

Physical Properties

Material	Specific Gravity	Dynamic Co-efficient of Friction Against Steel	Melting Decomposition Temperature
			Deg. C
Nylon (Polyamide)	1.14	0.1 - 0.12	218
Polyester	1.38	0.12 - 0.15	256
Polypropylene	0.91	0.15 - 0.22	165
Polyester/Polyolefin Dual Fibres	0.99 / 1.14	0.1 - 0.15	140 Polyolefin 256 Polyester
Polyester/Polypropylene Melt Mixture	0.99	0.12 - 0.15	173
HMPE (Steelite)	0.97	0.07	147
Aramid	1.44	0.15	Chars @ 500
Steel	7.85	0.23*	1600

* Steel Wire is 0.23 but when lubricant / finishing is used the co-efficient may vary.

Chemical Resistance

This table shows the residual strengths of synthetic fibres after chemical exposure under specific conditions. Contact Bridon for more detailed information.

Chemical	Conc	Temp	Time	Nylon	Polyester	Polypropylene	Aramid	HMPE
	(W/W%)	(°C)	(Hours)	(%)	(%)	(%)	(%)	(%)
Acids								
Hydrochloric	34	20	100	0	90	100	95	100
Nitric66	20	100	0	70	100	95	95	
Sulphuric	96	20	100	0	100	100	40	90
Formic	90	20	100	0	95	100	90	100
Acetic	100	20	10	85	95	100	100	100
Alkalis								
Caustic Soda	40	20	100	50	0	90	90	100
Caustic Soda	20	70	150	100	0	100	85	90
Caustic potash	40	20	100	90	0	90	90	100
Solvents								
Trichloroethylene	100	30	150	100	95	80	100	100
Carbon Tetrachloride	100	20	150	100	100	100	98	100
Benzene	100	70	150	100	100	100	98	95
Metacresol	100	100	4	0	0	100	80	100
Oxidising Agent								
Hydrogen Peroxide	10	20	100	0	100	90	95	100

Extension and Elasticity

Rope extension and elasticity are important characteristics because they will determine rope behaviour in terms of peak loads and mooring excursions. Synthetic fibre ropes differ from steel because their load-extension characteristics are non-linear and time dependent.

The overall extension of a rope is made up from several different components:

Elastic Extension

Elastic extension is the extension that is immediately recoverable upon the release of the load. In a continuously working environment elastic extension will dominate the rope behaviour.

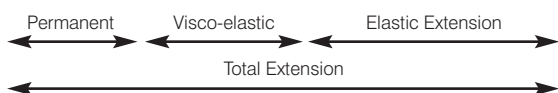
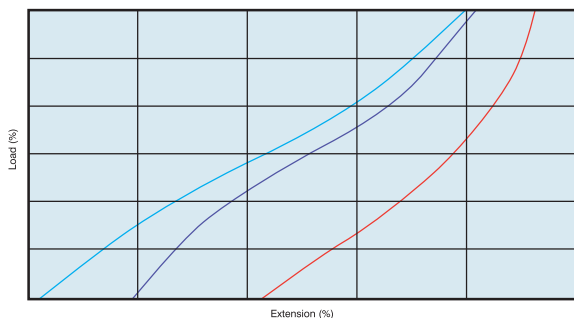
Visco-elastic Extension

Visco-elastic extension is only recoverable with time after the release of the load. The behaviour of ropes subjected to occasional high loads will be significantly influenced by this visco-elastic component.

