30 Nov 2015

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SUBJ: BLUMCRAFT SMOKE BAFFLE BASE SHOES - SB200

The Blumcraft smoke baffle base shoes are intended to provide a method of mounting glass of various thicknesses overhead. A complete assembly consists of the base shoe(s), mounting fasteners, tempered glass light(s) and through glass fasteners. It may also be used to mount glass by supporting along a wall or any combination of 1, 2 or 3 sides. The smoke baffle assembly is suitable to restrict airflow and smoke movement along ceilings to assist in HVAC control, smoke detector and fire sprinkler isolation. When installed partial height the smoke baffle assembly is not intended to meet any building code or fire code requirements for area separation, smoke partitions or smoke barriers. The smoke baffle base shoes may be used to construct full height smoke partitions in accordance with *International Building Code* Section 711 - Smoke Partitions. Layout and size of the smoke baffle assemblies is outside the scope of this report. The smoke baffle base shoes may also be used to mount glass for other purposes including glass store fronts, glass partitions and decorative glass. Typically the assemblies shall be capable of resisting the following minimum loads or other loads as determined appropriate for the specific application:

Concentrated live load = 50# on one sf any location.
Distributed load = 5 psf perpendicular to the entire area either direction.
Wind load : When applicable to the installation shall be site determined.

Refer to IBC Section 1607.7.1
All allowable loads shown in this report are Allowable Stress Design (ASD) loads (service level loads.)

Glass stresses are designed for a safety factor of of 4.0 (IBC 2407.1.1) where human impact is likely. Allowable stress for wind and seismic loads are based on ASTM E1300-12a. Aluminum components are designed in accordance with the *2015 Aluminum Design Manual* and prior editions. Aluminum extrusions comply with ASTM B221. Stainless steel screws comply with ASTM A564. Glass shall be fabricated in accordance with ASTM C1048.

The engineering properties provided in this report are intended to assist a qualified designer to specify a system capable of complying with the *International Building Code*, all editions and local adaptations. A qualified individual must evaluate the suitability, applicability, loading conditions and strength for a specific installion. **The system specifier is responsible for verifying that the system meets specific jurisdictional and project requirements. This report is not a substitute for a project specific evaluation.**

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Typical Installations:
Glass attached to base shoe with screws through glass at 12” on center.

Base shoe attached to structure with 1/4” screws through base shoe to ceiling structure at 12” on center.

Allowable load is lesser of glass, base shoe, or anchorage strength or deflection limits
MOMENT STRENGTH - SUMMARY

B200 Shoe	ASTM F879 Cond AF		1/2” Temperd glass	
H_g (ft)	w psf	P plf	w psf	P plf
1	402.0	201.0	777.3	220.0
2	100.2	100.2	194.3	110.0
3	44.4	66.6	86.4	73.3
4	24.9	49.8	48.6	55.0
5	15.9	39.7	31.1	44.0
6	11.0	33.0	21.6	36.7
7	8.1	28.2	15.9	31.4
8	6.2	24.6	12.1	27.5
8.9	5.0	22.1	9.8	24.7

Lowest moment strength will control- use allowable load tables found in this report.
Where deflections at service loads may be a concern verify deflections, see pages 6, 7 and 12.

Some installations may require use of laminated glass - verify with local building official to verify if laminated glass is required. Glass must be fully tempered when not laminated.

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LOADS:

Dead load =
1/2" glass, weight = 6.5 psf = D_g
B200 base shoe = 10.5 plf = D_b

$D = (D_g * A_g + D_b) * L$

Where A_g = glass height
L = length

Typical interior installation:
Live Loads
5 psf or 50# on 1 sf

W_L = 5psf*H plf
M_L = 5psf*H^2/2 '#

Where:
$H = H_s + H_g$
H = total height of system
H_g = height of glass not including glass within the base shoe
H_s = height of base shoe

M_P = 50#*H_g
Resisted by lesser of full glass light length or
2*H_g+1'

Wind loads must be evaluated for the project specific conditions. Smoke baffle wind loads may be dependent on specific HVAC conditions or other factors that must be determined for the specific installation. At a minimum the smoke baffles must be designed for 5 psf uniform load over the entire area.

