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**TLSF82-XS**

### A. Wind Pressures

The wind load was found using the formula below for the specific glass temper and thickness. The value of the effective thickness ($t_{min}$) was found on Table 4 from ASTM E1300 for monolithic glass and calculated for laminated glass. Glass properties were found from the GANA Glazing Manual and from Table X7.1 from ASTM E1300.

$$Wind\ Load = 462545 * \frac{t_{min}^2}{\beta * H_g^2}$$

Where $H_g$ is the glass height minus the glass bottom's distance from the walking surface, and $\beta$ an amplification factor. The effective thickness of laminated glass was calculated and is shown on Table 2.

The glass composition uses two 1/4" lites with 0.060" SGP or Trosifol ® EXTRA STIFF Interlayer. A comparison between the recommended wind loads is shown below for monolithic and laminated glass types,

*Table 11: Monolithic and Laminated glass recommended wind load comparison.*

| Allowable Windload 1/2" Monolithic Glass (psf) | | | | | | |
|---|---|---|---|---|---|---|
| Glass Height (in) | Glass Width (in) | | | | | |
| | 52 | 54 | 56 | 58 | 60 | |
| 36 | 16.59 | 15.62 | 14.77 | 13.92 | 13.18 | |
| 38 | 14.32 | 13.53 | 12.73 | 12.11 | 11.48 | |
| 40 | 12.35 | 11.65 | 11.04 | 10.49 | 9.90 | |
| 42 | 10.87 | 10.29 | 9.78 | 9.31 | 8.80 | |

| Allowable Windload 1/2" Laminated Glass (psf) | | | | | | |
|---|---|---|---|---|---|---|
| Glass Height (in) | Glass Width (in) | | | | | |
| | 52 | 54 | 56 | 58 | 60 | |
| 36 | 20.71 | 19.91 | 19.21 | 18.51 | 17.91 | |
| 38 | 17.44 | 16.74 | 16.14 | 15.64 | 15.04 | |
| 40 | 14.81 | 14.21 | 13.71 | 13.21 | 12.81 | |
| 42 | 12.67 | 12.17 | 11.77 | 11.37 | 10.97 | |

The deflection values were also calculated using beam theory and amplification factors for the wind loads and 50 plf distributed load using,

$$\Delta_{dist.\ load} = \frac{\lambda * 50plf * H_g^3}{3 * 10.4 * 10^6 * t_{ave}^3}$$

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$$\Delta_{wind\ load} = \frac{3 * \lambda * w * H_g^2}{8 * 10.4 * 10^6 * t_{ave}^3}$$

The results are summarized below for **1/2" monolithic glass**,

*Table 12: Allowable deflection values based on wind load and ASTM E2358 requirements of H/12 deflection, and on 50 plf Load as specified on ICC AC 439 requirements of 1" deflection.*

| Deflection (in) | | | | | | |
|---|---|---|---|---|---|---|
| Glass Height (in) | Glass Width (in) | | | | | |
| | 52 | 54 | 56 | 58 | 60 | |
| 36 | 2.99 | 2.99 | 3.00 | 2.99 | 2.98 | |
| 38 | 3.16 | 3.16 | 3.15 | 3.16 | 3.15 | |
| 40 | 3.33 | 3.33 | 3.33 | 3.33 | 3.31 | |
| 42 | 3.49 | 3.49 | 3.49 | 3.50 | 3.46 | |

| Deflection (in) | | | | | | |
|---|---|---|---|---|---|---|
| Glass Height (in) | Glass Width (in) | | | | | |
| | 52 | 54 | 56 | 58 | 60 | |
| 36 | 0.63 | 0.64 | 0.66 | 0.67 | 0.68 | |
| 38 | 0.73 | 0.75 | 0.76 | 0.77 | 0.78 | |
| 40 | 0.85 | 0.86 | 0.87 | 0.89 | 0.90 | |
| 42 | 0.96 | 0.97 | 0.99 | 1.00 | NG | |

Based on ASTM E2358 criteria for wind load deflection of H/12, and on ICC's AC439 of 1" deflection, the sizes deemed to pass the criteria are summarized above.

