PUYALLUP PUBLIC SAFETY BUILDING

PROJECT SUMMARY/SCOPE OF WORK

POINT SUPPORTED CANOPY GLAZING SYSTEM INSTALLATION

GLAZING SYSTEM MATERIAL SUMMARY

SYSTEM....CRL Heavy-Duty Spider Fittings

FINISH....Brushed Stainless Steel.

GLAZING....13/16" Clear fully tempered Laminated with .060 White Diffused (65% VLT) PVB Interlayer. ALL EXPOSED EDGES TO BE FLAT POLISHED.
GENERAL:

FASTENERS...PER PLANS, ENGINEERED AS REQUIRED, NON MAGNETIC SERIES 300 STAINLESS STEEL U.O.N.

SEALANTS....DOW CORNING 795 as required

OTHER.......PLASTIC BLOCKING AND SHIMS,FOAM BACKER ROD, GLAZING TAPE

ISOLATORS...DISSEMILAR METALS SHALL BE ISOLATED TO PREVENT ELECTROLYSIS THROUGH THE USE OF PLASTIC SHIMS OR RUBBER TAPE

GENERAL NOTES

1. *STEEL SUPPORT STRUCTURE MUST BE INSTALLED TO ARCHITECTURAL TOLERENCES, SQUARE, ALIGNED AND HORIZONTAL 6x6 HSS MUST BE PARRALELL TO ONE ANOTHER. ALL STRUCTURAL FRAMING BY OTHERS. ALL SUPPORTING MATERIALS MUST BE CAPABLE OF WITHSTANDING THE FORCES IMPOSED BY THE GLAZING SYSTEM.
2. LACEY GLASS IS NOT RESPONSIBLE FOR THE PROTECTION OF INSTALLED GLAZING SYSTEMS, FINAL CLEANING, BREAKAGE BY OTHERS, OR TEMPORARY COVER.
3. ALL GUTTERS AND DOWNSPOUTS ARE BY OTHERS. DRAINAGE CONTROL AND WATERPROOFING OF ADJACENT STRUCTURE BY OTHERS.
4. THE DIMENSIONS AND DETAILS ARE TO BE CHECHED BY GC/ARCH. FOR CORRECTNESS IN RELATION TO ADJACEINT FINISHES, ESPECIALLY FOR FINISES NOT COMPLETED OR ADDED TO PROJECT.
5. IF STEEL BRACKETS FOR SIGNAGE OR SIGN ARE TO BE REQUIRED, THEY MUST COORDINATED TO WORK WITH OUR GLAZING SYSTEM AND CAN NOT BE IN THE WAY FOR OUR INSTALLATION OF SAID GLAZING SYSTEM!

SYMBOLS KEY

REVISION # — DETAIL — SECTION

DRAWING INDEX

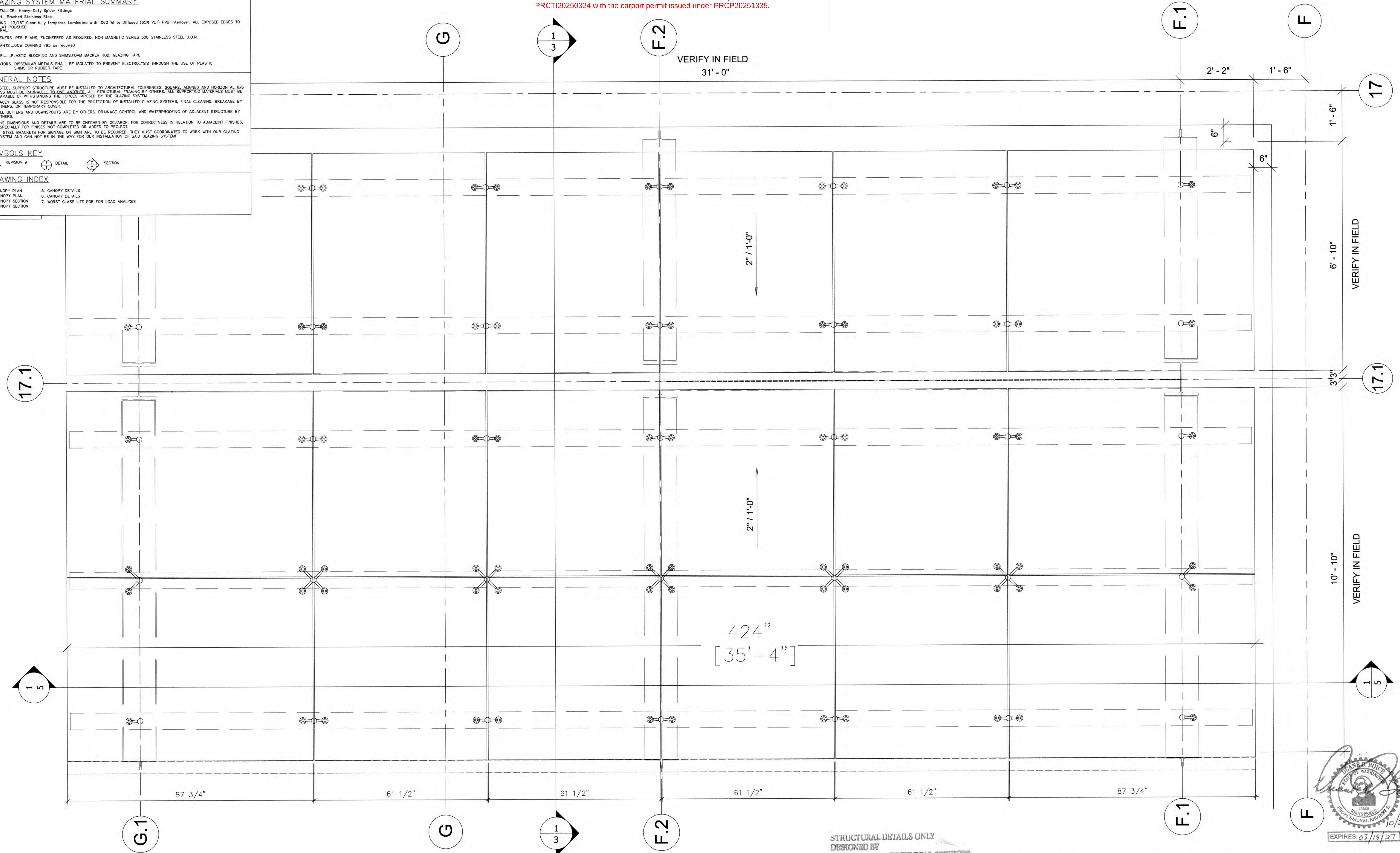
1. CANOPY PLAN
2. CANOPY PLAN
3. CANOPY SECTION
4. CANOPY SECTION
5. CANOPY DETAILS
6. CANOPY DETAILS
7. WORST GLASS LITE FOR FOR LOAD ANALYSIS

Please provide verification that design/submittal meets category IV construction requirements. See Structural calculations dated March 4, 2025 Tatkowski.

Please provide engineering review approval from the engineer of record.

Please work with the architect of record and reconcile this permit PRCTI20250324 with the carport permit issued under PRCP20251335.

PRCP20251335



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ENGINEERING & TECHNICAL SERVICES

EXPIRES: 03/18/27

10/27/25

PLAN NORTH

1 CANOPY PLAN – SOUTH ENTRANCE

SCALE 3/4" = 1'

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FAX: 360.438.7894
WWW.LACEYGLASS.COM

LG JOB # 251391

PROJECT
Puyallup Public Safety Building
1015 39th Ave. SE.
Puyallup, WA. 98374

CONTRACTOR: JTM CONSTRUCTION
ARCHITECT: MACKENZIE ARCHITECTURE
ENGINEER: MACKENZIE ENGINEERING
OWNER: CITY OF PUYALLUP
INSTALLER: LACEY GLASS INC

DRAWN BY: WK

DATE: 10-27-25

REVISIONS:

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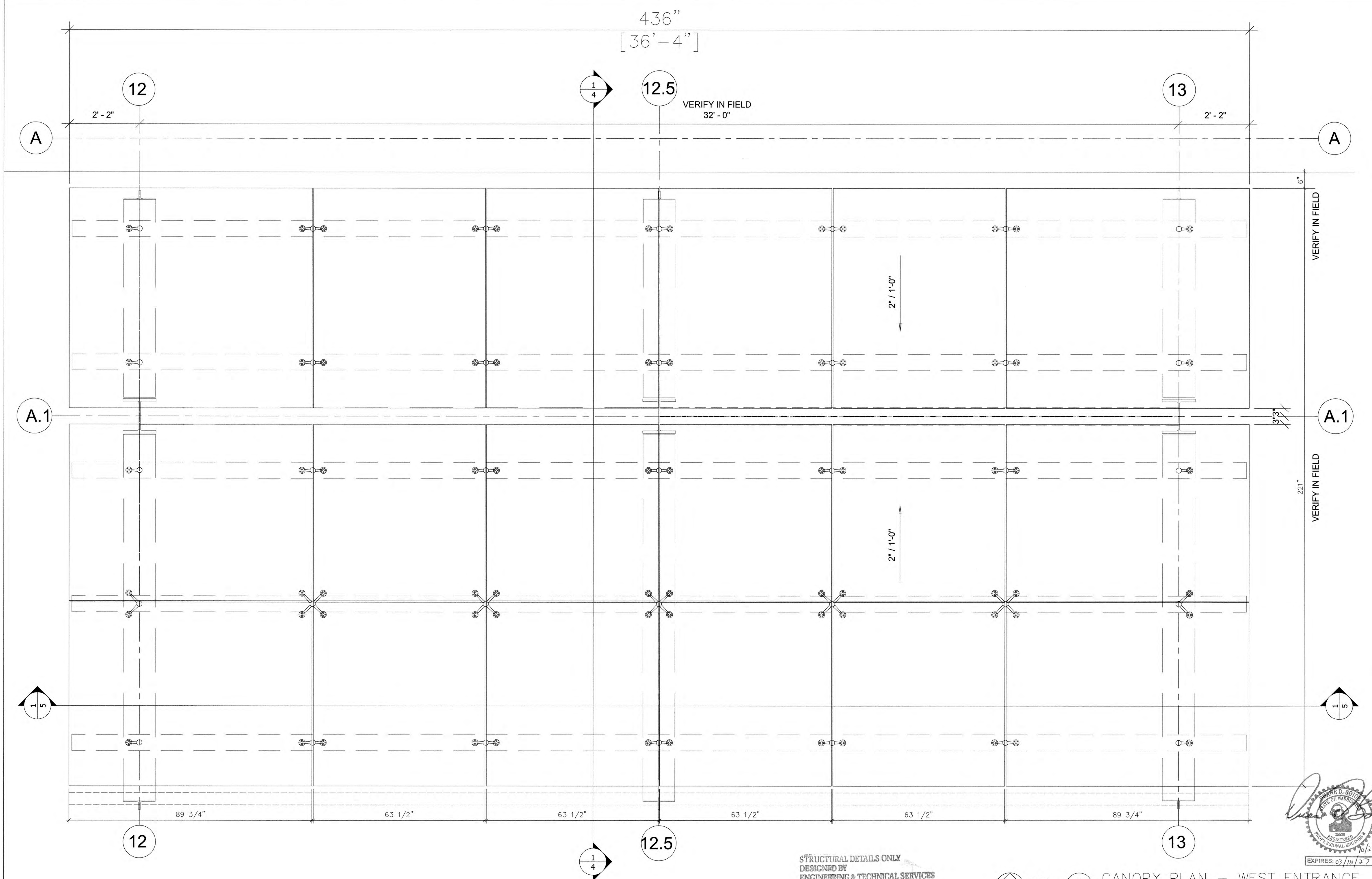
PLOT CHECK
0 1/4" 1/2" 3/4" 1"

1



1 CANOPY PLAN – WEST ENTRANCE

SCALE 3/4" = 1'

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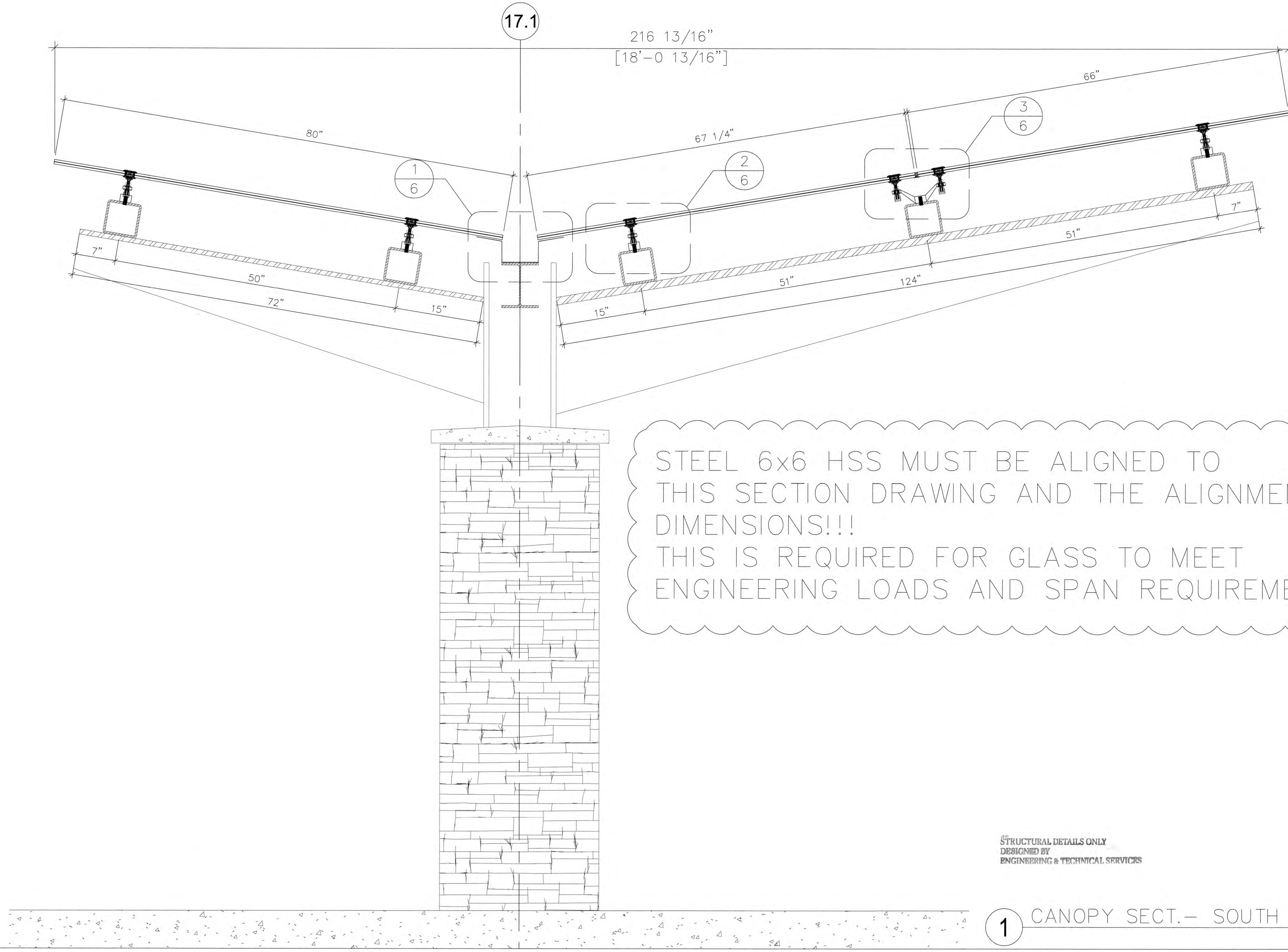
PLOT CHECK 0 1/4" 1/2" 3/4" 1"



STEEL 6x6 HSS MUST BE ALIGNED TO THIS SECTION DRAWING AND THE ALIGNMENT DIMENSIONS!!!
THIS IS REQUIRED FOR GLASS TO MEET ENGINEERING LOADS AND SPAN REQUIREMENTS!!!

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1 CANOPY SECT.– SOUTH ENTRANCE

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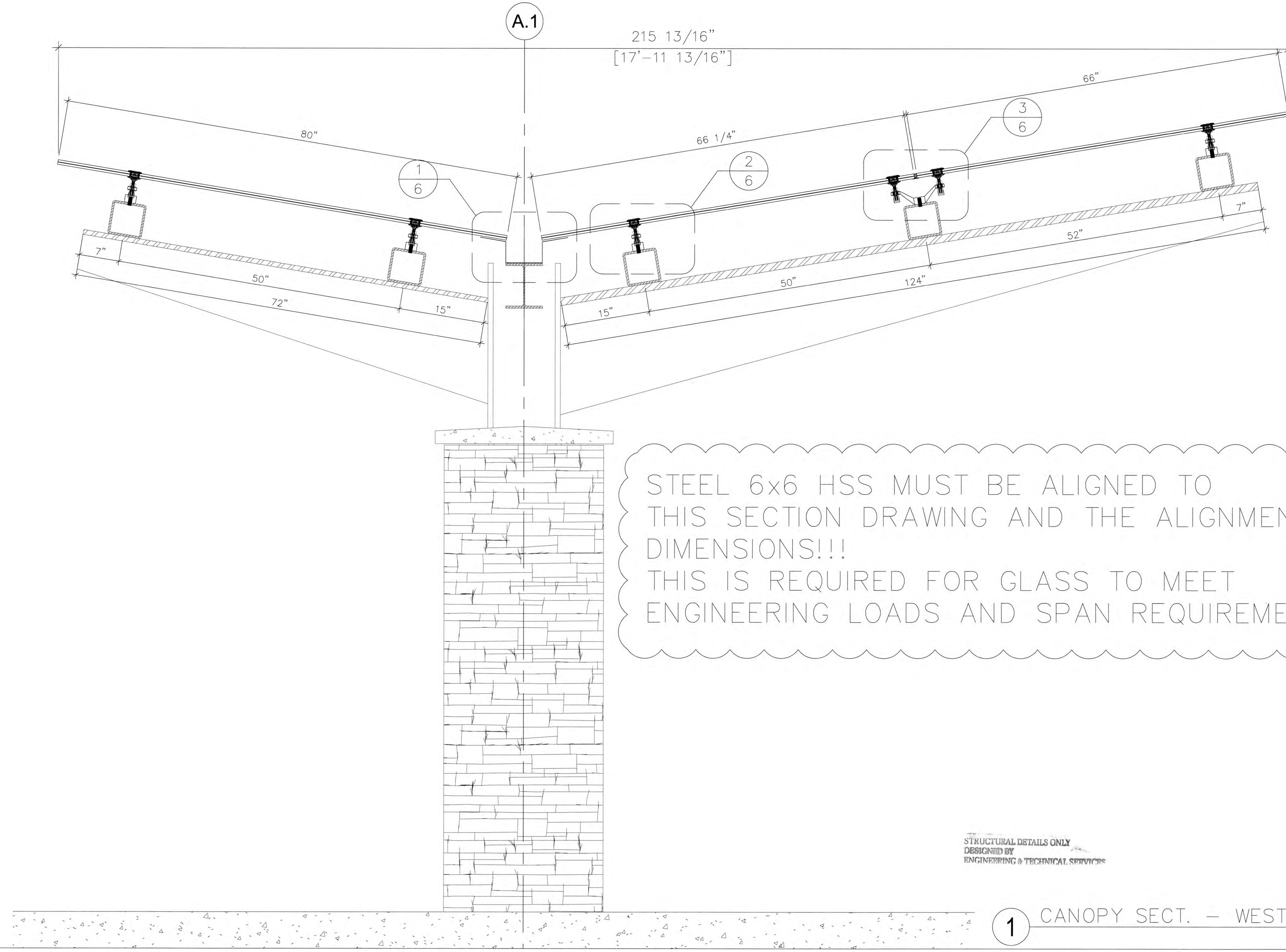
PLOT CHECK



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DUANE D. BOICE — STATE OF WASHINGTON — 25530 — REGISTERED PROFESSIONAL ENGINEER
10/27/25
EXPIRES: 03/18/27

1 CANOPY SECT. – WEST ENTRANCE

SCALE 1 1/2" = 1'

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PLOT CHECK
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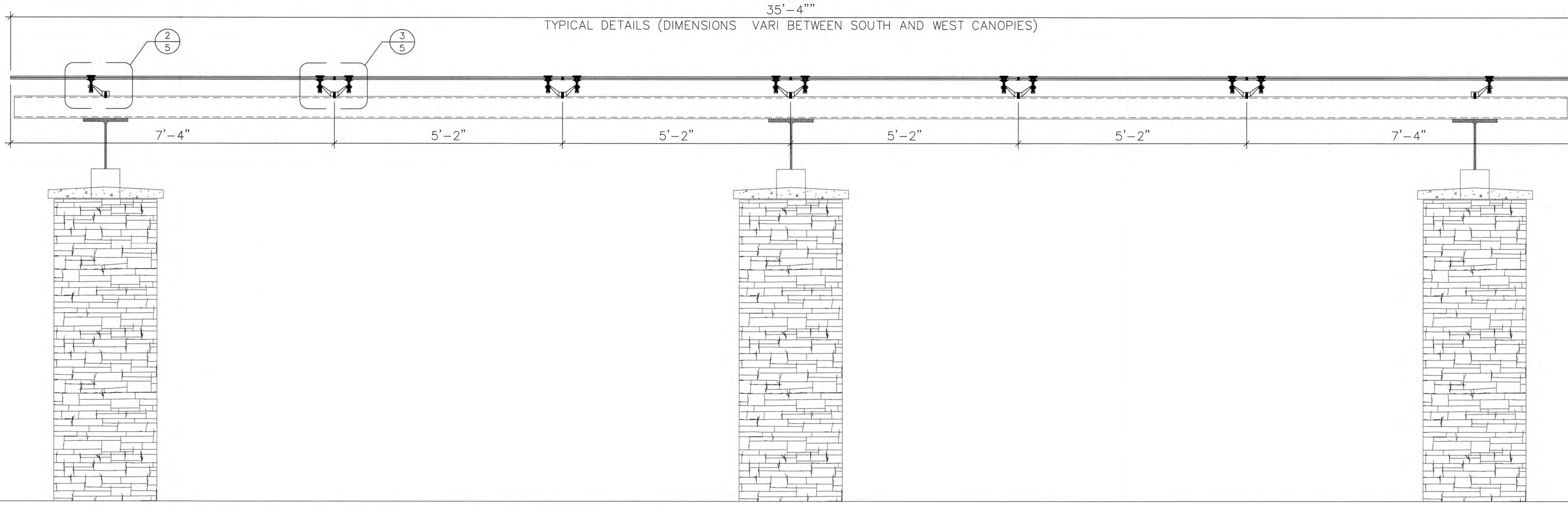
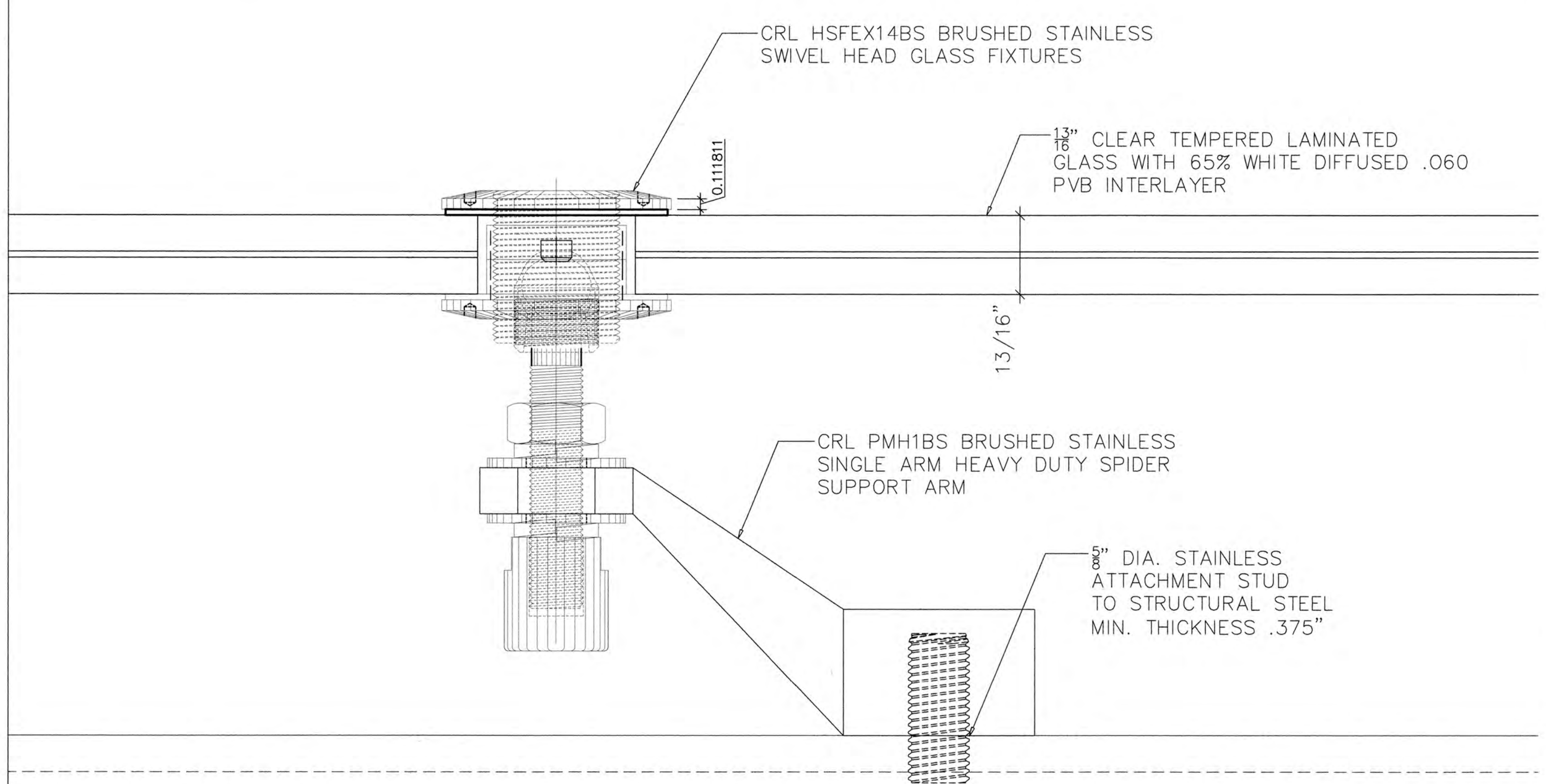


