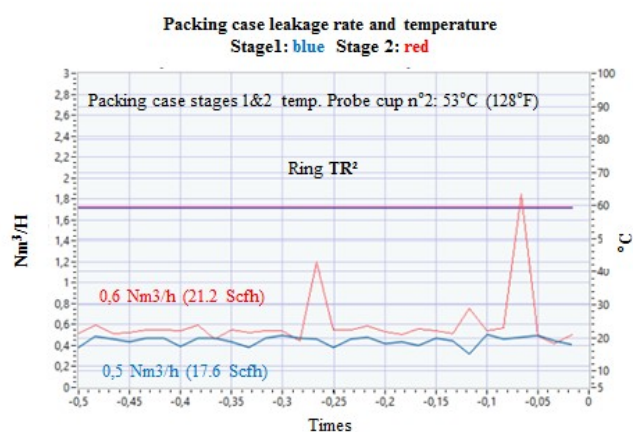
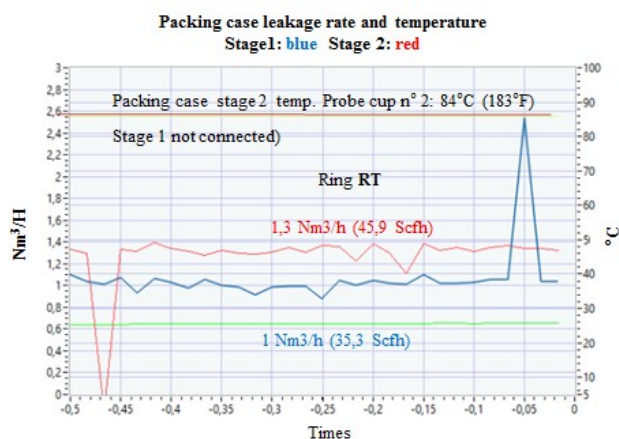


The EMISSIONGUARD™ TR² packing ring design multiplies the positive features of a tangent to rod ring with those of a step tangent ring by combining the two rings into one. The radial gas load is shared between the inner and outer rings as the outer radial force squeezes the tangent to rod ring, resulting in: improved sealing performance, lower friction, reduced heat generation and longer running life.

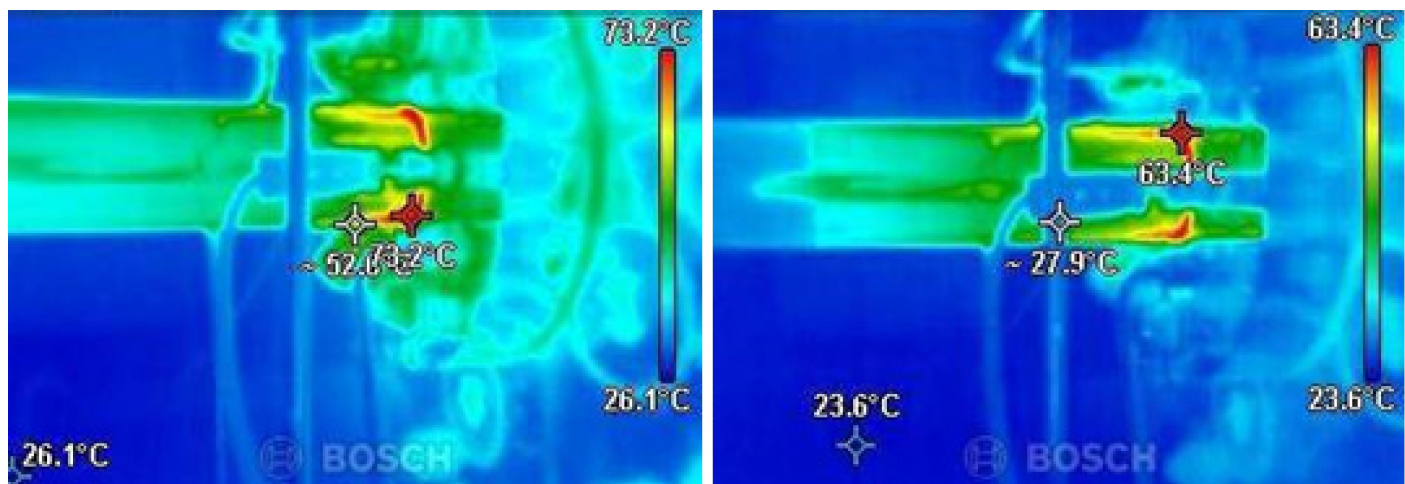


Tests have been conducted on CPI's Reciprocating Test Compressor, located in CPI's R&D laboratory, Feignies, France, which can operate up to 60 bar (870 psi) with either air or nitrogen, having a linear speed from 2.47 to 4.40 m/s (8.1 to 14.4 ft/s) and a rod diameter of 50 mm (~2").

