

# HARDWIRE® Laminate Calculator

## Wire Cord Comparison

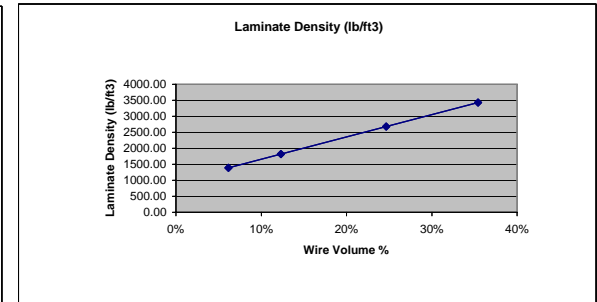
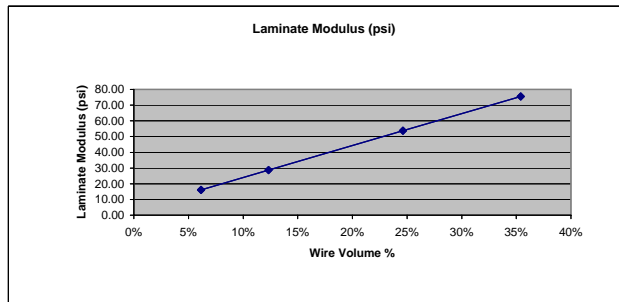
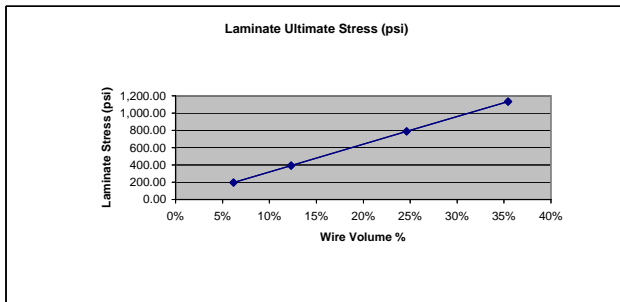
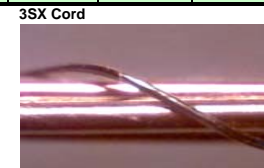
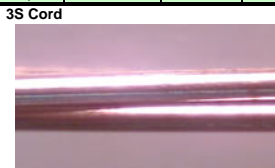
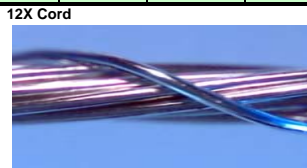
Wire Type	Construction	Cord Diameter (in)	Cord Area (in <sup>2</sup> )	Wire Area (in <sup>2</sup> )	Break Strength (lbs)	Wire Filament Modulus (psi)	Cord Stress (bare or composite) (psi)	Wire Filament Stress (psi)	Cord Composite Modulus (psi)	Wire volume % within cord	Wire Weight (lb/ft)	Resin Density (lb/ft <sup>3</sup> )	Resin or Hybrid Modulus (psi)	Resin or Hybrid CTE (per 1 degree F)
Ultra Tensile	12X	0.035	0.00096	0.000642	281	30,000,000	292,075	437,432	20,031,101	67%	0.002240	62	520000	4.61E-05
Ultra Tensile	3x2	0.035	0.00096	0.000746	346	30,000,000	359,637	464,046	23,250,047	78%	0.002569	62	520000	4.61E-05
Ultra Tensile	3S	0.036	0.00102	0.000841	302	30,000,000	296,965	358,917	24,821,761	83%	0.002892	62	520000	4.61E-05
Ultra Tensile	3SX	0.040	0.00126	0.000869	302	30,000,000	240,332	347,602	20,741,948	69%	0.002999	62	520000	4.61E-05
Ultra Tensile	ST2	0.024	0.00044	0.000219	100	30,000,000	228,186	456,372	15,000,000	50%	0.000753	62	520000	4.61E-05

