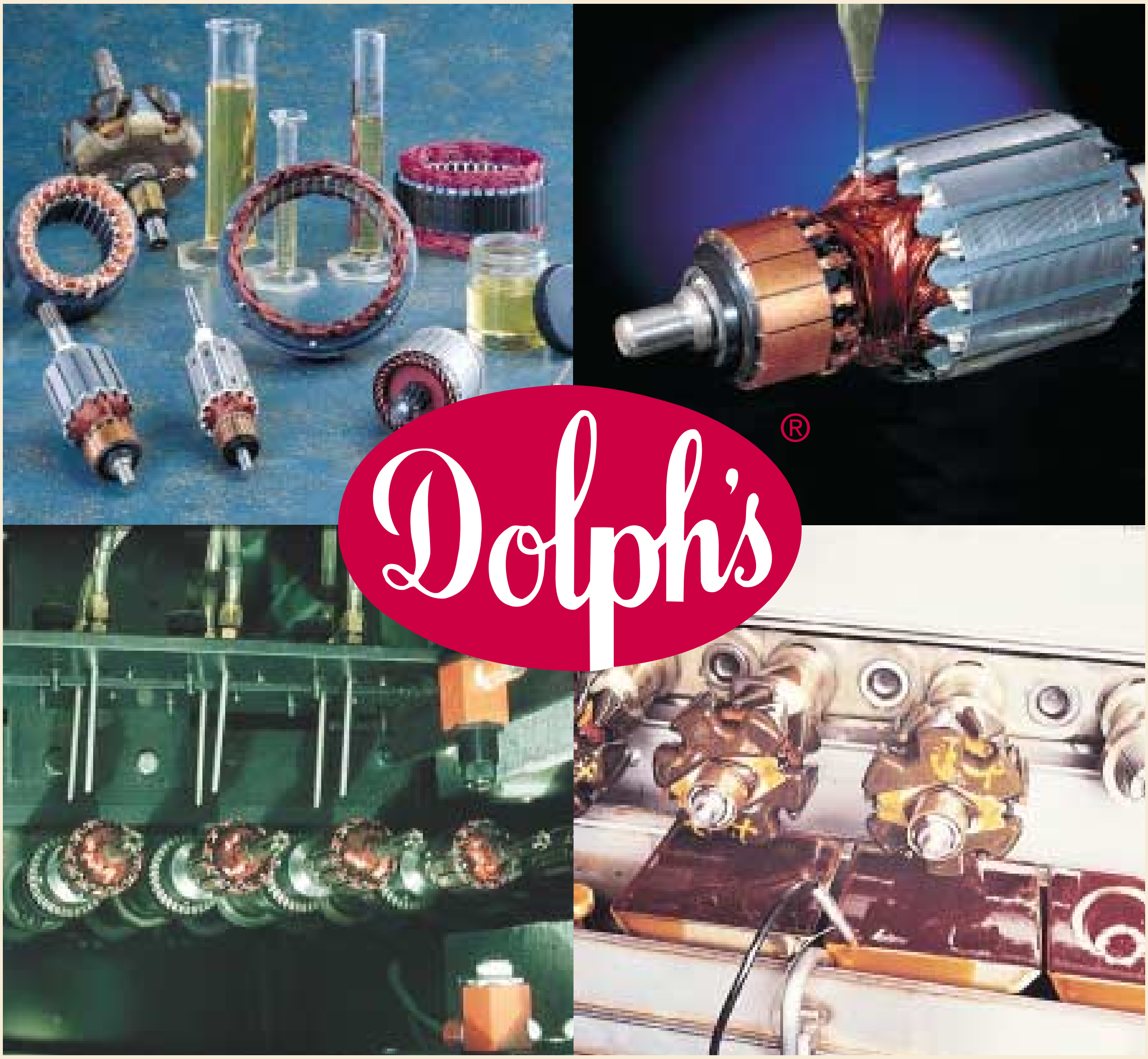
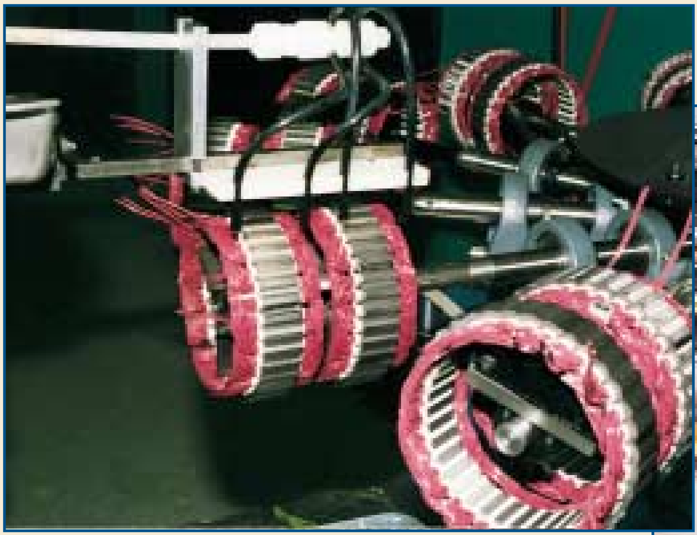
NEW
REVISED
EDITION

