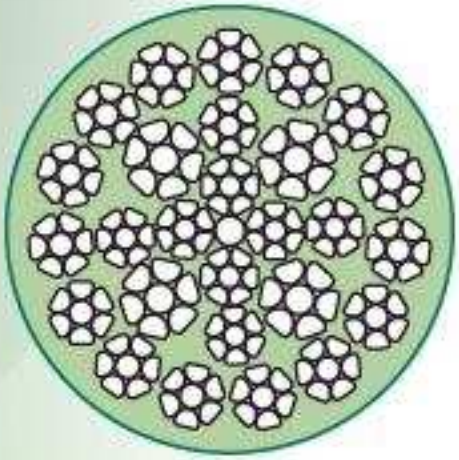
CORDOARIA

OLIVEIRA SÁ



Technical manual for hoisting steel wire ropes and its applications

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OLIVEIRA SÁ

HISTORY:

OLIVEIRA SÁ was established in 1825 and is a market leader for steel wire ropes, especially for lifting, cranes, all elevation systems and fishing.
Our steel wire ropes are produced according to the most advanced technology using always the best steel available. The fibre cores are produced at our own factory so that we can guarantee consistent quality.
OLIVEIRA SÁ has implemented a quality assurance system according to ISO 9001:2000 which has been certified by APCER (Associação Portuguesa de Certificação, a IQNET member).
All wire ropes sold by OLIVEIRA SÁ are provided with mill test certificates. The mill test certificates can be issued in accordance with Det Norske Veritas and Lloyd's Register of Shipping and all other Classification Societies upon request.
OLIVEIRA SÁ has his own, fully equipped Research and Development Department which supports production and ensures that the optimum quality, for all products, is supplied to our customers.
We must also enphasize the traditional presence of OLIVEIRA SÁ in all the important markets around the world.

1975 – Implementation of the factory in a new area in Maia, Porto.
1993 – Acquisition of new machines for industrial ropes.
1999-2007 – Building of a new plant dedicated to the production and fabrication of large diameter synthetic ropes and systems for the Offshore Market.
2003 – Acquisition of 12 new machines dedicated to the production of high-tech steel wire ropes for the hoist and elevator market.
2008 - Incresing of the capacity with 6 new machines

OLIVEIRA SÁ: (2 Plants)

• MAIA, PORTO: Exclusively dedicated to the high tech hoisting steel wire ropes, elevator ropes, and ropes for the fishing industry.

• BEIRE, PAREDES: For all types of synthetic ropes and twines, and for specialized ropes and mooring systems of the Offshore Market. Owning one of the biggest machines in the world puts OLIVEIRA SÁ among the leaders of the world in this field.

PRODUCTION RANGE:

- 4200 tons/year of high tech steel wire ropes,
- 8000 tons/year of fishing steel wire ropes

MACHINERY for the production of Steel Wire Ropes:

- 36 Stranders from 6 to 42 bobbins with a rize up to 680mm;
- 10 Closers from 6 to 42 bobbins. Among these are 4 large planetary machines;
- 3 extrusion lines (2 with continuous process);
- All the suitable equipment leading to optimise the performances of the ropes (Compacting, plastic impregnation, heating...).

RAW MATERIAL:

All the wires used in the production of our steel wire ropes are tested and certified at source, and are purchased only from the top worldwide quality suppliers.
Complementary tests are made in the plant by our own Quality Control Department.

EXPERIENCE REFERENCES:

In these last 5 years, OLIVEIRA SÁ has been homologated by several most well known big OEM (crane manufacturers) in the world.

DESIGN / NEW TECHNOLOGIES

Our performance-updated software required to calculate rope behaviour and breaking strength allows the Oliveira Sá design team to optimise the right construction of rope for each application.
Our Research and Development team is constantly improving its service to our customers, by investing in, and keep up to date with all the new technologies.

LABORATORY:

Fully equipped with all the necessary machinery, in order to achieve the Quality Control and Testing during and after the manufacturing process. This machinery includes 2 pulling benches for 150 and 500 tonnes and equipment for testing and controlling the carbon content of the wires.

TOTAL STAFF:

473 people:
- 21 engineers and executives;
- 32 administratives;
- 420 production personnel.

Head Quarters - Main Factory:
R. do Outeiro, 906 • 4475-150 Gemunde • Portugal
Tel.: +351 229 434 900 • Fax: +351 229 434 949
E-mail: cos.maia@oliveirasa.pt • web: www.oliveirasa.com

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References to specifications and standards in this catalogue are only intended to show a general compliance and must not be interpreted as meeting all terms of a purchase or contract. All the information and technical characteristics contained in this catalogue are strictly indicative. OLIVEIRA SÁ reserves the right to change product design, materials and specifications without any prior notification.

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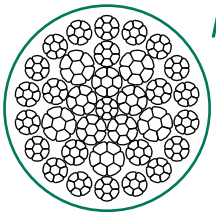
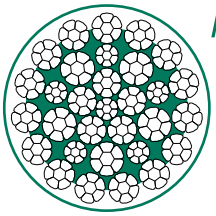
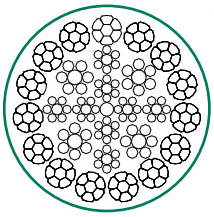
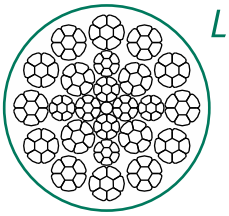
Index of Ropes and Applications

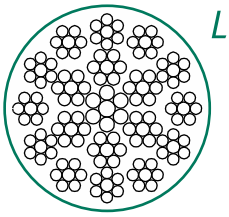
Hoist Ropes

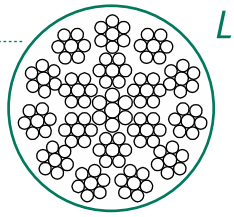


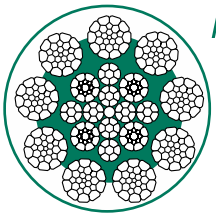












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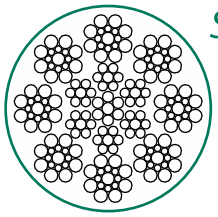

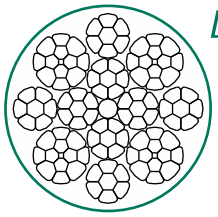

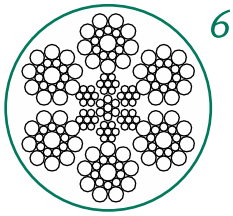

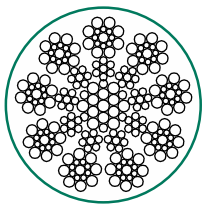

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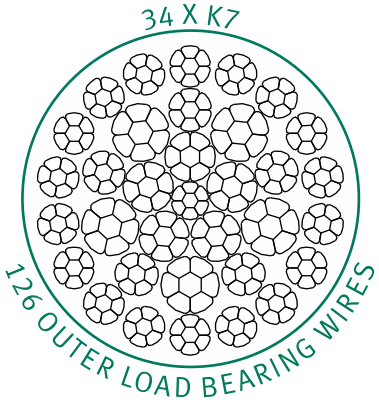
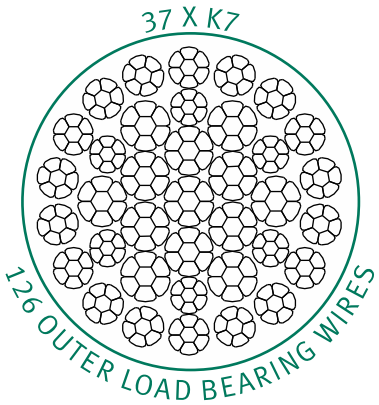
NR MAXIPACT®

Non Rotating High Performance - Steel Wire Ropes

	Diameter		Cross Section	Weight	MBL kN	
	mm	inch	mm²	kg/m	1960 N/mm²	2160 N/mm²
	18 outer strands					
	10mm, 11mm and 12mm report to NR Maxilift					
34(W)xK7	13	1/2	94	0.81	156	164
	14	9/16	109	0.94	182	191
	15		124	1.07	207	217
	16	5/8	143	1.24	239	250
	17		160	1.39	267	280
	18		178	1.54	297	311
	19	3/4	198	1.71	330	347
	20		220	1.90	367	385
	21		247	2.14	412	432
	22	7/8	267	2.31	446	467
	23		295	2.55	492	516
	24		320	2.77	534	560
	25	1	353	3.06	581	617
	26		379	3.27	632	663
	27		407	3.52	679	712
	28	1 1/8	436	3.77	728	763
37(W)xK7	30		507	4.38	846	887
	32	1 1/4	575	4.97	959	1006
	34	1 3/8	647	5.59	1079	1132
	36		732	6.33	1221	1281
	38	1 1/2	811	7.01	1352	1418
	40		896	7.75	1495	1568
	42	1 5/8	997	8.62	1664	1745
	44	1 3/4	1090	9.43	1819	1907
	46		1196	10.34	1996	2093
	48	1 7/8	1301	11.26	2171	2277
	50.8	2	1443	12.47	2407	2524
	52		1528	13.21	2549	2673



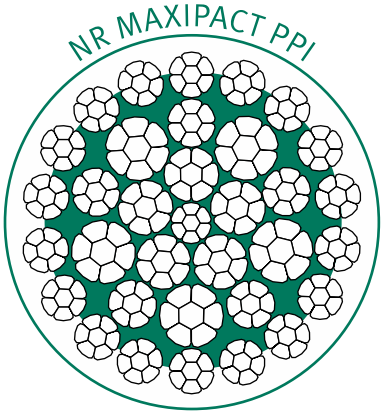


Tolerance on Diameter: EN: (0; +5%);
Design Oliveira: (+1%; +4%)
Filling factor (f): 34xK7=0,707; 37xK7=0,717
Spinning Factor (k): 1960 N/mm² = 0,830; 2160 N/mm²= 0,810
Modulus of elasticity: E = 120000 N/mm² (± 5000 N/mm²)
Torque factor = 0.009

NR MAXIPACT® PPI

Plastic Protected Impregnated core

- Leads every component of the rope to an homogeneous stress and behaviour in service
- Improves the structural stability
- Encapsulates the lubricant of the core
- Protects the core from corrosion



Resulting in:

- A longer service life
- Keeping its non rotational properties in the most severe conditions
- Internal rope protection against corrosive environment
- Favouring outer maintenance

- Recommended for all marine and submarine applications and all environmental severe conditions.

NR MAXIPACT and NR MAXIPACT PPI can be used with a swivel and can work with a sigle fall

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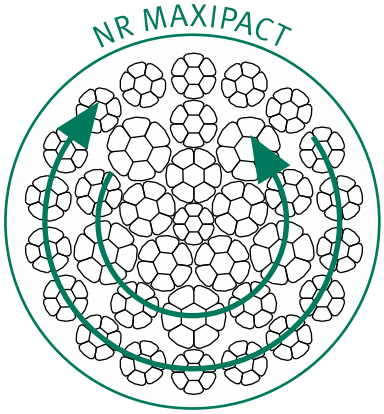
NR MAXIPACT®

NR = Non Rotating

- Non rotating construction
- Compacted strands
- Lang's lay flexible hoist rope
- Galvanized wires
- Fully lubricated (internal and external)
- Extremely high Breaking Load



Main Properties:

Non-rotational: The design of the NR Maxipact generates its special geometrical assembly resulting in an optimal non-rotating property.

