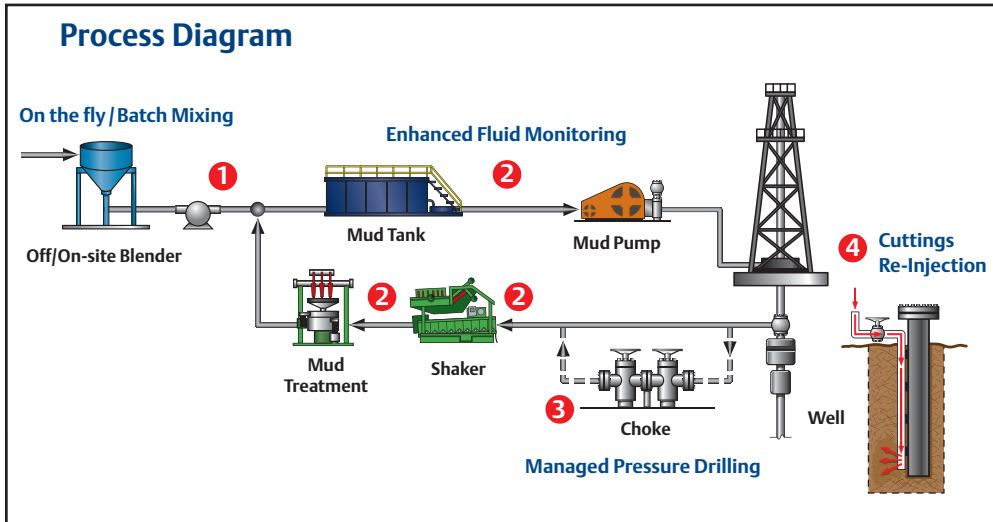


# Drilling Fluids Management



## Micro Motion Key Benefits

- Improved job safety and regulatory compliance
- Reduced exposure to hazardous materials
- Less non-productive time
- Improved job cost control
- More precise well bore pressure profile management

## Relevant Applications

- 1 On the fly / Batch Mixing
- 2 Enhanced Fluid Monitoring
- 3 Managed Pressure Drilling
- 4 Cuttings Re-Injection

## Overview

Drilling fluids management can involve a number of elements associated with blending, transportation / supply, quality management and drilling waste management. Blending, transportation and supply are dependent upon the drilling rig location. Offshore operations may be space constrained and require off-site blending followed with transporting and transferring the mud to storage facilities on the offshore platform. Where feasible, drilling fluid blending occurs on-site through either batch or on-the-fly operations.

Water, oil or synthetic based drilling fluids are blended with a wide variety of weighting materials (clay) and chemicals (surfactants, corrosion inhibitors) to achieve specific blends and fluid properties required during the drilling operation.

The appropriate quantity of drilling fluid is pumped down the drillstem and back up the annulus of a well to cool and lubricate the drill bit, flush cuttings from the bottom of the hole and counterbalance formation pressure.

Drilling fluid density is used to control the bottomhole pressure (BHP) of the well as a means to counterbalance formation pressure. Overbalanced drilling involves managing the BHP pressure gradient such that it is greater than the formation pressure. In underbalanced drilling operations maintaining the BHP at slightly less than formation pressure allows a controlled amount of formation fluids to flow into the well bore during drilling.

The challenges associated with balancing flow and hydrostatic pressure in some wells has resulted in the development of Managed Pressure Drilling (MPD) systems. MPD allows a more precise control of the bottomhole pressure. This is typically achieved through a closed, pressurizable fluid system in which drilling fluid pumps, fluid density and backpressure control on the fluid returns (choke manifold) are used to dynamically set and control the well bore pressure.

Drilling returns are prepared for recirculation through a number of intermediate treatment processes prior to returning them to the mud pit (mud tanks). This includes a shaker to remove cuttings, a desilter for fine materials, a desander for removing abrasive materials and a degasser to remove entrained gas.

