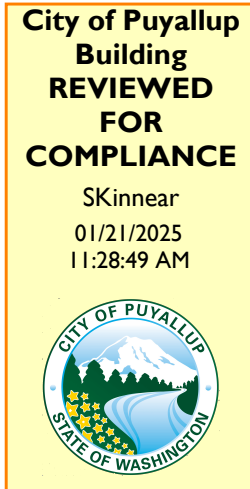
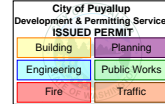


# BSE

Brien Structural Engineers, P.S.



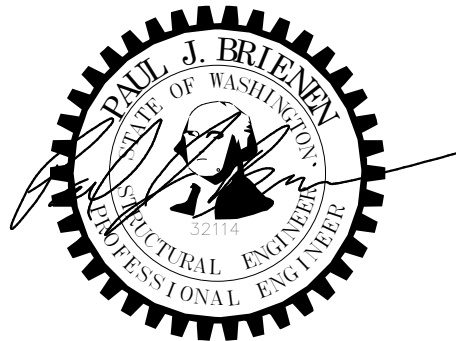
PRCTI20242004



Centeris Voltage Park Data Hall  
1023 39th Avenue South East  
Puyallup, WA 98374

Interior Framing  
Structural Calculations

Calculations required to be provided by  
the Permittee on site for all Inspections



Project Number 24201.6  
December 22, 2024

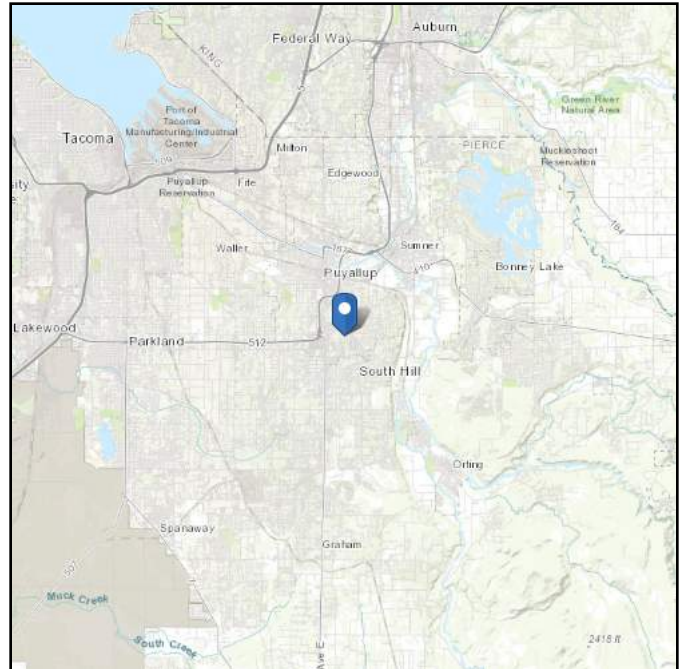
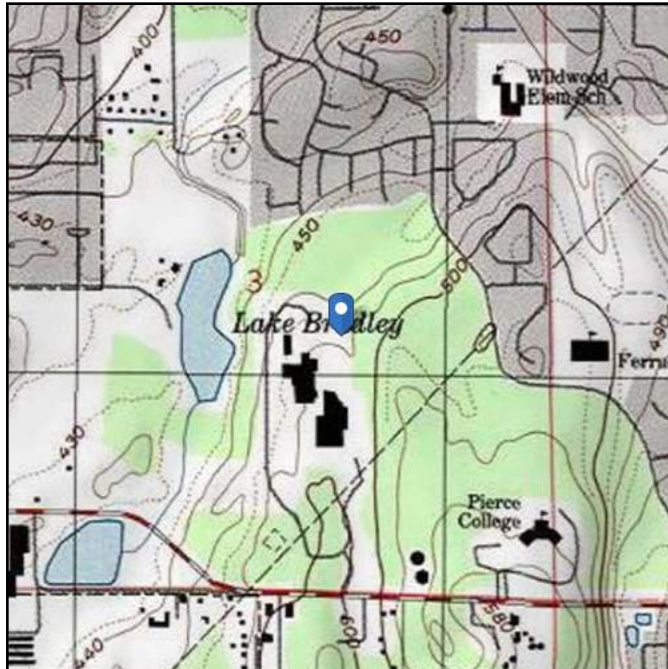
## DESIGN LOADS

# ASCE Hazards Report

**Address:**  
1023 39th Ave SE  
Puyallup, Washington  
98374

**Standard:** ASCE/SEI 7-16  
**Risk Category:** II  
**Soil Class:** D - Default (see  
Section 11.4.3)

**Latitude:** 47.160853  
**Longitude:** -122.279318  
**Elevation:** 482.88472036372787 ft  
(NAVD 88)



## Wind

### Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	73 Vmph
50-year MRI	78 Vmph
100-year MRI	83 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2

Date Accessed: Mon Feb 05 2024

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

**Site Soil Class:** D - Default (see Section 11.4.3)

**Results:**

$S_s$ :	1.257	$S_{D1}$ :	N/A
$S_1$ :	0.434	$T_L$ :	6
$F_a$ :	1.2	PGA :	0.5
$F_v$ :	N/A	PGA <sub>M</sub> :	0.6
$S_{MS}$ :	1.509	$F_{PGA}$ :	1.2
$S_{M1}$ :	N/A	$I_e$ :	1
$S_{DS}$ :	1.006	$C_v$ :	1.351

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

**Data Accessed:** Mon Feb 05 2024

**Date Source:** [USGS Seismic Design Maps](#)

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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# BSE

B rienen S tructural E ngineers, P.S.

## Seismic Forces

## Wall Type Infill Walls

### Wall Seismic Weight, W

**PSF**

- Metal Stud Framing
- (2) Layers 5/8" Gypsum Wall Board

1.5

5

Total = 7 PSF

### Wall & Fastener Seismic Force

$$a_p = \frac{1}{1.006} \quad R_p = \frac{2.5}{1} \quad z/h = \frac{1}{1}$$

$$F_d = \frac{0.4a_p S_{DS} W I_p}{R_p} \left(1 + 2 \frac{z}{h}\right)$$

$$F_d = 0.483W \quad (\text{LRFD})$$
$$E_{ASD} = 0.7F_d = 0.338W \quad (\text{ASD})$$

ASD  
Force = 2.2 PSF

# **BSE**

Project: \_\_\_\_\_

Date: \_\_\_\_\_

**B**rienen **S**tructural **E**ngineers, P.S.

## ANCHOR DESIGN

## Track Connection Distances - Based on Connector Capacities

For 5.0 psf (Live Load)

Max Considered Height

21.42 ft	Track Demand =	$(Ht)/2 * 5 \text{psf} =$	53.6	plf		
Connecting Material	Concrete	MIN SHOTPIN CAPACITY v =	120lbs/anchor	spacing $\leq$	26.9	in
	Concrete on Metal Deck	MIN SHOTPIN CAPACITY v =	215lbs/anchor	spacing $\leq$	36.0	in
	27mil Steel	MIN SCREW CAPACITY v =	89lbs/anchor	spacing $\leq$	19.9	in
	Steel (3/16" Min)	MIN SHOTPIN CAPACITY v =	230lbs/anchor	spacing $\leq$	36.0	in

For 2.2 psf (Seismic)

Max Considered Height

21.42 ft	Track Demand =	$(Ht)/2 * 4 \text{psf} =$	23.6	plf		
Connecting Material	Concrete	MIN SHOTPIN CAPACITY v =	90lbs/anchor	spacing $\leq$	36.0	in
	Concrete on Metal Deck	MIN SHOTPIN CAPACITY v =	90lbs/anchor	spacing $\leq$	36.0	in
	27mil Steel	MIN SHOTPIN CAPACITY v =	89lbs/anchor	spacing $\leq$	36.0	in
	Steel (3/16" Min)	MIN SCREW CAPACITY v =	230lbs/anchor	spacing $\leq$	36.0	in



## Screw Capacities

### Table Notes

- Capacities based on AISI S100 Section E4.
- When connecting materials of different steel thicknesses or tensile strengths, use the lowest values. Tabulated values assume two sheets of equal thickness are connected.
- Capacities are based on Allowable Strength Design (ASD) and include safety factor of 3.0.
- Where multiple fasteners are used, screws are assumed to have a center-to-center spacing of at least 3 times the nominal diameter (d).
- Screws are assumed to have a center-of-screw to edge-of-steel dimension of at least 1.5 times the nominal diameter (d) of the screw.
- Pull-out capacity is based on the lesser of pull-out capacity in sheet closest to screw tip or tension strength of screw.
- Pull-over capacity is based on the lesser of pull-over capacity for sheet closest to screw header or tension strength of screw.
- Values are for pure shear or tension loads. See AISI Section E4.5 for combined shear and pull-over.
- Screw Shear (Pss), tension (Pts), diameter, and head diameter are from CFSEI Tech Note (F701-12).
- Screw shear strength is the average value, and tension strength is the lowest value listed in CFSEI Tech Note (F701-12).
- Higher values for screw strength (Pss, Pts), may be obtained by specifying screws from a specific manufacturer.

### Allowable Screw Connection Capacity (lbs)

Thickness (Mils)	Design Thickness	Fy Yield (ksi)	Fu Tensile (ksi)	#6 Screw (Pss = 643 lbs, Pts = 419 lbs)			#8 Screw (Pss = 1278 lbs, Pts = 586 lbs)			#10 Screw (Pss = 1644 lbs, Pts = 1158 lbs)			#12 Screw (Pss = 2330 lbs, Pts = 2325 lbs)			¼" Screw (Pss = 3048 lbs, Pts = 3201 lbs)		
				0.138" dia, 0.272" Head			0.164" dia, 0.272" Head			0.190" dia, 0.340" Head			0.216" dia, 0.340" Head			0.250" dia, 0.409" Head		
				Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over
18	0.0188	33	33	44	24	84	48	29	84	52	33	105	55	38	105	60	44	127
27	0.0283	33	33	82	37	127	89	43	127	96	50	159	102	57	159	110	66	191
30	0.0312	33	33	95	40	140	103	48	140	111	55	175	118	63	175	127	73	211
33	0.0346	33	45	151	61	140	164	72	195	177	84	265	188	95	265	203	110	318
43	0.0451	33	45	214	79	140	244	94	195	263	109	345	280	124	345	302	144	415
54	0.0566	33	45	214	100	140	344	118	195	370	137	386	394	156	433	424	180	521
68	0.0713	33	45	214	125	140	426	149	195	523	173	386	557	196	545	600	227	656
97	0.1017	33	45	214	140	140	426	195	195	548	246	386	777	280	775	1,016	324	936
118	0.1242	33	45	214	140	140	426	195	195	548	301	386	777	342	775	1,016	396	1,067
54	0.0566	50	65	214	140	140	426	171	195	534	198	386	569	225	625	613	261	752
68	0.0713	50	65	214	140	140	426	195	195	548	249	386	777	284	775	866	328	948
97	0.1017	50	65	214	140	140	426	195	195	548	356	386	777	405	775	1,016	468	1,067
118	0.1242	50	65	214	140	140	426	195	195	548	386	386	777	494	775	1,016	572	1,067

### SUPREME Allowable Screw Connection Capacity (Pounds Per Screw)

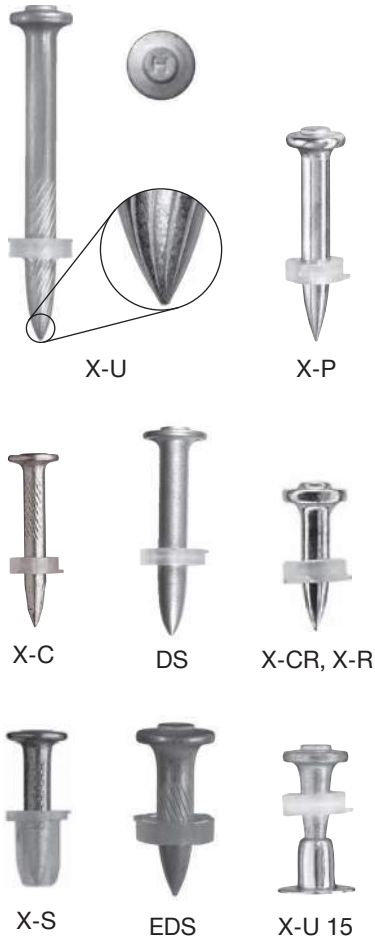
Thickness (mil)	Design Thickness (in)	Fy Yield (ksi)	Fu Tensile (ksi)	#6 Screw (Pss = 643 lbs, Pts = 419 lbs)			#8 Screw (Pss = 1278 lbs, Pts = 586 lbs)			#10 Screw (Pss = 1644 lbs, Pts = 1158 lbs)			#12 Screw (Pss = 2330 lbs, Pts = 2325 lbs)			¼" Screw (Pss = 3048 lbs, Pts = 3201 lbs)		
				0.138" Dia; 0.272" Head			0.164" Dia; 0.272" Head			0.190" Dia; 0.340" Head			0.216" Dia; 0.340" Head			0.250" Dia; 0.409" Head		
				Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over
D25	0.0155	50	65	111	39	137	111	47	137	111	54	171	-	-	-	-	-	-
D20	0.0188	57	65	142 <sup>1</sup>	48	140	150 <sup>1</sup>	57	166	164 <sup>1</sup>	66	208	109	75	208	-	-	-
30EQD	0.0235	57	65	174 <sup>1</sup>	60	140	184 <sup>1</sup>	71	195	236 <sup>1</sup>	82	260	152	93	260	-	-	-
33EQD	0.0235	57	65	174 <sup>1</sup>	60	140	184 <sup>1</sup>	71	195	236 <sup>1</sup>	82	260	152	93	260	-	-	-
33EQS	0.0295	57	65	171	75	140	187	89	195	201	103	326	214	117	326	231	136	392
43EQS	0.0400	57	65	270	102	140	295	121	195	317	140	386	338	159	442	364	184	532

<sup>1</sup>Values are based on testing using AISI S100 procedures.

3.2.5.1	Product description
3.2.5.2	Material specifications
3.2.5.3	Technical data
3.2.5.4	Ordering information

## 3.2.5 GENERAL APPLICATION FASTENERS

### 3.2.5.1 PRODUCT DESCRIPTION



**X-U Universal Series** This universal high performance fastener is designed for applications in concrete and high strength or standard strength steel. The shank diameter is consistent through the fastener offering at 0.157". X-U fastener lengths range from 5/8" through 2-7/8" and are available as single fasteners (P8) or collated (MX) in strips of 10. All X-U fasteners have a unique twist knurling reaching 7/8" from the tip up the shank.

**X-P Premium Concrete Fastener** The X-P fastener is optimized for high performance in concrete base materials. With a shank diameter of 0.157", an optimized conical tip design, and high steel hardness, the X-P is designed for demanding concrete applications, in base materials up to 8,000 psi in strength. The X-P fastener is available in lengths ranging from 5/8" to 1-9/16", making it ideal for drywall track to concrete applications. X-P fasteners are available as single fasteners (P8) or collated (MX) in strips of 10.