Safety: The construction of the NR Maxipact is designed to avoid cross nickings between the inner strands (core: Warrington construction). This protects the rope of internal deterioration. Outer broken wires will become first evident. (Visual inspection).

Applications:

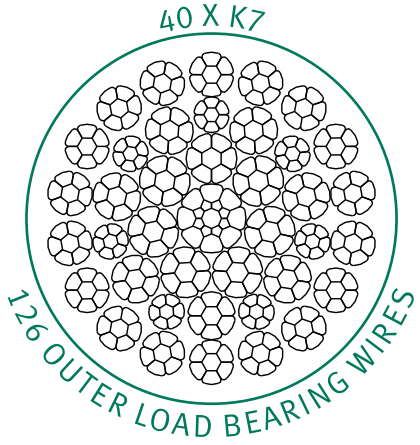
All cranes and performant lifting devices where non-rotating and high MBL ropes are required.

Option PPI: Recommended for offshore, deck cranes and marine environment.

NR MAXIPACT - 40(W)xK7 - Special design for a maximum unit length

40(W)xK7

Diameter mm	Diameter inch	Cross Section mm²	Weight kg/m	MBL kN 1960 N/mm²	Maxi Unit Length (m)
30		507	4.38	835	4000
32	1 1/4	576	4.98	950	3500
34	1 3/8	658	5.71	1085	3050
36		736	6.38	1213	2750
38	1 1/2	819	7.11	1350	2450
40		906	7.86	1493	2200
42	1 5/8	1003	8.71	1652	2000
44	1 3/4	1100	9.55	1814	1800
46		1203	10.44	1983	1650
48	1 7/8	1313	11.40	2165	1500
50		1423	12.32	2345	1300
50.8	2	1451	12.54	2391	1250



Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor: f = 0,722. Spinning factor k = 0,82
Modulus of elasticity: E = 120000 N/mm² (± 5000 N/mm²)

Maximum unit weight net: 17,5 Tonnes

Can be used with a swivel.
Can work with a single fall.

Applications:

Same technology and applications than the NR Maxipact in 34(W)K7 and 37(W)xK7

Options: - PPI
- 2160 N/mm²

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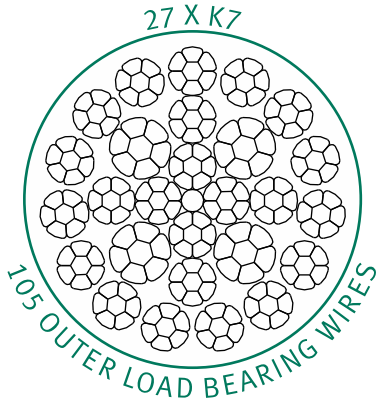
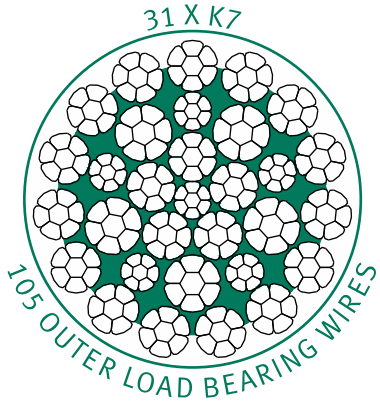
NR 15 MAXILIFT

Non Rotating High Performance - Steel Wire Ropes

	Diameter		Cross Section	Weight	MBL kN	
	mm	inch	mm²	kg/m	1960 N/mm²	2160 N/mm²
27(W)xK7	10		53.9	0.47	90	95
	11	7/16	66.6	0.58	111	117
	12		77.3	0.67	129	135
	13	1/2	90.9	0.79	152	159
	14	9/16	105.5	0.91	176	187
	15		122.3	1.06	204	214
	16	5/8	138.8	1.20	232	243
	17		155.5	1.34	260	272
	18		175.0	1.52	292	306
	19	3/4	193.9	1.68	324	340
	20		215.7	1.86	360	378
	21		241.7	2.09	403	423
31(W)xK7	22	7/8	266.5	2.31	445	
	23		290.4	2.52	485	
	24		315.9	2.74	527	
	25	1	344.6	2.98	575	
	26		369.9	3.20	617	
	27		395.5	3.44	660	
	28		437.1	3.79	729	
	28.6	1 1/8	451.8	3.92	754	
	30		496.0	4.30	828	
	32	1 1/4	560.5	4.84	935	
	34	1 3/8	628.0	5.45	1048	
	36		717.2	6.22	1197	
	38	1 1/2	797.3	6.93	1330	
	40		873.6	7.58	1457	
	42	1 5/8	981.7	8.53	1638	





(With option PPI)

Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 27xK7=0,689; 31xK7=0,700
Spinning Factor (k): 1960 N/mm² = 0,83; 2160 N/mm²= 0,810
Modulus of elasticity: E = 120000 N/mm² (± 5000 N/mm²)

Main properties similar to the NR Maxipact

Applications:

For all the most severe hoist applications, intensive use, corrosive environment...

Offshore cranes, deck cranes, cargo cranes, foundation cranes (Kelly cranes), harbour cranes, and all the traditional applications: mobile cranes, tower cranes, crawler cranes...

PPI*: OLIVEIRA SÁ has developed the most advanced plastic impregnation process in continuous closing operation, leading to an optimal and unique efficiency.

Option PPI:

- Improves the structural stability
- Protects the core against the corrosion
- Encapsulates the lubricant of the core
- Increases the service life

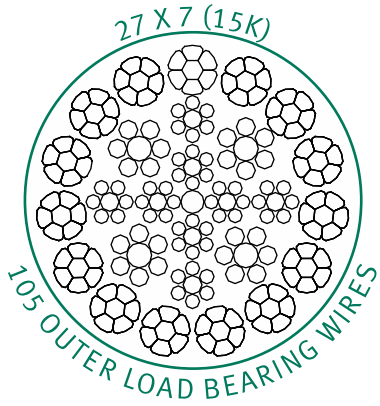
Can be used with a swivel.
Can work with a single fall.

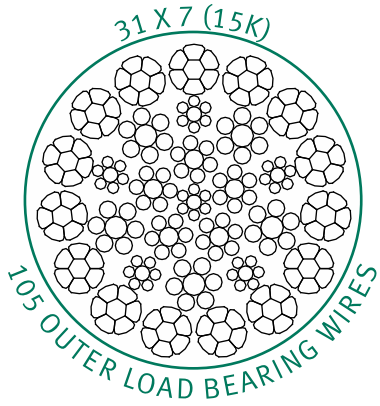
TOWERLIFT 15

Non Rotating

	Diameter		Cross Section	Weight	MBL kN
	mm	inch (1)	mm²	kg/m	1960 N/mm²
27(W)x7 (15 K OUTER STRANDS)	8	5/16	31,4	0,27	52,4
	9		39,0	0,34	65,0
	10		50,0	0,43	83,4
	11	7/16	62,0	0,54	103
	12		73,3	0,64	122
	13	1/2	84,7	0,73	141
	14	9/16	100,3	0,87	168
	15		115,6	1,00	193
	16	5/8	129,7	1,12	217
	17		147,6	1,28	246
	18		162,4	1,41	271
	19	3/4	180,5	1,56	301
	20		200,0	1,74	334
	21		224,8	1,95	375
31(W)x7 (15 K OUTER STRANDS)	22	7/8	245,8	2,13	410
	23		271,0	2,35	452
	24		295,8	2,56	494
	25	1	320,3	2,77	535
	26		343,9	2,97	574
	27		377,8	3,27	631
	28	1 1/8	403,5	3,49	674
	30		463,3	4,01	773
	32		522,4	4,52	872
	34	1 3/8	594,0	5,15	991
	36		666,1	5,77	1111
	38	1 1/2	738,4	6,40	1232

Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 27x7=0,645; 31x7=0,653
Spinning Factor (k): 0,83
Modulus of elasticity: E = 115000 N/mm² (± 5000 N/mm²)
Torque factor = 0,012
Option PPI: Available from 13 mm
(1) Inch sizes fit with inch diam requirements





- Can be used with a swivel
- Can work with a single fall

Applications:

The Towerlift 15 can be used for all cranes and hoisting systems where non-rotating properties are required:
Tower cranes, mobile cranes, crawler cranes, offshore cranes, cargo cranes...
For the marine applications the PPI option is recommended (galvanized).

Note of the designer: Thanks to its special feature (outer strands compacted and inner strands conventional) the Towerlift 15 remains very flexible and keeps a high grade of non rotational property. Can be used for tower cranes (big height) when a very high MBL is not required.

- Non-rotating construction
- Compacted outer strands
- Lang's lay – very flexible
- Ungalvanized or galvanized
- High MBL
- Option PPI
- Lubricated

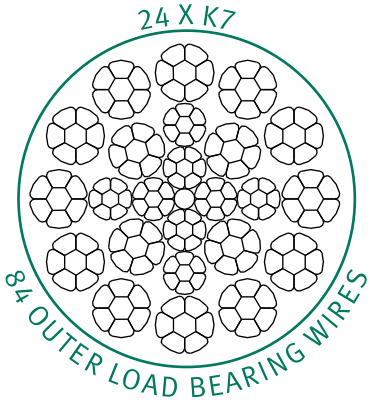
- Compacted outer strands avoid crushing.
- For multireeving systems and also a lower pressure on the drum/pulleys
- The internal Warrington core maintains a high grade of flexibility
- The ratio outer / inner strands allows a very low torque factor (0,012)
- The option PPI will reinforce the structural stability

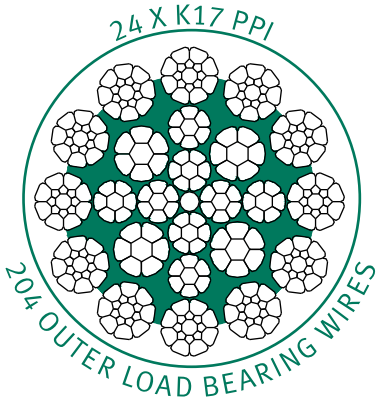
LT 24 K

Rotation Resistant Rope (LT = Low Torque)

	Diameter		Cross Section	Weight	MBL kN
	mm	inch	mm²	kg/m	1960 N/mm²
24(W)xK7	7,2		26	0,23	43,7
	8	5/16	33	0,29	55,1
	9		41	0,37	69,6
	10		53	0,46	88,2
	11	7/16	65	0,57	108
	12		77	0,68	128
	13	1/2	89	0,78	149
	14	9/16	104	0,91	173
	15		119	1,04	198
	16	5/8	137	1,21	230
	18		177	1,55	295
	19	3/4	194	1,70	324
	20		212	1,86	354
	22	7/8	259	2,27	432
	24		311	2,74	519
24(W)xK17	16	5/8	138	1,21	229
	18		174	1,54	290
	19	3/4	194	1,72	324
	20		215	1,91	359
	22	7/8	259	2,30	433
	24		315	2,79	526
	25,4	1	345	3,06	575
	26		366	3,24	610
	28	1 1/8	423	3,75	706
	30		484	4,27	808
	32	1 1/4	561	4,96	937
	34	1 3/8	628	5,54	1047
	36		699	6,17	1165
	38	1 1/2	776	6,85	1295

Tolerance on Diameter: actual EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 24xK7 = 0,679; 24xK17 = 0,686
Spinning Factor (k): 1960 N/mm² = 0,830
Modulus of elasticity: E = 115000 N/mm² (±5000 N/mm²)





The LT24K **PPI** rope has 12 outer strands and can replace all the traditional 19x19 or 18x7 ropes, achieving a far better performance thanks to its Warrington core.
Its properties lead the LT24K to be used in other applications than tower cranes or mobile cranes, such as overhead cranes (when height can be critical) or luffing wire (when the distance between the sheaves is important).
It can prevent or eliminate the block twisting effect.

