ECLIPSE ENGINEERING
A CUSHING TERRELL COMPANY

City of Puyallup
Development & Permitting Services
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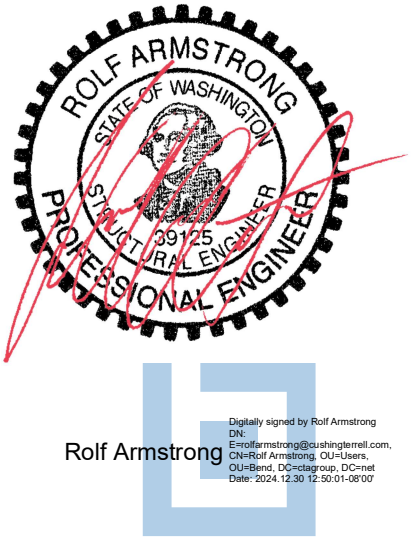
Structural Calculations

Steel Stockroom Shelving

By PIPP Mobile Storage Systems Inc.

PIPP PO #78963 SO #162538

DEC 30 2024



Rolf Armstrong

Digitally signed by Rolf Armstrong
DN: E=rolfarmstrong@cushingterrell.com, CN=Rolf Armstrong, OU=Users, OU=Bend, DC=ctagroup, DC=net
Date: 2024.12.30 12:50:01-08'00'

Barnes & Noble

3500 S. Meridian Street – Unit 800
Puyallup, Washington 98373

Prepared For:

PIPP Mobile Storage Systems Inc.
2966 Wilson Drive NW
Walker, MI 49534

The calculations contained within justify the seismic resistance of the shelving for both vertical and lateral forces as required by the 2021 IBC, ASCE 7-16, AISI S100-20, ACI 318-19, and ANSI/RMI-MH16.1-2012. These storage shelves are not accessible to the public.

PIPP MOBILE STORAGE SYSTEMS INC.

STEEL STORAGE SHELVING - LIGHT RETAIL

CODES: Current Editions of the: IBC & CBC & ASCE 7 & RMI

Design Inputs: Steel Storage Shelving: 36"x18" UNITS

Shelving Geometry -

Height of Shelving Unit =	8.0	ft	Steel Yield Stress =	33	ksi
Width of Shelving Unit =	3.0	ft	Modulus of Elast. =	29000	ksi
Depth of Shelving Unit =	1.5	ft	Eff. Lx Factor =	1.7	
Number of Shelves/Unit =	8		Unbraced Length,x =	13.000	in
Average Vertical Shelf Spacing =	13.13	in	Unbraced Length,y =	13.000	in
Back to Back Unit?	YES		Type of Post?	14ga Upright Posts	
Unit Type:	FIXED		Type of Beam?	DRL Low Profile	
Number of Units per Track?	NA		Top Shelf Loaded?	YES	
Mobile Anchor Spacing?		in	Intermediate Anchor:	Double	
Wall Supported Unit?	YES				

Shelving Loading -

Live Load per Shelf =	14.00	psf	Display On Plaque Near Shelving Units
Maximum Weight per Shelf =	60	lbs	Per 36.00 in. x 18.00 in. shelf
Dead Load per Shelf =	2.0	psf	Perforated Metal Shelf
Weight of Each Post =	5.9	lbs	Shelving is NOT accessible to public
Weight of Mobile Carriage =	0	lbs	
Floor Load Calculations:			
Total Load on Each Post =	144	lbs	Ground Flr Conc Slab
Total Load On Each Unit =	576	lbs	2500 psi NWC Concrete
Floor Area Load =	6.0	ft2	3/8"ϕ KB-TZ2 w/ 2.000" Embedment
Allowable Floor Loading =	100	psf	
Floor Load Under Shelf =	96	psf	OK FOR 100psf RETAIL FLOOR LOADING

Seismic Information -

Risk Category =	II	Not Open to the Public	SDC: D
Seismic Importance Factor (I_E) =	1.0		
Site Class =	D	– Default	Worst Case Assumed

Mapped Accel. Parameters: ρ = 1.3

Ss = 1.264	Fa = 1.200	Sms = 1.517	Sds = 1.011
S1 = 0.436	Fv = 1.864	Sm1 = 0.813	Sd1 = 0.542

Structural System: ASCE 7 Section 15.5.1

Steel Storage Shelving:	R = 4	ap = 2.5	Ip = 1.0

Average Roof Height =	20	ft	0'-0" For Ground Floor Location
Height of Base Attachment =	0	ft	Ground Floor

Shear Coeff Boundaries =	Vmin = 0.044	RMI, 2.6.3	
	Vmax = 0.253	RMI, 2.6.3	
Design Base Shear Coeff =	V_t = 0.230	Adjusted For ASD	RMI, 2.6.3

Lateral Force Distribution: per ASCE 7 Section 15.5.1

Total Dead Load per Level =	12.0	lbs
Total Live Load per Level =	60	lbs
Lateral DL Force per Level =	2.7	lbs
Lateral LL Force per Level =	13.8	lbs
67% of LL Force per Level =	9.2	lbs
Total DL Base Shear =	22.0	lbs
Total LL Base Shear =	110.4	lbs

LC1: Each Level, Loaded to 67% of its Live Weight — Cumulative Moment: 20053 in-lbs

Total Base Shear = 96.0 lbs — LC #1 Governs

LC 2: Top Level Only, Loaded to 100% of its Live Weight — Cumulative Moment: 10266 in-lbs

Total Base Shear = 35.8 lbs — LC #2 Does NOT Govern

	Load Case #1:		Load Case #2:		Lateral Force/Shelf:		
Shelf Heights:	Load:	% Per Shelf:	Load:	% Per Shelf:	Force #:	LC #1:	LC #2:
h1 = 2 in	52 lbs	0.5%	12 lbs	0.2%	F1 =	0.5 lbs	0.1 lbs
h2 = 15 in	52 lbs	3.9%	12 lbs	1.7%	F2 =	3.7 lbs	0.6 lbs
h3 = 29 in	52 lbs	7.4%	12 lbs	3.3%	F3 =	7.1 lbs	1.2 lbs
h4 = 42 in	52 lbs	10.9%	12 lbs	4.9%	F4 =	10.5 lbs	1.8 lbs
h5 = 54 in	52 lbs	14.0%	12 lbs	6.3%	F5 =	13.5 lbs	2.3 lbs
h6 = 68 in	52 lbs	17.6%	12 lbs	7.9%	F6 =	16.9 lbs	2.8 lbs
h7 = 81 in	52 lbs	21.1%	12 lbs	9.4%	F7 =	20.2 lbs	3.4 lbs
h8 = 95 in	52 lbs	24.6%	72 lbs	66.2%	F8 =	23.6 lbs	23.7 lbs
h9 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F9 =	0.0 lbs	0.0 lbs
h10 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F10 =	0.0 lbs	0.0 lbs
h11 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F11 =	0.0 lbs	0.0 lbs
h12 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F12 =	0.0 lbs	0.0 lbs
h13 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F13 =	0.0 lbs	0.0 lbs
h14 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F14 =	0.0 lbs	0.0 lbs
h15 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F15 =	0.0 lbs	0.0 lbs
h16 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F16 =	0.0 lbs	0.0 lbs
h17 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F17 =	0.0 lbs	0.0 lbs
h18 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F18 =	0.0 lbs	0.0 lbs
h19 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F19 =	0.0 lbs	0.0 lbs
h20 = 0 in	0 lbs	0.0%	0 lbs	0.0%	F20 =	0.0 lbs	0.0 lbs
		Sum = 100%		Sum = 100%	Total =	96.0 lbs	35.8 lbs

By inspection, the force distribution for intermediate level without live load (case 2) is negligible. Calculate the moment for each column based on the total seismic base shear for each shelf being loaded to 67% of it's allowable live weight. The column at the center of the shelving system is the worst case for this condition.

