BRIDON · BEKAERT
THE ROPES GROUP

Standard High Performance

ENDURANCE DYFORM 34LR/XL/MAX
- Best combination of strength, rotation resistance, crush resistance and bendi fatigue in the rotation resistant product range
- Strongest of all ropes in the rotation resistant product range confirmed by Bridon's "Powerchecked" testing of a sample from each production length.
- Greatest resistance to rotation of all ropes in the rotation resistant product range - confirmed by Bridon's unique "Twistchecked" type testing program.
- Superior bending fatigue life when compared with conventional rotation resistant ropes - confirmed by laboratory testing and extensive field experience
- Excellent resistance to crushing and abrasion resulting from the overall compactness and robustness of the rope and the Dyform strands -recommended when multi-layer spooling is involved
- Reduced elongation results from increased steel content and the Dyform process
- Dimensional stability
- Optional plastic coating (PI) of IWRC to further extend fatigue life, improve structural stability and resistance to corrosion

ENDURANCE DYFORM 28 HML
- Provides up to 20% greater fatigue performance when compared with conventional multistrand ropes
- Strongest of all ropes in the rotation resistant product range confirmed by Bridon's "Powerchecked" testing of a sample from each production length
- Greatest resistance to rotation of all ropes in the rotation resistant product range - confirmed by Bridon's unique "Twistchecked" type testing program
- Superior bending fatigue life when compared with conventional rotation resistant ropes - confirmed by laboratory testing and extensive field experience
- Excellent resistance to crushing and abrasion resulting from the overall compactness and robustness of the rope and the Dyform strands -recommended when multi-layer spooling is involved
- Reduced elongation results from increased steel content and the Dyform process
- Dimensional stability

ENDURANCE DYFORM 18/PI
- High strength rotation resistant rope incorporating Dyform strands- confirmed by Bridon's "Powercheck" testing of a sample from each production length.
- Good resistance to rotation - confirmed by Bridon's unique "Twistchecked" type testing program
- Superior bending fatigue life when compared with conventional multistrand ropes - confirmed by laboratory testing and extensive field experience.
- Excellent resistance to crushing and abrasion resulting from the overall compactness and robustness of the rope and the Dyform strands are recommended when multi-layer spooling is involved
- Optional plastic coating (PI) of IWRC to further extend fatigue life, improved structural stability and resistance to corrosion

ENDURANCE DYFORM 6/PI
- Strongest of all ropes in the six strand product range-confirmed by Bridon's "Powerchecked" testing of a sample from each production length
- Superior bending fatigue life when compared with conventional six strand ropes - confirmed by laboratory testing and extensive field experience
- Excellent resistance to crushing and abrasion resulting from the overall compactness and robustness of the rope and the Dyform strands - recommended when multi-layer spooling is involved
- Reduced elongation results from increased steel content and the Dyform process
- Optional plastic coating (PI) of IWRC to further extend fatigue life, improved structural stability and resistance to corrosion

ENDURANCE DYFORM 8/PI/MAX
- High breaking force - confirmed by Bridon's "Powerchecked" testing of a sample from each production length
- Superior bending fatigue life when compared with conventional eight strand ropes - confirmed by laboratory testing and extensive field experience
- Highest strength boom hoist rope offered by Bridon
- Excellent resistance to crushing and abrasion resulting from the overall compactness and robustness of the rope and the Dyform strands - recommended when multi-layer spooling is involved
- Reduced elongation results from increased steel content and the Dyform process
- Optional plastic coating (PI) of IWRC to further extend fatigue life, improved structural stability and resistance to corrosion

CONSTRUCTEX®
- Nine strand rope comprised of three different strand constructions. Each outside strand manufactured with a soft plastic center
- High strength - confirmed by Bridon's "Powerchecked" testing of a sample
- Excellent resistance to crushing and wear resulting from the overall compactness and robustness of the rope
- Flexible construction with good fatigue life in most applications

