

### 3M INNOVATIVE PAPER TECHNOLOGIES

1 PAPER TRL TILTON NH 03276-5250

**System Component**  
**CeQuin I, CeQuin II, CeQuinbord CGA, CeQuinbord 3000, CeQuin IF, IFI, FIF, CeQuin IG, IGI, GIG, CeQuin 30F, 30F30, F30F, CeQuin 30G, 30G30, G30G, CeQuin 500, CeQuin 3000, CeQuin V, CeQuin III, CeQuin 510, CeQuin VG, VGV, GVG, ThermaVolt, Thermal Shield, CeQuin IIIF, VF, VFV, FVF, ThermaVolt TvG, GTvG, TvGTv, ThermaLam TvTs, TsTvTs, TvTsTv, ThermaVolt TvF, FTvF, TvFTv, Thermal Shield TsF, TsFTs, FTsF**

**System Designation**  
**IPT-220**

**System Temp(Class)**  
**220(R)**

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Complies with IEC Publication 85

## Construction Details (Table II)

alternate constructions 

The use of this insulation system is limited to the combination of materials specified below. Where more than one item is designated under Insulation Function, they may be used together, unless otherwise indicated, or they may be used as alternates to one another. Functions designated "optional" are not necessarily required for every design. Insulation thicknesses and/or layers indicated below are minimum.

### Winding Wire

- Recognized Component - Magnet wire (OBMW2), single build or greater, round or rectangular listed below or
- Recognized Component - Single and Multi-Layer Insulated Winding Wire (OBJT2) listed below or
- Recognized Component - Appliance Wiring Material (AVLV2) listed below

(unless otherwise noted, winding wire types listed below may be used in combination within a single product)

- MW 16 or 240C Polyimide
- MW 35A or 220C Polyester-amide-imide (Polyamide-imide)
- MW 36A or 220C Polyester (Polyamide-imide)
- MW 37 or 220C Polyester (Polyamide-imide)
- MW 38 or 220C Polyester (Polyamide-imide)
- MW 73A or 220C Polyester-amide-imide (Polyamide-imide)
- MW 74A or 220C Polyester-amide-imide
- Bare Conductor - wrapped with any Ground insulation in this table, 2mils (0.051mm) min. 50% overlap

- Bo Sung**  
SR PW AWM Style 3122
- Han Kyung**

HKSW-1 AWM Style 3122

**Nikkan Industries**

WP-60-10S AWM Style 3122

**Nissei Electric Co.**

RSU-T AWM Style 3122

**Yung Chang Silicone Co.**

YSRP-W AWM Style 3122

**Ground & Interwinding Insulations**

Designation (no.)	mils(mm)	comments
<b>3M Innovative Paper Technologies</b>		
CeQuin 3000	5 (0.13)	
CeQuin 30F, 30F30, F30F	5 (0.13)	minimum thickness of CeQuin 3000 portion
CeQuin 30G, 30G30, G30G	5 (0.13)	minimum thickness of CeQuin 3000 portion
CeQuin 500	5 (0.13)	minimum thickness of CeQuin I portion
CeQuin 510	5 (0.13)	minimum thickness of CeQuin 3000 portion
CeQuin I	5 (0.13)	unfired ceramic based rubber bonded paper
CeQuin IF, IFI, FIF	5 (0.13)	minimum thickness of CeQuin I portion
CeQuin IG, IGI, GIG	5 (0.13)	minimum thickness of CeQuin I portion
CeQuin II	5 (0.13)	unfired ceramic based rubber bonded paper
CeQuin III	5 (0.13)	
CeQuin IIIF, VF, VFV, FVF	5 (0.13)	minimum thickness of CeQuin III or V portion
CeQuin V	5 (0.13)	heat treated unfired ceramic like base rubber bonded paper
CeQuin VG, VGV, GVG	5 (0.13)	minimum thickness of CeQuin V portion
CeQuinbord 3000	5 (0.13)	
CeQuinbord CGA	5 (0.13)	unfired ceramic millboard and rubber bonded paper
ThermaLam TvTs, TsTvTs, TvTsTv	4 (0.1)	minimum thickness of ThermaVolt portion
ThermaVolt	4 (0.1)	
ThermaVolt TvF, FTvF, TvFTv	4 (0.1)	minimum thickness of ThermaVolt portion
ThermaVolt TvG, GTvG, TvGTv	4 (0.1)	minimum thickness of ThermaVolt portion
<b>E. I. Dupont de Nemours &amp; Co.</b>		
Nomex 410	5 (0.13)	aramid insulating paper
Nomex 411	11.5 (0.29)	aramid insulating paper
Nomex 414	5 (0.13)	aramid insulating paper
Nomex 418	5 (0.13)	aramid insulating paper
Nomex 424	5 (0.13)	aramid insulating paper
Nomex 425	5 (0.13)	aramid insulating paper
Nomex 992	10 (0.25)	aramid insulating paper
Nomex 993	8.25 (0.21)	aramid insulating paper
Nomex 994	8.265 (0.21)	aramid insulating paper
Nomex E56A	7.5 (0.19)	aramid insulating paper
<b>Powell LLC</b>		
Thermal Shield	5 (0.13)	