Column Calculations - Combined Bending and Axial

Post Type: **Double Rivet "L" or "T" Post**

Width =	1.5	in	r_x =	0.470	in
Depth =	1.5	in	S_x =	0.044	in3
Thickness =	0.075	in	I_x =	0.049	in4
			A_p =	0.217	in2

Column Bending Calculations -

Max Column Moment =	12.9	ft-lbs	
Allowable Bending Stress =	19.8	ksi	
Bending Stress on Column =	3.5	ksi	**Bending Stress OK**

Column Deflection Calculations -

Max Deflection =	0.064	in	At Top of Unit
Deflection Ratio =	1497		L/Δ
Allowable Deflection =	4.8	in	Max Deflection = 5% of Height
			Deflection OK

Column Axial Calculations - Per "L" Post

DL + PL =	127	lbs	RMI Load Combination #1
DL + PL + EQ =	214	lbs	RMI Load Combination #6

Column Capacity Calculations -

Controlling Buckling Stress =	20.2	ksi	
Allowable Comp. Stress =	19.5	ksi	
Factor of Safety for Comp. =	1.80		
Nominal Column Capacity =	3825	lbs	
Allowable Column Capacity =	2125	lbs	
Static Axial Load on Column =	127	lbs	**Axial Load OK**

Combined Bending And Axial Forces -

Critical Buckling Load =	28539	lbs		
Axial Stress Unity =	0.101		Magnification Factor =	0.992
Bending Stress Unity =	0.152		C_m =	0.85
Combined Stress Unity =	0.252		**Column is Adequate**	

Overturning and Anti-Tip Calculations

Overturning Forces On Anchors (LRFD) **Per Back-to-Back Unit** **Overstrength Factor, Ω = 2.00**

Load Combination	Total Weight, W (lbs)	Base Shear, Eh (lbs)	Vertical Seismic Force, Ev (lbs)	Overturning Moment (Ω=2), Mo (ft-lbs)	Resisting Moment, Mr (ft-lbs)	Net Overturning Moment, Mn (ft-lbs)	Shear Force per Anchor, V (lbs)	Tension Force per Anchor, T (lbs)
LC1	834	211	169	1178	873	305	**105**	**102**
LC2	311	79	63	539	326	213	**39**	**71**

Per Side of Unit

$W(LC1) = \left(DL_{Shelf} + 0.67 * LL_{Shelf}\right) * \#\ of\ Shelves$
$W(LC2) = DL_{Shelf} * \#\ of\ Shelves + LL_{Shelf}$
$Eh = (Vt * W)/(0.7 * \rho)$
$Ev = 0.20 * Sds * W$
$Mo(LC1) = \Omega * \sum(hx * fx/0.7)$
$Mo(LC2) = \Omega * Vt/0.7 * \left(DL_{Total} * \left(\frac{H}{2} + S\right) + LL_{Shelf} * H\right)$

$Mr = (0.9 * W - Ev) * \frac{d}{2}$
$Mn = Mo - Mr$
$V = \frac{\Omega * Eh}{\#\ of\ Anchors}$
$T = \frac{\frac{Mn}{d}}{\#\ of\ Anchors}$

USE: POST INSTALLED ANCHOR BOLTS / LAG SCREWS AS REQUIRED FOR FLOOR NOTED BELOW

Fixed Units - Allowable Loads
Allowable Tension Force = 1327 lbs
Allowable Shear Force = 1043 lbs

2500 psi NWC Concrete
3/8"ϕ KB-TZ2 w/ 2.000" Embedment
DUE TO WALL CONNECTION AT TOP OF UNIT, ANCHOR TENSION = 0 LBS

Fixed Units - Combined Loading	LC1:	0.077	
	LC2:	0.054	**Floor anchors are adequate**

Mobile Units - Allowable Loads
Allowable Tension Force = 1448 lbs
Allowable Shear Force = 1723 lbs

Mobile Unit Anchors -	LC1:	N/A	
	LC2:	N/A	

Anti-Tip Track Design - **N/A**

Type of Anti-Tip Device =	**NONE**			
Tension per Carriage Anchor =	N/A	lbs		
Combined Loading =	N/A		**N/A**	
Tension per Shelf Post =	N/A	lbs		
Capacity of Screws to Carriage =	N/A	lbs	**N/A**	
Anti-Tip Peg Yield Stress =	40.275	ksi	Steel	Fy = 53.700 ksi
Thickness Anti-Tip Peg Head =	0.09	in		Fu = 63.800 ksi
Width of Anti-Tip Peg Head =	0.43	in		
Section Modulus of Peg Head =	0.0006	in3		
Allowable Stress on Leg =	40.275	ksi		
Bending Stress on Leg =	N/A	ksi		
Anti-Tip Stress Unity =	N/A		**N/A**	
Section Modulus of Track =	0.093	in3		
Spacing of Track A.B's =	0.00	in		
Allowable Alumn. Stress =	21	ksi	6061-T6	Fty = 35.000 ksi
Bending Stress on Track =	N/A	ksi		Ftu = 38.000 ksi
Track Stress Unity =	N/A		**N/A**	

Shelf Beam Calculations

Shelf Beam Calculations: **DRL Low Profile**

Steel Yield Stress =	33	ksi	Shelf DL =	2.0	psf
Modulus of Elast. =	29000	ksi	Shelf LL =	14.00	psf

Beam Type: DRL Low Profile

Area of Beam =	0.264	in2
Section Modulus of Beam =	0.098	in3
Moment of Inertia of Beam =	0.072	in4

Shelf Width =	3.0	ft	Allowable Bending Stress =	19.8	ksi
Shelf Depth =	1.5	ft	Allowable Shear Stress =	13.2	ksi
Total Load/Shelf =	72	lbs			
Distributed Load =	12	plf			

