

Nelco® N9000

PTFE Laminates

The N9000 PTFE laminate system is designed for critical microwave components, antennas, power amplifiers and subassemblies. Superior mechanical and electrical performance make the N9000 PTFE laminate system the material of choice for your lowest loss, high frequency applications.

Key Features

Complete spectrum of controlled dielectric constants

- Dk of 2.08 through Dk of 4.50
- The first reinforced PTFE laminate with a dielectric constant less than 2.17 for very low loss antenna designs
- Available in sheets up to 80 inches long (2.03 meters) by 48 inches wide (1.22 meters)

Enhanced N9000 IM materials available

- Enables reduced passive intermodulation in antenna and high power designs - up to up to 25% better than other PTFE laminates available
- Offers two-tone passive intermodulation performance of less than -155 dBc which is typically 8-20 Db lower than other PTFE materials available.

Consistent Quality

- Statistic Process Control "SPC" methods provide consistent dielectric values from sheet to sheet and lot to lot
- Nelco facilities are ISO 9001:2000 quality certified and comply to ISO 14001:2004 environmental regulations
- Meets UL 94V-0 specifications
- All Nelco materials are RoHS compliant.

Optimized N9000 PTFE processing

- Foil adhesion is 50-100% greater than competitive glass reinforced PTFE laminates and 200-300% greater than other ceramic loaded hydrocarbon laminates.
- Superior solvent absorption resistance compared to ceramic-loaded PTFE.
- Reduced dielectric constant changes due to solvent absorption and no additional baking cycles are needed during processing



Applications

- Cellular Base Station Antennas
- Wireless Communications
- Power Amplifiers
- Dual Band Hi Power Passive Circuits
- Automotive Applications
- Digital/Microwave Hybrid Multilayer PCB Assemblies
- Millimeter Wave Components
- Telecommunications

Global Availability

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Park's UL file number: E36295

Nelco® N9000 Series - Typical Engineering Values

Typical Parameter	Test Method	9208		9217		9220		9233		9240		9245		9250		9255		9260	
		NY SERIES		NX SERIES		NX SERIES		NX SERIES		NX SERIES		NX SERIES		NX SERIES		NX SERIES		NX SERIES	
Dielectric Constant at 10 GHz (Dk)	IPC-TM-650, 2.5.5.5	2.08±.02	2.17±.02	2.20±.02	2.33±.02	2.40±.04	2.45±.04	2.50±.04	2.55±.04	2.60±.04									
Dissipation Factor at 10 GHz (Df)	IPC-TM-650, 2.5.5.5	0.0006	0.0008	0.0009	0.0011	0.0016	0.0016	0.0017	0.0018	0.0019									
Passive Intermodulation Formulation Availability		Yes	Yes																
Passive Intermodulation Performance		-155 dBc	-155 dBc																
Dielectric Breakdown	IPC-TM-650, 2.5.6	50kV	50kV																
Volume Resistivity	IPC-TM-650, 2.5.17	10 ⁹ M / cm	10 ⁹ M / cm																
Surface Resistivity	IPC-TM-650, 2.5.17	10 ⁷ M	10 ⁷ M																
Arc Resistance	ASTM D-495	180 sec.	180 sec.																
Flexural Strength Lengthwise	IPC-TM-650, 2.4.4	82.7 MPa	82.7 MPa																
Flexural Strength Crosswise	IPC-TM-650, 2.4.4	68.9 MPa	68.9 MPa																
Copper Peel Strength	IPC-TM-650, 2.4.8	2.33 kN / m	2.33 kN / m																
18, 35, and 70µm copper (1/2 oz, 1 oz, and 2 oz copper)																			
After Thermal Shock (30 sec. at 260°C)																			
Moisture Absorption	IPC-TM-650, 2.6.2.1	0.02%	0.02%																
Specific Gravity	ASTM D-792, A	2.23 g / cm ³	2.23 g / cm ³																
Thermal Conductivity	ASTM E-1225	0.272 W / m / K	0.272 W / m / K																
Coefficient of Thermal Expansion (CTE)																			
X	IPC-TM-650, 2.4.41			25 ppm / °C															
Y	IPC-TM-650, 2.4.41			35 ppm / °C															
Z	IPC-TM-650, 2.4.24			260 ppm / °C															
Flammability	IPC-TM-650, 2.3.10			V-0															

Cladding - Copper Foil

Foil Weight	Foil Thickness Microns	Foil Thickness inches	Copper Type Copper Deposited (ED)
.25 oz	9	0.00034	CQ
.33 oz	12	0.00045	CT
.50 oz	18	0.00067	CH RH
1 oz	35	0.00134	C1 R1
2 oz	70	0.00268	C2 R2

Cladding - Heavy Backed Metal

Plate Thickness		Plate Thickness		Plate Thickness	
mm	inches	mm	inches	mm	inches
0.800	0.032	2.362	0.093	4.750	0.187
1.000	0.039	2.500	0.098	5.000	0.197
1.200	0.047	3.000	0.118	6.000	0.236
1.500	0.059	3.175	0.125	6.350	0.250
1.575	0.062	4.000	0.157	7.000	0.276
2.000	0.079	4.750	0.187	8.000	0.315
V-0					

Heavy cladding plate material available in aluminum or brass for all NY and NX constructions.

Rolled annealed available upon request.

