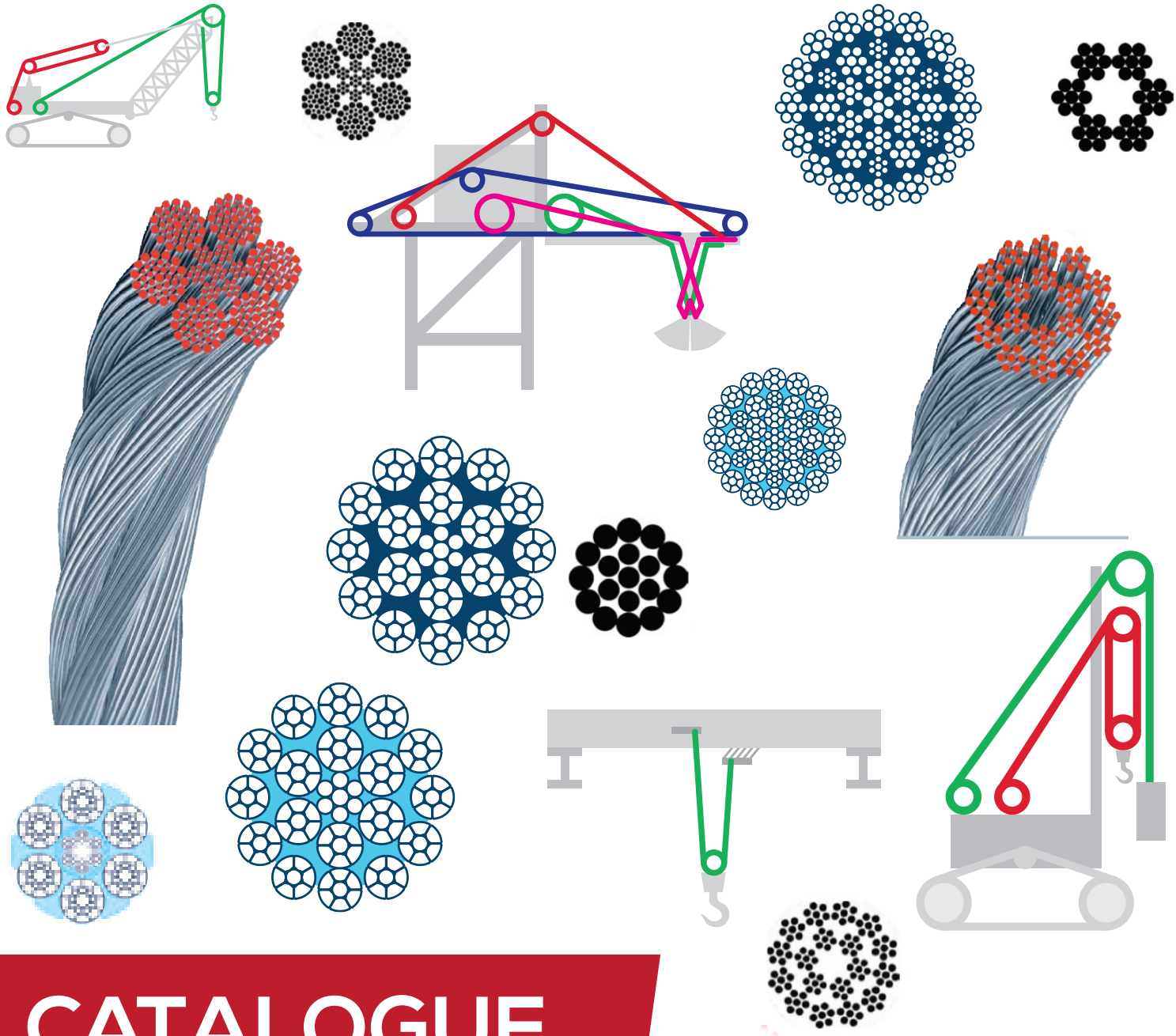
MIFA
EQUIPEMENT



CATALOGUE

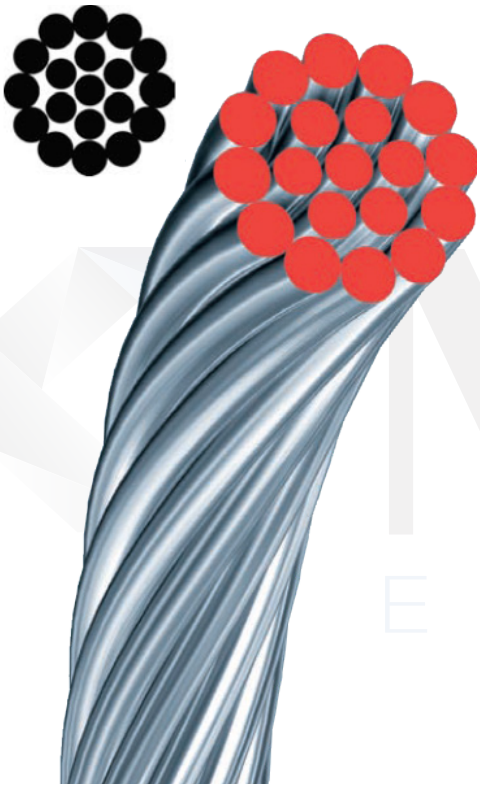
CÂBLES EN ACIER

SOMMAIRE

CÂBLES EN ACIER 1X7+0 DIN: 3052

DIAM. CABLE	DIAM. FILS.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL
MM.	MM	MM²	KGS/MT	1770 N/MM² KN	1770 N/MM² KG.
1	0,34	0,5	0,00502	0,963	98,6
1,5	0,5	1,5	0,0113	2,17	221
2	0,65	2,5	0,0201	3,85	392
2,5	0,85	4	0,0314	6,02	613
3	0,98	5	0,0452	8,67	882
3,5	1,15	7,5	0,0615	11,8	1.206
4	1,32	10	0,0803	15,4	1.570
4,5	1,5	12,5	0,102	19,5	1.980
5	1,65	15	0,126	24,1	2.450
6	1,98	22	0,181	37,4	3.530
7	2,28	29	0,246	47,2	4.800
8	2,61	38	0,321	61,7	6.270
9	2,94	48	0,407	78	7.940
10	3,26	59	0,502	96,3	9.800
11	3,59	72	0,607	116,5	11.900
12	3,92	86	0,723	139	14.100
13	4,24	101	0,849	163	16.600
14	4,57	117	0,984	189	19.200
15	4,9	134	1,13	217	22.100
16	5,22	153	1,29	247	25.100

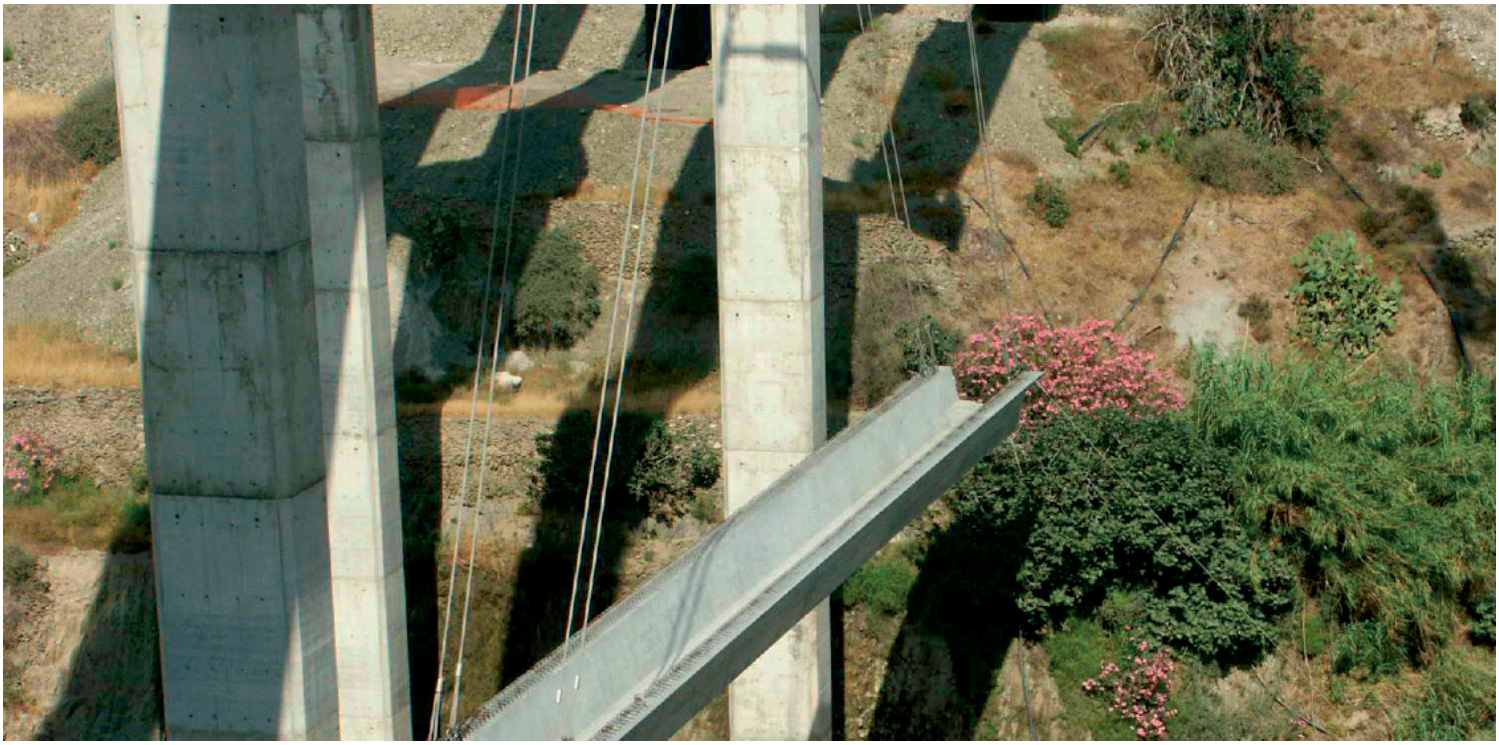
CÂBLES EN ACIER 1X19+0 DIN: 3053



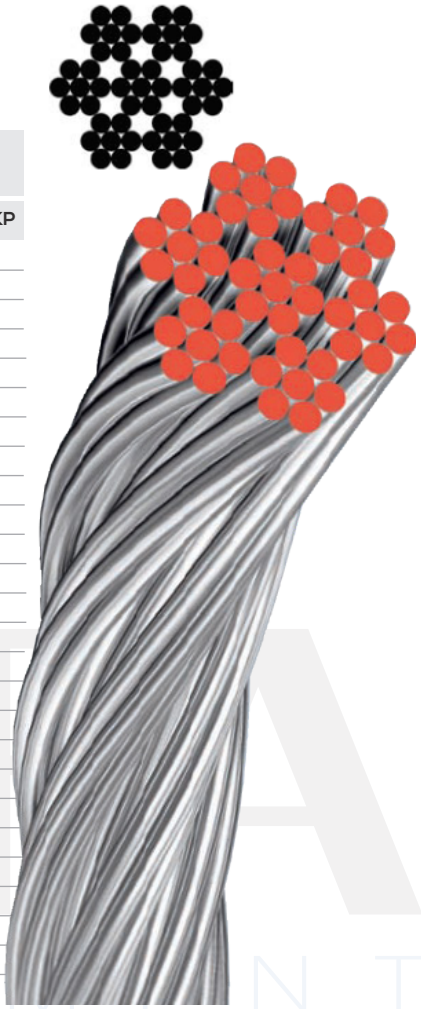
DIAM. CABLE	DIAM. FILS.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL
MM.	MM	MM²	KGS/MT	1770 N/MM² KN	1770 N/MM² KG.
1	0,2	0,6	0,00495	0,93	94,5
1,25	0,25	0,92	0,0077	1,45	147,9
1,5	0,3	1,34	0,0111	2,09	213
2	0,4	2,4	0,0198	3,72	378
2,5	0,5	3,7	0,031	5,81	591
3	0,6	5,3	0,0446	8,37	851
3,5	0,7	7,3	0,0607	11,4	1.160
4	0,8	10	0,0793	14,9	1.510
5	1	14	0,124	23,2	2.360
6	1,2	21	0,178	33,5	3.400
7	1,4	29	0,243	45,6	4.630
8	1,6	38	0,317	59,5	6.050
9	1,8	47	0,401	75,3	7.660
10	2	59	0,495	93	9.450
11	2,2	70	0,599	112	11.400
12	2,4	83	0,713	134	13.600
13	2,6	97	0,837	157	16.000
14	2,8	113	0,971	182	18.500
15	2,94	130	1,11	209	21.300
16	3,2	148	1,27	238	24.200

CÂBLES EN ACIER STANDARDS 6X7+1 (FC) EN 12385-4

DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM 1770 N/MM²	CRM 1770 N/MM²	CRM 1960 N/MM²	CRM 1960 N/MM²
MM.	MM	MM²	KGS/MT	180 KP/MM² KN	180 KP/MM² KP	200 KP/MM² KN	200 KP/MM² KP
2	0,21	1,6	0,0138	2,35	240	2,6	265
3	0,32	3,8	0,0311	5,29	539	5,86	597
4	0,42	6,7	0,0552	9,4	958	10,4	1.060
5	0,53	10	0,0863	14,7	1.498	16,3	1.662
6	0,63	14	0,124	21,2	2.161	23,4	2.385
7	0,74	18	0,169	28,8	2.936	31,9	3.252
8	0,9	25	0,221	37,6	3.833	41,6	4.241
9	1	31	0,279	47,6	4.852	52,7	5.372
10	1,1	38	0,345	58,8	5.994	65,1	6.636
11	1,2	47	0,417	71,1	7.248	78,7	8.022
12	1,3	55	0,497	84,6	8.624	93,7	9.551
13	1,45	64	0,583	99,3	10.122	110	11.213
14	1,5	74	0,676	115	11.723	128	13.048
16	1,75	98	0,883	150	15.291	167	17.023
18	1,95	124	1,12	190	19.368	211	21.509
20	2,2	151	1,38	235	23.955	260	26.504
22	2,4	182	1,67	284	28.950	315	32.110
24	2,6	217	1,99	338	34.455	375	38.226
26	2,75	254	2,33	397	40.469	440	44.852
28	3	294	2,7	461	46.993	510	51.988
32	3,4	386	3,53	602	61.366	666	67.890
36	3,8	487	4,47	762	77.676	843	85.933
40	4,25	603	5,52	940	95.821	1040	106.014



CÂBLES EN ACIER STANDARDS 7X7+0 EN 12385-4



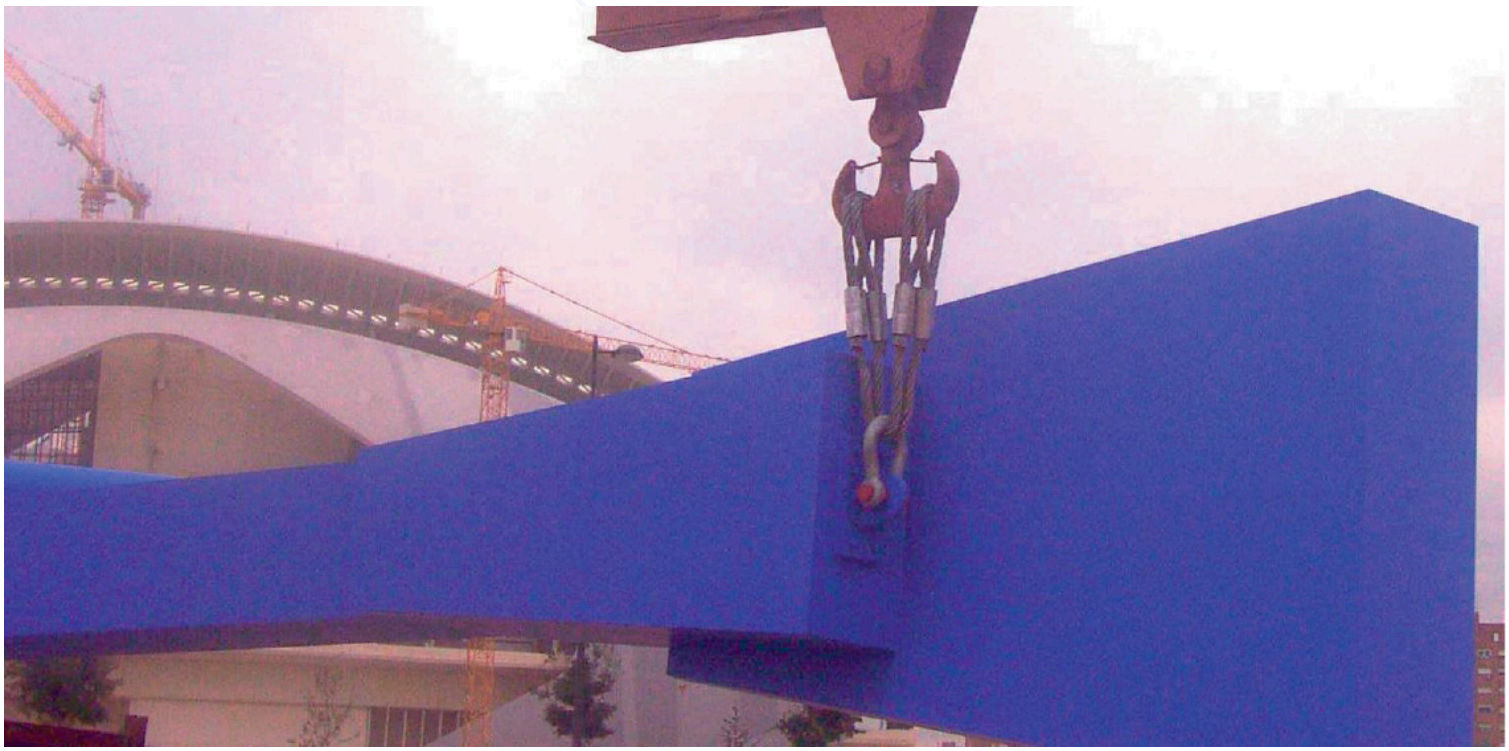
DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM 1770 N/MM²	CRM 1770 N/MM²	CRM 1960 N/MM²	CRM 1960 N/MM²
MM.	MM	MM²	KGS/MT	180 KP/MM² KN	180 KP/MM² KP	200 KP/MM² KN	200 KP/MM² KP
1	0,11	0,5	0,0039	0,64	65	0,70	72
1,5	0,16	1	0,0087	1,43	146	1,58	161
2	0,21	2	0,0154	2,54	259	2,81	286
2,5	0,28	3	0,0240	3,98	405	4,40	449
3	0,32	4	0,0346	5,72	583	6,33	645
4	0,42	8	0,0614	10,2	1.040	11,3	1.152
5	0,53	12	0,096	15,9	1.621	17,6	1.794
6	0,63	17	0,138	22,9	2.334	25,3	2.579
7	0,74	12	0,188	31,1	3.170	34,5	3.517
8	0,9	30	0,246	40,7	4.149	45,0	4.587
9	1	38	0,311	51,5	5.249	57,0	5.810
10	1,1	46	0,384	63,5	6.473	70,4	7.176
11	1,2	57	0,465	76,9	7.838	85,1	8.674
12	1,3	67	0,553	91,5	9.327	101	10.295
13	1,45	78	0,649	107	10.907	119	12.130
14	1,5	90	0,753	125	12.741	138	14.066
16	1,75	120	0,983	163	16.615	180	18.347
18	1,95	151	1,24	206	20.998	228	23.240
20	2,2	184	1,54	254	25.890	281	28.642
22	2,4	223	1,86	308	31.395	341	34.758
24	2,6	265	2,21	366	37.307	405	41.282
26	2,75	311	2,6	430	43.830	476	48.519
28	3	360	3,01	498	50.761	552	56.266
32	3,4	470	3,93	651	66.357	721	73.492
36	3,8	595	4,98	824	83.991	912	92.960
40	4,25	735	6,14	1.020	103.969	1130	115.181

CÂBLES EN ACIER STANDARDS 6X25+1 FILLER EN 12385-4

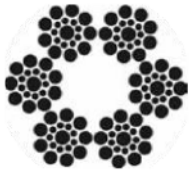
DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM 1770 N/MM²	CRM 1770 N/MM²	CRM 1960 N/MM²	CRM 1960 N/MM²
MM.	MM	MM²	KGS/MT	180 KP/MM² KN	180 KP/MM² KP	200 KP/MM² KN	200 KP/MM² KP
6	0,4	15	0,129	21	2.141	23,3	2.375
7	0,45	20	0,176	28,6	2.915	31,7	3.231
8	0,5	28	0,23	37,4	3.812	41,4	4.220
9	0,56	36	0,291	47,3	4.822	52,4	5.341
10	0,64	41	0,359	58,4	5.953	64,7	6.595
11	0,7	49	0,433	70,7	7.207	78,3	7.982
12	0,76	58	0,517	84,1	8.573	93,1	9.490
13	0,84	70	0,607	98,7	10.061	109	11.111
14	0,9	81	0,704	114	11.621	127	12.946
16	1,02	104	0,919	150	15.291	166	16.922
18	1,14	131	1,16	189	19.266	210	21.407
20	1,28	164	1,44	234	23.853	259	26.402
22	1,4	196	1,74	283	28.848	313	31.906
24	1,53	233	2,07	336	34.251	373	38.022
26	1,65	274	2,43	395	40.265	437	44.546
28	1,8	321	2,81	458	46.687	507	51.682
32	2,04	416	3,68	598	60.958	662	67.482
36	2,28	521	4,65	757	77.166	838	85.423
40	2,54	646	5,74	935	95.311	1040	106.014
44	2,79	780	6,95	1130	115.189	1250	127.421
48	3,05	931	8,27	1350	137.615	1490	151.886
52	3,3	1091	9,71	1580	161.060	1750	178.389
56	3,56	1268	11,3	1830	186.544	2030	206.932
60	3,81	1454	12,9	2100	214.067	2330	237.513

CÂBLES EN ACIER STANDARDS 6X25+0 FILLER EN 12385-4

DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM 1770 N/MM²	CRM 1770 N/MM²	CRM 1960 N/MM²	CRM 1960 N/MM²
MM.	MM	MM²	KGS/MT	180 KP/MM² KN	180 KP/MM² KP	200 KP/MM² KN	200 KP/MM² KP
6	0,4	17	0,144	22,7	2.314	25,1	2.559
7	0,45	23	0,196	30,9	3.150	34,2	3.486
8	0,51	30	0,256	40,3	4.108	44,7	4.557
9	0,57	38	0,324	51	5.199	56,5	5.759
10	0,64	48	0,4	63	6.422	69,8	7.115
11	0,7	57	0,484	76,2	7.768	84,4	8.603
12	0,76	68	0,576	90,7	9.246	100	10.194
13	0,84	81	0,676	106	10.805	118	12.029
14	0,9	94	0,784	124	12.640	137	13.965
16	1,02	122	1,02	161	16.412	179	18.247
18	1,14	153	1,3	204	20.795	226	23.038
20	1,28	191	1,6	252	25.688	279	28.440
22	1,4	229	1,94	305	31.091	338	34.455
24	1,53	273	2,3	363	37.003	402	40.979
26	1,65	320	2,7	426	43.425	472	48.114
28	1,8	374	3,14	494	50.357	547	55.759
32	2,04	487	4,1	645	65.749	715	72.885
36	2,16	610	5,18	817	83.282	904	92.151
40	2,54	757	6,4	1010	102.956	1120	114.169
44	2,79	912	7,74	1220	124.363	1350	137.615
48	3,05	1089	9,22	1450	147.808	1610	164.118
52	3,3	1278	10,8	1700	173.293	1890	192.661
56	3,56	1482	12,5	1980	201.835	2190	223.242
60	3,81	1700	14,4	2270	231.397	2510	255.861



CÂBLES EN ACIER STANDARDS 6X19+1 SEALE EN 12385-4



DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM 1770 N/MM²	CRM 1770 N/MM²	CRM 1960 N/MM²	CRM 1960 N/MM²
MM.	MM	MM²	KGS/MT	180 KP/MM² KN	180 KP/MM² KP	200 KP/MM² KN	200 KP/MM² KP
6	0,47	18	0,129	21	2.141	23,3	2.375
7	0,55	22	0,176	28,6	2.915	31,7	3.231
8	0,63	25	0,23	37,4	3.812	41,4	4.220
9	0,71	31	0,291	47,3	4.822	52,4	5.341
10	0,79	39	0,359	58,4	5.953	64,7	6.595
11	0,88	47	0,433	70,7	7.207	78,3	7.982
12	0,95	57	0,517	84,1	8.573	93,1	9.490
13	1,03	66	0,607	98,7	10.061	109	11.111
14	1,11	77	0,704	114	11.621	127	12.946
16	1,28	102	0,919	150	15.291	166	16.922
18	1,43	128	1,16	189	19.266	210	21.407
20	1,58	158	1,44	234	23.853	259	26.402
22	1,73	190	1,74	283	28.848	313	31.906
24	1,92	230	2,07	336	34.251	373	38.022
26	2,07	267	2,43	395	40.265	437	44.546
28	2,22	309	2,81	458	46.687	507	51.682
32	2,54	404	3,68	598	60.958	662	67.482
36	2,86	513	4,65	757	77.166	838	85.423
40	3,17	631	5,74	935	95.311	1040	106.014
44	3,5	763	6,95	1130	115.189	1250	127.421
48	3,8	908	8,27	1350	137.615	1490	151.886
52	4,1	1066	9,71	1580	161.060	1750	178.389
56	4,3	1236	11,3	1830	186.544	2030	206.932
60	4,6	1420	12,9	2100	214.067	2330	237.513

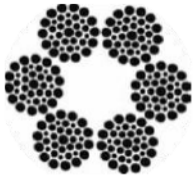
CÂBLES EN ACIER STANDARDS 6X19+1 EN 12385-4

DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM 1770 N/MM²	CRM 1770 N/MM²	CRM 1960 N/MM²	CRM 1960 N/MM²
MM.	MM	MM²	KGS/MT	180 KP/MM² KN	180 KP/MM² KP	200 KP/MM² KN	200 KP/MM² KP
3	0,2	7	0,0311	4,89	498	5,42	552
4	0,25	9	0,0554	8,69	885	9,63	982
5	0,33	12	0,0865	13,6	1.380	15	1529
6	0,38	14	0,125	19,6	1.990	21,7	2212
7	0,44	18	0,17	26,6	2.710	29,5	3007
8	0,51	24	0,221	34,8	3.540	38,5	3925
9	0,57	30	0,28	44,1	4.480	48,8	4975
10	0,63	37	0,346	54,4	5.530	60,2	6137
11	0,71	47	0,419	65,8	6.690	72,8	7421
12	0,77	55	0,498	78,3	7.970	86,7	8838
13	0,83	64	0,585	91,9	9.350	102	10398
14	0,89	73	0,678	107	10.800	118	12029
16	1,03	98	0,886	139	14.200	154	15698
18	1,15	122	1,12	176	17.900	195	19878
20	1,27	148	1,38	218	22.100	241	24567
22	1,41	183	1,67	263	26.800	291	29664
24	1,55	220	1,99	313	31.900	347	35372
25	1,62	237	2,16	340	34.681	376	38328
26	1,68	255	2,34	368	37.400	407	41488
28	1,8	293	2,71	426	43.400	472	48114
32	2,07	388	3,54	557	56.600	616	62793
36	2,31	483	4,48	705	71.700	780	79511
40	2,57	598	5,54	870	88.500	963	98165
44	2,82	720	6,7	1.050	107.000	1165	118756
48	3,08	859	7,97	1.250	127.000	1386	141284
52	3,3	1008	9,36	1.470	150.000	1627	165851
56	3,6	1170	10,9	1.710	173.000	1887	192355

CÂBLES EN ACIER STANDARDS 7X19+0 EN 12385-4

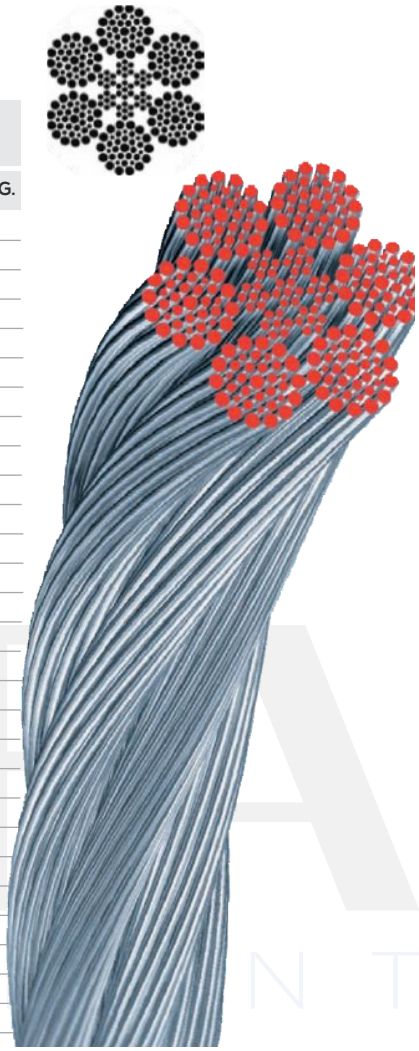
DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM 1770 N/MM²	CRM 1770 N/MM²	CRM 1960 N/MM²	CRM 1960 N/MM²
MM.	MM	MM²	KGS/MT	180 KP/MM² KN	180 KP/MM² KP	200 KP/MM² KN	200 KP/MM² KP
2	0,15	1,7	0,0152	2,56	261	2,84	290
2,5	0,18	3	0,0238	4,01	408	4,44	452
3	0,2	8	0,0343	5,77	588	6,39	651
4	0,26	11	0,061	10,3	1.050	11,4	1.162
5	0,33	13	0,0953	16	1.631	17,7	1.804
6	0,39	16	0,137	23,1	2.355	25,5	2.599
7	0,45	21	0,187	31,4	3.201	34,8	3.547
8	0,51	28	0,243	41	4.179	45,4	4.628
9	0,58	36	0,308	51,9	5.291	57,5	5.861
10	0,64	44	0,381	64	6.524	70,9	7.227
11	0,7	53	0,461	77,5	7.900	85,8	8.746
12	0,77	64	0,548	92,3	9.409	102	10.398
13	0,83	74	0,643	108	11.009	120	12.232
14	0,89	86	0,746	126	12.844	139	14.169
16	1,01	111	0,974	164	16.718	182	18.552
18	1,15	143	1,23	208	21.203	230	23.445
20	1,27	176	1,52	256	26.096	284	28.950
22	1,39	211	1,84	310	31.600	343	34.964
24	1,51	249	2,19	369	37.615	409	41.692
26	1,68	301	2,57	433	44.139	480	48.930
28	1,8	346	2,98	502	51.172	556	56.677
32	2,07	458	3,9	656	66.871	727	74.108
36	2,31	572	4,93	830	84.608	920	93.782
40	2,57	708	6,09	1025	104.485	1135	115.698
44	2,82	852	7,37	1.240	126.402	1374	140.061
48	3,08	1017	8,77	1.476	150.459	1635	166.667
52	3,3	1193	10,3	1.733	176.656	1919	195.617
56	3,6	1384	12	2.009	204.791	2225	226.809

