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

Bump: Briefly revert from vacuum to atmospheric pressure and again draw the vacuum. Applied in the wet vacuum cycle to help dislodge trapped air and improve penetrability.

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

Film Build: Average build-up of cured resin on one side of a metal panel.

Copolymer: A polymer formed by the in situ polymerization of two or more chemically different monomers with each other.

cps: Unit of viscosity. Usually measured in centipoise, or in minutes and seconds.

Dry: Describes a coil or devices that have not been treated, coated or sealed.

Dielectric Constant: The voltage a material can withstand before breakdown occurs. Usually expressed in “Volts Per Mil”. Interestingly, a thicker material can withstand a higher voltage, but for 2 mils, breakdown would be only 5000 Volts but a lower dielectric strength, i.e. dielectric constant.

Form Wound: Describes a coil that is formed or shaped in a fixture, often made with rectangular conductors laid precisely together, interleaved with flexible insulation. Also usually covered with one or more layers of tape before incorporating such coils.

Green: Describes coils or devices that have not been treated, coated or sealed.

Half Lap: Spiral tape wrap in which each turn overlaps the previous one by a half tape width. Provides a double thickness of tape.

Hertz: A term indicating the frequency of one cycle per second.

Hg: Chemical symbol for the element, mercury.

Hold Tank: A reservoir for keeping the varnish when it is not in use. Should be equipped with heavy duty mixer and vacuum capability. Refrigeration may be needed in warmer climates.

Refrigeration may be needed in warmer climates when infrequent use is anticipated. Also consider cooling when infrequent use (low tank turnover) is anticipated. Storage @ <75°F is suggested. Vacuum cycles can be shorten by storing the resin under vacuum to prevent build up of air and other gases in the resin.

H2: See Hertz.

Millibar: A unit of atmospheric pressure: 0.75 mm Hg (75 microns). One mm equals 1.33 mbar.

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

Preheat: To bake the device before processing.

Preheated Oven: Oven heated until the skin shrinks only at an even rate. Suitable for a mini oven or furnace when oven temperature is held constant but for 2 min, breakdown would be only 5000 Volts (2500 VPM).

Disipation Factor: An indication of energy loss in the circuit, as in the production of unwanted heat. A multiplier used to obtain useful energy compared to supplied energy.

Vacuum Chamber: A vessel where devices are processed. May be equipped for both vacuum and pressure. Usually, also includes 2 port, the eight port and the light port, one for illumination, the other for viewing the process.

Vacuum: The measure of force used to conduct heat. Usually expressed as: Centigrade/second/cm thickness of tape.

Thixotropy (Thixotropy): Describes materials that liquify or flow when agitated (mixed) and return to a thick consistency when allowed to rest, e.g. ketchup. A thixotropic material can therefore be used both at high and low temperatures.

TT: Limit of pressure (vacuum): 1 mm Hg.

Thermal Conductivity: The ability of a material to conduct heat. Usually expressed as: Calorie/sec/cm²/°F/cm thickness of tape.

Volume Resistivity: The resistance of a material to flow. Higher viscosity liquid flows more slowly, lower more quickly. May be measured in ohm-cm. See Hertz.

Vapor Pressure: An indication of the evaporation rate. The pressure in an enclosed container when the vapor and liquid are in equilibrium.

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.

Volume Resistivity: The ability of a material to resist the passage of electricity through it. The value is expressed in “Ohm-Cm”.

Glossary of VPI Terms Continued

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

Storage Life: The time during which a liquid resin can be stored @ 70°F and remain suitable for use. Also called “Shelf Life”. See Tank Life.

Stress Crack: A fissure in the cured resin caused by unequal expansion and contraction of the core, flexible insulation, resin, etc.

Tank Life: The time the product remains usable in service. Tank life is affected by the frequency of use, processing temperatures, humidity of material, storage temperature, and occasionally by contaminants. Also called “Life”.

Thermal Conductivity: The ability of a material to conduct heat. Usually expressed as: Calorie/sec/cm²/°F/cm thickness of tape.

Viscosity: An indication of the evaporation rate. The pressure in an enclosed container when the vapor and liquid are in equilibrium.

Volume Resistivity: 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.

