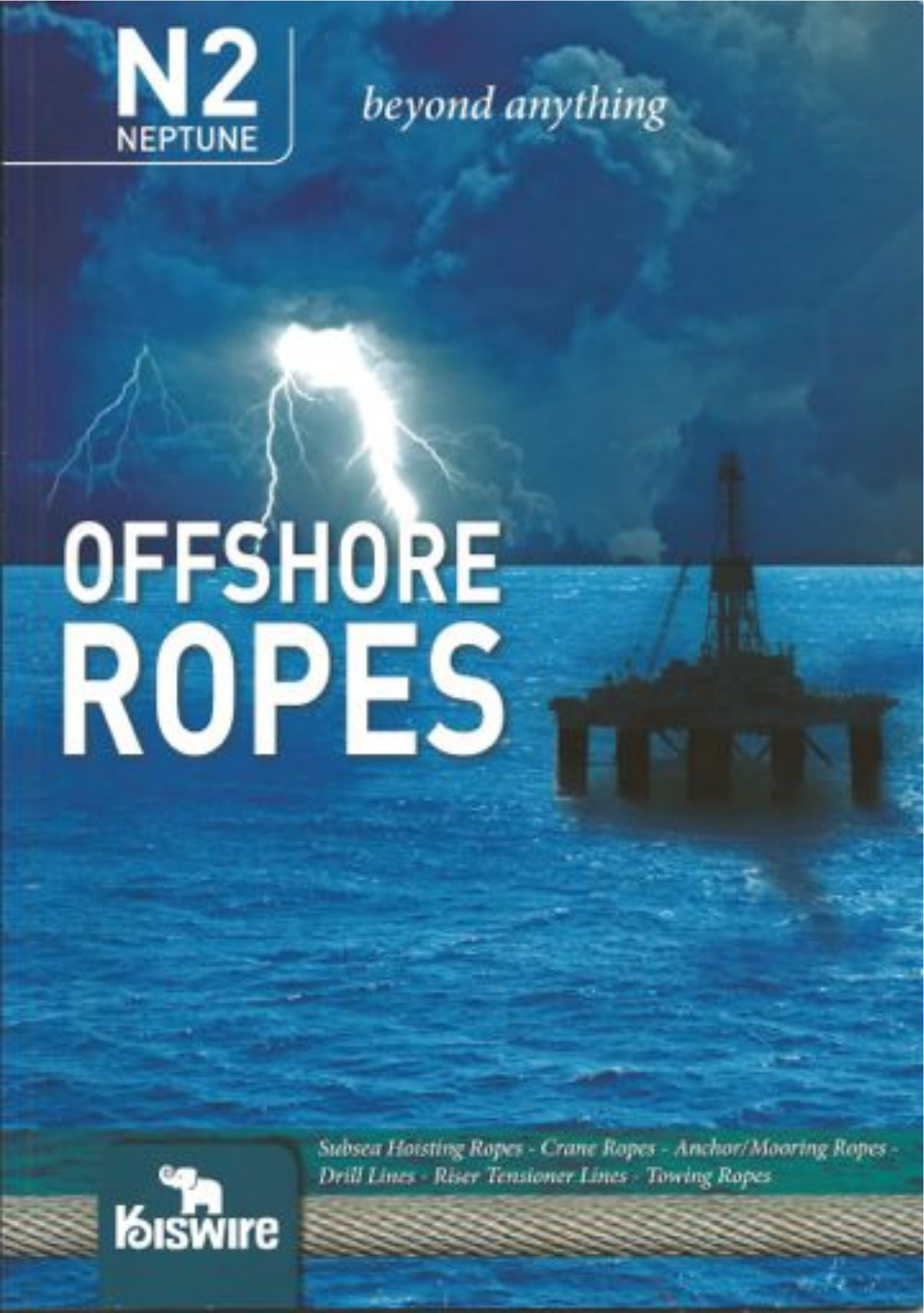
N2
NEPTUNE

beyond anything



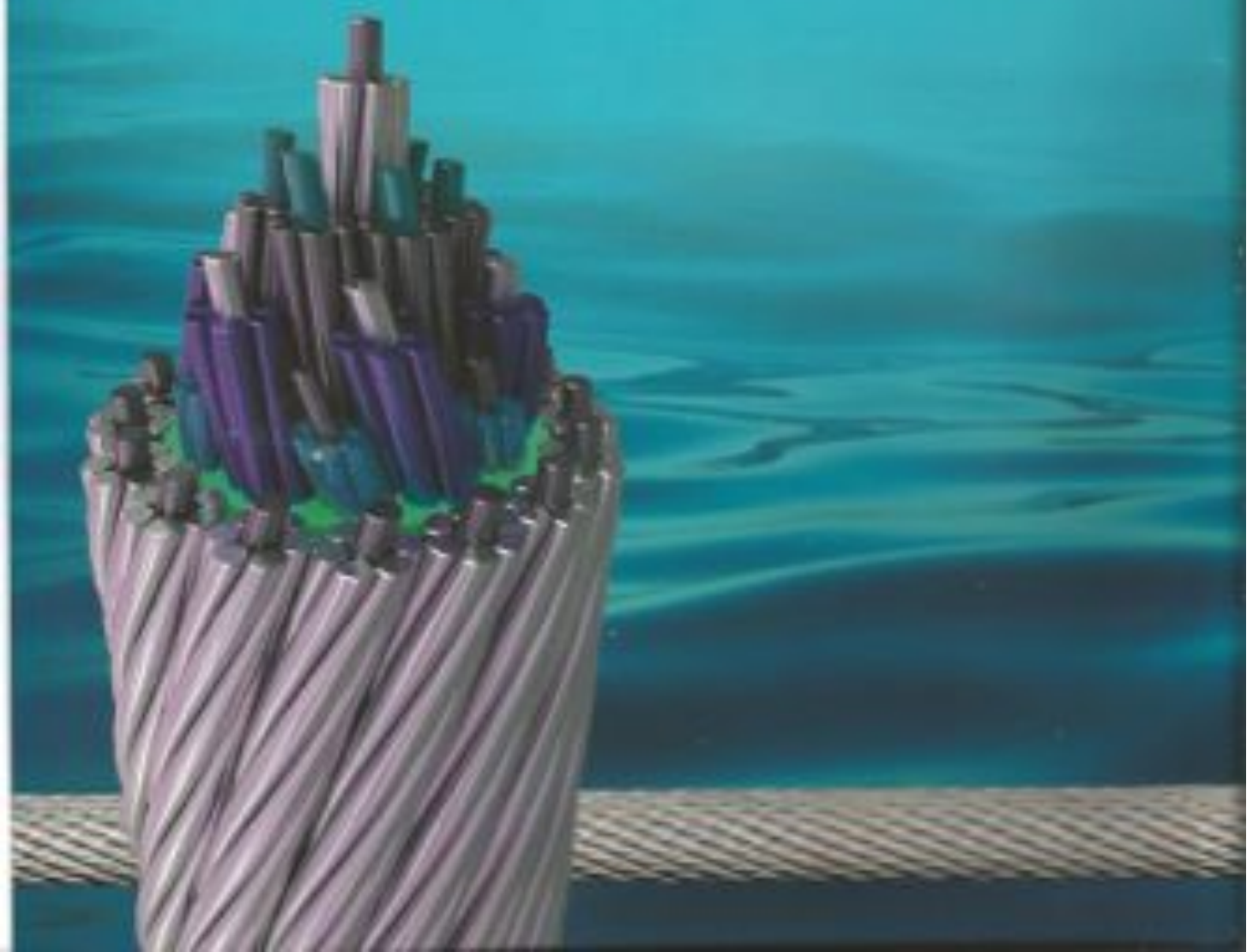
OFFSHORE ROPES

Subsea Hoisting Ropes - Crane Ropes - Anchor/Mooring Ropes - Drill Lines - Riser Tensioner Lines - Towing Ropes

KISWIRE

KISWIRE has been manufacturing a special range of offshore ropes for the global market for decades. Today the company produces 140.000 metric tons of wire rope annually, 40 000 tons of which find its way into the offshore sector in the form of special, large diameter rope for cranes, winches, anchor lines, mooring systems, subsea hoisting and other demanding applications.

In the Autumn of 2012, a brand new wire rope plant in Johor on the Malaysian coast has been taken into use. The plant is called NEPTUNE 2 – N2 for short. This new plant designs and produces 6 and 8 strand ropes as well as N2 multi strand, non-rotating ropes in diameters ranging from 50 to 180 mm. a wide variety of N2 rope types will be available, with features including zinc/aluminium coating (Alumar®), plastic infill, variable strand compaction, special lubricants, and more.




KISWIRE

N2 HYROPE

beyond anything

Kiswire is the largest wire rope producer in the world. Annually, about 140.000 tons of wire rope is delivered worldwide. For decades Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one of a main market for Kiswire since 25 years, meanwhile.

Crane Ropes

Single and multiple part reeving

Pedestal cranes may come in different ways as to rope reeving lay outs. We are speaking of multiple part reeved ropes and single part reeved main hoist and whip hoist systems.

The multiple part systems may allow to be equipped with six or eight strand ropes in right and left lay version in a tandem, whereas single part systems are almost exclusively equipped with multi strand non rotating ropes.

Compacted crane ropes

By compacting hoist ropes the resistance to crushing improves substantially. Especially on multi layer drums, wire ropes could interlock between the different layers. By compacting a wire rope, one makes the surface of the outer layers (outer wires) of the rope more flat. This flatter surface leaves the rope with less grip to get hold of. Consequently, layers slide more smooth along each other. Besides, compacted ropes perform better on the surface pressure issue and brings consequently a higher resistance to fatigue.

Plastic infill

In order to improve constructional stability of a rope, the IWRC is extruded with a special plastic medium. When eventually the strands are laid around the IWRC, the plastic finds its final position between strands and IWRC and spreads among each other. The plastic infill prevents excessive internal rope wear and prevents dirt and water to penetrate into the rope, at the same time.

Special lubricants
For a perfect conservation of wire ropes in harsh environments, it is recommended to protect the rope from corrosion by providing the rope with a special sea water resistant lubricant. Wire rope lubricants are applied to smoothen rope bending and axial torsion as well. Contact between rope and sheave or drum is enhanced by rope lubricants too.

ALUMAR® aluminised ropes
The galvanizing of steel wire and steel wire ropes is made by KISWIRE under the brand name ALUMAR®. We apply this technology for about 10 years now, it started in 1999. Initially the ALUMAR technology was developed for products applied in the aviation and car industry – the core demand was to extend the life time of the wires by sustaining the steel wire quality! Apart from many different kinds of improvement we could establish in this respect, it was obvious that an important improvement was to be made by protecting the wires from corrosion as long as possible. The ALUMAR zinc/aluminium coating was developed as an alternative for the regular galvanizing of wire. Many tests have been done in the meantime, showing that the ALUMAR wires stay corrosion free 3,5 times longer than galvanized products. Third party Salt Spray Tests are available.

The offshore industry, both oil and gas as well as fishing, could benefit from ALUMAR ropes substantially, as sea water is a corrosive environment.

BOOM HOIST ROPES
6x36WS+IWRC / 6x36WS+IWRC

MAIN HOIST ROPES
6X36WS+IWRC / 8x36WS+IWRC

N2 HYROPE
35xK7, 40xK7 / 55xK7 / 67xK7
N2 HYROPE
35xK19S / 35xK26WS

WHIP HOIST ROPES
N2 HYROPE
35xK7 / 40xK7 / 55xK7 / 67xK7
N2 HYROPE
35xK19S / 35xK26WS

Average torque factors for the following rope constructions are:

35xK7 and 40xK7 torque factor 0.0080
55xK7 and 67xK7 torque factor 0.0050

N2
HYROPE

Crane Ropes

N2 Hyrope Catalogue Data (35X7)

Nominal Rope Diameter		Cast Weight (kg/m)		Minimum Breaking Force (Tons)				Max Length (m)	Rope stiffness (kN)	Torque at 20% Rope Load		Weight from 1m hook (mm)
				N Grade		S Grade						
mm	inches	Hi Tol	Hi Strength	kg/cm²	kN	kg/cm²	kN			Lbs/ft	Kg/m	
10.0	3	12.9	11.2	329	3250	241	2360	23200	159	342	219	1200
12.0		13.4	11.7	340	3340	251	2490	22200	159	360	204	1460
14.0	2 1/8	14.8	12.7	359	3540	271	2680	20500	170	412	330	1980
16.0		15.2	13.7	378	3720	291	2870	19100	183	459	367	1870
17.2	2 1/4	16.3	14.2	385	3790	300	2940	18400	191	480	384	1720
18.0		16.9	14.7	394	3880	301	3010	17700	196	499	401	1820
18.3	2 3/8	16.2	15.9	314	3080	331	3250	16400	212	556	446	1960
20.0		19.3	16.9	335	3290	353	3460	15400	224	612	489	2020
20.3	2 1/2	20.2	17.8	352	3460	371	3640	14600	235	668	547	2180
22.0		20.2	17.8	357	3500	376	3690	14000	239	672	538	2230
22.2		21.5	18.7	380	3730	400	3930	13900	254	738	595	2350
24.0	2 5/8	22.2	19.3	388	3800	408	4000	13300	260	761	609	2400
24.0		22.9	19.9	404	3960	425	4170	12700	269	808	646	2500
24.4	2 3/4	24.4	21.3	426	4180	448	4400	12200	285	874	703	2640
26.0		25.8	22.4	452	4430	476	4670	11600	301	957	766	2790
26.4	2 7/8	26.7	23.2	465	4560	489	4800	11200	309	998	799	2870
28.0		27.4	25.8	475	4650	500	4910	10900	318	1041	832	2950
28.4		29.0	25.2	504	4940	530	5200	10400	335	1128	901	3110
28.6	3	29.0	25.2	504	4940	530	5200	10300	335	1128	903	3110
30.4	3 1/8	31.0	27.4	541	5300	570	5590	9680	366	1261	1010	3340
32.0		31.9	29.5	568	5570	598	5860	8890	398	1375	1100	3620
32.4	3 1/4	34.3	29.2	568	5570	598	5860	8700	396	1388	1100	3670
34.0		34.9	30.4	588	5770	619	6070	8500	416	1456	1160	3800
35.7	3 3/8	36.7	31.9	616	6030	641	6280	8100	427	1540	1240	3950
36.0		36.4	32.4	641	6280	673	6600	7900	458	1670	1340	4170
36.5	3 1/2	39.5	34.8	659	6460	693	6790	7500	454	1720	1380	4250
38.0		39.5	34.8	668	6550	691	6780	7100	470	1740	1390	4360