1 TYPICAL CANOPY SECTION
SCALE 1 1/2" = 1'



2 TYPICAL CANOPY SECTION
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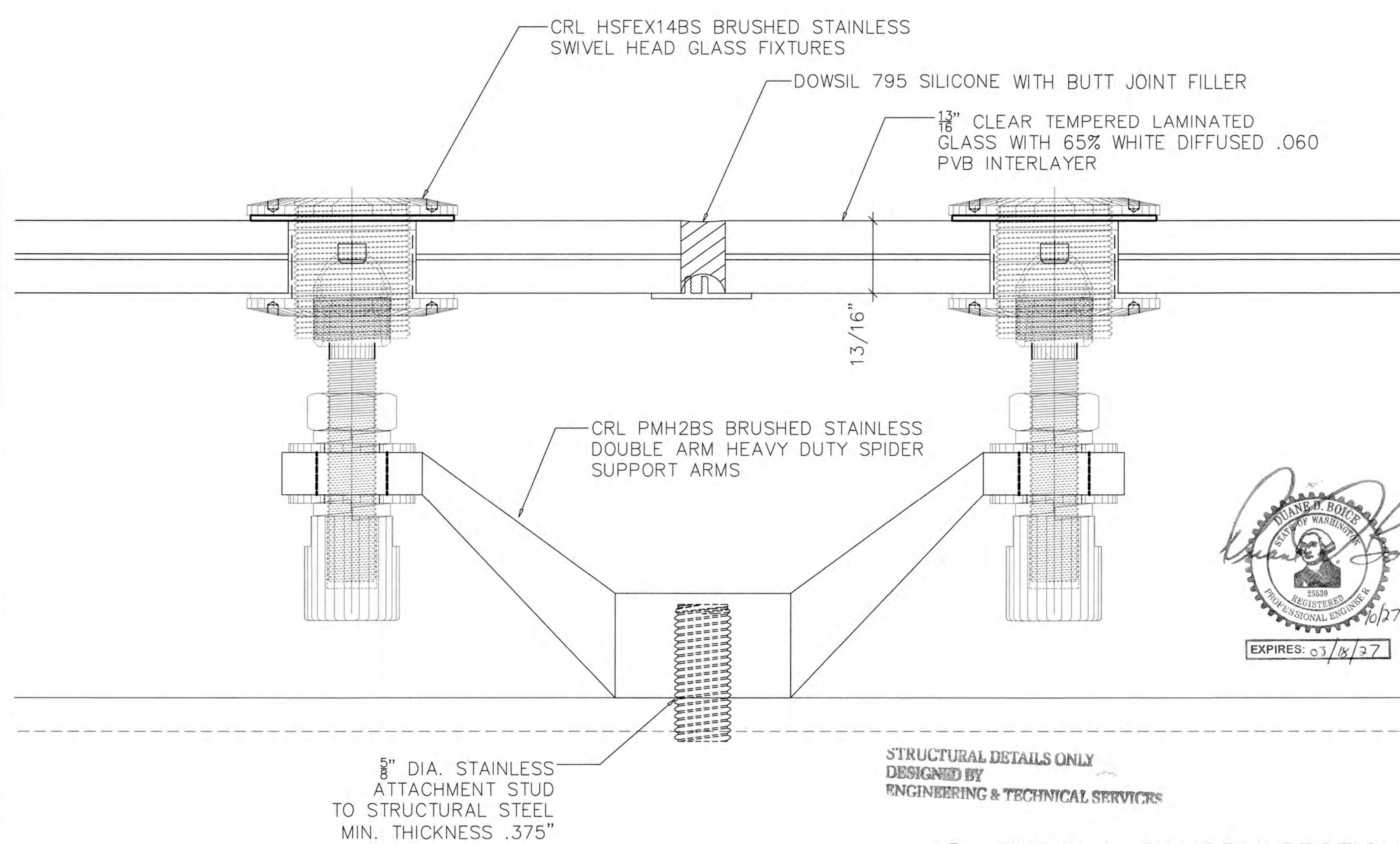

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3 TYPICAL CANOPY SECTION
SCALE 1 = 1

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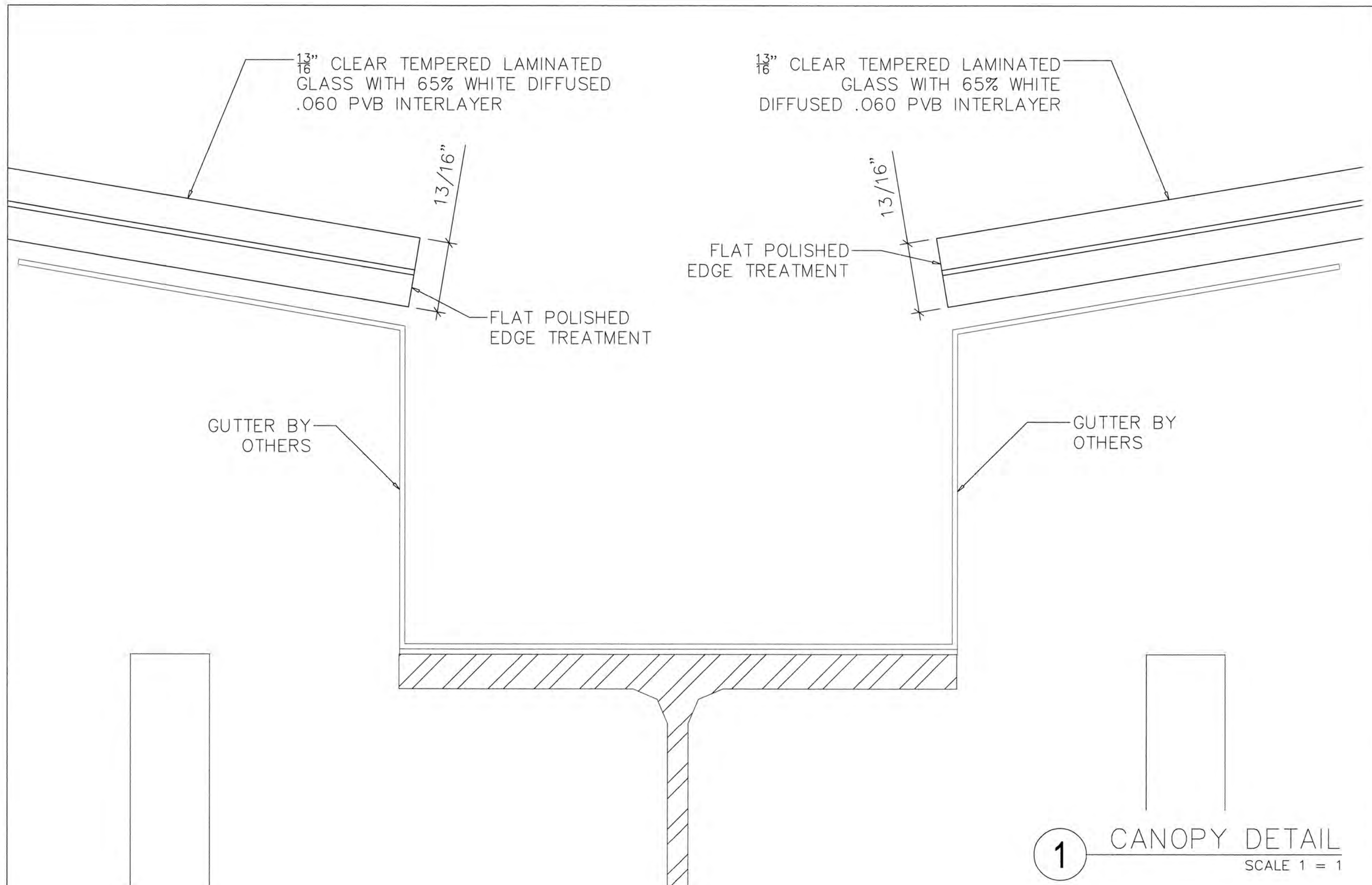
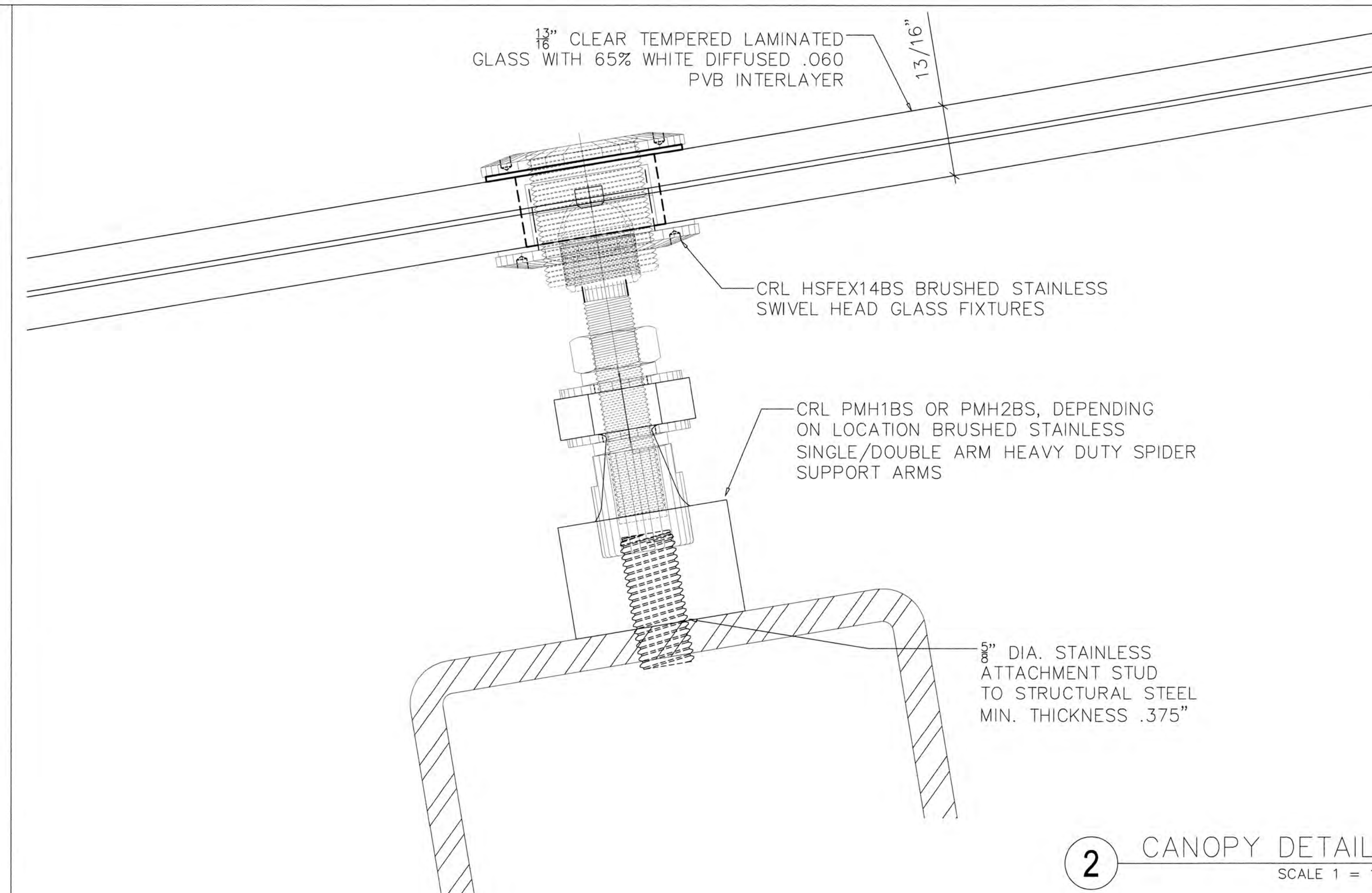


1 CANOPY DETAIL
SCALE 1 = 1



2 CANOPY DETAIL
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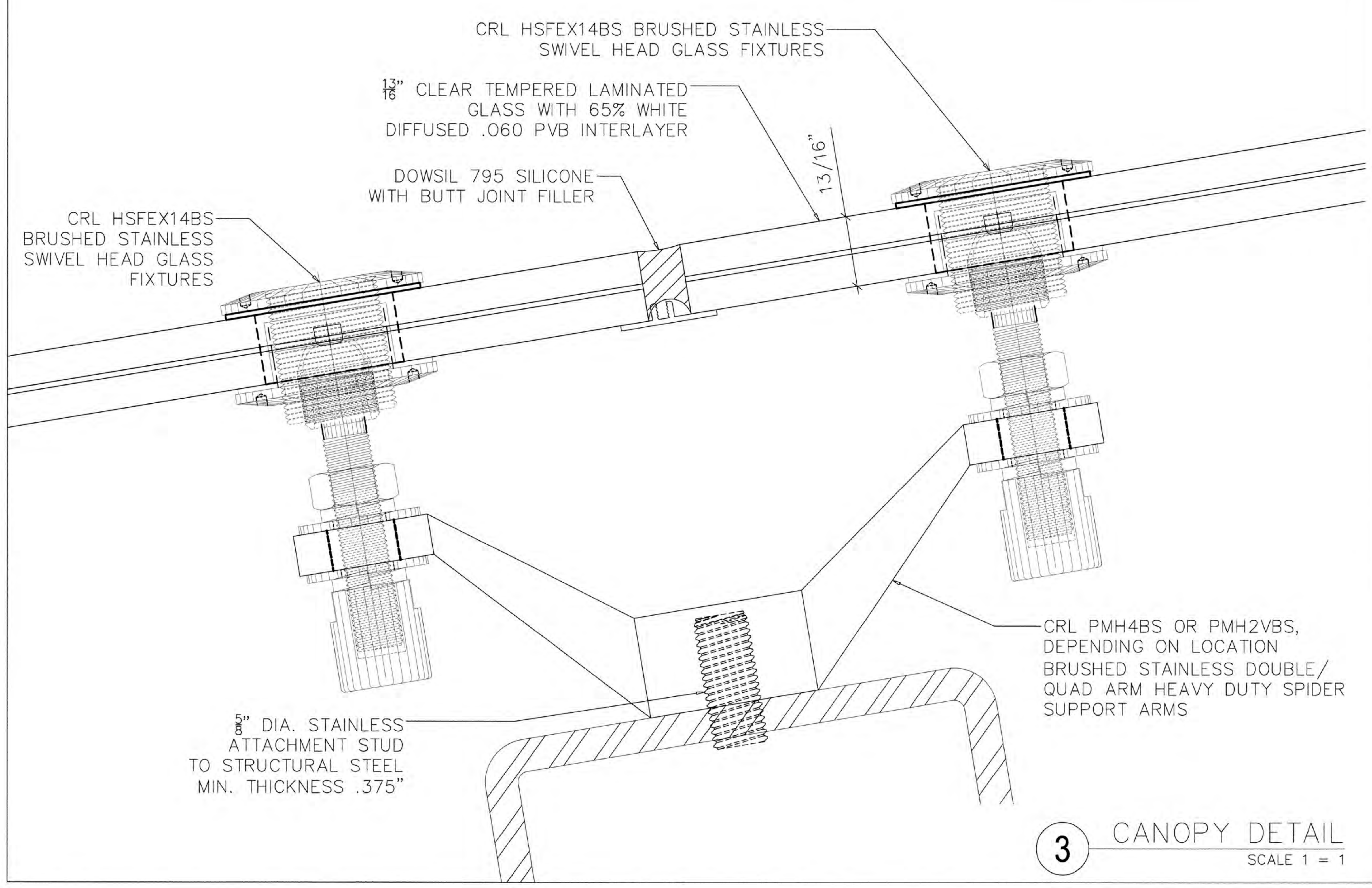

3 CANOPY DETAIL
SCALE 1 = 1

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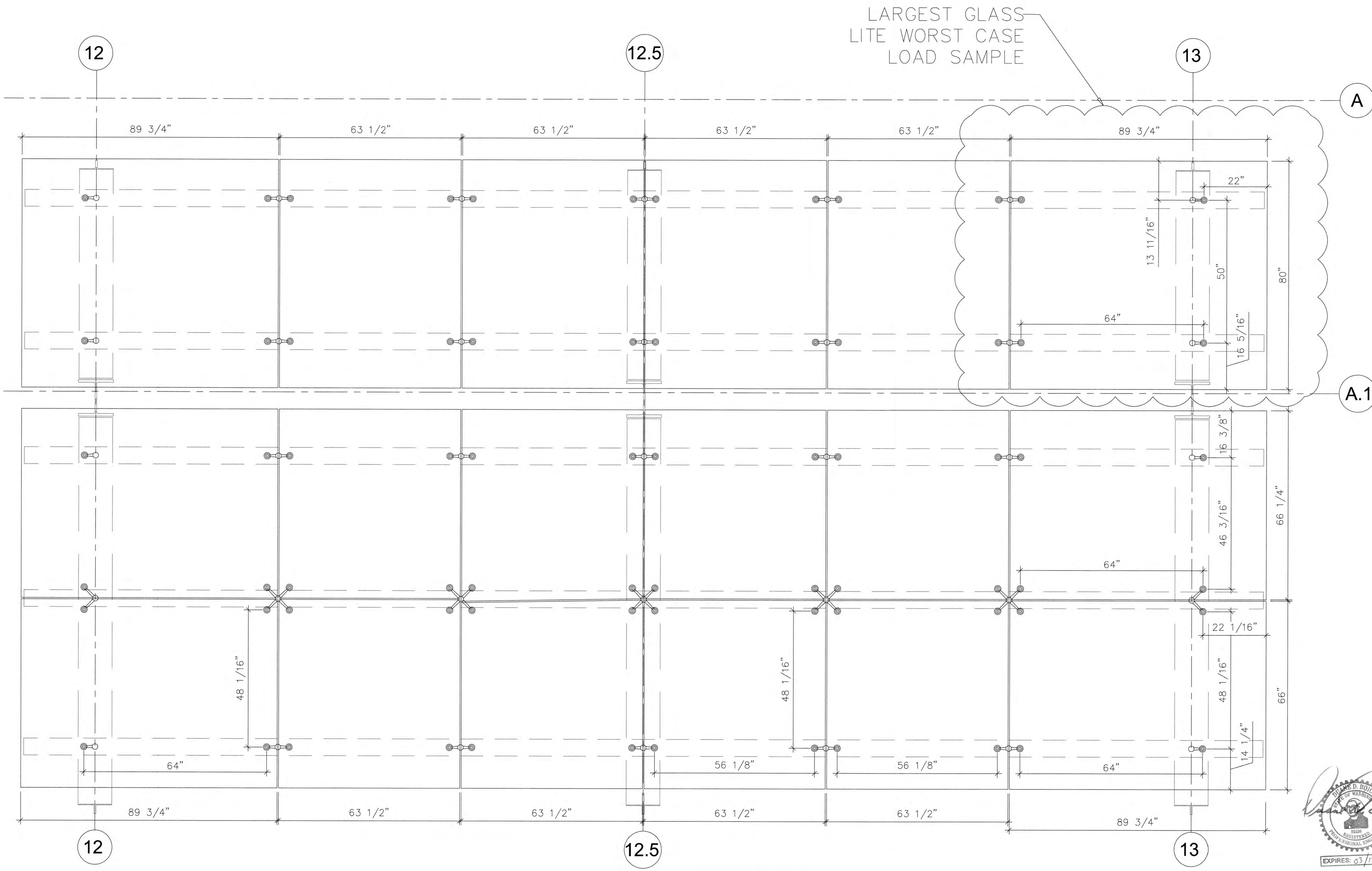

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DUANE D. BOICE, STATE OF WASHINGTON, REGISTERED PROFESSIONAL ENGINEER
10/27/25
EXPIRES: 03/18/27

1 LARGEST GLASS LITE WORST CASE LOAD SAMPLE
SCALE 3/4" = 1'

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23 July 2012

Architectural Railing Division
C.R.Laurence Co., Inc.
2503 E Vernon Ave.
Los Angeles, CA 90058
(T) 800.421.6144
(F) 800.587.7501
www.crlaurence.com

Pertinent CRL Spider Fitting Engineering PDF sheets: 8-10, 17-18, 24

SUBJ: STAINLESS STEEL SPIDER FITTINGS
LOAD RATINGS

I have evaluated the strengths of the CRL stainless steel spider fittings in accordance with the 2006 and 2009 International Building Code. The cast stainless steel components conform to ASTM A 743.

The structural properties and fitting strengths shown in this report are provided for reference purposes. The Specifier or Engineer-of-Record shall be responsible to determine that the fittings are appropriate for the application and the design of the supporting structure.

		Allowable Load per Arm			$\sqrt{(F_x^2+F_y^2+F_x^2)}$
Contents:	Page	F_x	F_y	F_z	Total resultant load on Fitting
FMH	4 - 5	135#	135#	491#	1,354#
GRF	6 - 7	135#	135#	759#	1,886#
GRP	8 - 9	135#	135#	632#	2,528# 412# total for F_x, F_y
PMH	10 - 11	224#	224#	942#	1,237# for unbalanced fittings 2,804# for balanced fittings
PMR	12-13	141#	141#	298#	1,192#
Glass Fittings:					
RRF10	14	139#	139#	715#	765#
RSF10	15	135#	135#	715#	742#
HRF14	16	592#	592#	1,430#	1,430#
HSF14	17	592#	592#	1,430#	1,430#

Resultant load = $\sqrt{[F_x^2+F_y^2+F_z^2]}$

Edward Robison, P.E.

