



Peralatan dan Pengangkutan Tambang Bawah Tanah (UNDERGROUND MINING EQUIPMENT)



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Wire Rope

Course 8 (Post Midterm)

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Wire Rope



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Wire Rope

- ❖ Wire Rope adalah tali baja yang terbuat dari beberapa WIRE yang dipilin membentuk STRAND, lalu beberapa STRAND tersebut dipilin mengelilingi CORE untuk membentuk wire rope

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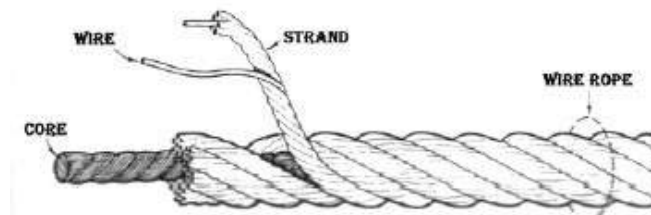


KONSTRUKSI



Konstruksi menyatakan banyaknya wire dan strand dalam suatu wire rope.

Format konstruksi wire rope :
Banyaknya Strand x Banyaknya Wire.



Construction of wire rope

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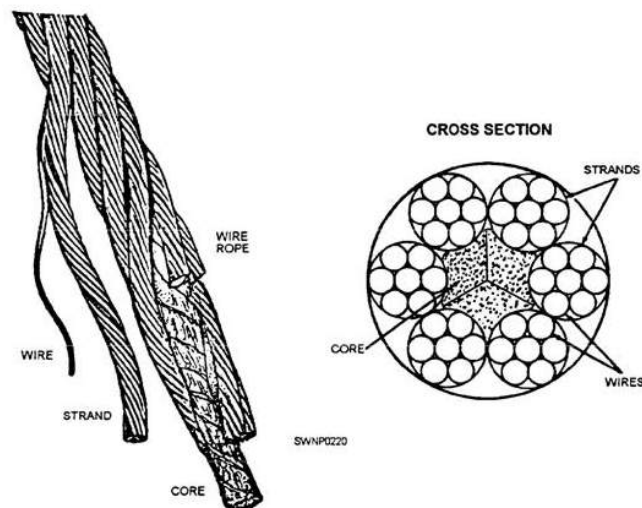
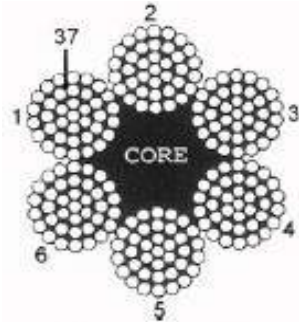


Figure 5-1.-Fabrication of wire rope

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Contoh konstruksi wire rope



Wire Rope 6 x 37 terdiri dari 6 strand yang mengelilingi 1 core dimana masing masing strand terdiri dari 37 wire

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- ❖ Semakin banyak jumlah wire didalam strand membuat ukuran individual wire lebih kecil sehingga wire rope lebih flexible,
- ❖ sebaliknya semakin sedikit jumlah wire di dalam strand membuat ukuran wire menjadi lebih besar sehingga wire rope menjadi lebih kaku.

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- ❖ Wire Rope yang flexible mempunyai daya tahan terhadap tekukan yang baik sehingga cocok digunakan pada crane.
- ❖ Wire rope dengan ukuran individual wire yang besar mempunyai ketahanan terhadap gesekan yang baik sehingga sesuai digunakan untuk menarik



CORE/HATI

Core wire rope umumnya terdiri dari 3 bahan:

1. Fiber Core (FC) – tali plastic.
2. Hemp Core (HC) – tali manila.
3. Wire Core (IWRC) – kawat baja



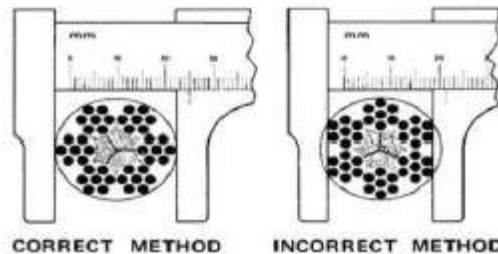
- ❖ Keuntungan FIBER (FC) atau HENEP CORE (HC) adalah wire rope lebih flexible dan lebih tahan karat.
- ❖ Keuntungan WIRE CORE (IWRC) adalah breaking load yang lebih tinggi.

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UKURAN

- ❖ Ukuran diameter wire rope dinyatakan dalam mm atau inch dan dapat diukur menggunakan sigmat.
- ❖ Ilustrasi berikut menunjukkan cara mengukur wire rope yang salah dan benar:



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- ❖ Faktor yang mempengaruhi ukuran wire rope adalah besarnya sheave yang dilalui wire rope dan beban yang akan digerakkan oleh wire rope.