SELECTION CHART



TRICKLE IMPREGNATION RESINS

FORMULATED SPECIFICALLY
FOR THE ELECTRICAL INDUSTRY



Thomas and William Machinery Co.-Nashville, Tennessee

Mazzali Systems, SPA-Italy

ADJUSTMENTS AND TROUBLESHOOTING

DOLPH resins often penetrate better and cure faster than others. It may be necessary to adjust the conveyor speed, preheat temperature and shot size or flow rate when a new part or new resin is introduced.

PROBLEM	CAUSE	SOLUTION
ADJUSTING SHOT SIZE	Switching to a new resin.	Dispense a shot into a cup; adjust the pump and nozzle to dispense an equal amount of new resin. If necessary, adjust shot size until only one or two drops of excess resin come off.
	Changing part size.	Experiment with shot size until only one or two drops of excess resin come off.
BLISTERING	Cure temperature or preheat too high.	Check temperatures and reduce heat as needed.
EXCESSIVE BUILD ON END TURNS: PREMATURE CURING	Preheat temperature too high.	Reduce preheat temperature.
	Too much catalyst.	Adjust catalyst to resin ratio.
LITTLE OR NO RESIN IN THE SLOTS	Preheat temperature too high (premature gel).	Reduce preheat temperature.
	Preheat temperature too low (gel too slow, resin runs out).	Increase preheat temperature.
	Insufficient catalyst.	Adjust catalyst to resin ratio.
	Too little resin dispensed.	Increase shot size; See “Adjusting shot size”.
SOFT OR INCOMPLETE CURE	Insufficient catalyst.	Adjust catalyst to resin ratio.
	Heat too low or bad heating element.	Correct voltage or replace element.
	Conveyor too fast; heat cure too short.	Slow down the line, or increase temperature.
	Gel time too long; product with longer gel time will require a longer cure time.	Check gel time and add catalyst for faster cure. Call DOLPH’S Technical Service for more help.

WHAT IS TRICKLE IMPREGNATION?

Trickle Impregnation is the process of applying resin through nozzles directly onto electrical windings. The cycle is automated, usually within a self-contained machine or in a series of machines designed to work as a unit. Hundreds of parts can be manufactured each hour with only one attendant to load and remove the parts. The process is ideal for automated systems that combine winding machines, loading machines, ovens and robots. Trickle application is generally used for high volume motor manufacture such as automotive parts, power tools, home appliances, vacuum cleaners, fans, and personal appliances, i.e. shavers, electric tooth brushes, etc.

TRICKLE IMPREGNATION APPARATUS

There are several variations of the trickle process, but all have essentially the same operations: load/unload, preheat, resin application, gel and cure. The heat source may be radiant heat (calrods), resistance, convection or induction heat. Variations of the resin application include measured-shot/indexed trickle, continuous flow (flood coating), and roll-thru. In recent years equipment for the “heatless cure” or “chemical cure” process has been developed for treating parts with resins that cure without a final bake.