**X-C Standard Series** The X-C series of fasteners is a cost effective solution for applications in concrete and masonry. This fastener is not suited for fastening to steel base materials. Fastener lengths range from 3/4" through 2-7/8" with a shank diameter of 0.138". X-C fasteners are offered in a single (P8) fastener version as well as in collated (MX) strips of 10.

**X-CR and X-R Fastener Series** The X-CR is a high performance, corrosion resistant fastener equivalent to SAE 316 stainless steel. This fastener is ideally suited for applications where corrosion is a concern whether on concrete or steel base materials. The X-CR is designed mainly for concrete applications and is offered as a single (P8) fastener in lengths from 5/8" through 2-1/8". The X-R fastener is intended for steel applications and is offered in 1/2" shank length. Shank diameter for these fasteners is 0.145" for shank lengths less than 1-1/2" and 0.157" for longer fasteners.

**X-S Steel Fastener** The X-S is an economical fastener for steel. It has a 0.145" smooth shank diameter and is offered in a 1/2" and 5/8" length. The X-S13 comes collated (MX) in strips of 10 or individually with a plastic "tophat" (THP). The X-S16 comes singly with a metal "tophat" (TH). This fastener is ideally suited for fastening drywall track to standard strength steel and is discussed further in Section 3.2.9.

**X-C G2/G3/B3, X-P G2/G3/B3, X-PN G3, X-S B3** These collated fastener lines for Hilti's gas-actuated and battery actuated tools are designed for applications in interior finishing, mechanical and electrical trades. These fasteners are used for fastenings in concrete and masonry (X-C G2/G3/B3 standard, X-P G2/G3/B3 premium), and steel (X-S B3 and X-P G2/G3). For more details refer to Section 3.2.9.

**DS/EDS Fastener Series** The DS series fastener is a high performance fastener of 0.177" shank diameter suitable for both concrete and steel applications. It is offered in a single fastener version only with a 10 mm dome head design and a 10 mm guidance washer. Available lengths are 3/4" through 2-1/2". Knurling is offered on 3/4" and 7/8" lengths; designated as EDS and ideally suited for steel applications.

**X-U 15 Steel Fastener** The X-U 15 is a premium, high performance fastener designed specifically for attachments to steel (e.g. drywall track, tagging, etc.). It is offered in a 0.145" shank diameter and 5/8" length with a unique step shank design as either single fasteners with metal tophat or collated in strips of 10.

#### Listings/Approvals

**ICC-ES (International Code Council)**  
 ESR-2269 with LABC/LARC Supplement (X-P, X-U and X-U 15)  
 ESR-1663 with LABC/LARC Supplement (DS, EDS, X-R and X-CR)  
 ESR-1752 with LABC/LARC Supplement (X-C, X-P G2/G3/B3, X-S)



### 3.2.5.2 MATERIAL SPECIFICATIONS

Fastener designation	Fastener material	Fastener plating <sup>1</sup>	Steel washer or clip material <sup>1,2</sup>	Washer or clip plating <sup>1,2</sup>
X-P	Carbon Steel	5 µm Zinc	N/A	N/A
X-U	Carbon Steel	5 µm Zinc	Carbon Steel	5 µm Zinc
DS/EDS	Carbon Steel	5 µm Zinc	N/A	N/A
X-C	Carbon Steel	5 µm Zinc	Carbon Steel	5 µm Zinc
X-R, X-CR <sup>3</sup>	SAE 316	N/A	SAE 316	N/A
X-C/ X-P/ X-PN/ X-S: G2/G3/B3	Carbon Steel	2-10 µm Zinc	N/A	N/A
X-CT Forming Nail	Carbon Steel	5 µm Zinc	N/A	N/A
BC X-C	Carbon Steel	5 µm Zinc	Carbon Steel	5 µm Zinc

- The 5 µm zinc coating is in accordance with ASTM B 633, SC 1, Type III. Refer to Section 2.3.3.1 for more information.
- Most fasteners have a plastic washer for guidance when installing. Not all fastener lengths have a pre-mounted steel washer. Refer to Section 3.2.2.4 for more information on available fasteners.
- The X-CR and X-R fastener material is a proprietary material, which provides a corrosion resistance equivalent to SAE 316 stainless steel. The steel washer material is SAE 316 stainless steel.

\* More details about the innovative X-P and X-U fasteners can be found in Section 3.2.6.

### 3.2.5.3 TECHNICAL DATA

#### Allowable loads in normal weight concrete <sup>1,2</sup>

Fastener description	Fastener	Shank diameter in. (mm)	Minimum embedment in. (mm)	Concrete compressive strength							
				2000 psi		4000 psi		6000 psi		8000 psi	
				Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
Premium Concrete Fastener	X-P	0.157 (4.0)	3/4 (19)	100 (0.44)	155 (0.69)	100 (0.44)	175 (0.78)	105 (0.47)	205 (0.91)	135 (0.60)	205 (0.91)
			1 (25)	165 (0.73)	220 (0.98)	180 (0.80)	225 (1.00)	150 (0.67)	300 (1.33)	150 (0.67)	215 (0.96)
			1-1/4 (32)	240 (1.07)	310 (1.38)	280 (1.25)	310 (1.38)	180 (0.80)	425 (1.89)	-	-
			1-1/2 (38)	310 (1.38)	420 (1.87)	-	-	-	-	-	-
Universal Knurled Shank Fasteners	X-U	0.157 (4.0)	3/4 (19)	100 (0.44)	125 (0.57)	100 (0.44)	125 (0.57)	105 (0.47)	205 (0.91)	-	-
			1 (25)	165 (0.73)	190 (0.85)	170 (0.76)	225 (1.00)	110 (0.49)	280 (1.25)	-	-
			1-1/4 (32)	240 (1.07)	310 (1.38)	280 (1.25)	310 (1.38)	180 (0.80)	425 (1.89)	-	-
			1-1/2 (38)	275 (1.22)	420 (1.87)	325 (1.45)	420 (1.87)	-	-	-	-
Standard Fastener	X-C (Black collated strip or guidance washer)	0.138 (3.5)	3/4 (19)	45 (0.20)	75 (0.33)	65 (0.29)	105 (0.47)	95 (0.42)	195 (0.87)	-	-
			1 (25)	85 (0.38)	150 (0.67)	160 (0.71)	200 (0.89)	105 (0.47)	270 (1.20)	-	-
			1-1/4 (32)	130 (0.58)	210 (0.93)	270 (1.20)	290 (1.29)	165 (0.73)	325 (1.45)	-	-
			1-1/2 (38)	175 (0.78)	260 (1.16)	270 (1.20)	360 (1.60)	-	-	-	-
Heavy Duty Fastener	DS	0.177 (4.5)	3/4 (19)	50 (0.22)	120 (0.53)	125 (0.56)	135 (0.60)	-	-	-	-
			1 (25)	130 (0.58)	195 (0.87)	155 (0.69)	240 (1.07)	-	-	-	-
			1-1/4 (32)	220 (0.98)	385 (1.71)	270 (1.20)	425 (1.89)	-	-	-	-
			1-1/2 (38)	300 (1.33)	405 (1.80)	355 (1.58)	450 (2.00)	-	-	-	-
Stainless Steel Fastener	X-CR	0.145 (3.7)	3/4 (19)	30 (0.13)	40 (0.18)	65 (0.29)	40 (0.18)	-	-	-	-
			1 (25)	55 (0.24)	185 (0.82)	120 (0.53)	190 (0.85)	100 (0.44)	170 (0.76)	-	-
			1-1/4 (32)	110 (0.49)	290 (1.29)	125 (0.56)	300 (1.33)	120 (0.53)	440 (1.96)	-	-
		0.157 (4.0)	265 (1.18)	405 (1.80)	350 (1.56)	450 (2.00)	-	-	-	-	
Gas Fastener	X-C B3, X-C G3	0.118 (3.0)	3/4 (19)	110 (0.5)	190 (0.9)	110 (0.5)	190 (0.9)	110 (0.5)	190 (0.9)	-	-
Premium Gas Fastener	X-P 17 G2, X-P 20 G2, X-P G3, X-P B3	0.118 (3.0)	5/8 (16)	-	-	50 (0.2)	120 (0.5)	50 (0.2)	90 (0.4)	-	-
			3/4 (19)	80 (0.4)	120 (0.5)	50 (0.2)	120 (0.5)	50 (0.2)	90 (0.4)	-	-
Forming Fastener	X-CT 47 <sup>3</sup>	0.145 (3.7)	1 (25)	60 (0.27)	65 (0.29)	-	-	-	-	-	-
	X-CT 62 <sup>3</sup>	0.145 (3.7)	1 (25)	75 (0.33)	75 (0.33)	-	-	-	-	-	-

- The tabulated allowable load values are for the low-velocity fasteners only, using a safety factor that is greater than or equal to 5.0, calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.
- Multiple fasteners are recommended for any attachment.
- For temporary fastening of formwork only.

Allowable loads in minimum  $f'_c = 3000$  psi structural lightweight concrete<sup>1,5</sup>

Fastener description	Fastener	Shank diameter in. (mm)	Minimum embedment in. (mm)	Fastener location					
				Installed into concrete		Installed through 3" deep metal deck into concrete <sup>2,3</sup>			
				Tension lb (kN)	Shear lb (kN)	Tension lb (kN)		Shear lb (kN)	
						Upper flute	Lower flute	Upper flute	Lower flute
Premium Concrete Fastener	X-P*	0.157 (4.0)	3/4 (19)	155 (0.7)	165 (0.7)	130 (0.6)	105 (0.5)	285 (1.3)	285 (1.3)
			1 (25)	225 (1.0)	300 (1.3)	215 (1.0)	165 (0.7)	340 (1.5)	340 (1.5)
			1-1/4 (32)	325 (1.4)	445 (2.0)	295 (1.3)	230 (1.0)	375 (1.7)	375 (1.7)
			1-1/2 (38)	425 (1.9)	480 (2.1)	400 (1.8)	330 (1.5)	365 (1.6)	365 (1.6)
Universal Knurled Shank Fasteners	X-U*	0.157 (4.0)	3/4 (19)	125 (0.56)	115 (0.51)	130 (0.58)	95 (0.42)	245 (1.1)	245 (1.1)
			1 (25)	205 (0.91)	260 (1.16)	215 (0.96)	155 (0.69)	330 (1.5)	330 (1.5)
			1-1/4 (32)	315 (1.40)	435 (1.93)	295 (1.31)	200 (0.89)	375 (1.7)	375 (1.7)
			1-1/2 (38)	425 (1.89)	475 (2.11)	400 (1.78)	260 (1.16)	430 (1.9)	430 (1.9)
Standard Fastener	X-C (Black collated strip or guidance washer)	0.138 (3.5)	3/4 (19)	120 (0.53)	175 (0.78)	120 (0.53)	95 (0.42)	265 (1.2)	265 (1.2)
			1 (25)	180 (0.80)	260 (1.16)	215 (0.96)	155 (0.69)	485 (2.2)	485 (2.2)
			1-1/4 (32)	225 (1.00)	400 (1.78)	250 (1.11)	200 (0.89)	500 (2.2)	500 (2.2)
			1-1/2 (38)	285 (1.27)	400 (1.78)	285 (1.27)	210 (0.93)	555 (2.5)	555 (2.5)
Heavy Duty Fastener	DS <sup>4</sup>	0.177 (4.5)	3/4 (19)	100 (0.44)	200 (0.89)	100 (0.44)	-	200 (0.9)	200 (0.9)
			1 (25)	180 (0.80)	360 (1.60)	180 (0.80)	180 (0.80)	405 (1.8)	405 (1.8)
			1-1/4 (32)	300 (1.33)	520 (2.31)	300 (1.33)	250 (1.11)	515 (2.3)	515 (2.3)
			1-1/2 (38)	450 (2.00)	680 (3.02)	450 (2.00)	325 (1.45)	625 (2.8)	625 (2.8)
Stainless Steel Fastener	X-CR	0.145 (3.7)	1 (25)	230 (1.02)	240 (1.07)	230 (1.02)	-	240 (1.1)	240 (1.1)
		0.157 (4.0)	1-1/4 (32)	320 (1.42)	400 (1.78)	320 (1.42)	-	400 (1.8)	400 (1.8)
			1-1/2 (38)	405 (1.80)	500 (2.22)	405 (1.80)	-	500 (2.2)	500 (2.2)
Gas Fastener	X-C B3, X-C G3	0.118 (3.0)	3/4 (19)	115 (0.5)	140 (0.6)	75 (0.3)	85 (0.4)	175 (0.8)	215 (1.0)
			1 (25)	170 (0.8)	220 (1.0)	155 (0.7)	160 (0.7)	255 (1.1)	315 (1.4)
Premium Gas Fastener	X-P 17 G2, X-P 20 G2, X-P G3, X-P B3	0.118 (3.0)	5/8 (16)	60 (0.3)	140 (0.6)	60 (0.3)	60 (0.3)	175 (0.8)	215 (1.0)

<sup>1</sup> The tabulated allowable load values are for the low-velocity fasteners only, using a safety factor that is greater than or equal to 5.0, calculated in accordance with ICC-ES AC708. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.

<sup>2</sup> The steel deck profile is 3" deep composite floor deck with a minimum thickness of 20 gauge (0.0358"). Figure 1 (Section 3.2.1.6) shows the nominal flute dimensions, fastener locations, and load orientations for the deck profile.

<sup>3</sup> Structural lightweight concrete fill above top of metal deck shall be a minimum of 3-1/4" deep.

<sup>4</sup> DS fasteners installed at 1-1/2" embedment through steel deck into the lower flute must be installed at a minimum distance of 6" from the edge of the floor deck.

<sup>5</sup> Multiple fasteners are recommended for any attachment.

\* More details about the innovative X-P and X-U fasteners can be found in Section 3.2.6.

