

STEEL WIRE ROPES FOR OFFSHORE OIL AND GAS APPLICATIONS

 **SCAW METALS
GROUP**

Introduction

The Scaw Metals Group - manufacturers of the **haggie**[®] brand of steel wire rope used on South Africa's underground mines, and in many other important applications, has factories in South Africa, Zimbabwe and Zambia which produce the **haggie**[®] brand of high carbon wire and strand, steel wire ropes and fibre ropes and twines.

Scaw's operation continues to convey men and materials to and from the depths of the deepest mines in the world. Ropes of 15 000 metres in length and exceeding 140 tonnes in mass are well within Scaw's capabilities. Through the expertise developed in designing and producing sophisticated large diameter wire ropes for deep-level mining and deep-sea anchor lines, Scaw's - steel wire rope operation can justifiably claim to be **Specialists in the world of wire and rope.**

Scaw's Jupiter Ropeworks outside Johannesburg



Steel Wire Ropes for Offshore Oil and Gas Applications



Scaw has built up its reputation as a leading supplier of anchor lines to the offshore industry since 1986. Supplying ropes into virtually every segment of the offshore industry, the Scaw Metals range of large diameter anchor line ropes are supported by a wide range of products for related applications, such as pennant, drilling, riser tensioning, sand rod and tubing lines. Continuous product research and development has placed Scaw's offshore ropes at the leading edge of technology.

The ropes that Scaw supplies to the oil industry can be divided into two categories:

- Ancillary Ropes for offshore use
- Anchor lines for offshore application

General Application Table

Application	Construction	API 9A	Notes
Anchor line	6x36/IWRC 6x41/IWRC 6x49/IWRC 6x55/IWRC	6x37 class 6x37 class 6x37 class 6x61 class	Up to 77mm(3in) Up to 90mm(3½in) Up to 103mm(4in) Up to 128mm(5in) Above 128mm on request
Drill Line	6x19/IWRC 8x19/IWRC	6x19 class 8x19 class	Up to 38mm (1½in) Up to 38mm (1½in)
Sand/Cable Tooling Line	6x7/P	6x7 class	Polypropylene Core
Rod and Tubing/General Purpose Winch Line	6x25/IWRC 6x36/IWRC 19x7 non-rotating	6x19 class 6x37 class 19x7 class	Abrasion Resistance More Flexibility Long Length Application
Pennant Line	6x25/IWRC 6x36/IWRC	6x19 class 6x37 class	Up to 52mm (2in) Up to 77mm (3in)
Riser Tensioner Line	6x41/IWRC	6x37 class	Lang's Lay
Crane Ropes	19x7 19x19 34x7 34x19	–	Non-rotating ropes for general purpose cranes
Special Installation Line	18x36	–	Up to 96mm (3¾in) non-rotating rope

Anchor Lines for Offshore Exploration

Scaw offers a comprehensive range of large diameter ropes for anchor line purposes. They have robust constructions in order to be able to withstand the deployment and re-deployment process when the drilling unit shifts location from one exploration job to the next.

Using one of the largest closing machines in the world, Scaw can manufacture anchor lines as large as 150mm in diameter in continuous lengths up to the equivalent of 120 tonnes per length. Due to the rough handling anchor lines receive, it is sometimes considered that a galvanised surface is not warranted.



This range of ropes is therefore available as drawn-galvanised or ungalvanised. For rope diameters between 77mm and 103mm, a 6 x 49/IWRC construction is recommended. For larger diameter ropes the preferred construction is 6 x 55/IWRC.

These constructions change as the rope diameter increases to ensure that wires having appropriate properties for the application are used. Higher breaking forces are available subject to negotiations at the time of enquiry.

Anchor Lines for Offshore Exploration

Anchor Lines for Offshore Drilling Units 6x36, 6x41, 6x49 Wire Ropes, Drawn-Galvanised or Ungalvanised, Independent Wire Rope Core

