This presentation is made to identify stress levels associated with the extreme loads that occur when landing very heavy casing strings in deep water wells.

SPE/IADC 105524


This paper details the development trials carried out on a multilateral system to meet the needs of drilling and completing a subsea multilateral producer in the North West Area Development (NWAD) of the Schiehallion field, about 175 km west of the Shetland Islands. The selected multilateral system consists of a hollow whipstock, which is perforated through after the completion is installed. The perforating system was not new technology but still required substantial qualification due to the unique construction of the well. The test programme culminated in a full-scale stack-up of the intelligent completion within a test well followed by the perforating and quantifying of the debris generated and captured.

SPE/IADC 104698


In deepwater and other wells, fluids trapped in casing annuli above the top of cement are heated by warm produced oil and gas, and thermal expansion can create pressures of 10,000 psi or more, which can cause the collapse of casing and tubing strings. A new mitigation method has created a water-based spacer fluid that will be used just ahead of the cement. The spacer contains 20-25% of emulsified methyl methacrylate monomer (MMA). Upon polymerization, the MMA phase shrinks by 19%, alleviating pressure from thermal expansion.

SPE/IADC 105881


Linear paraffin-based invert emulsions are frequently used as non-aqueous drilling muds offshore Brazil. Fast and non-progressive gelation is desired to prevent drilled solids sedimentation during pumps off while avoiding excessive pressure peaks when circulation is resumed. Gelation tendencies are normally higher at low temperatures typical of deepwater risers. Additionally, excessive pressures and/or difficulties to resume circulation have been observed drilling in water depths greater than 1,800 m.

The paper shows the results of an experimental study to evaluate the rheological behavior and gelation properties of non-aqueous drilling muds below 4°C and pressures up to 5,000 psi. The study aimed to quantify pressure effects on freezing temperatures and to develop representative methodologies for the evaluation of thixotropic properties of such fluids.

Technical Session 7: Bit Technology

SPE/IADC 105017


Drill bits are iteratively developed to meet performance objectives such as aggressiveness, durability, stability, steerability, etc. The transition from one iteration to the next occurs when dull bits are examined, run data is analyzed and the inferences are implemented as revisions to the bit design and/or the operating parameters. Experience shows that the efficiency of the process depends on the appropriateness and significance of the data collected.

One way to improve the significance of the data is to implement a special-purpose data acquisition system within the bit. The paper describes an effort to develop, validate and utilize a bit-based module designed to monitor accelerometer and magnetometer sensors and to record selected data.

SPE/IADC 104388


The operator has been active in the Panna Field for several years drilling a main horizontal and 2 laterals through a window milled in pre-existing 9 5/8-in. casing. Initially, the operator used RSS/MWD to geosteer the BHA to the target formation. However, previously chosen PDC bits were causing severe lateral vibrations, stick slip and BHA whirl, resulting in multiple downhole tool failures. An in-depth study revealed the BHA was exposed to severe stick slip and lateral vibrations. There were also regular
instances of BHA whirl and severe acceleration and deceleration caused by stick slip.

To enhance overall bit/BHA stability, a new style 8 1/2 in. PDC was implemented with innovative depth of cut (DOC) technology and enhanced stability features. The result was a significant reduction in stick slip, lateral vibration and BHA whirl.

**Technical Session 8: Tubulars I**

**SPE/IADC 105026**

*Catastrophic Drill String Failures Caused by Downhole Friction Heating — An Increasing Trend*  
Grady Prideco; J. Shepard, GlobalSantaFe.

Drillstring failures caused by friction heating of BHA components and drillpipe have increased dramatically over the last several years. In one failure mode, the drillpipe is heated above a critical transformation temperature accompanied by a rapid decrease in tensile strength. Subsequently, the component fails under a tension loading, well below the rated strength of the drillstring.

This paper addresses the features of a downhole heating failure, including the material attributes that can be used to identify the phenomena. Guidelines and operating practices that can be employed to minimize the occurrence of these costly and potentially dangerous failures are discussed.

**SPE/IADC 105930**

*Special Issues in the Stress Analysis of Casing Strings in Steam Injection Wells — Mathematical Development and Design*  

The design and development of steam injection wells is a mature subject. Since the strings in these wells invariably experience inelastic loading, issues such as the effects of temperature on the static and cyclic material properties become important. Due to the high temperatures involved, miscellaneous issues such as wellhead loading and particle breakage. Data on the cyclic thermal properties of OCTG steels is rare in oil field literature.

This paper presents a comprehensive mathematical model of casing strings subjected to thermal loads in steam injection wells. The model includes the effects of temperature on material properties and the effects of wellbore curvature and pre-stress during the heating cycle. Several counter-intuitive aspects of the casing stress state during topping, unloading are examined by an analytical model and finite element analyses. Test data and the mathematical model are used to determine the stressors in the casing at different points in the life of the well via a generic example design.