

Sheet Products - Property Comparison

			BR60	BR70	MC223	NP310
			Cotton (Canvas)			
			Phenolic - MoS ₂	Phenolic - Alumina	Phenolic	
PHYSICAL PROPERTIES						
Specific Gravity (0.062")		-	1.40	1.42	1.44	1.37
Rockwell Hardness (0.250" Build-up)		M Scale	80	95	105	100
Moisture Absorption (0.062")	Condition D ₁ -24/23	%	0.78	0.63	1.20	3.50
Flexural Strength (0.062")	Condition A Lengthwise / Crosswise	psi	16,200 / 12,700	20,200 / 13,600	18,000 / --	18,000 / 17,000
	Condition E-1/150 T150 Lengthwise / Crosswise		-- / --	-- / --	-- / --	-- / --
Flexural Modulus (0.062")	Lengthwise / Crosswise	kpsi	937 / 818	1,358 / 1,034	-- / --	1,600 / 1,500
Tensile Strength (0.125")	Lengthwise / Crosswise	psi	10,200 / 6,300	11,400 / 11,300	12,000 / --	12,000 / 9,700
Izod Impact Strength (0.500")	Condition E-48/50 Lengthwise / Crosswise	ft-lb/in (notched)	6.00 / 2.89	6.36 / 2.83	1.60 / --	1.95 / 1.75
Compressive Strength (0.500")	Flatwise	psi	34,000	36,500	38,000	34,000
Bonding Strength (0.500")	Condition A	lb	2,100	2,300	1,700	2,500
	Condition D-48/50		2,000	2,100	--	2,300
Shear Strength (0.062")	Perpendicular	psi	12,200	13,900	13,000	14,000
THERMAL PROPERTIES						
Maximum Operating Temperature ¹	Electrical / Mechanical	°C	-- / 125	-- / 125	-- / 125	-- / 125
Coefficient of Thermal Expansion (0.062")	X-axis / Y-axis	" / " / °C x 10 ⁻⁶	26.4 / 39.4	19.5 / 27.6	-- / --	20.0 / 22.0
Flammability Rating U.L. 94	Condition A	Class	HB	HB	HB	HB
ELECTRICAL PROPERTIES						
Dissipation Factor (0.062")	Condition D ₁ -24/23	-	--	--	--	--
Permittivity (0.062")	Condition D ₁ -24/23	-	--	--	--	--
Breakdown Voltage (0.062")	Condition A	kV	--	--	--	20
	Condition D-48/50		--	--	--	5
Electric Strength (0.062")	Condition A	V/mil	--	--	--	400
	Condition D-48/50		--	--	--	150
Arc Resistance D495 (0.125")	Condition A	sec	--	--	--	15
Comparative Tracking Index D3638 (0.125")		V	--	--	--	155

NOTE a: A double dash (--) indicates that the value has not been determined or is not applicable to the product.

NOTE b: All testing per ASTM D348 unless otherwise noted.

¹ NEMA LI-6: This temperature is a recommendation only and is based upon experience in various applications. The maximum operating temperature is dependent upon the application and should be investigated prior to use.

