

HIGH-PERFORMANCE

Synthetic Lifting & Lowering Solutions



samson
THE STRONGEST NAME IN ROPE

THE SAMSON ADVANTAGE

Wire Replacement Considerations

Samson has more experience replacing wire ropes with high-performance synthetics than any other manufacturer in the world

Starting in the 1980s, when the first high-modulus lines were developed using HMPE fiber, it became obvious that this was a perfect replacement for wire ropes in commercial marine applications. The problems with wire are very well known in the industry. The sheer weight of wire ropes creates handling problems. The equipment that handles it requires significant horsepower to run and creates a very large footprint on deck.

Size for size, high-performance synthetic ropes are at least as strong as the wire they replace, and, in most applications, last at least three times longer. They are typically one-seventh the weight of wire, and are easily handled by reduced crews. There are no fishhooks from broken strands, and back problems are greatly reduced.

Most of Samson's high-performance synthetics are neutrally buoyant in seawater, with a specific gravity just slightly over 1. Wire rope has a break length, the amount of rope that is capable of supporting its own weight, that must be taken into consideration when planning a long lowering operation. The load must be reduced, or the size (and the weight) of the wire increased to compensate.

High-performance synthetics are virtually weightless in seawater. There is an effectively unlimited depth that can be accommodated. The only loads that need to be anticipated are those of the payload and the connecting hardware.

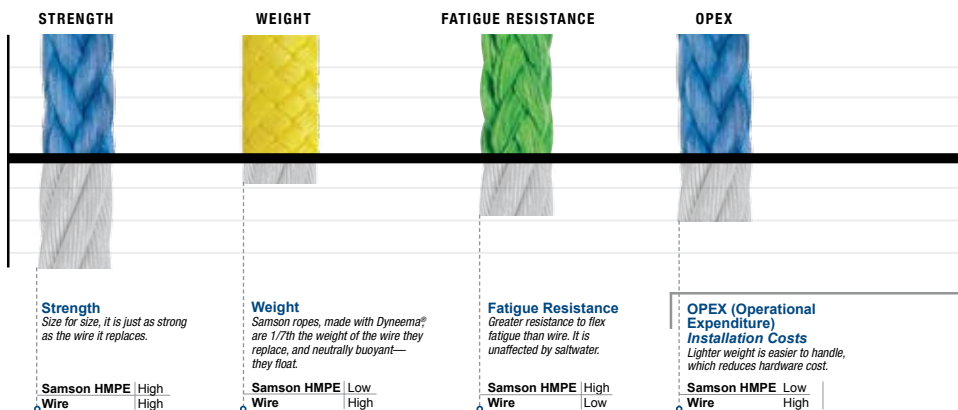
Equipment can be smaller, the footprint on deck reduced, and the power requirements for winches and cranes reduced. The service life in most applications is longer, and any handling required is much safer and more efficient. All important considerations when working well offshore, where space and power are at a premium.

HMPE ropes are at least as strong as the wire they replace, 1/7th the weight, and last at least 3 times longer



COMPARISON

SYNTHETICS VS. WIRE ROPE



DeepCool® Technology: Pushing high-performance synthetics past wire in CBOS applications

As offshore exploration and production moves into increasingly deeper waters, the use of heave-compensating lifting and lowering equipment becomes more prevalent. The repetitive bending over sheaves, combined with the high loads and increased depths, extracts a heavy toll on winch lines—wire or synthetic.