- Rotation resistant (but NOT non rotating)
- Galvanized wires
- Flexible – Lang's lay
- High Breaking Load
- For multilayer spooling
- Resistant against drum crushing
- Option LT 24 K PPI

The option **PPI** improves the basic properties of the LT 24 K and can allow working with higher fleet angle ($1°30 < \alpha < 4°30$).

- Protects the core to prevent from undetectable inner breaks
- Structural stability
- More homogeneous behaviour under extremely severe conditions

Applications:

Tower cranes, all marine and offshore cranes when rotation resistance is required.
Recommended for intensive use and severe hoist applications where rotation resistance property is required.

LT24K and LT 24 can be used with a swivel with a minimum of 2 falls.
Cannot be used with a single fall (with or without a swivel)

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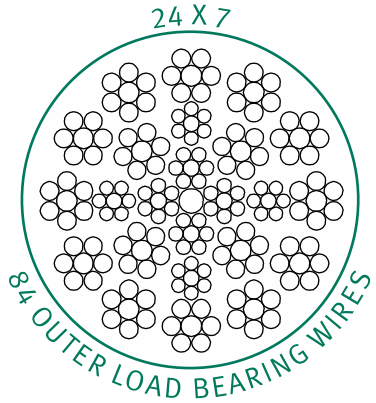
LT 24

Rotation Resistant Rope (LT = Low Torque)

	Diameter		Cross Section	Weight	MBL kN
	mm	inch	mm²	kg/m	1960 N/mm²
24(W)x7	7.2		23.4	0.21	39.1
	8	5/16	29.0	0.25	48.4
	9		37.9	0.33	63.2
	10		48.8	0.42	82.0
	11	7/16	57	0.51	96
	12		69	0.60	114
	13	1/2	80	0.71	134
	14	9/16	93	0.82	155
	15		107	0.94	178
	16	5/8	120	1.06	201
	18		155	1.37	259
	19	3/4	170	1.50	284
	20		188	1.65	313
	22	7/8	231	2.03	385
	24		276	2.43	461

Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 24x7 = 0,606
Spinning Factor (k): 1960 N/mm² = 0,830
Modulus of elasticity: E = 110000 N/mm² (± 5000 N/mm²)

LT24K and LT 24 can be used with a swivel with a minimum of 2 falls.
Cannot be used with a single fall (with or without a swivel)



- Rotation resistant rope
- Galvanized wires
- Flexible lang's lay
- Same properties as the LT 24 K, and same applications when a lower MBL is required.

Applications:

Applications LT24 / LT17 / LT18: All lifting applications when MBL is not critical, and when rotation resistant properties only are required.

LT 17 /LT 18

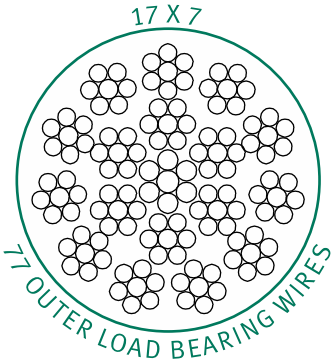
Rotation Resistant Rope (LT = Low Torque)

	Diameter		Cross Section	Weight	MBL kN
	mm	inch	mm²	kg/m	1960 N/mm²
17 x 7	7		23.6	0.21	39.0
	7.5		27.6	0.24	45.5
	8	5/16	30.5	0.27	50.3
	9		37.4	0.33	62.0
18 x 7	10		47.4	0.41	78.2
	11	7/16	58	0.50	95.0
	12		69	0.60	114
	13	1/2	80	0.70	132
	14	9/16	93	0.81	154
	15		108	0.94	178
	16	5/8	121	1.05	199
	18		155	1.35	256
	19	3/4	171	1.49	281

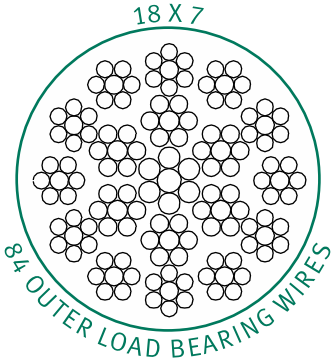
Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 17x7 = 0,607; 18x7 = 0,607
Spinning Factor (k): 1960 N/mm² = 0,820
Modulus of elasticity: E = 105000 N/mm² (± 5000 N/mm²)

Can never be used with a single fall

- Rotation Resistant
- Regular lay
- Galvanized wires



- Rotation Resistant
- Lang's lay
- Galvanized wires



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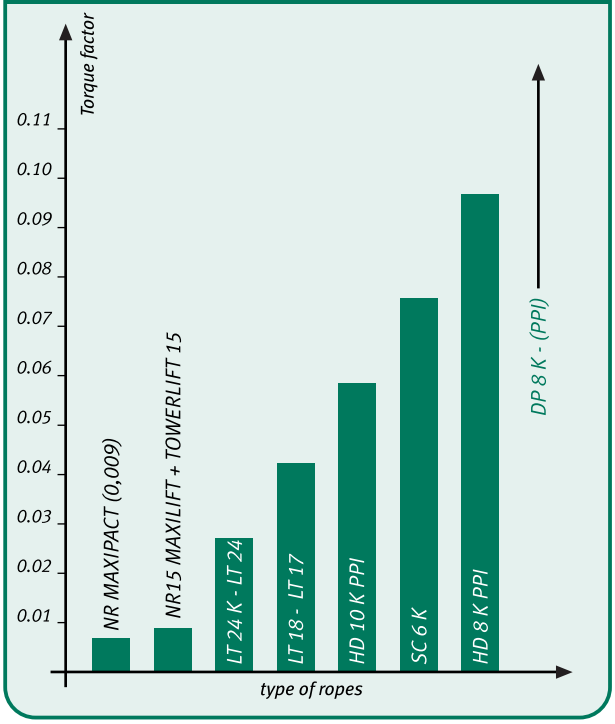
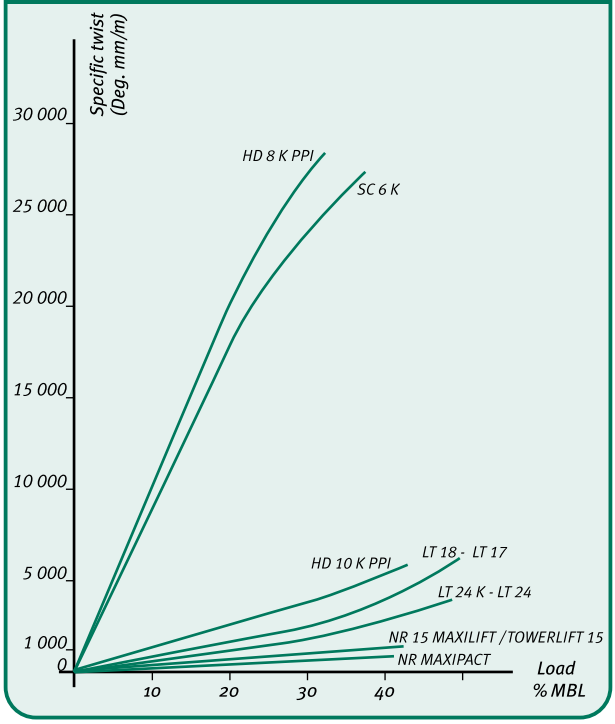
ROTATIONAL CHARACTERISTICS

Torque Factor

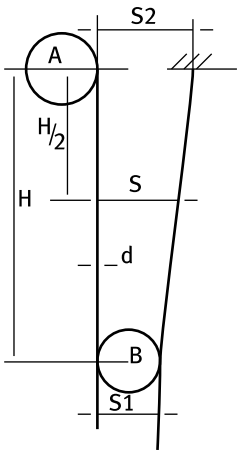


Torsional Stability Under Load



Torque factor = $\frac{\text{Moment of torsion (N.m)}}{\text{Load (kN) x Rope Diam. (mm)}}$

ROTATIONAL STABILITY OF THE SHEAVE BLOCKS



H: Loading height
S: Spacing / 2 falls
d: Rope nom. diam.
T : Torque factor

$S = \frac{S1 + S2}{2}$

Formulas:

$H = \frac{S^2}{4000\ T.d} \text{ Sin } \alpha$

For a maximum twist of 90° we have: sin $\alpha = 1$

$S = \sqrt{4000\ H.T.d}$

• Example 1: For LT 24 K. Diam = 22mm. 2 falls
d = 22mm
S = 20 d = 440mm
T = 0,028 (LT 24 K)
Maximum twist 90° (SIN $\alpha = 1$)

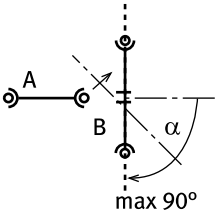
$H = \frac{440^2}{4000x0,028x22} \text{ x } 1 = 78m$

For a maximum twist 30°
sin $\alpha = 0,5$ H=39m

• Example 2: For HD 8 K P. Diam = 16mm. 4 falls
d = 16mm
S = 18 d = 288mm
T = 0,097 (HD 8 P)
Maximum twist 30° (SIN $\alpha = 0,5$)

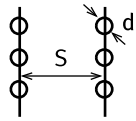
$H = \frac{288^2}{4000x0,097x16} \text{ x } 0,5 = 6,70m$

For a maximum twist 90°
sin $\alpha = 1$ H=13,40m



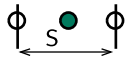
$\alpha = 90°$ Sin $\alpha = 1$
$\alpha = 30°$ Sin $\alpha = 0,5$

