

**OFFSHORE**  
PRODUCT AND TECHNICAL GUIDE



**samson**  
THE STRONGEST NAME IN ROPE





## High-performance synthetic ropes outperform wire and other synthetic alternatives

The offshore oil and gas industry is finding out that Samson is a heavyweight when it comes to heavylift slings made with Dyneema® which have been proven safe, easy to handle, and easy on the payload.

When going into deepwater, offshore operators have come to count on ropes made with Dyneema® for safe and lightweight solutions that increase winch efficiency and remote operated vehicles can easily manipulate.

### THE SAMSON OFFSHORE ADVANTAGE: SECOND TO NONE

Samson's unparalleled service package to the offshore oil and gas industry includes application knowledge, technical support, and product training and service. Offshore companies worldwide are finding out that they can count on Samson.

#### Technology

- > Accurate and reliable product specifications based on rigorous testing
- > Certifications with DNV, ABS, NK, Lloyd's, and others
- > Extensive technical resources available

#### Products

- > Specialty products designed for the offshore oil and gas exploration and production industry

#### Service

- > Sales and engineering staff with application knowledge for technical support
- > Qualified service technicians with training in HUET, TWIC, and survival
- > On-site training in installation, usage, inspection, repair, and retirement
- > A worldwide network of Master Fabricating Distributors

## HIGH-PERFORMANCE SYNTHETIC OFFSHORE LINE ADVANTAGES



Slings made with Samson's large-diameter AmSteel®Blue lifted 140 monopiles for installation at the Greater Gabbard Windfarm in the North Sea.

*The benefits of offshore lines made with Dyneema® are proven:*

- > Safer operations
- > More efficient rigging
- > No contact damage to the payload
- > Reduced fabrication costs
- > Lightweight and strong
- > Abrasion resistant
- > Neutrally buoyant
- > Long lengths available
- > Easy to handle, inspect, and repair

### CLASS II OFFSHORE LINES



● = Class II  
(high-performance fiber content)  
● = Class I  
(traditional fiber content)

PRODUCT NAME	FAMILY CODE	OFFSHORE				CONSTRUCTION	FIBER (Core/Cover)
		Lifting Slings	Synthetic Extension Pendants	Winch Lines	Working Lines		
AmSteel®Blue	872	●	●	●	●	12-S	Dyneema®
HTP-12	703	●	●	●	●	12-S	Polyester
Neutron-8	867	●		●	●	8x3	Dyneema®
Quantum-8	863	●		●	●	8-S	Dyneema®/Polyester Blend
Quantum-12	873	●		●	●	12-S	Dyneema®/Polyester Blend
RP-12 Nylon	323	●			●	12-S	Nylon
RP-12 Polyester	402	●			●	12-S	Polyester
Turbo-75	864		●	●		CD	Dyneema®/Dyneema®
Turbo-EPX	886		●	●		CD	Dyneema®/Polyester
Ultra Blue-3	130				●	3-S	Ultra Blue Polyolefin

DB = Double Braid  
CD = Core-Dependent Double Braid  
3-S = 3-Strand  
8-S = 8-Strand  
8x3 = 8x3 Strand  
12-S = 12-Strand

For product details and specifications please see our *Commercial Marine Product and Technical Guide* or visit [SamsonRope.com](http://SamsonRope.com)

## OFFSHORE SPECIALTY PRODUCTS



### DeepCool® ASB

DeepCool® ASB has been designed to increase significantly the bend fatigue resistance of our standard AmSteel®Blue construction when used in applications that are subjected to cyclic bending over sheaves (CBOS). The engineered combination of fiber and coating technology result in a rope with significantly improved CBOS fatigue life; perfect for use in lifting and lowering operations that require the use of active heave compensation. Lighter in weight, stronger, and more resistant to CBOS fatigue than the wire it replaces, DeepCool® ASB is virtually weightless in seawater.

Breaking length is no longer a limiting factor. Equipment can be engineered to handle the payload, not the rope when delivering subsea hardware to deepwater and ultra-deepwater sites. That means you can design with a smaller equipment footprint on crowded decks, have lighter overall equipment loads, and a reduced draw on precious power in operation.



### DeepCool® Q-12

DeepCool® Q-12 combines the proven benefits of Samson's DPX™ fiber technology for enhanced grip and abrasion resistance with DeepCool® technology to enhance the bend fatigue resistance of ropes used in CBOS (cyclic bend over sheave) applications. Compared with wire ropes and untreated

synthetics, the combination of fiber and coating technologies of DeepCool® provides significantly longer service life to ropes used in applications requiring active heave compensation and other high-cycle/ high-frequency low-stroke systems.

