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Technical Data

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Flexible Composites

Composites of Nomex®②

Nomex paper or mat can be combined with nearly any other flexible insulating material to form a composite. Those which possess the most obvious advantages and are of the greatest current interest are:

Nomex/Polyester Film

The combination of Nomex paper or mat with polyester film represents an improvement in cut-through resistance and superior thermal aging characteristics. Combinations of this type can be made with any number of plies, the most common composites being of two and three plies. In selecting the type of construction to be used, it is well to consider the function of the polyester film. If the film is simply a reinforcing material, and is not required as a long term dielectric, then two ply composites are the most economical. They are also higher in tear resistance than three ply composites of the same thickness. This is especially so in applications where the composite can be inserted in such a manner that the film ply must withstand the greater elongation. For example, in motor slot applications, higher tear resistance is usually obtained when the film is next to the steel laminations.

When the film is to be used as a dielectric throughout the life of the unit, three ply combinations are recommended. This allows the film to be covered on both sides, and as tests and field experience have indicated, this greatly extends its useful life at elevated temperatures.

Nomex/Kapton®③

In order to utilize the full thermal stability of Nomex (Underwriter's Laboratories, Inc. recognize Nomex paper for use up to 220C) it is desirable to form composites with films of like thermal stability. One such suitable material is duPont's Kapton polyimide film. At room temperature the properties of Kapton are similar to those of polyester films; however, both the electrical and mechanical characteristics are maintained over a much broader temperature range. Tests indicate that Kapton is suitable for continuous operation at 230C. In addition, it does not melt and is infusible. Thus Nomex-Kapton composites offer many of the familiar advantages of polyester mat/polyester film combinations plus thermal stability adequate for Class H applications, provided they are bonded with a suitable adhesive.

Nomex Type 410/Polyester Film/Nomex Type 410

Product	Composite thickness ASTM D374 (Inches)	Yield Sq. Yds./ Lb.	Lbs./Sq. Yd.	Dielectric Strength ASTM D149 (2 In. Dia. Electrodes) (Volts)	Volume Resistivity① ASTM D257 (ohm/cm)	Surface Resistivity① ASTM D257 (ohms)	Tensile Strength ASTM D828 M.D. Lbs./In. of Width	C.M.D.	Tear Strength Graves M.D. (Lbs.)	C.M.D.
3-3-3	0.010	2.01	0.50	11,600	10^{14}	10^{13}	142	116	11	10
3-5-3	0.012	1.54	0.65	12,600	10^{14}	10^{13}	175	150	14	12
5-3-5	0.0135	1.38	0.72	15,000	10^{14}	10^{13}	235	165	16	13

① Values Obtained Were Greater Than Values Shown.

Nomex Type 410/Kapton/Nomex Type 410

Product	Composite thickness ASTM D374 (Inches)	Yield Sq. Yds./ Lb.	Lbs./Sq. Yd.	Dielectric Strength ASTM D149 (2 In. Dia. Electrodes) (Volts)	Volume Resistivity① ASTM D257 (ohm/cm)	Surface Resistivity① ASTM D257 (ohms)	Tensile Strength ASTM D828 M.D. Lbs./In. of Width	C.M.D.	Tear Strength Graves M.D. (Lbs.)	C.M.D.
3-1	0.005	4.55	0.22	5,300	10^{14}	10^{13}	60	40	4	5
3-2	0.005	3.82	0.26	6,000	10^{14}	10^{13}	70	55	6	5
5-2	0.007	2.77	0.36	9,500	10^{14}	10^{13}	115	90	10	10
2-2-2	0.006	2.77	0.36	7,300	10^{14}	10^{13}	67	57		
3-1-3	0.008	2.55	0.39	8,900	10^{14}	10^{13}	112	76	8	6
3-2-3	0.008	2.22	0.45	6,600	10^{14}	10^{13}	104	81	10	6
3-3-3	0.0095	1.92	0.52	16,000	10^{14}	10^{13}	150	105	11	9

① Values Obtained Were Greater Than Values Shown.

Nomex Mat/Kapton

Product	Composite thickness ASTM D374 (Inches)	Yield Sq. Yds./Lb.	Lbs./Sq. Yd.	Dielectric Strength ASTM D149 (2 In. Dia. Electrodes) (Volts)	Tensile Strength ASTM D828 M.D. Lbs./In. of Width	C.M.D.	Tear Strength MIL-I-22834 (Ships) M.D. (Lbs)	C.M.D.
2-1-2	.0056	3.69	0.27	7,800	60	40	10	10
2-2-2	.0066	3.06	0.33	13,000	84	77	16	15

② duPont registered TM for its aramid paper.
③ duPont registered TM for its polyimide film.

Pyromid 180

A flexible insulation, high temperature combination material, that looks, feels and handles like DMD, but operates up to 180C.
The fact that it is a mat rather than a hard paper product, enables it to absorb varnish and enhance the bonding of the wires and steel to the insulation, thus making a more homogeneous structure.

Miscellaneous Nomex* Composites

Nomex may also be combined with any number of other fibrous materials, cloths of films where certain specific properties are desired; for example:

Nomex-Asbestos for high temperature stability, good compressive creep characteristics and low cost.
Nomex-Glass where unidirectional or woven glass can be oriented to provide increased mechanical strength in one or more specific directions. Such a material would also have good thermal stability and flame resistance.
Nomex-Varnished Glass for higher electric strength and excellent physical properties over a wide temperature range.

Nomex-Nomex where a thickness of Nomex greater than .030 inches is required, multiple layers of Nomex can be combined to obtain the desired thickness.

* duPont registered TM for its aramid paper.

Typical Properties of Pyromid 180

Product	Composite thickness ASTM D374 (Inches)	Yield Sq. Yds./ Lb.	Lbs./Sq. Yd.	Dielectric Strength MIL-I-22834 2" Electrodes (Volts) as received	Aged 96 hrs at 180°	Tensile Strength MIL-I-22834 (Lbs./In. of Width) M.D.	C.M.D.	Tear Resistence Finch (Lbs/In. of Width)
3-3-3	.009	2.17	0.46	10,000	10,000	120	75	190
3-5-3	.011	1.69	0.59	14,000	14,000	150	100	260
3-7.5-3	.0135	1.35	0.74	18,000	18,000	190	200	350

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