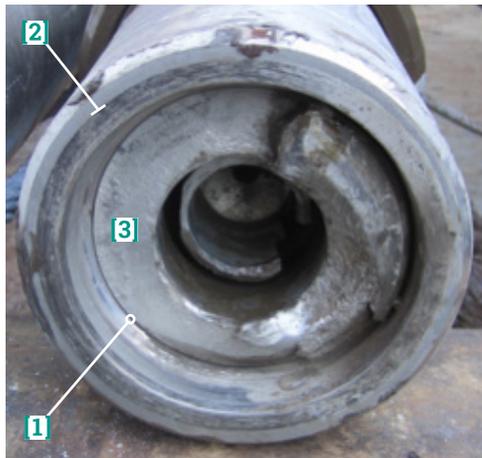


Technical Bulletin

BHA pin connection failure



Background

This pin/pin crossover was in a rotary steerable BHA that was Geosteering - it worked through some significant doglegs so saw high bending loads while rotating - these are the key ingredients for fatigue.

It also saw some high stick/slip, vibration and shock loads. After one of these loads, a loss of 500psi was seen which indicated a leak in the drill string. Soon after, there was a loss of transmitted data from the MWD, coupled with a loss of weight - It was correctly concluded that they had suffered a twist-off.

Primary observations

The BHA was seeing high torsional, bending and stick/slip loads (therefore significant fatigue) due to the amount of directional work being executed. The crossover sub did not have stress relief features.

The root cause of the failure was probably a high load that resulted in a 'fast fracture' (characterised by the large flat, grainy face on the left half of the failure [3]). The lack of a stress relief groove contributed to the failure and this can be demonstrated by the fact that the failure initiated at a stress raiser (thread root, see [1]). This stress raiser would not have existed had a 1" SRG been present. i.e. if the component had complied with the NS-1™ Standard.

Although they did not contribute to this failure, the miss-matched bevel diameters, evidenced by the size of the engaged seal area [2] do not comply with NS-2™ Standards and can also lead to failures.

Secondary observations from certification review

The sub was manufactured to API Spec 7 in 2009. There is no evidence in the manufacturing certs that confirm the bore of the sub was surface treated (e.g. hammer peened) - This is an optional treatment in API Spec 7 but mandatory in NS-1™. Surface treatments which provide compressive residual stresses may provide additional resistance to transgranular stress corrosion cracking & corrosion pitting. There is also a significant amount of washing in the bore [4] from fluid flowing round the internal component (In place in photo above)

Recommendations

- > Make sure Contracts reference NS Standards for Manufacture (NS-1™) and Inspection (NS-2™).
- > Seriously consider utilising 3rd party QAQC verification prior to load-out. They would have highlighted the missing SRG, the mis-matched bevels, the washed bore and the incorrect spec of manufacture.

More info:

For more information or assistance in defining appropriate requirements for tools or our equipment verification/QAQC services, contact Fearnley Procter Drill String Engineering at DShelp@fp-g.com