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Shale shaker makers push advances in power, efficiency, automation

By Jerry Greenberg, contributing editor

EFFICIENT SOLIDS CONTROL equipment translates into, among other things, higher rates of penetration (ROP), reduced stuck pipe incidents and good wellbore stability. These translate into better drilling performance by the drilling contractor and savings for the operator.

Upon first glance, shale shakers and other solids control equipment appear to look the same as always. However, some equipment manufacturers have enhanced the "typical" shaker with better and more efficient screens, more powerful and lighter motors resulting in higher G forces to better clean mud, and varying levels of automation, from simple sensors to complete automation that one company claims can eliminate the human factor.

Additionally, centrifuges are becoming bigger and faster, with larger bowl sizes capable of higher horsepower and more G forces for higher mud volume drilling situations.

The following review of the latest shale shakers illustrates the type of thinking and resulting products that aid the drilling industry to work more efficiently in these days of deepwater and deep and horizontal wells.

MORE POWERFUL, MORE EFFICIENT

One trend in the solids control industry relates to centrifuges, which are increasing in size with bigger and faster models with larger and longer lift bowl sizes capable of reaching higher rpm and providing higher G forces. "This provides for a finer cut while still processing more volume," said **Chuck Peltier**, operations manager for the **Stallion Solids Control** division of **Stallion Oilfield Services**. "Additionally, variable frequency drive provides the capability to increase and decrease the centrifuge's speed for different applications."

Centrifuges are becoming larger due to bigger rigs with larger mud pit volumes. The larger centrifuges provide the capability to process more fluid with increasing circulating rates.

The variable frequency drive (VFD) does a couple of things. In the past, the centrifuge had to be stopped and the sheave changed in order to change the unit's speed. With a VFD, speed changes can be made on the fly. The VFD also provides the capability of starting the centrifuge with less amperage, using less rig power due to its soft-start capability. "A centrifuge with VFD takes less power to run than a conventional unit that starts and stops with clutch fluid," said **Tom Atkinson**, general manager of Stallion Solids Control, which typically rents its equipment rather than sell.

Stallion Oilfield Services' solids control division supplied the centrifuges on Nabors Rig 764 operating in the Barnett Shale field. New centrifuges are larger and faster to provide higher rpm and G forces for a finer cut and to process more volume.

Mr Atkinson noted that centrifuges with VFD are becoming less of an exception on rigs and are about on par with the use of conventional centrifuges (without VFD), mainly due to the number of conventional centrifuges in use. "(VFD) centrifuges raise the cost of the unit exponentially," Mr Atkinson said. "It is much more expensive to have a variable drive unit."

Shaker efficiency ratings have and will continue to improve, Mr Atkinson believes. A shaker's G force can be increased by using a larger (and heavier) motor, but the motor also is shaking; thus, increasing the G force via a heavier motor could negate any gain in G force. The answer is a lighter-weight motor that can provide a higher G force without the extra weight.

Derrick Equipment's Dual Pool series of shakers can provide 50% more performance over existing shakers in virtually the same footprint, according to the company. The Dual Pool unit uses two screens in reverse crown with the screens in compression rather than tension.

However, the VFD, especially used offshore with synthetic muds, provides the ability to make a better cut on low-gravity solids, according to Mr Peltier.

More to the cutting-edge technology in centrifuges includes the use of computer drives. "Solids control is being controlled from the drill floor in your most high-tech applications," Mr Atkinson explained. "The driller himself can effectively change the speed or direction of the centrifuge from the drill floor."

As far as shale shaker technology is concerned, G forces have been increasing during the past 10 years or so. While shakers built a decade or so ago were capable of producing about two Gs, that figure is now as high as 8-9 Gs in some cases for a linear motion shaker. A typical G force in a shaker today is around 4.5-4.7, although some shaker manufacturers offer units that reach 7-8 Gs, including some of Stallion's shakers, according to Mr Atkinson.

"High G force shakers provide the capability to run finer screens, while producing drier solids from those screens resulting in less fluid clinging to the solids," Mr Peltier said.

