International Hydrocarbon
"Innovations in shale-shaker technology"

by Mitchell Derrick, Derrick Equipment Company

There are numerous criteria which one must consider when selecting a shale shaker for solids control. Due to recent technological innovations, shaker handling capacity and efficiency have grown such that a combination of fewer shakers with finer screens can be used to satisfy the screening needs of a drilling effort. These innovations include a higher vibrating G-force and increased available screening area due to larger shakers and/or three-dimensional (corrugated) screen technology. Such technological advancements provide dramatic reductions in mud costs and waste volumes while providing increased rates of penetration due to more efficient solids control.

Conventional shakers are operated in the 4.0 to 5.5 G-force range, but higher levels are being attained with modern day shakers. By increasing the in-line G-force on a linear motion shaker from 5 to 7 G's, for example, capacity has proven to increase by 45%. This enables a drilling effort to use fewer shakers, or to screen finer with same number shakers used in a conventional system. Field tests have shown that mud costs can be reduced by over 50% by utilizing a High G Solution. Shell recently upgraded to high G's on a deepwater semi-submersible in the Gulf of Mexico and recouped the cost within 13 hours due to a dramatic reduction in mud costs.

Another way to attain additional handling capacity is by increasing available screening area. This can be done in any combination of the following two ways:

- The machine length and/or width can be extended.
- A three-dimensional screen can be installed.

To increase available screen area, a shaker can be widened and/or lengthened. Assuming that the handling capacity of the last panel, or drying panel, is comparable, it is shown that a 50% gain in handling capacity is realized by moving from a three to four-panel machine (see figure 1). Additionally, increased differential head on the first screen panel increases the drilling mud throughput. Due to the discussed effects, tests show that performance gains of up to 70% can be attained by adding an additional screen panel.

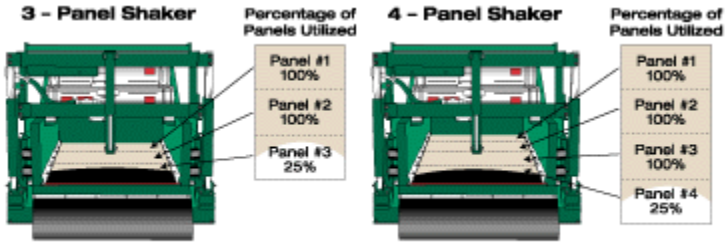

figure 1

Figure 1: Drying distance is equivalent on both three and four-panel machines. By utilizing a four-panel machine, 3 full panels will be used for mud processing verses two panels on the 3-panel machine. This equates to a 50% improvement in handling capacity.

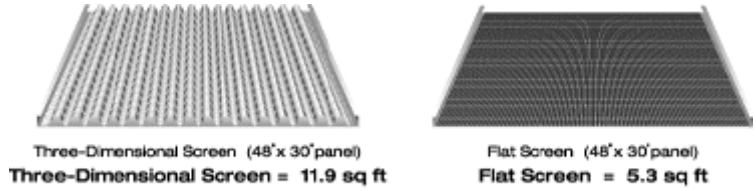

figure 2

In addition to extending the shaker length or width, additional handling capacity can be achieved with a three-dimensional screen panel (see figure 2). A standard, flat screen measuring 48"x30" will have available screening area of 5.3 square feet. The three-dimensional screen with equivalent overall dimensions will have an actual screening area of 11.9 square feet, thus providing a 125% gain in available screening area. By utilizing a full set of three-dimensional screens on a shaker, tests show that, depending on the height of the corrugations, a shaker's capacity can be improved by as much as 70%, while still retaining an equivalent cut-point to flat screens.

The data from the following field test illustrates the type of performance which can be attained by combining the improvements mentioned above. A single shale shaker with four screen panels utilizing 7.3 G's and three-dimensional screens was able to exceed previous performance standards by more than 100%. The implementation of the High G Solution allowed the rig to process over 900 gallons per minute of 9.0 lb/gal water base drilling fluid over a single shaker equipped with three dimensional DX™ 175 screens. This occurred during the intermediate section with a hole size of 14.75" and a penetration rate of 37 ft/hr. Later the same single shaker was fitted with three-dimensional DX 210 mesh screens. During this part of 14.75" intermediate hole with a penetration rate of 51 ft/hr, 7.4 gpm of drill solids were circulated to the surface by 908 gpm of 9.1 lb/gal water based drilling fluid for a total circulating rate of 915 gpm. This single four-panel shaker employing the High G Solution was able to remove 51.3% of the total drills reporting to the surface while processing the full circulating rate (915 gpm).

Improvements in drilling rates of penetration correspondingly increase mud processing demands. The solids control industry has met this challenge with a series of significant technological advances. By using extended shakers with over 7 G's of vibrating force, coupled with three-dimensional screens, today's driller can dramatically improve the effectiveness of his solids control system. In comparing a 7.3 G, four-panel machine utilizing three-dimensional screens, with a 5.2 G, three-panel machine using flat screens, tests show that there is as much as a three-fold improvement in capacity. This means that a solids control system which once required five shakers may now require only three. This translates into a shaker solution which performs more efficiently, requires less space, and costs less.