Nominal Diameter		Approximate Mass		Improved Plow Steel			Extra Improved Plow Steel			Extra Extra Improved Plow Steel		
in.	mm	lb/ft	kg/m	lb	kN	Metric Tonnes	lb	kN	Metric Tonnes	lb	kN	Metric Tonnes
2	52	7.4	11.0	344 000	1530	156	396 000	1760	180	434 000	1930	197
2 $\frac{1}{8}$	54	8.4	12.4	384 000	1710	174	442 000	1970	200	488 000	2170	221
2 $\frac{1}{4}$	58	9.4	13.9	430 000	1910	195	494 000	2200	224	544 000	2420	247
2 $\frac{3}{8}$	60	10.4	15.5	478 000	2130	217	548 000	2440	249	604 000	2690	274
2 $\frac{1}{2}$	64	11.6	17.3	524 000	2330	238	604 000	2690	274	664 000	2950	301
2 $\frac{5}{8}$	67	12.8	19.0	576 000	2560	261	658 000	2930	299	728 000	3240	330
2 $\frac{3}{4}$	71	14.0	20.8	628 000	2790	285	736 000	3270	333	794 000	3530	360
2 $\frac{7}{8}$	74	15.3	22.8	682 000	3030	309	796 000	3540	361	864 000	3840	392
3	77	16.6	24.7	740 000	3290	336	856 000	3810	389	936 000	4160	425
3 $\frac{1}{8}$	80	18.0	26.8	798 000	3550	362	920 000	4090	417	1 010 000	4490	458
3 $\frac{1}{4}$	83	19.5	29.0	858 000	3820	389	984 000	4380	447	1 086 000	4830	493
3 $\frac{3}{8}$	87	21.0	31.3	918 000	4080	416	1 074 000	4780	487	1 164 000	5180	528
3 $\frac{1}{2}$	90	22.7	33.8	982 000	4370	445	1 144 000	5090	519	1 242 000	5520	563
3 $\frac{3}{4}$	96	26.0	38.7	1 114 000	4960	505	1 290 000	5740	585	1 410 000	6270	640
4	103	29.6	44.0	1 254 000	5580	569	1 466 000	6520	665	1 586 000	7050	720

Anchor Lines for Offshore Drilling Units 6x55 Wire Ropes, Drawn-Galvanised or Ungalvanised, Independent Wire Rope Core

Nominal Diameter		Approximate Mass		Improved Plow Steel			Extra Improved Plow Steel		
in.	mm	lb/ft	kg/m	lb	kN	Metric Tonnes	lb	kN	Metric Tonnes
3 $\frac{1}{2}$	90	22.7	33.8	966 000	4300	438	1 110 000	4940	503
3 $\frac{3}{4}$	96	26.0	38.7	1 098 000	4880	498	1 264 000	5620	573
4	103	29.6	44.0	1 240 000	5520	562	1 426 000	6340	647
4 $\frac{1}{4}$	109	33.3	49.6	1 388 000	6170	630	1 598 000	7110	725
4 $\frac{1}{2}$	115	37.4	55.7	1 544 000	6870	700	1 776 000	7900	806
4 $\frac{3}{4}$	122	41.7	62.1	1 706 000	7590	774	1 962 000	8730	890
5	128	46.2	68.8	1 874 000	8340	850	2 156 000	9590	978

Ancillary Ropes for Offshore Use

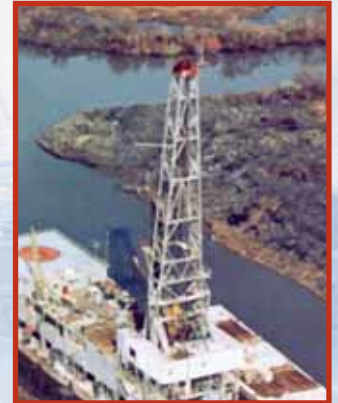


These ropes are general engineering ropes, suitable for most operations on offshore drilling units other than anchoring.

The following are the type of lines used under this category:

- **Drill Lines:**

The string of drill pipes is raised & lowered by means of the drill line. This operation requires a rope construction with maximum resistance to abrasion and crushing on the multi-layered drum. The recommended rope is a 6 x 19/IWRC EIPS grade, right regular lay, ungalvanised. (see tables below for other recommendations)



Drill Lines 6x19(9/9/1)/IWRC Extra Improved Plow Steel Right Regular Lay Ungalvanised					
Nominal Diameter		Approximate Mass		Strength	
inches	mm	lb/ft	kg/m	lb	kN
¾	19	1.04	1.55	58 800	262
7/8	22	1.42	2.11	79 600	354
1	26	1.85	2.75	103 400	460
1 1/8	29	2.34	3.48	130 000	578
1 1/4	32	2.89	4.30	159 800	711
1 3/8	35	3.50	5.21	192 000	854
1 1/2	38	4.16	6.19	228 000	1010

Drill Lines 8x19(9/9/1)/IWRC Extra Improved Plow Steel Right Regular Lay Ungalvanised					
Nominal Diameter		Approximate Mass		Strength	
inches	mm	lb/ft	kg/m	lb	kN
¾	19	1.06	1.58	51 800	230
7/8	22	1.44	2.14	70 000	311
1	26	1.88	2.80	91 000	405
1 1/8	29	2.39	3.56	114 600	507
1 1/2	38	4.23	6.29	233 580	1039

