

## DuPont™ Nomex® 410 Paper, 10 mil Nominal Thickness

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

### Material Notes:

Nomex® Type 410 is a calendared insulation paper which offers high inherent dielectric strength, mechanical toughness, flexibility, and resilience. It is the original form of Nomex® paper and is widely used in a majority of electrical applications. 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 (fibrils) 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 fibrils 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-410-Paper-10-mil-Nominal-Thickness.php](http://www.lookpolymers.com/polymer_DuPont-Nomex-410-Paper-10-mil-Nominal-Thickness.php)

| Physical Properties | Metric      | English                   | Comments           |
|---------------------|-------------|---------------------------|--------------------|
| Bulk Density        | 0.960 g/cc  | 0.0347 lb/in <sup>3</sup> |                    |
| Density             | 0.960 g/cc  | 0.0347 lb/in <sup>3</sup> |                    |
| Thickness           | 254 microns | 10.0 mil                  | Nominal            |
|                     | 259 microns | 10.2 mil                  | Typical; ASTM D374 |

| Mechanical Properties        | Metric        | English     | Comments  |
|------------------------------|---------------|-------------|---|
| Film Elongation at Break, MD | 19 %          | 19 %        | ASTM D828   |
| Film Elongation at Break, TD | 15 %          | 15 %        | ASTM D828   |
| Tear Strength, Total         | 42.0 N        | 9.44 lb (f) | Initial in TD; ASTM D1004   |
|                              | 71.0 N        | 16.0 lb (f) | Initial in MD; ASTM D1004   |
| Elmendorf Tear Strength, MD  | 2.36 g/micron | 60.0 g/mil  | Calculated from mfr's report of 6 N per TAPPI-414 and the typical thickness |
|                              |               |             | Calculated from mfr's report of   |

| Elmendorf Tear Strength, TD<br>Mechanical Properties | 4.25 g/micron<br>Metric | 108 g/mil<br>English | 10.8 N per TAPPI-414 and the typical thickness<br>Comments                       |
|--|-------------------------|----------------------|--|
| Film Tensile Strength at Break, MD                   | 110 MPa                 | 16000 psi            | Calculated from mfr's report of 285 N/cm per ASTM D828 and the typical thickness |
| Film Tensile Strength at Break, TD                   | 58.7 MPa                | 8510 psi             | Calculated from mfr's report of 152 N/cm per ASTM D828 and the typical thickness |

| Thermal Properties               | Metric                             | English  | Comments   |
|----------------------------------|------------------------------------|--|--|
| Thermal Conductivity             | 0.139 W/m-K<br>@Temperature 150 °C | 0.965 BTU-in/hr-ft <sup>2</sup> -°F<br>@Temperature 302 °F |  |
| Maximum Service Temperature, Air | 220 °C                             | 428 °F   | 220°C insulation by UL, the US Navy, and other tests       |
| Oxygen Index                     | 27 - 32 %                          | 27 - 32 %  | Range at RT for Type 410; depends on thickness and density |
| Shrinkage, MD                    | 0.40 %                             | 0.40 %   | at 300°C   |
| Shrinkage, TD                    | 0.10 %                             | 0.10 %   | at 300°C   |

| Electrical Properties          | Metric                       | English                      | Comments                      |
|--------------------------------|------------------------------|------------------------------|-------------------------------|
| Volume Resistivity             | 2.00e+16 ohm-cm              | 2.00e+16 ohm-cm              | 50% RH; ASTM D257             |
| Surface Resistivity per Square | 2.00e+16 ohm                 | 2.00e+16 ohm                 | ASTM D257                     |
| Dielectric Constant            | 2.6<br>@Frequency 10000 Hz   | 2.6<br>@Frequency 10000 Hz   | 50% RH; ASTM D150             |
|                                | 2.7<br>@Frequency 60 Hz      | 2.7<br>@Frequency 60 Hz      | ASTM D150                     |
| Dielectric Strength            | 32.0 kV/mm                   | 813 kV/in                    | AC Rapid Rise; ASTM D149      |
|                                | 63.0 kV/mm                   | 1600 kV/in                   | Full-wave Impulse; ASTM D3426 |
| Dissipation Factor             | 0.0060<br>@Frequency 60 Hz   | 0.0060<br>@Frequency 60 Hz   | ASTM D150                     |
|                                | 0.014<br>@Frequency 10000 Hz | 0.014<br>@Frequency 10000 Hz | ASTM D150                     |

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