Maximum Design Moment =	13.5	ft-lbs	
Maximum Design Shear =	18.0	lbs	
Beam Bending Stress =	1.7	ksi	
Bending Stress Unity =	0.084		**Bending Stress OK**
Beam Shear Stress =	0.07	ksi	
Shear Stress Unity =	0.005		**Shear Stress OK**
Max Allowable Deflection =	0.200	in	L/180
Maximum Beam Deflection =	0.011	in	**Deflection OK**

Shelf Beam Rivet Check:

Diameter of Rivet =	0.25	in	
Post Moment Shear on Rivet =	103.4	lbs	
Beam Shear on Rivet =	18.0	lbs	
Resultant Shear =	105.0	lbs	
Bearing Capacity of Rivet =	519.8	lbs	**Bearing Stress OK**
Allowable Shear Stress =	13.5	ksi	
Shear Stress on Rivet =	2.1	ksi	**Shear Stress OK**

Seismic Uplift on Shelves -

Vertical Seismic Component =	14.6	lbs	
Vertical Total Load per Shelf =	52.2	lbs	
Connection Points per Shelf =	4.0	(1) per Corner	
Net Uplift Load per Shelf =	-16.7	lbs	
Uplift Forcer per Connection =	-4.2	lbs	**Rivet Connection OK**

Wall Supported Unit Calculations

Seismic Force at Top of Units -

Average Roof Height =	20.0	ft	
Height of Attachment =	7.9	ft	
Shear Coeff Boundaries =	V_{min} =	0.303	
	V_{max} =	1.618	
Design Base Shear Coeff =	V_t =	0.411	Adjusted For ASD and "ρ"
Total Weight per Unit =	417	lbs	
Lateral Force at Top/Bottom =	86	lbs	
Standard Stud Spacing =	16	in	
Wall Connections per Unit =	2		
Tek Screw Capacity =	84	lbs	Tension Cap. for #10 Screw in 20ga Stud
Force Per Connection =	43	lbs	**Screw Capacity OK**

Light Gauge Steel Stud Wall Framing

Stud Design Data -

Height of Wall Studs =	16.0	ft	Int. Non-Brg - Worst Case Ht Assumed
Location of Point Load =	7.9	ft	
Design Lateral Load =	42.9	lbs	From Shelving Unit
Additional Lateral Load =	5.0	psf	Interior Seismic Force
Design Axial Load =	85.3	lbs	Dead Load of Wall Framing
Spacing of Studs =	16.0	in	

TRY: 3-5/8" x 1-5/8" x 20ga Studs @ 16" o.c. (Worst Case Assumed)

Width =	3.625	in	rx =	1.450	in
Depth =	1.625	in	ry =	0.616	in
Thickness =	0.035	in	Sx =	0.268	in3
Fy =	33	ksi	Ix =	0.551	in4
E =	29000	ksi	Ap =	0.262	in2
K =	1.0		Unbraced Length X =	16	ft
			Unbraced Length Y =	4	ft

Stud Capacity -

Buckling Stress, X =	16.32	ksi	
Buckling Stress, Y =	47.14	ksi	
Allowable Buckling Stress =	16.32	ksi	
Nominal Axial Strength =	4277	lbs	
Factor of Safety =	1.92		
Allowable Axial Load =	2228	lbs	
Maximum Design Moment =	384.9	ft-lbs	
Maximum Design Shear =	74.4	lbs	
Allowable Bending Stress =	21.78	ksi	
Actual Bending Stress =	17.23	ksi	**Bending Stress OK**
Allowable Shear Stress =	13.20	ksi	
Actual Shear Stress =	0.28	ksi	**Shear Stress OK**
Allowable Axial Stress =	8.50	ksi	
Actual Axial Stress =	0.33	ksi	**Axial Stress OK**
Combined Stress Unity =	0.83		**Combined Stress OK**

Slab Bearing & Uplift Calculations

Slab Design Properties -

Minimum Concrete Strength =	2500	psi	Assumed
Thickness of Concrete Slab =	4	in	Assumed
Weight of Concrete Slab =	50	psf	
Allowable Bearing Pressure =	500	psf	Assumed
Bearing Loads On Post =	24	lbs	Dead Load
	120	lbs	Live Load
	196	lbs	EQ Load
Uplift Loads on Post =	199	lbs	Resultant Uplift

Slab Bearing Capacity -

Depth of Post on Slab =	1.5	in		
Factored Bearing Load =	501	lbs		
Required Bearing Area =	98.00	in2	9.90	inches per side
Critical Section =	2.20	in	For Bending	
Soil Pressure on Crit. Section =	736.5	plf	Along Critical Length	
Section Modulus =	32.0	in3	Plain Concrete per Foot	
Shear Area =	22	in		
Conc. Shear Stress =	5.7	psi		
Allowable Shear Stress =	73.2	psi	**Shear Stress OK**	
Conc. Bending Stress =	4.6	psi		
Allowable Bending Stress =	137.5	psi	**Bending Stress OK**	

Slab Uplift Capacity -

Required Area to Resist Uplift =	0.00	ft2		
Length of Slab Req'd =	0.00	ft	Assume Required Area / Full Shelf Width	
Worst Case Length of Slab =	0.75	ft	Maximum Length Required	
Distance to Anchor Bolt =	0.38	ft		
Length of 1ft Strip =	0.75	ft	Length Safety Factor:	2.00
Shear Force on 1ft Strip =	52.5	lbs		
Allowable Shear Force =	1760.0	lbs	**Shear OK**	
Bending Moment on 1ft Strip =	4.9	ft-lbs		
Allowable Bending Moment =	366.7	ft-lbs	**Bending OK**	

PIPP MOBILE STORAGE SYSTEMS INC.

STEEL STORAGE SHELVING - LIGHT RETAIL

CODES: Current Editions of the: IBC & CBC & ASCE 7 & RMI

Steel Storage Shelving Summary (Rivet)

Project Name: Barnes & Noble
Location: 3500 S. Meridian Street - Unit 800
PO #: 78963

NOTE: THE FOLLOWING RESULTS ARE A SUMMARY OF THE ENGINEERING CHECKS PERFORMED FOR EACH SHELVING CONFIGURATION. REF. THE FULL SET OF CALCULATIONS FOR THE DESIGN METHODOLOGY USED ON EACH SEPARATE ELEVATION.

Shelving Components

Post Section = 14ga Upright Posts
Typical Anchors = 3/8"ϕ KB-TZ2 w/ 2.000" Embedment

Seismic Parameters

Importance Factor (I_E) =	1.0	Not Open to the Public	
Risk Category =	II		
Site Class =	D	– Default	
Ss =	1.264	Sds =	1.011
S1 =	0.436	Sd1 =	0.542
SDC =	D		
V_t =	0.231		

Summary of Results

Elevation Label		Geometry				GOVERNING BEAM SECTION	Max Load per Shelf Level per Unit		Max Floor Live Load
		Width	Depth	Height	Lvl's				
1	36"x18" UNITS	36 in	18 in	96 in	8	DRL Low Profile	14.0 psf	**60 lbs**	96 psf
2	36"x12" UNITS	36 in	12 in	120 in	8	DRL Low Profile	15.5 psf	**45 lbs**	97 psf

PIPP MOBILE STORAGE SYSTEMS INC.

