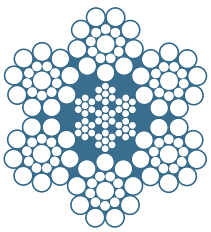
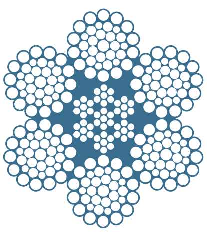
Choose the right wire rope for your application

All wire ropes include a combination of characteristics that give them specific performance traits depending on design, engineering, materials and composition. With the many specialized procedures required for efficient well drilling, it is important to select ropes that are best suited for each application. No single rope can do it all.



IF YOU NEED ABRASION RESISTANCE

> Abrasion resistance increases with fewer, larger outside wires per strand.



IF YOU NEED FATIGUE RESISTANCE

> Fatigue resistance increases with more, smaller outside wires per strand.

DESIGN CHARACTERISTICS OF WIRE ROPE

Consider how the composition of a rope can affect its performance characteristics. A rope with fewer, but larger, outside wires per strand will deliver more **abrasion resistance** because of the greater rope surface area exposed to drums and sheaves. However, this most often results in a reduction of fatigue resistance.

A greater number of smaller outside wires per strand allows the rope to bend more freely which will **increase fatigue life**, but at the same time the smaller wires are more susceptible to abrasion.

Additional choices in design can modify these characteristics. You may choose a rope with more wires in each strand for **increased fatigue resistance** and with compacted strands, which will also provide **increased abrasion resistance**.

Choose the rope you need based on the type of operation to be performed. Different tasks demand different characteristics and the right rope for each task can be critical to the overall success of operations. The primary characteristics you will need to evaluate include several rope design characteristics.

> **FATIGUE RESISTANCE** Fatigue resistance involves metal 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, a rope passing over a sheave.

Increased fatigue resistance is achieved in a rope design by using a large number of wires. It involves both the basic metallurgy and the diameters of wires.

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 permanently bend the wires or rope. There are precise recommendations for sheave and drum sizes to properly accommodate all sizes and types of ropes.

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

> **ABRASION RESISTANCE (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 wear reduces the strength of a rope.

The most common form of metal deformation is usually referred to as **"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. 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.

> **STRENGTH** Wire rope strength is usually measured in tons of 2,000 lbs. In published material, wire rope strength is shown as minimum breaking force (MBF) – referring to calculated strength figures that are accepted by the wire rope industry.

When placed under tension on a test device, a new rope will break at a figure equal to – or higher than – the MBF shown for that rope.

Minimum breaking force applies to new, unused rope. A rope should never operate at – or near – its MBF. During its useful life, a rope loses strength gradually due to natural causes such as surface wear and metal fatigue. Sudden loss of strength can be caused by abusive situations.

> **CRUSHING RESISTANCE** Crushing is the result 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. Six-strand ropes have greater crush resistance than eight-strand ropes or 19-strand ropes. Flex-X® ropes are more crush resistant than standard round-strand ropes.

> **STABILITY** The word "stability" is most often used to describe handling and working characteristics of a rope. It is not a precise term since the idea expressed is to some degree a matter of opinion, and is more nearly a "personality" trait than any other rope feature.

For example, a rope is called stable when it spools smoothly on and off a drum – or doesn't cause the ropes to twist together when a multi-part reeving system is used.

Strand and rope construction contribute to stability for the most part. Regular lay rope tends to be more stable than lang lay. A rope made of seven-wire strands will usually be more stable than a more complicated construction with many wires per strand.

There is no specific measurement of rope stability.

> **BENDABILITY** Bendability relates to the ability of a rope to bend easily in an arc. Four primary factors affect this capability:

1. Diameters of wires that make up the rope.
2. Rope and strand construction.
3. Metal composition of wires and finish such as galvanizing.
4. Type of rope core – fiber core or IWRC.

Some rope constructions are by nature more bendable than others. Small ropes are more bendable than big ones. Fiber core ropes bend more easily than comparable IWRC ropes. As a general rule, ropes of many wires are more bendable than same-size ropes made with fewer, larger wires.

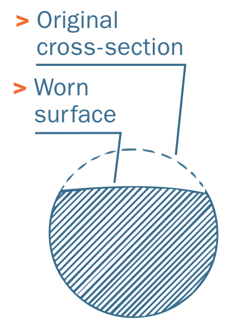
"SQUARED ENDS"

> Typical example of breaks due to fatigue.

"CRUSHING"

> Typical example of external pressure on a wire rope.

CROSS-SECTION OF A WORN WIRE



CROSS-SECTION OF A PEENED WIRE