## Minor Sheet Insulations

(optional) layer, outer, wrap etc.

Any sheet insulation or tape described in this table with no minimum thickness requirement.

Designation (no.)	comments
<b>3M Innovative Paper Technologies</b>	
CeQuin 500	
CorQuin	
DMD	
DMD180	
TufQuin 100, 110, 120	
TufQuin PC	
TufQuin TF, TFT, FTF	
TufQuinbord	
<b>Acme</b>	
Acuflex DMD	
NMN	
<b>Arlon (Chase Foster, Keene)</b>	
DM	
DMD	
Epoxy coated Nomex	
FCMS	friction coated mylar
Kraft/Mylar/Kraft	
NMN	
XHX	
XXM	
<b>Cotrrell</b>	
Copaco	
<b>E. I. Dupont de Nemours &amp; Co.</b>	
Nomex 410	
Nomex N196	
<b>Essex</b>	
Polymat	
<b>Fibertek</b>	
DMD	
<b>Isovolta</b>	
DMD	
NMN	
<b>NVF</b>	
Peerless Forbon	
<b>Pilcher Hamilton</b>	

Kraft Paper

**Pucaro**

DMD

**Riegel Products (James River)**

Kraft Paper

**Von Roll USA Inc.**

Alm-X

CQMCQ

DM

Flexlam DMD

Flexlam NMN

NKN

NM

NMNM

Real AL

TQMTQ

Thermal H

**Von Roll USA Inc. (Bedford)**

5JF

DM

DMD

Hovotherm

Memco 100

NM

NMN

Pyroglass

Pyrolam 100

**Windsor-Stevens Inc.**

Hitex H

Kraft Paper

**Cores, Tubes**

**Bobbins**

(optional) for mechanical support only

Designation (no.)

comments

**D&B**

Kapton

Nomex

Nomex/Mylar

**E. I. Dupont de Nemours & Co.**

Rynite 530

Rynite 935

Rynite FR515

Rynite FR530

Rynite FR943

Rynite FR945

**Electrolock Inc.**

Nomex

Nomex/Mylar

**Insulation Sales**

Nomex

Nomex/Mylar

**Paramount**

Kraft

Nomex Wrapped Kraft

Paraquin

Paratherm

Rigid Paraquin

Rigid Paratherm

**Phillips**

Ryton R7

**Precision Paper**

Flame Retardant Resinite

HS Mylar

Kapton

Kraft

Mylar

Nomex

P100

Pyroform 310

Pyroform 360

Valconized Fiber

**Stone**

Kraft

**Tapes (optional)**

Designation (no.)	comments
<b>3M (Minnesota Mining &amp; Mfg Co)</b>	
1	polyester film/epoxy resin composite
10	thermosetting rubber, polyester nonwoven/epoxy resin composite
11	thermosetting rubber adhesive, black acetate cloth
1169	thermosetting rubber adhesive, polyester film
1205	acrylic adhesive, polyimide film
1276	
1298	acrylic adhesive, polyester film
1312	polyester filament reinforced polyester film
1318	acrylic adhesive, polyester film

