

Comparison of Hydrogen and Helium Leak Test Results

The leakage performance of gaskets under different conditions provides useful information and aids evaluation of the performance of different filler materials.

In this preliminary report, we look at a comparison of EN13555 leakage results from tests performed with both hydrogen and helium. In the gasket industry, helium is widely used as test gas to evaluate leakage performance because it is a very “searching” gas therefore can highlight very low leakage levels; it is inert so does not pose a risk in the laboratory; and can be detected using mass spectrometry so accurate results can be reported. However, testing with hydrogen provided very useful data to compare to.

This report looks at spiral wound gaskets (SWG) with three different filler materials:

1. Flexible Graphite SEL+
2. Thermiculite® 835
3. Corriculite® 235

Each 4” #300 CGI gasket comprised:

- 316L stainless steel inner ring
- carbon steel outer ring
- 316L winding material

The hydrogen testing was completed by an external third party according to the EN13555 leak procedure, which consists of loading and unloading the gasket in a cyclic manner with measurement of the leak rate at several specific gasket stress levels. The gaskets were tested at room temperature with 40 bar hydrogen.

The third-party hydrogen test results were compared to historical helium test results. The historical helium testing was completed at Flexitallic using the same specification of gaskets and following the same EN13555 procedure on equivalent test rigs.

Results

The results for hydrogen and helium are shown in graphical form on the next page. These graphics show that, above the minimum seating stress of 69MPa, the measured leakage rate with hydrogen and helium are similar. These results suggest testing gasket leakage with helium will provide results that are consistent with testing with hydrogen. This testing was completed on different test rigs with different gasket batches, so it is recommended to only compare the order of magnitude for the leakage rates not the specific leakage values.

Conclusions

When comparing leakage rates, helium and hydrogen generate results with very similar orders of magnitude. As such helium test data can be inferred to provide similar results to hydrogen.

These experiments also concluded that when tested with either He or H₂, spiral wound gaskets with Thermiculite® and Corriculite® perform better than those with graphite filler showing a leak rate of approximately one order of magnitude lower at the maximum measured gasket stress of 160 MPa. At the minimum seating stress this gap increases to between two and three orders of magnitude. i.e. x100 to x1000 times tighter.

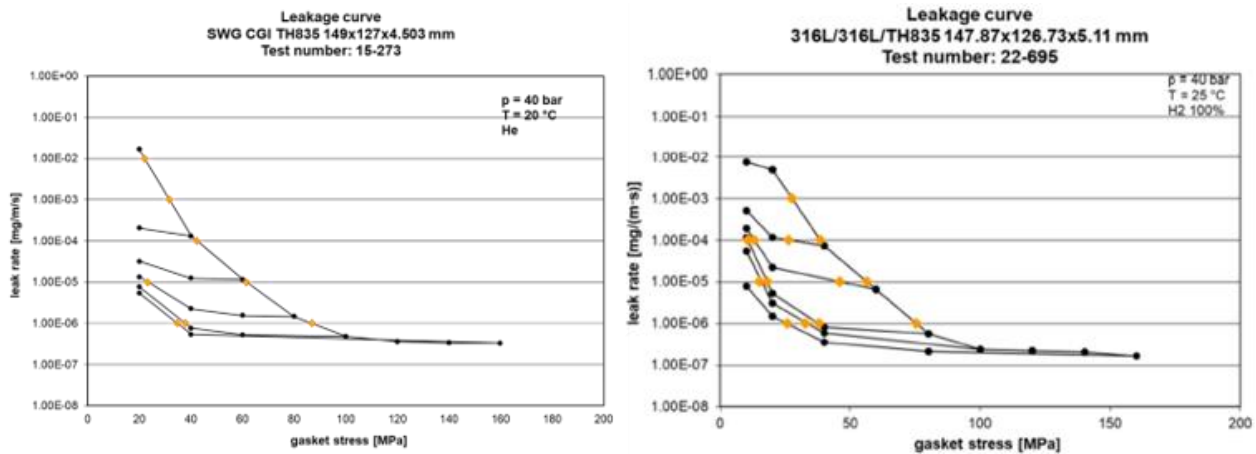


Figure 1 Thermiculite® Leakage results (Left- He, Right - H₂)

