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The Pencil Buoy Method—A Subsurface Transportation and Installation Method

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Abstract

The Pencil Buoy Method has been developed for transportation and installation of subsea structures. Based on the standard equipment onboard top class anchor handling vessels and tailor-made special equipment such as a slender pencil shaped buoy and a passive heave compensator, the offshore operation is performed as a winch operation instead of offshore lift through the splash zone. The tow to field operation, when the cargo is suspended from the Pencil Buoy, can be designed for a typical unrestricted summer storm. The lowering operation is a typical weather window operation similar to most other offshore lifting operations.

The first generation had cargo weight capacity of 150 tonnes, the second 250 tonnes and most recently being enhanced to 350 tonnes.

Submerged tows are exposed to a complex combination of VIV and wave action. The paper will show how the data from full scale measurements with strain gauges are used to verify computer analyses tools.

Introduction

The Pencil Buoy Method is an Aker Marine Contractors (AMC) patented subsurface transportation and installation method. By use of this method the cargo is lifted through splash zone inshore and wet towed to destination, suspended from a pencil shaped buoy. The wet tow can be designed for a typical unrestricted summer storm, while the offshore lowering operation is a typical weather window operation.

A major concern with offshore lifts is the overall dimensions of the structures to be lifted. The dimensions often limit the practical crane capacity significantly, and require a large deck for transport of the structures. These problems are avoided by use of the Pencil Buoy Method.

The method has already been used on seven projects, including a total of 17 wet tows. For the first projects a Pencil Buoy of 150 tonnes submerged capacity was used, for the later projects a newer Pencil Buoy of 250 tonnes has been used. The capacity is currently enhanced, and for future wet tows a buoy of about 350 tonnes will be available.

During wet tow of the Langede Subsea Valve Station (SSVS) done early in 2006, full scale measurements were made by use of strain gauges. The measured stresses are compared to non-linear dynamic analysis for verification.

The Pencil Buoy Method

The Pencil Buoy Method has been developed for transportation and installation of subsea structures. The structure to be installed is first transported by barge from the fabrication site to the load-out site, in order to make the wet tow distance as short as possible for best project economy.

By use of a crane barge, typically the 400 tonnes "Conlift", the structure is lifted from the transportation barge to a nearby inshore transfer location with sufficient water depth. The structure weight will then be transferred from the crane barge to an Installation Vessel (IV). The structure rigging will be connected to IV winch wire and the tubular buoyancy tank shaped as a pencil. The pencil buoy is then launched from IV deck by paying out of the towing winch while IV moves slowly forward. The structure and the rigging weight are carried by the Pencil Buoy during tow.

The Pencil Buoy is a steel structure with internal ring stiffeners. The buoy is subdivided into watertight compartments, in order to accommodate one-compartment damage. Normally a tow speed of 3 - 3.5 knots is used.

At installation site the towing wire is winched in, the structure weight is transferred from the Pencil Buoy back to the towing winch wire, and the buoy is disconnected. To ensure no contact between IV and buoy, the IV will move slowly forward during load transfer. A passive heave compensator is used during lowering of structure to seabed.

Advantages

Compared to traditional installation of subsea structures, e.g. wide templates, the Pencil Buoy Method has several advantages.

The normal situation for offshore lifts usually have risk elements related to pendulum motions in air and slamming/uplift loads during lowering through splash zone. With the Pencil Buoy Method these critical phases are