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ASAL (produsen)

- Saat ini wire rope yang kita stock berasal dari 2 negara: RRT dan Korea. Wire rope Korea menawarkan kualitas yang lebih tinggi dan kualitas yang konsisten

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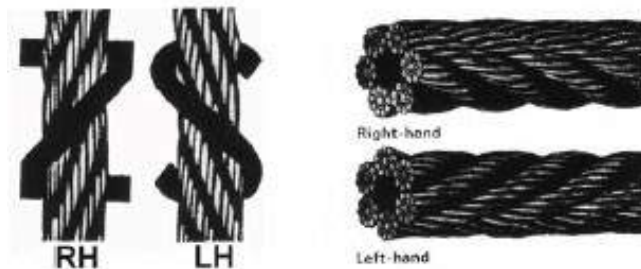
PUTARAN

- ❖ Putaran menunjukkan arah strand wire rope diputar mengelilingi Core.
- ❖ Wire rope strand yang diputar searah jarum jam disebut Putaran Kanan atau Right Hand Regular Lay disingkat (RHRL).
- ❖ Sebaliknya strand yang diputar berlawanan arah jarum jam disebut Putaran Kiri atau Left Hand Regular Lay (LHRL).

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- ❖ Untuk membedakan, wire rope PUTARAN KANAN jika dilihat secara vertikal, sudut pada strand akan membentuk huruf "Z",
- ❖ sedangkan wire rope PUTARAN KIRI, jika dilihat secara vertikal akan membentuk huruf "S"



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FINISHING

2 type finishing wire rope:

- ❖ BRIGHT/UNGALVANIS
- ❖ GALVANIS

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- ❖ Wire rope galvanis permukaan luarnya berwarna putih karena dilapisi zinc.
- ❖ Keuntungannya lebih tahan karat daripada wire rope ungalvanis. Kerugiannya: harganya lebih mahal.
- ❖ Wire rope ungalvanis keuntungannya lebih murah namun kurang tahan karat dibandingkan wire rope galvanis.

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QUANTITY

- ❖ Panjang Wire Rope yang akan digunakan, biasa dinyatakan dalam meter

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GRADE

- ❖ Wire rope diproduksi berdasarkan beberapa grade.
- ❖ Setiap grade memberikan kombinasi tensile strength, kekerasan, ketahanan terhadap gesekan dan tekukan yang berbeda

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The three primary grades of wire rope are as follows:

- Mild plow steel wire rope is tough and pliable. It can stand repeated strain and stress and has a tensile strength (resistance to lengthwise stress) from 200,000 to 220,000 pounds per square inch

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- Plow steel wire rope is usually tough and strong. This steel has a tensile strength of 220,000 to 240,000 psi. Plow steel wire rope is suitable for hauling, hoisting, and logging.
- Improved plow steel wire rope is one of the best grades of rope available and is the most common rope used in the NCF. This type of rope is stronger, tougher, and more resistant to wear than the others. Each square inch of improved plow steel can stand a strain of 240,000 to 260,000 psi. This makes it especially useful for heavy-duty service, such as on cranes with excavating and weight-handling equipment.

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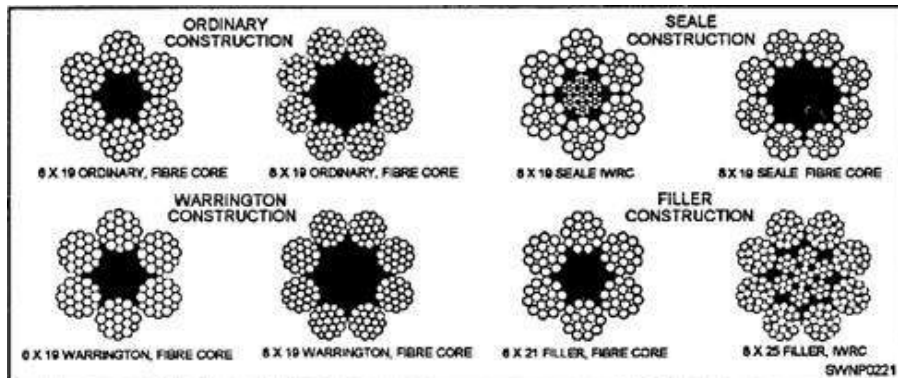
Standard industri yang banyak dipakai untuk menentukan grade adalah A.P.I (American Petroleum Institute) dan JIS (Japan Industrial Standard).

| TENSILE STRENGTH | A.P.I | JIS |
|------------------------|---------------------------------|-----|
| 165 kg/mm ² | PS | A |
| 1620 N/mm ² | Plow Steel | |
| 180 kg/mm ² | IPS | B |
| 1620 N/mm ² | Improved Plow Steel | |
| 190 kg/mm ² | EIPS | C |
| 1770 N/mm ² | Extra Improved Plow Steel | |
| 220 kg/mm ² | EEIPS | SC |
| 1860 N/mm ² | Extra Extra Improved Plow Steel | |



Tipe-tipe wire rope

1. ORDINARY construction wires are all the same size
2. SEALE is where larger diameter wires are used on the outside of the strand to resist abrasion and smaller wires inside to provide flexibility
3. WARRINGTON is where alternate wires are large and small to combine great flexibility with resistance to abrasion
4. FILLER is where very small wires fill in the valleys between the outer and inner rows of wires to provide good abrasion and fatigue resistance



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LUBRIKASI

- ❖ Lubrikasi pada wire rope berfungsi mencegah karat dan mengurangi gesekan antar strand dan wire didalam wire rope sehingga memperpanjang usia.