Seismic loads- earthquake loads must be calculated based on ASCE 7-10 Chapter 13 using the project specific criteria.

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GLASS STRENGTH

All glass is fully tempered glass conforming to the specifications of ANSI Z97.1, ASTM C 1048-97b and CPSC 16 CFR 1201. For the glass the minimum Modulus of Rupture F_r is 24,000 psi. The Safety Factor of 4.0 applicable to glass subject to human impact is based on IBC Section 2407. For wind and seismic loads allowable stress = 10,600 psi per ASTM E1300-12a.

Allowable glass bending stress: 24,000/4 = 6,000 psi. – Tensile stress calculated.
Allowable bending stress: 24,000/4 = 6,000 psi - transformed tensile stress.

Bending strength of glass for the given thickness:

$$S = \frac{12''*(t)^2}{6} = 2*(t_{min})^2 \text{ in}^3/\text{ft}$$

t_{min} = minimum glass thickness per ASTM E1300-12a or as specified.

$M_{allL} = 6{,}000\text{psi}*S \text{ in}^3/\text{ft}$ For live loads
$M_{allw} = 10{,}600\text{psi}*S \text{ in}^3/\text{ft}$ For live loads
Maximum glass height can be determined by setting the calculated glass moment equal to the allowable moment:
$M_{allw} = w*H_g^2/2$; or
$M_{allL} = L*H_g$
H_g = glass height, w = uniform load,
L = live load at edge of glass typically not required for smoke baffle applications
$H_g = M_{allL}/L$
$H_g = (2*M_{allw}/w)^{1/2}$
Minimum length of glass required to support concentrated load, P at corner of light-
Assume triangular shear distribution down glass with 33% stress concentration at loaded corner end- no connection at free edge of glass to adjacent light:
P = 50 lb concentrated load typical for smoke baffle applications. P may be 200 lb concentrated for installations where glass is within 42” of a walking surface or is used as a balustrade with shoe at the base.
$b = 4/3*PH_g/M_{allL}$ =
Or for allowable loads based on height:
$L = M_{allL}/H_g$
$w = 2*M_{allw}/H_g^2$
$P = 3/4*bM_{allL}/H_g$

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For 1/2" glass $S = 2*(0.469)^2 = 0.44$ in³/ft
M_{allL} = 6,000psi*0.44 in³/ft = 2,640#"/ft = 220#' For live loads
M_{allw} = 10,600psi*0.44 in³/ft = 4,664#"/ft = 388.67#' For wind or seismic loads
Maximum glass height for wind load:
$H_g \leq \sqrt{(2*777.34\#'/w)}$

Allowable deflection of glass: There is no applicable code limit on the deflection of glass used in this type of installation. For practical purposes the deflection at the glass edge should be limited to $H_g/24$ or H/12 depending on project requirements.

$\Delta = wH_g^4/(8Et^3)$
Where:
E = 10,400,000 psi
t = average glass thickness, 0.5" for 1/2" glass and 0.75" for 3/4" glass
setting $\Delta \leq H_g/24$
$wH_g^4/(8Et^3) \leq H_g/24$
$3wH_g^3/(Et^3) \leq 1$
Solving for H_g:
$H_g \leq [(Et^3)/3w]^{1/3}$
$H_g \leq t*151.35[1/w]^{1/3}$
Simplifying for w = 5psf: for 1' width

$H_g \leq 202.63*t$ in inches
When deflection limits are applied glass deflection will always control.

OTHER GLASS THICKNESSES

The bases shoes will accommodate other glass thicknesses when installed using the appropriate thickness of insert. Roll-in vinyl or grommets are not available to accommodate all glass thicknesses however silicone sealant may be used.

1/4" glass is minimum thickness that may be suitable for use in the B200 shoe and will require use of 1/8" spacer strips on each side of glass or 1/4" spacer on one side.

