

Vacuum Pressure Impregnation of Electrical Motors and Transformer



Place Transformer Inside
Oven Min 100°C to 125°C

vacuum is pulled 'dry' on
the transformer upto 10
Torr

Admit Varnish into the
Chamber

vacuum is pulled 'wet' on
the transformer

chamber is pressurized to 100
psi completely filling the coil
and insulation with varnish

varnish is finally pushed
out of the chamber.

Vacuum Pressure Impregnation (VPI) is the process of treating the finished coils with varnish by placing it a vacuum chamber. First, the transformer is placed in an oven and heated to approximately 100 to 125 °C. This heat treatment drives out moisture from the insulation which could otherwise compromise the insulation.

After heating, the transformer is placed into the VPI hot. The advantage of doing it this way is that it makes it easier for the varnish to penetrate the insulation to the maximum extent possible since the viscosity of the varnish goes down as it is heated by the coil.

Next, the coil is placed in the vacuum chamber and a vacuum is pulled 'dry' on the transformer. The varnish is then admitted into the chamber and the vacuum is pulled 'wet'. Finally, the chamber is pressurized to 100 psi completely filling the coil and insulation with varnish, and then varnish is finally pushed out of the chamber. This results in a coil that is totally saturated with varnish (with atmosphere dip it is only partial). The insulation will then have its maximum dielectric strength and will not absorb moisture (key to longevity). Also, because varnish is a good adhesive, it has better mechanical strength. In addition, because varnish is a good thermal conductor, it runs significantly cooler.

The benefit of VPI on the plate transformer is that it reduces the temperature rise by approximately 20%, making it run appreciably cooler and quieter. And the result of that is greater reliability and extended life. This is recognized throughout the transformer industry and is backed up by numerous studies

We hope this information is helpful to you as you consider your options for your future designs. We believe that your transformers should all be treated with VPI, particularly given your application.

Vacuum Impregnation of Transformer

Vacuum impregnation is used in many different manufacturing processes to enhance mechanical strength, seal surfaces and to enhance electrical insulation properties. Vacuum Pressure Impregnation (VPI) is the process of treating the finished coils with varnish by placing it in a vacuum chamber.

One of the most common applications for impregnating compounds is in electrical transformer manufacturing.

Transformer coils are impregnated for some or all of the following reasons:

- Increase the overall dielectric strength
- Improve the structural integrity of the coils
- Reduce or eliminate winding noise
- Improve heat transfer
- Reduce partial discharge
- Provide increased environmental protection

The main purpose of vacuum impregnating transformer coils is to remove as much air as possible from the structure and replace it with varnish / epoxy which has significantly better dielectric strength. In addition, varnish / epoxies are excellent adhesives and will solidly bond the wires and other components of the structure to form a strong, solid assembly. As a side benefit, this also reduces noise during operation.

Material Requirements

Impregnating compounds are not designed to provide high build rates. They are designed to penetrate and seal the "nooks and crannies" of the structure.

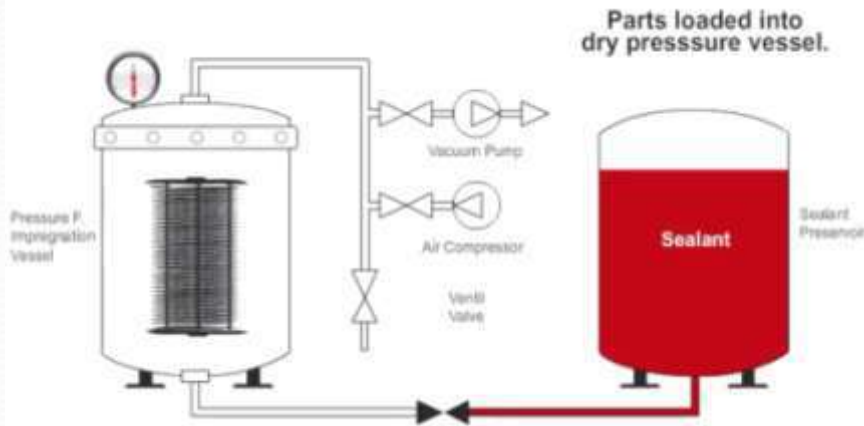
The best products have the following features:

- Reasonably low viscosity
- Reasonably good shelf life
- Long working time (pot life)
- Good dielectric strength
- High vapour pressure
- Operating temperature rating to match or exceed the rating for the coil
- Moderate cure temperature

