Statoil Improves Lateral Stability in Shale Horizontal Section Using PDC Bit with Central Stinger Element

Empirically confirmed reduction in vibration resulted in fewer changeout trips and saved associated costs, Bakken Shale

CHALLENGE
Increase PDC bit stability to reduce costs of drilling long horizontal laterals in the Bakken Shale.

SOLUTION
Add a Stinger* conical diamond element to the center of a baseline six-bladed PDC bit.

RESULTS
Reduced trips and associated costs through significantly improved lateral stability and reduced vibration.

Reduce impact damage in horizontal shale well
Statoil was experiencing high levels of lateral vibration while drilling a horizontal well through the Bakken Shale in the Williston basin of North Dakota. The target formation has an unconfined compressive strength (UCS) of between 15,000 and 21,000 psi [103.4 and 144.8 MPa]; the instability generated by conventional PDC bits while penetrating the target formation was causing downhole tool failures and impact-induced cutter damage.

To reduce drilling time and costs, Statoil required a PDC bit that would remain dynamically stable to increase borehole quality and to reduce the number of trips for changing out the bit and BHA components.

Extend bit life with Stinger element
Smith Bits, a Schlumberger company, used the IDEAS* integrated drillbit design platform to configure a customized bit that included a centrally located Stinger conical diamond element. The Stinger element is manufactured from synthetic diamond material that provides improved impact strength and resistance to abrasive wear.

The element was positioned at the center of a six-bladed bit by selectively removing conventional cutters, creating a void that allows a small rock core to develop at the bit’s central axis. When the bit’s void area locks onto the rock core, stability of the entire BHA is dramatically improved, and vibration is reduced.

The bit that included a central Stinger element demonstrated a higher percentage of drilling hours at the lower levels of lateral vibration while demonstrating a lower percentage of hours at higher levels of lateral vibration.
Increase BHA stability and reduce trips
A study was conducted using actual downhole MWD and LWD data to determine if a PDC bit with a central Stinger element provides increased lateral stability compared with a conventional bit. To ensure a valid comparison, all runs were performed by Statoil on a similar steerable-motor BHA with equivalent operating parameters. After compiling the data, engineers compared lateral vibration of the baseline 6-in MDi616 bit (13 runs; 885 h) with a 6-in MDiZ616 bit that was equipped with a centrally located Stinger element (2 runs; 209 h). The analysis was conclusive and confirmed that the element-equipped MDiZ616 bit had a higher percentage of drilling hours at lower levels of lateral vibration as well as a lower percentage of hours at high vibration levels. The reduction in vibration resulted in fewer trips for bit and MLWD changeouts, reducing drilling costs.