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Installing Disconnectable Turrets and Offloading Buoys

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Abstract

Cost and time pressures on installation and field operation, and health and safety concerns are encouraging new methods of subsea connection that reduce the cost and complexity of pile and buoy installation, yet also provide on-going operational benefits. This paper reports on how installing disconnectable turrets and offloading buoys is made quicker and easier, using subsea mooring connectors based on ball and taper technology, within the primary mooring lines.

The use of FPSOs with STP (disconnectable submersible turret production) or BTL (bulk turret loading) buoys has created a demanding environment for chain and shackle installations resulting in increased time, equipment and vessel costs. Subsea mooring connectors enable installation of piles without the need to use large vessels and no requirement for diving operations, resulting in a safer operation. Mooring pile installation and mooring line installation can be carried out in different campaigns and from different vessels.

Subsea connectors reduce the number and size of tugs required to facilitate hook-up of STP and BTL buoys; tugs with minimal bollard pull are used to manoeuvre the buoy to facilitate hook-up of the last mooring lines. No diver intervention is required to carry out the subsea connections. Safety concerns that arise from making up connections on the back deck of installation vessels are avoided. Moreover, disconnectable turrets and offloading buoys can be installed later in the project cycle; and with simpler mooring line arrangements, thus avoiding damage to other structures in the field and the environment such as coral reefs, during tow out.

In a recent development, subsea connectors featuring an on-board CCTV have been used to remotely find and connect a mid water buoy, providing easy retrieval without the need to search for a floating rope, ROVs and diver intervention. The connector systems allow an operator to abandon turrets in the event of tropical storms or temporary abandonment, retrieving them later once the vessel is back on location.

The paper will also touch on the implications of subsea mooring connectors on subsea field architecture with particular reference to the more efficient installation of Mid Water Arch Buoys.

Introduction

Installing disconnectable turrets and offloading buoys has traditionally relied on chain and shackle methods of mooring. However this approach can be costly in terms of the numbers and types of vessels needed for pile installation and buoy tow-out and connection. In addition the surface connection of the chains under-tension, can pose a significant health and safety hazard.

What's needed is a mooring connection system that enables pre-installation of anchors using lighter vessels and facilitates simpler mooring arrangements, all without the use of divers. Moreover by enabling later connection of the mooring lines, tow outs can be made easier and less complex, requiring less vessels. Ideally the connection system should have on-going operational benefits such as making buoy retrieval easier for FPSOs. A solution to the problem is to use subsea mooring connectors. The connection system works on the simple principle of a ball engaged in a taper. As the male connector's balls roll up the connector's tapers, the tightness of the grip increases in direct proportion to the load applied. In the field, the tool is aligned into position and inserted;