

HOW IS PC STRAND MADE?

PC Strand, or prestressed concrete steel strand, is a twisted steel cable composed of high strength steel wires that are stress-relieved (stabilized) for use in producing prestressed concrete. While there are different types of PC Strand including Bare Strand, Stainless Steel Strand, Epoxy Coated Strand and Carbon Fiber Strand, here we will focus on the most common - Bare Steel Strand.

The raw material used is 1080 Carbon Wire Rod. It is a hot-rolled, coiled bar product with alloys to achieve desired tensile and ductility properties. Typically, the rods used to make PC Strand are between 3/8" – 1/2" in diameter and are 1.6 NT – 2.8 NT in weight.

Once the raw material has been procured, the production process can begin. The first step in the process is wire rod descaling and precoating. The rod has mill scale (iron oxides) present on its surface that needs to be removed either mechanically or chemically before



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The rod is descaled on the pickling line.

production. Pickling, which is a chemical method of descaling, is a process where the rod is given an acid bath and the chemical reaction pops the mill scale off. After the rod has been pickled it is coated in a textured carrier coating that promotes lubrication adherence during the upcoming wire drawing process.

PC Strand is available in several diameters, so the next step in the process is to draw the individual wires to the desired diameter by drawing the wire rod through a series of 8 or 9 progressive carbide dies. This is a cold working process, so much care must be given to avoid premature die wear and damage to the steel. During this process the wire

rod cross-sectional area is reduced by approximately 85%. The tensile strength of the wire rod when it is received is normally about 172 ksi. Through this wire drawing process, the steel is work hardened to the desired tensile strength of >270 ksi. The diameter of the wire is tightly controlled to maintain very tight tolerances.

Once seven spools of wire have been drawn to the desired diameters they are loaded into the stranding machine. There are six outer wires and one single wire which has a slightly larger diameter per ASTM 416. The stranding machine pulls wires off the spools while maintaining a specified rate of wrapping. The wrapping rate controls the lay of the strand to comply with ASTM 416.



Progressive carbide dies.

After the wires have been stranded, the strand is subjected to high heat while under tension which relieves the residual wire drawing stresses, permanently elongating the strand, increasing the yield

strength and reducing relaxation losses. The combination of these steps gives the strand a very consistent modulus of elasticity up to and exceeding 80% of the strand's ultimate strength. Finally, the strand is put in a water bath to freeze the steel in the permanently elongated state and to rinse any residual drawing lubricant from its surface.

At this point the strand appears as seen in the field but it is in an unmanageable master coil of 20 – 27 net tons. It is now rewound into the desired packing size, typically 3.0 to 3.5 net tons. Samples will be cut for testing, the material will be banded and packaged for shipping.

The samples which were cut in the last step are sent to the lab for testing for compliance to ASTM 416. These tests include Ultimate Tensile Strength, Total Elongation, Yield Point at 1% Extension Under Load, Strand Diameter, Minimum Diameter Difference between the center wire and outer wire, Strand Lay and Strand Area and Modulus of Elasticity.

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Master coil of PC Strand.