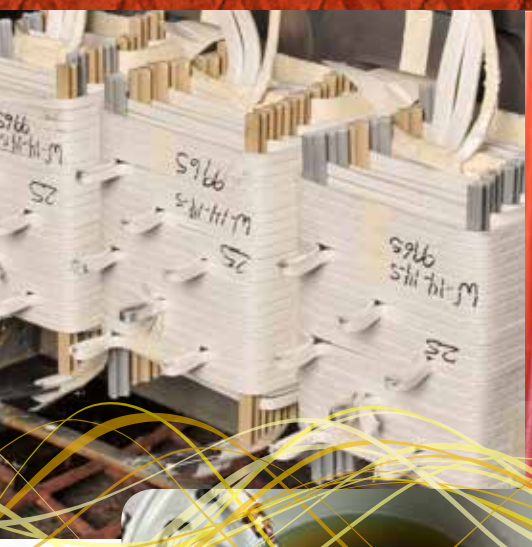
Electrical Markets
Electrical Insulations for Transformers



Reliable Insulation for More Reliable Transformers

3M's materials for transformers are proven in applications to effectively insulate, protect, connect and identify critical components in a broad range of electrical transformers. Use this guide to see where 3M solutions can help protect your transformer products.

3M™ Electrical Insulating Tapes and Electrical Flexible Insulation offer a broad range of solutions for dry-type transformers. These solutions include both minor and major insulation for ground, layer, interwinding and conductor wrap applications, and have been tested and approved for use in many UL 1446 Electrical Insulation Systems.

To meet the specific requirements for each application, these insulation solutions have been optimized for different transformer configurations and requirements.

3M Electrical Tapes are fabricated with a broad range of backings and adhesives for the optimal balance of electrical and mechanical properties while maintaining good handling characteristics. 3M Flexible Insulations have been designed to different levels of thermal, electrical and mechanical performance to meet the appropriate transformer requirements with the most cost effective solutions that meet the stringent quality requirements.

High Thermal Conductivity

- Lower temperature rise with existing design
  or
- Smaller designs

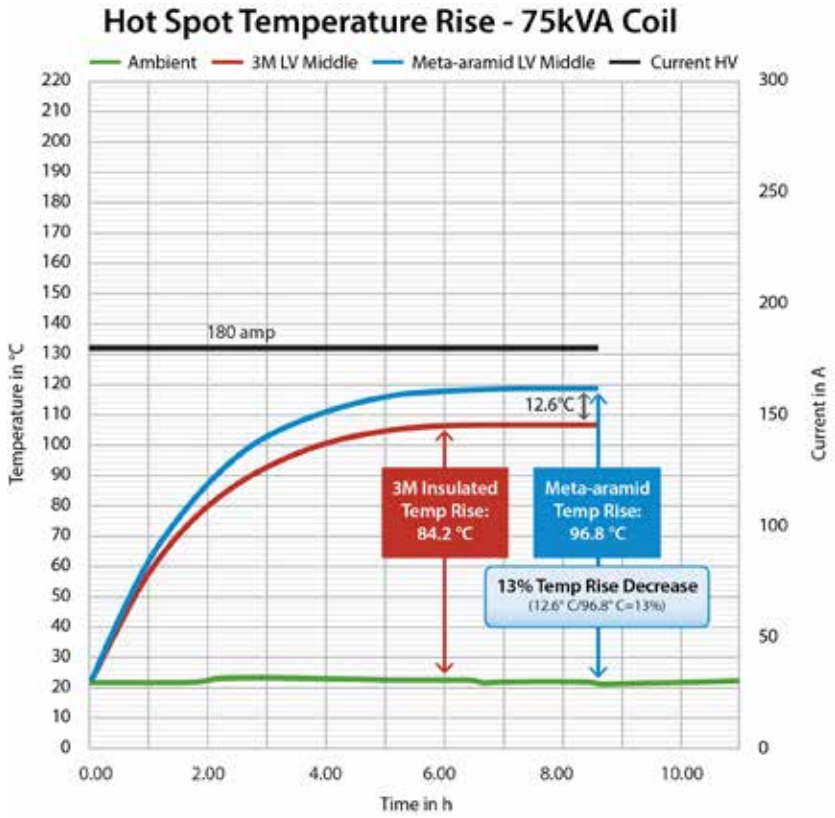
Smaller Coil Size
Shorter Conductor Length
Lower Conductor Cost

