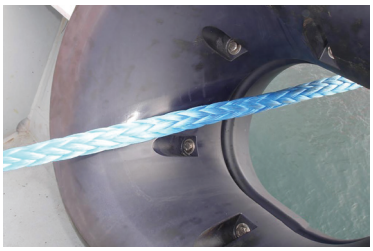
Increasing performance, safety and efficiency of Mooring operations worldwide



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ENGINEERING PLASTIC SOLUTIONS

In a marine industry fuelled by innovation and technology there are sometimes operations which are construed as having either peaked in development or not seen as an area of improvement unless absolutely necessary. The latter often being a reactive action due to safety risks.

One of the fundamental industry operations is the mooring of vessels. Traditionally, large vessels such as LNG vessels or tankers would have used steel wire ropes (on a winch with a synthetic 'stretchy tail' to absorb dynamic wave induced motions) for mooring due to their strength and heavy duty qualities, however overtime these would become difficult to handle, manage and maintain. This significantly increased the vessel time at berth in addition to creating safety risks from wire and rope breakages and wear.

As technology moved forward some vessels welcomed the introduction of HMPE rope, a synthetic fibre with high strength, making them largely equivalent in performance to the steel wire rope it replaced.

The use of HMPE as a mooring line material has provided a number of safety benefits to industry since its introduction, due to its good strength to weight ratio and ease of handling, ultimately contributing to a much lower risk of injury. Furthermore, the pollution, maintenance cost and time faced by regularly using lubricating oils and greases on wire rope are completely eliminated. It is now plain and simple to see the benefits of using HMPE over the traditional Wire Rope, but should the innovation of mooring technology peak with the introduction of new rope?

Although great advantages are provided with the use of HMPE ropes, a major weakness which often hinders their universal adoption is their poor resistance to external abuse and abrasion as they run through and come into contact with mating parts. The largest and most strenuous on the HMPE rope being the vessels cast steel chocks (sometimes referred to as Panama fairleads) and roller fairleads. HMPE ropes are often jacketed or temporary wear sleeves fitted to help with the abrasion issue but the jacket and wear sleeve quickly tear due to abrasion with the fairlead and poor load sharing within the core of the HMPE rope. This problem is particularly an issue where vessels are moored in ports subject to waves or swell.

Fig1 shows examples of wear sleeve, jacket and core damage even although the fairlead appears in perfect condition to the naked eye. In reality the surface is actually very rough and to prevent abrasion and poor load sharing with the HMPE rope you need a polished mirror looking surface and low friction between the HMPE rope and fairlead.

Smooth and polished when installed, without very regular maintenance and inspection, cast steel chocks very quickly suffer from forming a rough surface through constantly battling corrosion, rust and gouging from the passage of steel rope previously used on the vessel, all elements which greatly contribute to the accelerated wear of fibre ropes.

Fig1: Wear sleeve, jacket and core damage.

There are short term methods to overcome this, involving the use of protective sleeves, (as shown in Fig1) lubricants or temporary repair measures. All of which take great time, surveying and constant attention and monitoring by personnel, who also run the risk of injury by being in the immediate vicinity of worn equipment under high tension and stored energy created from the movement of the vessel in the water whilst moored.

An effective way of permanently addressing HMPE rope wear issues and risks which easily allows for the universal adoption of synthetic ropes over wire rope is the use of one of Nylacast's patented low friction Chock Liners.

The low friction Chock Liners are an engineering solution and application developed to address the mooring challenges faced within the marine industry. Designed and engineered by specialists in materials technology and science, the low friction Chock Liner is created from a custom formulated grade of engineering polymer. The use of this material allows for the delivery of increased performance, safety and efficiency for the mooring operation itself and the overall vessel.

The low friction Chock Liner technology stems from the knowledge and experience transfer of safety critical applications created for and utilised within the Oil & Gas industry for over four decades. In essence, the technology works as a lining component for the new or existing chocks on a vessel. Allowing for existing vessels to adopt HMPE mooring lines or increase the capital return in HMPE ropes by significantly extending their lifespan.

