Stretch of Wire Ropes

Stretch of a wire rope under load but within the elastic limit is of two distinct types: CONSTRUCTIONAL or PERMANENT stretch and ELASTIC stretch.

Constructional stretch is unrecoverable, that is, it is permanent and is the result of the seating of the wires in the strand and of the strands in the core of the rope.

Constructional stretch varies with construction and grade of rope and is affected by size of core and length of lay. However, approximate values for constructional stretch, percent of length, for various types of ropes may be listed as follows:

APPROXIMATE CONSTRUCTIONAL STRETCH OF WIRE ROPE, % OF LENGTH

Rope Construction		Carbon Steel	Stainless Steel
Aircraft Strand	1 x 7 PREformed	.010	.015
	1 x 19 PREformed	.018	.021
Aircraft Cord	7 x 7 PREformed	.06	.07
	7 x 19 PREformed	.25	.33
Wire Rope	6 x 7 PREformed	.38	.44
	6 x 7 IWRC PREf.	.25	.29
	6 x 19 PREformed	.50	.58
	6 x 19 IWRC PREf.	.33	.38
	7-FLEX IWRC	.38	...
	6 x 37 PREformed	.75	.87
	6 x 37 IWRC PREf.	.50	.58
	8 x 19 PREformed	.87	1.00
	8 x 19 IWRC PREf.	.66	.75
	18 x 7 PREformed	.66	.75
Elevator Rope	6 x 19 Non-PREf.	.625	...
	6 x 19 PREformed	.800	...
	8 x 19 Non-PREf.	.800	...
	8 x 19 PREformed	1.000	...

If loads are heavy and rope is subjected to severe bending, the constructional stretch occurs early in the life of the rope. But in light service, such as elevator ropes, it may take several months for the constructional stretch to work itself out.

Elastic stretch in a wire rope is caused by the elastic deformation of the wires themselves when under load. As the term implies, this stretch is recoverable when the load is removed.

After all constructional stretch has been removed and under loads within the elastic limit of the wire rope (approximately 60% of nominal rope strength), this elastic stretch varies directly

with the load and rope length under load and varies inversely with the metallic area and modulus of the rope, that is:

$e = PL/AE$, where

- e = elastic stretch, feet
- P = load on rope, lbs.
- L = rope length under load (constructional stretch removed), in feet
- A = rope metallic area, sq. in.
- E = modulus of elasticity, p.s.i.

APPROXIMATE ELASTIC STRETCH FORMULAE FOR WIRE ROPE, % OF LENGTH

To compute the elastic stretch of the rope, it is necessary to know not only the rope length and load but also the rope area and modulus. These latter values for various rope sizes, grades, and construction are many times unavailable to the design engineer; and to make the above formula more practical, it is better to reduce it to a form in which the metallic area and modulus values are intrinsic therein. Thus:

$e = [P/D^2] \times F$, where

- e = elastic stretch, % of length
- P = load on rope, lbs.
- D = nominal rope or strand dia., inches
- F = reciprocal AE factor x 100

Values of "F" for various types, constructions, and grades of Macwhyte rope and strand are as follows:

VALUES OF FACTOR "F"

CONSTRUCTION	F	CONSTRUCTION	F
1 x 7 Carbon	6.61×10^{-6}	6 x 37 FC Carbon	2.19×10^{-5}
Stainless	7.35×10^{-6}	Stainless	2.41×10^{-5}
1 x 19 Carbon	6.98×10^{-6}	6 x 37 IWRC Carbon	1.44×10^{-5}
Stainless	7.79×10^{-6}	Stainless	1.60×10^{-5}
7 x 7 Carbon	1.07×10^{-5}	8 x 19 FC Carbon	2.97×10^{-5}
Stainless	1.20×10^{-5}		
7 x 19 Carbon	1.40×10^{-5}	8 x 19 IWRC Carbon	1.70×10^{-5}
Stainless	1.62×10^{-5}		
6 x 19 FC Carbon	2.03×10^{-5}	19 x 7 Carbon	1.78×10^{-5}
Stainless	2.26×10^{-5}	(18 x 7) Stainless	1.97×10^{-5}
6 x 19 IWRC Carbon	1.36×10^{-5}	7-FLEX Carbon	1.59×10^{-5}
Stainless	1.57×10^{-5}		

Elastic stretch of wire rope as computed above, though approximate, should be accurate enough for the ordinary stretch determinations. For situations involving very accurate calculations, please contact Macwhyte wire rope engineers.