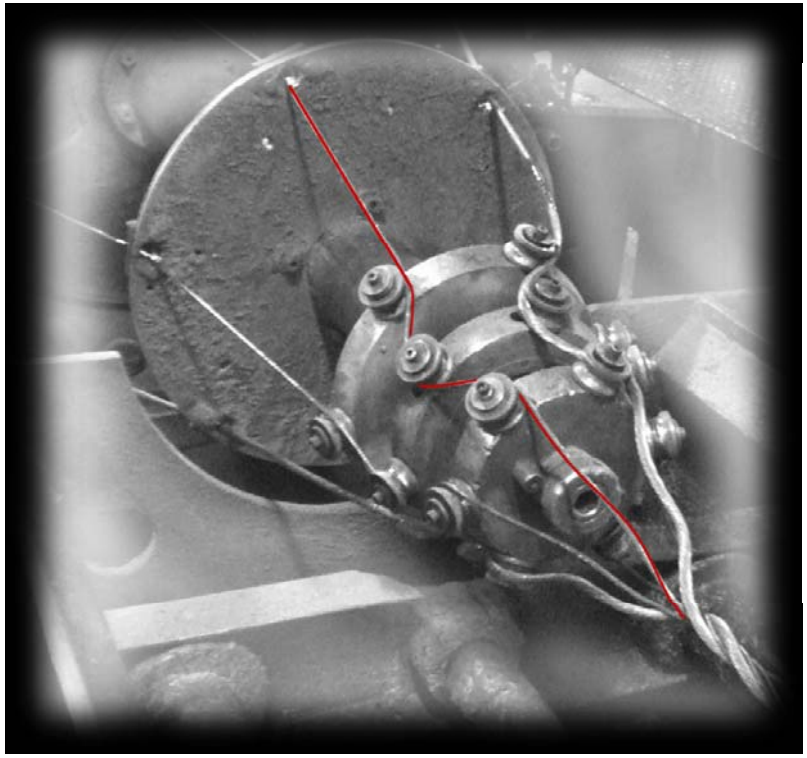
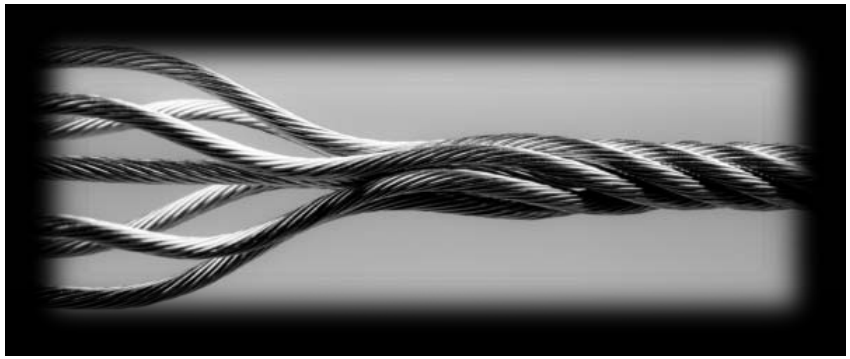
Preformed wire ropes

Preforming is a manufacturing process which has the effect of relieving the wires and the strands of much of the internal stress which exist in nonpreformed ropes. During the process the strands and wires are given the helical shape they will assume in the finished rope.

A preformed rope is one in which the component strands are shaped to their final helical form before being laid into the rope.

When wires, strand, and wire rope is preformed, it is actually curved slightly during the manufacturing process (think of a wave).





the path is traced of the strands through the performing head.

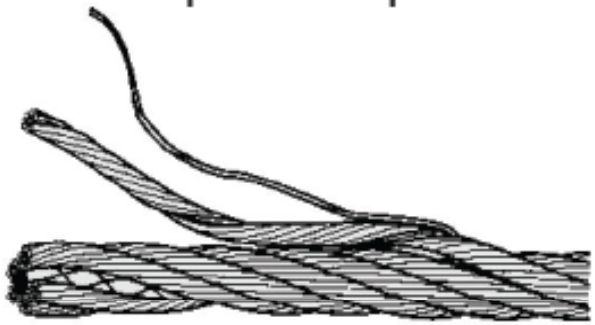
This curvature to the strands going into the wire rope, it lowers the propensity of the rope to rotate along its own axis

Preformed rope offers certain advantages over non-preformed rope, eg:

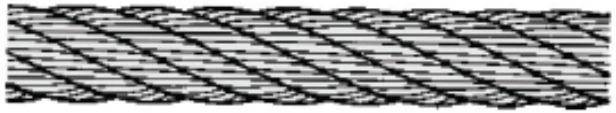
1. It does not tend to unravel and is less liable to form itself into loops or kinks and is thus more easily installed
2. It is slightly more flexible and conforms to the curvature of sheaves and pulleys
3. Due to the reduction in internal stresses it has greater resistance to bending fatigue. This makes the rope easier to handle and install.
4. Greater stability and better resistance to shock loading and abrasion
5. Improved rope life due to the better equalisation of loading between strands in the rope and reduction of internal stresses in the rope.
6. Greater safety in handling of ropes as broken wire ends do not protrude. This factor also reduces wear on equipment in contact with the rope.