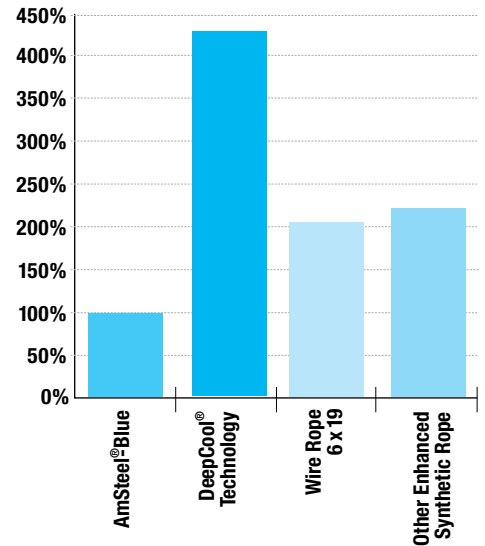
Samson's R&D department has developed a combination of fibers and coatings into a high-performance synthetic rope that improves performance in cyclic bend over sheave (CBOS) applications by up to 10 times that of standard ropes. High-performance synthetics with DeepCool® technology last significantly longer in situations of repetitive bending compared with wire ropes or other high-performance synthetic ropes without DeepCool® technology, while retaining the lightweight, flexibility and high-strength properties of Dyneema® ropes.

DeepCool® technology improves performance in CBOS applications by up to 10 times compared to standard ropes

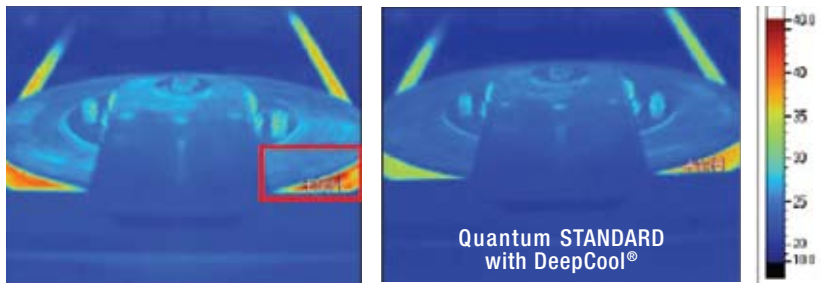
Testing for DeepCool® has been extensive, where different D/d ratios at different factors of safety have been compared, as well as different frequencies, wet and dry, and in both large and small diameter rope sizes. The data shows significant improvement in performance over wire ropes or standard high-performance synthetics. Internal heat from fiber-on-fiber abrasion is greatly reduced. See the test results in the column to the right.

The result is a rope that is more reliable and lasts longer in operations where active heave compensation is required.

CBOS PERFORMANCE: Improvement Over AmSteel®-Blue



Standard AmSteel®-Blue, made of 100% Dyneema®, is the baseline for the tests. The same product enhanced with DeepCool® technology, DeepCool® ASB, increases CBOS performance by 4x. DeepCool® ASB also outperforms wire and other synthetic ropes enhanced for CBOS performance by ~2x. If you have further questions, please contact one of Samson's Technical Representatives.



Internal heat generated by cyclic bend over sheaves (CBOS) is significantly reduced with DeepCool® Technology.

When you consider all the factors, from strength and weight to service life, there really is no comparison.

TRANSPORTATION	EQUIPMENT	SERVICE LIFE*	MAINTENANCE	DURABILITY
<p>Transportation Costs Lighter weight allows smaller handling vessels and machinery, fewer trips to transport.</p> <p>Samson HMPE Low Wire High</p>	<p>Equipment Costs Lighter weight allows smaller winches, decreased deck loads, and energy demands.</p> <p>Samson HMPE Low Wire High</p>	<p>Service Life* Samson ropes, made with Dyneema®, typically outlast wire by a factor of 3 in commercial marine applications.</p> <p>Samson HMPE Longer Wire Shorter</p>	<p>Maintenance Costs No lubing, chemicals, or spooling trucks required. Easy end for ending, in-the-field and on-the-spool splicing.</p> <p>Samson HMPE Low Wire High</p>	<p>Durability Strength remains the same wet or dry. Samson HMPE ropes are also abrasion resistant and resistant to most chemicals.</p> <p>Samson HMPE High Wire Low</p>

*While service life varies with the actual application and the environmental conditions of the installation, experience has shown that synthetics outlast wire by an average of three times. Some users report much longer service life.




