Engineers | Architect
Construction Manager

7041 Koll Center Parkway, Suite 200
Pleasanton, CA 94566
Phone – 415 619 6000
Fax – 415 500 9583
Email – hemal@zenithengineers.com
www.zenithengineers.com

PROJECT: 220123-CO2 – RFX Oasis Railing Design – Nationwide Industries

LOCATION: All 50 states

PREPARED BY: Hemal Modi, P.E.

REVIEWED BY: Senthil Puliyadi, M.S., M.Eng., P.E.

REV: 02

DATE: 05/29/2024

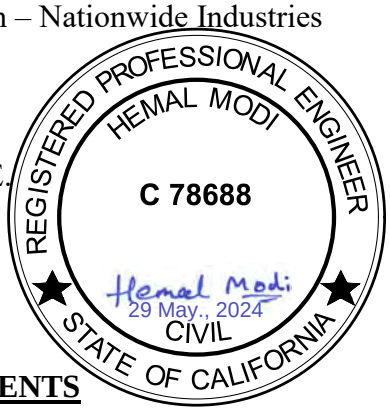

TABLE OF CONTENTS

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RFX Oasis aluminum guard rail system utilizes aluminum extrusions with prefabricated railing panels to construct building guards and rails for decks, balconies, stairs, fences and similar locations. The system is intended for interior and exterior weather exposed applications and is suitable for use in most natural environments. This system may be used for residential, commercial and industrial applications. It is an engineered system designed for the following criteria:

RFX Oasis Cable & Picket Rail System:

The design loading conditions are:

On Top Rail:

Concentrated load = 200 lbs any direction, any location

Uniform load = 50 plf, any direction, perpendicular to rail

For installations compliant with the IRC only the 200# top rail load is applicable.

Railing Material Specifications:

Top Rails & Post shall be Aluminum 6005A – T61 or better and shall conform to Aluminum Design Manual.

Bottom Rails & Rail Balusters shall be Aluminum 6063 – T6 or better and shall conform to Aluminum Design Manual.

Post Base shall be Aluminum 6061 – T6 or better and shall conform to Aluminum Design Manual.

The RFX Oasis system will meet all applicable requirements of the 2006, 2009, 2012, 2015, 2018, 2021 and 2024 International Building Codes and International Residential Codes, CBC and state building codes based on these versions of the IBC, and 2005 and 2010 Aluminum Design Manuals. Wood components and anchorage to wood are designed in accordance with the 2018 National Design Specification for Wood Construction.

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Typical Installations:

Surface mounted with base plates.

Residential Applications:

Rail Height 36” or 42” above finish floor.

Standard Post spacing based on the Rail Panel width from 4’ to 8’

Commercial and Industrial Applications:

Rail Height 42” above finish floor.

Standard Post spacing based on the Rail Panel width from 4’ to 8’.

Posts available:

38” high, 44” high & 54” high

Rail panels available:

36” high x 48” wide Level

36” high x 72” wide Level / Stair

36” high x 96” wide Level / Stair

42” high x 48” wide Level / Stair

42” high x 72” wide Level / Stair

42” high x 96” wide Level

Note: Provide support block connector for picket rail system and cable brace for the cable in-fill system shall be provided at a maximum spacing of 48”.

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BIKASH SIGDEL
LICENSED PROFESSIONAL ENGINEER
No. 20977-S
07/24/2024
HAWAII U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

Signature — 4/30/26 Expiration Date of the License

SIGNATURE & STAMPS

ALABAMA LICENSED No. 33346 PROFESSIONAL ENGINEER BRIAN JAMES SIELAFF
07/24/2024

STATE OF ALASKA 49TH BRIAN J. SIELAFF No. AELC11985 REGISTERED PROFESSIONAL ENGINEER
07/24/2024

STATE OF ARKANSAS LICENSED PROFESSIONAL ENGINEER No. 15369 BRIAN JAMES SIELAFF
07/24/2024

BRIAN JAMES SIELAFF STATE OF WASHINGTON 43821 REGISTERED PROFESSIONAL ENGINEER
5–18–2026
07/24/2024

COLORADO LICENSED BRIAN JAMES SIELAFF PE.0041126 PROFESSIONAL ENGINEER
07/24/2024

BRIAN J SIELAFF LICENSE No. 14574 DELAWARE PROFESSIONAL ENGINEER
07/24/2024

STATE OF CONNECTICUT BRIAN J SIELAFF PEN.0028259 LICENSED PROFESSIONAL ENGINEER
07/24/2024

BRIAN JAMES SIELAFF LICENSE No 69569 STATE OF FLORIDA PROFESSIONAL ENGINEER
Brian James Sielaff
Florida License # 69569
612 S LaCassia, Boise ID 83705
07/24/2024

GEORGIA REGISTERED No. PE034025 PROFESSIONAL ENGINEER BRIAN J SIELAFF
07/24/2024

PROFESSIONAL ENGINEER LICENSED P-10204 STATE OF IDAHO BRIAN J SIELAFF
07/24/2024

LICENSED PROFESSIONAL ENGINEER BRIAN J SIELAFF 062067451 exp 11-30-2025 OF ILLINOIS
07/24/2024

BRIAN J SIELAFF REGISTERED PE11200371 STATE OF INDIANA PROFESSIONAL ENGINEER
07/24/2024

LICENSED PROFESSIONAL ENGINEER BRIAN J SIELAFF P19649 IOWA
07/24/2024

BRIAN J SIELAFF LICENSED PE20525 KANSAS PROFESSIONAL ENGINEER
07/24/2024

STATE OF KENTUCKY BRIAN J SIELAFF 27420 LICENSED PROFESSIONAL ENGINEER
07/24/2024

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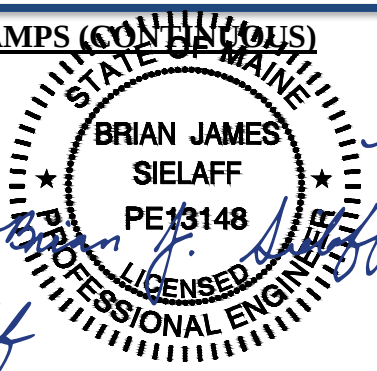

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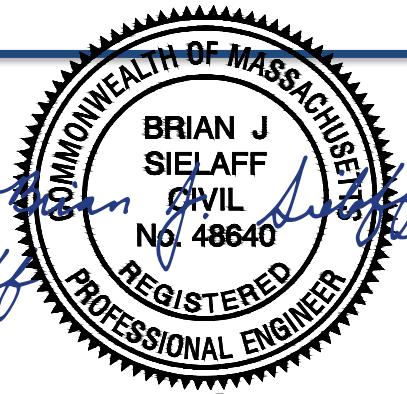