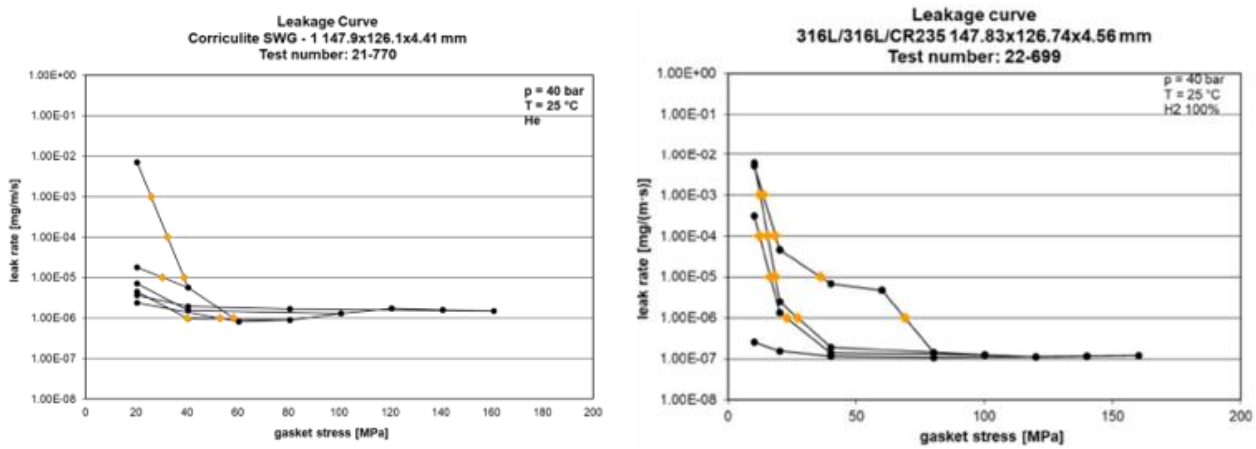


Figure 2 Corriculite® Leakage results (Left- He, Right - H₂)

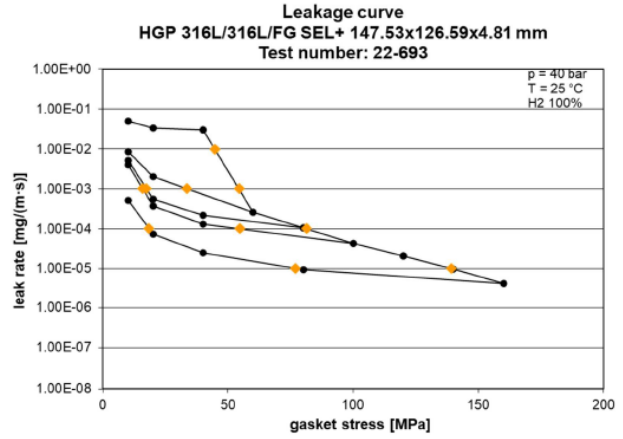
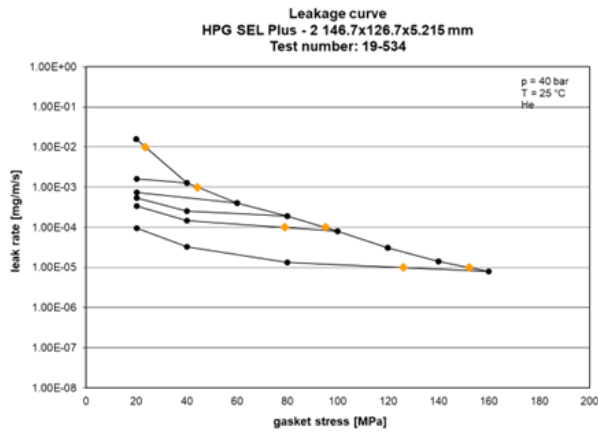


Figure 3 Graphite SEL+ Leakage results (Left - He, Right - H₂)