Allowable Loads Into Minimum  $f'_c = 3000$  psi Structural Lightweight Concrete Over 1-1/2" Deep, B-Type Steel Deck<sup>1,4</sup>

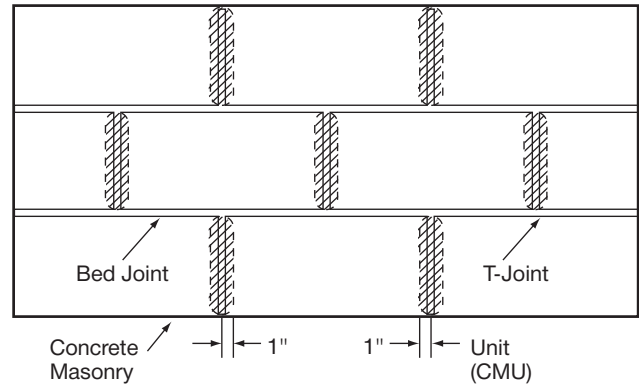
Fastener description	Fastener	Shank diameter in. (mm)	Minimum embedment in. (mm)	Fastener location installed through metal deck into concrete <sup>2,3</sup>				
				Tension lb (kN)				Shear
				Upper flute		Lower flute		lb (kN)
Premium concrete fastener	X-P	0.157 (4.0)	3/4 (19)	140 (0.6)	130 (0.6)	335 (1.5)		
			1 (25)	215 (1.0)	215 (1.0)	385 (1.7)		
			1-1/4 (32)	-	270 (1.2)	465 (2.1)		
Universal knurled shank fastener	X-U	0.157 (4.0)	3/4 (19)	95 (0.42)	95 (0.42)	370 (1.65)		
			1 (25)	125 (0.56)	125 (0.56)	415 (1.85)		
Standard fastener	X-C	0.138 (3.5)	3/4 (19)	80 (0.36)	80 (0.36)	315 (1.40)		
			1 (25)	205 (0.91)	205 (0.91)	445 (1.98)		
Gas fastener	X-C B3, X-C G3	0.118 (3.0)	3/4 (19)	75 (0.3)	85 (0.38)	175 (0.8)		
			1 (25)	155 (0.7)	160 (0.71)	255 (1.1)		
Premium gas fastener	X-P 17 G2, X-P 20 G2, X-P G3, X-P B3	0.118 (3.0)	5/8 (16)	60 (0.27)	60 (0.3)	175 (0.8)		

- 1 The tabulated allowable load values are for the low-velocity fasteners only, using a safety factor that is greater than or equal to 5.0, calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.
- 2 Steel deck profiles are 1-1/2" deep, B-type deck with a minimum thickness of 20 gauge (0.0358" thick steel). Fasteners may be installed through the metal deck into lightweight concrete having both nominal and inverted deck profile orientations with a minimum lower flute width of 1-3/4" or 3-1/2", respectively. Fasteners shall be placed at centerline of deck flutes. Refer to Figures 2 and 3 (Section 3.2.1.6) for additional flute dimensions, fastener locations, and load orientations for both deck profiles.
- 3 Structural lightweight concrete fill above top of metal deck shall be a minimum 2-1/2" deep.
- 4 Multiple fasteners are recommended for any attachment.

### Allowable Loads in Concrete Masonry Units<sup>1,2,3,4,5,10</sup>

Fastener Description	Fastener	Shank diameter in. (mm)	Min. embed. in. (mm)	Hollow CMU				Grout filled CMU					
				Face shell <sup>6</sup>		Mortar joint		Face shell <sup>6</sup>		Mortar joint		Top of grouted cell <sup>8</sup>	
				Tension lb (kN)	Shear <sup>9</sup> lb (kN)	Tension lb (kN)	Shear <sup>7</sup> lb (kN)	Tension lb (kN)	Shear <sup>9</sup> lb (kN)	Tension lb (kN)	Shear <sup>7</sup> lb (kN)	Tension lb (kN)	Shear <sup>9</sup> lb (kN)
Premium concrete fastener	X-P	0.157 (4.0)	1 (25)	70 (0.31)	105 (0.47)	85 (0.38)	70 (0.31)	150 (0.67)	145 (0.65)	150 (0.67)	155 (0.69)	165 (0.73)	240 (1.07)
Universal knurled shank fasteners	X-U	0.157 (4.0)	1 (25)	70 (0.31)	85 (0.38)	25 (0.11)	70 (0.31)	225 (1.00)	220 (0.98)	150 (0.67)	190 (0.85)	165 (0.73)	240 (1.07)
Standard fastener	X-C	0.138 (3.5)	3/4 (19)	40 (0.18)	85 (0.38)	25 (0.11)	50 (0.22)	100 (0.44)	105 (0.47)	45 (0.20)	80 (0.36)	115 (0.51)	175 (0.78)
Gas fastener	X-C B3, X-C G3	0.118 (3.0)	3/4 (19)	145 (0.65)	190 (0.85)	80 (0.36)	80 (0.36)	155 (0.69)	195 (0.87)	110 (0.49)	135 (0.60)	105 (0.47)	145 (0.65)
			1 (25)	185 (0.82)	205 (0.91)	105 (0.47)	105 (0.47)	205 (0.91)	215 (0.96)	135 (0.60)	190 (0.85)	120 (0.53)	150 (0.67)
Gas fastener	X-C G2	0.108 (2.7)	3/4 (19)	75 (0.33)	140 (0.62)	60 (0.27)	80 (0.36)	100 (0.44)	170 (0.76)	100 (0.44)	160 (0.71)	80 (0.36)	130 (0.58)
			1 (25)	110 (0.49)	190 (0.85)	70 (0.31)	145 (0.65)	135 (0.60)	195 (0.87)	125 (0.56)	165 (0.73)	110 (0.49)	145 (0.65)

- 1 The tabulated allowable load values are for the low-velocity fastener only, using a safety factor of 5.0 or higher calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.
- 2 The tabulated allowable load values are for low-velocity fasteners installed in normal weight or lightweight concrete masonry units conforming to ASTM C90.
- 3 The tabulated allowable load values are for low-velocity fasteners installed in concrete masonry units with mortar conforming to ASTM C270, Type N or S.
- 4 The tabulated allowable load values are for low-velocity fasteners installed in concrete masonry units with grout conforming to ASTM C476, as coarse grout.
- 5 The tabulated allowable load values are for one low-velocity fastener installed in an individual masonry unit cell and at least 4" from the edge of the wall.
- 6 Fastener can be located anywhere on the face shell or mortar joint as shown in the figure to the right.
- 7 Shear direction can be horizontal or vertical (Bed Joint or T-Joint) along the CMU wall plane.
- 8 Fastener located in center of grouted cell installed vertically.
- 9 Shear can be in any direction.
- 10 Multiple fasteners are recommended for any attachment.



Acceptable locations (NON-SHADED AREAS) for power-actuated fasteners in CMU walls

\* More details about the innovative X-P and X-U fasteners can be found in Section 3.2.6.



Allowable loads in minimum ASTM A36 ( $F_y \geq 36$  ksi,  $F_u \geq 58$  ksi) steel<sup>1,2,4,5</sup>

Fastener description	Fastener	Shank diameter in. (mm)	Steel thickness (in.)											
			1/8		3/16		1/4		3/8		1/2		≥3/4	
			Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
Universal knurled shank*	X-U <sup>6</sup>	0.157 (4.0)	-	-	500 (2.22)	720 (3.20)	775 (3.45)	720 (3.20)	935 (4.16)	720 (3.20)	900 (4.00)	720 (3.20)	350 (1.56)	375 (1.67)
Stepped-shank knurling-lengthwise	X-U 15 <sup>7</sup>	0.145 (3.7)	-	-	155 (0.69)	395 (1.76)	230 (1.02)	395 (1.76)	420 (1.87)	450 (2.00)	365 (1.62)	500 (2.22)	365 (1.62)	400 (1.78)
Standard knurled shank	X-S13	0.145 (3.7)	140 (0.62)	300 (1.33)	300 (1.33)	450 (2.00)	300 (1.33)	450 (2.00)	300 (1.33)	450 (2.00)	-	-	-	-
Drywall smooth shank w/metal top hat washer	X-S16 <sup>10</sup>	0.145 (3.7)	-	-	315 (1.40)	480 (2.14)	315 (1.40)	480 (2.14)	315 (1.40)	530 (2.36)	315 (1.40)	480 (2.14)	-	-
Heavy duty knurled shank	EDS <sup>3</sup>	0.177 (4.5)	-	-	305 (1.36)	615 (2.74)	625 (2.78)	870 (3.87)	715 (3.18)	870 (3.87)	890 (3.96)	960 (4.27)	400 (1.78)	655 (2.91)
Heavy duty smooth shank	DS	0.177 (4.5)	-	-	365 (1.62)	725 (3.22)	580 (2.58)	725 (3.22)	695 (3.09)	725 (3.22)	735 (3.27)	860 (3.83)	-	-
Stainless steel smooth shank	X-R <sup>8</sup> , X-CR	0.145 (3.7) 0.157 (4.0)	-	-	460 (2.05)	460 (2.05)	615 (2.74)	500 (2.22)	-	-	-	-	-	-
	X-R <sup>8,9</sup>	0.145 (3.7)	300 (1.33)	190 (0.85)	615 (2.74)	495 (2.20)	760 (3.38)	500 (2.22)	220 (0.98)	325 (1.45)	225 (1.00)	335 (1.49)	-	-
Standard gas fastener for steel	X-S 14 B3	0.118 (3.0)	140 (0.62)	230 (1.02)	220 (0.98)	245 (1.09)	225 (1.00)	290 (1.29)	280 (1.25)	330 (1.47)	280 (1.25)	330 (1.47)	280 (1.25)	330 (1.47)
Standard gas fastener for steel	X-S 14 B3 <sup>8</sup>	0.118 (3.0)	-	-	220 (0.98)	295 (1.31)	260 (1.16)	355 (1.58)	280 (1.25)	385 (1.71)	280 (1.25)	385 (1.71)	280 (1.25)	385 (1.71)
Premium gas fastener	X-P G3, X-P B3	0.118 (3.0)	125 (0.56)	230 (1.02)	170 (0.76)	245 (1.09)	200 (0.89)	230 (1.02)	250 (1.11)	255 (1.13)	-	-	-	-

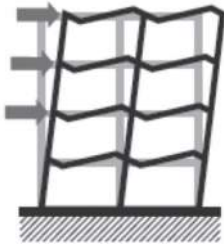
- The tabulated allowable load values are for the low-velocity fasteners only, using a safety factor that is greater than or equal to 5.0, calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.
- Low-velocity fasteners shall be driven to where the point of the fastener penetrates through the steel base material in accordance with Section 3.2.2.3, except as noted in this table.
- EDS fasteners installed into greater than 1/2" thick steel require 1/2" minimum penetration.
- Multiple fasteners are recommended for any attachment.
- Refer to guidelines for fastening to steel, Section 3.2.2, for application limits.
- Tabulated allowable load values provided for 3/4" steel are based upon minimum point penetration of 1/2" into the steel. If 1/2" point penetration into the steel is not achieved, but a point penetration of at least 3/8" is obtained, the tabulated tension value should be reduced by 20 percent and the tabulated shear load should be reduced by 8 percent.
- X-U 15 fasteners installed into greater than 3/8" thick steel require 15/32" minimum penetration into the steel.
- Based on testing with  $F_y = 50$  ksi base material.
- Fasteners installed into 3/8" or thicker base require 0.38" minimum penetration depth into the steel.
- Published values may vary from values in ICC-ESR

Allowable tensile pullover and shear bearing load capacities for steel framing with power driven fasteners<sup>1,2,3,4</sup>

Fastener description	Fastener	Head dia. in. (mm)	Sheet steel thickness													
			14 ga.		16 ga.		18 ga.		20 ga.		22 ga.		24 ga.		25/26 ga.	
			Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
0.157" shank with or w/o plastic washers or MX collation	X-U, X-P	0.322 (8.2)	825 (3.67)	1,085 (4.83)	685 (3.05)	720 (3.20)	490 (2.18)	525 (2.34)	360 (1.60)	445 (1.98)	300 (1.33)	330 (1.47)	205 (0.91)	255 (1.13)	120 (0.53)	145 (0.64)
0.145" shank with or w/o plastic washers or MX collation	X-C, X-R	0.322 (8.2)	-	985 (4.38)	685 (3.05)	720 (3.20)	490 (2.18)	515 (2.29)	360 (1.60)	440 (1.96)	300 (1.33)	310 (1.38)	205 (0.91)	235 (1.05)	120 (0.53)	145 (0.64)
0.177" shank without washer	DS, EDS	0.322 (8.2)	965 (4.29)	1,085 (4.83)	810 (3.60)	815 (3.63)	625 (2.78)	535 (2.38)	460 (2.05)	465 (2.07)	360 (1.60)	350 (1.56)	300 (1.33)	260 (1.16)	240 (1.07)	180 (0.80)
0.145" shank with plastic top hat washers	X-S13 THP X-S16 TH	0.322 (8.2)	-	985 (4.38)	685 (3.05)	720 (3.20)	490 (2.18)	515 (2.29)	360 (1.60)	440 (1.96)	300 (1.33)	310 (1.38)	205 (0.91)	235 (1.05)	120 (0.53)	145 (0.64)

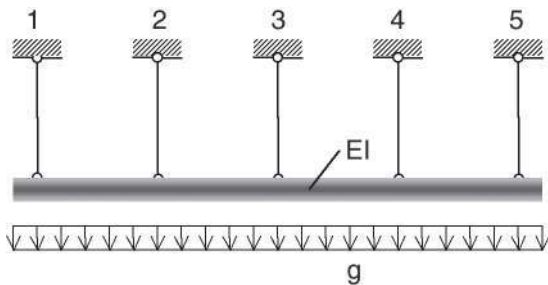
- Allowable load values are based on a safety factor of 3.0.
- Allowable pullover capacities of sheet steel should be compared to the allowable fastener tensile load capacities in concrete, steel, and masonry to determine controlling resistance load.
- Allowable shear bearing capacities of sheet steel should be compared to allowable fastener shear capacities in concrete, steel and masonry to determine controlling resistance load.
- Data is based on the following minimum sheet steel properties,  $F_y = 33$  ksi,  $F_u = 45$  ksi (ASTM A653 material).

\* More details about the innovative X-U fastener can be found in Section 3.2.6.



## 2.4.2 NONSTRUCTURAL SYSTEMS

Nonstructural systems are separate from structural systems and a clear distinction is made in the building codes and standards. These applications may involve suspended ceilings, conduit attachments, mechanical, plumbing, electrical and communications equipment, doors, windows, wood sill plates, cold-formed steel track attachments, architectural components and other applications that are not part of the structural systems.



ASCE 7-10 Minimum Design Loads for Building and Other Structures, which is referenced in the IBC 2015 and 2018, clarified language pertaining to the use of power-actuated fasteners for nonstructural component fastenings including suspended ceilings and distributed systems. A distributed system includes multiple fastening points for redundancy and load distribution across linear or grid like arrangements of fasteners. ASCE 7-10 Section 13.4.5 further establishes conservative baseline limiting load capacities for power-actuated fasteners at 90 lb (400 N) for concrete base materials and 250 lb (1,112 N) for steel base materials in typical applications, unless otherwise tested and approved for other load capacities. This clarified language pertaining to power-actuated fastening applications in all seismic design categories, including use as part of distributed systems in higher Seismic Design Categories D through F, is incorporated into the latest ICC-ES AC70 Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements. In addition, ICC-ES AC70 Annex A provides testing and acceptance criteria for power-driven fasteners in steel base materials to allow development of allowable load values greater than 250 lb (1,112 N). All Hilti power-driven fasteners intended for steel applications have been successfully tested per the ICC-ES AC70 Annex A seismic testing requirements. Reference Hilti power-actuated fastener evaluation reports ESR-2269, ESR-1663, ESR-1752, ESR-2347 and ESR-2795 for more detailed information.

