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Synthetic slings: safety in numbers

Dennis Sherman of Samson discusses safety factors and argues that synthetic ropes provide a safer method of moving heavy loads.

Projects involving heavy lifts are inherently dangerous. The damage that can be sustained from a dropped payload is stunning. In 2007 when a wire cable snapped and a 638 tonne petroleum reactor fell during offloading at a port in the USA, the ship in question was literally bounced onto the pier by the force of impact. Fortunately, there were no injuries to the crew, but the damage to the ship was massive and expensive to repair.

Labourers are not always so fortunate. The workers who must handle making attachments of heavy lift slings to payloads must deal with broken wire that tears at their hands. They often suffer back injuries resulting from handling the heavy wire ropes.

Synthetic slings: a safe alternative

No one involved with heavy lifts wants to see a payload dropped or a single labourer injured, but what are the alternatives to wire rope slings? The answer is simple: high-performance synthetic rope slings.

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For years, synthetics have successfully replaced steel wire strength members in many marine applications. High modulus polyethylene (HMPE) ropes for marine applications have effectively replaced wire rope moorings on product tankers in the shipping industry. The tug industry has also embraced HMPE lines as a standard wire replacement for towlines.

HMPE lines are as strong as wire at a seventh of the weight. They have essentially eliminated handling injuries in addition to making moorings easier and more efficient. In fact, the time it takes for mooring operations has been reduced by as much as two-thirds when compared with wire rope.

Discrepancy in factors of safety

These applications have proven the advantages of synthetic rope over wire, but a wide discrepancy in the factors of safety between wire and synthetic lifting slings exists. Certification bodies recommend a factor of safety (FOS) as low as three for wire lifts used repeatedly. For single-use synthetic slings, or slings used to lift the same object, however, an FOS up to seven is recommended. This tends to overcompensate on the safety factor, unnecessarily increasing the diameter, strength, and cost of the rope.

The industry understands that this is extreme, but a lack of long-term experience with synthetic rope technology holds them to excessive safety factors, and the industry resists using synthetic slings for repeated lifts, or lifts that involve varying sized payloads.

At Samson, we are working diligently through joint industry projects to understand better the needs of the industry and to educate the heavy lift community about the state of synthetic rope technology. Samson is also seeking to have the recommendations of certifying bodies revised, but as long as the disparity in the FOS between synthetic rope and wire slings exists, and companies abide by them, the payload is sure to be safely lifted by the synthetic sling.

Extra lifting power

The 144 mm diameter AmSteel®-Blue slings used in the UK's Greater Gabbard project are proof that this is true. With an FOS of seven and a minimum breaking load of 2,331 tonnes, the slings provided ample strength to lift the monopiles weighing 519 to 676 tonnes each. Lloyd's third-party supervision of break tests supported that the rope's minimum breaking strength exceeded the strengths required.

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– Dennis Sherman

When Seaway Heavy Lift decided to use Samson 144 mm diameter AmSteel®-Blue slings to install 140 monopiles for the Greater Gabbard project in the North Sea, one of the considerations was how the sling would affect the monopiles during operations.

Wire slings are often in direct contact with the payload in such lifts, but with synthetic rope and removable chafing protection, both the sling and the payload are protected from damage. The monopiles went through installation virtually without a scratch.

The jacket installation performed in the Pan Yu natural gasfield in 2008 was done with the assistance of four synthetic rope slings made with Samson Quantum-8. The rope slings were 120 mm in diameter with grommets and protected eyes at both ends to lift the jacket that was 75 m square, 213 m high, and weighed 16,213 tonnes.

China Offshore Oil Engineering Corporation reported that the synthetic slings outperformed both the cable-laid wire slings and the synthetic webbing slings they used in previous jobs. However, these lightweight, easy handling slings were attached manually by the workers on the job with no injuries, resulting in a faster, more efficient installation – a very positive outcome where windows of clear weather are so narrow.

One of the greatest benefits to using synthetic rope lifting slings is that they can be inspected for damage and retired before a payload is dropped due to failure.

The 144 mm diameter AmSteel®-Blue slings used in the Greater Gabbard project are proof that this is true. Two sets of slings were fabricated for lifting the monopiles weighing 519 to 676 tonnes each. The slings were certified by Lloyd's to meet or exceed the minimum breaking strength required to perform the job.

