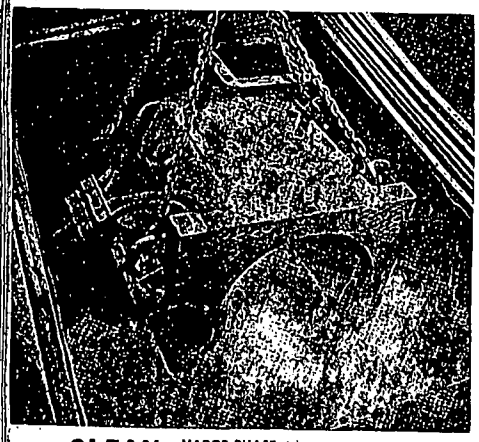
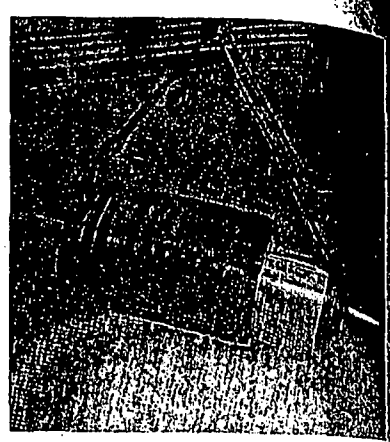
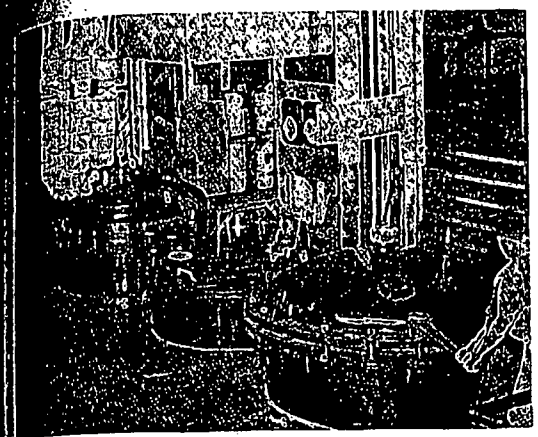


CLEAN VAPOR-PHASE degreasing is done with vaporized solvent in tank. Cold motor condenses vapor, which runs off carrying grease, dirt



ARMATURE in degreasing vapor. If part stays in tank until it reaches vapor temperature, uncondensed solvent will attack paint and varnish films. Remove part before condensing stops



DIP TANKS for dipping should stay at room temperature, be covered when not in use. Heat and exposure to air will change varnish specific gravity and viscosity. Preheated parts should cool below 140 F before dipping



MOTOR frame, field coils get varnish dip. After soaking, drain for at least one hour, then bake at 275 F, or above

Cleaning, Dipping and Baking Tips For Your Electrical Varnish Jobs

- ***Many varnishing ills stem from grease, dirt and other contaminants on dipped part***
- ***Others come from specific gravity or viscosity changes due to heat and oxidation***
- ***Bad mixing and proportion between varnish and thinner can give lots of trouble, too***
- ***Here is a rundown of good cleaning methods and ways to keep your varnish in tiptop condition for best dipping, impregnating and baking jobs***

► FOR A GOOD VARNISH job, the piece must be *clean*. A lot depends on this step because a good many varnishing problems can be traced directly to grease, dirt and old insulation missed in the cleaning operation.

Several cleaning methods are commonly used: (1) hand washing with suitable solvent or detergent, using rags or brushes (2) pressure spraying with solvents or a steam jenny (3) vapor-phase degreasing (4) pressure blasting with mildly abrasive material (5) combination of two or more.

Hand washing is the most common method. It can be used on equipment of all sizes and calls for the least capital outlay. Solvents for hand cleaning include naphtha, Stoddard's solvent (a mixture of cleaning naphtha and carbon tetrachloride), trichloroethylene and perchloroethylene. Naphtha is highly flammable and fumes from other three are somewhat toxic, so cleaning with solvents should be done only when well away from flame, heat or sparks, and with good air circulation.