Even number of falls



$H = \frac{S^2}{4000\ T.d}$

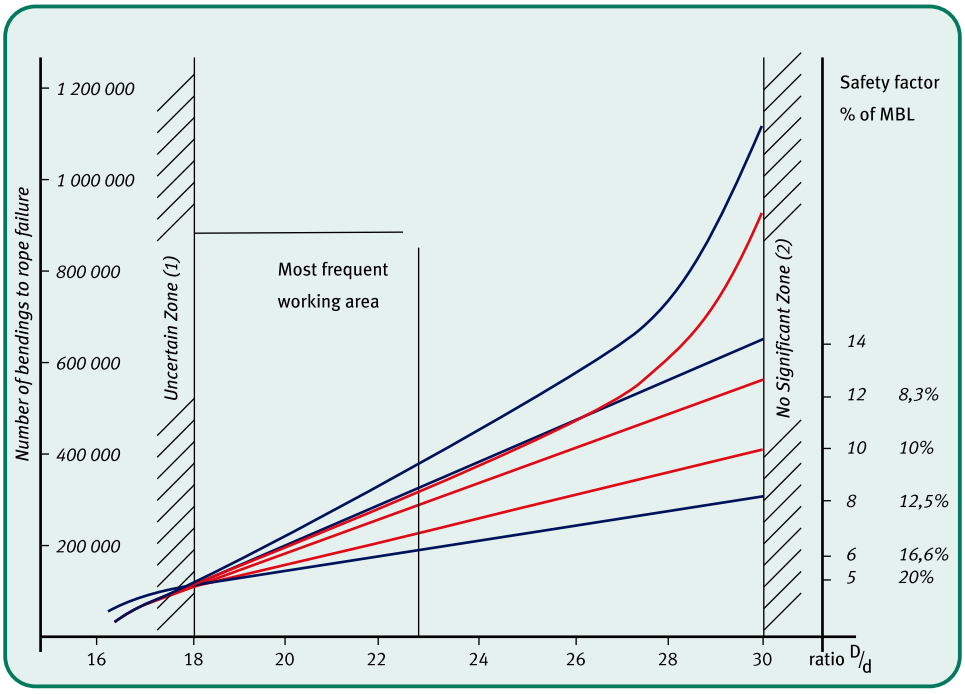
Uneven number of falls



$H = \frac{S^2}{6000\ T.d}$

Rope designer recommendation: Maximum rotation 30° of the sheave block should be considered (Sin $\alpha = 0,5$)

BEND FATIGUE - ENDURANCE



Cumul effect by increasing the D/d ratio and decreasing the apllied load

(1) Ratio $D/d < 18$: Bendings can drop toughly without prevent
(2) Ratio $D/d > 30$: Bending effect becomes less and less significant vs loading

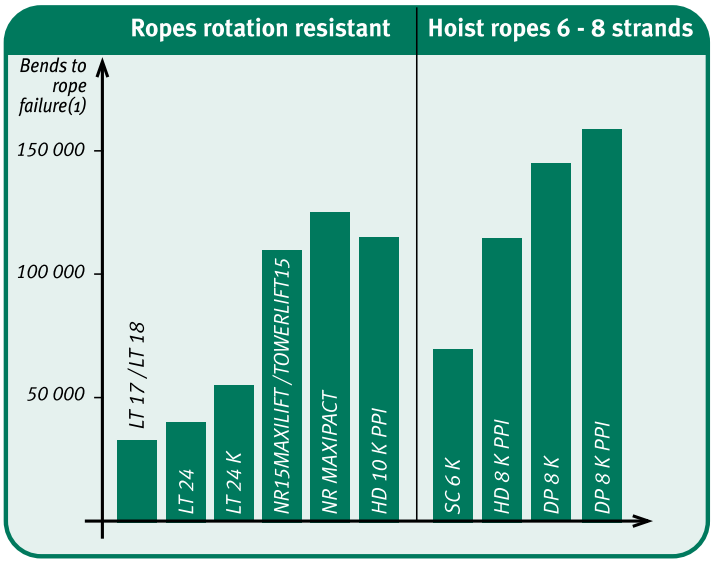
Exemple of the cumul effect by ↗ D/d and ↘ % load

HD 8 K PPI
D/d 18 —— 30
Load 20% – 8%
⇒ 900 000 Bendings

NR Maxipact
D/d 18 —— 30
Load 20% – 7%
⇒ 1 100 000 Bendings

(1)-(2) The contact pressure is the most significant factor in affecting the life of a rope. The most favourable ratio D/d will increase extremely the resistance to the fatigue.

MORE INFORMATION ABOUT RESISTANCE TO FATIGUE



Conditions of testing:

- Fleet angle < 1°30
- D/d = 18/1
- Load: 20% of MBL
- Groove: nom diam. +7%
- Rightly greased
- Ropes: galvanized – 1960 N/mm²
- Metallic grooves

Rope failure means: reaching the discard criterias (1)
Wires: bright-zinc effect: The fatigue charts are quite similar
Rope: greased – not greased: The performance in fatigue can vary from 1 to 3 between a not greased rope and a rightly greased rope.
Lack of maintenance (lack of grease): In case of lack of grease a galvanized rope will perform better than a bright steel rope (the zinc coating creates an auto-lubricant effect) and delates the fretting corrosion effect.
Using plastic grooves can increase the resistance to fatigue by 30% (not applicable for non compacted ropes and high pressure rope / sheave. For example: D/d-18/1 and load 20% MBL as prints of the wires can appear in the grooves).

(1) Rope failure: The gap and discrepancies between the appearance of the discard criteria and the failure. Can vary from 5000 cycles to 30000 cycles, depending on several parameters.

HD 9 K PPI

HD9K (PPI) 9 compacted strands + (1) IWRC (HD = High Density)

	Diameter		Cross section	Weight	MBL kN	
	mm	inch	mm²	kg/m	1960 N/mm²	2160 N/mm²
9 x K 16 W	9		44,8	0,39	75,7	80,4
	10		55,1	0,48	93,0	98,8
	11	7/16	66,7	0,58	112,6	119,6
	12		79,0	0,68	134,4	141,6
9 x K 19 W	12,7	1/2	90,3	0,78	152	162
	13		93,7	0,81	158	168
	14	9/16	107,2	0,93	181	192
	15		124,2	1,07	210	223
	16	5/8	142,3	1,23	240	255
	18		179,0	1,54	302	321
9 x K 26 WS	19	3/4	199,6	1,72	337	358
	20		217,1	1,87	367	389
	22	7/8	265,5	2,29	448	476
	24		313,6	2,71	529	562
	25		342,2	2,95	578	614
	25,4	1	353,7	3,05	597	634
	26		376,1	3,24	635	674
	28		427,7	3,69	722	767
	28,6	1 1/8	450,0	3,88	760	807
	30		489,0	4,22	826	877
	32	1 1/4	559,5	4,83	945	1003
	34		628,7	5,42	1061	1128
	35	1 3/8	667,5	5,76	1127	1197

Tolerance on diam: EN (0; +5%) - Design Oliveira: (+ 1%; + 4%)
Filling Factor (f): 9 x K 16 W = 0,701; 9 x K 19 W = 0,705; 9 x K 26 WS = 0,697
Spinning factor (k): 1960 N/mm² = 0,84; 2160 N/mm² = 0,83
Modulus of elasticity E = 120 000 N/mm² (±5000 N/mm²) - Torque factor: 0,072
(1) Particular: The core strands are closed in the opposite lay than the outer strands, leading the HD9K to have a low torque (lower torque than any 6 or 8 strands) for a better stability of the sheave blocks

- 9 outer compacted strands
- Galvanized
- Regular Lay
- Option (PPI)

SPECIAL APPLICATION: Snow cat, Snow sweeper for the ski slope smoothing

Applications:
- Boom hoist for deck cranes, luffing for mobile and crawler cranes, electric hoists, trolley for container cranes...
- All applications with multireeving systems when rotation resistant ropes aren't required.
- Big height overhead cranes and electric hoists with a minimum of 2 or 3 falls.

Main properties:
- Extremely high MBL
- Good resistance to drum crushing
- Very flexible
- Good resistance to fatigue
- PPI protects the core, increases the structural stability and the service life

PPI: Oliveira Sá process. The PPI operation is applied during the Oliveira Sá process in one continuous operation which guarantees a perfect impregnation and equal stress and tension of all the components.

Option PPI: Recommended for all marine and offshore applications and all the most severe working environmental conditions;

PPI: Protects durably the core and the inner wires and encapsulates the inner lubrication for the life of the rope

Must not be used with a swivel

REGULAR ORDINARY LAY OR LANG's LAY?

Obviously the LANG's LAY closing can bring out more properties and advantages than the respective construction REGULAR ORDINARY LAY.
But it´s a compromise depending mainly on the application

We can use as a guideline:

• Non-rotating ropes:
Due to the possible combination inner/outer strands, the Lang's Lay construction gathers all the main advantages. All the major high tech rope manufacturers propose their non-rotating ropes in Lang's Lay.

• Other constructions (8-9 and 10 strands):
In this case the Langs Lay closing brings out most advantages (fatigue, pressure, winding, flexibility,...) but introduces a higher rotational torque in the rope than the Regular Ordinary Lay.
The compromise can be more or less favourable to one or the other: LANG or REGULAR.

The best compromise can be determined with the crane manufacturer and the designer of the rope.

RIGHT HAND REGULAR LAY ROPE (sZ)

RIGHT HAND LANG's LAY ROPE (zZ)

AGEING

People must be aware that the ageing may alter the MBL of the ropes:

Good storage conditions (packing and protection against big changes in temperature) will maintain the rope properties.
The technology of compacting can be a major factor. Due to the internal stresses, compacting through a multi roll laminating system will be less sensible to ageing than compacting through a die.
High tensile (2160 N/mm²) is more sensible to ageing than lower tensiles (1770 and 1960 N/mm²).
Other factors such as the corrosion can affect the MBL

When gathering the favourable conditions in ageing, the MBL can be reduced from 0 to 4% max.
Unfavourable conditions can reduce the MBL up to 7%-12% in case of compacting through a die, without a permanent control of the temperature (heating of the strands), the ageing effect can decrease considerably the MBL

These figures are indicative only for the aim of preventing the ageing effect.
OLIVEIRA SÁ designers accept a decrease in the MBL up to 4%, using the multiroll compacting system.

BEND FATIGUE ENDURANCE

• Taking in consideration the friction [1] on the drum, the safety factor can be seriously affected at the level of the drum.
As a direct result, the resistance to fatigue can drop severely.

• Other factors than the applied loading and the ratio D/d can affect the service life (page 11).

• The form of the grooves must propose the adequate clearance for the rope (angle, diameter, pitch...).

• REVERSE BENDING [1] effect can decrease the resistance to fatigue on bending by 2 to 10 times the usual indicative figures for single bending.
A permanent distance of less than 10-12 lay lengths between the two respective tangential contact points can be considered as critical.

[1] Due to several different actual parameters in the application, the Designer recommends a specific survey of the considered equipment.