Lightweight, ultra-high strength ropes allow reduced deck loads, smaller equipment footprints, and lower power requirements. These ropes are neutrally buoyant — virtually weightless in seawater — and there is no breaking length limitation. Equipment can be sized to the payload without regard to the weight of the rope.



### M-8

M-8, Samson's specially designed 8-plait rope construction, is a lighter and more flexible option for multiple offshore applications. Each strand of M-8 is very strong and durable, combining the lightweight strength of high modulus polyethylene (HMPE) Dyneema® fiber with a tightly woven cover. The cover is offered in both polyester and Dyneema® fiber. M-8 features very low elongation, high abrasion resistance, and is available with or without filtration tape. Filtration tape is offered when preventing the ingress of sediment or particulate matter to the strength member is required.

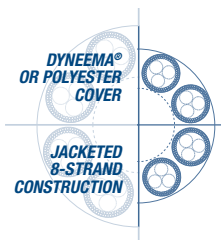
# M - 8 OFFSHORE ANCHOR RETRIEVAL LINE

**FEATURES:**

- > 8-plait construction
- > High strength
- > Lightweight
- > High abrasion resistance
- > Low elongation
- > Polyester cover offers negative buoyancy and lower cost
- > Dyneema® cover offers positive buoyancy and better abrasion resistance

**APPLICATIONS:**

- > Anchor lines
- > Lifting and lowering lines
- > Heavy lift slings



**SPECIFICATIONS: Dyneema® Cover**

Size Diameter INCHES	Size Circ. INCHES	Weight per 100 ft POUNDS	Samson Avg. Strength* POUNDS	Samson MBS* POUNDS	Size Diameter MILLIMETERS	Weight per 100 m KILOGRAMS	Samson MBS* METRIC TONS	ISO 2307 Strength** METRIC TONS	Maximum Length*** FEET
2-1/4"	7"	107 lb	441,000 lb	397,000 lb	56 mm	159 kg	180 t	200 t	2,800 ft
2-3/4"	8-1/2"	162 lb	661,000 lb	595,000 lb	68 mm	241 kg	270 t	300 t	1,600 ft
3-1/4"	10"	271 lb	882,000 lb	794,000 lb	80 mm	403 kg	360 t	400 t	1,400 ft
3-5/8"	11"	362 lb	1,102,000 lb	992,000 lb	88 mm	539 kg	450 t	500 t	1,200 ft
4"	12"	395 lb	1,323,000 lb	1,191,000 lb	96 mm	588 kg	540 t	600 t	900 ft
4-1/4"	13"	490 lb	1,543,000 lb	1,389,000 lb	104 mm	728 kg	630 t	700 t	730 ft
4-5/8"	14"	518 lb	1,764,000 lb	1,588,000 lb	112 mm	771 kg	720 t	800 t	600 ft

**SPECIFICATIONS: Polyester Cover**

Size Diameter INCHES	Size Circ. INCHES	Weight per 100 ft POUNDS	Samson Avg. Strength* POUNDS	Samson MBS* POUNDS	Size Diameter MILLIMETERS	Weight per 100 m KILOGRAMS	Samson MBS* METRIC TONS	ISO 2307 Strength** METRIC TONS	Maximum Length*** FEET
2-1/4"	7"	130 lb	441,000 lb	397,000 lb	56 mm	193 kg	180 t	200 t	2,800 ft
2-3/4"	8-1/2"	202 lb	661,000 lb	595,000 lb	68 mm	301 kg	270 t	300 t	1,600 ft
3-1/4"	10"	303 lb	882,000 lb	794,000 lb	80 mm	450 kg	360 t	400 t	1,400 ft
3-5/8"	11"	369 lb	1,102,000 lb	992,000 lb	88 mm	548 kg	450 t	500 t	1,200 ft
4"	12"	440 lb	1,323,000 lb	1,191,000 lb	96 mm	655 kg	540 t	600 t	900 ft
4-1/4"	13"	553 lb	1,543,000 lb	1,389,000 lb	104 mm	823 kg	630 t	700 t	730 ft
4-5/8"	14"	601 lb	1,764,000 lb	1,588,000 lb	112 mm	894 kg	720 t	800 t	600 ft

\*Spliced strength. \*\*This standard replaces BS EN 919 and ISO 2307:1995 and is for unspliced strengths. \*\*\*Cut length. ADD 10% TO WEIGHTS TO ACCOUNT FOR COATINGS AND FILTER TAPE.



