

Simply effective

by Fitzwilliam Scott

For carriers, damaged container corner castings create an operational hazard with potentially severe consequences for handling efficiency, cargo integrity, and vessel safety. Yet, little was known about the link between forces acting on container stacks in motion and corner-casting damage until two of the world's top five shipping companies worked with classification societies to identify the cause.

According to their studies, the issue stems from the vertical clearance between containers. When a ship rolls, the container stack opens slightly before the twistlocks engage. This elongation transfers directly to the container stack's upper lashing bar, which absorbs 100% of its allowable force, while the twistlock and lower lashing bar bear only around 60% and 40-50%, respectively, of their intended share of the load.

As a safety-focused leader in cargo-handling systems, MacGregor recognised the critical nature of these findings and set out to devise a solution. The result is the company's Balanced Lashing System, a mechanical innovation that not only improves operational safety but also significantly increases a vessel's cargo capacity.

Huge work behind a simple solution

After running a series of simulations, MacGregor's research and development (R&D) team determined that the company already possessed the in-house equipment and expertise needed to mitigate uneven lashing forces and thereby limit damage to corner castings.

Its solution is a patented elastic element based on a specialised compound

used in Flexipad, MacGregor's heavy-duty hatch cover. Integrated into the upper turnbuckle, this material prevents the upper lashing bar from absorbing excessive forces before the twistlock is fully active, ensuring all securing components, including the lower lashing bar, engage at the same time.

Although the Balanced Lashing System may appear simple, Arto Toivonen, MacGregor's Sales Manager for Lashings and Cargo Boost, explains that the solution is the product of a comprehensive R&D and testing process. "Arriving at this solution took three years of intensive R&D. Even though the base material was already proven in our Flexipads, adapting it for turnbuckles required rigorous UV and ozone testing, and exhaustive cycling tests to ascertain its operational lifecycle. The final product looks simple, but a huge amount of work went into its development."

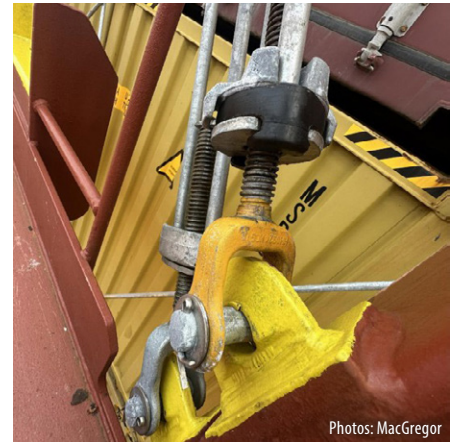
Small change, big payoff

Thanks to its uncomplicated design, the Balanced Lashing System is easy to install. Fitting inside a conventional turnbuckle, it requires no extra space, modified lashing eye plates, changes to

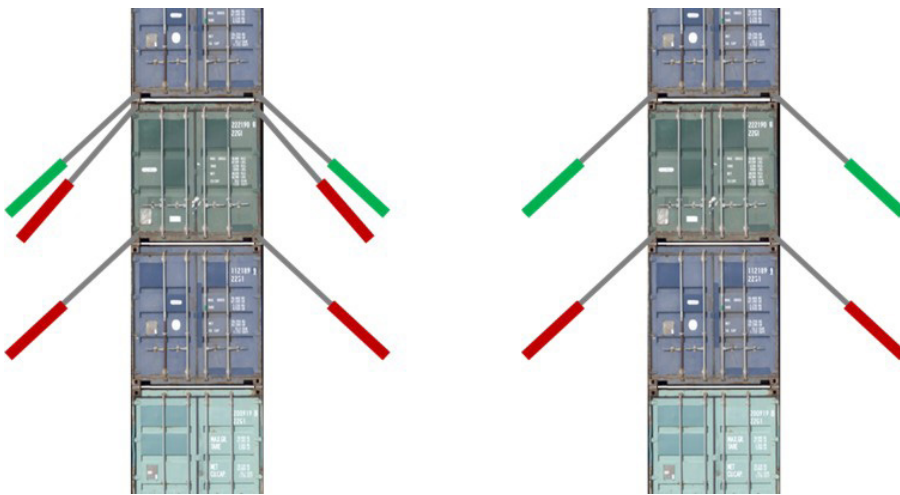
the lashing principle, or maintenance. It also has an extensive lifespan.