Allowable glass light height based on glass stress:

Glass Nominal Thickness	S in³ 2*t$_{min}$²	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
1/4	0.0959	69.86	49.40	40.33	34.93	28.78	11.51
5/16	0.1705	93.15	65.87	53.78	46.57	51.16	20.46
3/8	0.2521	113.24	80.08	65.38	56.62	75.62	30.25
1/2	0.4399	149.61	105.79	86.38	74.81	131.98	52.79
5/8	0.7081	189.80	134.21	109.58	94.90	212.42	84.97
3/4	1.0339	229.36	162.18	132.42	114.68	310.18	124.07

Allowable glass light height based on glass deflection limit of H/24:

Glass Nominal Thickness	t_{ave} in	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
1/4	0.239	21.15	16.79	14.67	13.33	29.79	18.84
5/16	0.312	27.62	21.92	19.15	17.40	44.43	28.10
3/8	0.375	33.19	26.34	23.01	20.91	58.55	37.03
1/2	0.5	44.26	35.13	30.68	27.88	90.14	57.01
5/8	0.625	55.32	43.91	38.36	34.85	125.97	79.67
3/4	0.75	66.38	52.69	46.03	41.82	165.60	104.73

Allowable glass light height based on glass deflection limit of H/12:

Glass Nominal Thickness	t_{ave} in	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
1/4	0.239	26.65	21.15	18.48	16.79	42.13	26.64
5/16	0.312	34.79	27.62	24.12	21.92	62.84	39.74
3/8	0.375	41.82	33.19	29.00	26.34	82.80	52.37
1/2	0.5	55.76	44.26	38.66	35.13	127.48	80.62
5/8	0.625	69.70	55.32	48.33	43.91	178.15	112.67
3/4	0.75	83.64	66.38	57.99	52.69	234.19	148.11

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LAMINATED GLASS

In some application the code or local jurisdictions may require the use of laminated glass so that all glass is retained in place in the event of glass fracture. Typically glass will be fabricated with two equal plies of glass with PVB interlayer.

Laminated glass may use annealed, heat strengthened or fully tempered glass.

Determine effective thickness of the laminated glass for stresses and deflections based on ASTM E1300-12a appendix X11.

For PVB G = 70 psi and for SentryGlas interlayer use G = 1,640 psi (11.3 MPa)

(from DuPont SentryGlas *Effective Laminate Thickness for the Design of Laminated Glass* based on 122˚F, (50˚C) and short term load duration)

For two plies of differing thickness:

$h_1 = h_2 = t_{min}$

$h_v = 0.06"$

a = minimum dimension

$h_s = 0.5(h_1+h_2)+h_v$

$h_{s;1} = (h_s h_1)/(h_1+h_2)$

$h_{s;2} = (h_s h_2)/(h_1+h_2)$

$I_s = h_1 h^2_{s;2} + h_2 h^2_{s;1}$

$\Gamma = 1/[1+9.6(EI_s h_v)/(G h_s^2 a^2)]$

effective thickness for deflection:

$h_{ef;w} = (h_1^3 + h_2^3 + 12\Gamma I_s)^{1/3}$

effective thickness for glass stress:

$h_{1;ef;\sigma} = [h_{ef;w}^3/(h_1+2\Gamma I_s)]^{1/2}$

$h_{2;ef;\sigma} = [h_{ef;w}^3/(h_2+2\Gamma I_s)]^{1/2}$

5/16" laminated glass

	h_1, h_2	h_v		$h_{s;1}$ $h_{s;2}$		I_s	h_s
3mm	0.115	0.06		0.0875		0.0017609	0.175
3mm	0.115	0.06		0.0875		0.0017609	0.175
	Shortest Dimension	**Γ PVB**	**Γ SGP**	**$h_{ef;w}$ PVB**	**$h_{ef;w}$ SGP**	**$h_{1;ef;\sigma}$ PVB**	**$h_{1;ef;\sigma}$ SGP**
	12	0.0284	0.4066	0.15386	0.226587	0.1742435	0.2499878
	24	0.1048	0.7327	0.17387	0.264592	0.1985429	0.2759749

