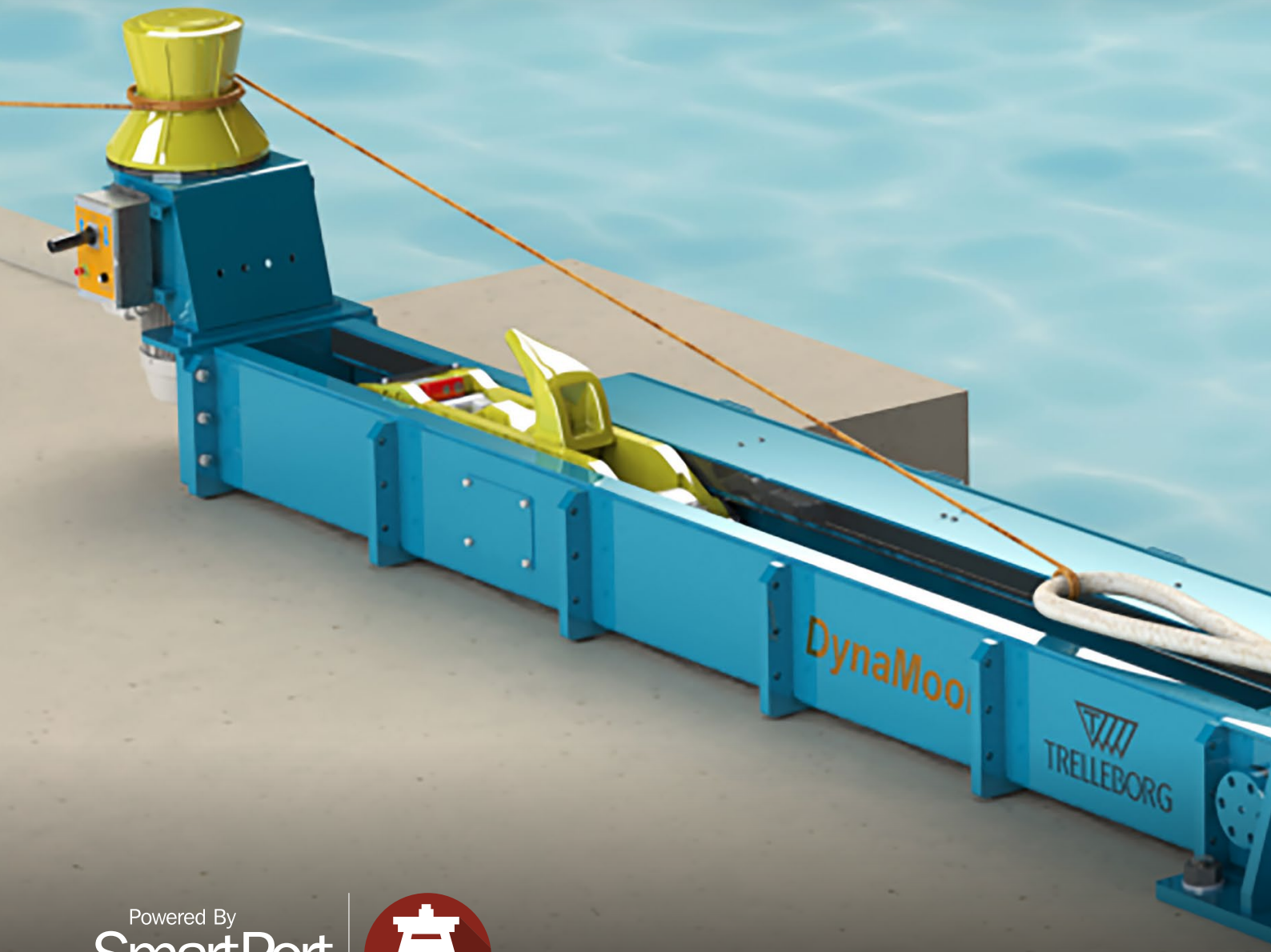
DynaMoor™

A DYNAMIC MOORING SOLUTION TO IMPROVE THROUGHPUT, EFFICIENCY AND SAFETY



Powered By SmartPort

The Smarter Approach

Connect with
The Smarter Approach
By Trelleborg Marine and Infrastructure

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The demanding nature of commercial ports and terminals means you need partnership that provides much more than technically superior products and technologies. You need to work with a partner that combines best practice expertise gained through worldwide experience with a deep understanding of local requirements and regulations. At Trelleborg, we call this the Smarter Approach.

Our Smarter Approach combines global reach with feet-on-the-ground local presence, delivering solutions that continually enhance your operations. Smart technologies are at the forefront of improving operational efficiencies. Trelleborg's innovative SmartPort offering deploys the latest in marine technology applications to help ports and terminals optimize their operations.