WINCH LINES


High-performance synthetic winch lines: The benefits add up




AmSteel®-Blue | A size-for-size 12-strand wire rope replacement made with Dyneema® fiber, AmSteel®-Blue is easy to splice, inspect in the field and available in high-visibility colors. AmSteel®-Blue is our most popular and versatile, high-performance synthetic rope.




Quantum-12 | A 12-strand wire rope replacement made with Dyneema® fiber and DPX™ technology for added grip—an excellent choice for traction winches.



Quantum-8 | Made with Dyneema® fiber and the addition of DPX™ technology for added grip, this 8-strand construction is firmer and rounder than 12-strand braided constructions. Quantum-8 works very well on traction winches.



Neutron-8 | Samson's strongest rope made with Dyneema® fiber, Neutron-8 is a patented 8x3 construction. This rope is a firmer construction than 12-strands but easily spliced and inspected in the field.



Turbo-75 | Samson's premier jacketed core-dependent braid, Turbo-75 incorporates a tightly woven Dyneema® fiber jacket (for cut and wear resistance) over a single braid core of same material. Turbo-75 is a very round, firm braid, which packs beautifully on a winch. Also available in tapered constructions.

Reduced deck loads, equipment footprint, and less demand for energy

Compared with wire rope of the same strength, high-performance Samson synthetic winch lines weigh in at one-seventh the weight of same strength wire ropes. They offer the offshore engineer the choice of reducing the overall deck load significantly, reducing the equipment footprint and power requirements, or increasing the capacity of existing equipment.

Samson winch lines reduce deck loads, equipment footprints, and power requirements

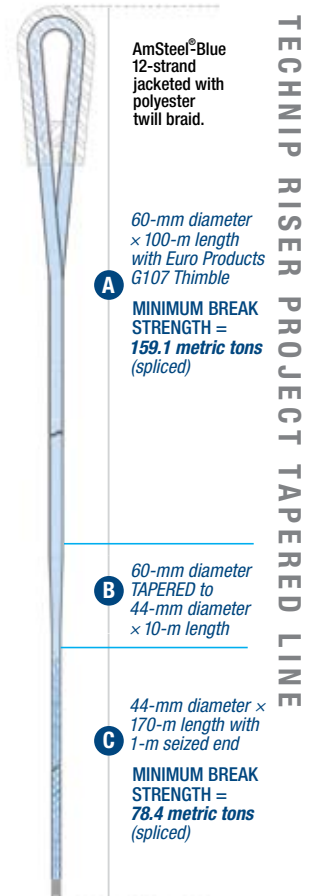
Greater capacity from existing equipment

High-strength, high-modulus synthetics are neutrally buoyant in seawater, and some constructions float. Unlike wire rope, they are virtually weightless in seawater. That means the energy required to operate winches is spent lifting or lowering the payload, not the rope. By comparison, wire rope has a breaking length—that amount of rope whose weight exceeds the strength of the rope itself—that limits its use at extreme depths. You could upsize the wire to compensate, but you're also increasing the power demands, the physical size of the winch, and deck space that is required to handle it.

CUSTOM-ENGINEERED SOLUTIONS: Tapered winch lines for offshore applications

Samson engineers have developed a method for producing tapered winch lines without the headache of using terminations, swivels, or shackles on discrete sections. The ropes are tapered on the braider, and can be produced in long continuous lengths without terminations.

The result is a line braided to your specifications, without the problems that connectors can cause in winch-based applications. Tapered winch lines retain all the lightweight flexibility of high-performance synthetics in a line designed specifically for your application, equipment, and operating conditions. They are currently in use as riser pull-in lines and turret buoy pull-in lines.



TECHNIP RISER CASE STUDY

A CASE IN POINT: Technip's Enfield Riser Project



Enfield riser column.