Permanent Extension

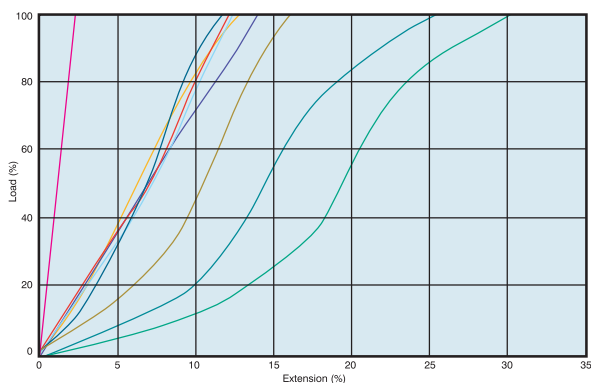
Permanent extension is non-recoverable. It will occur when a new rope is first used or when a rope is subject to an unusually high load. It occurs as a result of the individual fibre components of the rope "bedding in" to their preferred positions. Continuous loading of some ropes can also lead to further permanent extension due to creep at the molecular level.

Components of Rope Extension



● First Loading ● Worked and Rested ● Worked

Load-Extension Characteristics of Worked Ropes



● Steelite 12, Superline ● Hypamix & Supermix
 ● Superline Polyester ● M-Steel Winchline
 ● Fybaline Xtra ● Flexiline
 ● Braidline Polyester & 12 Strand Polyester
 ● Superline Nylon ● Braidline Nylon & 12 Strand Nylon

The graph above compares the load-extension characteristics of worked ropes but does not include permanent extension.

Tensile Strength

Strengths are determined on new ropes under laboratory conditions according to Bridon's QA25 quality procedures. Ropes can be supplied and tested to a number of international quality standards including EN 919, US Mil Specifications and Cordage Institute specifications.

Weight

Rope mass is determined by weighing a rope sample that has been measured at a reference load.

For most ropes this is calculated as:

$$\text{Reference Load (kg)} = D^2/8$$

Where D = Rope diameter (mm)

Care in use

Storage

Ropes should be stored, where possible under deck or under a suitable cover. The area should be clean, dry and cool out of direct sunlight. Rope should be stored off the ground, to allow adequate ventilation, and away from metal walls or steam pipes. Never store rope on concrete or dirty floors, or drag over rough ground - dirt and grit picked up by the rope can work into the strands cutting the inside fibres. Keep away from chemicals of all types. In the case of long term storage used ropes should be hosed down with fresh water to reduce salt crystals that can affect the life and efficiency of the ropes.

Handling

When a rope is supplied in a coil it should always be un-coiled from the inside so the first turn comes from the bottom in a counterclockwise direction. If a rope is supplied on a reel this must be allowed to freely rotate on a central pin or pipe so that the rope can be drawn off the top layer. Never take rope from a reel lying on its side.

Braided ropes can not be kinked or hockled, however, twist can be imparted into the ropes in service. Excessive twist can cause an imbalance between the right and left hand strands and should therefore be removed as soon as possible by counter-rotating the rope when it is relaxed. The best method for storing a braided rope is in a figure of eight fashion.

Rope Safety

Never stand in line with a rope under tension. If a rope fails it can recoil with sufficient force to cause serious injury or even death. Ensure all end terminations are adequate to take shock loads. Use correct safety factors. Remember to de-rate rope strengths for incorrect end fitting and wear.

Rope Inspection

In use, rope should be inspected regularly for evidence of chemical attack (discolouration other than operational soiling), kinking (hockles), surface abrasion (chafe) including major yarn or strand cuts and both external and internal strand heat fusion indicated by glazed areas or heavy fluffing and powdering.

Braided ropes should be examined along their entire length for areas of stiffening or inconsistent diameter, where the rope has either flattened (necking) or has an unusual lump or surface hernia. This can indicate internal damage or core failure due to overloading or severe shock loads. If limited to one small section the damaged area may be cut out and re-spliced, otherwise the rope should be discarded.

Check splices and tucks for evidence of movement or misalignment. If in doubt cut off and re-splice.



Rope installation and handling equipment

Full guidelines for rope installation and operation are available on request from Bridon.

