

# Neptune & N2 Hyrope

high strength wire rope  
for the Oil & Gas Industry





## The Global Leader in the Production of Steel Wire Ropes

### Outstanding Quality for High Carbon Steel Wire

Kiswire was established in 1945 in Busan, Korea. The Company has grown into a major international operation with a global sales and marketing presence and manufacturing facilities in Korea, Malaysia, China, Vietnam, Indonesia and USA.

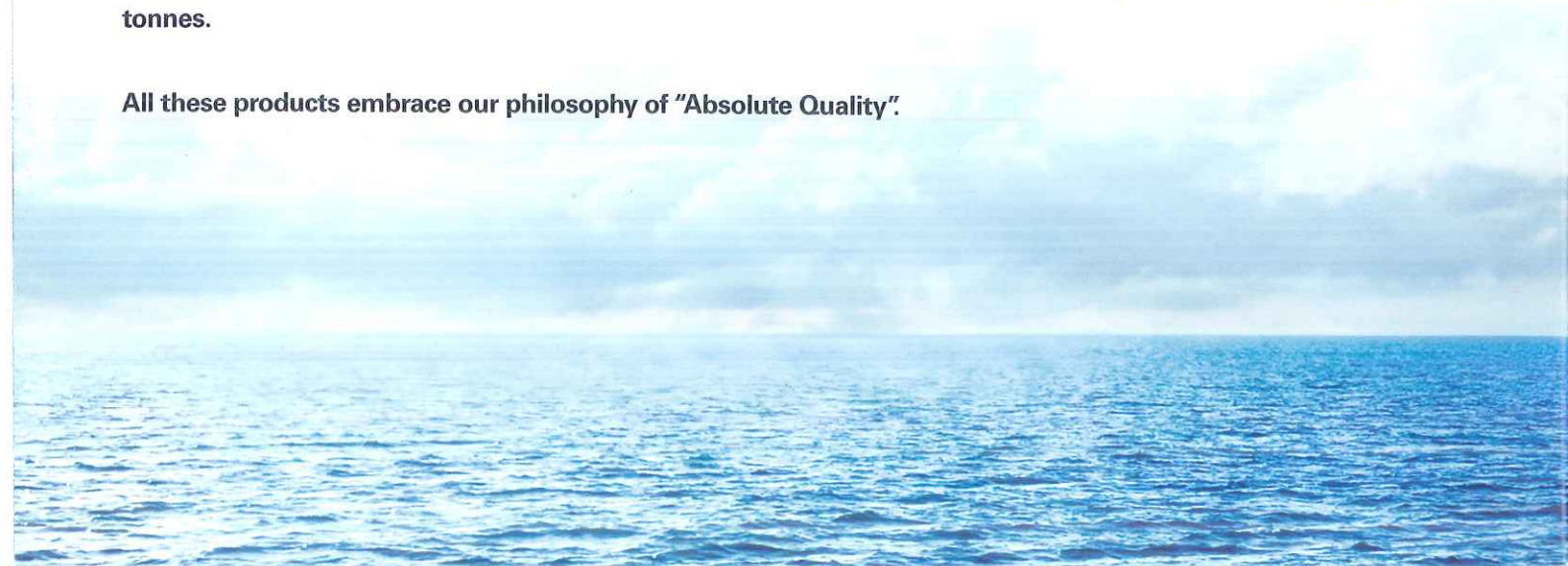
## Neptune & N2 Hyrope

In 1997, KISWIRE established a dedicated manufacturing operation in Johor, Malaysia. This factory offers **a complete range of wire ropes for use by the oil and gas industry, with unit weights for 6 strand rope reaching up to 120 tonnes.** Through continuous improvement, product development and expansion, Neptune Wire Rope (6 & 8 strand) has grown into one of the leading products for the offshore industry.

In 2011, KISWIRE established a new specialized factory for offshore rope at a strategic **location in Tanjung Langsat, Johor, Malaysia in order to meet with our various customers' demands.** Currently, the market requires longer, heavier, and stronger wire rope. Now, unit weights for our 6 and 8 strand wire rope can reach 320 and 405 tonnes, respectively.

**KISWIRE recently began N2 Hyrope (Rotation Resistant Rope) production.** These ropes are for use on offshore crane and in deep sea hoisting (A&R) applications. The unit weights for our **N2 Hyrope are available up to 600 tonnes.**

**All these products embrace our philosophy of "Absolute Quality".**



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**6 Strand Round** — Drilling, Riser Tensioner, Crane, Anchor & Mooring

**6 Strand Compacted** — Drilling, Riser Tensioner, Crane, Anchor & Mooring

**8 Strand Round** — Riser Tensioner, A&R Winch, Crane, Anchor & Mooring

**8 Strand Compacted** — Riser Tensioner, A&R Winch, Crane, Anchor & Mooring

## **N2 Hyrope**

**35×K7** — A&R Winch, Crane

**40×K7** — A&R Winch, Crane

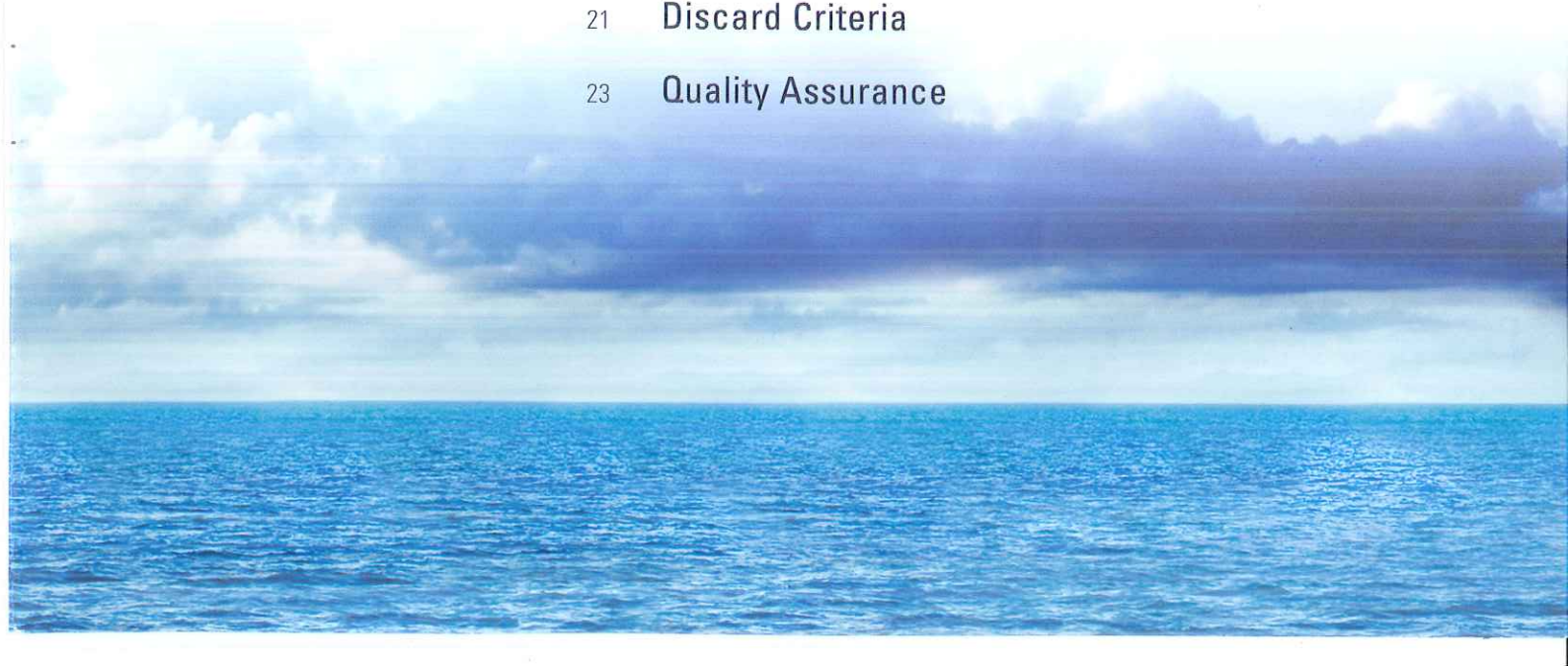
**55×K7** — A&R Winch, Crane

**67×K7** — A&R Winch, Crane

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# Neptune & N2 Hyrope

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## Key Product Features

### **The highest breaking strength and fatigue resistance**

In round and compacted strand rope made possible by the use of special, high technology wire drawing machinery coupled with special die and lubricant practices along with optimum rope design to minimize spinning loss

### **Outstanding resistance to corrosion**

Through heavy, uniform thickness zinc and zinc aluminum alloy (ALUMAR) coating in combination with highly effective water repellent blocking compounds developed specifically for use with Neptune & N2 Hyrope product

### **Excellent packing and product protection**

By careful control of rope spooling and the use of strong steel reels and protective wrapping

### **Rigorous Quality Assurance**

Through procedures and practices strictly applied according to internationally accredited standards

## Benefits of Neptune Rope

- Highest strength to weight ratio
- Wide range of rope construction options
- Excellent corrosion resistance
- High fatigue life
- Good abrasion and wear resistance
- Ease of rope handling
- Dedicated production unit
- Non-rotating property (N2 Hyrope)
- Plastic infilled option
- Quality Assurance

# Absolute Quality

## A. High Quality Wire

Kiswire made all ropes with own processes from raw material to final product. We produced our own drawn wire by advanced technology.