Du Pont has developed a cleaning mixture that minimizes the bad points of petroleum solvents. It is marketed under the name Cleaning Mixture #49.

Detergent solutions are sometimes used, but aren't as effective as solvents. Detergents, too, are not chemically neutral, and must be rinsed thoroughly from clean coils or insulation will slowly deteriorate.

Pressure-spray cleaning with solvents or steam is faster and more thorough than hand washing. Precautions with solvents, of course, must still be used. Steam and water vapor will not hurt insulation and varnish film but, since water and grease don't mix, steam is not as fast as solvent spraying.

Vapor-phase degreasing is a relatively new development. Chlorinated solvent, such as trichloroethylene or perchloroethylene, is heated in a closed tank until it vaporizes. When dirty part is lowered into hot vapor, solvent condenses on cold surfaces, runs off carrying dirt and grease. If, however, piece stays in tank until its temperature reaches that of vapor, uncondensed solvent will attack paint and varnish films.

Air blasting with mildly abrasive material, such as ground corncobs, is another recent cleaning method. Standard sandblasting equipment can be used for this job. For best results, piece

Basic information for this article was obtained from National Electric Coil Co, Columbus, Ohio.

should first be solvent cleaned, with blasting used to remove brittle varnish films without injury to winding or mica commutator insulation.

All these methods work if done properly. But most important is getting piece completely clean before varnishing. Each unit should also be baked out and tested after any cleaning, and before treating with varnish.

Modern insulating varnishes use a synthetic resin base (bakelite, polyester, glyptal, etc). These materials are *reactive*, that is, they set up and cure by heat. Some oils blended with the resins require oxidation to cure, hence the combination of heat and air in baking ovens.

Dip varnish in tanks is (1) warmed by preheated parts being dipped (2) oxidized and its solvent evaporated by surface exposure to air, and (3) contaminated by oil, dirt, carbon and grease left on objects immersed. So it's almost impossible to keep used varnish in top condition unless carefully handled under optimum conditions.

Pointers. Here are some hints to follow:

Keep varnish in dip or vacuum impregnating tanks close to room temperature, 70 to 90 F. If parts are preheated before treatment, let them cool to 140 F or below before dipping. Heating varnish will increase viscosity and evaporate thinner.

Keep tanks covered at all times when not in use to prevent oxidation of oils and evaporation of solvent. A blanket or slight pressure of an inert gas like carbon dioxide (CO_2) or nitrogen (N_2) in storage tanks is very helpful. Stir tanks often to cut separation of solvents from solids.

If it's necessary to treat a dirty piece, wrap it in muslin or duck cloth. When part is drained, sack will catch most contamination. In systems having recirculation or transfer pumps, filter is often put in line to strain out solid particles.

Varnish viscosity will go up even when specific gravity is held constant. *This is especially true in large tanks* that seldom have new varnish added. So it's wise to measure viscosity at least twice a week. Because viscosity varies with temperature, bring your sample to a constant standard temperature each time before measuring.

Holding down viscosity with a lot of thinner can be tricky. If proportion of thinner to nonvolatile content of varnish gets too high, varnish base will coagulate or separate out of your solution.

When mixing thinner with varnish, be sure both are about the same temperature. Adding warm thinner to cold varnish or cold thinner to warm varnish may cause varnish base to go out of solution. Add thinner slowly with constant stirring to make sure of thorough mix.

When you reach proper consistency, measure specific gravity with a hydrometer designed for liquids lighter than water. Then hold that specific gravity by adding thinner to within plus or minus .001. Specific gravity will also vary with temperature, so correct measurements to same standard temperature used for viscosity tests.

For best results in vacuum impregnation, preheat piece in baking oven, and let cool to 140 F or below. Place *in tank and draw* best vacuum possible. Stop vacuum pump. Then, without breaking vacuum, admit varnish until its level is at least 12 in. above windings. Release vacuum and let part soak. If you like, apply 75-80 psi inert atmosphere (CO_2 or N_2) above varnish.

Transfer varnish back to storage tank and let piece drain for at least one hour. Then bake with good air circulation at not less than 275 F.