



Unique Design and Processing Creates Encapsulated Stator for Remote Operated Vehicle

Deliverables:

- 10,000 psi capable hermetic package
- Injection molding system able to encapsulate a 60 pound insert with 17 pounds of thermoplastic
- Creation of a thermally conductive yet electrically insulative material meeting the physical and processing requirements
- Extremely high yield rates
- Program execution in under one year

The new Quest remote operated vehicle (ROV) from Alstom GEC was designed for advanced deep sea oil and gas exploration that requires it to withstand pressures of 10,000 psi at depths up to 20,000 feet below sea level. Since hydraulic thrusters are traditionally limited to depths of 5,000 feet, Alstom replaced the thrusters with Brushless DC (BLDC) electric motors. Alstom then turned to Encap Technologies to determine how to create an electric motor that could withstand such intense pressure - pressure equivalent to a five ton tractor trailer sitting on the end of a postage stamp.

Encap faced several challenges in designing and developing a hermetic motor package. Firstly, the **21 inch diameter motor stator** posed a unique design and manufacturing challenge. A part this large had never been encapsulated, requiring specialized tooling, equipment and handling. In addition, the 60 pound stator generates 12,500 watts of peak power, requiring an encapsulation material with the strength to withstand the pressure while dissipating heat from such a high powered motor.

To address the unique molding challenges of a part this size, Encap developed a tool with a specialized retracting pin system. With each wound stator valued at more than \$6,000, zero defects were a requirement. Even slight damage to the magnet wire would create a bad part. To meet this challenge, an advanced mold and process control system was used to augment traditional molding machine controls. Encap worked to create a thermally conductive, electrically insulative material that dissipates the heat yet meets the challenging environmental and molding requirements. These thermally conductive resins provide up to 50 times more thermal conductivity than typical unfilled and reinforced thermoplastics.

In less than one year, Encap completed the designs and prototypes, and built the commercial tooling needed for the ROV motors. According to Lars Pederson, Senior Engineer at Alstom Automation, "Encap Technologies provided a unique solution to a very difficult engineering problem. Without their assistance, the Quest ROV would not be a reality today."