K2 Wirerope Catalogue Data (40XK7)

Nominal Rope Diameter		Unit Weight (Kg/m)		Minimum Breaking Force (MBF)				Max Length (m)	Axial stiffness (MN)	Torque at 20% load (N.m)		Metallic Cross section (mm²)
				N Grade		S Grade						
mm	inches	In air	In Seawater	M/Ton	kN	M/Ton	kN			Lang's	Angular	
82,0		33,9	29,5	587	5760	616	6040	8800	399	858	663	3700
82,6	3 1/4	34,3	29,7	587	5760	616	6040	8700	405	856	666	3750
84,0		34,9	30,4	608	5960	640	6280	8500	419	902	703	3880
85,7	3 3/8	36,7	31,9	633	6210	671	6580	8300	436	964	758	4040
88,0		38,4	33,4	660	6470	695	6820	7900	461	1038	798	4270
88,9	3 1/2	39,5	34,4	691	6770	727	7130	7500	471	1048	842	4360
90,0		39,5	34,4	691	6770	727	7130	7500	482	1108	853	4470
92,0		41,3	35,9	722	7080	760	7450	7200	500	1170	912	4560
94,0		43,1	37,5	745	7300	784	7690	6900	514	1240	963	4760
95,3	3 3/4	41,4	39,5	755	7410	795	7800	6600	528	1270	988	4900
96,0		46,4	40,4	767	7520	807	7910	6400	536	1300	1010	4970
98,0		48,3	42,0	805	7890	847	8310	6200	559	1330	1080	5180
100		50,3	43,8	831	8150	875	8580	9900	582	1470	1140	5390
102	4	51,6	44,9	865	8480	910	8920	9600	600	1560	1210	5570
104		53,6	46,6	899	8820	946	9280	9300	629	1650	1280	5830
106		55,7	48,5	935	9160	984	9650	8900	664	1750	1360	6060
108	4 1/4	58,3	50,7	969	9500	1020	10000	8500	678	1850	1440	6290
110		60,5	52,6	998	9790	1050	10300	8200	704	1940	1510	6520
112		62,8	54,6	1030	10100	1080	10600	7900	719	2040	1580	6670
114	4 1/2	65,1	56,6	1070	10500	1120	11000	7600	745	2150	1670	6910
116		67,6	58,8	1090	10700	1150	11300	7300	772	2230	1740	7150
120		72,4	63,0	1170	11500	1230	12100	6900	826	2480	1930	7660

Crane Ropes

N2 Hyrope Catalogue Data (5X8K7, 6X8K7)

Nominal Rope Diameter		Rope Weight (kg/100 m)		Minimum Breaking Force (kN)				Rope Length (m)	Rope Area (mm²)	Torque at 20% Load (N.m)		Metallic Cross-section (mm²)
				1770 Grade		1960 Grade						
mm	inches	Bright	Galvanized	kN/Ton	kN	kN/Ton	kN			Lang's	Regular	
112		59.5	63.8	3000	9810	3360	10400	1000	600	2120	2080	6230
116	4 1/2	62.0	63.9	3050	10000	3500	10600	1040	625	2200	2160	6370
116		64.2	68.9	3070	10100	3530	11100	1000	700	4140	3810	7290
120		66.2	70.8	3160	11000	3580	11600	1040	757	4340	3950	7520
121	4 3/4	68.1	68.1	3150	11300	3610	11900	1000	720	4640	4000	7850
122		70.3	68.1	3180	11500	3580	12000	1000	783	4840	3950	7980
124		72.6	68.2	3220	12000	3700	12800	1000	800	5040	4150	8240
124		74.9	70.2	3260	12400	3720	12900	1000	835	5240	4360	8530
127	5	76.6	66.8	3280	12600	3740	13100	1000	848	5420	4460	8650
128		77.4	67.7	3280	12600	3700	13200	1000	860	5460	4580	8700
130		80.3	69.9	3320	12900	3780	13600	1000	889	5720	4770	9060
132		82.8	72.6	3360	13300	3820	13900	1000	916	5900	4950	9340
133	5 1/4	84.4	73.9	3390	13600	3880	14000	1000	930	6000	5000	9480
134		85.7	74.6	3400	13700	3870	14000	1000	934	6060	5120	9530
136		88.3	76.8	3430	14000	3930	14400	1000	972	6400	5340	9920
138		91.5	79.1	3470	14300	3950	15000	1000	1008	6760	5570	10300
140	5 1/2	92.6	80.6	3520	14900	4000	15300	1000	1038	7100	5840	10600
142		95.3	82.9	3570	15400	4060	16000	1000	1060	7420	6120	10900
144		98.0	85.3	3600	15800	4090	16400	1000	1090	7720	6370	11300
146	5 3/4	100.0	87.9	3650	16200	4150	17100	1000	1120	8020	6610	11800
148		104.0	91.5	3690	16600	4200	17500	1000	1150	8340	6870	12200
150		107.0	94.3	3730	17100	4230	17900	1000	1180	8670	7170	12700
152	6	110.0	95.7	3790	17600	4300	18600	1000	1210	9020	7470	12900
154		112.0	97.4	3820	17900	4320	18900	1000	1250	9360	7700	13200
156		115.0	100.0	3860	18200	4360	19200	1000	1280	9670	7970	13600
158		118.0	103.0	3900	18600	4400	19600	1000	1310	10000	8240	13900
159	6 1/4	121.0	104.0	3930	18900	4430	19900	1000	1330	10200	8380	13600
160		121.0	105.0	3950	19100	4450	20100	1000	1350	10400	8570	13900
162	6 3/8	124.0	108.0	3990	19500	4500	20800	1000	1380	10700	8850	14300
165	6 1/2	129.0	112.0	4050	20100	4550	21400	1000	1430	11100	9240	14800
171	6 3/4	138.0	122.0	4240	21000	4550	22000	1000	1540	12000	10000	15700

Torque generated based on 3760 grade

Minimum Rope Value in Sea Water = 0.87 x Rope Name

All ropes manufactured to [illegible] with API/ISO standards

Preformed Crane Ropes

6x36WS+IWRC / 8x36WS+IWRC

Grade				ARA							
nominal diameter		weight of rope		EIPS		ALPHA		EIPS		OMEGA	
mm	inch	kg/m	kg/m	tonnes	kN	tonnes	kN	tonnes	kN	tonnes	kN
		6x36	8x36								
50.8	2	11.3	11.5	997	1931	220	2230	233	2285	243	2381
54.0	2 1/8	12.8	13.0	220	2160	249	2363	252	2471	263	2579
57.2	2 1/4	14.3	14.5	247	2420	275	2697	289	2834	301	2952
60.3	2 3/8	15.7	15.9	275	2697	306	3005	322	3158	335	3289
63.5	2 1/2	17.8	18.1	301	2951	336	3295	353	3462	368	3609
66.7	2 5/8	19.7	20.0	330	3236	370	3628	389	3815	406	3979
69.9	2 3/4	21.4	21.7	360	3530	409	4011	429	4207	448	4393
73.0	2 7/8	23.5	23.9	392	3848	447	4384	469	4599	490	4805
76.2	3	25.4	25.8	425	4168	491	4815	516	5060	538	5274
79.4	3 1/8	27.6	28.0	458	4491	522	5119	548	5374	572	5609
82.6	3 1/4	29.9	30.3	494	4844	557	5462	585	5737	611	5992
85.7	3 3/8	32.2	32.7	528	5178	607	5953	637	6247	666	6531
88.9	3 1/2	34.8	35.3	563	5521	659	6463	692	6786	723	7090
95.3	3 3/4	39.9	40.5	640	6276	714	7002	759	7355	785	7698
101.6	4	45.3	46.0	720	7061	796	7806	836	8198	873	8561
108.0	4 1/4	51.1	51.9	788	7728	865	8287	887	8699	926	9081
114.3	4 1/2	57.4	58.3	876	8591	939	9208	986	9669	1029	10091
120.7	4 3/4	63.9	64.9	967	9483	1016	10160	1088	10670	1136	11140
127.0	5	70.8	71.9	1068	10474	1118	11160	1195	11719	1248	12239
133.4	5 1/4	76.2	77.3	1138	11159	1217	11935	1278	12533	1335	13088
139.7	5 1/2	84.4	85.7	1223	11994	1305	12828	1374	13471	1435	14066
146.1	5 3/4	91.8	93.2	1315	12894	1406	13790	1477	14481	1542	15123
152.4	6	99.5	101.0	1410	13823	1508	14785	1585	15525	1653	16214
158.8	6 1/4	*	109.7	1497	14682	1601	15704	1682	16490	1756	17222
165.1	6 1/2	*	114.8	1549	15092	1648	16161	1728	16950	1805	17702

Estimated Rope Mass in Sea Water = 0.87x Rope Mass in Air. All Ropes Manufactured in accordance with API/ISO Standards

Crane Ropes

Pedestal Crane Ropes

6xK36WS+IWRC / 8xK36WS+IWRC compacted

Grade				ABR							
nominal diameter		weight of rope		EEIPS		ALPHA		DELTA		OMEGA	
mm	inch	kg/m	kg/m	tonnes	kN	tonnes	kN	tonnes	kN	tonnes	kN
		6x36	8x36								
50.8	2	12.1	12.2	258	2538	246	2413	259	2540	270	2648
54.0	2 1/8	13.8	13.9	244	2393	282	2618	280	2746	284	2785
57.2	2 1/4	15.5	15.7	274	2687	305	2991	321	3148	326	3197
60.3	2 3/8	16.9	17.1	305	2994	340	3333	358	3507	363	3562
63.5	2 1/2	19.1	19.3	336	3275	373	3658	392	3844	398	3903
66.7	2 5/8	21.1	21.3	367	3599	411	4031	432	4236	439	4305
69.9	2 3/4	23.1	23.3	400	3923	454	4452	476	4668	484	4746
73.0	2 7/8	25.2	25.5	435	4266	496	4864	521	5109	529	5188
76.2	3	27.4	27.7	472	4629	545	5345	573	5619	581	5698
79.4	3 1/8	29.8	30.1	508	4982	579	5678	608	5962	618	6061
82.6	3 1/4	32.3	32.6	548	5374	618	6061	649	6365	660	6472
85.7	3 5/8	34.8	35.1	586	5747	674	6610	707	6933	719	7051
88.9	3 1/2	37.6	38.0	625	6129	732	7178	768	7532	781	7659
95.3	3 3/8	43.0	43.4	711	6973	791	7757	831	8149	846	8296
101.6	4	48.9	49.4	799	7836	861	8448	904	8867	920	9024
108.0	4 1/8	55.1	55.6	884	8669	978	9591	1027	10068	1045	10251
114.3	4 1/2	59.7	60.3	971	9520	1074	10533	1127	11057	1146	11235
120.7	4 1/4	66.5	67.2	1059	10386	1172	11491	1230	12063	1250	12258
127.0	5	*	74.4	1149	11264	1271	12462	1334	13082	1356	13298
133.4	5 1/4	*	82.0	1232	12081	1362	13356	1431	14031	1454	14258
139.7	5 1/2	*	90.6	1322	12963	1462	14341	1535	15053	1560	15298
146.1	5 1/4	*	98.4	1419	13915	1570	15395	1648	16162	1675	16423

Estimated Rope Mass in Sea Water = 0.87x Rope Mass in Air. All Ropes manufactured in accordance with API/ISO Standards

N2 HYROPE

beyond anything

Kiswire is the largest wire rope producer in the world. Annually about 140,000 tons of wire rope is delivered worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one of a main market for Kiswire since 25 years. Meanwhile,

SubSea Hoisting Ropes

Pipe Lay Barges manufacture oil and gas pipes, which are laid on the bottom of the sea. For several reasons, the manufactured pipe has to be disconnected from the barge, and laid down on the seabed for a certain time(abandon) once in a while. Eventually, the same pipe needs to be taken up from the seabed and lifted onboard again to continue the manufacturing process (recovery). Both S-lay and J-lay barges operate with A&R systems as described. Depending on water depth and subsequently the length of A&R ropes required, a choice of rope is made out of the following available rope constructions.

6x36WS+IWRC in single or dual use

Dual use of A&R ropes consist of a right and a left laid rope, operating as a pair. In the event of greater working depths, multi strand, low rotating ropes are applied. For instance: 35xK7, 35xK19S, 35xK26WS, 55xK7, 55xK19S, 55xK26WS, 55xK31WS.

Single layer ropes, such as 6 and 8 strand constructions, have a much greater tendency to rotate under load than multi strand ropes. In fact, a multi strand rope is designed and manufactured to not to rotate at all, or minimal.

The longer the rope, the deeper the operation depths, the higher the tendency to rotate.

Torque

All wire ropes have inherent rotation characteristics that will produce a turning moment in the rope. With both ends fixed and unable to rotate, the turning moment will generate a torque at the fixed points. Whereas, if one end of the rope is free to rotate, the generated force will result in rope TURN and therefore load rotation.

Kiswire

www.kiswire.com

Average torque factors for the following rope constructions are :

35x7 and 40x7 torque factor 0.0060
35x7 and 67x7 torque factor 0.0050

Torque calculation
The formula to calculate the torque of a certain rope is: applied load x torque factor x diameter of rope = absolute torque

Example: the applied load 150kN (20% of its MBL) x 0.0060 (torque factor) x 96 mm (Ø) = 1.152 kN.

Traction winches

The A&R winch ropes are commonly stored on a storage drum onboard the vessel. To generate the power to abandon and recover the pipe, traction winches are applied. A twin drum winch device, requiring precise diameter/groove ratios, stable rope constructions, superior rope bending fatigue properties, excellent resistance to abrasion and rope crushing.

ALUMAR® aluminised ropes

The aluminizing of steel wire and steel wire ropes is made by KISWIRE under the brand name ALUMAR®. We apply this technology for about 10 years now. It started in 1995. Initially the ALUMAR technology was developed for products applied in the aviation and car industry - the core demand was to extend the life time of the wires by sustaining the steel wire quality ! Apart from many different kinds of improvement we could establish in this respect, it was obvious that an important improvement was to be made by protecting the wires from corrosion as long as possible. The ALUMAR® zinc/aluminium coating was developed as an alternative for the regular galvanizing of wire. Many tests have been done in the meantime, showing that the ALUMAR® wires stay corrosion free 3,5 times longer than galvanized products. Third party Salt Spray Tests are available.

