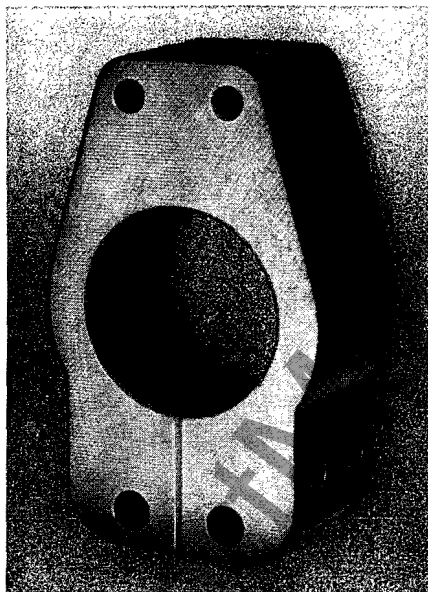
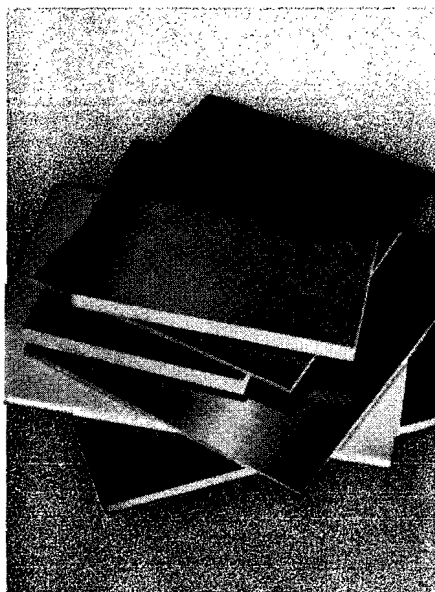


Westinghouse

**Micarta® Industrial Plate**

Laminated Plate Products
Paper, Cotton, Glass Base
Phenolics, Melamines, Epoxies, Silicones

**Industrial Plate Products**

Micarta industrial plate products consist of paper, cotton, glass and asbestos fillers impregnated with resins like phenolics, melamines, epoxies, and silicones. These are laminated under heat and pressure to obtain products having a wide range of characteristics. Micarta plate can be utilized in countless applications involving thermal, electric, mechanical, and chemical requirements. Specially lubricated grades are available for friction applications.

This publication presents, in table form, applications and requirements, as well as the mechanical and electrical properties of all grades of laminated Micarta shown on Price Lists 63-120, 63-220 and 63-230.

Laminated Micarta is available in standard size plates, sheets, angles, channels, rods and tubing. Micarta meets the performance characteristics of AIEE standards for Class A, B or H insulation and NEMA standards for laminated thermosetting products.

Grade Selection Table

Type of Laminate	Grade Number			NEMA Grade	Military Spec. Type and Number	Major Application Requirements
	Natural	Black	Chocolate			
Paper Phenolic	213	423		X		High tensile, flexural and compressive strength; used where machining or humidity characteristics are not important. Electrical insulation in dry or humid conditions where fair mechanical strength and good machining are needed. High humidity resistance; good dimensional stability; excellent resistance to splitting. Electrical insulation in applications requiring low dielectric losses in severe humidity conditions. Economical plate with fair electrical strength. Cold shearing and cold punching under normal conditions; low loss at high humidity. High impact cold shearing and punching under normal conditions. Excellent cold punching and shearing characteristics under normal conditions. Good cold shearing and punching under normal conditions. Low 60-cycle power factor
	219	429		XX	LP513a-PBG①	
	254			XXX	LP513a-PBE	
	279			XXP		
	H-2898	H-3429		X		
	H-5639			XXXPC	LP513a-PBEP	
	H-5640			XXXPC	LP513a-PBEP	
	H-18332	H-18333	H-18331	XPC		
	H-19128	H-19242	H-19243	XPC		
	H-19145			XX		
Paper Epoxy	H-9454			FR3	Mil-P-22324-PEE	Self-extinguishing; punchable, good dimensional stability.
Cotton Cloth Phenolic	221	431		LE	Mil-P-15035-FBE①	Good machining qualities; mechanical and electrical strength; moisture resistance; toughness; good appearance. Low moisture absorption; toughness; fair dimensional stability. High mechanical strength; good appearance; strength in punching. Good mechanical properties with especially high impact strength. High resistance to moisture, acids, and alkalis; good dimensional stability. Low moisture absorption; good dimensional stability; good resistance to acids, alkalis. Low-voltage, low-frequency electrical performance; mechanical performance in moderately humid conditions. Low coefficient of friction; self-lubricating (graphite filled).
	223				Mil-P-18324	
	238	448		L	Mil-P-15035-FBI①	
	262	466		C	Mil-P-15035-FBM①	
	273					
	281					
Asbestos Phenolic	286	496		CE	Mil-P-15035-FBG①	
	400					
	200			AA	Mil-P-8059-FBA	Mechanical strength with high resistance to heat; high impact strength. Mechanical and electrical strength with heat resistance; fair impact strength. Mechanical strength; high heat resistance; good machinability. Mechanical strength with exceptional heat resistance.
	239			A	Mil-P-8059-PBA	
	H-9491			AA	Mil-P-8059-FBA	
Glass Melamine	H-15017			AA	Mil-P-8059-FBA	
	259-2			G-5		High mechanical strength and hardness; high arc and heat resistance; excellent electrical properties under dry conditions; self-extinguishing. High mechanical strength; high arc and heat resistance; excellent electrical properties under dry and humid conditions; self-extinguishing.
	H-12426			G-9	Mil-P-15037-GME	
Glass Phenolic	H-5834					Excellent retention of all properties at elevated temperatures. Good electrical properties under dry conditions; high impact and flexural strength; good dimensional stability.
	H-17635			G-3		