SHAKER, CENTRIFUGE

Derrick Equipment Company has been developing and testing its Dual Pool series shale shaker for the past 18 months and says the first units will be ready for the marketplace in first quarter 2008. The company's goal was to increase performance by 50% over its existing shakers in a similar footprint in order to simplify retrofitting into upgraded solids control systems.

"If you have more capacity and a smaller footprint, the result is far less engineering time to accommodate the extra space required for the equipment or additional space that can be utilized for other equipment such as onboard waste management equipment," said **Mitch Derrick**, president of Derrick Equipment and one of the company's principals.

Typically when a rig is upgraded, an additional mud pump is added to the system, which normally would require an additional shaker to handle the extra mud capacity. Derrick's reasoning for the Dual Pool is that if there isn't room in the shaker house for an additional unit, the contractor will need to find room elsewhere on the rig or redesign the shaker house. Or, find a shaker that fits in the same footprint and offers a 50% performance improvement that the company claims.

The Dual Pool concept utilizes two screens compared with one screen typically used in shakers, which the company refers to as fluid centering technology and which maximizes fluid throughput. The company refers to this as reverse crown with screens in compression. There have been reverse crown solutions offered in the past, Mr Derrick noted, but they utilized the screens in tension, called underslung technology.

"What we have done is lock the screens in place not in tension but in compression," Mr Derrick explained. "The tighter the screens are held down, the more efficient the energy can be transmitted to convey the solids out of the sea pond.

"We also direct the flow to the area that is most efficient for fluid processing."

Derrick's patented Pyramid screen technology, which has been available for a number of years and is utilized in its other shakers, also increases capacity due to its pyramid shape design. Depending on whether one uses the Pyramid or Pyramid Plus screen, solids removal capacity increases between 105% to 184% due to a larger screen area.

Additionally, the Dual Pool design features automated screen tensioning, electric hydraulic deck angle adjustment, actuated Posi-Lok screen compression and high G performance. The Posi-Lok system results in fast and easy screen removal and installation and provides a secure screen seal to the vibrating deck with a 2,000-lb spring force. A preset compression system eliminates guesswork by the rig crew.

An optional scalping deck features a unique design allowing for a complete view of, and access to, the lower deck for screen changes.

The company's newest centrifuge, DE7200 provides 2 ½ times the capacity of the company's previous centrifuge model and includes variable frequency drive to provide the ability to increase or decrease the speed for different applications.

"Rather than install two or three centrifuges," Mr Derrick said, "we can do the same target with one unit. We decreased the weight and the footprint of the total package that is installed on the rig."

AUTOMATION STEP CHANGE

NOV Brandt developed a new shaker dubbed King Cobra II, a step change in automation technology, according to **Mark Crabbe**, global product line manager, shakers and screens, for NOV Brandt. "The King Cobra II allows a person to do a better job by letting the machine adjust itself," Mr Crabbe said. "It frees up the shaker-hand to use his time more effectively elsewhere and not be tied to the shakers."

The shaker adjusts its deck angle to produce an optimum fluid end point. The unit has an automated on-demand G force boost that temporarily increases the G force in order to handle more flow. The unit can also switch from linear motion to elliptical motion at the flip of a switch, to adjust for different formation types to improve cuttings transport.

NOV Brandt benefited from another NOV company's success with a small Single Board Computer (SBC) used in pipe-rackers, top drives and automated driller chairs. The SBC makes decisions using a custom control algorithm and feedback from ultrasonic sensors on the shaker, according to Mr Crabbe.

The operator calibrates the system to operate at the desired fluid end point. If the feed flow rate decreases, the shaker adjusts itself to a lower inclination to return the fluid end point to the desired position. If the feed flow rate increases, the shaker adjusts itself to a steeper inclination to again return the fluid end point to the desired position. In cases where extremely high flow or solids loading causes the shaker to adjust itself to a fully uphill position (possibly caused by a bottoms-up condition, or a sweep), the unit will automatically increase the motor speed via a VFD to provide 21% more G force (6.1 to 7.2 G force) to prevent the loss of hole mud. Maintaining a constant fluid end point increases screen life (reducing cost) and allows the operator to screen finer (more aggressively) to achieve improved solids control efficiency.

