Tip of the month/No. 9

Using built-in rotary vane pumps

Question:
I am operating a rotary vane pump in an analytical instrument. The heat dissipation of the rotary vane pump leads to a drift of the measurement signal. In addition, the pump compartment is often contaminated with oil. What could be improved here?

Answer:
The differences between individual rotary vane pumps are often perceived as very small. In terms of final pressure and pumping speed, this may be broadly true between individual series; however, there are significant differences with rotary vane pumps and accessories in terms of thermal performance and leakage. The correct selection of pump and accessories can offer significant improvements.

Background:
Pumps built into analytical instruments allow the measuring setup to have compact dimensions. However, the operating environments of rotary vane pumps in the interior of an analyzer often mean limited venting and difficult access to the pump compartment. Heat emitted by the pump may lead to the instability of electronic components, as it has in your case.

Pump compartments generally have cooling slits. The distance recommended by the manufacturer between the wall and analyzer must always be maintained for optimal cooling.

Temperature problems are minimized by the use of a rotary vane pump designed for relatively cold operation. When designing a rotary vane pump, the developer may design the product for best possible water vapor tolerance. This means high temperatures in the pump. However, what is good for the pump's water vapor tolerance is counter-productive for oil back-diffusion and low heat dissipation. Find general information on operating rotary vane pumps in our Tip No. 4.

In this case, we would recommend using a new DuoLine series pump (DUO 1.6, DUO 3, DUO 6 or DUO 11). The air circulation through the entire pump is significantly improved in this series with an optimized motor flange design and improved device base. Together with additional cooling fins on the pump's oil reservoir, this results in a reduction in the surface temperature of 7 K in the case of the DUO 3 and of 16 K in fact with the DUO 1.6 compared to their previous versions.

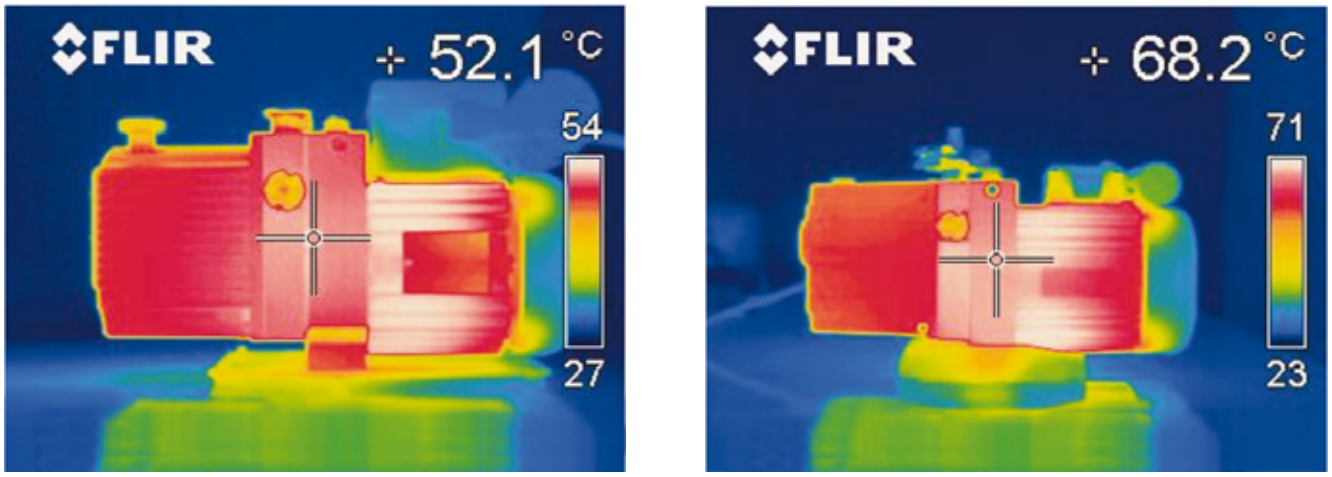

Fig.: Thermal image of the DUO 1.6 in comparison to the previous version DUO 1.3

The motor outputs for the DUO 1.6 are only 75 W and are 150 W for the DUO 3. With these outputs, in comparison to previous versions and other modules, significantly less electrical power loss is converted into heat and the entire instrument remains more thermally stable.