Additional seismic research is being conducted to evaluate the performance of power-actuated fasteners in both structural and nonstructural applications. In 2012, the University of California San Diego (UCSD) Building Nonstructural Component and System (BNCS) seismic research project sponsored by the National Science Foundation (NSF) and Network for Earthquake Engineering Simulation (NEES) involved the use of power-actuated fasteners for many common nonstructural applications including lay-in acoustical ceilings, cold-formed steel interior partition walls, exterior balloon framing walls and electrical conduit attachments. The initial results are promising and provide additional confirmation that power-actuated fasteners are reliable attachment methods for these typical applications in seismic events. Further research is being conducted by Hilti to extend the load capacities and applications of power-actuated fastenings in steel base materials as part of diaphragms, shear walls and nonstructural component fastenings.



In 2012, AISI also established design provisions for power-actuated fastenings in steel base materials and these are now codified in Section J5 of AISI S100. These provisions formally recognize power-actuated fasteners consistent with an extensive historical use in cold-formed steel framing applications and provide a rational basis for the determination of safety and resistance factors consistent with LRFD and LSD design provisions with the corresponding safety and resistance factors for steel fastenings is a significant development for power-actuated fastening technology in North America, as previously, only ASD design was used based on a minimum safety factor of 5:1. The data contained herein this Product Technical Guide is still presented in the traditional ASD format for steel base materials, with the ICC-ES AC70 minimum safety factor of 5:1 applied, but alternative safety and resistance factors are provided in the AISI S100 specification for a more optimized and statistically justified design approach.





## TYPICAL INTERIOR STUDS

## AISI S240-20 Eq. B3.2.5.1-2

### TRACK Capacity

stud designated thickness, mil =

design track thickness,  $t_t = 0.0235$  in

coefficient for conversion of units,  $\alpha =$

$w_{st} = 1.03$  in

tensile strength of track,  $F_{ut} = 65000$  psi

$\Omega =$

$P_{nst} = 944.0$  lbs

$P_{nst}/\Omega = 555.3$  lbs

Beside Opening:  $P_{nst}/\Omega = 277.6$  lbs

# SLT - Standard Slotted Leg Track

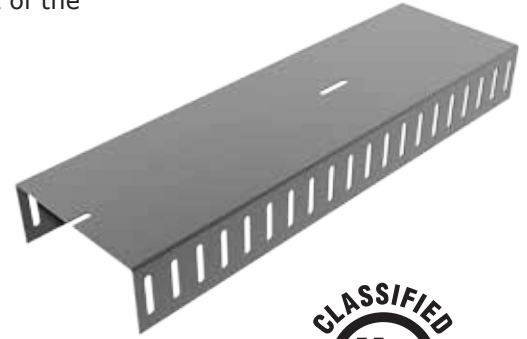
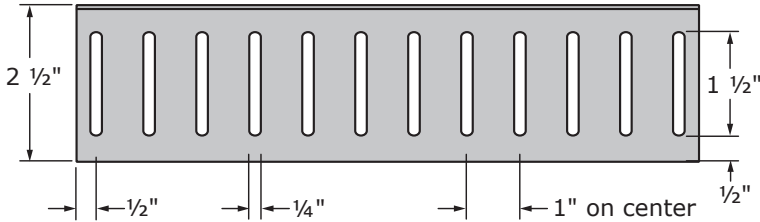
TOP TRACK

The SLT Slotted Deflection Track allows for a positive attachment of the stud to the top track through the slots designed to accommodate the vertical movement of the primary structure, in compliance with Section 713.2 of the IBC.

The SLT is designed to allow a total vertical movement of 1 1/2" (+/- 3/4").

## Dimension

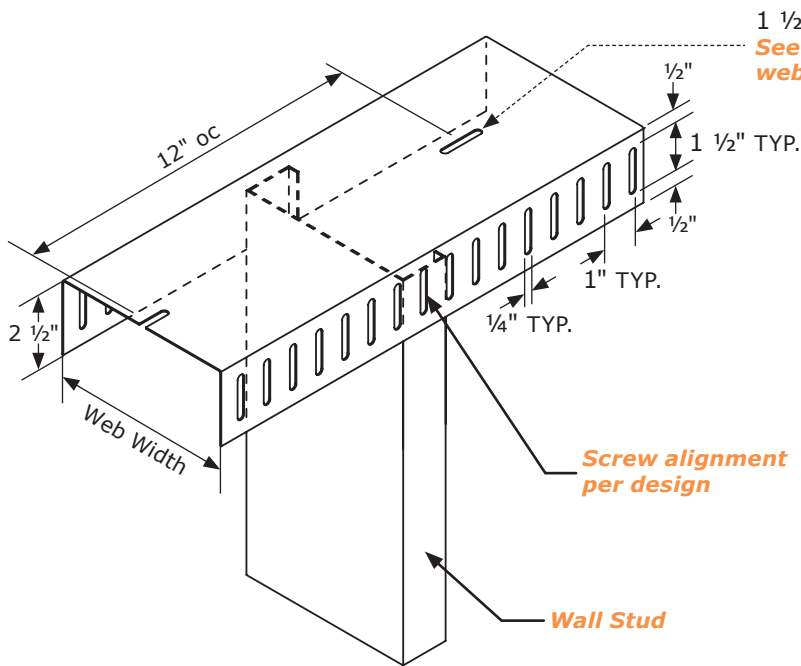
The section legs (flanges) are 2 1/2" in length and have 1 1/2" long by 1/4" wide vertical slots spaced every 1" along the length of the member.



UL Classified for US and Canada  
UL File No. R25017

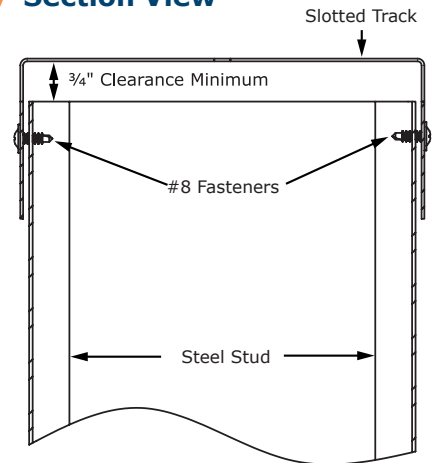
NOTE: SCAFCO DEFLECTION TRACK IS SHOWN IN CALCULATIONS — CEMCO SIMILAR

## Standard Slotted Leg Track Detail (SLT)



1 1/2" x 1/4"  
See page 3 for additional web slot configurations

## Section View



## Additional Slotted Track Styles



Slotted Angle



Slotted Rake Track



Slotted Curved Track



Slotted Pitched Track

Note: Additional styles available in both SLT and SDLT. UL Numbers do not apply to the non-standard shapes.

Standard Slotted Leg Track Section Properties

Part No.	F <sub>y</sub> (ksi)	Design Thickness (in)	Gross Properties						Effective Properties		Allowable Lateral Load (lbs)
			Area (in <sup>2</sup> )	Weight (lb/ft)	I <sub>x</sub> (in <sup>4</sup> )	R <sub>x</sub> (in)	I <sub>y</sub> (in <sup>4</sup> )	R <sub>y</sub> (in)	S <sub>xx</sub> (in <sup>3</sup> )	I <sub>xx</sub> (in <sup>4</sup> )	
250SLT250-D20	57	0.0188	0.141	0.48	0.184	1.141	0.097	0.830	0.032	0.062	37
250SLT250-30EQD	57	0.0235	0.176	0.60	0.230	1.142	0.121	0.829	0.046	0.083	55
250SLT250-33EQS	57	0.0295	0.221	0.75	0.289	1.143	0.152	0.828	0.065	0.110	90
250SLT250-33	33	0.0346	0.259	0.88	0.339	1.144	0.178	0.827	0.087	0.129	106
250SLT250-43EQS	57	0.0400	0.300	1.02	0.393	1.145	0.205	0.826	0.100	0.149	173
250SLT250-43	33	0.0451	0.338	1.150	0.443	1.146	0.230	0.826	0.108	0.163	174
250SLT250-54	50	0.0566	0.424	1.44	0.565	1.155	0.287	0.824	0.141	0.213	344
250SLT250-68	50	0.0713	0.534	1.82	0.728	1.168	0.360	0.821	0.177	0.273	475
250SLT250-97	50	0.1017	0.761	2.59	1.086	1.195	0.506	0.815	0.249	0.399	1147
350SLT250-D20	57	0.0188	0.160	0.54	0.372	1.526	0.109	0.824	0.046	0.129	37
350SLT250-30EQD	57	0.0235	0.200	0.68	0.466	1.527	0.135	0.823	0.067	0.175	55
350SLT250-33EQS	57	0.0295	0.251	0.85	0.585	1.528	0.169	0.822	0.096	0.235	90
350SLT250-33	33	0.0346	0.294	1.00	0.687	1.528	0.198	0.821	0.138	0.286	106
350SLT250-43EQS	57	0.0400	0.340	1.16	0.794	1.529	0.229	0.820	0.153	0.331	173
350SLT250-43	33	0.0451	0.383	1.303	0.896	1.530	0.257	0.819	0.178	0.362	174
350SLT250-54	50	0.0566	0.480	1.63	1.137	1.538	0.321	0.817	0.232	0.471	344
350SLT250-68	50	0.0713	0.605	2.06	1.454	1.550	0.401	0.814	0.290	0.598	475
350SLT250-97	50	0.1017	0.862	2.93	2.139	1.575	0.563	0.808	0.409	0.867	1147
362SLT250-D20	57	0.0188	0.162	0.55	0.401	1.573	0.110	0.823	0.048	0.140	37
362SLT250-30EQD	57	0.0235	0.203	0.69	0.502	1.573	0.137	0.822	0.069	0.190	55
362SLT250-33EQS	57	0.0295	0.254	0.87	0.630	1.574	0.171	0.821	0.100	0.254	90
362SLT250-33	33	0.0346	0.298	1.01	0.740	1.575	0.200	0.820	0.144	0.312	106
362SLT250-43EQS	57	0.0400	0.345	1.17	0.856	1.576	0.231	0.819	0.159	0.359	173
362SLT250-43	33	0.0451	0.389	1.322	0.966	1.577	0.260	0.818	0.188	0.395	174
362SLT250-54	50	0.0566	0.487	1.66	1.224	1.585	0.324	0.816	0.244	0.512	344
362SLT250-68	50	0.0713	0.614	2.09	1.565	1.597	0.406	0.813	0.306	0.650	475
362SLT250-97	50	0.1017	0.875	2.98	2.300	1.621	0.570	0.807	0.432	0.942	1147
400SLT250-D20	57	0.0188	0.169	0.58	0.496	1.712	0.113	0.818	0.053	0.173	37
400SLT250-30EQD	57	0.0235	0.212	0.72	0.620	1.712	0.141	0.817	0.077	0.236	55
400SLT250-33EQS	57	0.0295	0.265	0.90	0.779	1.713	0.177	0.816	0.111	0.317	90
400SLT250-33	33	0.0346	0.311	1.06	0.914	1.714	0.207	0.815	0.162	0.396	106
400SLT250-43EQS	57	0.0400	0.360	1.22	1.058	1.715	0.238	0.814	0.179	0.450	173
400SLT250-43	33	0.0451	0.406	1.380	1.193	1.715	0.268	0.813	0.219	0.502	174
400SLT250-54	50	0.0566	0.509	1.73	1.511	1.723	0.335	0.811	0.284	0.650	344
400SLT250-68	50	0.0713	0.641	2.18	1.928	1.735	0.418	0.808	0.356	0.825	475
400SLT250-97	50	0.1017	0.913	3.11	2.823	1.758	0.587	0.802	0.502	1.192	1147
600SLT250-D20	57	0.0188	0.207	0.70	1.214	2.422	0.128	0.786	0.081	0.420	37
600SLT250-30EQD	57	0.0235	0.259	0.88	1.518	2.423	0.159	0.785	0.118	0.579	55
600SLT250-33EQS	57	0.0295	0.324	1.19	1.906	2.424	0.209	0.784	0.172	0.780	90
600SLT250-33	33	0.0346	0.380	1.29	2.236	2.424	0.233	0.783	0.260	1.021	106
600SLT250-43EQS	57	0.0400	0.440	1.59	2.593	2.425	0.293	0.782	0.293	1.145	173
600SLT250-43	33	0.0451	0.496	1.687	2.916	2.425	0.303	0.781	0.378	1.402	174
600SLT250-54	50	0.0566	0.622	2.12	3.678	2.432	0.377	0.779	0.478	1.769	344
600SLT250-68	50	0.0713	0.783	2.67	4.670	2.442	0.472	0.776	0.655	2.266	475
600SLT250-97	50	0.1017	1.116	3.80	6.767	2.462	0.662	0.770	0.960	3.253	1147
800SLT250-33EQS	57	0.0295	0.383	1.30	3.681	3.098	0.215	0.749	0.233	1.504	90
800SLT250-33	33	0.0346	0.450	1.53	4.318	3.099	0.252	0.748	0.358	1.994	106
800SLT250-43EQS	57	0.0400	0.520	1.77	4.992	3.099	0.290	0.747	0.387	2.216	173
800SLT250-43	33	0.0451	0.586	1.994	5.629	3.100	0.326	0.746	0.530	2.800	174
800SLT250-54	50	0.0566	0.735	2.50	7.090	3.106	0.407	0.744	0.671	3.522	344
800SLT250-68	50	0.0713	0.926	3.15	8.978	3.114	0.509	0.741	0.943	4.675	475
800SLT250-97	50	0.1017	1.320	4.49	12.944	3.132	0.713	0.735	1.536	6.835	1147

Table Notes

- Web-height to thickness ratio exceeds 200. Web Stiffeners are required at all support points and concentrated loads.
- Gross properties based on the full section, not reduced for flange slots
- Effective properties based on a compression flange of 1/2" (before local buckling reductions) and a tension flange of 1"
- For deflection calculations, use effective I<sub>xx</sub>
- All properties based on unpunched webs
- Web depth is equal to the nominal depth plus two times the design thickness, plus the inside bend radius
- X-X properties are 'strong-axis' properties, Y-Y properties are about the 'weak-axis'
- Effective properties based on the "North American Specification for the Design of Cold-Formed Steel Structural Members," 2001 edition with 2004 Supplement
- For SI: 1 inch = 25.4 mm, 1 ksi = 6.8948 kPa, 1 lb/ft = 14.594 N/m.