The results are summarized below for **1/2" laminated glass**,

*Table 13: Allowable deflection values based on wind load and ASTM E2358 requirements of H/12 deflection, and on 50 plf Load as specified on ICC AC 439 requirements of 1" deflection.*

| Deflection (in) | | | | | | |
|---|---|---|---|---|---|---|
| Glass Height (in) | Glass Width (in) | | | | | |
| | 52 | 54 | 56 | 58 | 60 | |
| 36 | 2.99 | 2.99 | 2.99 | 2.99 | 2.99 | |
| 38 | 3.16 | 3.15 | 3.15 | 3.17 | 3.15 | |
| 40 | 3.33 | 3.32 | 3.32 | 3.31 | 3.32 | |
| 42 | 3.49 | 3.48 | 3.49 | 3.49 | 3.49 | |

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| Deflection (in) | | | | | | |
|---|---|---|---|---|---|---|
| Glass Height (in) | Glass Width (in) | | | | | |
| | | 52 | 54 | 56 | 58 | 60 |
| | 36 | 0.63 | 0.64 | 0.66 | 0.67 | 0.68 |
| | 38 | 0.73 | 0.75 | 0.76 | 0.77 | 0.78 |
| | 40 | 0.85 | 0.86 | 0.87 | 0.89 | 0.90 |
| | 42 | 0.96 | 0.97 | 0.99 | 1.00 | NG |

**B. Load on Spigots**

Based on the geometry of the side plates, the allowable moment per clamp was calculated. The actual moment per clamp was then compared to the reactions at the base generated by 50 plf with use of simple beam theory and moment attenuation factors described below,

$$M_{actual} = \beta * H_g * 50\ plf$$

The results are summarized below, further calculations including the mathematical procedure are present on the appendix of this report.

*Table 14: Moments based on 50 plf requirement for 1/2" laminated & monolithic glass.*

| Actual Moment (lbs-in/ft) | | | | | | |
|---|---|---|---|---|---|---|
| Glass Height (in) | Glass Width (in) | | | | | |
| | | 52 | 54 | 56 | 58 | 60 |
| | 36 | 2088.7 | 2130.3 | 2170.5 | 2209.2 | 2246.7 |
| | 38 | 2162.9 | 2202.3 | 2240.2 | 2276.7 | 2312.1 |
| | 40 | 2246.3 | 2283.4 | 2319.2 | 2353.7 | 2387.1 |
| | 42 | 2302.0 | 2334.0 | 2364.9 | 2394.7 | 2423.5 |

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# TLSF82-XS Spigot System Calculations

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**LOADS ON GLASS - PROCEDURE TO DETERMINE ALLOWABLE LOADS ON GLASS**

Sample Wind Load (w) = 11 psf
Width (S) = 58 in
Height (H) = 42 in

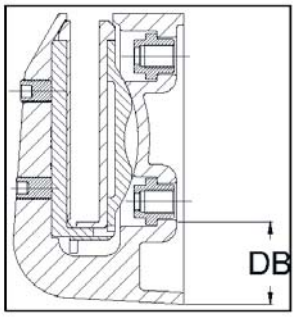
Distance from bottom of Mount to Glass (DB): = 42.5 mm or 1.7 in

Distributed load, z= 50 plf
Concentrated load, P= 200 lbs

Vc = 50plf*S/2 = 120.8 lbs
Mc = 50plf* 42 *S/2 = 5075 lb-in } 50 plf along glass

Vc = 200/Cc = 167.89 lbs
Mc = 42 * S = 7052 lb-in } 200 lbs concentrated

Vc = w*H*S/2 = 96.13 lbs
Mc = Vc*H*0.55 = 2221 lb-in } Wind load




**GLASS STRENGTH**

Glass type: Tempered For 1/4 " lites of laminated glass with 0.060" SGP

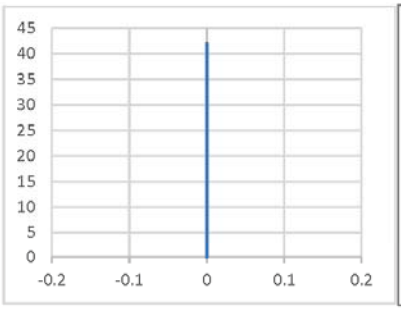
Modulus of rupture = 24000 psi
All. Bending Stress = 6000 psi
All. Compressive Stress = 6000 psi
ASTM E1300 = 10600 psi

tavg = 0.25 in
tmin = 0.219 in
Γ = 0.815 in
heffw = 0.471 in
h1effs = 0.484 in

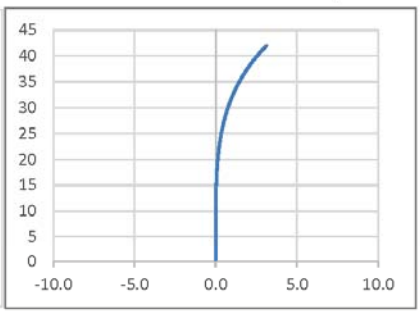
$S_1 = \frac{12 * (t)^2}{6} = 2 * (t)^2$ in^3/ft
= 0.47 in^3/ft

All. Moment, load conditions = 2806 in-lb/ft
233.9 ft-lb/ft

All. Moment, ASTM E1300 = 4958 in-lb/ft
413.2 ft-lb/ft




Undeflected glass




Deflected glass

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**LOADS ON GLASS - PROCEDURE TO DETERMINE ALLOWABLE LOADS ON GLASS**

