# Types of wire, lay and preforming affect wire rope performance and operation

**PREFORMING PRESHAPES STRANDS BEFORE THE ROPE IS CLOSED.**

> Preforming helically shapes the wires and strands into the shape they will assume in the finished rope. It improves handling and resistance to kinking by conforming the strands to the position they take in the rope.

> The superior qualities of preformed ropes result from wires and strands being "at rest" in the rope, which minimizes internal stresses within the rope. Today, preforming is virtually standard in most standard ropes, but specialty ropes may be non-preformed.

## THE BASIC TYPES OF WIRE USED IN ROPES

**BRIGHT WIRE** Most ropes are made with uncoated (bright) wire that is manufactured from high-carbon steel. The chemistry of the steel used and the practice employed in drawing the wire are varied to supply the ultimate combination of tensile strength, fatigue resistance and wear resistance in the finished rope.

**GALVANIZED WIRE** This is often used to improve corrosion resistance of wire ropes. We use the following two different procedures to manufacture galvanized wire:

**Galvanized to finished size wire** is first drawn as a bright wire to a predetermined size that's smaller than the required finished wire size. This wire is then run through the galvanizing line, and the resultant coating of zinc increases the wire diameter to the finished size. Galvanized to finished size wire has a strength 10% lower than the same size and type of bright wire. Ropes made from this wire therefore have a minimum breaking force that's 10% lower than the equivalent size and grade of bright rope.

**Drawn galvanized wire** is galvanized before the final drawing to finish size. Since the galvanized coating also goes through the drawing process, it is much thinner than the coating on galvanized to finished size wire. Drawn galvanized wires are equal in strength to the same size and type of bright wire and drawn galvanized rope is equal in strength to the same size and grade of bright rope.

**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 grade of rope today is called **Extra Improved Plow Steel Grade (XIP®)**. For most ropes, this will be the grade supplied. XIP ropes have a 15% higher minimum breaking force than most Improved Plow Steel Grade (IPS), the former standard strength.

Other grades of wire rope are also available, including **Extra Extra Improved Plow Steel Grade (XXIP®)**. Many equipment designers are specifying XXIP grade wire rope for the operating ropes on modern higher-rated equipment. They're taking advantage of its higher minimum breaking force to help reduce total system weight. New machines can be designed with higher ratings using smaller diameter rope due to XXIP's higher strength. Minimum breaking force of XXIP grade wire rope is 10% higher than XIP grade. Ropes are available in all three grades – Improved Plow Steel (IPS), Extra Improved Plow Steel (XIP) and Extra Extra Improved Plow Steel (XXIP).

# “Lay” has three meanings in rope design

> Right lay – Regular lay

> Left lay – Regular lay

> Right lay – Lang lay

> Left lay – Lang lay

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 CHARACTERISTICS

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