The offshore industry, both oil and gas as well as fishing, could benefit from ALUMAR® ropes substantially, as sea water is a corrosive environment.

N2
HYROPE

Subsea Hoisting Ropes

N2 Hyrope Catalogue Data (15X7)

Nominal rope diameter		Unit Weight (kg/m)		Minimum Breaking Force (kN)				Min bend radius (mm)	Axial stiffness (MN)	Weight in 20% Seawater (kg/m)		Metallic Cross-section (mm²)
				R Grade		X Grade						
(in)	(inches)	Bright	R Galvanized	Al/Tex	kN	Al/Tex	kN			Bright	Polyolefin	
30.4	2	12.9	13.2	229	2230	241	2360	23200	350	343	274	1690
32.3		13.4	13.7	240	2340	253	2480	23900	370	358	286	1760
34.0	2 1/8	14.6	15.2	269	2640	283	2780	25500	370	432	330	1980
36.0		15.2	15.7	279	2730	293	2870	26100	393	449	347	2060
37.2	2 1/4	15.3	16.2	285	2790	300	2940	26600	395	483	384	2170
38.0		15.9	16.3	294	2880	309	3030	27100	396	501	401	2220
40.3	2 3/8	16.2	16.8	314	3080	331	3250	26800	412	559	446	1960
42.0		16.4	16.9	319	3130	333	3400	27400	424	612	489	2160
43.5	2 1/2	20.2	17.6	332	3400	371	3640	34800	435	658	527	2580
44.0		20.2	17.6	337	3430	376	3690	34800	439	671	538	2270
46.0		21.5	18.7	388	3730	408	3920	33900	434	738	590	2350
46.7	2 5/8	22.2	19.5	388	3800	418	4030	33500	439	765	609	2430
48.0		22.9	19.9	404	3960	425	4170	33300	449	800	640	2560
49.0	2 3/4	24.4	21.2	436	4280	468	4600	32200	445	874	701	2640
52.0		25.8	22.4	462	4530	496	4870	31600	467	957	766	2790
53.0	2 7/8	26.7	23.2	465	4560	499	4910	31200	469	996	799	2870
54.0		27.4	23.8	478	4690	513	4930	30900	478	1040	832	2950
56.0		29.0	25.2	504	4940	530	5200	30300	495	1130	903	3110
56.2	3	29.0	25.2	504	4940	530	5200	30300	495	1130	903	3110
59.4	3 1/8	31.0	27.4	541	5310	570	5590	29500	466	1260	1010	3390
62.0		32.9	29.5	568	5570	598	5860	28900	500	1370	1100	3620
62.6	3 1/4	33.1	29.7	568	5570	598	5860	28700	506	1390	1120	3670
64.0		34.9	30.4	588	5770	619	6070	28300	493	1450	1160	3800
65.2	3 3/8	34.9	30.9	593	5810	625	6130	28300	501	1501	1210	3950
66.0		36.4	32.4	606	6330	679	6660	28000	450	1670	1340	4370
66.9	3 1/2	39.0	34.4	668	6550	684	6710	27600	459	1721	1380	4500
70.0		39.2	34.4	658	6450	691	6780	27600	470	1741	1390	4560

Synergo Catalogue Data (4X8K7)

Nominal Rope Diameter		Unit Weight (kg/m)		Minimum Breaking Force (kN)				Max Length (m)	Axial Stiffness (kN)	Torque @ 20% MBF (Nm)		Bending Fatigue (cycles to wire failure)
				1770 N/mm²		1960 N/mm²						
mm	inches	In air	In Seawater	N/mm²	kN	N/mm²	kN			Long'l	Regular	
32.0		3.3.9	29.5	387	5360	419	6060	6800	389	850	661	3780
33.4	1 3/4	34.1	29.7	387	5360	419	6060	6750	435	890	666	3750
34.0		34.9	30.4	400	5960	445	6380	8050	419	902	701	3580
35.7	1 3/8	36.7	31.9	437	6210	473	6580	8100	416	964	750	4340
36.0		38.4	33.4	460	6470	495	6820	7800	461	1030	799	4170
38.9	1 1/2	39.9	34.8	481	6770	522	7130	7500	474	1080	840	4260
40.0		41.5	36.2	501	7060	543	7430	7500	482	1100	853	4470
41.3		43.1	37.5	522	7350	564	7690	7200	514	1170	913	4360
42.0		43.1	37.5	745	7300	784	7690	6900	514	1240	961	4360
43.2	1 3/4	45.4	39.5	755	7400	798	7800	6600	528	1270	980	4560
44.0		46.8	40.8	767	7500	807	7900	6400	536	1300	1010	4570
46.2		48.3	42.0	806	7880	847	8300	6200	559	1390	1080	5160
48.0		50.3	43.8	831	8150	875	8580	5900	582	1470	1140	5290
50.2	2	53.6	44.9	861	8440	918	8920	5640	608	1560	1210	5570
50.4		53.6	46.6	899	8820	946	9280	5500	629	1650	1280	5830
52.6		55.7	48.5	931	9130	968	9650	5300	654	1730	1340	6260
54.0	2 1/4	58.3	50.7	969	9500	1020	10000	5100	678	1830	1480	6290
55.6		60.0	52.2	998	9790	1054	10300	4900	704	1940	1510	6520
57.2		62.8	54.6	1030	10100	1080	10600	4760	719	2040	1580	6870
57.4	2 1/2	65.3	56.8	1070	10500	1130	11100	4600	745	2150	1670	6910
59.6		67.6	58.8	1090	10700	1150	11300	4500	772	2230	1740	7150
60.0		72.4	63.0	1110	10900	1210	12000	4400	824	2380	1830	7660

Subsea Hoisting Ropes

N2 Hyrope Catalogue Data (5X8K7, 6/36K7)

Nominal Rope Diameter		Unit Weight (Kg/m)		Minimum Breaking Force (kN)				Rope Length (m)	Axial Stiffness (kN)	Torque at 20% load (N.m)		Minimum Bend Radius (mm)
				N Grade		S Grade						
mm	inches	Bright	Galvanized	kN/ton	kN	kN/ton	kN			Lang's	Regular	
102		39.3	37.8	1030	9810	1060	10400	10000	660	2730	3000	4230
103	4 1/2	42.8	41.9	1070	10200	1100	10800	9600	681	2990	3290	4370
106		44.2	43.9	1070	10600	1110	11000	9500	708	4140	3400	7210
109		48.7	45.6	1180	11200	1210	11400	8700	737	4360	3760	7318
121	4 3/4	49.1	48.1	1150	11300	1210	11900	8600	770	4640	3830	7850
127		54.3	53.3	1310	13000	1360	13200	8500	761	4588	3990	7968
124		52.6	51.7	1220	12000	1280	12900	8300	809	5088	4180	8240
126		54.9	54.2	1240	12400	1320	12900	8000	826	5238	4380	8520
127	5	56.0	54.6	1290	12600	1340	13100	7800	848	5428	4460	8650
128		57.8	56.7	1300	12800	1350	13200	7700	862	5468	4530	8780
130		58.3	56.9	1320	12900	1390	13600	7400	889	5728	4710	9060
132		62.8	62.8	1360	13300	1420	14000	7200	916	5900	4910	9340
133	5 1/4	66.4	65.4	1390	13600	1480	14500	7100	930	6060	5080	9480
134		65.7	64.8	1400	13700	1470	14400	7000	944	6200	5210	9630
136		68.3	66.8	1430	14000	1530	14800	6700	972	6480	5540	9920
138		70.9	69.3	1470	14400	1570	15200	6400	1000	6760	5820	10200
140	5 1/2	70.6	69.6	1520	14900	1600	15700	6400	1030	7000	5860	10580
142		75.1	73.9	1570	15400	1650	16200	6400	1060	7230	6150	10880
144		78.8	75.3	1610	15800	1690	16600	6100	1090	7230	6370	11180
146	5 3/4	81.8	77.9	1650	16200	1740	17100	5900	1120	8130	6630	11480
148		84.9	80.5	1690	16600	1780	17500	5700	1150	8340	6870	11780
150		87.9	83.1	1730	17000	1820	17900	5600	1180	8580	7090	12100
152	6	91.0	85.7	1790	17600	1880	18400	5300	1210	8870	7400	12400
154		92.0	87.4	1820	17800	1920	18800	5200	1250	9150	7700	12700
156		95.0	90.0	1860	18200	1960	19200	5200	1280	9670	7870	13000
158		98.0	92.6	1900	18600	2000	19600	5000	1310	10000	8240	13400
159	6 1/4	101.0	95.8	1980	19400	2080	20400	4900	1340	10200	8388	13600
160		102.0	96.8	1990	19500	2090	20500	4900	1370	10400	8578	13782
162	6 3/8	104.0	98.8	1990	19500	2100	20600	4800	1380	10700	8858	14100
165	6 1/2	109.0	102.8	2070	20300	2180	21400	4600	1430	11400	9380	14700
170	6 3/4	114.0	107.8	2130	20900	2250	22100	4500	1480	11800	9800	15300

Torque generated based on 2160 grade
Estimated Rope Mass in Sea Water = 0.87 x Rope Mass
All ropes manufactured to accredited international standards

Winch Ropes

6x36WS-IWRC / 8x36WS-IWRC

Grade				MPa							
nominal diameter		weight of rope		EEIPS		ALPHA		DELTA		OMEGA	
mm	inch	kg/m	kg/m	tonnes	kN	tonnes	kN	tonnes	kN	tonnes	kN
		6x36	8x36								
36.0	1	11.3	11.5	197	1931	226	2216	231	2265	240	2353
38.0	1 1/8	12.8	13.0	220	2160	241	2363	252	2471	263	2579
39.2	1 1/8	14.3	14.5	247	2420	275	2697	289	2834	301	2952
40.5	1 3/8	15.7	15.9	275	2697	306	3005	322	3158	336	3289
41.5	1 1/2	17.8	18.1	301	2951	336	3295	353	3462	368	3609
44.7	1 5/8	19.7	20.0	330	3236	370	3628	389	3815	406	3979
44.9	1 3/4	21.4	21.7	360	3530	409	4011	429	4207	448	4393
47.8	1 7/8	23.5	23.9	392	3844	447	4384	469	4599	490	4805
50.2	2	25.4	25.8	425	4168	491	4835	516	5060	538	5276
51.8	2 1/8	27.6	28.0	458	4491	522	5119	548	5374	572	5609
53.0	2 1/4	29.9	30.3	494	4844	557	5462	585	5737	611	5992
54.7	2 3/8	32.2	32.7	528	5178	607	5953	637	6247	666	6531
56.0	2 1/2	34.8	35.3	563	5521	659	6463	692	6786	723	7090
57.3	2 3/4	38.9	40.5	680	6226	714	7002	750	7355	785	7698
59.6	4	45.3	46.0	720	7063	796	7806	836	8199	873	8563
60.8	4 1/4	51.1	51.9	788	7728	845	8287	887	8696	926	9081
63.4	4 1/2	57.4	58.3	876	8591	939	9208	986	9669	1029	10091
66.7	4 3/4	63.9	64.9	967	9483	1036	10160	1088	10670	1136	11140
69.0	5	70.8	71.9	1064	10434	1138	11160	1195	11719	1248	12239
69.4	5 1/4	76.2	77.3	1138	11159	1217	11935	1278	12533	1335	13088
70.7	5 1/2	84.4	85.7	1223	11994	1308	12828	1374	13471	1435	14068
73.1	5 3/4	91.8	93.2	1315	12894	1406	13790	1477	14481	1542	15123
77.4	6	98.5	101.0	1418	13873	1508	14785	1583	15525	1653	16214
78.8	6 1/4	*	109.7	1497	14682	1601	15704	1682	16499	1756	17222
80.9	6 3/8	*	114.0	1539	15092	1646	16144	1728	16950	1803	17760

Estimated Rope Mass in Sea Water = 0.87x Rope Mass in Air. All Ropes manufactured in accordance with API/ISO Standards