**6" STUD WALL**  
**DESIGN HT = 21'-5"**  
**LATERAL LOAD = 5 PSF**  
**DEFLECTION = L/240**

**Section :** 600S162-33 (33 ksi) @ 24" o.c. Single C Stud (punched)

**Maxo =** 950.6 ft-lb      **Va =** 638.1 lb      **I =** 1.79 in<sup>4</sup>

Loads have not been modified for strength checks  
 Loads have not been modified for deflection calculations

**Bridging Connectors - Design Method =AISI S100**

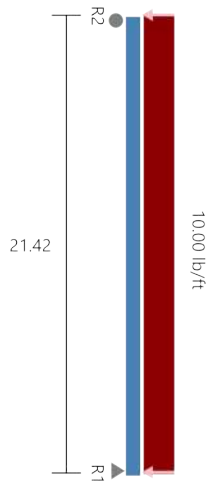
Span	Axial KyLy, KtLt	Flexural, Distortional	Connector	Stress Ratio
Span	NA	72.0", 257.0"	LSUBH3.25 (Min)	0.27

**Web Crippling**

Support	Load (lb)	Bearing (in)	Pa (lb)	M (ft-lbs)	Max Int.	Stiffener?
R2	107.10	--Slip Track Design, Ref Connectors--				NO
R1	107.10	--Stud/Track Design, Ref Connectors--				NO

**Gravity Load**

Type	Load (lb)
Uniform	0.00plf



	Code Check	Required	Allowed	Interaction	Notes
Span	Max. Axial, lbs	0.0(t)	-	0%	$K\Phi=0.00$ lb-in/in Max KL/r = N/A
	Max. Shear, lbs	107.1	638.1	17%	Shear (Punched)
	Max. Moment (MaFy, Ma-dist), ft-lbs	573.5	788.8	73%	Ma-dist (control), $K\Phi=0.00$ lb-in/in
	Moment Stability, ft-lbs	573.5	764.3	75%	
	Shear/Moment	0.60	1.00	60%	Shear 0.0, Moment 573.5
	Axial/Moment	0.75	1.00	75%	Axial 0.0(c), Moment 573.5
	Deflection Span, in	0.896	--meets L/287--		

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie Connector	Connector Interaction	Anchor Interaction
R2	107.1	0.0	600SLT250-33 (33) & (2) .157", 3/4" embed SST PDKA/PDPAT to 4000 nw concrete	71.40 %	64.01 %
R1	107.1	0.0	600T125-33 (33) & (1) .157", 3/4" embed SST PDKA/PDPAT to 4000 nw concrete	44.08 %	79.33 %

\* Reference catalog for connector and anchor requirement notes as well as screw placement requirements

**BSE**

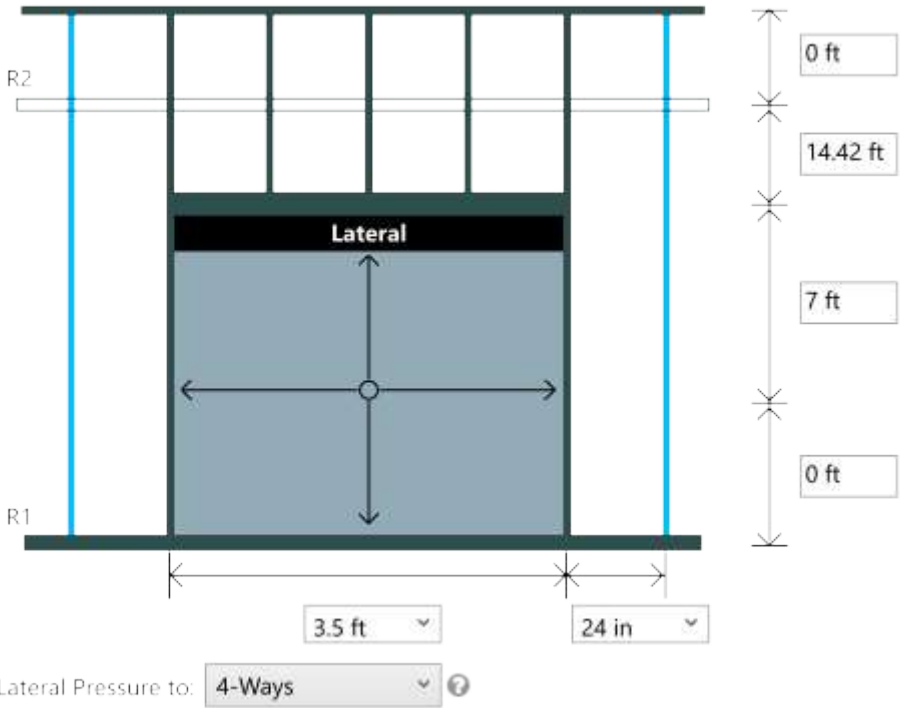
Project: \_\_\_\_\_

Date: \_\_\_\_\_

**B**rienen **S**tructural **E**ngineers, P.S.

OPENING DESIGNS

**6" STUD WALL**  
**OPENING WIDTH = 3'-6"**  
**DESIGN HT = 21'-5"**  
**LATERAL LOAD = 5 PSF**  
**DEFLECTION = L/240**



**Design Loads**

Wall Lateral Pressure :	<b>5 psf</b>
Parapet Lateral Pressure :	
RO Lateral Pressure :	<b>4-Ways</b>
Lateral element force multiplier	
Strength :	<b>1.0</b>
Deflection :	<b>1</b>
Header:	<b>Single Member</b>
Gravity Load at Header:	<b>0 psf</b>

**Brace Settings**

Component(s)	Members(s)	Flexural Bracing	Axial KyLy	Axial KtLt	Distortional K-Phi(lb-in/in)	Distortional Lm	Interconnection Spacing
Jamb Studs	600S162-43(33), Single	72 in	72 in	72 in	0	None	N/A
Vertical Header	600T125-33(33), Y-Y Axis	Full	N/A	N/A	0	None	N/A
Lateral Header	600T125-33(33), Single	Full	N/A	N/A	0	None	N/A

**Analysis Results**

Component(s)	Members(s)	Axial Load (lb)	Max KL/r	Max. Moment (ft-lb)	Max. Shear (lb)	Bottom Reaction (lb)	Top or End Reaction (lb)
Jamb Studs	600S162-43(33), Single	0.0	0	694.0	139.6	147.3	84.2
Vertical Header	600T125-33(33), Y-Y Axis	N/A	N/A	0.0	0.0	N/A	0.0
Lateral Header	600T125-33(33), Single	N/A	N/A	64.1	70.7	N/A	70.7

**Design Results**

Component(s)	Members(s)	Deflection		A + M Interaction	V + M Interaction	Web Stiffeners	Design OK
		Span	Parapet				
Jamb Studs	600S162-43(33), Single	L/335	L/0	0.658	0.50	No	Yes
Vertical Header	600T125-33(33), Y-Y Axis	L/0	NA	0.00	0.00	No	Yes
Lateral Header	600T125-33(33), Single	L/11080	NA	0.13	0.13	No	Yes
Combined Header				0.13	0		

**Simpson Strong-Tie® Connectors @ Jamb**

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie® Connector	Connector Interaction	Anchor Interaction
R2	84.18	0.00	600SLT250-33 (33) & (2) .157", 3/4" embed SST PDPA/PDPAT to 4000 nw concrete	56.12 %	50.31 %
R1	147.26	0.00	600T125-33 (33) & (2) .157", 3/4" embed SST PDPA/PDPAT to 4000 nw concrete	71.83 %	54.54 %

\* Reference catalog for connector and anchor requirement notes as well as screw placements requirement

**Simpson Strong-Tie® Wall Stud Bridging Connectors @ Jamb**

Span/Parapet	Bracing Length(in.)	Design Number of Braces	Pn(lb.)	LSUBH (Min) <sup>1</sup>	LSUBH (Max) <sup>1</sup>	SUBH (Min) <sup>1</sup>	SUBH (Max) <sup>1</sup>	MSUBH (Min) <sup>1</sup>	MSUBH (Max) <sup>1</sup>
Span	72	N/A	0.0	OK (0.25)	OK (0.16)	OK (0.21)	OK (0.12)	No Soln	No Soln

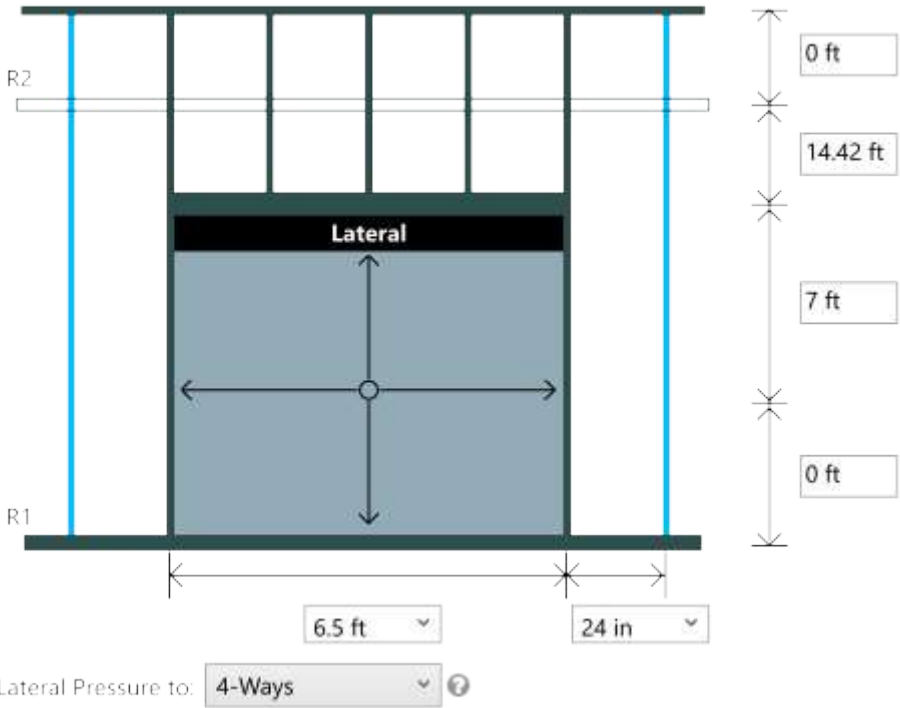
**Notes:**

- 1) Values in parentheses are stress ratios.
- 2) Bridging connectors are not designed for back-back, box, or built-up sections.
- 3) Reference [www.strongtie.com](http://www.strongtie.com) for latest load data, important information, and general notes.
- 4) CFS Designer will not select bridging connectors unless all flexural and axial bracing settings are the same.
- 5) If the bracing length is larger than the span length, bridging connectors are not designed.



Project Name: 24201.6 Centeris Data Ha  
 Model: 6" UP TO 21'-5" 6'-6" OPNG  
 Code: 2012 NASPEC [AISI S100-2012]

**6" STUD WALL**  
**OPENING WIDTH = 6'-6"**  
**DESIGN HT = 21'-5"**  
**LATERAL LOAD = 5 PSF**  
**DEFLECTION = L/240**



**Design Loads**

Wall Lateral Pressure :	<b>5 psf</b>
Parapet Lateral Pressure :	
RO Lateral Pressure :	<b>4-Ways</b>
Lateral element force multiplier	
Strength :	<b>1.0</b>
Deflection :	<b>1</b>
Header:	<b>Single Member</b>
Gravity Load at Header:	<b>0 psf</b>

**Brace Settings**

Component(s)	Members(s)	Flexural Bracing	Axial KyLy	Axial KtLt	Distortional K-Phi(lb-in/in)	Distortional Lm	Interconnection Spacing
Jamb Studs	600S162-54(50), Single	72 in	72 in	72 in	0	None	N/A
Vertical Header	600T125-33(33), Y-Y Axis	Full	N/A	N/A	0	None	N/A
Lateral Header	600T125-33(33), Single	Full	N/A	N/A	0	None	N/A

**Analysis Results**

Component(s)	Members(s)	Axial Load (lb)	Max KL/r	Max. Moment (ft-lb)	Max. Shear (lb)	Bottom Reaction (lb)	Top or End Reaction (lb)
Jamb Studs	600S162-54(50), Single	0.0	0	1072.5	201.2	227.6	110.4
Vertical Header	600T125-33(33), Y-Y Axis	N/A	N/A	0.0	0.0	N/A	0.0
Lateral Header	600T125-33(33), Single	N/A	N/A	247.6	143.6	N/A	143.6

**Design Results**

Component(s)	Members(s)	Deflection		A + M Interaction	V + M Interaction	Web Stiffeners	Design OK
		Span	Parapet				
Jamb Studs	600S162-54(50), Single	L/282	L/0	0.709	0.43	No	Yes
Vertical Header	600T125-33(33), Y-Y Axis	L/0	NA	0.00	0.00	No	Yes
Lateral Header	600T125-33(33), Single	L/1551	NA	0.51	0.51	R1, R2	Yes
Combined Header				0.51	0		

**Simpson Strong-Tie® Connectors @ Jamb**

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie® Connector	Connector Interaction	Anchor Interaction
R2	110.43	0.00	600SLT250-33 (33) & (2) .157", 3/4" embed SST PDPA/PDPAT to 4000 nw concrete	73.62 %	65.99 %
R1	227.59	0.00	600T125-33 (33) & (2) .157", 3/4" embed SST PDPA/PDPAT to 4000 nw concrete	66.16 %	84.29 %

\* Reference catalog for connector and anchor requirement notes as well as screw placements requirement

**Simpson Strong-Tie® Wall Stud Bridging Connectors @ Jamb**

Span/Parapet	Bracing Length(in.)	Design Number of Braces	Pn(lb.)	LSUBH (Min) <sup>1</sup>	LSUBH (Max) <sup>1</sup>	SUBH (Min) <sup>1</sup>	SUBH (Max) <sup>1</sup>	MSUBH (Min) <sup>1</sup>	MSUBH (Max) <sup>1</sup>
Span	72	N/A	0.0	OK (0.31)	OK (0.22)	OK (0.25)	OK (0.16)	OK (0.15)	OK (0.10)

**Notes:**

- 1) Values in parentheses are stress ratios.
- 2) Bridging connectors are not designed for back-back, box, or built-up sections.
- 3) Reference [www.strongtie.com](http://www.strongtie.com) for latest load data, important information, and general notes.
- 4) CFS Designer will not select bridging connectors unless all flexural and axial bracing settings are the same.
- 5) If the bracing length is larger than the span length, bridging connectors are not designed.

# **BSE**

Project: \_\_\_\_\_

Date: \_\_\_\_\_

**B**rienen **S**tructural **E**ngineers, P.S.

## CEILING DESIGN

## Ceiling Design

### Ceiling Weight, W

- USG Donn Brand Framing
- (1) Layer 3/4" USG Mars ACT
- Finishes, MEP, Misc

### PSF

1

1

1

→  $W_{MAX} \approx 3$  PSF

### Seismic Force per ASCE

$$a_p = \boxed{1}$$
$$S_{DS} = \boxed{1.006}$$

$$R_p = \boxed{2.5}$$
$$I_p = \boxed{1}$$

$$z/h = \boxed{1}$$

$$F_d = \frac{0.4a_p S_{DS} W I_p}{R_p} \left(1 + 2 \frac{z}{h}\right)$$

$$F_d = 0.483W \quad (\text{LRFD}) \quad \longrightarrow \quad E_{ASD} = 0.7F_d = \boxed{0.338W} \quad (\text{ASD})$$

→  $E_{MAX} = 1$  PSF

However,  $W_{MIN} \approx 4$  PSF, so  $E_{MIN} = 1.35$  PSF

# **BSE**

**B**rienen **S**tructural **E**ngineers, P.S.

**ACT:**

Grid System = USG Donn Brand Advancespan

Panel = USG 2ft x 4ft 3/4in Mars 88189CR

System Weight = 3.0 PSF; Code Minimum = 4.0 PSF

Main Runner Spacing = 4' oc

Main Runner Distributed Loads  $w_{max} = 4.0 \text{ PSF} \times 4' = 16 \text{ PLF}$

Main Runner Hanger Spacing = 4' oc

Use Main Runner DXL26, Allowable Load =  $16\text{PLF} \geq w_{max} \rightarrow \text{OK}$

Cross Runner Span = 4' max between main runners @ 2' oc

Use Cross Runner DXL424

Main Runner and Cross Runner Info Attached.