## SAMSON PARTNERS WITH DELMAR SYSTEMS TO DEVELOP M-8



### OMNI-Max™ anchor uses M-8 as anchor-retrieval line

**THE PROBLEM** Hurricanes Ivan, Katrina, and Rita proved the true power of Mother Nature. As these storms swept through the Gulf of Mexico, several platforms were either severely damaged, parted their moorings, or both, resulting in billions of dollars in damages and loss of production. Since these storms, many regulations changed to minimize the risk associated with mooring during hurricane season.

**THE BUSINESS SITUATION** To meet these regulations, Delmar Systems developed the OMNI-Max™ gravity-installed anchor system for MODU installations in the Gulf of Mexico. This design called for special mooring and anchor-retrieval lines because the use of traditional anchor chain or wire rope in this application would affect the trajectory of the anchor's deployment, causing insufficient embedment into the seabed.

**AN ENGINEERED SOLUTION** Samson engineers were asked to engineer the anchor-retrieval line. M-8, an 8-strand rope of high-performance synthetic fiber was the result. In this unique design, each of the 8-strands is composed of a 3-strand, all-Dyneema® fiber core covered with a filter barrier to resist soil infiltration, and protected from abrasion by a braided Dyneema® fiber cover. Construction of the rope was accomplished through the combined efforts of Samson's Ferndale, Wash., and Lafayette, La., plants. The all Dyneema® fiber construction met all break strength requirements of Delmar and resulted in a rope with positive buoyancy that did not alter the anchor's trajectory when deployed.

**TESTED IN THE FIELD** Testing was conducted in 2006, at Vioska Knoll in about 1,400 ft of water, and was sponsored by Shell. Additional testing conducted by Anadarko, near one of its spar production facilities took place in March, 2007. The first OMNI-Max™ anchor installation for offshore oil and gas use in the Gulf of Mexico was completed on December 30, 2007. This marked the first time a gravity-installed vertical-lift anchor was successfully deployed for offshore outer-continental-shelf use in the Gulf of Mexico. The OMNI-Max™ can be scaled for various applications from permanent facilities to pipelines.

From the start of testing to the June 2008 installation of eight OMNI-Max™ anchors at Eni's Pegasus in approximately 3,600 feet of water, the Samson R&D team was there to ensure that the anchors would deploy and embed as designed, and be ready for retrieval whenever necessary.

**PROMISED PERFORMANCE** To date, OMNI-Max™ with M-8 mooring lines have performed as designed. The first installation received the ultimate test from Mother Nature, taking a direct hit from Hurricane Gustav. The storm wreaked havoc on this particular installation, resulting in the failure of many mooring components; however, even with seven of the eight mooring legs broken or damaged, the platform remained on location. Mooring wires, chains, and polyester lines all experienced failures. Of all the components in the mooring legs, the M-8 was the only component not to fail.

"The OMNI-Max™ system is working great and we are seeing some real cost savings. Installation times so far have confirmed our expectations that the OMNI-Max™/M-8 combination is a more efficient anchor system to install," says Brady Como, executive vice president, Delmar Systems, Inc.

Hurricane Gustav wreaked havoc on this particular installation, breaking or damaging seven of the eight mooring legs, but the platform remained on location. Of all the components in the mooring legs, the M-8 was the only component not to fail.

## SAMSON OFFSHORE WINCH LINES



## SMALL SOLUTIONS TO BIG PROBLEMS

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. With the problems of steel wire rope in offshore applications, now more than ever Samson synthetic winch lines are the perfect solution.

Problem: STEEL WIRE ROPE	Solution: SAMSON SYNTHETIC ROPE
Heavy weight makes length limited	Light weight makes length limitless
Sinks in water	Neutrally buoyant
Reduces lifting capacity of winches	Increases lifting capacity of winches and cranes
Heavier deck loads	Lighter deck loads
Increases power requirements	Reduces power requirements
Difficult handling for crews and ROVs	Easy handling for crews and ROVs

*On the deck of the Perdido Spar, 60-mm Quantum-12 is used to lower a subsea tree. Samson's patented DPX™ Technology allows Quantum-12, made with Dyneema® to work on conventional traction winch systems.*

## TECHNOLOGY AT WORK: UNIQUE SOLUTIONS FOR UNIQUE PROBLEMS

## DeepCool® Technology

As offshore exploration and production moves into increasingly deeper waters, the need for higher capacity lifting and lowering equipment becomes more prevalent. Most of these cranes and winches require active or passive heave compensation. The repetitive bending over sheaves, combined with the high loads and increased depths, extracts a heavy toll on winch lines—wire or synthetic.

