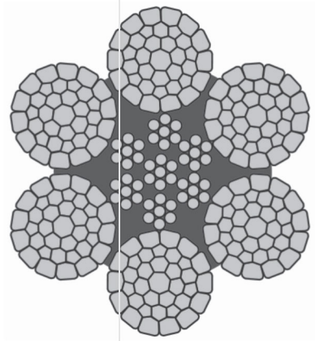
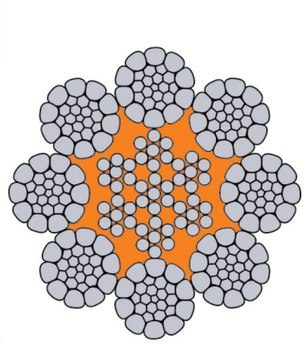
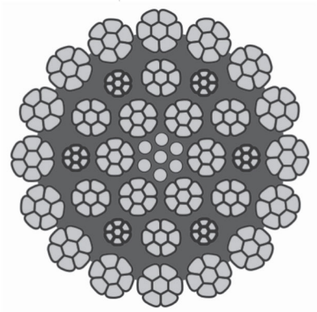
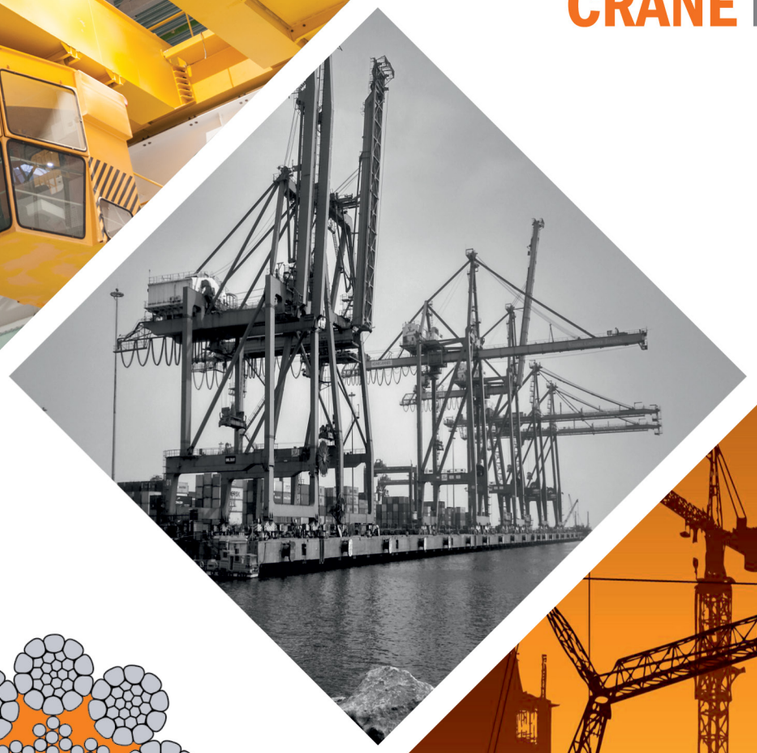
CRANE ROPES









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WIRE | WIRE ROPE | STRAND | CABLE | MACHINERY | PRE-STRESSING ACCESSORIES

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OUR **WORLD**

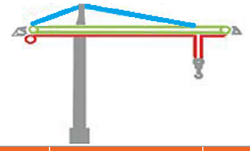
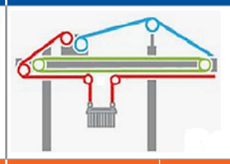
Usha Martin is one of the largest manufacturers of wire ropes in the world. For more than five decades of excellence, we have always focussed on delivering value added products and services to our customers. The drive to innovation, high standards of production, stringent testing measures and customization to specific client needs, makes Usha Martin crane rope as one of the most preferred brand in world market.

The wire rope shown in this brochure are special products, which are being designed and manufactured to meet individual customer requirements. Our quality management system has been certified as per standard ISO 9001 : 2015, along with manufacturing assessment certifications from ABS, DNV-GL and Lloyds. Usha Martin crane ropes are supported by an extensive global network which can offer expert advice to both crane manufacturers and end users.

Our manufacturing facility at Ranchi in India is one of the largest in the world. Apart from this, manufacturing plants are also located at Hoshiarpur in India, Dubai, Bangkok, and UK. Our global R&D centre in Italy has been at forefront leading to find innovative solutions for industry-wise technical needs. In addition to manufacturing units, Usha Martin has developed comprehensive service centres that are well equipped with world class rigging facilities located in Scotland, Netherlands and Singapore. The company has set-up its global distribution centres in USA, Europe, Australia, Singapore, Vietnam and Indonesia along with authorised channel partners in South Africa, Russia, UAE, Chile, Brazil, Morocco and Sri Lanka.

GUIDE TO APPLICATION & ROPE SELECTION

usha martin

	Dock-Side / Deck Cranes / Off-shore Pedestal			Tower Cranes			Mobile and Crawler Cranes		Container Cranes/ Unloaders			Pilling	Ladle Cranes
Typical Application													
	Main Hoist	Boom Hoist	Whip Hoist	Main Hoist	Stay	Trolley	Main Hoist	Boom Hoist	Main Hoist	Boom Hoist	Trolley/ Racking	Hoist	Hoist
Hyflex 6/6P Powerform 6/6P	X	✓	X	X	✓	✓	X	✓	✓	✓	✓	!	✓
Hyflex 8/8P Powerform 8/8P	!	✓	X	X	✓	✓	X	✓	✓	✓	✓	X	✓
Hyflex 4	✓	X	X	X	X	X	✓	X	X	X	X	!	X
Hyflex 18/18P Powerform 18/18P	✓	X	✓	✓	X	X	✓	X	X	X	X	✓	X
Hyflex 35/35P Powerform 35/35P	✓	X	✓	✓	X	X	✓	X	X	X	X	✓	X

Key: ✓ Recommended | ! Allowed | X Not Recommended

POWERFORM® 35/35P

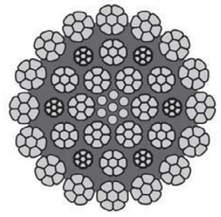
- Maximum resistance to rotation.
- Suitable for use on single part and multi-part hoist reeving systems.
- High fatigue life resulting from the unique compaction process.
- Increased resistance to crushing. Recommended for multi-layer spooling operations.
- Increased abrasion resistance resulting from the unique compaction process.
- Optional plastic impregnation. (P) signifies full plastic impregnation of the rope.
- Fully lubricated in manufacturing.