### • Wire Rod

- High quality and high purity wire rod from the world's leading steel makers
- Meet the requirements of various international/national industrial standards
- Strict quality control of the wire rod surface

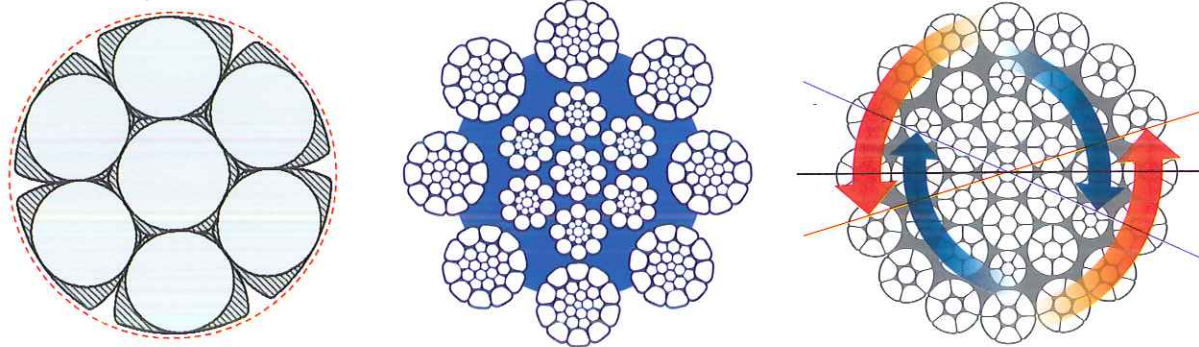
### • Patenting & Galvanizing

- Automated in-line process with optimized control of microstructure
- Uniform and highly adherent galvanized coatings
- Alumar (95% Zn + 5% Al) coating option available upon request

### • Drawing

- Accurate diameter control
- High-tensile, high-ductility and homogeneous wire
- By the up-to-date drawing machine and precise drawing dies
- Sophisticated cooling control technique





## B. Compaction

- **The Wires are plastically deformed and the surface is made smooth resulting in reduced contact stress between wires.**
  - Fill factor ↑ (metallic area)
  - Surface contact area ↑
  - Resistance to the abrasion ↑ and mechanical damages ↑

## C. Plastic in-filled

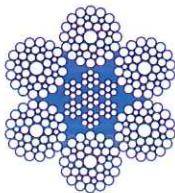
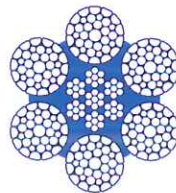




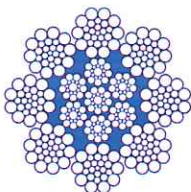
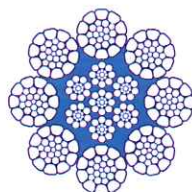




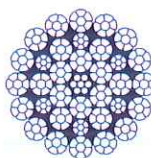
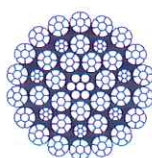


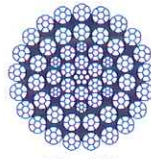
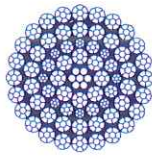
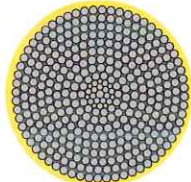

- **The plastic layer acts as a cushion between the layers of strands.**
- **The plastic layer has many advantages ;**
  - Reducing the incident of internal wire breaks
  - Stabilizing the rope construction during installation and actual service
  - Preventing invasion of water and harmful elements
  - Retaining the internal lubricant for a long time
  - Absorbing internal dynamic energy and reducing the internal stress

## D. Torque control of N2 Hyrope

- **The torques of the core and outer strands counteract each other**
  - IWRC and outer strands closed in opposite direction
  - Positive and negative torque balanced to zero
  - Rotation of free under load

# Product Cross-Sections

## Neptune, N2 Hyrope & N2 Spiral

		Drilling Lines	Riser Tensioner	Anchor & Mooring	Crane	A&R Winch	Permanent Mooring	
<b>Neptune</b>		 6 Strand Round	 6 Strand Compacted					
<b>Neptune</b>		 8 Strand Round	 8 Strand Compacted					
<b>N2 Hyrope</b>		 35 x K7	 40 x K7					
	 55 x K7	 67 x K7						
<b>N2 Spiral</b>								

# Product Data

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- 9 **Neptune**
- 6 Strand Round**  
- Drilling, Riser Tensioner, Crane, Anchor & Mooring
  - 6 Strand Compacted**  
- Drilling, Riser Tensioner, Crane, Anchor & Mooring
  - 8 Strand Round**  
- Riser Tensioner, A&R Winch, Crane, Anchor & Mooring
  - 8 Strand Compacted**  
- Riser Tensioner, A&R Winch, Crane, Anchor & Mooring

- 13 **N2 Hyrope**
- 35×K7**  
- A&R Winch, Crane
  - 40×K7**  
- A&R Winch, Crane
  - 55×K7**  
- A&R Winch, Crane
  - 67×K7**  
- A&R Winch, Crane

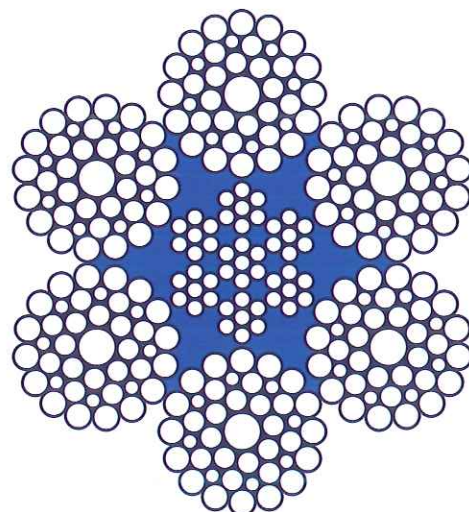
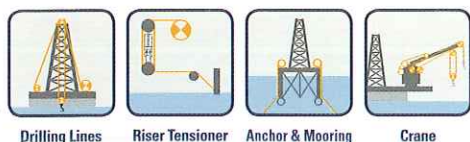
- 17 **N2 Spiral**
- Permanent Mooring



# Neptune

## 6 Strand Round

- Fully lubricated
- Plastic infilled option
- High breaking force
- Zinc coated / Alumar coated / Bright