Empat jenis lubrikasi yang umum:

1. Dry: tanpa gemuk hanya dilapisi minyak ringan dibagian dalam core dan strand.
2. Gemuk ringan, warna coklat kekuningan biasa diaplikasikan pada wire rope galvanis.
3. Gemuk hitam.
4. Gemuk hitam pekat, memberi proteksi yang baik terhadap karat. Ideal digunakan di laut, konstruksi, dan logging.

<http://www.asmarines.com/pemesanan-wire-rope>

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TIPS MEMILIH WIRE ROPE BERKUALITAS

1. Harga wire rope sangat bervariasi, mulai dari yang paling murah sampai yang paling mahal.
Supaya anda tidak salah pilih, pastikan:
 - a. Jika anda membeli wire rope berkualitas dari Korea, Jepang, atau Eropa pastikan wire rope anda datang dengan ID tape untuk memastikan wire rope yang anda terima benar benar asli.



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- b. Jika anda membeli wire rope RRT pastikan:
 - ☐ Panjang wire rope yang anda terima tidak kurang. Cara mudah mengecek panjang wire rope adalah dengan cara menimbang wire rope yang anda terima.



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- ❑ Diameter wire rope full, tidak kurang.



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- ❑ Putaran wire rope tidak renggang. Wire rope yang renggang saat dipotong ujungnya mudah buyar dan saat dipakai cepat rusak



Ujung wire rope yang renggang



Perbandingan wire rope yang padat dibagian bawah dan wire rope yang renggang dibagian atas

<http://www.asmarines.com/tips-memilih-wire-rope-berkualitas>




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Tali baja

❖ Tali baja : Struktur, diameter dan pemakaiannya





Contoh tali baja yang umum untuk di laut

| Type | Struktur dan diameter | Contoh penerimaan | S |
|---|---|---|----|
|  | 7 x 7 (6/1) Inti tengah : baja Ø 12 sampai 28 mm | Standing rigging | + |
|  | 6 x 7 (6/1) Inti tengah : tekstil Ø 8 Sampai 16 mm | Standing rigging Harp untuk trawler kecil Kapal-kapal kecil | + |
|  | 6 x 12 (12/fibre) Inti tengah : strand cores, serat, Ø 8 sampai 16 mm | 8ridle dan warp pada trawl kecil Moring dan running rigging | ++ |

S = kelenturan
+ = kurang atau rata - rata
++ = baik

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| Type | Struktur dan diameter | Contoh penerimaan | S |
|---|--|---|----|
|  | 6 x 19 (9/9/1) Inti tengah : dari baja atau tekstil, Ø 16 - 30 mm | Tali penarik trawl (warp) | + |
|  | 6 x 19 (12/6/1) Inti tengah : dari tekstil Ø 8 sampai 30 mm | Tali penyapu (sweep) dan warp pada trawl Running rigging | + |
|  | 6 x 24 (15/9/fibre) Inti tengah : dari tekstil Running rigging | Tali penyapu (sweep) dan warp pada trawl Running rigging | + |
|  | 6 x 37 (18/12/6/1) Inti tengah : dari tekstil Ø 20 sampai 72 mm | Purse wire Moring dan running Rigging mooring | ++ |

S = kelenturan
+ = kurang atau rata - rata
++ = baik

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Tali baja galvanis : runnage, breaking strength

| 6 x 7 (6/1) | | |
|-------------|--------------|----------|
| diam. mm | kg/ 100 m | R kgf |
| 8 | 22.2 | 3 080 |
| 9 | 28.1 | 3 900 |
| 10 | 34.7 | 4 820 |
| 11 | 42.0 | 5 830 |
| 12 | 50.0 | 6 940 |
| 13 | 58.6 | 8 140 |
| 14 | 68.0 | 9 440 |
| 15 | 78.1 | 10 800 |
| 16 | 88.8 | 12 300 |

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| 6 x 19 (9/9/1) | | |
|----------------|--------------|----------|
| diam. mm | kg/ 100 m | R kgf |
| 16 | 92.6 | 12 300 |
| 17 | 105 | 13 900 |
| 18 | 117 | 15 500 |
| 19 | 131 | 17 300 |
| 20 | 145 | 19 200 |
| 21 | 160 | 21 200 |
| 22 | 175 | 23 200 |
| 23 | 191 | 25 400 |
| 24 | 208 | 27 600 |
| 25 | 226 | 30 000 |
| 26 | 245 | 32 400 |

