

3M™ CeQUIN™ I, II Inorganic Insulating Paper

For High Performance Electrical Applications

Data Sheet

August 2008

Product Description

3M™ CeQUIN™ I, II Inorganic Insulating Papers are 3M's highest inorganic-content papers – comprised primarily of glass fibers and microfibers, inorganic fillers, and less than 10% organic binders. CeQUIN I paper is a highly flexible paper available in continuous roll stock in thicknesses ranging from 5 mil (.13 mm) to 30 mil (.76 mm). See Table 1 for Typical Product Properties of standard thicknesses of CeQUIN I, II paper. Other thicknesses are available on special order.

CeQUIN I Paper

The high inorganic content of CeQUIN I paper provides the excellent thermal and dielectric stability that is required for today's high-performance designs. CeQUIN I electrical insulation papers are designed to outperform competitive organic materials that cost substantially more.

CeQUIN II Paper

CeQUIN II is designed to provide thicker roll stock for barrier, end filter, and core wrap insulation applications. CeQUIN II paper exhibits enhanced physical and dielectric properties. It is available in thicknesses ranging from 20 mil (.51 mm) to 60 mil (1.52 mm).

Regulatory Agencies



CeQUIN Insulating Papers are designed to provide high-temperature performance in electrical insulation systems. CeQUIN 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 ground insulation in systems rated through Class 220(R).

Several UL Recognized Insulation systems are listed under IPT File No. E65007 in the OBJS2 category for Class 130(B), Class 155(F), Class 180(H), and 220(R) applications. This open file is free for use by any electrical apparatus manufacturer by contacting the nearest UL office. This file is also recognized by UL as being in compliance with International Electrotechnical Commission (IEC) Publication 85, "Thermal Evaluation and Classification of Electrical Insulation."

The 3M logo, consisting of the letters '3M' in a bold, sans-serif font.

3M™ CeQUIN™ I, II Inorganic Insulating Paper

Features

- Thermally stable
- Low moisture absorption
- Long-term dielectric strength
- Superior varnish absorption
- High thermal conductivity
- Cost effective
- UL Systems Recognition through Class 220(R)
- CSA Component Acceptance: Temperature Class 220°C
- IEC qualified Electrical Insulation Systems per IEC 60085

Applications

High Temperature Electrical Insulation for:

Dry-Type Transformers, Coils, Reactors (ground, barrier, layer, end-turn and interwinding insulation)

Traction Motors, Generators (interwinding insulation for form-wound coils, slot insulation and phase insulation)

Wire and Cable Wrap

Battery Separators

Capacitor and Electromagnet Layer Insulation

Switchgear Insulation

Spiral and Convolute Tubing

Typical Product Properties											
		CeQUIN I						CeQUIN II			ASTM Test Method
Thickness	mm	.13	.18	.25	.38	.63	.76	.75	1.0	1.5	D-645
	mil	5	7	10	15	25	30	30	40	60	
Basis Weight	g/m ²	125	185	271	413	706	814	814	1140	1629	D-202
	lb/yd ²	.23	.34	.50	.76	1.3	1.5	1.5	2.1	3.0	
Density	g/cc	0.98	1.04	1.07	1.08	1.11	1.07	1.07	1.12	1.07	
Tensile Strength MD	lb/inch	6	9	12	16	20	23	51	55	61	D-828
	N/cm	11	16	21	28	35	40	89	96	107	
Elongation, MD	%	<2	<2	<2	<2	<2	<2	<2	<2	<2	D-828
Dielectric Breakdown Strength	kV	1.0	1.3	1.8	2.6	3.2	3.8	6.5	8.8	9.2	D-149
Moisture Absorption	%	<1	<1	<1	<1	<1	<1	<1	<1	<1	D-644

Performance Characteristics

The excellent thermal conductivity (Graph 1) of 3M™ CeQUIN™ I, II Inorganic Insulating Paper helps dissipate heat build-up in electrical equipment resulting in reduced operating temperatures, longer life, and higher energy efficiency. Dry-type transformer coils wound with CeQUIN paper have exhibited 10-15°C lower average winding temperature rise, as compared to coils of the same design wound with competitive high-temperature insulation materials. Alternatively, equipment design engineers can take advantage of the improved heat dissipation afforded by CeQUIN paper to design more compact coils and reduce overall costs.

3M™ CeQUIN™ I, II Inorganic Insulating Paper

CeQUIN papers exhibit low moisture content and very little moisture absorption, even under high humidity conditions, especially when compared to aramid paper, thus reducing the need for extended drying cycles prior to varnishing. CeQUIN papers are not susceptible to hydrolytic degradation as are some organic-based insulation materials.

