HECO
All systems go

Vacuum Pressure Impregnation or VPI Process

Since 1981 HECO has been a leader in VPI process

Vacuum Pressure Impregnation (VPI)

You've probably heard that vacuum pressure impregnation (VPI) is a good alternative to the old "dip and bake" varnish process, but there's actually a bit more to it than that.

While VPI offers excellent benefits for smaller electric motors, it may not always be the best choice for larger ones. When it comes time to decide which route to go with your electric motor, you need the facts in order to make a smart decision.

The Vacuum Pressure Impregnation (VPI) Process

The VPI process represents a significant technological advancement over the traditional "dip in varnish and then bake" approach used to insulate electric motors. In place of standard insulating varnish for electric motors, a special VPI epoxy insulation is used on the coils. The preheated stator or rotor is then lowered into the VPI pressure chamber and a vacuum is drawn. As that occurs, a solventless epoxy resin is drawn into the chamber until the unit is completely submerged.

Pressure is then applied and the unit becomes thoroughly impregnated with the resin, and then the unit is removed and baked in a curing oven. The result of the VIP process is a 4 to 5 ml build of insulating resin and an almost void-free insulation system for your motor's windings.

Vacuum Pressure Impregnation Equipment

VPI requires some special (and strong!) equipment. Typical setups include a resin (or varnish) vessel, an impregnation vessel, and a curing oven. A control panel operates the vacuum pump used to remove all the air from the impregnation vessel, then the resin is drawn in from the resin vessel via a set of resin pipes. The rotor/stator that is being processed is allowed to soak in the resin. Once the soaking is complete, positive pressure is applied to the impregnation vessel to remove voids and thoroughly compress the resin.

When the impregnation stage of the process is complete, the rotor or stator that has been impregnated with resin is placed in a curing oven at a high temperature until all of the resin has been cured. The entire process takes time, including curing and subsequent cool-down. The motor cannot be worked on while it is undergoing VPI.

Why VPI Is Used Instead of Traditional Methods

VPI is often preferred over the traditional methods of insulating electric motors for four distinct reasons:

1. Better electric motor performance in harsh environments
2. Improved electric motor efficiency made possible by better heat transfer
3. Improved mechanical winding design
4. Reduced probability of motor failure

How VPI Reduces Electric Motor Failure

If you're the decision maker when it comes to electric motor maintenance and repair (and the costs that go along with it), then you're very interested in its potential to reduce motor failure. But how does VPI actually reduce the likelihood of electric motor failure?

VPI Reduces Coil Vibration

The main case of winding failure used to be abrasion of the turn insulation or the ground as a result of the movement or flexing of the windings. When VPI is used, the resin acts as a powerful adhesive between the strands and turns. This adhesion significantly increases the stiffness of the windings, reducing both movement and flexing.

VPI Increases Resistance to Contamination

Because VPI results in a practically void-free insulation, there are far fewer openings and crevices where contaminants can produce unwanted conducting paths either to ground or between turns. Depending on the resin used, the insulation is also highly resistant to aggressive chemicals, too (hence its ability to perform well in chemically harsh environments).

VPI Improves Heat Transfer

Because the resin fills the voids between the conductors and insulation and between the insulation and the lamination, the windings have much better heat transfer characteristics: heat is conducted away from critical components more easily. An added benefit of filling these voids is how this prevents the insulation material from degrading due to extremely high, excessive temperatures.

VPI and Larger Motors

VPI insulation is not the answer for every electric motor, however: it may be a good move economically, but it isn't always the longest lasting solution for larger motors and its use may not be encouraged for vintage machines unless there is a specific reason for it. While VPI is readily available and regularly used for 12KV to 15KV electric motors, keep in mind that B-stage winding is still a valid (and often longer lasting) option for many applications.

B-Stage Coils for Large Electric Motors

B-stage insulation systems have been used to insulate motor windings for the last fifty plus years in large motors and generators. B-stage consists of resin rich coils that are manufactured using epoxy loaded tapes. While this method

is not new, it remains extremely reliable (with coils often lasting 50+ years). For larger motors, this remains a very durable insulation system. It may not be as economical as a high voltage VPI in the short run, but it has a proven track record when it comes to larger motors and generators.

HECO is Your Expert on VPI & B-stage Insulation

At HECO, we are your expert when it comes to insulation systems for electric motors. We have the state-of-the-art equipment and expertise to help. In fact, we've been doing VPI since 1981 -- and compiled our own data, based on in-house testing, to get a realistic idea of its performance and potential for a range of motor sizes. We have also been performing high voltage motor rewinds (12kv to 13.8kv) for over 20 years and perform both high voltage VPI and high voltage B-stage rewinds.

Not only can we answer your questions about VPI, but we can give you the facts you need in order to decide if it is the best choice for your electric motors.