STEEL STORAGE SHELVING - LIGHT RETAIL

CODES: Current Editions of the: IBC & CBC & ASCE 7 & RMI

Steel Storage Shelving Summary (Rivet) Continued

Summary of Results Cont...

Elevation Label		Post Unity	Beam Unity	Rivet Unity	Anti-Tip Unity	Anchor Unity	Wall Unity	Slab Check	Max Base Shear	Max Horizontal Drift
1	36"x18" UNITS	0.25	0.08	0.20	N/A	0.08	0.83	0.08	96 lbs	0.064 in
2	36"x12" UNITS	0.20	0.06	0.19	N/A	0.04	0.76	0.03	73 lbs	0.095 in

The ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

ATC Hazards by Location site operations will discontinue at 11:59pm (PST) on December 31, 2024

Hazards by Location

Search Information

Address: 3500 S Meridian Street, Puyallup, Washington 98373

Coordinates: 47.1579611, -122.2965855

Elevation: 433 ft

Timestamp: 2024-12-23T22:34:36.112Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: II

Site Class: D-default

Basic Parameters

Name	Value	Description
S_S	1.264	MCE_R ground motion (period=0.2s)
S_1	0.436	MCE_R ground motion (period=1.0s)
S_{MS}	1.516	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.011	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.914	Coefficient of risk (0.2s)
CR_1	0.898	Coefficient of risk (1.0s)
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	1.264	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.383	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.436	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.485	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

Geometric Properties

Area	0.217	in^2
Ix	0.049	in^4
Ixy	-0.029	in^4
Iy	0.049	in^4
Sx+	0.044	in^3
Sx-	0.120	in^3
Sy+	0.044	in^3
Sy-	0.120	in^3
Xc	0.406	in
Yc	0.406	in
rx	0.473	in
ry	0.473	in

Polar Properties

Ip	0.097	in^4
rp	0.669	in

Principal Properties

I1	0.078	in^4
I2	0.019	in^4
S1+	0.074	in^3
S1-	0.074	in^3
S2+	0.035	in^3
S2-	0.036	in^3
r1	0.599	in
r2	0.296	in
α	45.000	deg

Overall Properties

Depth	1.500	in
Perimeter	5.920	in
Weight	0.001	K/ft
Width	1.500	in

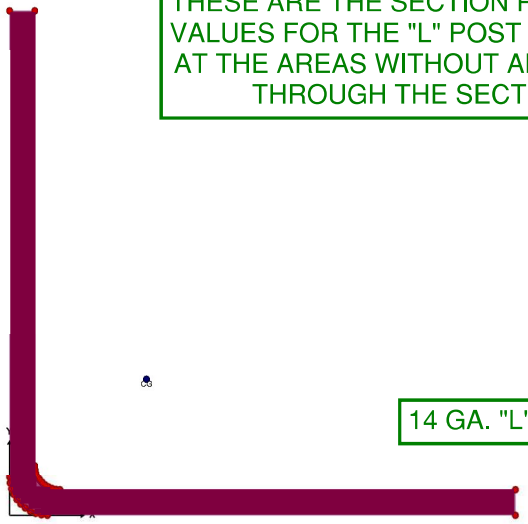
Torsion Properties

Cw	0.000	in^6
H	0.626	
J	0.000	in^4
Xsc	0.041	in
Ysc	0.041	in
ro	0.845	in
B1	0.000	in

Plastic Properties

Xpna	0.074	in
Ypna	0.074	in
Zx	0.080	in^3
Zy	0.080	in^3

THESE ARE THE SECTION PROPERTY VALUES FOR THE "L" POST MEMBERS AT THE AREAS WITHOUT ANY HOLES THROUGH THE SECTION.



14 GA. "L" POST

Geometric Properties

Area	0.401	in^2
Ix	0.183	in^4
Ixy	0.000	in^4
Iy	0.192	in^4
Sx+	0.140	in^3
Sx-	0.291	in^3
Sy+	0.113	in^3
Sy-	0.113	in^3
Xc	1.693	in
Yc	0.629	in
rx	0.676	in
ry	0.692	in

Polar Properties

Ip	0.375	in^4
rp	0.967	in

Principal Properties

I1	0.192	in^4
I2	0.183	in^4
S1+	0.113	in^3
S1-	0.113	in^3
S2+	0.140	in^3
S2-	0.291	in^3
r1	0.692	in
r2	0.676	in
α	90.000	deg

Overall Properties

Depth	1.938	in
Perimeter	14.293	in
Weight	0.001	K/ft
Width	3.387	in

Torsion Properties

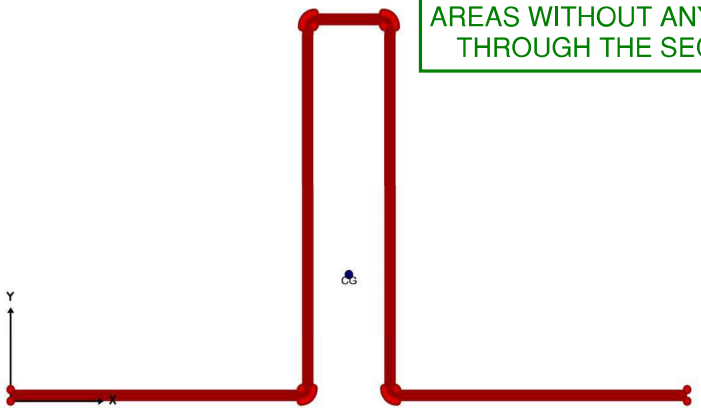
Cw	0.059	in^6
H	0.967	
J	0.000	in^4
Xsc	1.693	in
Ysc	0.807	in
ro	0.983	in
B1	0.000	in

Plastic Properties

Xpna	1.693	in
Ypna	0.328	in
Zx	0.231	in^3
Zy	0.205	in^3

16 GA. "T" POST

THESE ARE THE SECTION PROPERTY VALUES FOR THE "T" POST MEMBERS AT THE AREAS WITHOUT ANY HOLES THROUGH THE SECTION.



NOTE THAT THE "T" POST MEMBER SECTION PROPERTIES ARE APPROXIMATELY THREE TIMES THE VALUES FOR THE "L" POST MEMBERS, BUT ONLY SUPPORT ABOUT TWICE THE LOADS.