CÂBLES EN ACIER STANDARDS 6X36+1 WS EN 12385-4

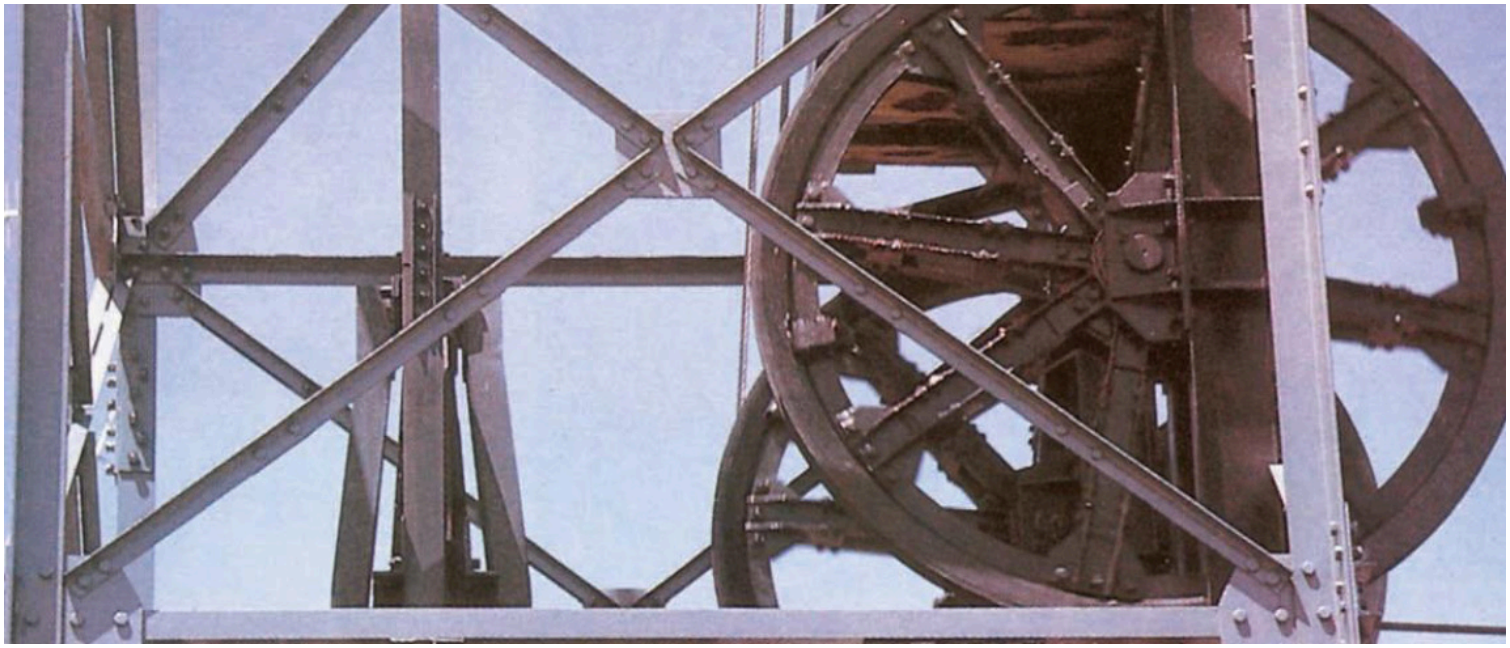


DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM 1770 N/MM²	CRM 1770 N/MM²	CRM 1960 N/MM²	CRM 1960 N/MM²
MM.	MM	MM²	KGS/MT	180 KP/MM² KN	180 KP/MM² KP	200 KP/MM² KN	200 KP/MM² KP
8	0,44	25	0,235	37,4	3.812	41,4	4.220
9	0,51	33	0,297	47,3	4.822	52,4	5.341
10	0,55	40	0,367	58,4	5.953	64,7	6.595
11	0,62	50	0,444	70,7	7.207	78,3	7.982
12	0,66	58	0,528	84,1	8.573	93,1	9.490
13	0,74	70	0,62	98,7	10.061	109	11.111
14	0,8	81	0,719	114	11.621	127	12.946
16	0,89	105	0,94	150	15.291	166	16.922
18	1,01	134	1,19	189	19.266	210	21.407
20	1,11	165	1,47	234	23.853	259	26.402
22	1,23	198	1,78	283	28.848	313	31.906
24	1,33	235	2,11	336	34.251	373	38.022
26	1,45	276	2,48	395	40.265	437	44.546
28	1,6	325	2,88	458	46.687	507	51.682
30	1,67	364	3,3	525	53.517	582	59.327
31	1,75	390	3,53	561	57.187	622	63.405
32	1,8	420	3,76	598	60.958	662	67.482
33	1,85	448	4,00	636	64.828	704	71.766
34	1,91	476	4,26	675	68.807	747	76.181
35	1,95	502	4,50	716	72.939	792	80.728
36	2	528	4,76	757	77.166	838	85.407
38	2,12	587	5,3	843	85.933	934	95.160
40	2,23	650	5,87	935	95.311	1040	106.014
42	2,36	720	6,48	1030	104.955	1147	116.881
44	2,45	787	7,11	1130	115.189	1250	127.421
45	2,5	823	7,44	1187	120.950	1316	134.174
46	2,57	858	7,76	1236	125.968	1366	139.268
48	2,7	934	8,46	1350	137.615	1490	151.886
50	2,79	1012	9,17	1460	148.828	1617	164.807
52	2,9	1099	9,92	1580	161.060	1750	178.389
54	3,01	1182	10,69	1702	173.458	1887	192.376
55	3,1	1226	11,09	1765	179.876	1958	199.567
56	3,15	1272	11,5	1830	186.544	2030	206.932
60	3,36	1461	13,2	2100	214.067	2330	237.513

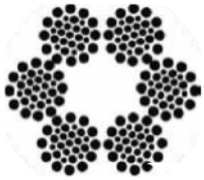
CÂBLES EN ACIER STANDARDS 6X36+(7X7+0) WSO EN 12385-4

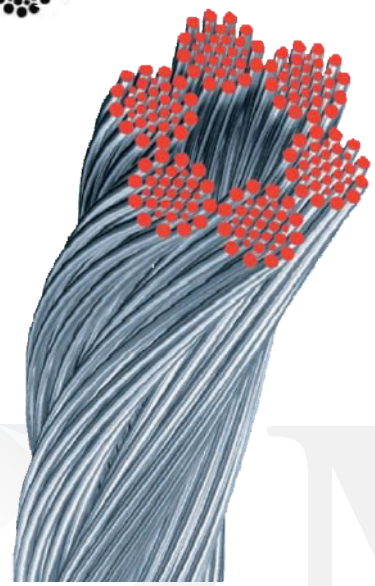


DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL	CRM/MBL	CRM/MBL
MM.	MM	MM²	KGS/MT	1770 N/MM² KN	1770 N/MM2 KG.	1960 N/MM2 KG.	1960 N/MM2 KG.
8	0,44	30	0,262	40,3	4.108	44,7	4.557
10	0,55	47	0,409	63	6.422	69,8	7.115
12	0,66	67	0,589	90,7	9.246	100	10.194
14	0,8	94	0,802	124	12.640	137	13.965
16	0,89	122	1,05	161	16.412	179	18.247
18	1,01	155	1,33	204	20.795	226	23.038
20	1,11	190	1,64	252	25.688	279	28.440
22	1,23	232	1,98	305	31.091	338	34.455
24	1,45	272	2,36	363	37.003	402	40.979
26	1,67	322	2,76	426	43.425	472	48.114
28	1,75	377	3,21	494	50.357	547	55.759
30	1,8	426	3,68	566	57.696	628	64.015
32	1,85	489	4,19	645	65.749	715	72.885
34	1,95	555	4,7	728	74.210	806	82.161
36	2	614	5,3	817	83.282	904	92.151
38	2,12	686	5,9	910	92.762	1008	102.708
40	2,23	760	6,54	1010	102.956	1120	114.169
42	2,36	840	7,22	1112	113.314	1231	125.469
44	2,45	919	7,92	1220	124.363	1350	137.615
46	2,57	1003	8,65	1332	135.748	1476	150.506
48	2,7	1093	9,42	1450	147.808	1610	164.118
50	2,79	1182	10,2	1571	160.143	1747	178.084
52	3,01	1280	11,1	1700	173.293	1890	192.661
54	3,1	1430	12,4	1906	194.292	2111	215.160
56	3,15	1487	12,8	1980	201.835	2190	223.242
58	3,24	1591	13,7	2121	216.200	2345	239.040
60	3,36	1705	14,7	2270	231.397	2510	255.861
62	3,46	1815	15,7	2424	247.080	2682	273.414
64	3,57	1935	16,70	2583	263.300	2858	291.330



CÂBLES EN ACIER STANDARDS 6X31+1 WS EN 12385-4

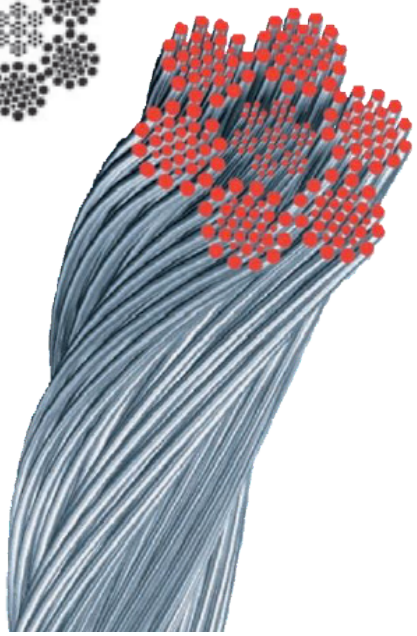




DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL
MM.	MM	MM²	KGS/MT	1770 N/MM² KN	1770 N/MM² KG.
12	0.75	57	0.528	84.10	8573
14	0.89	79	0.719	114.00	11684
16	1.01	103	0.94	150.00	15255
18	1.13	130	1.19	189.00	19306
20	1.27	162	1.47	234.00	23837
22	1.39	194	1.78	283.00	28847
24	1.54	233	2.11	336.00	34327
26	1.64	272	2.48	395.00	40296
28	1.79	318	2.88	458.00	46724
30	1.91	364	3.22	525.00	53570
32	2.03	415	3.76	598.00	61031
34	2.15	467	4.14	675.00	68877
36	2.27	520	4.76	757.00	77245
38	2.40	581	5.14	843.00	86000
40	2.53	644	5.87	935.00	95408

Banc d'essai jusqu'à 100 tonnes
Plus de 3 000 tonalités de câbles en stock permanent.
Production propre d'échoirs de câble jusqu'à Ø 80 mm.

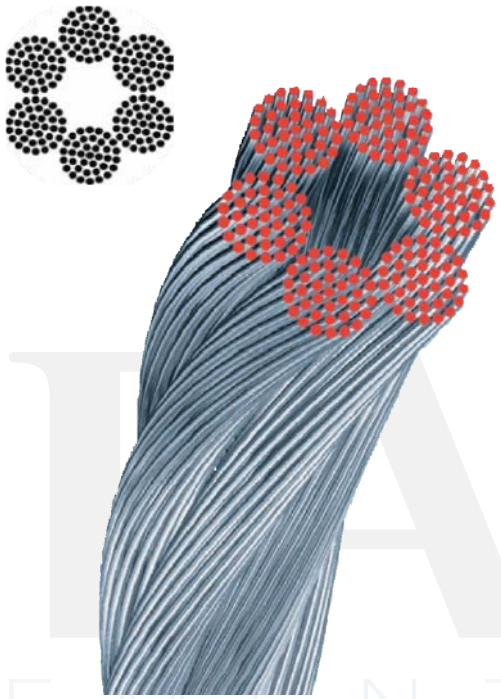
CÂBLES EN ACIER STANDARDS 6X31+(7X7+0) WS EN 12385-4



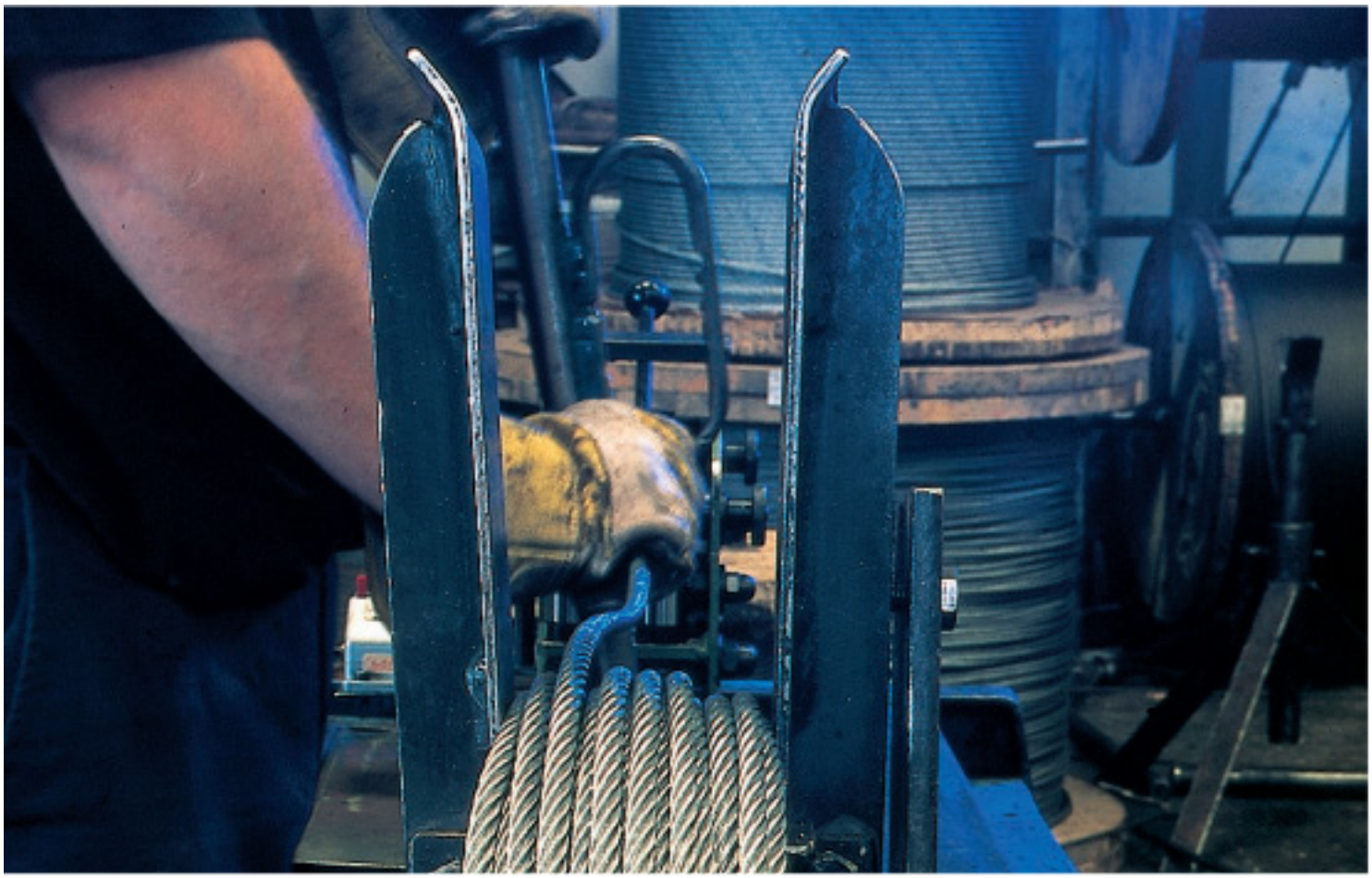
DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL
MM.	MM	MM²	KGS/MT	1770 N/MM² KN	1770 N/MM² KG.
12	0.75	67	0.589	90.7	9255
14	0.89	92	0.802	124.00	12602
16	1.01	121	1.05	161.00	16459
18	1.13	152	1.33	204.00	20837
20	1.27	190	1.64	252.00	25714
22	1.39	227	1.98	305.00	31122
24	1.54	272	2.36	363.00	37031
26	1.64	317	2.76	426.00	43469
28	1.79	371	3.21	494.00	50408
30	1.91	426	3.64	565.00	57653
32	2.03	486	4.19	645.00	65837
34	2.15	547	4.68	729.00	74388
36	2.27	609	5.3	817.00	83367
38	2.40	679	5.81	910.00	92857
40	2.53	754	6.54	1010.00	102956

CÂBLES EN ACIER STANDARDS 6X37+1 (FC) EN 12385-4

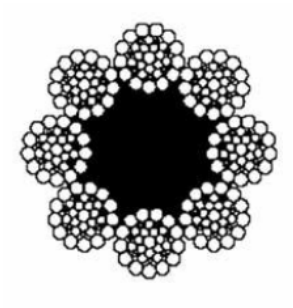
DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL
MM.	MM	MM^2	KGS/MT	1770 N/MM^2 KN	1770 N/MM^2 KG.
8	0.35	30	0.221	33.40	3400
10	0.45	38	0.346	52.20	5310
12	0.54	54	0.498	75.10	7640
14	0.63	71	0.678	102.00	10400
16	0.73	95	0.886	134.00	13600
18	0.81	118	1.12	169.00	17200
20	0.91	150	1.38	209.00	21200
22	1.01	182	1.67	253.00	25700
24	1.11	214	1.99	301.00	30600
26	1.19	252	2.34	353.00	35900
28	1.29	289	2.71	409.00	41600
30	1.37	334	3.00	470.00	47900
32	1.45	376	3.54	534.00	54300
34	1.55	429	3.82	604.00	61600
36	1.66	480	4.48	676.00	68800
38	1.73	532	4.99	754.00	77000
40	1.82	590	5.54	835.00	84900
42	1.93	650	6.09	921.00	93950
44	2.02	710	6.70	1010.00	103000
46	2.11	777	7.12	1104.00	112600
48	2.18	844	7.97	1200.00	122000



Plus de 3000 tonnes de câbles en stock permanent.

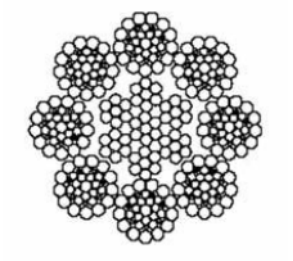


CÂBLES EN ACIER STANDARDS 8X36+1 (WS) EN 12385-4



DIAM. CABLE	POIDS	CRM 1770 N/MM² KN-180 KP/MM²		CRM 1960 N/MM² KN-200 KP/MM²	
MM.	KGS/MT	KN	KP	KN	KP
8	0,223	33,2	3.384	36,8	3.751
9	0,282	42	4.281	46,5	4.740
10	0,348	51,9	5.291	57,4	5.851
11	0,421	62,8	6.402	69,5	7.085
12	0,501	74,7	7.615	82,7	8.430
13	0,588	87,6	8.930	97,1	9.898
14	0,682	102	10.398	113	11.519
16	0,891	133	13.558	147	14.985
18	1,13	168	17.125	186	18.960
20	1,39	207	21.101	230	23.445
22	1,68	251	25.586	278	28.338
24	2	299	30.479	331	33.741
26	2,35	351	35.780	388	39.551
28	2,73	407	41.488	450	45.872
32	3,56	531	54.128	588	59.939
36	4,51	672	68.502	744	75.841
40	5,57	830	84.608	919	93.680
44	6,74	1000	101.937	1110	113.150
48	8,02	1200	122.324	1320	134.557
52	9,41	1400	142.712	1550	158.002
56	10,9	1630	166.157	1800	183.486
60	12,5	1870	190.622	2070	211.009

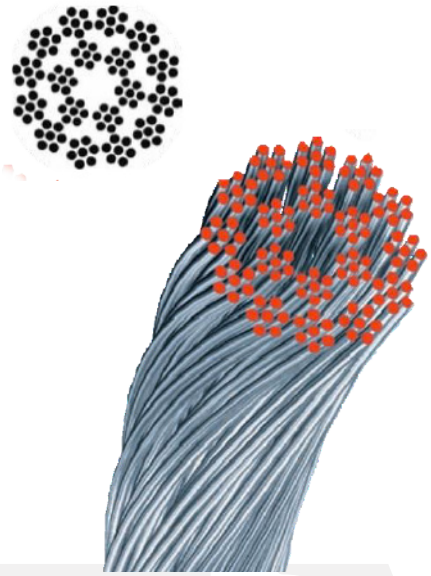
CÂBLES EN ACIER STANDARDS 8X36+0 (WS) EN 12385-4



DIAM. CABLE	POIDS	CRM 1770 N/MM² KN-180 KP/MM²		CRM 1960 N/MM² KN-200 KP/MM²	
MM.	KGS/MT	KN	KP	KN	KP
8	0,267	40,3	4.108	44,7	4.557
9	0,338	51	5.199	56,5	5.759
10	0,417	63	6.422	69,8	7.115
11	0,505	76,2	7.768	84,4	8.603
12	0,6	90,7	9.246	100	10.194
13	0,705	106	10.805	118	12.029
14	0,817	124	12.640	137	13.965
16	1,07	161	16.412	179	18.247
18	1,35	204	20.795	226	23.038
20	1,67	252	25.688	279	28.440
22	2,02	305	31.091	338	34.455
24	2,4	363	37.003	402	40.979
26	2,82	426	43.425	472	48.114
28	3,27	494	50.357	547	55.759
32	4,27	645	65.749	715	72.885
36	5,4	817	83.282	904	92.151
40	6,67	1010	102.956	1120	114.169
44	8,07	1220	124.363	1350	137.615
48	9,61	1450	147.808	1610	164.118
52	11,3	1700	173.293	1890	192.661
56	12,1	1980	201.835	2190	223.242
60	15	2270	231.397	2510	255.861

CÂBLES EN ACIER ANTIGIRATOIRES 18X7+1 (FC) EN 12385-4

DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL
MM.	MM	MM²	KGS/MT	1960 N/MM² KN	1960 N/MM² KG.
6	0,4	20	0,138	23,1	2.355
7	0,45	23	0,187	31,5	3.211
8	0,5	26	0,244	41,1	4.190
9	0,56	33	0,309	52,1	5.311
10	0,63	41	0,382	64,3	6.555
11	0,69	49	0,462	77,8	7.931
12	0,75	59	0,55	92,6	9.439
13	0,83	69	0,646	109	11.111
14	0,89	80	0,749	126	12.844
16	1,01	105	0,978	165	16.820
18	1,2	142	1,24	208	21.203
20	1,3	167	1,53	257	26.198
22	1,45	207	1,85	311	31.702
24	1,6	253	2,2	370	37.717
26	1,7	285	2,58	435	44.343
28	1,8	320	2,99	504	51.376

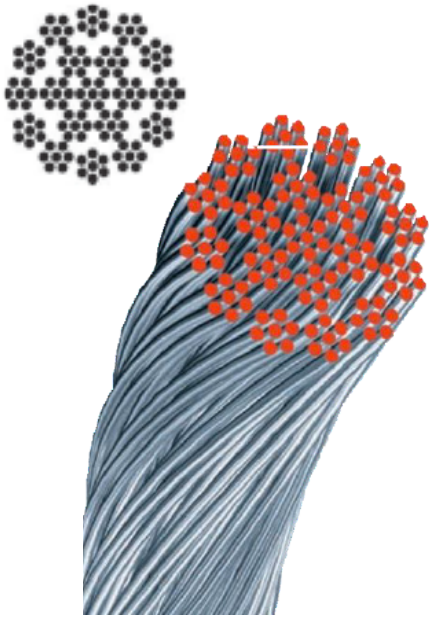


Disponibles:

TORSION LANG, CROSS TORSION

CÂBLES EN ACIER ANTIGIRATOIRES 19X7+0 (SC) EN 12385-4

DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL
MM.	MM	MM²	KGS/MT	1960 N/MM² KN	1960 N/MM² KG.
6	0,4	16	0,144	23,1	2.355
7	0,45	22	0,196	31,5	3.211
8	0,5	29	0,257	41,1	4.190
9	0,56	37	0,325	52,1	5.311
10	0,63	46	0,401	64,3	6.555
11	0,69	55	0,485	77,8	7.931
12	0,75	66	0,577	92,6	9.439
13	0,83	77	0,678	109	11.111
14	0,89	90	0,786	126	12.844
16	1,01	117	1,03	165	16.820
18	1,14	146	1,3	208	21.203
20	1,28	183	1,6	257	26.198
22	1,4	218	1,94	311	31.702
24	1,53	261	2,31	370	37.717
26	1,65	303	2,71	435	44.343
28	1,77	350	3,14	504	51.376

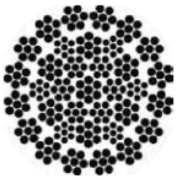


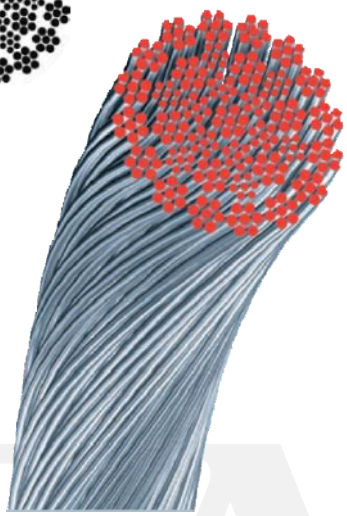
Disponibles:

TORSION LANG, CROSS TORSION

CÂBLES EN ACIER ANTIGIRATOIRES 35X7+0 (W) EN 12385-4

DIAM. CABLE	DIAM. ALAM.	SECTION CABLE	POIDS	CRM/MBL	CRM/MBL
MM.	MM	MM²	KGS/MT	1960 N/MM² KN	1960 N/MM² KG.
12	0,58	79	0,654	109	11.111
14	0,68	92	0,89	148	15.087
16	0,8	123	1,16	194	19.776
17	0,84	136	1,31	219	22.277
18	0,88	150	1,47	245	24.975
19	0,94	171	1,64	273	27.783
20	0,97	185	1,82	302	30.785
21	1,02	205	2,01	333	33.945
22	1,07	225	2,2	366	37.309
23	1,14	251	2,4	400	40.775
24	1,17	270	2,62	435	44.343
25	1,22	290	2,84	472	48.160
26	1,27	317	3,07	511	52.090
28	1,37	368	3,56	593	60.449
32	1,58	486	4,65	774	78.899
36	1,76	607	5,88	980	99.898
38	1,85	670	6,56	1090	111.111
40	1,97	752	7,26	1210	123.344

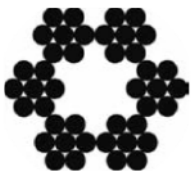




CÂBLES EN ACIER GALVANISÉS POUR APPAREILS DE LEVAGE

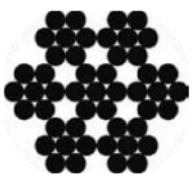
DIAM. CABLE	DIAM. ALAM.	POIDS	CRM/MBL	CRM/MBL
MM.	MM	KGS/MT	1960 N/MM² KN	1960 N/MM² KG.
8.3	0.66	0.27	49.20	5000
11.3	0.73	0.52	98.20	10000
16.3	0.93	1.10	202.50	20600

CABLE PLASTIQUE (PVC, POLYPROPYLENE)

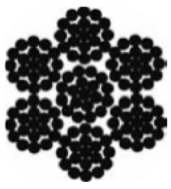


6X7+1 (FC)

6X19+1



7X7+0



7X19+0

Couleurs disponibles: Rouge, verre, blanc, bleu, orange, brun, noir et vert.

GENERAL GUIDANCE ON ROPE SELECTION

When selecting a steel wire rope to suit a particular application the following characteristics should be taken into consideration.

- Strength
- Rotation resistance
- Fatigue resistance
- Resistance to wear and abrasion
- Resistance to crushing
- Resistance to corrosion
- Rope extension

Strength

The responsibility for determining the minimum strength of a rope for use in a given system rests with the manufacturer of the machine, appliance, or lifting equipment. As part of this process the manufacturer of the machine, appliance or lifting equipment will need to be aware of any local regulations, standards or codes of practice which might govern the design factor of the rope (often referred to nowadays as the coefficient of utilisation), and other factors which might influence the design of sheaves and drums, the shape of the groove profiles and corresponding radius, the drum pitch and the angle of fleet, all of which have an effect on rope performance.

Once the strength (referred to as minimum breaking force or minimum breaking load) of the rope has been determined it is then necessary to consider which type of rope will be suitable for the intended duty. It is important therefore for the designer to be fully aware of the properties, characteristics and limitations on use of the many different kinds of steel wire ropes which are available.

Resistance to Rotation

It is important to determine whether there is a requirement to use a low rotation or rotation resistant rope. Such ropes are often referred to as multi - strand ropes.

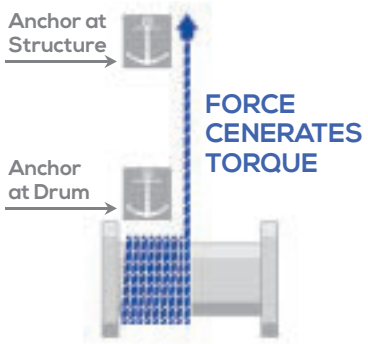
Six or eight strand rope constructions are usually selected unless load rotation on a single part system or "cabling" on a multi - part reeving system are likely to cause operational problems.

When loaded, steel wire ropes will generate:

- "Torque" if both ends are fixed.
- "Turn" if one end is unrestrained.

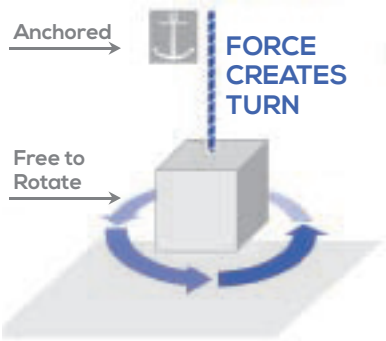
Torque

When both ends of a rope are fixed, the applied force generates "torque" at the fixing points.



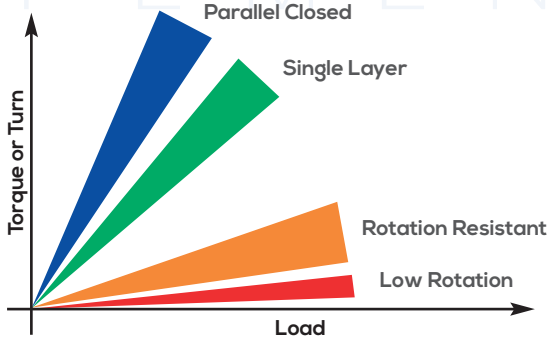
Turn

When one end of a rope is free to rotate, the applied load causes the rope to turn.



The torque or turn generated will increase as the load applied increases. The degree to which a wire rope generates torque or turn will be influenced by the construction of the rope. Having recognised what can happen when a rope is loaded it is necessary to select the correct type of rope. It should be noted that all ropes will rotate to some degree when loaded.

The diagram below serves to illustrate the differences in rotational properties between the four basic types of stranded rope.



Specific information including the torque factor and the turn value expressed in degrees per lay length for individual rope constructions.

The tendency for any rope to turn will increase as the height of lift increases. In a multi - part reeving system the tendency for the rope to cable will increase as the spacing between the parts of rope decreases. Selection of the correct rope will help to prevent "cabling" and rotation of the load.

"Endurance" low rotation and rotation resistant ropes ensure that problems associated with cabling and load rotation are minimised .

3 layer -
Low Rotation

2 layer -
Rotation Resistant

Fatigue Resistance

Steel wire ropes are likely to deteriorate due to bend fatigue when subjected to bending around a sheave or drum. The rate of deterioration will be influenced by the number of sheaves in the system, the diameter of the sheaves and drum, and the loading conditions.

When selecting a wire rope for an application where bending fatigue is a principal cause of deterioration it is important to select a rope containing small wires e.g.

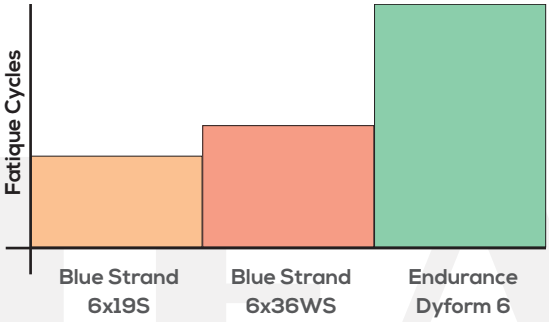
6x36 WS (14/7 & 7/7/1) as opposed to a 6x19 S (9/9/1).

Additional resistance to fatigue leading to real cost savings can be achieved by selecting a "Dyform" wire rope.

Standard

Dyform

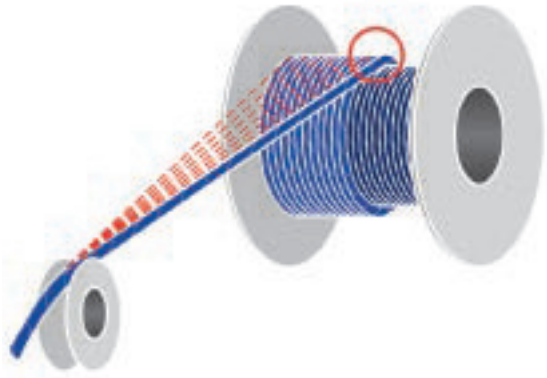
The smooth surface of the "Dyform" product provides improved rope to sheave contact leading to reduced wear on both rope and sheave . Increased cross-sectional steel area and improved inter - wire contact ensures that the rope will operate with lower internal stress levels resulting in longer bending fatigue life and lower costs.