The oil in the compartment may have several causes. It may be due to oil discharge from the rotary vane pump outlet. We assume that an oil mist filter has been installed. Oil mist filters with an integrated oil return system prevent insufficient lubrication for a significant length of time and extend the service life of the entire system. Especially in the case of built-in rotary vane pumps where the oil sight glass on the rotary vane pump cannot be readily seen, installing an oil mist filter with an integrated oil return system is recommended for dry processes. However, this does not release the operator from the obligation to carry out regular oil level checks and inspections of the filter element in the oil mist filter.

Oil accumulation may also be caused by leaks in the pump. Many current rotary vane pumps still use compressed cork seals on the oil reservoir. Instead, we recommend rotary vane pumps with guided O-ring seals. Another potential leak site is the shaft seal between the pump motor and suction chamber. A defective shaft seal is the most frequent cause of an oil leak from a rotary vane pump. For example, the shaft seal can be attacked by particles and crushed. Particles are not only introduced into the pump by processes but can also be generated inside the pump. There may be play between couplings joining individual pumping stages resulting in attrition. Particles generated in this way can then settle on the shaft or shaft sleeve and crush or wear down the seal. Operating the pump at low temperatures also results in reduced hardening of the shaft seal. The low operating temperature of the new DuoLine pumps and the fact that they no longer use coupling stages results in a longer service life for the shaft seal and longer maintenance intervals.

Shaft seals can be avoided at the design stage by using magnetic couplings. Rotary vane pumps such as those in the DUO M series do not have rotating shafts leading out of the pump block, and so provide the best possible long-term leak-tightness at this point.

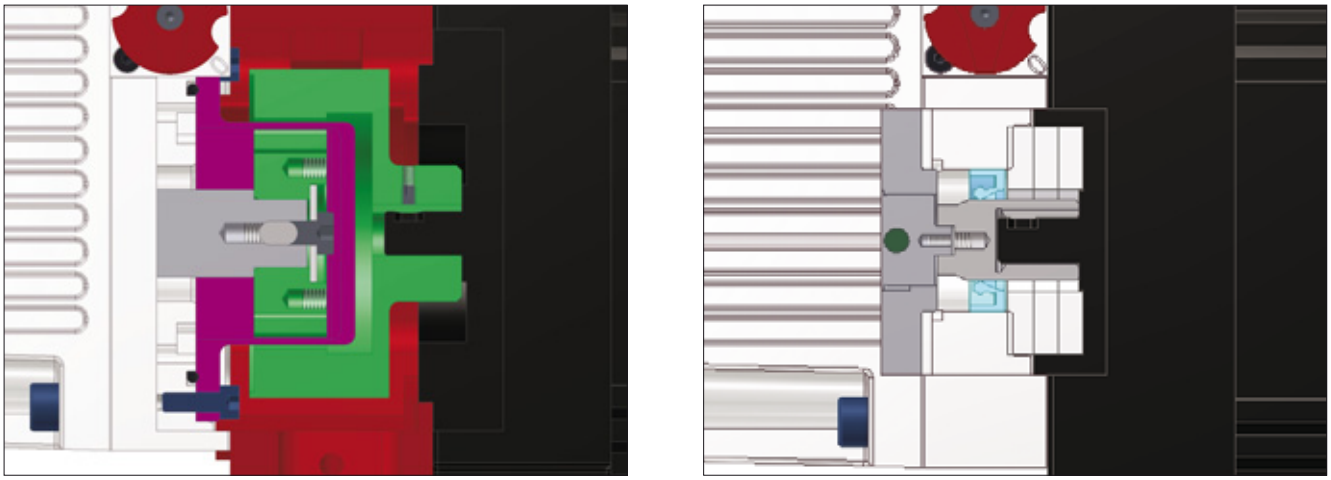

Fig.: Magnetic coupling compared to the use of a shaft seal

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