

Case Study

Sealless Technology Increases Uptime and Reduces Emissions for Carbon Dioxide Recovery Plant

To increase uptime and ensure the highest level of health and safety, a technology driven Oil and Gas Company in North America has recently invested in state of the art 'sealless' multi-stage magnet drive pumps which comply with American Petroleum Institute (API) standards and feature several revolutionary new technologies.

Background

The carbon dioxide recovery plant in Oklahoma uses the Ryan-Holmes Process for high efficiency extraction of Natural Gas Liquids (NGL) from a carbon dioxide stream.

Prior to the upgrade, the process used two in-line vertical pumps to achieve the required head with a further duty standby unit. All three pumps were fitted with dual mechanical seals and located at the base of the Propane Recovery Column (PRC).

At the pump inlet, the process liquid is high temperature and near its bubble point, resulting in frequent mechanical seal failures with associated costs, downtime and emissions. The Senior Process Engineer on site identified this as an opportunity for improvement.



3 Stage 3x2x10 Pump

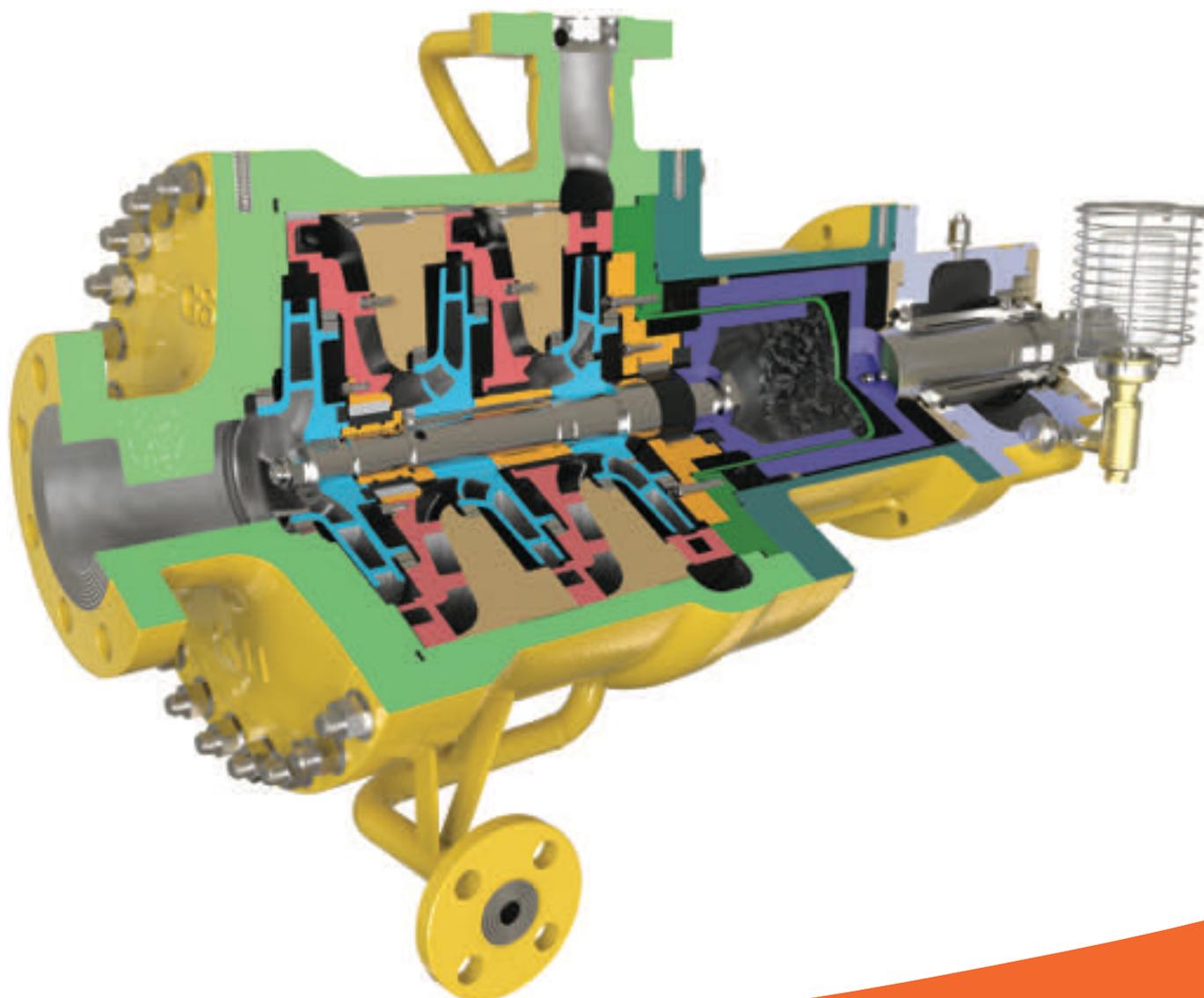
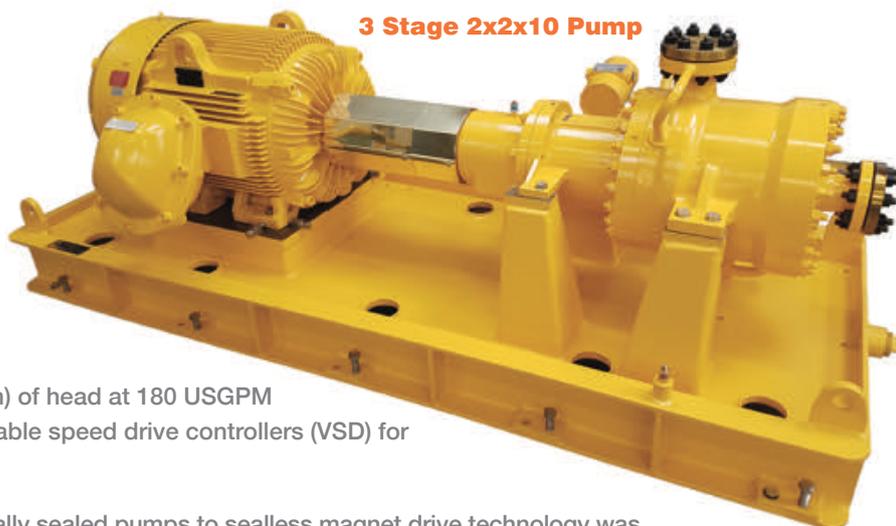
Multi-Stage Sealless Design