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

## Flat Sheet Composite Comparison

	# of wires/ inch	# of wires / ft	Sheet (T) (in)	Space Between Wires (in)	Wire Volume (%)	Wire Weight (lb/ft <sup>2</sup> )	Wire Weight (oz/yd <sup>2</sup> )	Tensile Load (lbs/in)	Sheet Stress (psi)	Effective Modulus (psi)	E*T (lb/in)	Resin Volume (%)	Resin Weight (lb/ft <sup>2</sup> )	Composite Weight (lbs/ft <sup>2</sup> )	Laminate Density (lb/ft <sup>3</sup> )	Wire Weight (%)	Resin Weight (%)	al Laminate CTE
12X-4-12	4	48	0.048	0.215	5%	0.11	15.48	1,124	23,193	2,083,083	100,950	95%	0.237	0.345	85.3	31%	69%	1.56E-05
12X-6-12	6	72	0.048	0.132	8%	0.16	23.22	1,686	34,790	2,864,624	138,825	92%	0.230	0.392	97.0	41%	59%	1.28E-05
12X-8-12	8	96	0.048	0.090	11%	0.21	30.96	2,248	46,387	3,646,166	176,700	89%	0.224	0.439	108.7	49%	51%	1.12E-05
12X-12-12	12	144	0.048	0.048	16%	0.32	46.44	3,372	69,580	5,209,249	252,451	84%	0.211	0.533	132.0	60%	40%	9.47E-06
12X-16-12	16	192	0.048	0.028	21%	0.43	61.92	4,496	92,774	6,772,331	328,201	79%	0.197	0.627	155.3	69%	31%	8.53E-06
12X-23-12	23	276	0.048	0.008	30%	0.62	89.01	6,463	133,362	9,507,726	460,763	70%	0.174	0.792	196.2	78%	22%	7.63E-06
3X2-4-12	4	48	0.048	0.215	6%	0.12	17.76	1,384	28,558	2,334,266	113,123	94%	0.235	0.358	88.7	34%	66%	1.45E-05
3X2-6-12	6	72	0.048	0.132	9%	0.18	26.64	2,076	42,838	3,241,399	157,085	91%	0.227	0.412	102.1	45%	55%	1.19E-05
3X2-8-12	8	96	0.048	0.090	12%	0.25	35.51	2,768	57,117	4,148,532	201,046	88%	0.220	0.466	115.4	53%	47%	1.05E-05
3X2-12-12	12	144	0.048	0.048	18%	0.37	53.27	4,152	85,675	5,962,798	288,969	82%	0.204	0.574	142.2	64%	36%	8.95E-06
3X2-16-12	16	192	0.048	0.028	25%	0.49	71.03	5,536	114,234	7,777,065	376,892	75%	0.189	0.682	168.9	72%	28%	8.13E-06
3X2-23-12	23	276	0.048	0.008	35%	0.71	102.10	7,958	164,211	10,952,030	530,757	65%	0.162	0.871	215.6	81%	19%	7.34E-06
3S-4-12	4	48	0.048	0.214	7%	0.14	19.99	1,208	24,927	2,567,381	124,420	93%	0.233	0.372	92.1	37%	63%	1.36E-05
3S-6-12	6	72	0.048	0.131	10%	0.21	29.98	1,812	37,390	3,591,071	174,030	90%	0.224	0.433	107.1	48%	52%	1.13E-05
3S-8-12	8	96	0.048	0.089	14%	0.28	39.98	2,416	49,853	4,614,762	223,641	86%	0.216	0.493	122.1	56%	44%	9.99E-06
3S-12-12	12	144	0.048	0.047	21%	0.42	59.97	3,624	74,780	6,662,143	322,861	79%	0.198	0.615	152.2	68%	32%	8.58E-06
3S-16-12	16	192	0.048	0.027	28%	0.56	79.95	4,832	99,707	8,709,523	422,081	72%	0.181	0.736	182.3	75%	25%	7.83E-06
3S-23-12	23	276	0.048	0.007	40%	0.80	114.93	6,946	143,329	12,292,440	595,716	60%	0.150	0.949	234.9	84%	16%	7.13E-06
3SX-4-12	4	48	0.055	0.210	6%	0.14	20.73	1,208	22,057	2,390,686	130,928	94%	0.265	0.409	89.6	35%	65%	1.43E-05
3SX-6-12	6	72	0.055	0.127	10%	0.22	31.10	1,812	33,086	3,326,029	182,153	90%	0.256	0.472	103.4	46%	54%	1.18E-05
3SX-8-12	8	96	0.055	0.085	13%	0.29	41.46	2,416	44,115	4,261,372	233,378	87%	0.247	0.535	117.2	54%	46%	1.04E-05
3SX-12-12	12	144	0.055	0.043	19%	0.43	62.20	3,624	66,172	6,132,058	335,828	81%	0.229	0.661	144.8	65%	35%	8.86E-06
3SX-16-12	16	192	0.055	0.023	25%	0.58	82.93	4,832	88,230	8,002,744	438,278	75%	0.211	0.787	172.4	73%	27%	8.05E-06
3SX-21-12	21	252	0.055	0.008	33%	0.76	108.84	6,342	115,802	10,341,102	566,341	67%	0.189	0.945	207.0	80%	20%	7.45E-06
ST2-4-12	4	48	0.029	0.226	3%	0.04	5.21	400	13,907	1,418,358	40,795	97%	0.144	0.180	75.2	20%	80%	2.03E-05
ST2-12-12	12	144	0.029	0.060	9%	0.11	15.62	1,200	41,722	3,215,075	92,472	91%	0.135	0.243	101.6	45%	55%	1.20E-05
ST2-23-12	23	276	0.029	0.020	18%	0.21	29.94	2,300	79,967	5,685,561	163,528	82%	0.123	0.330	137.9	63%	37%	9.13E-06
ST2-36-12	36	432	0.029	0.004	27%	0.33	46.86	3,600	125,165	8,605,226	247,504	73%	0.108	0.433	180.8	75%	25%	7.86E-06

Wire Volume %	Ult. Stress (psi)	Modulus (psi)	Density (lb/ft <sup>3</sup> )
6%	28,558	2,334,266	88.7
12%	57,117	4,148,532	115.4
25%	114,234	7,777,065	168.9
35%	164,211	10,952,030	215.6



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