Bit design, selection and optimisation

SPE/IADC 52878

"How to Design Tricone Bits to Drill Ultra Abrasive Quartzitic Sandstone in Horizontal Wells, Algeria"

Drilling a long horizontal section within an ultra-abrasive formation means short bit runs and high drilling costs. Despite many trials with standard technology bits in this gas reservoir in Algeria, the drilling performances were so poor that the profitability of the development project was greatly reduced. This paper describes the process to achieve the development of a specific bit design which eventually greatly improved the drilling performance in ultra abrasive sandstone formation and reduced the number of bits used.

After developing 2 different bit designs and drilling 3 wells, rate of penetration and footage more than tripled.

—A Besson, J L Rabourdin, Total SA

SPE/IADC 52879

"Dual Torque Concept Enhances PDC Bit Efficiency in Directional and Horizontal Drilling Programs"

A new concept has been developed which enhances PDC bit efficiency in directional, horizontal and extended-reach drilling (ERD) applications. The concept uses a unique cutting structure (cutter layout) to establish a dual torque response, which improves effectiveness in sliding and rotating modes.

The paper will define 3 new characteristics for the dual torque concept, namely sliding slope, rotating slope and transition WOB. It will show the relationships between them and establish the dual torque concept's effectiveness at enhancing PDC bit performance in directional, horizontal and Extended Reach Drilling (ERD) applications. Analytical, laboratory and field data will be presented to establish the dual torque concept's positive effects on drilling programs and operational costs.

—G Mensa-Wilmot, Smith Intl-Geodiamond
—I A Stephen, Mobil Producing Nigeria

SPE/IADC 52880 (ALT)

Application of Steerable Ream While Drilling Technology Dramatically Reduces Drilling Costs in Valhall Field, Norway

As part of a major oil company's objective to save rig time as well as reduce open-hole exposure time in the Valhall overburden, steerable ream while drilling technology was utilized in their deviated and horizontal wells to eliminate under-reaming thus cutting drilling costs.

The well paths required good directional control with hold ability while drilling tangent and sufficient build rates when changing inclination and direction or geosteering in the horizontal section.

This paper describes the application of steerable ream while drilling in different hole sections on several wells. Case studies will be presented from wells drilled from the Valhall platform by an offshore rig cantilevered over the wellhead. The authors will outline the reasons for utilizing SRWDs and the operational achievements of the system drilling well F-8, particularly in the 2 largest hole sections where the tool saved 10-12 days of rig time at an estimated cost saving of US$ 2 million.

—K Sigurd, Triangle Technology, et al

Tubulars II

SPE/IADC 52882

"Hardbanding and Its Role in Deepwater Drilling

Hardbanding of drill pipe tool joints and other drilling equipment has been around since the late 1930s. Originally, hardbanding was applied primarily to protect the drill pipe and other tools from premature abrasive wear. Since that time there have been numerous changes in hardbanding, but only within the last few years has new technology been introduced that allows hardbanding to protect both the casing and the drill pipe at the same time.

The proper hardbanding doubles the wear life of a drill pipe tool joint; reduces casing wear by 75%-85%; reduces downhole drag and torque up to 30%; reduces rig fuel consumption up to 10%; allows operator to use lower weight and grade of casing; and prevents environmental catastrophes.

—J G Mobley, Arnco Technology Ltd

SPE/IADC 52848

"Low Stress Level PinUp Drillstring Optimizes Drilling of 20,000 ft Slimhole Well in Southern Oklahoma"

One size larger tubulars and bottom hole assembly (BHA) tools are used in the design a Low Stress Level PinUp drillstring. Larger tubulars are stronger, in torsional and tensile yield strengths and provide a significant hydraulic advantage while larger BHA components are also stronger and provide greater stiffness for wellbore directional control. These key drillstring improvements facilitated the successful drilling of Marathon's Mitchell well.

Typically, when drilling a 5 7/8-in. hole section from under 7-in. casing a conventional drillstring would be comprised of 3 1/2-in. IF drill pipe, 3 1/2-in. IF heavy wall drill pipe and 4 1/4-in.OD drill collars. A number of limitations are imposed with this conventional drillstring design. The 3 1/2-in. IF connections are torsionally weak and prone to torsional failure (twist off) while tensile yield strength (over-pull) is limited. Due to the relatively small tubular bore size (2. 7-in. ID) in 3 1/2-in. IF drill pipe, mud flowrates, bit hydraulic horsepower (HSI) and wellbore cleaning are significantly handicapped. The conventional 4 1/4-in. OD drill collars in the BHA have a very low moment of inertia (stiffness) which frequently leads to the creation of dog legs, keyseats and spirals during the drilling process.

In comparison, the PinUp design allows the use of 4-in. FH drillpipe, 4-in. FH heavy wall drillpipe and 5 1/4-in. OD drill collars in a 5-7/8-in. hole size. The 4-in. FH drill pipe connection is 30% stronger torsionally and with a half inch (3.3 in.) larger tube ID provides a significant hydraulic advantage. Specifically, calculations from Marathon's well with a 3 1/2-in. IF drillstring showed that at a surface pressure of 3,000 psi with11.0 lb/gal mud, a maximum flow rate of 141 gallons per minute was possible which resulted in 0.39 bit HSI The 4-in. FH PinUp drillstring at 3,000 psi provided 179 gal/min flow rate (+38 gal/min) and 0. 81 bit HSI (+107%). When these hydraulic parameters were coupled with a stiffer PinUp BHA design smoother drilling, faster penetration rates and a higher quality wellbore resulted.

—R A Dudman, Pin Tec Services Inc
—C West, Marathon Oil Co
—J Hubbard, Smith Intl Inc