We have observed a significant reduction in the leakage rate of almost 50% in the dynamic mode but also a significant improvement when the compressor was stopped. This leakage reduction was shown to remain consistent across various states of wear on the rings.



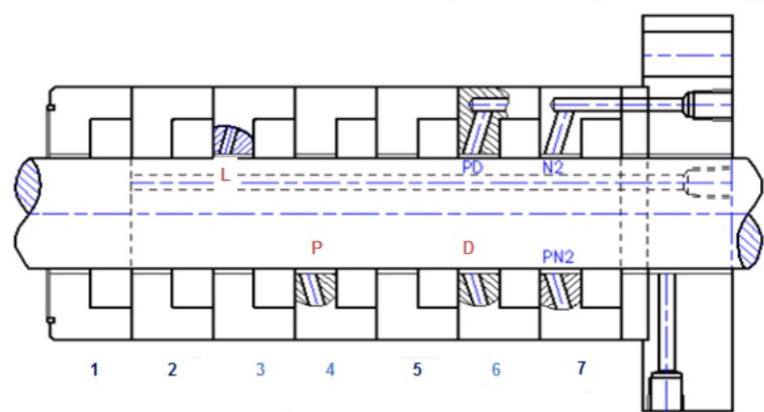
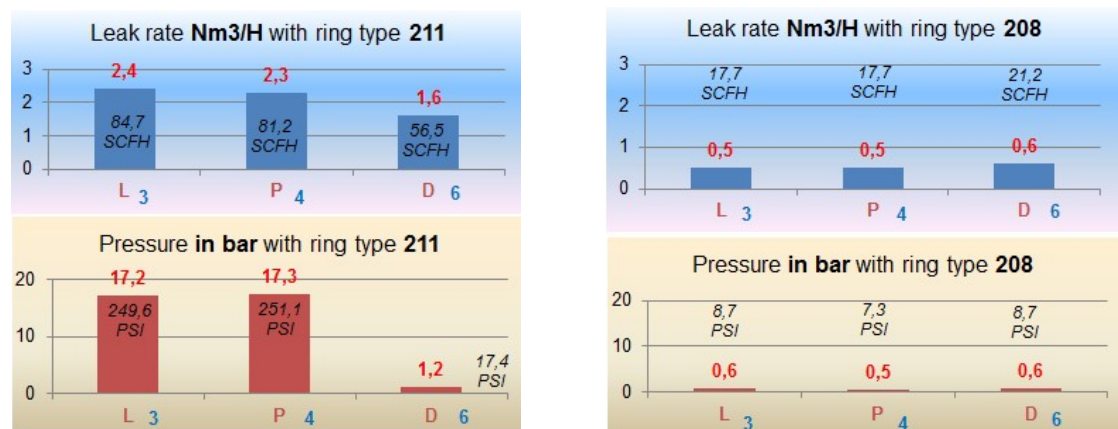
It was also observed that the piston rod temperature was reduced by 10°C (50°F) when using EMISSIONGUARD™ TR² rings compared to conventional radial/tangent ring pairs. This is the result of reduced friction due to the gas radial load being shared between the inner and outer ring of the EMISSIONGUARD™ TR². The infrared images below illustrate the differences observed.

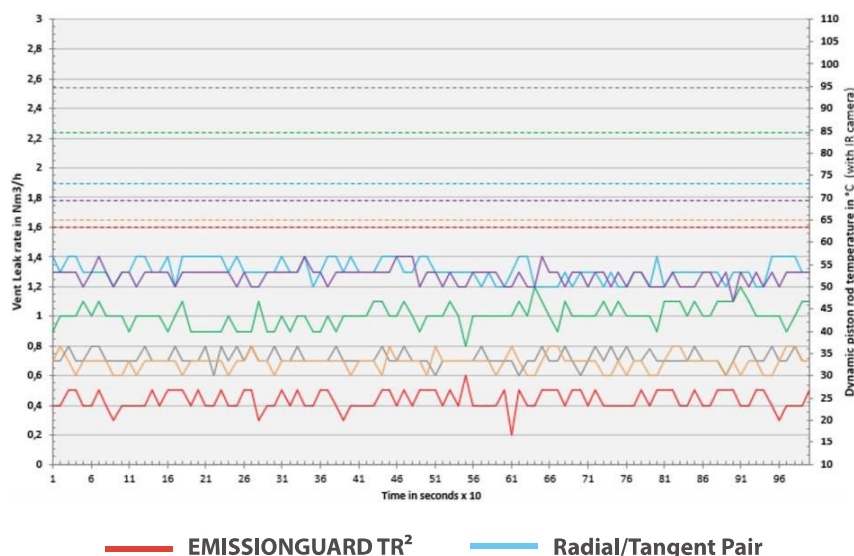


The behaviour of reciprocating compressor piston rod packing was tested by DST Raubenheimer, Shell Research limited, Thornton Research Center, UK (1989).