Connect with a partner that combines smart solutions, proven product capability and industry expertise to maintain and enhance port and vessel performance. Take a Smarter Approach, with Trelleborg Marine and Infrastructure.

Docking and Mooring Systems

When installing or upgrading Docking & Mooring Systems, you need to ensure you choose the right partner. Ensure your provider can deliver the solution for you, on time and on budget, wherever you are in the world.

Ensure your solution is designed around the needs of you and your operations, with a dedicated team that has the experience to understand them.

Ensure your Docking & Mooring Systems feature technically superior products to maximize durability and reliability, whilst minimizing downtime and whole life costs.

Ensure your partner can offer you the maintenance and aftersales service you need.

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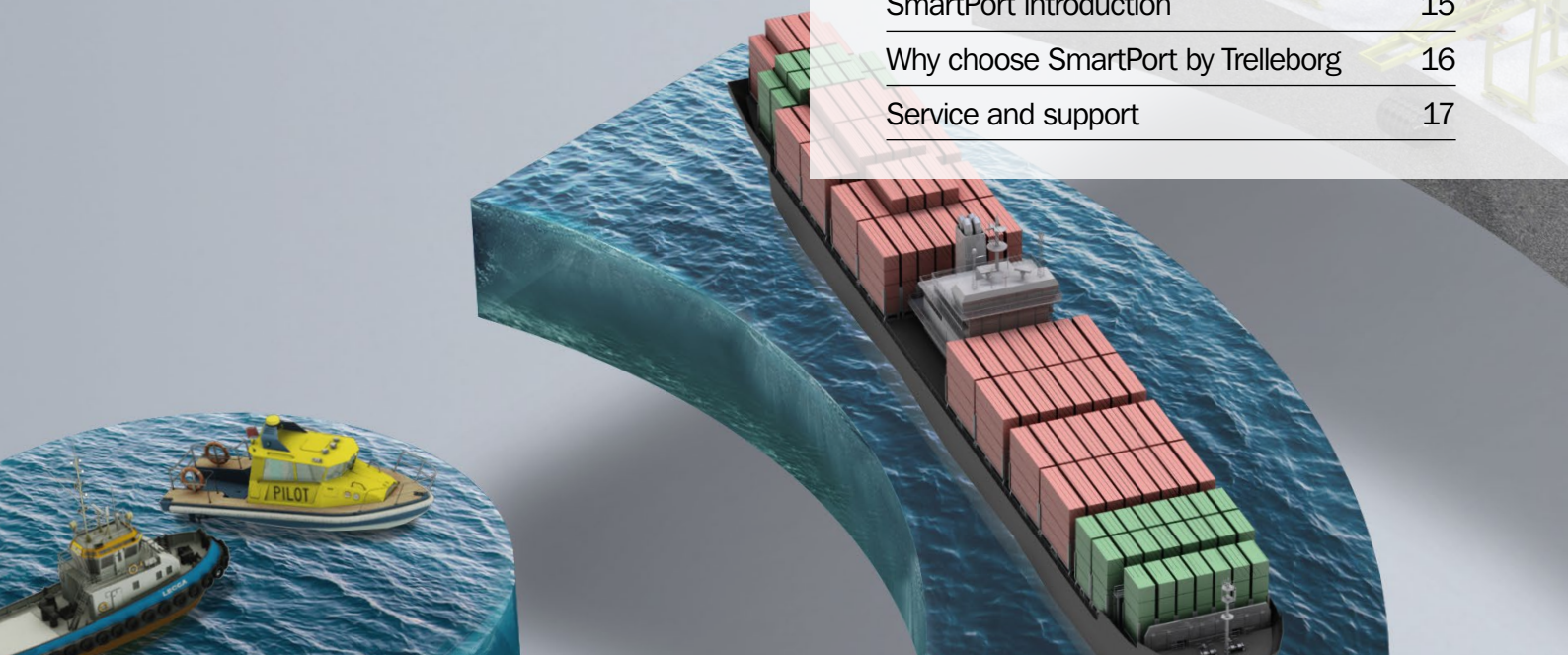


A Smarter Approach at every stage

A smarter approach to...

CONSULTATION

Consultation from the earliest project phase to ensure the optimum fender systems and marine technology solutions are specified, with full technical support from our global offices.

CONCEPT

Conceptual design in your local office – with full knowledge of local standards and regulations, delivered in your language – for optimized port and vessel solutions.

DESIGN

Concepts are taken to our Engineering Centers of Excellence in India where our team generates 3D CAD designs, application-engineering drawings, a bill of materials, finite engineering analyses and calculations for both our fender systems and marine technology solutions.