EDWARD C. ROBISON, PE
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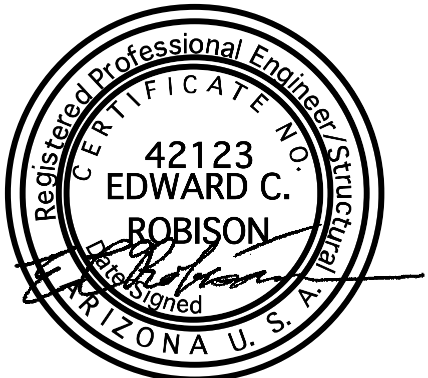
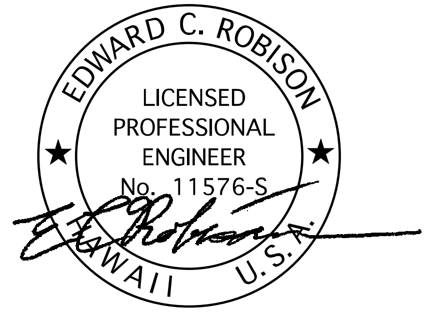
Gig Harbor, WA 98329
253-858-0855/Fax 253-858-0856 elrobison@narrows.com

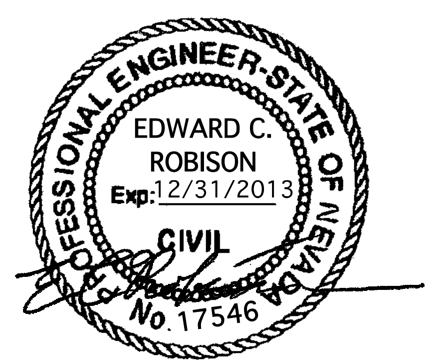
Signed 07/23/2012



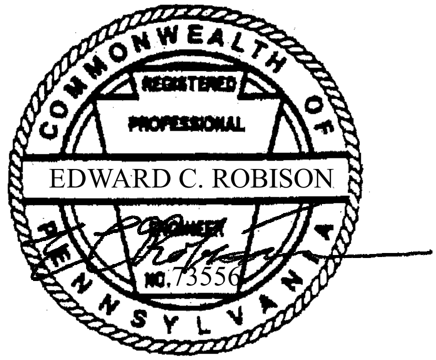
EXP 03/31/2014



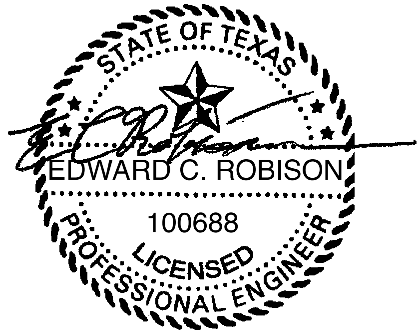
EXP 04/30/2014



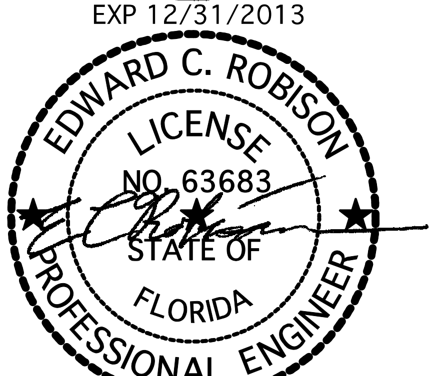
EXP 12/31/2013



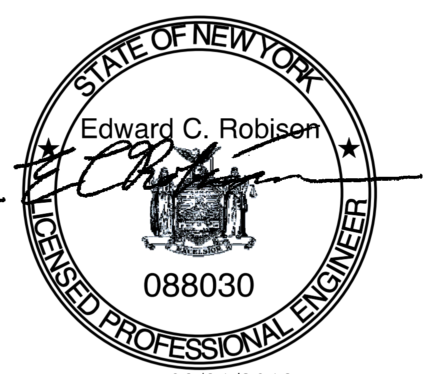
EXP 09/30/2013



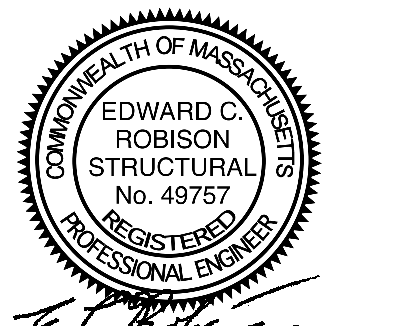
FIRM #F-12044
EXP 12/31/2012



EXP 02/28/2013

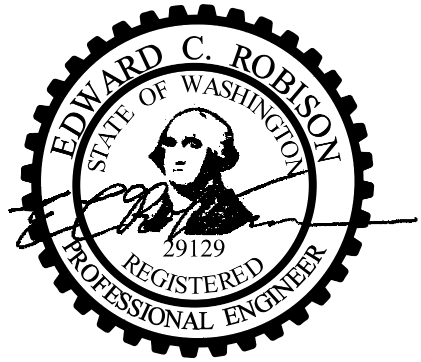


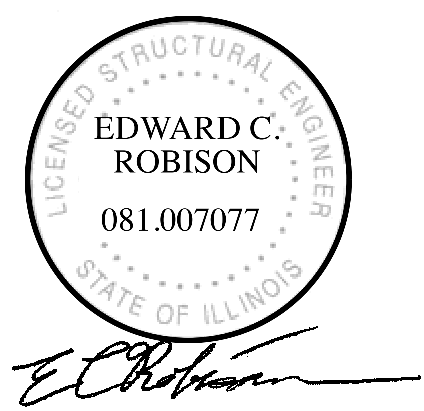
EXP 03/31/2013



EXP 06/30/2014

EXP 12/31/2012

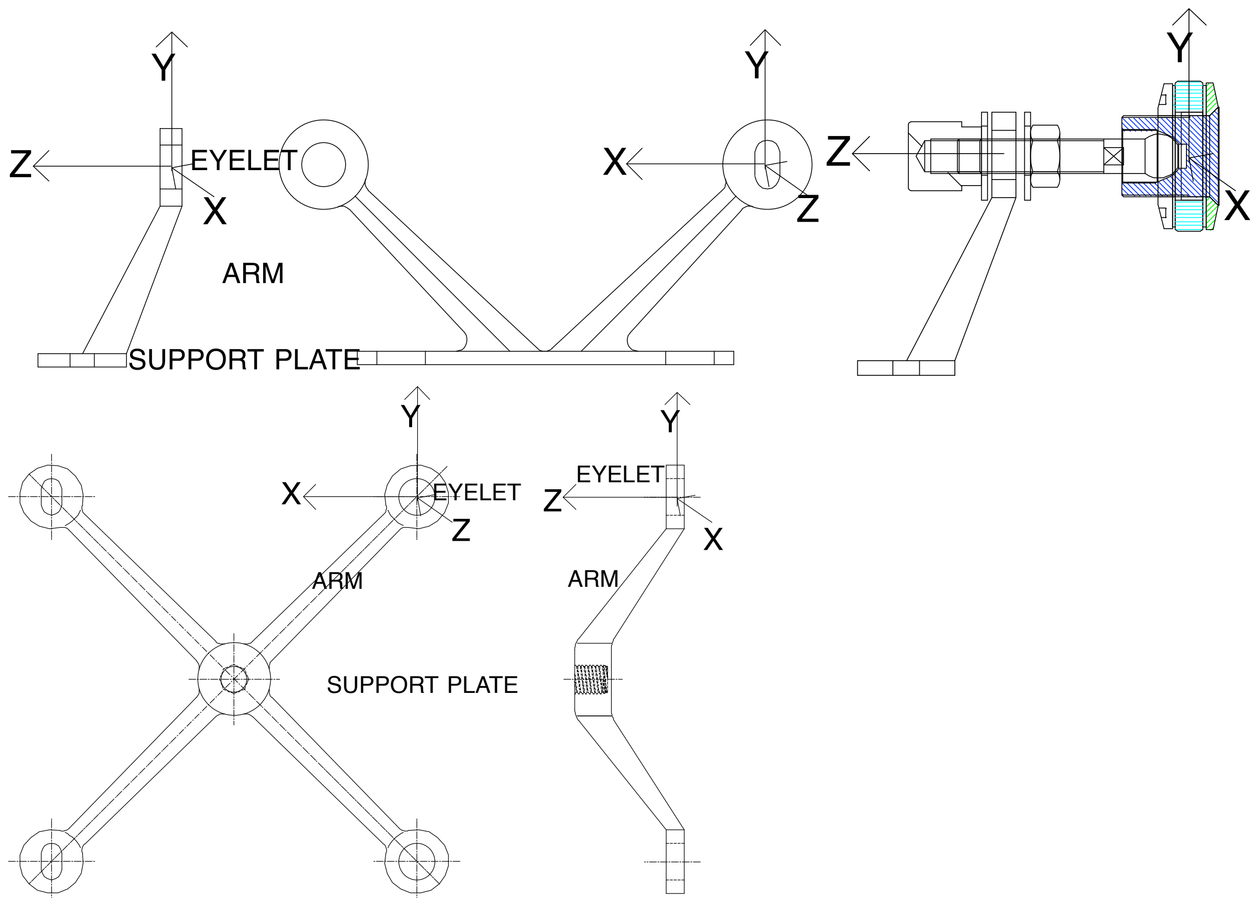




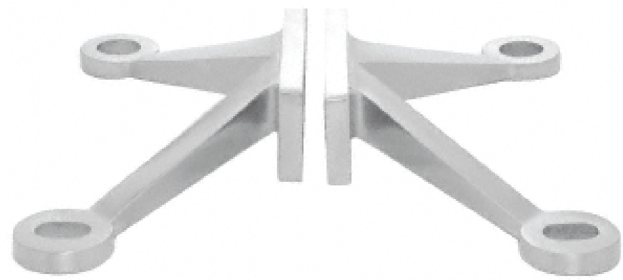
EXP 11/30/2012

CAST STAINLESS STEEL STRENGTH: Design yield strength, $F_y \geq 45$ ksi used for calculations based on 0.02% offset at 30 ksi and $F_u \geq 70$ ksi. Part geometry allows for rapid strain hardening of the part at the base of the fitting arms so that part yield strength in use increases to over 45 ksi, For ultimate strength use $F_u = 70$ksi.
$b/t = 0.625/4.24 < 33.9$ thus $C_y = 3.0$, $E_0 = 28x10^6$ psi, $E_{30} = 14.45x10^6$ psi (at 30 ksi)
$F_{yeff} = C_y*E_{30}/E_0*F_y = 3*14.45/28*30$ksi $= 46.4$ ksi: Use 45 ksi.

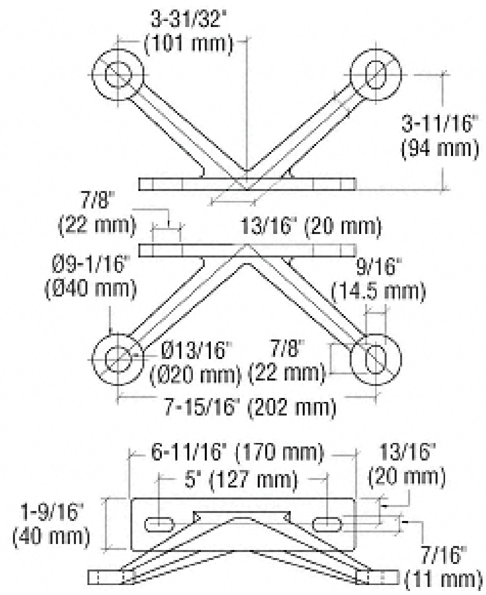
SPIDER FITTING NOMENCLATURE



SPIDER FITTINGS
FMH4

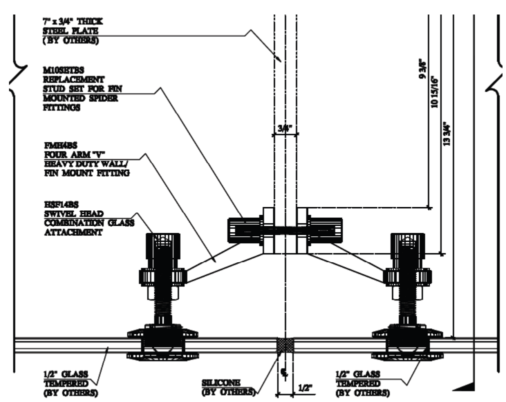


Determine standoff strength:
M = P*2.5" where P = V or H
Shear on screw = Z = H or V
C = T = M/(1.75"/2) = P*(2.5"/0.875") = 2.86P
STRENGTH OF BOLTS TO SUPPORTS
Strength of bolts into support plate
screw 316 Condition CW ASTM F593-98
size 10 mm
$A_t = 57.99mm^2 = 0.0899in^2$
$A_v = 78.54mm^2 = 0.1217in^2$
$øV_n = 0.65*0.1217in^2*42.8$ ksi = 3,386#
$øT_n = 0.75*0.0899in^2*71.2$ ksi = 4,800#



Moment resistance of connection:
For vertical parallel loading
$øM_n$ = 3,386#*(5") = 16,930#"
$M_s = øM_n/1.6$ = 16,930/1.6 = 10,581#"
$V_s = øV_n/1.6$ = 2*3,386/1.6 = 4,232.5#
Determine allowable horizontal load:
V = √[4,232.5²-(10,581#"/4")²] = 3,304#
3,304 < 2*(10,581/4)=5,290#

For Horizontal load:
$øM_n$ = 4,800#*(1.5625"/2) = 3,750#"
$M_s = øM_n/1.6$ = 3,750/1.6 = 2,344#"
H_s = 2,344#"/3.6875 = 636#
$V_s = øV_n/1.6$ = 2*3,386/1.6 = 4,232.5#
Determine service load of standoff from interaction equation where:

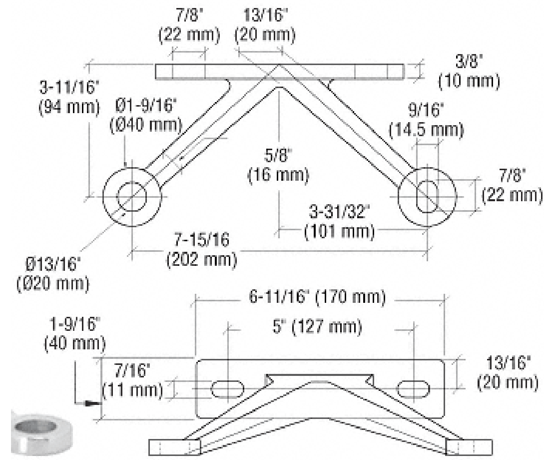


$(M/M_s)^2+(Z/Z_s)^2 \leq 1.0$
$P = \sqrt{(H^2+V^2)} = Z$ and M = 3.6875"*P
substituting using P:
$(3.6875P/2,344)^2 + (P/4,232.5)^2 = 1$ then solving for P

$P = \{1/[(3.6875/2,344)^2 + 1/4,232.5^2]\}^{1/2}$
P = 629# = Maximum horizontal load

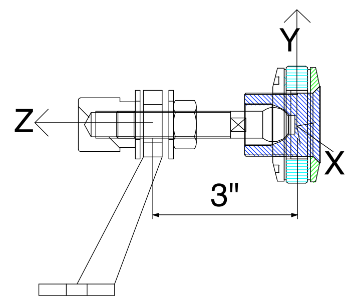
Vertical (dead load) will not reduce the allowable horizontal load until it is over:
0.2*2*3,386 = 1,354#
This greatly exceeds the maximum light weight because of other limitations.

FMH (continued)
Check strength of spider fitting arm
horizontal bending strength:
$F_y \geq 45$ ksi, For ultimate strength use $F_u = 70$ksi.
Bending of arm base at support plate:
$Z_{yy} = 5/8*0.75^2/4 = 0.0879\ in^3$
$M_{sx} = M_{sx} = øM_n/1.6 = 0.9*0.0879*45/1.6 = 2{,}225$#"
$H_{sx} = 2{,}225$#"/4.533" = 491# perpendicular to glass



$Z_{xx} = Z_{yy} = (5/8)^2*0.75/4 = 0.0732\ in^3$
$M_{sx} = M_{sx} = øM_n/1.6 = 0.9*0.0732*45/1.6 = 1{,}854$#"
$H_{sx} = 1{,}854$#"/3.3125 = 560#
$H_{sy} = 1{,}854$#"/3.85 = 482#

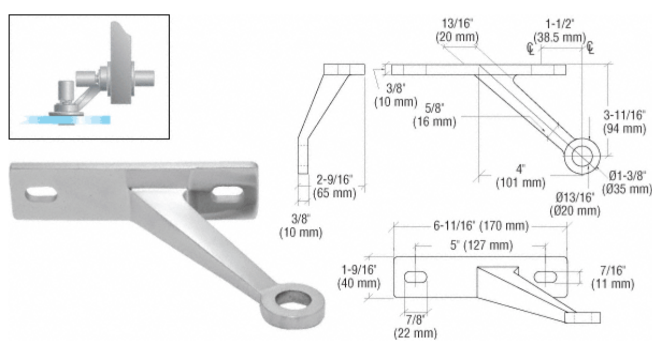
Check strength of eyelet attachment to arm for loads in the glass
plane with a maximum offset of 3".
Offset from glass fitting causes torsion at the eyelet to arm
b = 0.482" ; = c = 0.375"; $\alpha = 0.221$
$\tau_{max} = F_y \alpha b c^2 = 45ksi*0.221*0.482*0.375^2 = 674$"#
$P_{ax} = P_{ay} = (674/1.67)/3" = 135$#



Allowable horizontal load on glass light (perpendicular to glass)
each fitting arm-
H = 491#*4 fittings = 1,964#
For loads in the glass plane (dead load and seismic load for vertical glass):
V = 135# per fitting

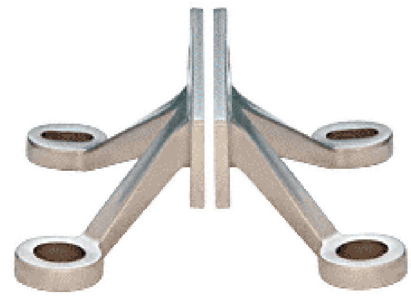
Fitting variations:
FMH2
Fitting is identical to the FMH4 except only installed on one side of the support fin.
Same allowable load per arm.
Same allowable load on fitting.

FMH1
single arm allowable vertical load per
fitting:
Check eccentricity in fin plate:
$Z = 1.5625*0.375^2/4$
$Z = 0.0549 in^3$
$øM_n = 0.9*0.0549*45ksi = 2{,}225$#"
$V_s = 2{,}225$#"/(1.2*3.3125) = 560#



Bending in fin plate will limit vertical/dead
load to 560# maximum.
FOR FMH FITTING LIMIT TOTAL RESULTANT LOAD ON A SINGLE ARM TO 491#

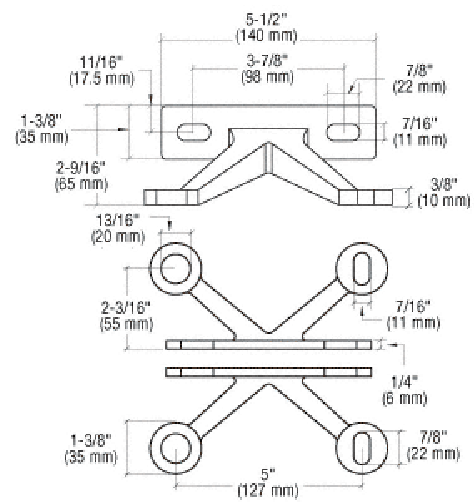
GRF SPIDER FITTINGS



Check strength of spider fitting arm
horizontal bending strength at face of connection plate
$Z_z = (13/16)^2*0.575/4 = 0.0949\ in^3$
$M_{nz} = ZF_y$
$M_{sz} = øM_n/1.6 = 0.9*0.0949*45/1.6 = 2{,}402\#”$
$H_{sz} = 2{,}402\#”/3.163” = 759\#$

$Z_x = Z_y = 13/16*0.575^2/4 = 0.0672\ in^3$
$M_{nx} = M_{ny} = ZF_y$
$M_{sx} = M_{sy} = øM_n/1.6 = 0.9*0.0672*45/1.6 = 1{,}700\#”$
$H_{sx} = 1{,}700\#”/1.9375” = 877\#$
$H_{sy} = 1{,}700\#”/2.5” = 680\#$

For interaction between vertical and horizontal:
$Z/759+X/877+Y/680 \leq 1.0$



Check strength of eyelet attachment to arm for loads in the glass plane with a maximum offset of 3”.
Offset from glass fitting causes torsion at the eyelet to arm
$b = 0.482”$; $= c = 0.375”$; $\alpha = 0.221$
$\tau_{max} = F_y\alpha bc^2 = 45ksi*0.221*0.482*0.375^2 = 674”\#$
$P_{ax} = P_{ay} = (674/1.67)/3” = 135\#$

Determine connection strength to support post:
Loads on fasteners
$M = P*2\ 3/16”$ where $P = V$ or H
Shear on fasteners = $Z = 1/2*(H \text{ or } V)$
$C = T = M/(1.375”/2) = P*(2.1875”/0.6875”) = 3.182P$

Strength of bolt into support
screw 316 Condition CW ASTM F593-86a
size 10 mm
$A_t = 57.99mm^2 = 0.0899in^2$
$A_v = 78.54mm^2 = 0.1217in^2$
$øV_n = 0.65*0.1217in^2*42.8\ ksi = 3{,}386\#$
$øT_n = 0.75*0.0899in^2*71.2\ ksi = 4{,}800\#$

For GRF4
Moment resistance of connection:
For horizontal loads:
$øM_n = 2*4{,}800\#*(1.375”/2) = 6{,}600\#”$
$M_s = øM_n/1.6 = 6{,}600/1.6 = 4{,}125\#”$
$V_s = øV_n/1.6 = 2*3{,}386/1.6 = 4{,}232\#$

GRF (continued)

For vertical loads:

$\phi M_n = 3{,}386\#*(3.875) = 13{,}121\#"$

$M_s = \phi M_n/1.6 = 13{,}121/1.6 = 8{,}200\#"$

For Horizontal Loads:

$M = 2.1875P$ $P_{sh} = 4{,}125\#/2.1875 = 1{,}886$

For Vertical loads:

$M = 2.125P$ $P_{sv} = 8{,}200\#"/2.125 = 3{,}859\#$

GRF2

Arm and bolt strength is the same.

For vertical loads:

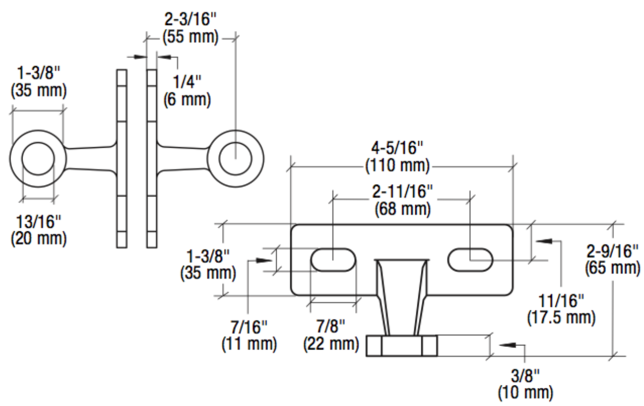
$\phi M_n = 3{,}386\#*(2.6875) = 9{,}100\#"$

$M_s = \phi M_n/1.6 = 9{,}100/1.6 = 5{,}687\#"$

For Horizontal Loads:

$M = 2.1875P$

$P_{sh} = 4{,}125\#/2.1875 = 1{,}886$



For Vertical loads:

$M = 2.125P$

$P_{sv} = 5{,}687\#"/2.125 = 2{,}676\#$

LOADS ARE LIMITED BY THE ARM STRENGTH

Allowable load on arm for the GRF2 fitting:

$M_s = 0.9*0.1342*45/1.6 = 3{,}397\#"$

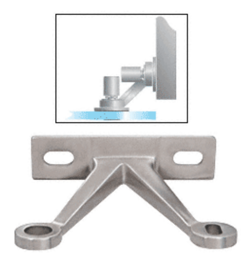
$H_s = 3{,}397\#"/1.9375" = 1{,}753\#$

$V_s = H_s = 1{,}753\#$ or vertical or horizontal load acting alone

For interaction between vertical and horizontal:

$\sqrt{[H_s^2+V_s^2]} = 1{,}753\#$

For balanced load case $V_s = H_s = 1{,}753\#/\sqrt{2} = 1{,}240\#$

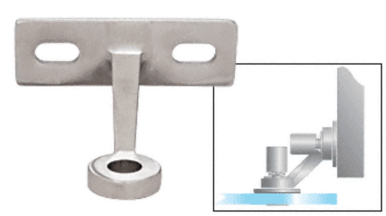


GRF2V

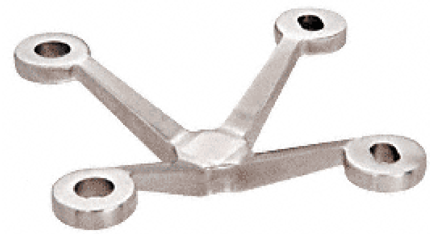
Same strength as the GRF4 fitting except is mounted to only one side.