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3/8” laminated glass

	h_1, h_2	h_v		$h_{s;1}$ $h_{s;2}$		I_s	h_s
4mm	0.149	0.06		0.1045		0.0032542	0.209
4mm	0.149	0.06		0.1045		0.0032542	0.209
	Shortest Dimension	**Γ PVB**	**Γ SGP**	**$h_{ef;w}$ PVB**	**$h_{ef;w}$ SGP**	**$h_{1;ef;\sigma}$ PVB**	**$h_{1;ef;\sigma}$ SGP**
	12	0.0221	0.3459	0.19556	0.271999	0.2206413	0.3015562
	24	0.0829	0.679	0.21437	0.321178	0.24338011	0.3374735

7/16” laminated glass

	h_1, h_2	h_v		$h_{s;1}$ $h_{s;2}$		I_s	h_s
5mm	0.18	0.06		0.1200		0.005184	0.24
5mm	0.18	0.06		0.1200		0.005184	0.24
	Shortest Dimension	**Γ PVB**	**Γ SGP**	**$h_{ef;w}$ PVB**	**$h_{ef;w}$ SGP**	**$h_{1;ef;\sigma}$ PVB**	**$h_{1;ef;\sigma}$ SGP**
	12	0.0184	0.3045	0.23396	0.312795	0.2635215	0.3477509
	24	0.0696	0.6365	0.25195	0.371469	0.2851395	0.3924824

1/2” - 9/16” laminated glass

	h_1, h_2	h_v		$h_{s;1}$ $h_{s;2}$		I_s	h_s
6mm	0.219	0.06		0.1395		0.0085236	0.279
6mm	0.219	0.06		0.1395		0.0085236	0.279
	Shortest Dimension	**Γ PVB**	**Γ SGP**	**$h_{ef;w}$ PVB**	**$h_{ef;w}$ SGP**	**$h_{1;ef;\sigma}$ PVB**	**$h_{1;ef;\sigma}$ SGP**
	12	0.0151	0.2646	0.28254	0.363601	0.3178715	0.4051691
	24	0.0579	0.59	0.29974	0.433308	0.3384072	0.4605181

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Laminated glass with unequal ply thicknesses may be used. If specified the effective glass thickness must be calculated using the ASTM E1300-12a Appendix 11 or other acceptable method. The glass strength and deflection must be calculated based on the project specified conditions.

Use of annealed glass is limited to laminated glass only. When annealed glass light size should be limited to no more than 48 square feet times the glass thickness each and length to height ratio should not exceed 4. Because annealed glass is more likely to crack from stress concentrations or thermal stresses extra caution is recommended when annealed glass is specified.Allowable glass light height based on glass stress-

Laminated with PVB interlayer annealed glass

Glass Nominal Thickness	S in^3 2*t_{min}^2	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.0788	31.66	22.39	18.28	15.83	5.91	2.36
3/8	0.1185	38.82	27.45	22.41	19.41	8.89	3.55
7/16	0.1626	45.47	32.15	26.25	22.74	12.19	4.88
1/2	0.229	53.97	38.17	31.16	26.99	17.18	6.87

Laminated with PVB interlayer heat strengthened glass

Glass Nominal Thickness	S in^3 2*t_{min}^2	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.0788	44.77	31.66	25.85	22.39	11.82	4.73
3/8	0.1185	54.90	38.82	31.70	27.45	17.77	7.11
7/16	0.1626	64.31	45.47	37.13	32.15	24.38	9.75
1/2	0.229	76.33	53.97	44.07	38.17	34.35	13.74

Laminated with PVB interlayer fully tempered glass

Glass Nominal Thickness	S in^3 2*t_{min}^2	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.0788	63.32	44.77	36.56	31.66	23.64	9.46
3/8	0.1185	77.64	54.90	44.83	38.82	35.55	14.22
7/16	0.1626	90.95	64.31	52.51	45.47	48.77	19.51
1/2	0.229	107.95	76.33	62.32	53.97	68.71	27.48

