Oil & gas

Flow assurance for offshore production

Metering pumps are relatively small components on a production platform but they perform a critical role. This article takes a look at how metering pumps were customized to effectively deliver chemicals to record depths, for deep offshore production in Indonesia.

Milton Roy's Primeroyal R triplex metering pumps that were specially-configured to the meet the project requirements.

Today, deep water activity throughout Asia Pacific outpaces traditional offshore activities in many parts of the world. This trend is growing in Indonesia which is accelerating offshore production to address its own domestic needs.

With a population of more than 250 million people, Indonesia is the most populous country in Southeast Asia and the fourth most populous country in the world, behind China, India and the United States. The country's total energy consumption grew by more than 40% over the last decade according to the Indonesian government.

Natural gas, which has previously accounted for just 15% of the country's energy mix, is expected to play a much larger role in the energy mix moving forward. By 2025, the government plans to reduce its reliance on oil, and double its natural gas consumption to more than 30%, to meet its domestic needs.

To meet this goal, Indonesia will need to tap its western ocean basins which are rich in resources, with fields such as Gendalo, Maha, Gandang, Gehem and Bangka containing up to four Trillion Cubic Feet (Tcf) of recoverable gas reserves.

A challenge in exploiting these energy rich basins is the presence of gas condensates which exist in many of these offshore fields, along with the presence of natural-gas hydrates; ice-like solids that form when light hydrocarbons and water mix under high pressure and low temperature. Hydrates not only restrict flow, but they can also form solid plugs that can block production and damage equipment.

"When working in deep water environments, power and performance matter."

Overcoming depth, pressure and power challenges

Preventing hydrate formation and corrosion is mitigated with the help of chemical inhibitors that are delivered continuously or intermittently by metering pumps. In order to effectively deliver these inhibitors, high pressures are required to overcome friction losses in the long piping runs required to reach the deep fields. Because many of these chemicals are toxic, an efficient delivery with minimal leakage is required.

To accommodate different operator production and structure requirements, metering pumps must be configurable through a modular design, and they must be powerful enough to deliver reliable fluid flow to the required depths efficiently to ensure hydrate inhibitors reach the wellhead with minimal leakage.

When working in deep water environments, power and performance matter. Beyond the ability to deliver chemicals thousands of feet below the ocean surface, operations also need to extend far below the seabed, where backpressure can measure five to seven times greater than the pressure on the seafloor.

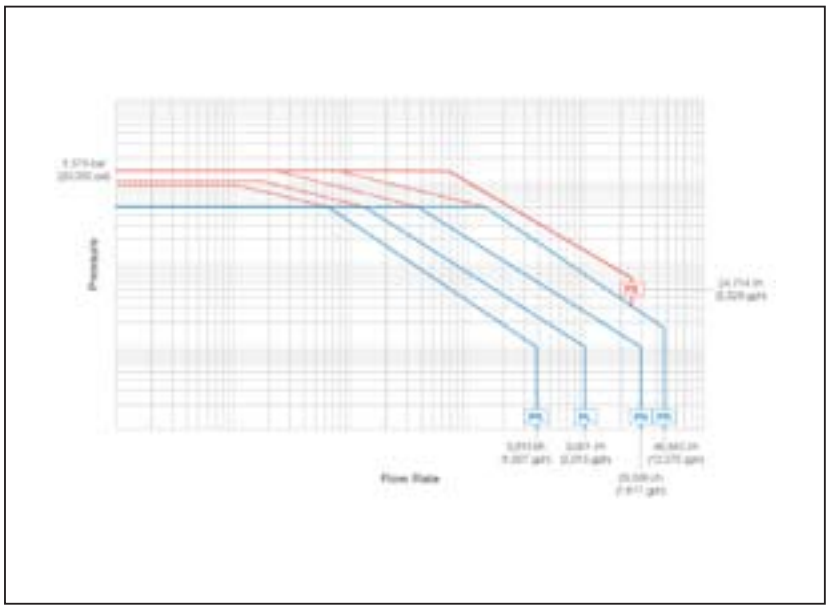
Delivering massive amounts of hydraulic power is a requirement, but it cannot be accomplished through tradeoffs in efficiency. Electrical energy is a precious commodity in offshore environments that need to autonomously produce their own electricity – so any pump deployed in these job sites must be efficient.

Although power, efficiency and flexibility are important, the one requirement that tops the list is reliability. Metering pumps are relatively small components on a production platform or floating production storage and offloading (FPSO) vessel, but they perform a critical role. If the chemicals they deliver stop flowing for any reason, the entire production can come to a halt. Because the value of a single day's production far exceeds the cost of the pump, it is easy to see why reliability is paramount.

