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Fiber Rope Deployment System For Ultradeepwater Installations

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Abstract

The industry trend of more oil and gas exploration in deep and ultra deep water has put focus on finding faster and cheaper methods for installation and construction work at these water depths. One significant driver in this picture is the weight of the lifting line. The weight penalty of steel wire is increasing rapidly with depth, and is becoming a significant cost driver for depths beyond 2000 meters.

A solution to this is to avoid the weight penalty by using lifting line that is close to neutrally buoyant in water. Using fiber rope as substitute for steel wire for deep water installation is an attractive solution. However, several challenges with regards to suitable handling system for fiber rope must be solved.

The light weight of the fiber rope results in a major difference in load between deployment of a load and recovery of empty hook. Active heave compensation being a pre-requisite for many deep water installation tasks results in cyclic bend over sheave for the fiber rope. Further, fiber rope has lower axial stiffness than steel wire and is more sensitive to heat. To take full advantage of using fiber rope, the handling system must also be able to handle splices. Taking all these requirements into account means that a new type of handling system is required to be developed.

Since 2002 a Joint Industry Project has been working on building and demonstrating a Fiber Rope Deployment System (FRDS). The system is based upon a traction unit consisting of individually driven sheaves. A 46Te SWL prototype has been built and extensively tested. Furthermore, the system has been through a field pilot at the Ormen Lange gas field in Norway. The system has also been taken into commercial use in 2006 and is currently doing installation work at 2750 meters water depth in the Gulf of Mexico.

The major challenges of handling fiber rope have been solved and the applicability of the technology in real use in offshore environment has been demonstrated.

Introduction

With the ever increasing drive to find and deliver more oil, exploration companies are being forced to look to areas with greater water depth. Large offshore discoveries have been made in Brazil, West Africa and the Gulf of Mexico in water depths in excess of 2000 meters.

Traditionally, steel wire is used as lifting lines in offshore lifting operations. These lifting lines have limitations, particularly in deepwater, primarily due to their self weight. Thus, the size of the handling system tends to be very large, not only in size and weight, but also in terms of investment and operating cost. Utilizing high strength, low weight synthetic fiber ropes instead of steel wire for the lifting line substantially reduces the size and weight of the handling system. This will in turn provide a larger range of vessels for deepwater construction.

Comparisons between steel wire and fiber rope with regard to weight of lifting line and required working load for winch for installation of a module of 125 mT submerged weight is shown below. A factor of safety of 4 has been used both for steel wire and fiber rope.

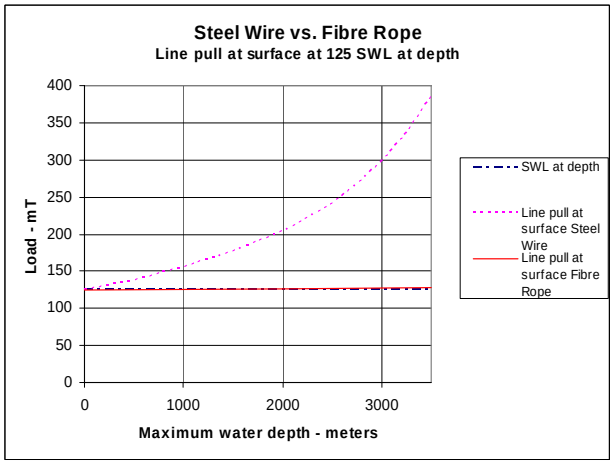

Fig. 1: Line-pull at surface.