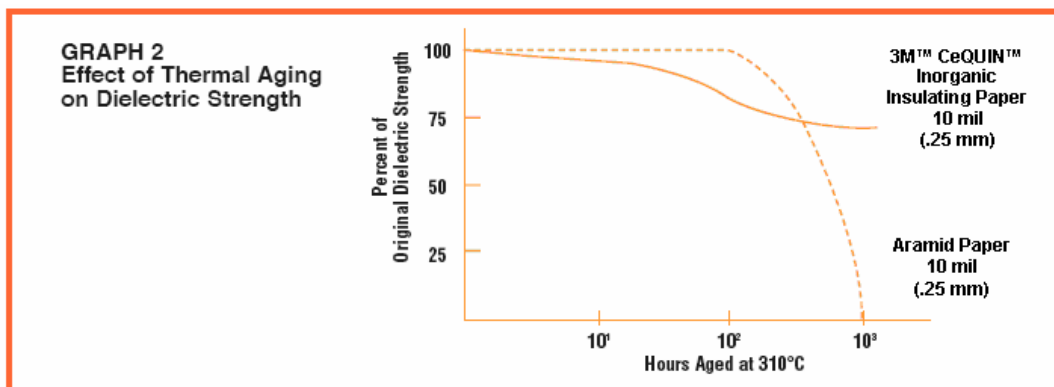
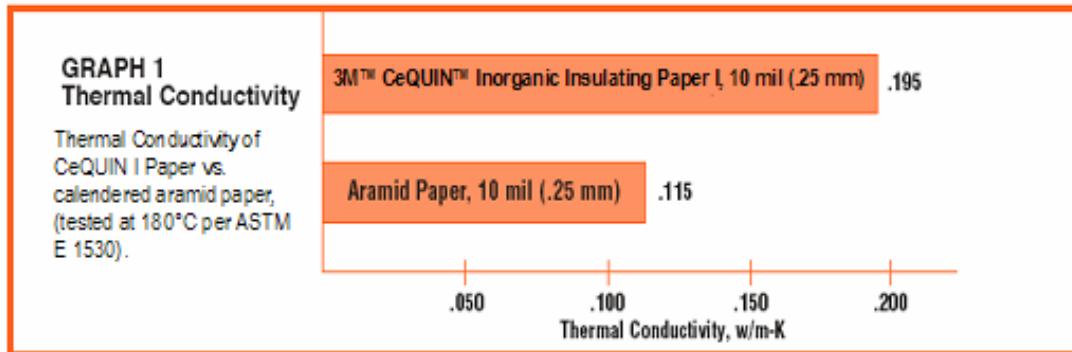
CeQUIN papers are easily impregnated and fully compatible with standard varnishes and resins, yielding tightly bonded coils and further improving thermal conductivity.

The high inorganic content of CeQUIN I and II papers equates to excellent dimensional stability, whether exposed to varying humidity conditions or long-term thermal aging.

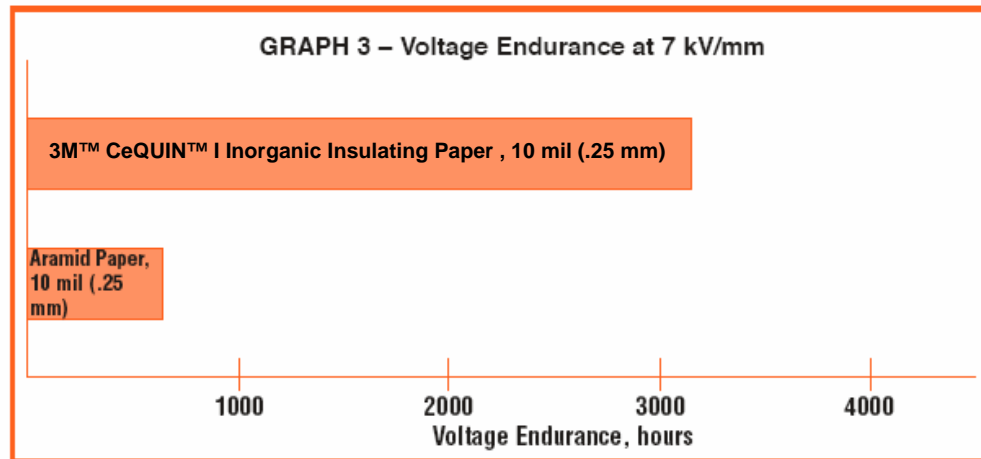
Electrical Characteristics

The thermal stability of CeQUIN papers is demonstrated in their retention of dielectric strength, even after thermal aging at temperatures in excess of 300°C. Graph 2 exhibits the performance of 10-mil (.25mm) CeQUIN paper vs. 10-mil (.25mm) calendared aramid paper when aged at 310°C.

The inorganic content of CeQUIN papers reduces the effect of long-term electrical stress and partial discharge on their insulation qualities. For example, when exposed to a continuous electrical stress of 1.8kV, 10 mil CeQUIN I paper will typically exhibit over three times the voltage endurance of 10-mil calendared aramid paper (see Graph 3).



3M™ CeQUIN™ I, II Inorganic Insulating Paper



Voltage endurance of 3M™ CeQUIN™ I Inorganic Insulating Paper vs. calendered aramid paper; average of five data points for each material; materials tested concurrently on same machine at 20°C. 5-% RH.

Recommended Practice for Using CeQUIN 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. CeQUIN paper's resistance to moisture absorption can minimize drying time required prior to varnish impregnation or encapsulation. Varnishing is recommended for construction of equipment that may be exposed to the elements. CeQUIN papers are easily saturated and will tend to assume the aging characteristics of the resin or varnish that is used.

Additional Information

The CeQUIN family of products includes a full line of laminate and coated products, as well as a line of related semi-rigid board materials. In addition, 3M supports an active research program to develop new products.

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