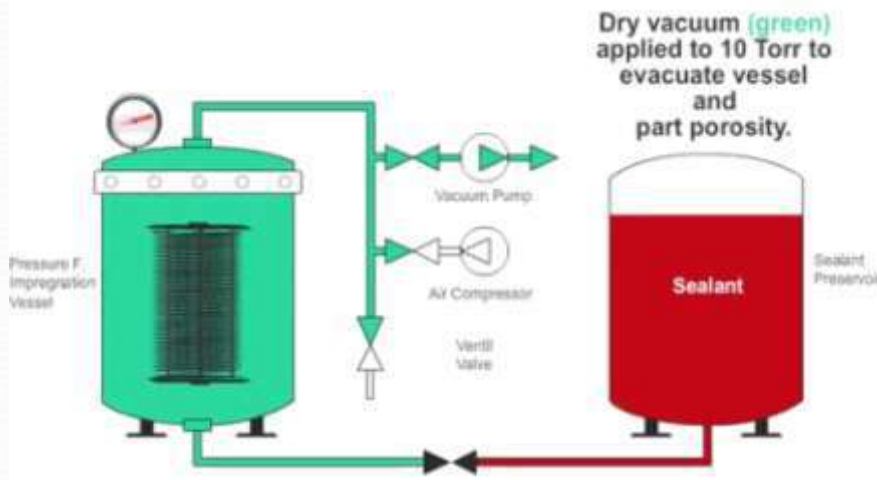
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Vacuum Impregnation of Transformer Process

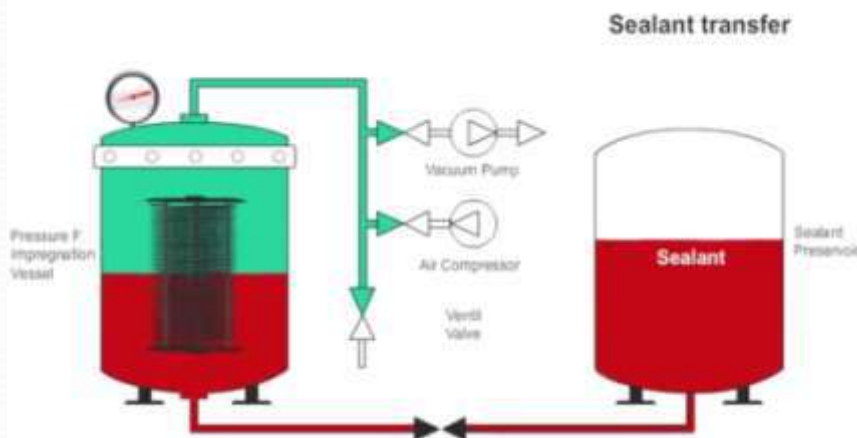
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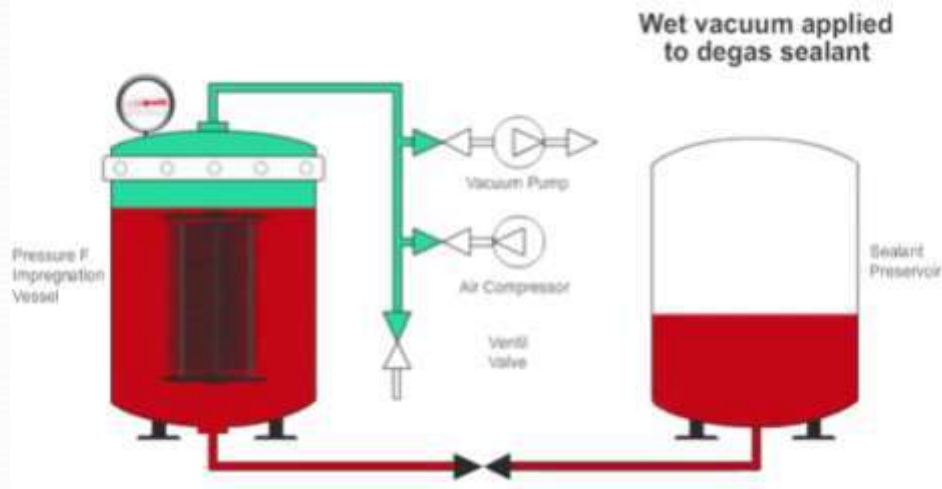


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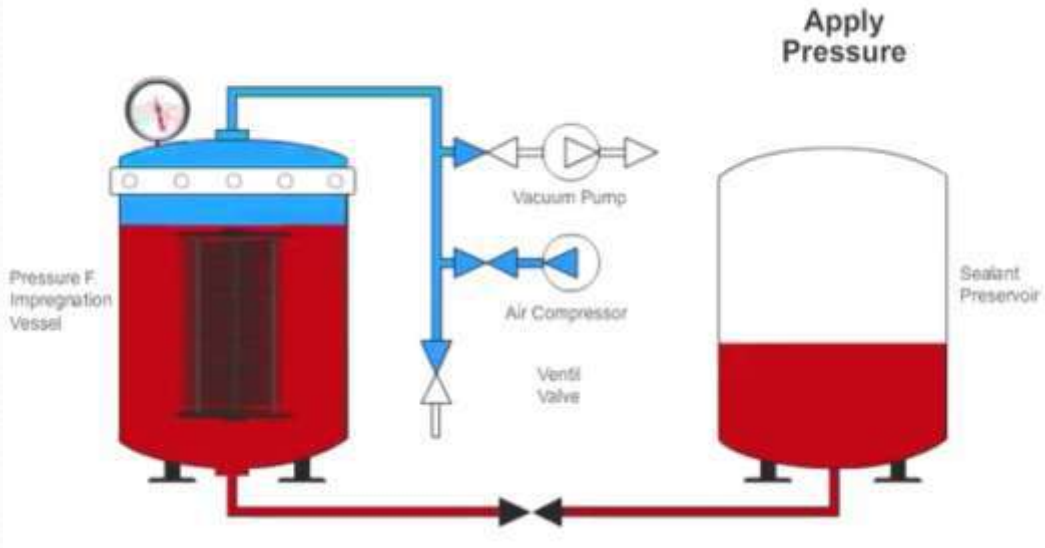