With the help of a custom-tapered winch line supplied by Samson, installation of the world's largest riser column was successful. The riser column at the Enfield oil field development site off the coast of Exmouth, Australia, that uses special angled flow tubes to shorten the catenary required for the riser tubes. Using synthetic ropes eliminated the possibility of abrasion damage to the flow tubes at the bend, a potential source of corrosion.

When the original supplier was unable to deliver, Samson was contacted for a solution that would eliminate the problem while keeping the installation on schedule. Samson engineers recommended a custom designed 12-strand made of Dyneema®, tapered to conform to the loads anticipated for the riser pull-in.

WITH
Dyneema®

Dyneema® is a registered trademark of Royal DSM N.V. Dyneema is DSM's high performance polyethylene product.

when you're working offshore.

TRACTION WINCHES: The DPX™ Advantage

HMPE fibers typically have a low coefficient of friction (CoF), limiting their use in traction winches and capstans. Samson's R&D department has developed an entirely new way of combining the strength, light weight, cut and abrasion resistance of Dyneema® fiber with the higher CoF and heat resistance of polyester. DPX™ technology is a patented process that integrates textured polyester fiber on the surface of the rope's yarns to increase the CoF without compromising the strength of the HMPE.

DPX™ technology has been incorporated into two patented constructions—

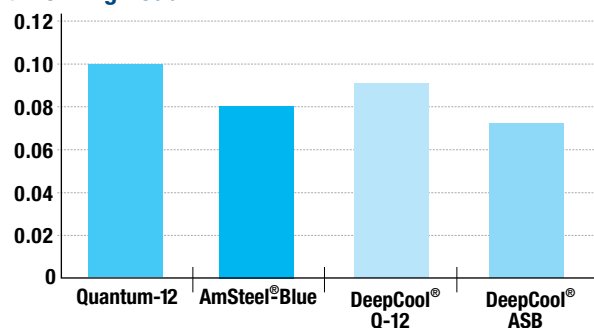
Samson's Quantum-12 and Quantum-8. They have both been used as direct drop in replacements for wire rope in existing traction winches without modification.

DPX™ technology also increases the efficiency of splices in these two constructions, making them excellent for fabricating high-performance, light weight heavy lift slings.



Quantum-8 turret buoy pull-in line installed on a traction winch on the FPSO Stybarrow.

STATIC COEFFICIENT OF FRICTION: At Working Load



The lines are jacketed in polyester, with master links spliced into the ends. Since they are smaller in diameter and the D/d ratio is different than originally specified, in-house testing was provided by Samson to confirm the lines' performance for the engineers at Technip.

Installation was completed successfully on schedule, with the tapered lines meeting all expectations. A real life example of The Samson Advantage in action.



Installation of riser.



Tapered AmSteel®Blue with polyester jacket winch line, 60-mm diameter tapering to 44-mm diameter with master links spliced in.

Samson offshore high-performance synthetic ropes—the clear performance choice over wire rope

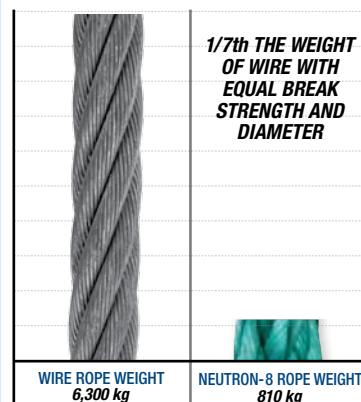
REDUCE DECK LOADS BY SIGNIFICANTLY REDUCING THE TOTAL WEIGHT OF THE WINCH SYSTEM

Comparing systems with the same capacities, Samson high-performance winch lines significantly reduce total deck loads. For a typical winch system with a line pull of 300 metric tons, using 4-inch diameter lines 150 meters in length, **there is a 30% reduction in the weight of the winch alone** using Samson high-performance synthetic ropes.

That's before factoring in the weight of the rope itself.

Add in the weight reduction of the winch line and you've got a significant reduction in the total deck load of the winch system.

