MINING PRODUCTS CATALOG

Bethlehem Wire Rope®

manufactured by
Wirerope
Works,
Inc.

Our Service Pledge

- **To understand that our customers always come first.**
- **To treat each customer as our best customer.**
- **To make our customers' jobs as easy as possible, saving their time and their money.**
- **To remember, if a customer perceives a problem, a problem really exists.**
- **To provide fast, friendly responses to our customers, offering service with a smile.**
- **To provide efficient, error-free order entry and billings.**
- **To help our customers solve their problems, assist them in product selection and track their orders.**
- **To follow up with our customers, satisfying their requirements and developing personal relationships.**
- **To hear what our customers are saying and to understand their needs.**

Wirerope Works, Inc.

Table of Contents

Bethlehem Mining Rope

Bethlehem Structural Strand

Bethlehem Wire Rope and Strand Pendants

Wire rope and strand products will break if abused, misused or overused. Regular inspection and maintenance are necessary. Consult Industry recommendations and OSHA Standards before using.

Wirerope Works, Inc., expressly prohibits the resale of worn, previously owned and used Bethlehem Wire Rope and S wi or secondary charges including but not limited to personal injury, labor costs and a loss of profits resulting from the use of worn, previously owned and used products. WW-06/04

wire grades used in Bethlehem Mining Ropes

Wirerope Works, Inc. (WW), manufacturer of Bethlehem Wire Rope, offers four grades of Bethlehem Mining Rope for different applications.

Purple grade wire, known as Improved Plow Steel (IPS), is a strong, tough, durable steel which combines great strength with high resistance to fatigue. Its minimum tensile strength varies from 223 to 258 ksi, depending upon wire size.

WW's *Purple Plus* grade wire, or Extra Improved Plow Steel (EIP or XIP), is a high strength grade designed for use where a higher breaking strength is required. Minimum tensile strength varies from 245 to 284 ksi, depending on wire size.

The *Excavator* grade applies to an improved outer strand and core construction. WW tailors the wire properties within the rope and manufactures each Excavator grade Bethlehem Mining Rope using a variety of wire grades. WW manufactures the independent wire rope core (IWRC) wires and center wires of the main strands with very ductile steel. This ductility prevents wire failure by better absorption of the extreme internal pressures which occur during the rope's operating life. Custom selection of steel grade and our wire drawing practices for the wires in the outer layer of each strand provide excellent resistance to failure from abrasion and bending fatigue.

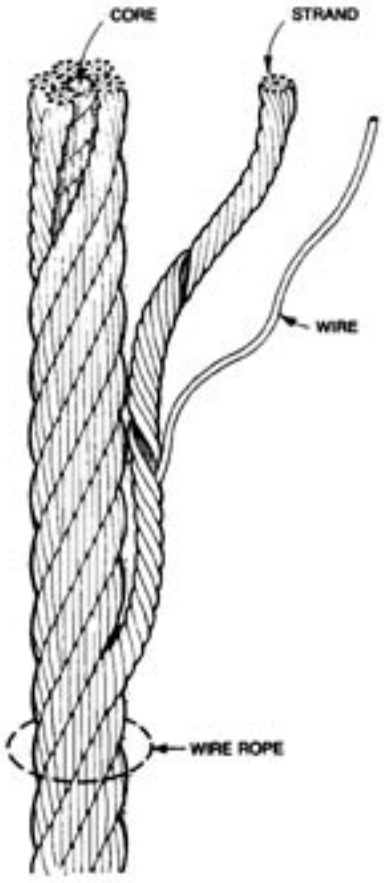
Excavator-AR (abrasion resistant), an extension of WW's proven Excavator grade, is intended for those applications where more severe, abrasive operating conditions exist. Abrasion resistance is improved by changing the chemical and physical properties of the outside wires while maximizing wire ductility by closely controlling the wire drawing practices.

cores

For surface and underground mines, WW supplies Bethlehem Mining Ropes with fiber or steel cores. The core is the foundation of a wire rope. Its primary function is to support the wire strands of the rope, maintaining them in their correct positions during the operating life of the rope.

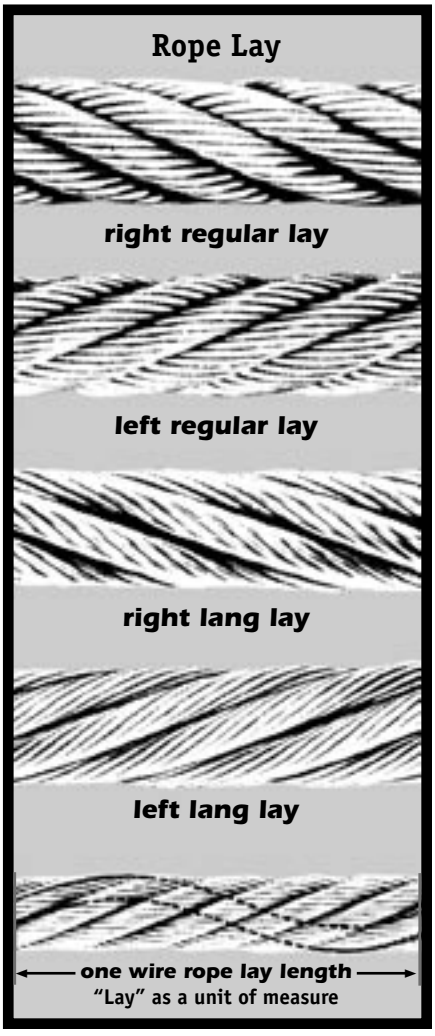
Fiber cores are ropes made from fibers formed into yarns, then into strands and finally into the finished core form. There are two general types of fiber: natural vegetable material, such as sisal, and synthetic filaments, such as polypropylene.

Steel wires comprise the Independent Wire Rope Core (IWRC). Ropes with IWRCs resist crushing, are resistant to heat, reduce stretch and increase the strength of the rope.



wire rope lay

The direction of the helix or spiral of the wires and strands in a rope is called the *lay*. *Regular lay* means the wires and strands spiral in opposite directions; the wires appear to run roughly parallel to the center line of the rope. *Lang lay* is the opposite; the wires and strands spiral in the same direction and seem to run at a diagonal to the center line of the rope. If the strands rotate around the rope in a clockwise direction (as the threads do in a right-hand bolt), the rope is said to be *right lay*. When the strands rotate in a counterclockwise direction, the rope is *left lay*.



When a *lay-length* is used as a unit of measure, it refers to the length it takes a single strand to make one complete turn around the rope. Lay-length is measured in a straight line parallel to the center line of the rope, not following the path of the strand. The appropriate time to replace a wire rope in service is frequently determined by counting the number of broken wires in the length of one rope lay and comparing the number of breaks with industry standards.

preformed wire rope

Form-set is WW's trade name for preformed wire rope. Form-set means that the wires and strands have been preset during manufacture into the permanent helical form they take in the completed rope. Unless otherwise specified, Bethlehem Mining Rope is furnished Form-set.

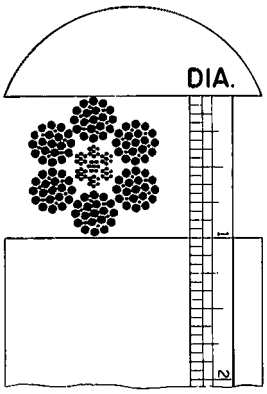
Preformed wire rope has definite characteristics which are advantageous in most wire rope applications. Preforming greatly reduces internal stresses, eases rope handling and gives more equal distribution of load on the wires and strands. Preformed rope runs smoother and spools more uniformly on a drum than non-preformed, has greater flexibility and gives longer service in bending.

Inspection of preformed rope. Preformed wires tend to remain in position after breaking. This reduces the tendency for them to protrude and damage the wires next to them. However, because the wires do not protrude, we strongly suggest greater care and more thorough inspection to detect broken wires in a preformed rope.

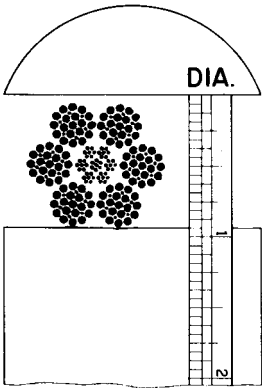
how to caliper a wire rope

Rope diameter is specified by the user and is generally given in the equipment manufacturer's instruction manual accompanying the machine on which the rope is used.

Rope diameter is determined by measuring the rope as shown below:



Right Way



Wrong Way

specifications

Federal Specification RR-W-410-E and the recommended specifications of the U.S. Bureau of Mines serve as a basis for the manufacture of Bethlehem Mining Ropes.

Specifications serve a useful purpose in establishing manufacturing limitations. However, they do not specify how good a wire rope may be. They only indicate the nominal requirements. Bethlehem Mining Ropes include many quality features not defined in specifications.

wire rope diameter tolerances

Wire rope diameter tolerances are normally -0 +5%. Bethlehem Mining Ropes, however, are manufactured to a tolerance of -0 +2½%.

Bethlehem Mining Rope length tolerance

Standard tolerance on "as-ordered" lengths is +/-.5%. Lengths specified as *exact, taped or matched* are manufactured with a tolerance of .025%. Tighter tolerances are available upon request.

end preparation and packaging

Bethlehem Mining Ropes are available with the following end preparations:

- Plain cut (saw cut) end and seized
- Becket
- Taper and weld
- Zinc- or resin-attached sockets
- Ferrule beckets (beer cans)
- Swaged sockets and fittings

Technical Data

6x19 class wire rope
6 strands, nominally 19 wires per strand

This class is the most widely used and is found in its many variations throughout many industries. With its good combination of flexibility and wear resistance, rope in this class is suited to the specific needs of many kinds of machinery and equipment.

The designation 6x19 is only nominal; the number of wires ranges from 15 to 26. The following constructions are included in this class.

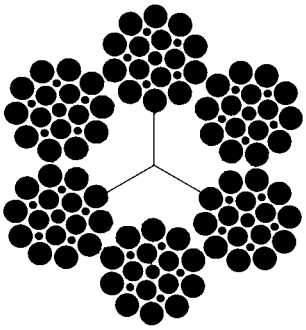
6x25 Filler Wire. In this construction, there are 19 main wires in each strand, plus six small filler wires. The filler wires are located between the outer layer of 12 wires and the inner layer of six. They provide support and stability to the strand. This construction is the best combination of flexibility and abrasion resistance found in the 6x19 Class.

6x19 Warrington. Each strand is made up of 19 wires. The outer layer of 12 wires has two different sizes of wire; the inner layer of six is one size of wire. The Warrington construction is somewhat less flexible than 6x25 Filler Wire, but more flexible than 6x21 Filler Wire.

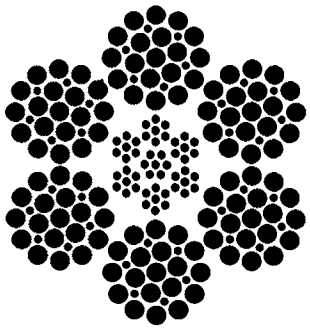
6x21 Filler Wire. Each strand is made up of 21 wires. The rope has an outer layer of 10 large wires, an inner layer of five smaller wires and a still smaller center wire. There are five filler wires, located between the outer layer of ten wires and the inner layer of five. The 6x21 Filler Wire ropes are more wear-resistant but less flexible than Warrington, and less abrasion-resistant but more flexible than 6x19 Seale constructions.

6x26 Warrington Seale. This construction is composed of 26-wire strands. It has the same size outer wires as the 6x21 Filler Wire, with an inner wire configuration similar to the 6x37 Class ropes. Thus, it combines the wear resistance of a 6x19 rope with a flexibility between 6x19 and 6x37 Class ropes.

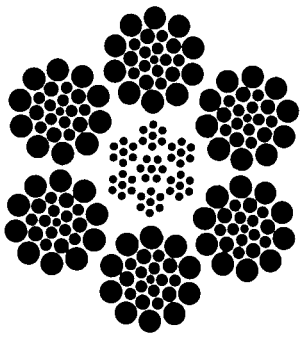
6x19 Seale. This construction has an outer layer of nine large wires, an inner layer of nine smaller wires and a single center wire. The Seale ropes are the least flexible of the 6x19 Class ropes. However, the large outer wires, solidly supported, provide resistance to abrasion and crushing.



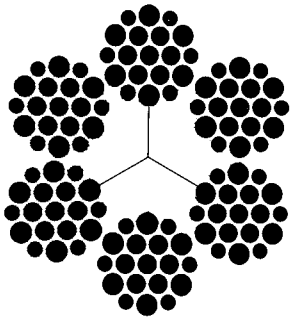
6x21 Filler Wire
with Fiber Core



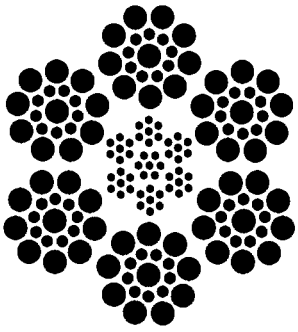
6x25 Filler Wire
with IWRC



6x26 Warrington Seale
with IWRC



6x19 Warrington
with Fiber Core



6x19 Seale
with IWRC

6x19 class wire rope

Regular or Lang Lay
IWRC or Fiber Core
Purple (IPS)
Purple Plus (EIP)
Excavator and Excavator-AR

Technical data for the following constructions in the 6x19 Class are listed below.