After 60 lifts, only one set of slings had been used. It was inspected by the fabricating master splicer and recertified by Lloyd's to finish the job – and the job was indeed finished with the single set. After further inspection, that set was determined still to be in excellent shape and will be used in future projects along with the set of slings that was saved as a back up. HLPFI

Please note, this article is intended for guidance only. Whilst every care has been taken to ensure the accuracy of the contents, no responsibility will be accepted by the publishers for any errors.

Dennis Sherman has worked in the synthetic rope industry for 15 years and is currently the director of sales for Samson's offshore segment. He has extensive experience in the fabrication, rigging, inspection, and design of synthetic ropes for applications ranging from industrial to offshore. Samson specialises in replacing wire with synthetic alternatives.

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SEAWAY CASE STUDY

A CASE IN POINT: Seaway Heavy Lifting Project

Samson high-performance synthetic slings used to install monopiles in rough seas, expected to perform 140 lifts total.

Seaway Heavy Lifting is currently using very large-diameter synthetic-rope slings fabricated from Samson's AmSteel®Blue in the installation of monopiles in the North Sea. The Greater Gabbard project involves installation of 140 turbine foundation monopiles in the typically demanding conditions of the British sector of the North Sea. Located in the sandbanks 23 km off the coast of England, the Greater Gabbard project is the world's largest wind farm currently under construction.

Seaway Heavy Lifting (SHL) anticipated rough seas during the installation of the monopiles. Because of their light weight and easy handling, SHL specified synthetic woven-round-sling systems for the job instead of the heavy, awkward wire or cable-laid version. Synthetic heavylift slings would also mitigate potential damage to the monopiles during their transfer from the supply barge to the deck of the installation vessel, the *Stanislav Yudin.* Each lift system called for two slings attached to the lifting pins at one end and a single grommet, making a basket configuration at the opposite end.

SHL has been a customer of Endenburg BV of Gouda, The Netherlands, for many years and has used Samson's synthetic ropes successfully in the past. Because of this relationship, SHL sought Endenburg's advice. Endenburg brought the Samson technical sales team into the discussion, and together with SHL, they examined the possibility of using a synthetic rope solution in place of the proposed round slings.

While the advantages of using synthetic fiber over wire in heavylift slings, such as the differences in weight and ease of handling, are obvious, the advantages of using synthetic rope over synthetic round slings are not commonly known. Among the key advantages of using synthetic rope slings are:

- **Strengths are available to 4,457 metric tons in a grommet configuration;**
- **Removable chafe gear can be placed on them for protection from abrasion, but are easily removed and replaced for inspection purposes;**
- **They are simple to repair and splice in the field; and**
- **Longer lengths are available.**

For the Greater Gabbard project, each monopile weighs from 519 to 676 metric tons. Based on the required working load limit supplied by SHL, Endenburg determined that heavylift slings fabricated from Samson's 144-mm diameter AmSteel®Blue would meet specifications.

SHL agreed and ordered two lifting systems; each included two slings and a grommet. The very large diameter rope was manufactured at Samson's Lafayette, La., plant. Break tests were performed locally under Lloyd's third party supervision to certify the rope's minimum breaking strength met or exceeded the strengths required. Endenburg, Samson's Master Distributor in Europe, then fabricated the slings and grommets, complete with all weight-bearing points protected with chafe gear. Upon delivery, these became the first very large-diameter synthetic heavylift slings certified by Lloyd's for multiple uses in offshore installations.

By the end of the third quarter of 2010, all 140 turbine foundation monopiles were installed using the first set of lifting slings.

Upon inspection, they showed no signs of wear according to Endenberg's master splicer who conducted several inspections throughout the project. These inspections included removing the chafe gear and closely examining the entire line for wear and damage. Lloyd's also proof loaded the slings and recertified them for continued use.

All 140 turbine foundation monopiles were installed using the first set of lifting slings. After completion Lloyd's proof loaded the slings and recertified them for continued use.

Through this process, it has been determined that the original set of slings and grommets can be used again. The second set is still in storage.