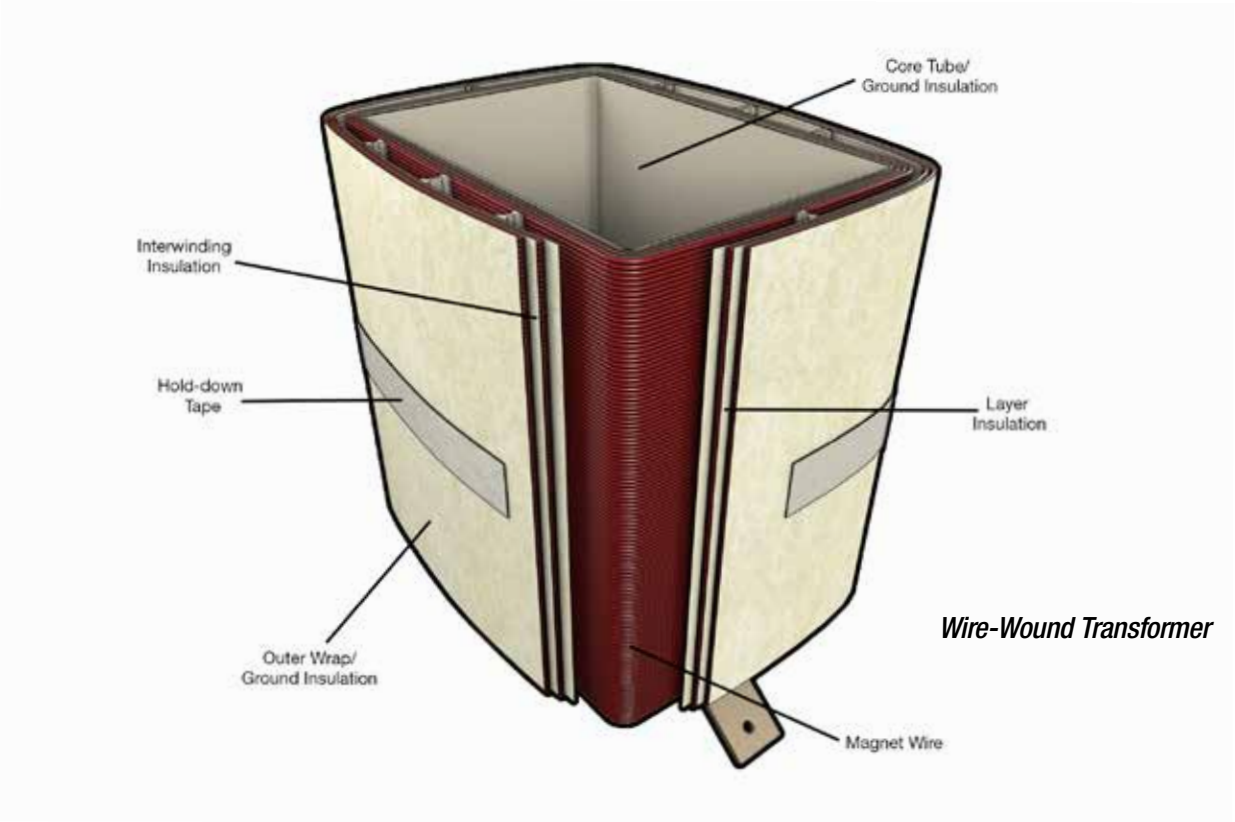
Benefits

- Cooler transformers are more efficient with greater overload protection
- Reduced conductor material costs

3M™ Insulations enable dry-type transformers to operate cooler or be smaller with low total cost

Two identical 75 kVA coils;
One with 3M™ Insulation and
one with calendared meta-aramid