This graph illustrates a "doubling" in life when moving from Blue Strand 6x36 to Endurance Dyform 6. This same relationship can be found when moving from any construction into an equivalent Dyform construction e.g. 18x7 to Endurance Dyform 18 or 35x7 to Endurance Dyform 34LR.

Resistance to Abrasive Wear

Abrasive wear can take place between rope and sheave and between rope and drum but the greatest cause of abrasion is often through "interference" at the drum.

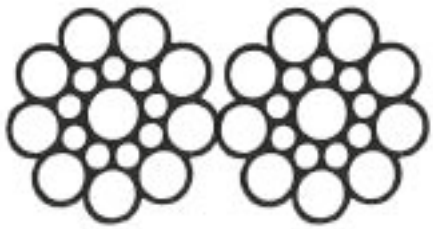


If abrasion is determined to be a major factor in rope deterioration then a wire rope with relatively large outer wires should be selected.

Comparison of outer wire sizes for single layer 22mm diameter rope.

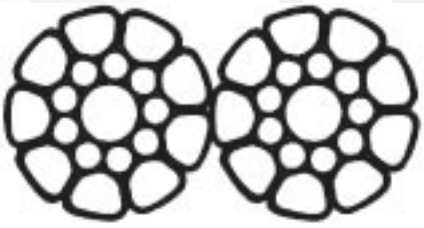
6x7	6 outer wires	2.20mm
6x19S	9 outer wires	1.83mm
6x25F	12 outer wires	1.47mm
6x36WS	14 outer wires	1.29mm
6x41WS	16 outer wires	1.16mm

Wire rope on adjacent drum laps can cause point contact and accelerated wear .



Non Dyform wire rope on adjacent drum laps can cause point contact and accelerated wear.

Selection of a Dyform product will reduce abrasion through improved contact conditions.



The smooth surface of Dyform rope creates better contact and leads to longer life.

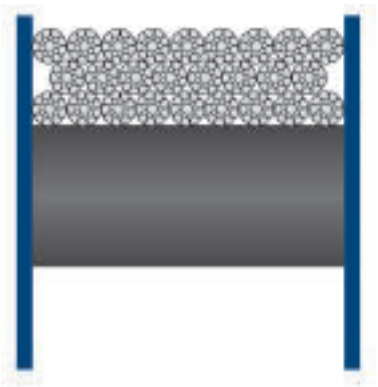
Crush Resistance

In multi - layer coiling applications where there is more than one layer of rope on the drum it is essential to install the rope with some back tension. If this is not achieved, or in certain applications where high pressure on underlying rope layers is inevitable e.g. a boom hoist rope raising a boom from the horizontal position, severe crushing damage can be caused to underlying layers.

Selection of a steel core as opposed to a fibre core will help this situation. Additional resistance to crushing is offered by a Dyform rope resulting from its high steel fill-factor.

Dyform ropes are recommended for multi - layer coiling operations where crushing on lower layers is inevitable.

Rotary hammer swaged Constructex ropes excel to combat problem spooling to minimise damage and crushing on the drum.



Corrosion resistance

If the wire rope is to be used in a corrosive environment then a galvanised coating is recommended. If corrosion is not a significant issue then a bright rope can be selected.

Where moisture can penetrate the rope and attack the core, plastic impregnation (PI) can be considered.

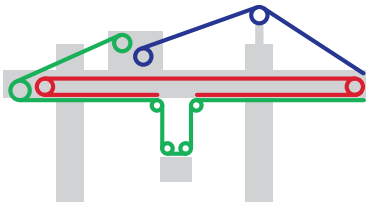
In order to minimise the effects of corrosion it is important to select a wire rope with a suitable manufacturing lubricant. Further advantages can be gained by lubricating the rope regularly whilst it is in service.

Rope Extension

If rope extension is critical refer to technical data.

PRODUCT SELECTION

CONTAINER CRANES

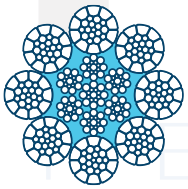


- Trolley Rope
- Boom Hoist Rope
- Main Hoist Rope

ENDURANCE DYFORM 6

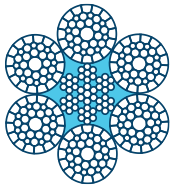
- Exceptional service life
- Robust crush resistant Dyform construction
- Accurate diameter for effective multi-layer spooling
- Consistent performance
- Long life, reduced downtime costs

ENDURANCE DYFORM 8-PI



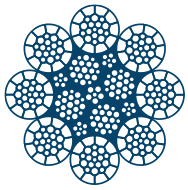
- Plastic encapsulated core
- Robust resistant Dyform construction
- Reduced stretch
- Recommended for multi-layer coiling
- Flexible eight strand construction
- High breaking force

ENDURANCE DYFORM,BRISTAR 6



- Plastic Bristar profile encapsulated core
- Robust crush resistant Dyform construction
- Reduced stretch
- Consistent performance
- Exceptional service life

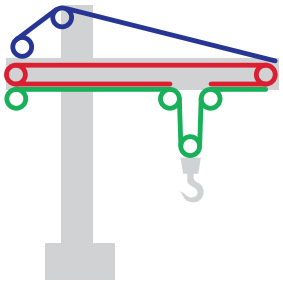
ENDURANCE DYFORM DSC8



- Parallel-laid eight strand
- Dyform construction
- Very high breaking force
- Crush resistant
- Recommended for multi-layer coiling
- Only recommended for boom hoist applications where both ends are fixed

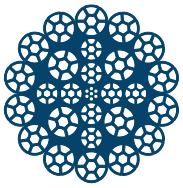
PRODUCT SELECTION

TOWER CRANES



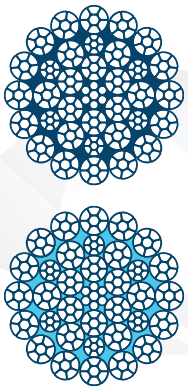
- Trolley Rope
- Derricking Rope
- Main Hoist Rope

ENDURANCE DYFORM 50DB



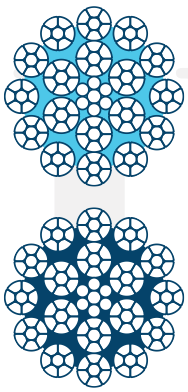
- High breaking force
- Excellent rotation resistant characteristics
- Crush resistant
- Excellent spooling
- Good wear characteristics
- Reduced sheave wear

ENDURANCE DYFORM 34LR & 34LR-PI



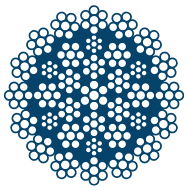
- Low rotation
- Recommended for high heights of lift
- Crush resistant
- Reduced sheave wear
- Long service life
- Reduced downtime
- High breaking force

ENDURANCE DYFORM 18 & 18PI



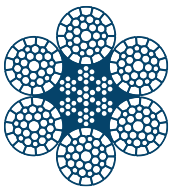
- High breaking force
- Rotation resistant
- Reduced sheave wear
- Long service life
- Reduced downtime

ENDURANCE 35LS



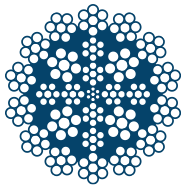
- Low rotation
- Recommended for high heights of lift
- Flexible construction
- Excellent spooling

ENDURANCE DYFORM 6



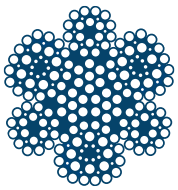
- Long service life
- Crush resistant
- Reduced downtime
- Lower lifetime cost
- Robust construction
- Suitable for multi-layer spooling

ENDURANCE 50DB



- Highest breaking force of all conventional rotation resistant constructions
- Good flexibility
- Rotation resistant construction
- Suitable for single part or multi-part reeving
- Lubricated during manufacture with a high performance lubricant

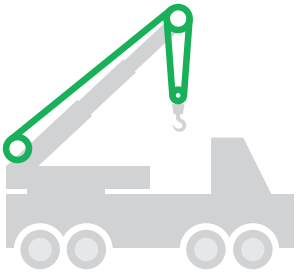
CONSTRUCTEX



- Exceptional service life in the most demanding applications
- Excellent crush resistance
- High breaking force
- Rotary hammer swaged for maximum resistance to damage
- Consistent diameter

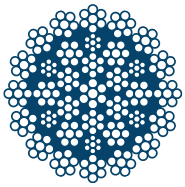
PRODUCT SELECTION

TELESCOPIC MOBILE CRANES



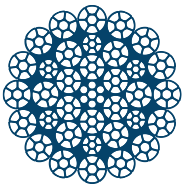
● Main Hoist Rope

ENDURANCE 35LS ●



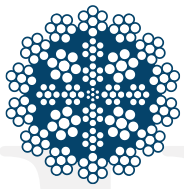
- Low rotation
- Recommended for high heights of lift
- Good flexibility
- Suitable for single-part and multi-part reeving

ENDURANCE DYFORM 34LR & 34LR-PI ●



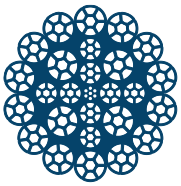
- Low rotation
- Long service life
- Crush resistant
- Recommended for multi-layer coiling
- Recommended for high heights of lift
- Suitable for single-part and multi-part reeving

ENDURANCE 50DB ●



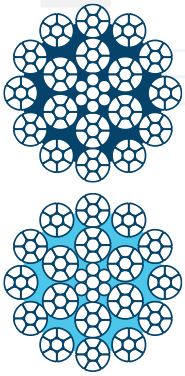
- Highest breaking force of all conventional rotation resistant constructions
- Good flexibility
- Rotation resistant construction
- Suitable for single part or multi-part reeving
- Lubricated during manufacture with a high performance lubricant

ENDURANCE DYFORM 50DB ●



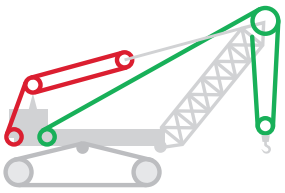
- High breaking force
- Excellent rotation resistant characteristics
- Crush resistant
- Excellent spooling
- Good wear characteristics
- Reduced sheave wear

ENDURANCE DYFORM 18 & 18PI ●



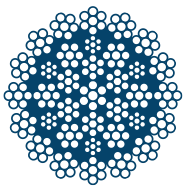
- High breaking force
- Rotation resistant
- Reduced sheave wear
- Long service life
- Reduced downtime

MOBILE LATTICE BOOM CRANES



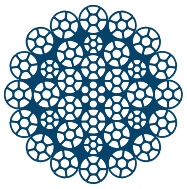
● Boom Hoist Rope
● Main Hoist Rope

ENDURANCE 35LS ●



- Low rotation
- Good flexibility
- Recommended for high heights of lift
- Suitable for single-part and multi-part reeving

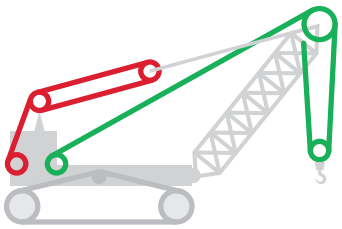
ENDURANCE DYFORM 34LR & 34LR-PI ●



- Low rotation Dyform
- Recommended for high lifting operations
- High strength
- Reduced rope sheave wear
- Accurate diameter, recommended for multi-layer coiling
- Suitable for single part and multi-part reeving
- Long service life

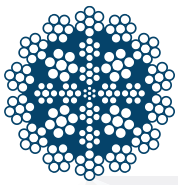
PRODUCT SELECTION

MOBILE LATTICE BOOM CRANES



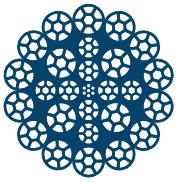
- Boom Hoist Rope
- Main Hoist Rope

ENDURANCE 50DB



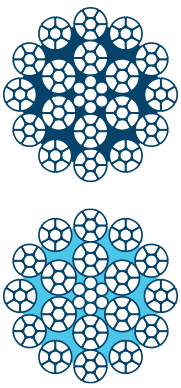
- Highest breaking force of all conventional rotation resistant constructions
- Good flexibility
- Rotation resistant construction
- Suitable for single part or multi-part reeving
- Lubricated during manufacture with a high performance lubricant

ENDURANCE DYFORM 50DB



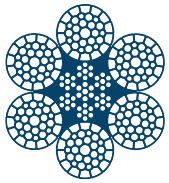
- High breaking force
- Excellent rotation resistant characteristics
- Crush resistant
- Excellent spooling
- Good wear characteristics
- Reduced sheave wear

ENDURANCE DYFORM 18 & 18PI



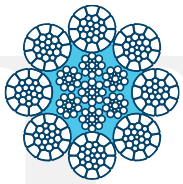
- High breaking force
- Rotation resistant
- Reduced sheave wear
- Long service life
- Reduced downtime

ENDURANCE DYFORM 6



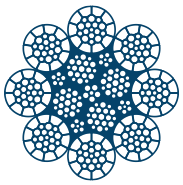
- Exceptional service life
- Robust crush resistant Dyform construction
- Accurate diameter, recommended for multi-layer coiling
- Long life, reduced lifetime costs

ENDURANCE DYFORM 8-PI



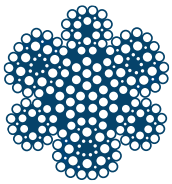
- Plastic encapsulated core
- Robust crush resistant Dyform construction
- Reduced stretch
- Recommended for multi-layer coiling
- Flexible eight strand construction
- High breaking force

ENDURANCE DYFORM DSC8



- Parallel-laid eight strand Dyform construction
- Very high breaking force
- Crush resistant
- Recommended for multi-layer coiling
- Only recommended for boom hoist applications where both ends are fixed

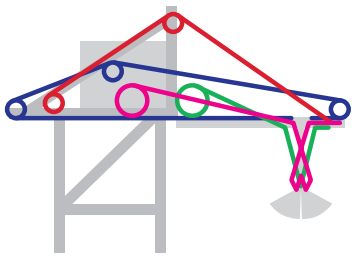
CONSTRUCTEX



- Exceptional service life in the most demanding applications
- Excellent crush resistance
- High breaking force
- Rotary hammer swaged for maximum resistance to damage

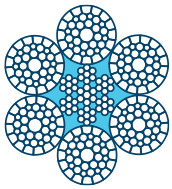
PRODUCT SELECTION

UNLOADER CRANES



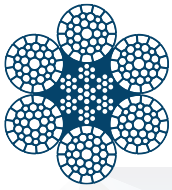
- Boom Hoist Rope
- Racking Rope
- Main Hoist Rope
- Grab Closing Rope

ENDURANCE DYFORM, BRISTAR 6



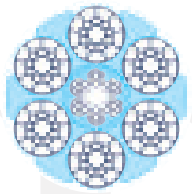
- Plastic Bristar profile encapsulated core
- Robust crush resistant Dyform construction
- Reduced stretch
- Exceptional service life

ENDURANCE DYFORM 6



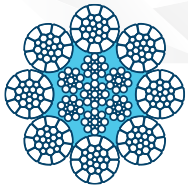
- Exceptional service life
- Robust crush resistant Dyform construction
- Accurate rope diameter
- Long life, reduced lifetime costs

Zebra



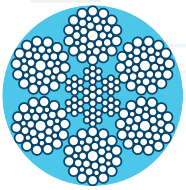
- Plastic encapsulated core incorporating plastic sections between outer strands
- Robust crush resistant Dyform construction
- Exceptional fatigue properties
- Reduced stretch
- Reduced lifetime costs

ENDURANCE DYFORM 8-PI



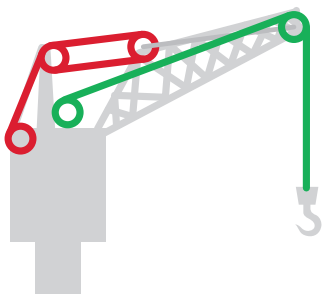
- Plastic encapsulated core
- Robust crush resistant Dyform construction
- Reduced stretch
- Flexible eight strand construction
- High breaking force

ENDURANCE BRIFIL



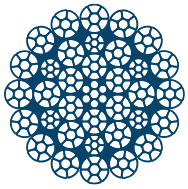
- Extruded plastic coated rope
- Robust crush resistant construction
- Exceptional fatigue properties
- Reduced stretch
- Reduced lifetime costs

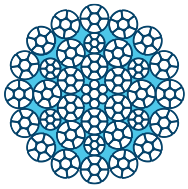
DOCKSIDE CRANES



- Boom Hoist Rope
- Main Hoist Rope

ENDURANCE DYFORM 34LR & 34LR-PI

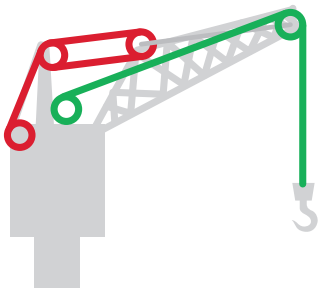




- Low rotation Dyform
- Recommended for high lifting operations
- High Strength
- Reduced rope sheave wear
- Accurate diameter, recommended for multi-layer coiling
- Suitable for single part and multi-part reeving
- Long service life

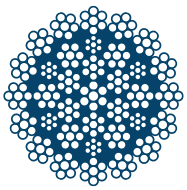
PRODUCT SELECTION

DOCKSIDE CRANES



- Boom Hoist Rope
- Main Hoist Rope

ENDURANCE 35LS

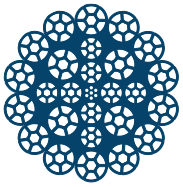


- Low rotation
- Flexible construction
- Excellent spooling
- Recommended for high lifting operations

ENDURANCE 50DB

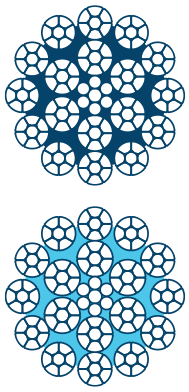
- Highest breaking force of all conventional rotation resistant constructions
- Good flexibility
- Rotation resistant construction
- Suitable for single part or multi-part reeving
- Lubricated during manufacture with a high performance lubricant

ENDURANCE DYFORM 50DB



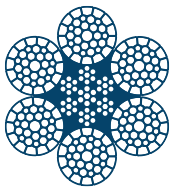
- High breaking force
- Excellent rotation resistant characteristics
- Crush resistant
- Excellent spooling
- Good wear characteristics
- Reduced sheave wear

ENDURANCE DYFORM 18 & 18PI



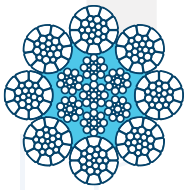
- High breaking force
- Rotation resistant
- Reduced sheave wear
- Long service life
- Reduced downtime

ENDURANCE DYFORM 6



- Exceptional service life
- Robust crush resistant Dyform construction
- Accurate diameter, recommended for multi-coiling
- Long-life, reduced lifetime costs

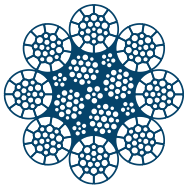
ENDURANCE DYFORM 8-PI



- Plastic encapsulated core
- Robust crush resistant Dyform construction
- Reduced stretch
- Recommended for multi-layer coiling
- Flexible eight strand construction
- High breaking force

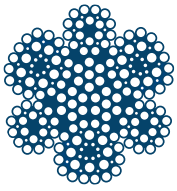
ENDURANCE DYFORM DSC8

(Only recommended for Boom Hoist applications where both ends are fixed)



- Parallel laid rope
- Very high breaking force
- Crush resistant

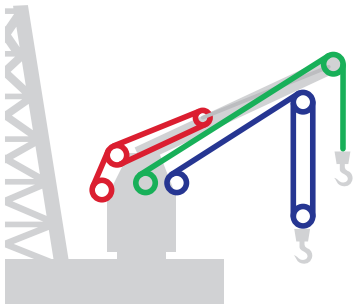
CONSTRUCTEX



- Exceptional service life in the most demanding applications
- Excellent crush resistance
- High breaking force
- Rotary hammer swaged for maximum resistance to damage

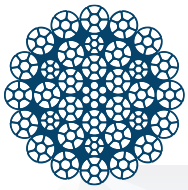
PRODUCT SELECTION

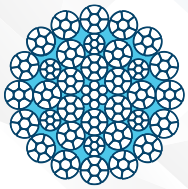
OFFSHORE PEDESTAL CRANES



- Boom Hoist Rope
- Main Hoist Rope
- Whip Hoist Rope

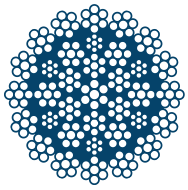
ENDURANCE DYFORM 34LR & 34LR-PI





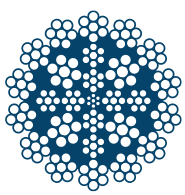
- Low rotation Dyform
- Recommended for high lifting operations
- High strength
- Reduced rope sheave wear
- Accurate diameter, recommended for multi-layer coiling
- Suitable for single part and multi-part reeving
- Long service life

ENDURANCE 35LS



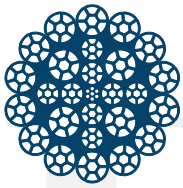
- Low rotation
- Flexible construction
- Excellent spooling
- Recommended for high lifting operations typically found in the North Sea

ENDURANCE 50DB



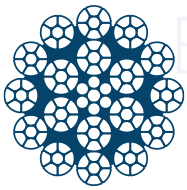
- Highest breaking force of all conventional rotation resistant constructions
- Good flexibility
- Rotation resistant construction
- Suitable for single part or multi-part reeving
- Lubricated during manufacture with a high performance lubricant

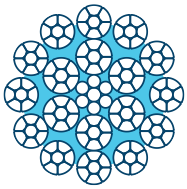
ENDURANCE DYFORM 50DB



- High breaking force
- Excellent rotation resistant characteristics
- Crush resistant
- Excellent spooling
- Good wear characteristics
- Reduced sheave wear

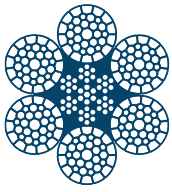
ENDURANCE DYFORM 18 & 18PI





- High breaking force
- Rotation resistant
- Reduced sheave wear
- Long service life
- Reduced downtime

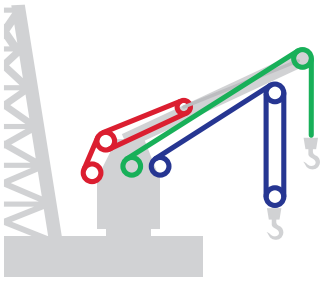
ENDURANCE DYFORM 6



- Exceptional service life
- Robust crush resistant Dyform construction
- Accurate diameter, recommended for multi-layer coiling
- Long-life, reduced lifetime costs

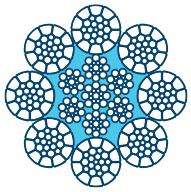
PRODUCT SELECTION

OFFSHORE PEDESTAL CRANES



- Boom Hoist Rope
- Main Hoist Rope
- Whip Hoist Rope

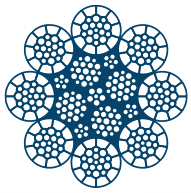
ENDURANCE DYFORM 8-PI



- Plastic encapsulated core
- Robust crush resistant Dyform construction
- Reduced stretch
- Recommended for multi-layer coiling
- Long life, reduced lifetime costs

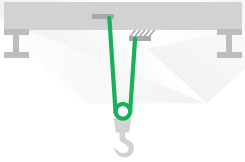
ENDURANCE DYFORM DSC8

(Only recommended for Boom Hoist applications where both ends are fixed)

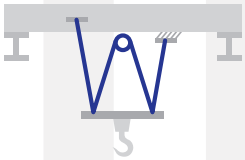


- Parallel laid rope
- Very high breaking force
- Exceptional service life
- Crush resistant

OVERHEAD CRANES

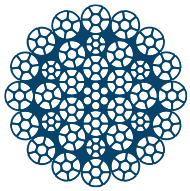


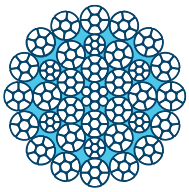
- Main Hoist Rope



- Main Hoist Rope

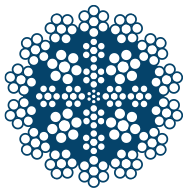
ENDURANCE DYFORM 34LR & 34LR-PI





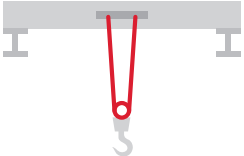
- Low rotation Dyform
- Recommended for high lifting operations
- High strength
- Reduced rope sheave & drum wear
- Accurate diameter
- Suitable for single part and multi-part reeving
- Long service life

ENDURANCE 50DB

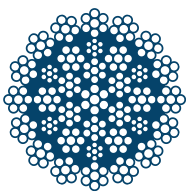


- Highest breaking force of all conventional rotation resistant constructions
- Good flexibility
- Rotation resistant construction
- Suitable for single part or multi-part reeving
- Lubricated during manufacture with a high performance lubricant

ENDURANCE 35LS

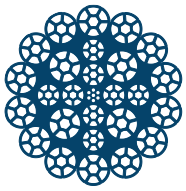


- Main Hoist Rope



- Low rotation
- Flexible construction
- Excellent spooling
- Recommended for high lifts

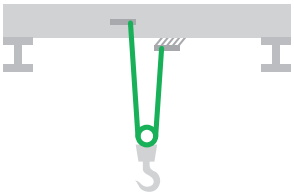
ENDURANCE DYFORM 50DB



- High breaking force
- Excellent rotation resistant characteristics
- Crush resistant
- Excellent spooling
- Good wear characteristics
- Reduced sheave wear

PRODUCT SELECTION

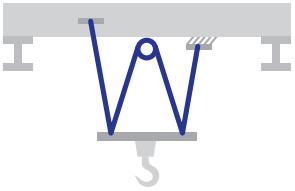
OVERHEAD CRANES



Main Hoist Rope

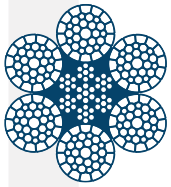
ENDURANCE DYFORM 18 & 18PI

- High breaking force
- Rotation resistant
- Reduced sheave wear
- Long service life
- Reduced downtime

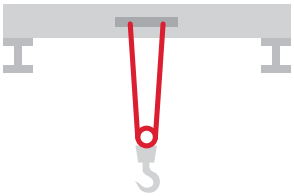


Main Hoist Rope

ENDURANCE DYFORM 6

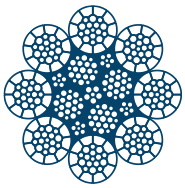


- Exceptional service life
- Robust crush resistant Dyform construction
- Accurate diameter
- Long-life, reduced lifetime costs



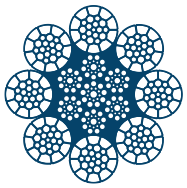
Main Hoist Rope

ENDURANCE DYFORM DSC8



- Parallel or double seale closed rope
- Robust crush resistant Dyform construction
- Very high breaking strength
- Exceptional service value
- Accurate diameter
- Long life, reduced lifetime costs

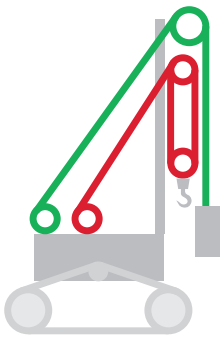
ENDURANCE DYFORM 8



- Excellent service life
- Lower downtime
- Flexible eight strand construction
- High temperature lubricant
- Consistently high quality
- Reduced lifetime costs

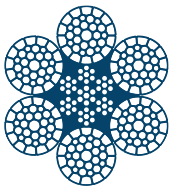
PRODUCT SELECTION

PILING ROPES



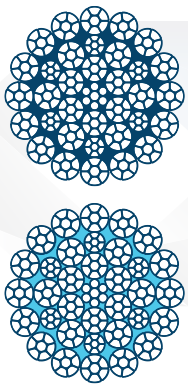
- Pipe Handling Rope
- Main Hoist Rope

ENDURANCE DYFORM 6



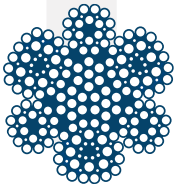
- Tough robust six strand Dyform rope
- Crush resistant
- Accurate rope diameter for effective spooling
- Long service life
- Reduced downtime
- Lower lifetime costs

ENDURANCE DYFORM 34LR & 34LR-PI



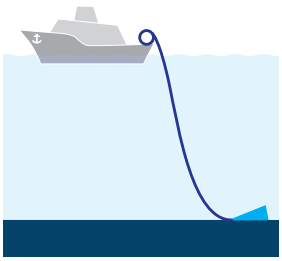
- Low rotation Dyform
- High breaking strength
- Crush resistant

CONSTRUCTEX



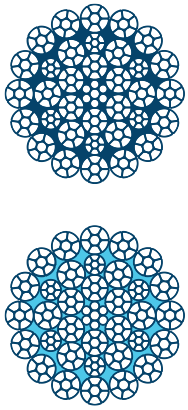
- Exceptional service life in the most demanding applications
- Rotary hammer swaged for maximum resistance to damage
- Robust construction

SEA PLOUGH ROPES



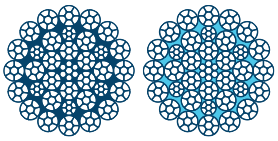
- Plough Rope

ENDURANCE DYFORM 34LR & 34LR-PI



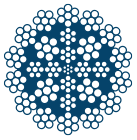
- Low rotation Dyform
- High breaking force
- Excellent service life
- Good resistance to abrasive wear
- Resists crushing in multi-layer coiling

ENDURANCE DYFORM 34LR & 34LRPI



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		EIPS / 1960 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
Dyform 34x7									
10	0.50	92.1	9.39	96.7	9.9	5.8	1.5	3.3	58
11	0.61	111	11.4	117	11.9	7.0	2.0	4.4	70
12	0.72	133	13.5	139	14.2	8.3	2.5	5.7	84
13	0.85	156	15.9	163	16.7	9.7	3.2	7.3	98
14	0.98	181	18.4	190	19.3	11	4.0	9.1	114
15	1.13	207	21.1	218	22.2	13	5.0	11	131
16	1.28	236	24.0	248	25.2	15	6.0	14	149
17	1.45	266	27.1	279	28.5	17	7.2	16	168
18	1.62	298	30.4	313	31.9	19	8.6	19	188
19	1.81	333	33.9	349	35.6	21	10	23	210
20	2.00	368	37.6	387	39.4	23	12	27	232
21	2.21	406	41.4	426	43.5	25	14	31	256
22	2.42	446	45.4	468	47.7	28	16	35	281
23	2.65	487	49.7	511	52.1	30	18	40	307
24	2.88	531	54.1	557	56.8	33	20	46	335
25	3.13	576	58.7	604	61.6	36	23	52	363
26	3.38	623	63.5	654	66.6	39	26	58	393
27	3.65	672	68.5	705	71.9	42	29	65	424
28	3.92	722	73.6	758	77.3	45	32	73	456
29	4.21	775	79.0	813	82.9	48	36	81	489
30	4.50	829	84.5	870	88.7	52	40	90	523
32	5.12	939	95.7	990	101	59	48	108	595
34	5.78	1060	108			67	58	130	672
35	6.13	1124	115			70	63	142	712
36	6.48	1189	121			75	68	154	753
38	7.22	1325	135			83	81	181	839
40	8.00	1468	150			92	94	211	930
Dyform 34x19									
42	8.82	1618	165			101	109	245	1025
44	9.68	1776	181			111	125	281	1125
46	10.6	1941	198			122	143	321	1230
48	11.5	2113	215			133	162	365	1339
50	12.5	2293	234			144	183	413	1453
52	13.5	2480	253			156	206	464	1572
54	14.6	2675	273			168	231	520	1695
56	15.7	2877	293			180	258	580	1823
58	16.8	3033	309			194	281	633	1955
60	18.0	3246	331			207	312	701	2092
62	19.2	3466	353			221	344	774	2234
64	20.5	3693	376			236	378	851	2381
66	21.8	3927	400			251	415	933	2532
68	23.1	4031	411			266	454	1021	2687
Dyform 34x31									
70	24.5	4272	436			282	489	1101	2848
72	25.9	4519	461			298	533	1198	3013
74	27.4	4774	487			315	578	1301	3183
76	28.9	5036	513			332	626	1409	3357