# USG MARS™ HEALTHCARE ACOUSTICAL PANELS CLIMAPLUS™ PERFORMANCE WITH CLEAN ROOM, HIGH-NRC AND AIRCARE™ COATING OPTIONS



USG Mars™ Healthcare  
Acoustical Panels with ClimaPlus™  
Performance/USG Donn® Brand DX®/  
DXL™ Acoustical Suspension System

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White  
050

## FEATURES AND BENEFITS

- Water-repellent membrane designed to be durable and safe with common disinfectants.\*\*
- Washable and soil-resistant finish. Impact and scratch resistant.
- Acoustics and cleanability exceed FGI guidelines for healthcare.
- Meets USDA/FSIS guidelines for use in food-processing areas.
- Achieves FDA standards for smoothness, durability and cleanability.
- Clean Room tested to ISO 5 (Class 100) (Items 86169CR, 88189CR, 86684CR, 88683CR).
- ClimaPlus™ 30-year limited system warranty against visible sag, mold and mildew.
- AirCare™ coating applied to face and back reduces 75% of formaldehyde over a 10-year period.<sup>4</sup>
- GREENGUARD Gold certified for low emitting performance.
- Balanced Acoustics. High-NRC and High-CAC provide excellent sound control that assist in addressing HIPAA standards.
- USG Mars™ Healthcare Acoustical Panels is part of the Ecoblueprint™ portfolio — meeting today's sustainability standards. For sustainability documentation go to [USG.com](http://USG.com) or [CGCInc.com](http://CGCInc.com).

## APPLICATIONS

- Kitchen and food-prep areas
- Lavatories and restrooms
- Laboratories and Clean Rooms
- Nurses' stations/  
waiting rooms
- Treatment/patient  
rooms

## SUBSTRATE

- Wet-formed  
mineral fiber

Fine-Textured Panel

# USG MARS™ HEALTHCARE ACOUSTICAL PANELS

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PRODUCT CERTIFIED  
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EMISSIONS:  
ULCOM/CG  
UL2818



UL Classified

Edge	Panel Size	Fire Rating	Item No.	NRC	CAC Min.	LR <sup>2</sup>	Color	Grid Options	VOC Emissions	Anti-Mold & Mildew/Sag Resistance	Recycled Content <sup>1</sup>	Panel Cost
USG MARS™ HEALTHCARE HIGH-NRC PANELS 85/35 Plant-Based Binder <sup>6</sup>	SQ	Class A	86256	0.85	35	0.90	White	A,B,C,D,E,F	Low		70%	\$\$
			88256	0.85	35	0.90	White	A,B,D,E,F	Low		70%	\$\$
USG MARS™ HEALTHCARE HIGH-NRC/ HIGH-CAC PANELS 80/40 Plant-Based Binder <sup>6</sup>	SLT	Class A	86257	0.85	35	0.90	White	G,H,I,J	Low		70%	\$\$
	FLB		86258	0.85	35	0.90	White	K,L,M,N	Low		70%	\$\$
	SQ	Class A	86115	0.80	40	0.90	White	A,B,C,D,E,F	Low		71%	\$\$
			88115	0.80	40	0.90	White	A,B,D,E,F	Low		71%	\$\$
		Class A	86343	0.80	40	0.90	White	G,H,I,J	Low		71%	\$\$
			88343	0.80	40	0.90	White	G,H,I,J	Low		71%	\$\$
USG MARS™ HEALTHCARE HIGH-NRC PANELS 80/35 Plant-Based Binder <sup>6</sup>	FLB	Class A	86344	0.80	40	0.90	White	K,L,M,N	Low		71%	\$\$
			88344	0.80	40	0.90	White	K,L,M,N	Low		71%	\$\$
	SQ	Class A	86152	0.80	35	0.90	White	A,B,C,D,E,F	Low		70%	\$\$
			86340	0.80	35	0.90	White	A,B,D,E,F	Low		70%	\$\$
		Class A	86470	0.80	35	0.90	White	G,H,I,J	Low		70%	\$\$
	FLB		86750	0.80	35	0.90	White	K,L,M,N	Low		70%	\$\$
USG MARS™ HEALTHCARE PANELS 75/35	SQ	Class A	86169	0.75	35	0.90	White	A,B,C,D,E,F	Low		69%	\$\$
			88189	0.75	35	0.90	White	A,B,D,E,F	Low		69%	\$\$
		Class A	86684	0.75	35	0.90	White	G,H,I,J	Low		69%	\$\$
			88683	0.75	35	0.90	White	G,H,I,J	Low		69%	\$\$
		Class A	86984	0.75	35	0.90	White	K,L,M,N	Low		69%	\$\$
			88983	0.75	35	0.90	White	K,L,M,N	Low		69%	\$\$
USG MARS™ HEALTHCARE HIGH-CAC PANELS 60/40	SQ	Class A	86270	0.60	40	0.90	White	A,B,C,D,E,F	Low		71%	\$\$
			88271	0.60	40	0.90	White	A,B,D,E,F	Low		71%	\$\$
		Class A	86272	0.60	40	0.90	White	G,H,I,J	Low		71%	\$\$
			86273	0.60	40	0.90	White	K,L,M,N	Low		71%	\$\$
		Class A	88273	0.60	40	0.90	White	K,L,M,N	Low		71%	\$\$
			88273	0.60	40	0.90	White	K,L,M,N	Low		71%	\$\$

### Low Emissions (VOC)

Third party (GREENGUARD Gold) certified for low-emitting performance, meets California Department of Public Health's (CDPH) Standard Method v1.2 - 2017 (CA Section 01350). 'Certificates of Compliance' for Low VOC Emissions are available on usg.com and at spot.ul.com.

### ClimaPlus™ Warranty Performance<sup>5</sup>

Contains a broad-spectrum antimicrobial additive on the face and back of the panel that provides resistance against the growth of mold and mildew. Includes sag-resistance performance.

### High Recycled Content

USG classifies High Recycled Content as greater than 50%. Total recycled content is based on product composition of postconsumer and preconsumer (postindustrial) recycled content per FTC guidelines.

# USG MARS™ HEALTHCARE ACOUSTICAL PANELS

CLIMAPLUS™ PERFORMANCE – NEW CLEAN ROOM, HIGH-NRC AND AIRCARE™  
COATING OPTIONS

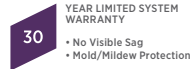
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PRODUCT CERTIFIED  
FOR LOW CHEMICAL  
EMISSIONS:  
ULCOM/GG  
UL2818



UL Classified

Edge	Panel Size	Fire Rating	Item No.	NRC	CAC Min.	LR <sup>2</sup>	Color	Grid Options	VOC Emissions	Anti-Mold & Mildew/Sag Resistance	Recycled Content <sup>1</sup>	Panel Cost
SQ 	2'x2'x3/4"	Class A	<b>86169AIR</b>	0.75	35	0.90	White	A,B,C,D,E,F	Low		69%	\$\$
	2'x4'x3/4"	Class A	<b>88189AIR</b>	0.75	35	0.90	White	A,B,D,E,F	Low		69%	\$\$
SLT 	2'x2'x3/4"	Class A	<b>86684AIR</b>	0.75	35	0.90	White	G,H,I,J	Low		69%	\$\$
	2'x4'x3/4"	Class A	<b>88683AIR</b>	0.75	35	0.90	White	G,H,I,J	Low		69%	\$\$
FLB 	2'x2'x3/4"	Class A	<b>86984AIR</b>	0.75	35	0.90	White	K,L,M,N	Low		69%	\$\$
	2'x4'x3/4"	Class A	<b>88983AIR</b>	0.75	35	0.90	White	K,L,M,N	Low		69%	\$\$
SQ 	2'x2'x3/4"	Class A	<b>86169CR</b>	0.75	35	0.90	White	O	Low		68%	\$\$
	2'x4'x3/4"	Class A	<b>88189CR</b>	0.75	35	0.90	White	O	Low		68%	\$\$
SLT 	2'x2'x3/4"	Class A	<b>86684CR</b>	0.75	35	0.90	White	P	Low		68%	\$\$
	2'x4'x3/4"	Class A	<b>88683CR</b>	0.75	35	0.90	White	P	Low		68%	\$\$

USG MARS™ HEALTHCARE  
WITH AIRCARE™ COATING<sup>4</sup>  
75/35

USG MARS™ HEALTHCARE  
CLEAN ROOM PANELS  
75/35

**Low Emissions (VOC)**  
Third party (GREENGUARD Gold) certified for low-emitting performance, meets California Department of Public Health's (CDPH) Standard Method v1.2 - 2017 (CA Section 01350). 'Certificates of Compliance' for Low VOC Emissions are available on [usg.com](http://usg.com) and at [spot.ul.com](http://spot.ul.com).

**ClimaPlus™ Warranty Performance<sup>3</sup>**  
Contains a broad-spectrum antimicrobial additive on the face and back of the panel that provides resistance against the growth of mold and mildew. Includes sag-resistance performance.

**High Recycled Content**  
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# USG MARS™ HEALTHCARE ACOUSTICAL PANELS

CLIMAPLUS™ PERFORMANCE — NEW CLEAN ROOM, HIGH-NRC AND AIRCARE™  
COATING OPTIONS

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PRODUCT CERTIFIED  
FOR LOW CHEMICAL  
EMISSIONS:  
ULCOM/GG  
UL2818



## GRID PROFILE OPTIONS

A USG DX®	B USG DXW™	C <sup>5</sup> USG Centricitee™ DXT™	D USG DXLA™
E USG ZXLA™	F USG AX™	G USG DX®	H USG DXLA™
I USG ZXLA™	J USG AX™	K USG Centricitee™ DXT™	L USG Fineline® DXF™
M USG Fineline® 1/8 DXFF™	N USG Identitee® DXI™	O USG CE™	P USG DXCE™

## PHYSICAL DATA/ FOOTNOTES

**Product literature**  
Data sheet: SC2585

**ASTM E1264 classification**  
ASTM E1264-22 Type IV, Form 1 & 2, Pattern E & G  
ASTM E1264-23 Type A, Form A2.1, Pattern E & G

**ASTM E84 and CAN/ULC S102 surface-burning characteristics Class A**

Flame spread: 25 or less  
Smoke developed: 50 or less

**Weight**  
1.03-1.24 lb./sq. ft.

**Thermal resistance**  
R-2.2

**Maximum backloading**  
See USG 30-Year Limited System Warranty Commercial Applications (SC2102).

**Online tools**  
usgdesignstudio.com or cgcdesignstudio.com

**ASTM D2486 scrubability test**  
(standard test)

**ASTM D4828 washability test**  
(modified test)

**Water repellency**  
Cobb method (Tappi T441 om-84) Water Drop Test

### \*\*Maintenance

To clean panel, use a clean, white cloth with water or a mild detergent and wipe surface. To disinfect panel, lightly spray surface and wipe clean with a clean, white cloth. Acceptable colorless disinfectants include:

- Hydrogen peroxide
- Isopropyl alcohol
- Quaternary ammonium
- Sodium hypochlorite

Do not mix cleaners. Follow cleaner manufacturer's recommendations.

### USG Mars™ Healthcare Clean Room

- Field-cut edges of USG Mars™ Healthcare Clean Room panels may be sealed with white latex paint. Use square edge panels for all lay-in field-cut perimeter panels.

- Clean Room-rated applications require a suspension system with gasketed tee flanges such as USG Donn® Brand CE™.

- Tested to ISO Class 5 particle emissions, per ISO 14644, by UL Environment. Rating may decrease to ISO Class 7 or greater with airflow above 1 ACH, pressure fluctuations, or vibrations in the ceiling system.

- For more information, please reference test report from UL Environment.

### Metric sizes available

Contact sales for minimum quantities and lead times.

### Footnotes

1. For details, see USG Sustainability tool at usgdesignstudio.com or cgcdesignstudio.com.
2. LR values are shown as averages.
3. Panel face and back surfaces treated with a proprietary broad-spectrum antimicrobial standard formulation that inhibits and retards the growth of mold and mildew. For details, see USG 30-Year Limited System Warranty Commercial Applications (SC2102).
4. AirCare™ coating removes formaldehyde by an average of 75% over 10 years at an average indoor concentration of 13 ppb.
5. Maximum 2'x2' with SQ edge panels.
6. All USG Mars™ High NRC Acoustical Panels with a "plant-based binder" label contain up to 65% plant-based material in the binder. For more information please refer to the USG Mars™ Acoustical Panels Health Product Declaration, available at www.usg.com

WEIGHT FOR 88189CR IS THE LOWER END SINCE IT'S 3/4" THICK AS OPPOSED TO THE UPPER END BEING 7/8".

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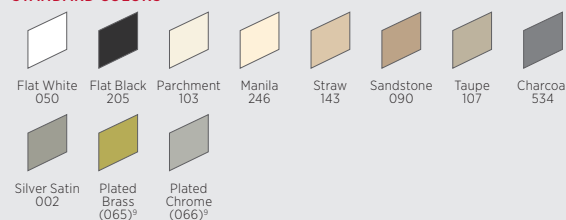


# USG DONN® BRAND DX®/DXL™ ACOUSTICAL SUSPENSION SYSTEM

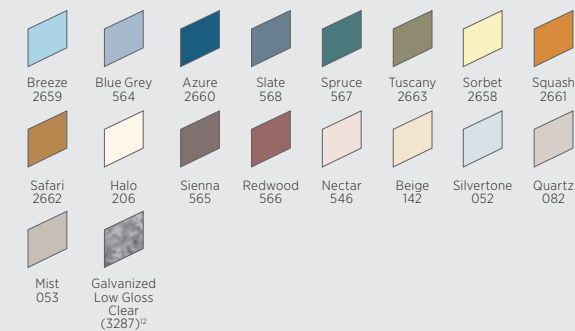
USG Donn® Brand DX®/DXL™  
Acoustical Suspension System/  
USG Eclipse™ Acoustical Panels

TO ORDER SAMPLES, GO TO [USG.COM](http://USG.COM) OR [CGCINC.COM](http://CGCINC.COM)

#### STANDARD COLORS<sup>4</sup>



#### ADVANTAGE COLORS<sup>4</sup>



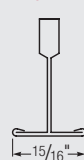
#### PREMIUM COLORS



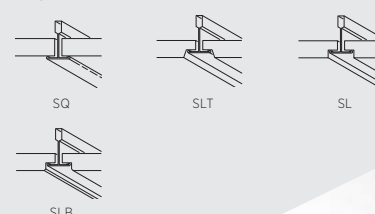
#### POWDER-COATED FINISH



#### PROFILE



#### EDGE DETAIL



#### FEATURES AND BENEFITS

- 15/16" exposed tee system. Components for use in general and fire-rated applications.
- Maximum economy and design simplicity.
- Compatible with USG Logix™ Integrated Ceiling System.
- USG DXL™ system features more than 80 UL designs (up to three hours).
- Cross-tee override-ends resist twisting and give a professionally finished look.
- Meets or exceeds all national code requirements, including seismic.
- Proprietary Quick-Release™ cross tees.
- High recycled content (HRC) available.
- Custom colors available.
- ICC-ES evaluated for seismic installations (ESR-1222).
- USG Donn® Brand DX™/DXL™ Acoustical Suspension System is part of the Ecoblueprint™ portfolio — meeting today's sustainability standards. For sustainability documentation go to [USG.com](http://USG.com) or [CGCInc.com](http://CGCInc.com).

