WIRE AND WIRE ROPES

OBJECTIVES

After reading this chapter, you should be able to:

- identify and explain the different types of wire ropes, their uses, and how they are constructed and preserved;
- identify and use properly the different wire rope fittings; and
- measure correctly the diameter of a wire rope and calculate the strength and the safe working load of the different sizes of wire ropes.

6.1 WIRE ROPES

Wire ropes used for marine purposes usually consist of six strands laid up around a central heart of fiber or about a seventh wire strand. Each strand is made up of several wires twisted around a central fiber core or around a single center wire, the number of wires of the rope depends also on the purpose for which it is required. Increasing the number of wires to the strand for the same size of rope gives greater strength and flexibility.

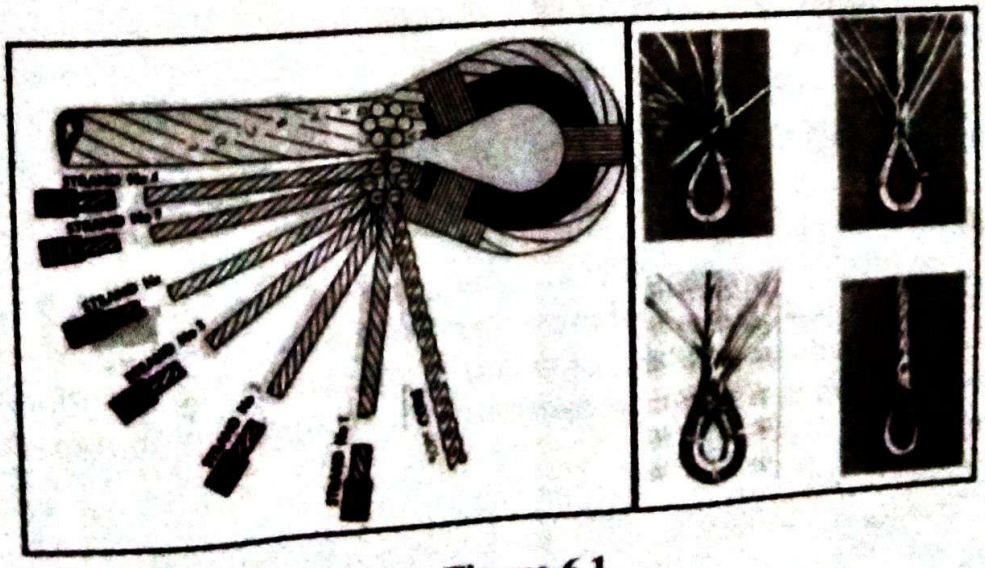

Figure 6.1

Wire ropes are referred to by two numbers, the first indicates the number of strands, including strands which maybe used for the central heart, and the second indicates the number of wires to the strand

6.2 TYPES OF LAY

1. Ordinary Lay

The wires are twisted in the opposite direction to the strands. Right-hand rope is normally used in which the wires are twisted left-handed in the strands re-twisted right-handed.

2. Lang's Lay

The direction of twist of the wires is the same as the direction of the strands. This lay provides a greater wearing surface but should only be used when both ends of the rope and the load are secured against rotation. It is not likely to be used for marine purposes.

3. Performed Rope

Each strand of this type of rope is performed into a helix so that it will be easier to handle and less likely to kink.

4. Spring Lay

This is a combined rope consisting of three galvanized wire strands and three fiber strands laid up around a central fiber core. The rope is cable laid, each main strand being made up of three-fiber strands and three 19-wires strands over a fiber strand core. Spring lay rope is four times stronger than fiber ropes and 50% stronger than nylon. It is much easier to handle than ordinary wire rope and is very suitable for mooring ropes and for preventers for derrick rigs.

6.3 APPLICATION

Standing Rigging

Wire ropes used for stays, shrouds, and preventers have a steel core to give extra strength. flexibility is not important. British Standard Publication 365 recommends *7 x 7* construction for wires up to 28 mm. In diameter, *7 x 19* for 32 to 48 mm, and *7 x 37* for over 52-mm rope.

Cargo Lashing

6 x 12 ropes are recommended for sizes 8 to 16 mm and *6 x 24* construction for larger sizes.

Cargo Handlings

6 x 24 construction is usually used but *6 x 19* ropes are also suitable for ropes up to 24 mm.

Mooring Ropes

Wire ropes *6 x 37* construction are recommended for general used but for powered winches, *6 x 36* ropes with a wire core should be used for sizes up to 40 mm and *6 x 41* for sizes 44 to 60 mm.