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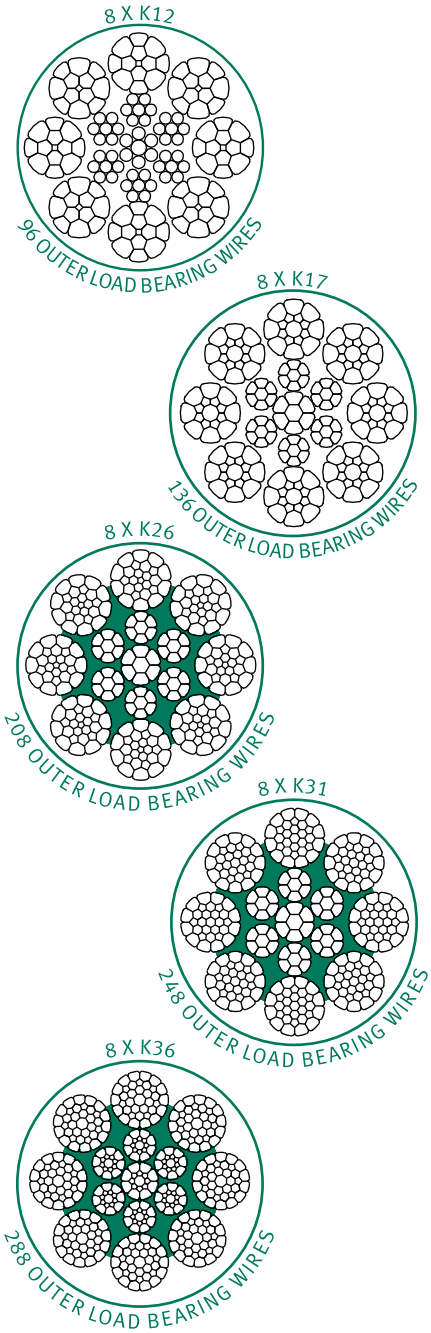
HD 8 K PPI

8 Strands Compacted + IWRC (HD = High Density)

	Diameter		Cross Section	Weight	MBL kN		
	mm	inch	mm²	kg/m	1960 N/mm²	2160 N/mm²	1960 N/mm²
8xK12W+IWRC	8		33	0.29		58.0	
	9		42	0.36		73.6	Lang's Lay (1)
	10		53	0.45		92.4	
	11	7/16	64	0.55		112	
8xK17S+IWRC	12		75	0.65	125	131	121
	13	1/2	90	0.77	150	157	143
	14	9/16	103	0.89	172	180	167
	15		120	1.03	200	210	191
	16	5/8	134	1.16	224	234	214
8xK26WS+IWRC	18		172	1.49	287	300	275
	19	3/4	191	1.65	318	334	304
	20		214	1.85	358	375	342
	22	7/8	257	2.23	430	451	406
	24		308	2.66	513	538	491
	26	1	359	3,10	600	629	571
	28	1 1/8	415	3.58	692	725	660
8xK31WS+IWRC	30		479	4.16	800	859	764
	32	1 1/4	549	4.75	916	961	868
	34	1 3/8	620	5.38	1035	1086	987
	36		689	5.95	1149	1205	1104
	38	1 1/2	771	6.66	1286	1349	1235
	40		852	7.36	1421	1480	1360
	42	1 5/8	938	8,12	1564	1640	1488
8xK36WS+IWRC	44	1 3/4	1031	8.92	1721		1685
	46		1133	9.80	1891		1834
	48	1 7/8	1222	10.57	2040		1997
	50	2	1327	11.51	2214		2178
	52		1440	12.53	2404		2344
	54	2 1/8	1565	13.51	2611		2536
	56		1667	14.42	2781		2727
	58	2 1/4	1794	15.52	2993		2925
	60	2 3/8	1920	16.61	3203		3119



Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 8xK12 =0,664; 8xK17=0,670; 8xK26=0,677; 8xK31=0,679; 8xK36=0,679
Spinning Factor (k): 1960 N/mm² = 0,830; 2160 N/mm²= 0,810
Modulus of elasticity: E = 115000 N/mm² (± 5000 N/mm²)

(1) For pure technical reasons, the HD8K Lang's lay are proposed with a conventional core (core with no compacted strands)

Applications:

When rotation resistant ropes are not required (twin hoist systems with right and left ropes, small heights, ...).
Hoist for steel mill cranes, container cranes, floating cranes and boom hoist for deck cranes, luffing and mobile cranes, grab cranes...

- 8 outer compacted strands
- Galvanized
- Regular or lang's lay
- Plastic Protected Impregnated core (PPI)

- High MBL
- Resistant against drum crushing
- Flexible
- Protected core
- The Plastic Impregnation increases the structural stability

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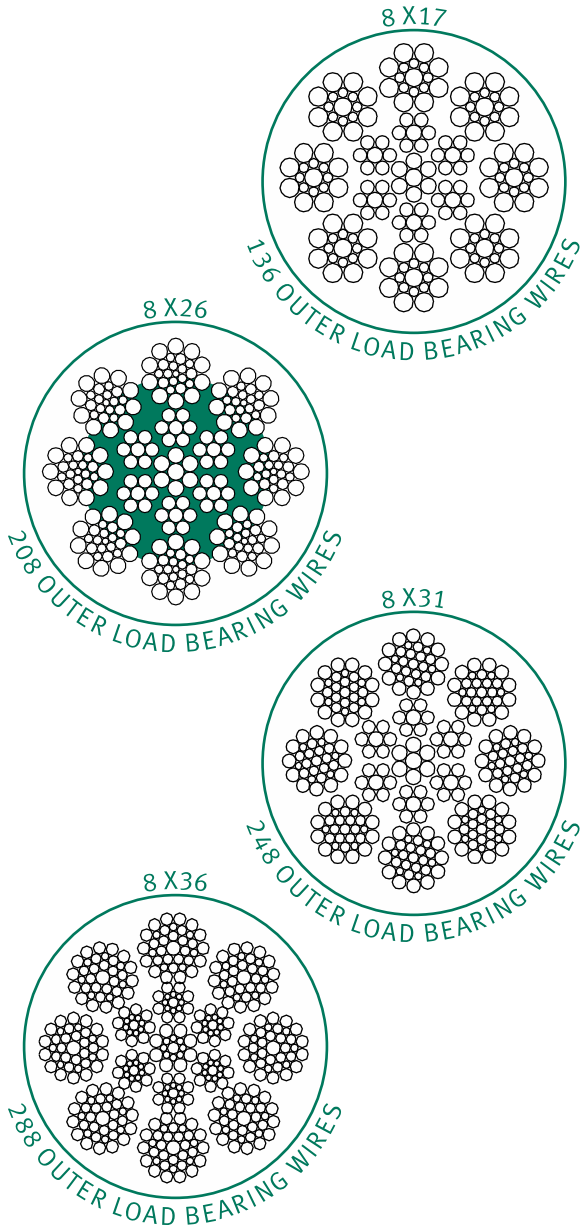
SC 8 (Not compacted - Option PPI)

8 Strands + IWRC (SC=Steel Core)

	Diameter		Cross Section	Weight	MBL kN
	mm	inch	mm²	kg/m	1960 N/mm²
8x17S+IWRC	8	5/16	30	0.26	49.4
	9		38	0.33	62.5
	10		46	0.40	76.4
	11	7/16	57	0.49	94.3
	12		69	0.59	113
	13	1/2	81	0.69	133
	14	9/16	92	0.79	152
	15		108	0.92	178
	16	5/8	121	1.03	199
8x26WS+IWRC	18		157	1.34	259
	19	3/4	173	1.48	285
	20		190	1.63	313
	22	7/8	233	2.00	384
	24		275	2.36	453
	26		326	2.79	538
	28	1 3/8	378	3.23	622
8x31WS+IWRC	30		438	3.74	722
	32	1 1/4	497	4.24	818
	34	1 3/8	558	4.76	919
	36		627	5.35	1033
	38	1 1/2	699	5.97	1152
	40		770	6.57	1269
	42	1 5/8	856	7.31	1411
	44	1 3/4	941	8.03	1550
8x36WS+IWRC	46		1040	8.88	1713
	48	1 7/8	1134	9.68	1869
	50	2	1244	10.60	2051
	52		1344	11.45	2216
	54	2 1/8	1458	12.42	2403
	56		1567	13.34	2583
	58	2 1/4	1683	14.33	2773
	60	2 3/8	1778	15.14	2930
	62		1904	16.21	3137

Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 8x17=0,602; 8x26=0,611; 8x31=0,617; 8x36=0,633
Spinning Factor (k): 1960 N/mm² = 0,820;
Modulus of elasticity: E = 110000 N/mm² (± 5000 N/mm²)

- 8 outer conventional strands
- Independant steel core
- Regular lay (Lang's lay)
- Galvanized wires
- Option: PPI (Plastic Protected Impregnated core)



- Very flexible
- Long service life
- Traditional and improved service when compared to the 6 strands

Option PPI:

- Gives to all the components an homogeneous behaviour
- Improves the structural stability and the service life

Applications:

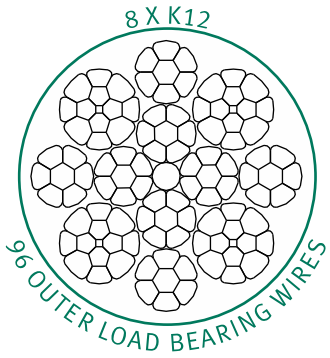
Can be used for all applications as the HD 8 K PPI when a very high MBL is not required.
Can be used for flexible slings.

