3M™ TufQUIN™ Hybrid Inorganic-Organic Insulating Paper

Tough, high-temperature papers and flexible laminates

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Product Description

3M™ TufQUIN™ Hybrid Inorganic-Organic Insulation Paper Products are a hybrid inorganic/organic paper based upon advanced manufacturing techniques. This family of innovative electrical insulation materials is the result of 3M Innovative Paper Technology's continued research to develop safe, cost-effective, high-performance products for the electrical/electronic industry. TufQUIN papers offer the high-temperature capabilities of inorganic materials combined with the high mechanical strength gained by the use of organic fiber. TufQUIN papers can be combined with polyester film to form a flexible laminate uniquely suited for high temperature electrical insulation applications.

TufQUIN 110 Paper

TufQUIN 110 paper is flexible, conformable paper exhibiting physical toughness in the form of high tensile strength and excellent tear resistance. TufQUIN 110 paper offers good dielectric characteristics and thermal conductivity in conjunction with high-temperature performance.

TufQUIN 120 Paper

TufQUIN 120 paper is made with a modified manufacturing process that yields thicker constructions while maintaining conformability. Although generically the same as TufQUIN 110 paper, TufQUIN 120 paper exhibits a rougher surface and a softer hand.

UL Recognition

3M TufQUIN Products are a combination of inorganic and organic ingredients designed to optimize the thermal and mechanical properties required in today's demanding applications. TufQUIN products have undergone extensive thermal aging evaluation per UL 1446, "Standard for Systems of Insulating Materials – General," and as a result are UL Recognized as suitable for use as major insulation in electrical insulation systems through Class 200(N).

Several UL Recognized Insulation Systems are listed under 3M IPT File No. E65007 in the OBJS2 Category for Class 130(B), Class 155(F), Class 180(H) and Class 200(N) applications, and may be found on UL's Electrical Insulation Systems Database at **http://www.ul.com/eis/**. All systems listed on this database are available for use by any electrical apparatus manufacturer by contacting the nearest UL office. TufQUIN TFT laminate insulations utilizing at least the minimum total thickness of TufQUIN per UL System requirements are acceptable for use in these systems.

Product Features

- Physically tough
- Cost effective
- Flexible and conformable
- Good thermal conductivity
- UL Systems Recognition through Class 200(N)
- CSA Component Acceptance: Temperature Class 200°C
- IEC qualified Electrical Insulation Systems per IEC 60085

Applications

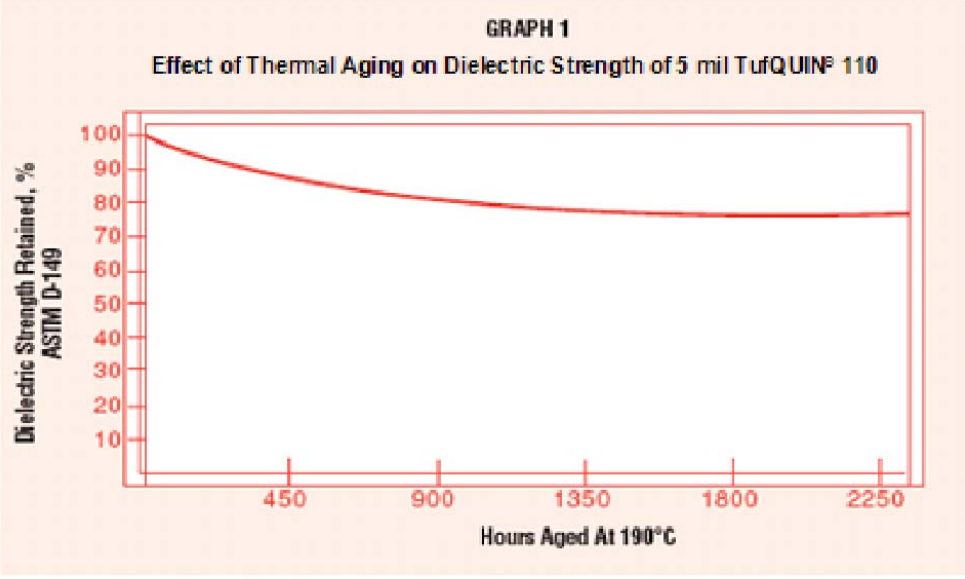
- Dry-Type Transformers, Coils, Reactors (ground, barrier, layer, end-turn and interwinding insulation)
- Spiral and Convolute wound Tubing
- Motors and Generators when used in laminates with PET film (slot, phase and wedge insulation)
- Wire and Cable Wrap
- Pressure Sensitive Tapes