6x19 Seale • 6x19 Warrington • 6x21 Filler Wire
6x25 Filler Wire • 6x26 Warrington Seale

table I

Nominal Diameter		Approximate Weight (lb. per ft.)		Nominal Strength (tons)*			
				Purple Plus (EIP)		Purple (IPS)	
Inches	mm.	Fiber	IWRC	Fiber	IWRC	Fiber	IWRC
1/4	6.4	0.11	0.12	3.01	3.40	2.74	2.94
5/16	8.0	0.16	0.18	4.69	5.27	4.26	4.58
3/8	9.5	0.24	0.26	6.71	7.55	6.10	6.56
7/16	11	0.32	0.35	9.10	10.2	8.27	8.89
1/2	13	0.42	0.46	11.8	13.3	10.7	11.5
9/16	14.5	0.53	0.59	14.9	16.8	13.5	14.5
5/8	16	0.66	0.72	18.4	20.6	16.7	17.7
3/4	19	0.95	1.04	26.2	29.4	23.8	25.6
7/8	22	1.29	1.42	35.4	39.8	32.2	34.6
1	26	1.68	1.85	46.0	51.7	41.8	44.9
1 1/8	29	2.13	2.34	57.9	65.0	52.6	56.5
1 1/4	32	2.63	2.89	71.1	79.9	64.6	69.4
1 3/8	35	3.18	3.50	85.5	96.0	77.7	83.5
1 1/2	38	3.78	4.16	101	114	92	98.9
1 5/8	42	4.44	4.88	118	132	107	115
1 3/4	45	5.15	5.67	136	153	124	133
1 7/8	48	5.91	6.50	155	174	141	152
2	52	6.72	7.39	176	198	160	172
2 1/8	54	7.59	8.35	197	221	179	192
2 1/4	58	8.51	9.36	220	247	200	215
2 3/8	60	9.48	10.40	244	274	222	239
2 1/2	64	10.50	11.60	269	302	244	262
2 3/4	70	12.70	14.00	321	361	292	314

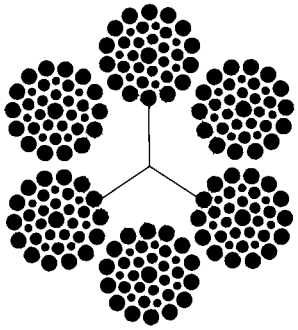
*Acceptance strength is not less than 2½% below the nominal strengths listed.

6x37 class wire rope

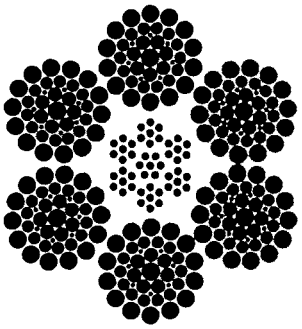
6 strands, nominally 37 wires per strand

The 6x37 Class of wire rope is characterized by the relatively large number of wires in each strand. Ropes of this class are more flexible than the 6x19 Class, but their resistance to abrasion is less than the 6x19 Class ropes.

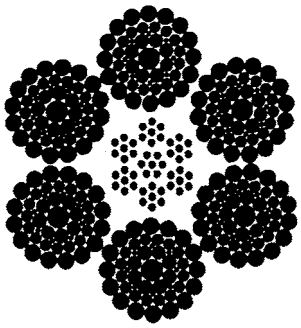
The designation 6x37 is only nominal, as is the case with 6x19 Class. Ropes in the 6x37 Class may contain 27 to 49 wires per strand. Improvements in wire rope design, as well as changing machine designs, resulted in the use of strands with widely varying numbers of wires and geometry.



6x36 Warrington-Seale with Fiber Core



6x43 Filler Wire Seale with IWRC



6x49 Filler Wire Seale with IWRC

6x37 Class Wire Rope

Regular or Lang Lay
IWRC or Fiber Core
Purple (IPS)
Purple Plus (EIP)
Excavator and Excavator-AR
Technical data for the following constructions in the 6x37 Class are listed below.

6x36 Warrington Seale • 6x43 Filler Wire-Seale
6x49 Filler Wire-Seale

table 2

Nominal Diameter		Approximate Weight (lb. per ft.)		Nominal Strength (tons)*			
				Purple Plus (EIP)		Purple (IPS)	
Inches	mm.	Fiber	IWRC	Fiber	IWRC	Fiber	IWRC
Inches	mm.	Fiber	IWRC	Fiber	IWRC	Fiber	IWRC
3/4	19	0.95	1.04	26.2	29.4	23.8	25.6
7/8	22	1.29	1.42	35.4	39.8	32.2	34.6
1	26	1.68	1.85	46.0	51.7	41.8	44.9
1 1/8	29	2.13	2.34	57.9	65.0	52.6	56.5
1 1/4	32	2.63	2.89	71.1	79.9	64.6	69.4
1 3/8	35	3.18	3.50	85.5	96.0	77.7	83.5
1 1/2	38	3.78	4.16	101	114	92.0	98.9
1 5/8	42	4.44	4.88	118	132	107	115
1 3/4	45	5.15	5.67	136	153	124	133
1 7/8	48	5.91	6.50	155	174	141	152
2	52	6.72	7.39	176	198	160	172
2 1/8	54	7.59	8.35	197	221	179	192
2 1/4	58	8.51	9.36	220	247	200	215
2 3/8	60	9.48	10.40	244	274	222	239
2 1/2	64	10.50	11.60	269	302	244	262
2 3/4	70	12.70	14.00	321	361	292	314

*Acceptance strength is not less than 2½% below the nominal strengths listed.

6x61 Class Wire Rope

Lang Lay
IWRC
Excavator and Excavator-AR
Technical data for the following constructions in the 6x61 Class are listed below.

6x50 Seale-Filler Wire-Seale • 6x57 Seale-Filler Wire-Seale
6x64 Seale-Filler Wire-Seale • 6x70 Seale-Filler Wire-Seale
6x77 Seale-Filler Wire-Seale

table 3

Nominal Diameter*		Approximate Weight (lb. per ft.)
Inches	mm.	
2 5/8	67	12.5
2 3/4	70	13.8
2 7/8	73	14.9
3	76	16.4
3 1/8	79	17.8
3 1/4	83	19.3
3 3/8	86	20.7
3 1/2	89	22.2
3 5/8	92	23.9
3 3/4	95	25.6
3 7/8	98	27.0
4	102	29.0
4 1/4	108	32.4
4 3/8	111	34.0
4 1/2	114	35.9
4 3/4	121	40.2
5	127	46.4

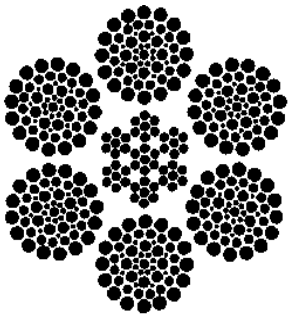
*Bethlehem Mining Ropes are available in diameters through 7".

6 strands, nominally 61 wires per strand

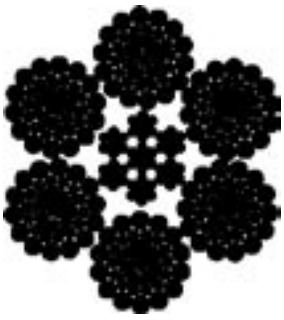
Larger wire ropes frequently incorporate a larger number of wires, resulting in a more complex geometry than found in the 6x19 or 6x37 Class wire ropes. WW's 6x61 Class Bethlehem Mining Ropes generally are designed to comply with Federal Specification RR-W-410-E geometry, although we added some innovations.

WW strands the 6x61 Class Bethlehem Mining Ropes in a single operation, relying on dense, well-fitted geometry to provide excep-tional rope performance and the flexibility normally associated with 6x61 Class ropes.

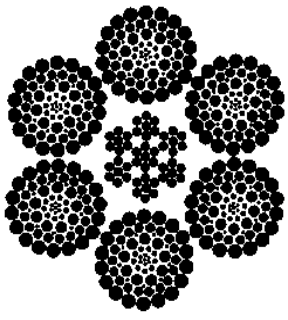
The 6x61 Class ropes have a Seale-Filler Wire-Seale design, as shown in Figure 6, containing from 50 to 77 wires per strand. WW further enhances Bethlehem Mining Rope performance by wire metallurgy and wire properties which are selectively modified to augment the specific rope geometries.



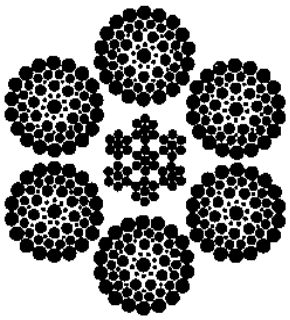
6x70 Seale Filler Wire Seale



6x50 Seale Filler Wire Seale



6x57 Seale Filler Wire Seale



6x64 Seale Filler Wire Seale

In certain instances the use of rotation-resistant wire rope is necessary to provide rotational stability to the lifted load. In general, the use of these specialized wire ropes is limited to those situations where it is impractical to:

- relocate rope dead end
- increase sheave sizes
- eliminate "odd-part" reeving
- significantly reduce rope loading and rope length

Rotation-resistant ropes have less of a tendency to unlay when loaded than do conventional wire ropes. This results in improved rotational stability to the lifted load within a safe working load range. Rotation-resistant wire ropes are designed in such a way that the rotational force of the outer rope is partially counteracted by the rotational force of the inner rope when the rope is subjected to a load.

The rated strengths of rotation-resistant ropes are less than the conventional 6x19 and 6x37 Class wire ropes, and larger sheaves and drums are required in order to achieve comparable fatigue life. Sheave and drum diameters should be 34 to 36 times rope diameter for the 19x7 and 35x7 rotation-resistant ropes and 21 to 27 times rope diameter for the 8x19 rotation-resistant ropes.

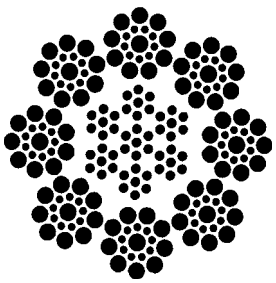
Flex Pac 19 and Super Flex Pac 19 are rotation-resistant ropes with the same nominal strengths as 6x19 IWRC ropes in the EIP and EEIP grades. The compacted strands resist drum crushing and improve flexibility in this rotation-resistant rope.

The required 5:1 strength design factor of rotation-resistant rope becomes very important from the standpoint of maintaining the inherent low rotation of the rope and eliminating any tendency to overload the inner rope, thereby causing a reduction in rope strength. Do not use a swivel during actual operation. It allows the inner rope to twist tighter and become weakened.

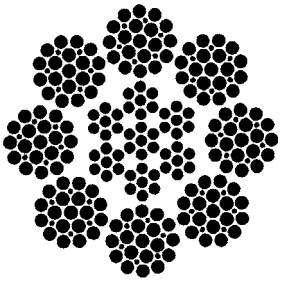
table 4

8x19 and 8x25 rotation resistant				
Rope Diameter		Approx. Weight lb. per ft.	Nominal Strength* (tons)	
Inches	mm.		Purple (IPS)	Purple Plus (EIP)
1/2	13	.47	10.1	11.6
9/16	14.5	.60	12.8	14.7
15/8	16	.73	15.7	18.1
3/4	19	1.06	22.5	25.9
7/8	22	1.44	30.5	35.0
1	26	1.88	39.6	45.5
1 1/8	29	2.39	49.8	57.3
1 1/4	32	2.94	61.3	70.5
1 3/8	35	3.56	73.8	84.9
1 1/2	38	4.24	87.3	100

*These strengths apply only when a test is conducted with both ends fixed. When a rope is in use, its strength is reduced if one end is free to rotate. Acceptance strength is not less than 2½% below the nominal strengths listed.

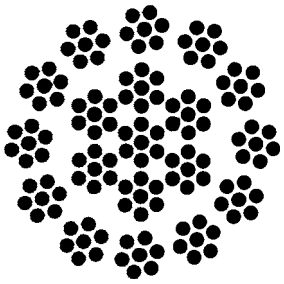


8x19 Seale with IWRC Rotation-Resistant



8x25 Seale with IWRC Rotation-Resistant

19x7 rotation resistant



19x7 Rotation-Resistant

table 5

19x7 rotation resistant				
Rope Diameter		Approx. Weight lb. per ft.	Nominal Strength* (tons)	
Inches	mm.		Purple (IPS)	Purple Plus (EIP)
3/16	4.5	.06	1.42	1.57
1/4	6.4	.11	2.51	2.77
5/16	8.0	.18	3.90	4.30
3/8	9.5	.26	5.59	6.15
7/16	11	.35	7.58	8.33
1/2	13	.45	9.85	10.8
9/16	14.5	.57	12.4	13.6
5/8	16	.71	15.3	16.8
3/4	19	1.02	21.8	24.0
7/8	22	1.39	29.5	32.5
1	26	1.82	38.3	42.2
1 1/8	29	2.30	48.2	53.1
1 1/4	32	2.84	59.2	65.1
1 3/8	35	3.43	71.3	78.4
1 1/2	38	4.09	84.4	92.8
1 5/8	42	4.80	98.4	108
1 3/4	45	5.57	114	125

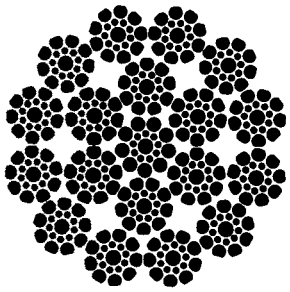
*These strengths apply only when a test is conducted with both ends fixed. When a rope is in use, its strength is reduced if one end is free to rotate. Acceptance strength is not less than 2½% below the nominal strengths listed.

super flex pac 19 rotation resistant

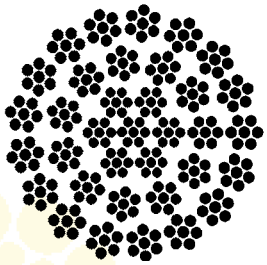
table 6

super flex pac 19 rotation resistant			
Rope Diameter		Approx. Weight lb. per ft.	Nominal Strength* (tons)
Inches	mm.		Super Flex Pac 19
3/8	9.5	0.31	8.30
7/16	11	0.42	11.2
1/2	13	0.55	14.6
9/16	14.5	0.70	18.5
5/8	16	0.86	22.7
3/4	19	1.24	32.4
7/8	22	1.69	43.8
1	26	2.21	56.9
1 1/8	29	2.79	71.5
1 1/4	32	3.45	87.9
1 3/8	35	4.17	106
1 1/2	38	4.97	125

*These strengths apply only when a test is conducted with both ends fixed. When a rope is in use, its strength is reduced if one end is free to rotate. Acceptance strength is not less than 2½% below the nominal strengths listed.



