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Insulation Film Enameled Guide

The information below should be used as a guide only. The data herein falls within a normal range but should not be used to establish specification limits or used alone as the basis of design. Dacron® is a registered trademark of DuPont.

Polyvinyl Acetal-Phenolic

NEMA **MW15C – MW18C**

Typical Applications
Square/Rectangular Oil-filled transformers, Random wound coils, Solenoids, Round Motors

Characteristics
Polyvinyl Acetal-Phenolic is a synthetic enamel composed of polyvinyl acetyl and phenolic resins. Polyvinyl Acetal-Phenolic's hot oil resistance sets it apart from all other magnet wire insulations. The flexibility, adhesion and abrasion scrape resistance of Polyvinyl Acetal-Phenolic film is excellent. Its electrical properties are very good and it is resistant to common solvents.

Polyurethane/Polyamide/Polyvinyl Acetate

NEMA **MW 29C**

Typical Applications

- ✓ Helical and toroidal coils
- ✓ Solenoid coils
- ✓ Voice coils

Characteristics
Polyurethane/Polyamide/Polyvinyl Acetate uses a polyurethane basecoat and a polyamide topcoat followed by a bond coat of polyvinyl acetate. This insulation system has a low temperature thermoplastic bond coat, which may be activated by heat or solvent (typically isopropyl alcohol). The electrical, chemical, physical and thermal properties of bondable wire are equivalent to those of the base insulation, except of course for the melting point or solvent resistance of the bond coat. The bond strength is excellent at room temperature.

Polyurethane/Polyamide

NEMA **MW 28C (Class 130) MW 80C (Class 155)**

Typical Applications
Polyurethane/Polyamide has excellent solderability in the 130/155°C thermal class. Widely used in coils and small motors. Not recommended where severe overloads are experienced.

- ✓ Appliance motors
- ✓ Encapsulated coils
- ✓ Relays
- ✓ Timer and clock coils

Characteristics
This insulation combines the magnet wire insulation characteristics of Polyurethane MW79 with the advantages of a nylon topcoat. With the nylon, this wire is solderable, yet the solvent resistance and thermal stability of the insulation are excellent. The nylon provides improvement in the wind-ability and tolerates more severe winding operations. Excellent for automatic winding machines.

Polyurethane

NEMA **MW79-C**

Typical Applications:
Widely used in coils and motor windings where severe overloads are not experienced and where solderability is important.

- ✓ Electronic coils
- ✓ Small motors
- ✓ Relays

Characteristics
This polyurethane insulation allows soldering without prior removal of the film from the wire. This wire has the equivalent physical and electrical properties of most other synthetic films. This insulation has excellent resistance to moisture and resists most common solvents including those used in synthetic baking varnishes.

Polyurethane

NEMA **MW 82C**

Typical Applications
This insulation is for applications requiring both high thermal resistance and low soldering temperatures. Care must be exercised in the application of this magnet wire, since this material does not exhibit overload resistance properties of most non-solderable Class 105, 130, 155 and 180 resin systems.

- ✓ Automotive Coils
- ✓ Relays
- ✓ Specialty Power Transformers

Characteristics
Thermoplastic flow (cut-through) temperature of this insulation is in the 250°C plus range; well above maximum process conditions found in molded coil work, trickle impregnation process and standard pre-heat varnish cycles specified for normal Class 130, 155 and 180 systems. Polyurethane solder strips readily without excessive build-up of solder dross associated with other solderable type resin coatings. It solders consistently at temperatures as low as 390°C.
Flexibility and adhesion properties of this magnet wire film are more than adequate for all but the most severe fine wire winding applications. Polyurethane exhibits high dielectric strength retention under high humidity conditions. Also, the low dissipation factor of this insulation at high frequencies makes it a prime candidate for RF coil applications. The solvent resistance properties of polyurethane are suitable for most Class 105, 130, 155, and 180 varnishes, encapsulates, and treating resins. It has improved salt-water resistance compared to other solderable insulations.