Standard Characteristics Powerform® 35/35P		
Compacted	Yes	No
	▪	
Grade	1960	2160
	▪	▪
Finish	Bright	Galvanised
	▪	▪
Lay Direction	Right Hand	Left Hand
	▪	
Lay Type	Ordinary	Langs
		▪
Nominal Fill Factor	0.745	
Turn value at 20% of Breaking force degrees/ '6d'	0.2	
Discard Criteria	Refer to ISO 4309:2019	

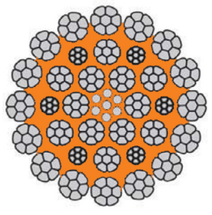
NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1960		2160	
mm	in	kg/100m	kN	tonnes	kN	tonnes
	1/2	81.1	148	15.1	160	16.3
13		85.0	155	15.8	167	17.0
14		98.6	180	18.3	192	19.6
16	5/8	129	233	23.8	252	25.7
18		163	300	30.6	321	32.7
19	3/4	182	331	33.7	358	36.0
20		201	372	37.9	399	40.7
21		222	402	41.0	434	44.2
22		243	444	45.3	484	49.3
	7/8	249	453	46.2	490	49.9
24		290	531	54.1	572	58.3
	1	325	591	60.2	640	65.2
26		340	621	63.3	661	67.4
28		394	720	73.4	788	80.3
	1-1/8	411	748	76.2	810	82.6
30		453	827	84.3	904	92.2
32	1-1/4	515	944	96.2	1040	106
35	1-3/8	616	1120	115	1220	124
36		652	1190	121	1290	131
38	1-1/2	726	1330	135	1440	146
40		805	1450	151	1590	162
42		887	1490	151	1620	165
44		974	1620	165	1780	181
	1-3/4	994	1650	168	1800	183
46		1060	1770	180	1930	196
48		1160	1940	197	2120	216
50		1260	2080	212	2300	234
	2	1300	2150	219	2380	242
52		1360	2260	230	2450	249

* Mass per unit length of POWERFORM 35P increases by approx. 3%

Note | POWERFORM 35P is available on special request and prior confirmation.
| Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.



Powerform® **35**

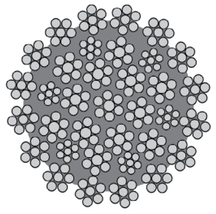


Powerform® **35P**

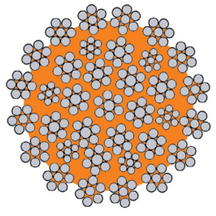
HYFLEX 35/35P

- Maximum resistance to rotation.
- Suitable for use on single part and multi-part hoist reeving systems.
- Construction offers maximum resistance to wear.
- Optional plastic impregnation (P) signifies full plastic impregnation of the rore.
- Fully lubricated in manufacturing.

Standard Characteristics Hyflex 35		
Compacted	Yes	No
		▪
Grade	1960	2160
		▪
Finish	Bright	Galvanised
		▪
Lay Direction	Right Hand	Left Hand
	▪	
Lay Type	Ordinary	Langs
	▪	▪
Nominal Fill Factor	0.635	
Turn value at 20% of Breaking force degrees/ '6d'	0.2	
Discard Criteria	Refer to ISO 4309:2019	



Hyflex **35**



Hyflex **35P**

NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1960		2160	
mm	in	kg/100m	kN	tonnes	kN	tonnes
10		44.8	76	7.7	86.5	8.8
11		54.2	91	9.3	104	10.6
12		64.5	107	10.9	125	12.7
	1/2	72.0	123	12.5	137	14.0
13		76.0	128	13.0	146	14.9
14		88.0	148	15.1	168	17.1
16	5/8	115	194	19.8	221	22.5
18		145	242	24.7	277	28.2
19	3/4	162	277	28.2	312	31.8
20		179	301	30.7	337	34.4
21		198	335	34.1	370	37.7
22		217	370	37.7	412	42.0
	7/8	221	376	38.3	418	42.6
24		258	441	45.0	498	50.8
	1	289	491	50.1	546	55.7
26		303	517	52.7	581	59.2
28		351	599	61.1	681	69.4
	1-1/8	366	621	63.3	704	71.8
30		403	679	69.2	775	79.0
32	1-1/4	459	769	78.4	865	88.2
35	1-3/8	549	945	96.3	1044	106
36		581	983	100	1085	111
38	1-1/2	647	1078	110	1205	123
40		717	1202	123	1335	136
42		790	1227	125	1352	138
44		867	1347	137	1484	151
	1-3/4	885	1375	140	1515	155
46		948	1472	150	1622	165
48		1032	1603	163	1766	180
50		1120	1740	177	1917	195
	2	1156	1796	183	1979	202
52		1211	1881	192	2072	211

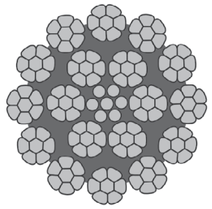
* Mass per unit length of HYFLEX 35P increases by approx. 3%

Note: | HYFLEX 35P is available on special request and prior confirmation.
| Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.

POWERFORM® 18

- Powerform® 18 is a high strength rotation resistant hoist rope.
- Good resistance to rotation.
- Suitable for use on single part and multi-part hoist reeving systems.

Standard Characteristics Powerform® 18		
Compacted	Yes	No
	▪	
Lay Direction	Right Hand	Left Hand
	▪	
Lay Type	Ordinary	Langs
		▪
Nominal Fill Factor	0.663	
Turn value at 20% of Breaking force degrees/ '6.25d'	4	
Discard Criteria	Refer to ISO 4309:2019	



NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1960		2160	
mm	in	kg/100m	kN	tonnes	kN	tonnes
6		17.5	29.4	3.0		
7		23.8	38.0	3.9		
8		31.0	51.8	5.3		
9		39.3	64.6	6.6		
10		48.5	80.8	8.2		
11		58.7	101	10.3	111	11.3
12		69.8	116	11.8	127	12.9
	1/2	78.2	135	13.8	148	15.1
13		82.0	141	14.4	155	15.8
14		95.1	160	16.3	177	18.0
15		109	182	18.6	201	20.5
16	5/8	124	209	21.3	232	23.6
17		140	237	24.2	262	26.7
18		157	266	27.1	295	30.1
	3/4	175	291	29.7	322	32.8
20		194	320	32.6	359	36.6
22		235	379	38.6	424	43.2
24		279	462	47.1	523	53.3
	1	313	517	52.7	585	59.6
26		328	542	55.2	613	62.5
28		380	632	64.4	710	72.4
30		437	721	73.5	809	82.5
32	1-1/4	497	820	83.6	920	93.8

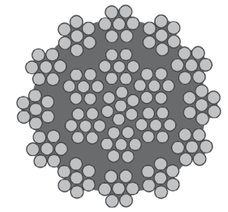
Note: Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.

HYFLEX 18

usha martin

- Hyflex 18 is a rotation resistant hoist rope.
- Good resistance to rotation.
- Consistent performance.
- Fully lubricated in manufacturing.
- Also available in fibre core construction.

Standard Characteristics Hyflex 18		
Compacted	Yes	No
		▪
Lay Direction	Right Hand	Left Hand
	▪	
Lay Type	Ordinary	Langs
		▪
Nominal Fill Factor	0.615	
Turn value at 20% of Breaking force degrees/ '6.25d'	5	
Discard Criteria	Refer to ISO 4309:2019	



NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1960		2160	
mm	in	kg/100m	kN	tonnes	kN	tonnes
6		14.6	25.0	2.5	27.0	2.8
7		19.9	34.0	3.5	36.7	3.7
8		26.0	45.0	4.6	48.6	5.0
9		32.9	56.5	5.8	61.0	6.2
10		40.6	70.0	7.1	75.6	7.7
11		49.1	84.0	8.6	90.7	9.2
12		58.5	101	10.3	109	11.1
	1/2	65.5	113	11.5	121	12.3
13		68.6	118	12.0	127	12.9
14		79.6	137	14.0	148	15.1
15		91.4	157	16.0	169	17.2
16	5/8	104	180	18.3	194	19.8
17		117	203	20.7	219	22.3
18		132	226	23.0	244	24.9
	3/4	147	253	25.8	273	27.8
20		162	279	28.4	301	30.7
22		197	339	34.6	366	37.3
	7/8	201	346	35.3	374	38.1

Note: Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.

