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Benguela-Belize Compliant Piled Tower: Tower Fabrication

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Abstract

Kiewit Offshore Services, Ltd. (KOS) was subcontracted by DSME to fabricate two of the major components of the Benguela-Belize Compliant Piled Tower (CPT). KOS' work scope included the fabrication and loadout of the Tower Base Template (TBT) weighing 3,200 tons and the Tower Base Section (TBS) weighing 28,000 tons.

Materials used in the fabrication of the TBT and TBS included high-end API grade plates and tubulars. KOS used German, Japanese, and domestic steel mills to supply the tower material.

The TBS and TBT were divided into several major subassemblies weighing from 100 to 2,000 tons. Subassembly components such as tower legs and flex legs were fabricated by domestic subcontractors and required intense subcontract coordination efforts.

Due to the offshore installation window, the fabrication schedule was critical from beginning of the project and had to be accelerated to meet the delivery date.

Dimensional control was a major fabrication effort and required extensive involvement and coordination between all parties involved to achieve acceptable tolerances.

Given the aggressive fabrication schedule, all the riser joints and field splice coatings were applied in the air, resulting in a critical path activity which had its own unique set of challenges.

KOS loaded out the TBT using self-propelled modular transporters. Due to the heavy weight of the TBS, KOS utilized strand jacks in a skidding operation to loadout the structure onto Heerema's H-851 launch barge.

Introduction

KOS was responsible for the procurement, fabrication, loadout and sefastening of the Tower Base Section (TBS) and Tower Base Template (TBT) structures of the CPT.

KOS' traditional safety program combined with Chevron's Incident and Injury Free (IIF) program resulted in a strong safety performance on an extremely fast track project.

Committed to constructing a quality product, the KOS project team implemented these new programs:

- Weekly client quality meetings
- Craft Quality Tool Box meetings
- Quality stand-downs

The TBS structure was 110' x 110' square, 830' long and weighed 28,000 tons. The structure consisted primarily of tubular members ranging in size from 16" to 144" in diameter, with wall thicknesses up to 4". In addition to four main legs, the TBS had twelve pre-installed flex legs starting from Elev. (-) 485' and extending down to Elev. (-) 1,216'. These flex legs were attached to the tower main legs at the top via shear and yoke plate assemblies. Additionally, each flex leg was freely supported by a series of eight flex leg guides, which were evenly spaced along the main legs. The TBS structure is illustrated in Figure 1.

The TBT structure was 110' x 110' square, 46' tall and weighed 3,200 tons. This structure had four main and four dummy legs, which were 72" in diameter with wall thicknesses up to 3.5". Additionally, there were twelve pile sleeves (119" in diameter with wall thicknesses up to 3.5") which were connected to the main legs via short horizontal and diagonal braces. This structure was constructed and loaded out in an upright position.

Material and Procurement

The CPT structural components consisted of seven different grades of steel, ranging from lower grades such as API 5L Grade B and ASTM A36, up to higher qualified steel grades such as API 2W Grades 50 and 60.

Upon receipt of letter of intent, KOS initiated efforts to source the structural materials domestically. However, just before the first MTO issue, KOS recognized that the steel could not be procured domestically due to ownership changes of the qualified steel mills. As a result of this, KOS started dialog with the European steel mill, Dillinger Hutte as an alternate