Polyurethane/Polyamid

NEMA **MW 83 C**

Typical Applications
Polyurethane/Polyamid is designed for applications requiring high thermal resistance and low soldering temperatures. Care must be exercised in the application of this insulation since this material does not exhibit overload resistance properties of most non-solderable Class 105, 130, 155 and 180 resin systems.
Automotive coils Small motors, armatures and fields
Specialty power transformers Bobbin wound and paper section coils
Toroidal coils Molded and encapsulated coils
Characteristics
Thermoplastic flow or cut-through temperature of Polyurethane/Polyamid is in the 250°C plus range; well above maximum process conditions found in molded coil work, trickle impregnation processes and standard pre-heat varnish cycles specified for normal Class 130, 155 and 180 systems.
This insulation solder strips readily without excessive build up of solder dross associated with other solderable type resin coatings. It solders consistently at temperatures as low as 390°C. Flexibility and adhesion properties of Polyurethane/Polyamide, because of its tough nylon topcoat, are more than adequate for most wire winding applications.
This magnet wire insulation exhibits high dielectric strength retention under high humidity conditions. The solvent resistance properties of Polyurethane/Polyamide are suitable for most. Class 105, 130, 155 and 180 varnishes, encapsulates, and treating resins. This insulation has improved salt-water resistance compared to other solderable insulations.

Modified Polyester-imide

NEMA **MW 77 C**

Typical Applications
Modified Polyester-imide is designed for those special coil applications where solderability is coupled with a need for high thermal resistance. It is not recommended for in-slot motor windings or applications subject to high winding stresses.

- ✓ Automotive coils
- ✓ Electronic coils
- ✓ Shaded pole motor coils
- ✓ Special transformer coils

Characteristics
Modified Polyester-imide is produced by insulating the conductor with a single coat of a solder-strippable modified polyester resin. Physical properties are adequate for most coil applications. More severe winding requirements such as in-slot stator windings are not recommended without thorough evaluation. This film may be readily stripped from the conductor by immersing in an 850° - 950°F solder pot; care must be exercised in preventing the film from over-curing due to poor immersion techniques.

Modified Polyester-amide/Polyimide

NEMA **MW 78 C**

Typical Applications
Modified Polyester-imide/Polyamide is designed for those special coil applications where solderability is coupled with a need for high thermal resistance. The application potential for this insulation is enhanced by the addition of the polyamide overcoat to the high temperature modified polyester basecoat.

- ✓ Automotive coils
- ✓ Shaded pole motor coils
- ✓ Special control coils

Characteristics
Modified Polyester-imide/Polyamide consists of a nylon topcoat over a solderable, high temperature modified polyester-imide. The solder stripping characteristic of the composite has been optimized for processing in a solder pot at 850° - 950°F. Physical properties are adequate for most coil applications. More severe winding requirements such as in-slot stator winding are not recommended without thorough evaluation. The electrical properties are influenced slightly by the hygroscopic nature of the nylon topcoat.

Characteristics
Polyester/Polyamide is a film insulation with a modified polyester basecoat and a nylon topcoat. Typical of dual-coat construction, advantage is taken of the high thermal properties of the polyester and the mechanical properties of the nylon. Polyester/Polyamide has become the standard of non-hermetic, fractional horsepower motors. This insulation offers the advantage of thermal endurance, high thermoplastic flow and excellent burnout performance. The 180°C thermal life and its outstanding burnout make it suitable for almost all motor applications except those operating in refrigerants or high moisture environments.

Polyester/Polyamideimide/Bondcoat

NEMA **MW 1000**

Typical Applications

- ✓ Clutch and brake coils
- ✓ Deflection yoke coils
- ✓ Helical and toroidal coils
- ✓ Motor field coils

Characteristics
This film describes a number of possible constructions of bondable wire having a base insulation with a thermoplastic bond coat. The bond coat may be epoxy or aromatic polyamide. The bond strength and "melt" temperatures required will define the proper bond coat to use. Both bond coats have excellent bond strength at room temperatures. Bond S should be used where bond strength is more critical at elevated temperatures. The type M bond coat may be activated by solvent (typically methylethyl ketone) or heat while the type S bond coat is heat activated. Only this bond coat allows the use of resistance, induction or radiant heating to flow the bond. Typically, the addition of the bond coat adds one overall build level to the wire dimension.