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Laminated with PVB interlayer - all glass types
Allowable glass light height based on glass deflection limit of H/24:

Glass Nominal Thickness	t_{ave} in	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.1739	15.39	12.22	10.67	9.70	18.49	11.69
3/8	0.2144	18.98	15.06	13.16	11.95	25.31	16.01
7/16	0.2520	22.30	17.70	15.47	14.05	32.25	20.40
1/2	0.2997	26.53	21.05	18.39	16.71	41.83	26.46

Allowable glass light height based on glass deflection limit of H/12:

Glass Nominal Thickness	t_{ave} in	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.1739	19.39	15.39	13.45	12.22	26.15	16.54
3/8	0.2144	23.91	18.98	16.58	15.06	35.79	22.64
7/16	0.2520	28.10	22.30	19.48	17.70	45.61	28.85
1/2	0.2997	33.42	26.53	23.17	21.05	59.16	37.41

For laminated annealed or laminated heat strengthened glass typically glass stress will control and for fully tempered glass deflections will control.

Allowable glass light height based on glass stress-
Laminated with DuPont Sentry Glas Plus interlayer annealed glass

Glass Nominal Thickness	S in^3 $2*t_{min}^2$	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.1524	44.02	31.13	25.42	22.01	11.43	4.57
3/8	0.2278	53.83	38.06	31.08	26.92	17.09	6.83
7/16	0.3081	62.60	44.27	36.14	31.30	23.11	9.24
1/2	0.4241	73.45	51.94	42.41	36.72	31.81	12.72

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Laminated with DuPont Sentry Glas Plus interlayer heat strengthened glass

Glass Nominal Thickness	S in^3 $2*t_{min}^2$	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.1524	62.26	44.02	35.94	31.13	22.85	9.14
3/8	0.2278	76.13	53.83	43.95	38.06	34.17	13.67
7/16	0.3081	88.53	62.60	51.12	44.27	46.22	18.49
1/2	0.4241	103.87	73.45	59.97	51.94	63.62	25.45

Laminated with DuPont Sentry Glas Plus interlayer fully tempered glass

Glass Nominal Thickness	S in^3 $2*t_{min}^2$	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.1524	88.04	62.26	50.83	44.02	45.71	18.28
3/8	0.2278	107.66	76.13	62.16	53.83	68.34	27.34
7/16	0.3081	125.21	88.53	72.29	62.60	92.43	36.97
1/2	0.4241	146.90	103.87	84.81	73.45	127.24	50.89

Laminated with DuPont Sentry Glas Plus interlayer - all glass types
Allowable glass light height based on glass deflection limit of H/24:

Glass Nominal Thickness	t_{ave} in	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.2646	23.42	18.59	16.24	14.75	34.70	21.95
3/8	0.3212	28.43	22.56	19.71	17.91	46.41	29.35
7/16	0.3715	32.88	26.10	22.80	20.71	57.73	36.51
1/2	0.4333	38.35	30.44	26.59	24.16	72.72	45.99

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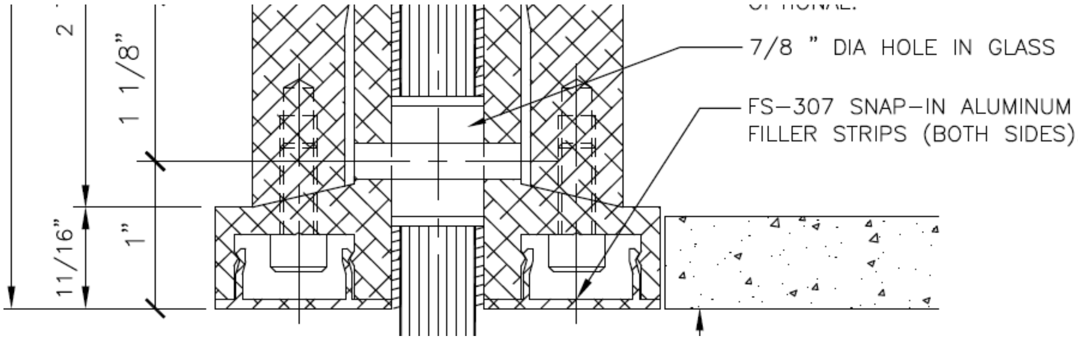
Allowable glass light height based on glass deflection limit of H/12:

