Insulation System
Micatherm

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INSULATION SYSTEM
Weg insulation system for rotation electric machines

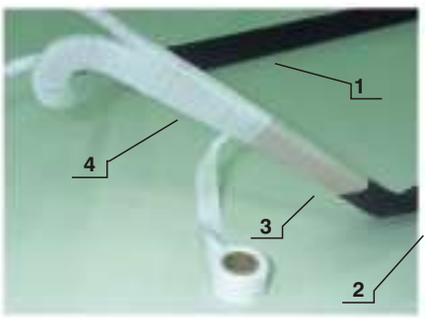
The WEG insulation system is based on the Global Vacuum Pressure Impregnation (GVPI) process, which was developed in conjunction with the most reliable suppliers of insulating materials for electric machines worldwide. For many years, the GVPI process has proven to be efficient and reliable for electric rotating machines in a wide variety of applications. The insulation system is applied to low a high voltage machines, manufactured with 380 to 15000 V form coils.

Manufacturing Process:

Depending on the application, the coils can be manufactured with rectangular copper wires fitten with
four types of insulation such as:

1. Enameled cooper wires;
2. Enameled copper wires coated with either one or two Layers of fiber glass filament;
3. Raw copper wires coated with mica based tape;
4. Enameled copper wires coated with mica based tape.

After being expanded and moldered to its final shape, the coils are insulated with a Mica based porous tape, where the insulation thickness depends on the machine rated voltage. These procedures guarantee that the coils are perfectly compacted and the ideal dielectric strength is achieved. Protection against corona effect is guaranteed with the application of two special tapes: The conductive tape, which prevents the coils from discharges generated in the stator slots, and the semi-conductive tape which is responsible for the equalization of the potential gradient at the end of the stator core.



1. Conductive tape
2. Semi-conductive tape
3. Main insulation
4. Polyester tape

Once all coils have been properly insulated, they are inserted into the slots of the stator core. Depending on the application, the slots can be closed with magnetic wedges or not. These wedges are inserted into diamond shaped channels located at the upper part of the slot. The application of a manta based fiberglass, with expanding properties, guarantee they are properly fixed.

The coil ends are lashed and tied to bracing rings, suitably designed to withstand shock and vibration under the most severe overload and operating conditions.

Once the stator has been wound and tested, it is vacuum and pressure impregnated with Epoxy resin. This resin is specially developed and prepared for the GVPI impregnation process, which results in outstanding electric and mechanical properties, such as high dielectric strength, excellent heat transfer, low dielectric losses and low absorption of humidity. All these characteristics ensure that the machine will present an excellent performance throughout its lifetime.

Insulation System:

Wire Insulation (1, 2 and 3)

The voltage level between turns and the wire dimensions are what determine the type of insulation to be used on the coils. The wire insulation basically consists of a polyester-amide varnish for high temperatures and either one or two layers of fiberglass filaments or Mica based tape. Additionally, the raw copper is also coated with a Mica based tape.

Turn-to-turnInsulation (4)

Depending on the voltage level, an additional insulation is necessary to increase the machine dielectric strength. The turn-to-turn insulation consists of an aramide paper (Nomex) located between two wires.

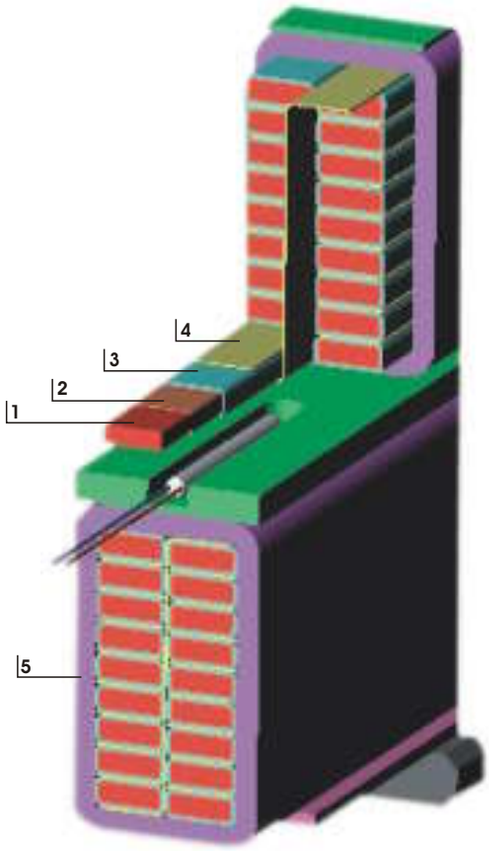
Main Insulation (5)

The main insulating materials used on the form coils consist of a highly absorbent Mica paper, special Epoxy resin and fiberglass tissue. The mica paper and fiberglass are suitably designed with the necessary mechanical strength for manual or mechanical, through a headstock, application. The machine rated voltage determines the number of layers to be applied, which guarantees the coils withstand the tests described on IEEE 522 and IEC 34-15 standards.

Protection against corona effect

Undesired electrical discharges, caused by the corona effect, can be present on electrical machines with rated voltages higher than 5000 V. In order to avoid these electrical discharges, and their destructive consequences, the coils are wrapped with a conductive tape, impregnated with a conductive varnish composed of graphite particles, having the function of dissipate surface discharges avoiding electric stress in the main insulation.

Machines with rated voltage higher than 6000 V are protected with a semi-conductive tape, impregnated with a resin containing silicon carbeto. This tape is applied to the coil ends, having the function of equalize the potential gradient on the stator core outlet, where the highest electric stress occurs due to surface discharges.



Connection insulation:

All connections are insulated with the same tape e same number of layers of the main insulation so as to guarantee a reliable insulation on all wound stator pointes.

Impregnation:

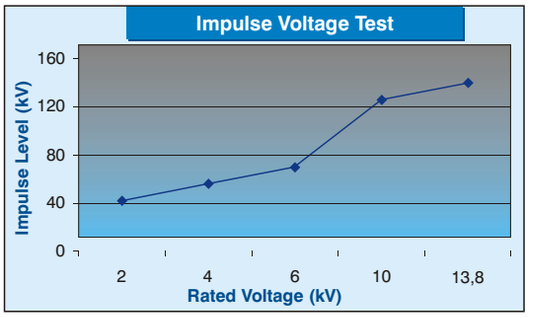
Vacuum and Pressure

Once the coils have been inserted to the stator core, slots closed and connections finished, the wound stator is vacuum and pressure impregnated. A solvent free Epoxy resin with Class “H” insulation is used to guarantee excellent electrical and mechanical properties as well as resistance to weather and humidity influence. The Epoxy resin is the most recommended impregnating material to be used on electric machines. Its composition ensures homogeneity during the impregnation and excellent mechanical and electrical performance after polymerization and cure.

Quality Control:

After the application of the Mica based porous tape, all coils have their dimensions checked. This procedure guarantees that they are within the pre-determined tolerances and that the proper insertion into the stator slots will be achieved. After the insertion, some tests are performed to ensure the coils still have the mechanical and electrical integrity. These tests are performed in accordance with the instructions and procedures defined by IEEE 522 and IEC 34-15.

The High Potential Test is performed before and after the Global Vacuum Pressure Impregnation process to ensure quality and reliability of the insulation system. The Dielectric Losses Test is also performed with the purpose of guarantee the insulation is homogeneous throughout the stator core and that the polymerization and cure were successful.



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