Super Flex Pac 19
Rotation-Resistant



35x7 Rotation-Resistant

excavator grade wire rope

Lang Lay • IWRC • Excavator and Excavator-AR (XAR)

table 7

excavator family mining rope								
Nominal Diameter		6x19 Class (const.)	Grade	6x37 Class (const.)	Grade	6x61 Class (const.)	Grade	Lb./Ft.
In.	mm.							
1 3/4	45	6x26 6x25	XAR	6x49	Excavator or XAR			5.6
1 7/8	48	6x26 6x25	XAR	6x49	Excavator or XAR			6.6
2	52	6x26 6x25	XAR	6x49	Excavator or XAR			7.5
2 1/8	54	6x26 6x25	XAR	6x49	Excavator or XAR			8.3
2 1/4	58	6x26 6x25	XAR	6x49	Excavator or XAR			9.4
2 3/8	60	6x26 6x25	XAR	6x49	Excavator or XAR			10.3
2 1/2	64	6x25	XAR	6x49	Excavator or XAR			11.7
2 5/8	67	6x25	XAR	6x43	XAR	6x57	Excavator or XAR	12.5
2 3/4	70	6x25	XAR	6x43	XAR	6x57	Excavator or XAR	13.8
2 7/8	73			6x43	XAR	6x57	Excavator or XAR	14.9
3	76					6x50 6x57	XAR Excavator	16.4
3 1/8	79					6x50 6x57	XAR Excavator	17.8
3 1/4	83					6x50 6x57	XAR Excavator	19.3
3 3/8	86					6x50 6x57	XAR Excavator	20.7
3 1/2	89					6x50 6x57	XAR Excavator	22.2
3 5/8	92					6x50 6x57	XAR Excavator	23.9
3 3/4	95					6x50 6x57	XAR Excavator	25.6
3 7/8	98					6x50 6x57	XAR Excavator	27.0
4	102					6x50 6x57	XAR Excavator	29.0
4 3/8	111					6x57 6x64	Excavator or XAR	34.0
4 1/2	114					6x57 6x64	Excavator or XAR	35.9
4 3/4	121					6x57 6x70	Excavator or XAR	40.2
5	127					6x70 6x77	Excavator or XAR	46.4

Note: XAR = Excavator-AR

WW, while a division of Bethlehem Steel, pioneered the practice of combining wires of different grades in the manufacture of surface mining ropes. In Bethlehem Mining Ropes, for example, the IWRC is made from a different grade of wire, and in total, as many as four wire grades are used in each rope. Physical properties of the selected wires have a significant influence on the performance and service life of the entire mining rope because the wire properties more perfectly meet the require- ments needed for specific wire location.

This concept of tailor-made surface mining ropes for specific applications led to the creation of the Excavator Family of Bethlehem Mining Ropes. The Excavator Family incorporates: (1) metallurgical properties, (2) geometric variations, (3) IWRC options, and (4) compacted strands. Virtually any mining rope application can benefit from one or more of these options.

rope grades based on metallurgical properties

Excavator grade, introduced in the 1970s in Bethlehem Mining Ropes, revolutionized surface mining ropes. The idea was to provide performance-based ropes and depart from the usual practice of meeting a minimum rope strength rating. In order to provide these rope characteristics, the metallurgical properties of the wires were changed, and multiple wire grades were used in the same rope structure.

The original concept was successful in two ways. First, the rope service life was usually much better than conventional rope grades. Second, other wire rope manufacturers followed suit and stopped listing rope strengths. Though they have tried to copy the original, the Excavator Family of Bethlehem Mining Ropes still outperforms other mining ropes.

Excavator-AR, a more resilient grade of the original Excavator grade, was introduced to provide greater abrasion resistance and increased rope strength for dragline use. This adaption of performance-based rope design has improved rope life for many applications where increases in loading and duty cycle over the years have created conditions of great rope abuse.

Rope Geometry

The concept of using the rope property of "flexibility" for improvement in rope life is not new to industry. However, in surface mining, most wire rope companies have offered only one choice of rope geometry for any given rope size.

The Excavator Family of Bethlehem Mining Ropes are offered in two geometries, which result in rope properties that are either (A) more flexible, or (B) more abrasion-resistant.

The flexible Type A rope is specifically designed for hoist ropes and drag ropes with reverse bends in the rope path. These ropes generally are produced in diameters 1¾" through 4¾" and contain 49 to 77 wires per strand. This geometry is used in conjunction with the more ductile metallurgy of Excavator grade.

The abrasion-resistant Type B is specifically designed for drag ropes with straight fairleads. The relatively large outerwires can accommodate much more sunface wear. Rope diameters 1¾" through 4⅜" are produced. These ropes contain 26 through 57 wires per strand. The Type B geometry achieves optimum performance when used in conjunction with the more abrasion-resistant metallurgy of Excavator-AR grade.

IWRC Options: Maxi-core

Many wire rope users have observed that heavily loaded ropes fail internally due to the failure of the IWRC. Such conditions illustrate that heavy IWRC stresses exist, which promote fewer fatigue cycles and create short rope life. WW designed Maxi-core to improve rope life under these conditions.

Maxi-core utilizes an IWRC design which features eight strands around a strand center. Maxi-core's IWRC provides longer life, and, therefore, increases the overall service life of the rope. Because of its specialized IWRC, Maxi-core is resilient and able to accommodate shock loads better than conventional IWRC designs. Maxi-core also adds 33% more core support to the outer strands, thereby reducing internal stresses and promoting longer rope life.

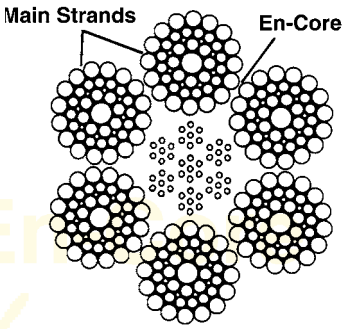
As with all Bethlehem Excavator Family Ropes, WW does not publish Maxi-core rope strengths. WW relies on specific rope improvements and specialized features to provide rope designs which give proven, superior field service.

table 8

maxi-core			
Nominal Diameter		Construction	Approximate Weight (lb. per ft.)
Inches	mm.		
1¾	45	6x25, 6x26, 6x49	5.8
1⅞	48	6x25, 6x26, 6x49	6.6
2	52	6x25, 6x26, 6x49	7.5
2⅛	54	6x25, 6x26, 6x49	8.4
2¼	58	6x25, 6x26, 6x49	9.5
2⅜	60	6x25, 6x26, 6x49	10.5
2½	64	6x25, 6x49	11.7
2⅝	67	6x25, 6x57	12.9
2¾	70	6x25, 6x57	14.1
2⅞	73	6x43, 6x57	15.5
3	76	6x50, 6x57	16.8
3⅛	79	6x50, 6x57	18.2
3¼	83	6x50, 6x57	19.7
3⅜	86	6x50, 6x57	21.2
3½	89	6x50, 6x57	22.9
3⅝	92	6x50, 6x57	24.5
3¾	95	6x50, 6x57	26.3
3⅞	98	6x50, 6x57	28.1
4	102	6x50, 6x57	30.0
4⅜	111	6x57, 6x64	35.7

En-core refers to a tough, extruded jacket encapsulating the IWRC and pressure-filling the interstrand spaces. The plastic material used for En-core was selected for:

- **mechanical toughness**
- **low temperature flexibility**
- **resistance to oil and water absorption**



6x49 Filler Wire Seale with En-Core

This plastic jacket acts as a cushion or shock absorber between adjacent main strands and at main strand-to-IWRC contact points. The improved internal support is especially significant for ropes subjected to continual bending stresses and fluctuating loads (shock loading). Reduction of wear and damage at internal contact points results in longer and more predictable service life.

En-core is available in both Excavator and Excavator-AR grades in diameters 1¾" through 4¾", as shown.

table 9

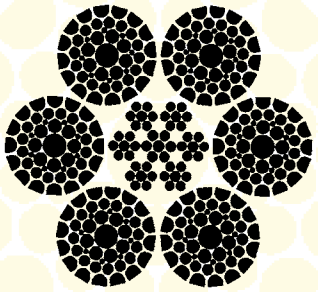
en-core			
Nominal Diameter		Construction	Approximate Weight (lb. per ft.)
Inches	mm.		
1 3/4	45	6x25, 6x26, 6x49	5.8
1 7/8	48	6x25, 6x26, 6x49	6.6
2	52	6x25, 6x26, 6x49	7.5
2 1/8	54	6x25, 6x26, 6x49	8.4
2 1/4	58	6x25, 6x26, 6x49	9.5
2 3/8	60	6x25, 6x26, 6x49	10.5
2 1/2	64	6x25, 6x49	11.7
2 5/8	67	6x25, 6x57	12.9
2 3/4	70	6x25, 6x57	14.1
2 7/8	73	6x43, 6x57	15.5
3	76	6x50, 6x57	16.8
3 1/8	79	6x50, 6x57	18.2
3 1/4	83	6x50, 6x57	19.7
3 3/8	86	6x50, 6x57	21.2
3 1/2	89	6x50, 6x57	22.9
3 5/8	92	6x50, 6x57	24.5
3 3/4	95	6x50, 6x57	26.3
3 7/8	98	6x50, 6x57	28.0
4	102	6x50, 6x57	29.9
4 3/8	111	6x57, 6x64	35.8
4 1/2	114	6x57, 6x64	37.8
4 3/4	121	6x70	42.1

table 10

beth pac				
Nominal Diameter	Drags		Hoists	
	Const. Weight	Approx. (lb./ft.)	Const. Weight	Approx. (lb./ft.)
1 1/2	6x25, 6x26	4.33	6x36	4.33
1 5/8	6x25, 6x26	5.08	6x36	5.08
1 3/4	6x25, 6x26	5.90	6x49	5.90
1 7/8	6x25, 6x26	6.76	6x49	6.76
2	6x25, 6x26	7.69	6x49	7.69
2 1/8	6x25, 6x26	8.68	6x49	8.68
2 1/4	6x25	9.73	6x49	9.73
2 3/8	6x25	10.80	6x49	10.80
2 1/2	6x25	12.10	6x49	12.10
2 5/8	6x43	13.30	6x57	13.30
2 3/4	6x43	14.60	6x57	14.60

Compacted Strands: Beth Pac

Beth Pac refers to rope manufactured by compacting each individual strand before closing the rope. In comparison to conventional wire rope, Beth Pac has a higher metallic area, improved crushing resistance and a smoother surface contacting sheaves and drums. Beth Pac is offered in Excavator and Excavator-AR in diameters 1 1/2" through 2 3/4" in constructions 6x36 and 6x49 for hoist ropes and 6x26 and 6x43 for drag ropes, and is available in 8-strand up to 2 1/4" diameter. Beth Pac can be combined with other Bethlehem Mining Rope features, such as En-core. For more information and help in determining your need for Beth Pac, please contact WW's Sales and Engineering Departments.

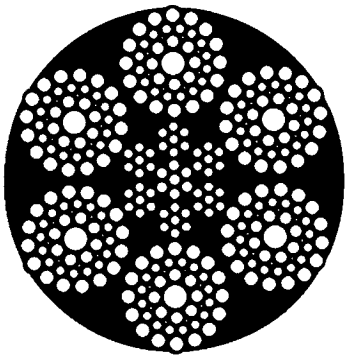


6x49 Beth Pac

plastic-infused wire rope

table 11

Diameter		BXL	BXL w/Maxi-core	
Inches	mm.	Approximate Weight (lb. per ft.)	Approximate Weight (lb. per ft.)	Constr Supplied
1 5/8	42	5.12	5.17	6x26
1 3/4	45	5.88	5.94	6x26, 6x49
1 7/8	48	6.93	7.00	6x26, 6x49
2	52	7.88	7.96	6x25, 6x26, 6x49
2 1/8	54	8.72	8.81	6x25, 6x26, 6x49
2 1/4	58	9.87	9.97	6x25, 6x26, 6x49
2 3/8	60	10.82	10.93	6x25, 6x26, 6x49
2 1/2	64	12.28	12.40	6x25, 6x49
2 5/8	67	13.12	13.25	6x25, 6x57
2 3/4	70	14.49	14.63	6x25, 6x57



Plastic-infused
Round Wire Rope

- Increased Fatigue Resistance
- Increased Abrasion Resistance
- Increased Resistance to Multilayer Drum Crushing
- Extended Sheave & Drum Service Life
- Increased Corrosion Protection
- Clean Handling & Operation

Construction

BXL is furnished as right regular or lang lay, Form-set, IWRC wire rope manufactured in the 6x19 and 6x37 Classes. Available grades are Excavator and Excavator-AR. For specific information, please refer to the table. For information on smaller diameters for mining applications, please contact our Customer Service Department.