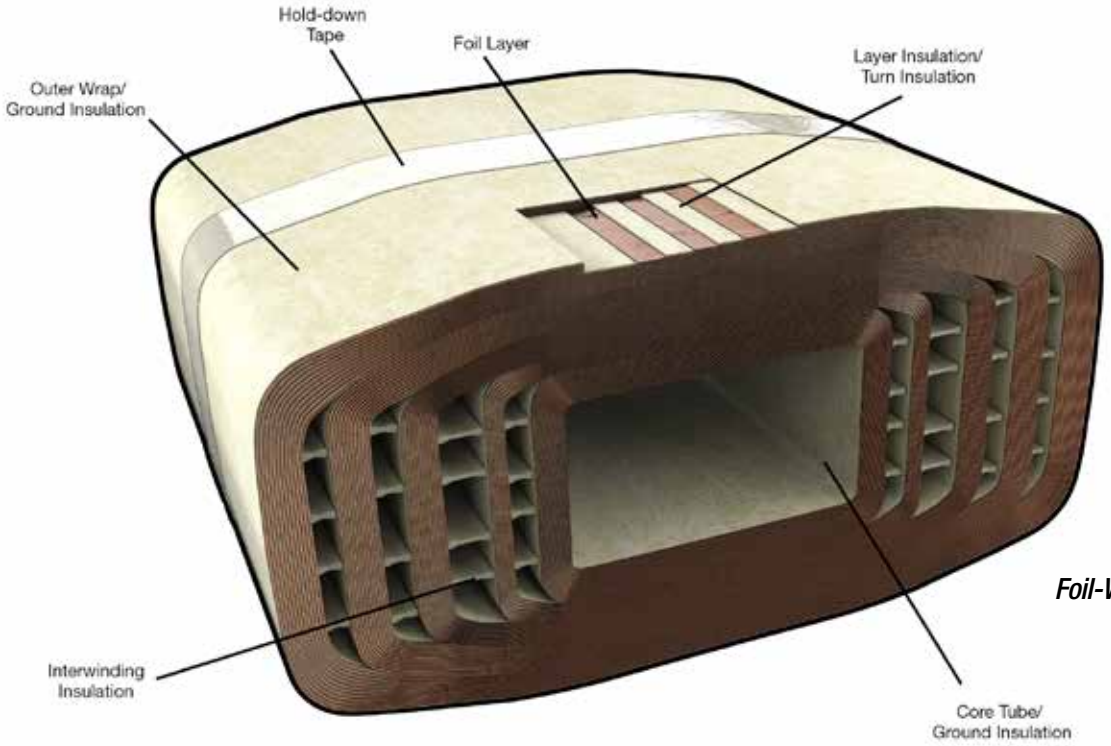


Wire-Wound Transformer

Wire-Wound Transformer

Application	Definition	Key Considerations in Selecting	Major Insulation	Applicable 3M™ Flexible Insulation				Appropriate 3M™ Insulating Tape*							
				CeQUIN	TufQUIN	ThermaVolt	ThermaVolt AR	Polyester		Filament Reinforced		Polyester Composite	Epoxy		Polyimide
								Rubber	Acrylic	Rubber	Acrylic	Rubber	Rubber	Acrylic	Acrylic
Core Tube/ Ground Insulation	Insulation that is wrapped around bobbin or core. May also be supplied as preformed tube. [It is major when it is the sole insulation between windings and grounded or dead metal.]	• Mechanical strength to resist cracking when wound around core • Sufficient dielectric strength to pass Hi-pot test • Temperature class • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Layer Insulation	The material interleaved between successive layers of an insulated conductor in the same winding. Used in a mechanical application only, and does not serve as electrical insulation.	• Sufficient mechanical strength to support wire layer to layer • No minimum thickness required • Minor insulation only		✓	✓	✓	✓	✓	✓	✓	✓				
Turn Insulation *(or Conductor Wrap)*	Insulation that is wrapped around bare conductor (in place of enamel coated wire).	• Mechanical strength and elongation to support high speed winding • Resist damage during installation to prevent turn to turn failure • Temperature class • For UL Systems, must meet EIS minimum thickness requirement	✓		✓			✓	✓						
Window Insulation/ Ground Insulation *(not shown)*	A material used to supplement an air gap between a winding and grounded or dead metal. [It is identified as major when the air gap separating the insulation from the grounded or dead metal is less than 1/32 inch (0.8 mm).]	• Must be able to be die punched and have good hinge strength at fold lines • If used as Major Insulation, must be able to pass Hi-pot testing • Temperature class • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓			✓	✓				✓		
Outer Wrap/ Ground Insulation	The material that is placed over the final layer of winding. [It is major when there is not a 1/32-inch (0.8-mm) minimum air gap separating it from grounded or dead metal.]	• If used as a Major Insulation, must be able to pass Hi-pot testing • Mechanical strenth to protect wire windings • Cosmetic function • Temperature class • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓
Interwinding Insulation	The electrical insulation between Primary and Secondary windings (i.e., High-Low Barrier).	• Sufficient dielectric strength to pass Hi-pot test • Mechanical strength to resist cut through (Wire wound over Hi-Low barrier is often pounded into shape) • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓	✓	✓								