150 meter by 4-inch diameter LINE WEIGHT



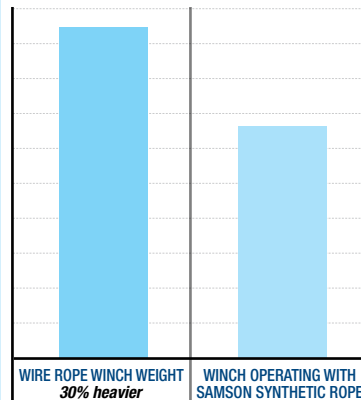
150 meter x 4-inch diameter
WIRE ROPE = 6,300 kg

150 meter x 4-inch diameter
SAMSON NEUTRON-8 HIGH-PERFORMANCE SYNTHETIC ROPE = 801 kg

WEIGHT SAVED: 5,499 kg

(just under 6 metric tons)

300 metric ton line pull WINCH WEIGHT



Benefits of synthetics over wire winch lines

- > Reliable strength and performance
- > Lightweight and flexible
- > Reduced maintenance costs
- > Longer service life
- > Better bend fatigue
- > Safer, easier handling

THE SAMSON ADVANTAGE

Samson Synthetic Extension Pendants

Extending the reach of existing equipment

With offshore installations reaching increasing depths, and with subsea hardware for processing becoming more prevalent in new operations, existing equipment can be severely taxed. With increasing loads and greater depths, wire ropes reach their capacity quickly. One way to get more out of existing cranes and winches is to use synthetic extension pendants (SEPs).

Samson extension pendants utilizing Dyneema® fiber have the same stiffness as steel wire, allowing for better lift consistency. Polyester or nylon options can create inconsistent motions, making the package harder to handle at the sea bed.

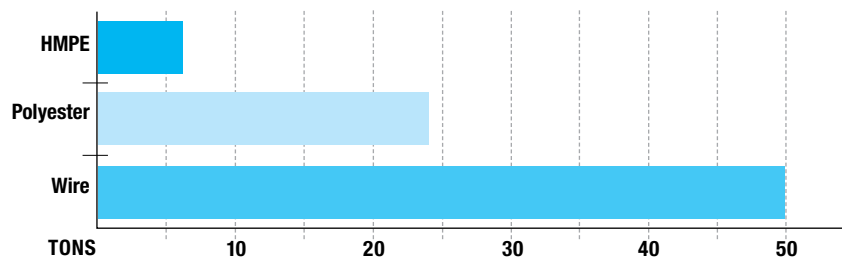
High-strength, lightweight Samson HMPE SEPs are buoyant in seawater; they are essentially weightless. The only weight the crane has to deal with is the payload itself, and this added weight savings allows you to increase the factor of safety (FoS) or add to the overall package weight. Eliminating wire weight adds tremendous lift capacity to existing equipment. Buoyant ropes can also be stored vertically from the sea bottom between deployments without corrosion or burying.

Virtually weightless in seawater, all of the crane's capacity and the energy required to operate it, is used to handle the package. Depth is no longer a limitation.

High-performance synthetics are essentially the same diameter as the wire they replace, significantly smaller and lighter than traditional synthetics, and don't absorb water. Longer lengths fit on the same reels, and more reels can be transported at one time.

A high-performance synthetic pendant 750-meters long, with 1,250-ton minimum break strength (MBS) weighs 6.5 tons, where 750 meters of wire weighs 50 tons. To reach the 1,250-ton MBS, a polyester rope would need to be approximately 8 inches in diameter, and, at 750 meters, would weigh 23.5 tons.

WEIGHT COMPARISON: 1,250-ton MBS line, 750-meters long



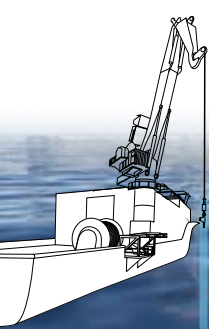
EXTENSION PENDANT PRODUCT SUGGESTIONS:

Turbo-75

Samson's premier jacketed core-dependent braid, Turbo-75 incorporates a tightly woven Dyneema® fiber jacket (for cut and wear resistance) over a single braid core of same material. Turbo-75 is a very round, firm braid, which packs beautifully on a winch. Also available in tapered constructions.