6X19 CLASSIFICATION
- High quality six strand rope
- High strength - confirmed by Bridon's "Powercheck" testing of a sample (where noted in table)
- Excellent resistance to wear
- Fully lubricated
- Steel core and fiber core

6X36 CLASSIFICATION
- High quality six strand rope
- High strength - confirmed by Bridon's "Powercheck" testing of a sample (where noted in table)
- Consistent bending fatigue performance
- Fully lubricated
- Steel core and fiber core

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Inspection of Wire Ropes

INTRODUCTION

The most important aspect of operating a rope safely is regular proper inspection. ASME crane safety standards such as B30.2 and B30.5 provide detailed inspection procedures and retirement criteria. Both standards specify that all running ropes in service should be visually inspected once each working day and shall consist of observation of all rope that can reasonably be expected to be in use during operations on that day. The inspection must be more than just a quick look. It needs to be done carefully and in enough light to find damage or broken wires that may require the rope to be taken out of service. It must also be remembered that a dirty or greasy rope is almost impossible to inspect properly, as dirt and grease may hide problem areas. The individual making the inspection should be familiar with the machine, the wire rope, and that particular application. The B30 standards provide information on both a frequent inspection to be done daily and a much more detailed periodic inspection that is done on a weekly or monthly basis.

FREQUENT INSPECTION

As stated previously, all running ropes in service should be visually inspected once each working day and shall consist of observation of all rope that can reasonably be expected to be in use during operations on that day. The inspector should know where and how rope on the particular application wears out so that the daily inspection can be focused on the known wear areas. Special care should always be taken when inspecting common repetitive wear sections such as:

Flange step up, cross over points and repetitive pick up on the drum; areas of the rope operating through a reverse bend in the reeving system, equalizer sheaves, and end connections.

The inspector should be concerned with discovering gross damage that may be an immediate hazard. Specific types of damage include the following:

Distortion to the uniform structure of the rope; broken wires; corrosion, gross damage to or deterioration of end connections, evidence of heat/electrical/lightning damage, and localized change in lubrication condition.

When damage is discovered, a qualified person must evaluate affected sections as detailed in the rope replacement section below to determine if the rope needs to be removed from service. The B30 standards do not require frequent inspections to be documented, but it is a good idea to keep a frequent inspection log on the crane, simply noting time, date and identity of the inspector.

PERIODIC INSPECTION

The inspection frequency needs to be based on factors such as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. Inspections need not be at equal calendar intervals and should be more frequent as the rope approaches the end of its useful life. There are many duty cycle rope applications where the service life is less than a month, or sometimes even a week in severe service conditions, so a periodic level of inspection may have to be performed daily.

The periodic inspection must cover the surface of the entire rope length and no attempt should be made to open the rope. In addition to common repetitive wear sections checked during the frequent inspection, additional sections prone to rapid deterioration such as the following need special attention.

(1) Locations where rope vibrations are damped, such as the following: sections in contact with equalizer sheaves, or other sheaves where rope travel is limited; sections of the rope at or near end connections where corroded or broken wires may protrude; bridle reeving in the boom hoist ropes; repetitive pickup points and crossover and change of layer points at flanges on drums; fleeting or deflector sheaves.

In addition to the specific types of damage listed in the frequent inspection section, these additional items need to be addressed: Measuring the rope diameter in numerous locations to assess uniform loss of diameter along the entire length of rope; close visual observation of the entire length to identify; lengthening of lay in localized areas; diameter reduction in localized areas; distortion of rope structure (kinking, birdcaging, crushing); steel core protrusion between the outer strands; internal corrosion; wear of outside wires; more detailed inspection of end connections for broken wires and corrosion; severely corroded, cracked, bent, worn or improperly applied end connections; waviness (corkscrew effect) of rope; high or low strand.