Volume Resistivity: The ability of a material to resist the passage of electricity through it. The value is expressed in “Ohm-Cm”.

Continued on Back Panel
Bond Strength: The measure of force required to break the bond of varnished helical coils of enamelled magnet wire.

Bump: Briefly revert from vacuum to atmospheric pressure and again draw the vacuum. Applied in the wet vacuum cycle to help dislodge trapped air and improve penetration.

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

Film Build: Average buildup of cured resin on one side of a metal panel.

Copolymer: A polymer formed by the simultaneous polymerization of two or more chemically different monomers with each other.

Cps: See Centipoise.

Deaerate: Remove air and other gasses by vacuum. Note that initial deaeration after a tank fill can take from several hours to as much as 3 or 4 days depending on the amount, type and condition of the resin.

Vacuum. Note that initial deaeration after a tank fill can take from several hours to as much as 3 or 4 days depending on the amount, type and condition of the resin.

General: A polymer formed by the different monomers with each other.

Deaerate: A reservoir for keeping the vacuum system filled with air or vacuum. Usually operated with a vacuum pump and bleeder valve. Several wraps of half lapped tape. Also a motor incorporating such coils.

Green: Describes coils or devices that have not been resized, coated or sealed.

Half Lap: Spiral tape wrap in which each turn overlaps the previous one by a half tape width. Provides a double thickness of tape.

Hertz: A term indicating the frequency of one cycle per second.

Hg: Chemical symbol for the element, mercury.

Holding Tank: A reservoir for keeping the vacuum system filled with air or vacuum. Usually operated with a vacuum pump and bleeder valve. Several wraps of half lapped tape. Also a motor incorporating such coils.

Dielectric Constant: A unit of viscosity. Usually measured by the drag on a plunging spindle immersed in the liquid. Brookfield viscosity. A force of 0.01 dyne per centimeter.

Dielectric Strength: The voltage a material can withstand before breakdown occurs. Usually expressed in “Volts Per Mil”. Sometimes called “Breakdown Voltage”.

Form Wound: A term indicating the frequency of one cycle per second.

Glossary of VPI Terms Continued

Flash Point: The temperature at which enough vapor is generated to fill a spark or flame to be ignited.

Foaming: An accumulation of frothy bubbles caused under vacuum by the expansion of air and other gasses trapped within the resin.

Glossary of VPI Terms Continued

Flash Point: The temperature at which enough vapor is generated to fill a spark or flame to be ignited.

Flux: A liquid that can be used for illumination, the other for viewing the process. Also includes 2 portholes, the sight port and the light port.

May be equipped for both vacuum and pressure. Usually, also includes 2 portholes, the sight port and the light port. One for illumination, the other for viewing the process.

Flexible: Provides a double thickness of tape.

Flooring: Describes coils or devices that have not been resized, coated or sealed.

Half Lap: Spiral tape wrap in which each turn overlaps the previous one by a half tape width.

Hertz: A term indicating the frequency of one cycle per second.

Hg: Chemical symbol for the element, mercury.

Holding Tank: A reservoir for keeping the vacuum system filled with air or vacuum. Usually operated with a vacuum pump and bleeder valve. Several wraps of half lapped tape. Also a motor incorporating such coils.

Green: Describes coils or devices that have not been resized, coated or sealed.

Half Lap: Spiral tape wrap in which each turn overlaps the previous one by a half tape width. Provides a double thickness of tape.

Hertz: A term indicating the frequency of one cycle per second.

Hg: Chemical symbol for the element, mercury.

Holding Tank: A reservoir for keeping the vacuum system filled with air or vacuum. Usually operated with a vacuum pump and bleeder valve. Several wraps of half lapped tape. Also a motor incorporating such coils.

Green: Describes coils or devices that have not been resized, coated or sealed.

Half Lap: Spiral tape wrap in which each turn overlaps the previous one by a half tape width. Provides a double thickness of tape.
DOLPH Resins for VPI...

When impregnated with resin, DOLPH products significantly contribute to the successful performance of the VPI process. We have continuously worked with our customers to obtain superior results. Our experience in the field and in the laboratory has allowed us to develop an array of solventless resin products that are recognized and exhibit the most desirable characteristics, through exacting formulation and selection of polymers and copolymers.