① Applies to natural color only.

May, 1967

Supersedes TD 63-060, pages 1 to 4, dated November 2, 1959 and TD 63-361, pages 1 to 4, dated November 2, 1959
E, D, C. WC/01

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Grade Selection Table, Continued

Type of Laminate	Grade Number			NEMA Grade	Military Spec. Type and Number	Major Application Requirements
	Natural	Black	Chocolate			
Glass Silicone	H-17825			G-7		Excellent heat and arc resistance; good electrical properties under humid conditions; good mechanical properties; self-extinguishing.
	20201-1			G-7	Mil-P-997-GSG	Excellent heat and arc resistance; good electrical properties under humid conditions; self-extinguishing.
	20201-2			G-7	Mil-P-997-GSG	Excellent heat and arc resistance; good electrical properties under humid conditions; stability at high temperature; self-extinguishing.
Glass Epoxy	H-2497			G-11	Mil-P-18177-GEB	Retention of high mechanical strength and 50% of initial flexural strength at temperatures up to 150°C; self-extinguishing.
	H-8457			G-10	Mil-P-18177-GEE	Good machining qualities; high flexural, impact and bond strength at room temperatures; good electrical properties under dry and humid conditions; should not be used at elevated temperatures under mechanical load.
	H-16010 (Pigmented Tan)			FR-4 (Except Color)	Mil-P-18177-GEE	Self-extinguishing; good machining and punching qualities; high flexural, impact and bond strength at room temperatures; should not be used under mechanical load at elevated temperatures.

Application, Mechanical and Electrical Properties

Grade	Typical Use	Property	Weight Lbs. per Cu. In.	Water Absorption, % Inch, %	Hardness, Rockwell M	Ultimate Strength		
						Tensile with Grain	Compressive Flatwise	Flexural Flatwise with Grain, 1/4" Thick
						ASTM Method		
						Condition		

Paper and Cotton Base Materials

213, 423	Insulating Washers	.049	3.2	115	16,000	41,000	26,000
219, 429	Swbd. panel, relay and switch bases	.049	0.8	110	16,000	34,000	17,000
254	Panelboards	.049	0.4	110	15,000	36,000	20,000
279	Punched parts for electronic equipment	.049	0.9	90	11,000	25,000	20,000
H-2898, H-3429	Panelboards	.050	2.2	105	16,000	42,000	25,000
H-5639	Radio and TV terminal boards	.047	0.4	100	14,000	25,000	22,000
H-5640	Radio and TV terminal boards	.047	0.4	105	14,500	28,000	25,000
H-18331, 32, 33	Intricate punched parts requiring little or no preheating	.049	3.0	95	....	....	25,000
H-19128, H-19242, 43	Intricate punched parts requiring little or no preheating	.049	3.0	105	....	....	20,000
H-19145	Transformer Tap Changer Boards	.049	1.0	110	....	....	25,000
H-9454	Commercial computer terminal boards	.055	0.3	105	18,000	31,000	24,000
221, 431	Marine relay bases; terminal boards, radio parts	.048	0.7	100	14,000	38,000	22,000
223	Papermill doctor blades; pump valves; marine bearings; piston and packing rings	.049	1.0	110	10,000	37,000	20,000
238, 448	Fine-tooth gears; radio parts; terminal boards	.048	1.5	105	14,000	38,000	21,000
262, 466	Gears, pinions, spacers	.049	1.1	100	11,000	40,000	19,000
273	Pneumatic pistons; wet-chlorine gas systems; ball retainers	.049	0.9	110	7,000	35,000	16,000
281	Valve bodies; plating barrels	.049	1.0	110	9,000	36,000	20,000
286, 496	Marine switchboard panels; small gears and pinions; radio parts	.048	1.1	105	13,000	39,000	22,000
400	Textile mill bearings; pistons, packing rings	.050	4.5	90	11,500	36,000	21,000