GRF1

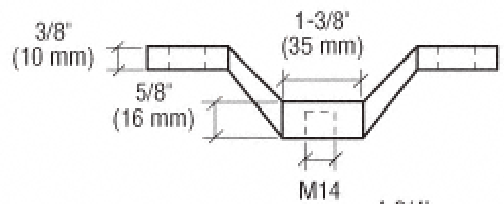
Same strength as the GRF2 fitting except is mounted to only one side.



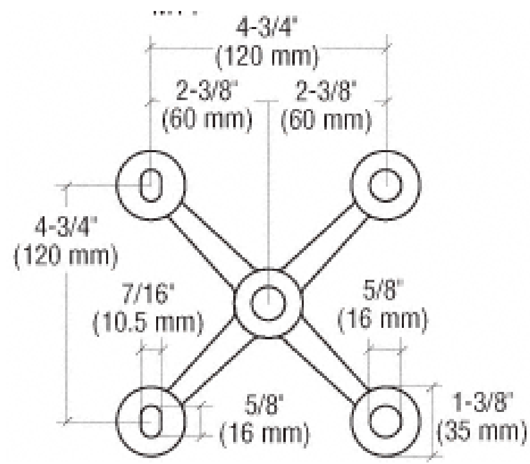
GRP SPIDER FITTINGS



Check strength of spider fitting arm
horizontal bending strength at face of connection hub
$Z_x=Z_y=Z_z = 5/8^3/4 = 0.061\ in^3$
$M_n = ZF_y$
$M_s = øM_n/1.6 =$
$M_s = 0.9*0.061*45/1.6 = 1{,}545”\#$
$H_{sx} = H_{sx} = 1{,}545”\#/1.6875” = 916\#$
$H_{sz} = 1{,}545”\#/2.386” = 647\#$
$V_s = H_s = 460\#$ or vertical or horizontal load acting alone
For interaction between vertical and horizontal:
$\sqrt{[H_s^2+V_s^2]} = 647\#$



Check strength of eyelet attachment to arm for loads in the glass plane with a maximum offset of 3”.
Offset from glass fitting causes torsion at the eyelet to arm
$b = 0.482”$; $= c = 0.375”$; $\alpha = 0.221$
$\tau_{max} = F_y\alpha bc^2 = 45ksi*0.221*0.482*0.375^2 = 674”\#$
$P_{ax} = P_{ay} = (674/1.67)/3” = 135\#$



For maximum dead load case $V_s = 135\#$
$H_s = [647\#^2 - 135^2]^{½} = 632\#$
Determine connection strength to support post:
Loads on fasteners
$M = P*3.359”$ where $P = V$ or H
Shear on fasteners $= Z = 1/2*(H \text{ or } V)$
$C = T = M/(1.375”/2) = P*(3.359”/0.6875”) = 4.886P$
Assumes unbalanced horizontal loads (all horizontal load concentrated on a single arm.

Strength of bolt into support
screw 316 Condition CW ASTM F593-98
M14 threaded rod 316 Stainless steel
Shear strength:
$A_t = 115.44mm^2 = 0.1789in^2$
$A_v = 153.94mm^2 = 0.2386in^2$
$øV_n = 0.65*0.238in^2*42.8\ ksi = 6{,}621\#$
$øT_n = 0.75*0.1789in^2*71.2\ ksi = 9{,}553\#$
Strength of threads into cap
$øV_n = 0.85*57ksi*0.79”*0.25”= 9{,}569\#$

GRP (continued)

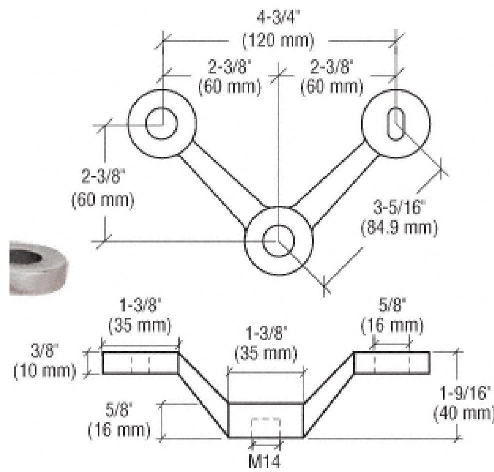
Moment resistance of connection:

For horizontal loads:

$øM_n = 0.9*9{,}553\#*(1.375''/2) = 5{,}910\#''$

$M_s = øM_n/1.6 = 5{,}910/1.6 = 3{,}694\#''$

$V_s = øV_n/1.6 = 6{,}621/1.6 = 4{,}138\#$



Check bending strength of stud for pure bending:

Applicable t vertical loads only

$Z = 0.55''^3/6 = 0.0277in^3$

$øM_n = 0.9*71.2ksi*0.0277in^3 = 1{,}777\#''$

for typical eccentricity = 1 3/16" = 1.1875"

$P_n = 1{,}777\#''/1.1875'' = 1{,}496\#$

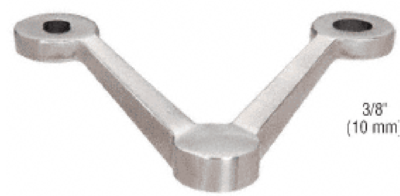
Determine allowable load:

$P_{sv} = 1{,}496\#/1.6 = 935\#$

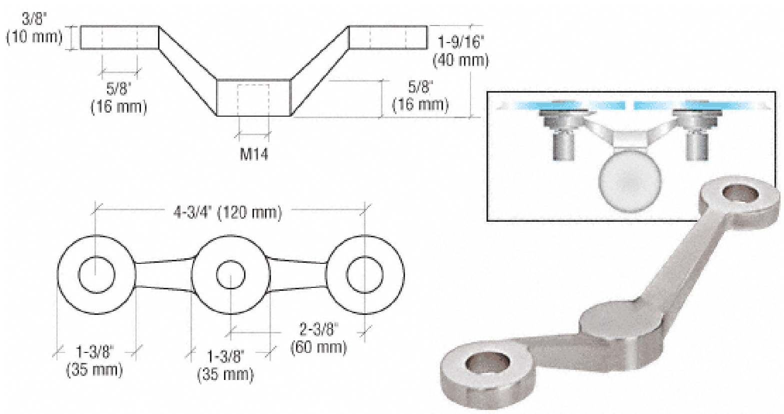
X or Y (in glass plane):

Vx = Vy = [1,777"#/4.3125"] = 412# total

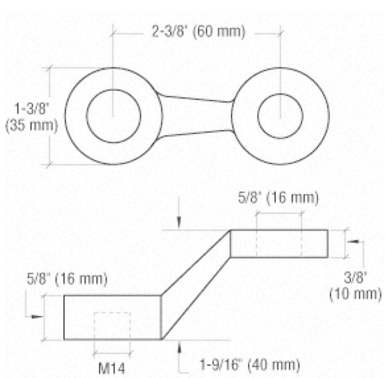
These strength parameters are applicable to all configurations:

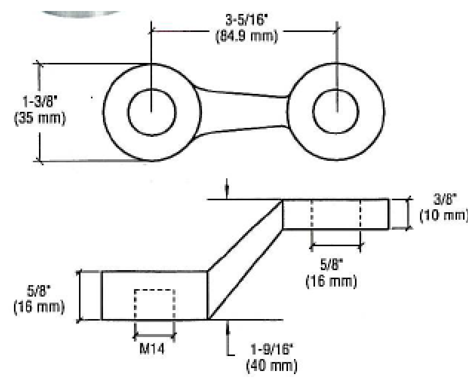


GRP2V



GRP2





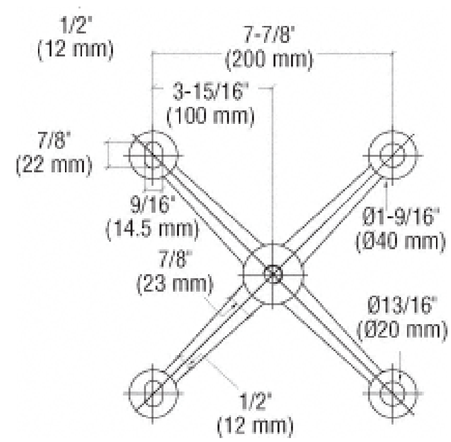
GRP1 (single arm) GRP1L

FOR GRP FITTING LIMIT TOTAL LOAD ON A SINGLE ARM TO 460# AND 935# TOTAL ON THE FULL FITTING.

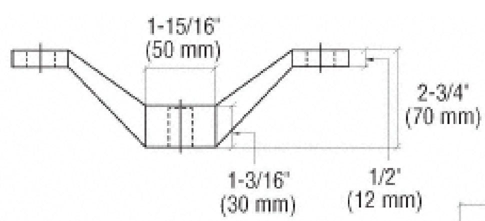
SPIDER FITTINGS
PMH4

Determine standoff strength:
Loads on anchor screw
M = P*2.5" where P = V or H
Shear on screw = Z = H or V
C = T = M/(1.75"/2) = P*(2.5"/0.875") = 2.86P

Strength of bolt into support
screw 316 Condition CW ASTM F593-98
size 16mm A_t = 156.67mm^2 = 0.2428in^2
A_v = 201.06mm^2 = 0.3116in^2
$øT_n$ = 0.75*71.2 ksi*0.2428in^2 = 12,966#
$øV_n$ = 0.65*42.8 ksi*0.3116in^2 = 8,668#



Moment resistance of connection:
$øM_n$ = 12,966#*(1.75"/2) = 11,345#"
$M_s = øM_n/1.6$ = 11,345/1.6 = 7,090#"
$V_s = øV_n/1.6$ = 8,668/1.6 = 5,418#
for typical eccentricity for in plane forces (X or Y) = 5.75"
For vertical load:
Determine service load of standoff from interaction equation where:
$(M/M_s)^2+(Z/Z_s)^2 \leq 1.0$
$P = \sqrt{(H^2+V^2)} = Z$ and M = 5.75"*P
substituting using P:
$(5.75P/7{,}090)^2 + (P/5{,}418)^2 = 1$ then solving for P
$P = \{1/[(5.75/7{,}090)^2 + 1/5{,}418^2]\}^{1/2}$
$P_{x,y}$ =1,202# = maximum load for $\sqrt{(X^2+Y^2)}$
$P_z = \sqrt{[7{,}090^2 - (5.75*4*224)^2]}/3.9375$ = 1,237# For unbalanced load

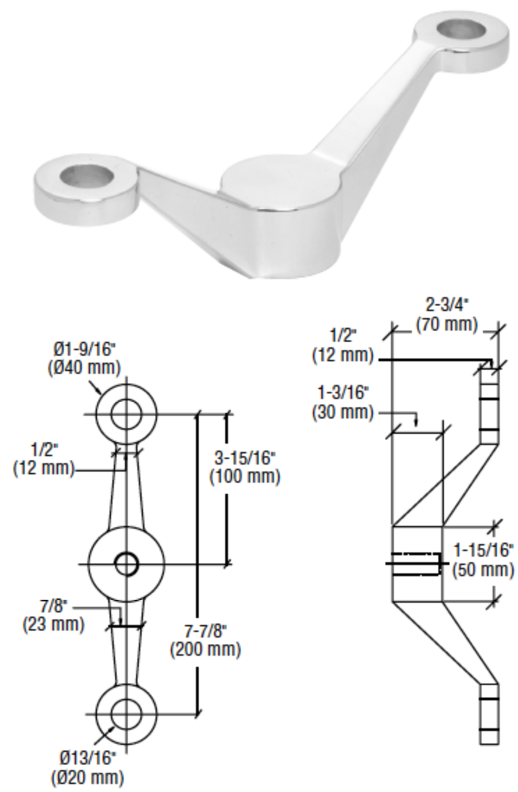


Allowable horizontal load based on standoff strength can be taken as the same as vertical load.
Check bending strength of stud for pure bending:
Applicable t vertical loads only
Z = 0.63"^{3}/6 = 0.0417in^3
$øM_n$ = 0.9*71.2ksi*0.0417in^3 = 2,671#"

Check strength of spider fitting arm
horizontal bending strength
$Z_x = Z_y$ = 1.1875*0.893^2/4 = 0.237 in^3
$M_{sx,y} = øM_n/1.6$ = 0.9*0.237*45/1.6 = 5,993#"
$H_{sx,y}$ = 5,993#"/(3.031") = 1,977#

PMH (continued)

$Z_z = 0.893*1.1875^2/4 = 0.315\ in^3$
$M_{sz} = øM_n/1.6 = 0.9*0.315*45/1.6 = 7{,}969\#"$
$H_{sz} = 7{,}969\#"/(5.585") = 1{,}427\#$
Bending at eyelet to arm:
$Z_z = 0.5253*0.472^2/4 = 0.0293$
$M_{sz} = 0.9*0.0293*45ksi/1.6 = 742"\#$
$P_z = 742\#/(1.575/2) = 942\#$

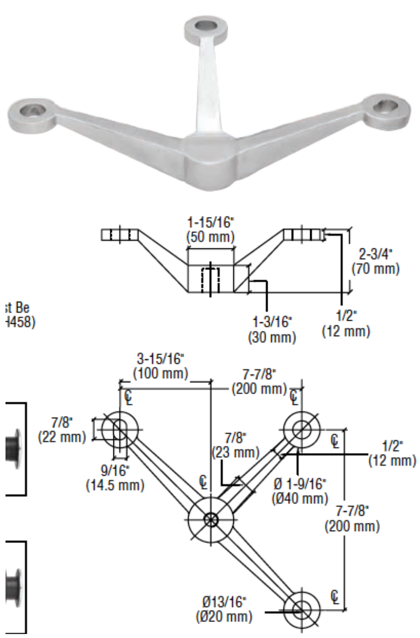


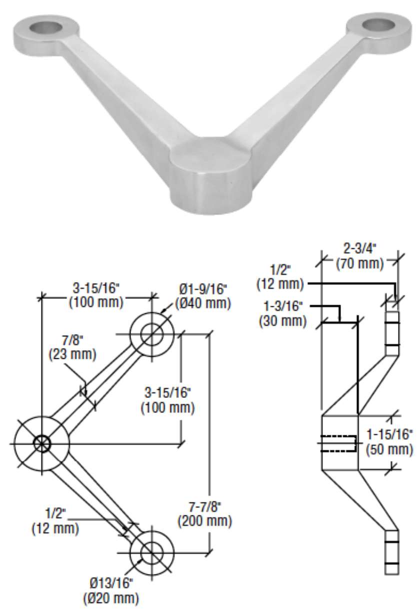
Check strength of eyelet attachment to arm for loads in the glass plane with an offset of 3".
Offset from glass fitting causes torsion at the eyelet to arm
$b = 0.5253"$; $= c = 0.472"$; $\alpha = 0.213$
$\tau_{max} = F_y\alpha bc^2 = 45ksi*0.213*0.5253*0.472^2 = 1{,}122"\#$
$P_{ax} = P_{ay} = (1{,}122/1.67)/3" = 224\#$

Fitting variations:
Same load per arm.
Total allowable load for all configurations is the same.

PMH2
Same allowable load per arm
1/2 the allowable load per fitting.
Unbalanced load moment strength is same as for

Will always be unbalanced load



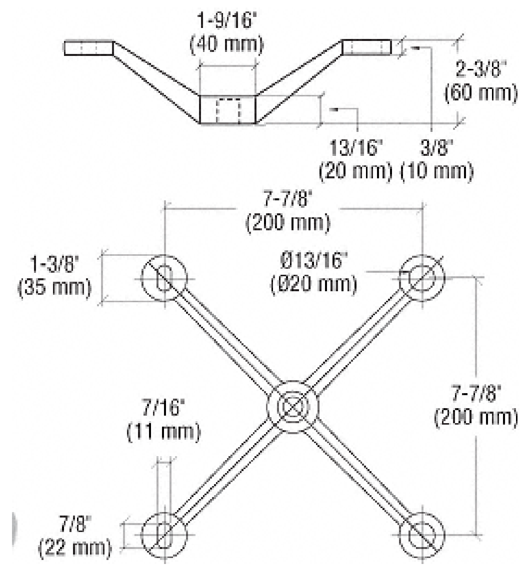


PMH3 PMH2V

PMR SPIDER FITTINGS
PMR4

Determine standoff strength:
Loads on anchor screw
$M = P*2.375"$ where $P = V$ or H
Shear on screw = $Z = H$ or V
$C = T = M/(1\ 9/16"/2) = P*(2.375"/0.781") = 3.04P$

Strength of bolt into support
screw 316 Condition CW ASTM F593-98
size 16mm $A_t = 156.67mm^2 = 0.2428in^2$
$A_v = 201.06mm^2 = 0.3116in^2$
$øT_n = 0.75*71.2\ ksi*0.2428in^2 = 12{,}966\#$
$øV_n = 0.65*42.8\ ksi*0.3116in^2 = 8{,}668\#$



Moment resistance of connection:
$øM_n = 12{,}966\#*(0.781") = 10{,}126\#"$
$M_s = øM_n/1.6 = 10{,}126\#"/1.6 = 6{,}329\#"$
$V_s = øV_n/1.6 = 8{,}668\#/1.6 = 5{,}418\#$

For vertical load:

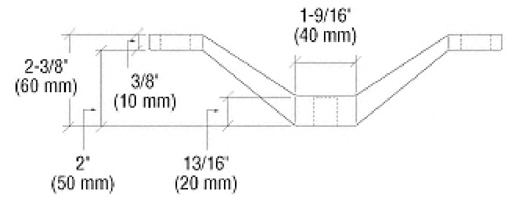
Determine service load of standoff from interaction equation where:
$(M/M_s)^2+(Z/Z_s)^2 \leq 1.0$
$P = \sqrt{(H^2+V^2)} = Z$ and $M = 5.375"*P$
substituting using P:
$(5.375P/6{,}329)^2 + (P/10{,}836)^2 = 1$ then solving for P
$P = \{1/[(5.375/6{,}329)^2 + 1/5{,}418^2]\}^{1/2}$
$P = 1{,}151\# = V$ for unbalanced load

Allowable horizontal load based on standoff strength can be taken as the same as vertical load.

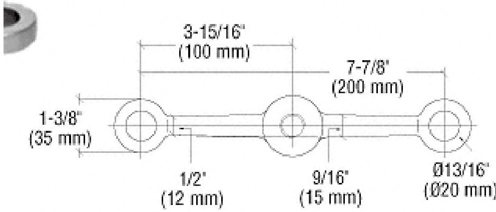
Check strength of spider fitting arm
horizontal bending strength at hub
$Z = 9/16*0.575^2/4 = 0.0464\ in^3$
$M_s = øM_n/1.6 = 0.9*0.0464*45/1.6 = 1{,}175\#"$
$H_s = 1{,}175\#"/3\ 15/16" = 298\#$
Bending at eyelet to arm:
$Z_z = 0.5*0.375^2/4 = 0.0176in^3$
$M_{sz} = 0.9*0.0176*45ksi/1.6 = 445"\#$
$P_Z = 445\#/(1.375/2) = 647\#$

PMR (continued)
Check strength of eyelet attachment to arm for loads in the glass plane with an offset of 3".
Offset from glass fitting causes torsion at the eyelet to arm
b = 0.5" ; = c = 0.375"; α = 0.223
$\tau_{max} = F_y \alpha b c^2$ = 45ksi*0.223*0.5*0.375^2 = 706"#
$P_{ax} = P_{ay}$ = (706/1.67)/3" = 141#

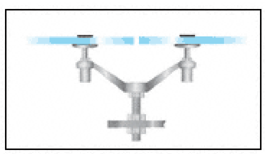
Allowable horizontal load on glass lite
each corner
H = 298#*4 fittings = 1,192#<1,541#
Fitting load limited by arm bending

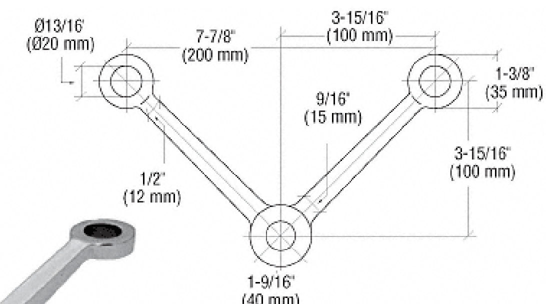


Fitting variations:
Same load per arm.
Total allowable load for all configurations is the number of arms times 298# < 1,541#

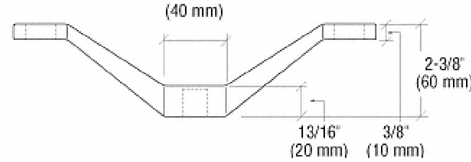


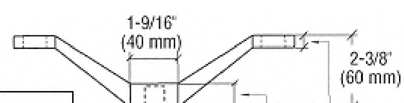
PMR2 or PMR2V
Same allowable load per arm
H= 298#,
Total = 2*298=596#
Unbalanced load moment strength is same as for PMR4

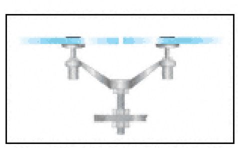


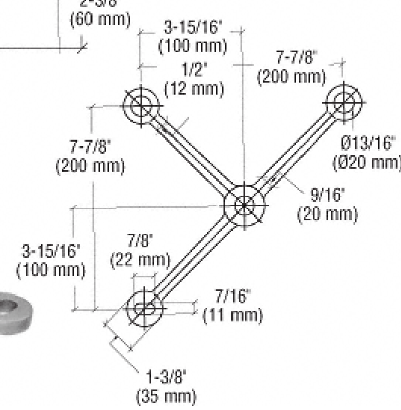


PMR3
Same allowable load per arm
H= 298#,
Total = 3*298=994#
Unbalanced load, moment strength is same as for PMR4



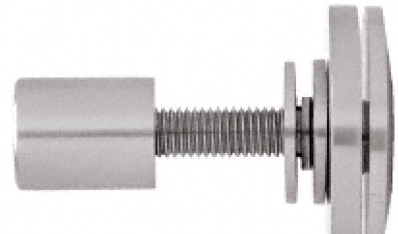


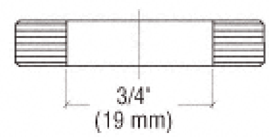




MAXIMUM LOAD ON PMR FITTING IS 298# PER ARM

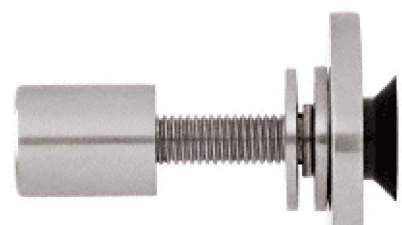
RRF10BS/PS
Rigid fixed head
Mount to spider fitting

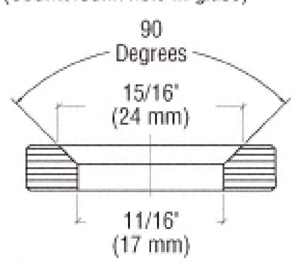

Cap Mount
(Standard hole through glass)



Cap mount glass fabrication

Fitting strength:
M10 threaded rod 316 Stainless steel
Shear strength:
$A_t = 57.99mm^2 = 0.0899in^2$
$A_v = 78.54mm^2 = 0.1217in^2$
$øV_n = 0.65*0.1217in^2*42.8$ ksi = 3,386#
$øT_n = 0.75*0.0899in^2*71.2$ ksi = 4,800#
For typical installation
$øM_n$ = 0.9*4,800#*0.39" = 1,691#" (based on rod in tension couple)
or for pure bending in rod:
$Z = 0.39"^3/6 = 0.00989in^3$
$øM_n = 0.9*71.2ksi*0.00989in^3$ = 634#"
for typical eccentricity = 1/4"+3/16" = 0.4375
P_n = 634#"/0.4375" = 1,449#
Determine allowable load
$(M/M_s)+(Z/Z_s) \leq 1.2$
Typical will be L = 200# or W = 350# and D = 100#
P_u = 1.6*200+1.2*100 = 440# or 1.6*350#+1.2*100 = 680#
M_u = 680#*0.4375" = 297.5#"
combined:
(680#/4,800#)+(297.5#"/634#") = 0.61 < 1.2 okay
Max allowable: F_R = 765# $F_x = F_y$ = 139#
FITTING SUPPORTS
Fittings are supported by steel with a minimum thickness of 1/4" designed for the concentrated load on the fitting.