BXL provides the characteristics common to Bethlehem Mining Rope, enhanced by the plastic-infusion. BXL starts with WW's special wire grades used in the manufacture of mining rope. *Excavator* grade is designed to provide excellent resistance to bending fatigue, such as those conditions found with hoist ropes. *Excavator-AR* is intended for those applications where more abrasive operating conditions exist, such as in drag line applications. Enhanced by plastic infusion, BXL offers several improved features.

Improved fatigue resistance is one key feature of BXL. BXL's polymer cushions each wire and strand, minimizing interstrand and interlayer nicking.

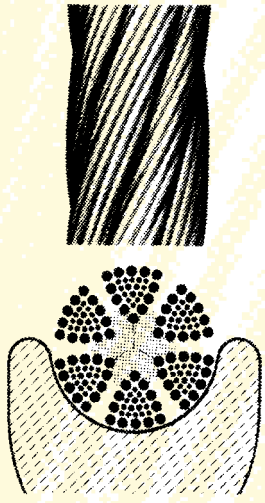
BXL also offers improved abrasion resistance. The polymer acts as a barrier between the individual strands, preventing penetration of any adverse material, such as dust, dirt and metal particles. The polymer also distributes and reduces contact stresses between the rope and sheave, reducing the wire rope wear normally associated with uncoated wire rope.

Perhaps the most important feature of BXL, however, is the polymer's ability to maintain the balance of the rope. When a rope is in operation, or simply wound upon a drum, the rope's components move and adjust accordingly. Due to the nature of wire rope, this movement may cause accelerated wear, and in uncoated rope, may also produce a flattening or ovaling of the rope. The polymer in BXL minimizes this movement by locking the individual wires and strands in place. With the rope's holding its intended shape during operation, operating stresses such as vibration are evenly distributed to all wires and strands, thereby reducing fatigue breaks and increasing service life.

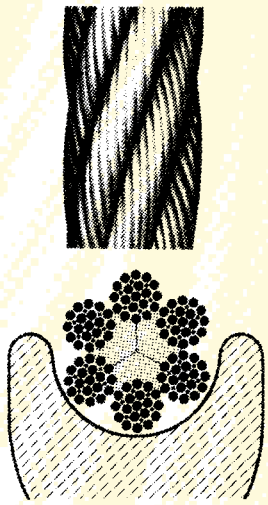
table 12

flattened strand shaft rope with fiber core—6x27 type H			
Nominal Diameter		Breaking Strength	Approximate Weight (lb. per ft.)
Inches	mm.		
1 1/8	29	70.1	2.28
1 1/4	32	85.9	2.81
1 3/8	35	103	3.40
1 1/2	38	122	4.05
1 5/8	42	143	4.75
1 3/4	45	167	5.51
1 7/8	48	188	6.33
2	52	213	7.20
2 1/8	54	237	8.13
2 1/4	58	264	9.10

Acceptance strength is not less than 2½% below the nominal strengths listed.



6x27 Type H Flattened Strand Rope with Fiber Core



Round Strand Rope

Flattened Strand Shaft Hoist Rope

This rope is particularly suitable where severe crushing and abrasion on a drum occur, or where a higher strength design is required than can be obtained with a similar round strand rope. The triangular strand shape not only provides better resistance to crushing, but also offers a greater exposed surface area for contact with sheaves, drums or underlying areas of spooled rope.
This feature, combined with Lang lay, distributes the abrasive wear over a greater number and longer length of wires. The broad, smooth surface of the rope also helps to minimize wear on drums and sheaves.

suggested ropes for surface mining equipment

table 13

Application	Diameter	Construction	Lay	Grade	Core
Shovels					
Shovel Hoist Lines	1/2 to 5/8 incl.	6x25 FW	Regular	Purple Plus or Purple	IWRC
	3/4 to 1 1/4 incl.	6x25 FW	Lang	Purple Plus or Purple	IWRC
	1 3/8 to 1 5/8	6x49 FW Seale	Lang	Purple Plus or Purple	IWRC
	1 3/4 to 2 1/2	6x49 FW Seale	Lang	Excavator or XAR	IWRC
	2 5/8 to 4	6x57 S-FW-S	Lang	Excavator or XAR	IWRC
where small sheaves and drums are used	3/4 to 1 1/4 incl.	6x37 Class	Lang	Purple Plus or Purple	IWRC
Crowd and Retract Lines	1/2	6x25 FW	Regular	Purple Plus or Purple	IWRC
	9/16 to 3/4	6x25 FW	Lang	Purple Plus or Purple	IWRC
	7/8 to 1 1/4	6x25 FW 6x36 Warrington Seale	Lang	Purple Plus or Purple	IWRC
	1 3/8 to 1 5/8	6x36 Warrington Seale	Lang	Purple Plus or	IWRC Purple
	1 3/4 to 2 1/2	6x49 FW Seale	Lang	Excavator or XAR	IWRC
	2 5/8 to 3	6x57 S-FW-S	Lang	Excavator or XAR	IWRC
Boom Lines	9/16 to 3/4 incl.	6x25 FW 6x26 Warrington Seale	Regular Alternate	Purple Plus or Purple	IWRC
	7/8 to 1 1/4 incl.	6x25 FW 6x26 Warrington Seale	Lang Alternate	Purple Plus or Purple	IWRC
	1 3/8 and larger	6x37 Class	Lang	Purple Plus or Purple	IWRC
Trip Lines	1/4	6x19 Warrington	Regular	Purple Plus or	Fiber Purple
	5/16 to 7/16 incl.	8x19 Warrington	Regular	Purple Plus or Purple	Fiber

continued . . .

table 13 (continued from page 19)

Application	Diameter	Construction	Lay	Grade	Core
Drag Lines					
Drag Ropes *please see Table 13 for special conditions	9/16 to 1 5/8	6x21 FW	Lang	Purple Plus	IWRC
	1 3/4 to 2 1/2	6x25 FW, 6x26 Warrington Seale	Lang	Excavator or XAR	IWRC
	2 5/8 to 2 3/4	6x25 FW 6x57 S-FW-S	Lang	Excavator or XAR	IWRC
	2 7/8	6x43 FW Seale 6x57 S-FW-S	Lang	Excavator or XAR	IWRC
	3 to 4	6x50 S-FW-S 6x57 S-FW-S	Lang	Excavator or XAR	IWRC
	4 1/4 to 4 1/2	6x64 S-FW-S 6x70 S-FW-S	Lang	Excavator or XAR	IWRC
	4 3/4	6x57 S-FW-S 6x70 S-FW-S	Lang	Excavator or XAR	IWRC
	5	6x70 S-FW-S	Lang	Excavator or XAR	IWRC
Hoist Ropes	1/2, 9/16, and 5/8	6x25 FW	Regular	Purple Plus or Purple	IWRC
	3/4 to 1 3/8 incl.	6x25 FW	Lang	Purple Plus or Purple	IWRC
	1 1/2 to 1 5/8	6x49 FW Seale	Lang	Purple Plus or Purple	IWRC
	1 3/4 to 2 1/2	6x49 FW Seale	Lang	Excavator	IWRC
	2 5/8 to 4	6x57 S-FW-S	Lang	Excavator	IWRC
	4 1/4 to 4 1/2	6x64 FW Seale	Lang	Excavator	IWRC
	4 3/4 to 5	6x70 S-FW-S 6x77 S-FW-S	Lang	Excavator	IWRC
Boom Lines	1/2 to 3/4 incl.	6x25 FW 6x26 Warrington Seale	Regular Alternate	Purple Plus or Purple	IWRC
	7/8 to 1 1/4 incl.	6x25 FW 6x26 Warrington Seale	Lang Alternate	Purple Plus or Purple	IWRC
	1 3/8 and larger	6x37 Class	Lang	Purple Plus or Purple	IWRC
Dump Line	5/8 to 1 incl.	6x25 FW	Regular or Lang	Purple Plus or Purple	IWRC
	1 1/8 to 3 1/2	6x37 Class	Lang	Purple Plus or Purple Excavator or XAR	IWRC

- FW = Filler Wire
- S-FW-S = Seale-Filler Wire-Seale
- Regular = right regular lay
- XAR = Excavator-AR
- Options such as En-core and Beth Pac are also available. Contact your Bethlehem Wire Rope sales representative for further information and recommendations.
- Form-set is furnished unless specifically noted otherwise.

table 14

for different fairleads				
Diameter	**Construction**	**Lay**	**Grade**	**Core**
drag ropes with reverse bends				
1 3/4 to 2 1/2	6x49 FW Seale	Lang	Excavator or XAR	IWRC
2 5/8 to 4	6x57 S-FW-S	Lang	Excavator	IWRC
4 3/8 to 4 1/2	6x64 S-FW-S	Lang	Excavator	IWRC
4 3/4 to 5	6x70 S-FW-S	Lang	Excavator	IWRC
drag ropes with straight fairleads				
1 3/4 to 2 3/4	6x25 Warrington Seale	Lang	XAR	IWRC
2 7/8 to 4	6x43 FW Seale	Lang	XAR	IWRC
3 to 4	6x50 S-FW-S	Lang	XAR	IWRC
4 1/4 to 4 3/4	6x57 S-FW-S	Lang	XAR	IWRC
5	6x70 S-FW-S	Lang	XAR	IWRC

- FW = Filler Wire ▪ S-FW-S = Seale-Filler Wire-Seale ▪ XAR = Excavator-AR
- Form-set is furnished unless specifically noted otherwise.
- Options such as En-core and Beth Pac are also available. Contact your Bethlehem Wire Rope sales representative for further information and recommendations.

table 15

for underground mining equipment				
Application	**Construction**	**Lay**	**Grade**	**Core**
shaft hoisting ropes				
Shallow Vertical Shafts	6x25 FW	Regular	Purple Plus or Purple	Fiber
	6x21 FW	Regular	Purple Plus or Purple	Fiber
Deep Vertical Shafts	6x21 FW	Lang	Purple Plus or Purple	Fiber
	6x25 FW	Lang	Purple Plus or	Fiber Purple
	6x27 FS Type H	Lang	Purple Plus or Purple	Fiber
Inclined Shaft Ropes	6x21 FW	Lang	Purple Plus or Purple	Fiber
	6x19 Seale	Lang	Purple Plus or Purple	Fiber
	6x27 FS Type H	Lang	Purple Plus or Purple	IWRC

- Regular = Right Regular Lay ▪ FW = Filler Wire ▪ FS = Flattened Strand
- Form-set is furnished unless specifically noted otherwise.

continued . . .

table 15 (continued from page 21)

for underground mining equipment				
Application	**Construction**	**Lay**	**Grade**	**Core**
mining machine ropes				
Head or Pull and Tail Ropes	6x36 Warrington Seale	Regular	Purple Plus or Purple	IWRC
	6x21 FW	Regular	Purple Plus or Purple	IWRC
Head or Pull Ropes	6x36 Warrington Seale	Lang	Purple Plus or Purple	IWRC
koepe or friction hoist ropes				
Hoist Ropes	6x27 FS Type H	Lang	Purple Plus or Purple	Fiber
Tail or Balance Ropes	Rotation-Resistant 35x7 or Flex Pac 19	–	–	–
other ropes				
Miscellaneous Slope and Inclined Plane Ropes	6x19 Seale	Regular	Purple Plus or Purple	Fiber
	6x21 FW	Lang	Purple Plus or Purple	Fiber
	6x7	Lang	Purple Plus or Purple	Fiber
	6x27 FS Type H	Lang	Purple Plus or Purple	Fiber
Shaft Sinking Ropes	19x7 Rotation Resistant	Regular	Purple Plus or Purple	WSC
General Haulage Ropes	6x19 Seale	Lang	Purple Plus or Purple	Fiber
Slusher and Scraper Ropes	6x19 Seale	Regular	Purple Plus or Purple	IWRC
	3x19 Seale	Regular	Purple Plus or Purple	–
Tugger Hoist Ropes	6x19 Seale	Regular	Purple Plus or Purple	IWRC
	6x21 FW	Regular	Purple Plus or Purple	IWRC
Car Puller and Retarder Ropes	6x25 FW	Regular	Purple Plus or Purple	IWRC
	6x21 FW	Regular	Purple Plus or Purple	Fiber
	6x19 Seale	Regular	Purple Plus or Purple	Fiber

bethlehem structural strand

definition

Bethlehem Galvanized (zinc-coated) Structural Strand is an arrangement of wires helically laid around a center wire, producing a symmetrical cross section. Strand has two basic uses: (1) generic strands, not structural, are used as components in the manufacture of wire rope, and (2) strand is used as an individual tension member where strength is needed and flexibility is not a major requirement. WW manufactures Bethlehem Structural Strand to meet ASTM A-586, which features a maximum strength-to-weight ratio for a given diameter.

corrosion protection features

Galvanized (zinc-coated) strand is used to combat the corrosive environments of salt water, atmospheric contaminants, and humid and moist conditions.