MANUFACTURE

Our entire product range is manufactured in-house, meaning we have full control over the design and quality of everything we produce. Our strategically located, state-of-the-art facilities ensure our global, industry leading manufacturing capability.

TESTING

Across our entire product range, stringent testing comes as standard at every step in our in-house manufacturing process. We ensure that lifecycle and performance of our entire product range meets your specifications, and more.

INSTALLATION

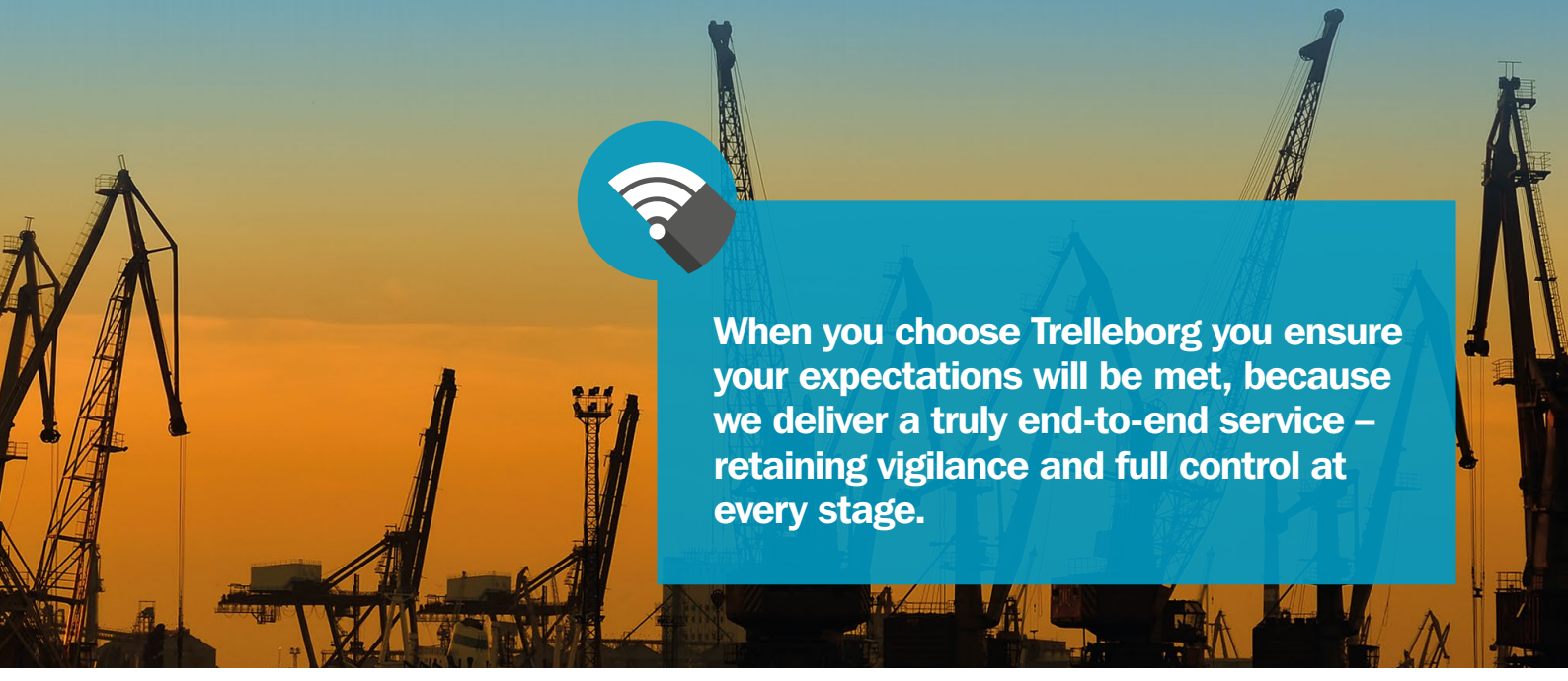
Dedicated project management, from solution design right the way through to on-site installation support. We design products and solutions that always consider ease of installation and future maintenance requirements.

SUPPORT

Local support on a truly global scale, with customer support teams all over the world. And this service doesn't stop after a product is installed. You have our full support throughout the entire lifetime of your project, including customized training programs, maintenance and onsite service and support.

THE FUTURE

Deploying the latest in smart technologies to enable fully automated, data-driven decision making that optimizes port and terminal efficiency. At Trelleborg, we're constantly evolving to provide the digital infrastructure our industry increasingly needs.



When you choose Trelleborg you ensure your expectations will be met, because we deliver a truly end-to-end service – retaining vigilance and full control at every stage.