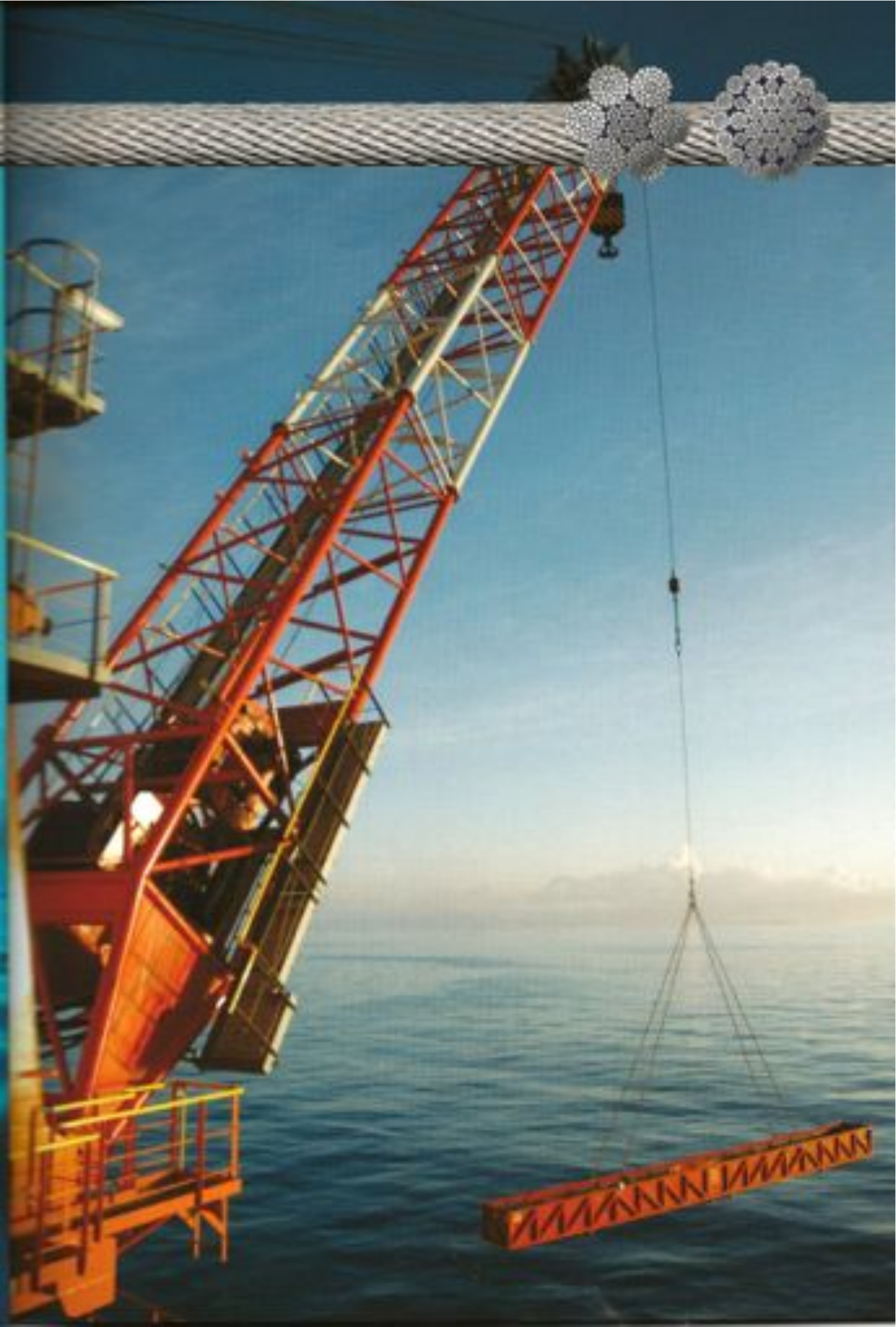
Subsea Hoisting Ropes

A & R Winch Ropes

6xK36WS+IWRC / 8xK36WS+IWRC compacted

Guide				IWRC							
nominal diameter		weight of rope		IWRS		ALPHA		DELTA		OMEGA	
mm	inch	kg/m	kg/m	tonnes	kN	tonnes	kN	tonnes	kN	tonnes	kN
		6x36	8X36								
38.8	2	12.1	12.2	216	2138	246	2412	259	2540	270	2648
54.0	2 1/8	13.8	13.9	244	2393	267	2618	280	2746	284	2785
57.2	2 1/4	15.5	15.7	274	2687	305	2991	321	3148	326	3197
60.3	2 3/8	16.9	17.1	305	2990	340	3333	358	3507	363	3562
63.5	2 1/2	18.1	19.3	334	3275	373	3658	392	3844	398	3903
66.7	2 5/8	21.1	21.3	367	3599	411	4031	432	4236	439	4305
69.9	2 3/4	23.1	23.3	403	3953	454	4452	476	4668	484	4740
73.0	2 7/8	25.2	25.5	435	4266	496	4864	521	5109	529	5188
76.2	3	27.4	27.7	472	4629	549	5385	574	5629	583	5698
79.4	3 1/8	29.8	30.1	508	4982	579	5678	608	5962	618	6061
82.6	3 1/4	32.3	32.6	548	5374	618	6061	649	6365	660	6472
85.7	3 3/8	34.8	35.1	586	5747	674	6610	707	6933	719	7051
88.9	3 1/2	37.6	38.0	625	6129	732	7178	768	7532	781	7659
95.3	3 3/4	42.0	43.4	711	6973	793	7777	833	8169	848	8316
101.6	4	48.9	49.3	797	7816	864	8659	908	9101	943	9246
108.0	4 1/4	53.1	53.6	884	8669	928	9591	1027	10068	1043	10231
114.3	4 1/2	59.7	60.3	971	9520	1014	10532	1127	11017	1146	11235
120.7	4 3/4	66.5	67.2	1059	10386	1177	11891	1230	12063	1250	12258
127.0	5	*	74.4	1149	11264	1271	12463	1333	13082	1356	13294
133.4	5 1/4	*	82.0	1232	12081	1363	13366	1431	14037	1454	14258
139.7	5 1/2	*	90.0	1322	12962	1462	14341	1535	15055	1560	15298
140.3	5 1/4	*	98.4	1419	13915	1570	15395	1648	16162	1675	16423

Estimated Rope Mass in Sea Water = 0.87x Rope Mass in Air. All Ropes manufactured in accordance with API/DIN Standards



N2 NEPTUNE

beyond anything

Kiswire is the largest wire rope producer in the world. Annually, about 1 40 000 tons of wire rope is delivered worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one is a main market for Kiswire since 25 years; meanwhile

Anchor Lines & Mooring Ropes

The use of Anchor and Mooring ropes is as old as the shipping industry. Every floating vehicle shall be anchored or moored at a certain point of time. We need ropes for that. Larger ships are anchored or moored with steel wire ropes. Winch systems, sheaves, rope length, rope diameter and other device designs determine the type of rope required. The most common types of anchor lines used nowadays, are the 6x36WS constructions. Alternatives are 6x41WS, 6x19WS. And, 8x31WS and 8x41WS.

Availability

Commonly the Offshore industry applies Anchor Lines in 6IX strand construction. Such due to the better availability of 6 strand ropes and secondly because any deviation from the basic 6 strand Anchor Lines means more investment in sales, purchasing, and know how to install and handle an Anchor Line. One could benefit from substantial higher efficiency and lower cost, though, if the alternative types of Anchor Lines were explored.

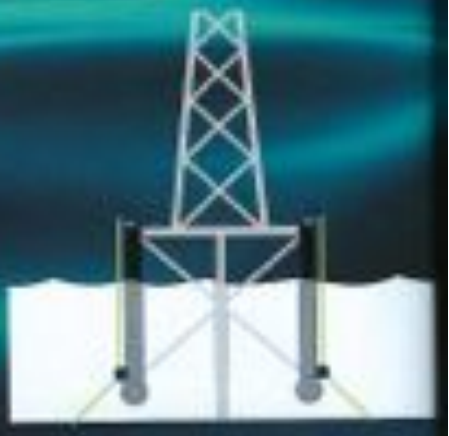
Installation of Anchor Lines

The full length, say 3000 meter 77 mm, is spooled from the steel storage reel on to the barge' winch drum. The Anchor Handling Tug takes the outer end of the rope on board and pulls the entire 3000 meter out, under approximately 5 to 10 tons tension. Then, the barge winch pulls the Anchor Line back in over the full length.

This operation is repeated one or two more times. The result is that the wire rope has bedded in sufficiently before the real work starts which appears to be of extreme importance for the problem free functioning of the Anchor Line, during its entire life time. Besides the life time of the Anchor Line improves considerably by this warming up.

Main risk

Most of all Anchor Lines are damaged and/or destroyed by wrong handling. Often the anchor, when lifted from the seabed, is turned one or more times. With the turning of the anchor, the Anchor Line turns. If the anchor is put into the seabed afterwards, and the rope is put under tension again, this torque can not get out of the rope. Severe damage or destruction of the Anchor Line are often the result.



Kiswire

www.kiswire.com

Anchor Lines & Mooring Ropes

Corrosion
Corrosion is a serious threat to the quality of Anchor or Mooring ropes. The offshore environment is a harsh one. Steel is effected quickly by it. Corrosion is the most regular and obvious phenomenon.
In order to avoid, or to postpone corrosion and the risks that corrosion brings along, KISWIRE produces Anchor and Mooring Lines in the unique ALUMAR® version. In this case, the wire ropes are coated with a zinc/aluminium layer, which protects 4 times longer against corrosion.

Crushing and abrasion features
By compacting our ropes the resistance to crushing improves substantially. Especially on multi layer drums, wire ropes could interlock between the different layers. By compacting a wire rope, one makes the surface of the outer layers (outer wires) of the rope more flat; this flatter surface leaves the rope with less grip to get hold of. Consequently, layers slide more smooth along each other.

Maintenance
It is recommended to lubricate Anchor Lines periodically. A well lubricated wire rope performs better and longer. A wire rope in service bends and rotates continuously, causing a permanent sliding of wires along each other in the rope. This causes friction, friction causes wearing. Lubricant influences a smoother sliding area and gives consequently less friction and wearing.
Any Anchor or Mooring Line shall be lubricated during production. A range of sophisticated lubricants are available.

The secondary feature of lubricant on wire rope is the protection from corrosion.

Swivels
Basically, the use of a swivel interferes with the regular behaviour of a rope in such a way, that it often distorts the rope construction and causes premature rope failure. Hence, the use of swivels shall be avoided as much as possible. In consult with a wire rope engineer. Particularly, a swivel shall not be used when installing a rope, nor during anchoring and mooring.

Storage
Kiswire Anchor Lines and Mooring Ropes are delivered on a steel reel. The ropes are lubricated well with special offshore bitumen based lubricant. On the reel, the rope is wrapped with a special polypropylene cloth, giving best protection from weather influences. This way, these reels can be stored outside for some time. In the event of longer storage of wire rope outside than one year, certain metallurgical issues may become of influence to the quality of wire rope. One of these phenomenon's is called strain aging. It is recommended to test a wire rope, prior to take it into use, when stored outside longer than one year. A breaking load test should be sufficient.

Anchor Lines & Mooring Ropes

Anchor & Mooring Ropes

6x36WS+IWRC / 8x36WS+IWRC

Grade				IWRC							
nominal diameter		weight of rope		EEIPS		ALPHA		DELTA		OMEGA	
mm	inch	kg/m	kg/m	tonnes	kN	tonnes	kN	tonnes	kN	tonnes	kN
		6x36	8x36								
50.8	2	11.3	11.5	197	1933	226	2216	233	2285	243	2383
54.0	2 1/8	12.8	13.0	220	2160	241	2363	252	2471	263	2579
57.2	2 1/4	14.3	14.5	247	2424	275	2697	288	2824	300	2942
60.3	2 3/8	15.7	15.9	275	2697	306	3005	322	3158	335	3289
63.5	2 1/2	17.8	18.1	301	2951	336	3295	353	3462	368	3609
66.7	2 5/8	19.7	20.0	330	3236	370	3628	389	3815	406	3979
69.9	2 3/4	21.8	21.3	360	3530	409	4011	429	4207	448	4393
73.0	2 7/8	23.5	23.9	392	3844	442	4334	469	4599	490	4805
76.2	3	25.4	25.8	425	4168	491	4815	516	5060	539	5276
79.4	3 1/8	27.6	28.0	458	4491	522	5119	548	5374	572	5609
82.6	3 1/4	29.9	30.3	494	4844	557	5462	585	5737	611	5992
85.7	3 3/8	32.2	32.7	528	5178	607	5953	637	6247	666	6531
88.9	3 1/2	34.8	35.3	563	5521	639	6463	672	6586	721	7090
95.3	3 3/4	39.9	40.5	640	6276	714	7002	750	7355	785	7699
101.6	4	45.3	46.0	720	7063	796	7806	836	8196	873	8561
108.0	4 1/4	51.1	51.9	788	7728	845	8287	887	8698	926	9081
114.3	4 1/2	57.4	58.3	876	8591	939	9208	986	9669	1029	10091
120.7	4 3/4	63.9	64.9	967	9483	1036	10160	1088	10670	1136	11140
127.0	5	70.8	71.9	1064	10434	1139	11168	1195	11719	1248	12239
133.4	5 1/4	78.2	77.3	1138	11159	1217	11935	1278	12533	1335	13088
139.7	5 1/2	84.4	85.7	1272	11990	1388	12828	1374	13471	1435	14068
146.1	5 3/4	91.8	93.2	1315	12899	1406	13790	1477	14481	1540	15171
152.4	6	99.3	101.3	1470	13823	1588	14785	1583	15526	1653	16214
158.8	6 1/4	*	109.7	1497	14682	1601	15704	1682	16490	1756	17222
165.9	6 5/8	*	114.8	1539	15092	1646	16141	1728	16950	1803	17747

Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air. All ropes manufactured in accordance with API/EN Standards

Anchor & Mooring Ropes

6x(36WS+IWRC) / 8x(36WS+IWRC) compacted

Grade				MBL							
nominal diameter		weight of rope		IDEAL		ALPHA		BETA		OMEGA	
mm	ins	kg/m	kg/m	tonnes	kN	tonnes	kN	tonnes	kN	tonnes	kN
		6x36	8x36								
50,8	2	12,1	12,1	218	2138	246	2412	259	2540	270	2648
54,0	2 1/8	13,8	13,9	248	2395	267	2618	280	2746	284	2785
57,2	2 1/4	15,5	15,7	274	2687	305	2991	321	3148	326	3197
60,3	2 3/8	16,9	17,1	305	2994	340	3333	358	3507	363	3562
63,5	2 1/2	19,1	19,3	334	3275	373	3659	392	3844	398	3903
66,7	2 5/8	21,1	21,3	367	3599	411	4031	432	4236	439	4305
69,9	2 3/4	23,1	23,3	408	3925	454	4452	476	4668	484	4748
73,0	2 7/8	25,2	25,5	435	4266	496	4864	521	5109	529	5188
76,2	3	27,4	27,7	472	4629	535	5245	573	5619	583	5718
79,4	3 1/8	29,8	30,1	508	4982	579	5678	618	5962	628	6061
82,6	3 1/4	32,3	32,6	548	5374	618	6061	649	6365	660	6472
85,7	3 3/8	34,8	35,1	586	5747	674	6610	707	6933	719	7051
88,9	3 1/2	37,6	38,0	625	6129	732	7178	768	7532	781	7659
92,1	3 3/4	43,0	43,4	711	6973	793	7777	833	8169	848	8316
101,6	4	48,9	49,4	799	7835	884	8669	928	9101	943	9248
108,0	4 1/4	53,1	53,6	868	8669	938	9593	1027	10068	1043	10231
114,3	4 1/2	59,7	60,3	971	9520	1074	10532	1127	11057	1146	11235
120,7	4 3/4	66,5	67,2	1059	10386	1172	11493	1230	12063	1250	12258
127,0	5	*	74,4	1149	11264	1271	12462	1334	13082	1356	13294
133,4	5 1/4	*	82,0	1232	12081	1363	13366	1431	14031	1454	14258
139,7	5 1/2	*	90,0	1322	12962	1462	14341	1535	15055	1560	15298
146,1	5 3/4	*	98,4	1419	13915	1570	15395	1648	16162	1675	16423

Estimated Rope Mass in Sea Water = 0.87x Rope Mass in Air. All Ropes manufactured in accordance with API/EN Standards

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Kiswire is the largest wire rope producer in the world. Annually, about 140.000 tons of wire rope is delivered worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one in a main market for Kiswire since 25 years meanwhile.

