



AUTHENTICATING FENDER PERFORMANCE



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Effective and reliable fender systems are mission critical equipment. However, not all fenders are created equal. Rubber compounds are changing and new manufacturing bases are emerging. Testing procedures need to keep pace to ensure fender performance standards are maintained. Regulations and guidelines exist, but how can you be sure that the product you buy is genuine? Is the test certificate enough to guarantee performance? Can you really trust catalog claims?

This article seeks to highlight the key steps to authenticating fenders to help designers, operators and owners of port infrastructure procure these systems confidently, safe in the knowledge that they are investing cost-effectively in equipment that guarantees quality and reliable performance over the long-term.

BERTHING VELOCITY AND TEMPERATURE

VELOCITY FACTOR

Velocity testing is critical to understanding how a fender will perform once in situ.

While it's impossible to replicate the actual berthing velocity of vessels in testing, which is normally anywhere between 20mm/sec and 500 mm/sec, it is possible to carry out rigorous testing that simulates these berthing conditions.

The type of raw rubber used in compound formulation significantly influences velocity factor (VF). Testing shows VF is highly dependent on the blend and ratio of natural rubber (NR) and synthetic based rubber (SBR) used in the overall rubber compound formulation. Fender manufacturers should always provide commentary in relation to the application of VF in their rubber compounds and fender designs. By performing this kind of research and making the data available, fender suppliers and manufacturers can increase understanding and improve standards across the industry.

Robust chemical and physical material testing is also required to ensure that reclaimed rubber and non-reinforcing fillers are not used in fender production. These substitutions may not always be

declared in supplier documentation, but will negatively impact the fender's ability to absorb the designated berthing energy of a vessel and therefore protect berthing vessels and port infrastructure.

TEMPERATURE FACTOR

Temperature factor (TF) is vital in understanding changes to reaction force and energy absorption of fenders in normal operating conditions. This is because the stiffness (modulus) of the rubber compound changes dramatically with temperature which, in turn, impacts how the fender performs in situ. Ideally, rubber elements for fender systems should be tested on a case-by-case basis in accordance with the temperatures they will be subjected to in the field.

Similar to VF, TF is highly sensitive to the type of rubber used – NR or SBR, or a blend of the two, as well as the inclusion of recycled rubber. TF therefore varies with fender type and from manufacturer to manufacturer, meaning test results are unique to each individual fender. Care

should be taken when comparing products from different manufacturers, as factors will differ depending on the type of rubber compound used during production. This is not always taken into consideration by manufacturers and suppliers due to a lack of testing data for their compounds.

ANGLE

Differing port infrastructures and vessel sizes mean that the angle of berthing will vary depending on circumstances. A fender system must be designed to have enough energy absorption capacity to accommodate the appropriate berthing patterns.

ANGLE FACTOR

Fender performance will vary depending on the angle of contact that results from a vessel's berthing approach. Therefore the capacity requirements in a fender system designed to accommodate parallel berthing will differ significantly from one with an acute angle of approach. Understanding how well a fender is able to absorb energy at different angles is critical to its performance at the quayside.

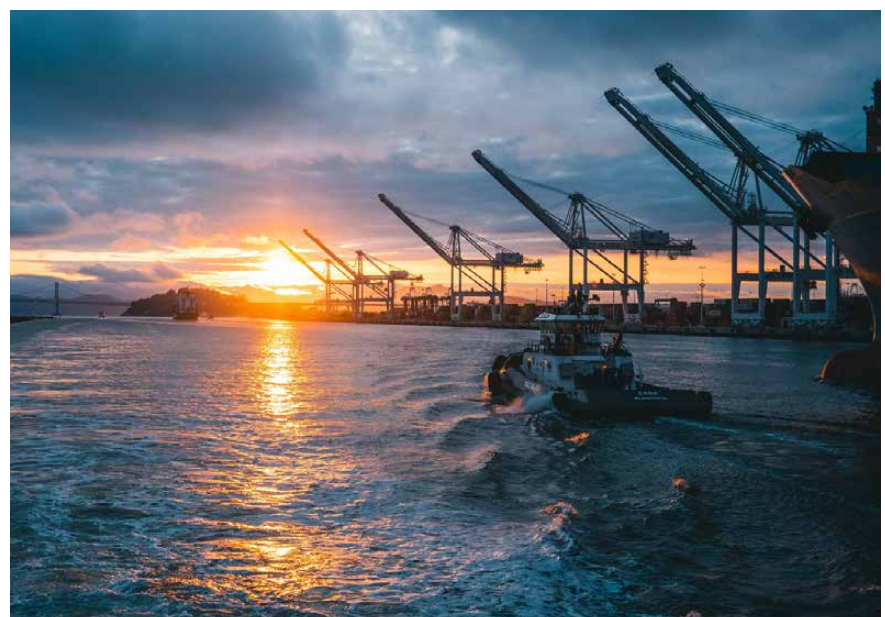
For fenders to meet Active Standard ASTM F2192 and PIANC 2002 guidelines requirements, rated performance data (RPD) must include the testing of fenders at zero degree angle of approach. By zeroing in on the angle factor, this should allow for easier comparison of fender performance data using other testing parameters (temperature, velocity, deflection). However, this is just the first step. In addition, manufacturers must also provide adjustment factor information for contact angles at 3, 5, 8, 10, 15 and 20 degrees – for each fender type. This makes it possible to determine if there is a reduction in performance (energy absorption) at larger berthing angles.