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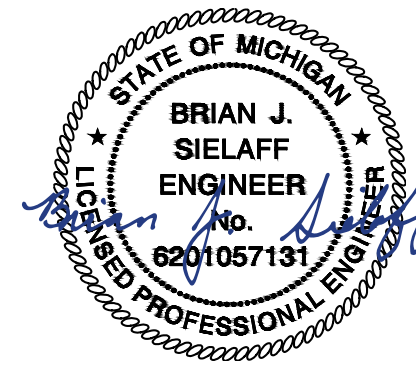

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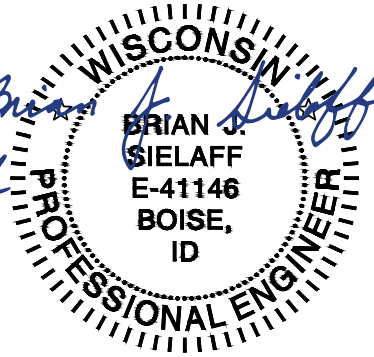

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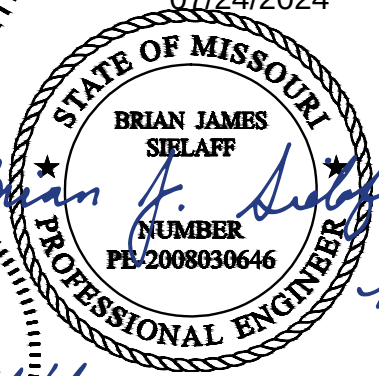

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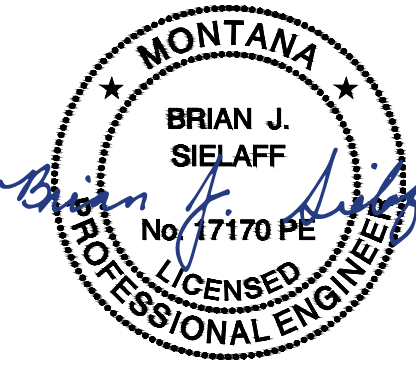

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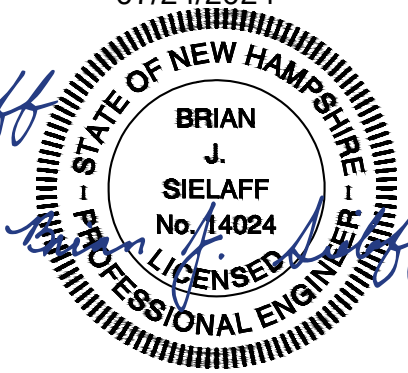

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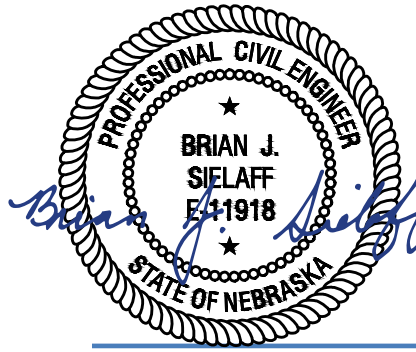

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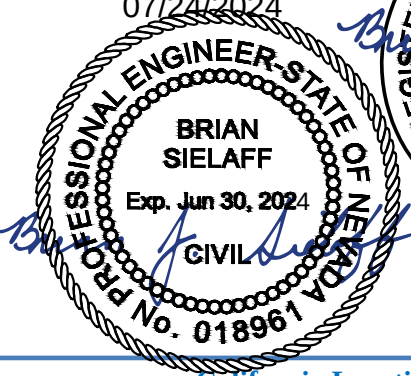

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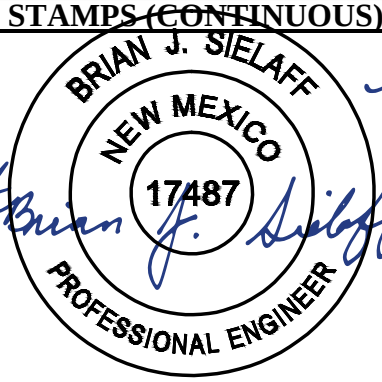

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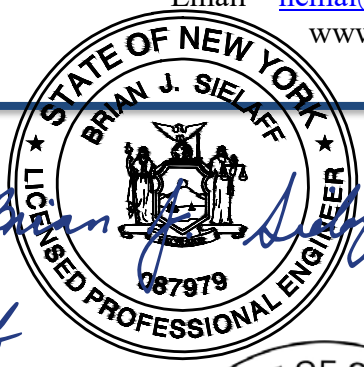

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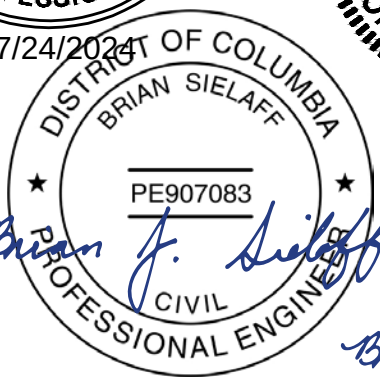

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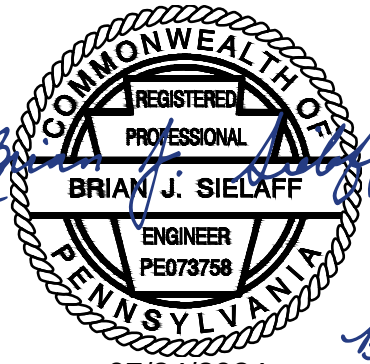

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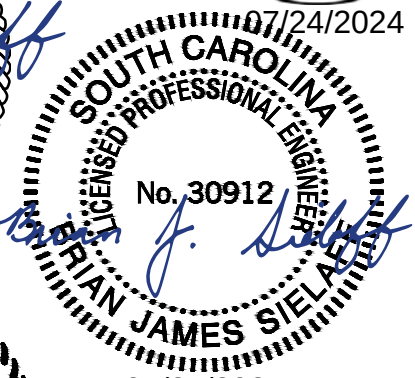
EXPIRES: Mar 31, 2025



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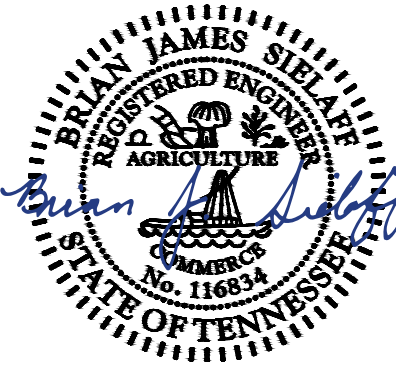

