HOME
COMPUTER PROGRAMS

COMPOSITE CYLINDER ANALYSIS
RTP-1 CALCULATIONS

LOADS:		OUTPUT:				FIBER PROPS:	
							e-glass
PRESSURE (PSI)	15.000	N-Z (LB./IN.)	225.00	AXIAL GTH (in)	0.0442	E, psi	1.0500E+07
AXIAL LOAD (LB.)	0.000	N-T (LB./IN.)	450.00	RADIAL GTH (in)	0.0518	nu	0.22
MOMENT (IN. LB.)	0.000	N-ZT (LB./IN.)	0.00	AXIAL STRAIN	0.000184	G, psi	4303279
SHEAR (LB.)	0.000	TOT. THICK. (IN.)	0.2080	HOOP STRAIN	0.00172	alpha, in/in/F	2.800E-06
TORQUE (IN.LB.)	0.000	OUT. RADIUS (IN.)	30.2080	**EFF MAT PROPS:**		density, lb/in^3	0.0910
HEAD(PSI)	0.000	MEAN RAD. (IN.)	30.1040	E-Z (PSI)	2.1548E+06		
		MAT1 WT. (LB.)	25.9891	E-THETA (PSI)	1.1513E+06	**MATRIX PROPS:**	
GEOMETRY:		MAT2 WT. (LB.)	0.0000	G-Z,THETA (PSI)	4.1558E+05		**Dow 470-36**
		MAT3 WT. (LB.)	293.9696	NU-TZ	0.1692	E, psi	5.1000E+05
IN. RADIUS (IN.)	30.0000	MAT4 WT. (LB.)	0.0000	NU-ZT	0.3167	nu	0.35
L. OF CYL. (IN.)	240.0000	MAT5 WT. (LB.)	0.0000	CTE-T (E-06) deg. F	18.3337	G, psi	188889
		MAT6 WT. (LB.)	182.5233	CTE-Z (E-06) deg. F	8.1180	alpha, in/in/F	2.900E-05
		MAT7 WT. (LB.)	0.0000	CTE-TZ(E-06) deg. F	0.0000	density, lb/in^3	0.0421
		TOT. WT. (LB.)	502.4819	Density, lb/in^3	0.0532		
		END AREA (IN^2)	39.3430	Glass Vol Fraction	0.2280		
		VOL. (IN.^3)	678584.01	Glass Weight Fraction	0.3899		
		I (IN^4)	17827.5231				
		EI (LB.-IN.^2)	3.8415E+10				
		EA (LB.)	8.4776E+07				
		GJ (LB.-IN^2)	1.4818E+10				
		KAG (LB.)	8.1751E+06				

MATERIAL PROPERTY INPUT: Blue cells are input directly,Red cells are calculated in Micromechanics and linked into COMPCYL.

	MAT 1	MAT 2	MAT 3	MAT 4	MAT 5	MAT 6	MAT 7
				24 oz. Woven	Roving 5/4 weave	24 oz	FW
NAME	c-veil	Nexus	1.5 Oz Mat	Uni	Uni	Uni	Roving
E11 (PSI.)	6.6845E+05	4.9841E+05	1.1743E+06	4.3630E+06	4.3630E+06	4.3630E+06	5.3919E+06
E22 (PSI)	6.6845E+05	4.9841E+05	1.1743E+06	1.0929E+06	1.0929E+06	1.0929E+06	1.3718E+06
G12 (PSI.)	2.4932E+05	1.8531E+05	4.4286E+05	3.9501E+05	3.9501E+05	3.9501E+05	4.9466E+05
NU12	0.3405	0.3448	0.3258	0.2924	0.2924	0.2924	0.2788
PLY THICK. (IN.)	0.0130	0.0200	0.0430	0.0147	0.0183	0.0330	0.0250
NUMBER OF PLIES	1	0	3.0	0	0	2	0
THICKNESS (IN.)	0.0130	0.0000	0.1290	0.0000	0.0000	0.0660	0.0000
ALPHA (DEG.)	0.0000	0.0000	0.0000	0.0000	90.0000	0.0000	54.7000
ALPHA (RAD.)	0.0000	0.0000	0.0000	0.0000	1.5708	0.0000	0.9547
VOL. FRACT.	0.0405	0.047	0.166	0.385	0.385	0.385	0.488
DENS. (LB./IN.^3)	0.0440	0.0424	0.0502	0.0609	0.0609	0.0609	0.0660
NU21	0.3405	0.3448	0.3258	0.0732	0.0732	0.0732	0.0709
CTE-1 (E-06)	22.87	28.82	13.87	4.68	4.68	4.68	4.07
CTE-2 (E-06)	22.87	28.82	13.87	24.01	24.01	24.01	20.56

COEFFICIENT OF THERMAL EXPANSION PRELIMINARY CALCULATIONS:

CTE-Z	301305	0	3117296	0	0	1894735	0
CTE-T .	301305	0	3117296	0	0	1870591	0
CTE-TZ	0	0	0	0	0	0	0
CLT CALC.	MAT 1	MAT 2	MAT 3	MAT 4	MAT 5	MAT 6	MAT 7
COS (ALPHA)	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.5779
SIN (ALPHA)	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.8161
TAN^2 (ALPHA)	0.0000						
Q11	7.561E+05	5.657E+05	1.314E+06	4.458E+06	4.458E+06	4.458E+06	5.501E+06
Q12	2.575E+05	1.951E+05	4.281E+05	3.266E+05	3.266E+05	3.266E+05	3.901E+05
Q22	7.561E+05	5.657E+05	1.314E+06	1.117E+06	1.117E+06	1.117E+06	1.399E+06
Q66	2.493E+05	1.853E+05	4.429E+05	3.950E+05	3.950E+05	3.950E+05	4.947E+05
QBAR11	7.561E+05	5.657E+05	1.314E+06	4.458E+06	1.117E+06	4.458E+06	1.848E+06
QBAR12	2.575E+05	1.951E+05	4.281E+05	3.266E+05	3.266E+05	3.266E+05	1.311E+06
QBAR16 (+/-)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.581E-14	0.000E+00	6.427E+05
QBAR22	7.561E+05	5.657E+05	1.314E+06	1.117E+06	4.458E+06	1.117E+06	3.210E+06
QBAR26 (+/-)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.047E-10	0.000E+00	1.291E+06
QBAR66	2.493E+05	1.853E+05	4.429E+05	3.950E+05	3.950E+05	3.950E+05	1.416E+06

A MATRIX

4.7357E+05	8.0120E+04	0.0000E+00
8.0120E+04	2.5302E+05	0.0000E+00
0.0000E+00	0.0000E+00	8.6441E+04

DET [A] 9.803E+15

A INVERSE

2.231E-06	-7.065E-07	0
-7.065E-07	4.176E-06	0
0	0	1.157E-05

STRAINS:	MAT1	MAT2	MAT 3	MAT 4	MAT 5	MAT 6	MAT 7
STRUCT. AXES							
EPS -Z	0.00018	0.00000	0.00018	0.00000	0.00000	0.00018	0.00000
EPS -T	0.00172	0.00000	0.00172	0.00000	0.00000	0.00172	0.00000
EPS -ZT	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
MAT. AXES							
EPS-1	0.00018	0.00000	0.00018	0.00000	0.00000	0.00018	0.00000
EPS-2	0.00172	0.00000	0.00172	0.00000	0.00000	0.00172	0.00000
EPS-12	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

STRESSES:	MAT 1	MAT 2	MAT 3	MAT 4	MAT 5	MAT 6	MAT 7
STRUCT. AXES							
SIGMA-Z	582.13	0.00	978.21	0.00	0.00	1382.47	0.00
SIGMA-T	1348.13	0.00	2338.82	0.00	0.00	1981.32	0.00
SIGMA-ZT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAT. AXES							
SIGMA-1	582.13	0.00	978.21	0.00	0.00	1382.47	0.00
SIGMA-2	1348.13	0.00	2338.82	0.00	0.00	1981.32	0.00
SIGMA-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00

STRENGTH CALCULATIONS:							
XT (psi)	10027	7476	17615	87260	87260	87260	107837
XC (psi)	13369	9968	23486	52356	52356	52356	64702
YT (psi)	10027	7476	17615	1639	1639	1639	2058
YC (psi)	13369	9968	23486	8743	8743	8743	10974
S (psi)	6682	4966	11869	10586	10586	10586	13257
Fxx	7.4600E-09	1.3419E-08	2.4172E-09	2.1889E-10	2.1889E-10	2.1889E-10	1.4332E-10
Fxy	-3.7300E-09	-6.7093E-09	-1.2086E-09	-1.9539E-09	-1.9539E-09	-1.9539E-09	-1.2597E-09
Fyy	7.4600E-09	1.3419E-08	2.4172E-09	6.9767E-08	6.9767E-08	6.9767E-08	4.4286E-08
Fss	2.2398E-08	4.0546E-08	7.0989E-09	8.9232E-09	8.9232E-09	8.9232E-09	5.6901E-09
Fx	2.4933E-05	3.3440E-05	1.4193E-05	-7.6400E-06	-7.6400E-06	-7.6400E-06	-6.1821E-06
Fy	2.4933E-05	3.3440E-05	1.4193E-05	4.9562E-04	4.9562E-04	4.9562E-04	3.9487E-04
G	1.0232E-02	0.0000E+00	1.0005E-02	0.0000E+00	0.0000E+00	2.6359E-01	0.0000E+00
H	4.8128E-02	0.0000E+00	4.7078E-02	0.0000E+00	0.0000E+00	9.7142E-01	0.0000E+00
R	7.81	Does Not Apply	7.92	Does Not Apply	Does Not Apply	0.84	Does Not Apply

This is based on the interactive strength theory adopted by RTP-1 1995 which is known as Tsai-Wu in the composites industry. The strengths are calculated based on allowable strain per the recommended equations on page 117. The strength ratio (R) shall be R>10 in the corrosion barrier and R>1.6 for all other layers for all loading conditions.

R fiber	17.22	Does Not Apply	18.01	Does Not Apply	Does Not Apply	63.12	Does Not Apply
R matrix	7.44	Does Not Apply	7.53	Does Not Apply	Does Not Apply	0.83	Does Not Apply

By eliminating the Fxy term from the Tsai-Wu criterion, the Fiber and Matrix strength calculations become uncoupled. The above formulation by Hahn, Erikson, and Tsai gives the relative contributions of the resin stresses and fiber stresses to the failure theory criteria.