Baroid Fluid Services

DHAST℠ Dynamic High Angle Settling Test Service Analyzes Potential for Sag

The DHAST℠ Dynamic High Angle Settling Test Service developed by Halliburton's Baroid Engineering and Development Laboratory analyzes dynamic and static barite "sag" in drilling fluids. The DHAST control system provides a wide range of shear rate, temperature and pressure options to simulate downhole conditions. Since early 2003, the DHAST apparatus has been used successfully as a planning and diagnostic tool in high angle well projects. As new fluid systems emerge and drilling challenges becomes more intense, the DHAST apparatus can provide new insights into drilling fluid design, sag prevention and sag remediation.

An Essential Tool for Drilling Fluid Design and Well Planning

Barite sag, usually manifested in deviated wells, can cause severe drilling problems. Drilling problems such as excessive torque, drag and lost circulation, due to increased equivalent circulating density (ECD), can be experienced during a sag episode. Typically, mitigating barite sag is a reactionary process. When barite sag is suspected, clay and other products are added to the fluid system in an attempt to slow or stop it; sometimes successfully and sometimes not. This reactionary process can create other problems such as excessive riser viscosity and even higher ECDs.

Rheological properties, such as low shear rate viscosity, tau-0, plastic viscosity, yield point, gel strength and others, have been used as guidelines to design drilling fluids in an effort to eliminate barite sag. Recommended ranges for these properties have evolved with time. Generally, the safe ranges crept up as sag incidents continued to occur. Some of these properties are better than others at indicating sag resistance, but all fall short of being a reliable measure of sag potential. The DHAST instrument fills this void in drilling fluid equipment technology by providing an essential tool for drilling fluid design and optimization against barite sag.

The DHAST Instrument

The DHAST apparatus is a robust and user friendly computer controlled instrument. Its small footprint (LWH: 3 ft x 2 ft x 3 ft) is ideal for the laboratory. More significant than its small size is its convenient 50 cc sample volume. The DHAST instrument can provide testing capabilities to 10,000 psi and 350°F. Unlike most high pressure systems it can be assembled very easily and its self-locking closure provides an extra margin of safety.

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Inside the pressure vessel is the fluid sample assembly. The sample assembly is about 1 ft long and is supported near its center by a very low friction pivot. Also included in the sample assembly are fluid expansion compensation and isolating pistons. These pistons can allow rapid system temperature and pressure changes while maintaining system equilibrium and isolating the test fluid from the pressurization fluid. The sample assembly has a coaxial internal bob that provides shear to the test fluid. A wide range of shear rates are possible with its magnetically coupled drive.

The sample assembly is maintained at 45 degrees during testing. As barite settles in the sample assembly, the center of mass of the fluid sample will change. The weight difference causes the sample assembly to tilt slightly, much like a beam balance. The DHAST control system energizes external coils to drive the assembly back to its initial zero position. Once it is driven back, the required coil current is measured. The sag rate is calculated using the coil current, fluid density, composition, geometry, and calibration considerations.