1339	acrylic adhesive, polyester film
1350	polyester film
27	thermosetting rubber adhesive, glass cloth
28	thermosetting rubber adhesive, acetate cloth
3	thermosetting rubber adhesive, flatback paper
44	thermosetting rubber adhesive, web reinforced polyester film
46	
5	acrylic adhesive, polyester film
54	thermosetting rubber adhesive, polyester film
55	thermosetting rubber adhesive, polyester film/mat
56	thermosetting rubber adhesive, polyester film
56(a)	
57	thermosetting rubber adhesive, polyester film
58	thermosetting rubber adhesive, polyester film
60	thermosetting silicone adhesive, PTFE film
61	thermosetting acrylic adhesive, PTFE film
62	thermosetting acrylic oil compatible adhesive, PTFE film
63	acrylic adhesive, PTFE film
69	thermosetting silicone adhesive, glass cloth
72	
74	thermosetting rubber adhesive, polyester film
75	thermosetting rubber adhesive, double coated polyester film
79	acrylic adhesive, glass cloth
92	thermosetting silicone adhesive, polyimide film
926	
MR93	thermosetting rubber adhesive, reinforced polyester film
MR94	polyester film/non-woven composite
MR94B	
MR96	thermosetting rubber adhesive, reinforced polyester film
MR98	
Super 10	polyester film/epoxy resin composite
Super 20	polyester film/epoxy resin composite
<b>Bryden Co.</b>	
HT5150 MWMSET	
<b>CNF</b>	
16412-2A	
<b>E. I. Dupont de Nemours &amp; Co.</b>	
Kapton FN	
<b>Electrolock Inc.</b>	
T-Series Woven polyester	
<b>Flouroglass (Mystik)</b>	
7020	thermosetting rubber adhesive, solvent resistant
7021	thermosetting rubber adhesive, solvent resistant

7100	silicone adhesive, glass cloth
7300	silicone adhesive, polyester film
7459	silicone adhesive, glass cloth/aluminum foil
<b>Hesgon</b>	
005ACTY	
<b>Ideal Tape Co Inc</b>	
700	thermosetting rubber adhesive, polyester film glass filament
7007	thermosetting acrylic adhesive, polyester film glass filament
7017	thermosetting acrylic adhesive, polyester film glass filament
702	thermosetting rubber adhesive, polyester film glass filament
705	thermosetting rubber adhesive, polyester film glass filament
720	thermosetting rubber adhesive, woven polyester cloth
724	thermosetting rubber adhesive, woven polyester cloth
725	thermosetting rubber adhesive, polyester knit
730	thermosetting rubber adhesive, glass cloth
7300	thermosetting silicone adhesive, glass cloth
7307	thermosetting acrylic adhesive, glass cloth
750	thermosetting rubber adhesive, polyester film glass filament
750 Black	polyester film glass filament
780	thermosetting rubber adhesive, polyester film glass filament
7807	acrylic adhesive, polyester/glass
<b>Intertape Polymer Group (Tesa, Tuck, Spinnaker)</b>	
17	thermosetting rubber adhesive, film/glass filament reinforced
4118	polyimide film
4237	thermosetting acrylic adhesive, polyester film
4238	polyester film glass reinforced
4354	
4426-00	polyester film laminated to rope fiber
4426-04	polyester film laminated to rope fiber
4427	
4428	polyimide film
4429	polyimide film
4500	teflon (FEP)
4560	acetate cloth
4570-00	
4570-04	acetate cloth
4616-00	glass cloth
4616-04	glass cloth
4617	glass cloth
4617-00	
4618	glass cloth
51	thermosetting rubber adhesive, glass cloth
51560-08	

51560-17	
51562-08	
51562-17	
51578-00	
51580-00	
51582	
51587-04	polyester film
51587-17	polyester film
51588-00	
51589-00	polyester film
51589-04	
51589-17	polyester film
51593-00	
51594	polyester film
51595-00	
51595-04	
51596-00	
51597-00	
51599	
51599-00	polyester film glass reinforced
54108	polyester film
54356	polyester/nomex paper laminate
58	rubber adhesive, glass cloth
59	thermosetting silicone adhesive, glass cloth
<b>P Leo &amp; Co (B C) Ltd</b>	
1G006	aramid fiber (Nomex) paper
1G015	silicone adhesive, glass cloth
1G130	glass cloth
K7170	
N012	
<b>Permaccel</b>	
Nitto 188UL	
Nitto 315	
Nitto 316	
Nitto 3161	
Nitto 31B	
Nitto 31C	
Nitto 354E	
Nitto 360N UL	
Nitto 380UL	
Nitto 903	
P-167	
P-201	cotton cloth

