

Test, Qualification & Reliability

REDUCING RISK, BUILDING CONFIDENCE

At Oceaneering Umbilical Solutions (OUS), our ability to predict how our products will behave, respond to and perform in any circumstance – and the application of this knowledge – means that we can deliver an umbilical solution that represents a significant operational risk reduction.

Nowhere is this commitment to our clients clearer than with our recent \$2 million investment in the development of a state-of-the-art Test, Qualification & Reliability (TQR) facility, at our site in Rosyth.

The TQR Group is specifically tasked with the advancement of our overall knowledge and understanding of our products based on the analysis of test results and reliability models, to support engineering, and business decisions and to continue to build the confidence of our clients in our products technical capabilities.

The TQR Laboratory works under strict quality and operating standards

- **Safety:** As our number one ethic, safety is embedded in our practices and procedures. No task will be executed unless all safety aspects have been evaluated and the operation is considered, by qualified and trained personnel, as safe to proceed. Safety will never be compromised.
- **Equipment Maintenance:** All test equipment (hardware and software) will be maintained by qualified personnel, in accordance with the suppliers' recommendations and schedule, and any applicable regulatory bodies and classification societies. Tests will only be performed when all equipment and procedures are in accordance with these standards.
- **Tests Control:** All test equipment (hardware and software) and procedures are designed to assure that the TQR personnel will have absolute control over tests execution, in terms of the loads and displacements applied to a test sample. No undesired/unplanned stresses shall be applied to the test samples during tests execution.
- **Data Acquisition and Management:** We will assure that, for every test executed, all the relevant data is acquired, organized and stored for further evaluation. We will manage the data generated in such a way that it is safely stored and easily retrievable.
- **Results Validation:** We will assure that our test processes generate valid results, with known accuracy and variability distributions. Tests will only be considered valid when conducted within these stringent limits of variability.



Working to the recommendations of ISO 13628-5:2009 and AP 17N, the Group provides an extensive range of testing (design validation – qualification and/or verification) and reliability (performance prediction) services, including:

- Combined Torsion balance and tension test (with axial stiffness verification and end strength terminations tensile test)
- Bend stiffness tests
- Combined tension with bend test (static)
- Umbilical squeeze/crush test
- Internal/External friction factor assessment
- Impact test
- Fatigue test
- Free-flooding rate verification test
- Axial compression test
- Materials and components fatigue test
- Materials and components tensile test
- Reliability Analysis
- Strain sensing and measurement



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The Laboratory is equipped with the latest technology and test machines, capable of identifying the performance limits of our products and materials.

Some examples of equipment shown below:



Materials & Components Fatigue Test Machine

Tensile Load: 100 kN (max.)
Actuator Stroke: +/- 75 mm
Frequency: 50 Hz (max.)

Materials & Components Tensile Test Machine

Tensile Load: 50 kN (max.)
Crosshead travel: 855 mm (max.)
Crosshead speed: 0.01 to 254 mm/min at full load



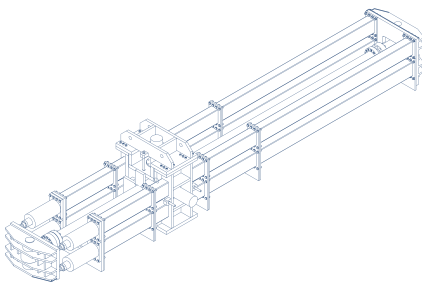
Impact Test Machine

Energy Range: 0.5 kJ to 40 kJ
Multiple striker profile options
Multiple bedding options



Free-flooding Rate Verification Test Equipment

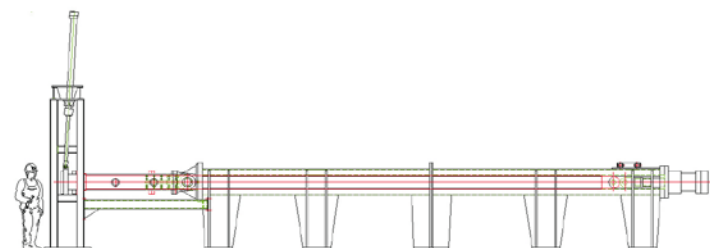
Test water volume: 100l, 200l or 300l (to maximize accuracy)
Sample diameter: 300mm (max.)



Umbilicals Tensile Test Machine (with Crush Module)

**to be commissioned by May 2011*

Tensile Load: 10,000 kN (max.)
Radial Load: 1,000 kN/pad (max.)
Number of Pads: 2, 3 or 4 pads (1m long - adjustable profiles)
1 Swivel End (for torsional balance verification)
Sample Length: 12 m (max.)



Full-scale Fatigue Test Machine

**to be commissioned by May 2011*

Tensile Load: 1,000 kN (max.)
Angular Variation: +/- 20° (max.)
Sample Length: 12 m (max.)