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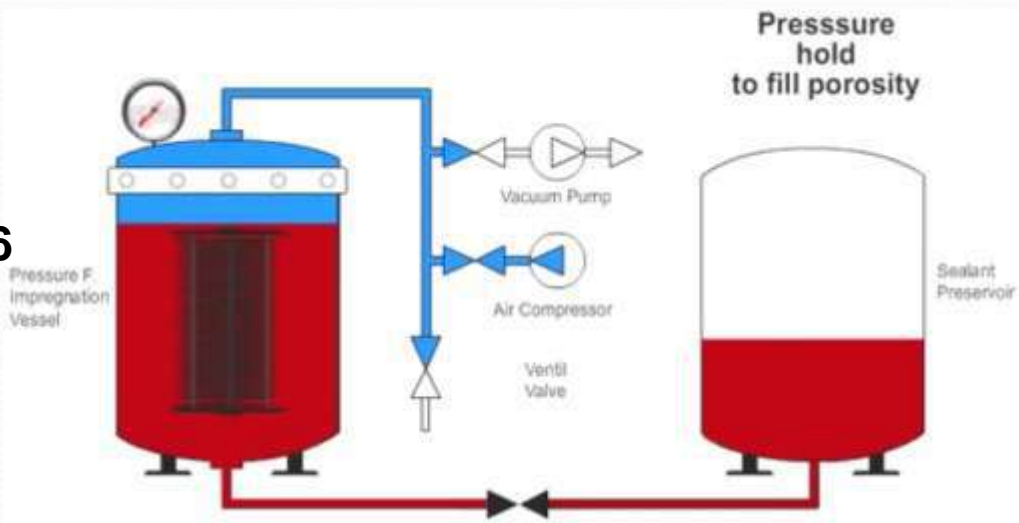
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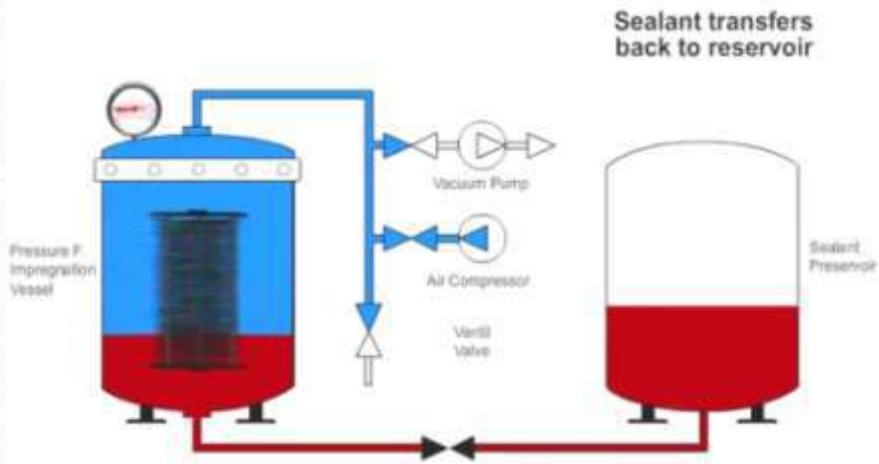


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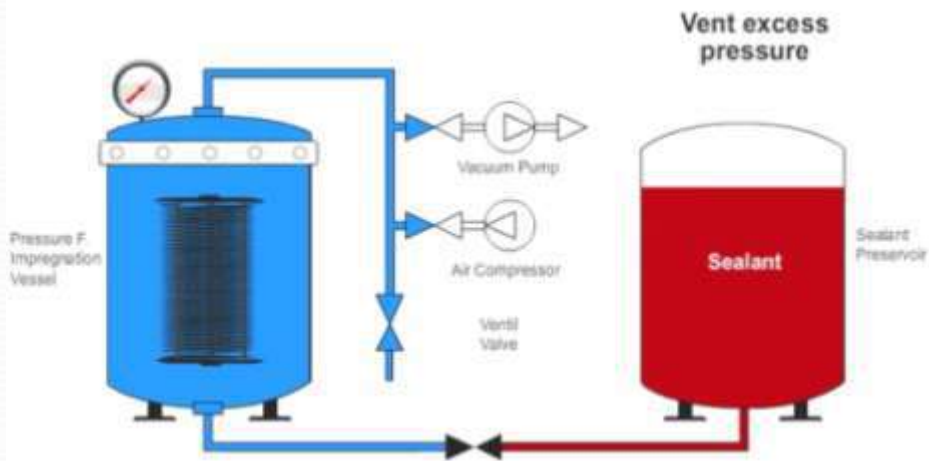


Vacuum Impregnation of Transformer

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