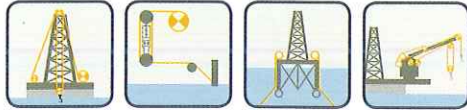
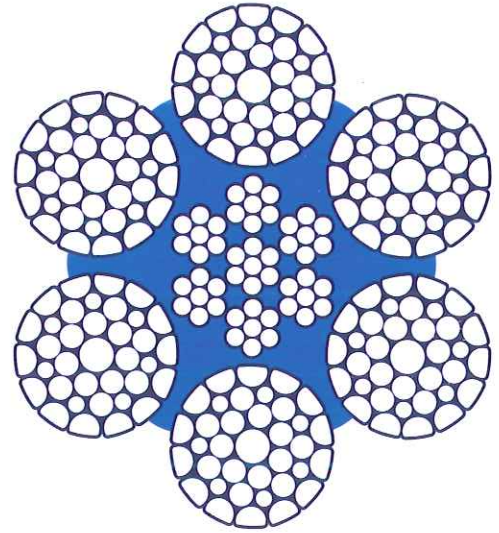
Rope Nominal Diameter		Approx. Weight in Air		Minimum Breaking Force												Reference information (Approximately)		
				EEIPS			ALPHA			DELTA			OMEGA			Axial Stiffness	Torque generated at 20% of Nominal Load	Metallic Cross Sectional Area
mm	inches	kg/m	lb/ft	tonnes force	kN	short tons	tonnes force	kN	short tons	tonnes force	kN	short tons	tonnes force	kN	short tons	MN	N.m	mm <sup>2</sup>
50.8	2	11.3	7.6	197	1,930	217	214	2,100	236	225	2,210	248	235	2,310	259	130	1,500	1,240
54.0	2 1/8	12.8	8.6	220	2,160	243	241	2,360	266	250	2,450	276	260	2,550	287	140	1,700	1,400
57.2	2 1/4	14.3	9.6	247	2,420	272	272	2,670	300	285	2,790	314	298	2,920	328	160	2,100	1,560
60.3	2 3/8	15.7	10.5	275	2,700	303	303	2,970	334	318	3,120	351	332	3,260	366	180	2,400	1,720
63.5	2 1/2	17.8	11.9	301	2,950	332	330	3,240	364	346	3,390	381	362	3,550	399	200	2,800	1,960
66.7	2 5/8	19.7	13.2	330	3,240	364	365	3,580	402	383	3,760	422	400	3,920	441	220	3,200	2,150
69.9	2 3/4	21.4	14.4	360	3,530	397	400	3,920	441	420	4,120	463	439	4,310	484	240	3,700	2,350
73.0	2 7/8	23.5	15.8	392	3,840	432	440	4,320	485	462	4,530	509	483	4,740	532	270	4,300	2,640
76.2	3	25.4	17.1	425	4,160	469	483	4,740	532	507	4,970	559	530	5,200	584	290	4,900	2,780
79.4	3 1/8	27.6	18.5	458	4,490	505	522	5,120	575	548	5,370	604	572	5,610	631	320	5,400	3,110
82.6	3 1/4	29.9	20.1	494	4,840	544	557	5,460	614	585	5,740	645	611	5,990	674	350	6,000	3,350
85.7	3 3/8	32.2	21.6	528	5,180	582	607	5,950	669	637	6,250	702	666	6,530	734	370	6,800	3,590
88.9	3 1/2	34.8	23.4	563	5,520	621	659	6,460	726	692	6,790	763	723	7,090	797	400	7,600	3,850
95.3	3 3/4	39.9	26.8	640	6,280	705	714	7,000	787	750	7,350	827	785	7,700	865	460	9,000	4,470
102.0	4	45.3	30.5	720	7,060	794	796	7,810	877	836	8,200	922	873	8,560	962	520	10,700	5,050
108.0	4 1/4	51.1	34.3	788	7,730	869	845	8,290	931	887	8,700	978	926	9,080	1,021	580	12,300	5,600
114.0	4 1/2	57.4	38.6	876	8,590	966	939	9,210	1,035	986	9,670	1,087	1,030	10,100	1,135	640	14,400	6,240
121.0	4 3/4	63.9	42.9	967	9,480	1,066	1,040	10,200	1,146	1,090	10,700	1,202	1,140	11,200	1,257	710	16,800	6,910
127.0	5	70.8	47.5	1,064	10,430	1,172	1,140	11,200	1,257	1,200	11,800	1,323	1,250	12,300	1,378	790	19,500	7,620

Ropes with higher Mbf could be custom designed upon special request.  
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

# Neptune

## 6 Strand Compacted

- Fully lubricated
- Plastic infilled option
- High breaking force
- Greater contact area
- Higher resistance to abrasion
- Zinc coated / Alumar coated / Bright



Drilling Lines   Riser Tensioner   Anchor & Mooring   Crane

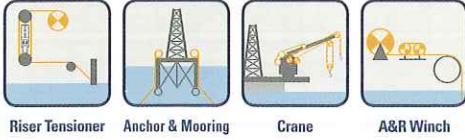
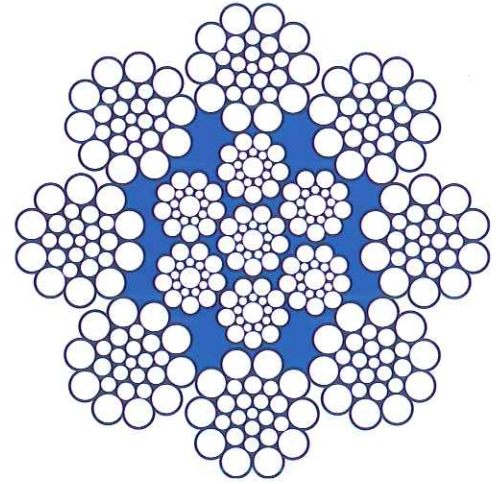
Rope Nominal Diameter		Approx. Weight in Air		Minimum Breaking Force												Reference information (Approximately)		
				EEIPS			ALPHA			DELTA			OMEGA			Axial Stiffness	Torque generated at 20% of Nominal Load	Metallic Cross Sectional Area
mm	inches	kg/m	lb/ft	tonnes force	kN	short tons	tonnes force	kN	short tons	tonnes force	kN	short tons	tonnes force	kN	short tons	MN	N.m	mm <sup>2</sup>
50.8	2	12.1	8.1	218	2,140	240	241	2,360	266	253	2,480	279	257	2,520	283	150	1,600	1,380
54.0	2 1/8	13.8	9.3	244	2,390	269	267	2,620	294	280	2,750	309	285	2,790	314	170	1,900	1,550
57.2	2 1/4	15.5	10.4	274	2,690	302	305	2,990	336	321	3,150	353	326	3,200	359	190	2,300	1,720
60.3	2 3/8	16.9	11.0	305	2,990	336	340	3,330	375	358	3,510	395	363	3,560	400	210	2,700	1,910
63.5	2 1/2	19.1	12.8	334	3,280	368	373	3,660	411	392	3,840	432	398	3,900	439	230	3,100	2,170
66.7	2 5/8	21.1	14.2	367	3,600	405	411	4,030	453	432	4,240	476	439	4,300	484	260	3,600	2,390
69.9	2 3/4	23.1	15.5	400	3,920	441	454	4,450	500	476	4,670	525	484	4,746	534	280	4,200	2,610
73.0	2 7/8	25.2	16.9	435	4,270	480	496	4,860	547	521	5,110	574	529	5,190	583	320	4,700	2,920
76.2	3	27.4	18.4	472	4,630	520	545	5,340	601	573	5,620	632	581	5,700	640	330	5,400	3,080
79.4	3 1/8	29.8	20.0	508	4,980	560	579	5,680	638	608	5,960	670	618	6,060	681	370	6,000	3,440
82.6	3 1/4	32.3	21.7	548	5,370	604	618	6,060	681	649	6,360	715	660	6,470	728	400	6,700	3,700
85.7	3 3/8	34.8	23.4	586	5,750	646	656	6,430	723	689	6,760	759	700	6,860	772	420	7,500	3,860
88.9	3 1/2	37.6	25.3	625	6,130	689	713	6,990	786	749	7,350	826	761	7,460	839	450	8,400	4,130
95.3	3 3/4	43.0	28.9	711	6,970	784	793	7,780	874	833	8,170	928	848	8,320	935	520	10,000	4,810
102.0	4	48.9	32.9	799	7,840	881	876	8,590	966	920	9,020	1,014	935	9,170	1,031	590	11,900	5,430
108.0	4 1/4	53.1	35.7	884	8,670	974	978	9,590	1,078	1,030	10,100	1,135	1,040	10,200	1,146	630	14,000	5,790
114.0	4 1/2	59.7	40.2	971	9,520	1,070	1,070	10,500	1,179	1,130	11,100	1,246	1,150	11,300	1,268	700	16,300	6,460
121.0	4 3/4	66.5	44.7	1,059	10,400	1,167	1,170	11,500	1,290	1,230	12,100	1,356	1,250	12,300	1,378	770	18,700	7,150

Ropes with higher Mbf could be custom designed upon special request.  
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

# Neptune

## 8 Strand Round

- Fully lubricated
- Plastic infilled option
- High breaking force
- Zinc coated / Alumar coated / Bright