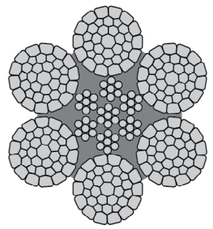
POWERFORM® 6/6P

- Powerform® 6 is a high strength rugged six strand rope ideal for situations where longer service life is required.
- High fatigue life resulting from the unique compaction process.
- Maximum resistance to crushing. Recommended for multi-layer spooling operations.
- Increased abrasion resistance resulting from the unique compaction process.
- Fully lubricated in manufacturing.
- Optional plastic impregnation (P) signifies full plastic impregnation of the steel core.

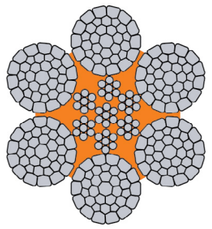
Standard Characteristics Powerform® 6/6P

Compacted	Yes	No
	▪	
Grade	1770	1960
	▪	▪
Finish	Bright	Galvanised
	▪	▪
Lay Direction	Right Hand	Left Hand
	▪	▪
Lay Type	Ordinary	Langs
	▪	▪
Nominal Fill Factor	0.675	
Turn value at 20% of Breaking force degrees/ '6.5d'	58	
Discard Criteria	Refer to ISO 4309:2019	

Warning : Powerform® 6/6P in Langs lay must only be used in applications where both ends are secured and are unable to rotate.



Powerform® **6**



Powerform® **6P**

NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1770		1960	
mm	in	kg/100m	kN	tonnes	kN	tonnes
10		46.4	69.5	7.1	85.7	8.7
11		56.1	83.8	8.5	98.6	10.1
12		66.8	100	10.2	114	11.6
	1/2	74.8	113	11.5	140	14.3
13		78.4	118	12.0	147	15.0
14		90.9	137	14.0	170	17.3
15		104	157	16.0	195	19.9
16	5/8	119	178	18.1	218	22.2
17		134	201	20.5	246	25.1
18		150	225	22.9	276	28.1
19	3/4	168	251	25.6	304	31.0
20		186	278	28.3	335	34.1
22		225	336	34.3	400	40.8
	7/8	229	343	35.0	408	41.6
24		267	400	40.8	489	49.8
	1	299	449	45.8	552	56.3
26		314	470	47.9	578	58.9
28		364	545	55.6	657	67.0
30		418	626	63.8	757	77.2
32	1-1/4	475	712	72.6	846	86.2
34		518	804	82.0	916	93.4
36		581	901	91.8	1065	109
38	1-1/2	647	1004	102	1165	119
40		717	1112	113	1295	132
42		790	1226	125	1425	145
44		867	1246	127	1505	153
46		948	1362	139	1665	170
48		1032	1483	151	1885	192
50		1120	1609	164	1975	201
52		1211	1741	177	2135	218
54		1306	1877	191	2325	237
56		1405	2019	206	2475	252
58		1507	2166	221	2650	270
60		1613	2317	236	2810	286

*Mass per unit length of POWERFORM 6P increases by approx. 3%

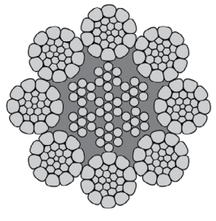
Note: | Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.
| POWERFORM 6P ia available only for 16 mm and above on special request and prior confirmation.

POWERFORM® 8/8P

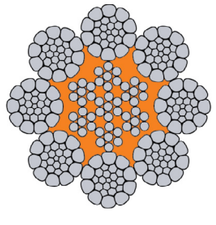
- Powerform® 8P is a high strength eight strand rope plastic impregnated ideal for situations where longer service life is required.
- High fatigue life resulting from the unique compaction process.
- Maximum resistance to crushing. Recommended for multi-layer spooling operations.
- Increased abrasion resistance resulting from the unique compaction process.
- Greater surface contact area resulting from the eight strand construction and compacted finish give longer rope life and reduced sheave wear.
- Fully lubricated in manufacturing.
- Optional plastic impregnation of the steel core. (P) signifies full plastic impregnation of the steel core.

Standard Characteristics Powerform® 8/8P		
Compacted	Yes	No
	▪	
Grade	1960	2160
	▪	
Finish	Bright	Galvanised
	▪	▪
Lay Direction	Right Hand	Left Hand
	▪	▪
Lay Type	Ordinary	Langs
	▪	
Nominal Fill Factor	0.655	
Turn value at 20% of Breaking force degrees/ '6.5d'	94	
Discard Criteria	Refer to ISO 4309:2019	

Warning : Powerform• 8/8P in Langs lay must only be used in applications where both ends are secured and are unable to rotate.



Powerform® **8**



Powerform® **8P**

NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1960		2160	
mm	in	kg/100m	kN	tonnes	kN	tonnes
10		46.0	87.8	9.0	94	9.6
11		55.7	106	10.8	114	11.6
12		66.2	126	12.8	135	13.8
	1/2	74.2	142	14.5	152	15.5
13		77.7	148	15.1	159	16.2
14		90.2	172	17.5	184	18.8
15		104	198	20.2	211	21.5
16	5/8	118	225	22.9	241	24.6
17		133	254	25.9	272	27.7
18		149	284	29.0	304	31.0
19	3/4	166	317	32.3	339	34.6
20		184	351	35.8	376	38.3
22		223	425	43.3	455	46.4
	7/8	227	434	44.2	464	47.3
24		265	506	51.6	541	55.1
	1	297	567	57.8	606	61.8
26		318	594	60.6	635	64.7
28		368	688	70.1	737	75.1
	1-1/8	384	717	73.1	767	78.2
30		423	790	80.5	846	86.2
32	1-1/4	481	899	91.6	960	97.9
34		543	1013	103	1083	110
36		609	1138	116	1218	124
38	1-1/2	679	1268	129	1357	138
40		752	1405	143	1503	153
42		847	1535	156	1651	168
44		929	1700	173	1819	185
	1-3/4	948	1735	177	1856	189
46		1016	1858	189	1985	202
48		1106	2023	206	2162	220
50		1200	2200	224	2349	239
	2	1239	2266	231	2425	247
52		1298	2374	242	2541	259

* Mass per unit length of POWERFORM 8P increases by 3%

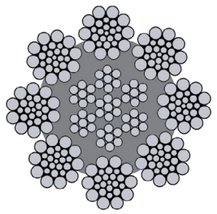
Note: | Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.
| POWERFORM 8P is available for rope diameter 16 mm and above on special request and prior confirmation.

HYFLEX 8/8P

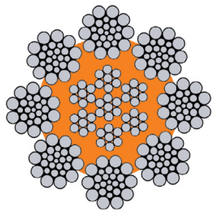
- Hyflex 8P is a flexible high strength eight strand steel wire rope with plastic impregnated core.
- Good bending fatigue life.
- Greater surface contact area resulting from the eight strand construction.
- Fully lubricated in manufacturing.
- Optional plastic impregnation of the steel core. (P) signifies full plastic impregnation of the steel core.

Standard Characteristics Hyflex 8/8P		
Compacted	Yes	No
		▪
Grade	1960	2160
	▪	
Finish	Bright	Galvanised
	▪	▪
Lay Direction	Right Hand	Left Hand
	▪	▪
Lay Type	Ordinary	Langs
	▪	
Nominal Fill Factor	0.598	
Turn value at 20% of Breaking force degrees/ '6.5d'	87	
Discard Criteria	Refer to ISO 4309:2019	

Warning : Hyflex 8/8P in Langs lay must only be used in applications where both ends are secured and are unable to rotate.