Advantages of VPI...

Vacuum Pressure Impregnation (VPI) produces a better insulation system than can be obtained by conventional methods, better environmental protection and superior chemical and moisture resistance (salt water immersion tests). It is often not fill any areas surrounded by resin).

Applications for VPI...

What is VPI?

Vacuum Pressure Impregnation (VPI) is a system in which vacuum and pressure are used to seal the penetration of liquids into various devices. It is often used to impregnate electrical apparatus with insulating resins (electrical varnishes), because it can provide a virtually air-free impregnation with only one VPI cycle (further cycles will fill small surface openings but will not fill any area surrounded by resin).

DOLPH Resins for VPI...

Vacuum Pressure Impregnation (VPI) is a system in which vacuum and pressure are used to seal the penetration of liquids into various devices. It is often used to impregnate electrical apparatus with insulating resins (electrical varnishes), because it can provide a virtually air-free impregnation with only one VPI cycle (further cycles will fill small surface openings but will not fill any area surrounded by resin).

DOLPH Products: ..When impregnated with resin.

...and lower temperature rise. Further, VPI with a

...conducted to the outside more efficiently, better

...longer electrical life and less opportunity for corona.

...and moisture resistance (salt water immersion tests).

...Advantages of VPI...

...may increase penetration.

...be varied according to the VPI equipment, resin and apparatus to be treated. Equipment to be processed

...The part is placed on an oven heated to 250˚-325˚F. The preheat serves to evaporate moisture and any volatile oils, which may be present. The preheat stage should be followed by a rolling thin resin viscosity surrounding the part, and creates suction when the part is cooled by immersion in the resin. Before proceeding to the next step, oven temperature should be held at 350˚F.

...increases the holding temperature for at least 15 minutes. Agitation will

...higher mechanical strength, and lower dielectric

...process, give better high temperature performance,

...higher thermal conductivity, exceptional bond

...reduced viscosity for effective penetration and fill.

...products should be agitated (mixed) in the holding tank for at least 15 minutes. Agitation will

...viscosity surrounding the part, and creates suction when the part is cooled by immersion in the

...viscosity for effective penetration and fill.

...The part is placed in an oven and heated to 250˚-325˚F. The preheat serves to evaporate moisture and any volatile oils, which may be present. The preheat stage should be followed by a rolling thin resin viscosity surrounding the part, and creates suction when the part is cooled by immersion in the resin. Before proceeding to the next step, oven temperature should be held at 350˚F.

...resulting in the vacuum chamber allowing it to flow up from the bottom as soon as it does not block full penetration. The resin should cover the part by a depth of at least 1/2 inch. In excesses occurring during the introduction of resin it allows time for air and gases to escape.

...VPI equipment, resin and apparatus to be treated. Equipment to be processed

...the vacuums may increase penetration.

...Inverters

...Vacuum Line

...Pressure Line

...Vacuum Line

...CC-1105

...CC-1105-HTC

...CC-1113

...CC-1120

...CC-1305-HTC

...XL-2102

...XL-2103

...XL-2103

...XL-2108

...XL-1115

...XL-1118-LV

...XL-1152

...XL-1143

...XL-1152

...XL-1143

...XL-1143

...XL-1143

...XL-1143

...XL-1143

...XL-1143

...XL-1143

...XL-1143

...XL-1143

...XL-1143

...XL-1143
What is VPI?
Vacuum Pressure Impregnation (VPI) is a system in which vacuum and pressure are used to obtain the penetration of liquids into various devices. It is often used to impregnate electrical apparatus with insulating resins (electrical varnish), because it can provide a virtually free from air-voids impregnation with only 1 cycle VPI. Further cycles will still seal small surface openings but will not fill any area surrounded by resin.

Advantages of VPI...
VPI produces a better impregnation system than can be obtained by conventional methods, better environmental protection and superior chemical and moisture resistance (salt water immersion tests). The removal of air voids from the winding assures excellent electrical strength, lower internal losses, whereas polyester is held to be easier to remove.