6.4 HANDLING A WIRE ROPE

1. When uncoiling a wire rope, it is important that no kinks are allowed to form as a kink is made, no amount of strain can take it out and the rope becomes unsafe to work. If possible, a turn-table should be employed (an old cart wheel mounted on a spindle makes an excellent one) with this the rope will then lead off perfectly straight without kinks.

2. If a turn-table is not available, the rope maybe rolled along the ground

3. In no case must the rope be laid in the ground and the end taken over or kinks will result and the rope will be completely spoiled.

4. The life of a wire rope depends principally upon the diameter of drums, sheaves, and pulleys, and too much importance cannot be given to the size of the latter. Wherever possible, the diameter of the sheave should not be less than 20 times the diameter of the the wire rope. The diameter of drums, sheaves, and pulleys should increase with the working load when the factor of safety is less than 5 is to 1.

5. The load should not be lifted with a jerk as the strain may become equal to three or four times the proper load, and a sound rope may easily be broken.

6. Examine ropes frequently, a new rope is cheaper than the risk of killing or maiming employees.

7. One-sixth of the ultimate strength of the rope should be considered a fair working load.

8. To increase the amount of work done, it is better to increase the working load than the speed of the rope. Experience has shown that the wear of the rope increases with the speed of the rope.

9. Wire rope should be greased when running or idle. Rust destroys as effectively as hard work.

10. Great care should be taken that the grooves of drums in sheaves are perfectly smooth, ample in diameter and conform to the surface of the rope. They should also be in perfect line with the rope so that the latter may not chafe on the sides of the grooves.

6.5 WIRE SPLICING

The Docks Regulations of the Factories Act requires that a thimble or eye splice should have at least three tucks with the whole strand of the rope and two with half the wires cut out of each strand. The strands must be tucked against the lay of the rope. The "Liverpool Splice" is relatively quick and easy as after the first tuck, each end is passed with the lay around the same strand, four or five times but such a splice should never be used if the end of the rope is free to rotate. If the splice is made with the lay, rotation will cause the tucks to draw and the splice to pull out.

A long tapering steel marline-spike is required. After placing it under a strand, do not withdraw it until the tuck is made and all the slack of the strand drawn through. Wire splices should be parceled with oily canvas and served with Hasbro' line.

6.6 SPLICING THIMBLES UNDER AND OVER STYLE

Ordinary type of wire rope serve the rope with wire or tarred yarn to suit the circumference of the thimble. Bend around thimble and tie securely in place with temporary lashing until splice is finished. Open out the strand taking care to keep the loose end of the rope to the left hand. Now insert markline-spike, lifting two strands and tuck away towards the right hand (that is inserting at the point and over the spikes) strand no. 1 pulling the strand well home. Next, insert markline-spike through next strand to the left only lifting one strand, the point of the spike coming out at the same place as before. Tuck away strand no. 2 as before.

The next tuck is the locking tuck. Insert markline-spike in next strand and missing no. 3, tuck away strand no. 4 from the point of the spike towards the right hand. Now, without taking out the spike, tuck away strand no. 3 behind the spike towards the left hand. Now insert spike in next strand and tuck away strand no. 5 behind over the spike no. 6. Likewise, pull all the loose strands well down.

This completes the first series of tucks and splice will, if made properly, be starting with strand no. 1 and taking each strand in rotation, tuck away under one strand and over the next strand until all the strands have been tucked three times. The strands should at this point be split, half of the wires being tucked away as before and the other half cut close to the splice shows the finished splice ready for serving over.

It will be noticed that this style of splice possesses a plaited appearance and the more strain applied to the rope, the tighter the splice will grip and there is no fear of the splice drawing, owing to the rotation of the rope.

The illustrations of the first series of tucks for the "Five-Tuck Splice" or "Boulevant Splice" are reproduced with permission of British Ropes Limited from their publication "Terminal Splicing of Wire Ropes." Subsequent tucks are made against the lay under one strand and over the next as in the previous case.

6.7 STRENGTH OF WIRE ROPE

The breaking stress of flexible steel wire rope in tonnes is given, approximately, by the following formulas:

$6 \times 12, \frac{15D^2}{500}$ tonnes

$6 \times 24, \frac{20D^2}{500}$ tonnes

$6 \times 37, \frac{21D^2}{500}$ tonnes

D is the diameter of the rope in millimeters.

The safe working load may be taken as one-sixth of the breaking stress.