Physical Characteristics

3M™ TufQUIN™ Inorganic-Organic Hybrid Insulating Paper 110 has a combination of tensile strength, tear resistance, stretch and stiffness that yields a tough, but conformable sheet. Typical Product Properties are shown in Table 1.

TufQUIN paper offers improved tear resistance and toughness that makes it suitable for use in more rigorous winding applications. It is especially well suited for layer insulation in strip coils.

TufQUIN paper retains a high percentage of its dielectric strength after extended thermal aging. See Graph 1.



Physical Characteristics

3M™ TufQUIN™ Inorganic-Organic Hybrid Insulating Paper exhibits low moisture content and very little moisture absorption, especially when compared to aramid paper, thus reducing the need for extended drying cycles prior to varnishing.

Good thermal conductivity allows more compact design, resulting in lower cost and cooler running units. TufQUIN papers are compatible with virtually all commonly used impregnating varnishes and resins. TufQUIN papers, when impregnated, exhibit enhanced thermal conductivity and coil bonding characteristics.

TufQUIN paper is available in thicknesses from 2 to 10 mils.

Table 1 – 3M™ TufQUIN™ Product Properties

		3M TufQUIN 110 Paper					3M TufQUIN 120 Paper				ASTM Test Method
Nominal Thickness	mil mm	2 0,05	2.5 0,06	3 0,08	5 0,13	10 0,25	7.5 0,19	12 0,30	15 0,38	20 0,51	D-645
Basis Weight	g/m^2 oz/yd^2	54 1.6	71 2.1	87 2.6	141 4.2	282 8.3	190 5.6	348 10.2	429 12.6	597 17.6	D-202
Density	g/cc	1.07	1.10	1.14	1.11	1.11	0.99	1.14	1.12	1.17	
Tensile Strength											
MD	lb/inch N/cm	12 21	15 26	20 35	27 47	50 88	45 79	55 96	90 158	110 193	D-828
CD	lb/inch N/cm	5 9	7 12	8 14	13 23	24 42	21 37	25 44	44 77	55 96	
Elongation											
MD	%	10	12	15	19	18	14	14	14	15	D-828
CD	%	8	9	10	11	11	11	11	12	12	
Elmendorf Tear											
MD	grams Newton	50 0.5	60 0.6	85 0.8	255 2.5	590 5.8	335 3.3	650 6.4	770 7.5	1110 10.9	D-689
CD	grams	145 1.4	170 1.7	200 2.0	525 5.1	1335 13.1	705 6.9	1600 15.7	1620 15.9	2005 19.6	
Dielectric Breakdown Strength	kV	0.4	0.6	0.7	0.9	2.0	1.0	2.3	2.7	4.0	D-149

Recommended Practice For Using TufQUIN Products

Optimum performance of an electrical insulation system is dependent upon many factors, including proper choice of materials, acceptable design criteria, and good manufacturing procedures. 3M™ TufQUIN™ Hybrid Inorganic-Organic Insulating Paper composition provides for very good resistance to moisture absorption, thereby minimizing the drying time required prior to varnish impregnation or encapsulation. Varnishing is recommended for construction of equipment that may be exposed to the elements.

TufQUIN 110 and 120 papers will undergo some shrinkage at elevated temperatures. This shrinkage factor should be considered in designing end-use equipment. Varnishing will minimize the shrinkage characteristics of TufQUIN products.

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