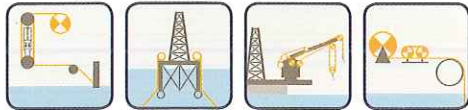
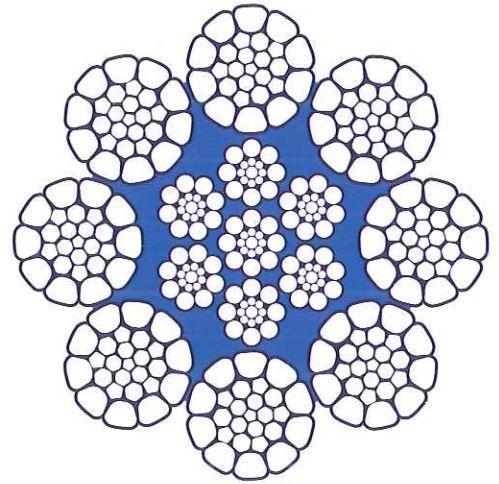
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50.8	2	11.5	7.7	197	1,930	217	214	2,100	236	225	2,210	248	235	2,310	259	120	1,800	1,260
54.0	2 1/8	13.0	8.7	220	2,160	243	241	2,360	266	250	2,450	276	260	2,550	287	130	2,100	1,420
57.2	2 1/4	14.5	9.7	247	2,420	272	272	2,670	300	285	2,790	314	298	2,920	328	150	2,500	1,580
60.3	2 3/8	15.9	10.6	275	2,700	303	303	2,970	334	318	3,120	350	332	3,260	366	160	2,900	1,750
63.5	2 1/2	18.1	12.1	301	2,950	332	330	3,240	364	346	3,390	381	362	3,550	399	190	3,400	1,990
66.7	2 5/8	20.0	13.4	330	3,240	364	365	3,580	402	383	3,760	422	400	3,920	441	210	3,900	2,210
69.9	2 3/4	21.7	14.6	360	3,530	397	400	3,920	441	420	4,120	463	439	4,310	484	230	4,500	2,420
73.0	2 7/8	23.9	16.1	392	3,840	432	440	4,310	485	462	4,530	509	483	4,740	532	250	5,100	2,700
76.2	3	25.8	17.4	425	4,160	468	491	4,820	541	516	5,060	569	538	5,280	593	270	5,800	2,850
79.4	3 1/8	28.0	18.8	458	4,490	505	522	5,120	575	548	5,370	604	572	5,610	631	290	6,500	3,150
82.6	3 1/4	30.3	20.4	494	4,840	545	557	5,460	614	585	5,740	645	611	5,990	674	320	7,200	3,400
85.7	3 3/8	32.7	21.9	528	5,180	582	607	5,950	669	637	6,250	702	666	6,530	734	340	8,100	3,670
88.9	3 1/2	35.3	23.7	563	5,520	621	659	6,460	726	692	6,790	763	723	7,090	797	370	9,100	3,940
95.3	3 3/4	40.5	27.2	640	6,280	706	714	7,000	787	750	7,350	827	785	7,700	865	430	10,800	4,580
102.0	4	46.0	31.0	720	7,060	794	796	7,810	877	836	8,200	922	873	8,560	962	480	12,800	5,170
108.0	4 1/4	51.9	34.8	788	7,730	869	845	8,290	931	887	8,700	978	926	9,080	1,021	540	14,700	5,830
114.0	4 1/2	58.3	39.2	876	8,590	966	939	9,210	1,035	986	9,670	1,087	1,030	10,100	1,135	610	17,300	6,490
121.0	4 3/4	64.9	43.6	967	9,480	1,066	1,040	10,200	1,146	1,090	10,700	1,202	1,140	11,200	1,257	670	20,100	7,190
127.0	5	71.9	48.2	1,064	10,400	1,173	1,140	11,200	1,257	1,200	11,700	1,323	1,250	12,300	1,378	740	23,300	7,930
133.0	5 1/4	77.3	51.8	1,138	11,200	1,254	1,220	11,900	1,345	1,280	12,600	1,411	1,330	13,000	1,466	810	26,200	8,710
140.0	5 1/2	85.7	57.4	1,223	12,000	1,348	1,310	12,800	1,444	1,370	13,500	1,510	1,430	14,000	1,576	900	29,500	9,650
146.0	5 3/4	93.2	62.5	1,315	12,900	1,450	1,410	13,800	1,554	1,480	14,500	1,631	1,540	15,100	1,698	980	33,100	10,500
152.0	6	101.0	67.7	1,410	13,800	1,554	1,510	14,800	1,664	1,580	15,500	1,742	1,650	16,200	1,819	1,060	37,100	11,400
159.0	6 1/4	109.7	73.5	1,497	14,700	1,650	1,600	15,700	1,764	1,680	16,500	1,852	1,760	17,300	1,940	1,150	41,000	12,300
162.0	6 3/8	114.0	76.4	1,539	15,100	1,696	1,650	16,100	1,819	1,730	17,000	1,907	1,810	17,800	1,995	1,190	43,000	12,800

Ropes with higher Mbf could be custom designed upon special request.  
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

# Neptune

## 8 Strand Compacted

- Fully Lubricated
- Plastic Infilled Option
- High Breaking Force
- Greater contact area
- Higher resistance to abrasion
- Zinc coated / Alumar coated / Bright



Riser Tensioner    Anchor & Mooring    Crane    A&R Winch

Rope Nominal Diameter		Approx. Weight in Air		Minimum Breaking Force												Reference information (Approximately)		
				EEIPS			ALPHA			DELTA			OMEGA			Axial Stiffness	Torque generated at 20% of Nominal Load	Metallic Cross Sectional Area
mm	inches	kg/m	lb/ft	tonnes force	kN	short tons	tonnes force	kN	short tons	tonnes force	kN	short tons	tonnes force	kN	short tons	MN	N.m	mm <sup>2</sup>
50.8	2	12.2	8.2	218	2,140	241	241	2,360	266	253	2,480	279	257	2,520	283	130	2,000	1,380
54.0	2 1/8	13.9	9.4	244	2,400	269	267	2,620	294	280	2,750	309	285	2,790	314	150	2,300	1,540
57.2	2 1/4	15.7	10.5	274	2,680	302	305	2,990	336	321	3,150	354	326	3,200	359	170	2,800	1,720
60.3	2 3/8	17.1	11.1	305	2,990	335	340	3,330	375	358	3,510	395	363	3,560	400	190	3,200	1,910
63.5	2 1/2	19.3	12.9	334	3,270	368	373	3,660	411	392	3,840	432	398	3,900	439	210	3,700	2,170
66.7	2 5/8	21.3	14.3	367	3,590	404	411	4,030	453	432	4,240	476	439	4,310	484	240	4,300	2,410
69.9	2 3/4	23.3	15.6	400	3,920	440	454	4,450	500	476	4,670	525	484	4,750	534	260	5,000	2,630
73.0	2 7/8	25.5	17.1	435	4,260	479	496	4,860	547	521	5,110	574	529	5,190	583	290	5,700	2,940
76.2	3	27.7	18.6	472	4,630	520	545	5,340	601	573	5,620	632	581	5,700	640	310	6,500	3,100
79.4	3 1/8	30.1	20.2	508	4,980	560	579	5,680	638	608	5,960	670	618	6,060	681	340	7,200	3,440
82.6	3 1/4	32.6	21.9	548	5,370	604	618	6,060	681	649	6,360	715	660	6,470	728	370	8,000	3,730
85.7	3 3/8	35.1	23.6	586	5,750	646	656	6,430	723	689	6,760	759	700	6,860	772	390	9,000	4,010
88.9	3 1/2	38.0	25.6	625	6,120	689	713	6,990	786	749	7,350	826	761	7,460	839	420	10,100	4,290
95.3	3 3/4	43.4	29.2	711	6,970	783	793	7,780	874	833	8,170	918	848	8,320	935	490	11,900	4,990
102.0	4	49.4	33.2	799	7,830	881	876	8,590	966	920	9,020	1,014	935	9,170	1,031	550	14,200	5,640
108.0	4 1/4	53.6	36.0	884	8,670	972	978	9,590	1,078	1,030	10,100	1,135	1,040	10,200	1,146	610	16,700	6,190
114.0	4 1/2	60.3	40.6	971	9,520	1,068	1,070	10,500	1,179	1,130	11,100	1,246	1,150	11,300	1,268	680	19,500	6,900
121.0	4 3/4	67.2	45.2	1,059	10,390	1,165	1,170	11,500	1,290	1,230	12,100	1,356	1,250	12,300	1,378	750	22,400	7,650
127.0	5	74.4	50.0	1,149	11,270	1,264	1,270	12,500	1,400	1,330	13,000	1,466	1,360	13,300	1,499	820	25,600	8,310
133.0	5 1/4	82.0	55.2	1,232	12,080	1,355	1,360	13,300	1,499	1,430	14,000	1,576	1,450	14,200	1,598	880	28,800	8,970
140.0	5 1/2	90.0	60.6	1,322	12,960	1,454	1,460	14,300	1,609	1,540	15,100	1,698	1,560	15,300	1,720	970	32,400	9,940
146.0	5 3/4	98.4	66.2	1,419	13,920	1,561	1,570	15,400	1,731	1,650	16,200	1,819	1,680	16,500	1,852	1,060	36,400	10,800

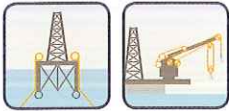
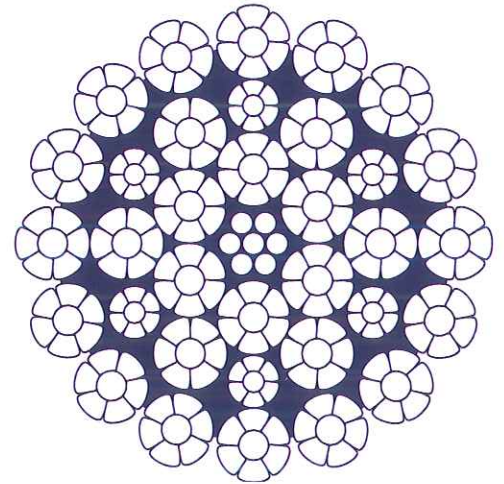
Ropes with higher Mbf could be custom designed upon special request.  
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

# N2 Hyrope

## 35xK7

### Rotation Resistant Rope

- Rotation resistant
- Fully lubricated
- Plastic infilled option
- High breaking force
- Compacted
- Greater contact area