Asbestos and Glass Cloth Base Materials

200	Rotor blocks in large rotating apparatus	.065	1.6	105	12,000	49,000	19,000
239	Transformer coil spacers, armature slot wedges, mechanical parts in furnaces and drying ovens, coil insulation	.065	0.95	110	13,000	41,000	17,000
H-9491	Motor, generator wedges, rotor vanes	.065	1.9	105	13,000	50,000	22,000
H-15017	Insulation of high-temperature pipe lines	.069	2.0	110	12,000	55,000	22,000
259-2	Switchboard panels, arc barriers, circuit breaker parts, structural electrical parts	.070	0.4	115	40,000	72,000	50,000
H-12426	Marine panels and structural parts	.069	0.2	120	45,000	65,000	55,000
H-5834	Ablative material	.070	0.12	120	50,000	62,000	74,000
H-17635	Armature-slot wedges, insulation in heating appliances	.067	0.4	115	40,000	75,000	65,000
H-17825	Class H insulation, heating appliance insulation	.064	0.02	105	....	....	25,000
20201-1	Radio-transmitter parts, Class H transformers, motors and generators, low-loss HF radio and radar insulators	.064	0.07	105	25,000	45,000	27,000
H-2497	Rotor slot insulation, structural members at elevated temperature	.070	0.04	115	45,000	80,000	75,000
H-8457	Terminal boards	.067	0.05	115	50,000	50,000	60,000
H-16010	Terminal boards	.067	0.06	110	....	....	62,000

Condition A: Conditioned for 24 hours and tested in standard laboratory atmosphere 23°C, 50% RH. This is representative data taken from production material. Properties may vary slightly, but in all cases are guaranteed to meet the applicable NEMA standards only.

① E-1/105, D-24/23, J-23/50.

② Tested in transformer oil, 23°C.

③ C-96/35/90, T-35/90.

④ Up to 1/4-inch thickness only.

Laminated Plate Products
Paper, Cotton, Asbestos, Glass Base
Phenolics, Melamines, Epoxies, Silicones

[illegible]

Micarta Industrial Plate

Laminated Plate Products

Paper, Cotton, Asbestos, Glass Base

Phenolics, Melamines, Epoxies, Silicones

Plate Sizes and Thicknesses Available

Grade	Plate Sizes, Inches					Grade	Plate Sizes, Inches				
	36 x 36	36 x 72	36 x 108	48 x 48	48 x 96		36 x 36	36 x 72	36 x 108	48 x 48	48 x 96
213, 423	.015-2	.031-2	.031-2	.031-2	.031-2	400	.031-2	.031-2	.031-2	....	....
219, 429	.031-2	.031-2	.031-2	.031-2	.031-2	200	.031-2.250	.031-2.250	.031-2.250	....	....
254	.015-2	.031-2	.031-2	.031-2	.031-2	239	.031-2	.031-2	.031-2	....	....
279	.031-.250	.031-.250	.031-.250	....	....	H-9491	.062-2.250	.062-2.250	.062-2.250	....	....
H-2898, H-3429	.031-.250	.031-.250	.031-.250	.031-.250	.031-.250	H-15017	.125-1.500	.125-1.500	.125-1.500	.140-1	.140-1
H-5639, H-5640	.015-.250	.031-.250	.031-.250	.031-.250	.031-.250	259-2	.015-2	.031-2	.031-2	.031-2	.031-2
H-18331, 32, 33	.031-.250	....	.031-.250	.031-.250	.031-.250	H-12426	.015-2	.031-2	.031-2	.031-2	.031-2
H-19128, 242, 243	.031-1	....	.031-1	.031-1	.031-1	H-5834	.015-2	.015-2	.031-2	....	....
H-19145	.062-1.50	.062-1.50	.062-1.50	.062-1.50	.062-1.50	H-17635	.015-2	.031-2	.031-2	....	....
H-9454	.031-.250	.031-.250	.031-.250	....	....	H-17825	.031-.750	.031-.750	.031-.750	....	....
221, 431	.015-4	.031-2	.031-2	.031-2	.031-2	20201-1	.010-1	.010-1	.031-1	....	....
223, 281	.031-4	.031-2	.031-2	.031-2	.031-2	20201-2	.010-1	.010-1	.031-1	....	....
238, 448	.015-2	.031-2	.031-2	....	....	H-2497	.031-2	.031-2	.031-2	....	....
262, 466	.031-10	.031-2	.031-2	.031-2	.031-2	H-8457	.015-2	.031-2	.031-2	.031-2	.031-2
273, 486, 496	.031-2	.031-2	.031-2	.031-2	.031-2	H-16010	.015-2	.031-2	.031-2	....	....