Zinc, by its nature, protects the steel base wire by means of a sacrificial ion exchange. This sounds complicated, but basically it means that even if a minor flaw were to develop in the zinc coating, the base wire (steel) would still be protected from corrosion as long as the zinc remains on the nearby wire surfaces. For mining applications, Bethlehem Structural Strand and Strand Pendants are always furnished with a zinc Class "A" coating.

bethlehem wire rope and strand pendants

description

Bethlehem Wire Rope and Strand Pendants are used for boom suspension systems on excavating equipment. Pendants consist of wire rope or galvanized strand with appropriate end fittings. Important considerations when ordering pendants are:

- Prestretching
- Striping
- Measuring @ required load
- Packaging (reel size, number of pieces per reel)
- End fittings (dimensions, pin sizes)
- Pin orientation
- Dampers
- Product (rope or strand)
- Size, strength and weight
- Modulus of elasticity
- Length and reference points
- Length tolerances

rope pendants

Rope pendants may be supplied in 6x19, 6x37 or 6x61 Class wire rope. Refer to **Table 16** for wire rope data.

*U.S. standard diameter tolerance: (-0%, + 5%). Metric standard diameter tolerance: (-1%, + 4%).

table 16

6-strand rope pendants		
Nominal Diameter*		Approximate Weight
Inches	mm.	(lb. per ft.)
1 1/8	29	2.34
1 1/4	32	2.89
1 3/8	35	3.50
1 1/2	38	4.16
1 5/8	42	4.86
1 3/4	45	5.67
1 7/8	48	6.50
2	52	7.39
2 1/8	54	8.36
2 1/4	58	9.36
2 3/8	60	10.40
2 1/2	64	11.60
2 3/4	70	14.00
3	76	16.60
3 1/4	83	19.50
3 1/2	89	22.70
3 3/4	95	26.00
4	102	29.60
4 3/8	111	34.30

strand pendants

Structural strand provides high modulus of elasticity, high strength-to-weight ratio and a relatively small diameter per unit of strength.

Galvanized steel structural strand is manufactured to meet ASTM A-586 in sizes through 5 1/2" diameter. Our in-house galvanizing and stranding facilities allow us the flexibility to manufacture zinc-coated structural strand to various specifications. Refer to **Table 16** for strand data.

table 17

properties of zinc-coated steel structural strand

Nominal Diameter		Approximate Weight		Approximate Metallic Area		Nominal Strength Class A Coating	
Inches	mm.	Lbs./Ft.	Kg./M	Inches²	mm.²	Tons	Tonnes
3/4	19	1.18	1.8	0.338	218.1	34.0	30.8
7/8	22	1.61	2.4	0.459	296.1	46.0	41.7
1	26	2.10	3.1	0.600	387.1	61.0	55.3
1 1/8	29	2.66	4.0	0.759	489.7	78.0	70.8
1 1/4	32	3.28	4.9	0.938	605.6	96.0	87.1
1 3/8	35	3.97	5.9	1.130	729.0	116.0	105.2
1 1/2	38	4.73	7.0	1.350	871.0	138.0	125.2
1 5/8	42	5.55	8.3	1.590	1026	162.0	147.0
1 3/4	45	6.43	9.6	1.840	1187	188.0	170.6
1 7/8	48	7.39	11.0	2.110	1361	216.0	196.9
2	52	8.40	12.5	2.400	1548	245.0	222.3
2 1/8	54	9.49	14.1	2.710	1748	277.0	251.3
2 1/4	58	10.64	15.8	3.040	1961	310.0	281.2
2 3/8	60	11.85	17.6	3.380	2181	344.0	312.1
2 1/2	64	13.13	19.5	3.750	2419	376.0	341.1
2 5/8	67	14.47	21.5	4.130	2665	417.0	378.3
2 3/4	70	15.88	23.6	4.540	2929	452.0	410.1
2 7/8	73	17.36	25.8	4.960	3200	494.0	448.2
3	76	18.90	28.1	5.400	3484	538.0	488.1
3 1/8	79	20.51	30.5	5.860	3781	584.0	529.8
3 1/4	83	22.18	33.0	6.340	4090	625.0	567.0
3 3/8	86	23.92	35.6	6.830	4407	673.0	610.5
3 1/2	89	25.73	38.3	7.350	4742	724.0	656.8
3 5/8	92	27.60	41.1	7.880	5084	768.0	696.7
3 3/4	95	29.50	43.9	8.430	5439	822.0	745.7
3 7/8	98	31.50	46.9	9.000	5807	878.0	796.5
4	102	33.60	50.0	9.600	6194	925.0	839.2
4 1/8	105	35.70	53.1	10.200	6581	985.0	893.6
4 1/4	108	37.90	56.4	10.800	6978	1002.0	909.1
4 3/8	111	40.20	59.8	11.500	7419	1108.0	1005.2
4 1/2	114	42.50	63.2	12.100	7807	1173.0	1064.2
4 3/4	121	47.40	70.5	13.500	8710	1306.0	1184.9
5	127	52.50	78.1	15.000	9677	1448.0	1313.7
5 1/4	133	57.90	86.2	16.500	10650	1596.0	1447.9
5 1/2	140	63.50	94.5	18.100	11680	1752.0	1589.5

Minimum moduli of elasticity of the above strands, when prestretch ad, are as follows:

- 1/2" to 2 9/16" diameter — 24,000,000 psi
- 2 5/8" to 4" diameter — 23,000,000 psi
- Over 4" diameter — 22,000,000 psi

strand pendant special features

Retired boom pendants usually display much greater deterioration near the center of the structural strand cross section. This is primarily the result of two factors: (1) the pressures resulting from the overlying layers of wire, and (2) the point contacts between wire layers which exist in conventional structural strand. The noted deterioration generally consists of broken wires, metallic dust and metallic oxides or rust. These small, dust-sized particles bind with the lubricant applied during the manufacturing process.

Based on this observation, WW offers the following optional advanced features in Bethlehem Strand Boom Support Pendants:

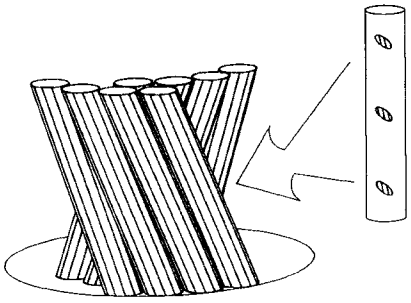
Parallel Contact Core

WW designed the Parallel Contact Core (PCC) to dissipate the very high internal strand pressures along the entire lengths of all wires in the core structure. This eliminates the former problems of point contact pressure on those wires which exists in conventional structural strand. PCC also significantly reduces the "fretting corrosion" (fatigue) which results in the formation of metallic particles and eventual broken wires. PCC is intended to reduce the notching and bending stresses which occur with the conventional cross-laid design.

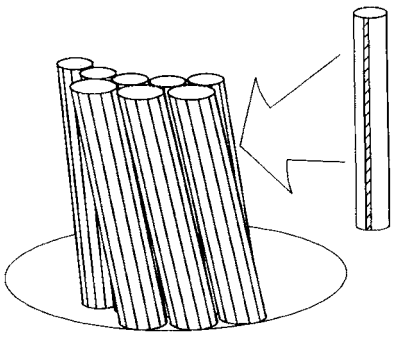
Poly-Bloc

Poly-Bloc is an internal lubricant and blocking compound which is melted and pumped around each wire and into the strand during fabrication. Poly-Bloc seals the interior, preventing the intrusion and entrapment of moisture into the structural strand interior which contributes to corrosion, rusting and general deterioration. The standard practice for pendants is to fill the strand with an asphalt-based compound.

As an alternative, Bethlehem Structural Strand Pendants can be filled with Poly-Bloc, a waterproof type of plastic. This material acts as a blocking agent against moisture and corrosion.



Cross-Laid Strand



Parallel Contact Core

end fittings

The most commonly used end fittings for rope and strand main pendants are open- and closed-type sockets. For intermediate and safety pendants, bridge sockets are often specified. These sockets, when properly attached, will develop the full strength of the rope or strand for which they are designed.

Sockets are manufactured from forging-quality steel or cast steel. Dimensional tolerances are consistent with commercial tolerances established by the forging and steel casting industries. More rigid tolerances can be met if specified.

The following nondestructive test methods are available for pendant sockets:

- Magnetic particle
- Dye penetrant
- Ultrasonic
- X-ray

Special customer and OEM requirements can be fulfilled upon request.

WW does not assume responsibility for the integrity of customer-provided sockets. The decision to reuse sockets is entirely the responsibility of the customer. When directed to do so, WW will attach customer sockets but will only assume the responsibility for the integrity of the attachment to the wire rope or strand. The customer accepts the complete responsibility for the condition and the performance of the used sockets.

Zinc- and Resin-Attached Sockets

Wire rope and strand sockets with tapered baskets (cone-shaped) have been in use for over 125 years. Since they develop the full strength of the attached rope or strand, these attachments are used in breaking strength tests. In fact, the attachments are secure enough that some using lead embedment were in continuous use on old suspension bridges for over 100 years.

Over the years, low-melting temperature metals such as lead, babbitt and white metal were used to "pot" wire rope and strand ends. Today, only babbitt (with at least 9% antimony) continues in use for elevators, and requires special techniques of end preparation. For modern day use, zinc and thermoset resin are regarded as acceptable embedment media for wire rope and strand tapered basket sockets. These two products differ significantly from each other, but both develop the full breaking strength of the attached wire rope or strand. Attaching is done by inserting a cleaned, broomed wire rope or strand end

(continued next page)

Zinc- and Resin-Attached Sockets
(continued from page 25)

into the tapered basket and embedding this end with zinc (spelter) or thermoset resin. We recommend that attaching of zinc and resin sockets be left to experts who possess the knowledge, training, special tools and fixtures to perform the job. This insures the safety of the termination and provides long service life.

Socket Design

Sockets may be specifically designed for resin or zinc. For example, a smooth (as-cast or as-forged) interior cone surface works best with resin, but causes zinc to seat an excessive amount. Review socket design when considering resin attachment. Other differences may exist which make it advisable to trust these connections to those who regularly attach such sockets.

Attachment Methods

Though the method of attachment for zinc differs greatly from that of resin, both methods require exceptionally clean, broomed wire rope or strand ends. Zinc must be poured into the socket basket in a vertical position. Socket preheating is beneficial to disperse moisture and insure zinc penetration into the small end of the tapered basket, especially on heavy sockets with thick socket walls and small sockets which are generally constricted. Resin may be poured either vertically or horizontally. For pouring resin, sockets should not be heated above 10°F.

Embedment Criteria

Most specifications for zinc socketing require High Grade or Special High Grade zinc. However, Best Western Grade is sometimes specified. All of these grades have performed throughout the years and provided socket attachments which develop the full strength of the wire rope or strand.

If good practice is followed, higher zinc purities found with High Grade and Special High Grade zinc will result in smaller amounts of socket cone seating following socket proofloading or pendant loading.

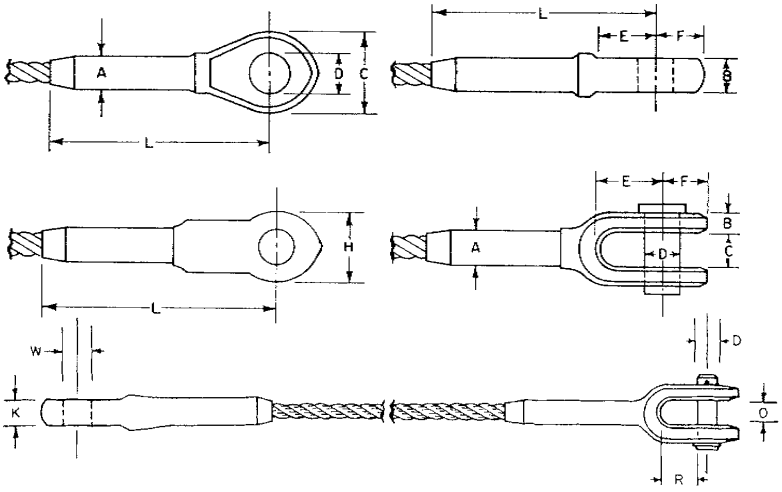
Resin used for socketing must be a thermo-setting resin designed and tested for socketing wire rope and strand. Several products are readily available from commercial socket sources. Using acceptable resins provides excellent results, providing the resin is fresh and has been stored in accordance with the resin manufacturer's directions. Improper resin curing may occur due to (1) improper volume or ratio, or (2) inadequate temperature or time (from excessive age or heat). In each and every case, the manufacturer's directions must be carefully followed.

fittings and assemblies

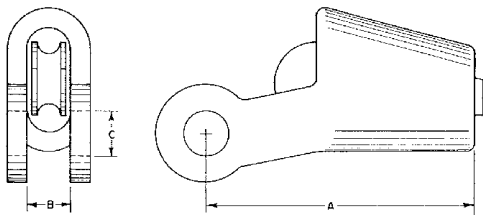
typical fittings used by draglines and shovels

Typical fittings used for pendants. Specific dimensions vary according to manufacture and pendant diameters. Critical dimensions need to be identified when ordering any fittings.