Hyflex **8**



Hyflex **8P**

NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1960		2160	
mm	in	kg/100m	kN	tonnes	kN	tonnes
10		43.5	72.9	7.4	81.4	8.3
11		52.6	86.1	8.8	96.5	9.8
12		62.6	105	10.7	117	11.9
	1/2	70.2	123	12.5	131	13.4
13		73.5	124	12.6	138	14.1
14		85.3	143	14.6	160	16.3
15		97.9	164	16.7	183	18.7
16	5/8	111	187	19.1	208	21.2
17		126	211	21.5	239	24.4
18		141	239	24.4	267	27.2
19	3/4	157	269	27.4	300	30.6
20		174	295	30.1	331	33.7
22		211	356	36.3	400	40.8
	7/8	215	360	36.7	402	41.0
24		251	423	43.1	475	48.4
	1	281	470	47.9	525	53.5
26		297	500	51.0	562	57.3
28		345	572	58.3	642	65.4
	1-1/8	359	596	60.8	665	67.8
30		396	656	66.9	733	74.7
32	1-1/4	451	747	76.1	836	85.2
34		509	843	85.9	945	96.3
36		570	935	95.3	1053	107
38	1-1/2	635	1043	106	1172	119
40		704	1162	118	1313	134
42		785	1305	133	1462	149
44		862	1412	144	1577	161
	1-3/4	879	1441	147	1613	164
46		942	1543	157	1731	176
48		1025	1680	171	1885	192
50		1113	1833	187	2065	210
	2	1148	1882	192	2101	214
52		1203	1972	201	2202	224

* Mass per unit length of HYFLEX 8P increases by approx. 3%

Note: | Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.
| HYFLEX 8P ia available for rope diameter 16 mm and above on special request and prior confirmation.

HYFLEX 6x36

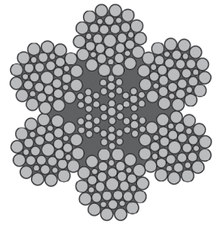
- High quality flexible 6x36 class crane rope.
- Consistent performance.
- Fully lubricated in manufacturing.
- Independent wire rope core.
- Supplied in high strength 1960N/mm² tensile steel as standard.

Standard Characteristics Hyflex 6X36		
Compacted	Yes	No
		▪
Grade	1770	1960
		▪
Finish	Bright	Galvanised
	▪	▪
Lay Direction	Right Hand	Left Hand
	▪	▪
Lay Type	Ordinary	Langs
	▪	
Nominal Fill Factor	0.609	
Turn value at 20% of Breaking force degrees/ '6.5d'	56	
Discard Criteria	Refer to ISO 4309:2019	

Warning : Hyflex 6x36 in Langs lay must only be used in applications where both ends are unable to rotate.

NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1770		1960	
mm	in	kg/100m	kN	tonnes	kN	tonnes
8		26.1	40.3	4.1	44.7	4.6
9		33.2	51.0	5.2	56.5	5.8
10		40.8	63.0	6.4	69.8	7.1
11		49.4	76.2	7.8	84.4	8.6
12		58.8	90.7	9.2	101	10.3
	1/2	66.0	102	10.4	113	11.5
13		69.2	107	10.9	118	12.0
14		80.2	124	12.6	137	14.0
16	5/8	104	161	16.4	179	18.3
18		132	204	20.8	226	23.0
20		163	252	25.7	279	28.4
22		197	305	31.1	338	34.5
	7/8	201	311	31.7	345	35.2
24	15/16	235	363	37.0	402	41.0
	1	263	407	41.5	450	45.9
26		276	426	43.4	472	48.1
28		320	494	50.4	547	55.8
32	1.1/4	418	645	65.8	715	72.9
36		531	817	83.3	904	92.2
40		655	1010	103	1120	114
44		793	1220	124	1350	138
48	1.7/8	943	1450	148	1610	164
52		1111	1700	173	1890	193
56		1281	1980	202	2190	223
60	2.3/8	1471	2270	231	2510	256

Note: Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.



Hyflex **6X36**

HYFLEX 6x19

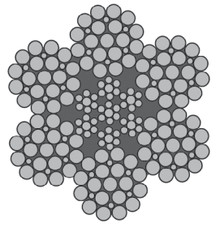
- High quality flexible 6x19 class crane rope.
- Good resistance to abrasion.
- Consistent performance.
- Fully lubricated in manufacturing.
- Independent wire rope core.

Standard Characteristics Hyflex 6X19		
Compacted	Yes	No
		▪
Grade	1770	1960
		▪
Finish	Bright	Galvanised
	▪	▪
Lay Direction	Right Hand	Left Hand
	▪	▪
Lay Type	Ordinary	Langs
	▪	
Nominal Fill Factor	0.596	
Turn value at 20% of Breaking force degrees/ '6.5d'	42	
Discard Criteria	Refer to ISO 4309:2019	

Warning : Hyflex 6x19 in Langs lay must only be used in applications where both ends are unable to rotate.

NOMINAL ROPE DIAMETER		APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1770		1960	
mm	in	kg/100m	kN	tonnes	kN	tonnes
6		14.3	22.7	2.3	25.1	2.6
7		19.5	30.9	3.1	34.2	3.5
8		25.5	40.3	4.1	44.7	4.6
9		32.2	51.0	5.2	56.5	5.8
10		39.8	63.0	6.4	69.8	7.1
11		48.2	76.2	7.8	84.4	8.6
12		57.3	90.7	9.3	101	10.3
	1/2	64.2	102	10.4	113	11.5
13		67.3	107	10.9	118	12.0
14		78.0	124	12.6	137	14.0
16	5/8	102	161	16.4	179	18.3
18		129	204	20.8	226	23.0
20		159	252	25.7	279	28.4
22		193	305	31.1	338	34.5
	7/8	197	311	31.7	345	35.2
24	15/16	229	363	37.0	402	41.0
	1	257	407	41.5	450	45.9
26		269	426	43.4	472	48.1
28		312	494	50.4	547	55.8
32	1.1/4	408	645	65.8	715	72.9
36		516	817	83.3	904	92.2
40		637	1010	103	1120	114
44		771	1220	124	1350	138
48	1.7/8	917	1450	148	1610	164
52		1076	1700	173	1890	193
56		1248	1980	202	2190	223
60		1433	2270	231	2510	256

Note: Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.

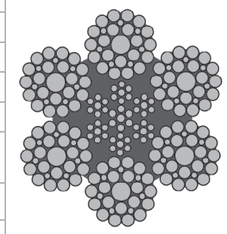


Hyflex **6X19**

HYFLEX 6x29 Fi

- High quality flexible crane rope.
- Consistent performance.
- Fully Lubricated in manufacturing.
- Independent wire rope core.

Standard Characteristics Hyflex 6X29Fi		
Lay Direction	Right Hand	Left Hand
	▪	▪
Lay Type	Ordinary	Langs
	▪	
Nominal Fill Factor	0.612	
Turn value at 20% of Breaking force degrees/ '6.5d'	52	
Discard Criteria	Refer to ISO 4309:2019	
Standard	JIS G. 3525	



Warning : Hyflex 6x29Fi in Langs lay must only be used in applications where both ends are unable to rotate.