AmSteel®-Blue

A size-for-size 12-strand wire rope replacement made with Dyneema® fiber, AmSteel® Blue is easy to splice, inspect in the field and available in high-visibility colors. AmSteel® Blue is our most popular and versatile, high-performance synthetic rope. **ALSO AN EXCELLENT ROPE FOR HEAVY LIFT SLINGS.**



1000m

2000m

TYPICAL WIRE ROPE MAX. DEPTH

WORK DEEPER WITH EXISTING EQUIPMENT AND SAMSON HIGH-PERFORMANCE SYNTHETIC EXTENSION PENDANTS

> Samson extension pendants utilizing Dyneema® fiber have the same stiffness as steel wire, allowing for better lift consistency. Polyester or nylon options can create inconsistent motions, making the package harder to handle at the sea bed.

3000m

4000m

5000m

6000m

7000m

8000m

9000m

SAMSON HIGH-PERFORMANCE SYNTHETIC ROPE MAX. DEPTH UNLIMITED

10000m

High-Performance Slings

Increase the efficiency of your lifts with easily inspected and repaired high-performance synthetic rope slings

Heavy lifts using Samson high-performance synthetic rope slings are remarkably efficient. Light weight, easily handled slings require less equipment during rigging, and can shorten the times associated with a heavy lift. Products made with Samson's patented DPX™ technology, Quantum-8 and Quantum-12, offer greater splice security due to the increased coefficient of friction.

Samson high-performance ropes are converted into slings by certified fabricators in Samson's worldwide network of offshore distributors. Slings are tagged and certified to your specific requirements. All of Samson's high-performance ropes produced in our ISO 9001-2000 certified plants are available with type certification from ABS, DNV, Lloyd's, NK, and CE.

Advantages of heavy lift slings made from Samson high-performance ropes:

COMPARED TO WIRE:

- > Higher strength-to-weight ratio
- > Extremely light weight, easily handled
- > Flexible and easy to store, transport, and rig
- > Better strength efficiency at lower D/d ratios
- > Less damage to equipment being lifted
- > Chafe gear can be applied at wear points

COMPARED TO ROUND SLINGS:

- > Greater strengths available; rope slings available to 4,457 metric tons (grommet)
- > No jacket, they're easily inspected on site
- > Simple to repair and splice in the field
- > Longer lengths available, rope can be braided to virtually unlimited lengths

In either case, fabrication by regional master distributors results in shorter lead times

Technical considerations when designing heavy lift slings:



STRENGTH D/d ratios, and sling configurations can affect rope strength, e.g., chokers and baskets. Grommets should be rated at 1.6× the ropes minimum break strength.

SPLICE POSITIONS If a grommet contains one splice, it should be placed at one of the pick points. If there are two splices, they should be placed between the load and the lifting device.

COEFFICIENT OF FRICTION The CoF should be considered when choosing ropes and contact surfaces on hooks and trunnions. The CoF can also affect splice lengths and length tolerances.

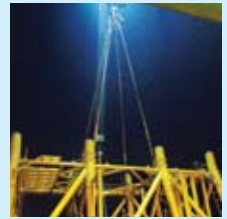
CONSTRUCTIONAL & FIBER ELONGATION Constructional elongation will change per construction, e.g., 8-strand vs. 12-strand. It is important to choose the best rope to meet your lift parameters.

Grommets will offer greater fiber elongation to a single leg sling as the load on the individual lengths will be at a higher percent of the ropes minimum break strength.

Samson's technical sales team is available to assist with any questions.