A Smarter Approach to docking & mooring

The marine industry is in a time of transition and change. We must constantly adapt and innovate to ensure efficient, safe solutions in an increasingly demanding environment.

Our docking and mooring systems play a critical role in optimizing the efficiency of both the berth and the overall port facility. Process refinement is key. That's why, at Trelleborg, we have rethought our approach, introducing a new concept we call lean mooring.

The lean mooring philosophy aims to transform berthing strategies and deliver superior efficiency in operations.

A lean mooring approach enables greater control of the operational window, optimizes berth utilization, lowers resource and space requirements and demands less time and infrastructure investment to increase berthing capacity.

A dynamic solution

Dynamic mooring is an important part of the solution to the key challenges faced by port and terminal owners and operators today.

Vessels are becoming larger.

Not only does the greater mass of the vessel being moored increase peak loads on mooring lines, but weather and wind have an increased effect on the larger vertical surface areas presented by today's large tankers, cargo vessels and cruise liners. Larger vessels also mean more powerful oscillations to berthed vessels as they pass by, creating alternating mooring line tension and increasing the risk of snapping lines.

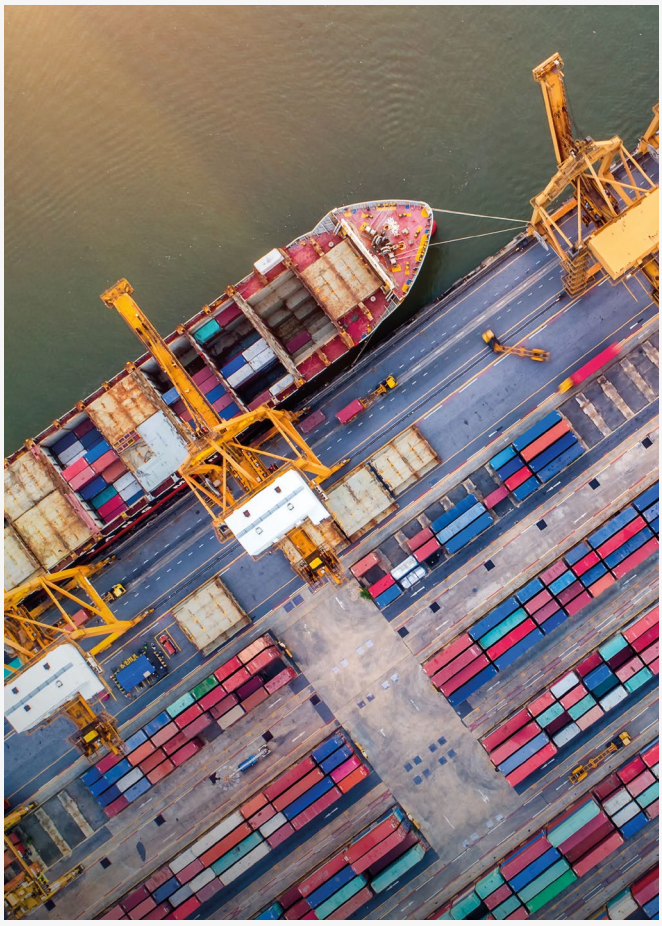
Environments and operations are becoming more demanding.

The rise of the LNG sector, in particular, has seen more work taking place offshore. Climate change and greater commercial demands on ports also necessitate that unloading and transfers take place in less than ideal conditions. In some cases, berths experience 15-20% downtime due to MetOcean factors.

Safety is paramount.

The more human involvement in the docking and mooring process, the more potential there is for human error. The greater the number of lines and fixtures like bollards and pulleys, the greater the potential for accidents on the wharf.

Dynamic mooring keeps constant tension in mooring lines to dampen vessel motion, simplifies the mooring and release processes, reduces wharf furniture and the risk of snapback, and monitors loads in real time. In these ways, and more, dynamic mooring helps you solve these most important challenges.



Introducing DynaMoor

The next generation of mooring systems, DynaMoor, combines Trelleborg's class leading Quick Release Hooks with an innovative constant tensioning system. This balances loads on the ship's mooring lines leading to safer, more secure mooring.

Dynamoor actively dampens vessel motion, which increases the range of environmental conditions in which cargo can be transferred, improving throughput. The risk of parted lines and excessive vessel excursion is significantly reduced, protecting people, assets and increasing uptime.

DynaMoor further enhances safety by minimizing 'snap back' zones, and also reduces the overall amount of wharf furniture, simplifying day-to-day operations. The system speeds up the berthing process and minimizes workload and manual line handling, improving overall efficiency.

DynaMoor is an engineered mooring solution, adopting the latest computer-aided design, finite element and hydrodynamic analysis technologies. It meets or exceeds numerous international engineering standards, while production is carried out by qualified technicians using components supplied by Trelleborg-owned factories or Trelleborg-approved supply chain partners.