#### APPLICATIONS

- Fire-rated Interior General-use Areas
- USG Logix™ Integrated System

# USG DONN® BRAND DX®/DXL™ ACOUSTICAL SUSPENSION SYSTEM

ORDER SAMPLES/LITERATURE  
USG: usg.com or samplitt@usg.com  
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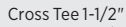
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usg.ecomedes.com



Declare® Labels on select finishes, see usg.ecomedes.com for more details and documentation.

## 15/16" TEE SYSTEM<sup>10</sup>



ASTM Class	Length	Height	Item No.	Fire Rating <sup>5</sup>	Color <sup>4,9</sup>	Seismic Design Category <sup>11</sup> / Rated Load <sup>12</sup>					
						IBC	ICC-ES Evaluated Installation	4' Hanger Spacing	Hanger Spacing	6' Hanger Spacing <sup>8</sup>	
Intermediate Duty	12' 3600 mm	USG 1.64" (42 mm)	DX24	Class A	Flat White Standard Advantage	A-C	7/8" Molding ACM7 Clip	12 lb./LF	6.3 lb./LF	3.7 lb./LF	
			DXL24								
			DXL24HRC								
Heavy Duty	12' 3600 mm	USG 1.64" (42 mm)	DX26	Class A	Flat White Standard Advantage	A-F	7/8" Molding ACM7 Clip	16 lb./LF	8.4 lb./LF	5 lb./LF	
			DXL26								
			DXL26HRC								
	2' 600 mm	USG 1" (25 mm)	DX216	Class A	Flat White, Standard, Advantage, and Premium						
			DXL216								
			DXL216HRC								
	CGC 1" (25 mm)	DX/DXL216									
	20"	1" (25 mm)	DX2016	Class A	Flat White, Standard, Advantage, and Premium						
	30"	1" (25 mm)	DX3016	Class A	Flat White, Standard, Advantage, and Premium						
	3'	1-1/2" (38 mm)	DX324	Class A	Flat White, Standard, Advantage, and Premium						
	4' 1200 mm	USG 1-1/2" (38 mm)	DXL424	Class A	Flat White, Standard, Advantage, and Premium						
			DXL424HRC								
			DX/DXL424								
	CGC 1-1/2" (38 mm)	DX422 <sup>5,7,9</sup>	Class A	Flat White, Standard, Advantage, and Premium							
	4' (1200 mm)	1" (25 mm)	DX416	Class A	Flat White, Standard, Advantage, and Premium						
	4' (1200 mm)	1-1/2" (38 mm)	DX426 HD	Class A	Flat White, Standard, Advantage, and Premium						
	5' (1500 mm)	1-1/2" (38 mm)	DXL524	Class A	Flat White, Standard, Advantage, and Premium						
	6'	1-1/2" (38 mm)	DX624	Class A	Flat White, Standard, Advantage, and Premium						
	8'	1-1/2" (38 mm)	DX824	Class A	Flat White, Standard, Advantage, and Premium						

Wall Angle	Length	Item No.	Color	Shadowline	Wall Angle	Length	Item No.	Color
	12' 3600 mm	M7	Standard Advantage Premium			12' 3600 mm	MS125	Flat White Standard Advantage Premium
		M7HRC						
	10' 3000 mm	M18	Standard Advantage Premium			12' 3600 mm	MS174	Standard Advantage Premium
							MS174HRC	
	10' 3000 mm	M20SM-2	Standard Advantage Premium			10' 3000 mm	MS274 <sup>5</sup>	
	10' 3000 mm	M20 <sup>5</sup>	Standard Advantage Premium					
		M20SM/Seismic						

**Low Emissions (VOC)**  
CDPH 01350 v1.2-2017 compliance on select finishes, see usg.ecomedes.com for more details and documentation.

**High Recycled Content**  
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AC3167/rev. 8-24

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### Product literature and samples

Data sheet: AC3167  
USG Logix™ system guide: IS268  
USG Logix™ architectural design guide: IS287  
USG Logix™ critical system dimensions: IS609  
Sample flat white—seismic: 271370,  
Sample flat white: 215673,  
Sample main tee: 206563,  
Sample flat black: 205100

### Material

Min. G30 hot-dipped galvanized steel body and cap. Baked-on polyester paint.

### Installation

Install according to ASTM C636, ASTM E580, Cisca and USG requirements. Alternate installation methods may be used when approved by the authority having jurisdiction.

### Online tools

usgdesignstudio.com, cgcdesignstudio.com  
usg.ecomedes.com

### ICC Evaluation Report for Code Compliance

See ICC-ES Evaluation Report ESR-1222 for allowable values and conditions of use in seismic design categories A through F. Reports are subject to reexamination, revision and possible cancellation. Refer to usg.com for most current version.

### ASTM Load Compliance

Classified as Light, Intermediate or Heavy Duty per ASTM C635 when tested and evaluated in accordance with ASTM E3090 and AC368.

### Notes

- All USG main tees, cross tees and main tee-hanger wire connections meet AC 368 and ASTM E580 requirements for tension and compression strength, as tested per ASTM E3090.
- Rated Load expressed in lb./LF based on simple span tests in accordance with ASTM E3090 with deflection limit of L/360. Duty rating is assigned based on rated load per ASTM C635.
- UL fire-rated listing, labeling and follow-up applies only to fire-rated components.
- Color program for imperial only. Consult Customer Service for custom color and metric-tee colors. Upcharges apply to Standard and Advantage colors.
- Non-fire-rated only.
- Non-fire-rated applications may mix USG DX® and DXL™ parts.
- Panels must be specified to be field-cut and field-revealed and to provide widest possible lay-on edge.
- For USG DXL™, channel moldings are also acceptable in some designs. Check *UL Fire Resistance Directory* for molding options.
- Brass and chrome available on limited items.
- Metric sizes listed are available with standard lead times. Other metric sizes available by RTQ.
- Non-Fire Rated DX424 offered for West Coast customers only.
- Galvanized Low Gloss Clear is available in USG Donn® Brand DX® / USG Donn® Brand DXL™ Acoustical Suspension System only.
- Seismically tested and evaluated in accordance with ASTM E3118 and AC156.

Manufactured by  
USG Interiors, LLC  
550 West Adams Street  
Chicago, IL 60661

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# BSE

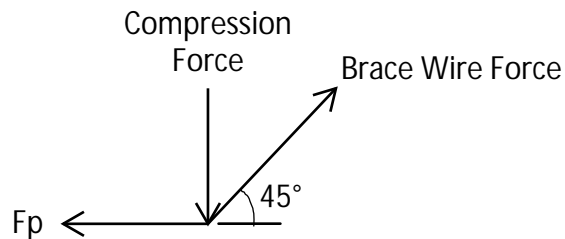
Brienen Structural Engineers, P.S.

## Ceiling Seismic Bracing:

$0.7E = 1.35 \text{ PSF MAX}$  (from previous)

Provide (4) way bracing wires @ 8' x 8' grid @ 45° angle from horizontal to the structure.

$F_p = 8' \times 8' \times 1.35 \text{ PSF} = 86.4 \text{ lbs}$



Brace wire force =  $F_p / \cos 45^\circ = 122.2 \text{ lbs} < \text{Allowable tension load of 12ga wire} = 275 \text{ lbs} \rightarrow \text{OK}$

Anchor force:

$R_x = F_p = 86.4 \text{ lbs}$  (shear)

$R_y = \text{brace wire force} \times \sin 45^\circ = 86.4 \text{ lbs}$  (tension) = Compression Force

Use HILTI X-CX ALH-27 Shotpin clips - Allowable Load at 45-degree = 125 lbs  
(Anchor load table attached.)

Compression Strut: Maximum unbraced length = 7'-0"

Use 250T125-22 [57] unbraced.

Allowable compression load when loaded through its web = 159 lbs (fully unbraced)

See attached load table.

3.3.2.1	Product description	_____
3.3.2.2	Material specifications	_____
3.3.2.3	Technical data	_____
3.3.2.4	Ordering information	_____



#### Listings/Approvals

ICC-ES (International Code Council)  
ESR-2184 with LABC/LARC Supplement



## 3.3.2 X-CX CEILING CLIP AND HANGER ASSEMBLIES

### 3.3.2.1 PRODUCT DESCRIPTION

Ceiling clip assemblies are an economical and recognized method of suspending acoustical ceiling grids and panels from concrete and steel. These pre-assembled ceiling clips consist of a sheet metal clip with a pre-mounted powder-actuated fastener and are pre-tied with wires of various lengths and gauges depending on ceiling height and other requirements. When the fastening is made, the clip, fastener and wire are installed in one step. Further productivity can be achieved through the use of a Hilti powder-actuated pole tool.

#### Product features:

The X-CX ceiling clip is premounted with either an X-AL-H fastener or an X-C fastener.

The X-AL-H fastener has a long conical tip design, which better ensures optimal tension loads and stick rate while X-C fastener is a standard solution for fastening into normal weight concrete or concrete over metal deck.

### 3.3.2.2 MATERIAL SPECIFICATIONS

Part	Material designation	Steel diameter/ thickness	Plating
X-AL-H Fastener	Carbon Steel	0.177"	5 µm Zinc <sup>1</sup>
X-C27 Fastener	Carbon Steel	0.138"	5 µm Zinc <sup>1</sup>
X-CX Clip	Carbon Steel	16 GA	5 µm Zinc <sup>1</sup>
Wire	Carbon Steel	12 GA, 9 GA or 8 GA	Class 1 <sup>2</sup>

<sup>1</sup> ASTM B633, SC 1, Type III.

<sup>2</sup> Pre-mounted ASTM A641/A641M Class 1 wires come attached with a minimum of three tight turns in 1-1/2" length.



### 3.3.2.3 TECHNICAL DATA

#### Allowable loads in normal weight concrete<sup>1,2,3</sup>

Fastener designation	Concrete compressive strength			
	4,000 psi		6,000 psi	
Load direction	Tension lb (kN)	45-degree lb (kN)	Tension lb (kN)	45-degree lb (kN)
X-CX ALH22	90 (0.40)	125 (0.56)	90 (0.40)	125 (0.56)
X-CX ALH27	125 (0.56)	165 (0.73)	110 (0.49)	150 (0.67)
X-CX ALH32	160 (0.71)	210 (0.93)	145 (0.64)	200 (0.89)
X-CX C27	90 (0.40)	125 (0.56)	-	-

1 The tabulated allowable load values are for the powder-actuated ceiling clip assemblies only, using a safety factor that is greater or equal to 5.0, calculated based on testing in accordance with ICC-ES AC70 and ASTM E1190. Connected components, including wires, must be investigated separately.

2 Multiple fasteners are recommended for any attachment.

3 The concrete thickness at the point of penetration must be a minimum of three times the fastener embedment depth.

#### Allowable Loads in structural 3000 psi lightweight concrete over metal deck<sup>1,2,3,4</sup>

Fastener designation	Fastener location			
	Lower flute		Upper flute	
Load direction	Tension lb (kN)	45-degree lb (kN)	Tension lb (kN)	45-degree lb (kN)
X-CX ALH22	90 (0.40)	110 (0.49)	110 (0.49)	110 (0.49)
X-CX ALH27	120 (0.53)	125 (0.56)	150 (0.67)	130 (0.67)
X-CX ALH32	150 (0.67)	145 (0.64)	190 (0.85)	160 (0.71)
X-CX C27	80 (0.36)	110 (0.49)	110 (0.49)	110 (0.49)

AT GRAVITY, USE X-CX ALH22  
ALLOWABLE TENSION = 90LBS

AT LATERAL, USE X-CX ALH27  
ALLOWABLE 45-DEGREE LOAD = 125LBS

1. The tabulated allowable load values are for the powder-actuated ceiling clip assemblies only, using a safety factor that is greater or equal to 5.0, calculated based on testing in accordance with ICC-ES AC70 and ASTM E1190. Connected components, including wires, must be investigated separately.

2. Multiple fasteners are recommended for any attachment.

3. The concrete thickness at the point of penetration must be a minimum of three times the fastener embedment depth.

4. Deck panel must be a 3-inch deep composite floor deck and have a minimum 0.0358 inch base-metal thickness, a minimum yield strength of 40 ksi and a minimum tensile strength of 55 ksi.

#### Allowable loads in minimum ASTM A36 (Fy ≥ 36 ksi; Fu ≥ 58 ksi) steel<sup>1,2,3</sup>

Fastener designation	Steel thickness in.					
	1/4		3/8		1/2 <sup>4</sup>	
Load direction	Tension lb (kN)	45-degree lb (kN)	Tension lb (kN)	45-degree lb (kN)	Tension lb (kN)	45-degree lb (kN)
X-CX ALH22	260	260	260	260	260	260

1 The tabulated allowable load values are for the powder-actuated ceiling clip assemblies only, using a safety factor that is greater or equal to 5.0, calculated based on testing in accordance with ICC-ES AC70 and ASTM E1190. Connected components, including wires, must be investigated separately.

2 Low-velocity fasteners shall be driven to where the point of the fastener penetrates through the steel base material, except otherwise noted.

3 Multiple fasteners are recommended for any attachment.

4 For fastening into 1/2-inch or thicker steel, DX460/DX5 with black cartridge may be needed. For more information, contact Hilti technical service.

# SYSTEM LOAD VALUE

**CEILING LOAD LIMITS (PSF) FOR DIFFERENT CONFIGURATIONS OF DRYWALL SYSTEMS AT L/360 WITH CROSS TEES AT 24 INCHES ON CENTER**

		Hanger Spacing on Main Runner (inches) <sup>1</sup>		
		48	32	16
Main Runner Spacing (inches on center)	72	2.9	2.9	2.9
	50	4.5	8.3	8.3
	48	4.7	9.2	9.2
	36	6.2	10.0	10.0
	24	9.3	10.0	10.0

For SI: 1 inch = 25.4 mm; 1 psf = 574.6 Pa.