Tolerances of Molded Plate

Nominal Thickness, Inches	Thickness Tolerance, Inches							
	213, 219, 254, 279, 423, 429, H-2898, H-3429, H-5639, H-5640, H-9454, H-18331, H-18332, H-18333, H-19128, H-19145, H-19242, H-19243	221, 273, 431	223, 239, 281, 286, 496	238, 448	262, 400, 466	200, H-9491, H-15017	259-2, H-2497, H-5834, H-8457, H-12426, H-16010, H-17635, H-17825, 20201-1, 20201-2	
1/32	±.0035	±.005	±.0065	±.005	±.0065	±.010	±.0065	
1/64	±.0045	±.0055	±.0075	±.0055	±.0075	±.018	±.0075	
1/16	±.005	±.006	±.0075	±.006	±.0075	±.018	±.0075	
3/32	±.007	±.007	±.009	±.007	±.009	±.018	±.009	
1/8	±.008	±.008	±.010	±.008	±.010	±.020	±.012	
5/32	±.009	±.009	±.011	±.009	±.011	±.024	±.015	
3/16	±.010	±.010	±.0125	±.010	±.0125	±.024	±.019	
7/32	±.011	±.011	±.014	±.011	±.014	±.028	±.021	
1/4	±.012	±.012	±.015	±.024	±.030	±.028	±.022	
5/16	±.0145	±.0145	±.0175	±.029	±.035	±.034	±.026	
3/8	±.017	±.017	±.020	±.034	±.040	±.038	±.030	
7/8	±.019	±.019	±.022	±.038	±.044	±.044	±.033	
1/2	±.021	±.021	±.024	±.042	±.048	±.048	±.036	
5/8	±.024	±.024	±.027	±.048	±.053	±.058	±.040	
3/4	±.027	±.027	±.029	±.054	±.058	±.068	±.043	
7/8	±.030	±.030	±.031	±.060	±.062	±.076	±.046	
1	±.033	±.033	±.033	±.065	±.065	±.086	±.049	
1 1/4	±.037	±.037	±.037	±.073	±.073	±.106	±.055	
1 1/2	±.041	±.041	±.041	±.081	±.081	±.124	±.061	
1 3/4	±.045	±.045	±.045	±.089	±.089	±.144	±.067	
2	±.049	±.049	±.049	±.097	±.097	±.160	±.073	

Tolerances of Sanded Plate

Nominal Thickness, Inches	Thickness Tolerance, Inches			
	213, 219, 221, 238, 254, 273, 279, 423, 429, 431, 448, H-2898, H-3429, H-5639, H-5640, H-9454, H-18331, H-18332, H-18333, H-19128, H-19145, H-19242, H-19243	200, 223, 239, 259-2, 262, 281, 286, 400, 466, 496, H-2497, H-5834, H-8457, H-9491, H-12426, H-15017, H-16010, H-17635, H-17825, 20201-1, 20201-2		
	Sanded One Side	Sanded Both Sides	Sanded One Side	Sanded Both Sides
.031 to .060	±.003	±.002	±.005	±.003
.061 to .125	±.004	±.003	±.006	±.004
.126 to .250	±.005	±.004	±.007	±.005
.251 to .375	±.0055	±.0045	±.0075	±.006
.376 to .500	±.006	±.005	±.0075	±.007
.501 to .625	±.0065	±.0055	±.008	±.0075
.626 to .750	±.0075	±.0065	±.010	±.0085
.751 to .875	±.009	±.007	±.011	±.0095
.876 to 1.000	±.010	±.0075	±.012	±.010
1.001 to 2.000	±.018	±.015	±.018	±.015

① Cannot be sanded if less than .061 inch thick.

The performance characteristics attributed to the products described herein are based on assumptions of general and reasonable use of the products. As results cannot be predicted or guaranteed for any specific set of conditions, each user should make his own determination of these products' suitability for his particular application. Statements about possible or suggested uses should not be construed as a license under any Westinghouse patent or as recommendations for use of these materials in the infringement of any patent. In any event, Westinghouse shall not have any responsibility beyond the replacement of the Micarta material furnished in accordance with standard warranties.

Westinghouse Electric Corporation

Industrial Micarta Division, Hampton, South Carolina 29924

Printed in USA