Ancillary Ropes for Offshore Use

Sand/Cable Tooling Lines
6x7(6/1)/Polypropylene Core Improved Plow Steel
Right Regular Lay
Ungalvanised/Galvanised

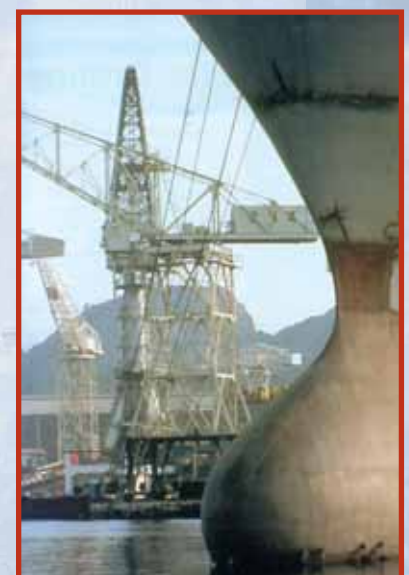
Nominal Diameter		Approximate Mass		Strength	
inches	mm	lb/ft	kg/m	lb	kN
1/2	13	0.38	0.57	20 600	92
5/8	16	0.59	0.88	31 800	141
3/4	19	0.84	1.25	45 400	202
7/8	22	1.15	1.71	61 400	273
1	26	1.50	2.23	79 400	353

- **Sand / Cable Tooling Lines**

These cables are used for cleaning out the well hole as well as raising or lowering of tooling for other purposes. Galvanised or ungalvanised ropes may be used depending on the nature of work, environment and expected service life. (see table above for recommendations)

- **Rod and Tubing / General Purpose Winch Lines**

Ropes in this application are used for removing rods, pipes, tubes and other general purpose work. Where a high degree of abrasion is likely to occur, a 6 x 25/IWRC construction is recommended. If flexibility is important, then a 6 x 36/IWRC is more suitable. For a long length of hanging rope, a 19 x 6 non-rotating rope will be the recommended choice.



Ancillary Ropes for Offshore Use

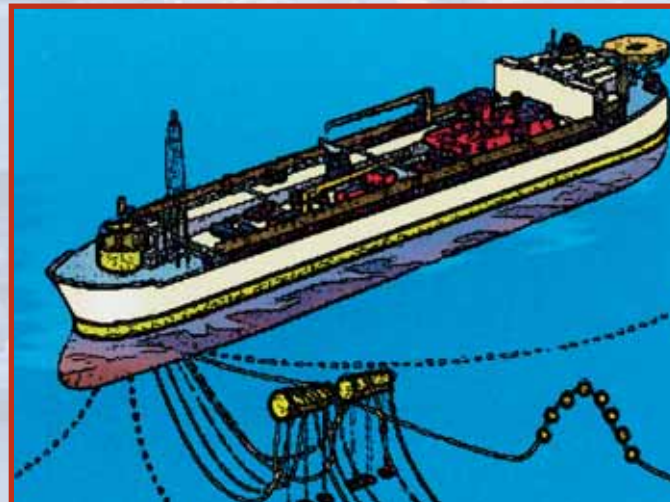
• Pennant Lines

These ropes are used for anchor recovery and are subjected to very severe operating conditions. They are subjected to continual vertical movement and consequent localised wear and fatigue in the part of rope nearest the anchor. In addition, heavy loads are normally applied to the rope during the recovery of anchors working over the stern roller of the work vessel.



• Riser Tensioner Lines

Ropes for these applications operate in bending fatigue over sheaves as they continually adjust to the heave motion of the platform on the sea, with the ends of the rope fixed and therefore unable to rotate. Experience has shown that ropes with a Lang's Lay construction operate extremely well under these conditions. Smaller diameter wires in greater number offer superior fatigue resistance in comparison to fewer wires of larger diameter for the relatively small sheaves involved. (see table below for recommendations)



Riser Tensioner Lines
6x41(16/8+8/8/1)/IWRC Extra Improved Plow Steel
Right Lang's Lay
Drawn-Galvanised

Nominal Diameter		Approximate Mass		Strength	
inches	mm	lb/ft	kg/m	lb	kN
7/8	22	1.42	2.11	79 600	354
1	26	1.85	2.75	103 400	460
1 1/8	29	2.34	3.48	130 000	578
1 1/4	32	2.89	4.30	159 800	711
1 3/8	35	3.50	5.21	192 000	854
1 1/2	38	4.16	6.19	228 000	1010

Steel Wire Ropes for Offshore Mooring Systems

Scaw has the JUPITER GULF STAR range of ropes for extra strength. The Jupiter Gulf Star range of large diameter ropes are manufactured using state-of-the-art technology, so as to provide exceptionally high strength-to-mass ratios. By using these ropes, the designer of the mooring system is offered a substantial saving in mass per meter which enables lighter deck weights, less requirement for lifting capacity, or simply a stronger mooring system.

