Mooring Analysis of Derrick/Lay Barge Lanjiang for Large Jacket Installation

Licheng Qin, Huailiang Li, Ziquan Wu, Wentai Yu, Weimei Xie, Min He
Installation Division, Offshore Oil Engineering Co., Ltd.,
Tanggu, Tianjin, China

ABSTRACT
This paper addresses the critical analysis results and how to incorporate these results into the jacket installation procedures. The findings suggested that two 25Te net buoyancy surface buoys should be added to the mooring lines No. 8 and No. 9 at the locations specified, thus providing the minimum vertical clearance between these two mooring lines and the existing subsea gas pipeline. The analysis results also indicate that the minimum tension should be applied to these mooring lines in order to maintain line clearance above the existing pipeline.

KEY WORDS: Mooring analysis; derrick barge; jacket installation; surface buoy.

NOMENCLATURE
AHTS = Anchor Handling Tow Supply
CG = Center of Gravity
CNOOC = China National Offshore Oil Corporation
DLB = Derrick/Lay Barge
EL = Elevation
LCG = Longitudinal Center of Gravity
NPD = Norwegian Petroleum Directorate
PY = Pan Yu
TCG = Transverse Center of Gravity
Te = Tonne
VCG = Vertical Center of Gravity
3-D = Three-Dimension

INTRODUCTION
The PY30-1 Gas Field is located at Liuhua Block 07 area in the basin of Pearl River Delta in South China Sea. The PY30-1 Platform is approximately 240 km South East of Hong Kong, which is located in a water depth of 200.6m with a 0.82m MSL. The total weight of the jacket is about 16,200Te with a top dimension of 18m×44m at EL(+8)8.0m and a bottom dimension of 74m×74m at EL(-197.67m). The total height of the jacket is 212.32m. The jacket was launched and successfully installed in the end of April 2008.

A series of mooring analyses were performed for the 3,800Te Derrick/Lay Barge Lanjiang in support of the 16,200Te jacket launch installation on the PY30-1 Gas Development Project. The DLB Lanjiang was moored in a water depth of 200 meters with 8 of 12 mooring lines in a spread configuration where Lines No. 6 and No. 7 are used to position the jacket while Lines No. 3 and No. 10 are spare. The jacket was launched by a 30,000Te launch barge CNOOC 229, the second largest launch barge in the world, and then self upended with a small-hole flooding scheme. The DLB Lanjiang was pre-connected with the jacket prior to launch via the mooring lines No. 6 and No. 7. Upon launch and during long upending lasting more than 2.5 hours, the jacket was wet towed towards the DLB Lanjiang by the stern mooring lines No. 6 and No. 7 with the help of two 10,000HP AHTS tugs. Once the jacket was fully upended and positioned next to the stern of DLB Lanjiang, the lifting riggings were hooked up, and then lifted and lowered onto the sea bed using the main hoist of the derrick barge with a flooding control and monitor system. Fig. 1 shows that the self-upended jacket is being held by the main hoist of DLB Lanjiang.

Intact and one-line damaged cases were investigated for the derrick barge in both operating and stand-by positions. The mooring analyses with the derrick barge in the operating position considered the environmental effects on the jacket, which was modeled and connected to the main hoist of the derrick barge. The mooring analyses of the derrick vessel in the operating position also added connectors between the derrick barge and the jacket to represent the tugger lines in details. The results of the mooring analysis indicate that the proposed mooring spread is acceptable for both the operating and stand-by positions. All mooring line loads are within allowable limits and the reported pull on the anchors should not cause any drag or uplift.

This paper describes the mooring analysis and buoy optimization study whose findings determine that two 25Te net buoyancy surface buoys should be added to the mooring lines No. 8 and No. 9 at the locations specified, which provide the minimum vertical clearance between these two mooring lines and the existing subsea gas pipeline. It should be pointed out that there is an existing jacket located at 385m west of the PY3-1 jacket. The interference between the DLB mooring lines and existing jacket underwater structure was also investigated at different conditions. The software MOSES was used to perform the standby