The benefits of DynaMoor

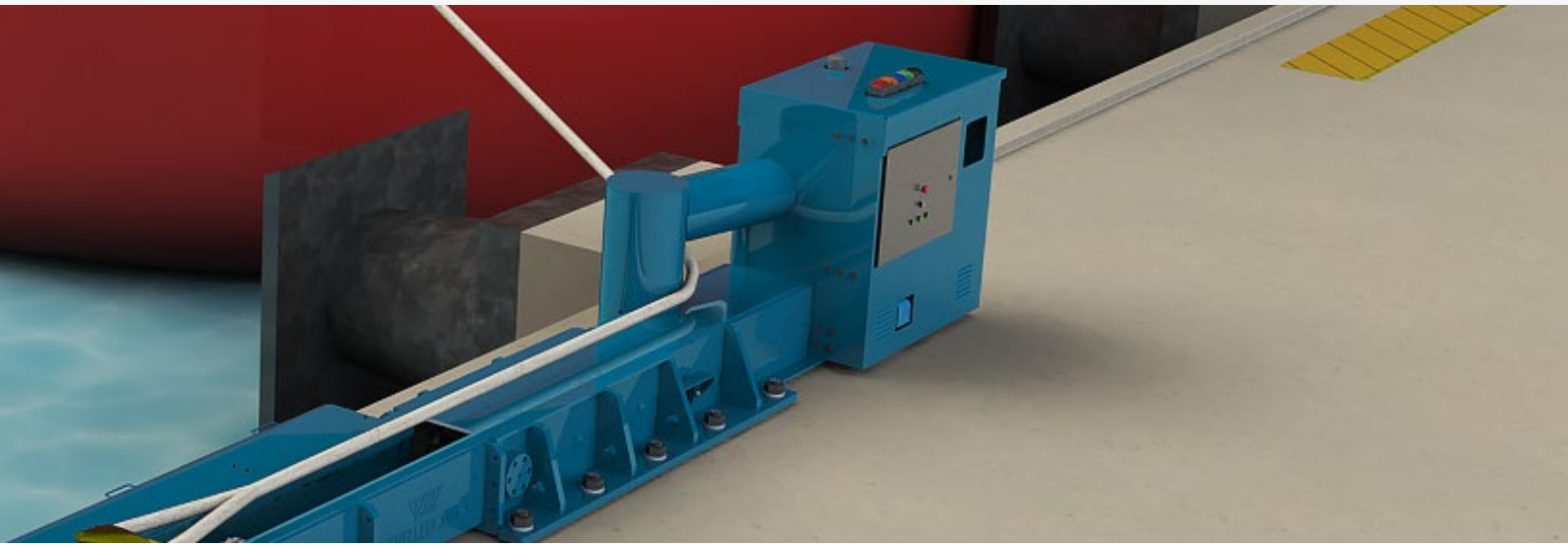
DynaMoor is a versatile mooring solution which can be used with the ship's mooring lines and winches or operate independently. It can form part of a complete jetty solution integrated with Trelleborg's Quick Release Hooks, AutoMoor, Smart Bollards, or be deployed as a separate system. DynaMoor units can be rail mounted for a wide range of mooring configurations and can come with an optional capstan fitted.

SAFETY

- Avoids the need for complex pulley systems to route mooring lines to the vessel.
- Local or remote release permits safe release of mooring lines up to the full SWL.
- Added safety interlocks prevent inadvertent or unauthorized release.

EFFICIENCY

- Dampens vessel motions allowing operations in a wider range of conditions.
- Integrated fairlead simplifies the mooring arrangement and eliminates bollards.
- Allows real time monitoring of mooring line tension and integrates with SmartPort.



Why use DynaMoor?

DynaMoor is an intelligent dynamic mooring solution that enables more efficient berthing and release operations and actively maintains constant tension in mooring lines, dampening vessel movements to facilitate product transfer operations.

DynaMoor:

- Improves throughput by allowing product transfer in a greater range of conditions.
- Different operating modes offer more efficent use of equipment, they help manage energy consumption and equipment fatigue
- Less reliant on shipping crew tending to mooring lines throughout the product transfer cycle, reducing human error resulting in parting lines.
- Enhances safety with the ability to release mooring lines remotely in an emergency.
- Moors vessels more securely with balanced loads and constant tension.
- Improves efficiency by speeding up the berthing process, minimizing workload.
- Contributes to a better connected more customer-friendly port with SmartPort connectivity.

DynaMoor at a glance

Trelleborg's DynaMoor is a safe, cost-effective, dynamic mooring solution that maintains constant tension in mooring lines and dampens vessel motions. DynaMoor increases port and terminal throughput by allowing operations to continue in a wider range of conditions, while improving safety and reducing operational costs.

