

Bollards

REDEFINING BOLLARD DESIGN, DELIVERING UNPARALLELED PERFORMANCE.



With increasing vessel sizes, growing port congestion, changing weather patterns, and stricter environmental regulations, it is essential to upgrade and future-proof port infrastructure. Designing mooring systems, including bollards, is a critical aspect of port infrastructure with significant safety implications.

At Trelleborg, we take a whole system approach to bollard performance, which includes application engineering, detailed design, manufacturing and testing, as well as installation and maintenance. By incorporating advanced materials into our bollard design, we offer a product that sets new benchmarks for quality and functionality. We employ meticulous foundry selection to ensure precise casting processes and an extensive inspection test plan to guarantee the quality and reliability of our bollards. Our bollards are subjected to rigorous testing and verification to deliver exceptional performance while ensuring safety, efficiency, and minimal risks to ports.

APPLICATION ENGINEERING

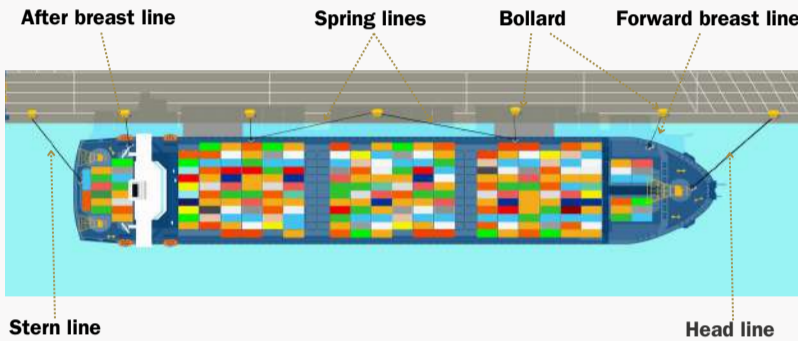
To determine the mooring loads, a high level of technical expertise from application engineers is required. Through this process, we assess the load and bollard capacity, perform mooring assessments, and carefully select the appropriate bollard for each application. This ensures that the bollard can handle the expected loads and perform reliably throughout its design life.

The BS6349-4 recommends five methods for selecting an appropriate bollard:

- | Elastic analysis
- | Simple share loads
- | Working line loads
- | Computer simulation
- | Notional bollard load capacity



Scan to learn more about the five methods.



MANUFACTURING AND TESTING

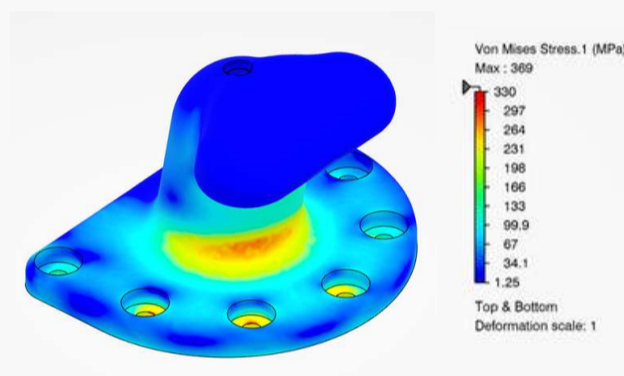
Every aspect of our bollards is meticulously tested through comprehensive testing procedures, including the casting process and control, melting and pour procedures, coupon testing of mechanical, chemical, and physical properties, non-destructive testing, and angular load testing. The comprehensive verification and testing techniques subject each bollard to a rigorous inspection and test plan, ensuring that our bollards meet all international standards and individual project requirements.

Trelleborg bollards are supplied with Manufacturing Data Records (MDR) as standard to highlight the key areas of quality control within Trelleborg's design and manufacturing process.

A TYPICAL MDR WILL INCLUDE:	
✓	Bollard Technical Details
✓	Anchor Details
✓	GA Drawings
✓	Bollard & Anchor Calculation
✓	Bollard FEA (Optional)
✓	Bollard ITP (Inspection and Test Plans)
✓	Certificate of Conformance
✓	QA/QC Documentation
✓	Installation, Operation and Maintenance Manual
✓	Bollard Load Test (Optional)

DETAILED DESIGN

The design of the bollard must be meticulously considered, including material grades and specifications based on project requirements to ensure durability. Our design process takes into consideration the safe working load of the bollard in relation to its breakload, ensuring that the bollard remains stable and safe for mooring even when used at full working load capacity. Engineering drawing and calculations are conducted to determine the structural integrity and load-bearing capacity of the bollard, ensuring a consistent and accurate solution. Finite Element Analysis (FEA) is utilized to evaluate the system's performance under various site conditions and throughout its design life, and paint specifications are strategically selected to enhance the bollard's performance. Anchors and hold-out bolts are also engineered to withstand the forces applied during mooring operations, providing a secure and reliable system. The integration of advanced engineering techniques, detailed simulations, and optimization processes ensures that the marine bollard is not only robust and efficient but also tailored to meet the specific demands of marine applications, offering a safe and reliable solution for mooring needs.



Trelleborg validates its design using FEA in conjunction with actual in-house testing.

INSTALLATION AND MAINTENANCE

Proper installation of bollards is crucial for optimal performance. Trelleborg's whole system approach includes consideration of the installation process right from the start. This helps in customization of bollards to suit specific environments, resulting in an extended lifespan and minimized downtime and maintenance requirements. Our services include installation, training manuals, on-site supervision, and maintenance recommendations. With our support, you can maintain continuous operations without any disruptions.



Load testing bollards is essential to ensure that they meet the rated capacity and to eliminate quality control defects.

Testing facilities should be used to assess the capacity of the entire system in all loading directions, verifying the strength of the bollard body to increase safety and reduce downtime during berthing operations.

Trelleborg offers tested bollards with third-party certificates.



TRELLEBORG BOLLARD TESTING MACHINE

Safety track record

With over 100 years of industry-leading expertise in engineered polymer solutions that seal, damp and protect critical applications in demanding environments, Trelleborg Marine and Infrastructure is one of the most trusted and reliable suppliers of high-quality marine solutions for all industries.

By combining robust materials, state-of-the-art testing, meticulous design calculations and manufacturing processes, we have set a new benchmark in bollard performance, durability, and safety.



Download our brochure for information on our industry-leading bollards.

[Download Now](#)

GET IN TOUCH

Website | trelleborg.com/marineandinfrastructure
 Email | marine_infra@trelleborg.com

LEARN MORE ABOUT MARINE FENDERS