P-21	thermosetting rubber adhesive, glass cloth
P-212	thermosetting silicone adhesive, glass cloth
P-212HD	thermosetting silicone adhesive, glass cloth
P-213	thermosetting acrylic adhesive, glass cloth
P-221	thermosetting silicone adhesive, polyimide film
P-222	thermosetting silicone adhesive, polyimide film
P-224	thermosetting silicone adhesive, polyimide film
P-232	thermosetting silicone adhesive, polyester film
P-234	
P-235	thermosetting rubber adhesive, polyester film/paper
P-236	thermosetting rubber adhesive, polyester film/paper
P-24	thermosetting rubber adhesive, acetate taffeta cloth
P-240	thermosetting silicone adhesive, polyester film/polyester non-woven
P-242	acetate taffeta cloth
P-243	thermosetting rubber adhesive, polyester film/non-woven mat
P-245	thermosetting rubber adhesive, polyester film/non-woven mat
P-245HD	polyester film/polyester non-woven
P-246	thermosetting rubber adhesive, glass cloth
P-247	oil resistant polyester film glass filament
P-248	thermosetting rubber adhesive, polyester film/paper
P-252	semi-cured rubber adhesive, polyester film
P-253	semi-cured rubber adhesive, polyester film
P-254	semi-cured rubber adhesive, polyester film
P-255	semi-cured rubber adhesive, polyester film
P-256	semi-cured rubber adhesive, polyester film
P-257	thermosetting rubber adhesive, polyester film
P-258	semi-cured rubber adhesive, printable polyester film
P-259	semi-cured rubber adhesive, printable polyester film
P-262	flame retardant thermosetting acrylic adhesive, aramid paper
P-277	thermosetting rubber adhesive, paper (creped kraft)
P-278	
P-281	thermosetting acrylic adhesive, printable polyester film
P-286	thermosetting acrylic adhesive, polyester film
P-286HD	thermosetting acrylic adhesive, polyester film
P-421	thermosetting silicone adhesive, PTFE film
P-422	
P-423	thermosetting silicone adhesive, bondable PTFE film
P-424	thermosetting silicone adhesive, PTFE film
P-430	thermosetting acrylic adhesive, PTFE film
<b>Saint-Gobain Performance Plastics Corp (CHR, Furon)</b>	
G540	silicone adhesive, fiberglass
G551	thermosetting rubber adhesive, glass cloth
G565	silicone adhesive, flame retardant fiberglass cloth

G569	acrylic adhesive, fiberglass cloth
K102	acrylic adhesive, polyimide film
K103	acrylic adhesive, polyimide film
K250	silicone adhesive, polyimide film flame retardant
K350	silicone adhesive, polyimide film flame retardant
M52	silicone adhesive, polyester film
M54	thermosetting rubber adhesive, polyester film
M56	thermosetting rubber adhesive, polyester film
M57	thermosetting rubber adhesive, polyester film
M60	acrylic adhesive, transparent polyester film
M64	thermosetting rubber adhesive, polyester film
M705	acrylic adhesive, polyester film
M706	acrylic adhesive, polyester film
M765	acrylic adhesive, polyester film
M787	rubber adhesive, polyester film
M97	acrylic adhesive, printable polyester film
M99	acrylic adhesive, polyester film
<b>Spec Tape</b>	
ST101	thermosetting rubber adhesive, reinforced polyester film
<b>Symbio Inc</b>	
GL06	silicone adhesive, glass cloth
GL15	acrylic adhesive, glass cloth
NM13	aramid (Nomex) paper
<b>Von Roll Isola</b>	
H7PST	

## Spacers and Wedges

(optional)

Any material described in this table with no thickness requirement.

Designation (no.)	comments
<b>E. I. Dupont de Nemours &amp; Co.</b>	
Rynite FR530	
<b>Glastic Corp.</b>	
1412	
1603GA	
FHT	
MTS	
SG-200	
TSF	polyester/glass
UTR	
UTS	
<b>Haysite</b>	

EHC  
ETS  
H755  
HTF

glass reinforced thermosetting polyester  
NRMA GPO-1 130  
NRMA GPO-1 155  
flexible, glass reinforced thermosetting polyester