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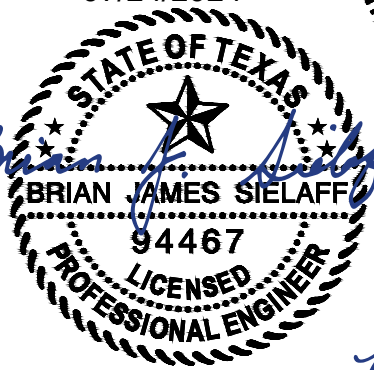

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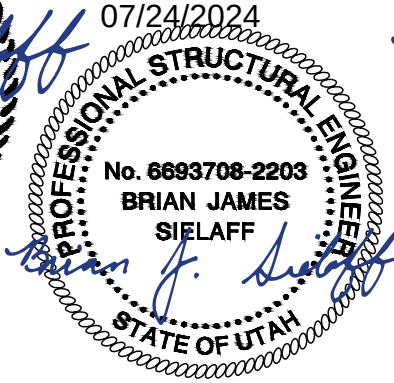

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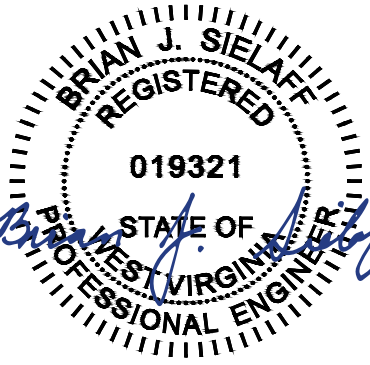

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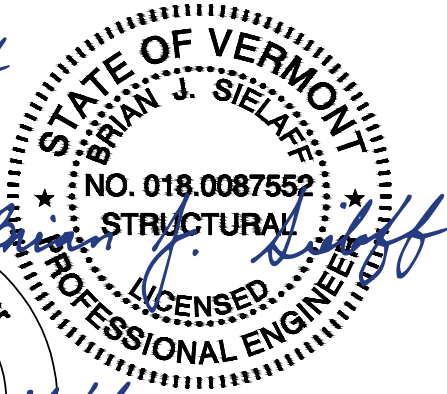

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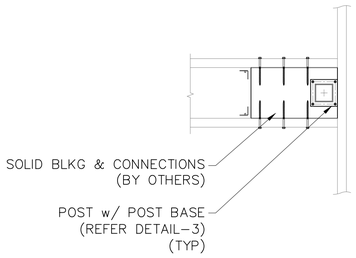

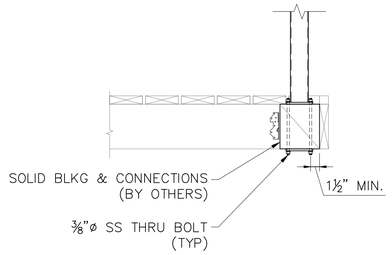

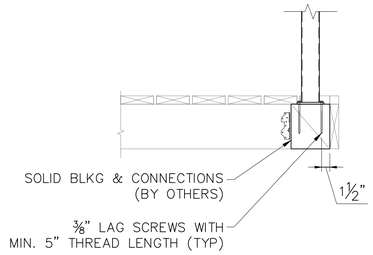

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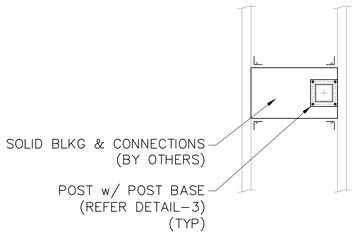

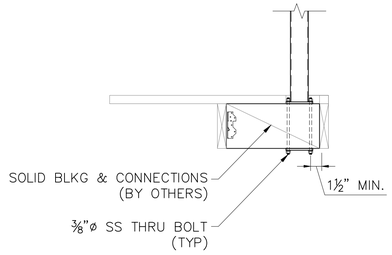

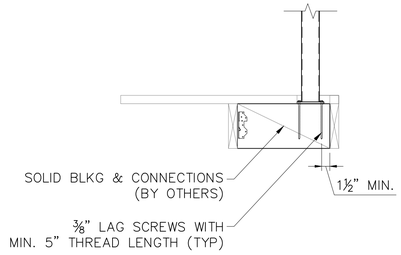

JOIST PARALLEL

3 TYPICAL POST BASE DETAIL

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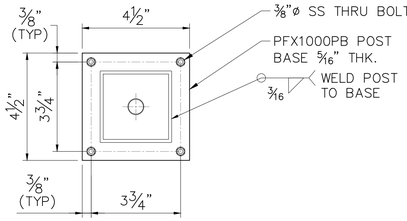
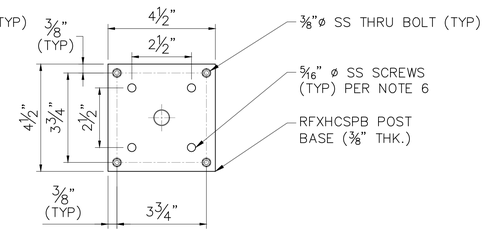
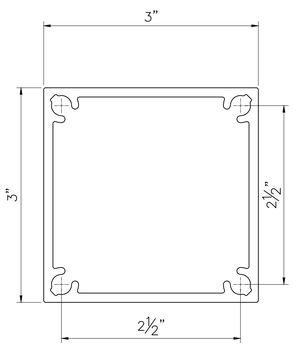


