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Trickle Impregnation for insulating motors

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ABSTRACT

This is a method of insulating the windings of a motor with epoxy resin. There are different processes involved- preheating the windings, dispensing of resin and curing the resin by heating. Here only the trickling process has been performed where the resin is dispensed on the winding coil with help of pneumatic motor at a designated flow rate. In comparison to Dip varnishing or vacuum impregnation, the trickle impregnation technique is distinguished by its low energy cost due to a relatively short cycle time. When compared to the Dip and Bake varnishing method, which uses varnishes containing 50 to 55 percent solvents and an impregnation cycle of 8 to 24 hours, the Dip and Bake varnishing method employs varnishes containing 50 to 55 percent solvents. The cycle times for trickle impregnation are quite short, ranging from 20 to 40 minutes.

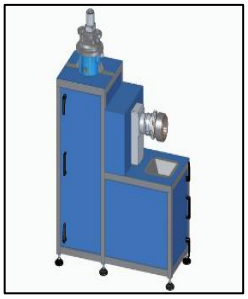
Keywords— *Impregnation, Trickle, Dispensing, Resin, Pneumatic gripper*

1. TRICKLING

This is a method of applying insulation through direct dispensing on coil windings. This technique impregnates resin to permeate undetectable porosity occurring while casting. Since undetectable porosity is inevitable in the casting process, some defects are always expected in results. The probability of rejection depends according to each casting i.e., the product. There are a set of processes involved in this which work in cycles. These cycles are usually automated that combines winding, loading machine, ovens and robots. Trickle impregnation is generally used for high motor manufacture capacity plant. By tricking impregnation technology, products that would otherwise be rejected can be made usable, so this technology is indispensable for life-supporting parts and on parts that must endure high pressure. Along with Trickle, there are other impregnation practices used in in industry as well. Dip and Bake is a common varnishing procedure that involves dipping the motor windings in a varnish tank and then curing them in an oven. Vacuum pressure impregnation - A vacuum pressure tank filled with varnish is used to fully impregnate motor windings and insulation with resin or varnish using vacuum pressure impregnation (VPI).

1.1 Experiment-Setup



1.2 Typical trickle application cycle

(a) Parts such as coils, motor windings, copper wire windings, etc. are mounted on rotating fixtures. They advance through the entire cycle on a continuous conveyor or carousel returning to the load/unload station completely impregnated and cured. While on the conveyor the parts are rotated continuously. Rotation assures that the resin does not run off and that it will be distributed evenly, producing a uniform coating and balanced parts.

(b) The preheat section brings the part to the proper temperature for impregnation. The temperature causes the resin to thin-out so it will flow the full length of the slot. This ensures that the wires are bonded and the voids are filled. The correct temperature is critical: If it's too low, the resin may not wick well into the slot; if too high, the resin will get too soon building up on the ends and not filling the slot. The preheat temperature also triggers the chemical reaction (cure), which

is a function of time and temperature.

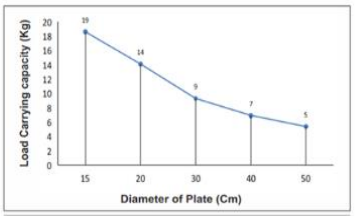
(c) Resin is applied for 10-15 seconds (2 to 3 full turns) to both ends (the end turns) at once. In some machines, where the parts are inclined rather than level, there may be nozzles on only one end.

(d) Following resin application, the parts advance to the final bake or curing oven. Or, in the case of the so called "heatless trickle" machine, they are removed after the resin gels, and will cure at ambient temperature within a few minute**s.** Because no final oven bake is needed, parts can be sent to the next production step while curing. The cooled parts may be weighed to determine resin pick-up. This information is useful for costing and quality control.

1.3 Major appliances

Rotary-indexing-unit

	SPECIFICATION Model No	BH-RIS-02-B (M)
1	Maximum load carrying capacity(kg)	19
2	Output RPM	0 to 100
2	Gear Ratio of Indexing Table	3:1
3	Positioning Accuracy (arc min)	≤ 8
4	Degree Of protection	IP 40
5	Total Weight Of Rotary Indexing (KG)	14.5



Function

A rotary indexing unit is a precise work placement instrument. It gives the operator the ability to drill or cut work at precise intervals along a fixed (typically horizontal or vertical) axis. The unit has to be chosen on the parameters:

- Maximum load carrying capacity
- O/P RPM
- Gear ratio
- Positioning accuracy

Manual Level Switch

Vertical float switches are a well-established and dependable method for sensing and controlling single or multiple liquid levels in open or pressurized vessels.

Gripper

A pneumatic gripper is a pick-and-place device that operates gripper jaws, also known as fingers, with compressed air. These fingers, which are akin to human fingers, are used to grasp, hold, and release work items. They usually have two fingers (parallel or angular) or three fingers (parallel or angular) with a single or double acting cylinder for control. They're typically employed to grab things in automated manufacturing operations.

Panasonic Servo Motor

A servo motor is a type of motor that has a high degree of precision in rotation. Servo motors often have a control circuit that provides feedback on the current position of the motor shaft; this feedback allows them to rotate with great precision

I/P – O/P & Feedback for Trickling Process

• Input

1. Cycle Start push button
2. Cycle stop push button
3. Level Switch
4. Gripper engages
5. Dripper disengages
6. Emergency

• Output

1. Stirrer motor ON
2. Speed -1 / flow-1
3. Speed 2 / flow-2
4. Vacuum pump

• Feedback

1. Stirrer motor overload Feedback
2. Vacuum pump overload feedback

2. ADVANTAGES

- Low resin consumption with high degree of the impregnation.
- Automatic and clean process which initiates no after works after process.
- Maximum resin filling on the winding slots with very high Bond-Strength standards.
- Excellent resin penetration in the whole winding.
- Small process times resulting high productivity

3. CONCLUSION

The "Trickling" system is particularly used for all products where thermodynamic stresses are relevant and strong in their service.

The control of impregnation parameters (resin volume, parts rotation speed, temperatures and times), the system can apply the resin with maximum accuracy, using the capillarity principle, ensuring maximum absorption and avoiding resin dropping from the parts.

The technology used in our trickling systems complies with the best quality, reliability and automation standards. These features result in several advantages by the trickling impregnation method.

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