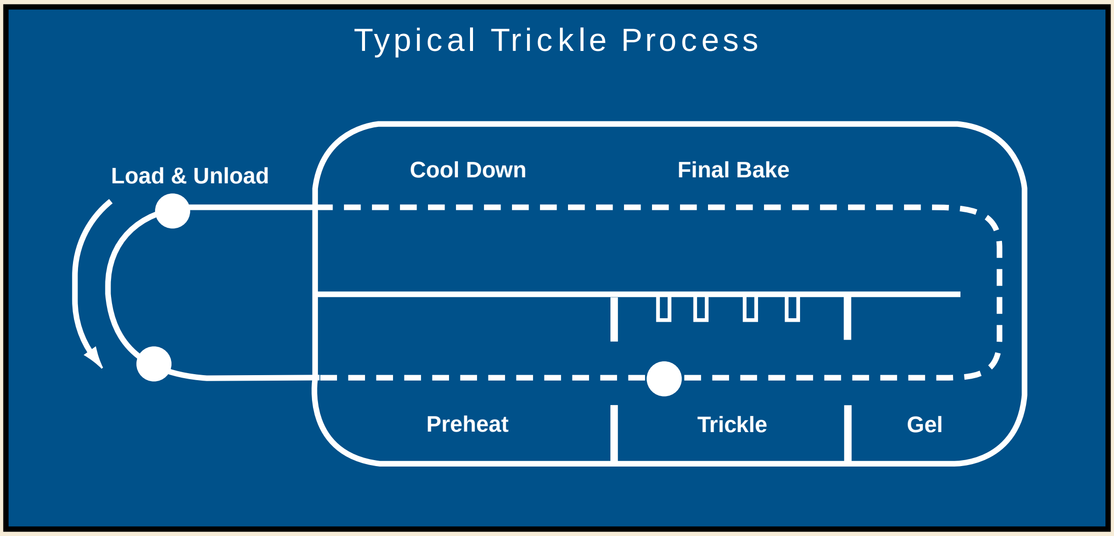
CHOOSING AND USING DOLPH TRICKLE RESINS

Resins for automated processing are moderate to ultra-fast curing. Most are solventless. Some are pre-catalyzed (one part), and others require a catalyst or activator to cure. Motor design, end use requirements, the trickle apparatus and resin application method will guide your choice of DOLPH impregnating products.

1. For the conventional trickle (measured-shot/indexed) machines, resin is fed through the nozzle in discrete amounts by a positive displacement pump. Very fast curing resins can be used for conventional trickle.
2. In flood coating the parts pass under continuous streams of resin. The overflow is captured in a reservoir and recirculated up to the nozzles. Products for flood coating will have longer cure times.
3. Roll-thru differs from trickle in that the parts are partially immersed in a trough of resin. As the parts rotate through the trough the shaft remains clear of the resin. Resins for roll-thru must have a somewhat longer gel time.
4. FAST-CURE resins used for heatless trickle should have a very fast, low temperature cure. Some of the machines are equipped with a meter/mix dispenser that will catalyze the resin as needed. DOLPH has developed two types of FAST-CURE resins. One type is formulated for meter/mix dispensing. The other type is catalyzed before use. The catalyzed resin can then be run in conventional or heatless cure trickle machines, and costly meter/mix dispensing equipment is not needed.

TYPICAL TRICKLE APPLICATION CYCLE

1. Parts 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.
2. 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 gel 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.
3. 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.
4. 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 minutes. 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.