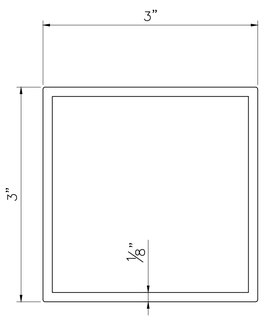
PFX1000PB



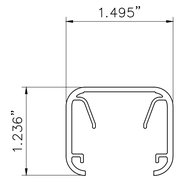
RFXHCSPB



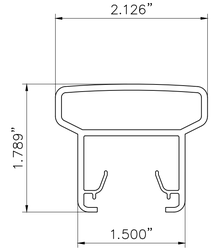
RFXHCSP POST



PFX1000P POST



RFXOBR
BOTTOM RAIL



RFXOTR
TOP RAIL

1 ALUMINUM RAIL POST SURFACE MOUNT ON WOOD

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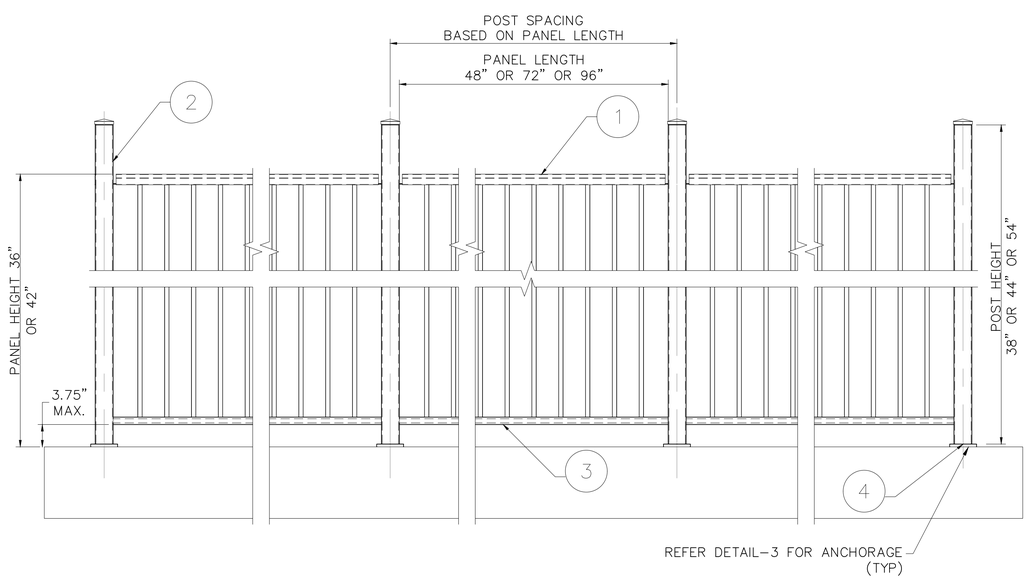

2 TYPICAL RAILING ELEVATION

Scale: N.T.S.

4 POST, BOTTOM RAIL & TOP RAIL PROFILES

Scale: N.T.S.

PICKET RAIL PANELS (36"/42" HIGH x 48"/72"/96" LONG)	
ITEM	PART NUMBER
1	RFXOTR TOP RAIL W/ RFXORI RAIL INSERT
2	PFX1000P/RFXHCSP POST
3	RFXOBR BOTTOM RAIL W/ RFXORI RAIL INSERT
4	PFX1000PB/RFXHCSPB POST BASE

NOTES: –

1. DESIGN CAPACITY OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. PICKET RAIL PANEL HARDWARE DESIGN IS NOT IN ZENITH SCOPE OF WORK.
3. CONNECTION OF BLOCKING AND RIM JOIST SHOULD BE VERIFIED BY REGISTERED PROFESSIONAL ENGINEER.
4. THE ⅜" LAG SCREW OPTION IS RESTRICTED TO THE ONE AND TWO FAMILY DWELLINGS ALLOWED UNDER IRC.
5. ONE SUPPORT BLOCK IS RECOMMENDED FOR BOTTOM RAILS MEASURING 48" TO 72" IN LENGTH, AT CENTER POINT OF THE BOTTOM RAIL WHILE TWO SUPPORT BLOCKS FOR 96" LONG BOTTOM RAILS AT THIRD POINTS (EQUAL DISTANCE FROM EACH END) OF THE BOTTOM RAIL.
6. SCREW ATTACHMENT OF RFXHCSP TO RFXHCSPB IN LIEU OF PFX1000P WELDED TO PFX1000PB
   a. IT IS STRUCTURALLY ACCEPTABLE TO USE ⅝"ø 304/316 SS SCREWS ONLY FOR MAX. 38" TALL POSTS WITH MAX. 48" POST SPACING, FOR ALL IBC COMPLIANT RESIDENTIAL AND COMMERCIAL INSTALLATIONS.
   b. IT IS STRUCTURALLY ACCEPTABLE TO USE ⅝"ø HARDENED 410 SS SCREWS FOR MAX. 54" TALL POSTS WITH MAX. 54" POST SPACING, FOR ALL IBC COMPLIANT RESIDENTIAL AND COMMERCIAL INSTALLATIONS.
   c. IT IS STRUCTURALLY ACCEPTABLE TO USE ⅝"ø HARDENED 410 SS SCREWS FOR MAX. 54" TALL POSTS WITH MAX. 96" POST SPACING, ONLY FOR INSTALLATIONS AT IRC COMPLIANT ONE OR TWO FAMILY DWELLINGS.

Zenith
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Construction Managers
22320 FOOTHILL BLVD,
SUITE 600 HAYWARD, CA 94541
WWW.ZENITHENGINEERS.COM

REGISTERED PROFESSIONAL ENGINEER
HEMAL MODI
C 78688
Hemal Modi 20 May, 2024
CIVIL
STATE OF CALIFORNIA

#	DESCRIPTION	BY

RFX OASIS RAILING DESIGN

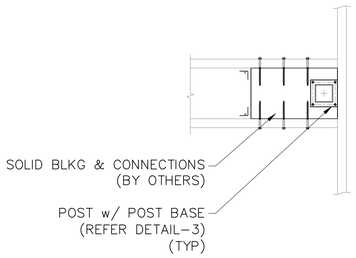
NATIONWIDE INDUSTRIES - UNITED STATES

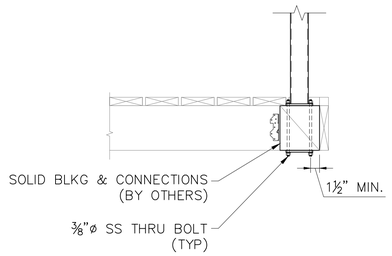
PICKET RAIL SYSTEM W/ POST ON WOOD

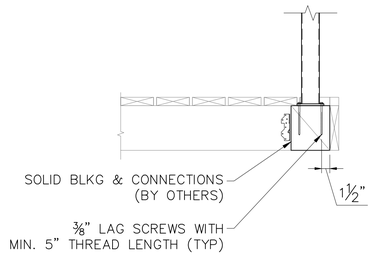
Project Number	220123
Date	20 May, 2024
Drawn By	SSK
Checked By	HM

S1.0

CONDITION OF ISSUANCE:
THESE PLANS HAVE BEEN ISSUED AS AN ENGINEERING PROGRESS CHECK OR FOR THE USE OF THE BUILDING OFFICIAL. THESE PLANS HAVE NOT BEEN COMPLETELY REVIEWED OR APPROVED BY THE BUILDING DEPARTMENT. THESE PLANS ARE SUBJECT TO REVISION UNTIL THE PLANS HAVE BEEN STAMPED AND APPROVED BY THE BUILDING DEPARTMENT. ANY BIDS MADE OR CONSTRUCTION PERFORMED BASED ON THESE UNAPPROVED DOCUMENTS IS THE SOLE RESPONSIBILITY OF THOSE MAKING THE BID AND PERFORMING THE CONSTRUCTION.







