Recent study of a 620 t jacket from seabed

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Recently, a minimum structure fixed template steel tripod jacket was toppled onto the seabed during installation. The jacket weighed 620 t in air and was to be installed at a water depth of 64 m. This study presents the technical, operational and safety considerations in the development of the recovery procedure, which led to the successful retrieval of the jacket and subsequent re-installation. The recovery procedure relied heavily on subsea saturation diving activities and the use of a heavy lift derrick barge. Owing to the delicate situation of the jacket on the seabed with two piles inside two of the jacket legs and one of the piles bent and penetrated into the seabed, and the need to preserve the jacket integrity, the recovery process was a very unique engineering challenge. This recovery of a fully submerged jacket from the seabed was a first, which involved procedures never attempted before.

Keywords: offshore structures; offshore construction; lifting

1. Introduction

Shallow and medium depth offshore oil and gas production and processing facilities are mainly built on fixed template steel jacket type platforms. These steel jacket structures are typically designed for installation by offshore lifting or for a large jacket, by launching from a transport barge. There is usually little or no consideration given to the removal or abandonment, as the integrity of the jacket at this stage is not a critical factor. Therefore, in an accidental event of a jacket toppling during installation, the scenario of recovering the jacket in a condition that it was not designed for poses a great engineering challenge. Such an event took place recently at an offshore location.

A tripod jacket weighing 620 t in air was to be installed at a water depth of 64 m. The jacket was successfully lifted from the transport barge, upended and set onto the seabed, and had commenced initial pile stabbing sequence. The first two sections of the pile make-up were successfully hung-off at two of the jacket legs (A and B) for the pile splicing according to the installation procedure. Upon completion of the splice welding, the leg B pile was successfully lowered to self-penetration. As the derrick crane was about to pick up the leg A pile for self-penetration, the jacket tilted excessively and finally toppled to the seabed on its row A – C face. All personnel were able to evacuate from the jacket prior to the toppling of the jacket. The situation of the toppled jacket on the seabed is illustrated in Figure 1.

Leg B pile which had been lowered to self-penetration, was ‘‘pinned’’ at the seabed and thus the pile was bent in a rather smooth circular shape as the jacket leg slid out of the pile during toppling. Leg A pile remained partly inside the jacket leg and partly outside, in the same position as before toppling. The jacket face A – C was lying flat on the seabed, with the protruding mudmat embedded in the seabed. Figures 2(a) and 2(b) show the pictures of the jacket on the seabed taken by a remotely operated vehicle (ROV) right after the toppling. Near the top of the jacket were a cluster of mangled scaffold material, welding cables and tools. The gangway, which was tied to the jacket top, was pulled down with the jacket and laid resting on its side as shown in Figure 2(a). Figure 3(a) shows leg B pile extruded from the jacket leg and bent in a near circular form by more than 90°.

Figure 3(b) shows the close-up view of the region just outside the bottom of leg B where the pile sustained local buckles due to the excessive bending.

2. Development of the recovery concept

The removal and relocation of jackets are performed quite routinely, as end-of-life platforms must be removed for disposal and jackets with substantial remaining life can be relocated to new locations to serve their remaining life (Disher and Maddox 1990, Carr and McDonald Jr 1991). However, such removal and relocation are typically for jackets that are fully submerged.