NOMINAL ROPE DIAMETER	APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED			
		ROPE GRADE A		ROPE GRADE A	
		1620		1770	
mm	kg/100m	kN	tonnes	kN	tonnes
mm	kg/100m	kN	tonnes	kN	tonnes
10.0	44.0	63.6	6.5	67.7	6.9
11.2	55.2	79.8	8.1	84.9	8.7
12.5	68.8	99.4	10.1	106	10.8
14.0	86.3	125	12.7	133	13.6
16.0	113	163	16.6	173	17.6
18.0	143	206	21.0	219	22.3
20.0	176	254	25.9	271	27.6
22.4	221	319	32.5	340	34.7
25.0	275	398	40.6	423	43.1
28.0	345	499	50.9	531	54.1
30.0	396	573	58.4	609	62.1
31.5	437	631	64.3	672	68.5
33.5	494	714	72.8	760	77.5
35.5	555	802	81.8	853	87.0
37.5	619	895	91.2	952	97.0
40.0	704	1020	104	1080	110
42.5	795	1150	117	1220	124
45.0	891	1290	132	1370	140
47.5	993	1440	147	1530	156
50.0	1100	1590	162	1690	172
53.0	1240	1790	183	1900	194
56.0	1380	2000	204	2120	216
60.0	1580	2290	233	2440	249

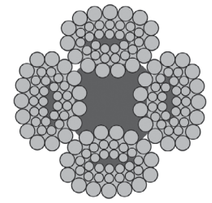
Note: Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.

HYFLEX 4

usha martin

- Rugged 4 strand steel wire rope.
- Good rotation resistance.
- Recommended for severe applications.
- Fully lubricated in manufacturing.

Standard Characteristics Hyflex 4		
Compacted	Yes	No
		▪
Lay Direction	Right Hand	Left Hand
	▪	
Lay Type	Ordinary	Langs
	▪	
Nominal Fill Factor	0.508	
Turn value at 20% of Breaking force degrees/ Rope Lay	25	
Discard Criteria	Refer to ISO 4309:2019	



Warning : Hyflex 4 in Langs lay must only be used in applications where both ends are secured and are unable to rotate.

NOMINAL ROPE DIAMETER	APPROX. MASS	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
		1770		1960	
mm	kg/100m	kN	tonnes	kN	tonnes
14.0	82.3	126	12.8	136	13.9
16.0	108	164	16.7	177	18.1
18.0	136	208	21.2	225	22.9
20.0	168	256	26.1	277	28.3
22.0	203	310	31.6	335	34.2
24.0	242	369	37.7	399	40.7
25.0	263	401	40.9	433	44.2
26.0	284	433	44.2	468	47.8
28.0	329	503	51.2	543	55.4
30.0	378	577	58.8	624	63.6
32.0	430	656	66.9	710	72.4
33.5	471	719	73.4	778	79.3
34.0	486	741	75.6	801	81.7
35.5	529	808	82.4	873	89.1
36.0	544	831	84.7	898	91.6
38.0	607	926	94.4	1001	102

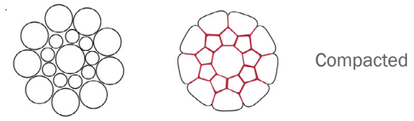
Note: Rope Sizes and Breaking Force not shown in the standard table, may be available on request and prior confirmation.

POWERFORM®
COMPACTED ROPE

Conventional Strand | Conventional Rope | Compacted Strand | Compacted Rope

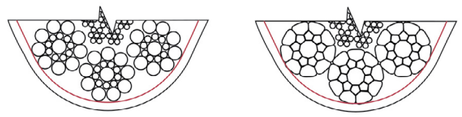
A Powerform® compacted rope is a steel wire rope which has been manufactured using individually compacted strands. During the compaction process the outside diameter of the strand is reduced and steel moves into the empty voids between the wires within the strand.

The forming process also produces a very smooth exterior strand surface.



Conventional | Compacted

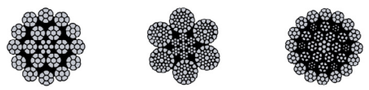
The compacted strand has very favourable internal contact conditions when compared with the point contact of round wires within a normal strand.



Conventional | Compacted

Exterior contact conditions are equally favourable. The smooth surface of the compacted rope offers a wider bearing surface to the sheave or drum groove.

Inter strand contact and contact between adjacent laps of rope on the winch drum is also improved.



6x36 | 18x7 | 35x7

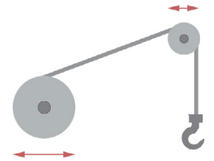
Usha Martin compacted ropes are referred to as “Powerform®” and are available in a number of constructions.

POWERFORM®
SELECTION

usha martin

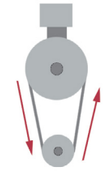
Optimised crane design

The breaking load to size relationship can allow crane manufacturers to optimise the design of crane components such as the winch drum and sheaves whilst still complying with international crane design standards.



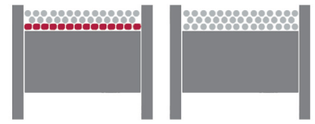
Long life

Laboratory fatigue testing indicates that it is possible to achieve a significant increase in rope life when comparing a Powerform® rope with a conventional rope of equivalent construction.



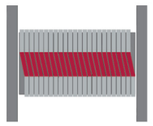
Greater resistance to crushing in multi-layer coiling situations

Powerform® ropes are recommended for all multi-layer coiling situations where crushing on lower layers is inevitable. The more solid cross section of the Powerform® rope offers much greater resistance to this type of damage.



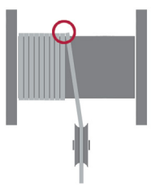
More effective resistance to crushing at crossover points

Because of the higher steel fill factor Powerform® ropes offer much better resistance to crushing damage at crossover points on the winch drum.



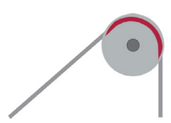
Greater resistance to “side crushing” at the drum

Abrasive wear between adjacent laps of rope which is normally most severe where the rope moves on and off the drum can be minimised by using a Powerform® rope.



Reduced wear on sheaves

The smooth exterior of the Powerform® rope can lead to reduced abrasive wear on both the sheave and rope.



STRENGTH & BREAKING FORCE

Rope breaking force can be seen as a function of metallic area, strength and spinning factor. These elements must be carefully combined to confer reliable mechanical properties.

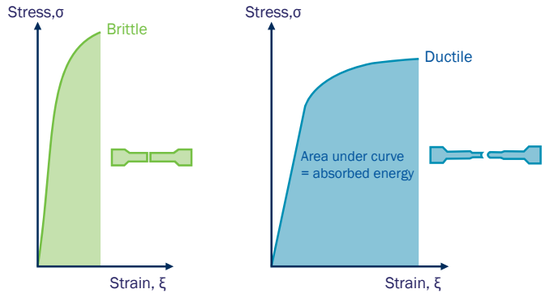
Metallic area depends on the rope's geometrical construction, diameter oversize and compacting level; strength is dependent on the characteristics of the wire; and spinning factor is dependent on manufacturing skill, geometrical construction and compacting level.

However, it must be emphasised that a high breaking force in itself is not suffcient to ensure safe working conditions.

For a wire rope to be considered safe, it must be possible to assess, within an acceptable timescale, that it is approaching the end of its service life or if the prescribed payload has been exceeded.

Good quality ropes must be composed of ductile wires, which will break gradually following remarkable plastic deformation. This gradual breakage will be clearly noticeable by a competent person with responsibility for rope integrity management.