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| 6 x 24 (15/9/fibre) | | |
|---------------------|-------------|----------|
| diam. mm | kg/ 100m | R kgf |
| 8 | 19.8 | 2 600 |
| 10 | 30.9 | 4 060 |
| 12 | 44.5 | 5 850 |
| 14 | 60.6 | 7 960 |
| 16 | 79.1 | 10 400 |
| 18 | 100 | 13 200 |
| 20 | 124 | 16 200 |
| 21 | 136 | 17900 |
| 22 | 150 | 19 700 |
| 24 | 178 | 23 400 |
| 26 | 209 | 27 500 |

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| 6 x 12(12/libre) | | |
|------------------|--------------|----------|
| diam mm | kg/ 100 m | R kgf |
| 6 | 9.9 | 1 100 |
| 8 | 15.6 | 1 940 |
| 9 | 19.7 | 2 450 |
| 10 | 24.3 | 3 020 |
| 12 | 35.0 | 4 350 |
| 14 | 47.7 | 5 930 |
| 16 | 62.3 | 7 740 |

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| 6 x 19(12/6/1) | | |
|----------------|--------------|----------|
| diam mm | kg/ 100 m | R kgf |
| 8 | 21.5 | 2 850 |
| 10 | 33.6 | 4 460 |
| 12 | 48.4 | 6 420 |
| 14 | 65.8 | 8 730 |
| 16 | 86.0 | 11 400 |
| 18 | 109 | 14 400 |
| 20 | 134 | 17 800 |
| 22 | 163 | 21 600 |
| 24 | 193 | 25 700 |

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| 6 x 37 (18/12/6/1) | | |
|--------------------|-------------|----------|
| diam mm | kg/ 100m | R kgf |
| 20 | 134 | 17 100 |
| 22 | 163 | 20 700 |
| 24 | 193 | 24 600 |
| 26 | 227 | 28 900 |

R = Daya tahan putus (baja 145 k gf/ mm²)

* Safe working load, lihat halaman 5.

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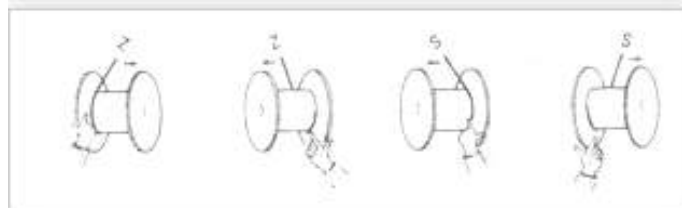
Penanganan tali baja

| NO | Yes |
|----|-----|
| | |
| | |
| | |
| | |
| | |

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Penggulungan ke gelondongan tergantung
pada arah pilinan tali



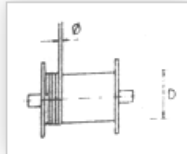
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Penyesuaian tali baja dengan drum dan sheaves

⊕ Drum:

Hubungan diameter drum (D) dengan diameter tali baja (\emptyset) yang digulung



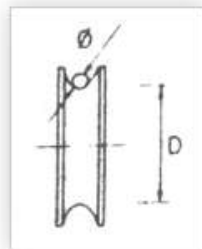
D/ \emptyset tergantung struktur tali baja dan situasi, D harus ber-kisar antara $20 \emptyset - 48 \emptyset$. Dalam praktek dikapal perikanan, tergantung pada luas tempat yang tersedia, biasanya : $0 = 14 \emptyset$ atau lebih

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Hubungan diameter sheave (1) dengan diameter tali baja (\emptyset) yang melwatinya

⊕ Sheaves:



D/ \emptyset tergantung struktur tali baja dan keadaan khusus, D ber-kisar antara $20 \emptyset - 48 \emptyset$. Dalam praktek di kapal perikanan, tergantung pada luas tempat yang tersedia, biasanya : $D = 9 \emptyset$ atau lebih

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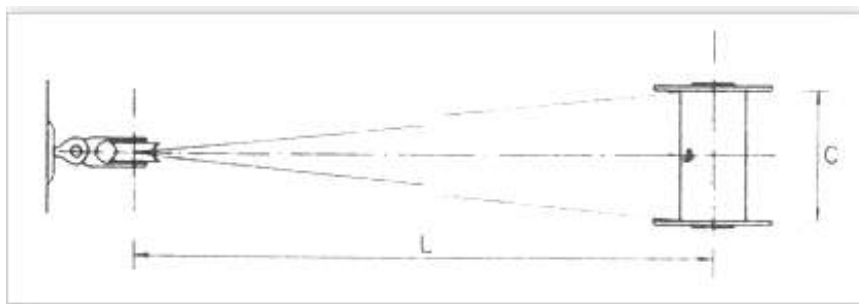
Lebar sheaves dibanding diameter tali baja



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Letak sheave terhadap drum



- ❖ Sudut maksimum tali baja antara tempat gantungan sheaves dan drum yang diputar otomatis atau manual
- ❖ Agar sheave bisa berputar dengan sudut yang bergantung, lebih baik menggantung block secara fleksibel dibanding dipasang menetap.