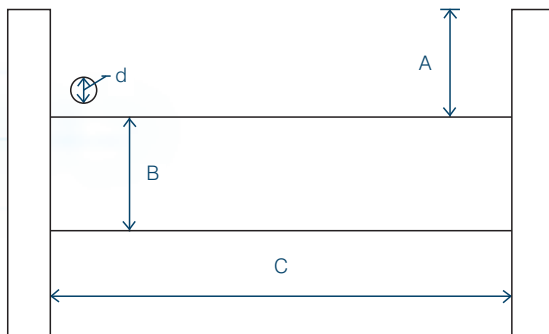
Capstans and Winches

Ropes used on single drum or split drum winches should be installed under tension and the initial layers should be a close tight fit between the flanges to prevent burying into the lower layers. A minimum of eight wraps of rope should be maintained on the drum at all times.

Care should be exercised to avoid surging while the capstan or winch head is rotating. Excessive surging or slippage causes localised over heating which can melt or fuse synthetic fibres with resulting loss of strength.

Where possible the working or bearing position of a rope should be moved frequently to spread wear. The "furry" look of a well used synthetic fibre rope is not necessarily an indication of weakness. In fact the "furry" or hairy surface can serve to protect the rope.

Winch/Reel Capacity



$$\text{Rope Length (metres)} = \frac{(A+B) \times A \times C \times \pi \times 10^3}{d^2}$$

Where A, B, C are in metres and d is millimetres

Pulleys and Sheaves

The ratio between rope diameter and sheave diameter is critical to the safe usage of a rope. As a general guide a ratio of 8:1 minimum should be used for 8-strand, 12-strand and Braidline (Double Braid) ropes and 12:1 minimum should be used for Superline ropes. The groove of the pulley should be "U" shaped and the groove width 10% greater than the rope diameter. The depth of the groove should be approximately half the rope diameter.

"V" shaped grooves should not be used as they tend to pinch and damage the rope by increasing friction and crushing the fibres. Sheave surfaces should be smooth and free from burs. Sheaves should be maintained regularly so that they are free to rotate at all times.

Sharp Bends

Sharp bends around any piece of equipment should be avoided. Where a static rope passes around any surface with a deflection of 10 degrees or more then the diameter of the surface should be a minimum of three times the rope diameter. Any sharp bend in a rope under load will substantially decrease its strength and may cause premature damage or failure.

Eye Splices

The length of an eye in a rope should be a minimum of three times, and preferably five times, the diameter of the item around which it is to be passed. This will ensure that the angle between the two legs of the eye will not cause a tearing action at the throat of the eye. For instance if the eye of a mooring line is passing around a 600mm diameter bollard then the eye should be a minimum of 1.8 metres and preferably 3 metres.

Retiring Ropes

Apart from rejecting your rope when obviously damaged, it is wise to establish lifetimes of your rope within the parameters of the use for which it was selected. This will allow you to retire your rope on a regular scheduled basis, provided of course, that your conditions of usage remain unchanged. Remember to re-establish your discard criteria if changing rope type, rope material or rope breaking load. Safety of life and property is the prime consideration. If in doubt ask Bridon for recommendations.

Quality & Service

QA/Certification

Bridon operate a strict quality system accredited to BS EN ISO 9001 approval by Bureau Veritas Quality International. In addition, recognised classification bodies such as Lloyds, ABS, BV and DNV can also certify products and systems. For offshore applications, ropes can be manufactured and certified in accordance with OCIMF guidelines where applicable.

Design Services

For specific jobs and applications our Research and Development department has extensive laboratory facilities and is available to design products tailored to individual requirements. Bridon can also offer advice and help in specifying ancillary equipment and developing operating procedures.

After Sales & Rigging Services

Bridon International Services are able to offer a full technical and rigging after sales service utilising our own dedicated trained personnel and approved distributors/stockists giving world wide coverage. Bridon supply a wide spectrum of services whether your requirements are onshore or offshore including the capability of offering emergency rigging, rope training and rigging courses, rope installation, visual inspection and destructive testing ensuring that our customers obtain maximum performance from our products.