Technology Assessment of Deepwater Pipelay Systems

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ABSTRACT

The movement of offshore oil and gas development into deepwater has required that the pipelay systems for umbilicals and rigid/flexible pipes shift from S-lay to J-lay/Reel-lay/Flex-lay and Multi-lay. Many deepwater pipelay concepts have been proposed to meet the above requirement in recent years. The five most widely known concepts are discussed in this paper to represent the entire range of concepts in terms of operational principles. The selected pipelay concepts discussed herein include pipelay methods and pipelay special equipments. The objective of this paper is to discuss the advantages and disadvantages of each pipelay system, and to offer the author’s opinions of future pipelay technology development direction and focus.

KEY WORDS: Deepwater; umbilicals; pipeline; pipelay.

INTRODUCTION

As pipelay moved into deeper water, vertically oriented integrated pipelay systems were introduced. This was a radical change of the face of the pipelay industry. The majority of these deepwater pipelay systems were delivered by a company (“company”).

In this paper different basic types of pipelay systems are shown. Most pipelay systems are according to any of these layouts. Also combinations are possible however. Especially combinations of J-lay and flex-lay, or reel lay and J-lay have been made. Also other combinations are conceivable: A few typical systems can be found in the references.

DIFFERENT TYPES OF PIPELAY SYSTEMS

S-Lay is the earliest method applied in offshore pipe laying and widely used in rigid pipe laying mode. Pipe joints are welded to the seabed over a stinger with large bending radius, which maintains pipe bending in the elastic range. The pipe is lowered and controlled by using tensioners. The main advantages of S-lay are high production rate because welding is done at multiple stations simultaneously, no plastic bending of pipe and allows laying of concrete coated pipe. The main disadvantages of S-lay are very long stinger required when laying in deep water and large vessel thrust required in deep water.

J-Lay is also used in rigid pipe laying. Pipe joints are welded in an inclined position, corresponding to the top angle of the pipe catenary to the seabed. The pipe is lowered with a traveling block engaging with collars on the pipe. The main advantages are no or smaller stinger required and no plastic bending of pipe; the main disadvantages are low production rate due to single station welding and coating, and Collars on pipes required which means high costs.

The disadvantages of J-lay can be mitigated with 2 workstation layout. This increases the layrate and it allows pipe lowering with tensioners. A much larger height of the tower is required however. Lay speed can also be increased by using longer pipe stalks. This also increases the required tower height.

Reel- Lay is used in rigid and flexible pipe laying. Large lengths of pipe are welded onshore and spooled on vertical reels on board the lay vessel. During pipelay the pipe is unspooled from the reel. Straightening of the pipe is required before it is over boarded. The main advantages are very high production rate and pipe welding onshore under controlled circumstances. The main disadvantages are dedicated spool base required for pipe preparation, pipe is bending plastically, tensioners need to move vertically to match the pipe elevation and very long stinger required when laying in deep water.

Carousel- Lay is also used in rigid and flexible pipe laying. Large lengths of pipe are welded onshore and spooled on horizontal reels on board the lay vessel. During pipelay the pipe is unspooled from the carousel. Straightening of the pipe is required before it is over boarded. The main advantages are very high production rate and pipe welding onshore under controlled circumstances. The main disadvantages are dedicated spool base required for pipe preparation, pipe is bending plastically, tensioners need to move vertically to match the pipe elevation and very long stinger required when laying in deep water.

Vertical –Lay is mainly used in Flexible pipe/Umbilicals laying. Flexible pipe is stored on reels, carousels or baskets. During pipelay the pipe is unspooled over a tower. A vertical mounted tensioner lowers the pipe to the seabed. The main advantages are pipe is not bending under tension, equipment is portable and location on stern, side or at moonpool. The main disadvantage is not suitable for rigid pipe.