

3M™ ThermaVolt Calendered Inorganic Insulating Paper

Data Sheet

September 2013

Description 3M™ ThermaVolt Calendered Inorganic Insulating Paper was developed to meet the high performance required for use in high-temperature, dry-type transformers. ThermaVolt paper offers good dielectric characteristics and thermal conductivity – making it especially suitable for use as interwinding insulation in strip-wound coils. ThermaVolt paper has been designed for use as major ground insulation in electrical insulation systems through Class 220(R).

Applications Open Ventilated Dry-Type Transformers rated through Class 220(R).

- Major ground insulation
 - Minor insulation
 - Core wrap
 - High-low barrier
 - Inter-winding insulation
 - Turn insulation
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Features

- High inorganic content
- Excellent thermal conductivity
- Good dielectric breakdown resistance
- Reduce costs with improved processability
- Low moisture absorption
- UL 94 V0,5VA Flammability Rating – Halogen Free
- Thicknesses: 3 mils (.08 mm) to 15 mils (.38 mm)

Agency Approvals & Self Certifications 3M ThermaVolt paper is designed to provide high-temperature performance in electrical insulation systems, and is UL Recognized as suitable for use as major ground insulation in systems rated through Class 220(R) per UL 1446, “Standard for Systems of Insulating Materials – General.”

UL Recognized Insulation systems are listed under File No. E65007 in the OBJS2 category. This open file is free for use by any electrical apparatus manufacturer by contacting the nearest UL office. This file is also recognized by UL as being in compliance with International Electrotechnical Commission (IEC) Publication 85, “Thermal Evaluation and Classification of Electrical Insulation.”

3M™ ThermaVolt Calendered Inorganic Insulating Paper

Typical Electrical Properties

Not for specifications. Values are typical, not to be considered minimum or maximum. Properties measured at room temperature 73°F (~23°C) unless otherwise stated.

Typical Electrical Properties		ASTM Test Method	ThermaVolt 3 mil	ThermaVolt 4 mil	ThermaVolt 5 mil	ThermaVolt 7 mil	ThermaVolt 10 mil	ThermaVolt 15 mil
Dielectric Breakdown Strength	kV	D-149	1.1	2.4	3.0	3.3	5.0	8.0
Dielectric Breakdown Strength	V/mil	D-149	365	600	600	470	500	530
Dielectric Constant 23 °C, 50 % RH, 50 Hz		D-150	3.5	3.5	3.9	4.0	4.0	4.0
Dissipation Factor 23 °C, 50 % RH, 50 Hz	%	D-150	7	7	7	7	7	7

Table 1 presents typical Corona Inception and Corona Extinction thresholds for 3M ThermaVolt Calendered Inorganic Insulating Paper. For design purposes, it is recommended that insulations from 3M be used in electrical apparatus where continuous operating electrical stresses do not exceed 1.6 kV/mm (40 Volts/mil).

Table 1			
Typical Corona Inception and Extinction ASTM D-1868 (60 Hz)		ThermaVolt 7 mil	ThermaVolt 10 mil
Corona Inception Voltage	V	660	750
Corona Extinction Voltage	V	645	720

Thermal Conductivity

The high thermal conductivity of ThermaVolt papers helps achieve the heat dissipation required in today's high efficiency electrical apparatus, allowing the design of smaller, more cost effective equipment.

Thermal Conductivity		ASTM Test Method	ThermaVolt 3 mil	ThermaVolt 4 mil	ThermaVolt 5 mil	ThermaVolt 7 mil	ThermaVolt 10 mil	ThermaVolt 15 mil
Thermal Conductivity (180°C)	W/m.K	E-1530	0.17	0.17	0.17	0.18	0.23	0.25

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Typical Mechanical Properties

Not for specifications. Values are typical, not to be considered minimum or maximum.
Properties measured at room temperature 73°F (~23°C) unless otherwise stated.

Typical Mechanical Properties		ASTM Test Method	ThermaVolt 3 mil	ThermaVolt 4 mil	ThermaVolt 5 mil	ThermaVolt 7 mil	ThermaVolt 10 mil	ThermaVolt 15 mil
Nominal Thickness	mil mm	D-645	3 0.08	4 0.10	5 0.13	7 0.18	10 0.25	15 0.381
Basis Weight	g/m ² lb/yd ²	D-202	103 0.19	156 0.29	195 0.36	274 0.49	366 0.67	561 1.04
Density	g/cc		1.4	1.5	1.5	1.5	1.5	1.5
Tensile Strength, MD	lb/inch N/cm	D-828	17 30	28 49	31 54	41 72	53 93	100 175
Tensile Strength, CD	lb/inch N/cm	D-828	8 14	14 25	16 28	22 39	34 60	58 102
Elongation to Break, MD	%	D-828	1.5	1.5	1.5	1.5	1.5	2.0
Elongation to Break, CD	%	D-828	1.1	1.1	1.1	1.1	1.1	2.0
Elmendorf Tear, MD	g N	D-689	40 0.4	88 0.9	108 1.1	172 1.7	280 2.7	534 5.2
Elmendorf Tear, CD	g N	D-689	60 0.6	132 1.3	142 1.4	302 3.0	354 3.5	734 7.2

Flammability

The UL 94 test method is used to classify materials based on results from specified small-scale flame tests. These classifications (5VA, 5VB, V-0, V-1, V-2, HB), listed in decreasing order of flame resistance, are used to distinguish a material's burning characteristics after test specimens have been exposed to a specified test flame under controlled laboratory conditions.

A material classified as 5VA or 5VB is subjected to a flame ignition source that is approximately five times more severe than that used in the V-0, V-1, V-2 and HB tests. Furthermore, specimens in 5VA or 5VB may not drip any flaming particles and 5VA rated specimens may not develop any burn-through holes during the test.

Flammability	Test Method	ThermaVolt 3 mil	ThermaVolt 4 mil	ThermaVolt 5 mil	ThermaVolt 7 mil	ThermaVolt 10 mil	ThermaVolt 15 mil
Flame Rating (UL File E65069)	UL 94	V0, 5VA	V0, 5VA	V0, 5VA	V0, 5VA	V0, 5VA	V0, 5VA

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Regulatory

- REACH compliant. Product contains no Substances of Very High Concern (SVHC's) on the REACH candidate lists according to article 59 of Regulation (EC) No 1970/2006 up to June 2012. For current status, go to www.3M.com/REACH
- RoHS Meets MCVs 2011/65/EU. "RoHS meets MCVs" means that the product or part does not contain any of the substances in excess of the maximum concentration values ("MCVs") in EU RoHS Directive 2011/65/EU. The MCVs are by weight in homogeneous materials.
- Halogen Free defined as both 1) no halogen compounds are intentionally added to the product or used in the manufacturing process for the product and 2) any impurities present are less than 900 ppm bromine, less than 900 ppm chlorine, and/or less than 1500 ppm total bromine and chlorine. The latter are the levels set forth in certain industry standards, such as the International Electrotechnical Commission (IEC) 61249-2-21 standard.

The above information represents 3M's knowledge and belief which may be based in whole or in part on information provided by 3rd party suppliers to 3M.

Availability

Please contact your local distributor; available from 3M.com/electrical [Where to Buy] or call 1-866-357-2737 or call 1-800-245-3573.

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