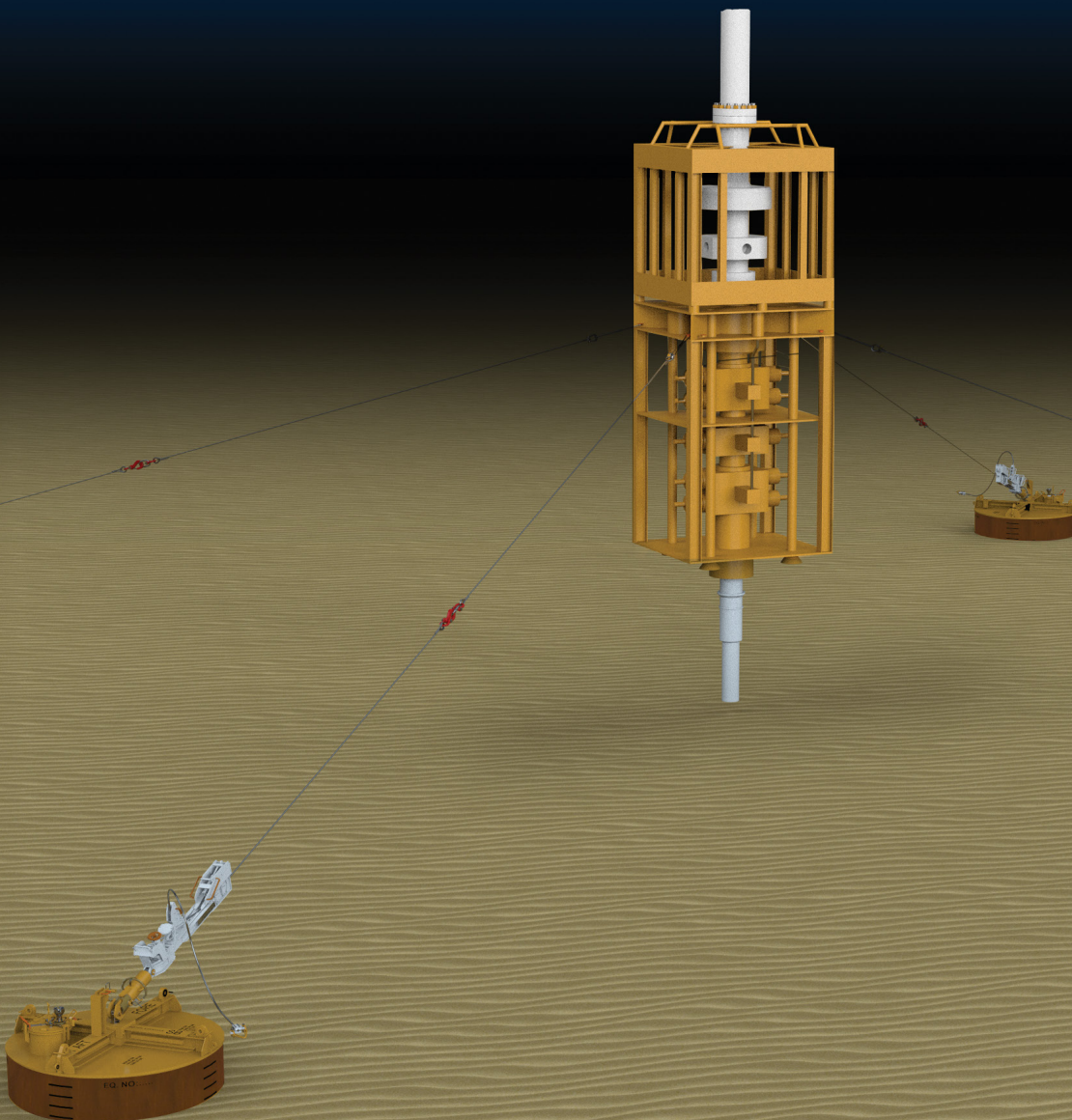




BOP Tethering

Safeguarding subsea wellheads



PROTECTING YOUR SUBSEA WELLHEAD

With SubseaDesign's BOP tethering system the cyclic loads that occur on the subsea wellhead during drilling operations, potentially causing fatigue failure of the wellhead, are drastically reduced.