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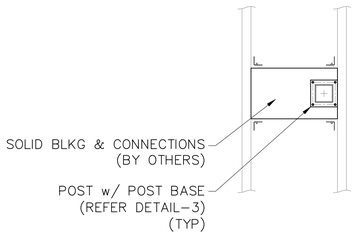
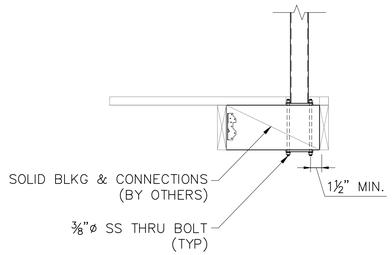
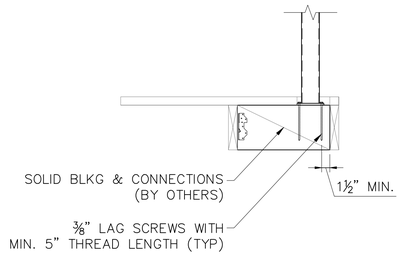


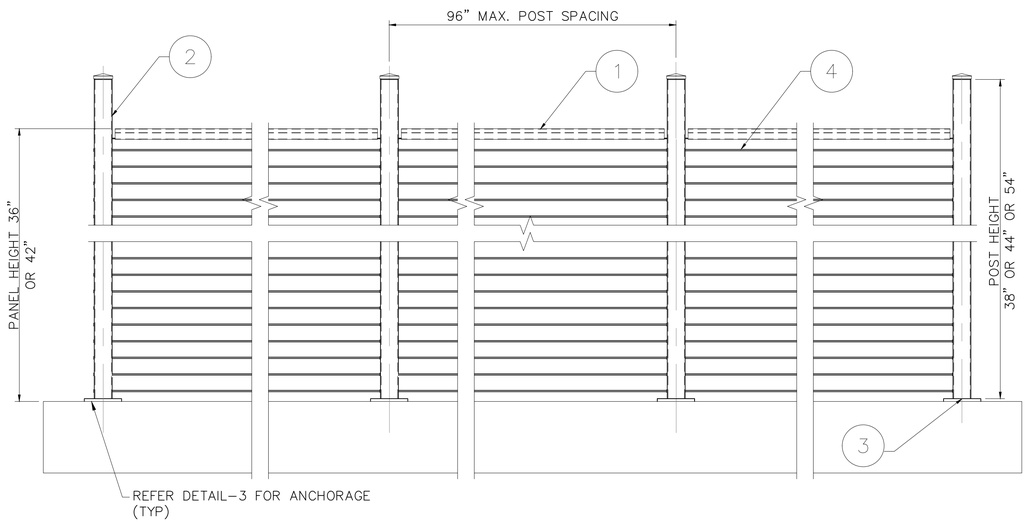




JOIST PARALLEL

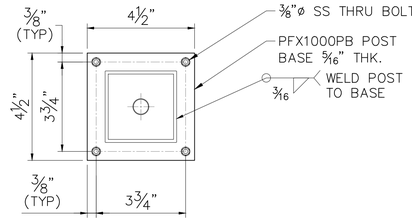
1 ALUMINUM RAIL POST SURFACE MOUNT ON WOOD

Scale: N.T.S.

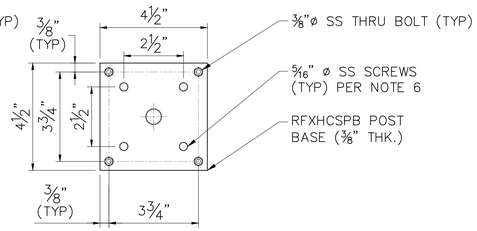


2 TYPICAL RAILING ELEVATION

Scale: N.T.S.



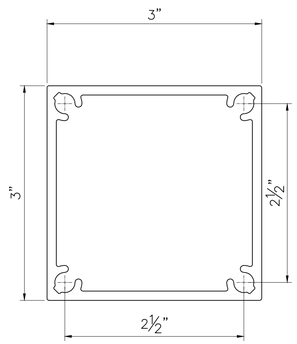
PFX1000PB



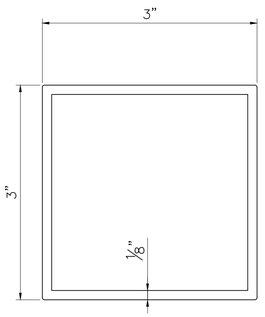
RFXHCSPB

3 TYPICAL POST BASE DETAIL

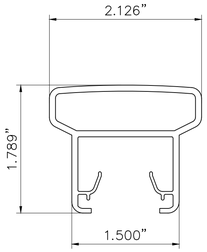
Scale: N.T.S.



RFXHCSP POST



PFX1000P POST



RFXOTR
TOP RAIL

4 POST & TOP RAIL PROFILES

Scale: N.T.S.

PICKET RAIL PANELS (36"/42" HIGH x 48"/72"/96" LONG)	
ITEM	PART NUMBER
1	RFXOTR TOP RAIL W/ RFXORI RAIL INSERT
2	PFX1000P/RFXHCSP POST
3	PFX1000PB/RFXHCSPB POST BASE
4	STAINLESS STEEL CABLE INFILL

NOTES: –

1. DESIGN CAPACITY OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAIL ATTACHMENT HARDWARE, CABLE IN–FILL & CABLE BRACE DESIGN ARE NOT IN ZENITH SCOPE OF WORK.
3. CONNECTION OF BLOCKING AND RIM JOIST SHOULD BE VERIFIED BY REGISTERED PROFESSIONAL ENGINEER.
4. THE ⅜" LAG SCREW OPTION IS RESTRICTED TO THE ONE AND TWO FAMILY DWELLINGS ALLOWED UNDER IRC.
5. ONE CABLE BRACE SUPPORT IS RECOMMENDED FOR TOP RAIL SUPPORT WHEN POST SPACING IS LARGER THAN 48".
6. SCREW ATTACHMENT OF RFXHCSP TO RFXHCSPB IN LIEU OF PFX1000P WELDED TO PFX1000PB
   a. IT IS STRUCTURALLY ACCEPTABLE TO USE 5⁄16"ø 304/316 SS SCREWS ONLY FOR MAX. 38" TALL POSTS WITH MAX. 48" POST SPACING, FOR ALL IBC COMPLIANT RESIDENTIAL AND COMMERCIAL INSTALLATIONS.
   b. IT IS STRUCTURALLY ACCEPTABLE TO USE 5⁄16"ø HARDENED 410 SS SCREWS FOR MAX. 54" TALL POSTS WITH MAX. 54" POST SPACING, FOR ALL IBC COMPLIANT RESIDENTIAL AND COMMERCIAL INSTALLATIONS.
   c. IT IS STRUCTURALLY ACCEPTABLE TO USE 5⁄16"ø HARDENED 410 SS SCREWS FOR MAX. 54" TALL POSTS WITH MAX. 96" POST SPACING, ONLY FOR INSTALLATIONS AT IRC COMPLIANT ONE OR TWO FAMILY DWELLINGS.