ENDURANCE 50DB

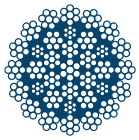


Diameter	Approx.nominal length mass	Minimum breaking force (Fmin) EIPS / 1960 grade		Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
					Ordinary	Lang's	
mm	kg/m	kN	tonnes	MN	N.m	N.m	mm²
8	0.27	49.6	5.06	3.1	n/a	2.9	32
9	0.35	62.8	6.41	3.9	n/a	4.1	40
10	0.43	77.6	7.91	4.8	n/a	5.6	49
11	0.52	93.9	9.6	5.8	n/a	7.4	60
12	0.61	112	11.4	6.9	n/a	10	71
13	0.72	131	13.4	8.1	n/a	12	84
14	0.84	152	15.5	9.4	n/a	15	97
15	0.96	175	17.8	11	n/a	19	111
16	1.09	199	20.2	12	n/a	23	127
17	1.23	224	22.9	14	n/a	27	143
18	1.38	251	25.6	16	n/a	33	160
19	1.54	280	28.5	17	n/a	38	179
20	1.71	310	31.6	19	n/a	45	198
21	1.88	342	34.9	21	n/a	52	218
22	2.07	375	38.3	23	n/a	59	239

ENDURANCE DYFORM 50DB

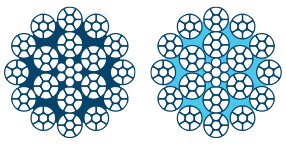
Diameter	Approx.nominal length mass	Minimum breaking force (Fmin) EIPS / 1960 grade		Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
					Ordinary	Lang's	
mm	kg/m	kN	tonnes	MN	N.m	N.m	mm²
8	0.30	57.2	5.83	3.6	n/a	2.7	37
9	0.38	72.4	7.38	4.5	n/a	3.9	46
10	0.47	89.3	9.10	5.6	n/a	5.4	57
11	0.57	108	11.0	6.7	n/a	7	69
12	0.68	129	13.1	8.0	n/a	9	83
13	0.80	151	15.4	9.4	n/a	12	97
14	0.93	175	17.8	11.0	n/a	15	112
15	1.06	201	20.5	13	n/a	18	129
16	1.21	229	23.3	14	n/a	22	147
17	1.36	258	26.3	16	n/a	26	166
18	1.53	289	29.5	18	n/a	31	186
19	1.70	323	32.9	20	n/a	37	207
20	1.89	357	36.4	22	n/a	43	229
21	2.08	394	40.2	25	n/a	50	253
22	2.28	432	44.0	27	n/a	57	277
23	2.50	473	48.2	29	n/a	65	303
24	2.72	515	52.5	32	n/a	74	330
25	2.95	558	56.9	35	n/a	84	358
26	3.19	604	61.6	38	n/a	94	388

ENDURANCE 35LS



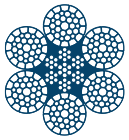
Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)		Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		EIPS / 1960 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	MN	N.m	N.m	mm²
10	0.45	75.5	7.69	5.1	1.2	2.7	50
11	0.54	91.3	9.31	6.2	1.6	3.6	61
12	0.65	109	11.1	7.4	2.1	4.7	72
13	0.76	128	13.0	8.7	2.7	6.0	85
14	0.88	148	15.1	10	3.3	7.5	98
15	1.01	170	17.3	12	4.1	9.2	113
16	1.15	193	19.7	13	4.9	11	129
18	1.46	244	24.9	17	7.0	16	163
19	1.62	272	27.8	18	8.3	19	181
20	1.80	302	30.8	20	9.7	22	201
21	1.98	333	33.9	23	11	25	221
22	2.18	365	37.2	25	13	29	243
23	2.38	399	40.7	27	15	33	266
24	2.59	435	44.3	29	17	38	289
25	2.81	472	48.1	32	19	42	314
26	3.04	510	52.0	35	21	48	339
28	3.53	592	60.3	40	27	60	394
32	4.61	773	78.8	52	40	89	514

ENDURANCE DYFORM 18 & 18PI



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)		Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
					Ordinary	Lang's	
mm	kg/m	kN	tonnes	MN	N.m	N.m	mm²
16	1.27	216	22.0	14	21	31	143
17	1.44	244	24.8	15	25	37	161
18	1.61	273	27.8	17	29	44	181
19	1.79	304	31.0	19	35	52	201
20	1.99	337	34.4	21	40	61	223
21	2.19	372	37.9	23	47	70	246
22	2.41	408	41.6	26	54	81	270
23	2.63	446	45.4	28	62	92	295
24	2.86	485	49.5	31	70	105	321
25	3.11	527	53.7	33	79	119	349
26	3.36	570	58.1	36	89	133	377
27	3.62	614	62.6	39	100	149	407
28	3.90	661	67.4	42	111	167	437
29	4.18	709	72.3	45	123	185	469
30	4.47	759	77.3	48	137	205	502
32	5.09	863	88.0	54	166	249	571

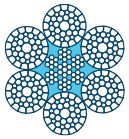
ENDURANCE DYFORM 6 & 6PI



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		EIPS / 1960 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
Dyform 6x26WS									
8	0.29	53.0	5.40	57.5	5.86	3.5	5.8	9.2	34
9	0.37	67.0	6.83	72.8	7.42	4.4	8.3	13	43
10	0.46	82.8	8.44	89.8	9.16	5.4	11	18	53
11	0.56	100	10.2	109	11.1	6.6	15	24	64
12	0.66	119	12.1	129	13.2	7.8	20	31	76
13	0.78	140	14.3	152	15.5	9.2	25	40	89
14	0.90	162	16.5	176	18.0	11	31	50	103
15	1.03	186	19.0	202	20.6	12	39	61	118
Dyform 6x36WS									
16	1.17	212	21.6	230	23.4	14	47	74	135
17	1.33	239	24.4	260	26.5	16	56	89	152
18	1.49	268	27.3	291	29.7	18	67	105	170
19	1.66	299	30.5	324	33.1	20	78	124	190
20	1.84	331	33.7	359	36.6	22	91	144	210
22	2.22	401	40.8	435	44.3	26	122	192	255
24	2.64	477	48.6	518	52.8	31	158	249	303
26	3.10	559	57.0	607	61.9	37	201	317	356
28	3.60	649	66.1	704	71.8	42	251	396	413
30	4.13	745	75.9	809	82.4	49	308	487	474
32	4.70	847	86.4	920	93.8	56	374	591	539
34	5.30	957	97.5	1039	106	63	449	709	608
36	5.95	1073	109	1164	119	70	533	842	682
38	6.62	1195	122	1297	132	78	627	990	760
40	7.34	1324	135	1438	147	87	731	1155	842
42	8.09	1460	149			96	846	1337	928
44	8.88	1602	163			105	973	1537	1019
46	9.71	1751	179			115	1112	1756	1113
Dyform 6x26WS									
48	10.57	1907	194			125	1263	1995	1212
50	11.47	2069	211			136	1428	1428	1316

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

DYFORM , BRISTAR 6



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		EIPS / 1960 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
16	1.09	213	21.7	227	23.1	14	47	74	133
17	1.23	240	24.5	256	26.1	15	56	89	150
18	1.38	269	27.5	287	29.2	17	67	106	168
19	1.54	300	30.6	320	32.6	19	79	124	187
20	1.70	333	33.9	354	36.1	21	92	145	207
22	2.06	403	41.0	429	43.7	26	122	193	251
24	2.45	479	48.8	510	52.0	31	159	251	299
26	2.88	562	57.3	599	61.0	36	202	319	350
28	3.34	652	66.5	694	70.8	42	252	398	406
30	3.83	748	76.3	797	81.2	48	310	489	467
32	4.36	852	86.8	907	92.4	55	376	594	531
34	4.92	961	98.0	1024	104	62	451	713	599
36	5.52	1078	110	1148	117	69	535	846	672
38	6.15	1201	122	1279	130	77	630	995	749

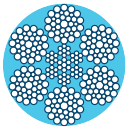
Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

Zebra

Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)		Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		IPS / 1770 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	MN	N.m	N.m	mm²
38	5.91	950	96.8	10	505	794	670
40	6.54	1055	108	11	591	928	742
44	7.92	1275	130	13	785	1234	898
48	9.42	1520	155	16	1021	1605	1069
52	11.1	1785	182	19	1299	2042	1255
56	12.8	2070	211	22	1623	2550	1455
60	14.7	2375	242	25	1995	3135	1670

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

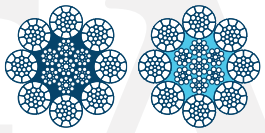
BRIFIL CLASS 6 X 36 STEEL CORE



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		IPS / 1770 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
16	1.05	161	16.4	179	18.2	12	40	63	118
18	1.33	204	20.8	226	23.0	16	57	89	149
19	1.48	227	23.1	252	25.7	17	67	105	166
20	1.64	252	25.7	279	28.4	19	78	123	184
22	1.98	305	31.1	338	34.5	23	104	164	223
24	2.36	363	37.0	402	41.0	28	135	212	265
26	2.76	426	43.4	472	48.1	32	172	270	311
28	3.21	494	50.4	547	55.8	38	214	337	361
32	4.19	645	65.7	715	72.9	49	320	503	471
36	5.30	817	83.3	904	92.2	62	456	716	596
38	5.91	910	92.8	1010	103	69	537	844	664
40	6.54	1010	103	1120	114	77	627	986	736
44	7.92	1220	124	1350	138	93	832	1307	891
48	9.42	1450	148	1610	164	110	1082	1700	1060

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

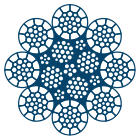
ENDURANCE DYFORM 8 & 8PI



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		EIPS / 1960 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
Dyform 8x19S									
10	0.47	88.2	8.99			5.3	12	16	53
11	0.57	107	10.9			6.5	16	21	65
12	0.68	127	12.9			7.7	21	27	77
13	0.80	149	15.2			9.0	27	35	90
14	0.92	173	17.6			10	34	44	105
15	1.06	198	20.2			12	42	54	120
16	1.20	226	23.0	236	24.1	14	51	65	137
17	1.36	255	26.0	267	27.2	15	61	78	154
Dyform 8x26WS									
18	1.52	286	29.1	299	30.5	17	72	93	173
19	1.70	318	32.5	333	33.9	19	85	109	193
20	1.88	353	36.0	369	37.6	21	99	127	214
22	2.28	427	43.5	446	45.5	26	131	169	258
24	2.71	508	51.8	531	54.2	31	171	219	308
26	3.18	596	60.8	623	63.6	36	217	279	361
28	3.69	691	70.5	723	73.7	42	271	349	419
30	4.23	794	80.9	830	84.6	48	333	429	481
32	4.82	903	92.1	944	96.3	55	405	520	547
34	5.44	1020	103.9	1066	109	62	485	624	617
Dyform 8x36WS									
36	6.10	1143	116.5	1195	122	69	576	741	692
38	6.79	1274	129.8	1332	136	77	678	871	771
40	7.53	1411	143.9	1476	150	85	790	1016	854
42	8.30	1556	158.6	1627	166	94	915	1176	942
44	9.11	1708	174.1	1786	182	103	1052	1352	1034
46	9.95	1866	190.2	1952	199	113	1202	1545	1130
48	10.8	2032	207.1	2125	217	123	1366	1756	1230
50	11.8	2205	224.8	2306	235	134	1544	1985	1335

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

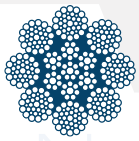
ENDURANCE DYFORM DSC8



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		EIPS / 1960 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
Dyform DSC 8x19S									
10	0.49	92.1	9.39	102	10.3	6.3	15	20	59
Dyform DSC 8x26WS									
11	0.59	111	11.4	123	12.5	7.6	20	27	71
12	0.71	133	13.5	146	14.9	9.1	26	35	85
13	0.83	156	15.9	172	17.5	11	33	45	100
14	0.96	181	18.4	199	20.3	12	41	56	115
15	1.10	207	21.1	228	23.3	14	50	68	133
16	1.26	236	24.0	260	26.5	16	61	83	151
17	1.42	266	27.1	293	29.9	18	73	100	170
18	1.59	298	30.4	329	33.5	20	87	118	191
19	1.77	333	33.9	366	37.4	23	102	139	213
20	1.96	368	37.6	406	41.4	25	119	162	236
22	2.38	446	45.4	491	50.1	31	159	216	285

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

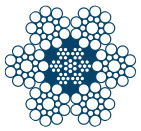
ENDURANCE 8



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		EIPS / 1960 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
Endurance 8x19S									
12	0.59	100	10.2	111	11.3	6.8	17	22	71
13	0.69	118	12.0	130	13.2	8.0	21	28	84
14	0.80	137	13.9	151	15.4	9.3	27	34	97
16	1.04	179	18.2	197	20.1	12	40	51	127
Endurance 8x25F									
18	1.32	226	23.0	249	25.4	15	57	73	160
19	1.47	252	25.7	278	28.3	17	67	86	179
20	1.63	279	28.5	308	31.4	19	78	100	198
22	1.97	338	34.4	372	37.9	23	104	134	239
24	2.34	402	41.0	443	45.1	27	135	174	285
26	2.75	472	48.1	520	53.0	32	172	221	334
28	3.19	547	55.8	603	61.5	37	214	276	388
30	3.66	628	64.0	692	70.5	43	264	339	445
32	4.17	715	72.8	787	80.3	49	320	412	507
34	4.70	807	82.2	889	90.6	55	384	494	572
Endurance 8x36WS									
36	5.27	904	92.2	997	102	62	456	586	641
38	5.88	1008	103	1110	113	69	536	689	714

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

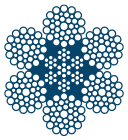
BLUE STRAND CLASS 6X19 STEEL CORE



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		IPS / 1770 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
6	0.14	22.7	2.31	25.1	2.56	1.66	2	3	16.2
7	0.20	30.9	3.15	34.2	3.49	2.27	3	4	22.0
8	0.26	40.3	4.11	44.7	4.56	2.96	5	6	28.7
9	0.32	51.0	5.20	56.5	5.76	3.75	7	9	36.4
10	0.40	63.0	6.42	69.8	7.12	4.62	10	13	44.9
11	0.48	76.2	7.77	84.4	8.60	5.60	13	17	54.3
12	0.58	90.7	9.25	100	10.2	6.66	17	22	64.7
13	0.68	106	10.8	118	12.0	7.82	21	28	75.9
14	0.78	124	12.6	137	14.0	9.06	27	35	88.0
16	1.02	161	16.4	179	18.2	11.8	40	52	115
18	1.30	204	20.8	226	23.0	15.0	57	73	145
19	1.44	227	23.1	252	25.7	16.7	67	86	162
20	1.60	252	25.7	279	28.4	18.5	78	100	180
22	1.94	305	31.1	338	34.5	22.4	104	134	217
24	2.30	363	37.0	402	41.0	26.6	135	174	259
26	2.70	426	43.4	472	48.1	31.3	172	221	304
28	3.14	494	50.4	547	55.8	36.3	214	276	352
32	4.10	645	65.7	715	72.9	47.4	320	412	460
36	5.18	817	83.3	904	92.2	59.9	456	586	582
38	5.78	910	92.8	1010	103	66.8	537	691	648
40	6.40	1010	103	1120	114	74.0	627	806	718
44	7.74	1220	124	1350	138	89.5	832	1069	869
48	9.22	1450	148	1610	164	107	1082	1391	1034
52	10.8	1700	173	1890	193	125	1376	1769	1214
56	12.5	1980	202	2190	223	145	1717	2208	1408
60	14.4	2270	231	2510	256	166	2108	2711	1616

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

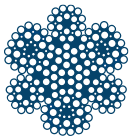
BLUE STRAND CLASS 6X36 STEEL CORE



Diameter	Approx.nominal length mass	Minimum breaking force (Fmin)				Axial stiffness @20% load	Torque generated @20% load		Metallic cross section
		IPS / 1770 grade		EEIPS / 2160 grade			Ordinary	Lang's	
mm	kg/m	kN	tonnes	kN	tonnes	MN	N.m	N.m	mm²
8	0.26	40.3	4.11	44.7	4.56	3	5	6	29
9	0.33	51.0	5.20	56.5	5.76	4	7	9	37
10	0.41	63.0	6.42	69.8	7.12	5	10	13	46
11	0.50	76.2	7.77	84.4	8.60	6	13	17	56
12	0.59	90.7	9.25	100	10.2	7	17	22	66
13	0.69	106	10.8	118	12.0	8	21	28	78
14	0.80	124	12.6	137	14.0	9	27	35	90
16	1.05	161	16.4	179	18.2	12	40	52	118
18	1.33	204	20.8	226	23.0	16	57	73	149
19	1.48	227	23.1	252	25.7	17	67	86	166
20	1.64	252	25.7	279	28.4	19	78	100	184
22	1.98	305	31.1	338	34.5	23	104	134	223
24	2.36	363	37.0	402	41.0	28	135	174	265
26	2.76	426	43.4	472	48.1	32	172	221	311
28	3.21	494	50.4	547	55.8	38	214	276	361
32	4.19	645	65.7	715	72.9	49	320	412	471
36	5.30	817	83.3	904	92.2	62	456	586	596
38	5.91	910	92.8	1010	103	69	537	691	664
40	6.54	1010	103	1120	114	77	627	806	736
44	7.92	1220	124	1350	138	93	832	1069	891
48	9.42	1450	148	1610	164	110	1082	1391	1060
52	11.1	1700	173	1890	193	129	1376	1769	1244
56	12.8	1980	202	2190	223	150	1717	2208	1443
60	14.7	2270	231	2510	256	172	2108	2711	1656

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

CONSTRUCTEX

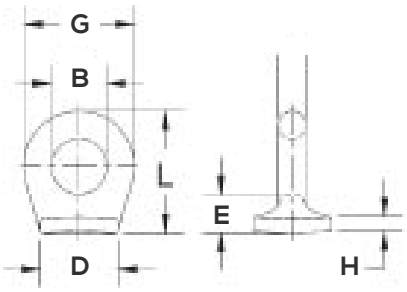


Diameter		Approx.nominal length mass		Minimum breaking force (Fmin)			Axial stiffness @20% load	Torque generated @20% load	Metallic cross section
				EIPS / 1960 grade				Ordinary	
mm	ins	kg/m	lb/ft	kN	tonnes	tons (200lbs)	MN	kN.m	mm²
15.9	5/8	1.34	0.90	227	23.1	25.5	15	0.051	143
19.1	3/4	1.64	1.10	325	33.1	36.5	22	0.087	206
22.2	7/8	2.23	1.50	432	44.0	48.5	30	0.134	279
25.4	1	2.98	2.00	556	56.7	62.5	39	0.198	365
28.6	1.1/8	3.87	2.60	707	72.1	79.5	50	0.283	463
31.8	1.1/4	4.76	3.20	868	88.5	97.5	61	0.387	572
34.9	1.3/8	5.66	3.80	1059	108	119	74	0.517	689
38.1	1.1/2	6.85	4.60	1237	126	139	88	0.660	822
41.3	1.5/8	7.89	5.30	1441	147	162	103	0.833	965
44.5	1.3/4	9.23	6.20	1646	168	185	120	1.025	1121

Lang's Lay must not be selected for use in any application where either end of the rope is free to rotate.

CROSBY PAD EYES S-264

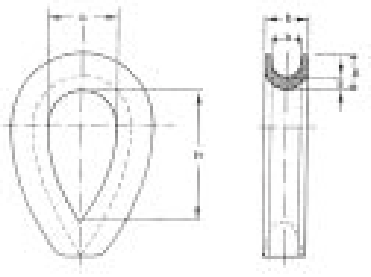
- Forged Steel - Quenched and Tempered.
- Forged from 1035 Carbon Steel.
- Excellent welding qualities.
- Widely used on farm machinery, trucks, steel hulled marine vessels and material handling equipment.
- Reference American Welding Society specifications for proper welding procedures.



Size number*	S-264 stock number	Weight per 100 (kg)	Dimensions (mm)						
			B	C	D	E	G	H	L
* 0	1090722	1.27	6.35	4.85	16	7.85	16	2.3	19.1
* 1	1090740	2.95	9.65	6.35	22.4	10.4	22.4	3.3	26.2
* 1.5	1090768	4.72	16	6.35	25.4	11.2	28.7	4.05	33.3
2	1090786	9.57	19.1	9.65	26.9	12.7	38.1	4.85	41.4
4	1090802	23.7	25.4	14.2	36.6	19.8	54	5.6	59.5
5	1090820	37.4	31.8	17.5	44.5	20.6	67	6.35	70

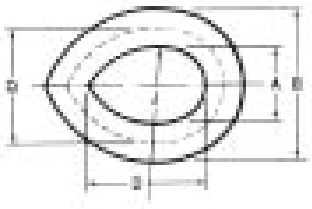
***Meets the requirements of Military Specification MS-51930A**

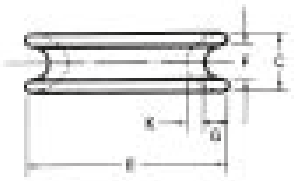
ORDINARY THIMBLE - TO DIN 3090



Nominal size (dia of rope)	a	b	c	s	p (min)	h	Approximate weight per 100 pieces
mm	mm	mm	mm	mm	mm	mm	kg
4	5	9	10	2.1	5.1	20	1.2
6	7	12	15	2.6	7.1	30	2.8
8	9	13	20	4	11	40	5.7
10	11	16	25	5	14	50	15.2
12	13	19	30	6	16	60	24
14	16	22	35	7	17	70	38
16	18	25	40	8	19	80	52
18	20	27	45	9	21	90	66
20	22	30	50	10	23	100	88
22	24	33	55	10	24	110	104
24	26	37	60	11	27	120	129
26	29	46	65	12	30	130	260
28	31	50	70	12	33	140	277
32	35	55	80	14	38	160	440
36	40	60	90	16	42	180	460
40	44	65	100	18	46	200	700
44	48	70	110	20	53	220	1000

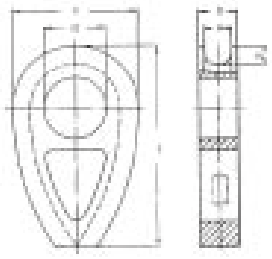
ORDINARY THIMBLE





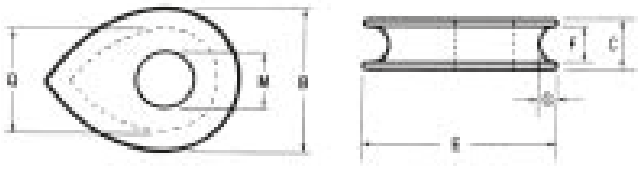
Nominal size (dia of rope)	A	B	C (min)	D	E	F (min)	G	J (approx)	K (min)	Q
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
8	22.2	38.1	12.7	33.3	54.0	7.9	4.0	63.5	4.0	30.2
9	25.4	47.6	14.3	38.1	63.5	10.3	6.4	76.2	4.8	34.9
11	28.6	54.0	17.5	41.3	73.0	12.7	7.9	76.2	4.8	38.1
13	31.8	58.7	20.6	44.4	79.4	14.3	7.9	88.9	5.6	42.9
14	31.8	58.7	20.6	44.4	79.4	14.3	7.9	88.9	5.6	42.9
16	41.3	74.6	22.2	58.7	98.4	15.9	8.7	114	7.9	57.2
17	44.4	79.4	28.6	66.7	108	19.0	9.5	127	7.9	60.3
19	50.8	92.1	28.6	73.0	124	20.6	11.1	152	9.5	69.8
21	50.8	92.1	28.6	73.0	124	20.6	11.1	152	9.5	69.8
22	57.2	102	31.8	82.6	133	22.2	12.7	165	9.5	76.2
24	63.5	110	33.3	92.1	146	25.4	12.7	178	10.3	84.1
25	69.8	119	34.9	108	162	27.0	14.3	203	10.3	90.5
29	76.2	133	38.1	111	178	28.6	15.9	229	12.7	102
32	95.2	152	41.3	133	197	33.3	15.9	254	12.7	121
35	105	175	47.6	152	229	38.1	19.0	305	15.9	137
38	114	197	54.0	165	254	41.3	23.8	330	17.5	149

SOLID THIMBLE - TO DIN 3091



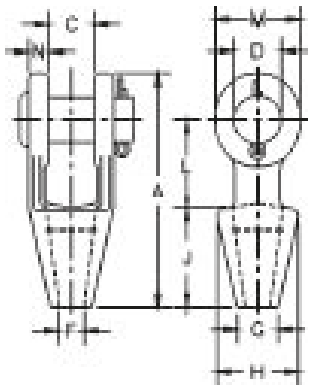
Nominal size (dia of rope)	a	b	d (min)	c	h	i	Approximate weight per 100 pieces
mm	mm	mm	mm	mm	mm	mm	kg
8	9	15	17	40	4.5	66	18.1
10	11	17.5	21	50	6	82	31.8
12	13	20	24	60	7.5	98	51.5
14	16	23.5	29	70	9	114	79.9
16	18	26	32	80	10.5	130	89.5
18	20	28.5	35	90	12	145	121
20	22	31	40	100	13.5	161	161
22	24	33.5	43	110	15	177	211
24	26	36	46	120	16.5	193	271
26	29	39.5	49	130	18	209	355
28	31	42	52	140	20	224	420
32	35	47	58	160	23	256	630
36	40	53	65	180	26	288	884
40	44	58	71	200	29	320	1100
44	48	63	76	220	32	352	1500

SOLID THIMBLE - TO BS464:1958



Nominal size (dia of rope)	Q	B	C	E	F (min)	G	M (max)
mm	mm	mm	mm	mm	mm	mm	mm
8	25.4	34.9	11.1	47.6	7.9	4.8	12.7
9	31.8	44.4	14.3	57.2	11.1	6.4	15.9
11	38.1	52.4	17.5	69.8	12.7	7.1	19.0
13	44.4	60.3	20.6	82.6	14.3	7.9	22.2
14	44.4	60.3	20.6	82.6	14.3	7.9	22.2
16	50.8	69.8	22.2	95.2	15.9	9.5	25.4
18	57.2	79.4	25.4	105	19.0	11.1	28.6
19	63.5	85.7	28.6	118	22.2	11.1	31.8
20	63.5	85.7	28.6	118	22.2	11.1	31.8
22	69.8	95.2	31.8	127	23.8	12.7	34.9
24	76.2	105	33.3	140	25.4	14.3	38.1
26	82.6	114	36.5	152	27.0	15.9	41.3
28	88.9	124	39.7	165	30.2	17.5	44.4
32	102	140	44.4	191	33.3	19.0	50.8
35	114	156	50.8	210	38.1	20.6	57.2
38	127	171	57.2	235	41.3	22.2	63.5

CROSBY OPEN SPELTER SOCKET G-416



Forged Steel Sockets through 38 mm, cast alloy steel 40 mm through 100 mm.

Spelter socket terminations have an efficiency rating of 100%, based on the catalogue strength of wire rope. Ratings are based on recommended use with 6 x 7, 6 x 19, or 6 x 37, IPS or XIP (EIP), XXIP (EEIP), RRL, FC, or IWRC wire rope.

Open Grooved Sockets meet the performance requirements of Federal Specification RR-S-550D, Type A, except for those provisions required of the contractor.

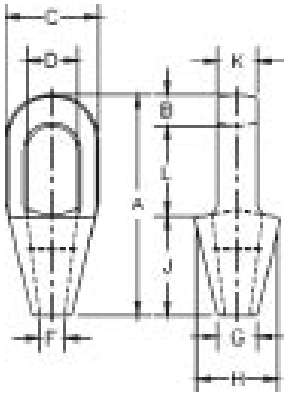
NOTICE: All cast steel sockets 40 mm and larger are magnetic particle inspected and ultrasonic inspected. Proof testing available on special order.

Drawing illustrates one groove used on sockets 6 mm through 19 mm. Sizes 22 mm through 38 mm use 2 grooves. Sizes 40 mm and larger use 3 grooves.

Rope dia. (mm)*	Structural strand dia. (mm)	Stock no.	Weight each (kg)	Dimensions (mm)									
		G-416 galv.		A	C	D	F	G	H	J	L	M	N
6-7	-	1039619	0.5	116	19.1	17.5	9.65	17.5	39.6	57	39.6	33.3	9.1
8-10	-	1039637	0.59	123	20.6	20.6	12.7	20.6	42.9	57	44.5	38.1	11.2
11-13	-	1039655	1.02	141	25.4	25.4	14.2	23.9	47.8	63.5	51	47.8	12.7
14-16	12-13	1039673	1.63	171	31.8	30.2	17.5	28.7	57	76	63.5	57	14.2
18	14-16	1039691	2.64	202	38.1	35.1	20.6	31.8	66.5	89	76	66.5	15.7
20-22	18-19	1039717	4.38	235	44.5	41.4	23.9	38.1	82.5	102	89	79.5	20.3
24-26	20-22	1039735	7.03	268	51	51	28.7	44.5	95.5	114	102	95.5	22.4
28-30	24-26	1039753	9.75	300	57	57	31.8	51	105	127	117	105	25.4
32-35	28	1039771	14.1	335	63.5	63.5	38.1	57	121	140	127	121	28.7
38	30-32	1039799	21.4	384	76	70	41.4	70	133	152	152	137	30.2
* 40-42	33-35	1039815	24.9	413	76	76	44.5	76	140	165	165	146	33.3
* 44-48	36-40	1039833	37.2	464	89	89	51	79.5	162	191	178	165	39.6
* 50-54	42-45	1039851	59	546	102	95.5	57	95.5	187	216	229	178	46
* 56-60	46-48	1039879	76	597	114	108	63.5	102	210	229	254	197	54
* 64-67	50-54	1041633	114	648	127	121	73	114	235	248	274	216	60.5
* 70-73	56-62	1041651	143	692	133	127	79	124	267	279	279	229	73
* 75-80	64-67	1041679	172	737	146	133	86	133	282	305	287	241	76
* 82-86	70-73	1041697	197	784	159	140	92	146	302	330	300	254	79
* 88-92	76-80	1041713	255	845	171	152	98.5	165	314	356	318	274	82.5
* 94-102	-	1041731	355	921	191	178	108	184	346	381	343	318	89

*Cast Alloy Steel

CROSBY CLOSED SPELTER SOCKET G-417



Forged Steel Sockets through 38 mm, cast alloy steel 40 mm through 100 mm.

Spelter socket terminations have an efficiency rating of 100%, based on the catalogue strength of wire rope. Ratings are based on the recommended use with 6 x 7, 6 x 19 or 6 x 37, IPS or XIP (EIP) , XXIP (EEIP), RRL, FC or IWRC wire rope.

Closed grooved Sockets meet the performance requirements of Federal Specification RR-S-550D, Type B, except for those provisions required of the contractor.

NOTICE: All cast steel sockets 40 mm and larger are magnetic particle inspected and ultrasonic inspected. Proof testing available on special order.

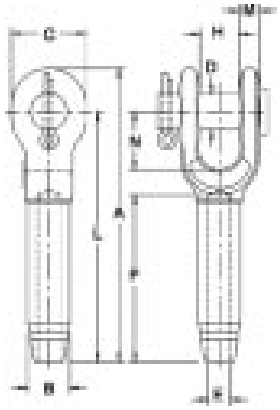
Drawing illustrates one groove used on sockets 6 mm through 19 mm. Sizes 22 mm through 38 mm use 2 grooves. Sizes 40 mm and larger use 3 grooves.

