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Tahiti Flowline Expansion Control System

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Abstract

The search for offshore petroleum reserves has taken the energy industry into deeper waters and deeper wells. A byproduct of deep-water discoveries is often a high-pressure, high-temperature (HPHT) reservoir. Reservoir fluids are often transported to a floating production facility (FPF) via carbon steel flowlines and risers. Pressurization and heating of flowlines that were installed empty and cold can lead to significant longitudinal expansion.

If left uncontrolled, significant expansion can often lead to excessive stresses and strains in flowlines or other system components. In some cases, uncontrolled expansion can lead to local buckling of the pipe cross-section or high stress-range (low-cycle) fatigue failure, resulting in a leak to the environment.

The Tahiti Project in the Gulf of Mexico presented a number of different flowline expansion system problems, including high pressure, high temperature, future water injection and reservoir souring, global lateral buckling and fatigue associated with a number of operating cycles, high flowline end expansions, high riser bottom tensions, and flowline walking (soil ratcheting). Additionally, the stringent design challenges of the project produced corresponding challenges in the area of welding.

This paper discusses some of the flowline expansion control techniques used on the Chevron Tahiti Project in the Gulf of Mexico. Midline expansion control via distributed buoyancy and end expansion control via a novel stab and hinge-over (patent pending) Pipeline End Termination (PLET) located on top of a suction pile are discussed, along with other expansion control topics. The welding requirements, the challenge of setting up an onshore multi-joint facility, welding strategies, and the corresponding results will also be discussed.

Project Overview

Tahiti is a joint venture development between Chevron, StatoilHydro and TOTAL E&P USA with Chevron as the designated operator. The nominal production capacity of the facilities is 125,000 BOPD with associated gas and water. The Tahiti field layout for the initial phase is shown in Figure 1. The field consists of two production drill centers, located in Green Canyon Block 596 and 640 respectively, in approximately 4,100 ft water depth. The production manifold from both drill centers is tied back to a single Floating Production Facility (FPF) in Block 641, through wet insulated flowlines and steel catenary risers (SCR). Not shown in Figure 1 are two future water injection drill centers, which will be tied back to the FPF with flexible pipe flowlines and risers.