Ropes that rely solely on the use of extremely high strength wires for their breaking force can have severe implications in terms of safety, as the wires will have the tendency to break suddenly without giving proper notice of arising problems.



The graph compares the behaviour of wires at break with different strengths: the green line represents a brittle trend typical of high strength steel (over 2160 N/mm^2). The blue line represents the typical trend of lower strength steel (1770 and 1960 N/mm^2).

It is therefore essential to adopt the minimum possible strength level and to achieve the desired breaking force by a combination of high compacting level, finely tuned geometrical construction and manufacturing reliability.

ROPE BEHAVIOUR UNDER LOAD

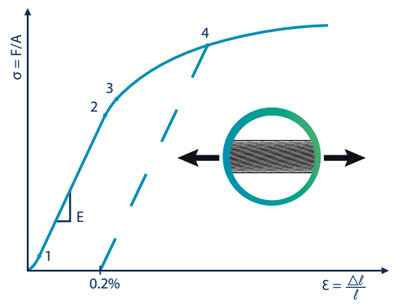
When a rope is subjected to axial loads, the elasticity of the material will cause elongation and consequential diameter reduction.

This behaviour is summarized in the figure, which shows the relationship between stress (the ratio between applied load and metallic area) and strain (ratio between elongation and initial sample length), while the slope of the curve represents Young modulus "E" during a tensile test.

In the first phase of its use (up to point 1), rope shows a certain permanent stretch due to the stabilization of the individual wires. After this step, the trend is basically linear up to the achievement of yield point (points 3 and 4), from which point permanent plastic deformation takes place, until the load reaches the actual rope breaking force.

As already mentioned in the section "Strength & Breaking Force", a good rope composed of ductile wires must have a long elastic area to ensure safe working conditions.

Rope diameter shows a permanent reduction after the first utilization cycles; the trend is shown in the second figure.



ROPE ROTATION AND TORQUE

Being composed of several helically laid components with elastic characteristics, each wire rope has the tendency to turn when subjected to load. This tendency is represented by rope torque factor, which is dependent on rope construction, previous working conditions and applied load.

In a similar way, rope will also opposes to forced rotation, depending on its rotational stiffness.

Ropes can be classified on the basis of torque factor, as spin resistant, low rotation or rotation resistant.

Since torque factor depends primarily on rope construction, this has to be selected on the basis of the reeving structure and lifting or deployment height, in order to ensure block and load stability.

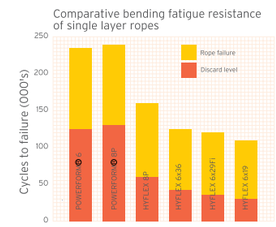
Non rotating ropes are strongly recommended for high lifting heights in single fall mode, while for multiple fall other constructions can be considered depending on block configuration

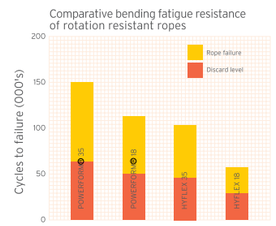
BEND FATIGUE TESTING

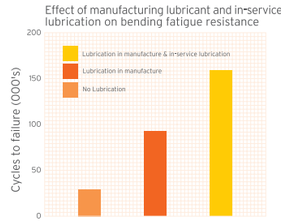
Resistance to bend fatigue is a key factor in determining the service life of wire rope and is therefore of great interest to both the rope manufacturer and the crane operator. Extensive comparative bend fatigue testing is carried out at Usha Martin in order to continuously develop and improve crane rope products.

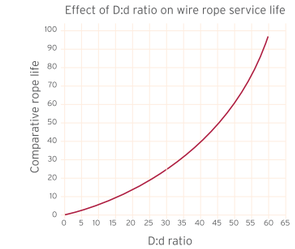
Fatigue testing involves cycling a length of rope through a sheave at a constant tension. The number of operating cycles is recorded at a point where the rope is rejectable under recommended discard levels specified under ISO 4309. The test continues until the rope under test is unable to sustain the load any longer and again the number of cycles is recorded.

Based on results obtained from an ongoing bend fatigue testing programme the charts give an indication of the likely comparative performance which can be obtained from various rope constructions. The lower charts show the importance of lubrication in-service and the relative improvement in performance as sheave diameter (D:d ratio) increases.









ROPE WINDING OVER SHEAVES

When a rope runs over the reeving, its strands are forced to modify their relative position to maintain contact with the system. If the reeving arrangement is not properly designed, the strands cannot recover their natural location in the passage between adjacent components, therefore the rope can suffer premature fatigue or localized damage.

This particularly applies in case of reverse bending configuration, where the strands are stretched and compressed between two sheaves (see sketch below). To avoid permanent damage, for complete reverse bending (see left sketch) the minimum recommended distance is about 100 times the rope diameter.

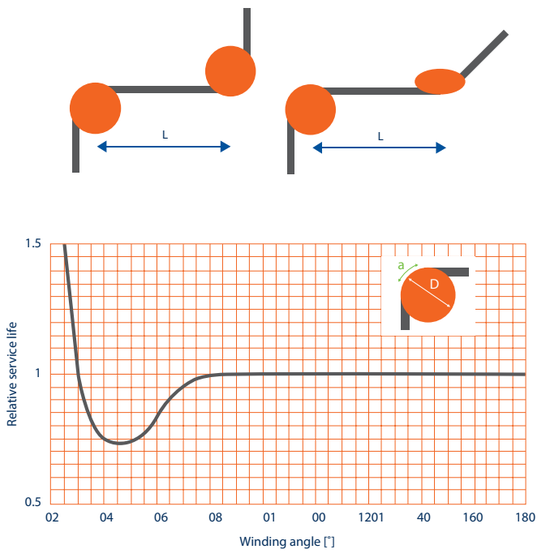
For partial reverse bending (see right sketch), a lower distance could be accepted.

Both in the case of reverse and simple bending, the sheaves have to be properly designed in terms of size, groove configuration and hardness.

The minimum recommended bending ratio is 20 times the rope nominal diameter, while the recommended groove oversize can vary from 1.06 to 1.1 times the rope diameter

In order to allow a smooth contact surface, the rope should be in touch with the sheave for at least 1.5 times its lay length, which corresponds approximately to a 60° winding angle for a sheave having a bending ratio of 20. For very small winding values the stress induced to the rope is not very relevant, while in the intermediate range, from 10° 45°, significant damage can occur, especially if the component is located in the high tension side of the reeving.

This figure does not apply in case of rollers or sheaves with reduced bending ratio (up to 10), since the rope has to deal with a relatively small bending ratio. In this case, it is always recommended to adopt a minimum bending ratio equal to the winding angle (e.g. 2 D/d minimum in case of 2° winding angle).



CONTACT PRESSURE BETWEEN REEVING COMPONENTS

When the rope is bent over a component, it generates pressure which is dependent on its diameter, the diameter of the component over which the rope is bent and the applied tension.

