

DuPont™ Nomex® 910 Engineered Cellulose Paper

Preliminary Technical Data Sheet

Insulation Papers for the 21st Century

Construction

DuPont™ Nomex® 910 is a unique insulating material comprised of high quality electrical grade cellulose pulp and web-like binders made from the same high temperature polymer as other Nomex® brand papers. Because the product is comprised of both cellulose and Nomex® aramid ingredients, it exhibits properties that are between Nomex® Type 410 and cellulosic papers. Nomex® 910 is currently offered in four thicknesses (0.08, 0.13, 0.18 and 0.25 mm [3, 5, 7 and 10 mil]). Additional grades of this new product may be offered in the future.

Applications

Nomex® 910 was developed as interlayer insulation in liquid-immersed transformers for distribution and small power transformers. It may also be used for wire-wrapping (conductor insulation) in any transformer, including large power transformers.

Properties

Nomex® 910 has improved physical and electrical properties over existing cellulose-only papers. Based on aging data, it also has longer life under standard thermal conditions. Cellulose (kraft) and TUK (thermally upgraded kraft) are well known as the incumbent insulation materials in liquid-immersed applications. Nomex® 910 is being compared to TUK since it is more thermally stable than standard kraft. The typical mechanical and electrical properties of Nomex® 910 are listed in Tables 1-2-3.



Table 1. Typical Mechanical Properties for DuPont™ Nomex® 910

Property	Units	Product Thickness - mm (mil)				Test Method
		0.08 (3)	0.13 (5)	0.18 (7)	0.25 (10)	
Typical Thickness	mm	0.08	0.13	0.18	0.25	ASTM D646
	mil	3.2	5.1	7.1	10.1	
Basis Weight	g/m ²	80	125	160	230	ASTM D646
	opsy	2.3	3.7	4.8	6.8	
Apparent Density	g/cc	0.8-1.0	0.8-1.0	0.8-1.0	0.8-1.0	ASTM D646
Burst Strength	N/cm ²	27	45	62	70	ASTM D828
	lbf/in ²	40	65	90	104	
Tensile Strength, MD	N/cm	70	110	175	190	ASTM D828
	lbf/in	40	65	100	110	
Tensile Strength, XD	N/cm	17	25	42	70	ASTM D828
	lbf/in	10	15	25	40	
Elongation, MD	%	2.2	2.5	2.8	2.5	ASTM D828
Elongation, XD	%	6.9	8.7	9.5	6.0	
Tear Strength, MD	N	0.45	0.8	1.2	1.6	TAPPI 414
	gf	45	80	120	160	
Tear Strength, XD	N	0.70	1.2	2.0	2.0	TAPPI 414
	gf	70	120	200	200	

MD = Machine Direction, XD = Cross Machine Direction



Table 2. Typical Electrical Properties of DuPont™ Nomex® 910 in Mineral Oil

Property	Units	Product Thickness - mm (mil)				Test Method
		0.08 (3)	0.13 (5)	0.18 (7)	0.25 (10)	
AC Rapid Rise Breakdown	kV/mm	87	83	75	60	ASTM D149
	V/mil	2200	2100	1900	1500	
Dielectric Constant at 60Hz @23 °C		3.2	3.4	3.3	3.3	ASTM D150
Dissipation Factor at 60Hz @23 °C	%	0.9	1.0	1.0	1.0	ASTM D150

Table 3. Typical Electrical Properties of DuPont™ Nomex® 910 in Ester Liquid

Property	Units	Product Thickness - mm (mil)				Test Method
		0.08 (3)	0.13 (5)	0.18 (7)	0.25 (10)	
AC Rapid Rise Breakdown	kV/mm	87	87	80	63	ASTM D149
	V/mil	2200	2200	2000	1600	
Dielectric Constant at 60Hz @23 °C		4.2	4.3	4.4	4.3	ASTM D150
Dissipation Factor at 60Hz @23 °C	%	0.9	1.0	1.1	0.9	ASTM D150

Dielectric Strength of Multiple Layers

Testing multiple layers in mineral oil per ASTM D149 indicates that DuPont™ Nomex® 910 offers an increase in AC rapid rise breakdown voltage compared to TUK. These results can be seen in Figure 1.

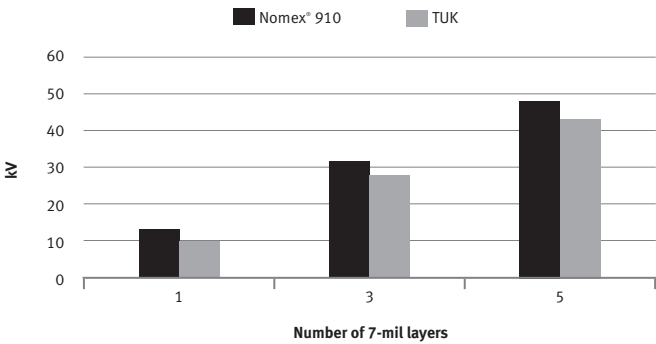


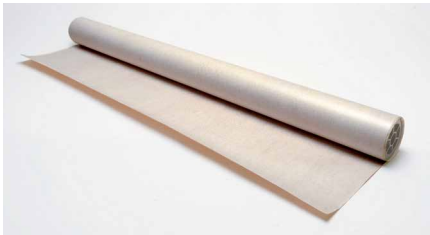
Figure 1. AC Rapid Rise Breakdown Voltage of Multiple Layers Comparing Nomex® 910 and TUK

Thermal Aging

Long-term thermal aging tests in sealed tubes were conducted in our laboratories using procedures outlined in the IEEE Standard for Thermal Aging (IEEE C57.100™ - 2011).

Based on long-term testing in mineral oil:
Nomex® 910 - Thermal Class 130

Based on long-term testing in ester liquid:
Nomex® 910 - Thermal Class 140



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Product safety information is available upon request. This information corresponds to our current knowledge on the subject. It is offered solely to provide possible suggestions for your own experimentation. It is not intended, however, to substitute for any testing you may need to conduct to determine for yourself the suitability of our products for your particular purposes. This information may be subject to revision as new knowledge and experience become available. Since we cannot anticipate all variations in actual end-use conditions, **DuPont makes no warranties and assumes no liability whatsoever in connection with any use of this information.** Nothing in this publication is to be considered as a license to operate under or a recommendation to infringe upon any trademark or patent right.

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