The dual in-line, vertical sealed pumps fitted were replaced by a single three stage sealless magnet drive pump that fully meets the requirements of API 685. A clever process redesign re-located the pump to a lower temperature location further downstream in the PRC reflux line. The new API-685 pump is located on a reflux stream from the PRC.

The multi-stage pump produces 1200ft (360m) of head at 180 USGPM (40m³/h) at 3500rpm and is controlled by variable speed drive controllers (VSD) for process flexibility.

The decision to switch from double mechanically sealed pumps to sealless magnet drive technology was an easy one, according to the Senior Process Engineer. He recognised the process efficiency and product lifetime cost savings of the sealless pumps, as well as the EH&S and Regulation compliance benefits from the elimination of fugitive emissions.

Whilst the plant re-design has made the pump application less troublesome, the nature of the process and light hydrocarbons means that the application is still potentially volatile. Therefore, the robustness of the new magnet drive multi-stage pump has been further improved by the selection of Sundyne HMD Kontro's innovative sealless technologies.



ZeroLoss™ Composite Containment Shells

A non-metallic containment shell was included. In a conventional magnet drive pump (MDP) the containment shell is metallic. Heat is, therefore, generated in the shell by eddy currents as the rotating magnetic flux passes through the shell. This heat reduces the margin to vapour pressure and can lead to bearing failures in process upset conditions.

By using the HMD Kontro chemically inert and very tough PEEK ZeroLoss™ composite shell, these eddy currents and the associated heat are eliminated, giving both increased margin to vapour pressure and much greater robustness in the event of a severe process upset causing a dry running event. This makes the ZeroLoss™ non-metallic shell an excellent choice for potentially volatile applications.

To further protect against process upset, the pump has been fitted with a ceramic matrix composite (CMC) thrust pad. This has an improved dry running life and provides a more benign ultimate failure mode (in severe process upset) than conventional Silicon Carbide (SiC) on SiC bearings.



VapourView® Real-Time Condition Monitoring

Another sealless technology, which has particularly delighted this customer, is the HMD Kontro VapourView® device, an award-winning, non-intrusive ultrasonic condition monitoring instrument. This provides real-time condition monitoring (visualising) inside the pump's containment shell and detects the early onset of vapour inside the pump. The vapour content is transmitted via a 4-20mA signal to the site distributed control system and provides alarm and shutdown signals.



“The ultrasonic condition monitoring instrument is proving even more useful than we thought,” commented the Senior Process Engineer. For example, he explained that, when the process is coming back on stream, the liquid entering the pump is unstable for a period of time. By having visibility of conditions inside the pump, the user can avoid premature start-up (which could damage the pump) and ensure that the pump is brought on-line as quickly as possible – maximising productivity.

Further, VapourView® has revealed issues upstream in the process. For example, the unexpected detection of vapour during ‘normal’ operating conditions was the primary indicator which allowed the user to detect a leak in an upstream heat exchanger. The plant controllers pay close attention to the VapourView® 4-20mA signal as it allows them to tune upstream processes to further improve plant efficiency and robustness.

In-line Filtration

A final robustness enhancement is the addition of an in-line strainer located in the discharge branch of the pump. This filtration system prevents the ingress of solids into the bearing system and eliminates the potential for consequential damage.

Conclusion

In conjunction with intelligent process design and local in-territory support, the HMD Kontro sealless technologies outlined above have given this customer a lower lifetime cost, lower maintenance and lower emissions solution than a mechanically sealed alternative, with the added advantage of greater operational safety, while allowing them to better understand and refine upstream processes.

As a result, the process uptime of this carbon dioxide recovery plant has been significantly increased.

For further information on HMD Kontro Sealless Pumps, please contact us on +44 1323 452000 or by email to info@hmdpumps.com.

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