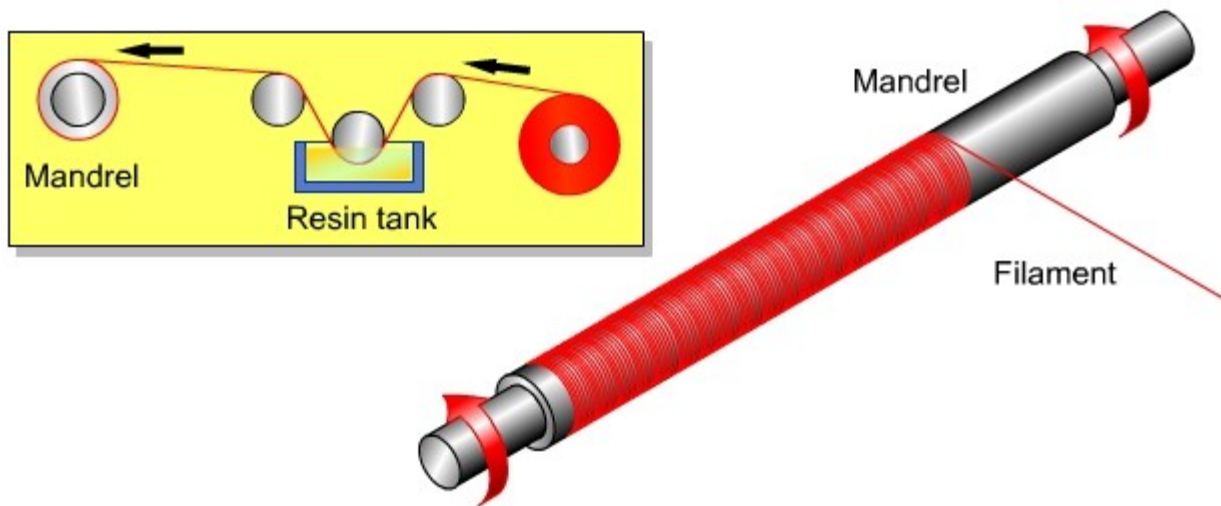


Filament Winding

Filament winding is a process used to make hollow polymer composites products.

The filament winding process involves pulling a polymer fibre from a reel, passing it through a resin bath in order to soak the fibre in resin, and then winding the fibre onto a shaft called a mandrel. In industry, filament winding is computer controlled so that the fibre filament is positioned precisely on the rotating mandrel. Often, two or more fibre strands are wound onto the mandrel at the same time, with each fibre hoop lying precisely next to the other.



Mandrels may be parallel cylindrical, tapered, bulbous or complex forms. Removal of the mandrel from complex forms may require destruction of the mandrel.

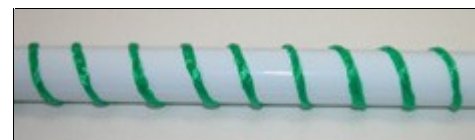
There are three main fibre winding patterns used:

Hoop pattern, where the winding angle is just below 90 degrees. This method lays each hoop of fibre precisely next to the previous hoop (See photo of the fishing rod above)



The tubes for this fishing rod were made by winding carbon fibres impregnated with resin onto a mandrel.

Helical pattern, where gaps are left between the hoops and complete coverage of the mandrel requires several layers of windings, going back and forth along the mandrel (See the illustration opposite)



Filament winding, helical pattern

Polar method, where the winding method produces domed ends or spherical forms. (Similar to the ball of string opposite)



Filament winding, polar method

Typical applications for filament wound structures include tubes, storage tanks, fishing rods and other hollow vessels such as yacht hulls.