Glass Nominal Thickness	t_{ave} in	Max Hg (in) for wind load (psf)				Max Hg (in) - Live	
		5	10	15	20	20 plf	50plf
5/16	0.2646	29.51	23.42	20.46	18.59	49.07	31.04
3/8	0.3212	35.82	28.43	24.84	22.56	65.63	41.51
7/16	0.3715	41.43	32.88	28.72	26.10	81.64	51.63
1/2	0.4333	48.32	38.35	33.50	30.44	102.84	65.04

For laminated annealed or laminated heat strengthened glass typically glass stress will control and for fully tempered glass deflections will control.

GLASS ATTACHMENT
GLASS AT SCREWS



Screw shear strength - 1/4” Countersunk stainless steel flat head screw, Alloy group 1, condition AF, ASTM F593 equivalent.
$F_t \geq 60ksi$, $F_y \geq 20$ ksi
$A_v = 0.0381$ in^2
$P_{nv} = 0.4*F_t*A_v = 0.4*60ksi*0.0381in^2 = 914\#$
Service shear load on screw:
$V_a = 0.65*P_{nv}/1.6 * 2$(double shear) = 743#

Check bearing on aluminum:
F_{Ba} = 23 ksi -ADM Table 2-23
P_{Ba} = 0.25”*0.25”*23ksi = 1,438# > 743#

Aluminum block shear strength (ADM 5.1.3):
$P_{sr} = (F_{su}A_{nv})/n_u$ = (13ksi*0.25”*(0.562-0.125/2)*2*2/3 = 2,164#

Glass bearing
P_{Bg} = 6,000psi*0.75”*0.5” = 2,250# (for 1/2” glass)
P_{Bg} = 6,000psi*0.75”*0.219” = 986# (for 1/4” glass)

For laminated annealed glass allowable glass bearing load is 1/4 of tempered glass calculated above and for laminated heat strengthened is 1/2 of above.

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Glass block shear -
P_{gsr} = 0.5”*0.672”*2*3,000psi = 1,875# for 1/2” glass
Screw shear strength controls the allowable load.
Maximum vertical (dead) load is 743# per screw for tempered glass.

To check allowable glass area apply 2 times glass deadload to allow for seismic load:
D+E = 2*(6.5psf) = 13 psf
A_a = 743/13psf = 57 sf

For a typical 10’ base shoe length the glass may be installed using only 2 screws:
Glass width = 2*57sf/10’ = 11.4’

Since dead load, block shear and glass bearing are all directly proportional to the glass thickness all glass thicknesses will have the same maximum area for dead load per screw based on glass strength.

The screw strength will limit the allowable glass dead load per screw-
D+E = 2*(D)
A_a = 743/(D+E)

Glass thickness	Area/screw Tempered	Area/screw Heat Strengthened	Area/screw Annealed
1/4	128.10	78.13	39.06
3/8	75.82	71.73	35.87
7/16	74.30	74.30	41.02
1/2	57.15	57.15	36.06