DOLPH products significantly contribute to the successful performance of the VPI process. We have continuously worked with our customers to obtain superior results. Our experience in the field and the laboratory has allowed us to develop an array of solventless VPI products that are user recognized and exhibit the most desirable characteristics, through exacting formulation and selection of resins and copolymers.

Applications for VPI...
- Chemical Duty Motors
- HID Ballasts
- High Voltage Machines
- Precision Wound Transformers
- Armatures With Coils Installed
- Form Wound Coils
- Inverters
- Rugged Duty Motors
- Formaldehyde, styrene, VT, tBS or DAP. Excellent processability, good cure rate.

Typical VPI cycle...
This process should be varied according to the VPI equipment, resin and apparatus to be treated. Equipment to be processed must be large, grounded (intertied), and taped unassembled, open, or permeable so as not to block the resin. When filled 3-Sided tapes or tape should not be used.

Vacuum Pressure Impregnation (VPI) is a system in which vacuum and pressure are used to obtain the penetration of liquids into various devices. It is often used to impregnate electrical apparatus with insulating resins (electrical varnish), because it can provide a virtually free from air-voids impregnation with only 1 cycle VPI. Further cycles will still seal small surface openings but will not fill any area surrounded by resin.

Advantages of VPI...
VPI produces a better impregnation system than can be obtained by conventional methods, better environmental protection and superior chemical and moisture resistance (salt water immersion tests). The removal of air voids from the winding assures excellent electrical strength, lower internal losses, whereas polyester is held to be easier to remove.

DOLPH products significantly contribute to the successful performance of the VPI process. We have continuously worked with our customers to obtain superior results. Our experience in the field and the laboratory has allowed us to develop an array of solventless VPI products that are user recognized and exhibit the most desirable characteristics, through exacting formulation and selection of resins and copolymers.

Applications for VPI...
- High Voltage Machines
- Diaphragms
- Transformers
- HD Ballasts
- Armatures With Coils Installed
- Form Wound Transformers
- Chemical Duty Motors

VPI Resins for various applications demonstrate excellent performance when properly applied. They exhibit the most desirable characteristics, through exacting formulation and selection of resins and copolymers.

Applications for VPI...

- High Voltage Machines
- High Temperature Apparatus
- Transformers
- HD Ballasts
- Armatures With Coils Installed
- Form Wound Transformers
- Chemical Duty Motors

DOLPH products significantly contribute to the successful performance of the VPI process. We have continuously worked with our customers to obtain superior results. Our experience in the field and the laboratory has allowed us to develop an array of solventless VPI products that are user recognized and exhibit the most desirable characteristics, through exacting formulation and selection of resins and copolymers.

Applications for VPI...

- High Voltage Machines
- High Temperature Apparatus
- Transformers
- HD Ballasts
- Armatures With Coils Installed
- Form Wound Transformers
- Chemical Duty Motors

C-1115
- High flash, very low VOC. Polyester resin. Solventless, vacuum cure. Excellent processability, high flexural strength, low cure shrinkage, superior moisture and chemical resistance. Approved for sealed units per Mil-M-17060E; resists refrigerants (R134A).
- Thixotropic, semi-rigid, high build, high flash, high solids content polyester: Excellent processability, high flexural strength, low cure shrinkage, superior chemical and moisture resistance. Approved on sealed units per Mil-M-17060E.
- Thixotropic, flexible epoxy resin. Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E, MIL-S-16220, MIL-DTL-5020.

C-1115U
- Thixotropic, flexible, epoxy resin. Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E, MIL-S-16220, MIL-DTL-5020.

C-1116
- High flash, very low VOC. Polyester resin. Solventless, vacuum cure. Excellent processability, high flexural strength, low cure shrinkage, superior moisture and chemical resistance. Approved for sealed units per Mil-M-17060E; resists refrigerants (R134A).
- Thixotropic, semi-rigid, high-build, high-flash Polyester: Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E.

C-1116UV
- Thixotropic, flexible, epoxy resin. Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E, MIL-S-16220, MIL-DTL-5020.

C-1122
- Thixotropic, flexible, epoxy resin. Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E, MIL-S-16220, MIL-DTL-5020.

C-1122-U
- Thixotropic, semi-rigid, high build, high flash, high solids content polyester: Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E, MIL-S-16220, MIL-DTL-5020.