Flush Mount
(Countersunk hole in glass)



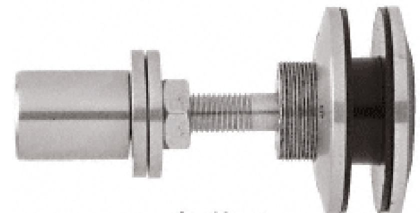
Flush mount glass fabrication

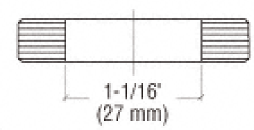
STRENGTH OF COUNTERSUNK FITTING:
Check failure of bearing ring:
$øV_n = 0.65*(3/16"*0.9375"*\pi*25$ ksi = 8.97k
Will not control

Check for glass stress:
$\sigma = P_n/(0.5t*0.6875\pi) = P_n/(1.08t)$
Using maximum from above with 3/8" glass:
σ = 906#/(1.08*0.375) = 2236 psi

Bearing area:
$A = (1/4)*13/16\pi = 0.638\ in^2$
FITTING REQUIRES TEMPERED GLASS

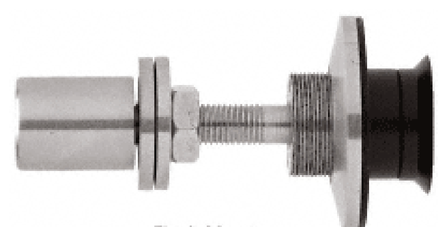
RSF10BS/PS
Combination Swivel head
Mount to spider fitting


Cap Mount
(Standard hole through glass)

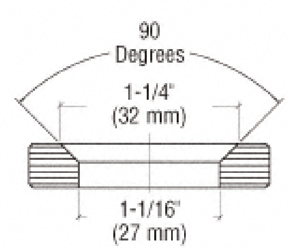


Cap mount glass fabrication

Fitting strength:
M10 threaded rod 316 Stainless steel
Shear strength:
$A_t = 57.99mm^2 = 0.0899in^2$
$A_v = 78.54mm^2 = 0.1217in^2$
$øV_n = 0.65*0.1217in^2*42.8$ ksi = 3,386#
$øT_n = 0.75*0.0899in^2*71.2$ ksi = 4,800#
Strength of swivel ball joint: Shear failure around socket rim:
$øV_n = 0.85*42ksi*0.95*0.55''*\pi*0.065''= 3,809\#$
For typical installation
$øM_n = 0.9*3,809\#*0.39'' = 1,337\#''$ (based on rod in tension couple)
or for pure bending in rod:
$Z = 0.39''^3/6 = 0.00989in^3$
$øM_n = 0.9*71.2ksi*0.00989in^3 = 634\#''$
for typical eccentricity = 1/4"+3/16" = 0.4375
$P_n = 634\#''/0.4375'' = 1,449\#$
Determine allowable load
$(M/M_s)+(Z/Z_s) \leq 1.2$
Typical will be L = 200# or W = 350# and D = 100#
$P_u = 1.6*200+1.2*100 = 440\#$ or $1.6*350\#+1.2*100 = 680\#$
$M_u = 680\#*0.4375'' = 297.5\#''$
combined:
$(680\#/3,809\#)+(297.5\#''/634\#'') = 0.65 < 1.2$ okay
Max allowable: $F_R = 550*1.35=742$ # $F_x = F_y = 135\#$
STRENGTH OF COUNTERSUNK FITTING:
Check failure of bearing ring:
$øV_n = 0.65*(3/16''*0.9375''*\pi*25$ ksi = 8.97k


Flush Mount
(Countersunk hole in glass)

Check for glass stress:
$\sigma = P_n/(0.5t*0.6875\pi) = P_n/(1.08t)$
Using maximum from above with 3/8" glass:
$\sigma = 906\#/(1.08*0.375) = 2236$ psi

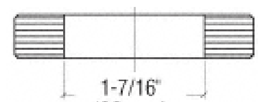


Flush mount glass fabrication

Bearing area:
$A = (1/4)*13/16\pi = 0.638$ in^2
FITTING REQUIRES TEMPERED GLASS

HRF14BS/PS
Fixed head
Mount to spider fitting

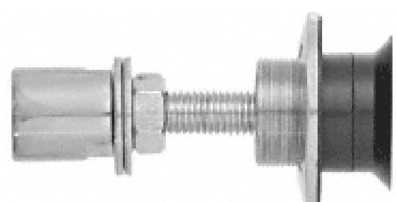

Cap Mount
(Standard hole through glass)

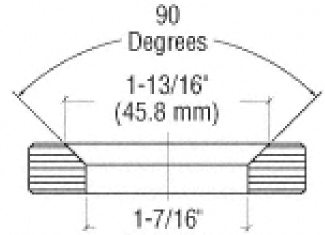


Cap mount glass fabrication

Fitting strength:
M14 threaded rod 316 Stainless steel
Shear strength:
$A_t = 115.44mm^2 = 0.1789in^2$
$A_v = 153.94mm^2 = 0.2386in^2$
$øV_n = 0.65*0.238in^2*42.8$ ksi = 6,621#
$øT_n = 0.75*0.1789in^2*71.2$ ksi = 9,553#
Strength of threads into cap
$øV_n$ = 0.85*57ksi*0.79"*0.25"= 9,569#

For typical installation
$øM_n$ = 0.9*9,553#*0.55" = 4,713#" (based on rod in tension couple)
or for pure bending in rod:
$Z = 0.55"^3/6 = 0.0277in^3$
$øM_n = 0.9*71.2ksi*0.0277in^3$ = 1,777#"
for typical eccentricity = 1/4"+3/8" = 0.625
P_n = 1,777#"/0.625" = 2,843#
Determine allowable load
$(M/M_s)+(Z/Z_s) \leq 1.2$
Typical will be L = 200# or W = 350# and D = 100#
P_u = 1.6*200+1.2*100 = 440# or 1.6*350#+1.2*100 = 680#
M_u = 680#*0.625" = 425#"
combined:
(680#/6,621#)+(425#"/1,777#") = 0.34 < 1.2 okay
$F_x = F_y$ = 1,777/3 = 592#


Flush Mount
(Countersunk hole in glass)



Flush mount glass fabrication

STRENGTH OF COUNTERSUNK FITTING:
Check failure of bearing ring:
$øV_n = 0.65*(3/16"*1.4375"*\pi*25$ ksi = 13.76k
Will not control

Check for glass stress:
$\sigma = P_n/(0.5t*1.4375\pi)$
Using maximum from above with 1/2" glass:
$\sigma = 1,252/(0.5*0.5*1.4375\pi)$ = 1,110 psi

Bearing area:
$A = (3/16)^2*1.4375\pi = 0.847$ in^2

FITTING REQUIRES TEMPERED GLASS

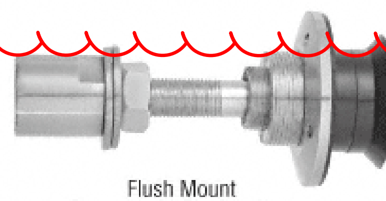
HSF14BS/PS
Combination Swivel head
Mount to spider fitting


Cap Mount
(Standard hole through glass)

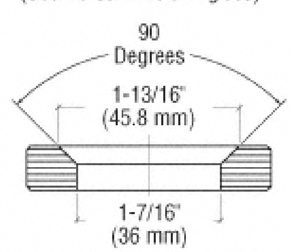
Fitting strength:
M14 threaded rod 316 Stainless steel
Shear strength:
$A_t = 115.44mm^2 = 0.1789in^2$
$A_v = 153.94mm^2 = 0.2386in^2$
$øV_n = 0.65*0.238in^2*42.8$ ksi = 6,621#
$øT_n = 0.75*0.1789in^2*71.2$ ksi = 9,553#
Strength of swivel ball joint: Shear failure around socket rim:
$øV_n = 0.85*42ksi*0.95*0.59''*\pi*0.18''= 11,315\#$

For typical installation
$øM_n = 0.9*9,553\#*0.55'' = 4,713\#''$ (based on rod in tension couple)
or for pure bending in rod:
$Z = 0.55''^3/6 = 0.0277in^3$
$øM_n = 0.9*71.2ksi*0.0277in^3 = 1,777\#''$
for typical eccentricity = 1/4"+3/8" = 0.625
$P_n = 1,777\#''/0.625'' = 2,843\#$
Determine allowable load
$(M/M_s)+(Z/Z_s) \leq 1.2$
Typical will be L = 200# or W = 350# and D = 100#
$P_u = 1.6*200+1.2*100 = 440\#$ or $1.6*350\#+1.2*100 = 680\#$
$M_u = 680\#*0.625'' = 425\#''$
combined:
$(680\#/6,621\#)+(425\#''/1,777\#''^2 = 0.34 < 1.2$ okay
$F_x = F_y = 1,777/3 = 592\#$

STRENGTH OF COUNTERSUNK FITTING:
Check failure of bearing ring:
$øV_n = 0.65*(3/16''*1.4375''*\pi*25$ ksi = 13.76k
Will not control


Flush Mount
(Countersunk hole in glass)

Check for glass stress:
$\sigma = P_n/(0.5t*1.4375\pi)$
Using maximum from above with 1/2" glass:
$\sigma = 1,252/(0.5*0.5*1.4375\pi) = 1,110$ psi



Flush mount glass fabrication

Bearing area:
$A = (3/16)^2*1.4375\pi = 0.847$ in^2

FITTING REQUIRES TEMPERED GLASS

Glazing Information

Edge Supports: 2 Sides
Glazing Angle: 5°
Lite Dimensions:
Unsupported Length: 64.0 in.
Supported Length: 83.0 in.

Project Details

Project Name: Puyallup Public Safety Building
Location: Puyallup WA
Comments:

Glass Construction (Rectangular)

Single Glazed Lite { Fully Tempered }

Interlayer Type:	PVB
Outboard Ply Thickness:	3/8 in.
Interlayer Thickness:	0.06 in.
Inboard Ply Thickness:	3/8 in.
Nominal Thickness:	3/4 in.

Short Load Duration, Resistance, and Deflection Data

Load (~ 3 sec.) + Glass Weight:	69.8 psf
Load Resistance:	175 psf
Approximate center of glass deflection:	0.55 in.

Long Load Duration, Resistance, and Deflection Data

Load (~ 30 days) + Glass Weight:	34.6 psf
Load Resistance:	131 psf
Approximate center of glass deflection:	0.27 in.

Conclusion

Based on your design information, the load resistance is greater than or equal to the specified loading.

Statement of Compliance

Procedures followed in determining the resistance of this window glass are in accordance with ASTM E1300-04.

Disclaimer:

This software can be used to determine the load resistance of specified glass types exposed to uniform lateral loads of short or long duration subject to the following conditions:

- The glass is free of edge and surface damage and has been properly glazed in the opening in conformance with the manufacturer's recommendations.
- Procedures exist to determine load resistance for rectangular glass assemblies that are:
  a. Continuously supported along all four edges,
  b. Continuously supported along three edges,
  c. Continuously supported along two parallel edges, and
  d. Continuously supported along one edge.
- The software user has the responsibility of selecting the correct procedures for the required application from the software.
- The stiffness of members supporting any glass edge shall be sufficient that under design load, edge deflections shall not exceed L/175, where L denotes that length of the supported edge.
- The manufacturer states that the Safety Plus II 0.090 Polyurethane Large Missile Resistant interlayer is comparable to the PVB interlayer.
- The non-factored load values for laminated glass are representative of test data and calculations performed for an interlayer at a temperature of 50° C (122° F).

For other limiting conditions that may apply, refer to Section 5 of ASTM E1300 and local building codes.

Prepared by: ______________________ on 9/3/2025
P.Zeutenhorst

Duane Boice P.E.
President

Engineering & Technical Services Inc.

STRUCTURAL CALCULATIONS

COVER SHEET

Date: October 27, 2025

Project: Lacey Glass / Puyallup Public Safety Building

Project Location: 1015 39th Ave SE
Puyallup, WA 98374

E.T.S. Designer: Colin Nelson

Contact: Wayne Koch

Comments:
(1) 18'-0.8125" x 35'-4" CANOPY SKYLIGHT SYSTEM
(1) 17'-11.8125" x 36'-4" CANOPY SKYLIGHT SYSTEM

DESIGN LOAD INFORMATION:
- **2021 WASHINGTON STATE BUILDING CODE**
- **DEAD LOAD: 12 PSF**
- **ROOF SNOW/LIVE LOAD: 25 PSF**
- **WIND LOAD = 108 MPH (Basic) EXPOSURE "C" (3 SECOND GUST)**
- **RISK CATEGORY = IV**
- **SEISMIC DESIGN CATEGORY: D**

SUPPORT STRUCTURE DESIGNED BY OTHERS.

DUANE D. BOICE
STATE OF WASHINGTON
25530
REGISTERED
PROFESSIONAL ENGINEER
10/27/25
EXPIRES: 03/15/27

Note: THE SEAL AFFIXED TO THIS PAGE APPLIES TO THE FOLLOWING:
- **34 PAGES OF CALCULATIONS (INCLUDING COVER PAGE).**

27121 469th Ave., PO Box 308, Tea, SD 57064
Phone: (605) 498-1290 Fax: (605) 498-1299
www.engtecsrv.com

Design Criteria

Code Authority:	2021	Washington State Building Code
Dead Load:	12	psf
Live Load:	20	psf
Snow Load:	25	psf
Wind Load:	108	MPH (V_{basic})
Exposure:	C	
Risk Cat.:	IV	
Seismic Category:	D	
Structure Type:	Canopy	
Curb Height:	< 15	Feet
Building Height	41	Feet

Seismic Loads

Sds = **1.01**

F= 1.6 Sds Ip Wp — Ip = **1.50**

F= 29.0 psf Max > Wind Loads — Wp = **12.0**

-> Use Seismic Load for Design

Design Wind Pressures (ASCE 7-16 Chap. 30.7)

p= $q_h GC_N$

$$q_h = 0.00256 K_{zt} K_h K_d K_e V^2 LF$$

K_e =	**1.00**	K_{ZT} =	**1.00**		LF_{ASD} =	**0.60**
K_d =	**0.85**	V =	**108.0**	MPH		
K_h =	**0.85**	qh =	**12.93**	psf		

$C_N = per\ Fig. 30.7-3$ $G = per\ 26.11$

(See MecaWind Calculations)

Inward p =	19.49	psf (for both South & West Entrances)
Outward p =	24.65	psf (for both South & West Entrances)

Inward p_{net} =	19.5	psf (W1)
Outward p_{net} =	-24.7	psf (W2)

Design Loads

DL =	12	PSF
LL =	25	PSF
W1 =	19.5	PSF
W2 =	-24.7	PSF
$E_{gravity}$ =	29.0	PSF
E_{uplift} =	-29.0	PSF

Load Combinations

1) D + L =	37.0	PSF
2) D + 0.75L + 0.75W1 =	45.4	PSF
3) D + 0.75L + 0.75W2 =	12.3	PSF
4) D + W1 =	31.5	PSF
5) D + W2 =	-12.7	PSF
6) 0.6D + W1 =	26.7	PSF
7) 0.6D + W2 =	-17.5	PSF
8) D + 0.75E =	33.8	PSF
9) D + 0.525E + 0.75S =	46.0	PSF
10) 0.6D - 0.7E =	27.5	PSF

Max Gravity Load = 46.0 PSF

MecaWind v2475

Wet Entrance - Obstructed

Calculations Prepared by:

Date: Oct 20, 2025

File Location: Current Project Not Saved

General:

Wind Load Standard	= ASCE 7-16	Basic Wind Speed	= 108.0 mph
Exposure Classification	= C	Risk Category	= IV
Structure Type	= Building	Design Basis for Wind Pressures	= ASD
MWFRS Analysis Method	= Ch 27 Pt 1	C&C Analysis Method	= Ch 30 Pt 5
Dynamic Type of Structure	= Rigid	Show Advanced Options	= True
Reset Advanced Options to Default Values	= Defaults	Simple Diaphragm Building	= False
Show Base Reactions in Output	= None	Altitude above Sea Level	= 0.000 ft
Base Elevation Of Structure	= 0.000 ft	MWFRS Pressure Elevations	= Mean Ht
Topographic Effects	= None	Override Directionality Factor K_d	= False
Override the Gust Factor G	= False	Override Minimum Pressure	= False

Building:

Roof Type	= Troughed	Enclosure Classification	= Open
Help = Help on Roof Type	= Help	Pitch = Pitch of Roof	= 2.0 :12
Slope = Slope of Roof	= 9.46 Deg	HtEnt = Height Entry Type	= Lowest
EHt = Lowest height of Roof	= 11.062 ft	H = Mean Roof Height	= 11.811 ft
RHt = Roof Highest Height	= 12.561 ft	L = Width Normal to Ridge	= 17.986 ft
D = Length Along Ridge	= 36.333 ft	Flow = Wind Flow Method	= Obstructed

Exposure Constants [Tbl 26.11-1]:

α = 3-s Gust-speed exponent	= 9.500	Z_g = Nominal Ht of Boundary Layer	= 900.000 ft
$\hat{a}$ = Reciprocol of α	= 0.105	b = 3 sec gust speed factor	= 1.000
α_m = Mean hourly Wind-Speed Exponent	= 0.154	b_m = Mean hourly Windspeed Exponent	= 0.650
c = Turbulence Intensity Factor	= 0.200	ε = Integral Length Scale Exponent	= 0.2000

Gust Factor Calculation for Wind: [Wind Dir 0 Deg]

Gust Factor Category I Rigid Structures - Simplified Method

G_1	= Simplified: For Rigid Structures can use 0.85	= 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m	= Equiv Struc Height: $Max(0.6 \cdot h, Z_{min})$	= 15.000 ft
I_{zm}	= Turbulence Intensity: $c \cdot (33/Z_m)^{1/6}$ [Eq 26.11-1]	= 0.228
L_{zm}	= Turbulence Integral Length Scale: $\ell \cdot (Z_m/33)^{\varepsilon}$ [Eq 26.11-9]	= 427.057 ft
B	= Building Width Width Normal to Wind Direction	= 36.333 ft
Q	= $[1/(1+0.63 \cdot [(B+h)/L_{zm}]^{0.63})]^{0.5}$ [Eq 26.11-8]	= 0.929
G_2	= Detailed: $0.925 \cdot [(1+1.7 \cdot g_q \cdot I_{zm} \cdot Q)/(1+1.7 \cdot g_v \cdot I_{zm})]$ [Eq 26.11-6]	= 0.888

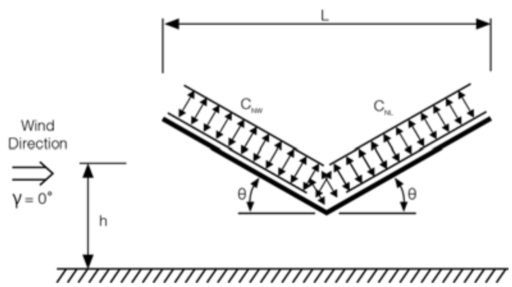
Gust Factor Used in Analysis

G	= Gust Factor: $Min(G_1, G_2)$	= 0.850

Main Wind Force Resisting System (MWFRS) Wind Calculations per Ch 27 Pt1:

h	= Mean structure height	= 11.811 ft
h_{grade}	= Elevation from Grade to Top of Structure	= 11.811 ft
K_h	= $2.01 \cdot (15/Z_g)^{2/\alpha}$ [Tbl 26.10-1]	= 0.849
K_{zt}	= No Topographic feature specified	= 1.000
K_d	= Wind Directionality Factor per Tbl 26.6-1	= 0.85
$+GC_{pi}$	= Open Positive Internal Pressure Tbl 26.13-1	= +0.00
$-GC_{pi}$	= Open Negative Internal Pressure Tbl 26.13-1	= 0.00
LF	= Load Factor based upon ASD Design	= 0.60
K_e	= Ground Elev Factor [Tbl 26.9-1]	= 1.000
q_h	= $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1]	= 12.93 psf

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-6 - Wind Dir 0 Deg:



q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-6 on Troughed Free Roof - Wind Dir 0 Deg
All wind pressures include a Load Factor (LF) of 0.6

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
Load Case A	-1.495	-0.500	-16.43	-5.49
Load Case B	-0.822	-0.800	-9.03	-8.79

Notes:

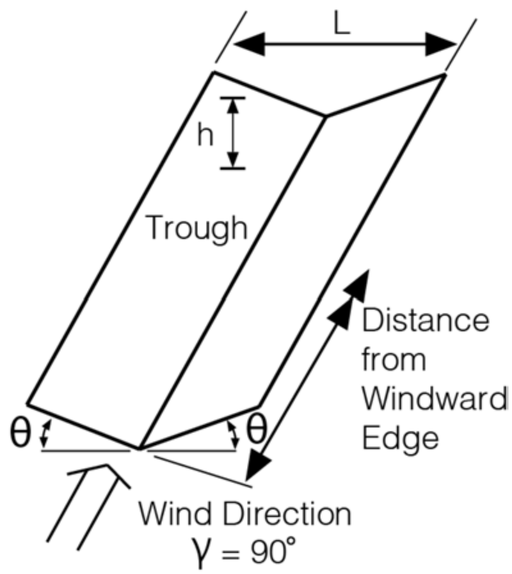
Pnw = Pressure on windward portion of roof: $q_h \cdot G \cdot (C_{nw})$ *[Eq 27.3-2]*

Pnl = Pressure On Leeward portion Of roof: $q_h \cdot G \cdot (C_{nl})$ *[Eq 27.3-2]*

All wind pressures include a Load Factor (LF) of 0.6

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-7 - Wind Dir 90 Deg:



q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-7 - Wind 90 Deg
All wind pressures include a Load Factor (LF) of 0.6

Roof Var	Start Dist ft	End Dist ft	CnA	CnB	Pressure PnA psf	Pressure PnB psf
Roof	0.000	11.811	-1.200	0.500	-13.19	5.49
Roof	11.811	23.623	-0.900	0.500	-9.89	5.49
Roof	23.623	36.333	-0.600	0.300	-6.59	3.30

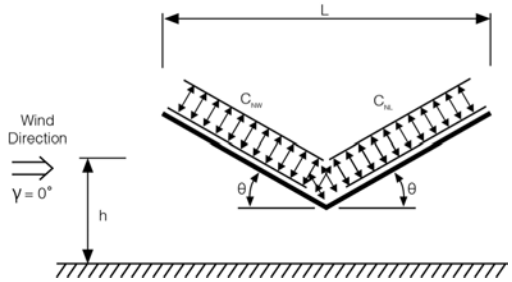
Notes Roof Pressures:

Start = Start Dist from Windward Edge
CnA = Cn for Load Case A
PnA = $q_h \cdot G \cdot (CnA)$ *[Eq 27.3-2]*

End = End Dist from Windward Edge
CnB = Cn for Load Case B
PnB = $q_h \cdot G \cdot (CnB)$ *[Eq 27.3-2]*