Towing Lines

Late sixties and further on during the seventies, the first high powered, ocean going tug boats were designed and built. The famous Dutch SMIT family took a lead in the global ocean towing market by expanding its fleet with the tug boat series - Smit Rotterdam, Smit London, Smit Singapore, and more. Nowadays, the availability of very powerful, modern towing vessels is large.

Regular towing rope constructions
The early generations ocean going tow vessels were equipped with towing ropes like 1.000 meter to 1.500 meter length, in diameter range of 50 to 70 mm, construction 6x36WS+IWRC, galvanized. Today, the latest version tug vessels work with 1.500 to 2.500 meter ropes, in diameters of 76 to 90 mm, Galvanized, 6x36WS or 6x41WS or 6x49WS+IWRC. Not seldom, the contemporary towing lines are coming in a compacted version, to protect from early corrosion of the ropes, and consequently, early deterioration of the steel, many NEPTUNE towing lines are ALUMAR coated - a zinc/aluminium based coating.

The next description of tug boat and towing rope criteria is a classical one.

Safety factor - MBL Towing wires.
This example towing system is based on the weak link principle, which means we use a shorter piece of wire rope (25 to 50 meters) Lianned pennant wire, with a lower breaking strength in our towing line configuration to avoid breakage of the main towing rope. Our main towing line is 1.400 meters long. Based on this principle, the MBL of the main towing line is 10% higher than the MBL of the pennant wire (weak link). This 10% is a regular criteria.

MBL - Bollard Pull
When tugs are involved in towages, normally the warranty surveyors have to approve the tug/towing connection and the tow. So, based on this, tugs and towing gear have to be approved by warranty surveyors before tugs can commence a towage.
Different warranty survey bureau's have different rules. For instance, the rules/criteria of DNV and Noble Denton are good and often applied. DNV advises a factor of 2.2, which means, that the MBL of the towing line has to 2.2 x Bollard Pull of the tug. Noble Denton has various factors, which are depending on the size of the tug.

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Towing Lines

Examples :
Bollard pull < 40 tons :
MBL towing line = 3.0 x Bollard pull.

Bollard pull > 40 and < 90 tons :
MBL towing line = (3.8 - BP/50) x Bollard pull.

Bollard pull > 90 tons :
MBL towing wire = 2.0 x Bollard Pull.

As you can see for DNV the factor 2.2 is used and for Noble Denton a factor of 2.0 multiplied by the Bollard Pull.

Obviously, as one works with a weak link system, this MBL x Safety factor calculation is applicable for the weak link or pennant wire. Not for the main towing line. The MBL of main towing line is 10% higher.

Hence, the MBL of the towing line is related to the Bollard Pull but always a safety factor (3.0 or 2.2 or 2.0 or another factor) is used to determine the Safe Working Load of the towing line.

Use of stretchers
Quite often, so called stretchers are used in the towing line configuration as shock-absorbers during the towages. The MBL of the stretchers is a bit higher than the MBL of the main towing lines.
Some type of stretchers are grommets of 19 -23 inch circumference (single), and have an MBL of approximately 720 metric tons, whilst the main towing lines in the same arrangement have a MBL of around 400 metric tons.

Not all tug boat companies use stretchers. An average 20 inch circumference stretcher (diameter 160 mm) could be 20 to 55 meters long. Handling and storage are often criteria not to use stretchers.

Life time of towing lines
The life time of towing lines is commonly based on the number of towing miles the wire was operational. Roughly, a towing line should make approximately 55.000 towing miles. When a tug boat operates on its average efficiency, these 55.000 miles are reached within approximately 2 and a half years.

Besides, the life time or service life of a towing line depends on a few other things as well. Weather conditions during towing is an important factor. If rough weather occurs, the towing arrangement can be subjected to shock loading, which is a destructive phenomenon to ropes.

Inspection of quality of towing lines
With regular intervals, towing lines shall be checked upon its quality. Visual inspection is one. Another one is to cut of a piece of the towing line and subject this piece of rope to an extensive, internal check. Last but not least, one can carry out a break test on the rope to determine the actual breaking load.

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Towing Lines

Compacted towing ropes
By compacting towing ropes the resistance to crushing improves substantially. Especially on multi layer drums, wire ropes could interlock between the different layers. By compacting a wire rope, one makes the surface of the outer layers (outer wires) of the rope more flat. This flatter surface leaves the rope with less grip to get hold of. Consequently, layers slide more smooth along each other. Besides, compacted ropes perform better on the surface pressure issue and brings consequently a higher resistance to fatigue.

ALUMAR® aluminised towing lines
The aluminizing of steel wire and steel wire ropes is made by KISWIRE under the brand name ALUMAR®. We apply this technology for about 10 years now. It started in 1999. Initially the ALUMAR technology was developed for products applied in the aviation and car industry – the core demand was to extend the life time of the wires by sustaining the steel wire quality ! Apart from many different kinds of improvement we could establish in this respect, it was obvious that an important improvement was to be made by protecting the wires from corrosion as long as possible. The ALUMAR zinc/aluminium coating was developed as an alternative for the regular galvanizing of wire. Many tests have been done in the meantime, showing that the ALUMAR wires stay corrosion free 3,8 times longer than galvanised products. Third party Salt Spray Tests are available.

The offshore industry, both oil and gas as well as the towing and fishing industry, could benefit from ALUMAR ropes substantially, as sea water is a corrosive environment.

Towing line maintenance
For a perfect conservation of wire ropes and maintenance in harsh environments, it is recommended to protect the rope from corrosion by providing the rope with a special sea water resistant lubricant. Wire rope lubricants are applied to smoothen rope bending and axial torsion as well. A smooth contact between rope and sheave or drum is enhanced by rope lubricants too.

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Towing Lines

6x36WS+IWRC / 6x36WS+IWRC

Grade				MN							
nominal diameter		weight of rope		EEIPS		ALPHA		DELTA		OMEGA	
mm	inch	kg/m	kg/m	tonnes	kN	tonnes	kN	tonnes	kN	tonnes	kN
		6x36	8x36								
50,8	2	11,3	11,5	197	1931	226	2216	233	2285	243	2383
54,0	2 1/8	12,8	13,0	220	2160	241	2363	252	2471	263	2579
57,2	2 1/4	14,3	14,5	247	2420	275	2697	289	2834	301	2952
60,3	2 3/8	15,2	15,9	275	2697	306	3005	322	3158	335	3289
63,5	2 1/2	17,0	18,1	303	2951	336	3295	353	3462	368	3609
66,7	2 5/8	19,2	20,0	330	3236	370	3628	389	3815	406	3978
69,9	2 3/4	21,4	21,7	360	3530	409	4011	429	4207	448	4393
73,0	2 7/8	23,5	23,9	392	3844	442	4384	463	4519	490	4805
76,2	3	25,4	25,8	425	4160	491	4815	516	5060	538	5276
79,4	3 1/8	27,6	28,0	458	4491	522	5119	548	5374	572	5609
82,6	3 1/4	29,9	30,3	494	4844	557	5462	585	5737	611	5992
85,7	3 3/8	32,2	32,7	528	5178	602	5853	637	6247	666	6533
88,9	3 1/2	34,8	35,3	563	5521	659	6463	692	6786	723	7090
95,3	3 3/4	39,9	40,5	640	6276	714	7002	750	7355	781	7658
101,6	4	45,3	46,0	720	7061	798	7826	836	8198	873	8561
108,0	4 1/4	51,1	51,9	788	7728	845	8287	887	8698	926	9081
114,3	4 1/2	57,4	58,3	826	8591	929	9208	986	9669	1029	10091
120,7	4 3/4	63,9	64,9	967	9483	1036	10160	1088	10670	1136	11140
127,0	5	70,8	71,9	1064	10434	1138	11160	1195	11719	1248	12239
133,4	5 1/4	78,2	77,3	1138	11159	1217	11935	1278	12535	1335	13089
139,7	5 1/2	84,4	85,7	1223	11994	1308	12828	1374	13471	1435	14068
146,1	5 3/4	91,8	93,2	1315	12894	1406	13790	1477	14481	1542	15123
152,4	6	99,3	101,0	1419	13823	1508	14785	1583	15525	1653	16214
158,8	6 1/4	*	109,7	1487	14682	1601	15704	1682	16490	1756	17222
161,9	6 3/8	*	114,0	1539	15092	1648	16147	1728	16950	1805	17702

Estimated Rope Mass in Sea Water = 0.87x Rope Mass in Air. All Ropes manufactured in accordance with API/DIN Standards.

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Towing Lines

Towing Lines

6x(36WS+IWRC) / 6x(36WS+IWRC) compacted

Guide				API							
nominal diameter		weight of rope		BBPS		ALPHA		BETA		OMEGA	
mm	ins	kg/m	kg/m	tonnes	kN	tonnes	kN	tonnes	kN	tonnes	kN
		6x36	8x16								
50.8	2	12.1	12.2	218	2138	246	2417	259	2540	276	2648
54.0	2 1/8	13.8	13.9	244	2393	267	2618	281	2746	284	2785
57.2	2 1/4	15.5	15.7	274	2687	305	2993	321	3148	326	3197
60.3	2 3/8	16.9	17.1	305	2994	340	3337	358	3507	363	3562
63.5	2 1/2	19.1	19.3	334	3276	373	3659	392	3844	398	3901
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73.0	2 7/8	25.2	25.5	435	4266	496	4864	521	5109	529	5188
76.2	3	27.4	27.7	472	4629	535	5245	562	5509	571	5599
79.4	3 1/8	29.8	30.1	508	4982	579	5678	608	5962	618	6061
82.6	3 1/4	32.3	32.6	548	5374	618	6063	649	6365	660	6472
85.7	3 3/8	34.8	35.1	588	5767	674	6610	707	6935	719	7051
88.9	3 1/2	37.4	38.0	625	6129	732	7178	768	7532	781	7659
95.3	3 3/4	43.0	43.4	711	6973	793	7777	833	8169	848	8316
101.6	4	48.9	49.4	799	7836	884	8669	928	9101	943	9248
108.0	4 1/4	53.1	53.6	884	8669	978	9591	1027	10068	1043	10231
114.3	4 1/2	59.7	60.3	971	9520	1074	10532	1127	11057	1146	11235
120.7	4 3/4	66.5	67.2	1059	10386	1172	11491	1230	12063	1250	12258
127.0	5	*	73.8	1149	11264	1271	12462	1334	13082	1356	13294
133.4	5 1/4	*	82.0	1242	12081	1363	13366	1431	14031	1454	14258
139.7	5 1/2	*	90.0	1322	12962	1462	14340	1535	15055	1560	15298
146.1	5 3/4	*	98.4	1419	13915	1571	15405	1648	16162	1675	16427

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DRILL LINES for land - and offshore drill rigs.

Since decades, drill lines are produced and applied in the constructions 6x19Scale=IWRC and 6x26 WarringtonSeale=IWRC. The choice between these 2 types depend on the wish for more flexibility and diameter range of the drill lines needed. The 6x26 type is more flexible than the 6x19 type. In larger diameters, from 1 ¼ inch and up, the 6x26 type is more applied than the 6x19 type.

Crown block
An assembly of sheaves or pulleys mounted on beams at the top of the derrick. The drilling line is run over the sheaves down to the draw works.

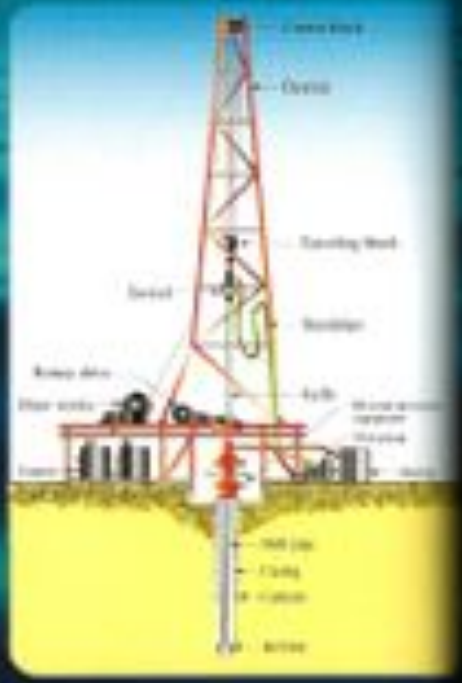
Derrick
a large load-bearing structure, usually bolted construction of metal beams in drilling. The standard derrick has four legs standing at the corners of the substructure and reaching to the crown block. The substructure is an assembly of heavy beams used to elevate the derrick and provide space underneath to install the blowout preventer, casing head, and other equipment.

Traveling block
an arrangement of pulleys or sheaves which moves up or down in the derrick through which the drilling cable is strung to the rotary drive.

Swivel
a mechanical device that suspends the weight of the drill pipe, provides for the rotation of the drill pipe beneath it while keeping the upper portion stationary, and permits the flow of drilling mud from the standpipe without leaking.

Standpipe
a rigid metal conduit that provides the pathway for drilling mud to travel about one-third of the way up the derrick, where it connects to a flexible hose (kelly hose), which the connects to the swivel.

Kelly
the heavy square or hexagonal steel member suspended from the swivel through the rotary table and connected to the topmost section of drill pipe to turn the drill pipe as the rotary table turns.



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DRILL LINES for land - and offshore drill rigs.

Rotary drive
the machine used to impart rotational power to the drill string while permitting vertical movement of the pipe for drilling. Modern rotary machines have a special component, the rotary or master bushing, to turn the kelly bushing, which permits up and down movement of the kelly while the drill pipe is turning.

Draw works
the hoisting mechanism on a drilling rig. It is a large winch that spools off or takes in the drilling cable or line, which raises or lowers the drill pipe and drill bit.

Blowout prevention equipment
the assembly of well control equipment including preventers, spools, valves, and nipples connected to the top of the wellhead to prevent the uncontrolled escape of oil or gas during drilling operations.
Mud pump: a large, high-pressure reciprocating pump used to circulate the mud on a drilling rig.

Engines
any of various types of power units such as a hydraulic, internal combustion, air, or electric motor that develops energy or imparts rotary motion that can be used to power other machines.

Mud pit
originally, an open pit dug in the ground to hold drilling mud or waste materials such as well bore cuttings or mud sediments. Steel tanks are much more commonly used for these purposes now, but they are still usually referred to as pits.

Drill pipe
the heavy, seamless steel tubing used to rotate the drill bit and circulate the drilling mud. Each section of drill pipe is about 30 feet long and is fastened together by means of threaded tool joints.