C-1135
- Slightly thixotropic, high flash, very low VOC. Polyester resin. Solventless, vacuum cure. Excellent processability, high flexural strength, low cure shrinkage, superior chemical and moisture resistance. Approved for sealed units per Mil-M-17060E.

C-1150
- High flash, high solids content polyester; Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E, MIL-S-16220, MIL-DTL-5020.

C-1150CC
- High flash, very low VOC. Polyester resin. Solventless, vacuum cure. Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E.

C-1160
- High flash, very low VOC. Polyester resin. Solventless, vacuum cure. Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E.

C-1160-SC
- High flash, very low VOC. Polyester resin. Solventless, vacuum cure. Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E.

C-1180
- High flash, very low VOC. Polyester resin. Solventless, vacuum cure. Exceptionally good mechanical properties, excellent chemical resistance, approved on sealed units per Mil-M-17060E.
**Glossary of VPI Terms**

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

**Bump:** Briefly revert from vacuum to atmospheric pressure and again draw the vacuum. Applied in 15 sec. for 2 mils, breakdown would be only 5000 Volts but for 2 mils, breakdown would be only 5000 Volts but a lower dielectric strength, i.e. dielectric section of material has a higher total breakdown strength for one mil Mylar tape may be 3000 VPM expressed in “Volts Per Mil”. Interestingly, a thicker tape, has stabilized. May take several hours.

**Continued on Back Panel**

**Flash Point:** The temperature at which enough vapor is generated to flash a spark or flame is introduced.

**Films Build:** A reservoir for keeping the resin where devices are processed. Also manufactured in: ENGLAND • ITALY • MEXICO

**Flash**: Descriptive coil or devices that have not been treated, coated or sealed.

**Half Lap:** Spiral tape wrap in which each turn overlaps the previous one by a half tape width. Provides a double thickness of tape.

**Hertz:** A term indicating the frequency of one cycle per second.

**Resins:** A class of organic, liquid, fusible materials of intermediate viscosity liquid flows more slowly, lower more quickly. May be used to increase the viscosity beyond that which can be achieved by storing the resin under vacuum to prevent build-up of air and other gases trapped within the resin.

**Form Wound:** Describes a coil that is formed or shaped over a fixture. Often made with rectangular conductors laid precisely together, interleaved with flexible insulation, and usually covered with one or several wraps of half lapped tape. Also a motor incorporating such coils.

**Green:** Describes coils or devices that have not been treated, coated or sealed.

**Glossary of VPI Terms Continued**

**Vacuum:** A vacuum chamber is used where devices are processed. May be equipped for both vacuum and pressure. Usually, it includes 2, the right port and the light port, one for illumination, the other for viewing the process .

**Vapor Pressure:** An indication of the evaporation rate. The pressure in an enclosed container when the vapor and liquid are in equilibrium.

**Viscosity:** The resistance of a material to flow: higher viscosity fluid flows more slowly, lower more quickly. May be measured in centipoise or in minutes and seconds. The unit of viscosity is the cP.

**Volume Reactivity:** The ability of a material to resist the passage of electricity through its bulk. The value is expressed in “Ohm-Cm”.

**Vital Signs:** AFibrillation, asystole, hypotension/low blood pressure, bradycardia, hypothermia.

**Vacuum Cycle:** The measure of force required to break the bond of varnished helical coils of enamelled magnet wire.

**Wet Vacuum Cycle:** A means of dislodging trapped air by the drag on a turning spindle immersed in the liquid, Brookfield viscosity. A force of 0.01 dyne per unit of time, Brookfield viscosity. A force of 0.01 dyne per unit of time, Brookfield viscosity. A force of 0.01 dyne per unit of time, Brookfield viscosity. A force of 0.01 dyne per unit of time, Brookfield viscosity.

**Wet Vacuum System:** A means of dislodging trapped air by the drag on a turning spindle immersed in the liquid, Brookfield viscosity. A force of 0.01 dyne per unit of time, Brookfield viscosity. A force of 0.01 dyne per unit of time, Brookfield viscosity. A force of 0.01 dyne per unit of time, Brookfield viscosity.

**Volume:** The pressure in an enclosed container when the vapor and liquid are in equilibrium.