THE BASIC TYPES OF WIRE USED IN ROPES

BRIGHT WIRE  Most wire ropes are made with uncoated (bright) high-carbon steel wires. The chemistries of the steel and the wire drawing practices are varied to supply the ultimate combination of tensile strength, fatigue resistance, and wear resistance in the finished wire rope.

GALVANIZED WIRE is often used to improve corrosion resistance of wire ropes. The following two types are used:

Galvanized-to-finished size wire starts as a smaller diameter bright wire and is then coated with a zinc layer that increases the diameter to the designed finished size.

Galvanized-to-finished wires are 10% lower in strength than the same size and grade bright wire. Therefore, ropes made with these wires have minimum breaking forces that are 10% lower in strength when compared to their bright version.

Drawn galvanized wire is bright wire galvanized just prior to it being drawn down to its final finished diameter. This leaves a much thinner zinc coating than is on galvanized-to-finished wires. Drawn galvanized wires are equal in strength to the same size and grade of bright wire. Therefore, ropes made with these wires have minimum breaking forces that are equal to their bright versions.

GALFAN WIRE  The most rapidly growing hot-dip coating for steel wire is made with the Galfan process. The process requires 95% zinc and 5% aluminum coating be applied to the wire. Basic Galfan coated carbon steel wire is addressed in ASTM A856 and EN 10244.

Combining the passive corrosion inhibition of aluminum oxidation with the active and passive effects of zinc results in approximately three times the amount of corrosion protection compared to standard zinc coated wires. The coating also provides an anodic feature that heals over the exposed steel when the wire is abraded or scratched.

STAINLESS STEEL WIRE  This is a special alloy containing approximately 18% chromium and 8% nickel. It has high resistance to many corrosive conditions and is used extensively in yachting ropes and control cables.

WIRE ROPE GRADES

The most common strength grades of wire rope are Extra Improved Plow Steel (XIP®) and 1960 grade. For many applications these are the grades supplied. XIP grade wire ropes have approximately 15% higher minimum breaking forces over the same ropes made with the former standard of Improved Plow Steel (IPS).

The next step up in strength grades includes Extra Extra Improved Plow Steel (XXIP®) and 2160 grade. The minimum breaking forces of XXIP grade wire ropes are approximately 10% higher than their XIP grade versions.

The minimum breaking force values associated with IPS, XIP, XXIP, and XXXIP are typically expressed in pounds (lbs) and/or short tons of 2,000 lbs.

The 1570, 1770, 1960, and 2160 values in the ISO grades indicate the number of newton force units required for each square millimeter of area of cross-sectional metal in a rope to make up its minimum breaking force. The associated minimum breaking force values are typically expressed in kilonewtons (kN) or metric tons of 2,204 lbs.
The first two meanings of “lay” are descriptive of the wire and strand positions in the rope. The third meaning is a length measurement used in manufacturing and inspection.

1. The direction strands lay in the rope – right or left. When you look down a rope, strands of a right lay rope go away from you to the right. Left lay is the opposite. (It doesn’t matter which direction you look.)

2. The relationship between the direction strands lay in the rope and the direction wires lay in the strands. In appearance, wires in regular lay appear to run straight down the length of the rope, and in lang lay, they appear to angle across the rope. In regular lay, wires are laid in the strand opposite the direction the strands lay in the rope. In lang lay, the wires are laid the same direction in the strand as the strands lay in the rope.

3. The length along the rope that a strand makes one complete spiral around the rope core. This is a measurement frequently used in wire rope inspection. Standards and regulations require removal when a certain number of broken wires per rope lay are found.

**THE LAY OF A ROPE AFFECTS ITS OPERATIONAL PROPERTIES**

Regular lay is more stable and more resistant to crushing than lang lay, while lang lay is more fatigue resistant and abrasion resistant. For standard non-rotation-resistant ropes, lang lay use is normally limited to single layer spooling and when the rope and load are restrained from rotation.