Casing
heavy steel pipe that lines the walls of the hole to prevent the wall of the hole from caving in, to prevent movement of fluids from one formation to another, and to aid in well control.

Cement
used to fill the space between the wall of the hole and the casing. Together with the casing, this prevents caving of the hole, prevents movement of fluids (water, oil, or gas) between rock layers, confines production to the well bore, and provides a means to control pressure.

Drill bit
the cutting or boring element used in drilling oil and gas wells. Most bits used in rotary drilling are roller-cone bits. The bit consists of the cutting elements and the circulating element. The circulating element permits the passage of drilling fluid and uses the hydraulic force of the drilling mud to improve drilling rates.

Crushing and abrasion features
By compacting our ropes the resistance to crushing improves substantially. Especially on multi layer drums, wire ropes could interlock between the different layers.
By compacting a wire rope, one makes the surface of the outer layers (outer wires) of the rope more flat. This flatter surface leaves the rope with less grip to get hold of. Consequently, layers slide more smooth along each other.

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DRILL LINES for land - and offshore drill rigs.

Installation instructions

Treatment of drill Lines shall be done as any other crane rope - with much care and knowhow. Here is a summary of issues.

Order the right diameter of rope for the drill rig. Check grooves of drums and sheaves prior to installing the drill line. When spooling the drill line from factory reel to draw-works storage reel, make sure it is done according to the general rules for such spooling. For instance, over-wind to over-wind and under-wind to under-wind spooling.

Commonly, the new drill line is spooled by connecting it to the old one. Be sure to make this connection strong enough, for instance by welded links.

Any drill line shall be spooled and installed 100% rotation free.

To guarantee a rotation free spooling it is recommended to unroll the drill line on a clean floor, make sure it is rotation free, and colour the rope with paint on the topside of the rope. When spooling the rope on the rig one can now notice any possible twist occurring. Let this twist out before fixing the ends in the machine.

The travelling block in the rig shall be aligned with the crown cluster block sheaves, as well as it shall be hung off, to prevent any movement of the travelling block.

The drill line shall be spooled under tension. Special tensioning tools to perform this job are available. Give attention to the position of possible cylinders when installing the drill line. Wrong cylinder positions could upset the tensioning during reeving the rope. Slack of rope could be the result. Finally, when the drill line has been installed, the system shall be lifted and lowered under working tensions, several times, in order to let the rope bed in.

Slip & Cut of Drill Lines

The life of a drill line can be increased dramatically by using and following a planned cut-off program based on work performed. Such a plan moves the rope through the system so that the wear is spread uniformly along the entire length of the rope, enabling the line to be removed from the drawworks drum only when it has reached the end of its useful service life. As the rope is cut off the drawworks drum end, new rope is fed into the system from the storage drum on the dead line side.

The art of slip and cut is to be prepared, have all the needed equipment ready and the number of ropes you intend to remove/slip worked out.

Use the heavy off line to hold the block and TBS weight before you remove the pigtail clamp on the dead man.

When making a cut and slipping never be pulled through a loosened dead man clamp this could put a twist in the rope. The clamp should be completely removed and inspected. If worn or damaged, replace.

Once ready, spool the amount of new line from the storage drum onto the drawworks drum. Insure the line moves freely throughout the system, modern rigs have a rotating center drum on the dead man if yours doesn't use a little oil to lubricate the wire so it slide freely around the dead man. Once we have transferred the amount of wire need across to the drawworks put the clamp back on the pigtail. With the clamp holding on the dead man you can now start to remove the wire you intend to cut off, mark the number of reps you need to cut off, count from the drawworks clamp in.

Using an air tugger with a sheave hoist the wire you intend to put back on the drum after the cut up the derrick, drive the wire from the drum.

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do not pull it off with the tugger. (If rags a mat is about as fast as you should reverse the drum any fast and the crew will not be able to keep up) the idea of taking it up the derrick is to keep it from picking up rubbish that it would do if it were laid out on the floor.

Once you get to the cut off point secure the hanging wire from pulling from the sheaves; wrap the drill line at the point being cut with duct tape prior to making the cut to prevent un-laying.

Cut the line and remove it from the drum remove the holding clamp and check the grip if they are used, get the junk wire off the floor before starting to install the loose wire back on the drum.

Line up the clamp hole on the drum so the reeving wire is easy to work with, lower just enough wire from the derrick to go under the drum and back through the tie down clamp, tighten the clamp on the wire, once tight rest it back into its guide, pull the line tight but do not crimp the line by pulling on the tugger, reinstall the line back on the drawworks drum keeping the wire in the grooves.

After making a cut, the dead wraps should be spooled on the drum with sufficient tension to prevent excessive drum crushing of the bottom layer once done remove the tugger and take up the slack wire, once everything is ready remove the hang off line and tie back in the derrick.

Lower the block so that the elevator lug the rotary (there must be a minimum of five raps left on the drum when the elevator lug the floor some companies will ask for more) slowly pick back up to ensure the line is spooling properly.

It is a good drilling practice to have pipe in the hole while cutting and slipping if you have done this you can use the string weight to test.

PS: don't forget to use an inside BOP on the drill string if you are not using a TDS.

Drilling Ton-Mile

Drilling Ton-Mile is the work of drilling line that is commonly measured as the cumulative of the load lifted in tons and the distance lifted or lowered in miles. When the predetermined ton-mile limit is reached, drilling contractors will perform slip and cut drilling line to prevent drilling line fatigue.

When drilling line is spooled on and off a drawworks drum during operation as drilling a well, running casing, coring, etc. The drilling line get worn out, therefore, drilling contractors must cut old section and replace with new section of drilling line at specific period based on ton mile calculation. The most worn area is the end of drilling line where is constantly spooled over the draw works drum. A section of drilling line, typically around 100 ft, is cut then the drilling line is re-attached to the draw works drum and the amount cut off is spooled back on the drum. This operation is called "slip and cut drilling line"

Note:

Ton-mile is the important figure that must be recorded correctly. However, the most important is to visually inspect drilling line all time to see if there is any worn out wire. If you see the worn out line, you need to cut the drilling line even though the drilling line does not reach ton-mile limit yet. All types of ton-mile service should be calculated and recorded in order to obtain a true picture of the total service received from the rotary drilling line. There are several types of ton miles as follows.

1. **Round trip ton-miles**
2. **Drilling or "connection" ton-miles**
3. **Coring ton-miles**
4. **Ton-miles setting casing**
5. **Short-trip ton-miles**

N2 NEPTUNE

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DRILL LINES for land - and offshore drill rigs.

Drill Lines								
6x19S+IWRC / 6x26WS+IWRC								
Nominal rope diameter		Weight of rope	EIPS		EEIPS		ALPHA	
			MBL		MBL		MBL	
mm	inch	kg/m	kN	metric tonnes	kN	metric tonnes	kN	metric tonnes
41.3	1 5/8	8	1167	119	1304	133	1471	150
44.5	1 3/4	8.7	1360	139	1520	155	1697	173
47.6	1 7/8	9.9	1549	158	1706	174	1932	197
50.8	2	11.3	1760	180	1951	199	2214	226
54	2 1/8	12.8	1970	201	2180	220	2463	241
57.2	2 1/4	14.3	2215	224	2420	247	2697	275

Drill Lines								
6xK19S/6xK26WS+IWRC compacted								
Nominal rope diameter		Weight of rope	EIPS		EEIPS		ALPHA	
			MBL		MBL		MBL	
mm	inch	kg/m	kN	metric tonnes	kN	metric tonnes	kN	metric tonnes
41.3	1 5/8	8	1206	123	1344	137	1520	155
44.5	1 3/4	9.2	1451	148	1618	164	1814	185
47.6	1 7/8	10.6	1687	172	1863	190	2108	215
50.8	2	12.1	1951	199	2178	218	2412	246
54	2 1/8	13.8	2206	225	2395	244	2618	267
57.2	2 1/4	15.5	2461	251	2687	274	2991	305

All ropes manufactured according to API 9A Standards

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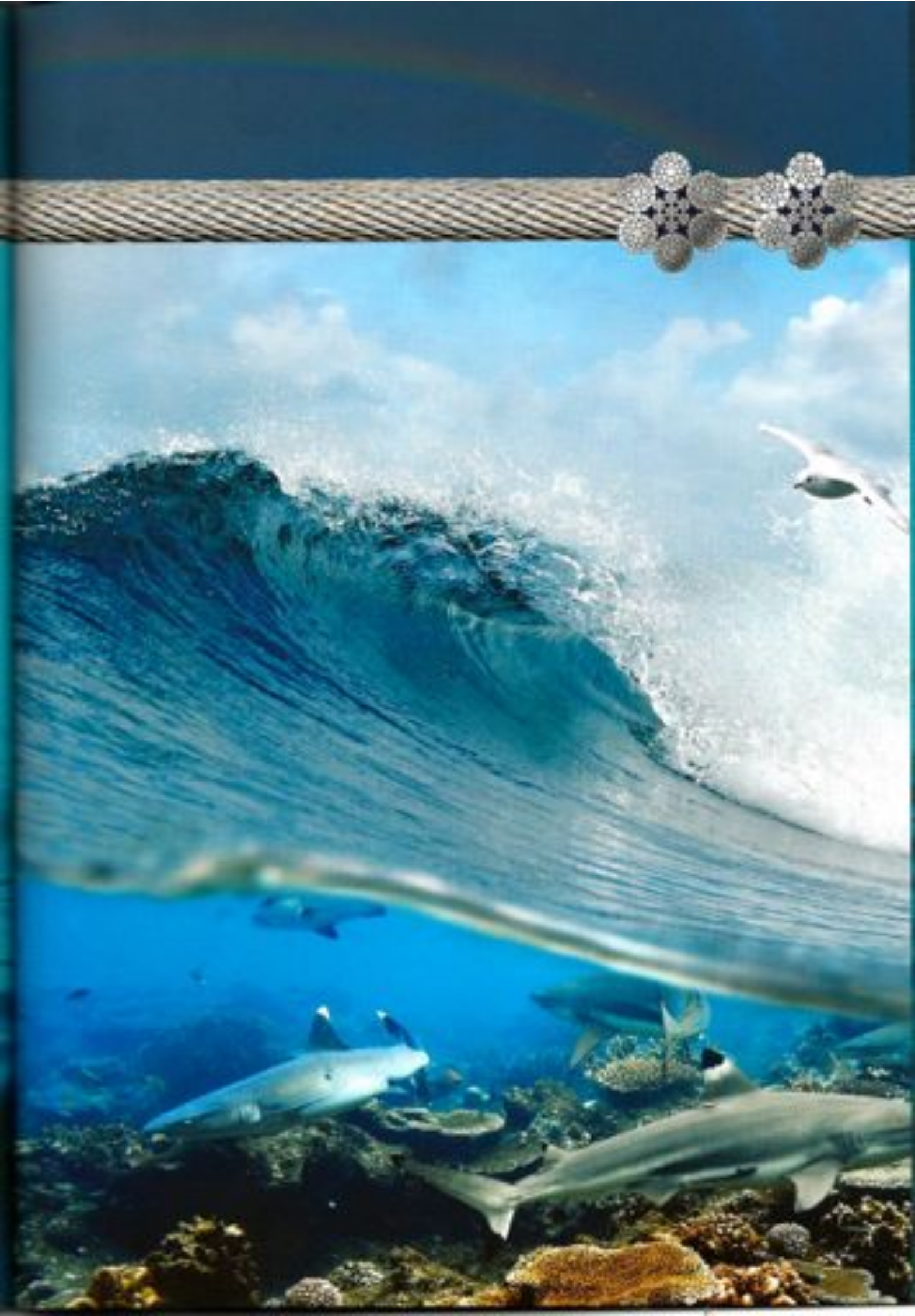

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Kiswire is the largest wire rope producer in the world. Annually, about 140 000 tons of wire rope is delivered worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one is a main market for Kiswire since 15 years, meanwhile.

Riser Tensioner Lines

Riser tensioners being installed on a drilling platform. By changing the distance between sheaves, the tensioners compensate for wave-induced movement of the platform to maintain constant tension on the cables supporting the riser that extends from the platform to the seabed.

Criteria

The most applied Riser Tensioner ropes are in the constructions 6x41WS-IWRC in Lang lay version. A Lang lay rope performs better on fatigue than a regular type. Nowadays these ropes are often coming with a plastic infill between the IWRC and the outer strands. This infill avoids internal wear of the rope substantially. Since tensioner lines come to the end of their service life due to fatigue, a better alternative would be the 6x31WS-IWRC construction.

This 6 strand type of rope, including a plastic infill would bring the highest resistance to fatigue. If laid out in Lang lay as well, this type of rope justifies high hopes and expectations on performance and life time.

Compacted Riser Tensioner ropes would bring advantages as to surface pressure performance. On the other hand, compacted ropes are less flexible than regular wired strand ropes.

See our data sheets for more detailed information. Paragraph Surface Pressure.

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Riser Tensioner Ropes

6xK41WS+IWRC / 8x31WS+IWRC

Grade				1770		1960		2160	
nominal diameter		weight of rope		MBL		MBL		MBL	
mm	inch	kg/m	kg/m	kN	tonnes	kN	tonnes	kN	tonnes
		6xK41	8x31						
44.5	1 3/4	8.2	8.8	1048	107	1160	118	1277	130
50.8	2	11.3	11.5	1368	140	1514	154	1668	170
54.0	2 1/8	12.8	13.0	1550	158	1716	175	1890	193
57.2	2 1/4	14.3	14.5	2200	224	2435	248	2682	273
61.5	2 1/2	17.8	18.1	2683	274	2969	303	3270	333
66.7	2 5/8	19.7	20.0	2945	300	3258	332	3588	366
69.9	2 3/4	21.4	21.7	3209	327	3551	362	3911	399
73.0	2 7/8	23.5	23.9	3491	356	3864	394	4254	434
76.2	3	25.4	25.5	3782	386	4186	427	4610	470

Riser Tensioner Ropes

6xK41WS+IWRC / 8xK31WS+IWRC compacted

Grade				1570		1770		1960	
nominal diameter		weight of rope		MBL		MBL		MBL	
mm	inch	kg/m	kg/m	kN	tonnes	kN	tonnes	kN	tonnes
		6xK41	8xK31						
44.5	1 3/4	9.3	9.3	1454	148	1639	167	1814	185
50.8	2	12.1	12.2	1851	189	2138	218	2412	246
54.0	2 1/8	13.8	13.9	2208	225	2395	244	2638	267
57.2	2 1/4	15.5	15.7	2461	251	2887	274	2991	305
61.5	2 1/2	19.1	19.3	2971	303	3235	334	3658	373
66.7	2 5/8	21.1	21.3	3287	335	3599	367	4031	411
69.9	2 3/4	23.1	23.3	3588	365	3923	400	4452	454
73.0	2 7/8	25.2	25.5	3890	396	4266	435	4864	496
76.2	3	27.4	27.7	4220	430	4629	472	5245	535

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Technical Data Sheet 1

Kiswire is the largest wire rope producer in the world. Annually, about 310000 tons of wire rope is delivered, worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one is a main market for Kiswire since 25 years, meanwhile.