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Klem tali baja harus dipasang dengan baut
pada bagian tali baja yang tengah



<http://www.fao.org/docrep/010/ah827o/ah827id03.htm>

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Wire ropes are made from steel wires of plain carbon steel having high tensile strength.

Typical analysis of steel is as follows (by weight percentage):

Carbon – 0.5

Silicon – 0.11

Manganese – 0.48

Sulphur – 0.033

Phosphorous – 0.014 and

Iron – rest

According to I.S. Specification no. 1835 of 1961, neither sulphur nor phosphorous content in the steel for wire rope should exceed 0.080 %.

Ultimate tensile strength (breaking strength) of the wires used for haulage/winding ropes is generally between 140 – 170 kgf/mm² (160 kgf/mm² = 1570 MN/m²).

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Ropes of stainless steel are not used as the material has less tensile strength.

If the wire rope is to be used in a wet shaft, the wires are galvanized, i.e. coated with molten zinc.

The wire is subjected to the following tests carried out according to the standards provided by I.S. specifications:

1. Tensile test
2. Torsion test
3. Bending test
4. Wrapping test
5. Looping test

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Types and construction of wire ropes:

On the basis of use, wire ropes are classified as:

➤ Standing Ropes

Required to carry the burden or load but are more or less stationary. i. e. guide ropes, track ropes etc.

➤ Running Ropes:

Undergo frequent movement, running or coiling often with varying loads and are flexible e. g. ropes used for winding, haulage coal cutting machine etc.

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On the basis of construction, wire ropes are classified as:

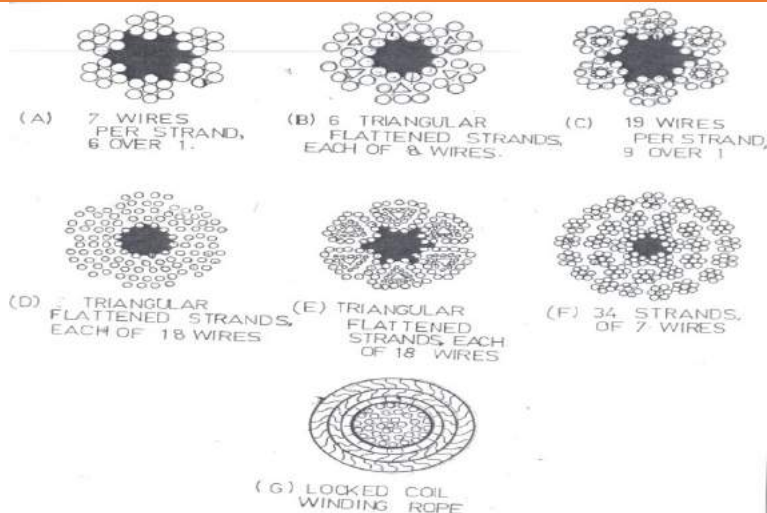
➤ *Stranded ropes:*

are made of strands and each strand consists of number of concentrically twisted wires laid in the form of helix round a central steel wire.

➤ *Non-stranded ropes:*

They include locked coil ropes.

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Cross-section of different wire ropes

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The **flexibility of a strand** depends upon:

1. **Type of core**- a strand with a flexible core is more flexible than one with steel core at the centre.
2. **Thickness of individual wires** – Thinner the wires, more is the flexibility.
and
3. **Number of wires**- Larger the number of wires, more is the flexibility.

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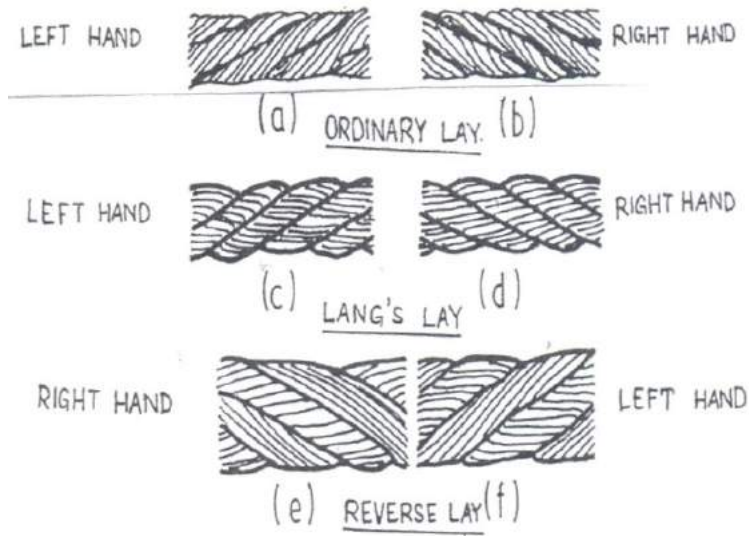
Lay of wire rope:

The lay of a wire rope describes the manner in which either the wires in a strand, or the strands in the rope, are laid in a helix.

