PLET Installation in Deepwater Based on Tension Control and Length Control

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ABSTRACT
Subsea production systems have been increasingly used for deepwater and ultra-deepwater field applications. As a result there are an increasing number of fields, which are developed with a long distance flowline tie-back, which can be in excess of hundreds of kilometers, either to a host facility or directly to the onshore plant. Consequently the marine operations associated with the installation of these long distance tie-backs must be able to deal with a range of conditions from the very deep water at the subsea facilities to the shallow water at the landfall area.

In this paper, we highlight the installation issues and solutions during the PLET installation. First we discuss two ways of the possible installation options, the tension control and the length control installation methods. The FEM analysis software is adopted for the simulation of each installation sequence. Then we compare the differences of the two options based on the bending strain results obtained.

It can be concluded from this paper that the tension control and the length control method are both applicable to the installation of PLET in deepwater fields. It depend on the project and the vessel used.

KEY WORDS: PLET installation, deepwater, tension control, length control.

INTRODUCTION
The LiWan offshore gas field is the first deepwater project in southern sea of China. The depth of water in LiWan project is over 4590ft (1400m) and many technology problems which are not met in shallow water arise. The method to install the heavy PLET with flowline is one of them.

The challenges of PLET installation are (1) use only one vessel for the whole PLET installation operation, (2) the diameter and the corresponding weight of the gas export pipeline is large, (3) the PLET is not designed in detail at present and some assumptions should be made.

For the PLET installation considered in this paper, it can be divided into four stages: (1) recover the pipeline to surface, (2) tension transfer from A&R (abandon and recover) wire to the crane on the vessel and deck handling, (3) deploy PLET with pipeline through splashing zone and water column, (4) tension transfer from the crane to the A&R wire and deploy to the objective place, (5) landing the PLET with pipeline within the target box.

The pick-up process can be accomplished with two approaches: (1) offset-vessel and then take in A&R wire, (2) offset-vessel while take in A&R wire. The first approach can be described as follows:
- Offset the vessel to a given position.
- Take-in A&R wire to a given length while holding the vessel position.
- Offset the vessel again to the next position while holding the cable length.
- Repeat the above take-in A&R wire and offset-vessel processes until the pipeline pull-head reaches the surface.

The second approach can be described by the following sequences:
- Offset the vessel to a given position
- Take-in A&R wire while the vessel is in transition of offsetting its position
- Synchronize the vessel motion speed and cable take-rate to avoid overstress the SCR
- Continue the above operation until the pipeline pull-head reaches the surface

The first approach provides better control of the pipeline stress during the pick-up process. On the other hand, the second approach is relatively quicker. As along as sufficient horizontal tension is provided, the pipeline stress can be easily controlled.

In a similar way, the PLET with pipeline can be deployed reversely with the above approaches. It is noted that for the successfully landing of the PLET on the seabed, one yoke is used to make the PLET from vertical direction to horizontal direction. The first approach is used in this paper for the deployment for the better control of pipeline. The process of deploying PLET with pipeline can be control by the A&R winch tension or the A&R wire length. The author is interested in finding the difference between the tension based PLET deployment and the length based PLET deployment. Four computation cases are considered in the paper, listed as follows:
- Case 1: deploy PLET with the control of A&R wire length without consideration of environment condition.
- Case 2: deploy PLET with the control of A&R wire length with consideration of environment condition.
- Case 3: deploy PLET with the control of A&R wire tension without consideration of environment condition.
- Case 4: deploy PLET with the control of A&R wire tension with consideration of environment condition.

The environment parameters used in the simulation are:
- Water depth: 1400m
- Seawater density: 1.025te/m³
- Wave period: 5.8s

327