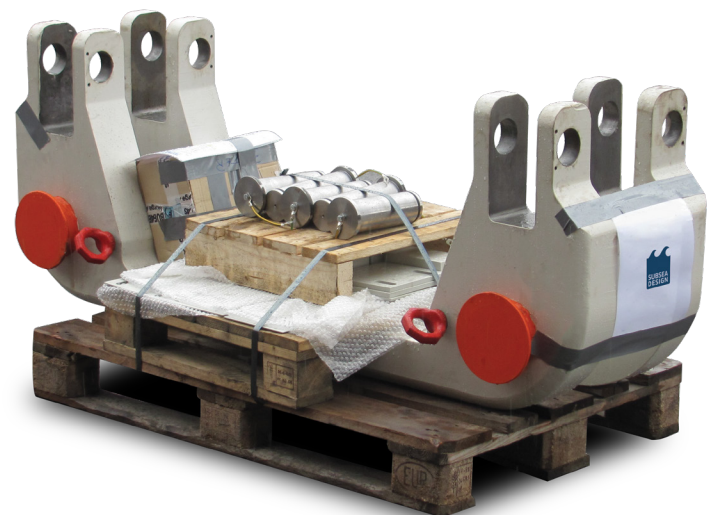
SubseaDesign has engineered and delivered BOP tethering systems since 2014:

- ✓ A large number of projects completed. More than 260 subsea wellheads protected using SubseaDesign equipment.
- ✓ More than 50 foundation structures (suction anchors and clump weights) designed and delivered
- ✓ Totally 156 rope tensioners in service

THE SYSTEM

A BOP – tethering system is typically designed and supported with the following:

- ✓ System drawings
- ✓ Efficiency analyses
- ✓ Geotechnical analyses
- ✓ BOP attachment points for rope arrangements
- ✓ Anchoring points (tension supports, clump weights, suction anchors etc.)
- ✓ Tensioning mechanism (rope tensioners)
- ✓ Detailed installation procedures and operational support
- ✓ Repair, maintenance, testing and storage of the equipment (test jig with load test up to 105 T)



BOP ATTACHMENT POINTS

Many types of BOP attachments-points have been designed delivered and approved by class.



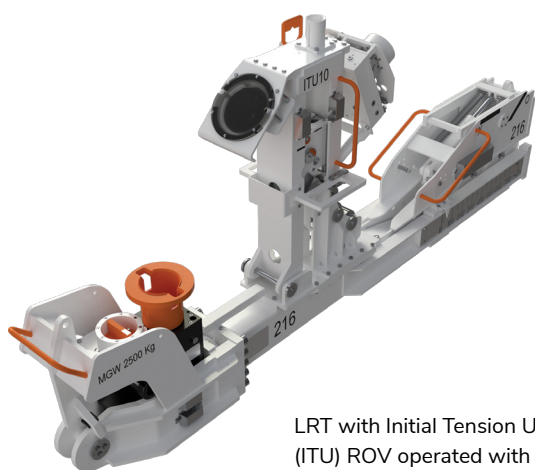
THE ROPE TENSIONER

The mechanism responsible for pretension the ropes is the Linear Rope Tensioner (LRT), designed with the ability to consistently retract excess rope length before the final tensioning process. This innovation introduces the flexibility to adjust the length of rope required for each tension line, eliminating the necessity for multiple adjustment lengths and consequently streamlining subsea rigging processes.

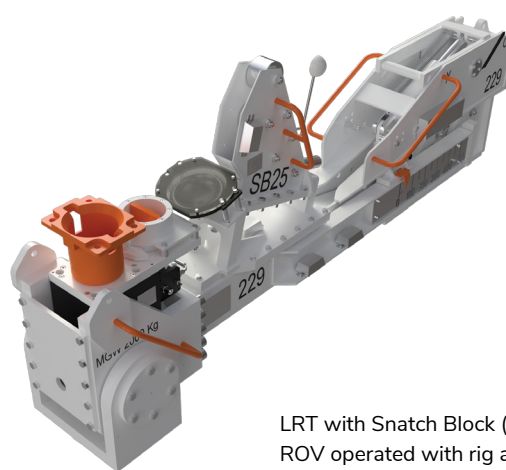
The LRT offers two distinct configurations for initial tensioning. The first involves utilizing a lift line from the surface through a snatch block, while the second employs a hydraulic-operated tensioning unit mounted directly on the LRT. The latter configuration is entirely remotely operated vehicle (ROV) controlled, making it particularly well-suited for applications in shallow water or locations inaccessible from the rig.

The integrated load monitoring system ensures that the remotely operated vehicle (ROV) can effectively monitor and adjust tension forces as needed. The Linear Rope Tensioner (LRT) facilitates seamless interfacing with various anchor points, whether on templates or the seabed, offering a rotational range of 360 degrees. Notably, the upward direction in which the rope exits the LRT mitigates any potential clashes with surrounding structures.

