Case study of onshore to offshore MV cabling under vibration conditions.

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ABSTRACT

Installation of power cables in Oil & Gas Platforms can present many kinds of challenges. These challenges stem from the constrains of installation due to limited areas and the climatic conditions that affect the laid cables, both during laying and during normal operation.

This study addresses the evaluation of the electrical characteristics of a suitable Medium Voltage cable to be installed, connecting between a fixed onshore platform and an offshore platform that is mechanically moving in axial, lateral and radial directions due to seawater tides, water currents, wind, and sea waves. The offshore unit vibration has a wide frequency spectrum which was analyzed for simulation purposes.

KEYWORDS

Cable, Medium Voltage, Onshore, Offshore, Moving, Vibration, Evaluation, Flexible cable tray, bridge.

INTRODUCTION

Power Cables are among the most critical components that ensure continuous energy supply. Recently, in the wake of increased demand, the oil-and gas industries have been increasing offshore activities, as well as the need for more power supply from shore to platforms.

Production platforms in the offshore oil and gas business have a large power demand to extract hydrocarbons from wells. Energy demands include a range of activities such as driving pumps, heating the output stream to allow separation of the oil, gas and water, powering compressors and pumps for transporting oil and gas through pipelines to processing plants or to shore, and supply of the electricity needed for on-site operations and living quarters.

The electric power for many platforms is generated from locally produced gas in steam plants or gas turbines at rather low efficiency. The power plants require precious space while their operation and maintenance staff need additional accommodation and transport. All this makes the onboard power production expensive. As the power need increases, it becomes more viable to connect the platform to onshore grids by power cables.

Fig. 01: Flexible tray [A bridge for cables connecting onshore and Offshore platforms]

The energy supply of floating platforms poses special challenges as the repeated movements, induced by wind and waves, can be detrimental to the power cables and thus require certain design considerations.

This case study focuses on evaluating a Medium Voltage Cable design that will be installed to connect a fixed onshore platform and a floating offshore platform that experiences vibrations consisting of a wide frequency spectrum (Fig.01). The vibrations were analyzed to produce a frequency spectrum that we used for our simulations. Whereas there is no provision in the IEC Standard for such installation, the cable manufacturer conducting this study was asked to prequalify a suitable cable structure that can withstand installation in these conditions without damage or affecting the cable's expected lifetime, accounting for the fact that the cables are to be installed on a flexible cable tray in continuous motion with respect to the cables.

The electrical characterization includes electrical tests such as lightning impulse testing, PD testing, AC voltage withstand test and additional bending have been evaluated.

DEVELOPMENT OF A CABLE EVALUATION TECHNIQUE

As the Cable will be connected to a floating platform that is in continuous movement due to the seawater current, waves, and winds with an average frequency of 0.3 Hz which is equal to 18 V.P.M. and to evaluate the long-term reliability of a dynamic of the cable, it was effective to perform an analysis of cable behaviour in these vibrating conditions.

TEST OBJECT AND TESTING PROCEDURE

Test Object:

A test object was developed to evaluate the effect of continuous mechanical vibration on MV Cables with a specific structure and to allow us to devise a solution that can withstand such continuous vibration through cable's entire service life without failures.
A mechanical pneumatic vibrator (Fig.02/a/b) was used to simulate the expected continuous mechanical vibration subjected to the cable.

Fig. 02/a: Pneumatic vibrator