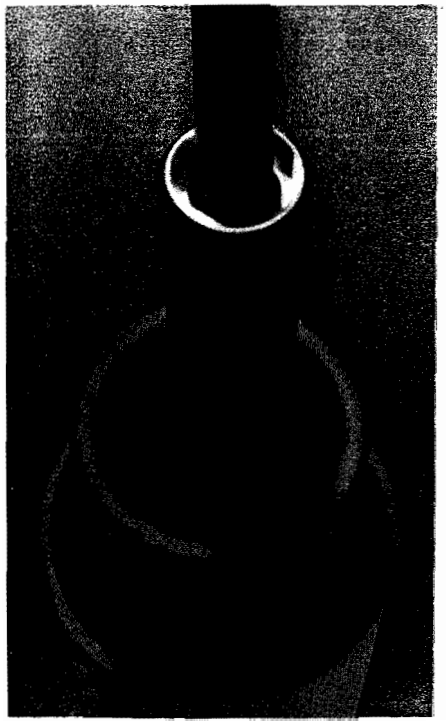
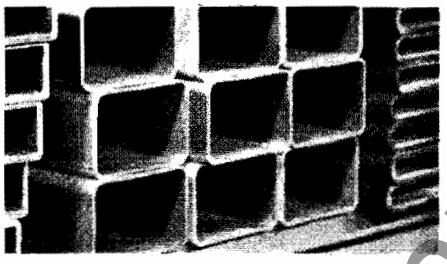
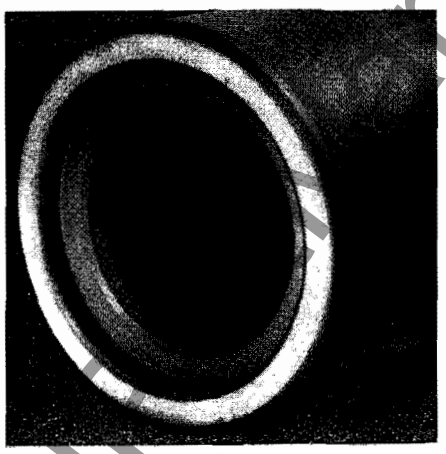
Westinghouse

Micarta® Convolute Tubing

Round, Square and Rectangular







Micarta Tubing

Almost any tubing need can be met with Micarta Convolute Tubing. Resins used to make Micarta tubing include phenolics, melamines, epoxies, and silicones; reinforcement materials include paper, cotton cloth, glass cloth, and asbestos. In addition to tubing with standard oil or sanded finishes, tubing with special finishes can be supplied. Tubing with special characteristics or dimensions can be made to order.

This publication presents, in table form, applications and requirements, as well as the mechanical and electrical properties of grades of laminated Micarta tubing shown on Price List 63-240.

Since Micarta has wide application in many industries, it is impossible to list all applications. Those shown are only representative of the uses in some fields.

Laminated Micarta tubes are available in a wide range of diameters and wall thicknesses to meet almost any need. Micarta tubing meets the performance characteristics of AIEE standards for Class A, B or H insulation and NEMA standards for thermosetting products.

Grade Selection Table

Type of Laminate	Grade Number and Color	NEMA Grade	Major Application Requirements
Paper Phenolic	52 Tan	X	Good mechanical strength
	58 Black	X	Good mechanical strength
	90 Tan	XX	Good general electrical properties in both dry and humid conditions; intermediate mechanical strength and resistance to splitting stress
	5A2 Black	XX	
	HY-290-2 Tan		Low moisture absorption; high rigidity; good machinability
	HY-1135 Tan	XXX	Heavy tube walls without circumferential cracks
	20,005 Tan	XXX	Good electrical characteristics under humid conditions; good dimensional stability and resistance to splitting stress
	20,006 Black	XXX	Good electrical characteristics under humid conditions; good dimensional stability and resistance to splitting stress
Cotton Fabric Phenolic	76 Tan	LE	Good machining qualities
	79 Tan	CE	Good physical and machining properties; fair electrical properties
	91 Tan		Low friction coefficient; self-lubricating
	97 Tan	LE	Low moisture absorption; acid and alkali resistance; excellent dimensional stability
	HY-1206 Tan	LE	Low moisture absorption; exceptionally good machinability and dimensional stability
Asbestos Phenolic	93 Tan	AA	Good heat resistance
	94 Tan	A	Good heat resistance with good machining and mechanical properties
Glass Melamine	5A4 White	G-5	Self-extinguishing; good arc resistance
	HY-689 Tan	G-5	Self-extinguishing; good machinability and mechanical strength; good arc resistance; good electrical properties under humid conditions
	HY-278 Tan	G-5	Flame resistance with good machinability and mechanical strength
	HY-1216 Tan	G-9	Self-extinguishing; good machinability and mechanical strength; good arc resistance; better electrical properties under humid conditions than HY-689
Glass Epoxy	HY-180 Green	G-10	Extremely good mechanical strength at room temperature; good machinability; low heat distortion point
	HY-180-1 Green	G-11	Extremely good mechanical strength at room temperature, with 50% axial compressive strength retained at 150°C; fair electrical properties
	HY-512 Green	G-10	Low heat-distortion point; extremely good mechanical strength at room temperature; very good machinability; small ID thin wall
Glass Silicone	HY-1293 White	G-7	Very good electrical properties under humid conditions; excellent heat and arc resistance; small ID thin wall
	20,000-2 White	G-7	Very good electrical properties under humid conditions; excellent heat and arc resistance