Polyester/Polyamideimide

NEMA **MW 35 C Round, MW 36 C Square & Rectangular, MW 73 C Hermetic Round**

Typical Applications

- ✓ Automotive and power tool motors
- ✓ Dry type transformers
- ✓ Electronic coils
- ✓ Fractional and integral horsepower motors (hermetic and open)
- ✓ General-purpose motors
- ✓ Large coil applications – unvarnished, varnished or encapsulated

Characteristics
Polyester/Polyamideimide is a multi-purpose film insulation which has a modified polyester base coat and a polyamideimide topcoat. This combination provides a film insulation, which has physical toughness, excellent dielectric properties, and superior chemical resistance to common solvents and refrigerants. Thermal properties of over 200°C qualify it for severe thermal overload applications. Compared to nylon over coated polyester, the properties most improved are physical moisture, chemical and thermal resistance. This is an extremely moisture-resistant film insulation coating, suitable for many uses including open motor, high moisture application and hermetic applications. Properties include thermal life, thermoplastic flow, and burnout and heat shock. Used for motor repair, maximum result, and minimum reject applications. This film insulation couples the extra advantages of high moisture resistance with ease of insertion.

Polyester/Polyamideimide

NEMA **MW 35 C**

Typical Applications
This insulation has been specifically designed for use in motors that may be subjected to higher voltage spikes present in inverter duty applications. The combination of the modified polyester basecoat and polyamideimide topcoat provides an insulation system with outstanding toughness and dielectric properties. This insulation has improved voltage endurance and thermal properties compared to standard NEMA MW 35 C magnet wire, while retaining superior chemical resistance to common solvents and refrigerants. This film insulation is recommended for various end uses as follows:

- ✓ Electronics (All types of coils, Class 105 through 200)
- ✓ Rotating Machines (Fractional and Integral HP Motors, Hermetic Motors, DC Motors,
- ✓ Power Tools, Automotive Alternators and Generators)
- ✓ Transformers (All dry type, Class 105 through 200, Control Type)

Characteristics
This film insulation has excellent thermoplastic flow (cut-through) properties, with typical test values in excess of 390°C. The product has been extensively wound in various motor applications and has been highly commended for its superior wind-ability performance. This insulation really excels in the area of voltage endurance. Testing with sinusoidal and with inverter wave shapes shows that polyester/polyamideimide lasts many times longer than standard NEMA MW35 insulation. While no standards for this type of testing have been universally accepted, our testing shows dramatic improvement in insulation life, especially under severe duty applications at higher temperatures.

Polyester

NEMA **MW 74 C**

Typical Applications
The principal application of polyester is in fine wire where a Class 200 construction is desired and solderability is not a requirement.

- ✓ Continuous operation coils
- ✓ Encapsulated coils
- ✓ Small appliance and power tool motors
- ✓ Sub-fractional instrument and servomotors

Characteristics
This insulation is manufactured with a thermally stable, modified polyester film and has excellent physical, chemical and electrical properties for small coils operating at high temperature.
The physical properties of flexibility, abrasion resistance, and adhesion compare favorably with polyvinyl acetal-phenolic.

Aromatic Polyamide

NEMA **MW 16 C Round, MW 20 C Square & Rectangular**

Typical Applications
Whenever high temperatures and extreme overload or ambient conditions are required, this insulation may be used.

- ✓ Encapsulated coils
- ✓ Fractional and integral horsepower motors
- ✓ Heavy-duty hand tool motors
- ✓ Hermetic and sealed units
- ✓ High temperature continuous duty coils and relays

General Properties
This insulation is a film-coated magnet wire made with aromatic polyimide resin. It is a Class 240 insulation with exceptional resistance to chemical solvents and burnout. It will operate at temperatures in excess of 240°C for intermittent duty. The outstanding thermoplastic flow of over 400°C and its ability to withstand excessive overloads extends the use of magnet wire in extreme conditions. This insulation is unaffected by prolonged exposure to varnish solvents and is compatible with most systems.

Glass Fibers

NEMA **MW 41 C thru MW 48C, MW 40 C thru MW 53 C**

Characteristics
Both glass and Dacron® glass can be served on either the bare magnet wire conductor or film construction. Dacron glass is available as fused unvarnished, while glass or Dacron glass is available varnished with epoxy (as standard), high-temperature organic polyester, or silicone varnish. The glass is a continuous filament glass yarn and the Dacron glass is a combination of glass and polyester fibers. The advantage of the glass is its high resistance to overload burnout, and the advantage of the Dacron glass is its abrasion resistance and increased flexibility.

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