

## DuPont™ Nomex® 411 Paper, 10 mil Nominal Thickness

Category : Other Engineering Material , Composite Fibers , Polymer , Film , Thermoset , Aramid

### Material Notes:

Nomex® Type 411 is the uncalendared precursor of Type 410. It has a lower density and lower property values. It is used in applications such as motor phase insulation and transformer coil end filler, where high bulk and conformability are of prime importance. Nomex® Type 411 offers increased impregnability and saturability compared to Type 410, making Type 411 suitable for use in cast resin applications such as turn and layer insulation. General NOMEX Information: Nomex® is a family of aromatic polyamide (aramid) fibers. This family consists of staple fibers, continuous filament yarns, paper, and spunlaced fabrics. The paper is produced from two forms of the aramid polymer. Small fibrous binder particles (fibrids) derived directly from the polymer under high shear conditions are mixed with short fibers (floc) which are cut to length from a fiber filament. The floc and fibrids are combined in a water based slurry from which a continuous sheet is produced on a specialized papermaking machine. This initial paper (as in Type 411) is low density and has poor properties. Subsequent densification and internal bonding is achieved by high temperature calendaring. The resulting paper is mechanically strong and has good electrical properties. Some uses for paper product include insulation in electric motors and transformers, wire wrapping, and honeycombed strength members in many aircraft. Nomex® brand fibers are inherently flame resistant: the flame resistance is a polymer property and does not diminish with the life of the fiber. Nomex® meta-aramid, poly(meta-phenyleneisophthalamide), is prepared from meta-phenylenediamine and isophthaloyl chloride in an amide solvent. It is a long chain polyamide in which at least 85% of the amide linkages are attached directly to two aromatic rings. The meta oriented phenylene forms bends in the polymer chain, reducing chain rigidity as compared to the para orientation in the chemically similar Kevlar® chain. This flexible polymer chain gives Nomex® more textile-like qualities while retaining high temperature properties similar to Kevlar®. Information provided by DuPont.

Order this product through the following link:

[http://www.lookpolymers.com/polymer\\_DuPont-Nomex-411-Paper-10-mil-Nominal-Thickness.php](http://www.lookpolymers.com/polymer_DuPont-Nomex-411-Paper-10-mil-Nominal-Thickness.php)

Physical Properties	Metric	English	Comments
Bulk Density	0.310 g/cc	0.0112 lb/in <sup>3</sup>	
Density	0.310 g/cc	0.0112 lb/in <sup>3</sup>	
Thickness	254 microns	10.0 mil	Nominal
	259 microns	10.2 mil	Typical; TAPPI-411

Mechanical Properties	Metric	English	Comments
Film Elongation at Break, MD	3.4 %	3.4 %	ASTM D828
Film Elongation at Break, TD	5.2 %	5.2 %	ASTM D828
Tear Strength, Total	8.00 N	1.80 lb (f)	Initial in TD; ASTM D1004
	13.0 N	2.92 lb (f)	Initial in MD; ASTM D1004
Elmendorf Tear Strength, MD	0.748 g/micron	19.0 g/mil	Calculated from mfr's report of 1.9 N per TAPPI-414 and the typical thickness

Mechanical Properties	Metric	English	Comments
Film Tensile Strength, TD	13.5 MPa	1960 psi	Calculated from mfr's report of 35 N/cm per ASTM D828 and the typical thickness
Film Tensile Strength at Break, MD	7.70 MPa	1120 psi	Calculated from mfr's report of 20 N/cm per ASTM D828 and the typical thickness

Thermal Properties	Metric	English	Comments
Maximum Service Temperature, Air	220 °C	428 °F	Electrical insulation
Shrinkage, MD	0.60 %	0.60 %	at 240°C
Shrinkage, TD	0.90 %	0.90 %	at 240°C

Electrical Properties	Metric	English	Comments
Dielectric Constant	1.2	1.2	ASTM D150
	@Frequency 60 Hz	@Frequency 60 Hz	
Dielectric Strength	1.3	1.3	ASTM D150
	@Frequency 1000 Hz	@Frequency 1000 Hz	
Dissipation Factor	9.00 kV/mm	229 kV/in	AC Rapid Rise; ASTM D149
	18.0 kV/mm	457 kV/in	
Dissipation Factor	0.0030	0.0030	ASTM D150
	@Frequency 60 Hz	@Frequency 60 Hz	
Dissipation Factor	0.0050	0.0050	ASTM D150
	@Frequency 1000 Hz	@Frequency 1000 Hz	

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