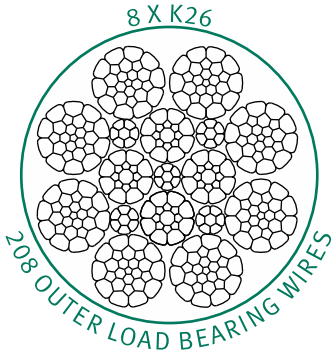
DP 8 K - DP 10 K

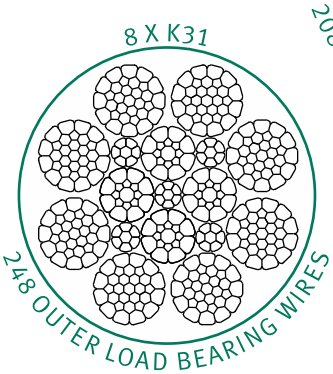
8 Strands Double Parallel (DP)

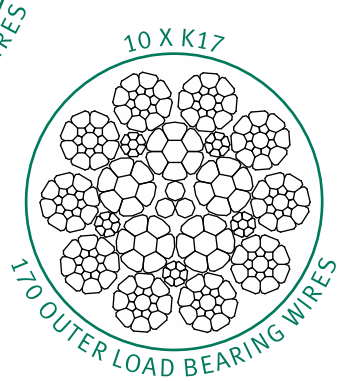
	Diameter		Cross Section	Weight	MBL kN
	mm	inch	mm²	kg/m	2160 N/mm²
8xK12W+CWP	6.4	1/4	22	0.19	41.4
	7		27.8	0.24	51.6
	7.2		29	0.25	53.2
	8	5/16	35	0.30	64.1
	9		44	0.38	82.3
8xK17S+CWP	10		55	0.47	102
	11	7/16	67	0.57	123
	12		79	0.68	147
	13	1/2	95	0.81	176
	14	9/16	109	0.94	203
	15		127	1.09	237
	16	5/8	143	1.22	265
8xK26WS+CWP	18		180	1.54	335
	19	3/4	202	1.73	376
	20		221	1.90	411
	22	7/8	270	2.31	500
	24		326	2.79	606
	26	1	377	3.23	701
	28	1 1/8	436	3.73	810
8xK31WS+CWP	30		508	4.34	943
	32	1 1/4	574	4.91	1066
	34	1 3/8	657	5.61	1220
	36		731	6.24	1358
	38	1 1/2	820	7.03	1524

Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 8xK12=0,700; 8xK17=0,719; 8xK26=0,710; 8xK31=0,720
Spinning Factor (k): 2160 N/mm² = 0,840
Modulus of elasticity: E = 125000 N/mm² (±5000 N/mm²)









DP 10 K

10 Strands Double Parallel (DP)

	Diameter		Cross Section	Weight	MBL kN
	mm	inch	mm²	kg/m	2160 N/mm²
10xK17	14	9/16	116	0.98	214,5
	16	5/8	151	1,29	279,9

Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor f = 0,751
Spinning Factor (k): k = 0,840
Modulus of elasticity: E = 125000 N/mm² (±5000 N/mm²)

- 8/10 outer strands closed in a parallel lay together with the inner core strands
- Regular lay
- Galvanized wires
- All compacted strands

- Extremely high breaking load
- Fitted for multilayer spooling and multipart reeving thanks to its very high grade of flexibility.
- Cannot be used when a fleet angle is ›1°30
- High modulus of elasticity, low stretch

Main applications:

When an extremely high MBL is required for a multipart reeving hoist system: electric hoists, twin hoist systems (right and left ropes), boom hoist and pendant rope for mobile cranes, tower cranes and all marine equipments

"Attention"

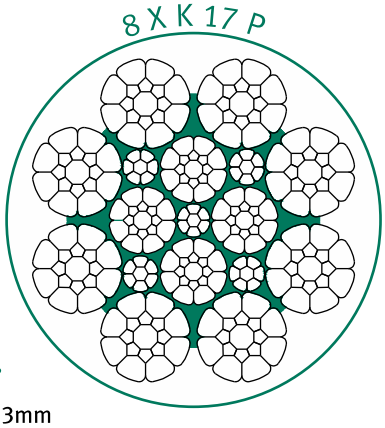
Due to its particular full unilay parallel closing (outer/inner strands), this rope is very sensible to the rotation and fleet angle.

Cannot be used for big lifting heights, unguided loads, short number of falls,...

DP 8 K must never be used with a swivel.

DP 8 K PPI

Similar to the DP 8 K with an internal Plastic Protection Impregnation (same steel contruction).
The internal Plastic Impregnation offers an homogeneous behaviour to all the components.
The DP 8 K PPI gathers all the properties of the DP 8 K, and sharply eliminates its weaknesses, so it is less sensible to the fleet angle effect.
The Plastic Impregnation of the core encapsulates the grease for life, and, the DP 8 K PPI performs particularly in long periods of service for the hoist devices: Boom and pendant ropes, multifall hoist systems,...



DP 8 K PPI:

Available from 13mm

NEW TECHNOLOGIES FOR HIGH TECH ROPES

The additional equipment and technologies allow OLIVEIRA SÁ reaching the highest level in regularity, quality and performance.

Compacting

OLIVEIRA SÁ is using the most improved and updated technology in the world (multiroll system) for compacting the strands, resulting in:
- Perfect control of the calibration and of the cross section
- No outer surface wearing and injuring
- No peel-off of the zinc coating
- No damage of the inner wires, thanks to the gradual lamination
- All these properties lead the ropes to the highest performance and resistance to fatigue, when compared with the other usual compacting technologies.

PPI - Plastic Protected Impregnation

As a synthetic rope manufacturer starting its production from the granulates, Oliveira Sá has a strong and deep know-how of plastic and its applications.
Oliveira Sá has developed its own plastic impregnation technology through an unique continuous process operation, resulting in an optimal efficiency.
Oliveira Sá can adapt the type of the plastic composition, depending on the type of the applications of the rope and the conditions in service.

SOME EXPLANATIONS ABOUT THE MBL

d = nominal rope diameter (mm)
d' = actual diameter = nominal diameter + tolerance
S = cross section of the rope – mettalic area (mm^2)
T = nominal tensile of the wires (1960 or 2160 N/mm^2)
k = spinning factor
f = filling factor
MBL= Minimum Breaking Load. It is calculated using the formula: MBL = T x S x k
Theoretical MBL = Aggregate BL = Totalized BL: T x S
Actual BL (or effective BL) is the breaking load that results from a breaking test. It must be higher than the MBL, but a tolerance of -3% can be accepted, considering the test efficiency.

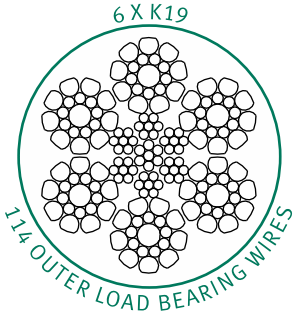
1) Wires tensile: The tensile strength is a classification: 1770, 1960 or 2160 N/mm^2. All the wires are supplied with a tolerance of (0 + 250 N/mm^2) or (0 + 350 N/mm^2), resulting in an actual average tensile higher than the nominal. For example: T = 1960 N/mm^2 can be supplied as an actual T = 1980/2150 N/mm^2 (as an example).
2) The metallic area is the result of the total area of all the cross sections of the individual wires.
3) k: The spinning factor is determined by the designer. It is used to calculate the MBL. It can differ from one company to the other.
4) f: The filling factor is the ratio between the cross section of the wires and the full cross section based on the overall diameter.

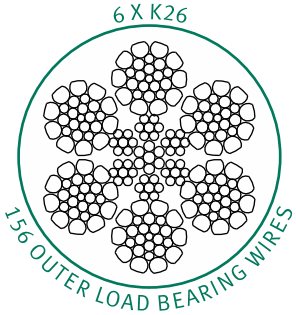
SC 6 K

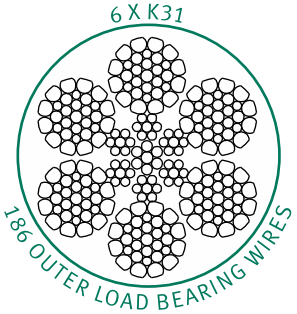
6 Strands Compacted + IWRC (SC=Steel Core)

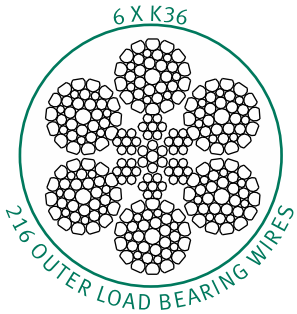
	Diameter		Cross Section	Weight	MBL kN
	mm	inch	mm²	kg/m	1960 N/mm²
6xK19S+IWRC	10		52	0.44	87.7
	11	7/16	64	0.54	107
	12		75	0.64	126
	13	1/2	89	0.76	150
6xK26WS+IWRC	14	9/16	103	0.87	169
	15		116	0.98	191
	16	5/8	133	1.12	219
	17		152	1.29	251
	18		168	1.42	277
	19	3/4	189	1.60	311
6xK31WS+IWRC	20		209	1.77	345
	22	7/8	254	2.15	419
	24		306	2.59	504
	26	1	363	3.08	598
	28	1 1/8	414	3.50	682
6xK36WS+IWRC	30		477	4.05	786
	32	1 1/4	541	4.59	891
	34	1 3/8	614	5.21	1012
	36		687	5.83	1132
	38	1 1/2	765	6.50	1261
	40		850	7.22	1402
	42	1 5/8	928	7.88	1530
	44	1 3/4	1032	8.77	1701
	46		1121	9.52	1847
	48	1 7/8	1221	10.37	2012
	50	2	1322	11.23	2179
	52		1434	12.18	2364

Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 6xK19 =0,665; 6xK26=0,667; 6xK31=0,673; 6xK36=0,675
Spinning Factor (k): 1960 N/mm² = 0,820
Modulus of elasticity: E = 100000 N/mm² (± 5000 N/mm²)









- 6 outer compacted strands
- Independent steel strands core
- Regular lay
- Galvanized wires
- High MBL
- Good service life
- Available in 2160 N/mm² on request

Main applications:

- Can be used for all hoist and pulling applications when a higher MBL instead of 6 strands conventional ropes is required
- Manufacturing of slings with a high MBL
- Mainly used for logging (wood forest industry).

"Attention"

Due to the very high contact pressure of the 6 strands in the grooves of the sheaves, this construction cannot be recommended for all the performant hoist devices and mainly when a reliable long service life is required, or an intensive use.

CONVERSION TABLE

LENGHT	inch	(in)	= 25,4	millimeter	mm	= 0,03937 in
	foot	(ft)	= 30,48	centimeter	cm	= 0,03281 ft
	yard	(yd)	= 0,9144	meter	mm	= 1,0936 yd
	statute mile		= 1,6093	kilometer	km	= 0,6213 mile
AREA	square inch	(in)²	= 645,16	square mm	mm²	= 0,00155 in²
	square foot	(ft)²	= 0,0929	square meter	m²	= 10,76 ft²
WEIGHT	ounce	(oz)	= 28,35	gramme	g	= 0,03527 oz
	pound	(lb)	= 0,4536	kilogramme	kg	= 2,205 lbs
	ton (long)		= 1,016	metric ton	mto	= 0,9842 long t
	ton (short)		= 0,9074	metric ton	mto	= 1,102 short t
WEIGHT/LENGHT	pound/foot	(lb/ft)	= 1,488	kilogr./meter	kg/m	= 0,672 lb/ft
VOLUME	cubic inch	(in)³	= 16,39	cubic centimeter	cm³	= 0,061 in³
	cubic foot	(ft)³	= 0,02832	cubic meter	m³	= 35,311 ft³
	US gallon	(gal)	= 3,7855	cubic decimeter	dm³	= 0,2642 gal
PRESSURE	pound/ sq. inch	(lb/in)²	= 0,00689	Newton/ sq. mm	N/mm²	= 145,04 psi
	pound/ sq. inch	(lb/in)²	= 0,06894	bar	bar	= 14,504 psi