To establish data as a basis for judging the proper time for replacement, a dated report of rope condition at each periodic inspection must be kept on file. This report shall cover points of deterioration listed above. If the rope is replaced, only the fact that the rope was replaced need be recorded.

Certain types of ropes and applications require special attention and require reduced time intervals between periodic inspections:

- Rotation Resistant ropes have a unique construction and are susceptible to damage and increased deterioration when working under difficult conditions such as duty cycle operation.
- Boom hoist ropes because of the importance of their function and because their location may make inspection difficult.

ROPE REPLACEMENT

There are no precise rules to determine the exact time for the replacement of the rope since many variable factors are involved. Once a rope reaches any one of the removal criteria, it must be replaced immediately unless allowed to operate to the end of the work shift by the judgment of a qualified person. If the rope was not removed immediately, it shall be replaced before the end of the next work shift. Specific inspection attributes and removal criteria are:

(1) Broken wires: (a) For ropes operating on equipment covered by B30.5: In running ropes, 6 randomly distributed wire breaks per rope lay or 3 wire breaks per strand per rope lay. A rope lay is the distance that it takes one outer strand to make one complete revolution around the rope. A 6-strand rope will typically have a rope lay of 6.4 times the rope diameter (i.e. a 1/2" 6x25FW EIP IWRC RRL rope will have rope lay of 3.2") (b) For ropes operating on equipment covered by B30.2, in running ropes is 12 randomly distributed wire breaks per rope lay or four wire breaks per strand (c) For all categories of Rotation Resistant ropes, the retirement criteria is 2 wire breaks in 6 rope diameters or 4 wire breaks on 30 rope diameters (i.e. 6 rope diameters in a 1" rope is 6") (d) One broken outer wire at the contact point with the core which has worked its way out of the rope structure and protrudes, loops out or is slightly raised from the body of the rope

Note: Broken wire removal criteria cited in this volume apply to wire rope operating on steel sheaves and drums and wire rope operating on multilayer drums regardless of sheave material. Due to the difficulty in detecting wire breaks when polymer are utilized with single layer drums, the user should contact the sheave manufacturer for broken wire removal criteria.

Reductions from nominal diameter greater than 5% (Minimum Value = Nominal Diameter x .95)

Distortion of rope structure: (a) Damage resulting in distortion of the rope structure (e.g., kinking, birdcaging, crushing) (b) Steel core protrusion between the outer strands (c) Localized change in lay length (d) Changes in original geometry due to crushing forces where the diameter across the distorted section is 5/6 of the nominal diameter.
(4) Waviness (corkscrew effect) in the rope that causes overall diameter to increase to a value greater than 110% of nominal rope diameter.
(5) A high or low strand that is higher or lower than ½ of the strand diameter above or below the surface of the rope.
(6) Any apparent damage from a heat source including, but not limited to welding, power line strikes, or lightning.
(7) Widespread or localized external corrosion as evidenced by pitting, and obvious signs of internal corrosion such as magnetic debris coming from valleys.
(8) Severely corroded, cracked, bent, worn, grossly damaged, or improperly installed end connections

Note: Consult the latest edition of the ASME B30 Volume that applies to your crane as removal criteria may be updated over time based on the latest knowledge and information. All rope that has been idle for a month or more due to shut down or storage of a crane should be given a detailed inspection according to the requirements of the periodic inspection provided by the B30 standards.

ROPE SERVICE LIFE

A long-range inspection program should be established and should include records on the examination of ropes removed from service so that a relationship can be established between visual observation and actual condition of the internal structure. There are a wide variety of wire rope constructions available to be used on cranes. It is important that the correct rope be used for each specific application. Because wire rope wears in service, the method by which the rope wears is an important factor in determining the most suitable rope. Replacement rope must have a rated strength at least equal to the original rope supplied or recommended for the machine. Any change from the original specification for the rope must be specified by the wire rope manufacturer, crane manufacturer, or qualified person. When there is a question, consult with Bridon American about the rope construction most appropriate for the application.

