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Casing Wear and Stiff String Modeling Sensitivity Analysis - The Contribution of DP Pipe-Body and Tool-Joint on Casing Contact

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Abstract

Casing wear due to pipe body and tool-joint of Range 2 and Range 3 DP is compared using a stiff-string torque & drag & buckling model coupled to a 3D meshed casing wear calculation. Results are compared for multiple well profiles, either smooth or tortuous, in addition to differing pipe-body and tool-joint wear factors.

The driving force behind the study was to investigate if the benefits Range 3 DP over Range 2 DP, such as reducing the ECD during drilling as well increasing the lifespan of rotating BOPs, outweigh the potential casing wear. To accurately determine casing wear, all rotating operations must be taken into account and therefore a complete BHA run program must be detailed. The casing wear was found by determining the evolution of tool-joint and pipe body contact points along the drillstring and during all the operations using a stiff-string Torque and Drag model. Then, based on the contact force history, a linear Hall model was applied to a detailed 3D casing mesh which takes into account the differing OD's of tool-joint and pipe body. A sensitivity analysis was performed by varying the wear factors attributed to either the pipe body or tool-joint along with the tortuosity and shape of the wells.

The results of the study show that, for smooth well trajectories, a Range 3 pipe will cause reduced overall casing wear even if an increased wear factor for the additional pipe body contacts is taken into account. If a realistic tortuosity is added to the well trajectory, the contact forces are much higher. For Range 3 drill pipe, the number of pipe body contact points increases significantly. For equal tool joint and pipe body wear factor, casing wear becomes preliminary dependent on the well shape and tortuosity. If an increased wear factor for the pipe body contacts is taken into account, Range 3 pipes will cause significantly more wear than Range 2 pipes depending on the well shape.

This paper will show the benefits of using a stiff string model, taking into account a 3D oriented casing contact, while performing casing wear calculations and which conditions the use of range 3 pipes may result in significantly increased casing wear.