DESIGN AND INSTALLATION OF FLOWLINE JUMPER FOR SOUTH CHINA SEA
APPLICATION

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ABSTRACT
Subsea flowline jumpers have been widely used in deepwater developments as a connection between flowline end terminations (FLET), subsea facilities, and riser bases. The engineering design and installation of rigid jumpers represents a complex engineering challenge. Design issues involve strength under extreme static loads including relative end displacements, and strength and fatigue under forced dynamics due to riser vortex induced vibration (VIV), direct VIV due to seabed bottom currents, internal flow induced vibration, cyclic thermal loads, and installation.

This paper presents the engineering design and installation of a deepwater flowline jumper study with application to the South China Sea. The design aspects include strength and fatigue under static and VIV loads since these conditions are generally dimensioning. A distinguishing feature in the engineering of such jumpers is a proper balanced approach to reconcile requirements for strength with those for fatigue because they tend to drive the design in opposite directions. In particular, strength considerations dictate a low stiffness solution to avoid high stress under jumper end motions, but in order to reduce fatigue damage, a high stiffness design is required. These conflicting requirements were satisfied by parameterizing selected design geometries and performing an automated design optimization to minimize the fatigue - producing dynamic stress range under a series of defined riser end load conditions while subject to a series of constraints arising from strength requirements. Following the global configuration design, other design conditions were checked and found to be satisfactory. Installation methodology is also outlined step by step to show the installability of the designed jumper. It concludes that based on the design basis, the designed jumper has been optimized and installability has been fully demonstrated.

Key Words: Flowlines, Jumper, South China Sea, Design, Installation

INTRODUCTION
Deepwater flowline jumper systems have been in use for some years, in particular with the booming of deepwater development in the last decade.

For jumper connections, as shown in Fig. 1, both rigid jumpers have been used extensively over the last decade for both first- and second-end pipeline connections. The rigid jumper or spool piece is a measured and fabricated steel piping component that connects subsea structures with diverless connectors on each end. Rigid jumpers have lately been used for pipeline connections between pipeline end manifolds (PLEM) and riser bases, as pipeline bundle midline connections, and between subsea trees and manifolds and PLEMs.