New approach to installation of offshore wind energy cables

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ABSTRACT

To reduce costs for offshore wind parks, a method to installing non-armoured MV and HV cables into PE pipes has been developed, alternative to direct installed armoured cables. Pipes are sunk by filling them with brine. After they are in safe position, the cables are installed by floating with the same brine. Surprisingly long lengths (>10 km?) can be reached. Impact test were done to prove the excellent cable protection by the pipe. Trials (shore and semi offshore) are described, also performing Intelligent Pigging. Stop-and-go tests (12 days) demonstrated the ability to install (from land?) long cables with vulcanized joints.

KEYWORDS

HV/MV cable installation; Pipe; Floating; Pushing; Water; Pressure; Pig; Intelligent Pigging; Offshore; Wind Energy.

INTRODUCTION

To reduce costs for subsea power cables in offshore wind applications, an alternative cable installation method has been developed. Instead of armoured cables, PE pipes are laid on or trenched into the seabed. The pipes are sailed out first, next their ends are brought into position at the Transition Pieces (TPs), using telescopic risers with bend restrictors, and finally sunk, simply by filling them with high salinity water (brine). The pipes, not showing a preferred torsional direction, have less risk to kink. And when damaged they can easily be repaired. Only after the pipe is safe in position, a non-armoured “land” cable (less costly, better availability) can be installed into the pipe, even offering better protection than armouring, because of the free space (well-known in telecommunications [1]).

Installation of the cables in the preinstalled pipes is done by the floating technique, using the same brine. Surprisingly long lengths can be reached: 3 km standard for energy cables, 10 km already reached with optical cables, in the future, with tuned density of cable and brine, maybe 100 km possible (for single phase cables “pipe installable” vulcanized joints can be used)? Floating installation can be done from a vessel, maybe even from shore. The compact installation equipment also allows pre-installing cable and equipment inside the TP. This system can with minor modifications be applied to other foundation types, e.g. gravity- and jacket-foundations.

In this paper the system of the non-armoured cabling in pipe is described, as well as the telescopic risers with bend restrictors to bring the pipe into position. Cable details and the vulcanized joint, which can pass through the pipe, are presented. Different techniques to install the cable in the pipe are discussed, of which floating is the most practical. Furthermore Intelligent Pigging of the pipes is treated, offering the possibility to map the pipe trajectory after the pipe is in position (before the cable is installed). The claim of better protection of the cable in the pipe is supported by impact tests performed on some (armoured and non-armoured) cables and pipes.

Trials at Lindø, DK (onshore) and Thyborøn, DK (semi-offshore) are described. In the latter trial sailing out of the pipe, functioning of the telescopic risers with bend restrictors and pipe sinking were evaluated. Different array cables (82 mm 3x300 mm^2 Alu in 125/102 mm pipe) and export cables (60 mm 1x630 mm^2 Alu in 90/80 mm pipe) were installed with lengths of about 1 km, with water push-pull and floating techniques. Vulcanized joints were tested to pass installation device and pipe. Intelligent Pigging was done to evaluate the installed pipe trajectory. Stop-and-go tests were carried out in Kalundborg, DK, during 12 days, to check whether cable in pipe installation can be started up after waiting during production of a vulcanized joint. Also thermal (cooling) behaviour is discussed. Finally, calculations have been done on what is possible with cable in pipes: installation of density tuned export cables over lengths >10 km, from land? Installation of even array cables from land, using FreeFloating?

BEND RESTRICTORS

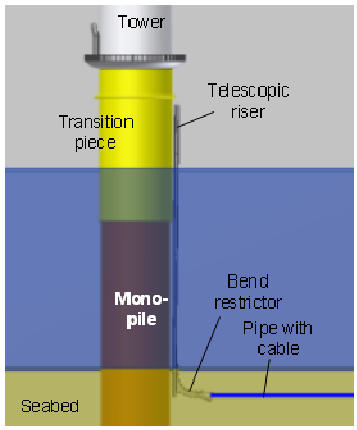

Fig. 1: Mono-pile with bend restrictor

A special telescopic riser has been developed to install pipes from the Transition Pieces (TPs), avoiding J-tubes. Specially designed bend restrictors bring the pipe into position near the feet of the mono-piles at seabed level.