COMPOSIFLEX
Advanced Composite Products

Terminology

Ply angle	Angle of fibers to indicated direction of panel, typically length of panel, for each layer.
Unidirectional	All fibers are aligned in 1 direction.
Spring Layup	1 ply at 90° as 2nd layer on top and bottom of panel with the rest at 0°, i.e. 0,90,0,0,0…0,0,0,90,0
Crossply	Fibers alternate 0° and 90° at specified intervals, typically 1:1. Example 0,90,0,90,0,90,0

Mechanical Property

	Unidirectional @ 0°	Spring Layup .25" thick		Crossply 1:1 .15" thick	
	73°F(23°C)	73°F(23°C)	160°F(71°C)	73°F(23°C)	160°F(71°C)
Flexural Strength, PSI [MPa]	176,100 PSI [1,214MPa]	116,000 PSI [800MPa]	108,000 PSI [745MPa]	92,300 PSI [636MPa]	84,600 PSI [583MPa]
Flexural Modulus, PSI [GPa]	5,550,000 PSI [38.3GPa]	4,370,000 PSI [30.1GPa]	4,310,000 PSI [29.7GPa]	3,470,000 PSI [23.9GPa]	3,210,000 PSI [22.1GPa]
ASTM D790					
Tensile Strength, PSI [MPa]	129,000 PSI [889MPa]	94,400 PSI [651MPa]	80,300 PSI [554MPa]	70,200 PSI [484MPa]	62,900 PSI [434MPa]
Chord Modulus from .1 to .3%, PSI[GPa]		6,840,000 PSI [47.2GPa]	6,740,000 PSI [46.5GPa]	4,700,000 PSI [32.4GPa]	4,390,000 PSI [30.3GPa]
ASTM D3039					
Compressive Strength, PSI [MPa]	150,000 PSI [1,034MPa]	87,000 PSI [600MPa]	65,400 PSI [451MPa]	67,600 PSI [466MPa]	50,600 PSI [349MPa]
ASTM D3410					

Chemical Resistance

Crossply laminate immersed in fluid for 7 days at 73°F(23°C) and measured per ASTM D543 and ASTM D790

	% Change in Wt	% Change in Thickness	% Change in Flexural Mod
Heptane	0.01	0	-0.58
Isopropyl Alcohol	-0.05	0	-3.46
Ethylene Glycol	-0.03	0	-2.31
Aviation Oil (20W-50)	0.02	0	-2.02
Aviation Hydraulic fluid (5606A)	0.01	0.39	0.58
Sulfuric Acid 3%	0.04	0.39	-3.46
Sulfuric Acid 30%	0.01	0.13	-2.31
Sodium Hydroxide 1%	0.08	0	-4.61
Sodium Hydroxide 10%	0.06	0.13	-2.88
Hydrogen Peroxide 3%	0.10	0.13	-0.86
Deionized Water	0.09	0	-2.01

Electrical Properties

	60Hz	1000Hz(1KHz)	100 KHz	1MHz
Dielectric Constant, k'	5.25	5.17	4.98	4.82
Dissipation factor, D	0.007	0.008	0.018	0.038
ASTM D150 @ 73°F and 50% humidity				
Dielectric Strength V/mil (AC)	428			
ASTM D149 @ 73°F and 50% humidity				

Physical Properties

Resin Content (% by weight)	36
Specific gravity (cured average)	1.85
Barcol Hardness	67
Tg (DMA, E')	265°F (129°C)
Available thickness per ply	.005"[.127mm] special order, .010"[.254mm] standard

Fatigue Life

Spring layup parts have been tested in controlled lab environments at stresses of 22,000psi[152MPa] for at least 40,000,000 cycles of fully reversed constant loading flexural fatigue monitoring the deflection over time. From this testing and experience built up of over 20 years of field use, Flexply can be successfully used in high cycle fatigue applications using design stresses of 12,000psi [83MPa]. Low cycle fatigue applications can use design stresses of 20,000psi[138MPa]. Although the springs can survive in higher stress environments, experience has shown following these design limits extends life in the real world as many applications have short durations of higher stresses or have beyond design intent situations such as overloading or startup and shutdown of equipment. Increased temperatures due to outdoor exposure, use of product next to ovens or other heat generating equipment will cause lower stiffnesses which will also increase strain.

Another important factor in equipment design is the use of wear pads between the composite spring and equipment mounting. These wear pads can be made of thin (.030"[.75mm]) phenolic sheets or Flexply material cut to the size of the mounting bracket. The wear pads minimize the stress concentration at the edge of the mounting braket and forces the wear of the pad rather than the wear of the composite spring.

Test Name	B4		**start date**	12/5/2018	
			start time	10:47	
given			**end date**	12/24/2018	
base-b	0.999	inch	**END TIME**	**10:30**	
height-h	0.253	inch	**# of cycles completed**	49,246,725	
eccentric force-p	160	lbs	**# OF MIN**	**27359.29167**	
modulus-E	4.28E+06	psi	**# OF DAYS TEST RAN**	**18.9995081**	
radius-R	3	inch	**# OF FULL DAYS RAN**	**18**	
free length-L	4	inch			
			DYNAMIC DEFLECTION	0.481	
calculated			**Ki=**	**332.6403326**	lb/in
deflection-x	**2.49E-01**	inch	**Kf=**	**298.5074627**	lb/in
			STOPPING pk-pk =	**0.536**	in
v-scope reading	**4.99E-01**	inch	**Change in Deflection**	11.4%	
			Dynamic modulus-E_D =	**4.44E+06**	psi
stress	**2.25E+04**	psi	**Spring Deflection-y =**	**0.241**	inch
			Difference of modulus =	**-3.73%**	Calc vs Act