One of the more common methods for drilling waste management is disposal by injection. Cuttings are milled to a size suitable for injection. Both the cuttings and drilling fluids are mixed with water, treated with chemicals to achieve desired fluid properties and injected into a disposal well.

## Customer Benefits

### Improved safety through responsible operations.



**Challenges:**

- Lost time or catastrophic accidents
- Regulatory compliance
- Exposure to hazardous materials

**Solutions:**

- Early kick detection
- Accurate volume / mass flow measurement of disposed fluids
- Non-nuclear density sensing technology

Maintaining the hydrostatic pressure in the well bore, by controlling mud density, within targeted levels is critical in managing the influx of formation fluids into the well bore. Kicks or the sudden influx of formation fluids are a significant safety hazard that can quickly lead to personal injury or rig damage. Managed Pressure Drilling systems incorporate a choke valve on the returns to further control back pressure and can include a returns flow meter for the earlier detection of influx situations.

Coriolis meters used to monitor drilling mud density provide a continuous, reliable and accurate means to control mud quality within targeted parameters. Coriolis flow technology offers accurate flow measurements over a wide turndown ratio in drilling returns and Managed Pressure Drilling applications. The ability to detect small changes in flow rate helps to provide essential data for early kick detection and control.

Drilling fluids disposal is highly regulated in relation to achieving desired blends, fluid properties and accurate accounting of the volumes disposed through injection.

Accurate volume / mass flow measurement in applications where a wide variety of fluid properties can be encountered – including slurries – ensures accurate metering of disposal volumes.

Job site exposure to hazardous materials can include a wide range of chemicals and nuclear based measurement devices for a select group of operations personnel.

Coriolis meters are non-nuclear thereby eliminating personnel exposure and the need to comply with various local, country and international regulatory agencies.

### Improved control of well bore pressure



**Challenges:**

- Managing Bottom Hole Pressure within narrow margins

**Solutions:**

- Control of drilling fluid properties within design parameters

Managing the BHP accurately and within a narrow window or margin helps to mitigate critical drilling events and contributes to improved well production. Well production is improved by minimizing the amount of drilling fluid pushed into the production formation that could later impede the flow of hydrocarbons to the well bore when the well is brought on-line.

Continuous, reliable and accurate mud density measurements with a Coriolis sensor contributes to a more precise control of Bottom Hole Pressure. This helps prevent drilling mud from entering the production zone and restricting hydrocarbon when the well is put into production. It also provides tighter control of the BHP during underbalanced operations.



Reliable operations for continuous and cost effective drilling programs.

**Challenges:**

- Non-productive time
- Job cost control

Managing the quantity and quality of drilling fluid is an essential element for improving safety, reducing mud costs, avoiding Non-Productive Time, and reaching target depth on schedule.

Measurement devices and equipment that require extensive maintenance, special logistics and handling or frequent repair / replacement can interrupt operations or increase the cost of completing a drilling program.

**Solutions:**

- Better indication of influx, lost returns or lost circulation events
- Reliable, field proven flow meters
- Lower cost of ownership associated with flow meter maintenance and replacement
- Effective management of loss returns

The sustained accuracy of Coriolis meters in slurries containing clays, sand, cuttings and entrained gas provides accurate flow measurement in injection and returns measurement. This augments the ability to detect well bore stability problems and resulting Non-Productive Time due to influx, lost circulation and plugs around the drillstring.

Flow measurement performance combined with continuous, accurate mud density measurements offers an effective means to control mud costs associated with the quantity of additives used and effective detection and management of lost circulation. Coriolis meters improve custody transfer measurements by providing accurate volume and mud quality measurements in off-site mixing applications.

The non-mechanical design and reliability of Micro Motion Coriolis flow and density meters means less failures in the field and little or no maintenance costs. As it is a non-nuclear device there are no costs associated with licensing, documentation, regulatory compliance, training and disposal of nuclear sources.

**Recommended Product Solution**

Micro Motion ELITE CMF400, CMFHC2 and CMFHC3

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