Left and right hand lay:

- Left hand lay or right hand lay describe the manner in which the strands are laid to form the rope.

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Different lays of stranded rope

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| | |
|----------------------|--|
| Ordinary lay | The lay of wires in each strand is in the opposite direction to the lay of the strands that form the rope. |
| Lang's lay | The lay of wires in each strand is in the same direction as the lay of the strands that form the rope. |
| Alternate lay | Strands alternate between Lang's lay and ordinary lay; e.g.: in a 6-strand wire, 3 strands are ordinary lay, and 3 are Lang's lay. |
| Regular lay | Alternate term for ordinary lay. |
| Reverse lay | Alternate term for alternate lay. |

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The **specification of a wire rope type** – including the number of wires per strand, the number of strands, and the lay of the rope – is documented using a commonly accepted coding system, consisting of a number of abbreviations.

The rope **6x19 FC RH OL FSWR** [where 6- Number of strands that make up the rope, 19 - Number of wires that make up each strand, FC- Fibre core, RH OL FSWR - Right hand Ordinary lay Flexible steel wire rope].







Warrington differs from the other types (Filler Wire and Seale construction) in that the outside layer of wires in each strand of the wire rope is composed of wires alternately large and small. The outside wires of both the Filler Wire and Seale construction ropes are uniform in size.

The fundamental difference between these types is that the layer of wires underneath the outside layer in the Seale type is made up of wires all of the same size. The wires under the outside layer of the Filler Wire rope are made up of a combination of main wires, each of the same size, and smaller filler wires, each of the same size, nested between the main wires. The outside layer of wires, therefore, is supported partly by the main inside wires and partly by the filler wires.

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Some ropes have shaped or formed (triangular) wires to improve the wear and bearing properties of the outer layers (rather than circular drawn wire).

By having different lay directions of the strands and wire (left and right - also known as S and Z); it is possible to balance the torque value - resulting in a rope that does not tend to untwist when load is applied. This is called torque balanced or non-rotating rope.

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Flat Rope:

These are used for winding and are made with a flat construction. It consists of a number of small ropes or strands laid side by side and laced or stitched together with soft iron wire. The individual wires are laid up in opposite direction so that those of adjoining ropes test closely together. For use with the flat rope, a special winder, known as the reel winder is designed. This is arranged so that the flat rope winds upon itself in concentric layers which are retained all the sides by radial arms or by side plates on the reel. By mounting two reels upon the common shaft, a partly balanced system of winding could be arranged. The effect is similar to that of a conical drum with which the cage at greater depth i.e. the greater suspended load (including rope) is at smaller diameter. The development of circular stranded ropes, which are cheaper to manufacturer, more reliable in use and easier to operate cause them to supersede the flat rope and lead to the development of reel winders by drum

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Advantages:

1. Compared to the round stranded ropes, they are more flexible.
2. They have been preferred as balancing ropes on the koepe system of winding.

Disadvantages:

1. Wear in the rope lacing or stitching which holds the individual rope section together causes difficulty in operating flat ropes while repairs are slow and expensive.
2. Their life is much shorter compared to the round stranded ropes.

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Round Wire Rope:

The most important attribute for a winding rope is the ability to withstand, without permanent deformation, repeated bending under stress such as when the rope is wound over the head sheave or on the drum.

This requires a construction which is flexible, which the constituent members are restrained in their respective positions. A construction using wires laid evenly in a helix about a central core has these properties and is able to yield under stress, returning to its original form when the load is removed.

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Advantages:

1. Ability to withstand without permanent deformation repeated bending under stress.
2. Flexible
3. It returns to its original form when the load is removed.

Disadvantages:

1. Compared to the flat rope they are less flexible.
2. Compared to the flat rope they have less strength.

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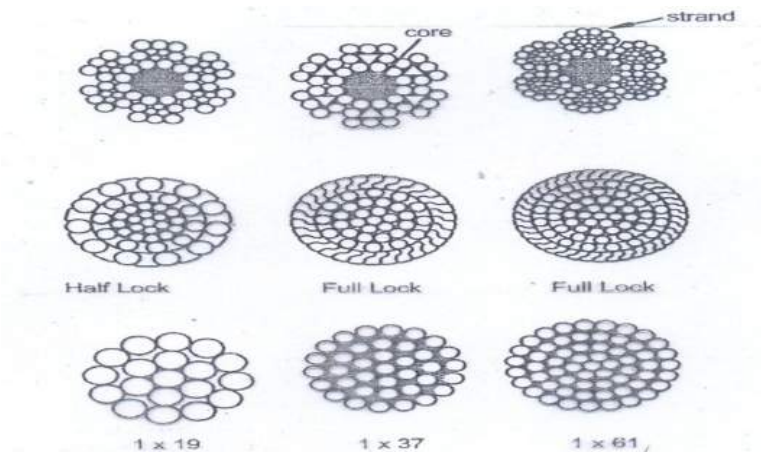
Locked Coil Rope:

They differ from standard ropes in construction and are made by spinning concentric layers of single wire around a core and finishing with one or more surrounding layer of shaped wires which are inter locked to restrain, the centre layers and to make a smooth cover.

