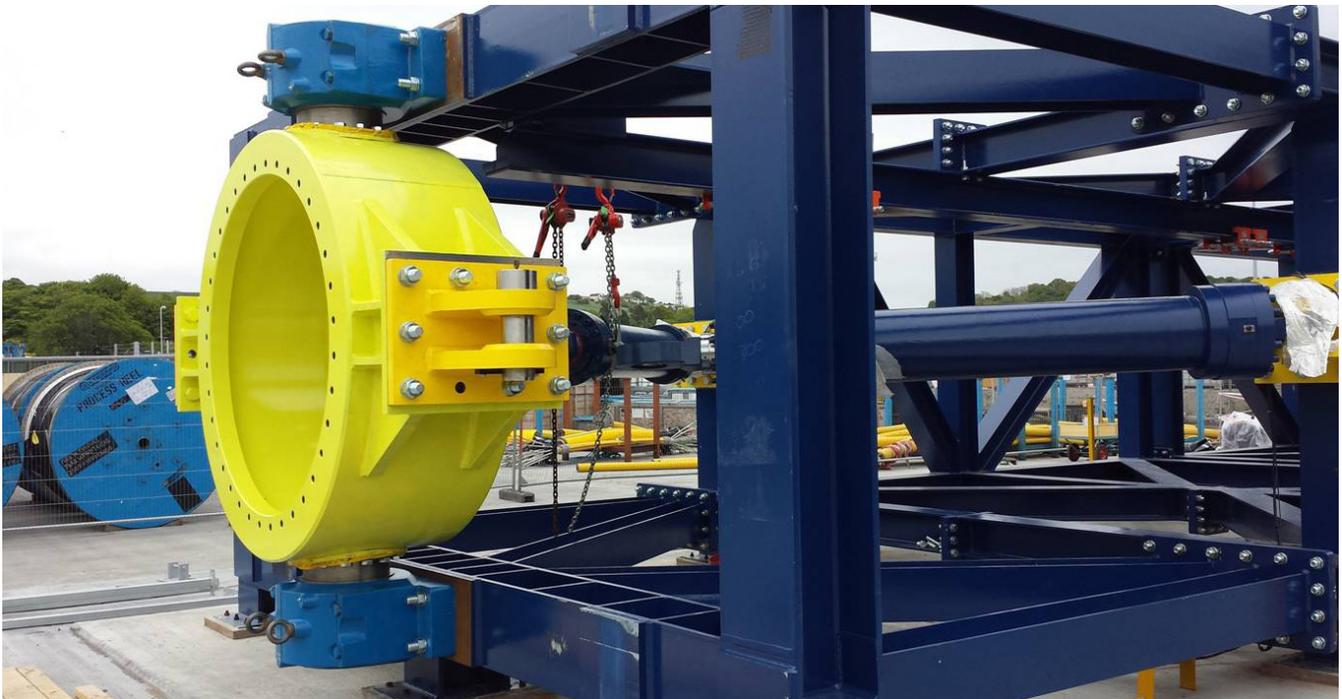


Oceaneering Engineers, Manufactures, and Installs Industry-Leading Flex Fatigue Test Equipment

Supporting the advanced, full-scale testing



Project Overview

The Oceaneering Testing, Qualification, and Reliability (TQR) laboratory in Rosyth, Scotland identified the need for a large-scale flex fatigue test rig capable of simulating in-service dynamic loads. Using

engineering expertise, industry knowledge, and in-depth analysis, the Oceaneering team was able to successfully provide the market with facility to test products and components.

The Oceaneering Solution

The TQR laboratory, located on the same site as the Subsea Distribution Solutions umbilical manufacturing facility, was already capable of performing ISO 13628-5 specified tests on umbilical samples, components, and other ancillary equipment. Benefiting from a suite of test equipment, the site offered comprehensive validation and qualification of manufactured products, mitigating project risk cost effectively. To further increase the testing offering Oceaneering could provide to customers, a bespoke, flex fatigue testing rig was developed and installed.



Execution Plan

Planning for the project began in 2014 with the identification of a new requirement to test Oceaneering's first dynamic steel tube umbilical. Testing requirements required a new, heavy-duty flex fatigue rig. The rig design was developed and analyzed by Oceaneering personnel and the TQR engineers provided the final review and technical sign off all drawings.

The entire installation and commissioning phase of the rig was co-ordinated and managed solely by the Rosyth-based TQR engineers. Due to its size and complexity,

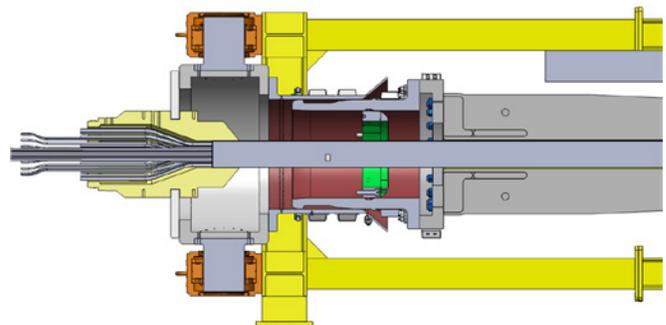
a step-by-step commissioning phase was needed to validate the mechanical operation, hydraulic, and electrical systems. As a new design, the site's engineers were able to identify numerous improvements and corrective actions that served to increase test capabilities.

Once all required modifications had been executed, the umbilical being tested, including an oversized BSR and ancillary hardware, were installed and tested beyond ten times their predicted service life before the required test completion deadline.

Challenges

Establishing the final design and revision of the controls package which acts as the interface for all of the fatigue subsystems was a challenge. This was the final step in commissioning the rig and was a vital contribution to the safe and efficient operation of the test machine. The original controls package was supplied by the main manufacturing contractor; however, the code and controls hardware was severely inadequate for safe and continued use.

Unfortunately, during preliminary testing, numerous glitches, bugs, and unknown



test stops would occur. Senior TQR engineers were tasked with finding a new controls contractor and defining the new operational requirements and supporting the controls contractor. This eventually led to a new host of features being added to the fatigue rig, including improved data-logging, fault tracing, and additional modes of control.



Completing the code before the test start date and the associated pressure of financial penalties if testing overran was a concern, but never one that surpassed the focus on developing a safe, efficient testing system. It also required learning and familiarization of new technical disciplines such as coding, PID tuning, and signal amplification in order to understand and correct the root causes behind operational issues.

Equipment Highlights

The machinery is capable of performing tensile or combined tension and bending fatigue testing on products including umbilicals, bend stiffeners, latching mechanisms, flexible and composite pipes,

power cables, and ropes.

The rig accepts a maximum sample length of 85 ft (26 m) and maximum sample diameter of 59 in (150 cm). Advanced computerized systems provide machine control and datalogging of sample instrumentation. Sensors provide integrated displacement and load monitoring and additional sensors such as thermocouples and strain gauges can be provided, if required.

Results

Oceaneering can now provide state-of-the-art flex fatigue equipment capable of simulating the dynamic loads that are experienced in-service using accurate control of tension and bending cycles. Customers can use the data to reduce their risk and establish the service life of products. Additionally, the flex fatigue testing supports the advancement of overall knowledge and understanding of products while ensuring verification and compliance with industry standards.





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