**DeepCool® Technology pushes Samson high-performance synthetics past wire in cyclic-bending-over-sheave (CBOS) applications:**

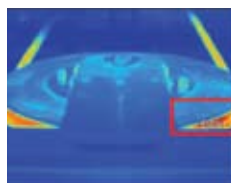
- > Equal D/d ratio
- > Improves performance up to 10 times that of standard ropes
- > Lasts significantly longer in CBOS applications compared with
  - steel wire ropes or
  - other high-performance synthetic ropes without DeepCool® Technology
- > Retains the lightweight, flexibility, and high-strength properties of Dyneema® ropes

**DeepCool® has been extensively tested**

- > At different D/d ratios
- > At different safety factors
- > At different cycling periods
- > Both wet and dry
- > In both large and small diameters

Testing has proven that DeepCool® Technology reduces the heat and abrasion caused by the relative motion within the rope construction that occurs during cyclic bending over sheaves.

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



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

## DPX™ Technology

Samson's patented DPX™ technology has been incorporated into two patented constructions: Quantum-8 and Quantum-12. The DPX™ technology, which blends the fibers of Dyneema® and polyester, increases the surface coefficient of friction allowing the rope to be used as a direct drop in for wire on traction winches:

- > High strength
- > Light weight
- > Better cut and abrasion resistance
- > Higher coefficient of friction
- > Better heat resistance



*Quantum-12 with DPX™ Technology for enhanced surface coefficient of friction.*



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

## Tapered Winch Lines

Samson engineers have developed a method for producing tapered winch lines, eliminating the need for in-line splices and/or heavy, bulky connection hardware. They are currently in use as

- > riser pull-in lines, and
- > turret buoy pull-in lines.

## Synthetic Extension Pendants

Work deeper with existing equipment by utilizing Samson high-performance synthetic extension pendants.

**Samson extension pendants made with Dyneema® fiber have**

- > similar stiffness as steel wire, and
- > similar strength as steel wire size for size.

## SAMSON SYNTHETIC HEAVYLIFT SLINGS

### TESTED AND PROVEN TECHNICALLY SOUND

Samson's R&D department has performed comprehensive testing of sling samples in different configurations, studying their efficiencies for required lifting capacities:

- > Working load limits (WLL)
- > D/d ratios
- > Optimal configurations
- > Splicing

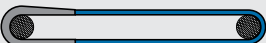



### SAMSON KNOWS SLINGS

Samson's testing program has developed an extensive knowledge base that has determined the perfect blend of safety, efficiency, and performance. Beginning with a 12-strand construction for

- > A high strength-to-weight ratio,
- > Excellent abrasion resistance, and
- > Easy fabrication,

one of two types of slings will meet your specifications.

GROMMET SLINGS	SINGLE-LEG SLINGS
	
WLL is dependent on the D/d ratio	More efficient at smaller D/d ratios
Efficiency factors are affected by: <ul style="list-style-type: none"> <li>• the position of the splice</li> <li>• the D/d ratio</li> </ul>	Length limits due to the free rope required between eye splices

### SLING CONFIGURATOR: BRINGING IT TOGETHER

This knowledge base is incorporated into the Sling Configurator, a custom-designed software tool that takes into consideration the critical requirements of your project and determines the optimum sling design to meet your objectives.

The Sling Configurator is a proprietary software tool developed by Samson's engineers to quickly analyze the lifting requirements and design options available:

- > Pin sizes
- > Working load limit (WLL)
- > Length requirements
- > D/d ratios



Samson's proprietary software tool quickly analyzes lift requirements and offers multiple configuration options.

The Configurator, a Samson exclusive.

