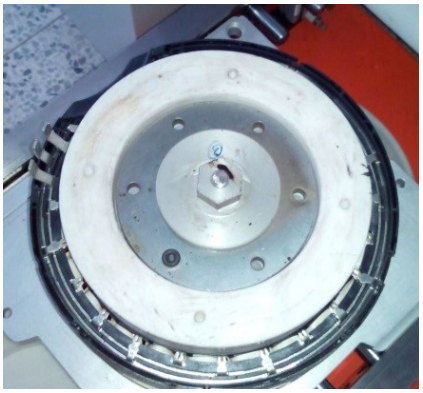
VACUUM ENCAPSULATION OF AUTOMOTIVE HYBRID DRIVE MOTORS



APPLICATION:

New electric automobiles are moving towards hybrid power that incorporates both electric and gasoline as a fuel source. In hybrid-powered automobiles, the motors serve as one of the most critical parts. Installed in a very confined space within the fuel engine compartment, the motors must operate under very demanding conditions. To ensure good motor performance under different operating conditions, their stator coils are typically filled with a sealant treatment that addresses concerns with heat dissipation and weather. Among the hybrid power cars available in the market, most use motors filled with a two-component epoxy sealant cured at high temperatures.

PRODUCT SUPPLIED:

- 1450 SA Single Acting Meter Mix Dispense System
- Vacuum Chamber

CHALLENGE:

The sealant treatment process of the motor stator coils includes several steps. First, the two-component, high-temperature epoxy sealant undergoes a degassing treatment, then is mixed to an exact ratio under vacuum conditions. Next, the epoxy flows into the gap of the stator coils under atmospheric pressure. The final step includes heating the epoxy for a solid cure.

The system must deliver the right mix ratio and volume of sealant at the appropriate speed to eliminate any air holes on the product surface and the part interior.

The high-temperature epoxy sealant is challenging as it contains two components (A and B) with very different viscosities. To meet thermal conductivity requirements, component A contains a high concentration of abrasive filler. As a result,a good fluidity/flow of the adhesive only is maintainable under heated conditions. The system must also prevent filler settling to maintain a high- wear resistance of the metering mechanisms.

In addition, the process must strictly control epoxy mixing to ensure a favorable Glass Transition (TG) temperature value (related to stability at high temperature) after curing. A deviation beyond 5% may result in a TG value outside the limit that leads to part rejection.

The biggest system challenge is dispensing the sealant into the product in a vacuum environment so the sealant completely fill gaps of the stator coils without creating air bubbles. All this must be accomplished while meeting the customer's productivity requirements.

SOLUTION:

The EXACT 1450 SA MMD system combined with an online vacuum chamber system addressed the requirements of this application. Components of

EXACT DISPENSING SYSTEMS

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the EXACT solution include:

- A vacuum degassing preparation step
- EXACT 1450 SA metering and proportioning system
- Online vacuum dispense station.

The vacuum chamber with embedded rotation disc accommodates a few dozen work pieces simultaneously. The encapsulation process is completed while maintaining a vacuum level of 5 m bar in compliance with the customer process requirements. As a result of rotation sealant filling, the sealant penetration speed in the coils is much faster along with the sealant filling speed. By improving overall process efficiency, the EXACT solution meets customer's expectation for higher productivity.

OVERALL SOLUTION DIAGRAM:

Shown is the online vacuum chamber with two embedded servo drive rotation tables.