Sheet Products - Property Comparison

			NP310BW	NP310E	NP310HT	NP310U	
			Cotton (Canvas)				
			Phenolic				
PHYSICAL PROPERTIES							
Specific Gravity (0.062")		-	1.47	1.37	1.37	1.35	
Rockwell Hardness (0.250" Build-up)		M Scale	100	100	100	100	
Moisture Absorption (0.062")	Condition D ₁ -24/23	%	2.50	2.00	3.40	2.00	
Flexural Strength (0.062")	Condition A	psi	-- / --	17,500 / 15,000	18,000 / 18,000	23,000 / 13,500	
	Lengthwise / Crosswise						
Flexural Modulus (0.062")	Condition E-1/150 T150	kpsi	-- / --	-- / --	-- / --	-- / --	
	Lengthwise / Crosswise						
Tensile Strength (0.125")			psi	43,000 / --	11,000 / 9,000	-- / --	7,500 / 6,000
Izod Impact Strength (0.500")	Condition E-48/50		ft-lb/in (notched)	-- / --	1.70 / 1.50	2.35 / 2.02	1.50 / 1.00
Compressive Strength (0.500")		Flatwise	psi	43,000	34,000	35,000	28,000
Bonding Strength (0.500")	Condition A		lb	1,200	1,700	2,700	1,900
	Condition D-48/50			--	1,700	2,400	--
Shear Strength (0.062")		Perpendicular	psi	--	14,000	--	13,000
THERMAL PROPERTIES							
Maximum Operating Temperature ¹		Electrical / Mechanical	°C	-- / 150	125 / 125	-- / 145	125 / 125
Coefficient of Thermal Expansion (0.062")		X-axis / Y-axis	" / " / °C x 10 ⁻⁶	-- / --	20.0 / 22.0	-- / --	20.0 / 22.0
Flammability Rating U.L. 94	Condition A		Class	HB	HB	HB	HB
ELECTRICAL PROPERTIES							
Dissipation Factor (0.062")	Condition D ₁ -24/23		-	--	--	--	--
Permittivity (0.062")	Condition D ₁ -24/23		-	--	--	--	--
Breakdown Voltage (0.062")	Condition A		kV	--	40	55	50
	Condition D-48/50			--	3	--	3
Electric Strength (0.062")	Condition A		V/mil	--	550	527	550
	Condition D-48/50			--	300	--	300
Arc Resistance D495 (0.125")	Condition A		sec	--	15	--	15
Comparative Tracking Index D3638 (0.125")			V	--	--	--	150

NOTE a: A double dash (--) indicates that the value has not been determined or is not applicable to the product.

NOTE b: All testing per ASTM D348 unless otherwise noted.

¹ NEMA LI-6: This temperature is a recommendation only and is based upon experience in various applications. The maximum operating temperature is dependent upon the application and should be investigated prior to use.

Sheet Products - Property Comparison

			NP313	NP313HT	NP315	NP318
			Cotton (Canvas)			
			Phenolic - MoS2	Phenolic - Graphite	Phenolic	
PHYSICAL PROPERTIES						
Specific Gravity (0.062")		-	1.40	1.40	1.40	1.35
Rockwell Hardness (0.250" Build-up)		M Scale	100	100	90	90
Moisture Absorption (0.062")	Condition D ₁ -24/23	%	1.95	1.50	2.20	4.20
Flexural Strength (0.062")	Condition A Lengthwise / Crosswise	psi	19,000 / 17,000	26,000 / 19,500	19,000 / 15,000	17,000 / 14,000
	Condition E-1/150 T150 Lengthwise / Crosswise		-- / --	-- / --	-- / --	-- / --
Flexural Modulus (0.062")	Lengthwise / Crosswise	kpsi	1,200 / 1,000	1,200 / 1,000	1,200 / 1,000	1,100 / 900
Tensile Strength (0.125")	Lengthwise / Crosswise	psi	11,000 / 9,000	16,000 / 9,000	10,000 / 7,000	10,000 / 6,000
Izod Impact Strength (0.500")	Condition E-48/50 Lengthwise / Crosswise	ft-lb/in (notched)	1.70 / 1.40	3.50 / 2.70	1.70 / 1.40	2.50 / 2.00
Compressive Strength (0.500")	Flatwise	psi	36,000	49,000	38,000	25,000
Bonding Strength (0.500")	Condition A	lb	1,900	2,300	1,800	1,800
	Condition D-48/50		--	--	--	--
Shear Strength (0.062")	Perpendicular	psi	13,500	13,500	13,000	12,000
THERMAL PROPERTIES						
Maximum Operating Temperature ¹	Electrical / Mechanical	°C	-- / 145	-- / 145	-- / 145	125 / 125
Coefficient of Thermal Expansion (0.062")	X-axis / Y-axis	" / " / °C x 10 ⁻⁶	18.0 / 24.0	10.0 / 15.0	18.0 / 24.0	-- / --
Flammability Rating U.L. 94	Condition A	Class	HB	HB	HB	HB
ELECTRICAL PROPERTIES						
Dissipation Factor (0.062")	Condition D ₁ -24/23	-	--	--	--	--
Permittivity (0.062")	Condition D ₁ -24/23	-	--	--	--	--
Breakdown Voltage (0.062")	Condition A	kV	--	--	--	65
	Condition D-48/50		--	--	--	4
Electric Strength (0.062")	Condition A	V/mil	--	--	--	480
	Condition D-48/50		--	--	--	350
Arc Resistance D495 (0.125")	Condition A	sec	--	--	--	10
Comparative Tracking Index D3638 (0.125")		V	--	--	--	150