**Hilec (Brand Rex, Voltube)**

Dog Bone

**Jenisco**

Poltruded Rod

**Liberty**

Polyester

**NVF**

GP-200HT

**Nohl**

APO-3

LST

NTR

**Politen**

G1GP10

**SEO**

Valox 420

**Sleevings (optional)**

Designation (no.)	comments
<b>D&amp;B Products</b>	
Heat Shrink Mylar	
<b>Delfingen US, Inc. (Sofanou, Jenisco)</b>	
ER 565	
<b>Federal Mogul (Bently Harris)</b>	
1062	silicone rubber coated fiberglass
Ben Har 1151-FR	
Ben Har 1151-HW	
Ben Har 1151-XL-200	silicone rubber coated fiberglass
Ben Har 1151-XL-220	
Ben Har 1151-XL-240	
Ben Har 1151-XL-FR-1	
Ben Har Acryl A	polyacrylate resin coated fiber glass
Ex-Flex	
ST	
Ben Har Ultra Acryl A	
<b>Hilec (Brand Rex, Voltube)</b>	
210	
317	
412	

547R  
710  
T-838  
Turbo 117E  
Turbo 117F

**Insul-Tab inc.**

TFE-300

**Markel**

Hygrade SR398  
TFE  
Thermo Flex 1200  
Thermo Flex 500  
polytube 463A

**Natvar**

727N  
Natglas  
Natglas TD  
SRG 200  
Vinyl

**Stone Industrial**

Mylar  
Nomex

**Suflex (Essex)**

Suflex 8A-150, RF  
Acryflex 155  
Acrylicflex F  
Suflex Flexicone 200  
Suflex Silicone Resin  
Suflex Silverflex T & D  
VW-1 OFS

**Varflex**

Varglas Non-Fray Type H  
Varglas Non-Fray Type HM  
Varglas Non-Fray Type HO  
Varglas Silicone Resin 500  
Varglas Silicone Rubber  
Varglas Silicone Rubber ES 4400  
Varfil  
Varglas 397  
Varglas Viton 231

**Tie Cords (optional)**

Designation (no.)

comments

**American Thread**

Polyester Tie

**Atkins and Pearce**

A4C1B1-S

**Breyden Products**38P, 58P, 60, 75, 90, 100, 100P, 200, 252, 330, 350, 390,  
500, 504, 504, 752, 990, P64, P96, P128, 3MC, 5MC, 7MC

5070, 5100, 5200, 5311, 5312, 5313, 5350, 150, 225, 350

60, 75, 100, 200, 252, 330, 350, 390, 500, 504, 6100, 6200,  
6500, 3MC, 5MC, 7MC

6100,6200,6500

BPCCT-155

BPCCT-180

**Hilec (Brand Rex, Voltube)**

828

**Ludlow Textile**

LP 1008

LP 1126

LP 1556

LP 1562

M1491

**Various Manufacturers**

Fiberglass, untreated

**Western Filament**

50DOF17W

DHS Series

DRT Series

EM2-CL

optional suffixes -LS, HT, -2

optional prefix of "G" or suffixes of "-1"

optional prefix of "HT" or suffixes of "-1" or "-LS"

optional prefix of "HT" or suffixes of "-1" or "LS"

**Varnishes****Recognized Component - Varnishes (OBOR2)**

Designation (no.)	comments
<b>Elantas Deatech S R L / P.D. George</b>	
1000	
2500	Varnish not acceptable for ANSI type MW35A.
40, F.C. 40, 13-0-40	Varnish not acceptable for ANSI type MW35A.
50(+3), 50S(+3), 50SM(+3), 50VT(+3), 50VTC(+3),	(+3) May be followed by XXF, where XX represents level of inorganic filler and letter F or filler
5180(+3), 5183(+3), 5183SW	Varnish not acceptable for ANSI type MW16.
70, 70VT, 70VTC, 70D, 70DVTC, 70DX VTC	
Y210	Varnish not acceptable for ANSI type MW35A.
<b>Elantas Deatech S R L / P.D. George / Ranbar</b>	
B-535-@, B-535-5S, B-535-NB-2	@ may be followed by the letters A, B, C, F, LV, M, PC, T or a color. Varnish not acceptable for ANSI type MW35A.
<b>Elantas Deatech S R L / P.D. George / Ripley Resin</b>	

468-2(+)

(+) may be preceded by prefix "E" and may be followed by a one to five alphanumeric suffix indicating % inert filler and/or color

**Elantas Deatech S R L / P.D. George / Schenectady**

Isonel 31-398, 32RF, 31-863, 31-863X, 30

Isonel 51, 51FC

Varnish not acceptable for ANSI type MW35A.

Varnish not acceptable for ANSI type MW35A.

**Potting  
Compounds**

(optional)

Designation (no.)

comments

**Cridel**

ER231-EH491

**ELANTAS, PDG, Inc.**

494-XD10-RQ

Pedigree 300