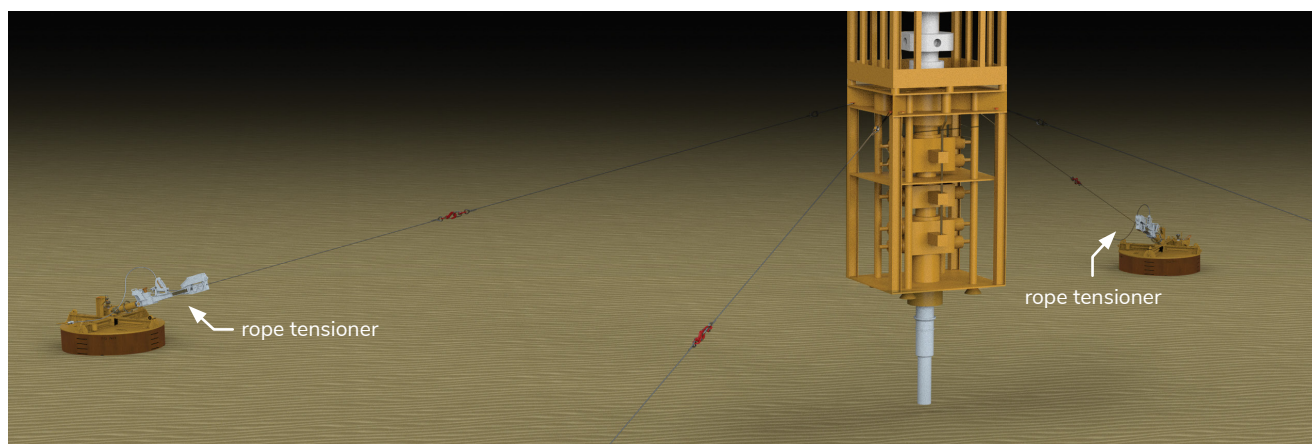
The BOP-Tethering system is comprised of multiple LRTs, each individually tethered to the Blowout Preventer (BOP). Determining the quantity and anchoring coordinates of the LRTs involves analysis of the system to optimize the system efficiency. Additional optimization considerations encompass loads on existing infrastructure, well properties, and soil conditions. Importantly, the system exhibits adaptability to different BOP designs, enhancing its versatility and applicability in various offshore scenarios.



LRT with Initial Tension Unit (ITU) ROV operated with hydraulic initial tensioning



LRT with Snatch Block (SB) ROV operated with rig assisted initial tensioning

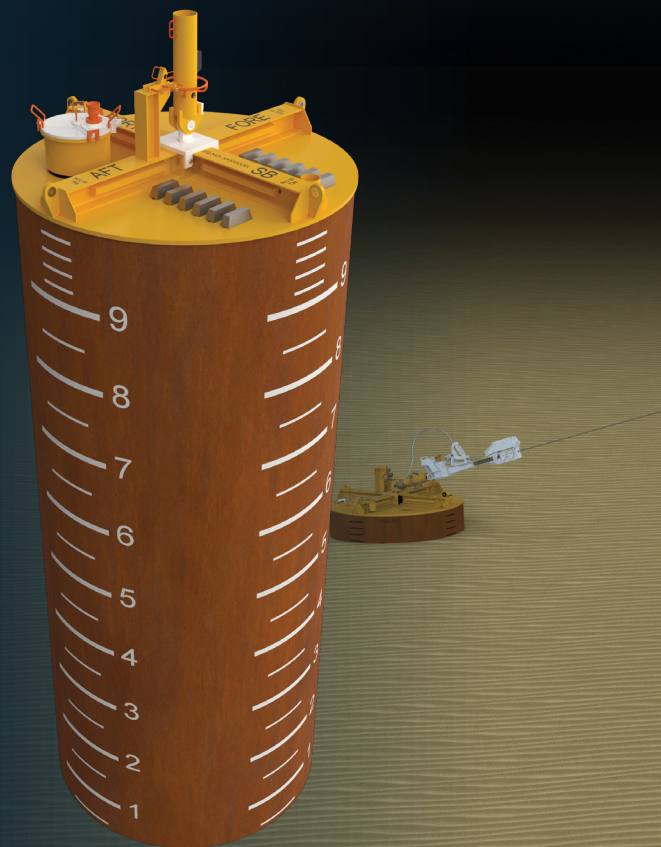


ROPE TENSIONER TECHNICAL DATA

Load limits	Ultimate load limit: 700kN Accidental load limit: 1050kN
Maximum tension by ROV Class 4 torque tool	300kN with a torque of 2700Nm
Maximum stroke	500mm
Load display	Analog load monitor
Wire dimension	Project specific, typically Ø36mm or Ø40mm
MGW	1700kg – wet weight 2000kg – dry weight
Dimensions – Linear Rope Tensioner with Initial Tension Unit	3100x425x1550mm
Dimensions Linear Rope Tensioner with Snatch Block	3100x425x1000mm
Operational hydraulic pressure	210 bar

FOUNDATION STRUCTURES

The type of foundation structure is decided based on soil data and rope tension. Most common are suction anchors and clump weights



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