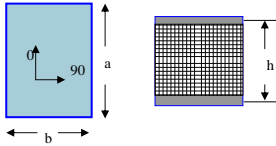


**Simple Plate**

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:   | SB.100 - 3/8" Panel | SB.100 - 1/2" Panel | SB.100 - 5/8" Panel | SB.100 - 3/4" Panel | SB.100 - 1" Panel        |
|---|---------------------|---------------------|---------------------|---------------------|--------------------------|
| <b>Plate Dimensions</b>   |                     |                     |                     |                     |                          |
| Plate Width   | 25.0                | 25.0                | 25.0                | 25.0                | 25.0 in.                 |
| Plate Length  | 25.0                | 25.0                | 25.0                | 25.0                | 25.0 in.                 |
| Design Pressure   | 3.0                 | 3.0                 | 3.0                 | 3.0                 | 3.0 psi                  |
| Deflection Limit, b/  | 100                 | 100                 | 100                 | 100                 | 100                      |
| <b>Compression Face Laminate</b>  |                     |                     |                     |                     |                          |
|   | E-LTM 1208 Skin     | E-LTM 1208 Skin     | E-LTM 1208 Skin     | E-LTM 1208 Skin     | E-LTM 1208 Skin          |
| Thickness   | 0.026               | 0.026               | 0.026               | 0.026               | 0.026 in                 |
| Weight  | 0.24                | 0.24                | 0.24                | 0.24                | 0.24 lb/sq.ft            |
| <b>Core Material</b>  |                     |                     |                     |                     |                          |
|   | Baltek SB.100       | Baltek SB.100       | Baltek SB.100       | Baltek SB.100       | Baltek SB.100            |
| Thickness   | 0.375               | 0.500               | 0.625               | 0.750               | 1.000 in                 |
| Weight  | 0.30                | 0.40                | 0.49                | 0.59                | 0.79 lb/sq.ft            |
| <b>Tension Face Laminate</b>  |                     |                     |                     |                     |                          |
|   | E-LTM 1208 Skin     | E-LTM 1208 Skin     | E-LTM 1208 Skin     | E-LTM 1208 Skin     | E-LTM 1208 Skin          |
| Thickness   | 0.026               | 0.026               | 0.026               | 0.026               | 0.026 in                 |
| Weight  | 0.24                | 0.24                | 0.24                | 0.24                | 0.24 lb/sq.ft            |
| <b>Plate Properties</b>   |                     |                     |                     |                     |                          |
| Thickness   | 0.427               | 0.552               | 0.677               | 0.802               | 1.052 in                 |
| Weight  | 0.77                | 0.87                | 0.97                | 1.06                | 1.26 lb/sq.ft            |
| <b>Stiffness</b>  |                     |                     |                     |                     |                          |
| Deflection at Design pressure   | 0.946               | 0.553               | 0.363               | 0.257               | 0.148 in                 |
| Allowable Deflection  | 0.250               | 0.250               | 0.250               | 0.250               | 0.250 in                 |
| Deflection at First Ply Failure   | 0.611               | 0.158               | 0.130               | 0.110               | 0.085 in                 |
| Pressure for 1" Deflection  | 3.2                 | 5.4                 | 8.3                 | 11.7                | 20.2 psi/in              |
| Specific Stiffness  | 4.1                 | 6.3                 | 8.6                 | 11.0                | 16.0 (psi/in) / (lb/sq.f |
| <b>Strength</b>   |                     |                     |                     |                     |                          |
| Pres. for First Failure   | 1.9                 | 2.6                 | 3.2                 | 3.9                 | 5.1 PSI                  |
| Pres. for Ultimate Failure  | 14.5                | 19.3                | 24.1                | 28.9                | 38.5 PSI                 |
| First Ply Failure Mode  | T.Face, 90° FPF     | T.Face, 90° FPF     | T.Face, 90° FPF     | T.Face, 90° FPF     | T.Face, 90° FPF          |
| Ultimate Failure Mode   | T.Face, 90° ULT     | T.Face, 90° ULT     | T.Face, 90° ULT     | T.Face, 90° ULT     | T.Face, 90° ULT          |
| Specific Strength   | 18.92               | 22.29               | 24.98               | 27.17               | 30.53 psi / (lb/sq.ft)   |
| <b>Safety Factors</b> <span style="float:right">These should all be greater than 1</span>   |                     |                     |                     |                     |                          |
| Deflection  | 0.3                 | 0.5                 | 0.7                 | 1.0                 | 1.7                      |
| First Ply Failure   | 0.6                 | 0.9                 | 1.1                 | 1.3                 | 1.7                      |
| Ultimate Failure  | 4.8                 | 6.4                 | 8.0                 | 9.6                 | 12.8                     |
| <b>Failure Pressures</b>  |                     |                     |                     |                     |                          |
| Pres. for C.Face FPF Stress   | 7.4                 | 9.8                 | 12.2                | 14.7                | 19.5 PSI                 |