Rope dia. (mm)*	Structural strand dia. (mm)	Stock no.	Weight each (kg)	Dimensions (mm)									
		G-417 galv.		A	B	C	D **	F	G	H	J	K	L
6-7	-	1039897	0.23	116	12.7	39.6	22.4	9.65	17.5	39.6	57.2	12.7	46
8-10	-	1039913	0.34	125	15.8	42.9	24.6	12.7	20.6	42.9	57.2	17.5	52.3
11-13	-	1039931	0.68	140	17.5	51	29.5	14.2	23.9	51	63.5	22.4	58.7
14-16	12-13	1039959	1.13	162	20.6	67	35.8	17.5	30.2	67	76.2	25.4	65
18	14-16	1039977	1.92	194	26.9	76.2	42.2	22.4	33.3	70	89	31.8	77.7
20-22	18-19	1039995	3.28	226	33.3	92	49.3	25.4	38.1	82.5	102	38.1	90.5
24-26	20-22	1040019	4.76	254	36.6	105	58.5	28.7	44.5	95.5	114	44.5	103
28-30	24-26	1040037	6.46	283	39.6	114	65	31.8	51	105	127	51	116
32-35	28	1040055	8.95	309	41.4	127	71	38.1	58.5	119	138	56.5	129
38	30-32	1040073	13.24	355	49.3	137	81	41.4	70.5	132	151	62.5	155
* 40-42	33-35	1040091	16.32	390	54	146	82.5	44.5	76.2	140	165	70	171
* 44-48	36-40	1040117	25.96	445	55.5	171	95.5	51	79.5	162	191	76.2	198
* 50-54	42-45	1040135	35.83	505	62	194	111	57.2	95.5	187	216	82.5	224
* 56-60	46-48	1040153	47.62	546	70	216	127	66.8	105	210	229	92	248
* 64-67	50-54	1041759	63.50	597	79.5	241	140	74.5	114	235	248	102	270
* 70-73	56-62	1041777	99.79	645	79.5	273	159	79.5	124	259	279	124	286
* 75-80	64-67	1041795	125	689	85.6	292	171	86	133	292	305	133	298
* 82-86	70-73	1041811	142	743	102	311	184	92	146	311	330	146	311
* 88-92	76-80	1041839	181	787	102	330	197	98.5	160	330	356	159	330
* 94-102	-	1041857	246	845	108	362	216	108	184	362	381	178	356

*Cast Alloy Steel

**Diameter of pin must not exceed pin used on companion 416 socket.

CROSBY OPEN SWAGED SOCKET S-501



Forged from special bar quality carbon steel, suitable for cold forming.

Swage Socket terminations have an efficiency rating of 100% based on the catalogue strength of wire rope.

Hardness controlled by spheroidize annealing.

Stamp for identification after swaging without concern for fractures (as per directions in National Swaging Brochure).

Swage sockets incorporate a reduced machined area of the shank which is equivalent to the proper «After Swage» dimension. Before swaging, this provides for an obvious visual difference in the shank diameter. After swaging, a uniform shank diameter is created allowing for a QUICCHECK® and permanent visual inspection opportunity.

Designed to quickly determine whether the socket has been through the swaging operation and assist in field inspections, it does not eliminate the need to perform standard production inspections which include gauging for the proper «After Swage» dimensions or proof loading.

U.S. Patent 5,152,630 and foreign equivalents.

NOTICE: S-501 Swage Sockets are recommended for use with 6 x 19 or 6 x 37, IPS or XIP (EIP), XXIP (EEIP), RRL, FC or IWRC wire rope.

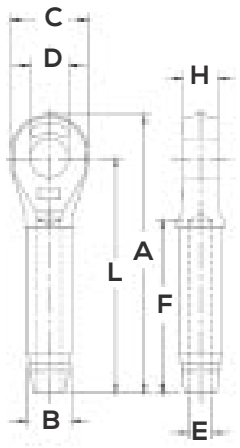
Before using any National Swage fitting with any other type lay, construction or grade of wire rope, it is recommended that the termination be destructive tested and documented to prove the adequacy of the assembly to be manufactured.

In accordance with ANSI B30.9, all slings terminated with swage sockets shall be proof loaded.*

S-501 Open Socket Secification													
S-501 stock number	Rope size (mm)*	Weight each (kg)	A	B	C	D	E	F	H	L	M	N	Max. after swage Dim (mm)
1039021	6	0.24	122	12.7	35.1	17.5	6.85	54	17.5	102	9.65	38.1	11.7
1039049	8	0.51	159	19.6	41.1	20.6	8.65	81	20.6	135	11.9	44.5	18
1039067	9-10	0.59	159	19.6	41.1	20.6	10.4	81	20.6	135	11.9	44.5	18
1039085	11-12	0.94	198	24.9	51	25.4	12.2	108	25.4	170	14.2	51	23.1
1039101	13	0.94	198	24.9	51	25.4	14	108	25.4	170	14.2	51	23.1
1039129	14	2.12	241	31.8	60.5	30.2	15.5	135	31.8	207	17.3	57	29.5
1039147	16	2.05	241	31.8	60.5	30.2	17	135	31.8	207	17.3	57	29.5
1039165	18-20	3.62	294	39.4	70	35.1	20.3	162	38.1	254	19.8	70	36.1
1039183	22	5.23	341	43.2	79.5	41.1	23.9	189	44.5	295	23.9	82.5	39.4
1039209	24-26	8.07	393	50.5	93.5	51	26.9	216	51	340	26.9	95.5	45.7
1039227	28	11.5	440	57	103	57	30.2	243	57	381	30.2	108	52
1039245	32	16.1	484	64.5	114	63.5	33.8	270	63.5	419	31	121	58.5
1039263	34-36	19.8	532	71	127	63.5	36.8	297	63.5	461	35.1	133	65
1039281	38-40	26.5	581	78	140	70	40.1	324	76	502	42.9	146	71.5
1039307	44	40.3	676	86	170	89	47.2	378	89	584	53.5	171	77.5
1042767	48-52	66	799	100	203	95.5	53.5	432	102	683	60	203	90.5

*Maximum Proof Load shall not exceed 50% of XXIP rope catalogue breaking strength.

CROSBY CLOSED SWAGED SOCKET S-502



Forged from special bar quality carbon steel, suitable for cold forming.

Swage Socket terminations have an efficiency rating of 100% based on the catalogue strength of wire rope.

Hardness controlled by spheroidize annealing.

Stamp for identification after swaging without concern for fractures (as per directions in National Swaging Brochure).

Swage sockets incorporate a reduced machined area of the shank which is equivalent to the proper «After Swage» dimension. Before swaging, this provides for an obvious visual difference in the shank diameter. After swaging, a uniform shank diameter is created allowing for a QUIC-CHECK® and permanent visual inspection opportunity.

Designed to quickly determine whether the socket has been through the swaging operation and assist in field inspections, it does not eliminate the need to perform standard production inspections which include gauging for the proper «After Swage» dimensions or proof loading.

U.S. Patent 5,152,630 and foreign equivalents.

NOTICE: S-502 Swage Sockets are recommended for use with 6 x 19 or 6 x 37, IPS or XIP (EIP), XXIP (EEIP), RRL, FC or IWRC wire rope.

Before using any National Swage fitting with any other type lay, construction or grade of wire rope, it is recommended that the termination be destructive tested and documented to prove the adequacy of the assembly to be manufactured.

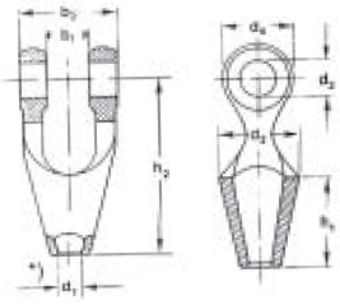
In accordance with ANSI B30.9, all slings terminated with swage sockets shall be proof loaded.*

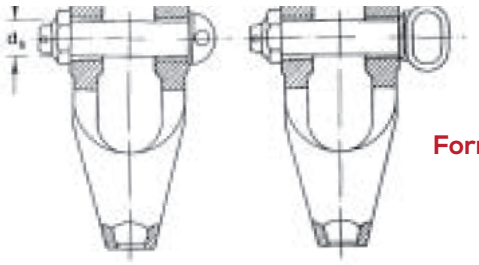
S-502 stock number	Rope size (mm)*	Weight each (kg)	Before swage dimensions								Max. after swage Dim (mm)
			A	B	C	D	E	F	H	L	
1039325	6	0.15	109	12.7	35.1	19.1	6.85	54	12.7	89	11.7
1039343	8	0.34	138	19.6	41.1	22.4	8.65	81	17	114	18
1039361	9-10	0.33	138	19.6	41.1	22.4	10.4	81	17	114	18
1039389	11-12	0.64	176	24.9	51	26.9	12.2	108	21.8	146	23.1
1039405	13	0.64	176	24.9	51	26.9	14	108	21.8	146	23.1
1039423	14	1.32	220	31.8	60.5	31.8	15.5	135	28.7	184	29.5
1039441	16	1.29	220	31.8	60.5	31.8	17	135	28.7	184	29.5
1039469	18-20	2.27	261	39.4	73	36.6	20.3	162	33.3	219	36.1
1039487	22	3.08	303	43.2	79	42.9	23.9	189	38.1	257	39.4
1039502	24-26	4.72	344	50.5	92	52.5	26.9	216	44.5	292	45.7
1039520	28	6.72	382	57	102	58.5	30.2	243	51	324	52
1039548	32	9.78	430	64.5	114	65	33.8	270	57	365	58.5
1039566	34-36	12.9	473	71	127	65	36.8	297	57	400	65
1039584	38-40	17.3	511	78	140	71.5	40.1	324	63.5	432	71.5
1039600	44	23.1	598	86	159	90.5	47.2	378	76	508	77.5
1042589	48-52	40.5	702	100	184	96.5	53.5	432	82.5	584	90.5

*Maximum Proof Load shall not exceed 50% of XXIP rope catalogue breaking strength.

OPEN SOCKET - TO DIN 83313

Form B

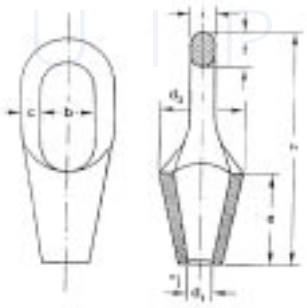




Form C

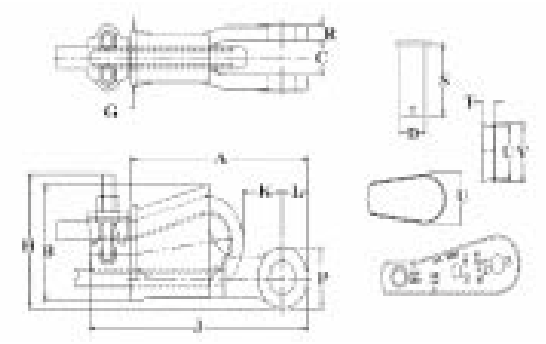
Nominal size	S.W.L	Rope Dia.	b1	b2	d1	d2	d3	d4	d6	h1	h2	Approximate weight per piece	
												Form B	Form C
t	t	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	kg
1	1	10 - 12	21	47	14	45	17	35	M16	50	105	0.5	0.6
1.6	1.6	12 - 14	27	61	17	55	21	45	M20	60	125	0.9	1.1
2.5	2.5	14 - 18	33	75	20	62	25	55	M24	69	148	1.4	1.8
3	3	16 - 20	38	86	22	69	28	60	M27	78	165	1.8	2.4
4	4	18 - 22	42	96	24	76	31	65	M30	84	180	2.4	3.2
5	5	20 - 24	47	107	27	85	37	75	M36	94	200	3.7	5.0
6	6	22 - 28	53	121	30	94	40	85	M39	106	220	5.0	6.7
8	8	26 - 30	60	136	33	103	46	95	M45	115	242	7.0	9.05
10	10	28 - 34	66	150	36	112	50	110	M48	125	265	10	13
12	12.5	32 - 38	73	167	40	125	54	120	M52	140	296	13	17
16	16	36 - 44	81	185	45	140	62	130	M60	159	332	18	24
20	20	40 - 50	90	206	50	156	70	140	M68	174	365	23	31

CLOSED SOCKET - TO DIN 83313



Nominal size	S.W.L	Rope Dia.	b	c	d1	d2	e	f	h	i	Approximate weight per piece
t	t	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
1	1	10-12	30	8	14	45	50	15	130	12	0.4
1.6	1.6	12-14	37	12	17	55	60	19	155	15	0.7
2.5	2.5	14-18	45	14	20	62	69	24	182	19	1.2
3	3.15	16-20	50	16	22	69	78	26	202	21	1.5
4	4	18-22	54	18	24	76	84	30	220	24	2
5	5	20-24	60	20	27	85	94	34	245	27	3.1
6	6.3	22-28	67	23	30	94	106	38	275	30	4.2
8	8	26-30	73	26	33	103	115	42	300	33	5.8
10	10	28.34	80	29	36	112	125	45	330	36	8
12	12.5	32-38	89	32	40	125	140	51	370	41	11
16	16	36-44	100	35	45	140	159	56	415	46	15
20	20	40-50	110	40	50	156	174	62	460	50	20

CROSBY WEDGE SOCKET S-421T TERMINATOR™ - TO EN13411-6:2003



Basket is cast steel.

Wedge socket terminations have an efficiency rating of 80% based on the catalogue strength of XXIP wire rope.

Crosby products meet or exceed all requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements. Importantly, Crosby products meet other critical performance requirements including fatigue life, impact properties and material traceability, not addressed by ASME B30.26.

Individually magnetic particle inspected.

Pin diameter and jaw opening allows wedge and socket to be used in conjuction with open swage and spelter sockets.

Secures the tail or «dead end» of the wire rope to the wedge, thus eliminates loss or «Punch out» of the wedge.

Eliminates the need for an extra piece of rope, and is easily installed.

The TERMINATOR™ wedge eliminates the potential breaking off of the tail due to fatigue.

The tail, which is secured by the base of the clip and the wedge, is left undeformed and available for reuse.

Incorporates Crosby's patented QUIC-CHECK® «Go» and «No-Go» feature cast into the wedge. The proper size rope is determined when the following criteria are met:

1. **The wire rope should pass through the «Go» hole in the wedge.**
2. **The wire rope should NOT pass through the «No-Go» hole in the wedge.**

Utilises standard Crosby Red-U-Bolt® wire rope clip.

Standard S-421 wedge socket can be retrofitted with the new style TERMINATOR™ wedge.
Available with Bolt, Nut, and Cotter Pin.
U.S. patent 5,553,360 and foreign equivalents.

Wire rope dia. (mm)	S-421T stock number*	Weight each (kg)	S-421TW stock number wedge only	Wedge only weight each (kg)	Optional G-4082 bolt, nut & cotter G-4082 stock number	Optional G-4082 bolt, nut & cotter G-4082 weight each (kg)
9-10	1035000	1.44	1035555	0.23	1092227	0.17
11-13	1035009	2.79	1035564	0.48	1092236	0.31
14-16	1035018	4.4	1035573	0.81	1092254	0.52
18-19	1035027	6.58	1035582	1.18	1092281	0.86
20-22	1035036	9.75	1035591	1.82	1092307	1.46
24-26	1035045	13.9	1035600	2.44	1092325	2.44
28	1035054	20.5	1035609	3.56	1092343	3.4
30-32	1035063	29.4	1035618	4.8	1092372	4.7

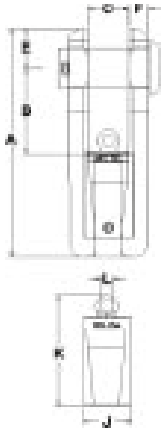
Wire rope dia. (mm)	S-421T stock number*	A	B	C	D	G	H	J†	K†	L	P	R	S	T	U	V
9-10	1035000	145	69.1	20.6	20.6	35.1	77.7	198	47.8	22.4	39.6	11.2	54.1	11.2	31.8	35.1
11-13	1035009	175	88.1	25.4	25.4	41.1	95.5	226	32	26.9	49.3	12.7	65	13.5	44.5	47.8
14-16	1035018	210	109	31.8	30.2	53.8	114	273	50.5	31	57.2	14.2	82.6	17.5	51	55.5
18-19	1035027	251	130	38.1	35.1	62	134	314	61.2	35.6	66.8	16.8	92.2	19.8	59.5	65
20-22	1035036	286	149	44.5	41.4	68.5	156	365	63	42.4	79.5	19.1	109	22.4	68.5	74.5
24-26	1035045	325	161	51	51	74.7	177	414	77.2	51	95.5	22.4	119	26.2	73	83.5
28	1035054	365	176	57	57	84	194	466	65	57	108	25.4	138	27.9	82.6	90.5
30-32	1035063	415	222	66.5	63.5	90.5	239	520	74.7	59.5	114	26.9	156	30.2	117	125

S-421T TERMINATOR™ Assembly includes Socket, Wedge, Pin and Wire Rope Clip.

† Nominal

NOTE: For intermediate wire rope sizes, use next larger size socket.

CROSBY BUTTON SPELTER SOCKETS SB-427



Available in six sizes from 13mm to 38mm.

Button Spelter terminations have a 100% efficiency rating, based on the catalogue strength of the wire rope.

Designed for use with mobile cranes. Can be used to terminate high performance, rotation resistant ropes, and standard 6 strand ropes.

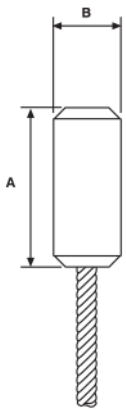
Easy to install assembly utilises Crosby® WIRELOCK® socketing compound. Refer to the Crosby Group Inc. general catalogue, April 2006 for WIRELOCK® requirements.

Sockets and buttons are re-usable.

Replacement buttons and sockets are available.

Wire rope size		SB-427 stock number	Weight each (kg)	Socket only stock number	Button only stock number	Dimensions (mm)								
In.	mm					A	B	C	D	E	F	J	K	L
1/2 - 5/8	13-16	1052005	2.76	1052107	1052309	183	67.6	32.5	30.2	31	15.7	38.1	88.9	6.35
5/8 - 3/4	16-19	1052014	4.67	1052116	1052318	217	79.2	38.8	35.1	36.6	19.1	44.5	109	9.65
3/4 - 7/8	19-23	1052023	7.75	1052125	1052327	254	92	45.2	41.1	42.9	22.4	52.3	121	9.65
7/8 - 1	22-26	1052032	13.24	1052134	1052336	298	111	51.6	51	51	26.2	61.9	143	15.7
1-1/8 - 1-1/4	28-32	1052041	20.86	1052143	1052345	351	127	64.3	57.2	63.5	28.2	74.7	180	19.1
1-3/8 - 1-1/2	35-38	1052050	35.38	1052152	1052354	424	152	77	69.9	79.2	32.3	91.9	205	19.1

CRANE ROPE END STOP



For use when pocket type housing has been selected for the crane as opposed to the traditional wire rope wedge socket.

Fully load bearing.

Factory fitted, therefore ensuring the integrity of the rope.

Designed for easy assembly and re-reeving operations.

Rope diameter	Overall length	OD max
	A	B
13	92	33.0
16 - 18	108	39.4
19 - 22	124	45.8
23 - 26	144	52.0

BRILUBE ADVANCED ROPE DRESSINGS

Ropes are like any other machine and to achieve maximum operating life in service lubrication must be applied.

The type of service lubricant and frequency of application varies with the rope construction the operating conditions and its functional application.

Brilube's advanced formulation with proven performance helps to get the best from your rope.

Brilube 30, 40 and 50 can be applied by brush, drip feed or portable pressurised sprayer.

Brilube 60, 70 and 90 can be pressure applied using in-line application systems which are available to suit a wide range of rope sizes and constructions. These systems operate by forcing the lubricant into the rope under high pressure, whilst simultaneously cleaning the rope and removing the moisture, residual lubricant and contaminants.

- Advanced corrosion protection
- High lubricity
- Reduced fling off
- Enhanced rope life
- Effective penetration
- Easy application

The air supply to thepump should be 6-7 bar.

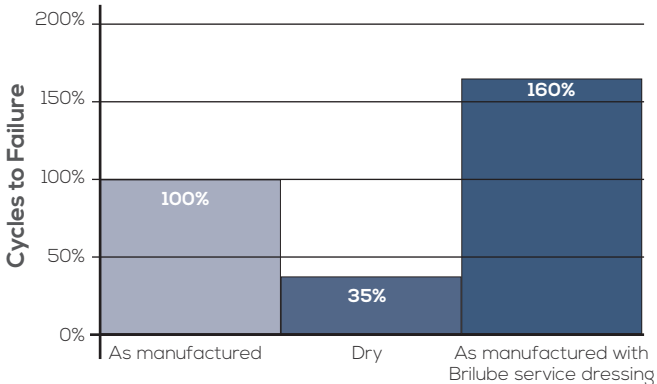
The complete Masto system consists of:

- High pressure pump with flow controlvalve, ballvalve, drumcover 9 ft. of 1/2" flexible hose.

- Masto Lubricating chamber.

- 2 lengths of chains.

Typical wire rope bend fatigue results



Composition	30	40	50	60	70	90
petroleum/oil base	●		●			
petroleum thixotropic gel		●		●	●	
synthetic						
biodegradeable						●
Properties						
excellent penetration	●	●	●			
excellent corrosion protection	●			●	●	●
stable over wide temperature range	●	●		●	●	●
slip resistant		●				
minimise fling off	●			●	●	●
semi dry thin film	●					
water repellent	●	●		●	●	●
Application						
general industries	●		●	●	●	●
marine/offshore	●			●	●	●
static ropes/rigging				●	●	
fishing ropes	●				●	
lifts/elevators		●				
friction drive systems		●				
drilling lines	●				●	
cranes	●		●	●	●	

BRILUBE HEALTH & SAFETY RECOMMENDATIONS

General Precautions

Do

- Keep away from heat and open flame
- Keep container closed
- Store under cover
- Ensure maximum temperature 25°C
- Keep away from food and drink
- Avoid prolonged and frequent skin contact and ensure good standards of personal hygiene

Do Not

- Keep oily rags in pockets or wear contaminated clothing
- Inhale fumes or vapours
- Swallow

Fire Extinguishing Media

- Carbon dioxide, dry chemicals, foam

Spillage

- Soak up with absorbent clay

Waste Disposal

- Burn or dispose of in an approved area
- Do not allow to contaminate water supplies

Potential Hazards

No significant hazard when properly used in the application for which it is designed. Prolonged and/or frequent skin contact may cause some defatting leading to irritation and it is recommended that protective gloves are worn.*

First Aid

• **Ingestion.** Do not induce vomiting due to risk of aspiration. Give 1/2 pint (300ml) of milk. Seek medical advice.

• **Skin Contact.** Mildly irritating. Remove by wiping and wash with soap and water.

• **Eye Contact.** Mildly irritating. Flush with copious amounts of warm water. If necessary seek medical advice.

• **Aspiration. I**f there is any suspicion of aspiration into the lungs (e.g. vomiting) admit to hospital immediately.

• **Inhalation.** Remove from exposure into fresh air. If necessary give artificial respiration or oxygen. Seek medical advice.

***See Cautionary Notice SHW 397 "Effects of mineral Oil on the Skin" published by the Health & Safety Executive.**

BRILUBE ADVANCED ROPE DRESSINGS

BRILUBE® 30

Tower Cranes
Mobile Cranes
Dockside Cranes
Fishing Ropes

BRILUBE 30 - a semi-dry thin film lubricant with excellent penetration and corrosion resisting properties.

Formulated for frequent use in harsh working conditions, whilst minimising lubricant build-up and abrasive particle contamination.

Effective operating range -30°C to +60°C

Minimum application temperature -5°C

BRILUBE® 40

Lifts & Elevators
Friction Hoists

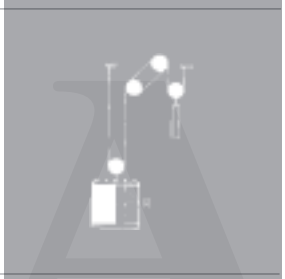
BRILUBE 40 - a synthetic lubricant which deposits a slip-resistant film on the wire surfaces.

Formulated for use where frictional grip is vital, it provides internal lubrication whilst avoiding excessive build-up with repeated applications.

BRILUBE 40 is recommended for use on lifts, elevators and similar friction driven rope installations.

Effective operating range -80°C to +40°C

Minimum application temperature -5°C



BRILUBE® 50

Indoor Cranes
Piling Applications
Small Excavators

BRILUBE 50 - an oil based lubricant with additives to increase adherence and enhance corrosion protection. It has excellent penetration and lubrication properties for working ropes in normal industrial environments.

BRILUBE 50 is recommended for overhead cranes, hoist ropes and similar working ropes, where fatigue is the major factor in rope deterioration.

Effective operating range -70°C to +30°C

Minimum application temperature -25°C

BRILUBE® 60

Excavators
Guy Ropes
Winch Ropes

BRILUBE 60 - a medium thixotropic gel lubricant with excellent corrosion protection and stable properties over a wide temperature range.

Formulated for long life on static or dynamic ropes.

BRILUBE 60 is recommended for outdoor use providing effective lubrication and corrosion protection where only infrequent lubrication is possible.

Effective operating range -55°C to +100°C

Minimum application temperature -20°C

BRILUBE® 70

Off-shore Crane Rigging
Mooring & Towing Cables
Fishing Ropes

BRILUBE 70 - a medium thixotropic gel lubricant with stable properties over a wide temperature range offering corrosion protection against marine working conditions.

Formulated for long life on static or dynamic ropes in highly aggressive environments

BRILUBE 70 is recommended for use in off-shore and other hostile environments where effective lubrication and optimum corrosion protection are vital.

Effective operating range -55°C to +100°C

Minimum application temperature -20°C

BRILUBE® 90

Off-shore Installations
Lake & River Ferries
Dock Facilities
Water Treatment Operations

BRILUBE 90 - a BIODEGRADABLE heavy duty, marine quality wire rope lubricant, developed to meet the needs of wire ropes working in highly aggressive conditions and the demand for environmental acceptability.

Formulated for heavy duty applications in environmentally sensitive locations.

BRILUBE 90 is recommended for use wherever rope lubrication is a problem due to environmental concerns.

Effective operating range -20°C to +120°C

TECHNICAL INFORMATION

PROPERTIES OF EXTENSION OF STEEL WIRE ROPES

Any assembly of steel wires spun into a helical formation either as a strand or wire rope, when subjected to a tensile load, can extend in three separate phases, depending on the magnitude of the applied load.

There are also other factors which produce rope extension which are very small and can normally be ignored.

Phase 1 - Initial or Permanent Constructional Extension

At the commencement of loading a new rope, extension is created by the bedding down of the assembled wires with a corresponding reduction in overall diameter. This reduction in diameter creates an excess length of wire which is accommodated by a lengthening of the helical lay. When sufficiently large bearing areas have been generated on adjacent wires to withstand the circumferential compressive loads, this mechanically created extension ceases and the extension in Phase 2 commences. The Initial Extension of any rope cannot be accurately determined by calculation and has no elastic properties.

The practical value of this characteristic depends upon many factors, the most important being the type and construction of rope, the range of loads and the number and frequency of the cycles of operation. It is not possible to quote exact values for the various constructions of rope in use, but the following approximate values may be employed to give reasonably accurate results.

	% of rope length	
	Fibre Core	Steel Core
Lightly loaded Factor of safety about 8:1	0.25	0.125
Normally loaded Factor of safety about 5:1	0.50	0.25
Heavily loaded Factor of safety about 3:1	0.75	0.50
Heavily loaded with many bends and/or deflections	Up to 2.00	Up to 1.00

The above figures are for guidance purposes. More precise figures are available upon request.

Phase 2 - Elastic Extension

Following Phase 1, the rope extends in a manner which complies approximately with Hookes Law (stress is proportional to strain) until the Limit of Proportionality or Elastic Limit is reached.

It is important to note that wire ropes do not possess a Young's Modulus of Elasticity, but an 'apparent' Modulus of Elasticity can be determined between two fixed loads.

The Modulus of Elasticity also varies with different rope constructions, but generally increases as the crosssectional area of steel increases.

By using the values given, it is possible to make a reasonable estimate of elastic extension, but if greater accuracy is required it is advisable to carry out a modulus test on an actual sample of the rope.

Elastic Extension = $\frac{WL}{EA}$ (mm)

W = load applied (kN)

L = rope length (mm)

E = elastic modulus (kN/mm²)

A = metallic cross section (mm²)

Phase 3 - Permanent Extension

The permanent, non-elastic extension of the steel caused by tensile loads exceeding the yield point of the material.

If the load exceeds the Limit of Proportionality, the rate of extension will accelerate as the load is increased, until a loading is reached at which continuous extension will commence, causing the wire rope to fracture without any further increase of load.

Thermal Expansion and Contraction

The coefficient of linear expansion ( ) of steel wire rope is 0.0000125 = (12.5 x10-6) per oC and therefore the change in length of 1 metre of rope produced by a temperature change of t °C would be;

Change in length $\Delta l = \alpha l_o t$

where:

α = coefficient of linear expansion

l_o = original length of rope (m)

t = temperature change (°C)

The change will be an increase in length if the temperature rises and a decrease in length if the temperature falls.

Extension due to Rotation

The elongation caused by a free rope end being allowed to rotate.

Extension due to Wear

The elongation due to inter-wire wear which reduces the cross-sectional area of steel and produces extra constructional extension.

Example: What will be the total elongation of a 200 metre length of 28mm diameter Blue Strand 6x36 wire rope at a tension of 55.8 kN and with an increase in temperature of 20°C.

Permanent Constructional Extension = 0.25% of rope length = 500mm

Elastic Extension = $\frac{WL}{EA} = \frac{110 \times 200{,}000}{104 \times 361} = 586$mm

Thermal Expansion = $\Delta l = \alpha l_o t = 0.0000125 \times 200{,}000 \times 20 = 50$mm

Therefore total extension = 500 + 586 + 50 = 1136mm

PRESSURES BETWEEN ROPES AND SHEAVES OR DRUMS

In addition to bending stresses experienced by wire ropes operating over sheaves or pulleys, ropes are also subjected to radial pressure as they make contact with the sheave.

This pressure sets up shearing stresses in the wires, distorts the rope's structure and affects the rate of wear of the sheave grooves. When a rope passes over a sheave, the load on the sheave results from the tension in the rope and the angle of rope contact. It is independent of the diameter of the sheave.

Load on bearing = $2T \sin \frac{\theta}{2}$

Assuming that the rope is supported in a well fitting groove, then the pressure between the rope and the groove is dependent upon the rope tension and diameter but is independent of the arc of contact.

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

P = pressure (kg/cm²)

T = rope tension (kg)

D = diameter of sheave or drum (cm)

d = diameter of rope (cm)

Maximum Permissible Pressures

Number of outer wires in strands	Groove material		
	Cast iron	Low carbon cast steel	11 to 13% Mn steel or equivalent alloy steels
	kgf/cm²	kgf/cm²	kgf/cm²
5 - 8 Ordinary lay	20	40	105
5 - 8 Lang's lay	25	45	120
9 - 13 Ordinary lay	35	60	175
9 - 13 Lang's lay	40	70	200
14 - 18 Ordinary lay	42	75	210
14 - 18 Lang's lay	47	85	240
Triangular strand	55	100	280

It should be emphasised that this method of estimation of pressure assumes that the area of contact of the rope in the groove is on the full rope diameter, whereas in fact only the crowns of the outer wires are actually in contact with the groove. The local pressures at these contact points may be as high as 5 times those calculated and therefore the values given above cannot be related to the compressive strength of the groove material.

If the pressure is high, the compressive strength of the material in the groove may be insufficient to prevent excessive wear and indentation and this in turn will damage the outer wires of the rope and effect its working life. As with bending stresses, stresses due to radial pressure increase as the diameter of the sheave decreases.

Although high bending stresses generally call for the use of flexible rope constructions having relatively small diameter outer wires, these have less ability to withstand heavy pressures than do the larger wires in the less flexible constructions. If the calculated pressures are too high for the particular material chosen for the sheaves or drums or indentations are being experienced, consideration should be given to an increase in sheave or drum diameter. Such a modification would not only reduce the groove pressure, but would also improve the fatigue life of the rope.

The pressure of the rope against the sheave also cause distortion and flattening of the rope structure. This can be controlled by using sheaves with the correct groove profile which, for general purposes, suggests an optimum groove radius of nominal rope radius +7.5%. The profile at the bottom of the groove should be circular over an angle of approximately 120°, and the angle of flare between the sides of the sheave should be approximately 52°.