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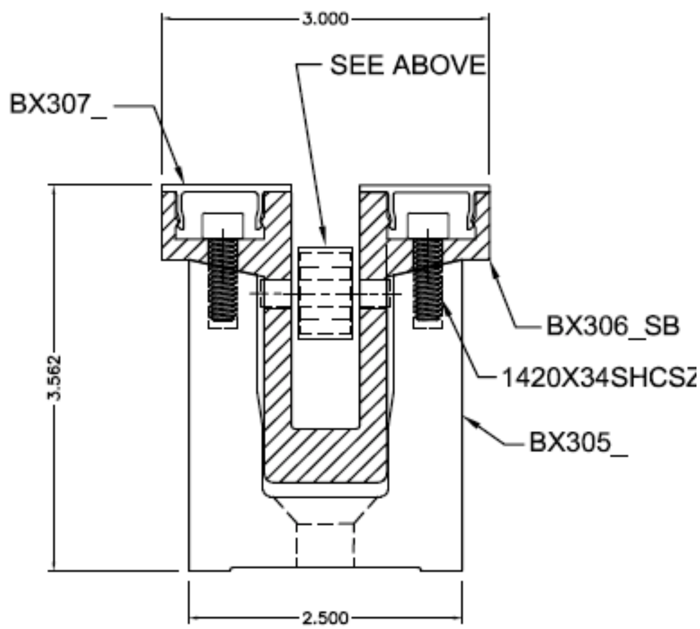
2 1/2" X 3 9/16" SMOKE BAFFLE BASE SHOE - B200

For 1/2" glass - can accommodate monolithic glass from 1/4" to 1/2" and laminated glass from 1/4" to 9/16"



6063-T52 Aluminum extrusion

Fully tempered glass glazed in place, using the dry-glazing system for smoke baffles.

Shoe strength – Vertical legs:
Glass reaction by bearing on legs to form couple. Allowable moment on legs:
$M_a = S_l * F_t$ or F_c
$F_t = F_c$ = 12.5 ksi (ADM Table 2-23, Sec 3.4.4)
S_l = 12"*0.656"^{2}*/6 = 0.8607 in^3/ft
M_a = 12.5 ksi*0.8607 in^3/ft = 10,458"#/ft
Base shoe supports full allowable glass moment.

Leg shear strength @ bottom
t_{min} = 0.656"
F_v= 8.5 ksi (ADM Table 2-24, Sec 3.4.20)
V_{all} = 0.656"*12"/ft*8.5 ksi = 66.9 k/ft

Connection of glass insert to base shoe- 1/4" cap head cap screw:
Screw strength:
T_a = 2,703/2 = 1,350#
For 1/4" machine screw to tapped aluminum
$T_n = 0.58 * A_{sn} * t_c * F_{tu}$
where t_c = thread depth = 0.375"; A_{sn} = 0.539" and F_{tu} = 58 ksi (A36 steel plate)
T_n =0.58*0.539"*0.375*22 ksi = 2,579#
Screw service tension load = 2,579/3 = 860#

Shear strength of screws:
T_a = 0.6*2,703/2 = 811#

Moment strength of glass insert to base shoe connection:
M = (T_a-D/2)*1.875"
M = (860#- 0.667'*6.5H_g/2)*1.875"*12/8"
M = 2,418.75"#- 6.094H_g = 201.5625'# - 0.57083H_g

Base shoe anchorage:
For 1/2" flat head cap screw to tapped steel
For ASTM F879 Cond AF screws
T_n = 12,061# ASTM F879
T_a = 12,061/2 = 6,030#

$T_t = T_d + T_m \leq$ 6,030#
Checked based on 1/2" glass dead load
T_d = D = 6.5psf*H_g+ 10.5 plf (base shoe + glass in base shoe)
T_m = M/(2.5"/2) = 0.8M = 6,019.5 - 6.5H_g
M = (7,524 - 8.125H_g)"#
Anchor spacing for balanced strength:
M = 2,418.75"#- 6.094H_g = (7,524 - 8.125H_g)"#/s
where s = anchor spacing
s = (7,524 - 8.125H_g)/(2,418.75"#- 6.094H_g)

Loading on base shoe is controlled by connection between the glass insert and base shoe.
Allowable loading on glass:
M = wH_g^2/2 = 201.5625'# - 0.57083H_g Solving for w:
w = 2*201.5625/H_g^2 - 2*0.57083/H_g = 403.125/H_g^2 - 1.1417/H_g