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-6 - Wind Dir 180 Deg:



q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-6 on Troughed Free Roof - Wind Dir 180 Deg
All wind pressures include a Load Factor (LF) of 0.6

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
Load Case A	-1.495	-0.500	-16.43	-5.49
Load Case B	-0.822	-0.800	-9.03	-8.79

Notes:

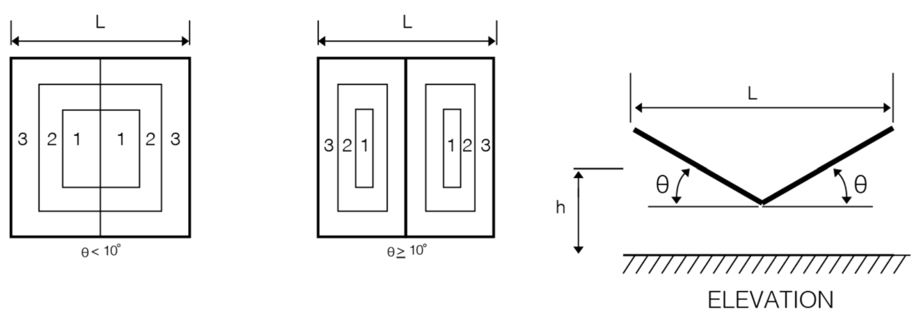
Pnw = Pressure on windward portion of roof: $q_h \cdot G \cdot (C_{nw})$ *[Eq 27.3-2]*

Pnl = Pressure On Leeward portion Of roof: $q_h \cdot G \cdot (C_{nl})$ *[Eq 27.3-2]*

All wind pressures include a Load Factor (LF) of 0.6

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Components And Cladding (C&C) Wind Loads per Ch 30 Pt 5:



h_{grade} = Elevation from Grade to Top of Structure = 11.811 ft

K_h = $2.01 \cdot (15/Z_g)^{2/\alpha}$ [Tbl 26.10-1] = 0.849

K_{zt} = No Topographic feature specified = 1.000

LF = Load Factor based upon ASD Design = 0.60

q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

Theta = Roof Slope = 9.46 Deg

LHD = Least Horizontal Dimension: Min(B, L) = 17.986 ft

a_1 = Min(0.1•LHD, 0.4•h) = 1.799 ft

a = Max(a_1, 0.04•LHD, 3 ft [0.9 m]) = 3.000 ft

Wind Pressures for C&C per Ch 30 Pt 5
All wind pressures include a Load Factor (LF) of 0.6

Description	Width ft	Span ft	Area ft	1/3 Rule	Reference Figure	Zone	Cn Pos	Cn Neg	p Pos psf	p Neg psf
Panel	2.708	5.293	14.333	No	30.7-3	1	0.500	-1.495	5.49	-16.43
Panel	4.250	5.293	22.495	No	30.7-3	2	0.800	-2.243	8.79	-24.65
Panel	2.750	5.293	14.556	No	30.7-3	3	0.800	-2.243	8.79	-24.65

C_n = Net Pressure Coefficient from Ch 30 Pt 5 | *p = Pressure: q_h•G•C_n [Eq 30.7-1]*

MecaWind v2475

West Entrance - Clear

Calculations Prepared by:

Date: Oct 20, 2025

File Location: Current Project Not Saved

General:

Wind Load Standard	= ASCE 7-16	Basic Wind Speed	= 108.0 mph
Exposure Classification	= C	Risk Category	= IV
Structure Type	= Building	Design Basis for Wind Pressures	= ASD
MWFRS Analysis Method	= Ch 27 Pt 1	C&C Analysis Method	= Ch 30 Pt 5
Dynamic Type of Structure	= Rigid	Show Advanced Options	= True
Reset Advanced Options to Default Values	= Defaults	Simple Diaphragm Building	= False
Show Base Reactions in Output	= None	Altitude above Sea Level	= 0.000 ft
Base Elevation Of Structure	= 0.000 ft	MWFRS Pressure Elevations	= Mean Ht
Topographic Effects	= None	Override Directionality Factor K_d	= False
Override the Gust Factor G	= False	Override Minimum Pressure	= False

Building:

Roof Type	= Troughed	Enclosure Classification	= Open
Help = Help on Roof Type	= Help	Pitch = Pitch of Roof	= 2.0 :12
Slope = Slope of Roof	= 9.46 Deg	HtEnt = Height Entry Type	= Lowest
EHt = Lowest height of Roof	= 11.062 ft	H = Mean Roof Height	= 11.811 ft
RHt = Roof Highest Height	= 12.561 ft	L = Width Normal to Ridge	= 17.986 ft
D = Length Along Ridge	= 36.333 ft	Flow = Wind Flow Method	= Clear

Exposure Constants [Tbl 26.11-1]:

α = 3-s Gust-speed exponent	= 9.500	Z_g = Nominal Ht of Boundary Layer	= 900.000 ft
â = Reciprocol of α	= 0.105	b = 3 sec gust speed factor	= 1.000
α_m = Mean hourly Wind-Speed Exponent	= 0.154	b_m = Mean hourly Windspeed Exponent	= 0.650
c = Turbulence Intensity Factor	= 0.200	ε = Integral Length Scale Exponent	= 0.2000

Gust Factor Calculation for Wind: [Wind Dir 0 Deg]

Gust Factor Category I Rigid Structures - Simplified Method

G_1 = Simplified: For Rigid Structures can use 0.85 = 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m	= Equiv Struc Height: Max(0.6•h, Z_{min})	= 15.000 ft
I_{zm}	= Turbulence Intensity: $c\cdot(33/Z_m)^{1/6}$ [Eq 26.11-1]	= 0.228
L_{zm}	= Turbulence Integral Length Scale: $\ell\cdot(Z_m/33)^{\varepsilon}$ [Eq 26.11-9]	= 427.057 ft
B	= Building Width Width Normal to Wind Direction	= 36.333 ft
Q	= $[1/(1+0.63\cdot[(B+h)/L_{zm}]^{0.63})]^{0.5}$ [Eq 26.11-8]	= 0.929
G_2	= Detailed: $0.925\cdot[(1+1.7\cdot g_q\cdot I_{zm}\cdot Q)/(1+1.7\cdot g_v\cdot I_{zm})]$ [Eq 26.11-6]	= 0.888

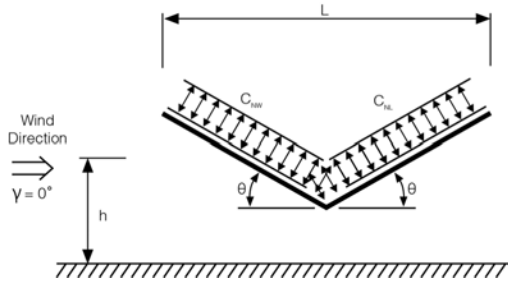
Gust Factor Used in Analysis

G = Gust Factor: Min(G_1, G_2) = 0.850

Main Wind Force Resisting System (MWFRS) Wind Calculations per Ch 27 Pt1:

h	= Mean structure height	= 11.811 ft
h_{grade}	= Elevation from Grade to Top of Structure	= 11.811 ft
K_h	= $2.01\cdot(15/Z_g)^{2/\alpha}$ [Tbl 26.10-1]	= 0.849
K_{zt}	= No Topographic feature specified	= 1.000
K_d	= Wind Directionality Factor per Tbl 26.6-1	= 0.85
$+GC_{pi}$	= Open Positive Internal Pressure Tbl 26.13-1	= +0.00
$-GC_{pi}$	= Open Negative Internal Pressure Tbl 26.13-1	= 0.00
LF	= Load Factor based upon ASD Design	= 0.60
K_e	= Ground Elev Factor [Tbl 26.9-1]	= 1.000
q_h	= $0.00256\cdot K_h\cdot K_{zt}\cdot K_d\cdot K_e\cdot V^2 * LF$ [Eq 26.10-1]	= 12.93 psf

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-6 - Wind Dir 0 Deg:



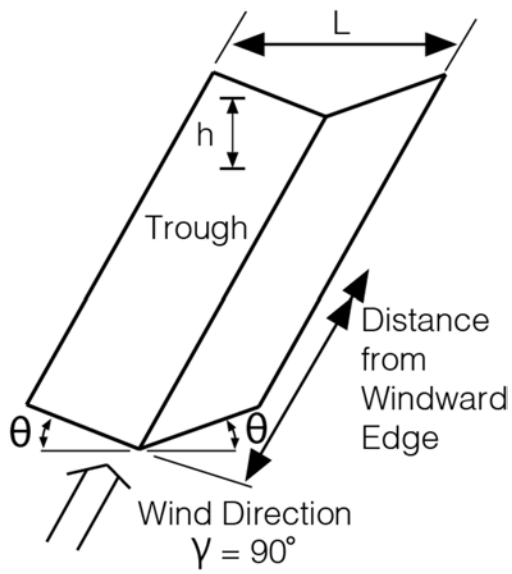
q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-6 on Troughed Free Roof - Wind Dir 0 Deg
All wind pressures include a Load Factor (LF) of 0.6

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
Load Case A	-1.100	0.326	-12.09	3.58
Load Case B	-0.122	1.174	-1.34	12.90

Notes:
Pnw = Pressure on windward portion of roof: $q_h \cdot G \cdot (C_{nw})$ [Eq 27.3-2]
Pnl = Pressure On Leeward portion Of roof: $q_h \cdot G \cdot (C_{nl})$ [Eq 27.3-2]
All wind pressures include a Load Factor (LF) of 0.6
• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-7 - Wind Dir 90 Deg:



q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

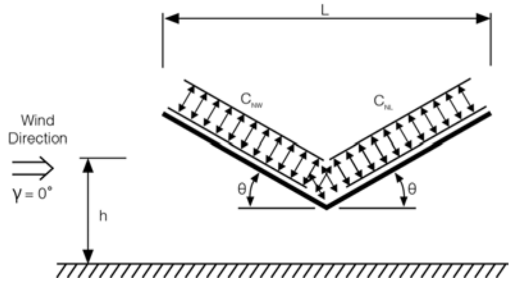
MWFRS Wind Pressures per Fig 27.3-7 - Wind 90 Deg
All wind pressures include a Load Factor (LF) of 0.6

Roof Var	Start Dist ft	End Dist ft	CnA	CnB	Pressure PnA psf	Pressure PnB psf
Roof	0.000	11.811	-0.800	0.800	-8.79	8.79
Roof	11.811	23.623	-0.600	0.500	-6.59	5.49
Roof	23.623	36.333	-0.300	0.300	-3.30	3.30

Notes Roof Pressures:
Start = Start Dist from Windward Edge
CnA = Cn for Load Case A
PnA = $q_h \cdot G \cdot (CnA)$ [Eq 27.3-2]
End = End Dist from Windward Edge
CnB = Cn for Load Case B
PnB = $q_h \cdot G \cdot (CnB)$ [Eq 27.3-2]

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-6 - Wind Dir 180 Deg:



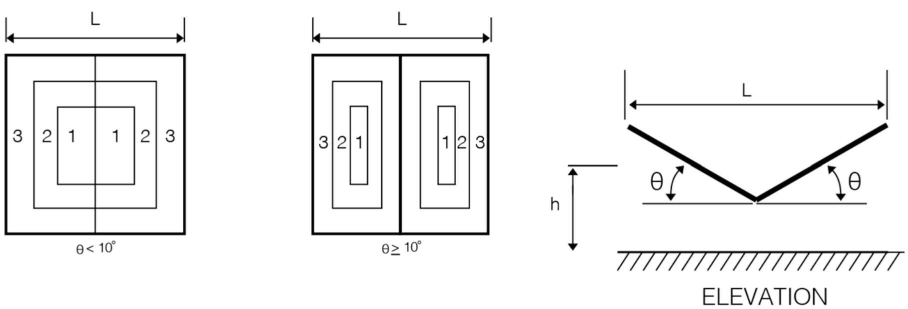
q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-6 on Troughed Free Roof - Wind Dir 180 Deg
All wind pressures include a Load Factor (LF) of 0.6

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
Load Case A	-1.100	0.326	-12.09	3.58
Load Case B	-0.122	1.174	-1.34	12.90

Notes:
Pnw = Pressure on windward portion of roof: $q_h \cdot G \cdot (C_{nw})$ *[Eq 27.3-2]*
Pnl = Pressure On Leeward portion Of roof: $q_h \cdot G \cdot (C_{nl})$ *[Eq 27.3-2]*
All wind pressures include a Load Factor (LF) of 0.6
• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Components And Cladding (C&C) Wind Loads per Ch 30 Pt 5:



h_{grade} = Elevation from Grade to Top of Structure = 11.811 ft
K_h = $2.01 \cdot (15/Z_g)^{2/\alpha}$ [Tbl 26.10-1] = 0.849
K_{zt} = No Topographic feature specified = 1.000
LF = Load Factor based upon ASD Design = 0.60
q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf
Theta = Roof Slope = 9.46 Deg
LHD = Least Horizontal Dimension: Min(B, L) = 17.986 ft
a_1 = Min(0.1•LHD, 0.4•h) = 1.799 ft
a = Max(a_1, 0.04•LHD, 3 ft [0.9 m]) = 3.000 ft

Wind Pressures for C&C per Ch 30 Pt 5
All wind pressures include a Load Factor (LF) of 0.6

Description	Width ft	Span ft	Area ft	1/3 Rule	Reference Figure	Zone	Cn Pos	Cn Neg	p Pos psf	p Neg psf
Panel	2.708	5.293	14.333	No	30.7-3	1	1.174	-1.100	12.90	-12.09
Panel	4.250	5.293	22.495	No	30.7-3	2	1.774	-1.700	19.49	-18.68
Panel	2.750	5.293	14.556	No	30.7-3	3	1.774	-1.700	19.49	-18.68

C_n = Net Pressure Coefficient from Ch 30 Pt 5 | *p = Pressure: q_h•G•C_n [Eq 30.7-1]*

MecaWind v2475

South Entrance - Obstructed

Calculations Prepared by:

Date: Oct 20, 2025

File Location: Current Project Not Saved

General:

Wind Load Standard	= ASCE 7-16	Basic Wind Speed	= 108.0 mph
Exposure Classification	= C	Risk Category	= IV
Structure Type	= Building	Design Basis for Wind Pressures	= ASD
MWFRS Analysis Method	= Ch 27 Pt 1	C&C Analysis Method	= Ch 30 Pt 5
Dynamic Type of Structure	= Rigid	Show Advanced Options	= True
Reset Advanced Options to Default Values	= Defaults	Simple Diaphragm Building	= False
Show Base Reactions in Output	= None	Altitude above Sea Level	= 0.000 ft
Base Elevation Of Structure	= 0.000 ft	MWFRS Pressure Elevations	= Mean Ht
Topographic Effects	= None	Override Directionality Factor K_d	= False
Override the Gust Factor G	= False	Override Minimum Pressure	= False

Building:

Roof Type	= Troughed	Enclosure Classification	= Open
Help = Help on Roof Type	= Help	Pitch = Pitch of Roof	= 2.0 :12
Slope = Slope of Roof	= 9.46 Deg	HtEnt = Height Entry Type	= Lowest
EHt = Lowest height of Roof	= 11.062 ft	H = Mean Roof Height	= 11.815 ft
RHt = Roof Highest Height	= 12.568 ft	L = Width Normal to Ridge	= 18.068 ft
D = Length Along Ridge	= 35.333 ft	Flow = Wind Flow Method	= Obstructed

Exposure Constants [Tbl 26.11-1]:

α = 3-s Gust-speed exponent	= 9.500	Z_g = Nominal Ht of Boundary Layer	= 900.000 ft
â = Reciprocol of α	= 0.105	b = 3 sec gust speed factor	= 1.000
α_m = Mean hourly Wind-Speed Exponent	= 0.154	b_m = Mean hourly Windspeed Exponent	= 0.650
c = Turbulence Intensity Factor	= 0.200	ε = Integral Length Scale Exponent	= 0.2000

Gust Factor Calculation for Wind: [Wind Dir 0 Deg]

Gust Factor Category I Rigid Structures - Simplified Method

G_1	= Simplified: For Rigid Structures can use 0.85	= 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m	= Equiv Struc Height: Max(0.6•h, Z_{min})	= 15.000 ft
I_{zm}	= Turbulence Intensity: $c\cdot(33/Z_m)^{1/6}$ [Eq 26.11-1]	= 0.228
L_{zm}	= Turbulence Integral Length Scale: $\ell\cdot(Z_m/33)^{\varepsilon}$ [Eq 26.11-9]	= 427.057 ft
B	= Building Width Width Normal to Wind Direction	= 35.333 ft
Q	= $[1/(1+0.63\cdot[(B+h)/L_{zm}]^{0.63})]^{0.5}$ [Eq 26.11-8]	= 0.930
G_2	= Detailed: $0.925\cdot[(1+1.7\cdot g_q\cdot I_{zm}\cdot Q)/(1+1.7\cdot g_v\cdot I_{zm})]$ [Eq 26.11-6]	= 0.888

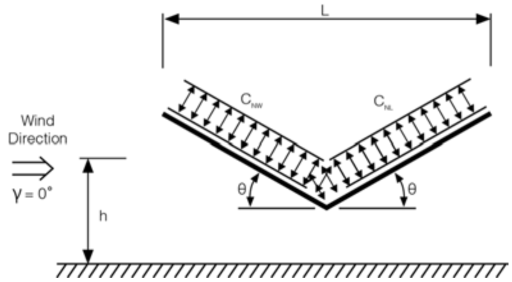
Gust Factor Used in Analysis

G	= Gust Factor: Min(G_1, G_2)	= 0.850

Main Wind Force Resisting System (MWFRS) Wind Calculations per Ch 27 Pt1:

h	= Mean structure height	= 11.815 ft
h_{grade}	= Elevation from Grade to Top of Structure	= 11.815 ft
K_h	= $2.01\cdot(15/Z_g)^{2/\alpha}$ [Tbl 26.10-1]	= 0.849
K_{zt}	= No Topographic feature specified	= 1.000
K_d	= Wind Directionality Factor per Tbl 26.6-1	= 0.85
$+GC_{pi}$	= Open Positive Internal Pressure Tbl 26.13-1	= +0.00
$-GC_{pi}$	= Open Negative Internal Pressure Tbl 26.13-1	= 0.00
LF	= Load Factor based upon ASD Design	= 0.60
K_e	= Ground Elev Factor [Tbl 26.9-1]	= 1.000
q_h	= $0.00256\cdot K_h\cdot K_{zt}\cdot K_d\cdot K_e\cdot V^2 * LF$ [Eq 26.10-1]	= 12.93 psf

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-6 - Wind Dir 0 Deg:



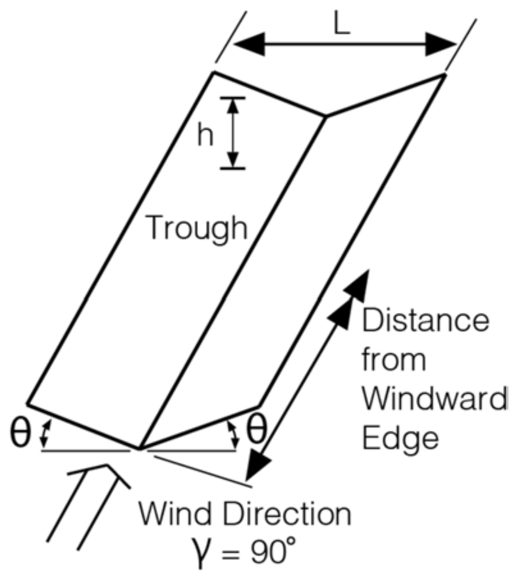
q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-6 on Troughed Free Roof - Wind Dir 0 Deg
All wind pressures include a Load Factor (LF) of 0.6

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
Load Case A	-1.495	-0.500	-16.43	-5.49
Load Case B	-0.822	-0.800	-9.03	-8.79

Notes:
Pnw = Pressure on windward portion of roof: $q_h \cdot G \cdot (C_{nw})$ *[Eq 27.3-2]*
Pnl = Pressure On Leeward portion Of roof: $q_h \cdot G \cdot (C_{nl})$ *[Eq 27.3-2]*
All wind pressures include a Load Factor (LF) of 0.6
• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-7 - Wind Dir 90 Deg:



q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

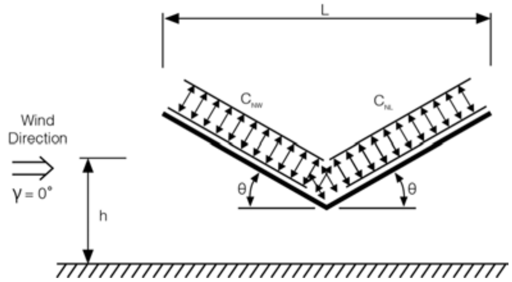
MWFRS Wind Pressures per Fig 27.3-7 - Wind 90 Deg
All wind pressures include a Load Factor (LF) of 0.6

Roof Var	Start Dist ft	End Dist ft	CnA	CnB	Pressure PnA psf	Pressure PnB psf
Roof	0.000	11.815	-1.200	0.500	-13.19	5.49
Roof	11.815	23.630	-0.900	0.500	-9.89	5.49
Roof	23.630	35.333	-0.600	0.300	-6.59	3.30

Notes Roof Pressures:
Start = Start Dist from Windward Edge
CnA = Cn for Load Case A
PnA = $q_h \cdot G \cdot (CnA)$ *[Eq 27.3-2]*
End = End Dist from Windward Edge
CnB = Cn for Load Case B
PnB = $q_h \cdot G \cdot (CnB)$ *[Eq 27.3-2]*

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-6 - Wind Dir 180 Deg:



q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-6 on Troughed Free Roof - Wind Dir 180 Deg
All wind pressures include a Load Factor (LF) of 0.6

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
Load Case A	-1.495	-0.500	-16.43	-5.49
Load Case B	-0.822	-0.800	-9.03	-8.79

Notes:

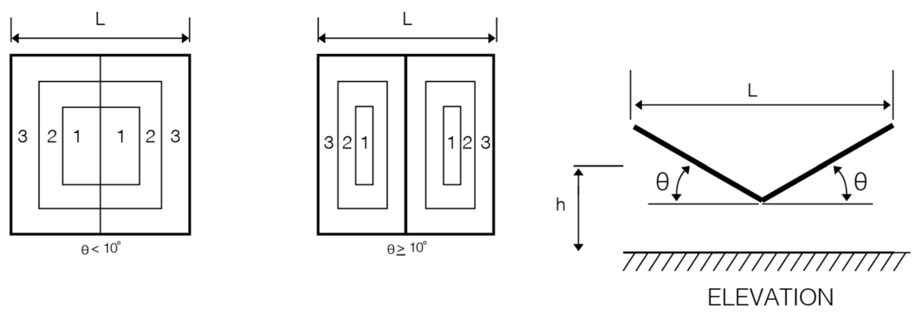
Pnw = Pressure on windward portion of roof: $q_h \cdot G \cdot (C_{nw})$ *[Eq 27.3-2]*

Pnl = Pressure On Leeward portion Of roof: $q_h \cdot G \cdot (C_{nl})$ *[Eq 27.3-2]*

All wind pressures include a Load Factor (LF) of 0.6

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Components And Cladding (C&C) Wind Loads per Ch 30 Pt 5:



h_{grade}	= Elevation from Grade to Top of Structure	= 11.815 ft
K_h	= $2.01 \cdot (15/Z_g)^{2/\alpha}$ [Tbl 26.10-1]	= 0.849
K_{zt}	= No Topographic feature specified	= 1.000
LF	= Load Factor based upon ASD Design	= 0.60
q_h	= $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1]	= 12.93 psf
Theta	= Roof Slope	= 9.46 Deg
LHD	= Least Horizontal Dimension: Min(B, L)	= 18.068 ft
a_1	= Min(0.1•LHD, 0.4•h)	= 1.807 ft
a	= Max(a_1, 0.04•LHD, 3 ft [0.9 m])	= 3.000 ft

Wind Pressures for C&C per Ch 30 Pt 5
All wind pressures include a Load Factor (LF) of 0.6

