

Simple Plate

This worksheet calculates stress & deflection for a plate under a uniform pressure load with simple supports. Equations are extrapolations from tables in MIL HDBK 23, and SPDM.

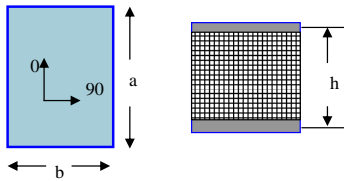


	Plate Name: C70.75 - 1/2" Panel	C70.75 - 3/4" Panel	C70.75 - 1" Panel
Plate Dimensions			
Plate Width	25.0	25.0	25.0 in.
Plate Length	25.0	25.0	25.0 in.
Design Pressure	3.0	3.0	3.0 psi
Deflection Limit, b/	100	100	100
Compression Face Laminate			
	E-LTM 1208 Skin	E-LTM 1208 Skin	E-LTM 1208 Skin
Thickness	0.026	0.026	0.026 in
Weight	0.24	0.24	0.24 lb/sq.ft
Core Material			
	Airex C70.75	Airex C70.75	Airex C70.75
Thickness	0.500	0.750	1.000 in
Weight	0.21	0.31	0.42 lb/sq.ft
Tension Face Laminate			
	E-LTM 1208 Skin	E-LTM 1208 Skin	E-LTM 1208 Skin
Thickness	0.026	0.026	0.026 in
Weight	0.24	0.24	0.24 lb/sq.ft
Plate Properties			
Thickness	0.552	0.802	1.052 in
Weight	0.68	0.78	0.89 lb/sq.ft
Stiffness			
Deflection at Design pressure	0.605	0.292	0.175 in
Allowable Deflection	0.250	0.250	0.250 in
Deflection at First Ply Failure	0.520	0.125	0.100 in
Pressure for 1" Deflection	5.0	10.3	17.1 psi/in
Specific Stiffness	7.3	13.1	19.3 (psi/in) / (lb/sq.ft)
Strength			
Pres. for First Failure	2.6	3.9	5.1 PSI
Pres. for Ultimate Failure	9.0	13.4	17.9 PSI
First Ply Failure Mode	T.Face, 90° FPF	T.Face, 90° FPF	T.Face, 90° FPF
Ultimate Failure Mode	Face Wrinkling	Face Wrinkling	Face Wrinkling
Specific Strength	13.23	17.18	20.20 psi / (lb/sq.ft)
Safety Factors These should all be greater than 1			
Deflection	0.4	0.9	1.4
First Ply Failure	0.9	1.3	1.7
Ultimate Failure	3.0	4.5	6.0
Failure Pressures			
Pres. for C.Face FPF Stress	9.8	14.7	19.5 PSI
Pres. for T.Face FPF Stress	2.6	3.9	5.1 PSI
Pres. for C.Face Ult Stress	22.3	33.4	44.5 PSI
Pres. for T.Face ULT Stress	19.3	28.9	38.5 PSI
Face Wrinkling Pres.	9.0	13.4	17.9 PSI
Pres. for Core Shear	10.1	15.2	20.2 PSI
Safety Factors on Design Pressure			
C.Face, 0° FPF	3.3	4.9	6.6
C.Face, 90° FPF	3.3	4.9	6.5
T.Face, 0° FPF	0.9	1.3	1.7
T.Face, 90° FPF	0.9	1.3	1.7
C.Face, 0° ULT	7.5	11.2	15.0
C.Face, 90° ULT	7.4	11.1	14.8
Face Wrinkling	3.0	4.5	6.0
T.Face, 0° ULT	6.5	9.7	13.0
T.Face, 90° ULT	6.4	9.6	12.8
Core Shear(a)	3.6	5.3	7.1
Core Shear(b)	3.4	5.1	6.7
Face Wrinkling Calculations			
X Dir. Face Wrinkling Stress	26,419	26,419	26,419 PSI
Safety Factor	4.26	6.37	8.49
Y Dir. Face Wrinkling Stress	26,419	26,419	26,419 PSI
Safety Factor	4.21	6.31	8.40

Plate Calculations (SPDM, p.617-619)

Lambda 3	1.00	1.00	1.00
K1	0.00	0.00	0.00
K2	0.04	0.04	0.04
K3	0.04	0.04	0.04
Bending Deflection	0.541	0.249	0.142 in.
Shear Deflection	0.064	0.043	0.033 in.
Maximum Deflection	0.605	0.292	0.175 in.
Shear Deflec., % of Total	0.11	0.15	0.19
Mx	81.0	81.0	81.0 in-lb/in
My	81.8	81.8	81.8 in-lb/in
0 C. Stress @ Design Press.	6,206	4,144	3,110 PSI
90 C. Stress @ Design Press.	6,273	4,189	3,144 PSI
0 T. Stress @ Design Press.	6,206	4,144	3,110 PSI
90 T. Stress @ Design Press.	6,273	4,189	3,144 PSI
0° Bending Stiffness	8,865	19,286	33,709 lb.in
90° Bending Stiffness	8,865	19,286	33,709 lb.in

Used for bending deflection and moments, and face stresses:**Plate Calculations (MIL. HDBK 23)**