M = PH_g = 201.5625'# - 0.57083H_g Solving for P:
P = 201.5625'#/H_g - 0.57083

B200 Shoe	ASTM F879 Cond AF		Maximum base shoe anchor spacing, ft
H_g (ft)	w psf	P plf	
1	402.0	201.0	3.1152
2	100.2	100.2	3.1197
3	44.4	66.6	3.1242
4	24.9	49.8	3.1288
5	15.9	39.7	3.1334
6	11.0	33.0	3.1380
7	8.1	28.2	3.1426
8	6.2	24.6	3.1473
8.9	5.0	22.1	3.1515

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ALTERNATIVE ATTACHMENTS
The base shoes may be attached to substrate other than steel by substituting appropriate anchors. Alternative anchors may be designed and the allowable loading calculated using the methods shown in this report.

ALTERNATIVE ANCHOR SPACING
The capacity of the anchorage for spacing greater than the on center spacing for the balanced condition may be calculated directly based on $(w \text{ or } P)_a = (w \text{ or } P)_{table} * s_{table}/(\text{spacing})$
M_{table} = moment from the table for the specific fastener and base shoe.

WOOD SUBSTRATE:
Attachment to solid wood framing, density G ≥ 0.50 (Douglas Fir, Southern Pine or similar):
Wood lag screw 1/2" diameter withdrawal strength in accordance with the *National Design Specification for Wood Construction* Table 11.2B
W = 378 #/in
C_d = 1.6 For wind load and impact live loads
For 12" on center lag screw spacing the required withdrawl strength = 6,030/3.115 = 1,936#
Required embed depth:
e = 1,936/(378*1.6) = 3.201"
Required lag screw length = 3.201"+1" + 5/16" = 4.514"
Use 1/2" x 5" lag screws

Screws shall be lubricated with soap and a 5/16" pilot hole shall be drilled.

For reduced lag screw embedment the allowable load shall be multiplied by:
actual embedment/3.514"
Minimum allowable screw embedment is 2.0".

For wood species with specific gravity less than 0.5 allowable loads shall be multiplied by:
$G^2/0.25$
where G = specific gravity of wood species used.

Or embedment length may be increased based on:
$e = 3.514*0.25/G^2$

Note: For wood species with specific gravity greater than 0.5 the above equation may be used to calculate a reduced embedment depth.

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TO CONCRETE:

Use Hilti Kwik HUS-EZ (KH EZ) 1/2" x 4" (ESR-3027)

Minimum concrete strength is 3,000 psi and 3" nominal, 2.16" effective anchor embedment.

Concrete Breakout strength:

$N_{cb} = [A_{Nc}/A_{Nco}]\ \psi_{ed,N}\psi_{c,N}\psi_{cp,N}N_b$

A_{Nc}= 1.5*2.16"*2*1.5*2*2.16 = 41.99 (assumes minimum edge distance of 4.5")

A_{Nco}= 9*2.16^2 = 41.99 in^2

$\psi_{ed,N} = 1.0$

$\psi_{c,N} = 1.0$

$\psi_{cp,N}= 1.0$

$N_b = 24*\sqrt{3000}*2.16^{1.5} = 4{,}695\#$

$øN_{cb}$ = 0.65*41.99/41.99*1.0*1.0*0.*4,695 = 4,695#

$T_s = øN_{cb}/1.6$ = 0.75*4,695/1.6 = 2,201#

Pullout strength per ESR-3027:

Will not control.

Maximum anchor spacing:

$T_t = T_d+T_m \leq 2{,}201\#$

Checked based on 1/2" glass dead load

T_d = D = 6.5psf*H_g+ 10.5 plf (base shoe + glass in base shoe)

T_m = M/(2.5"/2) = 0.8M = (2,201-10.5) - 6.5H_g

M = (2,738.125 - 8.125H_g)"#

Anchor spacing for balanced strength:

M = 2,418.75"#- 6.094H_g = (2738- 8.125H_g)"#/s

where s = anchor spacing

s = (2,738 - 8.125H_g)/(2,418.75"#- 6.094H_g) = 1.131'

Use at 1' on center spacing

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