NON-PREFORMED ROPE

In PREFORMED rope the wires and strands are given the helix they take up in the completed rope



PREFORMED rope may be cut without servings although care must always be taken



Non-Strands ropes (locked coil ropes)

cross–section of a locked coil rope shows that the central portion consists of strands of thick round wires; only the outer layer (or two outer layers) consists of round wires placed between specially shaped wires of I section, rail section or trapezoidal section so that the wires lock with one another and the rope surface is smooth and plain compared to stranded ropes. By laying up the outer wires in the direction opposite to that of the inner wires, locked coil ropes are made non-spinning and this is a major advantage in sinking shafts where guide ropes are not installed.

- It is heavier and stronger but less flexible then the stranded rope of the same dia.
- It is used in winding and hoisting purposes.

- Its construction is difficult
- The interior cannot lubricated from outside
- It cannot spliced
- It is not flexible

Selection of wire ropes

- Watery places and corrosive atmosphere: a galavanised rope should used.
- High temperature: rope with fibre core should avoided
- Stationary and running coil rope:

Selection of wire ropes

- Spinning or rotating quality
- Shock loads
- Resistance to wear
- Tensile strength

- Bending strength
- Grove size
- Crushing and distortion

STRENGTH

Wire rope in service is subjected to several kinds of stresses.

The stresses most frequently encountered are direct tension, stress due to acceleration, stress due to sudden or shock loads, stress due to bending, and stress resulting from several forces acting at one time.

For the most part, these stresses can be converted into terms of simple tension, and a rope of approximately the correct strength can be chosen.

As the strength of a wire rope is determined by its, size, grade and construction, these three factors should be considered.

SAFETY FACTORS

The safety factor is the ratio of the strength of the rope to the working load. A wire rope with a strength of 10,000 pounds and a total working load of 2,000 pounds would be operating with a safety factor of five.

It is not possible to set safety factors for the various types of wire rope using equipment, as this factor can vary with conditions on individual units of equipment.

SAFETY FACTORS

The proper safety factor depends on the followings

- Loads applied,
- Speed of operation,
- Shock load applied
- Type of fittings used for securing the rope ends,
- Acceleration and deceleration,
- Length of rope,
- Number, size and location of sheaves and drums,
- Factors causing abrasion and corrosion
- Facilities for inspection.

FATIGUE

Fatigue failure of the wires in a wire rope is the result of the propagation of small cracks under repeated applications of bending loads.

It occurs when ropes operate over comparatively small sheaves or drums.

The repeated bending of the individual wires, as the rope bends when passing over the sheaves or drums, and the straightening of the individual wires, as the rope leaves the sheaves or drums, causing fatigue.

The best means of preventing early fatigue of wire ropes is to use sheaves and drums of adequate size.

To increase the resistance to fatigue, a rope of more flexible construction should be used, as increased flexibility is secured through the use of smaller wires

ABRASIVE WEAR

The ability of a wire rope to withstand abrasion is determined by the

- size, carbon and manganese content,
- heat treatment of the outer wires
- construction of the rope.

The larger outer wires of the less flexible constructions are better able to withstand abrasion than the finer outer wires of the more flexible ropes.

The higher carbon and manganese content and the heat treatment used in producing wire for the stronger ropes, make the higher grade ropes better able to withstand abrasive wear than the lower grade ropes.

EFFECTS OF BENDING

Loss of strength due to bending: Loss of strength due to bending is caused by the inability of the individual strands and wires to adjust themselves to their changed position when the rope is bent.
The loss of strength due to bending wire ropes over the sheaves found in common use will not exceed 6% and will usually be about 4%.

Fatigue effect of bending: The fatigue effect of bending appears in the form of small cracks in the wires at these over-stressed.

These cracks propagate under repeated stress cycles, until the remaining sound metal is inadequate to withstand the bending load. This results in broken wires showing no apparent contraction of cross section.

size of the sheave or drum

Mass and strength of wire ropes

Space factor of rope 50 to 60 % and 75% lock coil rope

Mass of rope = kd^2
Where k is a constant depending upon rope design, d is dia of rope in cm. and mass is in kg/m

Strength = sd^2
Where s is a constant depending on rope design and quality of steel.

Type of rope	k	s
Round strand with fibre core	0·36	52
Round strand with wire core	0·40	56
Flattened strand with fibre core	0·41	55
Flattened strand with wire core	0·45	58
Locked coil	0·56	85

Example

A wire rope, round stranded with fibre core, has a diameter of 2.54 cm. If the steel has a tensile strength of 160 kg/mm^2, find out the mass of the rope and the breaking strength in SI units.

mass of rope in kg/m $= kd^2$ (d in cm)

and using the value of k as 0·36 from the tables, we get mass

rope (kg/m) $= 0 \cdot 36 \times 2 \cdot 54^2$

$= 2 \cdot 32$

For 100 m long rope mass is 232 kg.

Breaking strength is given by the formula

B. S. (in kN) $= sd^2$, (d in cm)

From the tables, value of s is 52.

B. S. $= 52 \times 2 \cdot 54^2$

$= 335$ kN