PROVIDING EXPERT TESTING SOLUTIONS TO THE ENERGY INDUSTRY

element

STEEL CATENARY RISERS FATIGUE TESTING

MINIMIZE DAMAGE, AVOID OPERATION INEFFCIENCIES AND IN-SERVICE FAILURES

Element's pipeline testing facilties perform fatigue testing on steel catenary risers in our laboratory and on-site at the point of fabrication. Our testing containers can quickly be mobilized to various locations, making Element both flexible and faster than any other testing provider on the market.

OUR SERVICES

Due to their long unsupported length, wind, wave, ocean currents, and operating cycles can all impose cyclic loading on the catenary riser, increasing the susceptibility for the formation of cracks through metal fatigue. Fatigue cracks are particularly likely to form surface or near-surface discontinuities, making the girth welds joining the individual section of pipe potential crack initiation sites. It is therefore essential that there is the confidence that the welding process will produce welds that will exhibit the necessary level of resistance to the development of fatigue cracks.

Two approaches are used to assess the fatigue sensitivity of welds; small-scale testing on extracted coupons, and full-scale testing on entire welds:

Small-scale testing, while cheaper, has several limitations. The residual stress profile of the weld is altered by coupon extraction, the applied stress profile is not representative of operation, and it can miss stress-sensitive features present in the original weld.

Full-scale testing, conversely, allows the entire weld to be tested without alteration to its stress profile, using rotating bending stress that more accurately simulates the stress conditions seen in service. This stress can be applied by using large equipment to mechanical bend the welded pipe string, or by vibrating the test string near its natural resonant frequency (near resonance method). The advantage of this is that it can produce high-stress ranges in samples using relatively small, low powered vibratory motors. It tests the full 360 degrees of girth welds, and it can provide higher cycle frequencies (generally: 25-30 Hz), which speeds up testing.

ELEMENT'S MOBILE FATIGUE TESTING SOLUTIONS

Element's resonant fatigue testing rigs are fully integrated into modified shipping containers, making the rigs self-contained, modular, and mobile. Each container is equipped with its internal lifting system and all equipment necessary to load, test, and unload prepared test strings. The containerized design has several benefits over conventional lab-based models:

- It allows each rig to be **mobile**, allowing for quick and easy mobilization between Element and Client sites.
- It creates an **intrinsic barrier** between the test equipment and personnel by limiting access and improving security, as well as increasing safety for operators and site staff.
- It enables tests to be **remotely monitored** through the use of external workstations and CCTV cameras.
- It **removes the need for overhead lifting** during sample loading due to the presence of integrated dual hoist systems.
- It allows the rigs to be **located in uncovered areas outside of site buildings,** freeing up valuable floor space.

STANDARDS WE TEST TO

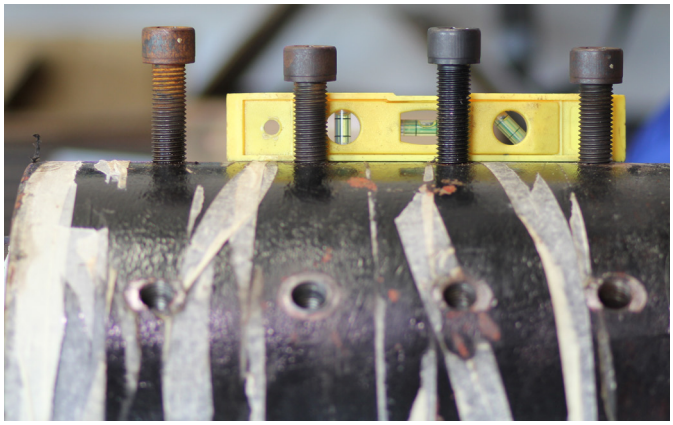
Although there is no standard covering fatigue testing on steel catenary risers, Client requirements are usually dictated by expected service conditions and design criteria.

The design assumptions are generally expressed as the requirement to meet a particular design curve given in standards and recommended practices covering resistance to fatigue in steel structures, such as DNVGL-RP-C203, BS7608, API RP2A-WSD or UK DoE Offshore installations: guidance on design, construction, and certification.

Element has experience with testing for conformance to all of these documents. Although SCR full-scale fatigue tests are conducted 'in-air,' 'knock-down' factors can be applied to testing requirements to account for environmental conditions. We can assist with the determination of these factors through environmental small-scale fatigue testing at one of our corrosion testing facilities.

OUR TRACK RECORD

We have supported our world-leading clients in the Oil & Gas sector for more than a decade in R&D projects and oil production at deepwater subsea oil fields like Coulomb, LLOG BWOLF, Gumusut-Kakap, Mad Dog, Mongstad EVM, Vito, and ERHA North Phase 2.



COMPLIMENTARY SERVICES:

Element's Complimentary Services include

- Mechanical testing
- Fracture Toughness testing
- Fracture and Fatigue testing in-situ
- Sour Service Corrosion testing (SSC and HIC)
- Full Ring Corrosion testing
- Engineering Critical Assessment (ECA)
- Finite Element Analysts (FEA)
- Fitness For Services (FFS)

For more information about our testing methods or to request a quotation, please contact us on **+44 808 2341667** or email us at **energy.sales@element.com**

Send your inquiries to: contact.us@element.com · www.element.com/contact-us
Americas +1 888 786 7555 · UK +44 808 234 1667 · Germany +49 800 000 5137 · Middle East +971 800 353 636

04.2022