Hardness of Rope Wire

Rope grade	Approximate Equivalent	Approximate Hardness	
Min. Tensile Strength	API 9A Grade	Brinel	Rockwell 'C'
2160N / mm²	EEIPS	480 / 500	52
1960N / mm²	EIPS	470 / 480	51
1770N / mm²	IPS	445 / 470	49
1570N / mm²	PS	405 / 425	45

Suggested pulley hardness: 250-300 Brinell for Mn steel or equivalent alloy steel.

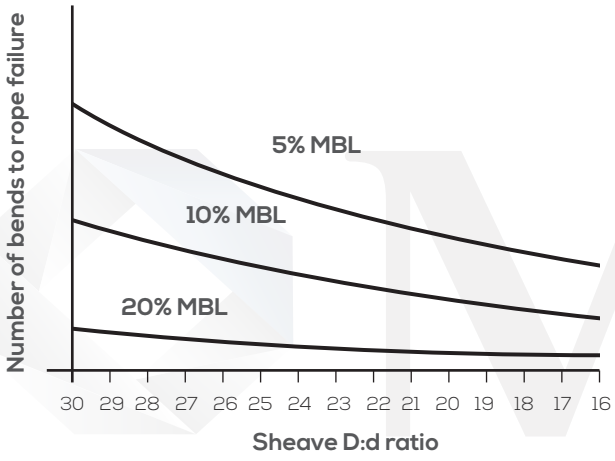
If the calculated pressure is too high for the particular material chosen for the pulley or drum, consideration should be given to increase in pulley or drum diameter. Such a modification would not only reduce the groove pressure, but would also improve the fatigue life of the rope by reducing the bending stresses imposed.

BEND FATIGUE

Bend fatigue testing of ropes usually consists of cycling a length of rope over a sheave while the rope is under a constant tension.

At the same time it has been possible to compare rope life to discard criteria (e.g. as laid down in ISO 4309) with that to complete failure of the rope, i.e. to the point where the rope has been unable to sustain the load any longer. As part of the exercise, it has also been possible to establish the residual breaking strength of the rope at discard level of deterioration.

Effects of D:d Ratio and loading on fatigue life – Typical example Dyform 6

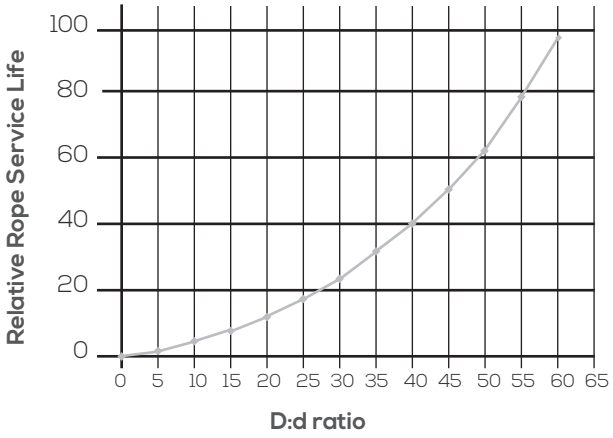


What needs to be recognised, however, is that very few ropes operate under these controlled operating conditions, making it very difficult to use this base information when attempting to predict rope life under other conditions. Other influencing factors, such as dynamic loading, differential loads in the cycle, fleet angle, reeving arrangement, type of coiling on the drum, change in rope direction, sheave alignment, sheave size and groove profile, can have an equally dramatic effect on rope performance.

However, the benefit of such testing can be particularly helpful to the rope manufacturer when developing new or improving existing products.

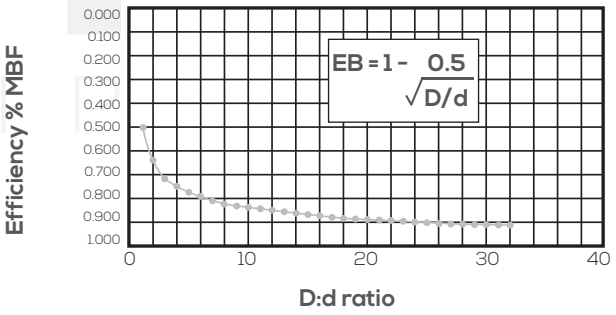
If designers or operators of equipment are seeking optimum rope performance or regard bending fatigue life as a key factor in the operation of equipment, such information can be provided for guidance purposes.

Service life curve for various D:d ratios



When considering the use of a steel wire rope around a minimum D:d ratio, it is generally accepted that at below 4:1 the effect on the strength of the rope needs to be considered. Permanent distortions within the rope will occur when using ratios of 10:1 and less and that a minimum ratio of 16:1 be used for a rope operating around sheaves.

Approximate loss in breaking strength due to bending



SWIVELS

Rotating loads can put at risk the safety of those persons within a lifting zone during a lifting operation.

In order to reduce the risk of rotation the machinery designer or user may find it may be necessary to incorporate a swivel in the reeving system; however, it should be recognised that excessive rotation could have an adverse effect on rope performance depending on the rope's rotational characteristics.

To assist the machinery designer or user in determining whether or not a swivel should be used in a lifting system, the following guidance, taking into account the rope type, construction and lay type and direction, is given.

For simplicity, the ropes are grouped according to their rotational characteristics.

Note 1: **A swivel should not be used when installing a rope.**

Note 2: **Further guidance on the use of swivels with six strand and rotation-resistant ropes is given in ISO 4308 'Cranes and lifting appliances - selection of wire ropes - part 1 General'.**

Note 3: **Swivels have varying degrees of efficiency and may be either an independent accessory or an integral part of a lifting accessory such as a crane hook.**

Group 1	
Both sets of ropes in this group have high values of rotation when loaded and must not be used unless both ends of the rope are fixed and prevented from rotating however **they must NOT be used with a swivel, under any circumstances.**	
DO NOT USE A SWIVEL	
Group 1a: Single layer ropes Lang's lay	**Group 1b: Parallel-closed ropes Lang's and Ordinary (Regular) lay**
Blue Strand 6x19 Lang's lay	Endurance DSC 8
Blue Strand 6x36 Lang's lay	Endurance Dyform DSC 8
Endurance 8 Lang's lay	
Endurance 8PI Lang's lay	
Endurance Dyform 8 Lang's lay	
Endurance Dyform 8PI Lang's lay	
Endurance Dyform 6 Lang's lay	
Endurance Dyform 6PI Lang's lay	

Group 1	
With one end free to rotate, all of the ropes in this group will generate less rotation when loaded than those listed in Group 1. However, such ropes are still likely to unlay and distort under this condition. When used in single part reeving they may require a swivel to prevent rotation in certain operating conditions but this should only apply when employee safety is an issue.	
Group 2: Single layer ropes Ordinary (Regular) lay	
Blue Strand 6x19 Ordinary lay	Endurance Dyform 8 Ordinary lay
Blue Strand 6x36 Ordinary lay	Endurance 8PI Ordinary lay
Endurance 8 Ordinary lay	Endurance Dyform 8PI Ordinary lay
Endurance Dyform 6 Ordinary lay	Endurance 6FS Ordinary lay
Endurance Dyform 6PI Ordinary lay	Endurance Dyform 6FS Ordinary lay

SWIVELS

Group 3

The ropes in this group incorporate a centre which is laid in the opposite direction to that of the outer strands and are specifically designed to have a medium amount of resistance to rotation.

If it is necessary to use a swivel with any of these ropes in single part reeving to prevent rotation of the load, the rope should operate within the normal design factor of 5, not be subject to any shock loading and be checked daily for any evidence of distortion.

Where any of these ropes are used in multi-part reeving, the use of an anti-friction swivel at the outboard anchor point is not recommended. However, a swivel which can be locked may be useful when optimising the reeving, following rope installation or after subsequent changes to the reeving arrangement.

It should be noted that if a swivel is used in conjunction with these ropes, the bending fatigue life may be reduced due to increased internal deterioration between the outer strands and the underlying layer.

Group 3: Rotation-resistant ropes Lang's and Ordinary (Regular) lay

Endurance 18	Endurance Dyform 18	Endurance 18PI

Group 4

The ropes in this group are designed to have extremely low levels of rotation when loaded and, if necessary, may operate with a swivel in both single and multi-part reeving systems.

Any induced rotation which might normally result from any fleet angle or loads cycle effect would be expected to be relieved when the rope is used with a swivel.

Testing has also shown that when used with a swivel at normal design factor of 5 and zero fleet angle, no reduction in either rope breaking force or bending fatigue life would be expected.

Group 4: Low rotation ropes

Endurance 35LS	Endurance Dyform 34LR	Endurance Dyform 34LRPI

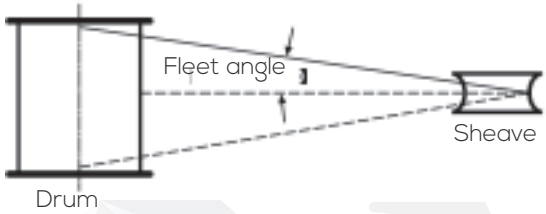
TECHNICAL INFORMATION

FLEET ANGLE

Of all the factors which have some influence on the winding of a rope on a smooth drum, the fleet angle, arguably, has the greatest effect.

Fleet angle is usually defined as the included angle between two lines, one which extends from a fixed sheave to the flange of a drum and the other which extends from the same fixed sheave to the drum in a line perpendicular to the axis of the drum. (See illustration).

Illustration of Fleet Angle



If the drum incorporates helical grooving, the helix angle of the groove needs to be added or subtracted from the fleet angle as described above to determine the actual fleet angle experienced by the rope.

At the drum

When spooling rope onto a drum it is generally recommended that the fleet angle is limited to between 0.5O and 2.5O. If the fleet angle is too small, i.e. less than 0.5O, the rope will tend to pile up at the drum flange and fail to return across the drum. In this situation, the problem may be alleviated by introducing a 'kicker' device or by increasing the fleet angle through the introduction of a sheave or spooling mechanism.

If the rope is allowed to pile up it will eventually roll away from the flange creating a shock load in both the rope and the structure of the mechanism, an undesirable and unsafe operating condition.

Excessively high fleet angles witll return the rope across the drum prematurely, creating gaps between wraps of rope close to the flanges as well as increasing the pressure on the rope at the cross-over positions.

Even where helical grooving is provided, large fleet angles will inevitably result in localised areas of mechanical damage as the wires 'pluck' against each other. This is often referred to as 'interference' but the amount can be reduced by selecting a Lang's lay rope if the reeving allows. The "interference" effect can also be reduced by employing a Dyform rope which offers a much smoother exterior surface than conventional rope constructions.

Floating sheaves or specially designed fleet angle compensating devices may also be employed to reduce the fleet angle effect.

At the sheave

Where a fleet angle exists as the rope enters a sheave, itinitially makes contact with the sheave flange. As the rope continues to pass through the sheave it moves down the flange until it sits in the bottom of the groove. In doing so, even when under tension, the rope will actually roll as well as slide. As a result of the rolling action the rope is twisted, i.e. turn is induced into or out of the rope, either shortening or lengthening the lay length of the outer layer of strands. As the fleet angle increases so does the amount of twist.

To reduce the amount of twist to an acceptable level the fleet angle should be limited to 2.5° for grooved drums and 1.5° for plain drums and when using rotation-resistant low rotation and parallel-closed ropes the fleet angle should be limited to 1.5°.

However, for some applications it is recognised that for practical reasons it is not always possible to comply with these general recommendations, in which case the rope life could be affected.

ROPE TORQUE

The problem of torsional instability in hoist ropes would not exist if the ropes could be perfectly torque balanced under load. The torque generated in a wire rope under load is usually directly related to the applied load by a constant torque factor'. For a given rope construction the torque factor can be expressed as a proportion of the rope diameter and this has been done below..

Variation with rope construction is relatively small and hence the scope for dramatically changing the stability of a hoisting system is limited. Nevertheless the choice of the correct rope can have a deciding influence, especially in systems which are operating close to the critical limit. It should be noted that the rope torque referred to here is purely that due to tensile loading. No account is taken of the possible residual torque due, for example, to rope manufacture or installation procedures.

Torsional Stability

The torque factors are approximate maximum values for the particular constructions. To calculate the torque value for a particular rope size multiply by the nominal rope diameter.
Example: for 20mm dia. Dyform 34LR Lang's Lay at 20% of minimum breaking force:-
Torque value = torque factor x rope dia.
= 1.8% x 20mm
= 0.36mm

To calculate the torque generated in a particular rope when subjected to a tensile load, multiply the load by the torque value and conbine the units.
Example:- For 20mm dia. Dyform 34LR Lang's Lay at 75kN:
Torque generated = torque value x load.
= 0.36 x 75 = 27Nm

TECHNICAL INFORMATION

ROPE TORQUE

The torsional characteristics of wire rope will have the effect of causing angular displacement of a sheave block when used in multi-fall reeving arrangements.
The formula below gives a good approximation under such arrangements.

$$S^2 = \frac{4000L.\ Tv}{\sin\theta}$$

Where S is the rope spacing in mm

- L is the length of each part in the reeving
- Tv is the torque value of the rope
- θ is the angular displacement of the sheave block

When the angular displacement of the sheave block exceeds 90O (sin θ = 1) torsional instability results and 'cabling' of the reeving will occur. Therefore the test for stability of any particular reeving can be expressed as:

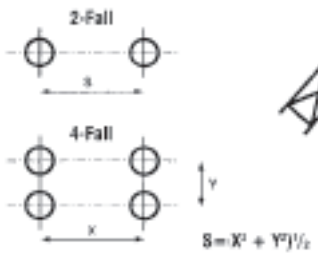
$$S > \sqrt{4\,000\ L.\ Tv}$$

Where - S is the rope spacing in mm
- L is length of each part in metres
- Tv is torque value in mm

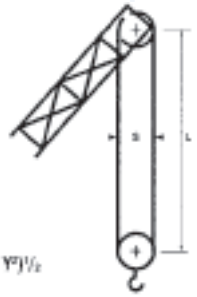
The preceding equations are all relative to a simple two part reeving. For more complex systems a similar approach may be used if account is taken of the different spacings of the ropes.

Even Number of Falls

Rope Plan



Effective Rope Spacing

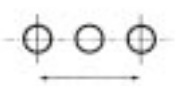


Note: For hoisting arrangements in which the rope falls are not parallel an average rope spacing should be used.

Uneven Number of Falls

(Rope Termination at Bottom Block)
Rope Plan

3-Fall



Effective Rope Spacing and modified formula for stable condition

Effective Rope Spacing S

Stable condition if

$$S > \sqrt{6\,000\ .\ L.\ Tv}$$

Angular displacement of block

To predict the amount of angular displacement by which a sheave block may turn under the influence of rope torque:

$$\sin\theta = \frac{(4\,000\ L.\ Tv)}{S^2}$$

(for even number of falls)

The equations assume that rope is torque-free in the no load condition, therefore, induced torque during or immediately after installation will adversely influence the calculated effect.

The above data assumes a constant torque value which is a valid assumption for a new rope. Wear and usage can have a significant effect on the torque value but practical work shows that under such circumstances the torque value will diminish, thus improving the stability of the arrangement. Some arrangements may be of such complexity that the evaluation demands a computer study.

Examples:

Assuming a pedestal crane working on two falls is roped with 20mm diameter DYFORM 34LR and the bottom block carries a sheave of 360mm diameter with the falls parallel:

Torque value = 1.8% x 20
= 0.36mm

If the rope is new (worst condition) and no account is taken of block weight and friction then angular displacement for a height of lift of 30 metres is given by

$$\sin\theta = \frac{(4\,000\ .\ 30\ .\ 0.36)}{360^2}$$

= 0.333 i.e. 19° 47'

The reeving would be expected to 'cable' at a height of lift calculated as:

$$L = \frac{S^2}{4\,000\ .\ Tv}$$

$$= \frac{360^2}{4\,000\ .\ 0.36}$$

= 90 metres

From the crane designer's viewpoint a safety factor against 'cabling' should be recognised (angular displacement limited at 30°) hence the practical height of lift is approximately 45 metres.

TECHNICAL INFORMATION

SUMMARY TECHNICAL INFORMATION AND CONVERSION FACTORS (FOR GUIDANCE PURPOSES ONLY)

High performance ropes are normally selected by customers when they require the specific characteristics of improved performance, high strength, low extension or low rotation.

Rope Construction	Fill Factor f '%	Nominal Metallic Area Factor C'	Extension characteristics		Rotational characteristics			Nominal Rope Lay length mm
			Rope modulus at 20% of breaking force kN/mm²	Initial permanent extension %	Torque factor at 20% of breaking force %		Turn value at 20% of breaking force degrees/ rope lay	
					Ordinary	Lang's		
6 & 8 Strand High Performance								
Dyform 6 & 6-PI	67.0	0.526	103	0.1	6.9	10.9	60	6.5 x Nom. rope dia.
Dyform Bristar 6	66.0	0.518	103	0.1	6.9	10.9	60	6.5 x Nom. rope dia.
Endurance 8 & 8-PI	63.0	0.495	96	0.2	7.0	9.0	90	6.5 x Nom. rope dia.
Dyform 8 & 8-PI	68.0	0.534	100	0.15	7.0	9.0	90	6.5 x Nom. rope dia.
Dyform DSC 8	75.0	0.589	107	0.09	8.1	11.0	70	6.5 x Nom. rope dia.
Constructex	72.1	0.566	108	0.05	7	n/a	60	6.0 x Nom. rope dia.
Dyform Zebra	59.1	0.464	103	0.1	7	11	60	6.5 x Nom. rope dia.
Brifil 6x36 iwrc class	58.6	0.460	102	0.15	7	11	60	6.5 x Nom. rope dia.
Rotation Resistant								
Dyform 18 & 18-PI	71.0	0.558	95	0.1	3	4.5	4	6.25 x Nom. rope dia.
Endurance 50DB	63.0	0.495	97	0.24	n/a	3.6	3	6.5 x Nom. rope dia.
Low Rotation								
Dyform 34LR & 34LR-PI	74.0	0.581	99	0.05	0.8	1.8	0.7	6.0 x Nom. rope dia.
Endurance 35LS	63.9	0.502	102	0.1	0.8	1.8	0.7	6.0 x Nom. rope dia.
Conventional Constructions								
Blue Strand 6 x 19 iwrc class	57.2	0.449	103	0.15	7	9	50	6.5 x Nom. rope dia.
Blue Strand 6 x 36 iwrc class	58.6	0.460	104	0.17	7	9	60	6.5 x Nom. rope dia.

The figures shown in the above table are nominal values given for the product range and are for guidance purposes only.

The above modulus vales are based on the nominal rope metallic area

TECHNICAL INFORMATION

GUIDE TO EXAMINATION

The continued safe operation of lifting equipment, lifting accessories (e.g. slings) and other systems employing wire rope depends to a large extent on the operation of well programmed periodic rope examinations and the assessment by the competent person of the fitness of the rope for further service.

Examination and discard of ropes by the competent person should be in accordance with the instructions given in the original equipment manufacturer's handbook. In addition, account should be taken of any local or application specific Regulations.

The competent person should also be familiar, as appropriate, with the latest versions of related International, European or National standards such as ISO 4309 "Cranes
- Wire ropes - code of practice for examination.

Particular attention must be paid to those sections of rope which experience has shown to be liable to deterioration. Excessive wear, broken wires, distortions and corrosion are the more common visible signs of deterioration.

Note: This publication has been prepared as an aid for rope examination and should not be regarded as a substitute for the competent person.

Wear is a normal feature of rope service and the use of the correct rope construction ensures that it remains a secondary aspect of deterioration. Lubrication may help to reduce wear.

Broken wires are a normal feature of rope service towards the end of the rope's life, resulting from bending fatigue and wear. The local break up of wires may indicate some mechanical fault in the equipment. Correct lubrication in service will increase fatigue performance.

Distortions are usually as a result of mechanical damage, and if severe, can considerably affect rope strength. Visible rusting indicates a lack of suitable lubrication, resulting in **corrosion**. Pitting of external wire surfaces becomes evident in some circumstances. Broken wires ultimately result.

Internal corrosion occurs in some environments when lubrication is inadequate or of an unsuitable type. Reduction in rope diameter will frequently guide the observer to this condition. Confirmation can only be made by opening the rope with clamps or the correct use of spike and needle to facilitate internal inspection.

Note: Non-destructive testing (NDT) using electromagnetic means may also be used to detect broken wires and/or loss in metallic area. This method complements the visual examination but does not replace it.

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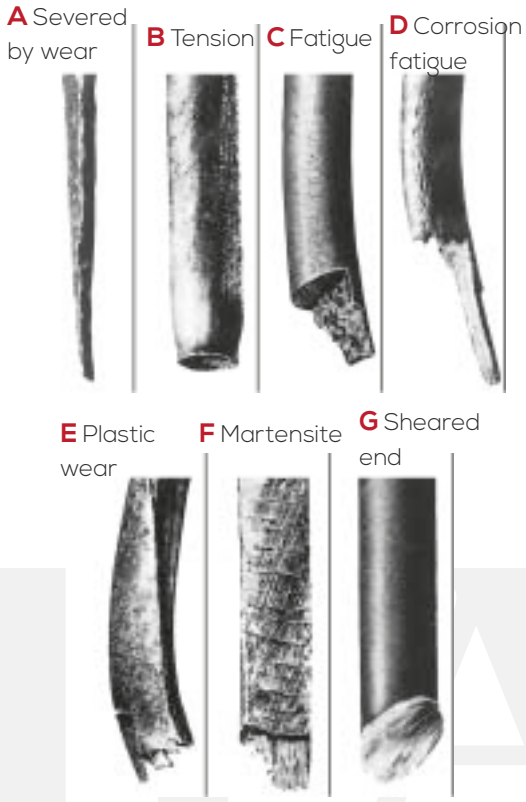
Some of the More Common Types of Wire Fractures Can Include:



FACTORS AFFECTING ROPE PERFORMANCE

Multi-coiling of the rope on the drum can result in severedistortion in the underlying layers.

Bad coiling (due to excessive fleet angles or slack winding) can result in mechanical damage, shown as severe crushing, and may cause shock loading during operation.

Small diameter sheaves can result in permanent set of the rope, and will certainly lead to early wire breaks due to fatigue.

Oversize grooves offer insufficient support to the rope leading to increased localised pressure, flattening of the rope and premature wire fractures. Grooves are deemed to be oversize when the groove diameter exceeds the nominal rope diameter by more than 15% steel, 20% polyurethane liners.

Undersize grooves in sheaves will crush and deform the rope, often leading to two clear patterns of wear and associated wire breaks.

Excessive angle of fleet can result in severe wear of the rope due to scrubbing against adjacent laps on the drum. Rope deterioration at the Termination may be exhibited in the form of broken wires. An excessive angle of fleet can also induce rotation causing torsional imbalance.

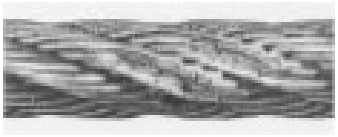
TECHNICAL INFORMATION

TROUBLESHOOTING GUIDE

Typical examples of Wire Rope deterioration

1 Mechanical damage due to rope movementover sharp edge projection whilst under load.

2 Localised wear due to abrasion on supporting structure.



3 Narrow path of wear resulting in fatigue fractures, caused by working in a grossly oversize groove, or over small support rollers.

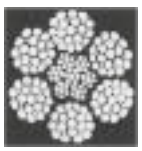
4 Two parallel paths of broken wires indicative of bending through an undersize groove in the sheave.

5 Severe wear, associated with high tread pressure

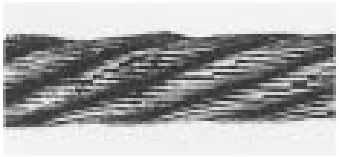
6 Severe wear in Lang's Lay, caused by abrasion.

7 Severe corrosion.

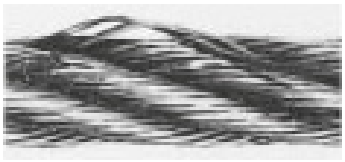
8 SInternal corrosion whilst external surface shows little evidence of deterioration.



9 Typical wire fractures as a result of bend fatigue.



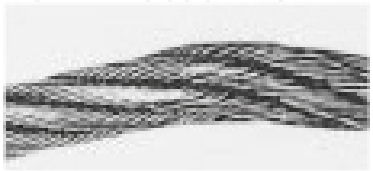
10 Wire fractures at the strand, or core interface, as distinct from 'crown' fractures



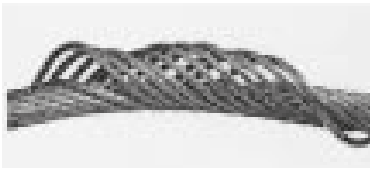
11 Break up of IWRC resulting from high stress application.

12 Looped wires as a result of torsional imbalance and/or shock loading..

13 Typical example of localised wear and deformation..

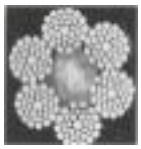


14 Multi strand rope 'bird caged' due to torsional imbalance.



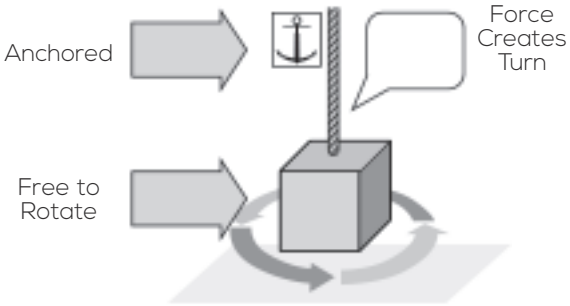
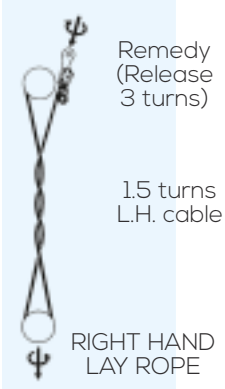
15 Protrusion of rope centre resulting from build up of turn.

16 Substantial wear and severe internal corrosion..



Problem	Cause/Action
Mechanical damage caused by the rope contacting the structure of the installation on which it is operating or an external structure - usually of a localised nature. 	•Generally results from operational conditions. •Check sheave guards and support/guide sheaves to ensure that the rope has not "jumped out" of the intended reeving system. •Review operating conditions
Opening of strands in rotation resistant, low rotation and parallel closed ropes - in extreme circumstances the rope may develop a "birdcage distortion" or protrusion of inner strands. **Note - rotation resistant and low rotation ropes are designed with a specific strand gap which may be apparent on delivery in an off tension condition. These gaps will close under load and will have no effect on the operational performance of the rope.** 	•Check sheave and drum groove radii using sheave auge to ensure that they are no smaller than nominal rope radius +5% - •Repair or replace drum/sheaves if necessary. •Check fleet angles in the reeving system - a fleet angle in excess of 1.5 degrees may cause distortion. •Check installation method - turn induced during installation can cause excessive rope rotation resulting in distortion. •Check if the rope has been cut "on site " prior to installation or cut to remove a damaged portion from the end of the rope. If so, was the correct cutting procedure used? Incorrect cutting of rotation resistant, low rotation and parallel closed ropes can cause distortion in operation. •Rope may have experienced a shock load.
Broken wires or crushed or flattened rope on lower layers at crossover points in multi - layer coiling situations. Wire breaks usually resulting from crushing or abrasion. 	•Check tension on underlying layers. - Care should be taken to ensure that tension is retained in service. Insufficient tension will result in these lower layers being more prone to crushing damage. •Review wire rope construction. Dyform wire ropes are more resistant to crushing on underlying layers than conventional rope constructions. •Do not use more rope than necessary. •Check drum diameter. Insufficient bending ratio increases tread pressure.
Wires looping from strands. 	•Insufficient service dressing. •Consider alternative rope construction. •If wires are looping out of the rope underneath a crossover point, there may be insufficient tension on the lower wraps on the drum. •Check for areas of rope crushing or distortion.

Problem	Cause/Action
"Pigtail" or severe spiralling in rope. 	•Check that the sheave and drum diameter is large enough •Indicates that the rope has run over a small radius or sharp edge. •Check to see if the rope has "jumped off" a sheave and has run over a shaft.
Two single axial lines of broken wires running along the length of the rope approximately 120 degrees apart indicating that the rope is being "nipped" in a tight sheave 	•Check sheave and drum groove radii using sheave gauge to ensure that they are no smaller than nominal rope radius + 5% •Repair or replace drum/sheaves if necessary.
One line of broken wires running along the length of the rope indicating insufficient support for the rope, generally caused by oversize sheave or drum grooving. 	•Check to see if the groove diameter is no greater than 15% greater than the nominal rope diameter. •Repair or replace drum/sheaves if necessary. •Check for contact damage.
Short rope life resulting from evenly/randomly distributed bend fatigue wire breaks caused by bending through the reeving system. Fatique induced wire breaks are characterised by flat ends on the broken wires. 	•Bending fatigue is accelerated as the load increases and as the bending radius decreases. Consider whether either factor can be improved. •Check wire rope construction - Dyform ropes are capable of doubling the bending fatigue life of a conventional steel wire rope.
Short rope life resulting from localised bend fatigue wire breaks. Fatique induced wire breaks are characterised by flat ends on the broken wires. 	•Bending fatigue is accelerated as the load increases and as the bending radius decreases. Consider whether either factor can be improved. •Check wire rope construction - Dyform ropes are capable of doubling the bending fatigue life of a conventional steel wire rope. •Localised fatigue breaks indicate continuous repetitive bends over a short length. Consider whether it is economic to periodically shorten the rope in order to move the rope through the system and progressively expose fresh rope to the severe bending zone. In order to facilitate this procedure it may be necessary to begin operating with a slightly longer length of rope.

Problem	Cause/Action
Broken rope - ropes are likely to break when subjected to substantial overload or misuse particularly when a rope has already been subjected to mechanical damage. Corrosion of the rope both internally and/or externally can also result in a significant loss in metallic area. The rope strength is reduced to a level where it is unable to sustain the normal working load. 	•Review operating conditions.
Wave or corkscrew deformations normally associated with multistrand ropes. 	•Check sheave and drum groove radii using sheave gauge to ensure that they are no smaller than nominal rope radius +5% •Repair or replace drum/sheaves if necessary. •Check fleet angles in the reeving system - a fleet angle in excess of 1.5 degrees may cause distortion. •Check that rope end has been secured in accordance with manufacturers instructions. •Check operating conditions for induced turn.
Rotation of the load in a single fall system. 	•Review rope selection. •Consider use of rotation resistant or low rotation rope.
Rotation of the load in a multi - fall system resulting in "cabling" of the rope falls. Possibly due to induced turn during installation or operation. 	•Review rope selection. •Consider use of rotation resistant or low rotation rope. •Review installation procedure or operating procedures

Problem	Cause/Action
Core protrusion or broken core in single layer six or eight strand rope. 	•Caused by repetitive shock loading - review operating conditions.
Rope accumulating or "stacking" at drum flange - due to insufficient fleet angle. 	•Review drum design with original equipment manufacturer - consider adding rope kicker, fleeting sheave etc.
Sunken wraps of rope on the drum normally associated with insufficient support from lower layers of rope or grooving. 	•Check correct rope diameter. •If grooved drum check groove pitch. •Check tension on underlying layers - Care should be taken to ensure that tension is retained in service. Insufficient tension will result in these lower layers being more prone to crushing damage. •Make sure that the correct rope length is being used. Too much rope (which may not be necessary) may aggravate the problem.
Short rope life induced by excessive wear and abrasion. 	•Check fleet angle to drum. •Check general alignment of sheaves in the reeving system. •Check that all sheaves are free to rotate. •Review rope selection. The smooth surface of Dyform wire ropes gives better contact with drum and sheaves and offers improved resistance to "interference" betweeen adjacent laps of rope.
External corrosion. 	•Consider selection of galvanised rope. •Review level and type of service dressing.
Internal corrosion. 	•Consider selection of galvanised rope. •Review frequency amount and type of service dressing. •Consider selection of plastic impregnated (PI) wire rope.

TECHNICAL INFORMATION

PRODUCT SAFETY: INSTRUCTIONS & WARNINGS ON THE USE OF STEEL WIRE ROPE

The following Instructions and Warnings combine to provide guidance on Product Safety and are intended for use by those already having a working knowledge of wire ropes, as well as the new user. They should be read, followed and passed on to others.