Sample Wind Load (w) = 9 psf
Width (S) = 58 in
Height (H) = 42 in

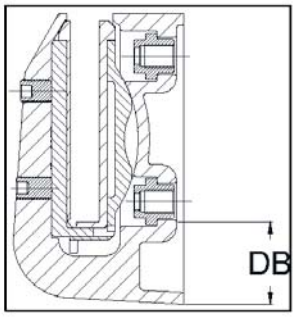
Distance from bottom of Mount to Glass (DB): = 42.5 mm or 1.7 in

Distributed load, z= 50 plf
Concentrated load, P= 200 lbs

Vc = 50plf*S/2 = 120.8 lbs
Mc = 50plf* 42 *S/2 = 5075 lb-in } 50 plf along glass

Vc = 200/Cc = 167.89 lbs
Mc = 42 * S = 7052 lb-in } 200 lbs concentrated

Vc = w*H*S/2 = 78.78 lbs
Mc = Vc*H*0.55 = 1820 lb-in } Wind load




**GLASS STRENGTH**

Glass type: Tempered For 1/2 " monolithic glass

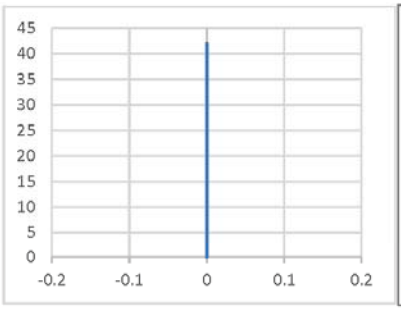
Modulus of rupture = 24000 psi
All. Bending Stress = 6000 psi
All. Compressive Stress = 6000 psi
ASTM E1300 = 10600 psi

tavg = 0.5 in
tmin = 0.469 in

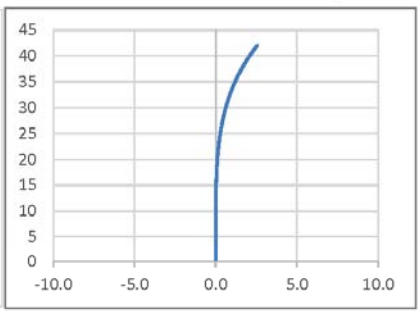
$S_1 = \frac{12 * (t)^2}{6}$ = 2 * (t)^2 in^3/ft
= 0.44 in^3/ft

All. Moment, load conditions = 2640 in-lb/ft
220 ft-lb/ft

All. Moment, ASTM E1300 = 4663 in-lb/ft
388.6 ft-lb/ft




Undeflected glass




Deflected glass

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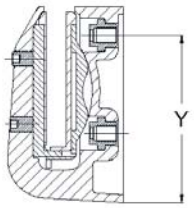
## LOADS ON CLAMPS

Plate geometry:

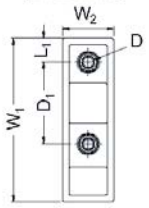
**TLSF82-XS**




D1 = 2.68 in  L1 = 1.34 in  Y = 5 in

W1 = 5.00 in  D = 1/2 in
W2 = 2.00 in  t = 3/16 in

**Base Plate**




Bending of side plates (For inst. w/o bolts through glass)

Side Plate Properties: $I_{xx}$ = 0.934 $in^4$  yc = 2.10 in
$F_y$ = 30000 psi
Material: 316 Stainless Steel  S = 0.44 $in^3$
$M_n$ = 13341.43 lbs-in
$M_a$ = 7988.88 lbs-in

$M_a$ = 7988.88 lbs-in > $M_{max}$ = 7051.53 lbs-in

DESIGN IS OK

**Side Plate**

Connection to Steel

Bolt dia. = 1/2 in  Tn = 9933.0 lbs
Proof Load = 70 ksi  Ta = 4966.5 lbs
Vs = 1192.0 lbs
Ms = 24832.5 lbs-in

DESIGN IS OK

Connection to Wood

Bolt dia. = 1/2" Lag Screw  T200 = 840 lbs
Embedment = 5.00 in  a = 1.48 in
T = 840.00 lbs
Proof Load = 70 ksi  Z's = 463.55 lbs/screw
Design load = 8400 lb-in  W'e = 2267.00 lbs/screw
Tension parallel to grain, Ft = 425 psi  θ = 88 degrees
Max. Shear based on Loads, Vc = 24 lbs/screw

Resultant Load = 840.3 lbs
Z'⊥ = 2260 lbs => Resultant Load

DESIGN IS OK

Connection to Concrete

**Check following pages**