Implementing the solution involves only minor hardware adjustments, with the elastic elements applied to the uppermost turnbuckles alone. On a standard double-cross layout, this means exchanging roughly one-third of the vessel's turnbuckles, while on a two-level single-cross set-up, around half would need to be replaced. Conveniently, the system serves both new-builds and retrofits, since it requires no structural modifications; the turnbuckles are simply swapped and the lashing calculations updated accordingly.

Despite its apparent simplicity, MacGregor's solution has a considerable impact on a vessel's cargo-carrying potential. Whereas in a conventional set-up, the upper lashing bar operates at its permissible limit, with the Balanced Lashing System the component absorbs just 70% of its maximum allowable force in the same loading case. "Due to the complex physics involved, reducing the force exerted on the upper lashing bar from 100% to 70% does not mean you can load 30% more cargo, but it can yield a 10% increase depending on the classification society's rules," explains Toivonen. "Given the size of ship the system



Photos: MacGregor



is designed for, even a 1% increase makes a big difference in terms of added revenue.”

Locking in the market worth

To demonstrate the system's true commercial value, MacGregor analysed a simulated loading profile for a 24,000-TEU vessel under DNV rules. The model assessed an 11-high stack of 40-foot high-cube containers located in bay 66, using a metacentric height of 1.9 metres to replicate heavy rolling forces. It focused specifically on the containers in the main stacks of tier 84 – the first unlashed tier above the lashing bridge – comparing the impact of four distinct lashing configurations on the capacity of those containers.

In a conventional set-up, using fully automatic twistlocks with a 20-mm vertical clearance, the capacity of the

containers in question is limited to 7.5 tonnes. Where the vertical clearance is 15 mm, container capacity rises to 9.5 tonnes; with a 12-mm vertical clearance, it reaches 11 tonnes. However, when 12-mm fully automatic twistlocks are combined with the Balanced Lashing System, container capacity jumps to 20 tonnes.

“Looking at the business case for a 24,000-TEU vessel, pairing the MacGregor Balanced Lashing System with premium 12-mm twistlocks enables you to carry two additional layers of fully loaded 40-foot containers,” highlights Toivonen. “A conventional system supports the same number of containers, but the uppermost tiers have to remain practically empty, offering very little value to the operator.”

On a 24,000-TEU ship, adding two layers across 20 bays allows an operator to

carry roughly 800 extra fully loaded containers per voyage. Assuming a conservative freight revenue of \$2,000 per 40-foot container on an Asia-Europe route, 800 full containers generate \$1.6 million in revenue per voyage – or \$8.0 million over five annual round trips. “Even if we slash this estimate by 80% and evaluate the business case on just 20% of that projected benefit, the payback period for the increase in loose lashing costs is still measured in mere months – if not days,” remarks Toivonen.

Problem solved, order book filled

Class approval, Toivonen notes, is key to convincing leading operators to invest in a new product. MacGregor's Balanced Lashing System already holds approval from three major classification societies, with the review process and discussions under way with several more.

However, the system's safety benefits exist independently of class rules, Toivonen adds. By preventing container damage in transit, the solution eliminates the operational headache and costs of reporting and replacing compromised container hardware. “Because we solved a problem that leading container shipping companies have been trying to fix for some time, we already have 110 ships in our order book,” he says. “We also have major international classification societies actively working to integrate the technology into their frameworks.”

For a company committed to optimising safety and efficiency in maritime cargo handling, receiving such interest from both operators and class serves as the ultimate endorsement of its latest lashing innovation – a solution as simple as it is effective. ■



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