Anchor & Mooring

Crane

Rope Nominal Diameter		Approx. Weight in Air		Minimum Breaking Force				Reference information (Approximately)			
				N grade		S grade		Maximum Length	Axial Stiffness	Torque generated at 20% of Nominal Load	Metallic Cross Sectional Area
mm	inches	kg/m	lb/ft	tonnes force	kN	tonnes force	kN	meter	MN	N.m	mm <sup>2</sup>
50.8	2	12.9	8.6	229	2,250	241	2,360	23,200	150	340	1,390
52.0		13.4	9.0	240	2,360	253	2,480	22,300	160	370	1,460
54.0	2 1/8	14.6	9.8	259	2,540	273	2,680	20,500	170	410	1,580
56.0		15.7	10.5	278	2,730	293	2,870	19,100	180	460	1,690
57.2	2 1/4	16.3	10.9	285	2,790	300	2,940	18,400	190	480	1,770
58.0		16.9	11.3	294	2,880	309	3,030	17,700	200	500	1,820
60.3	2 3/8	18.2	12.2	314	3,080	331	3,250	16,400	210	560	1,960
62.0		19.4	13.0	335	3,290	353	3,460	15,400	220	610	2,080
63.5	2 1/2	20.2	13.5	352	3,460	371	3,640	14,800	240	660	2,180
64.0		20.2	13.5	357	3,500	376	3,690	14,800	240	670	2,210
66.0		21.5	14.4	380	3,730	400	3,920	13,900	250	740	2,350
66.7	2 5/8	22.2	14.9	388	3,800	408	4,000	13,500	260	760	2,400
68.0		22.9	15.3	404	3,960	425	4,170	13,100	270	810	2,500
69.9	2 3/4	24.4	16.3	426	4,180	448	4,400	12,200	290	880	2,640
72.0		25.8	17.3	452	4,430	476	4,670	11,600	300	960	2,790
73.0	2 7/8	26.7	17.9	465	4,560	489	4,800	11,200	310	1,000	2,870
74.0		27.4	18.4	478	4,690	503	4,930	10,900	320	1,040	2,950
76.0		29.0	19.4	504	4,940	530	5,200	10,300	340	1,130	3,110
76.2	3	29.0	19.4	504	4,940	530	5,200	10,300	340	1,130	3,110
79.4	3 1/8	31.5	21.1	541	5,310	570	5,590	9,500	370	1,260	3,390
82.0		33.9	22.7	568	5,570	598	5,860	8,800	390	1,370	3,620
82.6	3 1/4	34.1	22.8	568	5,570	598	5,860	8,700	400	1,380	3,670
84.0		34.9	23.4	588	5,770	619	6,070	8,500	410	1,450	3,800
85.7	3 3/8	36.7	24.6	613	6,010	645	6,320	8,100	430	1,540	3,950
88.0		38.4	25.7	646	6,330	679	6,660	7,800	450	1,670	4,170
88.9	3 1/2	39.5	26.5	658	6,450	693	6,790	7,500	460	1,720	4,250
90.0		39.5	26.5	658	6,450	693	6,790	7,500	470	1,740	4,360
92.0		41.3	27.7	686	6,730	722	7,080	7,200	480	1,850	4,560
94.0		43.1	28.9	708	6,940	745	7,310	6,900	500	1,960	4,760
95.3	3 3/4	45.4	30.4	717	7,030	755	7,400	6,600	520	2,010	4,900
96.0		46.4	31.1	729	7,150	767	7,520	6,400	530	2,050	4,970

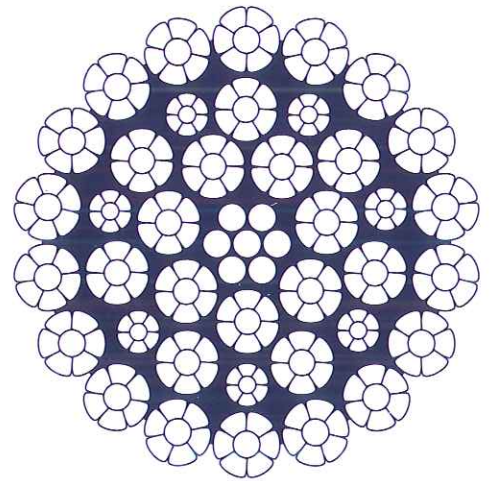
Ropes with higher Mbf could be custom designed upon special request.  
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

# N2 Hyrope

40×K7

## Rotation Resistant Rope

- Rotation resistant
- Fully lubricated
- Plastic infilled option
- High breaking force
- Compacted
- Greater contact area



Crane



A&R Winch

Rope Nominal Diameter		Approx. Weight in Air		Minimum Breaking Force				Reference information (Approximately)			
				N grade		S grade		Maximum Length	Axial Stiffness	Torque generated at 20% of Nominal Load	Metallic Cross Sectional Area
mm	inches	kg/m	lb/ft	tonnes force	kN	tonnes force	kN	meter	MN	N.m	mm²
82.0		33.9	22.7	587	5,760	618	6,060	8,800	400	850	3,700
82.6	3 1/4	34.1	22.8	587	5,760	618	6,060	8,700	410	860	3,750
84.0		34.9	23.4	608	5,960	640	6,280	8,500	420	900	3,880
85.7	3 3/8	36.7	24.6	637	6,250	671	6,580	8,100	440	960	4,040
88.0		38.4	25.7	660	6,470	695	6,820	7,800	460	1,030	4,270
88.9	3 1/2	39.5	26.5	691	6,770	727	7,130	7,500	470	1,080	4,360
90.0		39.5	26.5	691	6,770	727	7,130	7,500	480	1,100	4,470
92.0		41.3	27.7	722	7,080	760	7,450	7,200	490	1,170	4,560
94.0		43.1	28.9	745	7,300	784	7,690	6,900	510	1,240	4,760
95.3	3 3/4	45.4	30.4	755	7,410	795	7,800	6,600	530	1,270	4,900
96.0		46.4	31.1	767	7,520	807	7,910	6,400	540	1,300	4,970
98.0		48.3	32.4	805	7,890	847	8,310	6,200	560	1,390	5,180
100		50.3	33.7	831	8,150	875	8,580	9,900	580	1,470	5,390
102	4	51.6	34.6	865	8,480	910	8,920	9,600	600	1,560	5,570
104		53.6	35.9	899	8,820	946	9,280	9,300	630	1,650	5,830
106		55.7	37.3	935	9,160	984	9,650	8,900	650	1,750	6,060
108	4 1/4	58.3	39.1	969	9,500	1,020	10,000	8,500	680	1,850	6,290
110		60.5	40.5	998	9,790	1,050	10,300	8,200	700	1,940	6,520
112		62.8	42.1	1,030	10,100	1,080	10,600	7,900	720	2,040	6,670
114	4 1/2	65.3	43.8	1,070	10,500	1,130	11,100	7,600	740	2,150	6,910
116		67.6	45.3	1,090	10,700	1,150	11,300	7,300	770	2,230	7,150
120		72.4	48.5	1,170	11,500	1,230	12,100	6,900	830	2,480	7,660

Ropes with higher Mbf could be custom designed upon special request.

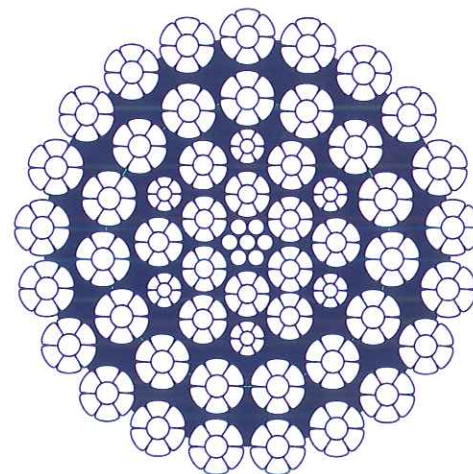
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

# N2 Hyrope

55×K7

## Rotation Resistant Rope

- Rotation resistant
- Fully lubricated
- Plastic infilled option
- High breaking force
- Compacted
- Greater contact area