NOTE a: A double dash (--) indicates that the value has not been determined or is not applicable to the product.

NOTE b: All testing per ASTM D348 unless otherwise noted.

¹ NEMA LI-6: This temperature is a recommendation only and is based upon experience in various applications. The maximum operating temperature is dependent upon the application and should be investigated prior to use.

Sheet Products - Property Comparison

			NP319	NP344	NP347
			Cotton (Canvas)		
			Phenolic - Graphite	Phenolic - MoS2	
PHYSICAL PROPERTIES					
Specific Gravity (0.062")		-	1.41	1.40	1.40
Rockwell Hardness (0.250" Build-up)		M Scale	100	100	100
Moisture Absorption (0.062")	Condition D ₁ -24/23	%	2.50	2.00	2.00
Flexural Strength (0.062")	Condition A Lengthwise / Crosswise	psi	20,000 / 18,000	23,000 / 19,000	23,000 / 19,000
	Condition E-1/150 T150 Lengthwise / Crosswise		-- / --	-- / --	-- / --
Flexural Modulus (0.062")	Lengthwise / Crosswise	kpsi	1,300 / 1,000	1,500 / 1,100	1,500 / 1,100
Tensile Strength (0.125")	Lengthwise / Crosswise	psi	11,000 / 9,000	12,500 / 9,500	12,500 / 9,500
Izod Impact Strength (0.500")	Condition E-48/50 Lengthwise / Crosswise	ft-lb/in (notched)	2.00 / 1.85	1.70 / 1.50	1.70 / 1.50
Compressive Strength (0.500")	Flatwise	psi	36,000	35,000	35,000
Bonding Strength (0.500")	Condition A	lb	2,000	1,900	1,900
	Condition D-48/50		--	--	--
Shear Strength (0.062")	Perpendicular	psi	13,000	14,000	14,000
THERMAL PROPERTIES					
Maximum Operating Temperature ¹	Electrical / Mechanical	°C	-- / 145	-- / 130	-- / 130
Coefficient of Thermal Expansion (0.062")	X-axis / Y-axis	" / " / °C x 10 ⁻⁶	18.0 / 22.0	10.0 / 12.0	10.0 / 12.0
Flammability Rating U.L. 94	Condition A	Class	HB	HB	HB
ELECTRICAL PROPERTIES					
Dissipation Factor (0.062")	Condition D ₁ -24/23	-	--	--	--
Permittivity (0.062")	Condition D ₁ -24/23	-	--	--	--
Breakdown Voltage (0.062")	Condition A	kV	--	--	--
	Condition D-48/50		--	--	--
Electric Strength (0.062")	Condition A	V/mil	--	--	--
	Condition D-48/50		--	--	--
Arc Resistance D495 (0.125")	Condition A	sec	--	--	--
Comparative Tracking Index D3638 (0.125")		V	--	--	--

NOTE a: A double dash (-) indicates that the value has not been determined or is not applicable to the product.

NOTE b: All testing per ASTM D348 unless otherwise noted.

¹ NEMA LI-6: This temperature is a recommendation only and is based upon experience in various applications. The maximum operating temperature is dependent upon the application and should be investigated prior to use.

