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Configuration, Fabrication, and Installation of Tahiti Truss Spar Belly Strakes

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Abstract

Two types of Vortex Induced Motion (VIM) suppression strakes were used on the Tahiti Truss Spar: yard installed strakes which were fabricated and installed in the shipyard and the field installed strakes, referred to as belly strakes. The belly side strakes were fabricated in the shipyard, but installed offshore after the hull upending and fixed ballast installation. Yard installation was not possible due to interference with the transportation arrangement. The major components of the belly strake system are as follows: Sleeves which are installed in the spar hull in the yard and serve as receptacles for the support pins, support pins which are swaged into the sleeves using the patented Oil States Inc. (OSI) Hydra-Lok® tool. The support pins serve as structural support members for the Belly Strake panels. Belly strake panels are approximately 20 ft wide and ranging from 15 ft long to 50 ft long. Panel lengths were optimized to achieve similar loading for each of the support pin to sleeve connection. Each strake panel was set onto its corresponding two support pins and is connected via a bolted connection. This paper describes the methods used for fabrication and installation of the Tahiti belly strake components. The fabrication methodology is outlined, including a detailed description of the belly strake system, the component fit-up, and the integration testing methods. Offshore installation of the belly side strakes is described, including the structural connections formed between the components. The installation was performed with on-hull installation aids and installation tools specifically designed for the belly strake installation. A detailed description of the installation aids and their functions is presented, together with the installation steps performed offshore.

Introduction

Cylindrical hulls require strakes to suppress vortex induced motions caused by currents passing around the hull. Model testing of the Tahiti truss spar showed that the spar required strakes with a width of 15% of the hull diameter and 360° of coverage with 30° overlap. Limited ground clearances (~2 feet) between the deck of the dry transportation vessel and the horizontal spar prevented the completion of the installation of the 20 foot wide strake panels in the fabrication yard in Finland, see Figure 1. Rotating the spar hull to install the belly side strakes at the Gulf of Mexico quayside was also not a viable option because the draft of the hull plus the strake panel width would total approximately 53 feet, exceeding the channel depth of 45 feet.

After considering several options for installing the strakes nearshore and at the offshore site, a post upending offshore installation method was selected. As this was the first time that strakes were installed offshore and underwater on a moored spar, the installation method had to be developed such that it could be performed in the offshore environment, exposed to the influences of wind, waves and currents. Heerema Marine Contractors (HMC, the hull installation contractor) provided early input to concept development, installation aid planning, and attendance at the system integration tests in Pori, Finland. This paper also details the development of the installation aids and their functions and the actual installation steps performed offshore.

The considerable challenge posed by the belly strake system development was that it had to be accomplished during the FEED and execution phases of the Tahiti Project. The development required a systematic execution plan with a disciplined management approach, which involved the following key factors: