Equipment Optimizes Mud Condition

By Colter Cookson

Even the most promising drilling fluid can fail to deliver if the equipment that is designed to maintain its condition works poorly or goes down. Consequently, companies behind everything from flowline shakers to barite recovery units and vertical cuttings dryers continue to innovate. Their latest products offer greater reliability and efficiency while coming in smaller, more manageable packages.

The right equipment can turn an otherwise troublesome and costly well into a joy to drill, suggests Jeff Woolums, National Oilwell Varco mud cooling product champion. Likening mud coolers to the radiator in a Formula 1 race car, Woolums says, “The radiator can be 20 percent the weight of the car, but no one would dare race without one. Mud coolers do not have that reputation, but they are high-performance radiators for the drilling rig. In hot wells, they are easily worth the cost.”

He says NOV’s mud coolers offer several benefits. “The temperature in the topside tanks goes down, extending the lives of surface expendables such as mud pump liners, valves and blowout preventers,” he begins.

“Cooling mud improves downhole tool life as well,” he continues. “In a series of South Texas wells, the cooler dropped the temperature-related failure rate from two per well to zero, which enabled the operator to drill three days faster.

“In hot wells, to avoid paying rebuild-tool costs and keep electronics in order, operators periodically cool their wellbores by pulling off bottom and circulating for 45 minutes to an hour,” Woolums notes. “With our mud cooler, we can cut that circulation time to 10-15 minutes.”

He says mud coolers offer tremendous savings, but traditional designs, which spray water over a bundle of tubes that contain the mud, can evaporate 8,000-10,000 gallons of water a day. “That is not sustainable, so we developed a closed-loop system that cools the mud without operating water,” Woolums says.

The result is the TUNDRA™ MAX land chiller, which has two stages. “The first stage uses an air cooler to knock 20-30 degrees off the approach temperature, and the second is a chiller that cools the mud another 20-30 degrees,” Woolums describes.

“Because the chiller is doing most of the heavy lifting, in high ambient conditions such as a 105-110 degree day in the Eagle Ford, we can operate as if it was 70-80 degrees,” he says. “That allows for a much smaller footprint than a traditional air-cooled unit and cools the mud an extra four, five, six or even 10 degrees.

“The TUNDRA is easy to transport and deploy,” Woolums says. “Rather than needing several trailers, we have one, and we do not need to offload the equipment. Instead, we back the trailer up to the mud tank and connect two hoses.

“The closed-loop system eliminates the cost and logistical hassle associated with bringing water on site for the cooler,” he adds. “With the simpler logistics, we can reduce mobilization times from a couple days to less than eight hours in most cases.”

Barite Recovery Unit

To help operators reduce their capital and operating expenditures, Fluid Systems Inc. has introduced the Barkeeper™ as an alternative to the centrifuges traditionally used to recover drilling fluid barite. In testing, the Barkeeper achieved 85-95 barite recovery, reports Ben Hiltl, FSI’s president and chief executive officer.

“The Barkeeper is an extremely simple piece of equipment with no moving parts, so it is easy to maintain,” he says. “The capital cost is less than half that of an equivalent centrifuge. The volume handling capacity is several times that of a centrifuge, and it does not lose capacity as the drilling mud’s specific gravity increases.”

The Barkeeper weighs only 500 pounds, compared with 10,000 pounds for an equivalent centrifuge, Hiltl adds. Because of its light weight and compact design, he describes the unit as ideal for offshore applications, including dual den-
sity drilling.

"In dual density drilling, offshore rigs may need to drill with mud circulation rates exceeding 1,250 gallons a minute," he says. "That capacity would require scores of centrifuges. The Barkeeper’s 250 gallon-a-minute capacity means only five of them would suffice.

"We are not against centrifuges," Hiltz emphasizes. "In fact, we make them. The Barkeeper is great for barite recovery, but it cannot replace the second centrifuge that is used to remove low-gravity solids. However, it will allow companies to recover barite at a lower cost and move the centrifuges previously used for that role into low-gravity separation, doubling the size of their centrifuge fleets."

**High-G Shaker**

How effective would a shaker be at drying cuttings if it could deliver 50-gravity force rather than the industry-standard five-eighths? The answer to that question once may have been a mystery, but Hiltz says FSI is working with a mining- and manufacturing-focused shaker company to adapt a technology capable of 50 Gs to the oil field.

"We named the product MultiG because it uses swinging masses called exciters to multiply the shaker’s energy to create multiple G forces and frequencies on the shaker screens," Hiltz says. "In testing against identical shakers without exciters, going to these high Gs has enabled us to cut the oil on cuttings in half. If a machine can achieve 20 percent oil on cuttings, we can get to 10 percent.

"The tests also suggest the machines with the exciters can process 30-50 percent more mud than a regular machine," he adds.

The shakers work so well partly because the combination of multiple G forces and frequencies keeps the screens from plugging or being blinded, Hiltz says. He notes that they can be used as flowline shakers, as well as cutters dryers. "With their efficiency and processing capacity, the MultiG shakers will provide capital and operating cost savings," he concludes.

