

HARDWIRE® Laminate Calculator

Wire Cord Comparison

Wire Type	Construction	Cord Diameter (mm)	Cord Area (mm ²)	Wire Area in Cord (mm ²)	Break Strength (N)	Wire Filament Modulus (GPa)	Cord Stress (bare or composite) (MPa)	Wire Filament Stress (MPa)	Cord Composite Modulus (GPa)	Wire Volume % Within Cord	Wire Weight (g/m)	Resin Density (kg/m ³)	Resin or Hybrid Modulus (GPa)	Resin or Hybrid CTE (per 1 degree C)
Ultra Tensile	12X	0.89	0.62070	0.414	1250	206.843	2,014	3,016	138	67%	3.33	961.108	3.585	8.30E-05
Ultra Tensile	3x2	0.89	0.62070	0.481	1539	206.843	2,479	3,199	160	78%	3.82	961.108	3.585	8.30E-05
Ultra Tensile	3S	0.91	0.65610	0.543	1343	206.843	2,047	2,474	171	83%	4.3	961.108	3.585	8.30E-05
Ultra Tensile	3SX	1.02	0.81071	0.561	1343	206.843	1,657	2,396	143	69%	4.46	961.108	3.585	8.30E-05
Ultra Tensile	ST2	0.60	0.28274	0.141	445	206.843	1,574	3,148	103	50%	1.12	961.108	3.585	8.30E-05

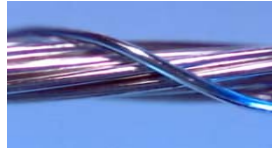
Note: Green inputs can be changed based on wire counts, resin types, and measured thickness.

Flat Sheet Composite Comparison

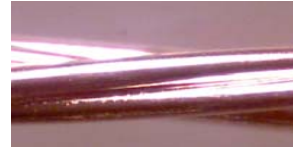
Diagram	# of wires/cm	# of wires /meter	Sheet T (cm)	Space Between Wires (cm)	Wire Volume (%)	Wire Weight (g/m ²)	Wire Weight (kg/m ²)	Tensile Load (N/cm)	Sheet Stress (MPa)	Effective Modulus (GPa)	Resin Volume (%)	Resin Weight (kg/m ²)	Composite Weight (kg/m ²)	Laminate Density (kg/m ³)	Wire Weight (%)	Resin Weight (%)	Longitudinal Laminate CTE (per 1 degree C)
	1.5748	157.48	0.123	0.546	5%	524.41	0.5244	1,969	160.04	14.3703	95%	1.119	1.644	1336.46	32%	68%	2.80E-05
	2.3622	236.22	0.123	0.334	8%	786.61	0.7866	2,953	240.06	19.7630	92%	1.088	1.875	1524.13	42%	58%	2.30E-05
	3.1496	314.96	0.123	0.229	11%	1048.82	1.0488	3,937	320.08	25.1556	89%	1.057	2.106	1711.81	50%	50%	2.02E-05
	4.7244	472.44	0.123	0.123	16%	1573.23	1.5732	5,906	480.12	35.9410	84%	0.994	2.567	2087.16	61%	39%	1.70E-05
	6.2992	629.92	0.123	0.070	21%	2097.64	2.0976	7,874	640.16	46.7263	79%	0.931	3.029	2462.51	69%	31%	1.54E-05
	9.0551	905.51	0.123	0.022	31%	3015.35	3.0154	11,319	920.24	65.6006	69%	0.821	3.837	3119.37	79%	21%	1.37E-05
	1.5748	157.48	0.123	0.546	6%	601.57	0.6016	2,424	197.04	16.1035	94%	1.109	1.711	1391.00	35%	65%	2.60E-05
	2.3622	236.22	0.123	0.334	9%	902.36	0.9024	3,635	295.56	22.3627	91%	1.073	1.975	1605.95	46%	54%	2.15E-05
	3.1496	314.96	0.123	0.229	12%	1203.15	1.2031	4,847	394.08	28.6220	88%	1.037	2.240	1820.89	54%	46%	1.89E-05
	4.7244	472.44	0.123	0.123	18%	1804.72	1.8047	7,271	591.13	41.1405	82%	0.964	2.768	2250.78	65%	35%	1.61E-05
	6.2992	629.92	0.123	0.070	25%	2406.30	2.4063	9,694	788.17	53.6590	75%	0.891	3.297	2680.67	73%	27%	1.46E-05
	9.0551	905.51	0.123	0.022	35%	3459.06	3.4591	13,936	1132.99	75.5663	65%	0.764	4.223	3432.98	82%	18%	1.32E-05
	1.5748	157.48	0.123	0.544	7%	677.17	0.6772	2,115	171.95	17.7120	93%	1.100	1.777	1444.85	38%	62%	2.46E-05
	2.3622	236.22	0.123	0.332	10%	1015.75	1.0157	3,172	257.92	24.7755	90%	1.059	2.075	1686.72	49%	51%	2.03E-05
	3.1496	314.96	0.123	0.226	14%	1354.33	1.3543	4,230	343.90	31.8390	86%	1.018	2.372	1928.59	57%	43%	1.80E-05
	4.7244	472.44	0.123	0.120	21%	2031.50	2.0315	6,345	515.84	45.9660	79%	0.936	2.967	2412.33	68%	32%	1.54E-05
	6.2992	629.92	0.123	0.067	28%	2708.66	2.7087	8,460	687.79	60.0930	72%	0.854	3.562	2896.07	76%	24%	1.41E-05
	9.0551	905.51	0.123	0.019	40%	3893.70	3.8937	12,161	988.70	84.8152	60%	0.710	4.603	3742.62	85%	15%	1.28E-05
	1.5748	157.48	0.139	0.533	6%	702.36	0.7024	2,115	152.16	16.4928	94%	1.251	1.953	1405.37	36%	64%	2.57E-05
	2.3622	236.22	0.139	0.322	10%	1053.54	1.0535	3,172	228.23	22.9467	90%	1.209	2.262	1627.50	47%	53%	2.12E-05
	3.1496	314.96	0.139	0.216	13%	1404.72	1.4047	4,230	304.31	29.4006	87%	1.166	2.571	1849.63	55%	45%	1.87E-05
	4.7244	472.44	0.139	0.110	19%	2107.09	2.1071	6,345	456.47	42.3084	81%	1.081	3.189	2293.89	66%	34%	1.59E-05
	6.2992	629.92	0.139	0.057	25%	2809.45	2.8094	8,460	608.62	55.2162	75%	0.997	3.806	2738.16	74%	26%	1.45E-05
	8.2677	826.77	0.139	0.019	33%	3687.40	3.6874	11,104	798.82	71.3509	67%	0.891	4.578	3293.48	81%	19%	1.34E-05
	1.5748	157.48	0.073	0.575	3%	176.38	0.1764	701	96.00	9.7837	97%	0.680	0.857	1173.41	21%	79%	3.66E-05
	4.7244	472.44	0.073	0.152	9%	529.13	0.5291	2,102	287.99	22.1811	91%	0.637	1.167	1598.02	45%	55%	2.16E-05
	9.0551	905.51	0.073	0.050	18%	1014.17	1.0142	4,030	551.99	39.2275	82%	0.579	1.593	2181.85	64%	36%	1.64E-05
	14.1732	1417.32	0.073	0.011	27%	1587.40	1.5874	6,307	863.98	59.3733	73%	0.509	2.096	2871.84	76%	24%	1.42E-05