Triflo International has developed portable single and multiple tank systems installed on trailers that are highway-legal and do not require special permits.

The unit can also be operated in manual mode, where it functions in the same manner as other shakers on the market. The default or fail-safe position for automation or mechanical issues is the positioning the deck in 3° uphill or a position least likely to lose hole mud.

The company offers the standard King Cobra and King Cobra Plus, which has a push button deck adjust rather than automated adjustment. "We expect to see the King Cobra II accepted more quickly for offshore market because the stakes are higher," Mr Crabbe explained, "but some of the aggressive land contractors have gone for it because of the automation. These land drillers have seen the value in making the shaker hand more efficient on the rig.

NOV Brandt's new King Cobra shale shaker can automatically adjust its deck angle to produce an optimum fluid end point. The unit has an automated on-demand G force boost that temporarily increases the G force in order to handle more flow.

"Operators are looking to improve mud performance and mud cost savings, while drilling contractors are justifying the premium of shaker automation by helping their hands become more effective.

"There's a great analogy between an electronic driller and an automated shaker," Mr Crabbe concluded. "With each, you narrow the gap in the disparity of talent."

ENVIRONMENTALLY FRIENDLY EQUIPMENT

Triflo International's philosophy, as far as solids separation equipment is concerned, is that equipment must be easy to set up and easy to move as wells become more expensive to drill and companies look at ways to become more cost-effective. The company has several portable solids separation systems for onshore wells. Triflo's line of shakers features capacities ranging from 150 gallons/min (gpm) to 1,040 gpm.

"We believe you have to have reduced labor costs in operating the equipment and maintaining it," said **Jerry Turk**, president of Triflo, "as well as a small footprint to reduce its environmental impact. We are trying to take what we have learned in other environmental areas and apply it to the oil field."

The company has diversified into three main markets — the oilpatch, construction and dredging — and has recently been moving toward custom equipment manufacturing.

"Everyone is building conventional mud systems," Mr Turk said. "They all look nice, but personally I am not impressed.

"We build those for our customers because that is what they are asking for (but) we are also trying to show the market that there is a better mousetrap, that you don't need to look at a mud system as tanks and solid separation equipment," he continued. "We can build a complete portable system that can clean drilling mud to whatever level you want. We can develop purification equipment that can totally clean and render the drill mud."

For example, the company developed and built a single tank system installed on a trailer that is highway-legal and does not require a permit. It can be operated by one person. This particular piece of equipment is destined for Nigeria. The system incorporates three pieces of solids control equipment that is operated via a single control panel. Oil-base drill mud and cuttings are transported from an offshore platform and run through the system, which removes the solids. The solids are then run through a thermal absorption unit where they are treated and the hydrocarbons burned off, allowing the purified solids to be added to the earth.

Triflo is building a similar complete mud system, including a mud lab for the coiled tubing market. "(The system) allows you to have mud mixing capabilities as well as mud cleaning capabilities," Mr Turk noted.

He said the company has equipment in the concept stages that do not allow mud to reach the ground and can show its customers how they can process their oil-base fluids without having to utilize an earthen pit. The company also has proven a chemical process in which hydrocarbons can be separated from oil-base mud and cuttings.

The chemical treatment process has been demonstrated to work, according to Mr Turk, and has been tested in a laboratory setting as well as with a 55-gallon drum of oil-base mud cuttings. "We were able to separate all of the hydrocarbons out of that drill mud," he said. "We should have our prototype equipment ready in another 90 days for the marketplace."

Another concept being developed by the company involves installing equipment on its mud systems that can analyze mud. The company has approached another firm that has equipment that can analyze drilling mud and benchmark its components. It can also analyze mud returns and provide the customer with a readout indicating if and which chemicals need to be added against the benchmark.

"Over time we think we can eliminate mud logging companies," Mr Turk said.