Geometric Properties

Area	0.142	in^2
Ix	0.041	in^4
Ixy	-0.026	in^4
Iy	0.041	in^4
Sx+	0.040	in^3
Sx-	0.089	in^3
Sy+	0.040	in^3
Sy-	0.089	in^3
Xc	0.461	in
Yc	0.461	in
rx	0.539	in
ry	0.539	in

Principal Properties

I1	0.067	in^4
I2	0.016	in^4
S1+	0.063	in^3
S1-	0.063	in^3
S2+	0.034	in^3
S2-	0.026	in^3
r1	0.685	in
r2	0.332	in
α	45.000	deg

Polar Properties

Ip	0.083	in^4
rp	0.762	in

Overall Properties

Depth	1.500	in
Perimeter	4.218	in
Weight	0.000	K/ft
Width	1.500	in

Plastic Properties

Xpna	0.074	in
Ypna	0.074	in
Zx	0.060	in^3
Zy	0.060	in^3

Shear Flow

Name	Qx in^3	Qy in^3	f(Vx) K/ft	f(Vy) K/ft
Part #2 0	0.036	0.022	0.000	0.000
Part #3 0	0.014	0.014	0.000	0.000
Part #4 0	0.022	0.036	0.000	0.000

THESE ARE THE SECTION PROPERTY VALUES FOR THE "L" POST MEMBERS AT THE AREAS WITH THE RIVET-CONNECTION HOLES THROUGH THE SECTION.

14 GA. "L" POST

Geometric Properties

Area	0.288	in^2
Ix	0.156	in^4
Ixy	0.000	in^4
Iy	0.120	in^4
Sx+	0.125	in^3
Sx-	0.226	in^3
Sy+	0.071	in^3
Sy-	0.071	in^3
Xc	1.693	in
Yc	0.689	in
rx	0.735	in
ry	0.646	in

Principal Properties

I1	0.156	in^4
I2	0.120	in^4
S1+	0.125	in^3
S1-	0.226	in^3
S2+	0.071	in^3
S2-	0.071	in^3
r1	0.735	in
r2	0.646	in
α	0.000	deg

Polar Properties

Ip	0.276	in^4
rp	0.978	in

Overall Properties

Depth	1.938	in
Perimeter	10.745	in
Weight	0.001	K/ft
Width	3.387	in

Plastic Properties

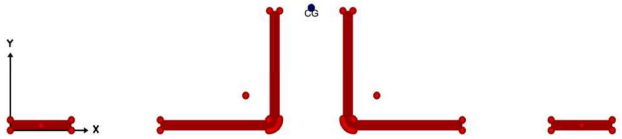
Xpna	1.693	in
Ypna	0.328	in
Zx	0.180	in^3
Zy	0.132	in^3

Shear Flow

Name	Qx in^3	Qy in^3	f(Vx) K/ft	f(Vy) K/ft
ClosedPoly 1	0.036	0.027	0.000	0.000
Part 1	0.013	0.030	0.000	0.000
Part 2	0.013	0.030	0.000	0.000
Part 3	0.097	0.000	0.000	0.000
Part 4	0.036	0.027	0.000	0.000

16 GA. "T" POST

THESE ARE THE SECTION PROPERTY VALUES FOR THE "T" POST MEMBERS AT THE AREAS WITH THE RIVET-CONNECTION HOLES THROUGH THE SECTION.



NOTE THAT THE "T" POST MEMBER SECTION PROPERTIES ARE APPROXIMATELY THREE TIMES THE VALUES FOR THE "L" POST MEMBERS, BUT ONLY SUPPORT ABOUT TWICE THE LOADS.

Screw Capacities

Table Notes

1. Capacities based on AISI S100 Section E4.
2. When connecting materials of different steel thicknesses or tensile strengths, use the lowest values. Tabulated values assume two sheets of equal thickness are connected.
3. Capacities are based on Allowable Strength Design (ASD) and include safety factor of 3.0.
4. Where multiple fasteners are used, screws are assumed to have a center-to-center spacing of at least 3 times the nominal diameter (d).
5. 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.
6. Pull-out capacity is based on the lesser of pull-out capacity in sheet closest to screw tip or tension strength of screw.
7. Pull-over capacity is based on the lesser of pull-over capacity for sheet closest to screw header or tension strength of screw.
8. Values are for pure shear or tension loads. See AISI Section E4.5 for combined shear and pull-over.
9. Screw Shear (Pss), tension (Pts), diameter, and head diameter are from CFSEI Tech Note (F701-12).
10. Screw shear strength is the average value, and tension strength is the lowest value listed in CFSEI Tech Note (F701-12).
11. 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) 0.138" dia, 0.272" Head			#8 Screw (Pss= 1278 lbs, Pts = 586 lbs) 0.164" dia, 0.272" Head			#10 Screw (Pss= 1644 lbs, Pts = 1158 lbs) 0.190" dia, 0.340" Head			#12 Screw (Pss= 2330 lbs, Pts = 2325 lbs) 0.216" dia, 0.340" Head			¼" Screw (Pss= 3048 lbs, Pts = 3201 lbs) 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)

See back cover for exclusive manufacturers of the Supreme Framing System.

Thickness (mil)	Design Thickness (in)	Fy Yield (ksi)	Fu Tensile (ksi)	#6 Screw (Pss = 643 lbs, Pts = 419 lbs) 0.138" Dia; 0.272" Head			#8 Screw (Pss= 1278 lbs, Pts = 586 lbs) 0.164" Dia; 0.272" Head			#10 Screw (Pss= 1644 lbs, Pts = 1158 lbs) 0.190" Dia; 0.340" Head			#12 Screw (Pss= 2330 lbs, Pts = 2325 lbs) 0.216" Dia; 0.340" Head			¼" Screw (Pss= 3048 lbs, Pts = 3201 lbs) 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	57	65	65	39	137	150	47	137	77	54	171	-	-	-	-	-	-
D20	0.0188	57	65	142 [1]	48	140	150 [1]	57	166	164 [1]	66	208	109	75	208	-	-	-
30EQD	0.0235	57	65	174 [1]	60	140	184 [1]	71	195	236 [1]	82	260	152	93	260	-	-	-
33EQD	0.0235	57	65	174 [1]	60	140	184 [1]	71	195	236 [1]	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

[1] *Values are based on testing using AISI S100 procedures.*

SUPREME products are only available from those SSMA members who are certified to produce SUPREME products.