Sheet Products - Property Comparison

			MC320LE	NP320	NP320E	NP320U
			Cotton (Fine Weave Linen)			
			Phenolic			
PHYSICAL PROPERTIES						
Specific Gravity (0.062")		-	1.38	1.34	1.34	1.34
Rockwell Hardness (0.250" Build-up)		M Scale	102	100	100	95
Moisture Absorption (0.062")	Condition D ₁ -24/23	%	0.87	2.30	1.90	3.00
Flexural Strength (0.062")	Condition A	psi	24,000 / --	24,500 / 18,500	22,000 / 16,000	19,000 / 13,500
	Lengthwise / Crosswise					
Flexural Modulus (0.062")	Condition E-1/150 T150	kpsi	-- / --	-- / --	-- / --	-- / --
	Lengthwise / Crosswise					
Tensile Strength (0.125")		psi	18,800 / --	14,000 / 10,000	13,000 / 9,000	13,000 / 9,000
Izod Impact Strength (0.500")	Condition E-48/50	ft-lb/in (notched)	1.50 / --	1.70 / 1.35	1.35 / 1.10	1.10 / 0.86
Compressive Strength (0.500")		psi	38,000	38,000	36,000	30,000
Bonding Strength (0.500")	Condition A	lb	1,700	2,000	1,900	1,700
	Condition D-48/50		--	--	--	--
Shear Strength (0.062")		psi	14,000	13,500	13,500	12,000
THERMAL PROPERTIES						
Maximum Operating Temperature ¹	Electrical / Mechanical	°C	125 / 125	-- / 125	125 / 125	125 / 125
Coefficient of Thermal Expansion (0.062")	X-axis / Y-axis	"/"°Cx10 ⁻⁶	-- / --	18.0 / 19.0	18.0 / 19.0	20.0 / 22.0
Flammability Rating U.L. 94	Condition A	Class	HB	HB	HB	HB
ELECTRICAL PROPERTIES						
Dissipation Factor (0.062")	Condition D ₁ -24/23	-	--	0.070	0.065	0.054
Permittivity (0.062")	Condition D ₁ -24/23	-	--	5.80	5.50	6.60
Breakdown Voltage (0.062")	Condition A	kV	--	45	50	50
	Condition D-48/50		--	--	5	5
Electric Strength (0.062")	Condition A	V/mil	--	575	625	625
	Condition D-48/50		--	450	500	500
Arc Resistance D495 (0.125")	Condition A	sec	--	15	15	15
Comparative Tracking Index D3638 (0.125")		V	--	170	170	170

NOTE a: A double dash (--) indicates that the value has not been determined or is not applicable to the product.

NOTE b: All testing per ASTM D348 unless otherwise noted.

¹ NEMA LI-6: This temperature is a recommendation only and is based upon experience in various applications. The maximum operating temperature is dependent upon the application and should be investigated prior to use.

Sheet Products - Property Comparison

			NP322	NP322HT	NP325	NP329
			Cotton (Fine Weave Linen)			
			Phenolic - MoS2	Phenolic - Graphite	Melamine	
PHYSICAL PROPERTIES						
Specific Gravity (0.062")		-	1.39	1.34	1.39	1.47
Rockwell Hardness (0.250" Build-up)		M Scale	103	100	100	110
Moisture Absorption (0.062")	Condition D ₁ -24/23	%	2.40	--	1.50	1.80
Flexural Strength (0.062")	Condition A	psi	23,800 / 18,000	-- / --	20,100 / 19,200	29,000 / 26,000
	Lengthwise / Crosswise					
Flexural Modulus (0.062")	Condition E-1/150 T150	kpsi	1,500 / 1,100	-- / --	1,500 / 1,100	1,800 / 1,400
	Lengthwise / Crosswise					
Tensile Strength (0.125")		psi	14,000 / 9,700	16,200 / 13,500	13,500 / 9,500	16,000 / 9,700
Izod Impact Strength (0.500")	Condition E-48/50	ft-lb/in (notched)	1.60 / 1.30	2.16 / 2.06	1.42 / 1.35	1.90 / 1.75
Compressive Strength (0.500")		psi	39,000	39,500	35,000	34,000
Bonding Strength (0.500")	Condition A	lb	1,900	2,400	1,900	1,900
	Condition D-48/50		--	--	--	--
Shear Strength (0.062")		psi	14,500	--	14,500	13,000
THERMAL PROPERTIES						
Maximum Operating Temperature ¹	Electrical / Mechanical	°C	130 / 130	130 / 130	-- / 125	130 / 130
Coefficient of Thermal Expansion (0.062")	X-axis / Y-axis	" / " / °C x 10 ⁻⁶	10.0 / 12.0	10.0 / 12.0	10.0 / 12.0	18.0 / 19.0
Flammability Rating U.L. 94	Condition A	Class	HB	HB	HB	V-0
ELECTRICAL PROPERTIES						
Dissipation Factor (0.062")	Condition D ₁ -24/23	-	--	--	--	0.050
Permittivity (0.062")	Condition D ₁ -24/23	-	--	--	--	7.00
Breakdown Voltage (0.062")	Condition A	kV	30	30	--	20
	Condition D-48/50		5	5	--	5
Electric Strength (0.062")	Condition A	V/mil	--	--	--	500
	Condition D-48/50		--	--	--	300
Arc Resistance D495 (0.125")	Condition A	sec	--	--	--	120
Comparative Tracking Index D3638 (0.125")		V	--	--	--	200