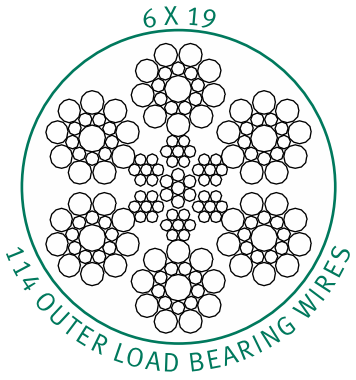
GENERAL PURPOSE 6 STRANDS ROPES

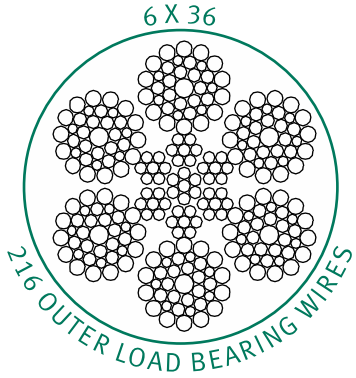
6 Strands + IWRC

	Diameter		Cross Section	Weight	MBL kN
	mm	inch	mm²	kg/m	1960 N/mm²
6x19S+IWRC	6		17	0.15	26.0
	7		23	0.20	35.9
	8	5/16	30	0.26	46.9
	9		38	0.33	58.4
	10		47	0.41	73.5
	11	7/16	58	0.51	91.0
	12		67	0.58	104
	13	1/2	82	0.71	127
	14	9/16	93	0.80	144
	15		108	0.94	168
6x36WS+IWRC	16	5/8	124	1.07	188
	18		158	1.36	239
	20		188	1.61	285
	22	7/8	223	1.92	338
	24		265	2.28	402
	26	1	324	2.78	491
	28	1 1/8	374	3.21	567
	30		418	3.59	634
	32	1 1/4	475	4.08	720
	34	1 3/8	558	4.80	847
	36		612	5.26	929
	38	1 1/2	682	5.86	1034
	40		751	6.46	1140
	42	1 5/8	850	7.30	1289
	44	1 3/4	894	7.68	1356
	46		1031	8.86	1564
	48	1 7/8	1079	9.28	1637
	50	2	1196	10.28	1815
	52		1288	11.07	1954
	54	2 1/8	1388	11.93	2105
	56		1490	12.80	2260
	58	2 1/4	1617	13.90	2453
	60	2 3/8	1727	14.84	2619
	62		1821	15.65	2762
	64	2 1/2	1981	17.03	3005

Tolerance on Diameter: actual EN: (0; +5%) ; Design Oliveira: (+1%; +4%)
Filling factor (f): 6x19S = o,603; 6x36WS = 0,604
Spinning Factor (k): 6x19S = 0,793; 6x36WS = 0,774
Modulus of elasticity: E = 125000 N/mm² (± 5000 N/mm²)

Class 6x36: Depending on the diameter and the application, the ropes can be proposed with different outer strand construction: 26, 31 or 36 wires WS.





6x19S+IWRC; 6x36WS+IWRC

- 6 outer conventional strands
- Independent steel wire core
- Regular lay (Lang's lay on request)
- Galvanized wires

Main applications:

- Manufacturing of slings

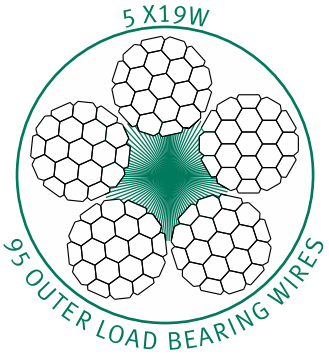
Others:
- 6x19: trolley ropes for tower cranes
- 6x36: All standard hoist and pulling applications, when no high performance is required.

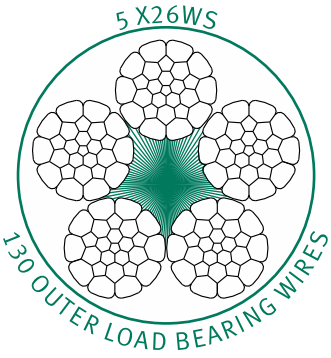
LP 5

5 strands + high density PP core
Regular lay – Galvanized. Calibrated strands

	Diam mm	Cross Section mm²	Weight kg/m	MBL kN 1960 N/mm²	MBL kN 2160 N/mm²
5x12W	6*	18.1	0.15	30.2	
5x19W	8.3	29.9	0,27		54.3
	9.5	38.1	0.34		69.1
	10.2	43.1	0.38		78.2
5x26WS	11.5	55.6	0.49	93.9	
	14	87.0	0.77		158
5x31WS	16.3	111.3	0.99	188	

Tolerance on Diameter: EN: (0; +5%) ; Design Oliveira: (+1%; +3%)
Filling factor (f): 5x19W =0,539; 5x26WS=0,550; 5x31WS=0,533;
Spinning Factor k = 0,840
Modulus of elasticity: E = 100000 N/mm² (± 5000 N/mm²)
*Diam 6mm with DP steel core





Main applications:

- Suspended gondolas and platforms
- Jaw pulling device
- Overhead cranes and electric hoists
- Wind mill hoists and forest winches

LP5 replaces all the old constructions with 4 and 6 strands for the same application.
LP5 is featured for the transport of people.

SOME CONSIDERATIONS ABOUT CONSTRUCTION AND FLEXIBILITY

More Flexible		Less Flexible
Bigger number of strands	(1)	Smaller number of strands
Smaller size of the outer wires	(2)	Bigger size of the outer wires
Warrington construction for the core (4+4.4)	(3)	Conventional core (1+6)
Homogeneous diameter of the wires	(4)	Big discrepancies in the wire diameter
Lang's lay	(5)	Regular Lay
Shorter lay length: Stranding and closing	(6)	Longer lay length: Stranding and closing

Resulting in:

More Flexible		Less Flexible
More fragile in service	(1)	Resistant to crushing
Sensible to wearing	(2)	Resistant to wearing
More mechanical: more points of contact between inner/outer strands	(3)	The core can break easier under high contact pressure
Better behaviour of each component	(4)	Smaller wires can brake prematurely
Depends on the application	(5)	Depends on the application
Designer belonging	(6)	Designer belonging

The flexibility of the rope depends more on its structural construction than on its sole number of wires of the outer strands.

CORDOARIA
OLIVEIRA SÁ

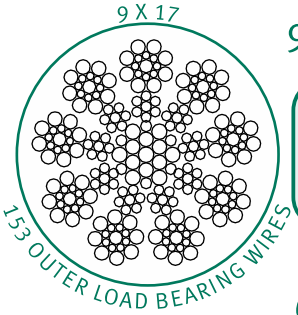
ENNELIFT

High performance hoist traction elevator rope

9x17S+IWRC

Diameter mm	Diameter inch	Cross Section mm²	Weight kg/m	MBL kN 1370/1770 N/mm²
8	5/16	31	0.27	40.4
9		39	0.34	51.2
10		49	0.42	62.8
11	7/16	60	0.51	76.8
12		71	0.61	92.0
13	1/2	83	0.71	107
14	9/16	96	0.82	124
15		113	0.96	145
16	5/8	126	1.08	163
18		161	1.37	207
19	3/4	179	1.53	231

Tolerance on Diameter:
Ø ≤ 10mm - Loaded 10% MBL min +0% - Unloaded +3%
Ø › 10mm - Loaded 10% MBL max +0% - Unloaded +2%

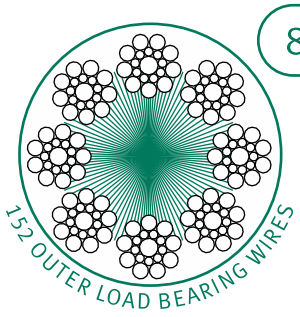


9X17S+IWRC

Ungalvanized
Right hand ordinary lay
Dual tensile 1370/1770 N/mm²

Option: PPI

- Plastic Protected Impregnated core
- Encapsulated grease for life
- Plastic cushion decreases the contact pressure between internal components
- Total protection of the core
- Homogeneous behaviour increases the structural stability

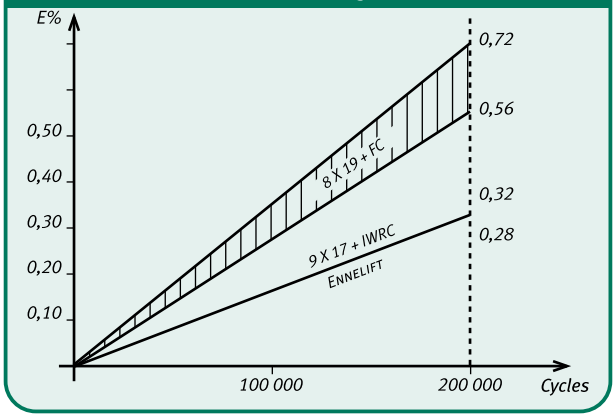


8x19S+FC (Sisal core)

Ungalvanized
Dual tensile 1370/1770 N/mm²
Right hand regular lay
Natural fibre core

Nom. Diameter mm	Nom. Diameter inch	Cross Section mm²	Weight kg/m	MBL kN
8	5/16	23	0.22	29
9		30	0.29	38
10		36	0.34	45
11	7/16	44	0.41	55
12		53	0.50	67
13	1/2	61	0.58	77
14		72	0.68	91
16	5/8	93	0.88	117

Permanent Elongation

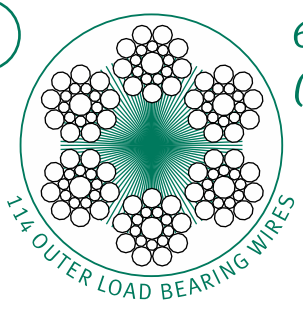


Testing according to the standard for elevators.

Tolerance on Diameter:
Ø ≤ 10mm - Loaded 10% MBL min +0% - Unloaded +3%
Ø › 10mm - Loaded 10% MBL max +0% - Unloaded +2%

Regulator / Governor rope

Diam. mm	Weight kg/m	MBL kN
6,0	0,12	21,5
6,3	0,13	24,0
7,0	0,16	28,0



6x19S+FC (polypropylene core)

Galvanized
1960 N/mm²
Right hand regular lay
Tolerance on diameter:
+0%; +5% (unloaded)

Traction elevator ropes: other constructions 8x19 + mixte core; 8x19 + steel core available on request

WHICH ROPE FOR EACH APPLICATION

Type of crane	Application of the rope	NR MAXIPACT (P)	LT 24 K (P)	NR 15 MAXILIFT TOWERLIFT 15	LT 17/18		HD 10 K (P)		HD 8 K (P)	SC 8 (P)	DP 8 K (P)		SC 6 K	LP5
Tower crane Self erecting crane High anchored tower crane	Hoist	x	x	x	x									
	Trolley									x			x	
	Boom, Pendant, Luffing								x		x			
	Balancing		x						x		x			
Telescopic mobile crane	Hoist	x		x										
Deck crane	Hoist	x		x										
Container crane	Hoist			x			x		x					
	Trolley								x	x				
Cable/Travelling crane	Hoist						x	→	x	x				
	Trolley						x		x					
Floating crane	Hoist	x	x	x										
Offshore crane	Hoist	x	x	x										
Electric hoist	Hoist		x		x		x	→	x		x	←		x
Steel mill crane	Hoist													
Suspended gondolas														x
Pulling jaw divice														x
Dragline	Hoist, Boom hoist, Drag rope						x		x	x				
Groomer	Winch rope						x		x				x	x
Drilling crane Fundation crane (1)	Hoist	x		x				→	x			→	x	
Scraper	Dump, Boom, Drag rope						x		x					
Floating grap crane	Hoist, Closing, Holding						x		x					
Lattice boom crane	Hoist	x	x	x	x									
Harbour mobile crane	Hoist	x		x										
Shovel	Hoist						x		x					
All cranes	Luffing, Pendant,		x				x		x		x		x	
	Boom hoist		x				x		x		x		x	

(P): PPI - Plastic Impregnation as a standard or as an option.