Wire Volume %	Ult. Stress (MPa)	Modulus (GPa)	Density (kg/m ³)
6%	197.04	16.10	1391.00
12%	394.08	28.62	1820.89
25%	788.17	53.66	2680.67
35%	1,132.99	75.57	3432.98

12X Cord



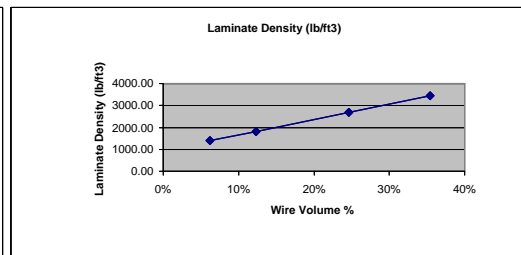
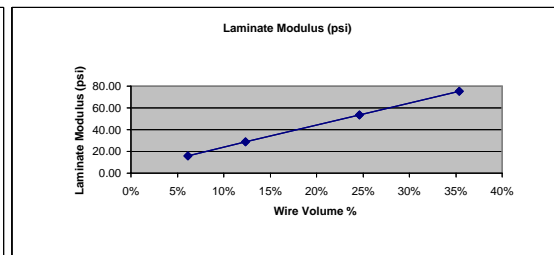
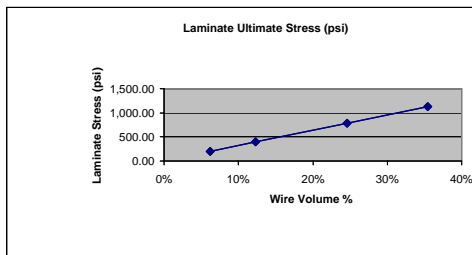
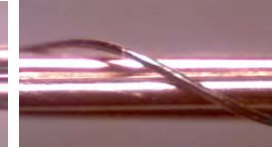
3X2 Cord



3S Cord



3SX Cord



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