14/19

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Company:	ECLIPSE ENGINEERING, INC.	Page:	1
Address:	365 NE QUIMBY AVE	Specifier:	nburnam
Phone I Fax:	541-389-9659 |	E-Mail:	
Design:	0.375x3 - HILTI KWIK KB-TZ2	Date:	7/15/2024
Fastening point:	Shelving Unit Anchors		

Specifier's comments: Bases of Fixed Shelving Unit Posts & Anti-tip tracks for Mobile Shelving Units

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - CS 3/8 (2) hnom2**
Item number:	2210236 KB-TZ2 3/8x3
Specification text:	Hilti KB-TZ2 stud anchor with 2.5 in embedment, 3/8 (2) hnom2, Carbon steel, installation per ESR-4266
Effective embedment depth:	$h_{ef,act}$ = 2.000 in., h_{nom} = 2.500 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/1/2023 | 12/1/2025
Proof:	Design Method ACI 318-19 / Mech
Stand-off installation:	
Profile:	
Base material:	cracked concrete, 2500, f_c' = 2,500 psi; h = 4.000 in.
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.10.5.3 (d)) Shear load: yes (17.10.6.3 (c))

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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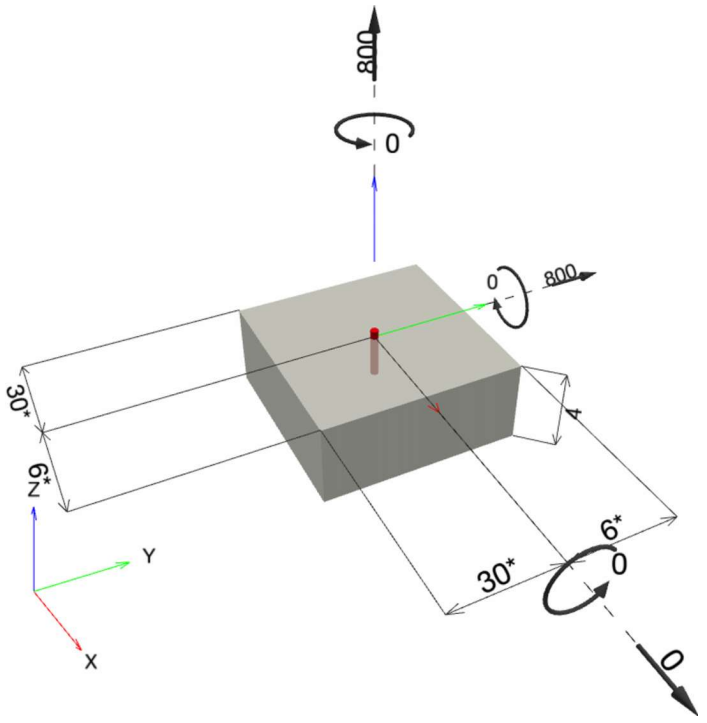
Address:	365 NE QUIMBY AVE	Specifier:	nburnam
Phone I Fax:	541-389-9659 |	E-Mail:	
Design:	0.375x3 - HILTI KWIK KB-TZ2	Date:	7/15/2024
Fastening point:	Shelving Unit Anchors		

Geometry [in.] & Loading [lb, in.lb]



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Address:	365 NE QUIMBY AVE	Specifier:	nburnam
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Design:	0.375x3 - HILTI KWIK KB-TZ2	Date:	7/15/2024
Fastening point:	Shelving Unit Anchors		

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Load case: Design loads	N = 800; V_x = 0; V_y = 800; M_x = 0; M_y = 0; M_z = 0;	yes	71

2 Load case/Resulting anchor forces

Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	800	800	0	800

THIS IS THE LIMITING TENSION VALUE FOR A SINGLE ANCHOR IS 1,448 LBS PER ANCHOR.

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	800	4,869	17	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	800	1,448	56	OK

* highest loaded anchor **anchor group (anchors in tension)

3.1 Steel Strength

N_{sa} [lb]	ϕ	ϕ N_{sa} [lb]	N_{ua} [lb]
6,493	0.750	4,869	800

3.2 Concrete Breakout Failure

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$c_{a,min}$ [in.]	c_{ac} [in.]	$\Psi_{c,N}$		
36.00	36.00	6.000	4.375	1.000		
$e_{c1,N}$ [in.]	$\Psi_{ec1,N}$	$e_{c2,N}$ [in.]	$\Psi_{ec2,N}$	$\Psi_{ed,N}$	$\Psi_{cp,N}$	k_{cr}
0.000	1.000	0.000	1.000	1.000	1.000	21
λ_a	N_b [lb]	ϕ	$\phi_{seismic}$	ϕ N_{cbg} [lb]	N_{ua} [lb]	
1.000	2,970	0.650	0.750	1,448	800	

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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THIS IS THE LIMITING SHEAR VALUE FOR A SINGLE ANCHOR IS 1,541 LBS PER ANCHOR.

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Phone I Fax:	541-389-9659 |	E-Mail:	
Design:	0.375x3 - HILTI KWIK KB-TZ2	Date:	7/15/2024
Fastening point:	Shelving Unit Anchors		

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	800	2,201	37	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	800	2,079	39	OK
Concrete edge failure in direction y+**	800	1,541	52	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

V_{sa} [lb]	$\alpha_{V,seis}$	ϕ	ϕ V_{sa} [lb]	V_{ua} [lb]
3,386	1.000	0.650	2,201	800

4.2 Pryout Strength

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$c_{a,min}$ [in.]	k_{cp}	c_{ac} [in.]	$\Psi_{c,N}$
36.00	36.00	6.000	1	4.375	1.000
$e_{c1,V}$ [in.]	$\Psi_{ec1,V}$	$e_{c2,V}$ [in.]	$\Psi_{ec2,V}$	$\Psi_{ed,N}$	k_{cr}
0.000	1.000	0.000	1.000	1.000	21
λ_a	N_b [lb]	ϕ	$\phi_{seismic}$	ϕ V_{cpg} [lb]	V_{ua} [lb]
1.000	2,970	0.700	1.000	2,079	800

4.3 Concrete edge failure in direction y+

l_e [in.]	d_a [in.]	c_{a1} [in.]	A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	
2.000	0.375	6.000	60.00	162.00	
$\Psi_{ed,V}$	$\Psi_{parallel,V}$	$e_{c,V}$ [in.]	$\Psi_{ec,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$
0.900	1.000	0.000	1.000	1.000	1.500
λ_a	V_b [lb]	ϕ	$\phi_{seismic}$	ϕ V_{cbg} [lb]	V_{ua} [lb]
1.000	4,403	0.700	1.000	1,541	800

5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.553	0.519	5/3	71	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- "An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-19, Chapter 17, Section 17.10.5.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.10.5.3 (b), Section 17.10.5.3 (c), or Section 17.10.5.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.10.6.3 (a), Section 17.10.6.3 (b), or Section 17.10.6.3 (c)."
- Section 17.10.5.3 (b) / Section 17.10.6.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.10.5.3 (c) / Section 17.10.6.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.10.5.3 (d) / Section 17.10.6.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_v.
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-19, Section 26.7.

Fastening meets the design criteria!

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7 Installation data

Profile: -

Hole diameter in the fixture: -

Plate thickness (input): -

Drilling method: Hammer drilled
Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: Kwik Bolt TZ2 - CS 3/8 (2) hnom2
Item number: 2210236 KB-TZ2 3/8x3
Maximum installation torque: 361 in.lb
Hole diameter in the base material: 0.375 in.
Hole depth in the base material: 2.750 in.
Minimum thickness of the base material: 4.000 in.

