



The multi-layer, non-shrink End Caps made of DuPont™ Kapton® film and Nomex® are designed for use in varnish-soaked electric motors. Two layers of Nomex® type 411 form a composite with a protective layer of three layers of Kapton®. The non-calendered, inner insulation takes on the properties of the impregnating varnish during impregnation, thus increasing the dielectric strength and mechanical stability of the End Caps.

The penetrated impregnating varnish also secures the End Caps in position. The End Caps retain their mechanical and electrical properties even at high temperatures. The ultrasonic welding of the End Caps is chemically resistant and contributes to the robustness of the products. These non-shrink End Caps are very suitable for use in series production where easy processing is required. They are mainly used in electric motors, aviation and the automotive industry.

Kapton® / Nomex® End Caps, Non-Shrinking, Class H (180°C)

Properties

- End Caps, non-shrinking, for insulation in varnish-impregnated electric motors of temperature class H
- Material: DuPont™ Kapton® HN
- Available with inner diameters from 2.00 mm and with wall thicknesses from 0.0350
- Five-layer composite of DuPont™ Nomex® 411 and Kapton® results in high dielectric strength and high mechanical stability.
- The materials are UL recognized
- Suitable for use in temperature class H up to 180 °C.

Technical Specifications

Outer Lamina

Electrical Properties						
Properties		lm Typical Value - 1 mil (25 µm)			Test Condition	Test Method
		-195 °C	25 °C	200 °C		
Short Term						
Dielectric strength	[kV]	10.8	7.0	5.6	60 cycles	ASTM D 149-64
Dielectric Constant		-	3.5	3.0	1 kilocycle	ASTM D 150-64T
Dissipation Factor		-	3	2	1 kilocycle	ASTM D 150-64T
Volume Resistivity	[ohm/m]	-	1016	1012	-	ASTM D 257-61
Surface Resistivity	[ohm/sq]	-	1016	-	50% Relative Humidity	ASTM D 257-61
Corona Start Voltage	[volts]	-	465	-	50% Relative Humidity	ASTM D 1868-61T
Insulation Resistance	[megohm/F]	-	100000	-		Based on 0.05 µF wound capacitor using 1-mil (25 µm) H

Physical Properties					
Properties		Typical Value 1 mil (25m) lm			Test Method
		-195°C	25°C	200°C	
Ultimate Tensile Strength (MD)	[kg/m2]	2450	1750	1200	ASTM D 882-64T
	[MPa]	241	172	117	
Yield Point (MD)	[kg/cm2]	-	700	420	ASTM D 882-64T
	[MPa]	-	69	41	
Stress to Produce 5% Elongation (MD)	[kg/cm2]	-	910	600	ASTM D 882-64T
	[MPa]	-	90	59	
Ultimate Elongation (MD)	[%]	2	70	90	ASTM D 882-64T
Tensile Modulus (D)	[kg/cm2]	35800	30000	18200	ASTM D 882-64T
	[MPa]	3500	2950	1800	
Impact Strength	[kg/cm] N/m]	-	6 0.6	-	DuPont™ Pneumatic Impact Test
Folding Endurance (MIT)	cycles	-	10000	-	ASTM D 2176-63T
Tear Strength - Propagating (Elmendorf)		-	878	-	ASTM D 1922-61T
Tear Strength - Propagating (Graves)	[g] [N]	-	510 5	-	ASTM D 1004-61
Bursting Test (Mullen)	[kg/cm2]	-	5.25	-	ASTM D 774-63T
	[kPa]	-	517	-	
Density	[Mg/m2]		1.42	-	ASTM D 1505-63T
Coefficient of Friction Kinectic (Film-to-Film)		-	0.42	-	ASTM D 1894-63
Refractive Index (Becke Line)		-	1.78	-	Encyclopaedic Dictionary of Physics, Volume 1
Area Factor	[m2/kg]	-	28	-	Calculation

Thermal Properties			
Properties	Typical Value - 1 mil (25m) lm	Test Condition	Test Method
Melting Point	None		
Zero Strength Temperature	815°C	1.4 kg/cm ² (138 kPa) load for 5 secs	Hot Bar (DuPont™ Test)
Cut-through Temperature	435°C 525°C	25 µm 50-125 µm	Weighted Probe on Heated Film (DuPont™ Test)
Coefficient of Thermal Expansion	2.0 x 10 ⁻⁵ /K	-14°C to 38°C	ASTM D 696-44
Coefficient of Thermal Conductivity [cal]/[cm]	3.72x10 ⁻⁴ [cm ²][s][°C] [0.156W/m/K]	25 °C	Model TC-1 000 Twin Heatmeter Comparative Tester
	3.89x10 ⁻⁴ [cm ²][s][°C] [0.163W/m/K]	75 °C	
	4.26x10 ⁻⁴ [cm ²][s][°C] [0.178W/m/K]	200 °C	
Flammability	Self-extinguishing	-	
Heat Sealable	No	-	
Thermal Capacity	0.261 cal./g/°C (1092 J/kg/K)	40 °C	Differential Calorimetry

Inner Lamina: DuPont™ Nomex® Type 411

Electrical Properties				
Properties of Base Material	Material Thickness		Test Condition	Test Method
	0.130mm	0.180mm		
Dielectric Strength [kV/mm]	12	12	AC Rapid Rise	ASTM D 149
Dielectric Constant	1.3	1.3	1000 Hz	ASTM D 150
Dissipation Factor	0.005	0.005	1000 Hz	ASTM D 150

Physical Properties			
Properties of Base Material	Typical Value	Test Condition	Test Method
Tensile Strength			
MD [N/cm]	17	28	ASTM D 828-60
TD [N/cm]	9	17	ASTM D 828-60
Elongation			
MD [%]	3.5	3.5	ASTM D 828-60
TD [%]	4.8	5	ASTM D 828-60

Item number:

Example: IENKN0100/005/0050

IEKN = master number

0100 = 1.00 mm inner diameter

005 = 0.05 mm wall thickness

0050 = 50 mm inner length (without protrusion)