Crane

A&R Winch

Rope Nominal Diameter		Approx. Weight in Air		Minimum Breaking Force				Reference information (Approximately)			
				N grade		S grade		Maximum Length	Axial Stiffness	Torque generated at 20% of Nominal Load	Metallic Cross Sectional Area
mm	inches	kg/m	lb/ft	tonnes force	kN	tonnes force	kN	meter	MN	N.m	mm <sup>2</sup>
112		59.5	39.9	1,000	9,810	1,060	10,400	10,000	660	3,730	6,730
114	4 1/2	62.0	41.5	1,050	10,300	1,100	10,800	9,600	680	3,990	6,970
116		64.2	43.0	1,070	10,500	1,130	11,100	9,300	710	4,140	7,210
120		68.7	46.0	1,140	11,200	1,200	11,800	8,700	760	4,560	7,720
121	4 3/4	69.1	46.3	1,150	11,300	1,210	11,900	8,600	770	4,640	7,850
122		70.2	47.0	1,180	11,600	1,240	12,200	8,500	780	4,800	7,980
124		72.6	48.6	1,220	12,000	1,280	12,600	8,200	810	5,040	8,240
126		74.9	50.2	1,260	12,400	1,320	12,900	8,000	830	5,290	8,510
127	5	76.6	51.3	1,280	12,600	1,340	13,100	7,800	850	5,420	8,650
128		77.8	52.1	1,280	12,600	1,350	13,200	7,700	860	5,460	8,780
130		80.3	53.8	1,320	12,900	1,390	13,600	7,400	890	5,720	9,060
132		82.8	55.5	1,360	13,300	1,430	14,000	7,200	920	5,990	9,340
133	5 1/4	84.4	56.5	1,390	13,600	1,460	14,300	7,100	930	6,160	9,480
134		85.7	57.4	1,400	13,700	1,470	14,400	7,000	940	6,260	9,630
136		88.3	59.2	1,430	14,000	1,510	14,800	6,700	970	6,480	9,920
138		90.9	60.9	1,470	14,400	1,550	15,200	6,600	1,000	6,760	10,200
140	5 1/2	92.6	62.0	1,520	14,900	1,600	15,700	6,400	1,030	7,100	10,500
142		95.3	63.9	1,550	15,200	1,630	16,000	6,200	1,060	7,430	10,800
144		98.0	65.7	1,590	15,600	1,670	16,400	6,100	1,090	7,730	11,100
146	5 3/4	101.0	67.7	1,620	15,900	1,710	16,800	5,900	1,120	8,030	11,400
148		104.0	69.7	1,650	16,200	1,740	17,100	5,700	1,150	8,340	11,700
150		107.0	71.7	1,690	16,600	1,780	17,500	5,600	1,180	8,700	12,100
152	6	110.0	73.7	1,740	17,100	1,830	18,000	5,400	1,210	9,070	12,400
154		112.0	75.0	1,780	17,500	1,880	18,400	5,300	1,250	9,350	12,700
156		115.0	77.1	1,800	17,700	1,900	18,600	5,200	1,280	9,670	13,000
158		118.0	79.1	1,840	18,000	1,940	19,000	5,000	1,310	10,000	13,400
159	6 1/4	120.0	80.4	1,860	18,200	1,960	19,200	5,000	1,330	10,200	13,600
160		121.0	81.1	1,890	18,500	1,990	19,500	4,900	1,350	10,400	13,700
162	6 3/8	124.0	83.1	1,930	18,900	2,030	19,900	4,800	1,380	10,700	14,100
165	6 1/2	129.0	86.4	1,950	19,100	2,050	20,100	4,600	1,430	11,400	14,600
171	6 3/4	140.0	93.8	2,090	20,500	2,200	21,600	4,200	1,540	12,800	15,700

Ropes with higher Mbf could be custom designed upon special request.

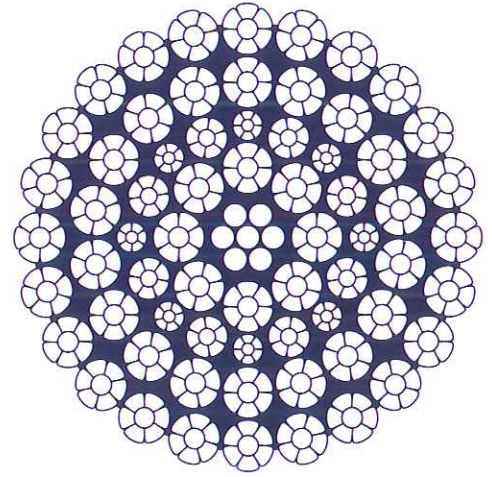
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

# N2 Hyrope

67×K7

## Rotation Resistant Rope

- Rotation resistant
- Fully lubricated
- Plastic infilled option
- High breaking force
- Compacted
- Greater contact area



Crane



A&R Winch

Rope Nominal Diameter		Approx. Weight in Air		Minimum Breaking Force				Reference information (Approximately)			
				N grade		S grade		Maximum Length	Axial Stiffness	Torque generated at 20% of Nominal Load	Metallic Cross Sectional Area
mm	inches	kg/m	lb/ft	tonnes force	kN	tonnes force	kN	meter	MN	N.m	mm <sup>2</sup>
112		59.5	39.9	1,000	9,810	1,060	10,400	10,000	660	3,730	6,730
114	4 1/2	62.0	41.5	1,050	10,300	1,100	10,800	9,600	680	3,990	6,970
116		64.2	43.0	1,070	10,500	1,130	11,100	9,300	710	4,140	7,210
120		68.7	46.0	1,140	11,200	1,200	11,800	8,700	760	4,560	7,720
121	4 3/4	69.1	46.3	1,150	11,300	1,210	11,900	8,600	770	4,640	7,850
122		70.2	47.0	1,180	11,600	1,240	12,200	8,500	780	4,800	7,980
124		72.6	48.6	1,220	12,000	1,280	12,600	8,200	810	5,040	8,240
126		74.9	50.2	1,260	12,400	1,320	12,900	8,000	830	5,290	8,510
127	5	76.6	51.3	1,280	12,600	1,340	13,100	7,800	850	5,420	8,650
128		77.8	52.1	1,280	12,600	1,350	13,200	7,700	860	5,460	8,780
130		80.3	53.8	1,320	12,900	1,390	13,600	7,400	890	5,720	9,060
132		82.8	55.5	1,360	13,300	1,430	14,000	7,200	920	5,990	9,340
133	5 1/4	84.4	56.5	1,390	13,600	1,460	14,300	7,100	930	6,160	9,480
134		85.7	57.4	1,400	13,700	1,470	14,400	7,000	940	6,260	9,630
136		88.3	59.2	1,430	14,000	1,510	14,800	6,700	970	6,480	9,920
138		90.9	60.9	1,470	14,400	1,550	15,200	6,600	1,000	6,760	10,200
140	5 1/2	92.6	62.0	1,520	14,900	1,600	15,700	6,400	1,030	7,100	10,500
142		95.3	63.9	1,570	15,400	1,650	16,200	6,200	1,060	7,430	10,800
144		98.0	65.7	1,610	15,800	1,690	16,600	6,100	1,090	7,730	11,100
146	5 3/4	101.0	67.7	1,650	16,200	1,740	17,100	5,900	1,120	8,030	11,400
148		104.0	69.7	1,690	16,600	1,780	17,500	5,700	1,150	8,340	11,700
150		107.0	71.7	1,740	17,100	1,830	17,900	5,600	1,180	8,700	12,100
152	6	110.0	73.7	1,790	17,600	1,880	18,400	5,400	1,210	9,070	12,400
154		112.0	75.0	1,820	17,800	1,920	18,800	5,300	1,250	9,350	12,700
156		115.0	77.1	1,860	18,200	1,960	19,200	5,200	1,280	9,670	13,000
158		118.0	79.1	1,900	18,600	2,000	19,600	5,000	1,310	10,000	13,400
159	6 1/4	120.0	80.4	1,920	18,800	2,020	19,800	5,000	1,330	10,200	13,600
160		121.0	81.1	1,950	19,100	2,050	20,100	4,900	1,350	10,400	13,700
162	6 3/8	124.0	83.1	1,990	19,500	2,100	20,600	4,800	1,380	10,700	14,100
165	6 1/2	129.0	86.4	2,070	20,300	2,180	21,400	4,600	1,430	11,400	14,600
171	6 3/4	140.0	93.8	2,240	22,000	2,350	23,000	4,200	1,540	12,800	15,700

Ropes with higher Mbf could be custom designed upon special request.  
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

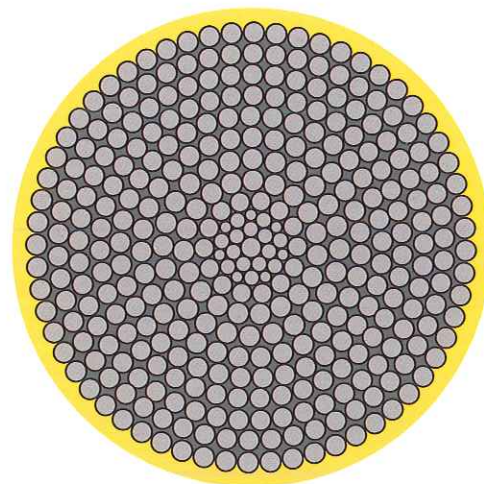


# N2 Spiral

## Permanent mooring for offshore industry

### Benefits

- High strength per weight ratio / High torsional balance
- Superior corrosion protection
- Longer service life to over 20 years
- Computer Aided Modeling and Dynamic Testing on tension-tension fatigue and axial fatigue for the best endurance and torque balance in predicting the life span of N2 Spiral
- Design and manufacture of N2 Spiral terminations compliance with contemporary requirements
- Sheathing in MDPE or HDPE