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BRIDON
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Integrity in Every Strand

Quick Reference Guide: Crane Ropes

Standard Hoist Wire Ropes

6x19 Classification

Diameter	Approx Mass IWRC		Min Breaking Force EIP IWRC		EEIP IWRC	
in	lb/ft	kg/ft	tons	kN	tons	kN
1/4	0.108	0.049	3.40	30.2		
5/16	0.169	0.077	5.27	46.9		
3/8	0.244	0.111	7.55	67.2		
7/16	0.332	0.151	10.2	90.7	11.2	100
1/2*	0.434	0.197	13.3	118	14.6	130
9/16*	0.549	0.249	16.8	149	18.5	165
5/8*	0.688	0.312	20.6	183	22.7	202
3/4*	0.975	0.442	29.4	262	32.4	288
7/8*	1.33	0.603	39.8	354	43.8	390
1	1.73	0.785	51.7	460	56.9	506
1 1/8	2.19	0.993	65.0	578	71.5	636
1 1/4	2.75	1.25	79.9	711	87.9	782
1 3/8	3.28	1.49	96.0	854	106	943
1 1/2	3.90	1.77	114	1,010	125	1,110

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

6x37 Classification

Diameter	Approx Mass IWRC		Min Breaking Force EIP IWRC		EEIP IWRC	
in	lb/ft	kg/ft	tons	kN	tons	kN
1/4*	0.108	0.049	3.40	30.3		
5/16*	0.169	0.077	5.27	46.9		
3/8*	0.244	0.111	7.55	67.2		
7/16*	0.332	0.151	10.2	90.7	11.2	100
1/2	0.434	0.197	13.3	118	14.6	130
9/16	0.549	0.249	16.8	149	18.5	165
5/8	0.688	0.312	20.6	183	22.7	202
3/4	0.975	0.442	29.4	262	32.4	288
7/8	1.33	0.603	39.8	354	43.8	390
1	1.73	0.785	51.7	460	56.9	506
1 1/8	2.19	0.993	65.0	578	71.5	636
1 1/4	2.75	1.25	79.9	711	87.9	782
1 3/8	3.28	1.49	96.0	854	106	943
1 1/2	3.90	1.77	114	1,010	125	1,110

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

Wire Rope Application Guide for Cranes

	Standard		High Performance					
	6x19	6x36	Dyform 34LR	Dyform 28 HML	Dyform 18	Dyform 6	Dyform 8	Constructex
Telescopic Mobile Crane								
Auxiliary Rope	•	•	•	•	•			
Tower Crane								
Main Hoist Rope	•	•	•	•		•		
Derricking Rope	•	•				•		
Trolley Rope	•	•				•		
Container Crane								
Main Hoist Rope	•	•				•	•	
Boom Hoist Rope	•					•	•	
Trolley Rope	•	•						
Mobile Lattice Boom Crane								
Main Hoist Rope			•	•	•			
Boom Hoist Rope	•					•	•	•
Auxiliary Rope	•	•	•	•	•	•		
Dockside Crane								
Main Hoist Rope			•	•	•			
Boom Hoist Rope	•					•		•
Overhead Crane								
Main Hoist Rope	•	•				•	•	
Steel Mill Ladle Crane								
Main Hoist Rope	•	•				•	•	
Offshore Pedestal Crane								
Main Hoist Rope			•	•	•			
Whipline Rope			•	•	•			
Boom Hoist Rope	•					•	•	•
Unloader Crane								
Main Hoist Rope	•	•				•		•
Boom Hoist Rope	•	•				•		•
Closing Rope	•	•				•		•
Racking Rope		•				•		
Piling Crane								
Main Hoist Rope					•			
Pipe Handling Rope						•		