Failure to read, understand and follow these instructions could result in harmful and damaging consequences.

A 'Warning' statement indicates a potential hazardous situation which could result in a significant reduction in rope performance and/or put at risk, either directly or indirectly, the safety or health of those persons within the danger zone of the rope and its associated equipment.

Note: As a result of the creation of the single European market and the 'New Approach' Directives which set out 'essential requirements'
(e.g. for safety) designers, manufacturers, suppliers, specifiers and users need to keep themselves abreast of any changes to the appropriate Regulations and national standards.

1. Storage

1.1 Unwrap the rope and examine the rope immediately after delivery to check its identification and condition and verify that it is in accordance with the details on the Certificates and/or other relevant documents.

Note: The rope should not be used for lifting purposes without the user having a valid Certificate in his possession.

Check the rope diameter and examine any rope terminations to ensure that they are compatible with the equipment or machinery to which they are to be fitted. (See Fig. 1)

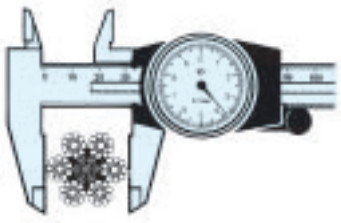


Fig 1

1.2 Select a clean, well ventilated, dry, undercover location. Cover with waterproof material if the delivery site conditions preclude inside storage.

Rotate the reel periodically during long periods of storage, particularly in warm environments, to prevent migration of the lubricant from the rope.

WARNING

Never store wire rope in areas subject to elevated temperatures as this may seriously affect its future performance. In extreme cases its original asmanufactured strength may be severely reduced rendering it unfit for safe use.

Ensure that the rope does not make any direct contact with the floor and that there is a flow of air under the reel.

WARNING

Failure to do so may result in the rope becoming contaminated with foreign matter and start the onset of corrosion before the rope is even put to work.

Support the reel on a simple A-frame or cradle, located on ground which is capable of supporting the total mass of rope and reel. (See Fig. 2) Ensure that the rope is stored where it is not likely to be affected by chemical fumes, steam or other corrosive agents.

Fig 2

WARNING

Failure to do so may seriously affect its condition rendering it unfit for safe use.

1.3 Examine ropes in storage periodically and, when necessary, apply a suitable dressing which is compatible with the manufacturing lubricant .
Re-wrap the rope unless it is obvious that this will be detrimental to rope preservation. (Refer to the relevant Product Data sheets on rope dressings for more detailed information.)

WARNING

Failure to apply the correct dressing may render the original manufacturing lubricant ineffective and rope performance may be significantly affected.

Ensure that the rope is stored and protected in such a manner that it will not be exposed to any accidental damage either during the storage period or when placing the rope in, or taking it out of storage.

WARNING

Failure to carry out or pay attention to any of the above could result in a loss of strength and/or a reduction in performance. In extreme cases the rope may be unfit for safe use.

2. Certification and Marking

Make sure that the relevant Certificate has been obtained before taking the rope into use for a lifting operation. (Refer to statutory requirements)

Check to verify that the marking on the rope or its package matches the relevant Certificate.

Note: The rating of a component part of a machine or lifting accessory is the responsibility of the designer of the machine or accessory. Any re-rating of a lifting accessory must be approved by a competent person.

Retain the Certificate in a safe place for identification of the rope when carrying out subsequent periodic statutory examinations in service. (Refer to statutory requirements)

3. Handling and Installation

3.1 Handling and installation of the rope should be carried out in accordance with a detailed plan and should be supervised by a competent person.

WARNING

Incorrectly supervised handling and installation procedures may result in serious injury to persons in the vicinity of the operation as well as those persons directly involved in the handling and installation.

3.2 Wear suitable protective clothing such as overalls, industrial gloves, helmet, eye protectors and safety footwear (and respirator, particularly where the emission of fumes due to heat is likely).

WARNING

Failure to wear suitable protective clothing and equipment may result in skin problems from over exposure to certain types of rope lubricants and dressings; burns from sparks, rope ends, molten lubricants and metals when cutting ropes or preparing sockets for re-use; respiratory or other internal problems from the inhalation of fumes when cutting ropes or preparing sockets for reuse; eye injuries from sparks when cutting ropes; lacerations to the body from wire and rope ends; bruising of the body and damage to limbs due to rope recoil, backlash and any sudden deviation from the line of path of rope.

3.3 Ensure that the correct rope has been supplied by checking to see that the description on the Certificate is in accordance with that specified in the purchaser's order.

3.4 Check by measurement that the nominal diameter of the new rope conforms to the nominal size stated on the Certificate.

For verification purposes, measure the diameter by using a suitable rope vernier fitted with jaws broad enough to cover not less than two adjacent strands.
Take two sets of measurements spaced at least 1 metre apart, ensuring that they are taken at the largest cross-sectional dimension of the rope. At each point take measurements at right angles to each other.

The average of these four measurements should be within the tolerances specified in the appropriate Standard or Specification.

For a more general assessment of rope diameter use a rope calliper. (See Fig 1)

3.5 Examine the rope visually to ensure that no damage or obvious signs of deterioration have taken place during storage or transportation to the installation site.

3.6 Check the working area around the equipment for any potential hazards which may affect the safe installation of the rope.

3.7 Check the condition of the rope-related equipment in accordance with the OEM's instructions. Include the following -

Drum

Check the general condition of the drum.

If the drum is grooved, check the radius and pitch and ensure that the grooves will satisfactorily accommodate the size of the new rope (see Fig 3)

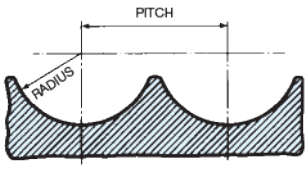


Fig 3

Check the condition and position of the kicker plates or wear plates, if fitted, to ensure that the new rope will spool correctly on the drum.

Sheaves

Ensure that the grooving is of the correct shape and size for the new rope

Check that all sheaves are free to rotate and in good condition.

Rope guards

Check that any rope guards are correctly fitted and are in good condition.

Check the condition of any wear plates or rollers which are protecting structural members.

WARNING

Failure to carry out any of the above could result in unsatisfactory and unsafe rope performance

Note: Grooves must have clearance for the rope and provide adequate circumferential support to allow for free movement of the strands and facilitate bending. When grooves become worn and the rope is pinched at the sides, strand and wire movement is restricted and the ability of the rope to bend is reduced. (See Fig. 4)

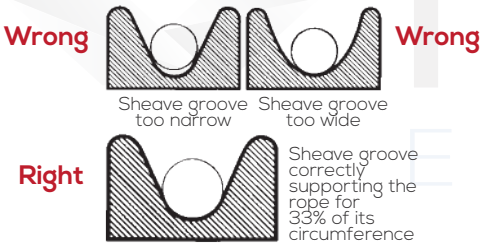


Fig 4

When a new rope is fitted a variation in size compared with the old worn rope will be apparent.
The new rope may not fit correctly into the previously worn groove profile and unnecessary wear and rope distortion is likely to occur. This may be remedied by machining out the grooves before the new rope is installed. Before carrying out such action the sheaves or drum should be examined to ensure that there will be sufficient strength remaining in the underlying material to safely support the rope.

The competent person should be familiar with the requirements of the appropriate application/machinery standard.

Note: General guidance to users is given in ISO 4309 Code of practice for the selection, care and maintenance of steel wire rope.

Transfer the wire rope carefully from the storage area to the installation site.

Coils

Place the coil on the ground and roll it out straightensuring that it does not become contaminated with dust/grit, moisture or any other harmful material. (See Fig. 5)

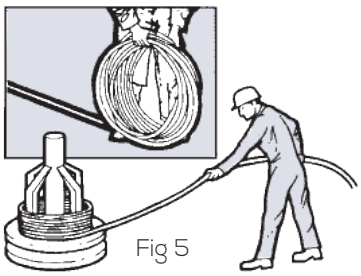


Fig 5

If the coil is too large to physically handle it may be placed on a 'swift' turntable and the outside end of the rope pulled out allowing the coil to rotate. (See Fig. 5)

WARNING

Never pull a rope away from a stationary coil as this will induce turn into the rope and kinks will form. These will adversely affect rope performance. (See Fig. 6)

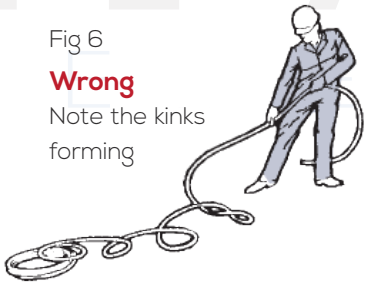


Fig 6
Wrong
Note the kinks forming

Reels

Pass a shaft through the reel and place the reel in a suitable stand which allows it to rotate and be braked to avoid overrun during installation. Where multi-layer coiling is involved it may be necessary for the reel to be placed in equipment which has the capability of providing a back tension in the rope as it is being transferred from reel to drum. This is to ensure that the underlying (and subsequent) laps are wound tightly on the drum. (See Fig. 7)

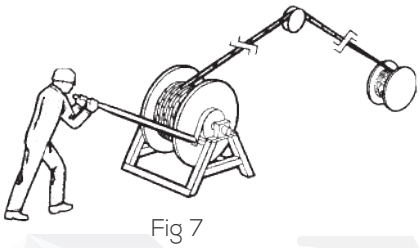


Fig 7

Position the reel and stand such that the fleet angle during installation is limited to 1.5 degrees. (See Fig. 8)

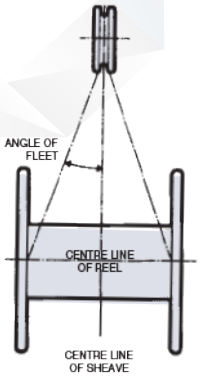


Fig 8

If a loop forms in the rope ensure that it does not tighten to form a kink.

WARNING

A kink can severely affect the strength of a six strand rope and can result in distortion of a rotation- resistant or low rotation rope leading to its immediate discard.

Ensure that the reel stand is mounted so as not to create a reverse bend during reeving (i.e. for a winch drum with an overlap rope, take the rope off the top of the reel). (See Fig. 7)

3.9 Ensure that any equipment or machinery to be roped is correctly and safely positioned and isolated from normal usage before installation commences. Refer to the OEM's instruction manual and the relevant 'Code of Practice'.

3.10 When releasing the outboard end of the rope from a reel or coil, ensure that this is done in a controlled manner. On release of the bindings and servings used for packaging, the rope will want to straighten itself from its previously bent position. Unless controlled, this could be a violent action. Stand clear.

WARNING

Failure to control could result in injury.

Ensure that the as-manufactured condition of the rope is maintained during installation.

If installing the new rope with the aid of an old one, one method is to fit a wire rope sock (or stocking) to each of the rope ends. Always ensure that the open end of the sock (or stocking) is securely attached to the rope by a serving or alternatively by a clip (See Fig. 9). Connect the two ends via a length of fibre rope of adequate strength in order to avoid turn being transmitted from the old rope into the new rope. Alternatively a length of fibre or steel rope of adequate strength may be reeved into the system for use as a pilot/ messenger line. Do not use a swivel during the installation of the rope.

3.11 Monitor the rope carefully as it is being pulled into the system and make sure that it is not obstructed by any part of the structure or mechanism which may cause the rope to come free.

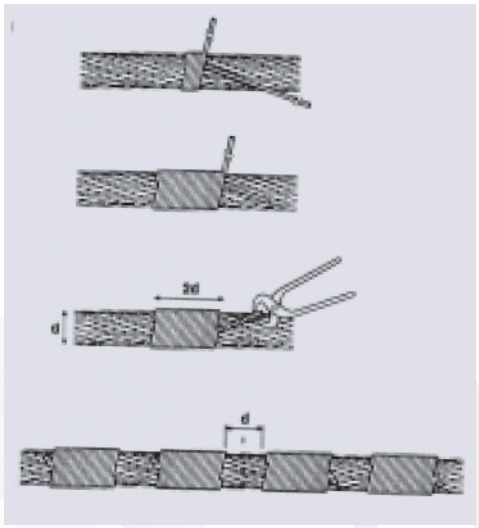


Fig 10

WARNING

Failure to monitor during this operation could result in injury.

This entire operation should be carried out carefully and slowly under the supervision of a competent person.

3.12 Take particular care and note the manufacturer's instructions when the rope is required to be cut.

Apply secure servings on both sides of the cut mark. (See Fig. 10 for typical method of applying a servingto a multi-layer rope.)

Ensure that the length of serving is at least equal to two rope diameters. (Note: Special servings are required for spiral ropes, i.e. spiral strand and locked coil.)

A minimum of two servings either side of the cut (see fig 10) is normally sufficient for ropes up to 100mm diameter and for larger ropes a minimum of four servings either side of the cut should be applied. It is essential that the correct size serving wire or strand (see fig 10a) is used and that adequate tension is applied during the serving process to ensure the integrity of the rope is maintained. It is particularly important to maintain the integrity of non-preformed ropes, multistrand rotational resistant ropes and parallel closed ropes as failure to do so could affect the ropes breaking strength and performance in service. During the serving procedure, serving mallets and hand operated serving machines can be used to generate tight servings.

MIFA EQUIPEMENT 'On-site serving instructions'

Rope Diameter	Diameter of Serving Wire or Strand	
	Single Wire	1x7 Wire Strand
<22mm	1.32mm	1.70mm
22mm to 38mm	1.57mm	1.70mm
40mm to 76mm	1.83mm	2.60mm
76mm to 100mm	2.03mm	3.00mm
>100mm	n/a	3.60mm

Fig 10a

Arrange and position the rope in such a manner that at the completion of the cutting operation the rope ends will remain in position, thus avoiding any

backlash or any other undesirable movement.

Cut the rope with a high speed abrasive disc cutter.

Other suitable mechanical or hydraulic shearing equipment may be used although not recommended when a rope end is required to be welded or brazed.

WARNING

When using a disc cutter be aware of the danger from sparks, disc fragmentation and fumes. (Refer 3.2.)

Ensure adequate ventilation to avoid any build-up of fumes from the rope and its constituent parts including any fibre core (natural or synthetic) any rope lubricant(s) and any synthetic filling and/or covering material.

WARNING

Some special ropes contain synthetic material which, when heated to a temperature higher than normal production processing temperatures, will decompose and may give off toxic fumes.

WARNING

Rope produced from carbon steel wires in the form shipped is not considered a health hazard. During subsequent processing (e.g. cutting, welding, grinding, cleaning) dust and fumes may be produced which contain elements which may affect exposed workers.

The products used in the manufacture of steel wire ropes for lubrication and protection present minimal hazard to the user in the form shipped. The user must however, take reasonable care to minimise skin and eye contact and also avoid breathing their vapour and mist.

After cutting, the rope cross-sections of nonpreformed ropes, multi-layer ropes and parallel closed ropes must be welded, brazed or fused and tapered such that all wires and strands in the rope are completely secured.

WARNING

Failure to correctly secure the rope end is likely to lead to slackness, distortions, premature removal from service and a reduction in the breaking force of the rope.

3.13 Ensure that any fittings such as clamps or fixtures are clean and undamaged before securing rope ends.

Make sure that all fittings are secure in accordance with the OEM's instruction manual or manufacturer's instructions and take particular note of any specific safety requirements e.g. torque values (and frequency of any re-application of torque).

When terminating a rope end with a wedge socket, ensure that the rope tail cannot withdraw through the socket by securing a clamp to the tail or by following the manufacturer's instructions.

(See Fig. 11 for two recommended methods of securing the rope tail of a wedge socket termination).

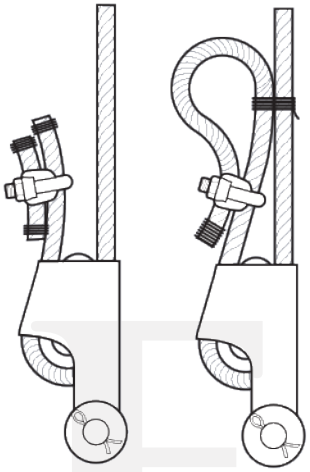


Fig 11

The loop back method uses a rope grip and the loop should be lashed to the live part of rope by a soft wire serving or tape to prevent flexing of the rope in service.

The method of looping back should not be used if there is a possibility of interference of the loop with the mechanism or structure.

WARNING

Failure to secure in accordance with instructions could lead to loss of the rope and/or injury.

3.14 When coiling a rope on a plain (or smooth) barrel drum ensure that each lap lies tightly against the preceding lap. The application of tension in the rope greatly assists in the coiling of the rope.

WARNING

Any looseness or uneven winding will result in excessive wear, crushing and distortion of the rope.

With plain barrel drums it is difficult to achieve satisfactory multi-layer coiling beyond three layers.

The direction of coiling of the rope on the drum is mportant, particularly when using plain barrel drums, and should be related to the direction of lay of the rope in order to induce close coiling.

(See Fig. 12 for proper method of locating rope anchorage point on a plain drum.)

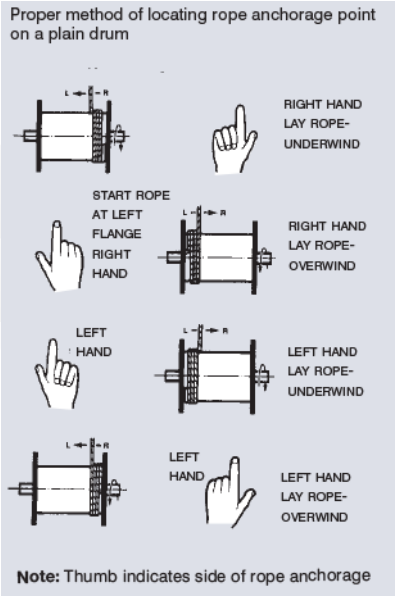


Fig 12

When multi layer coiling has to be used it should be realised that after the first layer is wound on a drum, the rope has to cross the underlying rope in order to advance across the drum in the second layer. The points at which the turns in the upper layer cross hose of the lower layer are known as the cross-over points and the rope in these areas is susceptible to increased abrasion and crushing. Care should be taken when installing a rope on a drum and when operating a machine to ensure that the rope is coiled and layered correctly.

3.15 Check the state of re-usable rope end terminations for size, strength, defects and cleanliness before use.

Non-destructive testing may be required depending on the material and circumstances of use. Ensure that the termination is fitted in accordance with the OEM's instruction manual or manufacturer's instructions.

When re-using a socket and depending on its type and dimensions, the existing cone should be pressed out. Otherwise, heat may be necessary.

WARNING

When melting out sockets which have previously been filled with hot metal, the emission of toxic fumes is likely. Note that white metal contains a high proportion of lead.

Correctly locate and secure any connection pins and fittings when assembling end terminations to fixtures.
Refer to manufacturer's instructions.

WARNING

Failure to pay attention to any of the above could result in unsafe operation and potential injury.

3.16 Limit switches, if fitted, must be checked and re-adjusted, if necessary, after the rope has been installed.

3.17 Record the following details on the Certificate after nstallation has been completed: type of equipment, location, plant reference number, duty and date of installation and any re-rating information/signature of competent person. Then safely file the Certificate.

3.18 'Run in' the new rope by operating the equipment slowly, preferably with a low load, for several cycles. This permits the new rope to adjust itself gradually to working conditions.

Note: Unless otherwise required by a certifying authority, the rope should be in this condition before any proof test of the equipment or machinery is carried out.

Check that the new rope is spooling correctly on the drum and that no slack or cross laps develop.

If necessary, apply as much tension as possible to ensure tight and even coiling, especially on the first layer.

Where multi-layer coiling is unavoidable, succeeding layers should coil evenly on the preceding layers of rope.

WARNING

Irregular coiling usually results in severe surface wear and rope malformation, which in turn is likely to cause premature rope failure.

3.19 Ensure that the as-manufactured condition of the rope is maintained throughout the whole of the handling and installation operation.

3.20 If samples are required to be taken from the rope for subsequent testing and/or evaluation, it is essential that the condition of the rope is not disturbed. Refer to the instructions given in 3.12 and, depending on the rope type and construction, any other special manufacturer's instructions.

4. In Service

4.1 Inspect the rope and related equipment at the beginning of every work period and particularly following any incident which could have damaged the rope or installation.

The entire length of rope should be inspected and particular attention paid to those sections that experience has proven to be the main areas of deterioration. Excessive wear, broken wires, distortion and corrosion are the usual signs of deterioration.

For a more detailed examination special tools are necessary (see Fig. 13) which will also facilitate internal inspection (see Fig. 14.)

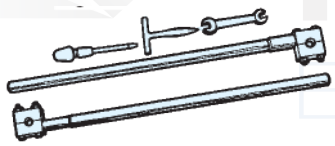


Fig 13

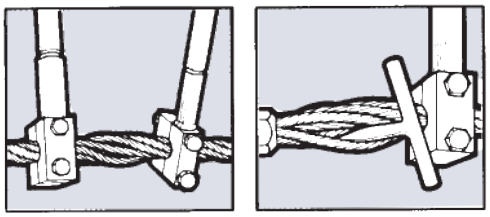


Fig 14

In the case of ropes working over drums or sheaves it is particularly necessary to examine those areas entering or leaving the grooves when maximum loads (i.e. shock loads) are experienced, or those areas which remain for long periods in exposed places such as over a Jib Head sheave.

On some running ropes, but particularly relevant to standing ropes (e.g. pendant ropes) the areas adjacent to terminations should be given special attention. (see Fig. 14).

Note: Shortening the rope re-positions the areas of maximum deterioration in the system. Where conditions permit, begin operating with a rope which has a slightly longer length than necessary in order to allow for periodic shortening.

When a non-preformed rope, multi-layer rope or parallel closed rope ie (DSC) is used with a wedge socket and is required to be shortened, it is essential that the end of the rope is secured by welding or brazing before the rope is pulled through the main body of the socket to its new position. Slacken the wedge in the socket. Pass the rope through the socket by an amount equivalent to the crop length or sample required. Note that the original bent portion of the rope must not be retained within the wedge socket. Replace the wedge and pull up the socket.

Prepare and cut in accordance with section 3.12.

Ensure that the rope tail cannot withdraw through the socket, see section 3.13.

WARNING

Failure to observe this instruction will result in a significant deterioration in the performance of the rope and could render the rope completely unfit for further service.

In cases where severe rope wear takes place at one end of a wire rope, the life of the rope may be extended by changing round the drum end with the load end, i.e. turning the rope 'end for end' before deterioration becomes excessive.

4.2 Remove broken wires as they occur by bending backwards and forwards using a pair of pliers until they break deep in the valley between two outer strands (see Fig. 15). Wear protective clothing such as overalls, industrial gloves, helmet, eye protectors and safety footwear during this operation.

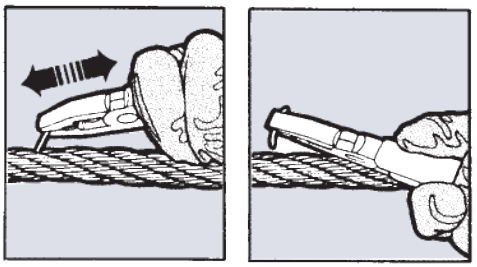


Fig 15

WARNING

Do not shear off the ends of broken wires withpliers as this will leave an exposed jagged edge which is likely to damage other wires in the rope and lead to premature removal of the rope from service. Failure to wear adequate protective clothing could result in injury

Note: Broken wires are a normal feature of service, more so towards the end of the rope's life, resulting from bending fatigue and wear. The local break up of wires may indicate some mechanical fault in the equipment.

Record the number and position in the rope of any removed broken wires.

4.3 Do not operate an appliance if for any reason (e.g. rope diameter, certified breaking force, rope construction, length or strength and type of rope termination) the wire rope and its termination is considered unsuitable for the required duty.

4.4 Do not operate an appliance if the wire rope fitted has become distorted, been damaged or has deteriorated to a level such that discard criteria has been reached or is likely to be reached prior to normal expected life based on historical performance data.

WARNING

Rope distortion is usually a result of mechanical damage and can significantly reduce rope strength.

4.5 An authorised competent person must examine the rope in accordance with the appropriate Regulations.

4.6 Do not carry out any inspection, examination, dressing / lubrication, adjustment or any other maintenance of the rope whilst it is suspending a load, unless otherwise stated in the OEM's instruction manual or other relevant documents.

Do not carry out any inspection or maintenance of the rope if the appliance controls are unattended unless the surrounding area has been isolated or sufficient warning signs have been posted within the immediate vicinity.

If the appliance controls are attended, the authorised person must be able to communicate effectively with the driver or controller of the appliance during the inspection process.

4.7 Never clean the wire rope without recognising the potential hazards associated with working on a moving rope.

WARNING

Failure to pay attention or take adequate precaution could result in injury.

If cleaning by cloth/waste, the material can be snagged on damaged surfaces and/or broken wires.

If cleaning by brush, eye protectors must be worn. If using fluids it should be recognised that some products are highly inflammable. A respirator should be worn if cleaning by a pressurised spray system.

WARNING

Failure to take adequate precaution could result in injury or damage to health.

Only use compatible cleaning fluids which will not impair the original rope lubricant nor affect the rope associated equipment.

WARNING

The use of cleaning fluids (particularly solvent based) is likely to 'cut back' the existing rope lubricant leading to a greater quantity of lubricant accumulating on the surface of the rope. This may create a hazard in appliances and machinery which rely on friction between the rope and the drive sheave (e.g. lifts, friction winders and cableways).

4.8 Lubricants selected for in-service dressing must be compatible with the rope manufacturing lubricant and should be referenced in the OEM's instruction manual or other documents approved by the owner of the appliance.

4.9 Take particular care when applying any in-service lubricant /dressing. Application systems which involve pressure should only be operated by trained and authorised persons and the operation carried out strictly in accordance with the manufacturer's instructions.

Most wire ropes should be lubricated as soon as they are put into service and at regular intervals thereafter (including cleaning) in order to extend safe performance.

WARNING

A 'dry' rope unaffected by corrosion but subject to bend fatigue, is likely to achieve only 30% of that normally attained by a 'lubricated' rope.

Do not dress/lubricate the rope if the application required it to remain dry. (Refer OEM's instruction manual.)

Reduce the period between examinations when ropes are not subjected to any in-service dressing and when they must remain dry.

Note: The authorised person carrying out a rope inspection must be capable of recognising the potential loss of safe performance of such a rope in comparison with lubricated rope.

Clean the rope before applying a fresh dressing/lubricant if it is heavily loaded with foreign matter e.g. sand, dust.

4.10 The authorised person responsible for carrying out wire rope maintenance must ensure that the ends of the rope are secure. At the drum end this will involve checking the integrity of the anchorage and ensuring that there are at least two and a half dead laps tightly coiled. At the outboard end the integrity of the termination must be checked to ensure that it is in accordance with the OEM's manual or other documents approved by the owner of the appliance.

Adjust the lengths of ropes in multi-rope systems in order that equal forces (within approved limits) are evident.

If a wire rope needs cutting refer to 3.12.

When securing rope ends refer to 3.13.

When re-usable end terminations are used refer to 3.15.

When re-connecting any end terminations to fixtures refer to 3.15.

4.11

WARNING

Damage to, or removal of component parts (mechanical or structural) caused by abnormal contact with wire rope can be hazardous to the safety of the appliance and/or the performance of the rope (e.g. damage to the drum grooving, such that coiling is erratic and/or the rope is 'pulled down' into underlying layers, which might cause a dangerous condition or, alternatively, cause localised rope damage at 'cross-over' positions, which might then radically affect performance; loss/removal of wear plates protecting the structure leading to major structural damage by cutting and/or failure of the wire rope due to mechanical severance).

4.12 Following any periodic statutory examination or routine or special inspection where any corrective action is taken the Certificate should be updated and a record made of the defects found, the extent of the changes and the condition of the rope.

4.13 Apply the following procedures for the selection and preparation of samples, from new and used lengths of rope, for the purpose of examination and testing to destruction.

Check that the rope end, from which the sample will be taken, is secured by welding or brazing. If not, select the sample length further away from the rope end and prepare new servings (see 3.12).

Handle the rope in accordance with the instructions given in section 3. Serve the rope, using the buried wire technique (see Fig. 10) and apply a rope clamp or grip as close to the cut mark as practically possible. Do not use solder to secure the servings.

Ensure that the sample is kept straight throughout the whole procedure and ensure that the minimum sample length is 4 metres for ropes up to and including 76mm diameter and 8 metres for larger diameter ropes.

The rope should be cut with a high speed abrasive disc cutter or an oxyacetylene torch. Weld the rope ends of the sample as described in section 3.12, after which the clamp or grip can be removed.

The identification of the rope must be established and the sample suitably marked and packed. It is recommended that the 3 metre sample is retained straight and secured to a wood batten for transportation. For a 12 metre sample, coil to a diameter as large as practically possible and never less than 2 metres.

Note: Samples taken for destruction testing are required to be terminated in accordance with a recognised resin socketing standard (e.g. BS EN 13411-4).

WARNING

Failure to comply with these procedures will result in measured breaking force values which are not truly representative of the actual strength of the rope.

5. Wire Rope Discard

5.1 Discard the wire rope in accordance with current Regulations and in accordance with the OEM's instruction manual.

Note: The authorised competent person should also be familiar with the latest versions of International Standard ISO 4309 'Cranes
- wire ropes - Code of practice for examination and discard' and B.S. 6570 ' The selection, care and maintenance of steel wire ropes' which provide greater detail than that given in the relevant Regulations. Other standards and instructions covering rope discard may also be applicable. In the case of synthetic sheaves (or synthetic linings) refer to the OEM's instruction manual or contact the sheave (or lining) manufacturer for specific discard criteria.

5.2 If a wire rope is removed from service at a level of performance substantially different to historically established performance data and without any obvious reason(s) .

5.3 Only qualified and experienced personnel, taking the appropriate safety precautions and wearing the appropriate protective clothing, should be responsible for removing the wire rope.

WARNING

Take particular care when removing ropes with mechanical damage as they may fail abruptly during the change-out procedure.

Take the utmost care when removing 'exhausted/failed' ropes from drums and sheaves as they may be grossly distorted, lively and tightly coiled.

WARNING

Failure to take adequate precautions could result in injury.

5.4 Store discarded rope in a safe and secure location or compound and ensure that it is suitably marked to identify it as rope which has been removed from service and not to be used again.

WARNING

Discarded rope can be a danger (e.g. protruding broken wires, excessive grease/lubricant and rope mass) to personnel and equipment if not handled correctly and safely during disposal.

5.5 Record the date and reason for discard on the Certificate before filing for future reference.

5.6 Pay attention to any Regulations affecting the safe disposal of steel wire rope.

6. Rope Selection Criteria

Ensure that the correct type of wire rope is selected for the equipment by referring to the OEM's instruction manual or other relevant documents.

6.1 Rope Strength

If necessary, refer to the appropriate Regulations and/or application standards and calculate the maximum force to which the rope will be subjected.

The calculation may take into account the mass to be lifted or moved, any shock loading, effects of high speed, acceleration, any sudden starts or stops, frequency of operation and sheave bearing friction.

By applying the relevant coefficient of utilisation (safety factor) and, where applicable, the efficiency of the rope termination, the required minimum breaking load or force of the rope will be determined, the values of which are available from the relevant National, European or International standards or from specific Product Data literature.

6.2 Bending fatigue

The size and number of sheaves in the system will influence the performance of the rope.

WARNING

Wire rope which bends around sheaves, rollers or drums will deteriorate through 'bending fatigue'. Reverse bending and high speed will accelerate the process. Therefore, under such conditions select a rope with high bending fatigue resistance.
Refer to Product Data Information, and if in doubt ask for advice.

6.3 Abrasion

Wire rope which is subject to abrasion will become progressively weaker as a result of:

Externally - dragging it through overburden, sand or other abrasive materials and passing around a sheave, roller or drum.

Internally - being loaded or bent.

WARNING

Abrasion weakens the rope by removing metal from both the inner and outer wires. Therefore, a rope with large outer wires should normally be selected.

6.4 Vibration

Vibration in wire rope will cause deterioration. This may become apparent in the form of wire fractures where the vibration is absorbed.

WARNING

These fractures may be internal only and will not be visually identified.