Jupiter Gulf Star ropes are manufactured from wire produced on specially adapted wire drawing machines, which impart the necessary metallurgical properties to the wire, to ensure the strength of the rope remains constant with time. (assuming no environmental degradation). So the next time you design a mooring system, consult Scaw about our Jupiter Gulf Star range.



Jupiter Gulf Star Range for Extra Strength Independent Wire Rope Core Construction – Drawn Galvanised Wire

Nominal Diameter		Approximate Mass		Strength			
in.	mm	lb/ft	kg/m	lb	kN	Metric Tonnes	Construction
2	52	8.0	12.0	503,000	2241	228	6x49/iwrc
2 $\frac{1}{8}$	54	8.6	12.9	552,000	2451	250	
2 $\frac{1}{4}$	58	9.9	14.8	633,000	2820	287	
2 $\frac{3}{8}$	60	10.4	15.5	662,000	2942	300	
2 $\frac{1}{2}$	64	12.1	18.0	763,000	3398	346	
2 $\frac{5}{8}$	67	13.2	19.6	825,000	3666	374	
2 $\frac{3}{4}$	71	14.9	22.2	922,000	4104	418	
2 $\frac{7}{8}$	74	16.0	23.9	999,000	4442	453	
3	77	17.5	26.1	1,079,000	4800	489	
3 $\frac{1}{8}$	80	19.0	28.3	1,152,000	5121	522	
3 $\frac{1}{4}$	83	20.1	29.9	1,240,000	5573	562	6x55/iwrc
3 $\frac{3}{8}$	87	22.5	33.4	1,343,000	5976	609	
3 $\frac{1}{2}$	90	24.4	36.3	1,454,000	6465	659	
3 $\frac{3}{4}$	96	27.2	40.6	1,577,000	7015	715	
4	103	31.1	46.4	1,762,000	7835	799	
4 $\frac{1}{4}$	109	35.0	52.2	1,910,000	8492	866	
4 $\frac{1}{2}$	115	39.3	58.4	2,078,000	9242	942	
4 $\frac{3}{4}$	122	43.6	64.9	2,311,000	10285	1048	
5	128	48.5	72.2	2,503,000	11134	1135	

Applications for Mooring Ropes

Note: This table serves as a guide only as each particular mooring system must be evaluated individually.



Applications Table for Mooring Ropes

with the possibility of not replacing wire rope segments

Required Design Life of Mooring System (years)	Area of Application Within Mooring System
	Jupiter Gulf Star (103-135mm)
Up to six	All locations
6 to 10	Not in splash zone; otherwise suitable for rest of system
10 to 12	Not suitable
12 to 15	Not suitable
15 to 20	Not suitable



Quality Assurance for Steel Wire Ropes



Certificate No: FM 77524
BS EN ISO 9001: 2000

In 1984, Scaw's operation became the third factory in South Africa to be listed by the South African Bureau of Standards as having a quality management system which complied with SABS 0157 Part 1, which has since evolved into SABS ISO 9001: 1994 – Model for Quality Assurance in design, development, production, installation and servicing. In addition, the company has been approved by the American Petroleum Institute, Lloyds of London and Germanischer Lloyd. Testing facilities are internationally endorsed, and products are manufactured, where applicable in accordance with British Standards, Federal, DIN and other specifications.

Customer Support

Scaw provides a full range of customer support services. A team of qualified engineers with extensive experience in all aspects of wire ropes are available to advise on the selection, handling, installation and maintenance of wire ropes, as well as provide on-site inspection of wire ropes and equipment.



Manufacturing Resources

Scaw's facilities and resources provide the means and expertise to produce technically advanced wire ropes to the world's leading mines. In addition to operating a modern and well equipped factory, the entire rope making process from receipt of the hot rolled rod, through the various manufacturing processes, to final inspection and testing is on a single site and under complete control.



**SCAW METALS
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 A member of the Ferrous Metals and Industries Division of Anglo American plc

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