NOTE a: A double dash (--) indicates that the value has not been determined or is not applicable to the product.

NOTE b: All testing per ASTM D348 unless otherwise noted.

¹ NEMA LI-6: This temperature is a recommendation only and is based upon experience in various applications. The maximum operating temperature is dependent upon the application and should be investigated prior to use.

Sheet Products - Property Comparison

			NP342	NP342LS
			Cotton (Fine Weave Linen)	
			Phenolic	
PHYSICAL PROPERTIES				
Specific Gravity (0.062")		-	1.35	1.35
Rockwell Hardness (0.250" Build-up)		M Scale	100	100
Moisture Absorption (0.062")	Condition D ₁ -24/23	%	1.80	1.70
Flexural Strength (0.062")	Condition A Lengthwise / Crosswise	psi	25,000 / 22,700	23,000 / 20,000
	Condition E-1/150 T150 Lengthwise / Crosswise		-- / --	-- / --
Flexural Modulus (0.062")	Lengthwise / Crosswise	kpsi	1,700 / 1,300	1,700 / 1,300
Tensile Strength (0.125")	Lengthwise / Crosswise	psi	12,700 / 10,900	12,700 / 10,900
Izod Impact Strength (0.500")	Condition E-48/50 Lengthwise / Crosswise	ft-lb/in (notched)	1.60 / 1.40	2.50 / 2.20
Compressive Strength (0.500")	Flatwise	psi	35,000	37,000
Bonding Strength (0.500")	Condition A	lb	1,900	--
	Condition D-48/50		--	--
Shear Strength (0.062")	Perpendicular	psi	14,000	16,000
THERMAL PROPERTIES				
Maximum Operating Temperature ¹	Electrical / Mechanical	°C	-- / 125	125 / 125
Coefficient of Thermal Expansion (0.062")	X-axis / Y-axis	"/"°Cx10 ⁻⁶	20.0 / 22.0	-- / --
Flammability Rating U.L. 94	Condition A	Class	HB	HB
ELECTRICAL PROPERTIES				
Dissipation Factor (0.062")	Condition D ₁ -24/23	-	--	--
Permittivity (0.062")	Condition D ₁ -24/23	-	--	--
Breakdown Voltage (0.062")	Condition A	kV	40	40
	Condition D-48/50		3	3
Electric Strength (0.062")	Condition A	V/mil	550	--
	Condition D-48/50		300	--
Arc Resistance D495 (0.125")	Condition A	sec	--	--
Comparative Tracking Index D3638 (0.125")		V	--	--

NOTE a: A double dash (--) indicates that the value has not been determined or is not applicable to the product.

NOTE b: All testing per ASTM D348 unless otherwise noted.

¹ NEMA LI-6: This temperature is a recommendation only and is based upon experience in various applications. The maximum operating temperature is dependent upon the application and should be investigated prior to use.