The study conducted by Shell Research was reproduced as part of this work by analysing pressures and leak rates after individual cups throughout the packing case. This confirmed the previous radial/tangent theories and tests where the suction pressure is sealed by the last pair of rings and the discharge pressure by the first ring pairs. The EMISSIONGUARD™ TR² rings behaved differently where both suction and discharge pressure are sealed by the first ring.

This proves that the EMISSIONGUARD™ TR² rings form a much more efficient seal due to the combination of the two rings styles working together to eliminate the leakage paths that exist around radial/tangent rings.





A selection of packing ring styles including other low emission rings from the industry were tested on CPI's test compressor. The vent leakage and piston rod temperature results are presented above.

This testing work clearly shows CPI's EMISSIONGUARD™ TR² Rings provide the most positive seal (lowest vent leak rate), while also exhibiting the lowest rod temperature.

This is the ideal situation, as the lower the rod temperature the better it is for the longevity of the ring lifetime. Typically, the more positive the seal the higher the rod temperature.

The combination of the two tangent rings creates this unique phenomenon.

More than 70 compressors have now been equipped with EMISSIONGUARD™ TR² rings, which have demonstrated a significant increase in sealing performance, but also in running life.

Example 1: Natural gas at 70 bar, non-lube, equipped with EMISSIONGUARD™ TR² rings in CPI 192 material running for more than 2 years with a leak rate of 3 to 4 Nm³/h (1.87 to 2.49 scfm) where before it was 6 to 9 Nm³/h (3.74 to 5.61 scfm) and we have also observed a 21°C (70°F) reduction of the piston rod temperature.

Example 2: Supercritical CO₂ at 80 bar (1160 psi), non-lube equipped with EMISSIONGUARD™ TR² rings in CPI 184 material, has seen an increase in the MTBF from 1,500 hours with a leakage of more than 20 Nm³/h (12.46 scfm) to a running life of more than 4600 hours and a leakage rate measured at 2 Nm³/h (1.25 scfm).

Example 3: 2 stage Hydrogen compressor with final discharge pressure of 122 bar (1769 psi)

Leakage with standard packing rings = 12 to 20 Nm³/h (7.48 to 12.46 SCFM)

Leakage after installing TR² Rings = 5 Nm³/h (3.12 SCFM)

Example 4: Single stage Hydrogen compressor with final discharge pressure of 10 Bar (145 psi)

Leakage with standard packing rings = 10 Nm³/h (6.23 SCFM)

Leakage after installing TR² Rings = 0.1 Nm³/h (0.06 SCFM)

GENERAL APPLICATION GUIDELINES

1. Critical applications where packing vent leakage from existing standard packing styles is considered a problem. The unique step tangent and tangent to the rod design provides better sealing as compared to standard packing.
2. Non-lube applications where the wear life from existing standard packing styles has been maximized but where customers want longer run times. The unique overlapping tangent to the rod ring allows the step tangent ring to have significantly larger gaps for more wear allowance.
3. Applications where the generation of heat creates problems with wear and chemical reactions within the gas. The shared loading between both tangent rings reduces the temperature at the surface of the rod.
4. Applications where the packing case overall length is a restriction. The narrower TR² rings can reduce the groove depth and allow flexibility with the groove and case design.

SPECIFIC COMPRESSOR TARGET APPLICATIONS

- Natural gas - where local vent emissions regulations are strict
- Chemical/Refinery gas - where local vent emissions regulations are strict
- Ethylene (non-lube) - where current packing wear life is short and heavy dust due to frictional temperature is an issue.
- Carbon Monoxide (non-lube) - where current packing wear life is short and carbon dust due to frictional temperature is an issue.
- Carbon Dioxide (non-lube) - where current packing wear life is short



CPI, part of the Howden group, is an industry-leading manufacturer of precision engineered components for reciprocating compressors used in petrochemical, refining, natural gas, and offshore industries. The CPI product range includes packing, piston and rider rings and a complete line of compressor valves designed to provide each customer with maximum performance and reliability for their application. In addition, CPI offers the highest quality lubrication system technology for further compressor efficiency and protection.

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