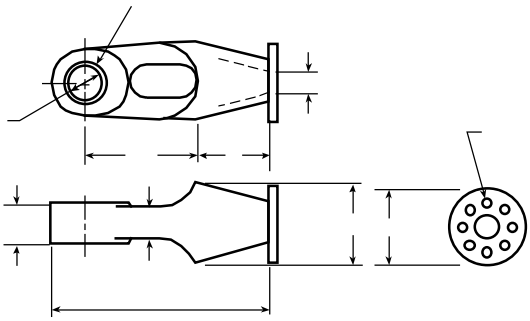
swagged



wedge



closed w/flange



typical open wire rope socket

For use on wire rope and multiple-strand structural cable. Not recommended for use on structural strand.

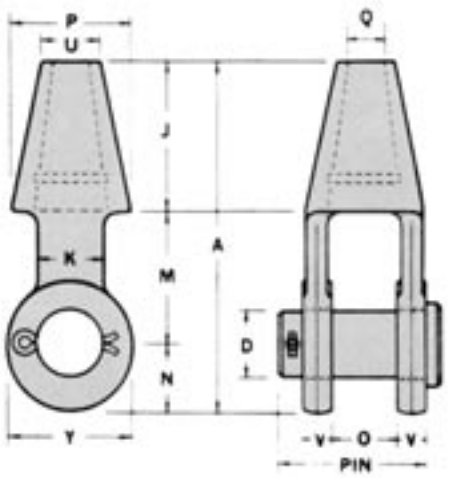


table 18

NOTE: Dimensions vary depending on socket vendor.

Rope Diam. In.	A In.	J In.	K In.	M In.	N In.	0 In.	P In.	Q In.	U In.	V In.	Y In.	Pin		Cotter Pin Diam. In.	Weight lb.
												Length In.	Diam. D In.		
drop-forged steel or steel castings															
3/16, 1/4	4 5/16	2	3/4	1 9/16	3/4	11/16		1 5/16	5/16	5/8	5/16	1 5/16	1 3/4	11/16	3/16 0.9
5/16, 3/8	4 5/8	2	13/16	1 3/4	7/8	13/16	1 9/16	7/16	3/4	13/32	1 1/2	2 1/16	13/16	3/16	1.1
7/8, 1/2	5 9/16	2 1/2	1	2	11/16	1	1 7/8	9/16	1	1/2	1 7/8	2 7/16	1	3/16	2.3
9/16, 5/8	6 3/4	3	1 1/4	2 1/2	1 1/4	1 1/4	2 1/4	11/16	1 3/16	9/16	2 1/4	2 7/8	1 3/16	1/4	3.8
3/4	7 9/16	3 1/2	1 1/2	3	1 7/16	1 1/2	2 5/8	13/16	1 5/16	5/8	2 5/8	3 1/4	1 3/8	1/4	6.0
7/8	9 1/4	4	1 3/4	3 1/2	1 3/4	1 3/4	3 3/4	31/32	1 1/2	3/4	3 1/8	3 7/8	1 5/8	5/16	10.0
1	10 9/16	4 1/2	2	4	2 1/16	2	3 5/8	1 1/8	1 3/4	7/8	3 3/4	4 1/2	2	3/8	15.5
1 1/8	11 13/16	5	2 3/8	4 1/2	2 5/16	2 1/4	4	1 1/4	2	1	4 1/8	5	2 1/4	3/8	22.0
1 1/8, 1 3/8	13 3/16	5 1/2	2 3/4	5	2 11/16	2 1/2	4 5/8	1 1/2	2 1/4	1 1/8	4 3/4	5 5/8	2 1/2	7/16	32.0
1 1/2	15 1/8	6	3	6	3 1/8	3	5 1/4	1 5/8	2 3/4	1 3/16	5 3/8	6 3/8	2 3/4	1/2	46.0
steel castings															
1 5/8	16 1/4	6 1/2	3 1/4	6 1/2	3 1/4	3	5 1/2	1 3/4	3	1 5/16	5 3/4	6 5/8	3	1/2	55.0
1 3/4, 1 7/8	18 1/4	7 1/2	3 7/8	7	3 3/4	3 1/2	6 3/8	2	3 1/8	1 9/16	6 1/2	7 5/8	3 1/2	1/2	85.0
2, 2 1/8	21 1/2	8 1/2	4 1/4	9	4	4	7 1/4	2 3/4	3 3/4	1 13/16	7	8 3/4	3 3/4	1/2	125.0
2 1/4, 2 3/8	23 1/2	9	4 3/8	10	4 1/2	4 1/2	8 1/4	2 1/2	4	2 1/8	7 3/4	9 7/8	4 1/4	1/2	165.0
2 1/2, 2 5/8	26 3/4	10 1/2	5	11	5 1/4	5	9	2 13/16	6 1/8	2 1/4	9	10 3/4	4 3/4	5/8	240
2 3/4, 2 7/8	28 3/4	11 1/2	5 1/4	11 1/2	5 3/4	5 3/8	10	3	7	2 3/8	10	11 3/8	5	5/8	305
3	30 9/16	12 1/2	5 1/2	12	6 1/16	5 3/4	10 3/4	3 3/16	7 5/8	2 1/2	10 1/2	12 1/4	5 1/4	3/4	370
3 1/4	34 3/4	14	7	14	6 3/4	6 1/4	11 1/2	3 7/16	8 1/2	2 3/4	11 1/2	13 1/4	5 1/4	3/4	510
3 1/2	36 1/2	15	8	14 1/2	7	7 1/2	13 1/4	3 11/16	9 1/4	3 1/4	12 1/2	15 1/2	6 3/4	3/4	760
3 3/4	38 3/4	16	8 1/4	15	7 3/4	7 3/4	14	3 15/16	10	3 3/8	14	16	7	3/4	890
4	40 1/2	17	8 1/2	15	8 1/4	8	14 1/2	4 1/4	10 1/2	3 1/2	14 1/2	16 1/2	7 1/4	3/4	1020
4 1/2	34 1/2	11 1/4	7	14 1/4	9	8	14 1/4	4 1/2	8 3/4	3 1/2	12 3/4	16 3/8	7 1/4	3/4	759
4 1/2, 4 3/4	35	11 3/4	7	14 3/4	8 1/2	8 1/4	13 3/4	5 1/4	9 1/2	2 3/4	12 3/4	15 1/8	7 1/4	3/4	659
5, 5 1/4	37	12 1/2	8	15 1/2	9	8 1/2	14 1/2	5 3/4	10 1/2	3	13 1/2	15 7/8	7 1/2	3/4	778
5 1/2, 5 3/4	40 1/4	13 3/4	9	16 1/2	10	8 3/4	14 3/4	6 1/4	12	3	14 3/4	16 1/8	8	3/4	947
6	43 1/2	15	10	17 1/4	11 1/4	9	15	6 1/2	13	3	16 1/2	16 3/8	8 1/2	3/4	1130

typical open strand sockets

For use on structural strand.

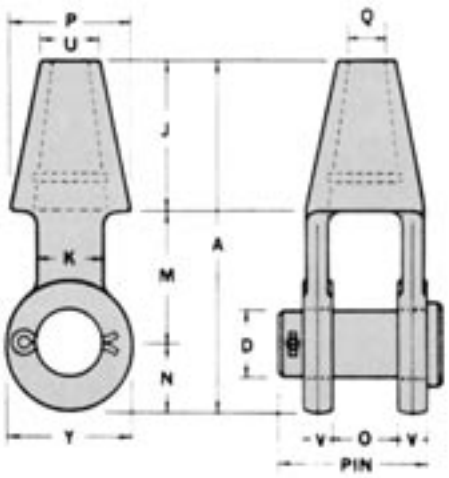


table 19

NOTE: Dimensions vary depending on socket vendor.

Strand Diam. In.	A In.	J In.	K In.	M In.	N In.	0 In.	P In.	Q In.	U In.	V In.	Y In.	Pin Length In.	Pin Diam. D In.	Cotter Pin Diam. In.	Weight lb.
drop-forged steel or steel castings															
1/2	6 5/8	2 7/8	1 1/4	2 1/2	1 1/4	1 1/4	2 1/2	3/4	1 1/2	5/8	2	3 1/16	1 3/16	1/4	4.4
9/16, 5/8	7 3/4	3 9/16	1 1/2	2 3/4	1 7/16	1 1/2	3	13/16	1 7/8	3/4	2 1/2	3 5/8	1 3/8	1/4	6.7
11/16, 3/4	8 15/16	4 1/4	1 3/4	3	1 11/16	1 3/4	3 3/8	15/16	2	13/16	2 3/4	4	1 5/8	1/4	10.2
13/16, 7/8	10 3/8	4 7/8	2	3 1/2	2	2	3 3/4	1 1/16	2 1/8	7/8	3 1/4	4 3/8	2	1/4	14.3
15/16, 1	12	5 5/8	2 1/4	4	2 3/8	2 1/4	4	1 1/4	2 3/8	7/8	3 3/4	4 1/4	2 1/4	3/8	19.0
1 1/16, 1 1/8	12 1/2	5 1/4	2 1/2	4 1/2	2 3/4	2 1/2	4 3/8	1 1/2	2 1/2	15/16	4 1/4	5 1/4	2 1/2	3/8	25.0
1 3/16, 1 1/4	13 5/8	5 1/2	2 3/4	5	3 1/8	3	4 1/2	1 5/8	2 3/4	1	4 3/4	5 7/8	2 3/8	3/8	32.0
steel castings															
1 5/16, 1 3/8	14 7/16	5 7/16	3 1/4	5 1/2	3 1/2	3	4 7/8	1 3/4	3	1	5 1/2	6	3	1/2	40.0
1 7/16, 1 5/8	16 5/8	6 1/8	3 1/2	6 1/2	4	3 1/2	6	2	4	1 1/4	6 1/4	7	3 1/2	1/2	71.0
1 11/16, 1 3/4	17 1/2	6 1/2	3 5/8	7	4	4	6 3/4	2 1/4	4	1 5/8	6 1/4	8 3/8	3 3/4	1/2	92.0
1 13/16, 1 7/8	19 1/4	6 3/4	3 3/4	8	4 1/2	4 1/4	7 1/8	2 3/16	4 1/2	1 5/8	6 7/8	8 5/8	4	1/2	111
1 15/16, 2	21 3/8	7	3 7/8	9 1/2	4 7/8	4 1/2	7 1/2	2 5/16	4 3/4	1 5/8	7 1/2	8 7/8	4 1/4	1/2	138
2 1/16, 2 1/8	22 1/2	7 3/4	3 7/8	10	4 3/4	4 1/2	8	2 1/2	4 3/4	2	7 1/2	9 5/8	4 1/2	1/2	161
2 3/16, 2 1/4	24 1/8	7 7/8	4	11	5 1/4	5	8 1/2	2 5/8	5 1/2	2	8	10 1/4	4 3/4	5/8	196
2 5/16, 2 3/8	24 3/4	8 1/4	4 1/2	11	5 1/2	5 1/4	9	2 3/4	6	2 1/8	8 1/2	10 3/4	5	5/8	231
2 7/16, 2 9/16	26 1/4	8 1/2	5	12	5 3/4	5 1/2	9 3/8	3	6 1/2	2 1/4	9	11 1/4	5 1/4	5/8	261
2 5/8, 2 3/4	27 3/8	8 3/4	5	12 1/4	6 3/8	6	10 1/4	3 1/8	6 1/2	2 1/2	9 3/4	12 1/4	5 3/4	5/8	320
2 7/8, 3	29 3/4	10	5 5/8	13	6 3/4	6 1/4	11	3 3/8	7	2 1/2	10 1/2	12 1/2	6	5/8	392
3 1/8, 3 1/4	31 1/2	10 1/2	6 1/8	13 1/4	7 3/4	6 3/4	11 3/4	3 3/4	7 1/2	2 3/4	11 1/4	13 1/2	6 1/2	5/8	433
3 3/8, 3 1/2	32 3/4	10 3/4	6 3/8	13 3/4	8 1/4	7 1/4	12 3/4	4	8	3	11 3/4	14 5/8	6 3/4	5/8	582
3 5/8, 3 3/4	33 1/2	11	6 3/4	14	8 1/2	7 1/2	13 1/2	4 1/4	8 1/2	3 3/8	12 1/4	15 1/2	7	5/8	677
3 7/8, 4	34 1/2	11 1/4	7	14 1/4	9	8	14 1/4	4 1/2	8 3/4	3 1/2	12 3/4	16 3/8	7 1/4	3/4	754
4 1/8, 4 3/8	35	11 3/4	7	14 3/4	8 1/2	8 1/4	13 3/4	5 1/4	9 1/2	2 3/4	12 3/4	15 1/8	7 1/4	3/4	659
4 1/2, 4 3/4	37	12 1/2	8	15 1/2	9	8 1/2	14 1/2	5 3/4	10 1/2	3	13 1/2	15 7/8	7 1/2	3/4	778
4 7/8, 5 1/8	40 1/4	13 3/4	9	16 1/2	10	8 3/4	14 3/4	6 1/4	12	3	14 3/4	16 1/8	8	3/4	947
5 1/4, 5 1/2	43 1/2	15	10	17 1/4	11 1/4	9	15	6 1/2	13	3	16 1/2	16 3/8	8 1/2	3/4	1130

typical open bridge sockets

For standard and 48 in. take-up.
For use on structural strand
and rope.

