FRP Composite Cooling Sleeves Keep Electric Motors from "Burning Out"

**Product:** Precision high temperature filament wound FRP composite tubes for use as internal cooling sleeves for high horsepower electric motors. Sleeves are 11.874" i.d., 11.974" o.d., by 37" long.

**Customer:** Leading manufacturer of large size electric motors.

**Application:** Internal coolant sleeves for large horsepower (300 to 400 Hp) electric motors. These motors are typically used to power equipment in pulp and paper plants. The FRP composite tubes (sleeves) must be suitable for 100 psi internal pressure, at design temperatures up to 430°F.

**Background:** Because of the motor operating temperatures this customer had first attempted to use exotic metals for this application. However, because of the magnetic fields generated within the motor, stainless steel and other metals failed, causing complete motor failures.

The customer searched world-wide for a composites manufacturer who could, or would, take on this project. They found no one able to provide these tubes in FRP composites. That is, until they contacted Industrial Fiberglass - who accepted the challenge.

**Type of Tube Construction:** These sleeves were made by filament winding, using a proprietary premium grade high temperature phenol novolac epoxy resin. This epoxy resin was reacted using a special blend of unique epoxy curing agents. The end results were finished FRP composite tubes that have a 430°F heat distortion temperature.

**Special Product Requirements - and the Challenges:** The epoxy resin system selected is "solid" at the normal winding temperatures. We had to develop special heating systems to convert the epoxy to a liquid resin, so that it could be filament wound.
Besides being able to handle the high motor temperatures, the FRP composite motor sleeves had to be produced to extremely close dimensional tolerances. These tolerances were required so that the customer could use O-Ring seals on the inside and outside of the coolant sleeves. It was important that cooling liquid not leak into the windings of the electric motor - causing motor failure. The required tolerance on the inside tube diameter was just 0.002".

To maintain this minuscule tolerance, we had to first, through making and testing trial samples, determine the amount the finished tubes would "grow" during the winding and curing cycles. Then a special precise diameter, close-tolerance mandrel was made to wind these FRP composite coolant sleeves.

The finished outside diameter of the coolant sleeves also had to be held to the same 0.002" tolerance. This was accomplished by high precision post fabrication machining of the tube o.d. To compare how difficult these specified tolerances were - the hair on your head has a typical thickness of approximately 0.010". Thus, the thickness of a single strand of hair is over five times greater than the tolerances we were allowed for the inside and outside diameters of these large FRP composite coolant sleeves. Talk about "splitting hairs"!

Since the coolant sleeves are to be "captured" in end bell grooves on each end of the motor, we also had to hold the finished 33" tube lengths to a tolerance of just 0.010". Again, this is the same as the thickness of a "hair".

Customer Benefits: We were able to "partner" with this OEM customer, providing a development product that will allow them to expand their range of large horsepower motors. The entire R&D project was carried out under our Engineering & Manufacturing Service Contract (EMSC) - saving the customer significant dollars. The end result provided this customer light weight, high pressure, corrosion resistant, and high temperature electric motor coolant sleeves.

Opportunities for Your Customers: Which of your customers or clients might be able to benefit from Industrial Fiberglass' unique abilities to provide leading-edge FRP composite technology and materials; while maintaining almost unheard of dimensional controls and tolerances?