**Shaker Screen Configuration**

To increase the effectiveness and reliability of shale shakers, Elgin Separation Solutions reports it has developed a proprietary, patent-pending screen layout that addresses the largest source of screen bypass: gasket wear. According to the company, traditional shaker screen decks allow drilling fluid to continuously pass over each screen’s rear flowline gasket, causing it to weaken or loosen. As time progresses, larger volumes of coarse solids can bypass the shaker screens and enter the active mud system.

"Bypass can accelerate the weight of the drilling fluid and the point at which the operator has to either dilute or remix the fluid," says Michael Rai Anderson, Elgin Separation Solutions’ president. "It is possible to prevent gasket-related bypass by properly installing the screens and inspecting the gaskets during installation, but that does not always happen. Since gasket wear accounts for almost 90 percent of the possible path for cuttings or contamination bypass, we wanted to offer a more reliable solution."

The waterfall cascade screen layout comes standard in the company’s newest Hyper-G™ shale shakers, Anderson notes.

**Beltless Cuttings Dryer**

Anderson expresses even greater excitement about a new vertical cuttings dryer (VCD) that eliminates the belt and sheaves that traditionally are used to transmit power from the motor to the gearbox by replacing them with a direct drive system. "We had three goals in developing the dryer," he says. "First, we wanted to increase reliability. Lack of attention and maintenance to belts is one of the major causes of dryer failure.

"Second, we wanted to make the dryer easy to service," he continues. "When a technician has to change a belt or inspect the sheaves, he has to get into the unit,
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which can be difficult and risky, especially if the technician is working alone.”

Anderson says the new dryer’s greatest benefit is safety. “When it is operating, the inside of any dryer may contain a cloud of dust and oil vapor, which is a Class I, Division 2 hazard,” he warns.

“If the incorrect replacement belts are used and static electric charges are generated, or if the belts fail and undergo friction heating, they can ignite the potentially combustible cloud,” Anderson says. “Under ISO standards, belts must have anti-static properties, but over time, they lose them. If a company forgets to replace the belt or buys a generic one without anti-static properties, it risks a Class I, Division 2 hazard.”

Fortunately, safety incidents relating to combustible dust remain unheard of in the oil and gas industry, Anderson says. However, he cautions that the three ingredients necessary for an occurrence—dry and dense particulate, ignition sources, and limited ventilation—are becoming more prevalent as VCD performance continues to evolve.

“Three trends concern us,” he says. “First, as VCDs become more efficient, they generate more dust, which increases the likelihood of combustible dust. Second, we see more people ignoring belt life or buying generic replacement belts that lack anti-static properties. Finally, growing concern about dust emissions has prompted more operators to enclose VCDs, therefore enclosing the dust that is generated within them.

“Together, these trends create a hazardous environment,” he warns. “A dust explosion itself is unlikely, but we want to make sure we never put a piece of equipment in place that would be prone to creating a potentially explosive environment.”

Eliminating the safety hazard is not the only benefit to replacing the belt with a direct drive, Anderson says. “In testing, the direct drive system is 20 percent quieter,” he reports. “We also have seen a significant drop in the unit’s amperage requirements. It is drawing less power, so we are going to look at reducing the motor size to increase efficiency.”

Anderson concludes by pointing out that the direct drive offers greater torque. “These are wonderful benefits to have on top of eliminating the nuisance of replacing belts and the safety hazards that can occur if the belt is not replaced,” he says.

In-Line Viscometer

After years of using in-line viscosity meters in completion applications, service companies gradually are applying them to monitor drilling fluids, reports Steven Cicchese, general manager of process sales and marketing for Brookfield Engineering. “They are using the viscometers to calculate plastic viscosity and yield points, then are combining that data with other measurements to determine the equivalent circulating density,” he says.

“In-line meters provide several advantages over the traditional approach of having a mud engineer periodically take a sample and a reading,” Cicchese states. “The company gets the data immediately, and there is less risk of an invalid sample or an incorrect measurement. The constant measurements make it easier to spot trends and control issues.

“They also enable the operator to maintain tighter set point control on the mud, which can allow him to run the mud slightly thinner with confidence of not going too low,” Cicchese adds. “This can result in faster drilling times or easier pipe removal, if needed.”

For in-line viscosity measurement, Cicchese recommends Brookfield Engineering’s TT100, which he says is a Couette geometry viscometer, like the industry-standard bench-top units generally used to take viscosity measurements. Cicchese says the meter’s measurement zone is protected from the main flow, enabling it to provide accurate, repeatable measurements in a wide range of pressures, temperatures, viscosities, and flow and shear rates.

“The TT100 is one of the best-recognized viscosity meters in the oil and gas industry, so there are multitudes of field hands who know how to calibrate and service it,” Cicchese remarks. “Our customers tell me that despite its precision, it is simple to calibrate and maintain.”

After proving themselves in initial drilling fluid applications, the meters are transitioning from being engineered and integrated into equipment on a case-by-case basis to becoming standard, Cicchese says. He predicts their role in the oil and gas industry will continue to expand.

“Other companies are using them for cuttings reinjection, and a few are applying them to polymer flooding,” he reports. “When I look ahead a few years, I see nothing but growth for in-line viscosity meters as oil field companies seek accurate, reliable data that can improve their decision making.”

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OCTOBER 2015 101