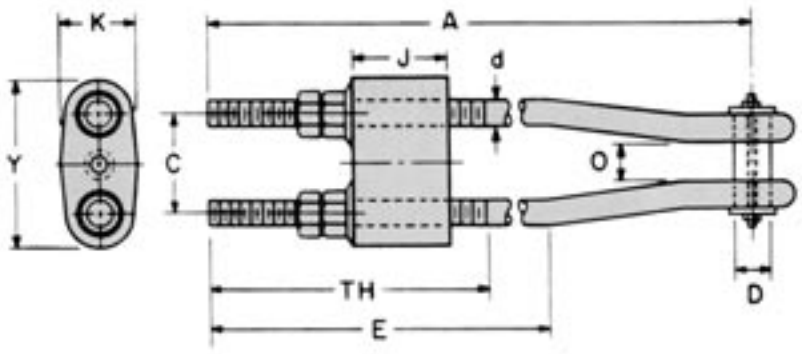


table 20

NOTE: Dimensions vary depending on socket vendor. Other take-ups available upon request.

(Read right) Rope Diam. In.	Std. Take-Up In.	A for Std. Take-Up In.	A for 48-in. Take-Up In.	C In.	d In.	D In.	E for Std. Take-Up In.	E for 48-in. Take-Up In.	J In.	K In.	O In.	Pin Length P In.	Std. Take-Up In.	48-in. Take-Up In.	TH for Y In.	TH for Cotter Pin Diam. In.	Weight Lb. Std. Take-Up	Weight Lb. 48-in. Take-Up	(Read left) Strand Diam. In.
1/2	9	20	59	3 3/8	5/8	1 3/16	14 1/2	53 1/2	3 1/8	2 1/16	1 1/4	3 1/16	10 1/2	49 1/2	4 5/8	1/4	9	16	1/2
5/8	9	22	61	4 3/8	3/4	1 3/8	15	54	3 13/16	2 7/16	1 1/2	3 5/8	10 3/4	49 3/4	5 7/8	1/4	16	26	9/16, 5/8
3/4, 7/8	9	23	62	4 11/16	1	1 5/8	16 1/2	55 1/2	4 7/16	3 1/4	1 3/4	4 3/8	11 1/4	50 1/4	6 9/16	1/4	28	45	11/16, 3/4
1	9	25	64	5 3/16	1 1/8	2	17	56	5 1/16	3 11/16	2	4 7/8	11 1/2	50 1/2	7 5/16	1/4	40	62	13/16, 7/8
1 1/8	9	26	65	5 3/4	1 1/4	2 1/4	18 1/2	57 1/2	6	4 1/16	2 1/4	5 1/2	11 3/4	50 3/4	8 1/8	3/8	55	82	15/16, 1
1 1/4	12	30	66	6	1 3/8	2 1/2	21 1/2	57 1/2	5 13/16	4 1/2	2 1/2	6 1/8	15	51	8 5/8	3/8	68	98	1 1/16, 1 1/8
1 3/8	12	33	69	6 3/4	1 5/8	2 3/4	22 1/2	58 1/2	6 3/8	4 7/8	3	7 1/8	15 1/2	51 1/2	9 3/4	3/8	100	143	1 3/16, 1 1/4
1 1/2	12	34	70	7 3/16	1 3/4	3	23 1/2	59 1/2	6 15/16	5 5/16	3	7 1/2	15 3/4	51 3/4	10 7/16	1/2	124	173	1 5/16, 1 3/8
1 5/8, 1 3/4	15	39	72	8 1/8	2	3 1/2	27	60	7 5/16	6 1/2	3 1/2	8 1/2	19 1/4	52 1/4	11 3/4	1/2	180	239	1 7/16, 1 1/2
1 7/8, 2	15	42	75	9	2 1/4	3 3/4	28 1/2	61 1/2	8 1/8	7 5/16	4	9 5/8	19 3/4	52 3/4	13 1/8	1/2	249	323	1 9/16, 1 3/4
2 1/8, 2 1/4	18	50	80	10 1/4	2 1/2	4 1/4	33	63	9 5/16	8 1/8	4 1/2	10 5/8	23 1/4	53 1/4	14 3/4	1/2	356	439	1 13/16, 2
2 3/8, 2 1/2	18	52	82	11 1/2	2 3/4	4 3/4	35 1/2	65 1/2	10 7/8	8 15/16	5	11 3/4	23 3/4	53 3/4	16 1/2	5/8	485	586	2 1/16, 2 1/4
2 5/8, 2 3/4	18	54	84	12 11/16	3	5	36 1/2	66 1/2	11 13/16	9 3/4	5 3/8	12 5/8	24 1/4	54 1/4	18 1/16	5/8	610	730	2 5/16, 2 3/8
2 7/8, 3	21	59	86	13 3/8	3 1/4	5 3/4	41	68	12 13/16	10 9/16	6	13 3/4	27 3/4	54 3/4	19 1/4	5/8	776	903	2 7/16, 2 5/8
3 1/4	21	61	88	14 1/16	3 1/2	5 3/4	42 1/2	69 1/2	13	9 7/8	6 1/4	14 1/4	28 1/4	55 1/4	20 5/16	5/8	882	1030	2 11/16, 2 3/4
3 1/2	21	63	90	15 1/4	3 3/4	6 3/4	45	72	15 1/2	12 3/16	7 1/2	16 3/8	28 3/4	55 3/4	22	5/8	1180	1349	2 7/8, 3
3 3/4	24	70	94	17 1/4	4	7	50	74	16	11 5/16	7 3/4	17	32 1/4	56 1/4	24 1/2	5/8	1508	1679	3 1/8, 3 1/4
(none)	24	75	99	18 5/16	4 1/4	7 1/4	53	77	16 3/4	11 7/8	8	17 7/8	32 3/4	56 3/4	26 1/16	3/4	1621	1821	3 3/8, 3 1/2
4	24	80	104	19 3/8	4 1/2	7 1/2	55 1/2	79 1/2	18 3/16	12 3/4	8 1/4	18 5/8	33 1/4	57 1/4	27 5/8	3/4	2031	2251	3 5/8, 3 3/4
4 1/4	24	85	109	20 7/16	4 3/4	7 3/4	57 1/2	81 1/2	20	13 7/16	8 1/2	19 3/8	33 3/4	57 3/4	29 7/16	3/4	2444	2684	3 7/8, 4
4 1/2, 4 3/4	27	87	108	20	4 1/4	7 1/4	59 1/2	80 1/2	20	14	8 1/4	18 1/4	36	57	28	3/4	2311	2480	4 1/8, 4 3/8
5, 5 1/4	27	90	111	21	4 3/4	7 1/2	62	83	21 1/4	14 7/8	8 1/2	19 1/2	37	58	30 1/4	3/4	2917	3129	4 1/2, 4 3/4
5 1/2, 5 3/4	30	96	114	22	5	8	67	85	22 3/4	16	8 3/4	20 1/4	40 1/2	58 1/2	31 1/2	3/4	3427	3627	4 7/8, 5 1/8
6	30	99	117	23	5 1/2	8 1/2	69 1/2	87 1/2	24 1/2	17	9	21 1/2	41 1/2	59 1/2	33	3/4	4166	4408	5 1/4, 5 1/2

prestretching

Stretching under load is inherent in wire rope and strand. This tendency is due to two factors:

(1) The elasticity of the product. Elastic stretch is fully recoverable upon release of the load, provided the elastic limit of the steel wires has not been exceeded.

(2) The non-elastic constructional stretch, which is a variable quantity depending upon diameter, construction, length of lay of the rope or strand and the manufacturing equipment.

To obtain uniform elastic behavior and the close length tolerances required for pendant applications, the inherent constructional stretch of the rope or strand must be removed. This is accomplished by prestretching.

Prestretching is the repeated application of a predetermined load to a finished wire rope or strand, for the following reasons: (1) to make the rope or strand truly elastic by removing constructional stretch, and (2) to permit measuring and marking at prescribed loads on the rope or strand in order to achieve close tolerances.

striping

For installation purposes, a longitudinal paint stripe is applied to the entire length of the wire rope or strand while it is under the prescribed measuring tension. Striping allows the rope or strand pendant to be installed in the same orientation as it was measured during fabrication.

measuring

To provide the necessary length tolerances specified by our customers, our measuring techniques include:

- **Measuring the rope or strand under prescribed tension using a calibrated, certified and tensioned steel tape secured to the rope or strand.**
- **Use of predetermined reference marks and a fixed gauge for accurate socket positioning.**

With these measuring practices, assembly tolerances of +/- 1/8" can be maintained.

attaching sockets

Spelter sockets are widely used for rope and strand end fittings. Therefore, attaching them correctly is of prime importance since the connection must be at least as strong as the rope or strand.

At WW, we follow the attachment procedures contained in the Wire Rope Technical Board Wire Rope Users Manual for zinc- and resin-poured sockets. In addition, our standard procedures include:

- **Ultrasonic degreasing of the broomed-out ends.**
- **Positive means of holding rope or strand ends to prevent loss of lay.**
- **Towers and equipment tailored to accommodate any size rope or strand to insure accurate alignment.**

Equipment and procedures are in place to meet the very latest customer and OEM specifications which require more stringent socket alignment and concentricity.

Zinc attachment is considered standard, though resin attachment using approved procedures is available when specified.

accurate socket alignment and concentricity

WW's Accurate Socket Alignment and Concentricity (ASAC) method of attaching sockets insures that the axis of the strand as it enters the socket basket is parallel to the centerline of the socket basket within 0° - 15' (1/4°) and concentric to within 0.010". When specified by the customer, this procedure is used for attaching sockets to main pendants on walking draglines. Sockets are inspected for dimensional limitations and machined on the base (or nose) and on the outside of the socket basket at the base. Sockets are attached to the strand using specially machined fixtures to insure the desired accuracy.

proofloading

Proofloading is the application of a prescribed, non-destructive tensile load to prove the integrity of the end fitting and connection, and is available upon request.

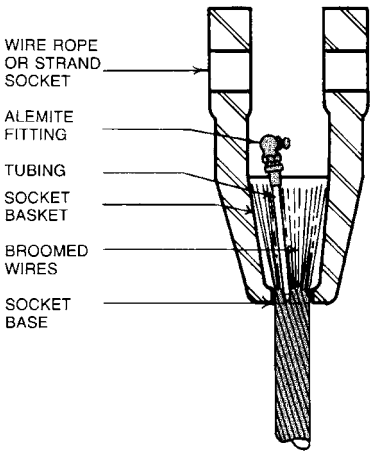
bethlehem rope and strand pendant specialty items

To improve pendant service life, WW offers the following items:

relubrication tube

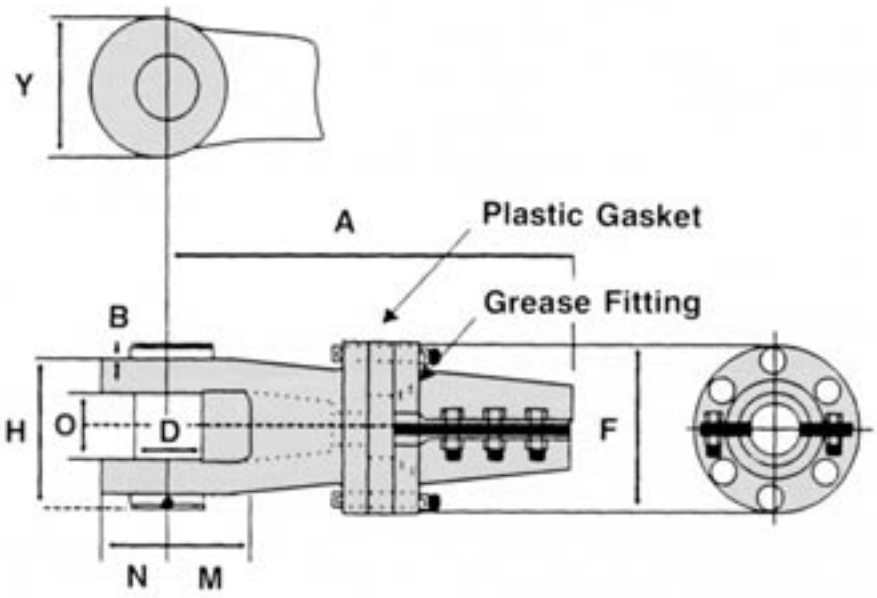
Originally patented by Bethlehem Wire Rope, the relubrication tube (lube tube) provides a means for internally lubricating the rope or strand at the socket base to combat corrosion and fatigue. WW installs a lube tube with a grease fitting in the socket. This hollow tube is carefully inserted between the wires in the socket base prior to pouring the zinc. WW recommends that relubrication be repeated as often as necessary to keep fresh lubrication in these areas.

Relubrication tubes are standard on Bethlehem Strand Pendants 2 5/8" diameter and larger. Lube tubes are not installed in smaller diameters unless specified by the customer.



vibration damping system

WW's Vibration Damping System consists of a split-flanged clamp resiliently secured to the rope or strand and bolted to a flanged socket through an elastomeric gasket. A lubricant reservoir is provided around the rope or strand within the gasket. This system is designed to reduce vibration and fatigue in the rope or strand wires adjacent to the end fitting, resulting in longer operating life.