Reducing Total Cost of Ownership

DYNAMOOR REDUCES CAPITAL AND OPERATIONAL COSTS BY:

- Improving berthing efficiency.
- Minimizing infrastructure and labour costs.
- Enhancing safety.

DYNAMOOR ENHANCES MARITIME SAFETY BY:

- Reducing human error as fewer personnel are required throughout the product transfer window.
- Requiring fewer lines, no pulleys and bollards in turn reducing snapback zones.
- Applying active tensioning to maintain vessel position, minimize oscillating vessel motions, and the risk of parted lines.

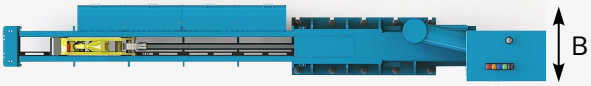
DYNAMOOR-L OR DYNAMOOR-R?

QUICK COMPARISON		
	DYNAMOOR-L	DYNAMOOR-R
Footprint (mm x mm)	8700 x 1200	3000 x 1900
Shipping mass (kg)	6500	10000
Constant Tension System Working Load	60T	60T
Safe Working Load (T)	150 In fully compressed position	100 In fully compressed position
Fairlead	Integrated	Integrated or remote

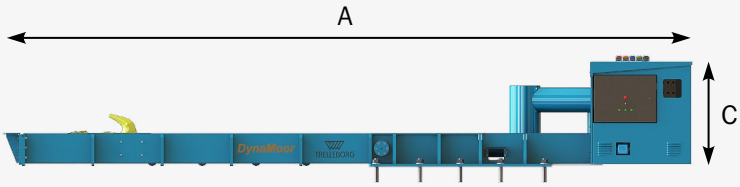
Dynamoor is available in linear or rotary configurations. The rotary configuration Dynamoor-R, has the advantage of a smaller footprint and the option for a remote fairlead roller.

DynaMoor-L – Details and Specifications

MODEL	A	B	C	ANCHOR BOLT SIZE (mm)	ANCHOR BOLT (QTY)	SHPPING MASS (KG)
DM60L 3m	8700	1200	1400	M56 x 1000	10	6500



Plan View



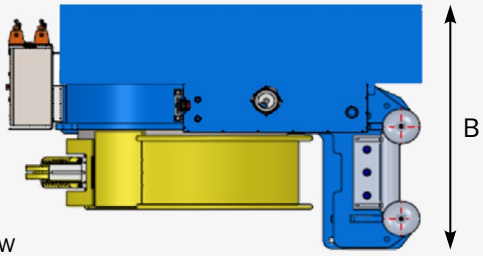
Elevation View

1	**GENERAL SPECIFICATIONS**	
1.1	Constant Tension System Working Load	60T
1.2	Line Stroke	3m to 6m
1.3	Safe Working Load	150T in fully compressed position
1.4	Key Standard Features	DynaMoor Control System
		Quick Release Hook (QRH)
		Constant Tension System
		Constant Tension Frame
		Built-in HPU with Accumulator
1.5	Optional Features	Electric Capstan 1.5T - 3T line pull
2	**DYNAMOOR CONTROLS**	
2.1	Operational Modes	Constant Tension Mode
		Passive Tension Mode
2.2	Testing	Selector Switch: Manual / OFF / Automatic Pushbuttons: Load Inc / Load Dec / Acknowledge Indicators: Running / Fault Emergency Stop: Push to set, twist to reset
2.3	Incoming Connections	Cable Entry – 25mm

