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Albacora Leste Field—Subsea Production System Development

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Abstract

The Albacora Leste Field development plan comprises thirty horizontal wells (16 production wells and 14 injection wells) tied back to a host FPSO platform, P-50, moored at a 1,230 m water depth, through an innovative spread mooring system. Three out of the injection wells are in a piggy-back configuration. After processing, treatment and storage, the oil production is transferred to onshore terminals using shuttle tankers.

The selected artificial lift method is the continuous subsea gas lift, comprising a very simple and reliable well completion. In terms of flow assurance, design strategies and operational procedures developed for the Campos Basin are employed, to prevent wax deposition, hydrate formation and severe slugging for normal operation and during shutdown and startup.

All risers are flexible and installed in a free hanging configuration due to the field water depth, the FPSO anchoring type and the pipe internal diameters ranging from 4in to 9.13in. Environmental conditions and FPSO motions were also relevant factors for flexible risers design definitions. All flexible lines were anchored by means of torpedo piles (free fall).

This paper will describe the relevant aspects of Albacora Leste field development regarding the subsea system, artificial lift design and flow assurance issues, comprising the planning, design, qualification, manufacturing, and installation activities.

Introduction

The Albacora Leste field is located in the deep north area of the Campos Basin, offshore Brazil, approximately, 120 km off the coast, see figure 1. Water depths in this field range from 800 m to 2,000 m, and the oil densities range from 17 to 21 API degrees.

The field development comprises 30 horizontal wells (16 production wells and 14 injection wells , three of which in a piggy-back configuration), tied back to a host FPSO (Floating Production Storage and Offloading Vessel) platform, P-50, by means of flexible risers and flowlines.

Bending stiffeners and top risers accessories development and qualification represented an important and challenging success factor for the project. A new concept was developed and qualified for bending stiffeners hanging systems at bellmouth for the umbilical of the piggy-back wells. Three test benches were designed and assembled, in order to perform the long term fatigue tests for the gas export flexible riser and to validate the new concept of the stiffeners hanging systems. A fourth test bench was upgraded to re-qualify production and injection umbilicals submitted to higher laying loads.

The FPSO will be moored at a 1,230 m water depth, using the innovative Differential Compliance Anchoring System (DICAS).

The P-50 topside processing plant was designed to handle 180,000 bpd of liquid, 6,000,000 std m^3/d of gas and 40,000 m^3/d for water injection. The oil, after treatment and storage in the FPSO tank, is pumped to a DP shuttle tanker in a tandem configuration. The produced gas is then cleaned, compressed and a fraction of the total measured volume utilized as fuel for power generation, gas lift injection re-circulation, internal consumption and the remaining volume exported to onshore via platform PGP-1, in the Garoupa field, Campos Basin, see figure 2.

Artificial Lift Design

During the Design Phase, the Continuous Gas Lift and Electrical Submersible Pump (ESP) artificial lift methods were selected as potential candidates for the wells. However, at that time of the design phase, the ESP was still not available to attend the very high expected well oil flowrates and, hence, the decision of the multiphase group was to install the Continuous Gas Lift as the artificial lift method for the production wells. The gas lift design strategy approved was to eliminate the installation of any required pressure operated valves along the well tubing by adopting a very simple and reliable well completion, including a single gas lift orifice valve. A high discharge pressure gas compressor was installed topside to guarantee either continuous gas injection through