May, 1967
New Information
E, D, C, WC/02

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Application, Mechanical and Electrical Properties

Grade	Typical Use	Property	Specific Gravity	Water Absorption, Percent
		ASTM Method		D570
		Condition	A	A
Paper Base Materials				
52, 58	Coil forms		1.25	2.0
90, 5A2	Insulation in switchboards, relays		1.20	2.0
HY-290-2	Textile bobbins		1.30	1.5
HY-1135	Transformer insulation		1.25	0.70
20,005, 20,006	Fuse tubes, coil forms and supports, circuit breaker feed tubes		1.25	1.0
Cotton Cloth Base Materials				
76	Pull Rods, applications where good machinability is required		1.25	2.0
79	Small bearings and gears		1.25	2.0
91	Bearings, moving parts		1.30	1.5
97	Parts requiring fine threads and good finish; ball bearing retainer rings; gas tubing systems		1.30	2.0
HY-1206	Ball-bearing retainers requiring intricate machining		1.30	1.2
Asbestos Base Materials				
93	Insulating parts in heavy motors and generators		1.50	2.0
94	Furnace and drying oven parts		1.50	1.5
Glass Base Materials				
5A4	Fuse tubes		1.80	2.0
HY-689	Fuse tubes, mounting parts in switchboards		1.75	2.0
HY-278	Small ID tubing applications		1.70	2.0
HY-1216	Fuse tubes, mounting parts in switchboards		1.75	2.0
HY-180	Potentiometer bushings		1.75	0.15
HY-180-1	Bushings for large rotating apparatus		1.75	0.10
HY-512	Small ID tubing applications		1.75	0.1
HY-1293	Small ID thin-wall tubing applications		1.65	0.10
20,000-2	"Class H" and heating appliance insulation		1.65	0.11

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. All values based on tube size of 1" ID x 1¼" OD (⅛" wall).

① Tested in transformer oil, 23°C.

② C-96/35/90, T-35/90

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.

Micarta Convolute Tubing

Round, Square and Rectangular

Ultimate Strength		Dielectric Strength, Perpendicular	Dissipation Factor at	Dielectric Constant at	Volume Resistivity,	Surface Resistivity,	Property
Tensile, psi	Axial Compressive, psi	Vpm (Short Time)	10^6 Cycles/Sec.	10^6 Cycles/Sec.	Ohm–cm	Ohms	
D348	D348	D348	D150	D150	D257	D257	ASTM Method
A	A	①	A	A	②	②	Condition
Paper Base Materials							
12,000	16,000	450	....	....	....	....	52, 58
8,000	15,000	350	.050	5.0	4×10^{12}	3×10^{7}	90, 5A2
13,000	23,000	400	....	....	....	....	HY-290-2
11,000	20,000	350	....	....	....	....	HY-1135
12,000	20,000	500	.050	5.0	1×10^{12}	3×10^{8}	20,005, 20,006
Cotton Cloth Base Materials							
8,000	20,000	140	....	....	....	....	76
6,000	18,000	120	....	....	....	....	79
6,000	20,000	200	....	....	....	....	91
8,000	24,000	140	....	....	....	....	97
7,900	31,000	320	....	....	....	....	HY-1206
Asbestos Base Materials							
4,000	15,000	....	....	....	....	....	93
7,500	12,000	150	....	....	....	....	94
Glass Base Materials							
20,000	18,000	300	....	....	....	....	5A4
20,000	18,000	300	....	....	....	....	HY-689
25,000	24,000	150	....	....	....	....	HY-278
20,000	18,000	300	....	....	....	....	HY-1216
25,000	30,000	300	.015	4.7	....	....	HY-180
25,000	30,000	300	.010	4.7	....	....	HY-180-1
25,000	30,000	300	.015	4.7	....	....	HY-512
20,000	9,000	150	.002	4.1	8×10^{12}	3×10^{10}	HY-1293
20,000	9,000	150	.002	4.1	8×10^{12}	3×10^{10}	20,000-2

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Wall Thicknesses, Standard Lengths and Finishes of Convolute Tubing

