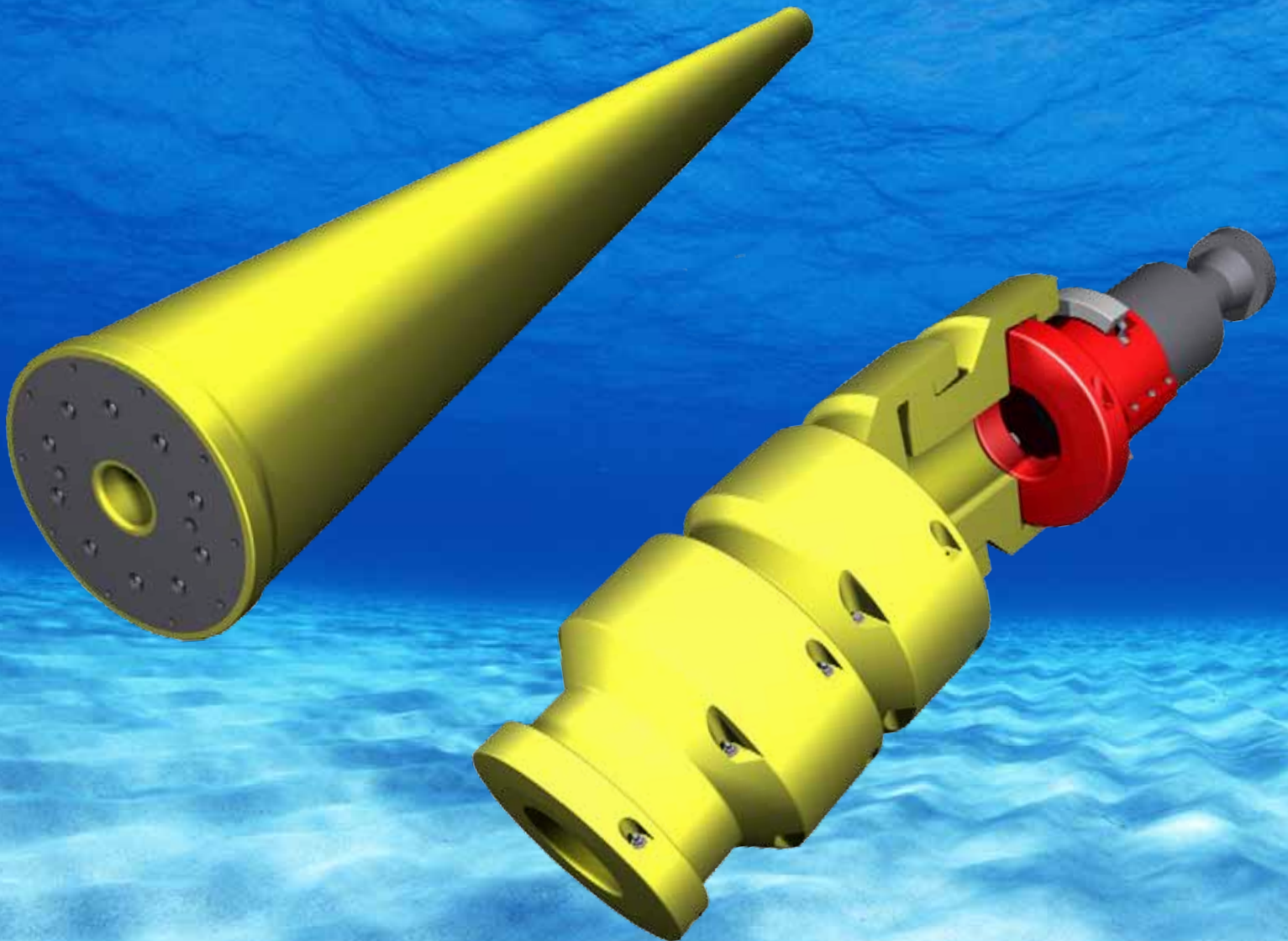


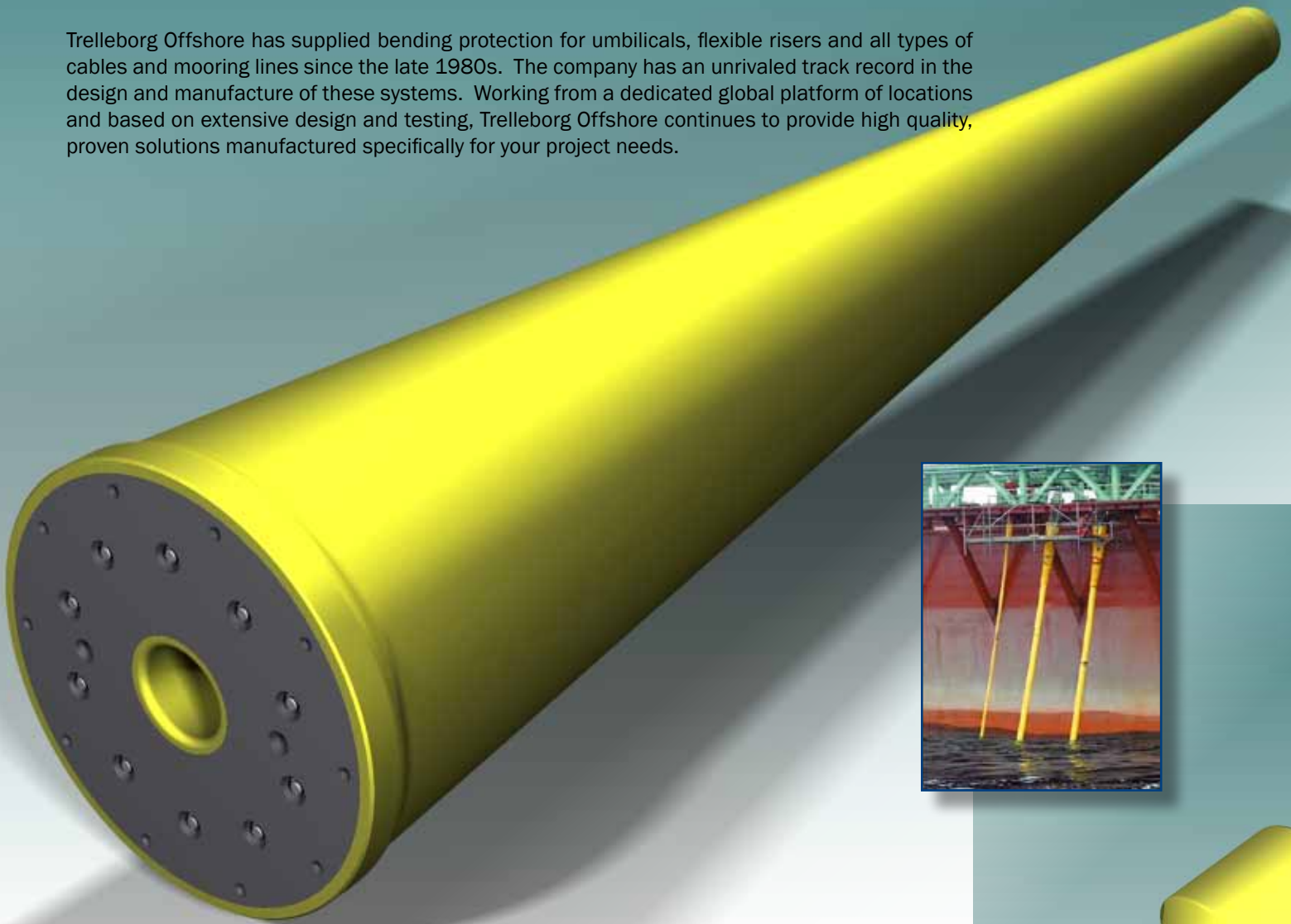
Controlled Bending Management

Engineered Bending Protection Systems



Bend Restrictor and Bend Stiffener Solutions

Trelleborg Offshore has supplied bending protection for umbilicals, flexible risers and all types of cables and mooring lines since the late 1980s. The company has an unrivaled track record in the design and manufacture of these systems. Working from a dedicated global platform of locations and based on extensive design and testing, Trelleborg Offshore continues to provide high quality, proven solutions manufactured specifically for your project needs.



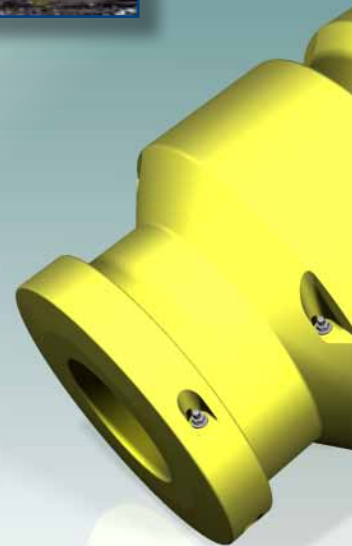
Solving the Problem

Where any flexible tubular connects to a structure, normal movement during operation (dynamic loading) or forces incurred during installation and retrieval (static loading) can cause catastrophic failure of the tubular at the termination point. The failure mode can be through collapse, rupture of internal lines or even rupture of the external layers leading to escape of the contents to the environment. This can happen as the result of a single event or be caused through fatigue damage over time.

Bend limiting devices are provided to protect the tubular from these problems and perform the following functions:

- Maintain the manufacturers recommended minimum bend radius (MBR) during the life of the project
- Provide a suitable load path from tubular to fixed structure
- Reduce point loading at the termination to an acceptable level

Typically two types of solution are available.