The use of a specially formulated grade of polymer for this performance enhancing technology allows for a number

of advantages delivered through the inherent properties of this material over other engineering materials available. The manufacturing process of the Nylacast material used combines a highly researched formula of the highest quality ingredients and chemicals, with the knowledge to process and create engineering applications from it. During the production process the custom formulated grade of polymer is put through an annealing process, this eliminates any internal stresses and allows for a much greater product strength and dimensional stability not achievable within other polymers on the market. This being one of many reasons the low friction Chock Liner is able to easily perform in an operation traditionally undertaken by metals.

In addition to high strength and dimensional stability, one of the many advantageous, inherent properties of the materials technology is its vast resistance to chemicals and corrosion. Used within the LNG industry worldwide for close to a decade, the low friction Chock Liner has eliminated any need for regular lubrication, maintenance, inspection and most importantly painting or cathodic protection of the chocks on a regular basis in order to maintain HMPE ropes from wearing.

Fig2 displays a direct comparison between two identical components, one manufactured from traditional steel and the other manufactured from the same material as Nylacasts low friction Chock Liner technology. Both components have been through the same testing conditions and methods for the same amount of time. The anti corrosive, self lubricated polymer displays a smooth surface with no need for coating, with the steel sporting a rough, rusted surface which would need regular maintenance to remain smooth when running against mooring lines.

Fig2: Corrosion and surface comparison between Polymer and Steel.

Another benefit of the low friction Chock Liner provided through its materials technology is the low coefficient friction of just 0.08. This allows for a leading resistance to wear and abrasion through its self lubricating properties, working excellently with the synthetic fibre ropes to reduce rope wear to a minimum and eliminate the risk of tearing, ripping or damaging the rope surface. The smooth, low friction surface allows the synthetic rope to easily glide through the low friction Chock Liner not only reducing wear and abrasion on the rope, but jointly removing any static build up and storage of energy created from the high relative motions of the mooring line in the chock.

The light weight of the low friction Chock Liner is also an advantage delivered through the unique material technology, typically 1/7th the weight of steel, the low friction Chock Liner adds little additional weight to a vessel and allows for ease of installation without the need for costly lifting equipment and installation teams. This is also coupled with no hot work being required during the installation process, meaning overall installation of low friction chock liner can be undertaken in a few hours. Allowing for existing vessels to adopt the technology too, not just new or refurbished builds.

Fig3 shows a chock being fitted using simple equipment.

Fig3: Chock Liner being fitted with standard equipment and no hot work.

The special formulated material utilised in the low friction Chock Liner technology is further developed and custom formulated by a team of industry chemists and engineers to not only meet, but also exceed the requirements and needs of the application. It is for this reason which the low friction Chock Liners can be used throughout the lifetime of the vessel with no need for replacement or regular maintenance. The low friction Chock Liner also allows for the use of mooring lines in accordance with OCIMF guidelines. Furthermore, Nylacast low friction Chock Liners are custom created for each vessel, ensuring a precision engineered fitting and finish each time.

Fig4 shows the chock of a moored vessel before and after being fitted with a low friction Chock Liner technology.

The use of low friction Chock Liner technology within marine vessels delivers cost efficiencies and savings across the life and service time of the vessel. The overall maintenance and replacement of both rope and chocks is significantly reduced in addition to a vast saving of time and man hours related to inspection, repair, paperwork and downtime. More importantly the number of safety risks are greatly reduced and in some cases eliminated, coupled with much smoother and efficient mooring operations and time at berth.

Fig4: Chock of moored vessel before (top) and after Chock Liner fitting (Bottom).

Increased efficiency is delivered through the use of low friction Chock Liner in comparison to a traditional steel chock which is unlined. Through substantial project experience, a typical LNG tanker with 16 unlined chocks would be 74% more costly to maintain a safe quality level of mooring rope and chocks, compared to the same vessel which utilises Chock Liner technology. This additional cost faced consists of the many elements associated with increased levels of maintenance, repair, replacement and administration work.

The many benefits of utilising the Nylacast low friction Chock Liner technology stretches worldwide through increasing the performance, safety and efficiency of mooring operations across an extensive range of vessels used globally within the marine industry from Royal Navies to ferries, tugs and tankers through to LNG industry Vessels including the BP Gem class; Diamond, Sapphire, Emerald and Ruby, through to BG fleet vessels. In total nearly five hundred Nylacast low friction Chock Liners are in active service, the first of which was installed in 2007.

The use of Nylacast low friction Chock Liner technology is also present on a number of leading FPSO and FLNG projects including the world's largest, Shell Prelude.