High Performance DYFORM® Main/Auxiliary Hoist Wire Ropes

Endurance Dyform® 34LR/PI

Diameter		Approx Mass WSC		Minimum Breaking Force Rope Grade EIP/1960		EEIP/2160	
in	mm	lb/ft	kg/ft	tons	kN	tons	kN
	14*	0.659	0.299	20.1	179	21.5	191
9/16		0.687	0.308	20.8	185	22.6	201
5/8	16	0.869	0.394	26.1	232	28.2	251
	18	1.07	0.484	33.5	298	35.9	319
3/4	19	1.22	0.553	37.0	329	40.0	356
	20	1.38	0.627	41.6	370	44.6	397
	22	1.63	0.739	49.7	442	54.2	482
7/8		1.65	0.750	50.4	448	54.7	487
	24	2.02	0.916	59.3	528	64.0	569
1		2.17	0.990	62.4	555	70.0	623
	26	2.28	1.04	69.5	618	74.2	660
	28	2.63	1.19	76.0	676	85.2	758
1 1/8		2.81	1.27	79.5	689	86.9	773
	30	2.30	1.36	92.5	823	94.0	836
1 1/4	32	3.43	1.56	98.2	874	110	979

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

Endurance Dyform® 34XL

Diameter		Approx Mass WSC		Min Breaking Force Rope Grade XL	
in	mm	lb/ft	kg/ft	tons	kN
5/8	16	0.84	0.370	30.6	272
3/4	19	1.31	0.596	42.9	382
1*		2.15	0.950	71.7	638
	26*	2.28	1.04	74.0	658
	28*	2.63	1.19	84.4	751
1 1/8		2.72	1.23	86.9	773
	29*	2.94	1.30	86.9	829

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

Endurance Dyform® 34MAX

Diameter		Approx Mass WSC		Min Breaking Force Rope Grade MAX	
in	mm	lb/ft	kg/ft	tons	kN
1		2.22	1.01	76.9	684
	26	2.38	1.08	79.3	705
	28	2.86	1.30	91.9	818
1 1/8*		3.06	1.39	95.3	848
1 1/4	32	3.74	1.69	122	1,085

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

Endurance Dyform® 28 HML

Diameter		Approx Mass WSC		Min Breaking Force Rope Grade Dyform	
in	mm	lb/ft	kg/ft	tons	kN
	15*	0.814	0.357	26.9	239
	17*	1.06	0.481	34.5	307
	18*	1.20	0.542	38.7	344
	20	1.57	0.712	47.7	424
	21*	1.64	0.743	52.6	468
7/8	22	1.88	0.853	58.9	424
	23	2.06	0.932	63.1	561
	25	2.41	1.09	74.5	663
	26	2.59	1.17	79.2	705
	28	2.85	1.29	91.9	818
1 1/8		2.90	1.32	95.3	848
	30*	3.06	1.39	105	935
1 1/4	32	3.37	1.53	122	1,085

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

Endurance Dyform® 18/18PI

Diameter		Approx Mass WSC		Min Breaking Force Rope Grade Dyform	
in	mm	lb/ft	kg/ft	tons	kN
3/8		0.281	0.127	8.31	73.9
	10*	0.336	0.152	9.49	84.4
	11*	0.407	0.185	11.7	104
7/16		0.415	0.188	11.2	100
	12*	0.484	0.220	13.7	122
1/2		0.542	0.246	14.6	130
	13*	0.568	0.258	16.1	143
	14*	0.659	0.299	18.5	165
9/16		0.686	0.311	19.3	172
5/8	16*	0.847	0.384	22.7	202
	18*	1.09	0.494	30.8	274
3/4	19*	1.22	0.553	32.4	288
	20*	1.34	0.608	37.9	337
	22*	1.63	0.739	46.8	416
7/8		1.66	0.753	43.8	390
	24*	1.94	0.880	54.6	486
1		2.17	0.984	57.5	512
	26*	2.27	1.03	64.1	570
	28*	2.63	1.19	74.3	661
1 1/8		2.74	1.24	71.5	636
1 1/4	32	3.39	1.54	87.9	782