ZENITH
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REGISTERED PROFESSIONAL ENGINEER
HEMAL MODI
C 78688
Hemal Modi
19 May, 2024
CIVIL
STATE OF CALIFORNIA

#	DESCRIPTION	BY

RFX OASIS RAILING DESIGN

NATIONWIDE INDUSTRIES - UNITED STATES

RAILING W/ STAINLESS STEEL CABLE INFILL & POST ON WOOD

Project Number	220123
Date	20 May, 2024
Drawn By	SSK
Checked By	HM

S2.0

CONDITION OF ISSUANCE:
THESE PLANS HAVE BEEN ISSUED AS AN ENGINEERING PROGRESS CHECK OR FOR THE USE OF THE BUILDING OFFICIAL. THESE PLANS HAVE NOT BEEN COMPLETELY REVIEWED OR APPROVED BY THE BUILDING DEPARTMENT. THESE PLANS ARE SUBJECT TO REVISION UNTIL THE PLANS HAVE BEEN STAMPED AND APPROVED BY THE BUILDING DEPARTMENT. ANY BIDS MADE OR CONSTRUCTION PERFORMED BASED ON THESE UNAPPROVED DOCUMENTS IS THE SOLE RESPONSIBILITY OF THOSE MAKING THE BID AND PERFORMING THE CONSTRUCTION.

Engineers | Architects
Construction Managers

220123-CO2 - RFX Oasis Railing Design
Nationwide Industries (Design for all 50 states)

1. SCOPE OF WORK:

Zenith scope of work includes design of the post and its anchorage.
Member design checked based on ASCE 7-16 Section 4.5.1 & IBC 2021 Section 1607.9

2. DESIGN CHECK OF RAIL BALUSTER RFXORB FOR PICKET RAIL SYSTEM

$L_{outterlength\_RB} := 0.75\ in$ $L_{innerlength\_RB} := 0.65\ in$ $s_{RB\_spacing} := 4.5\ in$

$t_{RB} := \frac{L_{outterlength\_RB} - L_{innerlength\_RB}}{2} = 0.05\ in$ Baluster size 0.75x0.75x0.05

$H_{RB\_length} := 44\ in - 5\ in = 39\ in$ Consider 50 pounds of pressure exerted over a 1 sq. ft. area or 25 psf of uniform pressure and spread over baluster spacing of 4.5"

$$M_{RB} := \max\left(\frac{50\ lbf \cdot \frac{s_{RB\_spacing}}{12\ in} \cdot H_{RB\_length}}{4}, \frac{25\ psf \cdot s_{RB\_spacing} \cdot H_{RB\_length}^{2}}{8}\right) = 0.18\ kip \cdot in$$

$A_{RB} := L_{outterlength\_RB}^{2} - L_{innerlength\_RB}^{2} = 0.14\ in^2$

$I_{RB} := \frac{\left(L_{outterlength\_RB}^{4} - L_{innerlength\_RB}^{4}\right)}{12} = 0.011\ in^4$

$y_{c\_RB} := \frac{L_{outterlength\_RB}}{2} = 0.38\ in$

$J := \frac{2}{3} \cdot L_{outterlength\_RB}^{3} \cdot t_{RB} = 0.01\ in^4$

$S_{RB} := \frac{I_{RB}}{y_{c\_RB}} = 0.031\ in^3$

$L_b := H_{RB\_length} = 39\ in$ $S_c := S_{RB} = 0.031\ in^3$ $I_y := I_{RB} = 0.01\ in^4$

$C_b := 1.0$

$S := \frac{2 \cdot L_b \cdot S_c}{C_b \cdot \sqrt{I_y \cdot J}} = 188.03$ while $S_1 := 70$ & $S_2 := 2400$

Since $S_1 < S < S_2$ (Aluminum Design Manual Table 2-20 6063 - T6

$\sigma_{bending\_aluminumallowable} := \left(16.7 - 0.14 \cdot \sqrt{S}\right) \cdot 1\ ksi = 14.78\ ksi$

$\sigma_{bending\_RB} := \frac{M_{RB}}{S_c} = 5.97\ ksi$

$DCR_{RB} := \frac{\sigma_{bending\_RB}}{\sigma_{bending\_aluminumallowable}} = 0.4$ Acceptable.

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Table A.3.4
MECHANICAL PROPERTIES FOR WROUGHT ALUMINUM PRODUCTS (Continued)

ALLOY	TEMPER	PRODUCT	THICKNESS in.	F_{tu} ksi	F_{ty} ksi	F_{cy} ksi	F_{su} ksi	E ksi
6005	-T5	Extrusions	up thru 1.000	38	35	35	24	10,100
6005A	-T61	Extrusions	up thru 1.000	38	35	35	24	10,100
6061	-T6, T651	Sheet & Plate	0.010 to 4.000	42	35	35	27	10,100
	-T6, T6510, T6511	Extrusions	All	38	35	35	24	10,100
	-T6, T651	Rod & Bar	up thru 8.000	42	35	35	25	10,100
	-T6	Drawn Tube	0.025 to 0.500	42	35	35	27	10,100
	-T6	Pipe	All	38	35	35	24	10,100
6063	-T5	Extrusions	up thru 0.500	22	16	16	13	10,100
	-T5	Extrusions	0.501 to 1.000	21	15	15	12	10,100
	-T52	Extrusions	up thru 1.000	22	16	16	13	10,100
	-T6	Extrusions & Pipe	All	30	25	25	19	10,100

Table 2-20
ALLOWABLE STRESSES FOR BUILDING-TYPE STRUCTURES (UNWELDED)

Allowable Stresses F/Ω (k/in²)	Section	F/Ω
Axial Tension		
axial tension stress on net effective area	D.2b	11.3
axial tension stress on gross area	D.2a	9.7

	6063 – T5	Extrusions (Up thru 0.500 in. thick)
	6063 – T52	Extrusions (Up thru 1.000 in. thick)
	F_{ty} = 16 k/in²	E = 10,100 k/in²
	F_{cy} = 16 k/in²	k_t = 1
	F_{tu} = 22 k/in²	