Nelco® N9000 Series - Typical Engineering Values

Typical Parameter	9270	9294	9300	9320	9294	9300	9320	9338	9348	9350	9410	9450
Dielectric Constant at 10 GHz (Dk)	2.70±.04	2.94±.04	3.00±.04	3.20±.04	NH SERIES							
Dissipation Factor at 10 GHz (Df)	0.0020	0.0022	0.0023	0.0024	NH SERIES							
PIM Formulation Availability	Yes											
Passive Intermodulation Performance	-155 dBc											
Dielectric Breakdown	50kV											
Volume Resistivity	10 ⁹ M / cm											
Surface Resistivity	10 ⁷ M											
Arc Resistance	180 sec.											
Flexural Strength Lengthwise	82.7 MPa											
Flexural Strength Crosswise	68.9 MPa											
Copper Peel Strength - 18, 35, 70 µm (1/2 oz, 1 oz, and 2 oz copper)	2.33 kN / m											
After Thermal Shock (30 sec. at 260°C)	2.31 kN / m											
Moisture Absorption	0.02%											
Specific Gravity	2.23 g / cm ³											
Thermal Conductivity	0.272 W / m / K											
Coefficient of Thermal Expansion (CTE)	2.31 kN / m											
X	0.08%											
Y	2.459 g / cm ³											
Z	0.230 W / m / K											
Flammability	9 ppm / °C											
	12 ppm / °C											
	71 ppm / °C											
	V-0											

For non-standard dielectric constants or additional copper foil options, please contact the factory or your local Nelco representative.

Ordering Information

Please specify the product and / or Dk, material thickness, copper thickness, copper type, and panel size. Request Passive Intermodulation Formulation when necessary for antenna applications.

Example: 9220, .010" thick, 1 oz two sides, ED copper, 12"x18" or Dk=2.20, .010" thick, 1 oz copper two sides, ED copper, 12"x18". For Passive Intermodulation Formulation material, add the IM suffix, i.e.: 9220IM.

Park Advanced Circuitry Materials

Nelco® RF and Microwave Materials

N4350-13 RF Controlled Dk/Df Modified Epoxy
Dk 3.50 / Df 0.0065 at 10 GHz

N4380-13 RF Controlled Dk/Df Modified Epoxy
Dk 3.80 / Df 0.0070 at 10 GHz

N9000-13 RF PTFE and Epoxy Composite
Dk 3.00 / Df 0.0040 at 10 GHz
Dk 3.20 / Df 0.0045 at 10 GHz
Dk 3.38 / Df 0.0046 at 10 GHz
Dk 3.50 / Df 0.0055 at 10 GHz

NH9000

Woven, Glass / Ceramic Loaded PTFE
Dk 2.94 - 4.50 / Df 0.0022 - 0.0030

NX9000

Woven Glass Reinforced PTFE
Dk 2.40 - 3.20 / Df 0.0016 - 0.0024

NY9000

Woven Glass Reinforced PTFE
Dk 2.08 - 2.33 / Df 0.0006 - 0.0011

Above values at 10 GHz

Nelco® N9000 Material - Standard Laminate Thicknesses

Series	Product	0.005	0.010	0.015	0.020	0.030	0.031	0.045	0.060	0.062	0.125
		0.127	0.254	0.381	0.508	0.762	0.787	1.143	1.524	1.575	3.175
NY	9208					X			X		X
NY	9217	X	X	X	X	X	X	X	X	X	X
NY	9220	X	X	X	X	X	X	X	X	X	X
NY	9233	X	X	X	X	X	X	X	X	X	X
NX	9240	X	X	X	X	X	X	X	X	X	X
NX	9245	X	X	X	X	X	X	X	X	X	X
NX	9250	X	X	X	X	X	X	X	X	X	X
NX	9255	X	X	X	X	X	X	X	X	X	X
NX	9260	X	X	X	X	X	X	X	X	X	X
NH	9294	X	X	X							
NX	9294				X	X	X	X	X	X	X
NH	9300	X	X	X							
NX	9300				X	X	X	X	X	X	X
NH	9320	X	X	X	X						
NX	9320					X	X	X	X	X	X
NH	9338	X	X	X	X	X	X	X	X	X	X
NH	9348	X	X	X	X	X	X	X	X	X	X
NH	9350		X	X	X	X	X	X	X	X	X

inches
mm

Constructions

NY: PTFE / woven-glass composite. Low glass:PTFE ratio for lowest loss applications.

NX: PTFE / woven-glass composite. Medium glass:PTFE ratio for increased mechanical strength.

NH: PTFE / woven-glass / ceramic composite. Medium glass:PTFE ratio with ceramic added for thermal stability and Dk uniformity at higher Dks.

Park Electrochemical Corp. is a global advanced materials company which develops and manufactures high-technology digital and RF/microwave printed circuit materials and advanced composite materials, parts and assemblies. The company operates under the Nelco®, Nelcote® and Nova™ names.

All test data provided are typical values and not intended to be specification values. For review of critical specification tolerances, please contact a Nelco representative directly. Nelco reserves the right to change these typical values as a natural process of refining our testing equipment and techniques.

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*CAF resistance has been established to greater than 500 hours using a specific OEM coupon design and test procedure. For details on this or other CAF tests, please visit www.parkelectro.com.

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