The nominal average pressure can be calculate using the following formula:

$$\text{Pressure, } P = \frac{2T}{Dd}$$

P = pressure [N/mm2]
T = rope tension [N]
D = diameter of sheave or drum [mm]
d = diameter of rope [mm]

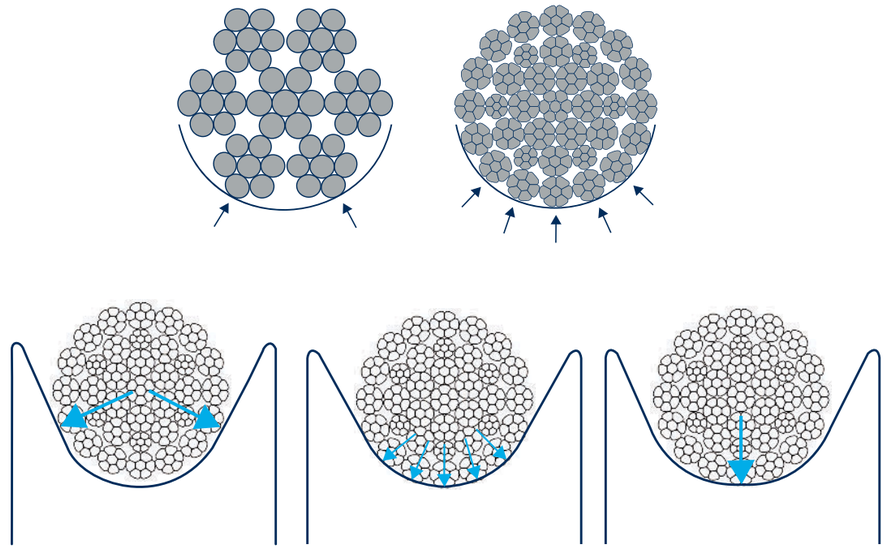
Multistrand and non rotating ropes ensure a better pressure distribution than six strand ropes, as the higher number of outer strands generates a wider contact surface (see figures below).

Compacted strands and Lang's lay ropes further extend the contact surface.

In order to ensure proper performance, the groove material should ensure a smooth and hard contact: in case of inadequate hardness, the steel will be locally hardened, with consequent embrittlement and detachment of steel flakes, which can damage both the rope and the component itself. The typical recommendation is to use hardened steel with approximate 300 HB value.

In case of synthetic sheaves, the yield point of the material should be higher than the exerted pressure, calculated using the formula above.

A good groove dimension is also important to achieve a reduced pressure. The diagram below shows different configurations depending on various groove oversize: narrow, well dimensioned and large groove.



STORAGE & PRE-INSTALLATION PROCEDURE

Crane ropes, like any machine or spares, deteriorate during storage as well as in service. Therefore, the assurance of safety and economy in use of the equipment, dictates the requirement for a procedure of proper storage, handling and installation of crane ropes.

STORAGE

- Store rope in a clean, dry, well ventilated, dust free undercover location.
- Cover the rope with water proof material and/or canopy, if not stored inside.
- Storage should be free from steam, chemical fumes or any other corrosive agent.
- Avoid direct contact of rope with floor.
- Place reels, preferably over a frame or cradle and allow flow of air under the reel.
- Avoid rope exposure to elevated temperatures.
- Avoid handling damages to wire ropes.
- Ensure that tag/marking is intact and follow 'first in, first out' principle.
- Inspect rope periodically and apply suitable rope dressing compatible with manufactured lubricant, whenever necessary.
- Rotate reel periodically, say after every 3 months, particularly in warm environment.

BEFORE INSTALLATION

- Before re-equipping the appliance, all grooves in drums and pulleys should be checked to ensure that they will correctly accept the replacement rope.
- Sheave groove diameter should be larger than the nominal rope diameter by about 5% to 10% and ideally at least 2.5% greater than the actual diameter of the new rope.
- The diameter of the new rope shall be measured with the rope under no tension and the value recorded.
- Maintain fleet angle at minimum during installation
- Prior to rope cutting, always follow proper procedure of rope seizing
- Never pull the rope from stationery coil or reel
- Avoid contact with ground while unwinding the rope
- Keep the reel on a suitable stand with braking arrangement
- Avoid formation of kink/ bends in the rope during handling
- Follow 'top to top' or 'bottom to bottom' practice for rope transfer from reel to drum / winch.

RUNNING IN PROCEDURE

- Run the newly installed wire rope in and out six times over its maximum working length with a load approx. 25% of safe working load at reduce speed.
- Repeat this procedure with load at 50% of safe working load.
- Continue the same procedure with load at 100% of safe working load.

SEIZING PROCEDURE

The purpose of seizing a rotation resistant wire rope is to prevent relative movement of individual strands of inner core as well as outer layer and thereby preserving its designed integrity and rotational balance. Therefore, before cutting any rotation resistant wire rope, tightly double seize with soft steel wire of suitable size, on either side of the intended cut. The length of each seizing should be at least equal to 2 x $d_{rope\ dia.}$ and each of the seizing should be spaced approximately 6 x $d_{rope\ dia.}$

- Use of adhesive tape in lieu of seizing is strictly discouraged.
- Fusing of cut ends in strongly recommended.

Powerform 18/Hyflex 18	Powerform 35/Hyflex 35
For 6.0 mm to 24.0 mm wire rope, use 1.0 mm wire	
For 25.0 mm to 36.0 mm wire rope, use 1.6 mm wire	
For 37.0 mm to 56.0 mm wire rope, use 2.0 mm wire	
Double seizing and end fusing mandatory	

HANDLING & INSTALLATION

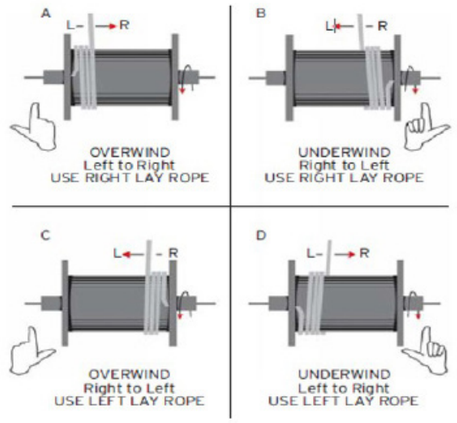
6/8 STRANDED ROPE

- Never pull out rope from stationary coil.
- Place rope reel on ground and roll out straight.
- If heavy, place coil on turntable and pull the end away from coil.
- Prevent combination with dust, grit, moisture, chemicals and other harmful material.
- Put a shaft of adequate strength through reel bore and place in a suitable stand.
- Allow reel to rotate freely and be braked to avoid overrun.
- Provide back tension for multilayer spooling and ensure to wind tightly, particularly the bottom layer.
- Maintain constant tension while reeving and avoid layer cross-over.
- Avoid formation of loops or kinks.
- Avoid reverse bending during reeving. Wind/Unwind 'top to top' or 'bottom to bottom'.
- Take special care while releasing the outboard end of rope from supplied reel or coil.
- Maintain fleet angle at minimum during installation.
- Check that the grooves of all sheaves are as recommended and sheaves are free to rotate.
- Check the diameter and pitch of drum grooves, and ensure that these are as recommended.
- 'Run' the new rope by running the equipment slowly, with a low load for a number of cycles.
- Inspect that the rope spools correctly on the drum and no slackness or cross-over occurs.