COOEC: High-performance synthetic slings lift 16,213 metric tons

COOEC reports that the slings used in the Pan Yu jacket installation, outperformed either the cable-laid wire or the synthetic webbing slings they had previously use. The lightweight, easy handling Quantum-8 slings were attached manually, without the assistance of heavy equipment required by cable-laid or synthetic webbing alternatives, resulting in a faster, more efficient installation. The slings were sold through and fabricated by Gaylin, Samson's Master Distributor in Asia.



CASCADE CHINOOK: Technip uses Samson slings and a "wet handshake" for subsea hardware installation



Two slings were used on each piece of subsea hardware, one to lift the package from the supply barge and one to transfer to the moonpool winch hook at a depth of about 100 meters. ROV's handled the lightweight, flexible slings with ease. The slings were sold through and fabricated by Southwest Ocean Services (SWOS), Samson's Master Distributor in Houston, Texas.



SEAWAY: Installing monopiles for 140 wind turbines goes smoother with lightweight slings

Rough sea states and heavy loads don't mix well. Lightweight, high-strength slings make for much easier, safer handling—even with multiple lifts. These are the first very-large diameter heavy lift slings certified by Lloyd's for multiple lifts for offshore use. The slings were sold through and fabricated by Endenburg BV, Samson's Master Distributor in Europe.



SLING PRODUCT SUGGESTIONS: See AmSteel®-Blue on previous page

Quantum-12

A 12-strand wire rope replacement made with Dyneema® fiber and DPX™ technology for added grip—an excellent choice for traction winches.

Quantum-8

Made with Dyneema® fiber and the addition of DPX™ technology for added grip, this 8-strand construction is firmer and rounder than 12-strand braided constructions. Quantum-8 works very well on traction winches.

RP-12 Polyester

This firm, round construction offers excellent abrasion resistance and flexibility. Polyester offers higher elastic elongation than HMPE, yet does not have the wet strength loss of nylon. Polyester also offers superior UV stability compared to nylon.

RP-12 Nylon

This firm, round nylon construction is easy to splice and inspect. Nylon offers high elongation and energy absorption for those applications that call for shock mitigation and energy absorption. Nylon also offers excellent wet abrasion resistance.

THE SAMSON ADVANTAGE

Offshore Projects List

Samson has extensive experience in supplying synthetic-rope solutions for critical offshore applications

