

Dynamic Test Rigs – Test Facilities

Risers - Umbilicals - Power Cables – Components - Structures

The main activities in The Marine Structures Laboratory are testing of structures, structural components and materials. Typical problems involve fatigue testing, ultimate strength and collapse testing, testing for serviceability, and advanced materials testing. Experimental work is often combined with analytical or numerical analysis.

The laboratory is operated by SINTEF Ocean in cooperation with Norwegian University of Science and Technology. The laboratory is certified to ISO 9001.

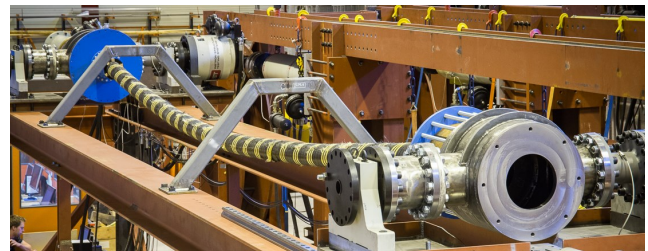
FULL SCALE TEST FACILITIES

SINTEF Ocean has two test rigs (DTR1 and DTR2) built specifically for full scale testing of flexible risers, loading hoses, umbilicals and power cables. The rigs provide a combination of axial tension and bending loading. Both loading axes can be programmed individually to give any load-time history. The test rigs are horizontal, and placed in a test frame on the laboratory floor. The axial loading is applied at one end, and bending loading in the opposite end. The test rigs comply with API requirements for full scale testing of flexible pipes.



Dynamic test rigs DTR1 and DTR2

Axial compression is a general challenge with regard to installation and operational loads of dynamic cables and umbilicals. One full-scale rig (DTR3) is designed to apply combined axial compression and bending loads. The purpose of the rig is to test umbilicals and power cables with respect to local buckling of components and possibly overall torsion instabilities.



Dynamic test rig DTR3

KEY PARAMETERS

	DTR 1	DTR 2
Max test specimen length, flange to flange	21 m	16 m
Tension actuator capacity, dynamic	4.0 MN	4.0 MN
Tension actuator stroke	500 mm	500 mm
Bending load capacity, dynamic	1.3 MNm	1.3 MNm
Angular rotation during bending	± 15 deg (max ±30 deg)	± 15 deg

	DTR 3
Max test specimen length, flange to flange	10 m
Axial actuator capacity, dynamic	400 kN
Bending load capacity, dynamic	24 kNm

GENERAL INSTRUMENTATION AND OPERATION

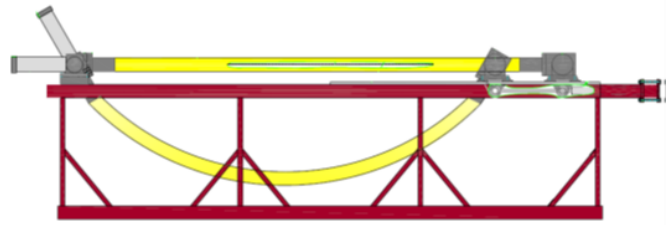
Load Signal: State-of-art digital control electronics, computerised load generation. The system accepts any sequence of peaks and troughs, e.g. generated by a block program to be specified by Client.

Environment:

- Internal pressure of test sample up to 700 bar
- Active temperature control (0-100 °C) and circulation of bore
- External cooling (ex: gap between pipe and bend stiffener)
- Cryogenic temperatures/nitrogen gas

Instrumentation:

- Number of cycles
- Internal temperature of sample
- Ambient temperature
- Surface temperature
- Internal pressure
- Applied tension
- Elongation of test specimen during cycling
- Applied bending angle
- Applied bending load
- Strain in outer armour layer
- Acoustic emission monitoring
- Twist
- Curvature
- Non-destructive examination of steel components using radiography



Test arrangement for compression bending test (DTR3)

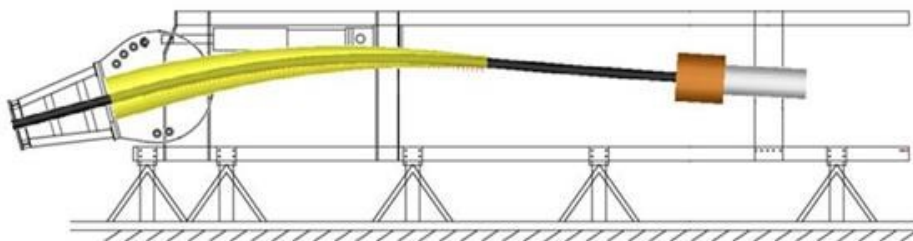
In addition to the specialized dynamic test rigs described above, the laboratory can facilitate tests such as:

- Fatigue tests (4-point bending, tension/bending and tension/tension, including internal pressure)
- Leak tests
- Axial stiffness test
- Torsion tests
- Bending tests
- Special and customized tests

SMALL SCALE TEST FACILITIES

Fully equipped structural laboratory for tests on flexible pipe, umbilical and power cable components, such as:

- Environmental chambers for fatigue testing of tensile armour wire in aqueous conditions (sea water, distilled water) with gas mixtures (CO₂, H₂S, N₂). Establishment/assessment of SN design curve
- Small scale tests of pressure armour wire, component tests, fatigue and wear
- Friction and wear of anti-friction layers, effect of elevated temperature
- Friction and wear testing of composite tensile armour
- Small scale tests of tensile armour, effects of fretting contact, wear, sea water etc.



Typical test arrangement for full-scale test with bend stiffener (DTR1 and DTR2)



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