Fatigue Qualification of UOE SAWL pipes

Rodrigo Galves De Lucca, Fabio Arroyo Moreira, Marcelo Fritz
Tenaris Confab
Pindamonhangaba, São Paulo, Brazil.

Phillipe P. Darcis
Tenaris Dalmine
Dalmine, Province of Bergamo, Italy.

Luigi Di Vito
Centro Sviluppo Materiali
Rome, Italy

ABSTRACT

The objective of the present research work is focused on evaluating the fatigue performance of UOE-SAWL, used for large diameter pipelines, risers, conductor or large OD casings. In addition, the results obtained from full-scale fatigue tests were compared with the DNV RP C203. Full scale testing was performed on two different sets of pipes and results are in compliance with the S-N curve set forth for welded pipes for 18” pipes and for welded pipes for 20” pipes.

KEY WORDS: UOE-SAWL pipes; fatigue; full-scale; risers; conductor casings;

INTRODUCTION

The demand of offshore oil & gas resources makes the exploration of demanding reserves viable, in fields which, in the past, were considered too risky or technically complex to be explored. Because of these fields, the demand for high performance pipes increased, moving towards more severe scenarios of applications meaning that offshore pipes must be able to withstand high pressure, high temperature, fatigue loading and sour environment, between other factors. Even in the current market scenario, the development of these reserves is still being evaluated and they could become a reality at any moment.

UOE-SAWL process is commonly used for manufacturing pipes of medium to large diameter, which can be used for exploration and transportation of fluids. Theses pipes can be manufactured for deep and ultra-deep water fields, as both pipelines, risers, conductor or surface large OD casings, with external diameter ranging from 14” to 48”, wall thicknesses of over 1.5” and pipe grades going up to 120ksi in yield strength.

In order to determine the applicability of UOE-SAWL pipes and explore the working window of these pipes in challenging environments presented by demanding reserves exploration, Tenaris Confab has worked in different initiatives in order to qualify UOE-SAWL line pipes for deep and ultra-deep water, sour service applications, and for sour environment applications with collapse enhancement. The main outcomes of these previous studies are presented in De Lucca (2015) and Arroyo et al (2011 and 2014), for heavy wall and high-grade UOE line pipes.

The present work intends on extending these qualifications by testing the fatigue performance of UOE-SAWL pipes by performing full scale testing, focusing on the pipe production process and variables control, testing set-up parameters and sequence, results from the full-scale test and its applicability in determining life expectancy of pipes in the field. In this way, pipes were tested to their limits as applying fatigue load typical of risers and conductor casings applications. A total of 18 full-scale fatigue tests were conducted and their results and corresponding failure analyses will be presented, with compared with S-N curve class of DNV RP C203 (2010).

Fatigue life of pipes can be affected by several factors, which include but are not limited to:

- Loading scheme (Eg. Mean stress, direction of applied stress)
- Mechanical properties (Eg. mechanical properties and their variation)
- Geometry (Eg. High-low, thickness variation, out of roundness)
- Surface condition (Eg. Weld profile, surface imperfections)

Pipes for steel catenary risers (SCR) and large OD casings are subjected to fatigue due to longitudinal stresses. Since the direction of