- > Technip for Petrobras *Cascade Chinook* AmSteel®Blue 10-inch circ. lifting slings, 2010
- > MODEC *Jubilee* FPSO Turbo-EPX 5-5/8 inch diameter riser pull-in and mooring tensioning rope, 2010
- > Seaway Windmill Pedestal Lift AmSteel®Blue 144-mm diameter slings, 2009
- > Shell *Perdido Spar* Quantum-12 72-mm diameter x 2800-m spar-based deepwater lifting line and winch, 2009
- > Intermoor for ATP Oil & Gas *Mirage* AmSteel®Blue 72-mm diameter rig tow lines, 2009
- > Intermoor for ATP Oil & Gas *Mirage* Super Strong Nylon 10-inch circ. SVMS (Supply Vessel Mooring System), 2009
- > Noble Drilling Corporation *Rig Noble Jim Day* Super Strong Nylon 12-inch circ. SVMS, 2009
- > Noble Drilling Corporation *Rig Noble Danny Atkins* Super Strong Nylon 12-inch circ. SVMS, 2008
- > CNOOC *PanYu 30-1* jacket-lift, Quantum-8 120-mm diameter (836 metric ton MBL) sling/grommets, 2008
- > CNOOC *FPSO MV Nan Hi Sheng Li* AmSteel®Blue 88-mm diameter buoy pick-up line, 2008
- > CNOOC *JV (Agip, Chevron/Texaco) FPSO MV Nan Hi Fa Xian* AmSteel®Blue 72-mm diameter buoy pick-up line, 2008
- > Technip for Vincent Field *NW Australia* 44-mm diameter polyester/Vectran riser hold-back line, 2008
- > Technip for Stybarrow Venture *NW Australia* 80-mm diameter Neutron-8 riser pull-in grommets, 2008
- > SOFEC *Pyrenees FPSO* multiple components supplied, 2008:
 - Spider Buoy Retrieval Lines:
Tapered Quantum-8 16-inch circ. x 80-m
 - Float Line:
RP-12 Ultra Blue 3-inch circ. x 75-m
 - Riser Recovery Winch Ropes:
Quantum-8 6-inch circ. x 35-m
Quantum-8 7 1/2-inch circ. x 250-m
 - Float Assembly Pendant:
Force-8 3-inch circ. x 90-m
 - Spider Buoy Floating Leader Rope:
Force-8 3-inch circ. x 50-m
- > Delmar Systems *Anadarko M-8* OMNI-Max™ anchor line, 2008
- > Technip *Kikeh Spar* AmSteel®Blue rig tows, 2007
- > Enfield Project Jacketed and tapered Dyneema® riser winch lines, 2006
- > Frontier Drilling Neutron-8 10-inch tow bridle, 2006
- > SOFEC *Stybarrow FPSO* multiple components supplied, 2006:
 - Tie-Down Sling:
AmSteel®Blue 7/8-inch x 21-m
 - Riser Install Winch Ropes:
Neutron-8 12-inch circ. x 60-ft
Neutron-8 10-inch circ. x 65-m
 - Riser Recovery Winch Rope:
Neutron-8 7 1/2-inch x 35-m
 - Two Spider Buoy Winch Ropes:
Tapered Quantum-8 16-inch circ. x 70-m
 - Float Assembly Pendants:
Force-8 3-inch circ. x 50-m
Force-8 3-inch circ. x 90-m
Force-8 3-inch circ. x 90-m
 - Slings:
AmSteel®Blue 3/8-inch x 165-m
AmSteel®Blue grommet 1 1/8-inch x 8-ft
Force-8 1 1/4-inch x 15-ft
Tech-12 grommet 3/4-inch x 11-ft
 - Winch Lines:
Quantum-8 7 1/2-inch circ. x 250-m
Tapered Quantum-8 16-inch circ. x 70-m
Neutron-8 7 1/2-inch circ. x 115-ft
- > SOFEC *Terra Nova* 16-inch circ. Neutron-8 winch lines, and 7-inch circ. x 18-ft AmSteel®Blue grommets, 2006
- > BP *Atlantis* AmSteel®Blue rig tows, 2005
- > Saipem AmSteel®Blue and Neutron-8 heavy lift slings, 2005
- > BP *Thunderhorse* AmSteel®Blue rig tows, 2004
- > Marco Polo TLP AmSteel®Blue riser protection barrier net, 2002
- > Prince TLP AmSteel®Blue riser protection barrier net, 2001
- > JHN FPSO AmSteel®Blue 11-inch spider buoy retrieval line, 2000
- > Shell Auger TLP Super Strong SVMS, 1991
- > Conoco Joliet TLP Super Strong SVMS, 1989
- > Diamond Offshore Drilling *Ocean Confidence* Super Strong SVMS
- > Noble Drilling *Noble Homer Ferrington* Super Strong SVMS
- > Aker Marine Contractors/Chevron *Genesis* SPAR Platform Super Strong SVMS
- > Diana/Hoover – SVMS
- > Gunnison – SVMS
- > Magnolia – Tow out system
- > Red Hawk – SVMS
- > Front Runner – SVMS
- > Shell Mars – SVMS
- > URSA – SVMS
- > Petronius – SVMS
- > Neptune – SVMS
- > Ram Powell – SVMS
- > BoomVang – SVMS

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DPX™ is a trademark of Samson Rope Technologies.

Dyneema® is a registered trademark of Royal DSM N.V.
Dyneema® is DSM's high performance polyethylene product.

Omni-Max™ is a trademark of DelMar.



samson
THE STRONGEST NAME IN ROPE

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