DUPONT™ NOMEX® 910 ENGINEERED CELLULOSE
INSULATION PAPERS FOR THE 21ST CENTURY

Preliminary Technical Data Sheet

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. Since 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 three thicknesses—0.08, 0.13, and 0.18 mm (3, 5, and 7 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. It may also be used for wire-wrapping of conductors in larger transformer designs.

Properties

Nomex® 910 has improved physical and electrical properties over existing cellulose-only papers. Based on aging data presented in Chart 2, 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 electrical and mechanical properties of Nomex® 910 are listed in Tables 1 and 2.

Table 1. Typical Electrical Properties of DuPont™ Nomex® 910 in Mineral Oil

Property	Product Thickness mm (mil)			Test Method
	0.08 (3)	0.13 (5)	0.18 (7)	
AC Rapid Rise Breakdown (kV/mm) (V/mil)	 90 2286	 75 1905	 69 1753	ASTM D149
Full Wave Impulse Breakdown (kV/mm) (V/mil)	 152 3863	 161 4100	 198 5029	ASTM D3426
Dielectric Constant at 60 Hz at 23 °C at 90 °C	 3.57 4.16	 3.6 3.96	 3.72 3.9	ASTM D150
Dissipation Factor at 60 Hz at 23 °C (%) at 90 °C (%)	 0.9 1.6	 1.1 3	 1.2 3.4	ASTM D150

Table 2. Typical Mechanical Properties of DuPont™ Nomex® 910

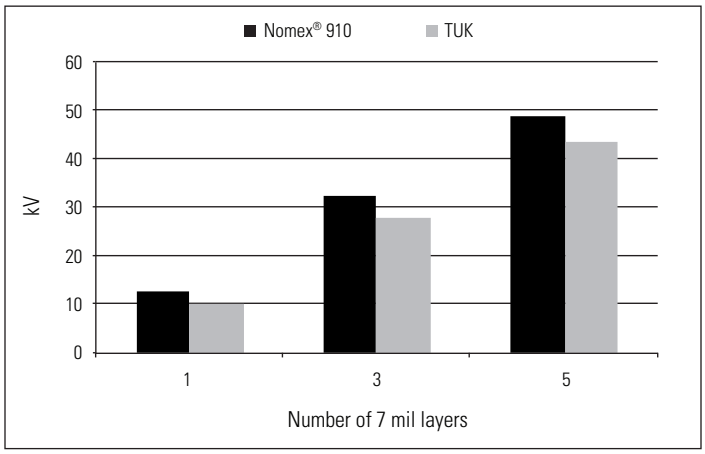
Property	Product Thickness mm (mil)			Test Method
	0.08 (3)	0.13 (5)	0.18 (7)	
Typical Thickness (mm) (mil)	 0.08 3.2	 0.13 5.1	 0.18 7.1	ASTM D646
Basis Weight (g/m^2) (opsy)	 80 2.3	 125 3.7	 160 4.8	ASTM D646
Apparent Density (g/cc)	0.9–1.1	0.9–1.1	0.9–1.1	ASTM D646
Burst Strength (N/cm^2) (lbf/in^2)	 27 40	 45 65	 62 90	ASTM D828
Tensile Strength MD (N/cm) XD (N/cm) MD (lbf/in) XD (lbf/in)	 70 17 40 10	 110 25 65 15	 175 42 100 25	ASTM D828
Elongation (%) MD XD	 2.2 6.9	 2.5 8.7	 2.8 9.5	ASTM D828
Tear Strength MD (N) XD (N) MD (gf) XD (gf)	 0.44 0.70 45 70	 1.08 1.32 110 135	 1.57 2.16 160 220	TAPPI 414

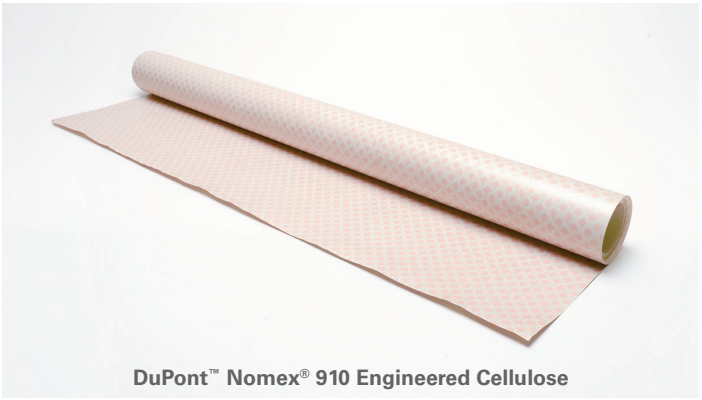
MD = Machine Direction, XD = Cross Machine Direction

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 over thermally upgraded kraft (TUK). These results can be seen in Chart 1.

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





DuPont™ Nomex® 910 Engineered Cellulose

Thermal Aging

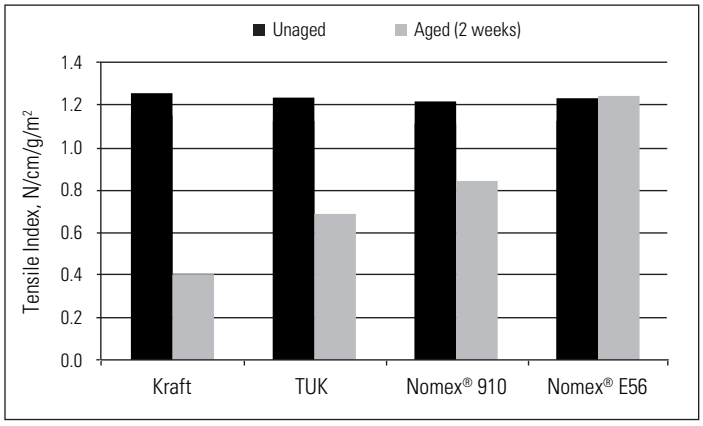
Long term thermal aging tests in sealed tubes and dual-temperature cells were conducted in our laboratories using procedures outlined in the IEEE Standard for Thermal Aging (IEEE C57.100™ - 2011).

Based on long term testing in mineral oil, projected results are:

- Nomex® 910—Thermal Class 130
- TUK— Thermal Class 120
- Standard Kraft—Thermal Class 105

Some of these results can be seen in Chart 2.

Chart 2. Thermal Effect on Mechanical Properties of 7 mil Papers (Aged at 170 °C in Mineral Oil)



Higher Aged Tensile Strength translates into extended life of DuPont™ Nomex® 910

For more information:

Phone Contact:

U.S. 1-800-221-2960

Canada 1-800-663-7027

Mexico 52 55 5722 1000

www.nomexpaper.dupont.com

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