Each layer of wires is spun in a helix about the centre core. Depending upon the design one or more of the inner layers are made up of alternate round and shaped or half locked wires

The outer layers of fully inter locked wires is laid on in the opposite directions to the inner layers with the result that the rope is almost non-spinning. The cross section of the locked coil rope shows that the central portion consists of strands of thick round wires only the outer layer (or two layers) consists of round wires placed between specially shaped wires of I section, rail section or trapezoidal so that the wires lock with one another and the rope surfaces is smooth and plain as compared to stranded ropes.

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Cross-section of different wire ropes

(First row: Flattened strand rope, Middle row: Locked coil rope and Bottom row: Spiral strands)

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Advantages:

1. It has a major advantage in sinking shafts where guide ropes are not available.
2. For winding and hoisting purposes a locked coil rope is sometimes preferred.
3. It has capacity factor which permits a high factor of safety.
4. Their smooth exterior causes less abrasion and wear of the surface in contact. Hence it gives more durability.
5. It has more space factor (75%). Hence greater strength.
6. It has more tendencies to twist or rotate. It reduces wear on the cage guide.
7. They are greater strength than the round rope because the wires are more completely arranged.
8. They are greater resistance to crushing.
9. They have fewer tendencies to twist and stretch in working.

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Disadvantages:

1. Construction is somewhat difficult.
2. Its interior cannot be lubricated from outside.
3. It is not so flexible.
4. It is somewhat difficult to cap as compared to the standard ropes.
5. They do not stretch as much as the standard ropes and their smooth exterior cause less abrasion and wear of the surface in contact.
6. They are not preferred for koepe winders because of smooth surface and low coefficient of friction.

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Precautions:

1. Avoid use of the rope with fiber core, when the rope is subjected to heat flames and extreme pressure.
2. Buy right construction of rope suitable for the job.
3. Corrosion can be delayed by using galvanized rope.
4. Do not load the rope beyond its safe working load.
5. Ensure that the rope is strongly seized before it is cut.
6. Flexibility of rope should be suitable to the size of the drums and pulleys and diameter of the rope grooves.
7. Grease the rope and cover properly before storing in a dry ventilated shed.
8. Handle the rope carefully while transporting and uncoiling to avoid kinks.
9. Inspect the rope periodically and lubricate with acid free lubricant.
10. Judge the safe life of the rope for the conditions under which it has to work and replace it in proper time.

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Selection of wire ropes:

A wire rope is to be selected on the following considerations:

1. **Watery place and corrosive atmosphere** - to prevent rusting and effect of corrosive fumes, a galvanized wire rope should be used in such places.
2. **High temperature** – ropes with fibre core should be avoided and in such places steel core should be used i.e. in foundries, steel melting shops, etc.
3. **Stationary or running /coiling rope** – stationary ropes can be of larger diameter rods or strands e.g. guide ropes in a shaft. Running or coiling ropes requires flexibility and smaller the drum/ pulley, more is the flexibility required.

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4. **Spinning or rotating quality** – in a crane rope, one end is free to rotate and a non-spinning rope or one with ordinary lay should be used. In a sinking shaft, the sinking bucket is not travelling on guides and therefore non-spinning rope of locked coil construction or a rope with ordinary lay should be used.
5. **Shock loads** – when the rope has to withstand shock loads, a rope with steel core should be used e.g. coal cutting machine rope.
6. **Resistance to wear**- Ropes for haulages and winders have to be flexible and resistance to abrasive wear. Such ropes should be of Lang's lay construction as they offer more wearing surface.
7. **Tensile strength and factor of safety** – ropes used for winding of men should have high tensile strength and high FOS than those used for winding of materials only. Ropes of Lang's lay construction stretches under load more than the rope of regular lay construction.

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8. **Bending fatigue**- Bending fatigue of a wire rope over sheaves or drums causes fatigue failure of the wires. The rope should be flexible which is possible in a rope having large number of smaller wires.
9. **Groove size** – the rope should not be loose or too tight in the groove of the pulley or drum.
10. **Crushing and distortion** – a flattened strand rope and locked coil rope is better able to withstand crushing than a round strand rope. The core should be of steel wire.

Once the construction lay and other characteristics of the rope are decided upon, one has to decide its size after calculating the stresses that the rope may have to withstand.