Permanent Mooring

Strand Nominal Diameter		Products Dia	Sheathing Thickness	Approx. weight		Minimum Breaking Force				Approx. Axial Stiffness	Approx. Metallic Cross Sectional Area
				In air		1770		1960			
mm	inches	mm	mm	kg/m	lb/ft	tonnes force	kN	tonnes force	kN	MN	mm <sup>2</sup>
65	2 1/2	77.0	6	22.7	15.3	420	4,120	465	4,560	410	2,520
68	2 5/8	80.0	6	24.4	16.4	455	4,460	500	4,900	440	2,680
70	2 3/4	86.0	8	26.7	17.9	480	4,710	545	5,350	480	2,940
73	2 7/8	89.0	8	29.3	19.7	525	5,150	605	5,930	540	3,250
76	3	92.0	8	31.8	21.4	580	5,690	655	6,420	580	3,540
79	3 1/8	95.0	8	34.9	23.5	625	6,130	720	7,060	620	3,880
82	3 1/4	98.0	8	37.7	25.3	670	6,570	780	7,650	670	4,200
86	3 3/8	102.0	8	38.9	26.1	735	7,210	825	8,090	710	4,450
90	3 1/2	110.0	10	43.1	29.0	810	7,940	890	8,730	770	4,790
92.5	3 5/8	112.5	10	46.1	31.0	860	8,430	945	9,270	810	5,080
95.5	3 3/4	115.5	10	49.2	33.1	915	8,970	1,015	9,950	870	5,440
98	3 7/8	118.0	10	54.0	36.3	965	9,460	1,110	10,890	950	5,960
102	4	124.0	11	57.6	38.7	1,050	10,300	1,180	11,570	1,020	6,350
105.5	4 1/8	127.5	11	59.4	39.9	1,110	10,890	1,230	12,060	1,060	6,600
108	4 1/4	130.0	11	62.9	42.3	1,165	11,430	1,310	12,850	1,120	7,000
111.5	4 3/8	133.5	11	67.2	45.2	1,240	12,160	1,395	13,680	1,200	7,480
114	4 1/2	136.0	11	71.1	47.8	1,305	12,800	1,475	14,470	1,270	7,920
118	4 5/8	140.0	11	74.6	50.1	1,390	13,630	1,550	15,200	1,310	8,310
121.5	4 3/4	143.5	11	78.5	52.7	1,465	14,370	1,635	16,030	1,380	8,760
124	4 7/8	146.0	11	82.2	55.2	1,540	15,100	1,710	16,770	1,450	9,190
127	5	149.0	11	86.3	58.0	1,605	15,740	1,800	17,650	1,530	9,670
131	5 1/8	153.0	11	89.3	60.0	1,715	16,820	1,865	18,290	1,550	10,010
133	5 1/4	155.0	11	93.6	62.9	1,755	17,210	1,960	19,220	1,630	10,510
137.5	5 3/8	159.5	11	99.6	66.9	1,865	18,290	2,095	20,550	1,740	11,200
141	5 1/2	163.0	11	104.0	69.9	1,960	19,220	2,195	21,530	1,820	11,730
144	5 5/8	166.0	11	108.0	72.6	2,030	19,910	2,270	22,260	1,880	12,150
146.5	5 3/4	168.5	11	113.0	75.9	2,090	20,500	2,375	23,290	1,970	12,700
147.5	5 7/8	169.5	11	119.0	80.0	2,135	20,940	2,475	24,270	2,060	13,280
153	6	175.0	11	123.0	82.7	2,255	22,120	2,580	25,300	2,150	13,850

Ropes with higher Mbf could be custom designed upon special request.  
**Estimated Rope Mass in Sea Water = 0.87 x Rope Mass in Air.**

# Technical Information

## Torque Factor

The offshore market requires wire rope for use in deep and ultra-deep water. The torque developed under load can be a problem when the pay load end is free to rotate. For such application, a low torque constructions are available. Rotation resistant ropes offer these properties and are very popular in the offshore market.

$$\text{Torque Factor} = \frac{T}{W \times D}$$

where :

**T** is torque by load (N.m)

**W** is the load applied (N)

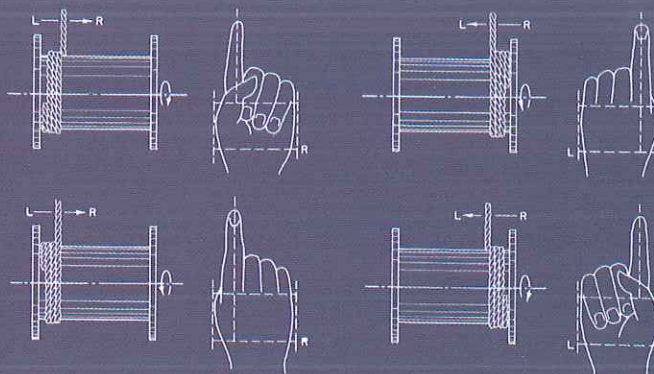
**D** is Rope diameter (mm)

Construction	Torque Factor
6x36WS+IWRC	0.068
8x36WS+IWRC	0.082
35xK7/40xK7/55xK7	0.0065

<Rotation Resistant Rope Torque Factor>

## Drum Winding

Always wind wire rope from the top of the one reel onto the top of the other or bottom to bottom. The winding directions are as shown.



## Axial Stiffness (MN)

Axial Stiffness is determined by  $E \times A$ ,

where :

**E** is the apparent modulus of the rope

**A** is the cross sectional area of the circumscribed circle.

## Drum and Sheave

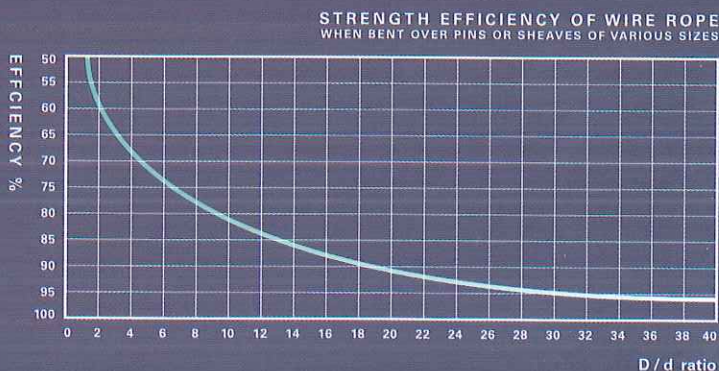
The relationship between sheave diameter and rope diameter is a critical factor that is used to establish the rope's fatigue resistance or relative service life. It is expressed in the  $D/d$

where :

**D**: Drum / Sheave Diameter

**d**: Rope Diameter

If  $D/d$  is higher, rope service life is longer



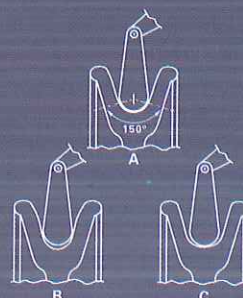
## Inspection of Sheave and Drum Groove

The first item when examining sheaves and groove is the condition of the groove.

To check the size, groove gauge is used.

The gauge should contact the groove for about 150 degree.

**A**: Correct, **B**: Too tight, **C**: Too loose



## Fleet Angle

The achievement of even winding on a smooth faced drum is determined mostly by the fleet angle. The greatest influence on fleet angle.

The fleet angle defined as the included angle between two lines :

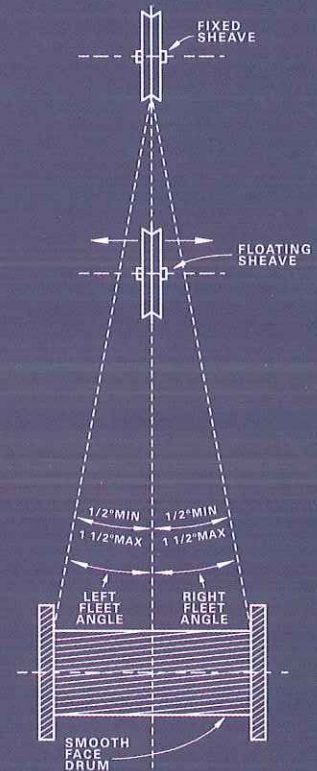
One line drawn through the middle of the fixed sheave and the drum- and perpendicular to the axis of the drum and a second line drawn from the flange of the drum to the base of the groove in the sheave.

There are left and right fleet angle, measured to the left or right of the center line of the sheave, respectively.

For optimum efficiency and service characteristics, the angle here should not exceed 1-1/2 degree for a smooth drum, nor 2 degree for a grooved drum.

Higher fleet angle can cause bad winding on the smooth drum, and the rope rubbing against the flange of the sheaved grooves.