Bend Stiffeners

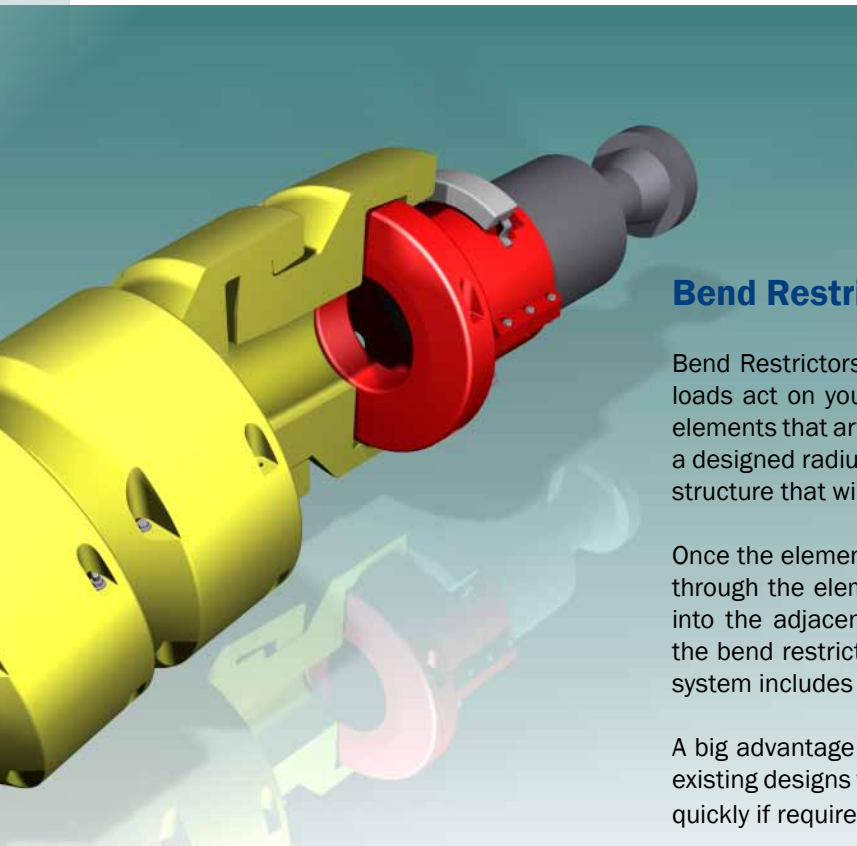
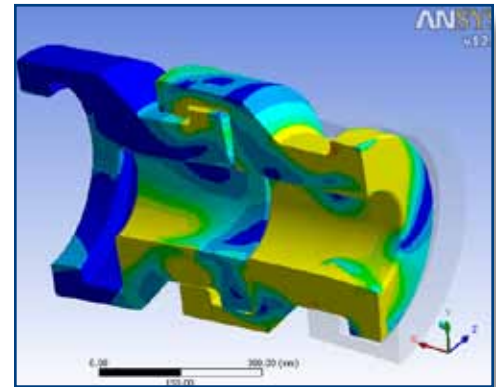
The Bend Stiffener is so called because the conical shape gradually increases the overall stiffness of the tubular in order to prevent over bending at the termination point. Manufactured from elastomeric material a bend stiffener is suited to the constant wave and current induced motion of dynamic installations but can also be used for static applications.

Typically installed on a tubular as it terminates at the vessel or platform, bend stiffeners incorporate a steel component that provides the connection mechanism and safe load path from the tubular to the structure. Bend stiffeners are project specific and fully engineered to accommodate your defined tension and angle combinations. Proprietary design software is used to develop the required geometry.

Trelleborg Offshore's track record in the supply of bend stiffeners, specifically for dynamic applications, is extensive and no other manufacturer can claim as successful a long term in service history as Trelleborg Offshore.

Diverless Bend Stiffener Connectors

For applications where termination of the tubular and bend stiffener is an issue or a retrofit solution is needed Trelleborg Offshore has a range of diverless connectors available. Please contact us for more information.



Bend Restrictors

Bend Restrictors are used when the concern is where static or quasi static loads act on your tubular. The system comprises a number of interlocking elements that articulate in 3 dimensions when subjected to external loads. At a designed radius the elements mechanically lock to form a semi rigid curved structure that will not move further.

Once the elements lock together the bending moment present is transferred through the elements to a specially designed steel interface structure then into the adjacent rigid connection. Trelleborg Offshore will correctly size the bend restrictor elements for you based on supplied information and the system includes termination steelwork configured to suit your project needs.

A big advantage that is available to you is the use of the extensive range of existing designs that can be checked against your project needs and provided quickly if required.

Let us help

Trelleborg Offshore is the world's foremost supplier of engineered bending protection systems. Your project requirements can be met and our proven track record, experience and expertise will minimize your project risk. If you need any additional information please do not hesitate to contact us.

We look forward to working with you.



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