Structural Assessment of a Shallow Water Subsea Wellhead System under Jack-up Drilling Conditions

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ABSTRACT

For the safety and convenience of sea transportation, X oilfield of 27 m water depth in China Bohai Sea will be developed by subsea production system under Jack-up drilling conditions, which is different from conventional mode of both shallow and deep water area. The stability of shallow-water subsea wellhead system should be the primary concern in this new mode. Three separate well configuration stages, namely as drilling with 30” riser, drilling with 20” high pressure riser and completion, are analyzed. Assessments include axial capacity, strength, wave fatigue and VIV fatigue assessment considering the 30” OD with 1.0” WT conductor size and 13-3/8” OD with 0.43” WT surface casing size. In additional, sensitivity analyses regarding to ice load parameter has been considered for critical load case identified. Results show that the operations are deemed as feasible in X oilfield. The top tension or equivalent CTU tension setting for drilling operations in which accommodates the strength and fatigue requirements is recommended.

KEY WORDS: subsea; wellhead; conductor; fatigue; tension.

NOMENCLATURE

AML - Above From Mudline
CTU - Conductor Tensioning Unit
FOS - Factor of Safety
HP - High Pressure
ML - Mud Line
OD - Outer Diameter
UB - Upper Bound
LU - Lower Bound
OP - Over Pull
RP - Return Period
VIV - Vortex Induced Vibration
WH - Wellhead
WT - Wall Thickness

INTRODUCTION

In general, jacket platform and surface wellhead are used for shallow water area, while the subsea wellhead is usually for deep water area. However, X oil field in Bohai Bay lays below a wide shipping route, so the jacket platform is not permitted to stand inside. In order to develop the oil field economically, the shallow water subsea model is put forward, as shown in Figure 1.