Technical Challenges and Practice of SSIV Umbilical Project in South China Sea

Huidong Wei, Ying Jiang, Xuanze Ju, Hui Liang, Wei Fang, Hanjun Yin
Offshore Oil Engineering Co. Ltd.
Tianjin, China

Wentao Yan, Chunsheng Miao, Chunna Song
Shenzhen Offshore Oil Engineering Subsea Technology Co. Ltd.
Shenzhen, China

ABSTRACT

In China’s first deepwater project Liwan 3-1 gas field development, COOEC completed EPIC work of the SSIV system successfully. From system design to subsea facility manufacture, several technical challenges were conquered. Detailed FE analyses were carried out to study the behavior of umbilical installation and structural integrity of SUTA foundation. Theoretical static balance formulas were derived to support the detailed analyses. Another challenging work was offshore installation. Detailed installation procedures for umbilical and SUTA installation were developed. The SUTA launching and curve laying operations were both carried out smoothly. The practice accumulated good experience for such kinds of umbilical project in China.

KEY WORDS: SSIV system; umbilical; foundation; finite element; installation.

INTRODUCTION

The Liwan 3-1 gas field is located in South China Sea, approximately 300 kilometers south of Hong Kong and in 1,500 meters water depth. The complete plan associated to the Liwan 3-1 gas field includes four segments designated as “deep water”, “shallow water”, “onshore” and “down stream gas pipelines”. The deepwater segment of the development accumulates and delivers well fluids to a central platform (CEP). The shallow water segment provides basic processing and compression required to transport the fluids from the CEP to an onshore plant. The onshore segment includes a gas processing plant. The down stream gas pipelines deliver the processed gas from the onshore plant to users. Fig.1 demonstrates the overall development of the Liwan 3-1 project.

COOEC is in charge of the development of the shallow water facilities associated to the Liwan 3-1 gas field. In order to guarantee the safety of CEP, all the pipelines connected to the platform were set with Subsea Shutdown Isolation Valve (SSIV) system. For the Liwan 3-1 30” pipeline and Panyu 34-1 14” pipeline, two Pipeline End Terminations (PLETs) were installed with ball valves. An umbilical was laid to control the two valves via flying leads from the Subsea Umbilical Termination Assembly (SUTA). As the SUTA was installed separately and there was no host facility nearby and the risk of dropping object form CEP existed. This is the first time for COOEC to carry out the EPIC project with SSIV system and subsea facilities. Several technical challenges were faced, especially for the umbilical system, like the SSIV system design, umbilical installation analysis with SUTA, SUTA foundation design, umbilical offshore installation etc.

Fig. 1 Liwan3-1 gas field and SSIV system

SSIV SYSTEM DESIGN

The main isolation function of SSIV system was finished by two ball valves on PLETs which was located 50 to 60 meters away from CEP. The actuators of the ball valve were manipulated by hydraulic sources supplied in the platform. Despite the valves, the other components of SSIV system include a Hydraulic Power Unit (HPU), a surface control panel, a Top Umbilical Termination Assembly (TUTA), a 500 meters long umbilical and attachments, a Subsea Umbilical Termination Assembly (SUTA), and two hydraulic/power flying leads, all of which...