Extreme strength and excellent ductility

KISWIRE is one of the largest and most specialized wire drawers in the world nowadays, featuring the making of wire qualities for high end markets, such as valve springs, and other automotive and aerospace applications. These N2 non rotating wire ropes are made of KISWIRE patented high ductile wires, guaranteeing an incomparable ratio between strength and flexibility, bending fatigue life and abrasion.

Length extensions

When a rope is loaded, constructional lengthening due to the bedding down of all the component wires in the rope, occurs. The precise lengthening due to constructional stretch is hard to calculate, as it depends on a variety of factors, such as : the type of construction of rope, the load amount, the frequency of loading. As a fact, wire rope with fibre cores lengthen more than those with steel cores, since steel cores perform a better bearing for the strands.

As a guidance, we can say that ropes with fibre cores lengthen due to constructional bedding from 0.25% of rope length to 2%, whereas steel core ropes lengthen from 0.125% to 1%.

Elastic length extension occurs due to the physical lengthening of steel under load. The more steel in a rope, the higher the lengthening. Elastic lengthening is not permanent. The precise elastic lengthening of a rope depends again on the same factors as given in the above chapter on constructional lengthening. To determine the exact elastic lengthening one would have to carry out sample tests. For approximate figures however, Hook's formula can be applied:

$$\frac{WL}{EA} = \text{mm lengthening}$$

W = load applied in kg
L = rope length in mm
E = elastic modulus in kg/mm²
A = cross-sectional rope area in mm²

Length extension due to overloading of a rope, more than the yield point of the material, causes permanent extension. Another plastic lengthening of a rope occurs due to wear of wire to wire and strand to strand. Both phenomenon's demand attention whether the rope can be maintained or shall be rejected.

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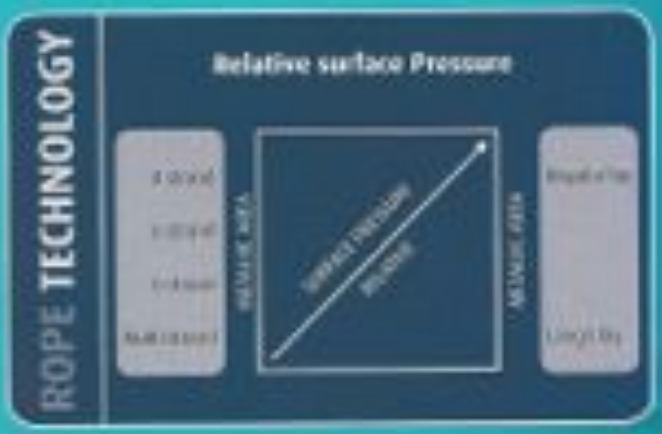
Technical Data Sheet 2

Kiswire is the largest wire rope producer in the world. Annually, about 140,000 tons of wire rope is delivered worldwide. For decades Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets on literally all corners of the world. The offshore industry is one of the main markets for Kiswire since 25 years. Meanwhile

Surface pressure – between ropes and drum/sheave grooves

When a ropes passes the groove of a sheave or a drum, pressure between the 2 surfaces occurs, due to radial forces. The working life of a rope depends partly on the amount of this surface pressure. Much pressure causes more deformation and fatigue. Here are some main criteria as to surface pressure. The more metallic area of the rope in contact with the groove, the lower the relative pressure will be. (1) Lang's Lay Wire Ropes have a **line contact** with the surface of sheaves and drums, whereas, Regular Lay Wire Ropes have **point contact** with the same. Hence, Lang's Lay Wire Ropes have more metallic area in contact with the sheave or drum than a Regular Lay Wire Rope. Assume, the absolute surface pressure is 100, while the contact metallic area of a regular lay wire rope is 20, the relative surface pressure becomes 100 / 20 = 5. Assume, the absolute surface pressure is 100, while the contact metallic area of a Lang's lay wire rope is 25, the relative surface pressure becomes 100 / 25 = 4



types of lay versus surface pressure

Be aware that Lang's lay wire ropes must be used at both ends of the rope, due to high torque characteristics.
(2) 8 strand (versus 6 strand wire ropes) have more metallic area to be in contact with sheaves and drums.
(3) Multi strand ropes expose the highest amount of groove contact. (4) Compacted ropes have an improved groove contact, hence compacted ropes show better surface pressure figures than regular round strand ropes.

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Technical Data Sheet 3

Kiswire is the largest wire rope producer in the world. Annually about 130'000 tons of wire rope is delivered worldwide for decades. Kiswire is specializing in the development and production of wire rope. Meanwhile, the company can acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one is a main market for Kiswire since 25 years, meanwhile.

Crushing and abrasion features

By compacting our ropes the resistance to crushing improves substantially. Especially on multi layer drums, wire ropes could interlock between the different layers. By compacting a wire rope, one makes the surface of the outer layers (outer wires) of the rope more flat. This flatter surface leaves the rope with less grip to get hold of. Consequently, layers slide more smooth along each other.

Swivels

Just to avoid safety risks with rotating loads when they are lifted, the idea of using swivels has arisen. Basically, the use of a swivel interferes with the regular behaviour of a rope in such a way, that it often distorts the rope construction, and causes premature rope failure. Hence, the use of swivels shall be avoided or used in consult with a wire rope engineer. Particularly, a swivel shall not be used when installing a rope. Then again, it is recommended to use a swivel on non rotating wire ropes.

Sockets

Many a rope is equipped with a rope termination. One of the most safe and secure rope terminations is a socket. The proper socket connection guarantees a 100% breaking load efficiency with the rope. Sockets come in 3 main types, i.e. the open spelter socket, the closed spelter socket and the special chain/rope socket, especially designed for the offshore industry. Apart from these regular products, sockets can be custom made for any special application. Today, most sockets are connected to the rope by casting them with a polyester based resin.

ALUMAR® aluminised ropes

The aluminizing of steel wire and steel wire ropes is made by KISWIRE under the brand name ALUMAR®. We apply this technology for about 18 years now, it started in 1999. Initially, the ALUMAR technology was developed for products applied in the aviation and car industry – the core demand was to extend the life time of the wires by sustaining the steel wire quality. Apart from many different kinds of improvement we could establish in that respect, it was obvious that an important improvement was to be made by protecting the wires from corrosion as long as possible. The ALUMAR zinc/aluminium coating was developed as an alternative for the regular galvanizing of wire. Many tests have been done in the meantime, showing that the ALUMAR wires stay corrosion free 3.5 times longer than galvanized products. Third party Salt Spray Tests are available.

The offshore industry, both oil and gas as well as fishing, could benefit from ALUMAR ropes substantially, as sea water is a corrosive environment.

See specific catalogues of our low spin and non rotating Crane Ropes for detailed data.

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Technical Data Sheet 4

Kiswire is the largest wire rope producer in the world. Annually, about 180,000 tons of wire rope is delivered worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one of the main markets for Kiswire since 25 years, meanwhile.

Measuring diameter

Hardness of rope and groove

An important factor in respect to surface pressure between rope and grooves, is the hardness of both the rope and the groove material. Groove hardness shall be slightly higher than the hardness of the wire rope. The other way around will cause damage to the grooves, which in return will damage the wire rope seriously. Formula to calculate surface pressure are available.

Groove dimensioning

Groove radius (r) : minimum = 0.53 to 0.535 x d and maximum = 0.55 x d
Groove depth (h) : 1.5 x d
Throat angle : 35 to 45 degrees (for normal applications)

Fleet angles

The angle under which a rope moves between a drum and a sheave shall be between 0.5 and 2.5 degrees. Fleet angle is calculated from the distance centre to the flanges of the drum. Too small or too big fleet angles cause the rope spool improperly. Either layers pile up on top of each other or layers leave gaps between each other on the drum. Too small fleet angles may cause the interlocking of the rope layers, which causes serious damage to the rope. In order to reduce this interlocking risk, compacted ropes are recommended. Compacted ropes have smoother surfaces than regular round strand ropes, which enhances a smoother sliding of ropes against each other.

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Technical Data Sheet 5

Kiswire is the largest wire rope producer in the world. Annually, about 148.000 tons of wire rope is delivered, worldwide for decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one of a main market for Kiswire since 25 years. Meanwhile,

Spinning loss

In the beginning there was a parallel laid bundle of wires to lift or to pull, to move load. But the parallel bundle could not be bent over drums or sheaves.

Hence, one twisted or spinned the bundle into a helical shape in order to bend the bundle, the rope. The parallel bundle of wires had a strength (MBL) which was the sum of each individual wire (calculated breaking load) In case of the spinned rope spinning loss occured. The average spinning loss is 10%. Calculated breaking load minus spinning loss is minimum breaking load

Constructional torque and axial stiffness

Torsional torque occurs due to the above spinning.

When a spinned rope is put under load, the individual wires want to return to their original parallel laid shape. When the load is taken off the rope, all components return to their helical, spinned shape. This phenomenon implies that all ropes untwist or turn out under load and turn in again when load is released. Torsional torque is one of the most crucial issues related to the design, choice, use of wire rope.

Torsional toeque is a phenomenon that goes with wire rope as rain and water : any wire rope type except the perfect non rotating ones show torsional torque under load.

The amount of torque depends on the amount of load, type of construction and lifting speech.

As a guide line torque values for each type of rope are available. Our N2 35X7 and 35x19S and 35x26WS have been indicated on the leaflets of these ropes. The same theory goes for axial stiffness. Data is shown in the tables of each catalogue.

Average torque factors for the following rope constructions are :

4x39WS+IWRC	torque 0.022
6x36WS+IWRC	torque 0.068
8x36WS+IWRC	torque 0.082
35xK7/40xK7/55xK7	torque 0.0065
35xK26WS	torque 0.0050

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Technical Data Sheet 6

Kiswire is the largest wire rope producer in the world. Annually, about 140,000 tons of wire rope is delivered worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one is a main market for Kiswire since 25 years, meanwhile!

Fatigue by bending

Almost any wire rope when used in bent over drums and sheaves. The number of bends (1), the types of bends (curves) (2), the load applied (3), the dimensions of the drums and sheaves (4), fleet angle, reeving arrangement, groove profile, are impacting factors on the service life of a rope. Ideal wire rope circumstances hardly exist. One shall attempt to create the best possible circumstances in order to optimize rope's service life and performance.

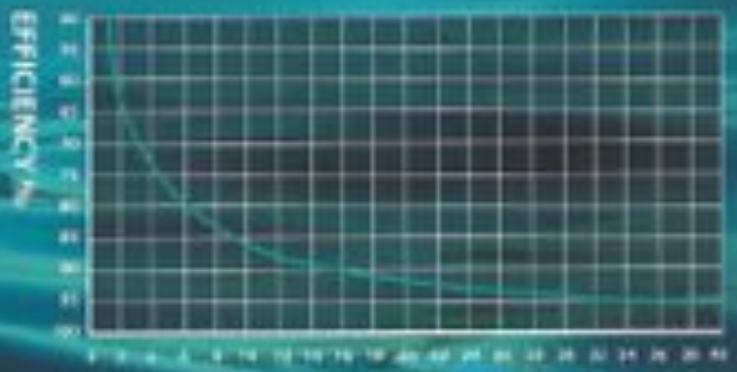
(1) The higher the number of bends of a rope, the higher its fatigue.

(2) Counter direction bends of rope in an installation complicate the performance of a rope substantially. The higher stress in the rope caused by complicated bends, shorten its service life and performance quality.

(3) The amount of load charged on a rope is of great impact on its service life. Within the maximum load allowed of 20% of the MBL of the rope, lower loading improves the fatigue life of the rope disproportionally.

A 15% less loading would result in a 20% better outcome. Be aware, that other issues are of impact as well. For instance, acceleration and deceleration (speed) of the rope. The slower the movement of a rope, the easier its going, the less risk on complications.

(4) The larger the drum and sheave bends, the better the performance and the longer the service life of the rope.



STRENGTH EFFICIENCY OF WIRE ROPE
WHEN BENT OVER PINS OR SHEAVES OF VARIOUS SIZES

$\frac{D}{d}$ = $\frac{\text{diameter of pin (or sheave)}}{\text{nominal diameter of rope}}$

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Technical Data Sheet 7

Kiswire is the largest wire rope producer in the world. Annually, about 140,000 tons of wire rope is delivered worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has secured a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one is a main market for Kiswire since 25 years, meanwhile.

Axial stiffness (EA)

In more common terms Axial Stiffness is the (non) flexibility of a rope.
We calculate the stiffness or flexibility as follows :

E x A x 10/4

E = the apparent modulus of the rope in kN/mm²
A = the cross sectional area of the circumscribed circle in mm², based on the nominal rope diameter

6x37 Class E modules in kN/mm² is 58.86.
The same in computed version is 63.77 kN/mm²

For example :
the EA for a 6x36WS+IWRC 76.2 mm wire rope is :
58.86 x 4560 x 10/4 = 268 MN (MN = Meter/newton)

Flexural Stiffness (EI)

Flexural Stiffness is the Bending stiffness of a rope. It is calculated as follows :

E x I x 10/6

E = the stiffness in N/mm2 (see below table)
I = the Second Moment of Area of the rope (d/4)
(d is the nominal diameter)
Stiffness Factors of 6x37 Class are :
6x36 (15.6) 6xK36 (16.8) 6x49 (14.5) 6xK41 (17.6) 6x49 (12.6) 6xK49 (14.4)

For example :
the EI for a 6x36WS+IWRC 76.2 mm wire rope is : 15.6 x 76.2 x 10/6 = 526 N/m2

the above stiffness values are due for new wire rope, with little or no load applied.

