

IPTC 12256

Extending Life and Usage of CT Strings by High-Performance Spoolable Connector

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This paper was prepared for presentation at the International Petroleum Technology Conference held in Kuala Lumpur, Malaysia, 3–5 December 2008.

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Abstract

World oil demand challenges the industry to continually find new and more effective methods of hydrocarbon extraction while competition and economics further drive the need for greater efficiency. Without question, the development of coiled tubing (CT) has greatly enhanced the industry's ability to satisfy both of these dynamics, especially as horizontal drilling has become more commonplace.

Today's state-of-the-art technology has led to multi-million dollar operations, but a fundamental and significant limitation to offshore CT operations is inadequate crane capacity. Because of deck space and weight limitations, the growing size and capacity of CT reels has made it necessary to lift strings in two or more sections, creating yet another challenge: reliably rejoining the pieces without compromising the integrity of the CT.

This challenge was initially addressed through careful butt-welding with highly qualified, well-trained individuals and scrutiny. However, even when these qualifications were met, the fatigue life of a butt-weld was typically derated 35%, thereby reducing the number of sequential runs before the entire process had to be repeated. Thus, there has been a great need for a spoolable connector that can:

- Mechanically join two pieces of CT.
- Seal pressure in harsh wellbore environments.
- Maintain CT fatigue life as good as that of the parent tubing.
- Spool flushly while contouring to the reel.
- Accomplish all of the above quickly, easily, and economically using a standard CT crew.

Although the offshore application has been the driving factor, a well-designed spoolable connector with good properties can also be used:

- To join two coiled-tubing strings with different ODs.
- In remote locations with poor road and bridge condition or in need of repair (cut-n-splice, damage).

A brief synopsis of these extended applications is discussed along with details of development and testing of spoolable connector.

Introduction

Spoolable connectors for CT are rapidly becoming a must-have item for everyday operations. Initially, the convenience of joining two like-sized sections of coil had its most viable and important use realized offshore where underrated cranes had insufficient capacity to lift an entire string of CT from the boat or barge to the rig floor.

As with many products, the variety of applications expands and grows with the imagination and experience of those working with them. The CT spoolable connector follows right along with this trend as new areas and avenues have expanded the potential for this tool beyond its original intent.

Flaws previously considered fatal to the CT life may now be little more than an inconvenience as removal of the damage and splicing now becomes a much less tedious task. Highway weight limits could become only a minor delay and an additional transportation vehicle can be used by breaking the string into manageable and load legal lengths with splices routinely done on location. Tapered OD CT strings would benefit greatly from this technology with a merger of the two birthing a hybrid, spoolable transition connector.