DuPont™ Nomex® 710

Technical data sheet

DuPont Nomex® 710 is a high-temperature capable, mechanically robust, chemically resistant electrical insulation paper specifically engineered for demanding requirements of emerging high power automotive applications, such as for slot liner insulation of traction motors in electric and hybrid vehicles.

Compared to the recognized benchmark Nomex® 410 paper, the properties of Nomex® 710 have been strengthened to provide the necessary mechanical robustness for a paper of a lower thickness during automatic manufacturing processes, with electrical properties that allow optimizing e-machines towards higher power densities.

The initial thickness introduced to the market is 0.22 mm (8.5 mil). It addresses the imminent need for the insulation paper with optimized thickness for both hairpin wire motor and round wire motor.

Designers who opt for the new paper will benefit from the possibility to use more copper cross-section area in the slot. Depending on the slot size and copper winding design, this could represent more power output from the same size motor or with a more compact design with the same power output.

Table 1: Typical mechanical properties of Nomex® 710

Property	Nomex® 710 (.22mm)	Test method
Typical Thickness,		
mm	0.22	
mil	8.5	
Basis Weight, g/m²	220	ASTM D646
Apparent Density, g/cm³	1.02	
Tensile Strength, N/cm		
MD	280	ASTM D828
XD	140	
Elongation, %		
MD	20	ASTM D828
XD	15	
Elmendorf Tear, N		
MD	4.6	TAPPI 414
XD	8.6	
Initial Tear Strength, N		
MD	62.3	ASTM D1004[1]
XD	35.6	
Shrinkage @ 300°C, %		
MD	0.2	
XD	0	

[1]Data presented for initial tear strength is listed in the direction of the sample, per ASTM D1004. The tear is actually 90 degrees to the sample of the direction; therefore, for papers with a higher reported machine direction initial tear strength, the paper will be tougher to tear in the cross direction.

Table 2: Typical electrical properties of Nomex® 710

Property	Nomex® 710 (.22 mm)		Test Method
	@ 23°C	@ 180°C	
AC Rapid Rise Breakdown, kV/mm	34	32	ASTM D149
Dielectric Constant			ASTM D150
50-60 Hz	2.8	2.8	
1000 Hz	2.7	2.7	
Dissipation Factor, x 10^{-3}			
50-60 Hz	4	2	
1000 Hz	1	1	
Partial Discharge Inception Voltage, V^{peak}	1400	1120	ASTM D1868
Volume Resistivity, ohm-cm	1 x 10^{15}	-	ASTM D257

Nomex® 710 is particularly suited to power-dense machines in high temperature operation, with continuous temperatures of 240°C possible for applications requiring 10000 hours life. The combined effect of higher thermal conductivity and lower thickness yields almost 30% reduction in heat dissipation resistance in the critical part of the heat flow, i.e. from the copper to the iron in application.

Table 3: Typical heat transfer properties of Nomex® 710

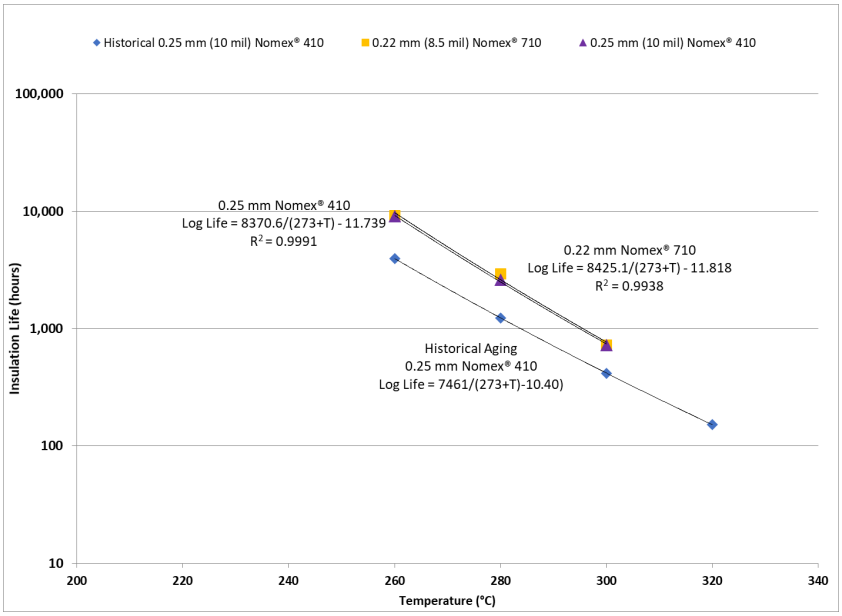
Property	Typical value	Test method
Thermal Conductivity, W/m·K		ISO 22007-2
23°C	0.11	
150°C	0.165	
Heat Dissipation Resistance, K/W	1.33	calculated
150°C		

Chemical stability

The compatibility of DuPont™ Nomex® paper and pressboard with virtually all classes of electrical varnishes and adhesives (polyimides, silicones, epoxies, polyesters, acrylics, phenolics, synthetic rubbers, etc.), as well as other components of electrical equipment, is demonstrated by the many UL-recognized systems comprising Nomex® as well as longstanding commercial experience. Nomex® papers are also proven by years of experience in the automotive industry to work reliably in direct contact with popular cooling media, such as automatic transmission fluids (ATFs), with no notable loss of its mechanical or electrical properties.

Additionally, the life curves for both materials are better than the historical life curve for Nomex® paper from the Nomex® 410 data sheet, showing life in the range of twice that of historic values. This confirms the thermal capability of Nomex® 710 as a material with a 228°C relative thermal index at 100,000 hours of life according to UL746B, which results in a thermal class of 220°C.

Figure 1: Thermal Aging of Nomex® 710 – Based on 50% Retention of MD Tensile Strength



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