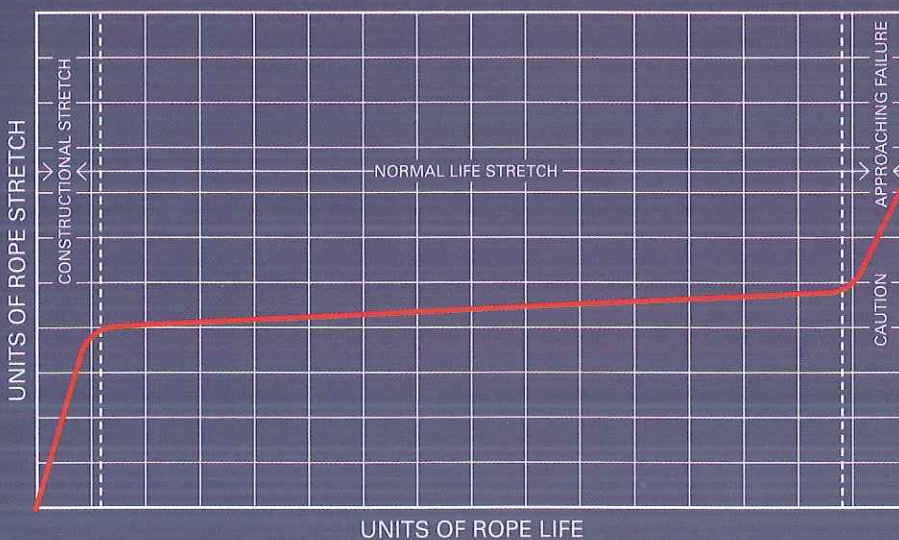
Conversely, small fleet angle can cause the rope to pile up.



## Rope Stretch

All rope will stretch when a load is initially applied.

As a rope degrades from wear, fatigue, etc., continued application of a load of constant magnitude will produce a varying amount of rope stretch.



- Phase 1
  - Initial/Constructional stretch
  - The rope adjusts to operating conditions.
- Phase 2
  - The greatest part of the rope service life.
  - This portion exhibits only a small amount of stretch.
- Phase 3
  - The stretch occurs at a quicker rate.
  - This second upturn of the curve is a warning indicating that the rope should soon be removed.

# Alumar Wire

## Alumar Wire

Alumar wire is coated with Zn-Al (5% Al) to enhance corrosion resistance and fatigue endurance. Application of this wire ranges extensively to wire rope, spring wire, ACSR, fence wire, wiper arms, and also recently customized in bridge cables.

## Corrosion Resistance

Compared to normal zinc galvanized wire, it has 4 times more corrosion resistance, especially useful for humid and salty seawater conditions.

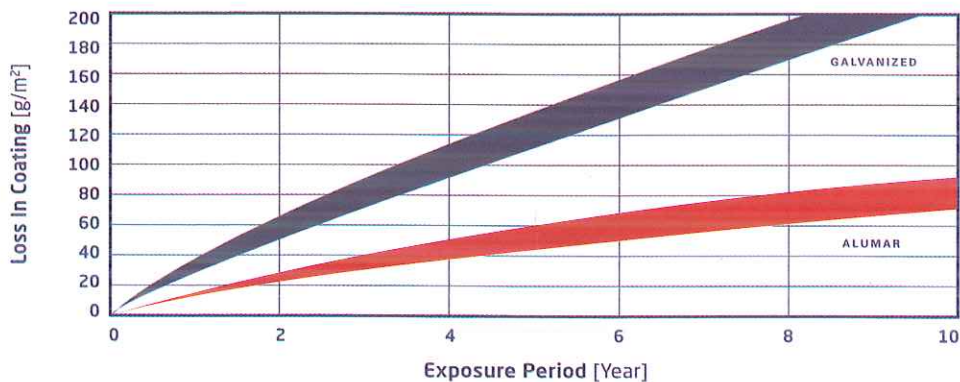
## Fatigue Endurance

Both Alumar and galvanized wire satisfies the one million cycles specification in a Tension-Tension test, however galvanized wire develops minute crack, where Alumar coated wire had no such occurrence. Alumar coated wire has 1.4 times more fatigue endurance as compared to Zn galvanized wire in the Reverse-Bending test.

## Stable Structure of Galvanized Layer

The dendritic structure of Zn galvanized wire can crack and reduce corrosion resistance.

The granular structure of Alumar coated wire promotes higher corrosion resistance and fatigue endurance.



Alumar Galvanized Wire



Zinc Galvanized Wire

# Discard Criteria

## According to ISO 4309:2010

### Nature and number of wire breaks

A wire rope must be discarded at the very latest when one of the number of visible wire break specified below table.

Total number of load-bearing wires in the outer strands (n)	Number of visible broken outer wires					
	Sections of rope spooling on a single layer drum				Sections of rope spooling on a multi-layer drum	
	Regular lay		Lang lay		Regular & Lang lay	
	Over a length of 6d	Over a length of 30d	Over a length of 6d	Over a length of 30d	Over a length of 6d	Over a length of 30d
$n \leq 50$	2	4	1	2	4	8
$51 \leq n \leq 75$	3	6	2	3	6	12
$76 \leq n \leq 100$	4	8	2	4	8	16
$101 \leq n \leq 120$	5	10	2	5	10	20
$121 \leq n \leq 140$	6	11	3	6	12	22
$141 \leq n \leq 160$	6	13	3	6	12	26
$161 \leq n \leq 180$	7	14	4	7	14	28
$181 \leq n \leq 200$	8	16	4	8	16	32
$201 \leq n \leq 220$	9	18	4	9	18	36
$221 \leq n \leq 240$	10	19	5	10	20	38
$241 \leq n \leq 260$	10	21	5	10	20	42
$261 \leq n \leq 280$	11	22	6	11	22	44
$281 \leq n \leq 300$	12	24	6	12	24	48
$n > 300$	$0.04 \times n$	$0.08 \times n$	$0.02 \times n$	$0.04 \times n$	$0.08 \times n$	$0.16 \times n$

**Note :** Ropes having outer strands of Seale construction where the number of wires in each strand is 19 or less (e.g. 6x19 Seale) are placed in this table two rows above that row in which the construction would normally be placed based on the number of load-bearing wires in the outer layer of strands.

<Table 1. Number of visible broken wires in single-layer and parallel-closed ropes>

Total number of load-bearing wires in the outer strands (n)	Number of visible broken outer wires			
	Sections of rope spooling on a single layer drum		Sections of rope spooling on a multi-layer drum	
	Over a length of 6d	Over a length of 30d	Over a length of 6d	Over a length of 30d
$71 \leq n \leq 100$	2	4	4	8
$101 \leq n \leq 120$	3	5	5	10
$121 \leq n \leq 140$	3	5	6	11
$141 \leq n \leq 160$	3	6	6	13
$161 \leq n \leq 180$	4	7	7	14
$181 \leq n \leq 200$	4	8	8	16
$201 \leq n \leq 220$	4	9	9	18
$221 \leq n \leq 240$	5	10	10	19
$241 \leq n \leq 260$	5	10	10	21
$261 \leq n \leq 280$	6	11	11	22
$281 \leq n \leq 300$	6	12	12	24
$n > 300$	6	12	12	24

**Note :** Ropes having outer strands of Seale construction where the number of wires in each strand is 19 or less (e.g. 18x19 Seale) are placed in this table two rows above that row in which the construction would normally be placed based on the number of load-bearing wires in the outer layer of strands.

<Table 2. Number of visible broken wires in rotation-resistant ropes>

## Broken wires at termination

Broken wires at, or adjacent to, the termination, even if few in number, are indicative of high stresses at this position and can be caused by incorrect fitting of the termination. The cause of this deterioration shall be investigated and, where possible, the termination shall be remade, shortening the rope if sufficient length remains for further use, otherwise the rope shall be discarded.

## Localized grouping of broken wires

Where broken wires are very close together, constituting a localized grouping of such breaks, the rope shall be discarded. If the grouping of such breaks occurs in a length less than  $6d$  or is concentrated in any one strand. It may be necessary to discard the rope even if the number of wire breaks is smaller than maximum number shown in Table 1.

## Fracture of strands

If a complete strand fracture occurs, the rope shall be immediately discarded.

## Reduction of rope diameter resulting from core deterioration

Reduction of rope diameter resulting from core deterioration can be caused by

- a) internal wear and wire indentation
- d) internal wear caused by friction between individual strands and wires in the rope, particularly when it's subject to bending
- c) deterioration of fiber core
- d) fracture of a steel core

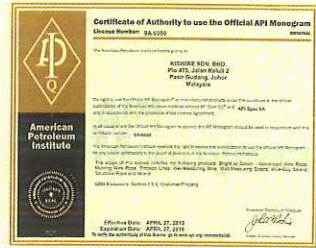
If these factors cause the actual diameter to decrease by 10%, the rope shall be discarded even if no broken wires are visible.

## External wear

If, due to external wear, the actual rope diameter has decreased by 7 % or more of the nominal rope diameter, rope shall be discarded even if no wire breaks are visible.



# Quality Assurance



- ISO 9001 Det Norske Veritas Management System**
- API Certificate of Approval to use the official API Monogram**
- Korean Register Approval Certificate for Manufacturing Process**
- ABS Certificate of Manufacturing Assessment**
- ABS Certificate of Design Assessment**
- ABS Certificate of Type Approval (AQS)**
- Det Norske Veritas Approval of Manufacturer Certificate**
- CCS Certificate of Works Approval**
- LR Approval of a Works for the Manufacturer of Steel Wire Rope**

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