3	**QRH GENERAL SPECIFICATIONS**	
3.1	Hook Construction	Frame (side plates): Carbon Steel ASTM A572 Grade 50 equivalent to AS 3678 Grade 350 Hook body, main pivot block, primary release block: cross shaft are high strength alloy steel to ASTM A148, equivalent to AS 2074.
3.2	Spark Prevention	The hook assembly is fitted with three elastomeric impact blocks for energy absorption. Material: polypropylene.
3.3	QRH Line Sizes (Ø mm)	Max Ø 110mm
4	**CONSTANT TENSION SYSTEM**	
4.1	HPU Enclosure	Non-Hazardous Areas – Stainless steel GR316, IP66 Hazardous Areas – Epoxy coated aluminium alloy, Zone 1 IIB, IP66
4.2	Electrical	Supply Voltage – 3 phase, 380 to 415 @ 50Hz, 440 to 480 60Hz Power – 3.0 kW
4.3	Incoming Connections	Power Entry – 32mm Control Stand – 25mm Communications Entry – 25mm
5	**CONSTANT TENSION FRAME**	
5.1	Fabricated frame and fairlead	Low Alloy Steel Grade Q345B to GB/T1591-2008 equivalent to ASTM A572 Grade 50.
5.2	Extended Temperature Range	For temperatures below -15ºC and above +60ºC, please consult our engineers.
6	**QUALITY & TESTING**	
6.1	NDT	ASTM E1444-05
6.2	Welding	AWS D1.1. or AS 1554
6.3	Testing	All hooks individually load tested using NATA (National Association of Testing Authorities [Australian]) calibrated testing equipment. Each QRH standard Proof Load = 125%. Each QRH is individually load tested to Proof Load and manually released at the rated Standard Working Load (SWL).
7	**SURFACE TREATMENT**	
7.1	Surface Treatment	Surface Preparation – Class 2.5 Blast* 1st Coat : 60-80 μm DFT epoxy zinc-rich primer 2nd Coat : 160-280 μm DFT two-part epoxy, containing MIO 3rd Coat : nominal 60-80 μm re-coatable two-part polyurethane. Colour : Sky Blue / Golden Yellow highlights. Other colours available on request. * AS1627.4 , USA, National Association Corrosion Engineers, NACE or Society for Protective Coatings, SSPC-SP10 Sweden, Sa 2-1/2)

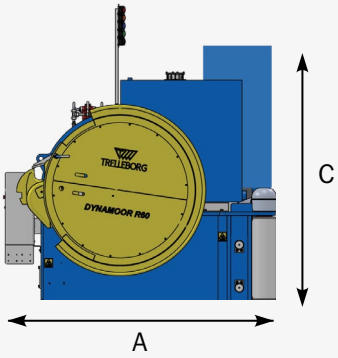
DynaMoor-R – Details and Specifications

MODEL	A	B	C	ANCHOR BOLT SIZE (mm)	ANCHOR BOLT (QTY)	SHPPING MASS (KG)
DM60R	3000	1900	3300	M42 x 1000	14	10000



Plan View

Elevation View



1	GENERAL SPECIFICATIONS	
1.1	Constant Tension System Working Load	60T
1.2	Line Stroke	4m
1.3	Safe Working Load	100T in fully compressed position
1.4	Key Standard Features	DynaMoor Control System
		Quick Release Hook (QRH)
		Constant Tension System
		Constant Tension Frame
		Built-in HPU with Accumulator
2	**DYNAMOOR CONTROLS**	
2.1	Operational Modes	Constant Tension Mode
		Passive Tension Mode
2.2	Testing	Selector Switch: Manual / OFF / Automatic Pushbuttons: Load Inc / Load Dec / Acknowledge Indicators: Running / Fault Emergency Stop: Push to set, twist to reset
2.3	Incoming Connections	Cable Entry – 25mm