This unique software tool is available to our Master Fabricating Distributors worldwide, which means

- > More efficient design
- > More efficient fabrication
- > Assistance with certification
- > Fast delivery



## A SAMPLING OF OUR SLING PROJECTS

**Greater Gabbard Windfarm monopile installation:**  
AmSteel®Blue combination single-leg and grommet slings



**Cascade and Chinook pumping station and manifold installation:**  
AmSteel®Blue grommet slings

**Pan Yu Jacket installation:**  
Quantum-8 single-leg slings



**GREATER GABBARD WINDFARM:** 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.

For full case studies on these and other sling projects, visit [SamsonRope.com](http://SamsonRope.com)



**CASCADE AND CHINOOK:** ROV handling grommets are used by the ROV to maneuver and position the AmSteel®Blue slings.

**PAN-YU:** Quantum-8 high-performance synthetic slings lift 16,213 metric tons.

# SYNTHETIC VS. WIRE COMPARISON FOR HEAVYLIFT SLINGS

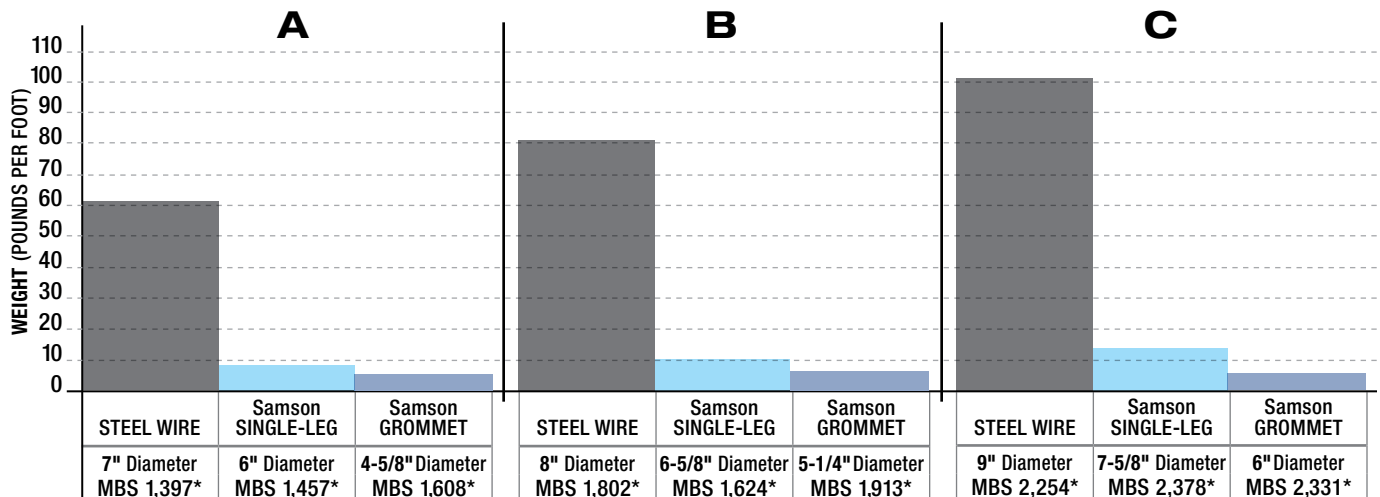
When considering Samson’s AmSteel®Blue slings as a wire rope replacement for heavy lift slings, the weight savings alone is compelling.

The table and graph below compare replacing a steel wire 9 part EIPS single leg sling with Samson’s AmSteel®Blue slings. Same Strength (approximately) with 87%–92% weight reduction.

Comparison	Steel Wire Rope (Gator Laid) 9 Part EIPS Single-Leg Sling						AmSteel®Blue Single-Leg Sling						AmSteel®Blue Grommet Sling							
	Size (Diameter) Total Sling		MBS		Weight		Size (Diameter) Total Sling		MBS		Weight		Size (Diameter) Total Sling		MBS		Weight			
	INCHES	MM	SHORT TONS	METRIC TONS	POUNDS PER FT.	KG PER METER	INCHES	MM	SHORT TONS	METRIC TONS	POUNDS PER FT.	KG PER METER	% OF WIRE ROPE SLING	INCHES	MM	SHORT TONS	METRIC TONS	POUNDS PER FT.	KG PER METER	% OF WIRE ROPE SLING
	<b>A</b>	7"	178	1,397	1,267	61.0	27.7	6"	152	1,457	1,322	7.80	3.54	13%	4-5/8"	112	1,658	1,504	5.25	2.38
<b>B</b>	8"	204	1,802	1,635	80.0	36.3	6-5/8"	168	1,624	1,473	10.10	4.58	13%	5-1/4"	128	1,812	1,644	5.80	2.63	8%
<b>C</b>	9"	229	2,254	2,045	101	45.8	7-5/8"	194	2,378	2,157	13.25	6.01	13%	6"	152	2,404	2,181	7.80	3.54	8%

Grommet efficiency factor of 1.65 is based on a 3:1 D/d ratio. Single-leg sling is based on a 1:1 D/d ratio.