Description	Width ft	Span ft	Area ft	1/3 Rule	Reference Figure	Zone	Cn Pos	Cn Neg	p Pos psf	p Neg psf
Panel	2.750	5.125	14.094	No	30.7-3	1	0.500	-1.495	5.49	-16.43
Panel	5.250	5.125	26.906	No	30.7-3	2	0.800	-2.243	8.79	-24.65
Panel	2.708	5.125	13.879	No	30.7-3	3	0.800	-2.243	8.79	-24.65

C_n = Net Pressure Coefficient from Ch 30 Pt 5 | p = Pressure: q_h•G•C_n [Eq 30.7-1]

MecaWind v2475

South Entrance - Clear

Calculations Prepared by:
Date: Oct 20, 2025
File Location: Current Project Not Saved

General:

Wind Load Standard	= ASCE 7-16	Basic Wind Speed	= 108.0 mph
Exposure Classification	= C	Risk Category	= IV
Structure Type	= Building	Design Basis for Wind Pressures	= ASD
MWFRS Analysis Method	= Ch 27 Pt 1	C&C Analysis Method	= Ch 30 Pt 5
Dynamic Type of Structure	= Rigid	Show Advanced Options	= True
Reset Advanced Options to Default Values	= Defaults	Simple Diaphragm Building	= False
Show Base Reactions in Output	= None	Altitude above Sea Level	= 0.000 ft
Base Elevation Of Structure	= 0.000 ft	MWFRS Pressure Elevations	= Mean Ht
Topographic Effects	= None	Override Directionality Factor K_d	= False
Override the Gust Factor G	= False	Override Minimum Pressure	= False

Building:

Roof Type	= Troughed	Enclosure Classification	= Open
Help = Help on Roof Type	= Help	Pitch = Pitch of Roof	= 2.0 :12
Slope = Slope of Roof	= 9.46 Deg	HtEnt = Height Entry Type	= Lowest
EHt = Lowest height of Roof	= 11.062 ft	H = Mean Roof Height	= 11.815 ft
RHt = Roof Highest Height	= 12.568 ft	L = Width Normal to Ridge	= 18.068 ft
D = Length Along Ridge	= 35.333 ft	Flow = Wind Flow Method	= Clear

Exposure Constants [Tbl 26.11-1]:

α = 3-s Gust-speed exponent	= 9.500	Z_g = Nominal Ht of Boundary Layer	= 900.000 ft
$\hat{a}$ = Reciprocol of α	= 0.105	b = 3 sec gust speed factor	= 1.000
α_m = Mean hourly Wind-Speed Exponent	= 0.154	b_m = Mean hourly Windspeed Exponent	= 0.650
c = Turbulence Intensity Factor	= 0.200	ε = Integral Length Scale Exponent	= 0.2000

Gust Factor Calculation for Wind: [Wind Dir 0 Deg]

Gust Factor Category I Rigid Structures - Simplified Method

G_1	= Simplified: For Rigid Structures can use 0.85	= 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m	= Equiv Struc Height: Max(0.6•h, Z_{min})	= 15.000 ft
I_{zm}	= Turbulence Intensity: $c \cdot (33/Z_m)^{1/6}$ [Eq 26.11-1]	= 0.228
L_{zm}	= Turbulence Integral Length Scale: $\ell \cdot (Z_m/33)^{\varepsilon}$ [Eq 26.11-9]	= 427.057 ft
B	= Building Width Width Normal to Wind Direction	= 35.333 ft
Q	= $[1/(1+0.63 \cdot [(B+h)/L_{zm}]^{0.63})]^{0.5}$ [Eq 26.11-8]	= 0.930
G_2	= Detailed: $0.925 \cdot [(1+1.7 \cdot g_q \cdot I_{zm} \cdot Q)/(1+1.7 \cdot g_v \cdot I_{zm})]$ [Eq 26.11-6]	= 0.888

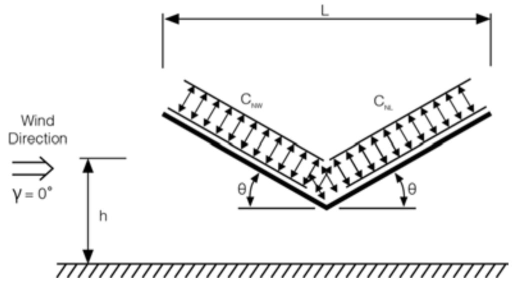
Gust Factor Used in Analysis

G	= Gust Factor: Min(G_1, G_2)	= 0.850

Main Wind Force Resisting System (MWFRS) Wind Calculations per Ch 27 Pt1:

h	= Mean structure height	= 11.815 ft
h_{grade}	= Elevation from Grade to Top of Structure	= 11.815 ft
K_h	= $2.01 \cdot (15/Z_g)^{2/\alpha}$ [Tbl 26.10-1]	= 0.849
K_{zt}	= No Topographic feature specified	= 1.000
K_d	= Wind Directionality Factor per Tbl 26.6-1	= 0.85
$+GC_{pi}$	= Open Positive Internal Pressure Tbl 26.13-1	= +0.00
$-GC_{pi}$	= Open Negative Internal Pressure Tbl 26.13-1	= 0.00
LF	= Load Factor based upon ASD Design	= 0.60
K_e	= Ground Elev Factor [Tbl 26.9-1]	= 1.000
q_h	= $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1]	= 12.93 psf

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-6 - Wind Dir 0 Deg:



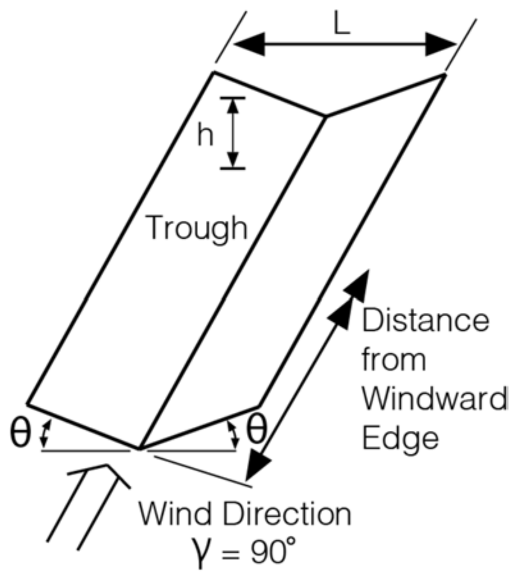
q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-6 on Troughed Free Roof - Wind Dir 0 Deg
All wind pressures include a Load Factor (LF) of 0.6

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
Load Case A	-1.100	0.326	-12.09	3.58
Load Case B	-0.122	1.174	-1.34	12.90

Notes:
Pnw = Pressure on windward portion of roof: $q_h \cdot G \cdot (C_{nw})$ [Eq 27.3-2]
Pnl = Pressure On Leeward portion Of roof: $q_h \cdot G \cdot (C_{nl})$ [Eq 27.3-2]
All wind pressures include a Load Factor (LF) of 0.6
• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-7 - Wind Dir 90 Deg:



q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

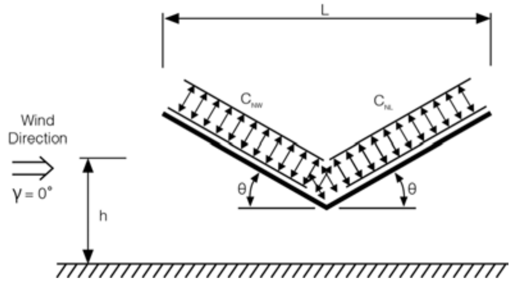
MWFRS Wind Pressures per Fig 27.3-7 - Wind 90 Deg
All wind pressures include a Load Factor (LF) of 0.6

Roof Var	Start Dist ft	End Dist ft	CnA	CnB	Pressure PnA psf	Pressure PnB psf
Roof	0.000	11.815	-0.800	0.800	-8.79	8.79
Roof	11.815	23.630	-0.600	0.500	-6.59	5.49
Roof	23.630	35.333	-0.300	0.300	-3.30	3.30

Notes Roof Pressures:
Start = Start Dist from Windward Edge
CnA = Cn for Load Case A
PnA = $q_h \cdot G \cdot (CnA)$ [Eq 27.3-2]
End = End Dist from Windward Edge
CnB = Cn for Load Case B
PnB = $q_h \cdot G \cdot (CnB)$ [Eq 27.3-2]

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Wind Pressures on Open Building Troughed Free Roof per Fig 27.3-6 - Wind Dir 180 Deg:



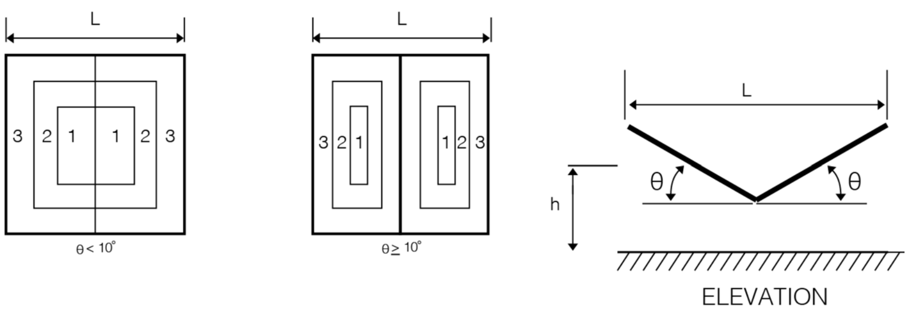
q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf

MWFRS Wind Pressures per Fig 27.3-6 on Troughed Free Roof - Wind Dir 180 Deg
All wind pressures include a Load Factor (LF) of 0.6

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
Load Case A	-1.100	0.326	-12.09	3.58
Load Case B	-0.122	1.174	-1.34	12.90

Notes:
Pnw = Pressure on windward portion of roof: $q_h \cdot G \cdot (C_{nw})$ *[Eq 27.3-2]*
Pnl = Pressure On Leeward portion Of roof: $q_h \cdot G \cdot (C_{nl})$ *[Eq 27.3-2]*
All wind pressures include a Load Factor (LF) of 0.6
• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Components And Cladding (C&C) Wind Loads per Ch 30 Pt 5:



h_{grade} = Elevation from Grade to Top of Structure = 11.815 ft
K_h = $2.01 \cdot (15/Z_g)^{2/\alpha}$ [Tbl 26.10-1] = 0.849
K_{zt} = No Topographic feature specified = 1.000
LF = Load Factor based upon ASD Design = 0.60
q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1] = 12.93 psf
Theta = Roof Slope = 9.46 Deg
LHD = Least Horizontal Dimension: Min(B, L) = 18.068 ft
a_1 = Min(0.1•LHD, 0.4•h) = 1.807 ft
a = Max(a_1, 0.04•LHD, 3 ft [0.9 m]) = 3.000 ft

Wind Pressures for C&C per Ch 30 Pt 5
All wind pressures include a Load Factor (LF) of 0.6

Description	Width ft	Span ft	Area ft	1/3 Rule	Reference Figure	Zone	Cn Pos	Cn Neg	p Pos psf	p Neg psf
Panel	2.750	5.125	14.094	No	30.7-3	1	1.174	-1.100	12.90	-12.09
Panel	5.250	5.125	26.906	No	30.7-3	2	1.774	-1.700	19.49	-18.68
Panel	2.708	5.125	13.879	No	30.7-3	3	1.774	-1.700	19.49	-18.68

C_n = *Net Pressure Coefficient from Ch 30 Pt 5* | p = *Pressure:* $q_h \cdot G \cdot C_n$ *[Eq 30.7-1]*

Engineering & Technical Services, Inc.
27121 469th Ave / PO Box 308
Tea, SD 57064-8100
Phone:(605) 498-1290 Fax:(605) 498-1299

Client:	Lacey Glass	Job #:	-
Job Name:	Puyallup Public Safety Building	Date:	10/23/2025
Location:	Puyallup, WA	Designed by:	CMN

South Entrance

Bracket to Steel

Uplift Loading : Actual Load = 780 # = 29 psf x 5.125' x 5.25'

Allowable = 5/8" stud screw to attach Bracket to Steel
Quantity = 1 - (1) @ each bracket
Tension / Withdrawal Capacity (lb)= 2414 #
Total Tension / Withdrawal Capacity (lb)= 2414 #

Actual / Allowable = **0.32**

Panel Fixture

Uplift Loading : Actual Load = 225 # = 29 psf x 3'-7.875" x 2'-1.5"

Allowable = HSFEX14BS Fixture
Quantity = 1 - (1) fixture at each panel corner
Tension / Withdrawal Capacity (lb)= 592 #
Total Tension / Withdrawal Capacity (lb)= 592 #

Actual / Allowable = **0.38**

Spider Fitting

Uplift Loading : Actual Load = 225 # = 29 psf x 3'-7.875" x 2'-1.5" (per arm in fitting)

Allowable = Spider fitting
Quantity = 1 - (1) arm
Tension / Withdrawal Capacity (lb)= 942 #
Total Tension / Withdrawal Capacity (lb)= 942 #

Actual / Allowable = **0.24**

Gravity Loading : Actual Load = 381 # = 46 psf x 3'-7.875" x 2'-1.5" (per arm in fitting)

Allowable = Spider fitting
Quantity = 1 - (1) arm
Tension / Withdrawal Capacity (lb)= 942 #
Total Tension / Withdrawal Capacity (lb)= 942 #

Actual / Allowable = **0.40**

Engineering & Technical Services, Inc.
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Client:	Lacey Glass	Job #:	-
Job Name:	Puyallup Public Safety Building	Date:	10/23/2025
Location:	Puyallup, WA	Designed by:	CMN

West Entrance

Bracket to Steel

Uplift Loading : Actual Load = 652 # = 29 psf x 4'-3" x 5'-3.5"

Allowable = 5/8" stud screw to attach Bracket to Steel
Quantity = 1 - (1) @ each bracket
Tension / Withdrawal Capacity (lb)= 2414 #
Total Tension / Withdrawal Capacity (lb)= 2414 #

Actual / Allowable = **0.27**

Panel Fixture

Uplift Loading : Actual Load = 225 # = 29 psf x 3'-7.875" x 2'-1.5"

Allowable = HSFEX14BS Fixture
Quantity = 1 - (1) fixture at each panel corner
Tension / Withdrawal Capacity (lb)= 592 #
Total Tension / Withdrawal Capacity (lb)= 592 #

Actual / Allowable = **0.38**

Spider Fitting

Uplift Loading : Actual Load = 225 # = 29 psf x 3'-7.875" x 2'-1.5" (per arm in fitting)

Allowable = Spider Fitting
Quantity = 1 - (1) arm
Tension / Withdrawal Capacity (lb)= 942 #
Total Tension / Withdrawal Capacity (lb)= 942 #

Actual / Allowable = **0.24**

Gravity Loading : Actual Load = 357 # = 46 psf x 3'-7.875" x 2'-1.5" (per arm in fitting)

Allowable = Spider Fitting
Quantity = 1 - (1) arm
Tension / Withdrawal Capacity (lb)= 942 #
Total Tension / Withdrawal Capacity (lb)= 942 #

Actual / Allowable = **0.38**

Engineering & Technical Services, Inc.
27121 469th Ave / PO Box 308
Tea, SD 57064-8100
Phone:(605) 498-1290 Fax:(605) 498-1299

Client:	Lacey Glass	Job #:	-
Job Name:	Puyallup Public Safety Building	Date:	10/23/2025
Location:	Puyallup, WA	Designed by:	CMN

Load Sample

Bracket to Steel

Uplift Loading : Actual Load = 449 # = 29 psf x 4'-6" x 3'-5.1325"

Allowable = 5/8" stud screw to attach Bracket to Steel
Quantity = 1 - (1) @ each bracket
Tension / Withdrawal Capacity (lb)= 2414 #
Total Tension / Withdrawal Capacity (lb)= 2414 #

Actual / Allowable = **0.19**

Panel Fixture

Uplift Loading : Actual Load = 449 # = 29 psf x 4'-6" x 3'-5.1325"

Allowable = HSFEX14BS Fixture
Quantity = 1 - (1) fixture at each panel corner
Tension / Withdrawal Capacity (lb)= 592 #
Total Tension / Withdrawal Capacity (lb)= 592 #

Actual / Allowable = **0.76**

Spider Fitting

Uplift Loading : Actual Load = 449 # = 29 psf x 4'-6" x 3'-5.1325"

Allowable = Spider Fitting
Quantity = 1 - (1) arm
Tension / Withdrawal Capacity (lb)= 942 #
Total Tension / Withdrawal Capacity (lb)= 942 #

Actual / Allowable = **0.48**

Gravity Loading : Actual Load = 713 # = 46 psf x 4'-6" x 3'-5.1325"

Allowable = Spider Fitting
Quantity = 1 - (1) arm
Tension / Withdrawal Capacity (lb)= 942 #
Total Tension / Withdrawal Capacity (lb)= 942 #

Actual / Allowable = **0.76**

Thread Engagement (HSS members)

$$L_e = \frac{A_t \times 2}{\pi \times K_{nmax} \left[\frac{1}{2} + 0.57735n(E_{smin} - K_{nmax})\right]}$$

Fsu = min tensile strength of screw material
Fnu = min tensile strength of internal thread material
Ast = tensile stress area
d = nom. diameter
E = pitch diameter = d - 0.649p
p = pitch
n = number of threads per inch
G = thread allowance
Tes = pitch diameter tolerance
Knmax = max minor diameter of the internal thread
Esmin = min pitch diameter of the external thread

Fsu = 70000 psi
Fnu = 62000 psi
At = π(0.534)² / 4 = 0.224 in²
d = 0.625
E = 0.625 - (0.649 x 0.091) = 0.566 in
n = 11 TPI
p = 11 TPI = 1" / 11 TPI = 0.091 in (course thread)
G = 0.0017 in (2A thread class)
Tes = 0.0055 in (2A thread class)
Knmax = 0.5119 in (course thread)

$$E_{max} = E - G = 0.566" - 0.0017" = 0.5646"$$

$$E_{smin} = E_{max} - T_{es} = 0.5646" - 0.0055" = 0.5591"$$

$$L_e = \frac{0.224\, in^2 \times 2}{\pi \times 0.5119" \times \left[\frac{1}{2} + 0.57735n(0.5591" - 0.5119")\right]} = 0.348"$$

Thread engagement of dissimilar materials $L_{e2} = J \times L_e \;\; if\, J > 1$

$$J = \frac{A_{ss} \times tensile\ strength\ external\ thread\ material}{A_{sn} \times tensile\ strength\ internal\ thread\ material}$$

$$A_{ss} = \pi \times n \times L_e \times K_{nmax}\left[\frac{1}{2n} + 0.57735(E_{smin} - K_{nmax})\right]$$

$$A_{ss} = \pi \times 11 \times 0.348" \times 0.5119"\left[\frac{1}{2(11)} + 0.57735(0.5591" - 0.5119")\right] = 0.4476\, in^2$$

$$A_{sn} = \pi \times n \times L_e \times E_{smin}\left[\frac{1}{2n} + 0.57735(E_{smin} - K_{nmax})\right]$$

$$A_{sn} = \pi \times 11 \times 0.348" \times 0.5591"\left[\frac{1}{2(11)} + 0.57735(0.5591" - 0.5119")\right] = 0.4889\, in^2$$

$$J = \frac{0.4476\, in^2 \times 70000\, psi}{0.4889\, in^2 \times 62000\, psi} = 1.03$$

$$L_{e2} = 1.03 \times 0.348" = 0.359"$$

Thickness of steel member = 0.375 in

Tensile yielding of connecting elements

$$R_n = \frac{F_y A_g}{\Omega} = \frac{(30{,}000\, psi)(0.224\, in^2)}{1.67} = 4024\, lbs$$

Rn = nominal strength
Fy = specified min. yield stress = 30,000 psi (screws)
Ag = gross area = π(0.534)² / 4 = 0.224 in²
Ω (ASD) = 1.67

Tensile rupture of connecitng elements

$$R_n = \frac{F_u A_e}{\Omega} = \frac{(70{,}000\ psi)(0.19\ in^2)}{2.00} = 6650\ lbs$$

R_n = nominal strength
F_u = ultimate yield stress = 70,000 psi (screws)
A_e = effective net area = $0.85A_g$ = 0.85(π(0.534)² / 4) = 0.190 in²
Ω (ASD) = 2.00

Shear yielding of the element

$$R_n = \frac{0.6F_y A_{gv}}{\Omega} = \frac{0.6(30{,}000\ psi)(0.224\ in^2)}{1.50} = 2414\ lbs\ \rightarrow Controls\ shear$$

R_n = nominal strength
F_y = specified min. yield stress = 30,000 psi (screws)
A_g = gross area subjet to shear = π(0.534)² / 4 = 0.224 in²
Ω (ASD) = 1.50

Shear rupture of the element

$$R_n = \frac{0.6F_u A_{nv}}{\Omega} = \frac{0.6(70{,}000\ psi)(0.19\ in^2)}{2.00} = 3990\ lbs$$

R_n = nominal strength
F_u = ultimate yield stress = 70,000 psi (screws)
A_{nv} = net area subject to shear = 0.85(π(0.534)² / 4) = 0.190 in²
Ω (ASD) = 2.00

Internal thread strength

$$F = S_u \times A_{ts}$$

F = nominal thread strength
S_u = shear strength of tapped material
A_{ts} = cross-sectional area which shear occurs

A_{ts} = $\pi\ n\ L_e\ D_{smin}\left[\frac{1}{2n} + 0.57735(D_{smin} - E_{nmax})\right]$ when shear occurs at the roots of the thread

D_{smin} = min. major dia. of external threads
E_{nmax} = max. pitch dia. of internal threads
n = thread per inch
L_e = length of thread engagement

D_{smin} = 0.6112 in
E_{nmax} = 0.5646 in
n = 11 TPI
L_e = 0.359 in
S_u = 0.6(62000 psi) = 37200 psi

$$A_{ts} = \pi(11)(0.359\ in)(0.6112\ in)\left[\frac{1}{2(11)} + 0.57735(0.6112\ in - 0.5646\ in)\right] = 0.5443\ in^2$$

$$F = \frac{(37200\ psi)(0.5443\ in^2)}{2.00} = 10123.9\ lbs$$

Pull-out strength

$$P_{not} = 0.85 t_c d F_{u2}$$

P_{not} = nominal pull-out strength (resistance) of sheet per screw
t_c = lesser of depth of penetration or thickness
d = nominal screw diameter
F_{u2} = tensile strength of member not in contact with screw head or washer
Ω (ASD) = 3.00

$$P_{not} = 0.85(0.359\ in)(0.625\ in)(62000\ psi) = 11824.6\ lbs$$

$$P_{allow} = \frac{P_{not}}{3} = \frac{11824.6\ lbs}{3} = 3941.5\ lbs$$

Thread Engagement (spider fittings)

$$L_e = \frac{A_t \times 2}{\pi \times K_{nmax} \left[\frac{1}{2} + 0.57735n(E_{smin} - K_{nmax})\right]}$$

F_{su} = min tensile strength of screw material
F_{nu} = min tensile strength of internal thread material
A_{st} = tensile stress area
d = nom. diameter
E = pitch diameter = d - 0.649p
p = pitch
n = number of threads per inch
G = thread allowance
T_{es} = pitch diameter tolerance
K_{nmax} = max minor diameter of the internal thread
E_{smin} = min pitch diameter of the external thread

F_{su} = 70000 psi
F_{nu} = 70000 psi
A_t = $\pi(0.534)^2 / 4$ = 0.224 in²
d = 0.625
E = 0.625 - (0.649 x 0.091) = 0.566 in
n = 11 TPI
p = 11 TPI = 1" / 11 TPI = 0.091 in (course thread)
G = 0.0017 in (2A thread class)
T_{es} = 0.0055 in (2A thread class)
K_{nmax} = 0.5119 in (course thread)

$$E_{max} = E - G = 0.566" - 0.0017" = 0.5646"$$

$$E_{smin} = E_{max} - T_{es} = 0.5646" - 0.0055" = 0.5591"$$

$$L_e = \frac{0.224\ in^2 \times 2}{\pi \times 0.5119" \times \left[\frac{1}{2} + 0.57735n(0.5591" - 0.5119")\right]} = 0.348"$$

