



Vacuum Pressure Impregnation (VPI) System

The Hyundai Ideal Electric Company (HIEC) insulation system is a proven insulation system based on a global Vacuum Pressure Impregnation (VPI) method using mica tapes combined with epoxy resin. Global VPI is a widely used insulation method in the electric machine manufacturing industry. HIEC uses epoxy resins in the VPI process as they have been shown to be superior to the other VPI resin types. This insulation system is employed over the full range of form wound machines produced by HIEC.

HIEC Insulation System Features

- Class F (155°C) Temperature Rating
- Voltages up to 15 kV
- Mica Insulation combined with Epoxy Resin VPI
- Excellent Chemical, Oil, and Moisture Resistance
- High Dielectric Strength with Low Dielectric Losses
- High Mechanical Strength
- High Thermal Conductivity for Improved Heat Transfer
- Withstands Starting and Short Circuit Stresses, Voltage Surges, and Thermal Cycling.

Coil Construction

The coils are manufactured from insulated copper conductor wire. Various combinations of conductor and turn insulation are used most employing mica turn tape to ensure high turn to turn impulse voltage withstand capability. Ground insulation consisting of multiple layers of fiberglass backed mica tape is applied to the entire coil to a thickness based on machine voltage. A conductive tape is applied over the mica as a final layer on the slot portion of the coil to suppress corona discharge. At higher voltages, a semi-conductive stress



HIEC Insulation System

grading tape is applied to the coil from the end of the slot and extending up the coil end turn.

The coils are installed in the stator slots and retained with segmented slot wedges covering the full length of the core. Absorbent polyester felt spacer blocks are installed between the coil end turns. In addition, the coils are individually tied to heavy fiberglass rope rings to form a completely arch bound system with exceptional radial support yet allowing for axial movement due to thermal expansion. This end turn support structure is thoroughly saturated with epoxy resin during the VPI process and when cured forms a rigid support ring for the coils. The coil and stator lead connections are insulated with the same mica tape used for coil insulation.

VPI Process

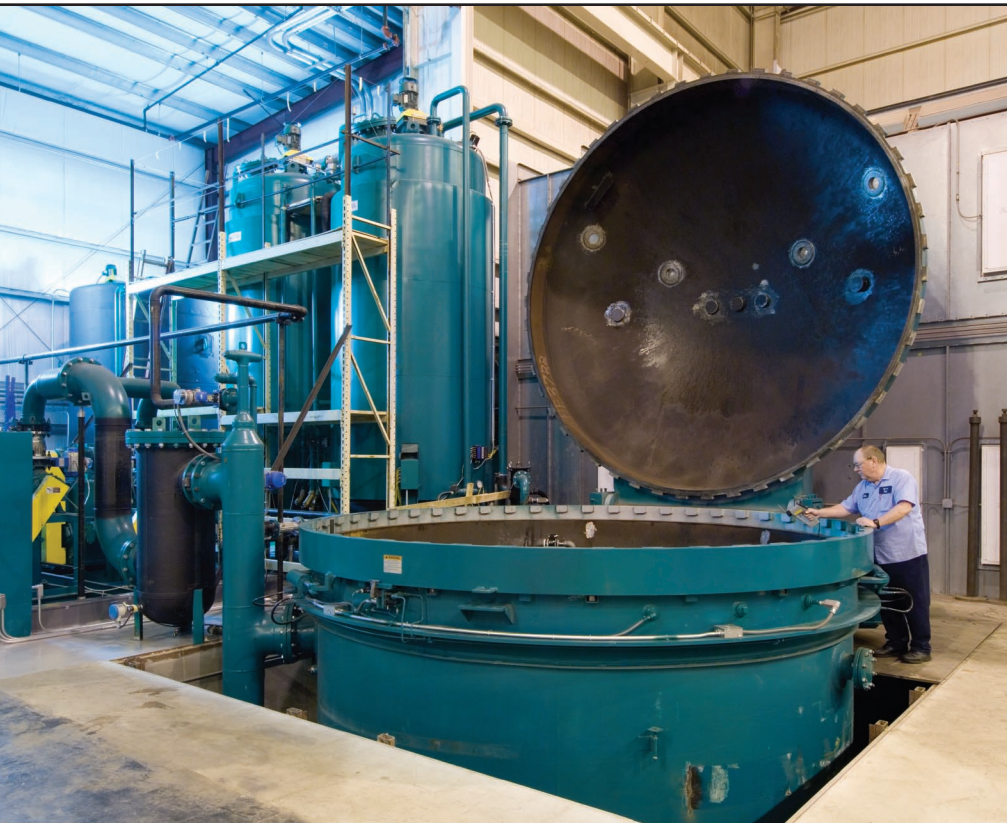
The fully insulated stator is preheated in an oven to drive off any moisture or volatile components. The stator is moved to the vacuum pressure impregnation tank where a vacuum is drawn removing nearly all the air from the insulation. Epoxy resin is admitted to the tank while still under vacuum to fully cover the stator. The vacuum is released and pressure applied over the resin covered stator to force the resin completely into the insulation materials. Winding capacitance is monitored during the VPI process to assure complete resin penetration of the insulation materials. After removing the stator from the VPI tank, the stator is placed in an oven and baked to cure the resin and fully develop the properties of the insulation system.

Quality Assurance

- Checks on stator coils to assure dimensional uniformity and proper fit of coils in stator slots.
- High potential tests of coils during coil installation and prior to VPI.
- Turn to turn insulation tests of coils prior to VPI.
- Periodic tests of epoxy resin system.
- Periodic tests of power factor tip-up per IEEE Standard 286 to monitor insulation system performance.
- Final high potential test of completed winding after VPI at twice rated voltage plus 1000 volts.



Repaired stator being lowered into HIEC VPI tank



14-foot diameter VPI tank



Bakeout Oven used to cure VPI epoxy resin

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Our mission is to produce the highest quality product, satisfy customer requirements, and provide rewarding employment in a profitable growth environment, while supporting the community.



This eco-friendly product is printed using soy-based inks on paper which is acid-free, contains 50% recycled content including 25% post-consumer waste, is bleached without using chlorine and the wood pulp is harvested from sustainable forests.



HYUNDAI IDEAL
ELECTRIC CO.

330 East First Street • Mansfield, OH 44902
phone 419.522.3611 • fax 419.522.9386



ISO 9001
Certificate Number 31576

www.IdealElectricCo.com