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

High Performance DYFORM® Boom Hoist Wire Ropes

Endurance Dyform® 6/6PI

Diameter		Approx Mass WSC		Min Breaking Force Rope Grade Dyform	
in	mm	lb/ft	kg/ft	tons	kN
3/8		0.285	0.129	8.79	78.2
	10*	0.308	0.140	9.69	86.2
	11*	0.373	0.169	11.9	106
7/16		0.376	0.171	11.9	106
	12	0.444	0.200	13.9	124
1/2		0.497	0.225	15.3	136
	13*	0.521	0.236	16.0	142
	14*	0.605	0.274	18.5	165
9/16		0.633	0.287	19.3	172
5/8	16	0.775	0.351	23.6	210
	18*	1.00	0.454	30.1	268
3/4	19	1.10	0.499	32.4	288
	20*	1.23	0.558	37.2	331
	22	1.47	0.669	45.07	401
7/8		1.52	0.691	43.8	390
	24*	1.78	0.807	53.6	477
1		1.92	0.871	57.5	512
	26	2.07	0.940	62.9	560
	28	2.36	1.10	73.0	649
1 1/8		2.54	1.15	76.0	676
1 1/4	32	3.13	1.38	87.9	782
1 3/8		3.79	1.67	106	943
1 1/2	38	4.00	1.99	125	1113

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

Endurance Dyform® 8 MAX PI

Diameter		Approx Mas WSC		Min Breaking Force MAX	
in	mm	lb/ft	kg/ft	tons	kN
	24.0	1.96	0.890	61.1	544
1		2.15	0.977	64	569
	26.0*	2.27	1.03	71.8	639
	28.0*	2.64	1.20	83.3	741
1 1/8*		2.75	1.25	86.9	773
	30.0*	3.03	1.37	95.7	851
1 1/4	32	3.65	1.65	109	970

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

Constructex®

Diameter	Approx Mass WSC		Minimum Breaking Force	
in	lb/ft	kg/ft	tons	kN
5/8*	0.900	0.390	25.5	227
3/4*	1.1	0.500	36.5	325
7/8*	1.5	0.680	48.5	432
1*	2.0	0.910	62.5	556
1 1/8*	2.6	1.18	79.5	707
1 1/4*	3.2	1.45	97.6	868
1 3/8	3.9	1.77	119	1059
1 1/2	4.7	2.15	139	1237
1 5/8	5.7	2.59	162	1441
1 3/4*	6.2	2.81	185	1,650

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item

Endurance Dyform® 8/8PI

Diameter		Approx Mass WSC		Min Breaking Force Dyform	
in	mm	lb/ft	kg/ft	tons	kN
3/8		0.306	0.139	9.69	86.2
	10*	0.316	0.143	10.0	89.2
	11*	0.383	0.174	12.4	110
7/16		0.391	0.177	12.4	110
	12*	0.456	0.207	14.4	128
1/2		0.505	0.229	16.2	144
	13*	0.535	0.243	16.9	150
	14*	0.620	0.281	19.6	174
9/16*		0.646	0.293	20.3	181
5/8	16	0.825	0.374	25.0	222
	18*	1.03	0.467	32.1	286
3/4	19	1.19	0.538	35.7	318
	20	1.25	0.568	36.7	353
	22	1.48	0.672	48.0	427
7/8		1.53	0.693	48.0	427
	24	1.76	0.797	58.2	517
1		1.20	0.905	62.8	559
	26*	2.14	0.971	67.0	596
	28	2.37	1.07	77.7	691
1 1/8		2.68	1.22	81.8	727
1 1/4	32	3.16	1.43	102	907
1 3/8		4.11	1.86	129	1148
1 1/2	38	4.64	2.10	138	1,228

Note: all sizes Powerchecked and mass calculation is approximate.
* Asterisk indicates nonstandard item