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LEBUS ROPE SPOOLING SYSTEM

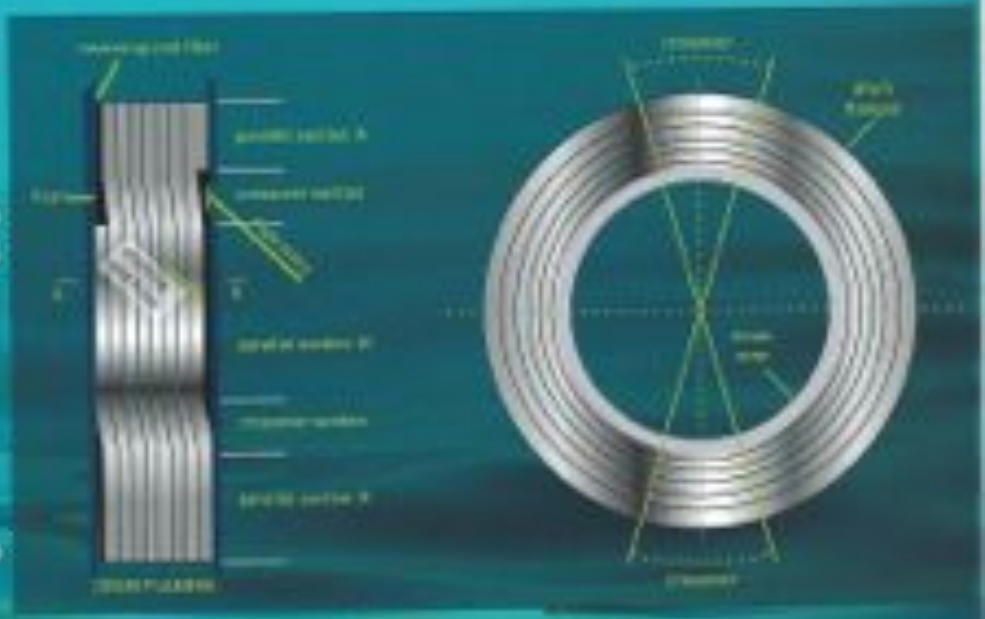
The Lebus spooling system is designed for any hoisting and winching application that uses multiple layers of wire rope on a drum. The geometry of Lebus grooving, coupled with Lebus know-how, ensures that your wire rope spools smoothly onto and off the rope drum under total control - a dependable performance every time. Every Lebus drum is custom engineered. It is designed and produced specifically to meet the application for which it is used. The groove pattern is engineered to suit the rope's length, diameter and construction type.

The Lebus system keeps the spooled rope in a uniformed pattern, evenly distributing the load between the individual layers of rope. This prevents lower layers being crushed or pinched by upper layers. Independent field tests have proved over the years that the Lebus system can extend rope life by more than 500%.

GEOMETRY

With the Lebus system, the continuous groove in the drum is parallel to the flange except for two crossover points on each revolution where the groove moves across the drum half a pitch to give a full pitch of movement.

for each revolution. With Lebus grooving it is possible to calculate exactly the direction of the forces that the rope imposes on the drum because the spooling is totally controlled. This is not possible with any other spooling system.



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SPLIT SLEEVES

It is not always necessary to purchase a new drum. Lebus can supply its grooving system on outer sleeves that can be bolted or welded onto your old drum, no matter how old or worn it is. Lebus split sleeves can also be an economic option for new drums. If in future a different type or size of wire rope is used, the sleeve can be taken off and replaced with a new sleeve engineered for the new application. The Lebus system is so flexible that it can be individually adapted to any existing or new hoist system, even in extreme operating conditions and high loadings. The Lebus system can be installed either during the manufacturing process or later onsite. the cost benefit of the technology speaks for itself.

ROPE DRUMS, SPLIT SLEEVES AND SPOOLING ACCESSORIES

Rope drums - rope drums with grooves cut directly into them (with or without bolted or welded flanges, as required).
Split sleeves - machine-grooved split sleeves, supplied in two sections that can be placed over smooth ungrooved drums.
Split sleeves are a good solution for retrofitting and for applications where drums may require replacing in future.

GROOVED SLEEVES

Sleeves are used to prevent damage to a drum. It is usually cheaper to replace a worn out sleeve instead of replacing or repairing the complete drum assembly. That is why grooved sleeves have become so popular.
The Lebus Grooving System involves a product made specifically for use on any or all types of hoisting drums requiring the use of wire rope or electro-mechanical cable. The Lebus grooves are made for the purpose of properly seating a specified size of wire rope and the proper movement of and spacing of the cable from flange to flange.

The material is supplied in cylindrical bars, either from steel, fiberglass, or aluminium to fit over any existing or new drum core. Sizes range from 3 inches to over 16 feet in diameter and 4 to144 inches (or more) in width. The grooved cylinders are split in halves for easy installation either by welding or bolting to an existing drum core. After the installation has been accomplished, the grooves supplied by Lebus set a pattern whereby a repetitive action of layer to layer spooling can be controlled regardless of the number of layers or drum speed, size and load on the drum.

The primary purpose of the Lebus Spooling System is to spool wire rope or cable onto hoisting drums in a true and correct manner. In most spooling operations, you never encounter severe spooling problems when spooling only one layer of cable on your drum. In all other cases, your trouble will begin when you start the second layer and from there on up through your last layer.

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Technical Data Sheet 8

The Lebus System is the only system on the market that can eliminate the 360o continuous cross winding of the cable as found on smooth drums. The Lebus System cuts down the cross winding to approximately 20% of the circumference of the drum while 80% of the wraps are parallel with the flanges. In view of this pattern, each layer of wire rope then becomes the groove pattern for each succeeding layer.

Another benefit is increased wire rope life. Since the wire is not "cutting in" and scrubbing on itself, the true pyramid stacking pattern promotes long rope life.
Next are faster operations.
By eliminating manual spooling or mechanical devices, a drum with Lebus grooving can be operated at higher speeds.

The Lebus pattern puts the same number of coils on each layer thereby eliminating the "cutting in" of the cable. This severe scrubbing action can cause the wire rope to fail prematurely. The Lebus System is the only known method that can accomplish this feat. Therefore it creates a much safer environment.

Flexibility is an asset that cannot be overlooked. The stress can be added to the smooth drum either during original manufacturing or after the hoist is in the field.

Wire rope savings - Wire Rope is expensive. Anything that promotes the increased life of the rope can be a huge cost saving.
In order for the Lebus system to operate properly, certain parameters must be met. First, the drum flanges must be perpendicular to the drum barrel at all times, even under loaded conditions. Second, there must be sufficient tension on the wire rope to hold the wire firmly in the groove and keep it from skipping grooves or "back tracking". Third, the fleet angle must be kept between ¼° and 1 ½° (If the parameters are such that this cannot be held, then a Lebus Fleet Angle Compensator can be used). This insures that the rope enters the grooving pattern at the most optimum angle for spooling. Fourth, the rope must go to a fixed point that is centered with the drum width. Last, the rope must retain its consistent and round shape even under maximum loading conditions. Given these conditions, a Lebus grooved sleeve should spool KISWIRE ropes in multiple layers without any problems.

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Kiswire is the largest wire rope producer in the world. Annually, about 140,000 tons of wire rope is delivered worldwide for decades. Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in basically all corners of the world. The offshore industry is one of the most important for Kiswire since 25 years, meanwhile.

STRAIN AGING

High Carbon Wire Rod

To reach higher as-drawn wire strengths for applications such as prestressed concrete tendons, higher starting rod strengths are required in the as-rolled condition. High strengths in pearlitic steels are obtained by maximizing the carbon level, and by producing as fine of a pearlite spacing as possible. The upper limit to the carbon level that can be used is dependent on the process capability of a given steel mill. The formation of a continuous grain boundary carbide film, usually in the segregated center of a billet or bloom cast steel, will determine the maximum carbon level that can be used. Typical maximum carbon levels for these applications are 0.82 to 0.85%. Since lead patenting is no longer a competitive alternative because of costs, additional strength is achieved by adding hardenability elements such as Mn and Cr to match hardenability to the controlled cooling capabilities of the rod rolling process. The objective is to produce a fine pearlite similar to a lead patented structure.

With the limitations of the rod cooling process compared to lead patented rods, strengths will still fall short of lead patented rods. Additional strengthening is achieved by precipitation hardening of the soft constituent of pearlite, the ferrite. Vanadium is widely used as a pearlite strengthener in eutectoid (Mn steel) for wire rod applications. Strength increases of 10 to 16 MPa per 0.01% V added are reported. The high solubility of the vanadium allows additions over 0.10% V to be added with predictable strengthening results. Because of this predictability, vanadium is the element of choice to be used as the strength control element when refining steel to specific strength levels. Direct drawn wire applications that require maximum strength, such as prestressed concrete tendons, like bead wire, and wire rope are common applications of vanadium micro alloyed pearlitic steels with eutectoid carbon levels.

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Technical Data Sheet 9

In addition, the addition of Vanadium will remove Nitrogen from solid solution as V(C,N). Nitrogen in solid solution contributes to strain aging during wire drawing, resulting in reduced ductility of the finished wire. Higher ductility, usually measured by the wire torsion test, is reported using vanadium micro alloyed steels in direct drawn wire applications. Again, vanadium changes the nitrogen from an undesirable element to an integral part of the alloy system.

Strain Age

Strain ageing is associated with strain that results from plastic deformation which is more commonly known as cold working. Steel is an alloy of iron and carbon and contains other alloying elements which provide it with specific performance characteristics. Severe cold working of steel causes the migration of carbon atoms in the iron crystals and the segregation of these atoms at dislocations in the steel causes a reduction in ductility of the steel. The ageing process is a function of temperature and time and

Avoiding Strain Age Embrittlement

To avoid the risk of strain aging embrittlement, the following design criteria should be followed:

- use a bend radius of 3 times the diameter of the steel wire
- avoid cold strain. Bend and/or work the steel hot. When galvanizing, anneal at 650-815 degrees Celsius

occurs very slowly at ambient temperature but very rapidly at the 450-460°C temperatures of the galvanizing process. Severe cold working of steel can be caused by hole punching in thicker sections, tight radius bending or riveting.

It should be noted that it is not the hot dip galvanizing that is the cause of accelerating the strain ageing of the steel, but the heat of the process. So strain age embrittlement can be induced in any severely cold worked steel by heating and the tendency to embrittlement by strain ageing will always be present and its manifestation will simply be a matter of time.

It is these two effects, the increased strength and reduction in ductility and toughness from cold strain followed by an additional strength increase and toughness loss through aging, that are the primary elements in strain aging.

Technical Data Sheet 9

Practical comments

Until not so long ago, the world was not familiar with the phenomenon, called strain aging, occurring in wire rope. As far as science shows us, much of cause of strain aging in wire rope could be due to the increase of tensile strengths of the wires used, during the past decades. Was a 1570 N/mm² tensile the benchmark until 1970, since then it became 1770 until the nineties, whereas the standard tensile strength today, is 1960 N/mm². The regular tensile strength is 1960, however, we see that much of the wire ropes are required with higher) breaking strengths than 1960 grades allow. Hence, tensile grades of 2060, 2160 and 2 300 have become quite common, meanwhile.

The need of these high strength ropes (and tensiles) are the result of the industry's wish to design small, light and ethical cranes, devices, and appliances.

One of the main possible causes of susceptibility for strain aging, is a high carbon content in steel. A high breaking strength rope requires high carbon steel wires.
Details of the metallurgical chemistry relating to strain aging and high carbon content, is given in above text.

KISWIRE, expert wire drawer

Of the total volume of delivered wire, being one million tonnes per year, 540 000 tonnes of wire rope, 400 000 tonnes of high ductile, oil tempered wire for the car industry, is produced. Another 500 000 tonnes of wire is made for the tyre industry and the conductor industry. Out of the 400 000 tonnes of car industry wires, 200 000 tonnes high carbon, high ductile, non strain aging susceptible, wire is drawn.
All wire rope is made to specific ordering. KISWIRE does not stock wire rope.

Conclusion and recommendation

Factors, which affect the susceptibility to Strain Aging of Wire Rope:

1. The chemical content of the steel used for the drawing of the wires (this chemical content impacts the mechanical characteristics of the wire)
2. Manufacturing process of steel.
3. One can minimize the risk of steel wire to strain age by choosing materials which are less susceptible to the phenomenon.
5. High(er) tensile strengths tend to be more susceptible to strain aging
6. Research and experience show that less than a percentage of all wire rope suffer from strain aging. Do not exaggerate the risks.
7. Average loss of strength by strain aging is under 5%
8. In the event, wire rope is stored longer than 12 months, one could break test the rope, prior to using it.

Kiswire

www.kiswire.com

N2 NEPTUNE

beyond anything

Technical Data Sheet 10

Kiswire is the largest wire rope producer in the world. Annually, about 140 000 tons of wire rope is delivered, worldwide. For decades, Kiswire is specializing in the development and production of wire rope. Meanwhile, the company has acquired a reputable and leading position in a great variety of markets, in literally all corners of the world. The offshore industry is one is a main market for Kiswire since 25 years, meanwhile.

WIRE ROPE WITH PLASTIC INFILL

To make things easy, let's call the plastication of a IWRC (wire rope core) PLASTIC INFILL.

- Plastic infill improves the **STABILITY** of wire rope *always*, regardless the construction. This makes a wire rope less sensitive for deformation.

- Secondary, a plastic infill enhances the **COHERENCY** of the different rope parts, such as (1) the strands and (2) the IWRC (core). It is essential that wire ropes are a 100% coherent entity; if that would not be the case, loads could be absorbed unequally over the different parts, which would certainly end a rope's service life, prematurely.

- Plastic infill avoids internal wear and friction between the IWRC and the outer strand layers, plus friction between the strands. Hence, with plastic infill there will always be a better resistance to **WEAR** and **FATIGUE** of the wire rope. More bending cycles will be obtained with plastic infilled wire ropes, regardless the construction.

- The plastic infill avoids water and dirt to enter the layer of steel wires (IWRC) which lays under the plastic infill. Hence, corrosion from the inside (invisible) will be less or not occurring.

- Overall, a plastic infill would improve the service life of a wire rope due to higher **FATIGUE**, **STABILITY** and **COHERENCY** features by 125 to 200 %, provided the right type of rope is applied for the right application, and the wire rope is not coming to the end of its service life due to other causes.

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