Spider fittings and scews are of similar materials, L_e = 0.348"

Embedment into spider fitting = 1.0 in

Tensile yielding of connecting elements

$$R_n = \frac{F_y A_g}{\Omega} = \frac{(30{,}000\ psi)(0.224\ in^2)}{1.67} = 4024\ lbs$$

R_n = nominal strength
F_y = specified min. yield stress = 30,000 psi (screws)
A_g = gross area = $\pi(0.534)^2 / 4$ = 0.224 in²
Ω (ASD) = 1.67

Tensile rupture of connecitng elements

$$R_n = \frac{F_u A_e}{\Omega} = \frac{(70{,}000\ psi)(0.19\ in^2)}{2.00} = 6650\ lbs$$

R_n = nominal strength
F_u = ultimate yield stress = 70,000 psi (screws)
A_e = effective net area = $0.85A_g$ = $0.85(\pi(0.534)^2 / 4)$ = 0.190 in²
Ω (ASD) = 2.00

Shear yielding of the element

$$R_n = \frac{0.6F_y A_{gv}}{\Omega} = \frac{0.6(30{,}000\ psi)(0.224\ in^2)}{1.50} = 2414\ lbs \rightarrow Controls\ shear$$

R_n = nominal strength
F_y = specified min. yield stress = 30,000 psi (screws)
A_g = gross area subjet to shear = $\pi(0.534)^2 / 4$ = 0.224 in²
Ω (ASD) = 1.50

Shear rupture of the element

$$R_n = \frac{0.6F_u A_{nv}}{\Omega} = \frac{0.6(70{,}000\ psi)(0.19\ in^2)}{2.00} = 3990\ lbs$$

R_n = nominal strength
F_u = ultimate yield stress = 70,000 psi (screws)
A_{nv} = net area subject to shear = $0.85(\pi(0.534)^2 / 4) = 0.190\ in^2$
Ω (ASD) = 2.00

Internal thread strength

$$F = S_u \times A_{ts}$$

F = nominal thread strength
S_u = shear strength of tapped material
A_{ts} = cross-sectional area which shear occurs

A_{ts} = $\pi\ n\ L_e\ D_{smin}\left[\frac{1}{2n} + 0.57735(D_{smin} - E_{nmax})\right]$ when shear occurs at the roots of the thread

D_{smin} = min. major dia. of external threads
E_{nmax} = max. pitch dia. of internal threads
n = thread per inch
L_e = length of thread engagement

D_{smin} = 0.6112 in
E_{nmax} = 0.5646 in
n = 11 TPI
L_e = 0.359 in
S_u = 0.6(30000 psi) = 18000 psi

$$A_{ts} = \pi(11)(0.359\ in)(0.6112\ in)\left[\frac{1}{2(11)} + 0.57735(0.6112\ in - 0.5646\ in)\right] = 0.5443\ in^2$$

$$F = \frac{(18000\ psi)(0.5443\ in^2)}{2.00} = 4898.7\ lbs$$

Pull-out strength

$$P_{not} = 0.85 t_c d F_{u2}$$

P_{not} = nominal pull-out strength (resistance) of sheet per screw
t_c = lesser of depth of penetration or thickness
d = nominal screw diameter
F_{u2} = tensile strength of member not in contact with screw head or washer
Ω (ASD) = 3.00

$$P_{not} = 0.85(0.359\ in)(0.625\ in)(45000\ psi) = 8582.3\ lbs$$

$$P_{allow} = \frac{P_{not}}{3} = \frac{8582.3\ lbs}{3} = 2860.8\ lbs$$

Glazing Information

Edge Supports: 2 Sides
Glazing Angle: 5°
Lite Dimensions:
Unsupported Length: 64.0 in.
Supported Length: 83.0 in.

Project Details

Project Name: Puyallup Public Safety Building
Location: Puyallup WA
Comments:

Glass Construction (Rectangular)

Single Glazed Lite { Fully Tempered }

Interlayer Type:	PVB
Outboard Ply Thickness:	3/8 in.
Interlayer Thickness:	0.06 in.
Inboard Ply Thickness:	3/8 in.
Nominal Thickness:	3/4 in.

Short Load Duration, Resistance, and Deflection Data

Load (~ 3 sec.) + Glass Weight:	69.8 psf
Load Resistance:	175 psf
Approximate center of glass deflection:	0.55 in.

Long Load Duration, Resistance, and Deflection Data

Load (~ 30 days) + Glass Weight:	34.6 psf
Load Resistance:	131 psf
Approximate center of glass deflection:	0.27 in.

Conclusion

Based on your design information, the load resistance is greater than or equal to the specified loading.

Statement of Compliance

Procedures followed in determining the resistance of this window glass are in accordance with ASTM E1300-04.

Disclaimer:

This software can be used to determine the load resistance of specified glass types exposed to uniform lateral loads of short or long duration subject to the following conditions:

- The glass is free of edge and surface damage and has been properly glazed in the opening in conformance with the manufacturer's recommendations.
- Procedures exist to determine load resistance for rectangular glass assemblies that are:
  a. Continuously supported along all four edges,
  b. Continuously supported along three edges,
  c. Continuously supported along two parallel edges, and
  d. Continuously supported along one edge.
- The software user has the responsibility of selecting the correct procedures for the required application from the software.
- The stiffness of members supporting any glass edge shall be sufficient that under design load, edge deflections shall not exceed L/175, where L denotes that length of the supported edge.
- The manufacturer states that the Safety Plus II 0.090 Polyurethane Large Missile Resistant interlayer is comparable to the PVB interlayer.
- The non-factored load values for laminated glass are representative of test data and calculations performed for an interlayer at a temperature of 50° C (122° F).

For other limiting conditions that may apply, refer to Section 5 of ASTM E1300 and local building codes.

Prepared by: ______________________ on 9/3/2025
P.Zeutenhorst

23 July 2012

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SUBJ: STAINLESS STEEL SPIDER FITTINGS
LOAD RATINGS

I have evaluated the strengths of the CRL stainless steel spider fittings in accordance with the 2006 and 2009 International Building Code. The cast stainless steel components conform to ASTM A 743.

The structural properties and fitting strengths shown in this report are provided for reference purposes. The Specifier or Engineer-of-Record shall be responsible to determine that the fittings are appropriate for the application and the design of the supporting structure.

		Allowable Load per Arm			$\sqrt{(F_x^2+F_y^2+F_x^2)}$
Contents:	Page	F_x	F_y	F_z	Total resultant load on Fitting
FMH	4 - 5	135#	135#	491#	1,354#
GRF	6 - 7	135#	135#	759#	1,886#
GRP	8 - 9	135#	135#	632#	2,528# 412# total for F_x, F_y
PMH	10 - 11	224#	224#	942#	1,237# for unbalanced fittings 2,804# for balanced fittings
PMR	12-13	141#	141#	298#	1,192#
Glass Fittings:					
RRF10	14	139#	139#	715#	765#
RSF10	15	135#	135#	715#	742#
HRF14	16	592#	592#	1,430#	1,430#
HSF14	17	592#	592#	1,430#	1,430#

Resultant load = $\sqrt{[F_x^2+F_y^2+F_z^2]}$

Edward Robison, P.E.

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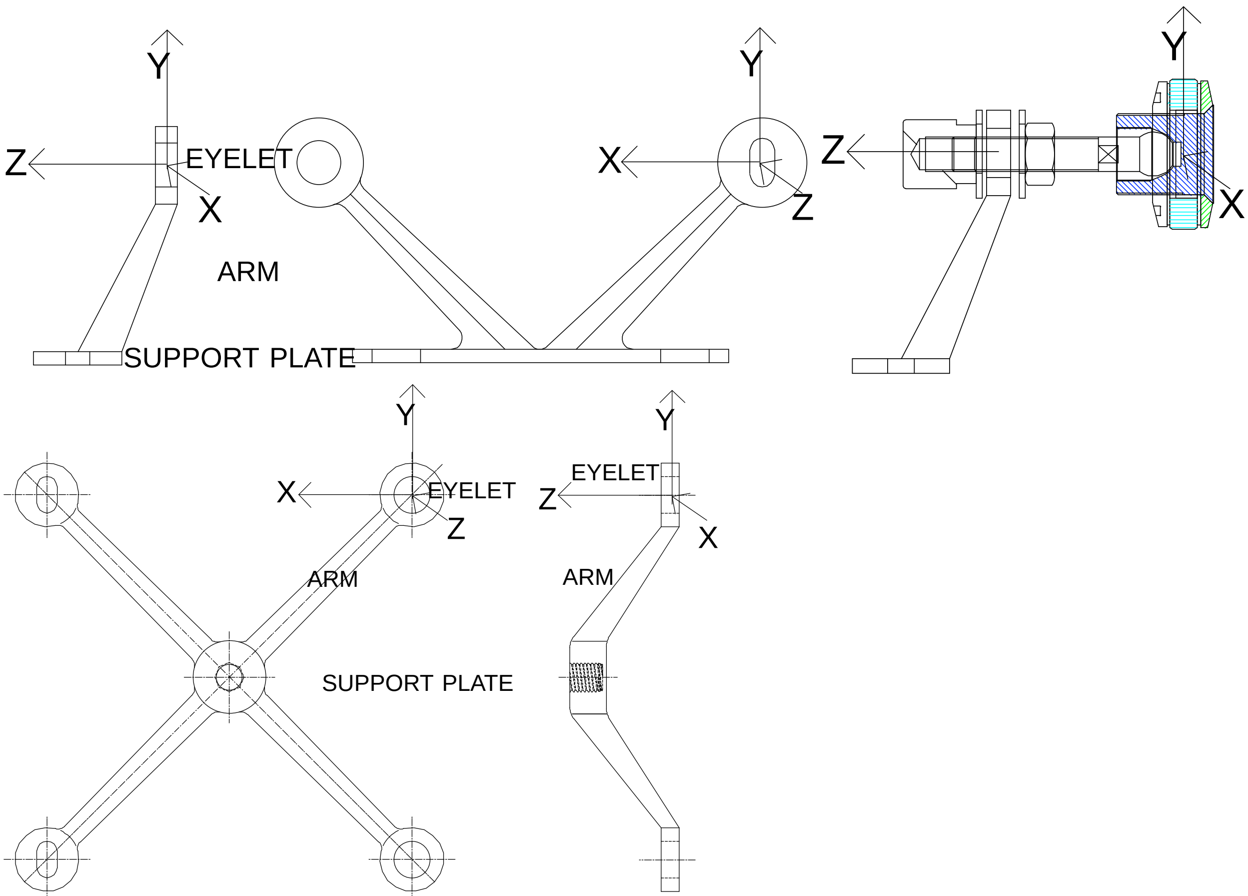
Signed 07/23/2012

CAST STAINLESS STEEL STRENGTH: Design yield strength, $F_y \geq 45$ ksi used for calculations based on 0.02% offset at 30 ksi and $F_u \geq 70$ ksi. Part geometry allows for rapid strain hardening of the part at the base of the fitting arms so that part yield strength in use increases to over 45 ksi, For ultimate strength use $F_u = 70$ksi.
$b/t = 0.625/4.24 < 33.9$ thus $C_y = 3.0$, $E_0 = 28x10^6$ psi, $E_{30} = 14.45x10^6$ psi (at 30 ksi)
$F_{yeff} = C_y*E_{30}/E_0*F_y = 3*14.45/28*30$ksi = 46.4 ksi: Use 45 ksi.

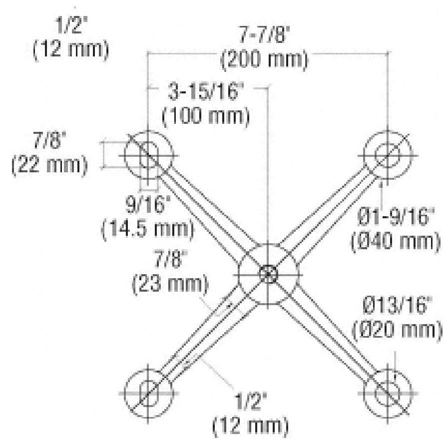
SPIDER FITTING NOMENCLATURE



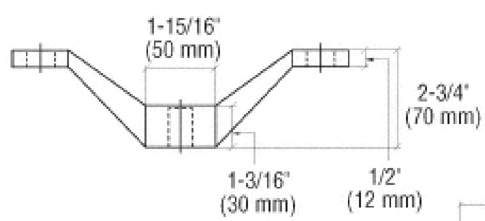
SPIDER FITTINGS
PMH4

Determine standoff strength:
Loads on anchor screw
$M = P*2.5"$ where $P = V$ or H
Shear on screw = $Z = H$ or V
$C = T = M/(1.75"/2) = P*(2.5"/0.875") = 2.86P$

Strength of bolt into support
screw 316 Condition CW ASTM F593-98
size 16mm $A_t = 156.67mm^2 = 0.2428in^2$
$A_v = 201.06mm^2 = 0.3116in^2$
$øT_n = 0.75*71.2$ ksi$*0.2428in^2 = 12{,}966\#$
$øV_n = 0.65*42.8$ ksi$*0.3116in^2 = 8{,}668\#$



Moment resistance of connection:
$øM_n = 12{,}966\#*(1.75"/2) = 11{,}345\#"$
$M_s = øM_n/1.6 = 11{,}345/1.6 = 7{,}090\#"$
$V_s = øV_n/1.6 = 8{,}668/1.6 = 5{,}418\#$
for typical eccentricity for in plane forces (X or Y) = 5.75"
For vertical load:
Determine service load of standoff from interaction equation where:
$(M/M_s)^2+(Z/Z_s)^2 \leq 1.0$
$P = \sqrt{(H^2+V^2)} = Z$ and $M = 5.75"*P$
substituting using P:
$(5.75P/7{,}090)^2 + (P/5{,}418)^2 = 1$ then solving for P
$P = \{1/[(5.75/7{,}090)^2 + 1/5{,}418^2]\}^{1/2}$
$P_{x,y} = 1{,}202\#$ = maximum load for $\sqrt{(X^2+Y^2)}$
$P_z = \sqrt{[7{,}090^2 - (5.75*4*224)^2]}/3.9375 = 1{,}237\#$ For unbalanced load

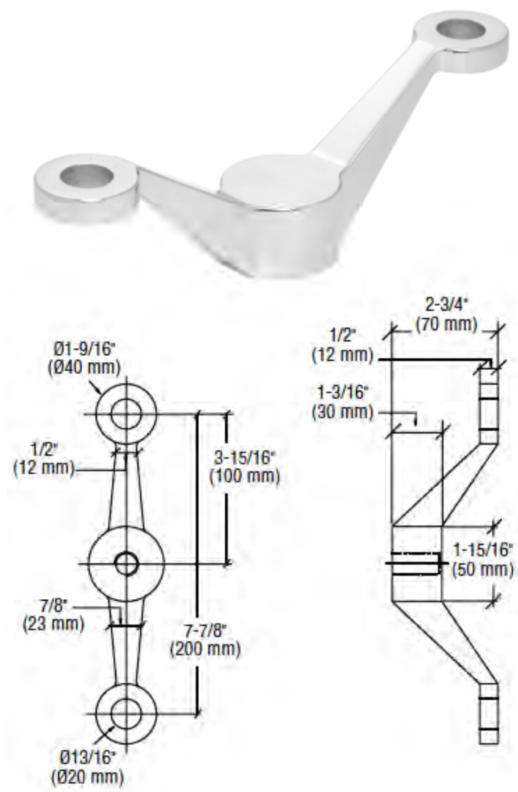


Allowable horizontal load based on standoff strength can be taken as the same as vertical load.
Check bending strength of stud for pure bending:
Applicable t vertical loads only
$Z = 0.63"^3/6 = 0.0417in^3$
$øM_n = 0.9*71.2ksi*0.0417in^3 = 2{,}671\#"$

Check strength of spider fitting arm
horizontal bending strength
$Z_x = Z_y = 1.1875*0.893^2/4 = 0.237\ in^3$
$M_{sx,y} = øM_n/1.6 = 0.9*0.237*45/1.6 = 5{,}993\#"$
$H_{sx,y} = 5{,}993\#"/(3.031") = 1{,}977\#$

PMH (continued)

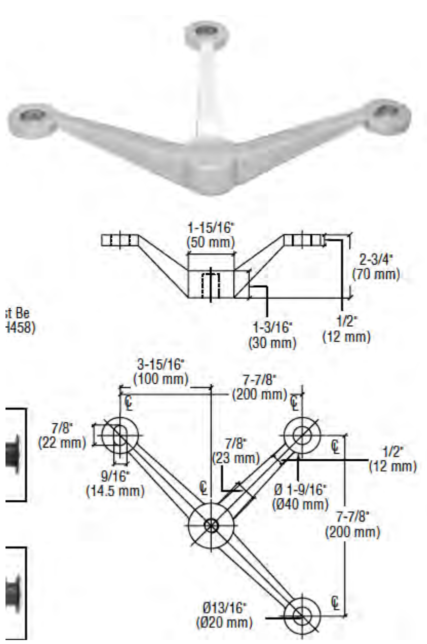
$Z_z = 0.893*1.1875^2/4 = 0.315$ in^3
$M_{sz} = øM_n/1.6 = 0.9*0.315*45/1.6 = 7{,}969$#”
$H_{sz} = 7{,}969$#”/(5.585”) = 1,427#
Bending at eyelet to arm:
$Z_z = 0.5253*0.472^2/4 = 0.0293$
$M_{sz} = 0.9*0.0293*45$ksi/1.6 = 742”#
$P_z = 742$#/(1.575/2) = 942#



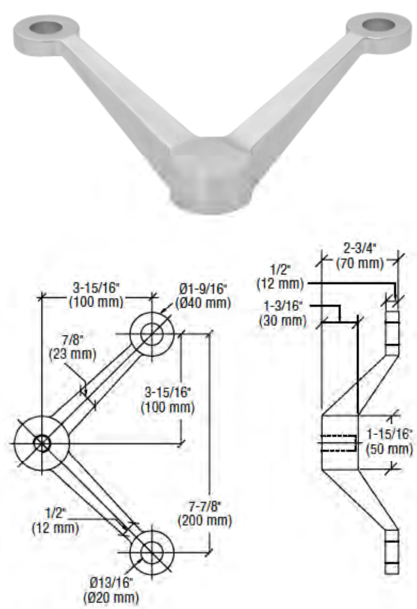
Check strength of eyelet attachment to arm for loads in the glass plane with an offset of 3”.
Offset from glass fitting causes torsion at the eyelet to arm
b = 0.5253” ; = c = 0.472”; $\alpha = 0.213$
$\tau_{max} = F_y\alpha bc^2 = 45ksi*0.213*0.5253*0.472^2 = 1{,}122$”#
$P_{ax} = P_{ay} = (1{,}122/1.67)/3$” = 224#

Fitting variations:
Same load per arm.
Total allowable load for all configurations is the same.
PMH2
Same allowable load per arm
1/2 the allowable load per fitting.
Unbalanced load moment strength is same as for

Will always be unbalanced load



PMH3



PMH2V

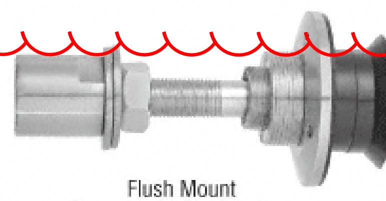
HSF14BS/PS **TYPICAL OF HSFEX14BS**
Combination Swivel head
Mount to spider fitting


Cap Mount
(Standard hole through glass)

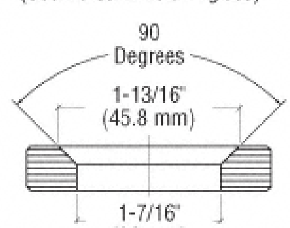
Fitting strength:
M14 threaded rod 316 Stainless steel
Shear strength:
$A_t = 115.44mm^2 = 0.1789in^2$
$A_v = 153.94mm^2 = 0.2386in^2$
$øV_n = 0.65*0.238in^2*42.8$ ksi = 6,621#
$øT_n = 0.75*0.1789in^2*71.2$ ksi = 9,553#
Strength of swivel ball joint: Shear failure around socket rim:
$øV_n = 0.85*42ksi*0.95*0.59"*\pi*0.18"= 11{,}315\#$

For typical installation
$øM_n = 0.9*9{,}553\#*0.55" = 4{,}713\#"$ (based on rod in tension couple)
or for pure bending in rod:
$Z = 0.55"^3/6 = 0.0277in^3$
$øM_n = 0.9*71.2ksi*0.0277in^3 = 1{,}777\#"$
for typical eccentricity = 1/4"+3/8" = 0.625
$P_n = 1{,}777\#"/0.625" = 2{,}843\#$
Determine allowable load
$(M/M_s)+(Z/Z_s) \leq 1.2$
Typical will be L = 200# or W = 350# and D = 100#
$P_u = 1.6*200+1.2*100 = 440\#$ or $1.6*350\#+1.2*100 = 680\#$
$M_u = 680\#*0.625" = 425\#"$
combined:
$(680\#/6{,}621\#)+(425\#"/1{,}777\#")^2 = 0.34 < 1.2$ okay
$F_x = F_y = 1{,}777/3 = 592\#$

STRENGTH OF COUNTERSUNK FITTING:
Check failure of bearing ring:
$øV_n = 0.65*(3/16"*1.4375"*\pi*25$ ksi = 13.76k
Will not control


Flush Mount
(Countersunk hole in glass)

Check for glass stress:
$\sigma = P_n/(0.5t*1.4375\pi)$
Using maximum from above with 1/2" glass:
$\sigma = 1{,}252/(0.5*0.5*1.4375\pi) = 1{,}110$ psi



Flush mount glass fabrication

Bearing area:
$A = (3/16)^2*1.4375\pi = 0.847$ in^2

FITTING REQUIRES TEMPERED GLASS

Reli-A-Pak® Bolt, Nut, & Gasket Sets by Reliable Fasteners, Inc.

18-8 Stainless Steel (AISI 304-SS)

18-8 stainless steel is the most popular type of stainless used in the production of fasteners. This stainless steel is composed of approximately 18% chromium and 8% nickel, thus the name 18-8. The term 18-8 is used interchangeably when referring to 300 series stainless steel. It characterizes fasteners made from 302, 303, 304, and 305 stainless steel, among others. All of these grades have good strength and corrosion resistance. There is little overall difference in corrosion resistance among these grades, but slight differences in chemical composition can make certain grades more resistant than others against particular chemicals or atmospheres. The most common grade of 18-8 stainless steel is 304.

AISI 316 Stainless Steel

The next level of stainless steel commonly used in fastener production is grade 316, which contains an addition of 2% to 4% molybdenum that gives it an improved resistance to corrosion in a wide range of environments. Compared to grade 304, grade 316 stainless steel has a higher resistance to pitting and crevice corrosion in chloride environments. 316 stainless steel also maintains its strength at higher temperatures than 18-8.

	Dimensional Properties	Mechanical Properties Cold Formed		Hot Formed
18-8 & 316 SS Bolts	Head & Body Dimensions to ANSI / ASME B18.2.1 Thread Dimensions to ANSI / ASME B1.1 Class 2A fit Thread Length to ANSI / ASME B18.2.1 minimum – actual thread length may be longer	100-125	Tensile, ksi	70 min
		55-75	Yield, ksi	30 min
		B100	Rockwell Hardness	B70 min
		30	Elongation %	30 min
		40	Reduction of Area %	40 min
		2.0 max	Magnetic Permeability	2.0 max
18-8 & 316 SS Nuts	Thickness & Width Across Flats to ANSI / ASME B18.2.2 Thread Dimensions to ANSI / ASME B1.1 Class 2B fit	100-125	Tensile, ksi	
		55-75	Yield, ksi	
		B100	Rockwell Hardness	
		30	Elongation %	
		40	Reduction of Area %	
		2.0 max	Magnetic Permeability	

This is only a partial description of these specifications, and should not be used as the only source of data.
For complete and up to date information, consult the current version of the specification.