<sup>1</sup> Hanger wires must comply with Section 3.3.2 of ICC ES ESR-3336.

**CEILING LOAD LIMITS (PSF) FOR DIFFERENT CONFIGURATIONS OF DRYWALL SYSTEMS AT L/240 WITH CROSS TEES AT 24 INCHES ON CENTER**

		Hanger Spacing on Main Runner (inches) <sup>1</sup>		
		48	32	16
Main Runner Spacing (inches on center)	72	3.8	4.4	4.4
	50	5.5	10.0	10.0
	48	5.7	10.0	10.0
	36	7.6	10.0	10.0
	24	10.0	10.0	10.0

For SI: 1 inch = 25.4 mm; 1 psf = 574.6 Pa.

<sup>1</sup> Hanger wires must comply with Section 3.3.2 of ICC ES ESR-3336.

**CEILING LOAD LIMITS (PSF) FOR DIFFERENT CONFIGURATIONS OF DRYWALL SYSTEMS AT L/360 WITH CROSS TEES AT 16 INCHES ON CENTER**

		Hanger Spacing on Main Runner (inches) <sup>1</sup>		
		48	32	16
Main Runner Spacing (inches on center)	72	3.1	4.4	4.4
	50	4.5	10.0	10.0
	48	4.7	10.0	10.0
	36	6.2	10.0	10.0
	24	9.3	10.0	10.0

For SI: 1 inch = 25.4 mm; 1 psf = 574.6 Pa.

<sup>1</sup> Hanger wires must comply with Section 3.3.2 of ICC ES ESR-3336.

**CEILING LOAD LIMITS (PSF) FOR DIFFERENT CONFIGURATIONS OF DRYWALL SYSTEMS AT L/240 WITH CROSS TEES AT 16 INCHES ON CENTER**

		Hanger Spacing on Main Runner (inches) <sup>1</sup>		
		48	32	16
Main Runner Spacing (inches on center)	72	4.7	6.5	6.5
	50	6.7	10.0	10.0
	48	7.0	10.0	10.0
	36	9.3	10.0	10.0
	24	10.0	10.0	10.0

For SI: 1 inch = 25.4 mm; 1 psf = 574.6 Pa.

<sup>1</sup> Hanger wires must comply with Section 3.3.2 of ICC ES ESR-3336.

# WIRE DATA (9-GAUGE AND 12-GAUGE)

**9-Gauge Wire Breaking Strength and Technical Data**

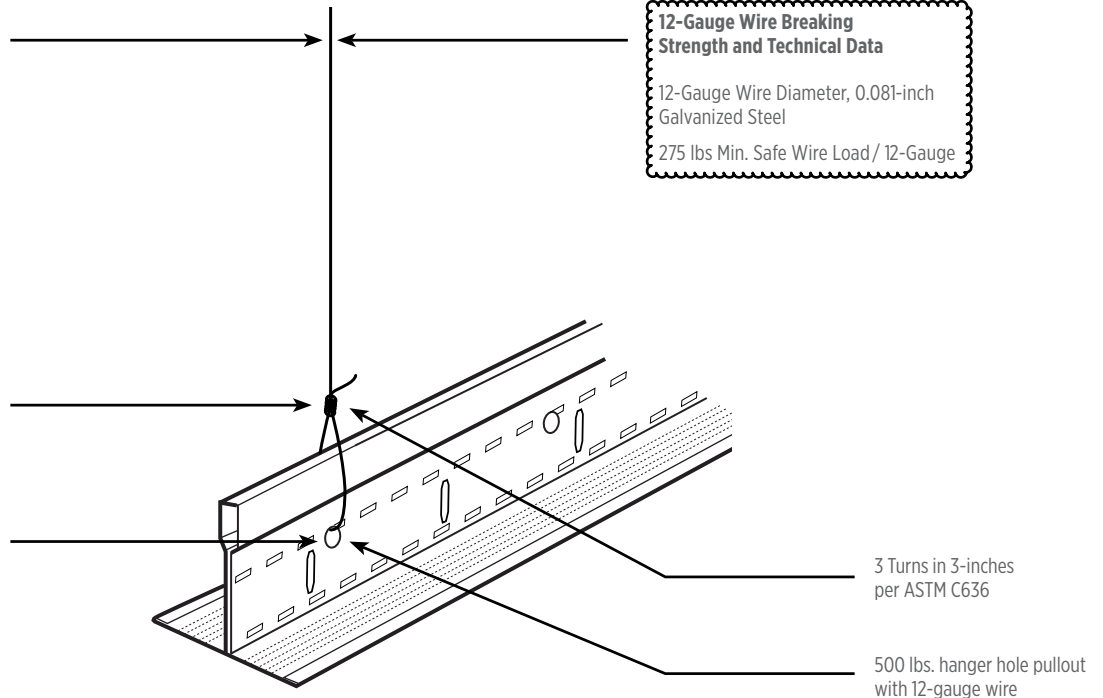
9-Gauge Wire Diameter, 0.114-inch  
Galvanized Steel  
645 lbs Min. Safe Wire Load / 9-Gauge

**12-Gauge Wire Breaking Strength and Technical Data**

12-Gauge Wire Diameter, 0.081-inch  
Galvanized Steel  
275 lbs Min. Safe Wire Load / 12-Gauge

3 Turns in 3-inches per ASTM C636

450 lbs. hanger hole pullout with 9-gauge wire



3 Turns in 3-inches per ASTM C636

500 lbs. hanger hole pullout with 12-gauge wire

NOTE: CertainTeed Drywall Grid System can be used with either 9-gauge or 12-gauge hanger wire. Consult local authorities having jurisdiction for local code requirements.

# SCAFCO Steel Stud Mfg.

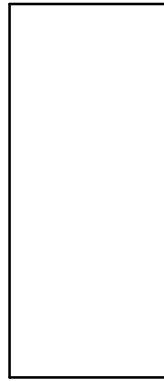


DATE: 11/7/2024

**SECTION DESIGNATION: 250SFT125-22 [57] Single**

**Section Dimensions:**

Web Height = 2.629 in  
Top Flange = 1.250 in  
Bottom Flange = 1.250 in  
Inside Corner Radius = 0.0820 in  
Design Thickness = 0.0235 in



**Steel Properties:**

Fy = 57.000 ksi

### ALLOWABLE AXIAL LOADS

**INPUT PARAMETERS**

Overall Stud Length = 7.17 ft  
Load has not been modified for load type or duration  
Member Configuration: SINGLE MEMBER

**TOTAL ALLOWABLE AXIAL LOADS (lb)**

<u>WEAK AXIS BRACING</u>	<u>MAXIMUM KL/r</u>	<u>CONCENTRIC LOADING</u>	<u>LOADED THROUGH WEB</u>
NONE	216	260	159
MID Pt	108	548	328
THIRD Pt	82	774	444

159LBS @ 7'-2" UNBRACED



# **BSE**

Project: \_\_\_\_\_

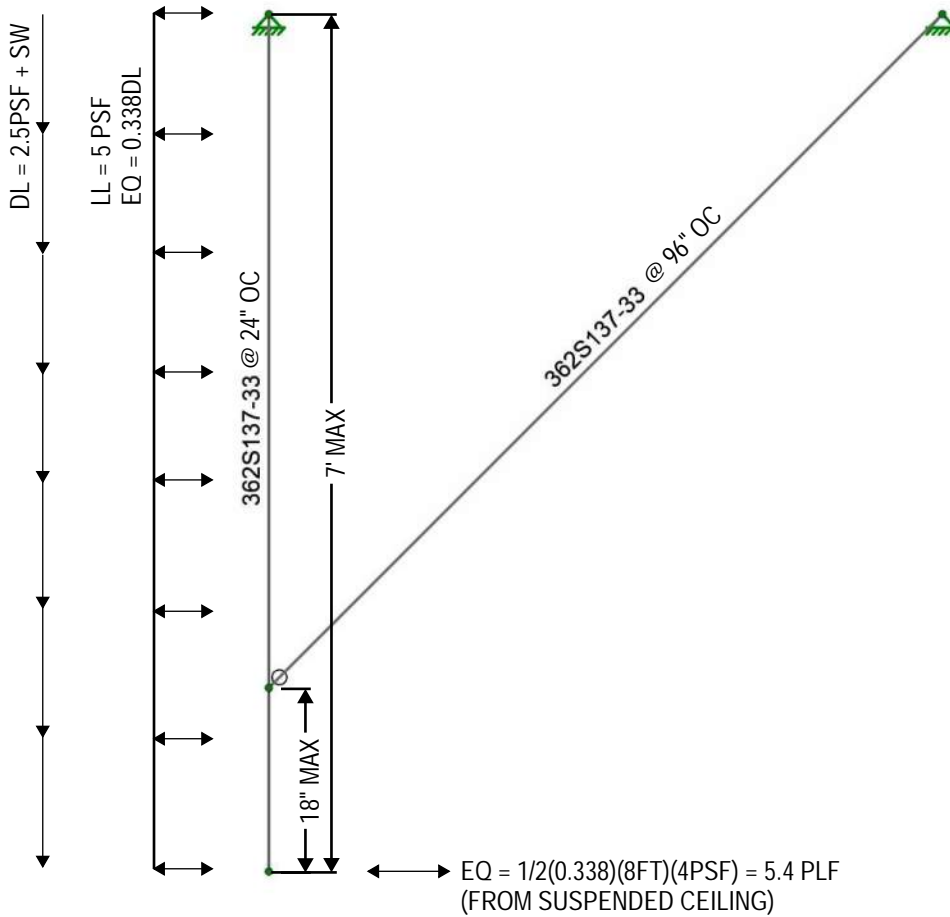
Date: \_\_\_\_\_

**B**rienen **S**tructural **E**ngineers, P.S.

## SOFFIT DESIGN



# 7ft SOFFIT DROP DESIGN





Code Check (Env)

Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-.90
Cyan	.50-.75
Blue	0-.50

PROVIDE (2) HILTI X-U PAF EMBEDDED 1" MIN TO EA LOWER FLUTE @ 36" OC

$(3/8)(398.9\text{lbs})/(2*90\text{lbs}) + (3/8)(101.8\text{lbs})/(2*330\text{lbs}) = 0.89 < 1.0 \text{ OK!}$

(REDUCED ANCHOR TENSION CAPACITY TO 90lbs FOR SUSTAINED DEAD LOAD)

101.8    -101.8

398.9 / 42.5

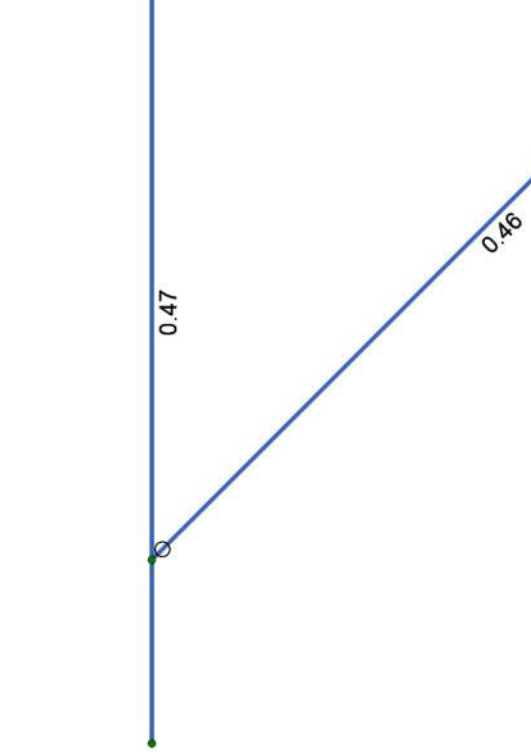
-153.2

178.2    -178.2

203.2

PROVIDE (2) HILTI X-U PAF EMBEDDED 1" MIN TO EA LOWER FLUTE

$203.2\text{lbs}/(2*155\text{lbs}) + 178.2\text{lbs}/(2*330\text{lbs}) = 0.93 < 1.0 \text{ OK!}$



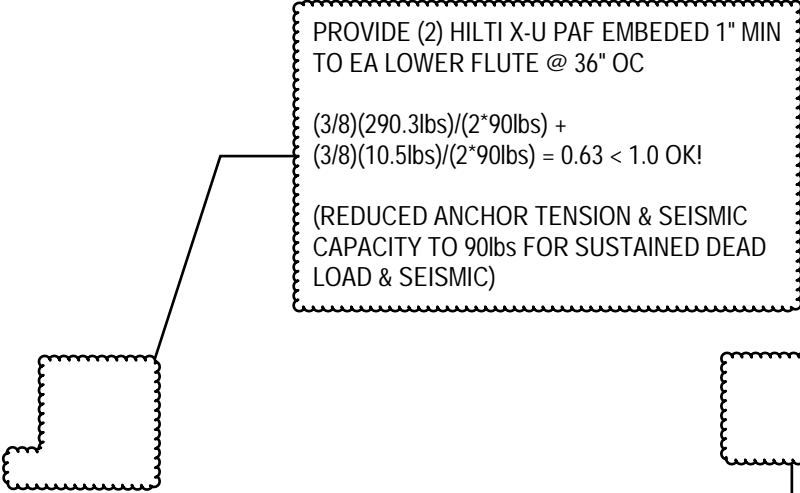
REACTIONS ARE FOR 8' TRIB

Member Code Checks Displayed (Enveloped)  
Reaction and Moment Units are lbs and lb-in (Enveloped)




Live Envelope

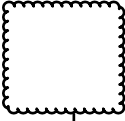
SK-1
Dec 22, 2024 at 02:08 PM
Soffit Drop.r3d



PROVIDE (2) HILTI X-U PAF EMBEDDED 1" MIN TO EA LOWER FLUTE @ 36" OC

$(3/8)(290.3\text{lbs})/(2*90\text{lbs}) + (3/8)(10.5\text{lbs})/(2*90\text{lbs}) = 0.63 < 1.0 \text{ OK!}$

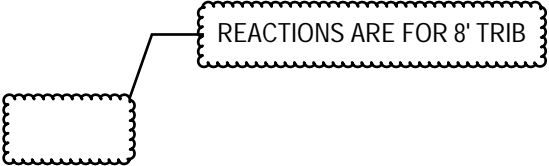
(REDUCED ANCHOR TENSION & SEISMIC CAPACITY TO 90lbs FOR SUSTAINED DEAD LOAD & SEISMIC)



PROVIDE (2) HILTI X-U PAF EMBEDDED 1" MIN TO EA LOWER FLUTE

$94.6\text{lbs}/(2*90\text{lbs}) + 75.5\text{lbs}/(2*90\text{lbs}) = 0.95 < 1.0 \text{ OK!}$

(REDUCED ANCHOR CAPACITY TO 90lbs FOR SEISMIC)



REACTIONS ARE FOR 8' TRIB