| Pres. for T.Face FPF Stress   | 1.9                 | 2.6                 | 3.2                 | 3.9                 | 5.1 PSI                  |
| Pres. for C.Face ULT Stress   | 16.8                | 22.3                | 27.8                | 33.4                | 44.5 PSI                 |
| Pres. for T.Face ULT Stress   | 14.5                | 19.3                | 24.1                | 28.9                | 38.5 PSI                 |
| Face Wrinkling Pres.  | 39.8                | 53.0                | 66.2                | 79.4                | 105.7 PSI                |
| Pres. for Core Shear  | 18.7                | 25.0                | 31.2                | 37.5                | 50.0 PSI                 |
| <b>Safety Factors on Design Pressure</b>  |                     |                     |                     |                     |                          |
| C.Face, 0° FPF  | 2.5                 | 3.3                 | 4.1                 | 4.9                 | 6.6                      |
| C.Face, 90° FPF   | 2.5                 | 3.3                 | 4.1                 | 4.9                 | 6.5                      |
| T.Face, 0° FPF  | 0.7                 | 0.9                 | 1.1                 | 1.3                 | 1.7                      |
| T.Face, 90° FPF   | 0.6                 | 0.9                 | 1.1                 | 1.3                 | 1.7                      |
| C.Face, 0° ULT  | 5.6                 | 7.5                 | 9.4                 | 11.2                | 15.0                     |
| C.Face, 90° ULT   | 5.6                 | 7.4                 | 9.3                 | 11.1                | 14.8                     |
| Face Wrinkling  | 13.3                | 17.7                | 22.1                | 26.5                | 35.2                     |
| T.Face, 0° ULT  | 4.9                 | 6.5                 | 8.1                 | 9.7                 | 13.0                     |
| T.Face, 90° ULT   | 4.8                 | 6.4                 | 8.0                 | 9.6                 | 12.8                     |
| Core Shear(a)   | 6.6                 | 8.8                 | 11.0                | 13.2                | 17.6                     |
| Core Shear(b)   | 6.2                 | 8.3                 | 10.4                | 12.5                | 16.7                     |
| <b>Face Wrinkling Calculations</b>  |                     |                     |                     |                     |                          |
| X Dir. Face Wrinkling Stress  | 155,870             | 155,870             | 155,870             | 155,870             | 155,870 PSI              |
| Safety Factor   | 18.88               | 25.12               | 31.36               | 37.61               | 50.11                    |
| Y Dir. Face Wrinkling Stress  | 155,870             | 155,870             | 155,870             | 155,870             | 155,870 PSI              |
| Safety Factor   | 18.68               | 24.85               | 31.03               | 37.21               | 49.58                    |
| <b>Plate Calculations (SPDM, p.617-619)</b> <span style="float:right">Used for bending deflection and moments, and face stresses</span> |                     |                     |                     |                     |                          |
| Lambda 3  | 1.00                | 1.00                | 1.00                | 1.00                | 1.00                     |
| K1  | 0.00                | 0.00                | 0.00                | 0.00                | 0.00                     |
| K2  | 0.04                | 0.04                | 0.04                | 0.04                | 0.04                     |
| K3  | 0.04                | 0.04                | 0.04                | 0.04                | 0.04                     |
| Bending Deflection  | 0.930               | 0.541               | 0.353               | 0.249               | 0.142 in.                |
| Shear Deflection  | 0.016               | 0.012               | 0.010               | 0.008               | 0.006 in.                |
| Maximum Deflection  | 0.946               | 0.553               | 0.363               | 0.257               | 0.148 in.                |
| Shear Deflec., % of Total   | 0.02                | 0.02                | 0.03                | 0.03                | 0.04                     |
| Mx  | 81.0                | 81.0                | 81.0                | 81.0                | 81.0 in-lb/in            |
| My  | 81.8                | 81.8                | 81.8                | 81.8                | 81.8 in-lb/in            |
| 0 C. Stress @ Design Press.   | 8,255               | 6,206               | 4,970               | 4,144               | 3,110 PSI                |
| 90 C. Stress @ Design Press.  | 8,344               | 6,273               | 5,024               | 4,189               | 3,144 PSI                |
| 0 T. Stress @ Design Press.   | 8,255               | 6,206               | 4,970               | 4,144               | 3,110 PSI                |
| 90 T. Stress @ Design Press.  | 8,344               | 6,273               | 5,024               | 4,189               | 3,144 PSI                |
| 0° Bending Stiffness  | 5,155               | 8,865               | 13,575              | 19,286              | 33,709 lb.in             |
| 90° Bending Stiffness   | 5,155               | 8,865               | 13,575              | 19,286              | 33,709 lb.in             |

