

## Jumper VIV – New Issues for New Frontiers

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### ABSTRACT

As more data on ocean currents accumulates, certain area in the Gulf of Mexico can be seen to experience high currents close to the seabed. The typical M shape geometry which gives the jumper the flexibility to accommodate large end displacement from pressure and temperature load cycles makes them susceptible to excitation by even low velocity currents. Although some designers have considered these structures as static they are in fact susceptible to VIV fatigue loading. When the vortices shed by the current match the natural frequency of the jumper, fatigue damage accumulates rapidly. These problems are compounded when designers do not optimize the design of the welds for high frequency fatigue loading.

A number of options are available for jumpers that are still in the design phase. These options include VIV suppression strakes, or qualification of the welds to allow for the use of a better fatigue curve. .

KEY WORDS: VIV; Jumpers; Fatigue; Strakes

### INTRODUCTION

#### Subsea Jumpers

Rigid steel jumpers are frequently used to join subsea equipment such as pipelines to manifolds, flowlines to trees, or pipelines to risers. The jumpers are designed to allow for expansion and contraction of the flowline or pipeline due to changes in pressure and temperature. The M-shape of the jumpers that allows them to accommodate the changes in length also makes them susceptible to vortex induced vibration (VIV). Further compounding the problem is that the designers of rigid jumpers often consider the structures static and do not optimize the design of the welds for high frequency fatigue loading.

A typical jumper will have 6 bends, and an unsupported length of 50 to 100 feet. The design of the structure lends itself to having low natural frequencies, and low structural damping. Figure 1 shows a diagram of a typical jumper arrangement.



Figure 1a – Typical Jumper Configuration

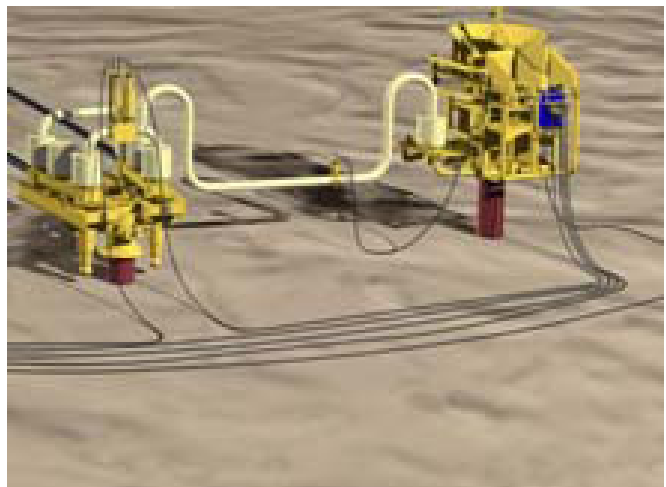


Figure 1b – Typical Jumper Installed

#### Vortex Induced Vibrations (VIV)

Although the VIV phenomenon has been the subject much study, the prediction of response amplitude in real world structures is best based on empirical data. Gathering empirical data is always expensive and this is especially so in deep water structures. In the recent years a great deal of data has been gathered on risers because of the high consequence of a riser failure. However, little or no data exists in the public domain on jumper VIV response. Consequently the designer must rely on design codes which were compiled for other types of