(1): PPI option highly recommanded

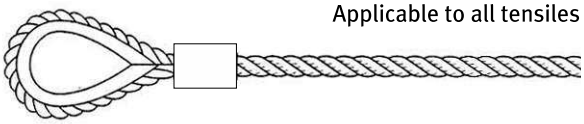
(→) Complement of request on the applications: If non-rotating rope is not required, or twin hoist with right and left hand ropes.

This table is indicative only and can indicate several kinds of ropes for one application. You can contact our technical team for your crane applications.

ROPE END TERMINATIONS

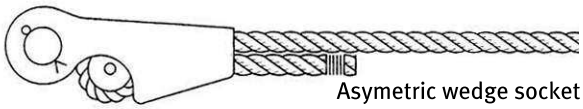
Fixed

Open socket filled with synthetic resin or white metal
Efficiency % MBL of rope: 97% - 100%
Applicable to all tensiles



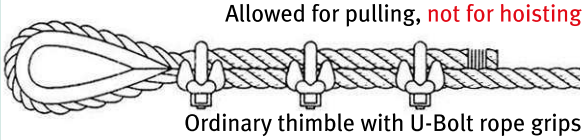
Ordinary thimble fitted with ferrule
Efficiency with aluminium ferrule % MBL of rope: 90%
Not applicable for tensiles ≥2160 N/mm² (EN. 13411)

Detachable



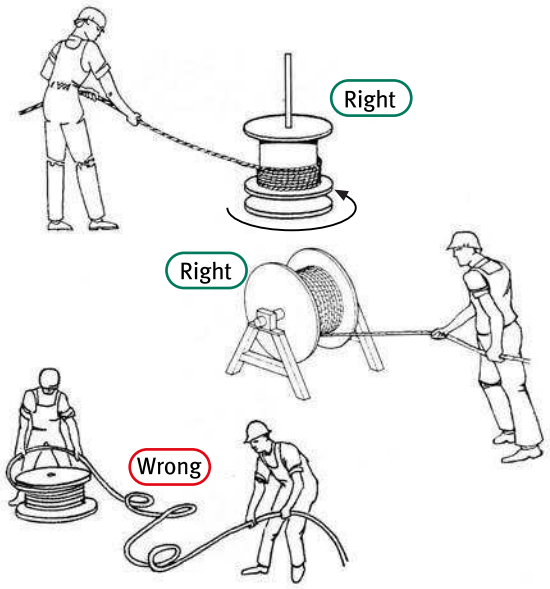
Asymetric wedge socket
Efficiency % MBL of rope 80 - 95%
Applicable to all tensiles

Allowed for pulling, not for hoisting



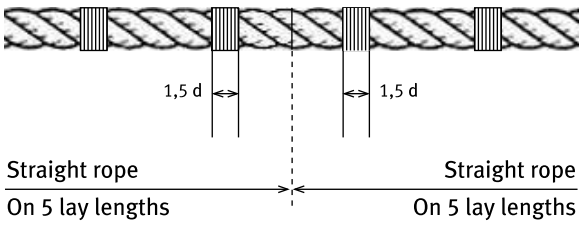
Ordinary thimble with U-Bolt rope grips
Efficiency % MBL of rope 80 - 95%
(not covered by EN 13411-5)

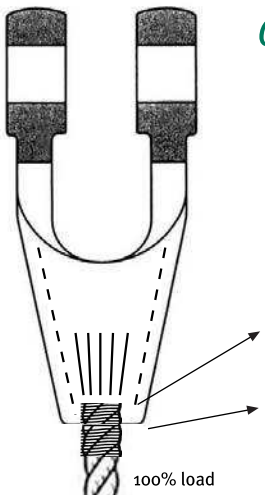
Efficiency depends on the following main factors:
- The nominal tensile of the wires (1770; 1960; 2160 N/mm²)
- The right size fitting for the right size rope and operating in the professional rules of the art.
- The torsional stability of the rope



Unwinding and Cutting of a rope:

- The rope must be correctly unwound.
- The rope must be straight on each side of the cut. (minimum 5 lay lengths on each side of the cut).
- Electric cut: to apply proportional alternative twist and pull.
- Cutting with abrasive disc: to apply a double seizing on each side of the rope.





Open Socket:

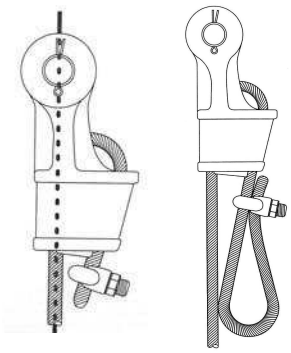
- Some surface wires must remain visible as a witness (no slipping).
- Recommended: 50% of the wires bended as to increase the wire brush volume for a more efficient pressure – cone effect.

Full pouring till the seizing of the rope

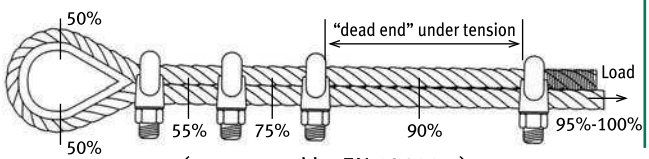
Penetration of the seizing in the socket (min. : 0,5 rope diam).

Asymetric Wedge Socket:

- Right way to operate

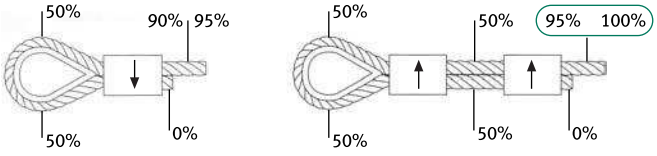


Ordinary thimble / U-Bolt rope grip:



(not covered by EN 13411-5)

Pressed aluminium Ferrule:



Efficiency / MBL of the rope
- For turn - back eyes, the designer recommends the use of a thimble (ordinary or solid thimble).

DISCARD CRITERIA (broken wires) ISO 4309

Guidance for the number of broken wires in round strands working is steel sheaves

Number of load bearing wires in all outer strands of a rope	Number of visible broken wires related to the fatigue of the rope in a crane which gives rise to rejection							
	Classification groups for M1, M2, M3 and M4 mechanisms				Classification groups for M5, M6, M7 and M8 mechanisms			
	Ordinary over a length of		Langs over a length of		Ordinary over a length of		Langs over a length of	
	6d	30d	6d	30d	6d	30d	6d	30d
n < 50	2	4	1	2	4	8	2	4
51 < n < 75	3	6	2	3	6	12	3	6
76 < n < 100	4	8	2	4	8	16	4	8
101 < n < 120	5	10	2	5	10	19	5	10
121 < n < 140	6	11	3	6	11	22	6	11
141 < n < 160	6	13	3	6	13	26	6	13
161 < n < 180	7	14	4	7	14	29	7	14
181 < n < 200	8	16	4	8	16	32	8	16
201 < n < 220	9	18	4	9	18	38	9	18
221 < n < 240	10	19	5	10	19	38	10	19
241 < n < 260	10	21	5	10	21	42	10	21
261 < n < 280	11	22	6	11	22	45	11	22
281 < n < 300	12	24	6	12	24	48	12	24
300 < n[2)]	0,04n	0,08n	0,02n	0,04n	0,08n	0,16n	0,04n	0,08n

(Page 8 of ISO 4309: 2004)

RIGHT HAND REGULAR LAY ROPE (sZ)

RIGHT HAND LANG's LAY ROPE (zZ)

Warning:

- Outer broken wires due to fatigue can occur after a certain period of usage. The number of breaks will increase at more shortening intervals.
- Fracture of a strand: If a complete strand fracture occurs the rope should be discarded.

(1) Reduction in diameter of the rope: The standard accepts a maximum of 7% in reduction of diameter for round wire ropes. The designer accepts a maximum of 4% in reduction of diameter for compacted wire ropes, and 5% for round wire ropes.

(2) Internal inspection by opening outer strands. The design for the Plastic Impregnated Cores (Extrusion through a hot process) results in a core protection against the corrosion (grease internally encapsulated for life).

Other determinant discard criteria:

- Local reduction in diameter resulting from core deterioration.
- Decrease in diameter (1) due to excess of wear.
- Severe external corrosion
- Internal corrosion (2) detected by means of a specific inspection.
- Other usual signs: wires protrusion; flattened portions; kinks of tightened loops; sharp angular bend; basket (birdcage) or lantern deformations.

Maintenance:

Checking care with a permanent greasing or oiling, compatible with the original lubricant, particularly on those lengths which bend when passing over pulleys.

To be seriously considered: a correct maintenance will increase the service life and will prevent from premature internal corrosion.

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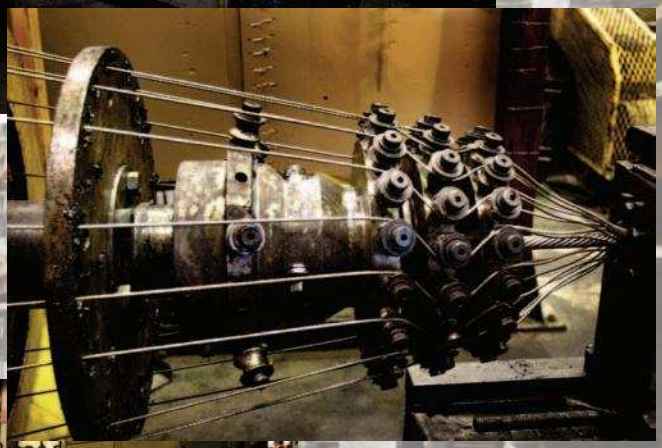

These last 5 years have led Oliveira Sá to be homolated by several of the most known big OEM's (crane manufacturers) in the world.

References to specifications and standards in this catalogue are only intended to show a general compliance and must not be interpreted as meeting all terms of a purchase or contract. All the information and technical characteristics contained in this catalogue are strictly indicative. OLIVEIRA SÁ reserves the right to change product design, materials and specifications without any prior notification.

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Head Quarters - Main Factory: (steel wire ropes)
Oliveira Sá
R. do Outeiro, 906, 4475-150 Gemunde - Portugal
Tel: + 351 229 434 900 I Fax: + 351 229 434 949
Email: cos.maia@oliveirasa.pt I www.oliveirasa.com

Agent / Distributor:

Cat. 31/10/02 replaces 31/08/01