## Replacing Steel Wire 9 Part EIPS Single-Leg Sling with Samson’s AmSteel®Blue Slings SAME STRENGTH WITH 87%–92% WEIGHT REDUCTION



\*MBS expressed in short tons. Grommet efficiency factor of 1.65 is based on a 3:1 D/d ratio. Single-leg sling is based on a 1:1 D/d ratio.

### HOW DO SAMSON SLINGS COMPARE?

#### Samson Slings vs. Wire Rope Slings

- > Safer operations
- > More efficient rigging—saves time and reduces rigging personnel
- > Neutral buoyancy
- > Increased lifting capacity
- > No contact damage to the payload

#### Samson Slings vs. Cable-Laid Steel Wire Rope Slings

- Same as wire rope slings PLUS
- > Reduced fabrication costs
  - > Dramatic weight savings
  - > No strength loss
  - > Easier handling
  - > No additional equipment required

#### Samson Slings vs. Round Slings

- > More robust construction
- > Easily fabricated
- > Easily inspected
- > Easily repaired
- > Long lengths available



# THE SAMSON ADVANTAGE

## Offshore Projects List

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

### LIFTING SLINGS

PROJECT: Cascade Chinook  
YEAR: 2010  
CONTRACTOR: Technip  
PRODUCT: AmSteel®Blue

PROJECT: Greater Gabbard Wind Farm  
YEAR: 2009  
CONTRACTOR: Seaway  
PRODUCT: AmSteel®Blue

PROJECT: PanYu 30-1  
YEAR: 2008  
CONTRACTOR: CNOOC  
PRODUCT: Quantum-8

PROJECT: Stybarrow  
YEAR: 2008  
CONTRACTOR: Technip  
PRODUCT: Neutron-8

PROJECT: Terra Nova  
YEAR: 2006  
CONTRACTOR: SOFEC  
PRODUCT: AmSteel®Blue

### FPSO WINCH LINES

PROJECT: Jubilee  
YEAR: 2010  
CONTRACTOR(S): Sofec/Technip  
PRODUCT(S): AmSteel®Blue, Turbo-EPX

PROJECT: MV Nan Hi Sheng Li  
YEAR: 2008  
CONTRACTOR: CNOOC  
PRODUCT: AmSteel®Blue

PROJECT: Pyrenees  
YEAR: 2008  
CONTRACTOR: SOFEC  
PRODUCT: Quantum-8

PROJECT: Enfield  
YEAR: 2006  
CONTRACTOR: Technip  
PRODUCT: Turbo-EPX

PROJECT: Stybarrow  
YEAR: 2006  
CONTRACTOR: SOFEC  
PRODUCT(S): Neutron-8, Quantum-8

### DEEP WATER WINCH LINES

PROJECT: Perdido  
YEAR: 2010  
CONTRACTOR: Shell  
PRODUCT: Quantum-12

PROJECT: Terra Nova  
YEAR: 2006  
CONTRACTOR: SOFEC  
PRODUCT: Neutron-8

### WORKING LINES

PROJECT: Mirage  
YEAR: 2009  
CONTRACTOR: Interroom  
PRODUCT: AmSteel®Blue

PROJECT: Vincent Field  
YEAR: 2008  
CONTRACTOR: Technip  
PRODUCT: Polyester/Vectran

PROJECT: Kikeh Spar  
YEAR: 2007  
CONTRACTOR: Technip  
PRODUCT: AmSteel®Blue

### SUPPLY VESSEL MOORING SYSTEM (SVMS)

PROJECT: Mirage  
YEAR: 2009  
CONTRACTOR: Interroom  
PRODUCT: Super Strong Nylon

PROJECT: Rig Noble Jim Day  
YEAR: 2009  
CONTRACTOR: Noble Drilling Corp.  
PRODUCT: Super Strong Nylon

PROJECT: Rig Noble Danny Atkins  
YEAR: 2008  
CONTRACTOR: Noble Drilling Corp.  
PRODUCT: Super Strong Nylon

### ANCHOR AND MOORING LINES

PROJECT: Anadarko  
YEAR: 2008  
CONTRACTOR: Delmar Systems  
PRODUCT: M-8 OMNI-Max™



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OMNI-Max™ is a trademark of DelMar.

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