Manufacturers should clearly indicate in their RPD if chain restraints are factored in, as this will impact results data. Similarly, manufacturers should show angle factor testing data in relation to both transverse and longitudinal angular berthing to illustrate performance under different berthing conditions.

INDEPENDENT TESTING

Performance verification testing is usually performed in a large press or test frame with either load cells or pressure transducers. Outside of manufacturers' facilities, these test frames are extremely rare. As a result, performance testing usually occurs in manufacturers' own factories, meaning results are sometimes not fully objective.

During testing, it is not uncommon for fenders to be specifically selected for the test rather than chosen at random.





These fenders could be built to pass performance tests, but when it comes to creating the products that actually go to market, some manufacturers may use low cost, substandard materials in production. Similarly, some unethical manufacturers may also simply manipulate test results before going on to build and sell low quality fenders which aren't fit for purpose.

The industry's response to this has been to introduce independent witnessing to verify the authenticity of results. However, the implementation of this process has also been flawed.

UNRELIABLE WITNESSES

Common practice in the industry has relied on factory testing with witnessing by either a third party or a consultant. However, there is no easy way for witnesses to verify the results independently of what the manufacturer is reporting. Modern data acquisition methods rely on computers to interpret the data and produce a report. The witness rarely has any understanding of how the data acquisition system functions, making it easy for unscrupulous manufacturers to manipulate the recorded data in the computer without the witness knowing.

Many project specifications require a third party inspection agency to witness the test. The shortcoming here is that witnesses do not provide oversight on how the test data was acquired or if the report they are asked to endorse is even from the test they observed. The inspection agencies are not necessarily guaranteeing the validity of the data they are endorsing - essentially potentially rendering their endorsement useless.

TRUE INDEPENDENT TESTING

The fender industry involves big contracts and vast sums of money and there is too much at stake to allow manufacturers to serve as their own regulators. Our industry must move towards true independent testing, rather than just witnessed testing, and the simplest way to get objective, trustworthy results is to conduct tests in an independent laboratory.

The long term goal for the industry is for manufacturers to have testing at their own facilities but with independently recorded results. This will remove any uncertainty from the results and enable end users to have confidence that the lifecycle and performance of fenders meet specification, and that fenders are therefore fit for purpose.

CONCLUDING THOUGHTS

Fenders have a direct impact on the safe and efficient operation of our ports, helping improve berthing management procedures and increase vessel throughput. Therefore it is vital that the industry works towards a deeper understanding of the impact of VF, TF, angle of berthing and independent testing on fender performance. This will ensure designers, operators and owners of port infrastructure invest in equipment that guarantees quality and reliable performance over the long-term.

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Notes to Editors: Trelleborg's marine and infrastructure operation and Trelleborg Group

The marine and infrastructure operation of the Trelleborg Offshore & Construction business area, is a provider of engineered polymer solutions to the marine, infrastructure and renewable energy industries. It manufactures and installs bespoke fender systems, docking and mooring equipment, oil and gas transfer technology and vessel efficiency technology for marine environments all over the world. Its polymer engineering expertise also extends to its range of general marine products, including navigation aids and buoys. Performing in some of the harshest environments on earth, its principal infrastructure and energy offerings are sealing systems for tunnels, dredging hoses, water management solutions, building vibration isolation, and polymer seals for offshore applications.

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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. The Trelleborg Group has annual sales of about SEK 34 billion (EUR 3.32 billion, USD 3.92 billion) in about 50 countries. The Group comprises five business areas: Trelleborg Coated Systems, Trelleborg Industrial Solutions, Trelleborg Offshore & Construction, Trelleborg Sealing Solutions and Trelleborg Wheel Systems. The Trelleborg share has been listed on the Stock Exchange since 1964 and is listed on Nasdaq Stockholm, Large Cap. www.trelleborg.com.

ABOUT THE AUTHOR

Richard Hepworth is a Chartered Mechanical Engineer, having studied for his degree at the University of Manchester Institute of Science and Technology and now holds the position of Business Unit President for Trelleborg's marine and infrastructure operation, based in Dubai. Richard has over 20 years' experience working in the offshore and marine construction industry.

ABOUT THE ORGANIZATION

Trelleborg's marine and infrastructure operation is a global provider of highly-engineered polymer solutions for the advancement of operational performance across the marine, infrastructure and renewable energy industries.

ENQUIRIES

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