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SmartPort introduction

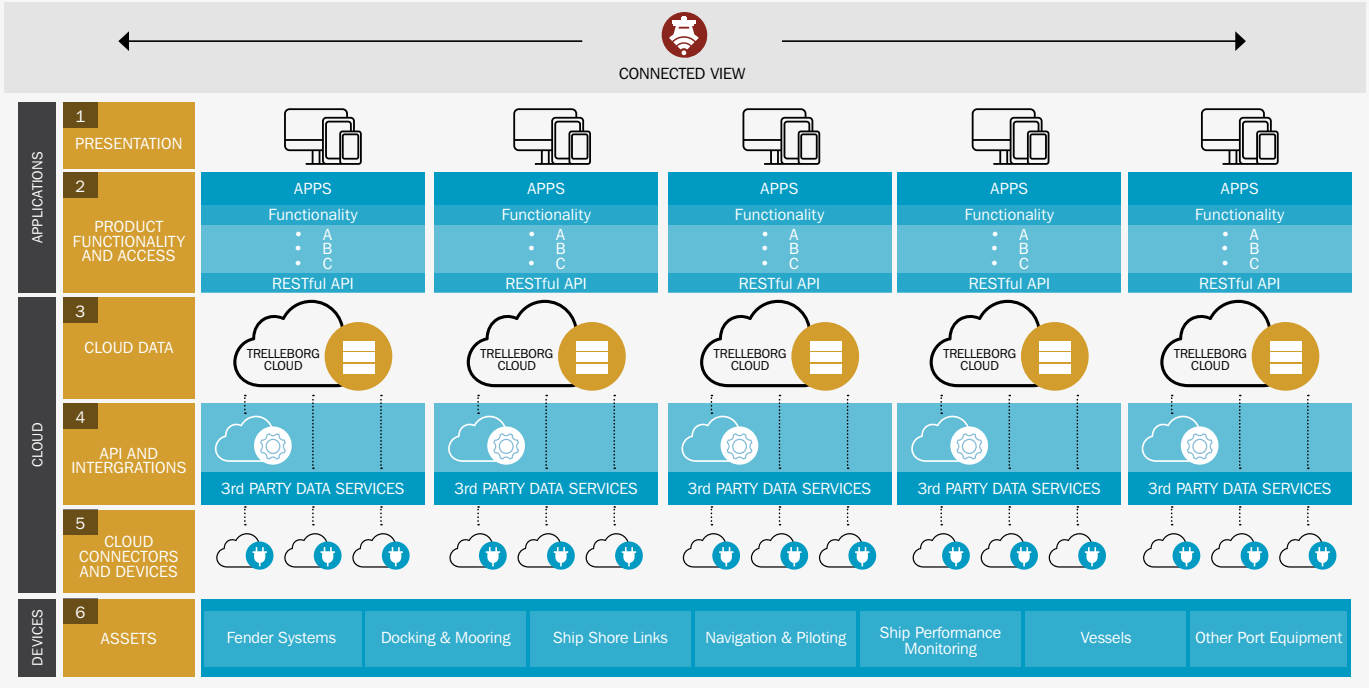
SMARTPORT

SmartPort is Trelleborg's answer to the need for a standardized way to collect and store data. It's a technology platform that connects port operations, allowing users to analyze asset performance and apply data insights, to improve day-to-day decision making and long-term operational improvements.

Historically, we have supplied many products for the port environment, from fenders to mooring equipment to ship performance monitoring to navigation and piloting systems: each of which have their own sensors fitted. By adopting SmartPort architecture, all of these systems can be brought under one cloud-based system.

Why choose SmartPort by Trelleborg

- The SmartPort technology platform is powering the marine industry to a new level of efficiency and asset optimization.
- SmartPort uses the latest smart technology to manage intelligent data collection, transfer and storage and combines this with access to unique product functionality and data insights.
- SmartPort products collect and transmit data, distributing it to the right people at the right time – whether they are on board the vessel, in the control room or on the jetty – to deliver improved operational efficiencies.
- SmartPort allows the performance of assets to be analyzed quickly and effectively to identify optimization and efficiency gains.
- SmartPort is built on an open API structure to enable collaboration with third-party systems and third party assets.



Service and support

Trelleborg Marine and Infrastructure offers exceptional service and support across its entire product range.

Our lean mooring solutions are supported by best practice aftersales services including operational training, comprehensive product warranties and simple, cost effective, predictive maintenance packages, giving you peace of mind from conception to completion and beyond.

Trelleborg will also offer data storage and analysis for customers using DynaMoor offering customers unique insight into their facility, into performance over time or individual events.

Our lean mooring solutions can be customized to meet your needs and reduce the Total Cost of Operation (TCO), they include:

- Global support, local presence, local spares holding.
- Cost effective remote diagnostics and support.
- Tailored maintenance and ongoing support packages.
- In-built system diagnostics.
- Run-time monitoring to optimize predictive maintenance requirements.
- Comprehensive product warranties.

Get in touch to see how we can customize a program to meet your needs.

TAKE A SMARTER APPROACH

Speak to the experts at Trelleborg to learn more about our approach to lean mooring and to discuss how DynaMoor could empower efficiency at your facility.

Email: marine_infra@trelleborg.com

SERVICE AGREEMENTS

Leading companies recognize that it's the total cost of ownership which really matters in the purchase of capital equipment.

Without doubt regular preventative maintenance reduces downtime, improves productivity and manages risk.

A Tailored Service Program gives you inside access to Trelleborg's product experts and allows you to leverage our experience and product knowledge for your benefit. A Trelleborg Aftersales representative will work with you to tailor a service solution including some or all of the following:

- Programmed maintenance and inspection.
- Callout service with defined response times.
- Refresher training.
- Audit of spare parts holdings.
- Remote technical support and diagnostics.
- Comprehensive reporting and recommendations.

Whether you need us onsite every year or every month, we can work with you to help you get the best out of your Trelleborg equipment.

DISCLAIMER

Trelleborg AB has made every effort to ensure that the technical specifications and product descriptions in this brochure are correct.

The responsibility or liability for errors and omissions cannot be accepted for any reason whatsoever. Customers are advised to request a detailed specification and certified drawing prior to construction and manufacture. In the interests of improving the quality and performance of our products and systems, we reserve the right to make specification changes without prior notice. All dimensions, material properties and performance values quoted are subject to normal production and testing tolerances. This brochure supersedes the information provided in all previous editions. If in doubt, please check with Trelleborg Marine Systems.

BC-DYNO-v1.0-EN, 2018

TRELLEBORG

Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

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