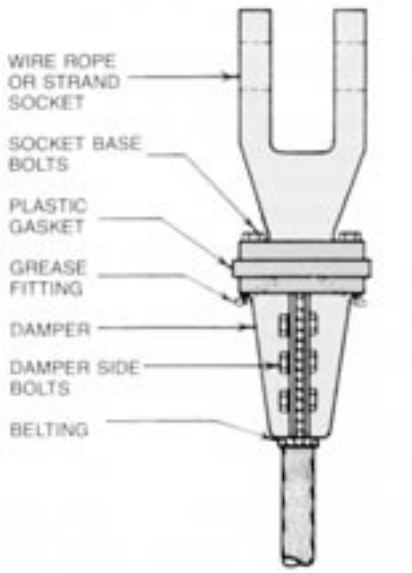


table 21

*covered under U.S. Patent 3,549,183

Strand Dia.	A In.	B In.	D In.	F In.	H In.	M In.	N In.	O In.	Y In.	Est. Wt. lbs.
2	27 1/2	7/8	4 1/4	9 1/4	8 7/8	9 1/2	4 7/8	4 1/2	7 1/2	200
2 1/8	29	9/16	4 1/2	9 3/8	9 5/8	10	4 3/4	4 1/2	7 1/2	228
2 1/4	30 1/8	1/4	4 3/4	9 3/8	10 1/4	11	5 1/4	5	8	268
2 3/8	30 1/2	1	5	10 1/4	10 3/4	11	5 1/2	5 1/4	8 1/2	308
2 1/2	32 1/4	1	5 1/4	10 5/8	11 1/4	12	5 3/4	5 1/2	9	352
2 5/8-2 3/4	33 1/4	1	5 3/4	10 1/4	12 1/4	12 1/4	6 3/8	6	9 3/4	401
2 7/8-3	37 1/2	1	6	11 1/2	12 1/2	13	6 3/4	6 1/4	10 1/2	529
3 1/8-3 1/4	38 1/2	1	6 1/2	12 1/2	13 1/2	13 1/4	7 3/4	6 3/4	11 1/4	663
3 3/8-3 1/2	39 1/2	1	6 3/4	13	14 5/8	13 3/4	8 1/4	7 1/4	11 3/8	794
3 5/8-3 3/4	40 1/2	1	7	13 3/4	15 1/2	14	8 1/2	7 1/2	12 1/4	907
3 7/8-4	41 1/2	1	7 1/4	14	16 3/8	14 1/4	9	8	12 3/4	1006

Boom pendants are normally prepared for shipment in two basic packages: coils and reels. Although each basic package requires certain specific handling procedures, there are a number of general precautions to be followed which are common to both.

Method of packaging is determined by WW, unless otherwise specified by the customer. Strand or rope pendants, 1" through 3" diameters with a maximum length of 100 feet are furnished in coils strapped to pallets. When shipped on reels, pendants are packaged two pieces per nonreturnable wooden reel.

general

(1) *During unpackaging of pendants in the field, lifting slings should be attached to the socket end attachments. If it is necessary to lift on the body of the assembly, either a nylon sling or a wire rope sling should be used. If a wire rope sling is used, cover the pendant with some protective material such as a piece of belting, a section of rubber tire, or the like. The purpose of this precaution is to prevent damage to the zinc coating or possible nicking of the outer wires of the pendant.*

(2) *When lifting on the body of the pendant, exercise care so the radius of curvature of the pendant at the point of lift is large enough to minimize wire displacement. A bridle sling with a three- to four-foot spreader should be used.* ***Never lift with a single hitch on the pendant.***

(3) *Do not pull pendants over sharp edges or short bend radii during handling. This may result in permanent damage to the arrangement and surface of the wires. Particular care must be taken to insure that nothing is done during handling to nick the outer wires. WW recommends that wooden planks or timbers be used when the pendant is being laid out prior to installation or storage to prevent the pendant from contacting the ground.*

(4) During manufacturing, a longitudinal stripe is placed along the entire length of the pendant. During installation, it is of the utmost importance that this stripe be kept in a straight line and not spiralled around the rope or strand.

(5) *Following installation and periodically thereafter, lubricate the pendants at the base of each socket for a minimum distance of three feet. If the socket does not have a relubrication tube, apply a suitable lubricant with a brush or pressurized spray can.*

coils

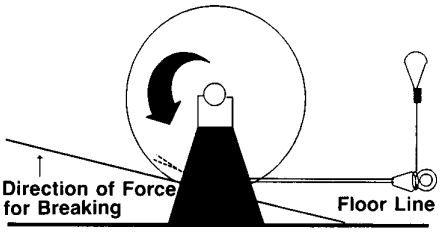
(1) *If the pendant is small enough to be uncoiled by hand, one man must hold the socket on the leading end. The second man should roll the coil along a level and obstacle-free surface away from the first man. In this way, the pendant is permitted to uncoil naturally without spiralling or twisting. Do not uncoil pendants like a garden hose, where the coil is laid on the ground and one end is carried away from the coil. This method can easily damage the pendant.*

(2) *If a turntable is used, and this is recommended for large diameter pendants shipped in coils, a drag-type braking device should be used to prevent the swift speed from exceeding the pulling speed so kinking or looping of the pendant does not happen. Attach the pulling device to the socket on the leading end.*

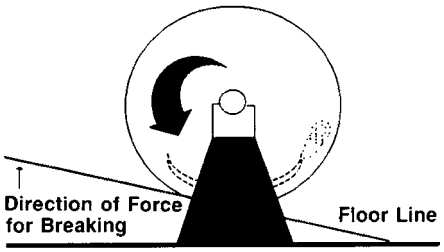
reels

(1) *Place the shaft through the center hole in the reel and jack up the reel so it clears the ground and revolves properly.*

(2) *Use a simple timber brake or other mechanical friction brake against the reel flange or flanges to prevent slack from developing. Caution must be used to prevent "run-away" unreeling caused by the heavy socket placement on the reel.*

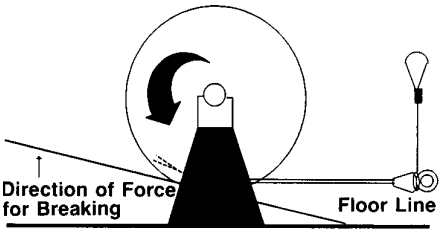


(3) *Position the reel so that the socket tagged "Front End" (tag stapled to reel flange) is* **as close** *to the bottom of the reel as practical, and remove this socket from the reel first.*



(4) *Unwind the pendant from the reel, as shown* **above,** *by pulling the free end away from the reel. We recommend that the pulling hitch or sling be attached to the socket. However, if the sling is attached to the pendant, exercise care so a kink or dog leg does not develop at the base of the socket and the wires are not nicked or damaged. Keep the longitudinal stripe aligned.*

WW "blocks-out" an area of the reel for positioning and securing the socket during shipping. Be careful when removing the end fittings from this "blocked-out" section.



(5) *During unwinding from the reel, pull the pendant in a straight line, avoiding sharp edges or objects on the ground.*

(6) *After the pendant has been nearly unwound from the reel, remove the socket tagged "Rear End" (tag stapled to reel flange).*

(7) *If more than one pendant is packaged on the reel, remove lengths in the order in which they are tagged, and proceed as above.*

the right way to recoil:

After wire rope has been used, it should be recoiled in the direction of its lay. It is not difficult to determine when wire rope is being coiled in the wrong direction; it becomes lively and hard to manage. This does not happen when rope is coiled properly.
Here is a good general rule: *looking down at the rope on the floor, coil right lay rope clockwise (overwind), and left lay rope counterclockwise (underwind).*

kinks

Great emphasis has been placed on the care that should be taken to avoid kinks in wire rope and strand. Kinks are places where the rope or strand has been bent to a permanent set. This happens where loops have been pulled through by tension on the rope or strand until the diameter of the loop is relatively small. Kinks are also caused by bending rope or strand around a sheave having too small of a radius. Wires in the kink are so bent that they are permanently damaged and will not give normal service, even after apparent restraightening.
A kink is forever.

inspection and maintenance

Inspection and maintenance consists of three components: (1) determining frequency of inspection and maintenance, (2) inspection and evaluation of rope conditions, and (3) maintenance. Conduct rope and strand pendant inspections on a regular basis, preferably coinciding with normal maintenance schedules. It is equally important to keep accurate records. Complete, accurate records help in analyzing existing problems and avoiding future problems.

The following components should be included in this inspection:

end fittings

Check for excessive or nonuniform zinc cone seating and any visual abnormalities. During this inspection, those fittings with a relubrication tube should be greased. If the socket does not have a relubrication tube, apply a suitable lubricant with a brush or pressurized spray can for a distance of several feet from the base of the socket.

vibration damping systems

All bolts on the socket flange and the clamp should be tightened using a torque wrench. A torque of 150 foot-pounds is recommended for the 3/4" diameter bolts and 100 foot-pounds for the 5/8" diameter bolts.

If any bolts are broken, they should be replaced with bolts of the same specification as originally furnished. The bolts on the dampers are heavy hex head galvanized grade A325 or galvanized hex head cap screws SAE Grade 5. Socket base bolts are modified to meet 100,000/125,000 psi tensile strength.

Grease should be applied through the alemite fittings on the damper flange. A grease such as Lubriplate 630 AAA or equivalent is recommended. When the damper was assembled at the mill, grease was pumped into the reservoir area where the strand enters the socket. The amount of grease to be replaced can be determined visually.

At six-month intervals, one of the dampers should be removed for examination of the strand that is under the clamp. The fabric belting was saturated with Gulf Harmony Oil No. 47, a light lubricant, prior to assembly and should be resaturated with light oil if it is dry. Soak belting in Harmony Oil No. 47, or equivalent, for a minimum of one hour. Apply belting around the strand so it protrudes beyond the nose of the damper 1/4" to 3/8". The split in the belting is to be positioned 45° to the bolted split of the damper housing. Wire belting in position with .048" galvanized wire at three positions prior to setting the damper halves (remove wire before attaching damper halves). Snug socket base bolts first, then snug damper side bolts, torquing all bolts as outlined above. Depending on the results of this inspection, other dampers should be removed for examination and servicing.

At approximately one-half of the pendant's expected service life, remove all damper clamps and store for future use. Removal of the clamps transfers the damping fatigue point to new, unaffected areas and will help in extending service life. Removing the clamps also allows for easy and proper x-ray inspection of critical pendant areas.

pendant spacers

Check for tightness of nuts and bolts to prevent movement of spacers on the pendants. Refer to the OEM for the proper location of spacers.

Never use wooden spacers made from oak. Tannic acid forms when oak becomes wet, which may cause displacement of the zinc-coating on the wires, eventually leading to fretting and corrosion of the contact areas.

pendants

Check rope and strand pendants for wire breakage and diameter reduction throughout their lengths. Special attention should be directed to the socket entrance and pendant spacers.

The number of visual broken wires alone is not a totally reliable criteria for evaluating the overall condition of the pendant; WW's analysis of pendants removed from service has shown the presence of internal wire breakage.
Length of service, number and rate of breaks, location of breaks, rouging and the general condition of pendants is very important in evaluating overall condition.

A sudden increase of visible broken wires indicates the overall condition of the pendant is deteriorating at an accelerated rate and may be just cause for removal.

For further information regarding rope and strand pendant replacement criteria, refer to Wire Rope Users Manual and the appropriate OEM recommendations.

standard product list

The following is a partial list of Bethlehem Wire Rope, Strand and High Carbon Wire products manufactured by Wirerope Works, Inc. If you require another product which is not shown below, please call our ***Customer Service Department*** *at* **1-800-541-7673** *for assistance.*

Bethlehem Wire Rope

6x1 9 Class General Purpose
6x37 Class General Purpose
6x25 Flex Seale
Rotation Resistant 8x19 Class,
19x7, 19x19 and 35x7
Drill line
Tubing line
Sand line
Torpedo line
Well measuring line (wire)
Well servicing line 1x16 and 1x19
Logging rope
Roepac
Roepac-T Crane Hoist
Teleroepac
Galvanized rope
Structural Rope and Assemblies

Bethlehem Elevator Rope

6x19 Class
8x19 Class
Iron Grade
Traction Grade
Xtrac Grade

Bethlehem Structural Strand and Strand Products

A-Coat Galvanized Strand
B-Coat Galvanized Strand
C-Coat Galvanized Strand
Structural Strand Assemblies
Guy Strand
Locked Coil Track Strand
Half-Lock Coil Track Strand
Round Wire Track Strand
Hose Reinforcing Strand

Bethlehem Mining Rope

6x19 Class
6x37 Class
6x61 Class
8x37 Class
Excavator Grade
Excavator-AR Grade
En-core
Beth Pac
Maxi-core
Structural Strand Pendants
Flattened Strand Rope

Bethlehem Wire Rope
Service Centers

Call **1-800-541-7673** for Customer Service

California>>Long Beach and Sacramento

Colorado>>Denver

Florida>>Tampa

Georgia>>Atlanta

Illinois>>Chicago

Indiana>>Boonville

Louisiana>>New Iberia and New Orleans

New Hampshire>>Exeter

Oklahoma>>Oklahoma City

Missouri>>St. Louis

North Dakota>>Williston

Pennsylvania>>Williamsport

Texas>>Houston

Wirerope Works, Inc.

Manufacturer of
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www.wireropeworks.com

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