**Plate Calculations (MIL. HDBK 23)**

**Used for core shear & shear deflection only.**

|                           |       |       |       |       |           |
|---------------------------|-------|-------|-------|-------|-----------|
| K1 =                      | 0.00  | 0.00  | 0.00  | 0.00  | 0.00      |
| K1 (no shear, defl.) =    | 0.00  | 0.00  | 0.00  | 0.00  | 0.00      |
| K3 =                      | 0.35  | 0.35  | 0.35  | 0.35  | 0.35      |
| K4 =                      | 0.33  | 0.33  | 0.33  | 0.33  | 0.33      |
| Bending Deflection        | 0.974 | 0.566 | 0.370 | 0.260 | 0.149 in. |
| Shear Deflection          | 0.016 | 0.012 | 0.010 | 0.008 | 0.006 in. |
| Maximum Deflection        | 0.989 | 0.578 | 0.379 | 0.268 | 0.155 in. |
| Shear Deflec., % of Total | 2%    | 2%    | 3%    | 3%    | 4%        |
| Core Shear (Side a)       | 65.69 | 49.27 | 39.42 | 32.85 | 24.63 PSI |
| Core Shear (Side b)       | 69.29 | 51.96 | 41.57 | 34.64 | 25.98 PSI |

**Compression Face Properties**

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

**Tension Face Properties**

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

**Core Properties**

|                         |               |               |               |               |               |
|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Core :                  | Baltek SB.100 | Baltek SB.100 | Baltek SB.100 | Baltek SB.100 | Baltek SB.100 |
| Core Thickness =        | 0.375         | 0.500         | 0.625         | 0.750         | 1.000 in.     |
| Compression Mod. =      | 580,914       | 580,914       | 580,914       | 580,914       | 580,914 PSI   |
| Shear Modulus =         | 23,191        | 23,191        | 23,191        | 23,191        | 23,191 PSI    |
| Shear Strength "a" Edge | 433           | 433           | 433           | 433           | 433 PSI       |
| Shear Strength "b" Edge | 433           | 433           | 433           | 433           | 433 PSI       |
| Density of Core=        | 10            | 10            | 10            | 10            | 10 lb/cu.ft   |

