Use of High Strength Steel Wires for Flexible Pipe in Low Sour Service Conditions: Impact on Deep Water Applications

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ABSTRACT

Due to the recent development of deep water fields, the mechanical loads in flexible risers have been significantly increased and very high strength wires are often needed (SMUTS \( \geq \) 1200 MPa). Moreover, the development of deep water fields containing H\(_2\)S leads to consider some H\(_2\)S content during the design phase. Steel wires are not in direct contact with the conveyed fluid, but are located in the annular space which is a specific medium for corrosion less severe than the bore. The new very high strength steel presented in this paper is compatible with annulus environment containing H\(_2\)S and is very beneficial for designing deep water risers.

KEY WORDS: High Strength Steel; Flexible Pipe; H\(_2\)S; Deep Water.

INTRODUCTION

This paper presents in a first part the qualification of a new high strength carbon steel wire (SMUTS = 1200 MPa) for use in low sour service conditions typical of new deep water and ultra-deep water developments. Results of Sulphide Stress Cracking (SSC) and Hydrogen Induced Cracking (HIC) tests are presented as well as corrosion fatigue curves. In a second part, it presents how the use of these high strength wires allows to design flexible risers for water depths of 1500 meter and deeper even with H\(_2\)S in the conveyed fluid. Feasibility studies and project cases will show how larger diameter pipes and/or greater water depths are achievable while keeping the total suspended weight compatible with existing installation vessels.

FLEXIBLE PIPE ANNULUS SPECIFICITY

Flexible Pipe Presentation

Flexible pipes are composed of different unbonded layers of polymers and steels, each layer being designed to resist to specific loadings.

Other layers can be added if necessary, like anti-wear tapes between steel layers, thermal insulation layers.