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APPLICATION REPORT

Oil & Gas

Flow and density measurement for Managed Pressure Drilling (MPD)

- Real-time monitoring of drilling mud for automated back pressure control of the wellbore
- Straight tube Coriolis flowmeter for compact installation in the confined space of an MPD unit
- No clogging and reduced abrasion prevents unplanned maintenance and non-productive time (NPT)
- Lower OPEX and CAPEX: Cost-effective alternative to bulky bent tube Coriolis meters

1. Background

Beyond Energy Services & Technology Corp. is an innovative North American company specializing in Managed Pressure Drilling (MPD) solutions for the oil and gas industry in the US, Canada and abroad. It engineers and supplies complete MPD packages for onshore and offshore exploration companies, including rotating control devices (RCD), choke manifolds or back pressure control units with flow instrumentation.

2. Measurement requirements

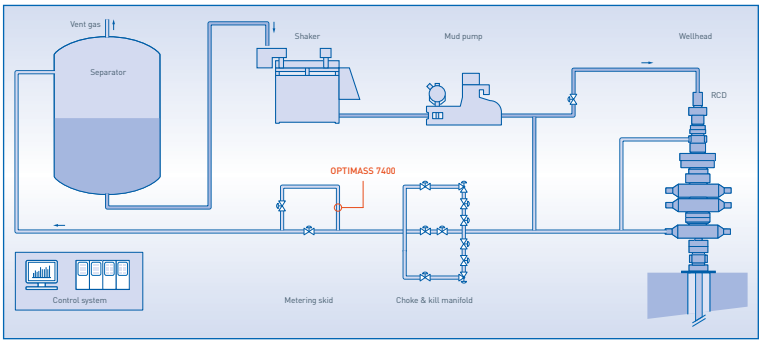
MPD is an advanced drilling process designed to enhance drilling performance and improve safety in challenging geological formations. In a closed-loop system, drilling mud is introduced into the wellbore at elevated pressures through an RCD, allowing operators to analyse the formation's response to different pressure conditions. Its main purpose is to prevent kicks (the influx of formation fluids to the surface) or the loss of drilling fluid into the formation. MPD enables more accurate bottom hole pressure (BHP) control, reducing pressure fluctuations and improving overall well stability. To achieve this, the annular pressure, which alongside the well depth has a decisive impact on the bottom hole pressure (BHP), must be precisely regulated. This pressure is continuously controlled by adjusting the return flow through the choke manifold.

Flow measurement of the returning drilling fluid is a critical control task in MPD to detect kicks early on and prevent dangerous pressure events or standstills. Coriolis meters have long been established as the preferred instrumentation for measuring mass flow and density. For one of its MPD packages, the customer required a Coriolis meter capable of handling extremely abrasive and gas-containing drilling mud. Due to space constraints in the MPD unit, a bent-tube Coriolis meter, which requires significant installation space, was not a viable option.

3. KROHNE solution

The OPTIMASS 7400 Coriolis mass flowmeter turned out to be the right flowmeter for this MPD application. Its single straight tube design is particularly suitable for the confined space in the customer's compact MPD unit. The KROHNE meter allowed for a space-saving installation thanks to its small and economical footprint. The tube design of the OPTIMASS 7400 is also well suited to measuring the abrasive, solids containing drilling mud. The risk of clogging is significantly reduced. Long-term comparisons and application experience have shown that the wear and tear of straight-tube Coriolis meters is significantly lower than that of bent-tube devices. Using the straight-tube OPTIMASS 7400 greatly reduces sensor wear and tear.

The OPTIMASS 7400 is used as both flow and density meter. Given that gas breakout can occur during the process, resulting in the drilling fluid carrying entrained gas, the Coriolis meter features Entrained Gas Management (EGM™). This allows indicating a 2-phase flow, which also helps with early kick detection while maintaining operation over the complex flow conditions in this difficult application.



Simplified MPD process scheme with Coriolis flowmeter

4. Customer benefits

The OPTIMASS 7400 plays a critical role in real-time wellbore pressure control within the automated back-pressure control system and thus contributes to safe drilling. Its seamless integration into the unit is a key advantage, requiring no modifications to the existing infrastructure. Thanks to its straight tube design, it eliminates the need for the additional space typically required by bulky bent tube Coriolis meters, allowing for flexible horizontal or vertical installation.

One of the most significant benefits of the OPTIMASS 7400 is its durability. Unlike bent tube meters, which are highly susceptible to wear and tear from abrasive drilling mud, the KROHNE meter requires significantly less maintenance. The straight tube design of the OPTIMASS 7400 greatly mitigates the impact of abrasion, which primarily occurs at the elbows of bent tube meters. This prevents NPT due to unplanned maintenance-related downtime, which can bring the entire Managed Pressure Drilling (MPD) system to a halt – an event that can be extremely costly, with MPD operating expenses reaching up to $10,000 per hour.

Additionally, the single straight tube design lowers capital expenditures (CAPEX), as the meter requires less material to manufacture, making production more cost-effective. Unlike bent tube meters, it does not require additional, costly wear protection and is readily available off the shelf. With a proven track record in handling abrasive and viscous media in the oil and gas industry, KROHNE's straight tube Coriolis meters are a trusted choice. As a global company, KROHNE operates sales offices, service teams, and manufacturing facilities worldwide, including a key location in Beverly, MA.

5. Product used

OPTIMASS 7400

- Coriolis mass flowmeter for advanced flow and density measurement
- Single straight tube design with only minimal wear even in abrasive applications
- Maintains operation over a wide range of gas fractions and complex flow conditions (EGM™)

Contact

Would you like further information about these or other applications?
Do you require technical advice for your application?
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