Choosing the right wire rope for your application

With each application, your choices of wire ropes can be many. How do you know which one works best for you? Ropes include a combination of properties that give them specific performance abilities. Before you choose, it pays to look closely at each rope's special properties.

NO SINGLE WIRE ROPE CAN DO IT ALL

All wire ropes feature design property tradeoffs. In most cases, a wire rope cannot increase both fatigue resistance and abrasion resistance. For example, when you increase fatigue resistance by selecting a rope with more wires, the rope will have less abrasion resistance because of its greater number of smaller outer wires.

When you need wire rope with greater abrasion resistance, one choice is a rope with fewer (and larger) outer wires to reduce the effects of surface wear. But that means the rope's fatigue resistance will decrease. That's why you need to choose your wire rope like you would any other machine. Very carefully. You must consider all operating conditions and rope properties.

THE BASIC PROPERTIES OF WIRE ROPE

How do you choose the wire rope that's best suited for your job? Following are the most common properties to be considered when selecting a rope for an application.

STRENGTH Wire rope strength in the United States is typically shown in tons of 2,000 lbs. The wire rope strength is shown as minimum breaking force (MBF).

This is a calculated strength that has been accepted by the wire rope industry. When tested on a tensile machine, a new rope will break at a value equal to – or higher than – the minimum breaking force shown for that rope.

The published values apply to new, unused rope. A rope should never operate at – or near – the minimum breaking force. The minimum breaking force of the rope must be divided by the design factor required for the application to determine the maximum load allowed on the rope. During its useful life, a rope loses strength gradually due to natural causes such as surface wear and metal fatigue.

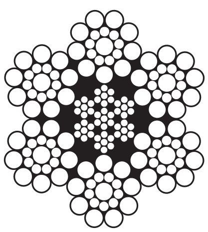
FATIGUE RESISTANCE Fatigue resistance involves fatigue of the wires that make up a rope. To have high fatigue resistance, wires must be capable of bending repeatedly under stress – for example, as a loaded rope passes over a sheave during operation.

Increased fatigue resistance is achieved in a rope design by using a large number of wires. It involves both the wire properties and rope construction.

In general, a rope made of many wires will have greater fatigue resistance than a same-size rope made of fewer, larger wires because smaller wires have greater ability to bend as the rope passes over sheaves or around drums. To overcome the effects of fatigue, ropes must never bend over sheaves or drums with a diameter so small as to bend wires excessively. Standards for specific applications contain requirements for minimum sheave and drum sizes.

Every rope is subject to metal fatigue from bending stress while in operation, and therefore the rope's strength gradually diminishes as the rope is used.

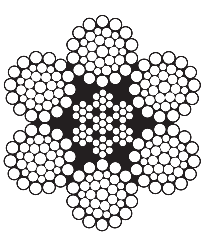
BENEFIT OF FEWER OUTSIDE WIRES PER STRAND



ABRASION RESISTANCE

- > Increases with larger wires.
- > Decreases with smaller wires.

BENEFIT OF MORE OUTSIDE WIRES PER STRAND



FATIGUE RESISTANCE

- > Decreases with larger wires.
- > Increases with smaller wires.

CRUSHING RESISTANCE Crushing is the effect of external pressure on a rope, which damages it by distorting the cross-section shape of the rope, its strands or core – or all three.

Crushing resistance therefore is a rope's ability to withstand or resist external forces, and is a term generally used to express comparison between ropes.

When a rope is damaged by crushing, the wires, strands and core are prevented from moving and adjusting normally during operation.

In general, IWRC ropes are more crush resistant than fiber core ropes. Regular lay ropes are more crush resistant than lang lay ropes. 6-strand ropes have greater crush resistance than 8-strand ropes or 19-strand ropes. Compacted-strand ropes are more resistant than standard round-strand ropes.

RESISTANCE TO METAL LOSS AND DEFORMATION Metal loss refers to the actual wearing away of metal from the outer wires of a rope, and metal deformation is the changing of the shape of outer wires of a rope.

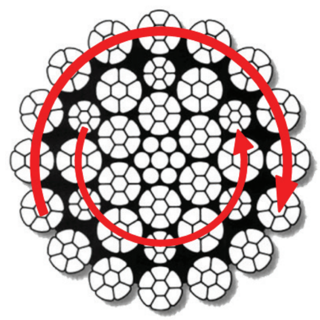
In general, resistance to metal loss by abrasion (usually called "abrasion resistance") refers to a rope's ability to withstand metal being worn away along its exterior. This reduces strength of a rope.

The most common form of metal deformation is generally called "peening" – since outside wires of a peened rope appear to have been "hammered" along their exposed surface.

Peening usually occurs on drums, caused by rope-to-rope contact during spooling of the rope on the drum. It may also occur on sheaves.

Peening causes metal fatigue, which in turn may cause wire failure. The hammering – which causes the metal of the wire to flow into a new shape – realigns the grain structure of the metal, thereby affecting its fatigue resistance. The out-of-round shape also impairs wire movement when the rope bends.

RESISTANCE TO ROTATION When a load is placed on a rope, torque is created within the rope as wires and strands try to straighten out. This is normal and the rope is designed to operate with this load-induced torque. However, this torque can cause both single part and multiple part hoisting systems to rotate. Load-induced torque can be reduced by specially designed ropes.



In standard 6- and 8-strand ropes, the torques produced by the outer strands and the IWRC are in the same direction and add together. In rotation-resistant ropes, the lay of the outer strands is in the opposite direction to the lay of the inner strands, thus the torques produced are in opposite directions and the torques subtract from each other.

"SQUARED ENDS"

> Typical example of breaks due to fatigue.

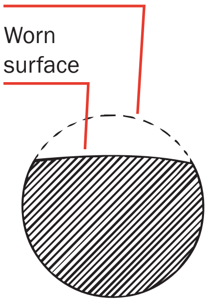
"CRUSHING"

> Typical example of external pressure on a wire rope.

CROSS-SECTION OF A WORN WIRE

> Original wire cross-section

> Worn surface



CROSS-SECTION OF A PEENED WIRE

> Original wire cross-section

> Peened surface