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Ropes used for different purposes:

1. Winding ropes:

- 6 x 7 Lang lay FC
- 6 x 19 Seale regular or Lang lay FC
- 6 x 21 Filler wire regular or Lang lay FC
- 6 x 25 Filler wire regular or Lang lay FC
- 6 x 27 Flattened strand Lang lay FC
- 6 x 30 Flattened strand Lang lay FC
- Locked coil hoist rope

2. Guide ropes:

- 3. Half locked coil guide rope

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3. Winding rope for shaft sinking:

- 19 x 7 Non-rotating Regular lay or locked coil hoist rope.

4. Haulage ropes:

- 6 x 7 and 6 x 19 Seale construction in either Regular or Langs lay FC, depending upon operating conditions.

5. Coal cutting machine ropes:

- 6 x 37 Regular lay with IWRC or 6 x 31 Regular lay with IWRC

6. Dipper shovel ropes:

•Dipper hoist ropes:

- For 32 mm and smaller size, 6 x 25 Filler Lang lay with IWRC
- For 35 mm to 68 mm size, 6 x 41 Seale Filler Lang lay with IWRC

•Crowd and Retract ropes:

- For 58 mm and smaller size, 6 x 41 Seale Filler Lang lay with IWRC

•Boom Hoist ropes:

- For 30 mm size, 6 x 25 Filler wire Lang lay with IWRC

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7. Dragline Hoist ropes:

For 32 mm to 58 mm size, 6 x 25 Filler wire Lang lay with IWRC or 6 x 41 Seale Filler Lang lay with IWRC

8. Dozers:

6 x 25 Filler wire Regular lay with IWRC (Blade hoist ropes)

9. Guy Ropes (ship masts- stability):

Galvanised strand 1 x 7, 1x 19, 1 x 37 etc or 7 x 7 or 7 x 19

10. Aerial ropeways:

• **Bi-cable ropeway:**

Track cable: Locked coil (Full or Half lock)

Traction ropes: 22 mm and larger, 6 x 19 seale Lang Lay FC or 6 x 25 Filler wire Lang lay with IWRC

• **Monocable ropeway:**

6 x 7 Lang lay FC

6 x 21 Filler wire Lang lay FC

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11. Mobile Cranes:

• **Main Hoist rope:**

6 x 25 Filler wire Regular lay with FC (use IWRC ropes to take care of crushing of the rope on the drum)

• **Boom hoist rope:**

6 x 25 Filler wire Regular lay with IWRC

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Mass and strength of wire ropes:

The mass of a rope depends upon the quantity of steel in it i.e. the space factor and the design of the rope.

$$\text{Mass of rope (kg/m length)} = kd^2$$

Where k is a constant depending on rope design and d is diameter of rope in cm

$$\text{Strength (Breaking strength) (KN)} = sd^2$$

Where k is a constant depending on rope design and quality of steel and d is diameter of rope in cm

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| Type of rope | k | s |
|----------------------------------|------|----|
| Round strand with fibre core | 0.35 | 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 |

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Socketing or Capping a rope end:

The end of a rope where the load is to be attached should be a good portion of the rope, free from worn, rusted, bent or broken wires and free from the effects of bending and corrosion.

The simplest and easiest way to make the rope end suitable for attachment of load is to use a grooved thimble and bend back the rope end on it and part of the rope before finally tightening 4-6 rope clips at intervals on it. It needs less skill and such attachment is permissible for haulage and skip hauling on inclined planes but not permitted for winding ropes. Rope length under clips is nearly 30 times the rope diameter.

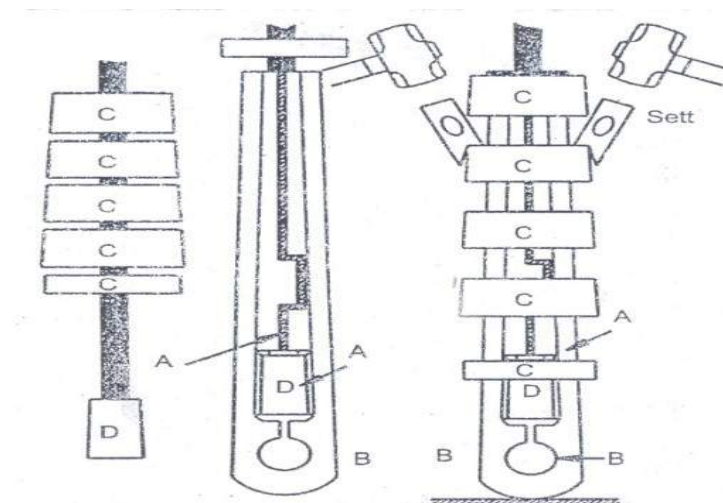
There are different ways of attaching capels or sockets

1. Split capel with rivets
2. Coned socket type capel
3. Interlocking wedge type capel (Reliance capel)

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Interlocking wedge type capel (Reliance capel)



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