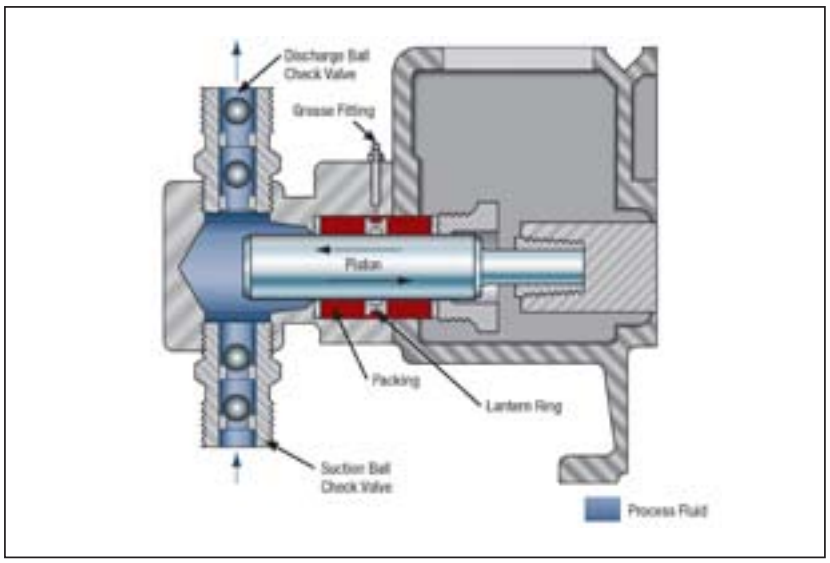
Pump design considerations and engineering

An operator offshore Indonesia was expanding their Production Sharing Contract (PSC), by adding new wells at depths of 3,200 feet – which represented one of the deepest projects ever undertaken in this part of the world. For this project, the metering pumps selected would have to be able to address pressures of 579 bar (8,397 PSI) and be able to maintain that pressure throughout the well's entire lifecycle.

In selecting the right type of metering pump, the operator considered a number of factors, starting with a modular and configurable design that could include different liquid end options. They also required variable stroke length, and adjustable flow capabilities, to be able to address the wide range of flow assurance chemicals and corrosion inhibitors required at the job site.



Performance ratings of Primeroyal Triplex Pumps.



The packed plunger liquid end offers the best performance when net-positive inlet pressure is an issue.

After a comprehensive evaluation, four sets of Milton Roy Primeroyal triplex metering pumps were selected, and an additional twenty API pumps were delivered to provide injections for corrosion/wax/scale inhibitors and demulsifiers.

A series of modifications were required to address the operator's requirements. These included the ability to accurately dose monoethylene glycol (MEG) and other corrosion inhibitors to the required depth of 3,200 feet - and they also needed the capability to withstand pressures of up to 579 bar (8,397 PSI) with flow rates up to 1,200 liters/hour.

At the customer's request, the Primeroyal pumps were fitted with Milton Roy's latest Packed Plunger NX Liquid End, which is specifically designed to reach higher pressures and higher flow rates. The packed plunger liquid end is best suited for projects where net-positive inlet pressure is an issue. With the packed plunger liquid end, the plunger comes in direct contact with the process fluid to provide efficient handling of viscous fluids. The liquid end is designed to handle temperatures as high as 315°C (600°F), with pressures up to 1,000 bar (14,504 PSI). The plunger has a field-tested track record of providing more than 20,000 hours of continuous operation with limited maintenance.

Milton Roy's engineers also made adjustments to the pump's variable eccentric drive. Because of the pump's broad turndown capabilities, the engineers were able to make a series of drive and stroke adjustments to achieve the 1,200 L/H that were required by the operator.

Technology and testing

All of the modifications and testing were completed at Milton Roy's manufacturing facility in France. Its in-house testing facility performed a number of API 675 tests, including Net Positive Suction Head (NPSH) tests, and hydrostatic tests that exceeded pressures required for the project (up to 955 bar). They also ran steady state accuracy, linearity and repeatability tests from 10 to 100% flow rates, and custom modifications were made to collect leakage from the plunger and return it to the suction line. As a result, the pumps ensure zero external leakage for up to 20,000 hours.

Conclusion

Through a long and trusted relationship with the Engineering and Procurement Contractor (EPC), Milton Roy's engineering team was able to get involved at the outset of this project. The successful delivery illustrates the value of detailed planning, a thorough understanding of project requirements, customization to create a tailored solution, and comprehensive testing to ensure that the modifications made successfully addressed the operator's requirements.

A part of the first deepwater oil and gas project in Indonesia, and with the equipment in place, the field is designed to produce 115 Million Standard Cubic Feet per Day (MMSCFD) and will be processed from a floating production unit (FPU).

The project and other gas condensate fields in Indonesia's western ocean basins will play a vital role serving Indonesia's growing domestic energy consumption needs, and companies like Milton Roy will continue to provide the innovation and the technology needed to help meet these needs. ●

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