6.5 Distortion

Wire rope can be distorted due to high pressure against a sheave, improperly sized grooves or as a result of multi-layer coiling on a drum.

Rope with a steel core is more resistant to crushing and distortion.

6.6 Corrosion

Rope with a large number of small wires is more susceptible to corrosion than rope with a small number of large wires. Therefore, if corrosion is expected to have a significant effect on rope performance select a galvanised rope with as large an outer wire size as possible bearing in mind the other conditions (e.g. bending and abrasion) under which the rope will be operating.

6.7 Cabling

'Cabling' of rope reeving due to block rotation can occur if the rope is incorrectly selected (see Fig.16).
Applications involving high lifts are particularly vulnerable to this condition therefore, ropes specifically designed to resist rotation need to be selected.
Corrective procedure for cabling, where the rope length involved is relatively short, may be simply to disconnect both ends of the rope and pull the rope out straight along the ground. This will allow any build up of turn in the rope to be released before the rope is re-installed on the crane. If cabling persists, or the rope length involved is relatively long, it may be necessary to correct by releasing or inducing turn at the outboard anchorage. If left hand cabling is produced in the reeving system, correction is usually achieved (on the right hand lay ropes, see Fig. 16) by releasing turn at the anchorage. Effort must be made to work released or induced turn throughout the working length of rope, by operating the crane at maximum height of lift with a light load. It may be necessary to repeat the process until the cabling has been corrected. For right hand cable it will normally be necessary to induce turn at the anchorage.

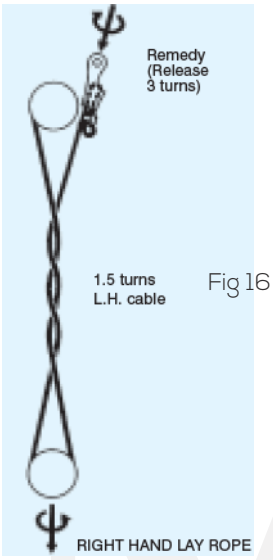


Fig 16

6.8 Fixing of Rope Ends

Ropes which have high rotation characteristics (such as single layer Lang's lay rope and parallel closed rope e.g. DSC) must not be selected unless both ends of the rope are fixed or the load is guided and unable to rotate.

6.9 Connecting Ropes

In the event that it is necessary to connect one rope to another (in series) it is essential that they have the required strength, are of the same type and both have the same lay direction (i.e. connect 'right' lay to 'right' lay).

WARNING

Failure to heed this warning could result in catastrophic failure particularly at a termination which is capable of being pulled apart (i.e. splice) due to unlaying.

6.10 Rope Length

Rope length and /or difference in length between two or more ropes used in a set may be a critical factor and must be considered along with rope selection.

WARNING

Wire rope will elongate under load. Other factors such as temperature, rope rotation and internal wear will also have an effect.
These factors should also be considered during rope selection.

6.11 Preformed and Non-preformed Ropes

Single layer round strand rope is normally supplied preformed. However, if a non-preformed rope is selected then personnel responsible for its installation and/or maintenance need to take particular care when handling such rope, especially when cutting. For the purposes of this instruction, multi-layer, parallel closed and spiral ropes should be regarded as non-preformed ropes.

6.12 Operating Temperatures

Wire rope with a steel core should be selected if there is any evidence to suggest that a fibre core will not provide adequate support to the outer strands and/or if the temperature of the working environment may be expected to exceed 100°C.

For operating temperatures above 100°C de-rating of the minimum breaking force of the rope is necessary (e.g. between 100°C and 200°C reduce by 10%; between 200°C and 300°C reduce by 25%; between 300°C and 400°C reduce by 35%). Do not use ropes with high carbon wires above 400°C.

WARNING

Failure to observe this general guidance could result in failure of the ropes to support the load.

For temperatures over 400°C, other materials such as stainless steel or other special alloys should be considered.

WARNING

Rope lubricants and any synthetic filling and/or covering materials may become ineffective at certain low or high operating temperature levels.

Certain types of rope end terminations also have limiting operating temperatures and the manufacturer should be consulted where there is any doubt. Ropes with aluminium ferrules must not be used at temperatures in excess of 150°C.

WARNING

Wire rope will fail if worn-out, shock loaded, overloaded, misused, damaged, improperly maintained or abused.

- **Always inspect wire rope for wear, damage or abuse before use**
- **Never use wire rope which is worn-out, damaged or abused**
- **Never overload or shock load a wire rope**
- **Inform yourself: Read and understand the guidance on product safety given in this catalogue; also read and understand the machinery manufacturer's handbook**
- **Refer to applicable directives, regulations, standards and codes concerning inspection, examination and rope removal criteria**

Protect yourself and others - failure of wire rope may cause serious injury or death!

WARNING

CAUTIONARY NOTICE – RESTRICTIONS ON THE USE OF LARGE DIAMETER MULTISTRAND ROPES.

All wire ropes are prone to damage if they are not roperly supported when used at high loads. Larger Multistrand ropes are particularly susceptible to this form of abuse, due to their rigid construction and the relatively fine wire sizes involved in their manufacture/construction. Instances have been recorded of ropes being heavily worked over plain drums and failing «prematurely», despite the nominal tension being in the region of half the breaking strength of the rope.

The best way of preventing difficulties of this sort is to avoid conditions that are likely to generate damagingly high contact stresses. A simple method of assessing the severity of the contact conditions is to firstly calculate the tread pressure based on the projected nominal area and then apply a factor (of say 10*) to allow for the highly localised and intermittent nature of the actual wire contacts, as indicated below :-

Type of contact	Close-fitting U-groove	Oversize U-groove	Plain drum
Level of support	Good	Fair	Poor
Tread path width	100% of rope dia.	50% of rope dia.	20% of rope dia.
Tread pressure =	2T/Dd	4T/Dd	10T/Dd
Contact stress =	20T/Dd	40T/Dd	100T/Dd

Note: Contact stresses which exceed 10% of the wire UTS should be considered a cause for concern, especially if the rope is operating at a low factor of safety.

[* This is because the true contact area is very much less than the projected nominal area.]

Worked example:

Consider case of a 50mm Multistrand rope (MBL=2100kN) operating at a 3:1 factor of safety. Then, for the Contact stress < 200 Mpa say, the following minimum bending diameters are indicated:

Close-fitting groove – 1400mm
Oversize U-groove - 2800mm
Un-grooved drum - 7000mm

TECHNICAL INFORMATION

MATERIAL SAFETY DATA

Introduction

Steel wire rope is a composite material and dependent upon its type may contain a number of discrete materials. The following provides full details of all the individual materials which may form part of the finished wire rope.

The description and/or designation of the wire rope stated on the delivery note and/or invoice (or certificate, when applicable) will enable identification of the component parts.
The main component of a steel wire rope is the wire, which may be carbon steel, coated (zinc or Zn95/A15) steel or stainless steel.

The other three components are (i) the core, which may be of steel of the same type as used in the main strands or alternatively fibre (either natural or synthetic), (ii) the rope lubricant and, where applicable, (iii) any internal filling or external covering. No Occupational Exposure Limits (OEL's) exist for steel wire rope and the values provided in this publication relate to component elements and compounds. The actual figures quoted in relation to the component parts are taken from the latest edition of EH40.

Rope produced from carbon, coated or stainless steel wires in the as-supplied condition is not considered a health hazard. However during any subsequent processing such as cutting, welding, grinding and cleaning, dust and fumes may be produced which contain elements that may affect exposed workers.

The following indicates the order in which specific information is provided:- Carbon steel wire, Coated steel wire, Stainless steel wire, Manufacturing rope lubricants, Fibre cores, Filling and covering materials, General information

Carbon Steel Wire - Hazardous Ingredients

Component	% Weight (Max)	Long term exposure limit (8-hour TWA reference period) mg/m3	Short term exposure limit (10-minute reference period) mg/m3
BASE METAL			
Aluminium	0.3	10	20
Carbon	1.0	None Listed	
Chromium	0.4	0.5	
Cobalt	0.3	0.1	
Copper	0.5	0.2	
Iron	Balance	5	10
Manganese	1.0	5	5
Molybdenum	0.1	5	10
Nickel	0.5	1	
Phosphorus	0.1	0.1	0.3
Silicon	0.5	10	
Sulphur	0.5	None Listed	
Vanadium	0.25	0.5	
Boron	0.1	10	20
Titanium	0.1	10	
Nitrogen	0.01	5	9
Lead	0.1	0.15	
Arsenic	0.01	0.2	
Zirconium	0.05	5	10
COATED			
Sodium	0.5	None Listed	
Calcium	0.5	2	
Boron	1.0	10	20
Phosphorus	1.0	0.1	0.3
Iron	1.0	5	10
Zinc	1.0	5	10
Oil may be applied	5.0	5	10

Physical Data

Specific Gravity:	7.5 - 8.5	Vapour Pressure:	N/A
Melting Point:	1350 - 1500 oC	Vapour Density:	N/A
Appearance & Odour:	Solid. Odourless Metal	Evaporation:	N/A
Solubility in water:	Insoluble	% Volatiles:	N/A
Flash Point:	None	Boiling Point:	> 2800 °C

Coated (Zinc and Zn95/A 15) Steel Wire - Hazardous Ingredients

Component	% Weight (Max)	Long term exposure limit (8-hour TWA reference period) mg/m3	Short term exposure limit (10-minute reference period) mg/m3
BASE METAL			
Aluminium	0.3	10	20
Carbon	1.0	None Listed	
Chromium	0.4	0.5	
Cobalt	0.3	0.1	
Copper	0.5	0.2	
Iron	Balance	5	10
Manganese	1.0	5	5
Molybdenum	0.1	5	10
Nickel	0.5	1	
Phosphorus	0.1	0.1	0.3
Silicon	0.5	10	
Sulphur	0.5	None Listed	
Vanadium	0.25	0.5	
Boron	0.1	10	20
Titanium	0.1	10	
Nitrogen	0.01	5	9
Lead	0.1	0.15	
Arsenic	0.01	0.2	
Zirconium	0.05	5	10
COATED			
Zinc	10.0	5	10
Aluminium	1.5	10	20
Iron	5.0	5	10
Sodium	0.5	None Listed	
Calcium	0.5	2	
Boron	1.0	100	20
Phosphorus	1.0	0.1	0.3
Sulphur	0.5	None Listed	
Oil may be applied	5.0	5	10
Wax may be applied	5.0	2	6

Physical Data

Specific Gravity:	7.5 - 8.5	Vapour Pressure:	N/A
Melting Point:	1350 - 1500 oC	Vapour Density:	N/A
Appearance & Odour:	Solid. Odourless Metal	Evaporation:	N/A
Solubility in water:	Insoluble	% Volatiles:	N/A
Flash Point:	None	Boiling Point:	> 2800 °C

Manufacturing Rope Lubricants

The products used in the manufacture of steel wire ropes for lubrication and protection present minimal hazard to the user in the as-supplied condition. The user must, however, take reasonable care to minimise skin and eye contact and also avoid breathing their vapours and mists.

A wide range of compounds is used as lubricants in the manufacture of steel wire rope. These products, in the main, consist of mixtures of oils, waxes, bitumens, resins, gelling agents and fillers with minor concentrations of corrosion inhibitors, oxidation stabilizers and tackiness additives.

Most of them are solid at ambient temperatures and provided skin contact with the fluid types is avoided, none present a hazard in normal rope usage.

However, to assist in the assessment of the hazard caused by these products, the following table contains all the components which may be incorporated into a wire rope lubricant and which may be considered hazardous to health.

Hazardous Ingredients:

Component	Long term exposure limit (8-hour TWA reference period) mg/m³	Short term exposure limit (10-minute reference period) mg/m³
Oil mist	5	10
Paraffin wax fume	2	6
Bitumen	5	10
Silica, fused		
Total inhalable dust	0.3	
Respirable dust	0.1	
Aluminium flake	10	20
Zinc oxide, fume	5	10
Butane	1430	1780

There are no other known constituents of any wire rope lubricant used that are classified as hazardous in the current edition of EH40.

General advice on handling ropes with lubricants

To avoid the possibility of skin disorders, repeated or prolonged contact with mineral or synthetic hydrocarbons must be avoided and it is essential that all persons who come into contact with such products maintain high standards of personal hygiene.

The worker **should:**

1) use oil impermeable gloves, or if not available, suitable oil repellent type barrier creams,
2) avoid unnecessary contact with oil using protective clothing,
3) obtain first aid treatment for any injury, however slight,
4) wash hands thoroughly before meals, before using the toilet and after work,
5) use conditioning creams after washing, where provided.

The worker **should not**:

1) put oily rags or tools into pockets, especially trousers,
2) use dirty or spoiled rags for wiping oil from the skin,
3) wear oil soaked clothing,
4) use solvents such as parafin, petrol etc., to remove oil from the skin.

Concentrations of oil mists, fumes and vapours in the working atmosphere must be kept as low as is reasonably practicable. Levels quoted in the current edition of HSE Guidance Note EH40 'Occupational Exposure Limits' must not be exceeded.

Health Hazards

Inhalation of oil mists or fumes from **heated** rope lubricants in high concentrations may result in dizziness, headache, respiratory irritation or unconsciousness. Eye contact may produce mild transient irritation to some users.

Fumes from **heated** rope lubricants in high concentrations may cause eye irritation.

If **heated** rope lubricants contacts skin, severe burns may result.

Prolonged or repeated skin contact may cause irritation, dermatitis or more serious skin disorders.

Fibre Cores

Being in the centre of a steel wire rope, the materials (natural or synthetic) from which fibre cores are produced do not present a health hazard during normal rope handling. Even when the outer core strands are removed (for example when the rope is required to be socketed) the core materials present virtually no hazard to the users, except, maybe, in the case of a used rope where, in the absence of any service dressing or as a result of heavy working causing internal abrasive wear of the core, the core may have decomposed into a fibre dust which might be inhaled, although this is considered extremely unlikely.

The principal area of hazard is through the inhalation of fumes generated by **heat**, for example when the rope is being cut by a disc cutter.

Under these conditions, natural fibres are likely to yield carbon dioxide, water and ash, whereas synthetic materials are likely to yield toxic fumes.

The treatment of natural fibres, such as rotproofing, may also produce toxic fumes on burning. The concentrations of toxic fumes from the cores, however, will be almost negligible compared with the products generated by heating from the other primary materials, e.g. wire and manufacturing lubricant in the rope. The most common synthetic core material is polypropylene, although other polymers such as polyethylene and nylon may occasionally be used.

Filling and Covering Materials

Filling and covering materials do not present a health hazard during handling of the rope in its as-supplied condition. The principal area of hazard is by the inhalation of fumes generated by heat, for example when the rope is being cut by a disc cutter.

Under these conditions, fillings and coverings, which are generally polypropylene, polyethylene and polyamid (but in some cases may be of natural fibre) are likely to produce toxic fumes.

General Information

Occupational protective measures

1) Respiratory protection - Use general and local exhaust ventilation to keep airborne dust or fumes below established occupational exposure standards (OES's). Operators should wear approved dust and fume respirators if OES's are exceeded. (The OES for total dust is 10mg/m^3 and for respirable dust is 5mg/m^3).

2) Protective equipment - Protective equipment should be worn during operations creating eye hazards. A welding hood should be worn when welding or burning. Use gloves and other protective equipment when required.

3) Other - Principles of good personal hygiene should be followed prior to changing into street clothing or eating. Food should not be consumed in the working environment.

Emergency medical procedures

1) Inhalation - Remove to fresh air; get medical attention.

2) Skin - Wash areas well with soap and water.

3) Eyes - Flush well with running water to remove particulate; get medical attention.

4) Ingestion - In the unlikely event that quantities of rope or any of its components are ingested, get medical attention.

Safety Information

1) Fire and explosion - In the solid state, steel components of the rope present no fire or explosion hazard. the organic elements present, i.e. lubricants, natural and synthetic fibres and other natural or synthetic filling and covering materials are capable of supporting fire.

2) Reactivity - Stable under normal conditions.

Spill or leak procedures

1) Spill or leak - Not applicable to steel in the solid form.

2) Disposal - Dispose of in accordance with local Regulations.

ROPE TERMINOLOGY

Wires

Outer wires: All wires positioned in the outer layer of wires in a spiral rope or in the outer layer of wires in the outer strands of a stranded rope.

Inner wires: All wires of intermediate layers positioned between the centre wire and outer layer of wires in a spiral rope or all other wires except centre, filler, core and outer wires of a stranded rope.

Core wires: All wires of the core of a stranded rope.

Centre wires: Wires positioned either at the centre of a spiral rope or at the centres of strands of a stranded rope.

Layer of wires: An assembly of wires having one pitch circle diameter. The exception is Warrington layer comprising alternately laid large and small wires where the smaller wires are positioned on a larger pitch circle diameter than the larger wires. The first layer is that which is laid immediately over the strand centre.

Note: Filler wires do not constitute a separate layer.

Tensile strength grade of wires: A level of requirement of tensile strength of a wire and its corresponding tensile strength range. It is designated by the value according to the lower limit of tensile strength and is used when specifying wire and when determining the calculated minimum breaking force or calculated minimum aggregate breaking force of a rope.

Wire finish: The condition of the surface finish of a wire, e.g. bright, zinc coated.

TECHNICAL INFORMATION

ROPE TERMINOLOGY

Strands

Strand: An element of rope usually consisting of an assembly of wires of appropriate shape and dimensions laid helically in the same direction in one or more layers around a centre.

Note: Strands containing three or four wires in the first layer or certainshaped (e.g. ribbon) strands may not have a centre.

Round strand: A strand with a cross-section which is approximately the shape of a circle.

Triangular strand: A strand with a cross-section which is approximately the shape of a triangle.

Note: Triangular strands may have built-up centres (i.e. more than one wire forming a triangle).

Oval strand: A strand with a cross-section which is approximately the shape of an oval.

Flat ribbon strand: A strand without a centre wire with a cross-section which is approximately the shape of a rectangle.

Compacted strand: A strand which has been subjected to a compacting process such as drawing, rolling or swaging whereby the metallic cross-sectional area of the wires remains unaltered and the shape of the wires and the dimensions of the strand are modified.

Single lay strand: Strand which contains only one layer of wires, e.g. 6-1.

Parallel lay strand: Strand which contains at least two layers of wires, all of which are laid in one operation (in the same direction), e.g. 9-9-1; 12-6F-6-1; 14-7+7-7-1. Each layer of wires lies in the interstices of the underlying layer such that they are parallel to one another, resulting in linear contact.

Note: This is also referred to as equal lay. The lay length of all the wire layers are equal.

Seale: Parallel lay strand construction with the same number of wires in each wire layer, each wire layer containing wires of the same size, e.g. 7-7-1; 8-8-1; 9-9-1.

Warrington: Parallel lay strand construction having an outer layer of wires containing alternately large and small wires, the number of wires in the outer layer being twice that in the underlying layer of wires, e.g. 6+6-6-1; 7+7-7-1.

Filler: Parallel lay strand construction having an outer layer of wires containing twice the number of wires than in the inner layer with filler wires laid in the intersticeswires of the underlying layer of wires, e.g. 12-6F-6-1; 14-7F-7-1.

Combined parallel lay: Parallel lay strand construction having three or more layers of wires, e.g. 14-7+7-7-1; 16-8+8-8-1; 14-14-7F-7-1; 16-16-8F+8-1.

Note: The first two examples above are also referred to as Warrington-Seale construction. The latter two examples are alsoreferred to as Seale-Filler contruction.

Multiple operation lay strand: Strand construction containing at least two layers of wires, at least one of which is laid in a separate operation. All of the wires are laid in the same direction.

Cross-lay: Multiple operation strand construction in which the wires of superimposed wire layers cross over one another and make point contact, e.g. 12/6-1.

Compound lay: Multiple operation strand which contains a minimum of three layers of wires, the outer layer of which is laid over a parallel lay centre, e.g. 16/6+6-6-1.

Ropes

Spiral Rope: An assembly of two or more layers of shaped and/or round wires laid helically over a centre, usually a single round wire. There are three categories of spiral rope, viz. spiral strand, half-locked coil and full-locked coil.

Spiral Strand: An assembly of two or more layers of round wires laid helically over a centre, usually a single round wire.

Half-locked Coil Rope: A spiral rope type having an outer layer of wires containing alternate half lock and round wires.

Full-locked Coil Rope: A spiral rope type having an outer layer of full lock wires.

Stranded Rope: An assembly of several strands laid helically in one or more layers around a core or centre. There are three categories of stranded rope, viz. single layer, multi-layer and parallel-closed.

Single Layer Rope: Stranded rope consisting of one layer of strands laid helically over a core.

Note: Stranded ropes consisting of three or four outer strands may,or may not, have a core. Some three and four strand single layerropes are designed to generate torque levels equivalent to thosegenerated by rotation-resistant and low rotation ropes.

Rotation-resistant Rope: Stranded rope having no less than ten outer strands and comprising an assembly of at least two layers of strands laid over a centre, the direction of lay of the outer strands being opposite (i.e. contra - lay) to that of the underlying layer of strands.

Low Rotation Rope: Rotation resistant rope having at least fifteen outer strands and comprising an assembly of at least three layers of strands laid over a centre in two operations.

Note: this category of rotation resistant rope is constructed in such a manner that it displays little or no tendency to rotate, or if guided, generates little or no torque when loaded.

Compacted Strand Rope: Rope in which the outer strands, prior to closing of the rope, are subjected to a compacting process such as drawing, rolling or swaging.

Compacted Rope: Rope which is subjected to a compacting process after closing, thus reducing its diameter.

Solid Polymer Filled Rope: Rope in which the free internal spaces are filled with a solid polymer. The polymer extends to, or slightly beyond, the outer circumference of the rope.

Cushioned Rope: Stranded rope in which the inner layers, inner strands or core strands are covered with solid polymers or fibres to form a cushion between adjacent strands or layers of strands.

Cushion Core Rope: Stranded rope in which the core is covered (coated) or filled and covered (coated) with a solid polymer.

Solid Polymer Covered Rope: Rope which is covered (coated) with a solid ploymer.

Solid Polymer Covered and Filled Rope: Rope which is covered (coated) and filled with a solid polymer.

Rope Grade (Rr): A number corresponding to a wire tensile strength grade on which the minimum breaking force of a rope is calculated.

Note: It does not imply that the actual tensile strength grades of the wires in a rope are necessarily the same as the rope grade.

Preformed Rope: Stranded rope in which the wires in the strands and the strands in the rope have their internal stresses reduced resulting in a rope in which, after removal of any serving, the wires and the strands will not spring out of the rope formation.

Note: Multi-layer stranded ropes should be regarded as nonpreformed rope even though the strands may have been partially (lightly) preformed during the closing process.

Rope Class: A grouping of rope constructions where the number of outer strands and the number of wires and how they are laid up are within defined limits, resulting in ropes within the class having similar strength and rotational properties.

Rope Construction: System which denotes the arrangement of the strands and wires within a rope, e.g. 6x36WS, 6x19S, 18x7, 34xK7.

Note: K denotes compacted strands.

Cable-laid Rope: An assembly of several (usually six) single layer stranded ropes (referred to as unit ropes) laid helically over a core (usually a seventh single layer stranded rope)

Braided Rope: An assembly of several round strands braided in pairs.

Electro-mechanical Rope: A stranded or spiral rope containing electrical conductors.

Strand and Rope Lays

Lay direction of strand: The direction right (z) or left (s) corresponding to the direction of lay of the outer layer of wires in relation to the longitudinal axis of the strand.

Lay direction of rope: The direction right (Z) or left (S) corresponding to the direction of lay of the outer strands in relation to the longitudinal axis of a stranded rope or the direction of lay of the outer wires in relation to the longitudinal axis of a spiral rope.

Ordinary lay: Stranded rope in which the direction of lay of the wires in the outer strands is in the opposite direction to the lay of the outer strands in the rope. Right hand ordinary lay is designated sZ and left hand ordinary lay is designated zS.

Note: This type of lay is sometimes referred to as 'regular' lay.

Lang's lay: Stranded rope in which the direction of lay of the wires in the outer strands is the same as that of the outer strands in the rope. Right hand Lang's lay is designated zZ and left hand Lang's lay is designated sS.

Alternate lay: Stranded rope in which the lay of the outer strands is alternatively Lang's lay and ordinary lay. Right hand

alternate lay is designated AZ and left hand alternate lay is designated AS.

Contra-lay: Rope in which at least one inner layer of wires in a spiral rope or one layer of strands in a stranded rope is laid in the opposite direction to the other layer(s) of wires or strands respectively.

Note: Contra-lay is only possible in spiral ropes having more than one layer of wires and in multi-layer stranded ropes.

Rope lay length (Stranded Rope): That distance parallel to the axis of the rope in which the outer strands make one complete turn (or helix) about the axis of the rope.

Cores

Core: Central element, usually of fibre or steel, of a single layer stranded rope, around which are laid helically the outer strands of a stranded rope or the outer unit ropes of a cable-laid rope.

Fibre core: Core made from natural fibres(e.g. hemp, sisal) and designated by its diameter and runnage.

Synthetic Core: Core made from synthetic fibres (e.g. polypropylene) and designated by its diameter and runnage.

Steel core: Core produced either as an independent wire rope (IWRC)(e.g. 7x7) or wire strand (WSC)(e.g. 1x7).

Solid polymer core: Core produced as a single element of solid polymer having a round or grooved shape. It may also contain internal elements of wire or fibre.

Insert: Element of fibre or solid polymer so positioned as to separate adjacent strands or wires in the same or overlying layers and fill, or partly fill, some of the interstices in the rope. (see Zebra)

Rope Characteristics and Properties

Calculated Minimum aggregate Breaking Force: Value of minimum aggregate breaking force is obtained by calculation from the sum of the products of the crosssectional area (based on nominal wire diameter) and tensile strength grade of each wire in the rope, as given in the manufacturer's rope design.

Calculated Minimum breaking Force: Value of minimum breaking force based on the nominal wire sizes, wire tensile strength grades and spinning loss factor for the rope class or construction as given in the manufacturer's rope design.

Fill factor: The ratio between the sum of the nominal cross-sectional areas of all the load bearing wires in the rope and the circumscribed area of the rope based on its nominal diameter.

Spinning loss factor (k) : The ratio between the calculated minimum breaking force of the rope and the calculated minimum aggregate breaking force of the rope.

Breaking force factor (K): An empirical factor used in the determination of minimum breaking force of a rope and obtained from the product of fill factor for the rope class or construction, spinning loss factor for the rope class or construction and the constant $\varpi/4$.

Minimum breaking force (Fmin): Specified value, in kN, below which the measured breaking force is not allowed to fall in a prescribed test and, for ropes having a grade, obtained by calculation from the product of the square of the nominal diameter, the rope grade and the breaking force factor.

Minimum aggregate breaking force (Fe,min): Specified value, in kN, below which the measured aggregate breaking force is not allowed to fall in a prescribed test and, for ropes having a grade, obtained from the product of the square of the nominal rope diameter (d), the metallic crosssectional area factor (C) and the rope grade (Rr).

Norminal length mass: The nominal mass values are for the fully lubricated ropes.

Rope torque: Value, usually expressed in N.m, resulting from either test or calculation, relating to the torque generated when both ends of the rope are fixed and the rope is subjected to tensile loading.

Rope turn: Value, usually expressed in degrees per metre, resulting from either test or calculation, relating to the amount of rotation when one end of the rope is free to rotate and the rope is subjected to tensile loading.

Initial extension: Amount of extension which is attributed to the initial bedding down of the wires within the strands and the strands within the rope due to tensile loading.

Note: This is sometimes referred to as constructional stretch.

Elastic extension: Amount of extension which follows Hooke's Law within certain limits due to application of a tensile load.

Permanent rope extension: Non-elastic extension.

TECHNICAL INFORMATION

CONVERSION FACTORS S.I. UNITS

Force			
1 kN	= 0.101 972 Mp	1 UK tonf	= 9964.02N
1 N	= 0.101 972 kgf	1 lbf	= 4.448 22N
1 kgf	= 9.806 65 N	1 lbf	= 0.453 592 kgf
1 kgf	= 1 kp	1 UK tonf	= 1.01605 tonne
1 N	= 1.003 61 x 104 UK tonf	1 UK tonf	= 9.964 02 kN
1 N	= 0.2244 809 lbf	1 UK tonf	= 2240 lbf
1 kgf	= 2.204 62 lbf	1 short tonf	
1 t	= 0.984 207 UK tonf	(USA)	= 2000 lbf
1 kN	= 0.100 361 UK tonf	1 kip (USA)	= 1000 lbf
1 kN	= 0.101 972 tonne (t)	1 kip	= 453.592 37 kgf

Pressure/Stress			
1 N/mm^2	= 0.101972 kgf/mm^2		
1 kgf/mm^2	= 9.806 65 N/mm^2		
1 N/mm^2	= 1 MPa		
1 kgf/mm^2	= 1 422.33 lbf/in^2	1 lbf/in^2	= 7.030 x 10^{-4} kgf/mm^2
1 kgf/mm^2	= 0.634 969 tonf/in^2	1 tonf/in^2	= 1.57488 kgf/mm^2
1 N/m^2	= 1.450 38 x 10^{-4}lbf/ in^2	1 lbf/in^2	= 6894.76 N/m^2
1 N/m^2	= 1 x 10^{-6}N/mm^2	1 tonf/in^2	= 1.544 43 x 10^8 dyn/cm^2
1 bar	= 14.503 8 lbf/in^2		
1 hectobar	= 10N/mm^2		
1 hectobar	= 10^{7}N/m^2		

Mass			
1 kg	= 2.204 62 lb	1 lb	= 0.453 592 kg
1 tonne (t)	= 0.984 207 UK ton	1 UK ton	= 1.01605 tonnes (t)
1 kg/m	= 0.671 970 lb/ft	1 lb/ft	= 1.488 kg/m
1 kg	= 1000 g	1 kip (USA)	= 1000 lb
1 Mp	= 1 x 10^6 g		
1 tonne (t)	= 9.80665 kN		

Length			
1 m	= 3.280 84 ft	1 ft	= 0.304 8 m
1 km	= 0.621 371 miles	1 mile	= 1.609 344 km

Area			
1 mm^2	= 0.001 55 in^2	1 in^2	= 645.16 mm^2
1 m^2	= 10.763 9ft^2	1 ft^2	= 0.092 903 0 m^2

Volume			
1 cm^3	= 0.061 023 7 in^3	1 in^3	=16.387 1 cm^3
1 litre (l)	= 61.025 5 in^3	1 in^3	= 16.386 6 ml
1 m^3	= 6.102 37 x 104 in^3	1 yd^3	= 0.764 555 m^3

TECHNICAL INFORMATION

GOOD PRACTICE WHEN ORDERING A ROPE

Basic information to be supplied;	
Application or intended use:	Boom / luffing rope
Nominal rope diameter:	22mm
Diameter tolerance (if applicable):	+2% to +4%
Nominal rope length:	245 metres
Length tolerance (if applicable):	-0% to +2%
Construction (Brand or Name):	Dyform 6x36ws
Type of core:	IWRC (Independent wire rope core)
Rope grade:	1960N/mm2
Wire finish:	B (Drawn galvanised)
Rope Lay:	zZ (Right hand Lang's)
Level of lubrication:	Lubricated internally, externally dry
Minimum breaking force:	398kN (40.6tonnes)
Rope standard:	BS EN 12385-4:2004
Supply package:	Wood compartment reel
Rope terminations - Inner end:	DIN 3091 solid thimble with 43mm pin hole
Outer end:	Fused and tapered
Third party authority (if required):	Lloyd's Register
Identification / markings:	Part number XL709 – 4567
Useful additional information;	
Equipment manufacturer:	J Bloggs, Model XYZ crawler crane
Drum details - Grooved:	Yes or No
If Yes:	Helical or Lebus
Pitch of grooving:	23.10mm
20. Spooling – Number of wraps per layer:	32
Number of layers:	Approximately 3 1/2

MIFA
EQUIPEMENT

Siège Social : **379 , Bd. Ibn Tachfine – Casablanca 20300**
Tél. : **(+ 212) 522 61 88 76 à 80 - Fax : (+ 212) 522 61 88 84**
E-mail : **info.mifaequipement@mifa.ma**