Hilti KB-TZ2 stud anchor with 2.5 in embedment, 3/8 (2) hnom2, Carbon steel, installation per ESR-4266

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Manual blow-out pump	• Torque controlled cordless impact tool • Torque wrench • Hammer

Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.000	0.000	30.000	6.000	30.000	6.000

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Address:	365 NE QUIMBY AVE	Specifier:	nburnam
Phone I Fax:	541-389-9659 |	E-Mail:	
Design:	0.375x3 - HILTI KWIK KB-TZ2 - Pair	Date:	7/15/2024
Fastening point:	Shelving Unit Anchors		

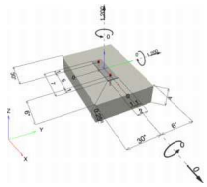
Specifier's comments: Bases of Fixed Shelving Unit Posts for Shelving Units

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - CS 3/8 (2) hnom2**
Item number:	2210237 KB-TZ2 3/8x3 1/2
Specification text:	Hilti KB-TZ2 stud anchor with 2,5 in embedment, 3/8 (2) hnom2, Carbon steel, installation per ESR-4266
Effective embedment depth:	$h_{ef,act}$ = 2.000 in., h_{nom} = 2.500 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/1/2023 | 12/1/2025
Proof:	Design Method ACI 318-19 / Mech
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.250 in.
Anchor plate[R]:	l_x x l_y x t = 7.000 in. x 2.000 in. x 0.250 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 2500, f'_c = 2,500 psi; h = 4.000 in.
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.10.5.3 (d)) Shear load: yes (17.10.6.3 (c))

[R] - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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Company:	ECLIPSE ENGINEERING, INC.	Page:	2
Address:	365 NE QUIMBY AVE	Specifier:	nburnam
Phone I Fax:	541-389-9659 |	E-Mail:	
Design:	0.375x3 - HILTI KWIK KB-TZ2 - Pair	Date:	7/15/2024
Fastening point:	Shelving Unit Anchors		

1.1 Design results

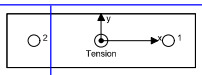
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Load case: Design loads	N = 1,200; V_x = 0; V_y = 1,200;	yes	68

THIS IS THE LIMITING SHEAR VALUE FOR A SINGLE ANCHOR IS 1,327 LBS PER ANCHOR.

2 Load case/Resulting anchor forces

Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	600	600	0	600
2	600	600	0	600



max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0,000/0,000): 1,200 [lb]
resulting compression force in (x/y)=(-/-): 0 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	600	4,869	13	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	1,200	2,654	46	OK

* highest loaded anchor **anchor group (anchors in tension)

3.1 Steel Strength

N_{sa} [lb]	ϕ	ϕ N_{sa} [lb]	N_{sa} [lb]
6,493	0.750	4,869	600

3.2 Concrete Breakout Failure

A_{Nc} [in.^{2}]	A_{Nco} [in.^{2}]	$c_{a,min}$ [in.]	c_{ac} [in.]	$\Psi_{c,N}$
66.00	36.00	6.000	4.375	1.000

$e_{c1,N}$ [in.]	$\Psi_{ec1,N}$	$e_{c2,N}$ [in.]	$\Psi_{ec2,N}$	$\Psi_{ed,N}$	$\Psi_{cp,N}$	k_{cp}
0.000	1.000	0.000	1.000	1.000	1.000	21

λ_a	N_b [lb]	ϕ	$\phi_{seismic}$	ϕ N_{cbg} [lb]	N_{cb} [lb]
1.000	2,970	0.650	0.750	2,654	1,200

THIS IS THE LIMITING TENSION VALUE FOR A SINGLE ANCHOR IS 1,027 LBS PER ANCHOR.

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Address:	365 NE QUIMBY AVE	Specifier:	nburnam
Phone I Fax:	541-389-9659 |	E-Mail:	
Design:	0.375x3 - HILTI KWIK KB-TZ2 - Pair	Date:	7/15/2024
Fastening point:	Shelving Unit Anchors		

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	600	2,201	28	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	1,200	3,811	32	OK
Concrete edge failure in direction y+**	1,200	2,055	59	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

V_{sa} [lb]	$\alpha_{V,seis}$	ϕ	ϕ V_{sa} [lb]	V_{ua} [lb]
3,386	1.000	0.650	2,201	600

4.2 Pryout Strength

A_{Nc} [in.^{2}]	A_{Nco} [in.^{2}]	$c_{a,min}$ [in.]	k_{cp}	c_{ac} [in.]	$\Psi_{c,N}$
66.00	36.00	6.000	1	4.375	1.000

$e_{c1,V}$ [in.]	$\Psi_{ec1,V}$	$e_{c2,V}$ [in.]	$\Psi_{ec2,V}$	$\Psi_{ed,V}$	k_{cp}
0.000	1.000	0.000	1.000	1.000	21

λ_a	N_b [lb]	ϕ	$\phi_{seismic}$	ϕ V_{cbg} [lb]	V_{ua} [lb]
1.000	2,970	0.700	1.000	3,811	1,200

4.3 Concrete edge failure in direction y+

l_e [in.]	d_a [in.]	c_{a1} [in.]	A_{Vc} [in.^{2}]	A_{Vco} [in.^{2}]
2.000	0.375	6.000	80.00	162.00

$\Psi_{ec,V}$	$\Psi_{parallel,V}$	$e_{c,V}$ [in.]	$\Psi_{ec,V}$	$\Psi_{c,V}$	$\gamma_{1,V}$
0.900	1.000	0.000	1.000	1.000	1.500

λ_a	V_b [lb]	ϕ	$\phi_{seismic}$	ϕ V_{cbg} [lb]	V_{ua} [lb]
1.000	4,403	0.700	1.000	2,055	1,200

5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.452	0.584	5/3	68	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

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Phone I Fax:	541-389-9659 |	E-Mail:	
Design:	0.375x3 - HILTI KWIK KB-TZ2 - Pair	Date:	7/15/2024
Fastening point:	Shelving Unit Anchors		

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- "An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-19, Chapter 17, Section 17.10.5.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.10.5.3 (b), Section 17.10.5.3 (c), or Section 17.10.5.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.10.6.3 (a), Section 17.10.6.3 (b), or Section 17.10.6.3 (c)."
- Section 17.10.5.3 (b) / Section 17.10.6.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength, Section 17.10.5.3 (c) / Section 17.10.6.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment, Section 17.10.5.3 (d) / Section 17.10.6.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_v.
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII), Reference ACI 318-19, Section 26.7.

Fastening meets the design criteria!

7 Installation data

Anchor type and diameter: Kwik Bolt TZ2 - CS 3/8 (2) hnom2

Profile: no profile

Item number: 2210237 KB-TZ2 3/8x3 1/2

Hole diameter in the fixture: d_f = 0,438 in.

Maximum installation torque: 361 in.lb

Plate thickness (input): 0,250 in.

Hole diameter in the base material: 0,375 in.

Recommended plate thickness: not calculated

Hole depth in the base material: 2,750 in.