Flexure		Tension	Compression	
elements in uniform stress	F.8.1.1	9.7	see B.5.4.1 thru B.5.4.5 and E.4.2	
elements in flexure	F.8.1.2, F.4.1	12.6	12.6	see also F.4.2
round tubes	F.6.1	11.3	11.3	see also F.6.2
rods	F.7	12.6	12.6	
Bearing				
bolts or rivets on holes	J.3.7a, J.4.7	22.6		
bolts on slots, pins on holes, flat surfaces	J.3.7b, J.7	15.0		

Axial Compression		Slenderness S	F/Ω for $S \le S_1$	S_1	F/Ω for $S_1 < S < S_2$	S_2	F/Ω for $S \ge S_2$
all shapes member buckling	E.3	kL/r			8.9 – 0.037 S	99	51,352 /S^2
Flexural Compression							
open shapes lateral-torsional buckling	F.2.1	$L_b/(r_{ye}C_b^{1/2})$			10.5 – 0.036 S	119	86,996 /S^2
closed shapes lateral-torsional buckling	F.3.1	$2L_bS_c/(C_b(I_yJ)^{1/2})$			10.5 – 0.070 $S^{1/2}$	3823	23,599 /S
rectangular bars lateral-torsional buckling	F.4.2	$(d/t)(L_b/(C_bd))^{1/2}$			17.2 – 0.256 S	45	11,420 /S^2
round tubes local buckling	F.6.2	R_b/t	17.5 – 0.917 $S^{1/2}$	95	11.6 – 0.320 $S^{1/2}$	275	3,776 /[$S(1+S^{1/2}/35)^2$]
Elements—Uniform Compression							
flat elements supported on one edge in columns whose buckling axis is not an axis of symmetry	B.5.4.1	b/t	9.7	8.2	11.8 – 0.260 S	19	2,417 /S^2
flat elements supported on one edge in all other columns and all beams	B.5.4.1	b/t	9.7	8.2	11.8 – 0.260 S	15.9	122 /S
flat elements supported on both edges	B.5.4.2	b/t	9.7	25.6	11.8 – 0.083 S	50	382 /S
flat elements supported on both edges and with an intermediate stiffener	B.5.4.4	λ_s	9.7	18.8	10.5 – 0.044 S	99	60,414 /S^2
curved elements supported on both edges	B.5.4.5	R_b/t	9.7	36.7	11.6 – 0.320 $S^{1/2}$	275	3,776 /[$S(1+S^{1/2}/35)^2$]
flat elements—alternate method	B.5.4.6	λ_{eq}	9.7	41.0	11.8 – 0.052 S	80	611 /S
Elements—Flexural Compression							
flat elements supported on both edges	B.5.5.1	b/t	12.6	62.9	17.2 – 0.072 S	119	1,017 /S
flat elements supported on tension edge, compression edge free	B.5.5.2	b/t	12.6	11.7	17.2 – 0.389 S	29	4,932 /S^2
flat elements supported on both edges and with a longitudinal stiffener	B.5.5.3	b/t	12.6	141.1	17.2 – 0.032 S	266	2,280 /S
flat elements—alternate method	B.5.5.4	λ_{eq}	12.6	40.9	17.2 – 0.111 S	77	661 /S
Elements—Shear							
flat elements supported on both edges	G.2	b/t	5.8	43.6	7.2 – 0.031 S	96	38,665 /S^2

3. DESIGN CHECK OF TOP & BOTTOM RAIL OPTIONS (STAIR / LEVEL) RFXOTR / RFXOBR (72" / 96" LONG)

Consider 200 pounds concentrated load or 50 pound per foot of uniform load for top rail, and 50 pounds of pressure exerted over a 1 sq. ft. area for the bottom rail, and assuming allowable bending of 18 ksi.

$F_b := 18\ ksi$ $E := 10100\ ksi$

Out-of-plane bending:

$L_{BR\_length} := 10\ ft$ $L_{TR\_length} := 8\ ft$ BR good for 10' and TR good for 8'

$$M_{BR\_Y} := \frac{50\ lbf \cdot L_{BR\_length}}{4} = 1.5\ kip \cdot in$$

$$M_{TR\_Y} := \max\left(\frac{200\ lbf \cdot L_{TR\_length}}{4}, \frac{50\ plf \cdot L_{TR\_length}^2}{8}\right) = 4.8\ kip \cdot in$$

$A_{BR} := 0.34\ in^2$ $A_{TR} := 0.66\ in^2$ From AutoCAD

$I_{BR\_Y} := 0.1193\ in^4$ $I_{TR\_Y} := 0.2985\ in^4$ From AutoCAD

$x_{c\_BR} := 0.7475\ in$ $x_{c\_TR} := 1.0631\ in$

$$S_{BR\_Y} := \frac{I_{BR\_Y}}{x_{c\_BR}} = 0.16\ in^3 \qquad S_{TR\_Y} := \frac{I_{TR\_Y}}{x_{c\_TR}} = 0.281\ in^3$$

$$DCR_{BR\_Y} := \frac{M_{BR\_Y}}{F_b \cdot S_{BR\_Y}} = 0.52 \qquad DCR_{TR\_Y} := \frac{M_{TR\_Y}}{F_b \cdot S_{TR\_Y}} = 0.95$$ Acceptable

$$\Delta_{BR\_Y} := \frac{50\ lbf \cdot L_{BR\_length}^3}{48 \cdot E \cdot I_{BR\_Y}} = 1.5\ in$$

$$\Delta_{TR\_Y} := \max\left(\frac{200\ lbf \cdot L_{TR\_length}^3}{48 \cdot E \cdot I_{TR\_Y}}, \frac{5 \cdot 50\ plf \cdot L_{TR\_length}^4}{384 \cdot E \cdot I_{TR\_Y}}\right) = 1.5\ in$$

Deflections are high, but ok by engineering judgement.

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In-plane bending:

$L_{SPRT\_spacing} := 48\ in$ $L_{Baluster\_Spacing} := 4.5\ in$

Rail support required at 48" spacing

So, TR & BR support recommended at mid span for panel lengths 6' & 8'

$L_{TopRail\_support} := \max\left(L_{SPRT\_spacing}, L_{Baluster\_Spacing}\right) = 4\ ft$

$M_{BR\_X} := \frac{50\ lbf \cdot L_{SPRT\_spacing}}{8} = 0.3\ kip \cdot in$

$M_{TR\_X} := \max\left(\frac{200\ lbf \cdot L_{TopRail\_support}}{8}, \frac{50\ plf \cdot L_{TopRail\_support}^{2}}{10}\right) = 1.2\ kip \cdot in$