**All tapes are minor insulation.*

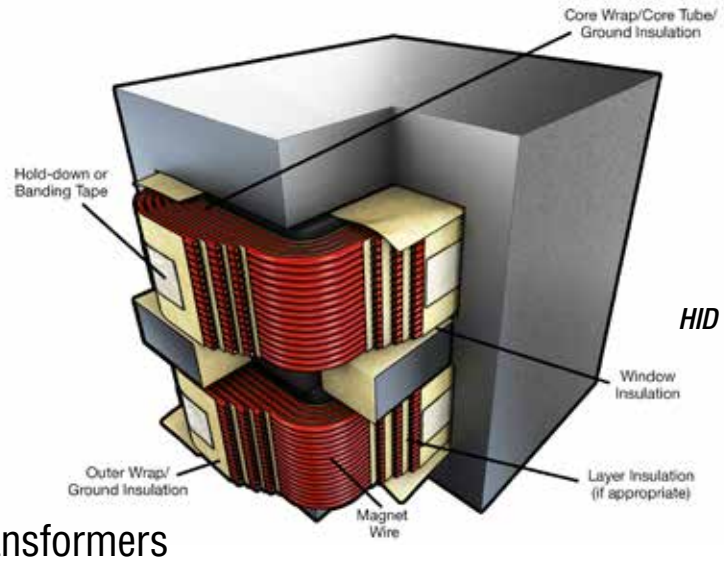


Foil-Wound Transformer

Foil-Wound Transformer

Application	Definition	Key Considerations in Selecting	Major Insulation	Applicable 3M™ Flexible Insulation				Appropriate 3M™ Insulating Tape*							
				CeQUIN	TufQUIN	ThermaVolt	ThermaVolt AR	Polyester: Rubber	Polyester: Acrylic	Filament Reinforced: Rubber	Filament Reinforced: Acrylic	Polyester Composite: Rubber	Epoxy: Rubber	Epoxy: Acrylic	Polyimide: Acrylic
Core Tube/ Ground Insulation	Insulation that is wrapped around bobbin or core. May also be supplied as preformed tube. [It is major when it is the sole insulation between windings and grounded or dead metal.]	• Mechanical strength to resist cracking when wound around core • Sufficient dielectric strength to pass Hi-pot test • Temperature class • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Layer Insulation/ Turn Insulation	The material interleaved between successive layers of (uninsulated) foil or strip conductor.	• Sufficient mechanical strength to resist puncture from burrs on edge of foil • For UL Systems, must meet EIS minimum thickness requirement	✓		✓	✓	✓	✓	✓	✓	✓				
Outer Wrap/ Ground Insulation	The material that is placed over the final layer of winding. [It is major when there is not a 1/32-inch (0.8-mm) minimum air gap separating it from grounded or dead metal.]	• If used as a Major Insulation, must be able to pass Hi-pot testing • Mechanical strenth to protect wire windings • Cosmetic function • Temperature class • For UL Systems, must meet EIS minimum thickness requirement	✓		✓	✓	✓	✓	✓				✓	✓	✓
Interwinding Insulation	The electrical insulation between Primary and Secondary windings (i.e., High-Low Barrier).	• Sufficient dielectric strength to pass Hi-pot test • Mechanical strength to resist cut through if wire is used in outer winding (Wire wound over Hi-Low barrier is often pounded into shape) • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			

**All tapes are minor insulation.*

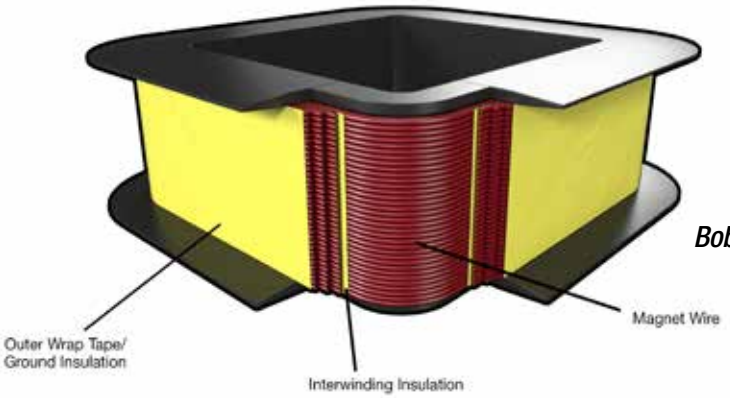


HID and Microwave Transformers

HID and Microwave Transformers

Application	Definition	Key Considerations in Selecting	Major Insulation	Applicable 3M™ Flexible Insulation				Appropriate 3M™ Insulating Tape*							
				CeQUIN	TufQUIN	ThermaVolt	ThermaVolt AR	Polyester		Filament Reinforced		Polyester Composite	Epoxy		Polyimide
								Rubber	Acrylic	Rubber	Acrylic	Rubber	Rubber	Acrylic	Acrylic
Interwinding Insulation	The electrical insulation between Primary and Secondary windings (i.e., High-Low Barrier).	• Sufficient dielectric strength to pass Hi-pot test • Mechanical strength to resist cut through (Wire wound over Hi-Low barrier is often pounded into shape) • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓	✓	✓								
Core Tube/Ground Insulation	Insulation that is wrapped around bobbin or core. May also be supplied as preformed tube. [It is major when it is the sole insulation between windings and grounded or dead metal.]	• Mechanical strength to resist cracking when wound around core • Sufficient dielectric strength to pass Hi-pot test • Temperature class • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Outer Wrap/ Ground Insulation	The material that is placed over the final layer of winding. [It is major when there is not a 1/32-inch (0.8-mm) minimum air gap separating it from grounded or dead metal.]	• If used as a Major Insulation, must be able to pass Hi-pot testing • Mechanical strenth to protect wire windings • Cosmetic function • Temperature class • For UL Systems, must meet EIS minimum thickness requirement	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓

**All tapes are minor insulation.*

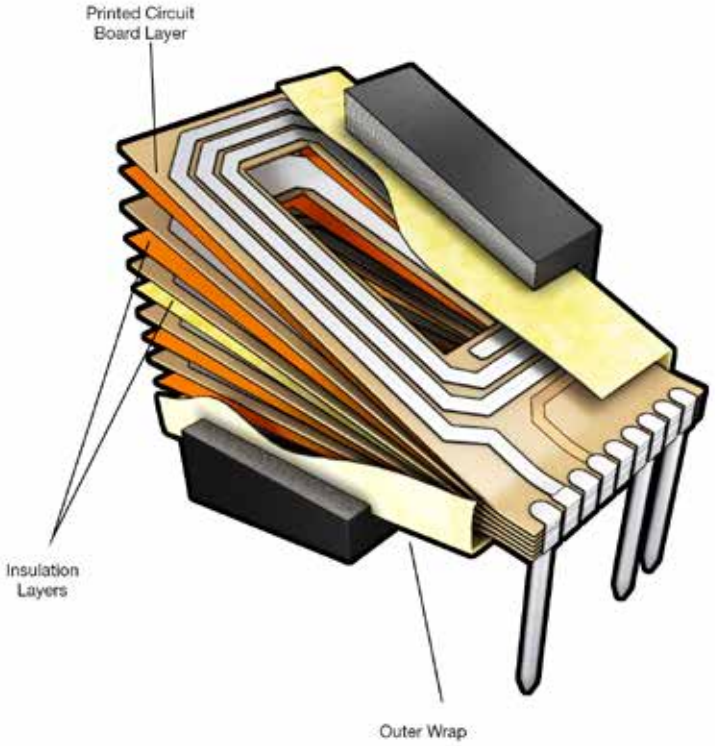


Bobbin-Wound Transformer

Bobbin-Wound Transformer

Application	Applicable 3M™ Flexible Insulation			Appropriate 3M™ Insulating Tape*											
	CeQUIN	TufQUIN	ThermaVolt AR	Polyester		Paper Tape	Composite	Epoxy		Polyimide		Glass Cloth			
				Rubber	Acrylic	Rubber	Rubber	Rubber	Acrylic	Silicone Thermosetting	Acrylic	Rubber	Silicone Thermosetting	Acrylic
Start Lead				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lead Pad	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Lead Pad Hold-Down				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
End Lead Anchor				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Interwinding Insulation				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Outer Wrap/Ground Insulation				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

**All tapes are minor insulation.*



Planar Transformer

Planar Transformer

Applicable 3M™ Flexible Insulation**				Appropriate 3M™ Insulating Tape*							
				Polyester		Filament Reinforced		Polyester Composite	Epoxy		Polyimide
CeQUIN	TurfQUIN	ThermaVolt	ThermaVolt AR	Rubber	Acrylic	Rubber	Acrylic	Rubber	Rubber	Acrylic	Acrylic
	✓	✓	✓		✓					✓	✓

**Available with or without adhesive.*
***All are minor insulation.*

Find out more about 3M solutions for your transformer applications. Call 800 676 8381 or visit www.3M.com/oem.

Important Notice

Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use.

Warranty; Limited Remedy; Limited Liability.

3M's product warranty is stated in its Product Literature available upon request. **3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** If this product is defective within the warranty period stated above, your exclusive remedy shall be, at 3M's option, to replace or repair the 3M product or refund the purchase price of the 3M product. **Except where prohibited by law, 3M will not be liable for any indirect, special, incidental or consequential loss or damage arising from this 3M product, regardless of the legal theory asserted.**

3M

Electrical Markets Division
6801 River Place Blvd.
Austin, TX 78726-9000
800 676 8381
Fax 800 828 9329
electricaloem@3M.com
www.3M.com/oem

Please recycle. Printed in USA.
© 3M 2014. All rights reserved.
80-6016-0765-0B