Drilling method: Hammer drilled

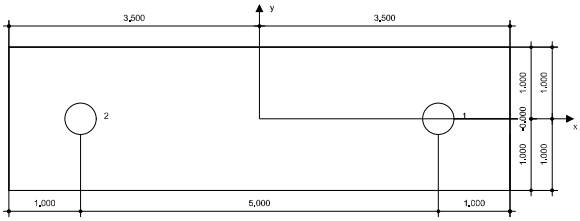
Minimum thickness of the base material: 4,000 in.

Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Hilti KB-TZ2 stud anchor with 2,5 in embedment, 3/8 (2) hnom2, Carbon steel, installation per ESR-4266

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Manual blow-out pump	• Torque controlled cordless impact tool • Torque wrench • Hammer



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_x	c_{-y}	c_y
1	2,500	-2,000	35,000	6,000	30,000	6,000
2	-2,500	0,000	30,000	11,000	30,000	6,000

Hilti PROFIS Engineering 3.1.1

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Fastening point:	Shelving Unit Anchors		

8 Remarks; Your Cooperation Duties

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Input data and results must be checked for conformity with the existing conditions and for plausibility!
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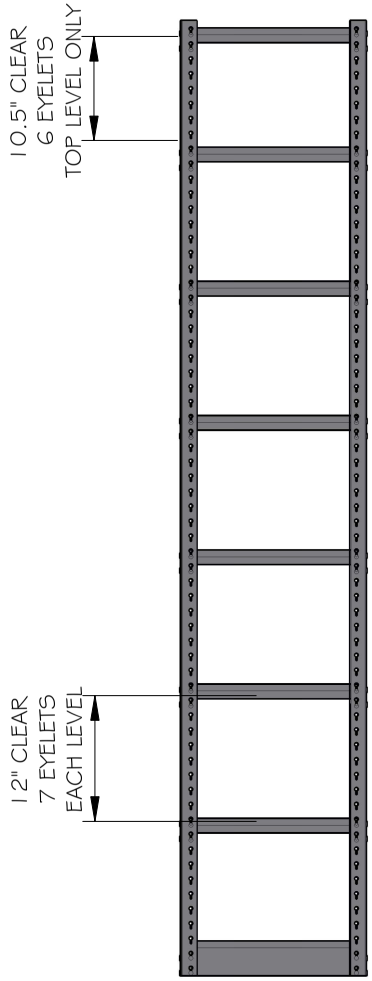
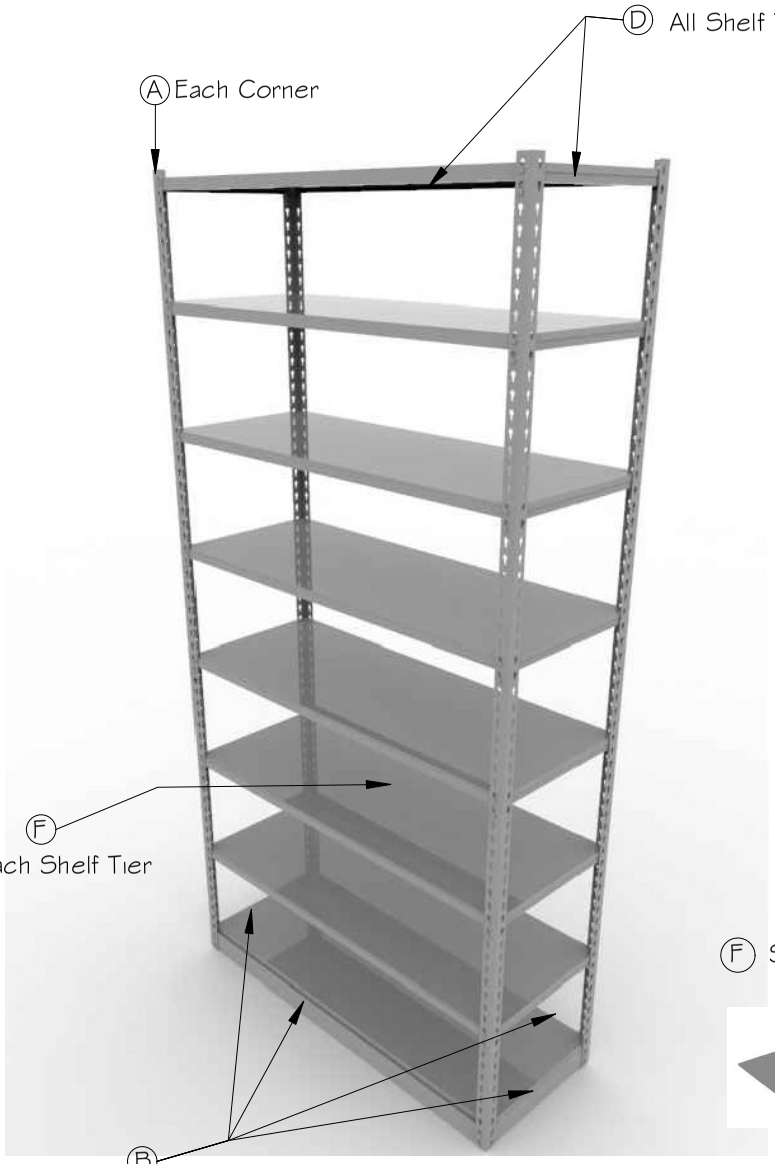
Specifications:
Height: 8' H
Size: 36"-48"X18"-12"
No. of Shelf Levels: 8
Shelf Openings: 7
Shelf Material: Solid Metal or Perf. Metal

Rivet Shelving Elevation

BARNES & NOBLE

PIPP® MOBILE STORAGE SYSTEMS

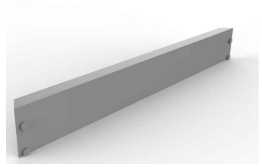




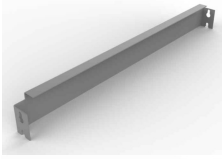
A L- Upright

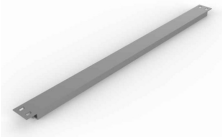
A T-Upright

B Double Rivet Beams

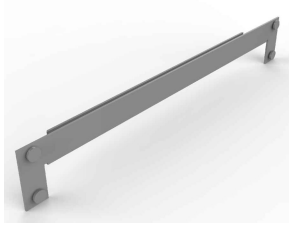


C Shelf Support



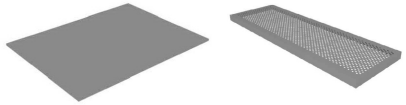


D Low Profile Rivet Beam



E Hang Bar

F Solid Metal or Perf. Metal



Material QTY
4-EUR-96
2-LRA36-48
2-LRA18-12
14-DRS36-48
14-DRS18-12
8-36-48X18-12
Solid Metal or Perf. Metal
- See Quote For Style

19/19

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