Grade	Wall Thickness, In.		Standard Lengths, Inches				Finish	
	Minimum	Maximum	Inside Diameter, Inches				Standard	Special②
			.125 to .249	.250 to .499	.500 to .999	1.00 and Over		
Paper and Cotton Cloth Base Tubing								
52, 58	.031	.625	18-20	32-36	42-46	42-46	Polished	Oil, wax or varnish
76	.031	2.00	18-20	32-36	42-46	42-46	Polished	Oil, wax or varnish
79	.125	1.00	③	③	42-46	42-46	Polished	Oil, wax or varnish
90, 5A2	.031	.625	18-20	32-36	42-46	42-46	Polished	Oil, wax or varnish
91	.125	1.00	③	③	32-36	32-36	Polished	Oil, wax or varnish
97	.031	2.00	18-20	32-36	42-46	42-46④	Polished	Oil, wax or varnish
HY-290-2	.031	.750	18-20	32-36	42-46	42-46④	Polished	Oil, wax or varnish
HY-1135	.250	2.00	③	③	42-46	42-46	Polished	Oil, wax or varnish
HY-1206	.031	2.00	18-20	32-36	42-46	42-46	Polished	Oil, wax or varnish
20,005	.031	.625	18-20	32-36	42-46	42-46④	Polished	Oil, wax or varnish
20,006	.031	.625	18-20	32-36	42-46	42-46	Polished	Oil, wax or varnish
Asbestos Base Tubing								
93	.125	.500	③	③	32-36	32-36	Polished	Oil, wax or varnish
94	.031	.500	③	32-36	42-46	42-46	Polished	Oil, wax or varnish
Glass Base Tubing								
5A4	.031	.750	③	32-36	32-36	32-36	Sanded	....
HY-180	.031	.500	③	③	42-46	42-46	Sanded	Oil, wax or varnish
HY-180-1	.031	.500	③	③	42-46	42-46	Sanded	Oil, wax or varnish
HY-689	.031	1.00	③	32-36	42-46	42-46	Sanded	....
HY-278	.031	.250	16-19	③	③	③	Sanded	....
HY-512	.031	.250	18-20	32-36	③	③	Sanded	....
HY-1216	.031	1.00	③	32-36	42-46	42-46	Sanded	....
HY-1293	.031	.250	18-20	32-36	③	③	Sanded	....
20,000-2	.062	.250	③	③	32-36	32-36	Sanded	....

Tolerances

In Wall Thickness

Wall Thickness in Inches	Tolerance in Inches, Plus or Minus				
	Grades 52, 58, 90, 5A2 HY-290-2, HY-1135, 20,005, 20,006, 94	Grades 76, 97, HY-1206, .187 to .500 ID	Grades 76, 97, HY-1206, Over .501 ID	Grades 79, 91, 93	Grades 5A4, HY-180, HY-180-1, HY-278, HY-512, HY-689, HY-1216, HY-1293, 20,000-2
Up to .062	.006	.010	.008	③	.008
.063 to .125	.007	.011	.009	③	.009
.126 to .250	.009	.013	.011	.020	.011
.251 to .500	.011	.015	.013	.020	.013

In Length

Length in Inches	Tolerance in Inches, Plus or Minus		
	.187 to 2.00 ID	2.01 to 4.00 ID	Over 4.00 ID
0 to 3	.010	.010	.030
3 to 6	.010	.015	.030
7 to 12	.015	.020	.030
12 to 48	.030	.030	.050

In Diameter⑤

Inside or Outside Diameter, Inches	Tolerance⑥ in Inches, Plus or Minus					
	All Grades except 79, 91, 93, HY-180, HY-180-1, HY-1135, 20,000-2		Grade 93		Grades 79, 91, HY-180, HY-180-1 HY-11135, 20,000-2	
	Inside Dia.	Outside, Dia., Ground	Inside Dia.	Outside Dia., Ground	Inside Dia.	Outside Dia., Ground
.125 to .749	.003	.005	③	③	③	③
.750 to 1.999	.004	.005	.005	.005	.004	.005
2.000 to 4.000	.008	.008	.008	.008	.008	.008
4.001 to 12.000	.010	.025⑦	.015	.025⑦	.010	.025⑦
12.001 to 18.000	.030	⑦	.030	⑦	.030	⑦
18.001 to 24.000	.040	⑦	.040	⑦	.040	⑦
24.001 to 48.000	.060	⑦	.060	⑦	.060	⑦

② Wax or varnish finish, when specified, at negotiated price.

③ Not available.

④ Can be obtained longer on ⅞" ID to 10" OD, if mandrels are available.

⑤ Diameter is determined by measuring at least four points on the tube and averaging these dimensions.

⑥ Tolerance does not pertain to tubes rolled on built-up mandrels.

⑦ Tubes over 9" OD cannot be ground and will be supplied with rough finish on plus side of ordered OD. Tubes over 9" OD requiring machined OD must be negotiated with Hampton for tolerance and turning charge.

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