	Used for core shear & shear deflection only.		
K1 =	0.00	0.00	0.01
K1 (no shear, defl.) =	0.00	0.00	0.00
K3 =	0.35	0.35	0.35
K4 =	0.33	0.33	0.33
Bending Deflection	0.566	0.260	0.149 in.
Shear Deflection	0.064	0.043	0.033 in.
Maximum Deflection	0.630	0.304	0.182 in.
Shear Deflec., % of Total	10%	14%	18%
Core Shear (Side a)	49.27	32.85	24.63 PSI
Core Shear (Side b)	51.96	34.64	25.98 PSI

Compression Face Properties

	1	1	1
Laminate	E-LTM 1208 Skin	E-LTM 1208 Skin	E-LTM 1208 Skin
Thickness	0.026	0.03	0.03 in.
Nuutral Axis Offset	-	-	- in.
X Modulus (a-Dir.)	2.46E+06	2.46E+06	2.46E+06 PSI
Y Modulus (b-Dir.)	2.46E+06	2.46E+06	2.46E+06 PSI
X Flex. Modulus (a-Dir.)	2.25E+06	2.25E+06	2.25E+06 PSI
Y Flex. Modulus (b-Dir.)	2.25E+06	2.25E+06	2.25E+06 PSI
PR12	0.20	0.20	0.20
PRo	0.20	0.20	0.20
Sxc, fpf C.Face	20,487	20,487	20,487 PSI
Syc, fpf C.Face	20,487	20,487	20,487 PSI
Sxc, ult C.Face	46,614	46,614	46,614 PSI
Syc, ult C.Face	46,614	46,614	46,614 PSI
Density	1.74	1.74	1.74 g/cc

Tension Face Properties

	1	1	1
Entered Laminate #	1	1	1
Laminate # Used	1	1	1
Laminate	E-LTM 1208 Skin	E-LTM 1208 Skin	E-LTM 1208 Skin
Thickness	0.026	0.03	0.03 in.
Nuutral Axis Offset	-	-	- in.
X Modulus (a-Dir.)	2.46E+06	2.46E+06	2.46E+06 PSI
Y Modulus (b-Dir.)	2.46E+06	2.46E+06	2.46E+06 PSI
X Flex. Modulus (a-Dir.)	2.25E+06	2.25E+06	2.25E+06 PSI
Y Flex. Modulus (b-Dir.)	2.25E+06	2.25E+06	2.25E+06 PSI
PR12	0.20	0.20	0.20
PRo	0.20	0.20	0.20
Sxt, fpf T.Face	5,391	5,391	5,391 PSI
Syt, fpf T.Face	5,391	5,391	5,391 PSI
Sxt, ult T.Face	40,379	40,379	40,379 PSI
Syt, ult T.Face	40,379	40,379	40,379 PSI
Density	1.74	1.74	1.74 g/cc

Core Properties

	Airex C70.75	Airex C70.75	Airex C70.75
Core :			
Core Thickness =	0.500	0.750	1.000 in.
Compression Mod. =	15,080	15,080	15,080 PSI
Shear Modulus =	4,350	4,350	4,350 PSI
Shear Strength "a" Edge	175	175	175 PSI
Shear Strength "b" Edge	175	175	175 PSI
Density of Core =	5	5	5 lb/cu.ft

Sandwich properties

Thickness =	0.55	0.80	1.05 in
Outer Face Weight =	0.24	0.24	0.24 lb/sq.ft
Inner Face Weight =	0.24	0.24	0.24 lb/sq.ft
Core Weight =	0.21	0.31	0.42 lb/sq.ft
Total Weight =	0.68	0.78	0.89 lb/sq.ft
Aspect Ratio, (a/b) R =	1.00	1.00	1.00
1/Aspect Ratio, b/a =	1.00	1.00	1.00
Faces Center Distance, h =	0.53	0.78	1.03 in.
Ex t , Comp. Face	64,030	64,030	64,030

Ex t , Tension Face	64,030	64,030	64,030
Ex t, Core	-	-	-
zcg,x, Comp.	0.26	0.39	0.51
zcg,x, Tension	(0.26)	(0.39)	(0.51)
zcg,x, Core	-	-	-
Ex t zcg, Comp. Face	16,840	24,844	32,848
Ex t zcg, Tension Face	(16,840)	(24,844)	(32,848)
N/A,x	-	-	-
EIx Comp. Face	4,433	9,643	16,855
EIx Tension Face	4,433	9,643	16,855
Eix Core	-	-	-
C,comp,x	0.276	0.401	0.526 in.
C,ten,x	0.276	0.401	0.526 in.
Ey t , Outer Face	64,030	64,030	64,030
Ey t , Inner Face	64,030	64,030	64,030
Ey t, Core	-	-	-
zcg,y, Outer	0.26	0.39	0.51
zcg,y, Inner	(0.26)	(0.39)	(0.51)
zcg,y, Core	-	-	-
Ey t zcg, Outer Face	16,840	24,844	32,848
Ey t zcg, Inner Face	(16,840)	(24,844)	(32,848)
N/A,y	-	-	-
Ely Outer Face	4,433	9,643	16,855
Ely Inner Face	4,433	9,643	16,855
Eiy Core	-	-	-
C,comp,y	0.28	0.40	0.53
C,ten,y	0.28	0.40	0.53
PR,xy	0.20	0.20	0.20
PR,yx	0.20	0.20	0.20
Average PR	0.20	0.20	0.20
Bending Stiffness, Dm =	8,865	19,286	33,709 lb.in
Shear Stiffness, V =	0.06	0.09	0.12 in.