ROTATION RESISTANT ROPE

Since rotation resistant wire ropes have special layering and arrangement of strands that are very sensitive, therefore, they require careful handling and installation in order to avoid deterioration, hoisting problems and premature removal of wire ropes. The recommendations given below should be followed in addition to the general mentioned before:

- Always wind 'top to top' or 'bottom to bottom' to avoid reverse bends.
- Ensure that wire rope anchorage point corresponds directly with wire rope lay.
- Provide back tension and maintain constant winding tension.
- The first and all subsequent layers should be wound tightly and correctly.
- There should not be any rope layer cross-over.
- There should not be any formation of loop or kink.
- Do not weld the old and the new rope during installation.
- Do not induce twist in the new rope, remove if induced.
- A swivel maybe used during installation to prevent transfer of torque to new rope.
- Swivels maybe used with Hyflex 35 and Powerform 35 ropes, but are not recommended for use with Hylfex 18 and Powerform 18 and should never be used with non-rotation resistant wire ropes.
- To adjust to operating conditions, 'Run in' the wire rope, after proper installation at reduced speed and load (up to approximately 10% of working load limit) for a number of operational cycles.
- Remove any accumulated torque or turn which is induced during initial stage of operation.



The user should always refer relevant standard/regulations like EN-12385, ISO 4309 for wire rope care, maintenance & installation.

DISCARD CRITERIA

Crane ropes must be removed from service if the examination reveals that the rope deterioration has exceeded limits of certain criteria. A general retirement plan states that one of the factors listed below, severe enough, can cause rope discard. However, rope deterioration and decision to discard, almost always, is the result of cumulative effect of combination of these factors.

- Broken Wires • Diameter Reduction • Corrosion • Deformation

Number & Characteristics of Broken Wires

Crane rope must be considered for discard if number of visible broken wires equals or exceeds the allowable limit. For 6 and 8 strand wire ropes, occurrence of wire breakages, to a large extent is on the outer surface, whereas for rotation-resistant wire ropes, majority of wire breakages are expected to occur internally and require specialized examination techniques to reveal.

The table below specifies the number of visible broken wires, which when equalled or exceeded requires mandatory discard of ropes working on steel sheaves.

VALLEY WIRE BREAKAGE

CROWN WIRE BREAKAGE

- Wire breaks in the strand valley, generally, indicate internal rope deterioration and require closer inspection of the rope equal to 6xd.
- Broken wires at, or adjacent to the termination, requires the termination to be remade by shortening the rope, otherwise the rope should be discarded.
- Concentrated close group of broken wires in a rope length of 6 x d or in any one strand, require discard of the rope even if the number given above are not reached.
- Complete fracture of one strand or collapse of core requires immediate discard of the wire rope.

Product	Construction	Section of rope working in steel sheaves and/ or spooling on a single layer drum				Section of rope spooling on a multi-layer drum			
		No. of visible broken wires in wire rope length equals				No. of visible broken wires in wire rope length equals			
		(Ordinary Lay)		(Langs lay)		(Ordinary lay)		(Lang lay)	
		6 x d	30 x d	6 x d	30 x d	6 x d	30 x d	6 x d	30 x d
HYFLEX 4	4X39	2	4	2	4	4	8	4	8
HYFLEX 6/ POWERFORM 6	6X25F	5	10	2	5	10	20	10	20
	6X29F	6	11	3	6	12	22	12	22
	6X26WS	6	13	3	6	12	26	12	26
	6X31WS	8	16	4	8	16	32	16	32
	6X36WS	9	18	4	9	18	36	18	36
	6X41WS	10	21	5	10	20	42	20	42
HYFLEX 8/ POWERFORM 8	8X25F	6	13	3	6	12	26	12	26
	8X26WS	9	18	4	9	18	36	18	36
	8X31WS	10	21	5	10	20	42	20	42
	8X36WS	12	24	6	12	24	48	24	48
	8X41WS	13	26	6	13	26	52	26	52
HYFLEX 18/ POWERFORM 18	18X7	2	4	2	4	4	8	4	8
	18X19S	4	8	4	8	8	16	8	16
	18X26WS	6	12	6	12	12	24	12	24
HYFLEX 35/ POWERFORM 35	35X7	3	5	3	5	5	10	5	10
	35X19S	6	12	6	12	12	24	12	24
	35X26WS	6	12	6	12	12	24	12	24

Rope diameter reduction

Rope diameter may reduce due to one or a combination of these factors:

- Internal wear or wire indentation.
- External wear due to abrasion of crowns of outer wires.
- Deterioration or collapse of core (fibre/steel) or internal layers of multi-layer rotation resistant ropes.
- Maintain records of diameter measurements.

The rope should be discarded:

- If the rope diameter reduction exceeds 7% of the nominal rope diameter, only due to external wear.
- If rope diameter reduction exceeds 3% of nominal rope diameter for rotation resisytant ropes and exceeds 10% for other 6 and 8 strand wire ropes, due to reasons other than external wear.

Corrosion

Corrosion may occur on the outer surface of the wire rope, which can be detected visually, or on the internal layers of the wire rope, which is more difficult to detect. The following conditions justify immediate discard of wire rope:

- Wire slackness due to corrosion of external wires.
- Confirmation of severe internal corrosion.

Deformation

Permanent distortion from its original shape and orientation is termed as deformation.

The following common forms of distortion, require immediate discard of the wire rope:

- Birdcage or Basket information.
- Wire, Strand or Core Protrusion/ Distortion.
- Kink or loop formation
- Localised diameter increase in excess of 5% of actual rope diameter.
- Localised rope diameter reduction and lay length variation associated with severe waviness.

CORROSION

BIRD CAGING

KINK OR LOOP FORMATION

WIRE PROTRUSION

The rope should be examined by a competent person who should always refer relevant code/recommendation/ stranded (like ISO: 4309) for deciding rope discard.

RECOMMENDED DO'S & DON'TS

DO'S

Lubricate ropes with good quality acid free and moisture free lubricant.
Regularly inspect the sheaves, rollers or pulleys - the life of a rope largely depends on their conditions.
Inspect ropes and fittings/terminations periodically.

DONT'S

Do not allow ropes in store to deteriorate.
Do not mishandle ropes when uncoiling or unreeling & aloow kinks to form.
Do not use langs lay with swivel for 6/8 standard rope.
Do not use a rope with too large groove diameter on drums and pulleys.
Do not cut a rope without seizing.
Do not load the rope beyond its safe working load. Reduction of safety factor may jeopardise not only rope, but also equipment, job and men.

Note: Care in handling, installation and careful inspection gives more life and performance.

METRIC – IMPERIAL DIAMETER CONVERSION											
in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
5/32	3.97	1/2	12.7	15/16	23.8	11/2	38.1	21/2	63.5	41/4	108.0
3/16	4.76	9/16	14.3	1	25.4	15/16	41.3	23/4	69.9	41/2	114.3
7/32	5.56	5/8	15.9	11/16	27.0	13/4	44.5	3	76.2	43/4	120.7
1/4	6.35	11/16	17.5	11/8	28.6	17/8	47.6	31/4	82.6	5	127.0
5/16	7.94	3/4	19.0	13/16	30.2	2	50.8	31/2	88.9		
3/8	9.53	13/16	20.6	11/4	31.8	21/8	54.0	33/4	95.3		
7/16	11.1	7/8	22.2	13/8	34.9	21/4	57.2	4	101.6		

CONVERSION TABLE				
Length	1m	= 1000 mm	= 3,281ft	= 39,37 inch
Force	1kN	= 101,97kp	= 0,10197 t metric-f	= 224lbs-f
Tensile Strength	1N/mm^2	= 0,10197 kp/mm^2	= 145,04 p.s.i.	= 10 bar
Cross Section	1 mm^2	= 0,00155 sq.inch		
Weight	1 metric t	= 1000 kg = 1,102 short t	= 0,9842 long t	= 2204,6 lbs
Weight per Length Unit	1 kg/m	= 0,672 lbs/ft		

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