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TRELLINE™—A Cost Effective Alternative for Oil Offloading Lines (OOLs)

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Abstract

For large offshore fields in benign conditions like West Africa a common field development option is a Spread Moored Floating Production Storage & Offloading (FPSO) vessel. Their large production rate requires weekly offloading operations which, for the sake of efficiency, reliability and safety, are performed via an offloading system with a Single Point Mooring (SPM) terminal. In deepwater there were until recently two types of Oil Offloading Lines (OOLs) connecting the FPSO to the SPM: steel pipe or un-bonded flexible pipe. Now another type of OOL is available, that is cost effective. Compared to un-bonded flexible pipe that is continuous and limited in diameter (up to 18.7 inch ID), the Trelline system is made of 12 m (about 40 foot) long hoses that can be transported in stackable pallets by conventional transportation vessels instead of expensive specialised vessels. Compared to both un-bonded flexible and steel pipes, the Trelline™ system can be installed using a light installation spread instead of expensive and over-booked specialised installation vessels. The Trelline™ system enables optimization of SPM offloading systems that leads to significant overall cost reductions for deepwater and high throughput.

SBM and Trelleborg have jointly developed and qualified the Trelline™ system that, in 1Q-06, was grated the API 17K Type Approval Certificate for internal diameters ranging from 18" to 26". The Trelline™ hoses should also receive the API Monogram as from 3Q-06. This paper details the conclusion of the successful process that has led to the Trelline™ system now being fully qualified for the Deepwater Oil Offloading Line (OOL) application.

Introduction

The discovery of giant fields in deepwater off the West coast of Africa has led to a series of field development schemes (e.g. Girassol, Bonga, Kizomba A, Kizomba B, Ehra, Dalia, Agbami, Greater Plutonio, etc). The choice of surface facilities is a large spread moored FPSO with around 2 Millions bbl storage capacity, and around 200,000 bbl/day of oil production. In view of the high production level, the economical viability of such development schemes requires an offloading system capable of exporting parcels of about 1 million bbls every 5-6 days. To fulfill these requirements, with a high level of safety in marine operations the offloading system is a Single Point Mooring (SPM) Terminal that can safely berth large (up to 350 kDWT) export tankers. This is because of the fact that due to regular but un-predictable squall events, tandem offloading from a spread moored FPSO is considered too hazardous and unreliable for such a critical operation. Instead, by using an SPM, the export tankers can weathervane around the buoy during the full duration of offloading operations (1 to 2 days). As the SPM terminal is usually 1 nautical mile away from the FPSO, the Oil Offloading Lines (OOLs) need to be of the largest diameter practical to minimize the pressure drop and consequently reduce the booster pump requirement on the FPSO. In deepwater, these OOLs are hanging from both floaters (the FPSO and its SPM buoy) and until now there have been only two types: the Un-Bonded Flexible pipe or the Steel Pipe. The Trelline™ system is an alternative OOL, jointly developed by SBM and Trelleborg, that gives a significant degree of freedom (project execution flexibility) and technical advantage leading to significant overall cost reductions.

In the first part of this paper, the 3 OOL types are described and then compared. In the second part, the Trelline™ development and qualification process is described.

TRELLINE™ Offloading line Description

General

The Trelline™ is used as a deepwater offloading line in a lazy wave configuration, between an FPSO and an offloading buoy, to transfer processed crude oil from the FPSO storage tanks to the export tanker over a distance of about 2 km. The line is composed of 12 m (about 40 ft) long bonded flexible hoses, manufactured by Trelleborg, and bolted together.
Typically, the export line will have a lazy wave configuration thanks to the installation of distributed buoyancy modules along the lines (bold areas in the graph below).