	DOLPHON PRODUCT NUMBER	PRODUCT DESCRIPTION	CATALYST	MIX RATIO[1] by weight Resin: Catalyst	GEL TIME MIN. @ °F	VISCOSITY Brookfield CPS @ 77°F	TYPICAL CYCLE for 1-2 lb. Part			FLASH POINT °F	DIELECTRIC STRENGTH VPM	BOND STRENGTH ASTM D-2519 lbs @ 150°C	U.L. SYSTEM CLASSES
							Preheated Part Temp°F	Cure Time 1 lb Rotor,Min	Cured Part Temp°F				
TRICKLE	CC-1096	Low viscosity, high bond, polyester resin. Excellent penetration. Fast cure at low temperautre. Power tools, appliance motors and automotive parts.	CA-2011	100:1	8-13 @ 212	100-200	180	5	260	88	3000	8	130-180
TRICKLE	CC-1105-OPT	One part: nothing to mix. High bond, high flash, polyester resin. Fast cure. Power tools, appliance motors and automotive parts.	Pre Catalyzed	One Part	12-19 @ 212	400-700	230-240	8	275	>200	3500	10	130-220
TRICKLE	CC-1106	High flashpoint, fast curing, high bond solventless polyester resin. Use for small motors, power tools and automotive parts.	CA-2011	100:1	8-12 @ 212	400-700	220-285	10-15	300	>200	3300	16	130-220
TRICKLE	CC-1126	Two part epoxy compound. Very high bond strength. High impact strength. Easy 1:1 mix ratio by weight or volume. Low exotherm. Impact tools, jack hammers, and automotive parts.	CC-1126 Part B	100:100	1-3 @ 285	4000-8000	240-290	8	255	>200	1600	30	130-180
TRICKLE	CC-1305TR	High flash, solventless polyester resin. Flexible, resilient, high bond. Excellent protection. Low odor.	CA-2011	100:2	8-14 @ 212	400-600	220-285	10-15	325	>200	3500	10	130-220
TRICKLE	XL-2101	High flash, very low VOC. No formaldehyde, styrene, VT, TBS or DAP. Excellent protection and electrical properties.	CA-2011	100:1	8-13 @ 212	200-400	200-210	20-40	250-275	>200	2750	8	130-220
FAST-CURE TRICKLE	CC-1261	FAST-CURE, flexible polyester resin for "Heatless Trickle," "Chemical Cure," or conventional trickle. No final bake needed. Optional heat will speed up cure. (also CC-1260 in styrene monomer)	CA-2011	100:3	5-10 @ 180	200-400	180-200	10-15	N/A	128	3000	12	130-180
FAST-CURE TRICKLE	XL-2110FC	High flash, very low VOC. No formaldehyde, styrene, VT, TBS or DAP. Excellent protection and electrical properties. Superior tank life. Fast cure.	CA-2011	100:3	5-10	200-400	220-230	19-30	250-275	>200	2750	10	130-180
TRICKLE OR ROLL-THRU	CC-1080L	High bond, polyester resin for trickle, flood coater, or roll-thru. Power tools, appliance motors and automotive parts.	CA-2011	100:1	10-15 @ 212	150-300	220	30	300	88	3000	10	130-180
TRICKLE OR ROLL-THRU	CC-1133-TR	High bond, flexible polyester resin for trickle, flood coater, and roll-thru. Reduces noise. Resists corrosion. Power tools, appliance motors and automotive parts.	CA-2011	100:1	8-13 @ 212	250-500	220-285	10	300	128	3500	10	130-220
TRICKLE OR ROLL-THRU	XL-2110LV	High flash, very low VOC. No formaldehyde, styrene, VT, TBS or DAP. Excellent protection and electrical properties. Good penetration	CA-2011	100:1	8-13 @ 212	200-400	200-210	20-40	250-275	>2000	3300	9	130-180
ROLL-THRU	AQUA-THERM BC-365LTC	Fast curing, water borne varnish. Good bond strength. Low build. Low viscosity, good penetration. Environmentally friendly.	One Part	One Part	-	100-400 thinned 1:1 with water	220-250	90	275	>200	3400	10	130-220
ROLL-THRU	CC-1099	Low viscosity polyester resin for trickle, flood coater and roll-thru. Low Build. Power tools, appliance motors and automotive parts.	CA-2011	100:1	10-15 @ 212	30-90	220	30	300	88	3000	6	-
ROLL-THRU	CC-1105	High bond, high flash, polyester resin. Rigid. Fast cure. Power tools, appliance motors and automotive parts.	CA-2011	100:1	110-160 @ 212	400-700	250-285	60	300	>200	4000	20	130-220
ROLL-THRU	CC-1133	Fast curing, flexible polyester. Good bond strength. Reduces noise. Resists corrosion. Power tools, appliance motors and automotive parts.	CA-2011	100:2	19-28 @ 212	300-600	220-285	30	300	128	3500	10	130-220
ROLL-THRU	XL-2110	High bond, high flash, epoxy-polyester hybrid resin. Excellent moisture resistance. Power tools, appliance motors and automotive parts.	CA-2011	100:1	8-13 @ 212	850-1000	180-200	30	285-300	>200	2750	10	130-180
TRICKLE STAKING COMPOUND	CN-1139	Filled polyester compound to reinforce wire connections. Apply behind the commutator tangs (risers) prior to preheat or through a trickle nozzle in a normal trickle station. Cures during trickle process. May eliminate string wrap and reduce arcing.	CA-2011	100:1	8-17 @ 212	10,000-16,000	180	5-10	260	88	-	N/A	-

ADVANTAGES OF TRICKLE RESIN IMPREGNATION

- Faster processing
- Minimal balancing
- Better impregnation and fill
- More uniform coating
- Labor saving
- Resin applied directly to windings
- Completely automated
- More resin retained
- Minimal clean up
- No dip tank and associated cost
- One operator handles cycle
- Superior performance
- Lower VOC's

GLOSSARY OF TRICKLE IMPREGNATION TERMS

Bond Strength: The measure of force required to break the bond of varnished helical coils of enameled magnet wire.

