



OTC 18373

Evaluation of a Casing Drilling Connection Subjected to Fatigue and Combined Load Testing

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Abstract

The initial requirements for casing drilling connections included fatigue resistance, high torque capacity, and economics. As casing drilling becomes more prevalent, the wells become more critical. These wells exhibit increasing depth, higher down-hole pressure, more load cycles and elevated temperature. The performance of connectors under these conditions must be verified. Fatigue life, pressure containment and combined axial and pressure capacity are of particular interest. To accomplish this, various tests are required.³

Included are:

1. Fatigue testing to target cycles followed by high pressure capped end test.
2. Fatigue testing to failure.
3. Combined load testing.
4. Fatigue testing to target cycles followed by ISO 13679 combined load test.

This paper will detail the results to date of such a program. Current status of the 4 phases mentioned above included completion of Phase 1, partial completion of Phase 2, and a rehearsal sample for Phase 4. Significant conclusions from this effort thus far include:

1. API modified thread compound out performed anaerobic thread compounds.
2. Teflon seal rings exhibited superior pressure containing performance compared to thread compounds.
3. Static capacity can be affected by dynamic loading.
4. Seal systems, both thread compound and seal rings, may exhibit cyclical failure before mechanical failure.

5. SN data for 9 5/8 inch, .545-inch wall, 53.50 lb/ft, P-110 exhibits sufficient fatigue life to drill wells under current conditions.
6. ISO Configuration 1 resulted in the poorest fatigue performance thus far.

Introduction

The objective of this project has four distinct goals. The first was design selection. The design selection phase considered three designs:

1. DWC/C connector using API Modified thread compound.
2. DWC/C connector using Anaerobic thread Compound.
3. DWC/C-SR connector using a Teflon Seal Ring (SR) and API Modified thread compound.

The preferred design was filtered out through harmonic fatigue testing of connectors machined to nominal tolerances, with subsequent capped end testing. The designs were also ranked and a second best performer or secondary design was determined.

The second goal was to generate an SN curve for the preferred design and compare it to a limited number of samples of the second best design. This was accomplished through harmonic fatigue testing of the preferred design with limited comparison to the secondary design.

The third goal was to determine the static capacity of the preferred design. This will be accomplished through combined load testing per ISO 13679.

The final goal was to determine if the static capacity of the connectors was affected by dynamic loading. This will be accomplished by fatigue testing to a percentage of the connectors expected life, followed by subsequent combined-load testing to ISO 13679.

Statement of Theory and Definitions

The designs were compared by fatigue testing with internal pressure to targeted cycles below failure with subsequent high-pressure hydrostatic test. Those that attained more cycles while maintaining their pressure integrity determined the preferred designs. The fatigue testing was done with 100-200 psi hydrostatic internal pressure for failure indication. The bending moment applied was equivalent to a dogleg of 5 degrees/100 feet for an outer fiber and alternating stress of 10500 psi, stress range of 21000 psi, and R ratio of -1. The target was 3 million cycles. This was based on the results of a rehearsal test.