**Sandwich properties**

|                            |          |          |          |          |               |
|----------------------------|----------|----------|----------|----------|---------------|
| Thickness =                | 0.43     | 0.55     | 0.68     | 0.80     | 1.05 in       |
| Outer Face Weight =        | 0.24     | 0.24     | 0.24     | 0.24     | 0.24 lb/sq.ft |
| Inner Face Weight =        | 0.24     | 0.24     | 0.24     | 0.24     | 0.24 lb/sq.ft |
| Core Weight =              | 0.30     | 0.40     | 0.49     | 0.59     | 0.79 lb/sq.ft |
| Total Weight =             | 0.77     | 0.87     | 0.97     | 1.06     | 1.26 lb/sq.ft |
| Aspect Ratio,(a/b) R =     | 1.00     | 1.00     | 1.00     | 1.00     | 1.00          |
| 1/Aspect Ratio, b/a =      | 1.00     | 1.00     | 1.00     | 1.00     | 1.00          |
| Faces Center Distance, h = | 0.40     | 0.53     | 0.65     | 0.78     | 1.03 in.      |
| Ex t , Comp. Face          | 64,030   | 64,030   | 64,030   | 64,030   | 64,030        |
| Ex t , Tension Face        | 64,030   | 64,030   | 64,030   | 64,030   | 64,030        |
| Ex t, Core                 | -        | -        | -        | -        | -             |
| zcg,x, Comp.               | 0.20     | 0.26     | 0.33     | 0.39     | 0.51          |
| zcg,x, Tension             | (0.20)   | (0.26)   | (0.33)   | (0.39)   | (0.51)        |
| zcg,x, Core                | -        | -        | -        | -        | -             |
| Ex t zcg, Comp. Face       | 12,838   | 16,840   | 20,842   | 24,844   | 32,848        |
| Ex t zcg, Tension Face     | (12,838) | (16,840) | (20,842) | (24,844) | (32,848)      |
| N/A,x                      | -        | -        | -        | -        | -             |
| EIx Comp. Face             | 2,578    | 4,433    | 6,788    | 9,643    | 16,855        |
| EIx Tension Face           | 2,578    | 4,433    | 6,788    | 9,643    | 16,855        |
| EIx Core                   | -        | -        | -        | -        | -             |
| C,comp,x                   | 0.214    | 0.276    | 0.339    | 0.401    | 0.526 in.     |
| C,ten,x                    | 0.214    | 0.276    | 0.339    | 0.401    | 0.526 in.     |
| Ey t , Outer Face          | 64,030   | 64,030   | 64,030   | 64,030   | 64,030        |
| Ey t , Inner Face          | 64,030   | 64,030   | 64,030   | 64,030   | 64,030        |
| Ey t, Core                 | -        | -        | -        | -        | -             |
| zcg,y, Outer               | 0.20     | 0.26     | 0.33     | 0.39     | 0.51          |
| zcg,y, Inner               | (0.20)   | (0.26)   | (0.33)   | (0.39)   | (0.51)        |
| zcg,y, Core                | -        | -        | -        | -        | -             |
| Ey t zcg, Outer Face       | 12,838   | 16,840   | 20,842   | 24,844   | 32,848        |
| Ey t zcg, Inner Face       | (12,838) | (16,840) | (20,842) | (24,844) | (32,848)      |
| N/A,y                      | -        | -        | -        | -        | -             |
| EIy Outer Face             | 2,578    | 4,433    | 6,788    | 9,643    | 16,855        |
| EIy Inner Face             | 2,578    | 4,433    | 6,788    | 9,643    | 16,855        |
| EIy Core                   | -        | -        | -        | -        | -             |
| C,comp,y                   | 0.21     | 0.28     | 0.34     | 0.40     | 0.53          |
| C,ten,y                    | 0.21     | 0.28     | 0.34     | 0.40     | 0.53          |
| PR,xy                      | 0.20     | 0.20     | 0.20     | 0.20     | 0.20          |
| PR,yx                      | 0.20     | 0.20     | 0.20     | 0.20     | 0.20          |
| Average PR                 | 0.20     | 0.20     | 0.20     | 0.20     | 0.20          |
| Bending Stiffness, Dm =    | 5,155    | 8,865    | 13,575   | 19,286   | 33,709 lb.in  |
| Shear Stiffness, V =       | 0.01     | 0.01     | 0.01     | 0.02     | 0.02 in.      |