Centipoise: Unit of viscosity. Usually measured by drag on a turning spindle immersed in the liquid, Brookfield viscosity. A force of 0.01 dyne per centimeter.

Chemical Cure: The process by which a liquid resin compound is converted into a solid by chemical reaction, with heat or without. See electrical varnish.

Convection Heat: Heat transferred to an object by circulation of hot air from a gas or electric heat source.

Conventional Trickle Machine: Trickle impregnation apparatus in which resin is dispensed from paired nozzles in discrete amounts or shots.

cps: See Centipoise

Electrical Varnish: A resinous material used to protect and insulate electrical apparatus, which is applied as a liquid and converted by chemical action, with heat or without, to form a solid film or mass.

FAST-CURE: DOLPH ultra fast curing resins especially formulated for “no-bake” cure. Recommended for the so called “Heatless” or “Chemical Cure” machines and conventional machines where the cure cycle is shortened or eliminated.

Film Build: Average coating thickness of cured resin on one side of a metal plate.

Final bake: A heat or oven cure as opposed to a room temperature cure.

Flash Point: The lowest temperature at which sufficient vapor is present, under specific test conditions, to burn if a flame is introduced, as opposed to the auto-ignition temperature, a much higher temperature, at which burning may begin spontaneously.

Flood Coater: Trickle impregnation apparatus in which resin is applied in a continuous stream. The overflow is captured in a reservoir and re-circulated. Heat (from preheated parts) can shorten the pot life of the resin. Refrigeration may be used to extend resin life.

Gel Time: Time required for a small amount of catalyzed resin, when heated, just to reach the semi-solid or gel stage. Often performed in a test tube immersed in a hot water bath. Reported as “time at temperature.”

Heatless Trickle: Term used to describe a varnish impregnation system in which the resin is applied through nozzles onto a preheated winding. The resin then cures at ambient temperature without a final heat cure. May include high precision meter/mix dispenser to accommodate high mix ratios (100:1). Also called chemical cure.

Induction Heat: Heat caused in an object placed in an electro-magnetic field.

Measured Shot: See conventional trickle machine.

Penetration and Fill: The process by which the varnish is drawn into and retained within the part.

Polymer: A chemical compound of high molecular weight which consists of repeating individual molecules linked by chemical bonds.

Polymerization (Polymerize): A chemical reaction in which two or more individual molecules combine to form larger molecules. See polymer.

Pot Life: The time the product remains usable after it is mixed with catalyst or activator. Sometimes called tank life.

Preheat: To heat the device before impregnating.

Radiant heat: Energy that is emitted by a glowing source (calrod, heat lamp, etc.) and is absorbed in the object as heat energy. Varies with the distance between the source and the object. Larger diameter parts will heat faster. Also called infrared.

Resins: A class of organic, liquid, fusible materials of synthetic or natural origin that are polymeric in structure.

Resistance Heat: Heat caused by passing electric current through a conductor. Supplied by connecting the leads on each part to a source on the conveyor or carousel. Varies with wire size, supplied voltage, and type of wire (copper, aluminum, etc.).

Roll-Thru Machine: Apparatus in which rotating parts are partially immersed in a trough of resin. Resin is pumped into the pan, allowed to overflow into a reservoir, and then recirculated. Heat (from preheated parts) can shorten the pot life of the resin. Refrigeration may be used to extend resin life.

Thermal Conductivity: The ability of a material to conduct heat. Usually expressed as: Calories/sec/cm^2/°C/cm thickness.

Trickle Impregnation: Process in which resin or electrical varnish is dispensed directly onto the electrical windings as opposed to dipping. Generally used for fractional, sub-fractional and small integral motors up to 70 or 80 pounds. May also be used on solenoids, coils and transformers.

Viscosity: The resistance of a material to flow. Higher viscosity liquid flows more slowly, lower more quickly. May be measured in centipoise, or in minutes and seconds.

Wicking (to wick): The process by which liquid is drawn into a bundle of fibers or strands of wire by capillary action, as in a lantern wick.

Dolph's®

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