



PERFORMANCE MATERIALS

Insulating Varnishes and Impregnating Resins for Electrical Insulation Systems

Streamline substitutions and additions of insulating varnishes by using UL Recognized Varnishes

Insulating varnishes and impregnating resins are critical components of today's modern motor, generator and transformer products. They increase the mechanical integrity, improve dielectric and thermal conductivity properties, and protect the insulation system from environmental factors.

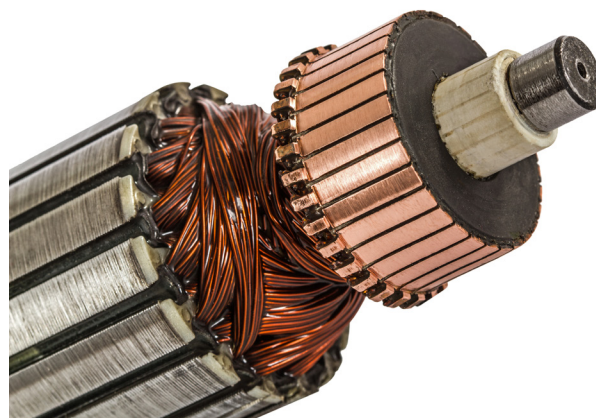
Overview

Varnish is a liquid insulator that coats the winding wires and glues the wires together when cured. If properly selected, this product provides a number of benefits by improving the Electrical Insulation System (EIS) thermal stability and structural integrity of the winding. Improperly selected varnishes can have an opposite effect by increasing the thermal degradation of the magnet wire, leading to turn insulation breakdown and failure. It is imperative that varnishes and impregnating resins are compatible with the magnet wire and other components in the EIS.

Certification

UL's certification program for varnishes (also includes impregnating resins) consist of testing and certifying the temperature class of the varnish when applied to specific ANSI Magnet Wire (MW) types. This is done through a three temperature thermal aging program outlined in Standard UL 1446 "Systems of Insulating Materials – General" using Twisted Pair, Helical Coil, and/or Curved Electrode test specimens to verify the thermal endurance performance of the varnish/resin for electrical, mechanical, and flexibility properties. Based on the results of the thermal aging program, a temperature class rating is assigned for each property applicable to the Magnet Wire ANSI type tested, (e.g. MW 80, MW 35, MW 77 etc.).

Varnish suppliers that meet UL's requirements are certified under the category Varnishes (OBOR2) and are authorized to bear UL's Recognized Component Certification Mark (R). All certified varnishes include UL's Follow-Up Service program, helping to ensure continued compliance with UL standard requirements through periodic unannounced factory inspections and sample selection for testing.



Benefits

This program provides a means to independently and objectively demonstrate varnishes work properly and do not damage the MW coating for a specific thermal class. The certified varnish class ratings then enable a short-term Sealed Tube Chemical Compatibility test to be performed to evaluate their use in an existing EIS without having to undergo full thermal aging of the EIS.

Test Specimen Type	Property Being Evaluated
Twisted Pair	Electrical
Helical Coil	Mechanical
Curved Electrode	Flexibility

Learn more at ul.com/EIS or contact UL directly at [UL.com/contactus](https://ul.com/contactus).

Varnish and Impregnating Resin manufacturers that establish Recognized Component Varnish (OBOR2) certification benefit by providing their customers a product that allows them a faster and easier process of adding and using these products in motors, generators, transformers and coils. This gives the end product user faster market access and greater supply chain flexibility.

Guidelines for Substitutions and Additions of a Varnish

When considering varnish substitution or addition in a certified EIS, the first step is to know if a varnish was used in the full thermal aging of the EIS. This can generally be determined by

Thermal Class Ratings	
UL Letter Class	Temperature Rating (°C)
E	120
B	130
F	155
H	180
N	200
R	220
S	240
C	Over 240

whether or not the varnish is considered optional in the EIS. When a varnish is listed as “Optional” in the EIS certification this means it was not included in the full thermal aging of the EIS and does not function as an Electrical Insulating Material (formerly known as Major Component). Conversely, if the varnish is required to be used in the EIS certification, it was included in the EIS full thermal aging and contributed to the thermal

performance of the EIS and is considered an Electrical Insulating Material (Major).

Varnish Listed as Optional in EIS:

When an EIS is thermally aged without a varnish, the varnish is considered a Non-electrical Insulating Material (formerly known as Minor Component). In this case, to add a new varnish it must be a Recognized Varnish (OBOR2) with a Twisted Pair temperature class rating for the applicable magnet wire ANSI Type that is no more than one temperature class below the

temperature class rating of the applicable magnet wire and must comply with the Sealed Tube Chemical Compatibility test in UL 1446.

Varnish is Required in EIS:

When an EIS is thermally aged with a varnish, the varnish is considered an Electrical Insulating Material (Major). In this case, to substitute a new varnish it must be a Recognized Varnish (OBOR2) with Twisted Pair and Helical Coil temperature class ratings for the applicable magnet wire ANSI Type that are both equal to or greater than the original varnish used in the full thermal aging of the EIS and must comply with the Sealed Tube Chemical Compatibility test in UL 1446. In some cases, if the varnish class ratings are not suitable, a one temperature aging maybe conducted in lieu or in addition to the Sealed Tube Chemical Compatibility test.

Learn More and Get Started:

UL has sales and engineering teams available globally to assist you with complying with the requirements of UL 1446 and the varnish interchangeability requirements. UL recommends involving the EIS team early in design process, so we can help review potential options and reduce risks. Please contact your local Customer Service Professional at UL.com/contactus or contact our sales team at PMSales@ul.com.

Learn more at ul.com/EIS or contact UL directly at UL.com/contactus.