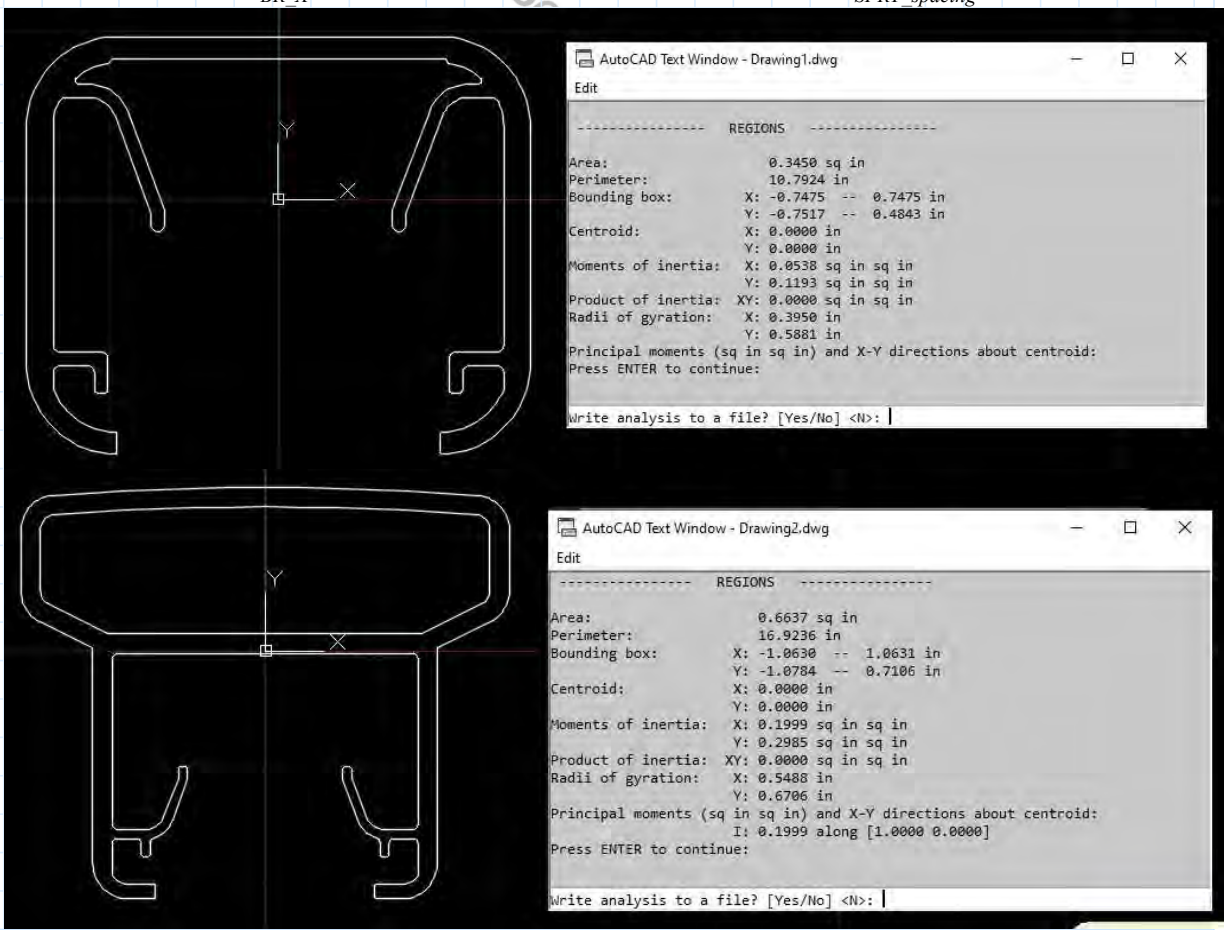
$I_{BR\_X} := 0.0538\ in^4$ $I_{TR\_X} := 0.1999\ in^4$ From AutoCAD

$y_{c\_BR} := 0.7517\ in$ $y_{c\_TR} := 1.0784\ in$

$S_{BR\_X} := \frac{I_{BR\_X}}{y_{c\_BR}} = 0.072\ in^3$ $S_{TR\_X} := \frac{I_{TR\_X}}{y_{c\_TR}} = 0.185\ in^3$

$DCR_{BR\_X} := \frac{M_{BR\_X}}{F_b \cdot S_{BR\_X}} = 0.23$ $DCR_{TR\_X} := \frac{M_{TR\_X}}{F_b \cdot S_{TR\_X}} = 0.36$

$\Delta_{BR\_X} := \frac{50\ lbf \cdot L_{SPRT\_spacing}^{3}}{48 \cdot E \cdot I_{BR\_X}} = 0.212\ in$ $DCR_{BR\_\Delta\_X} := \Delta_{BR\_X} \cdot \frac{180}{L_{SPRT\_spacing}} = 0.8$



4. DESIGN CHECK OF POST PFX1000P / RFXHCSP
(POST 54" w/ 42"x8' PICKET RAIL PANEL)

4A. DESIGN CHECK FOR COMMERCIAL USE

For commercial use or occupancies that are accessible to the public and area that serve an occupant load greater than 50:

Consider 200 pounds concentrated load for top rail or 50 pound per foot of uniform load for top rail.

$L_{outterlength\_post} := 3\ in$ $L_{innerlength\_post} := 2.75\ in$ Post size 3x3x1/8

$t_{post} := \frac{L_{outterlength\_post} - L_{innerlength\_post}}{2} = 0.125\ in$

$H_{post\_length} := 54\ in = 4.5\ ft$ $L_{panel\_length} := 96\ in = 8\ ft$

$P_{post\_load\_1} := \max(200\ lbf, 50\ plf \cdot L_{panel\_length}) = 400\ lbf$ Consider 200 pounds concentrated load or 50 pound per foot of uniform load.

$M_{post\_flexure\_1} := \max(200\ lbf \cdot H_{post\_length}, 50\ plf \cdot L_{panel\_length} \cdot (H_{post\_length} - 6\ in)) = 19.2\ kip \cdot in$

$A_{post} := L_{outterlength\_post}^{2} - L_{innerlength\_post}^{2} = 1.438\ in^2$ 1.44 from Table 23 of Manual
1.5 from AutoCAD

$I_{post} := \frac{(L_{outterlength\_post}^{4} - L_{innerlength\_post}^{4})}{12} = 1.984\ in^4$ 1.98 from Table 23 of Manual
2.051 from AutoCAD

$y_c := \frac{L_{outterlength\_post}}{2} = 1.5\ in$

$J := \frac{2}{3} \cdot L_{outterlength\_post}^{3} \cdot t_{post} = 2.25\ in^4$ 2.97 from Table 23 of Manual

$S_{post} := \frac{I_{post}}{y_c} = 1.323\ in^3$ 1.32 from Table 23 of Manual

$L_b := H_{post\_length} = 54\ in$ $S_c := S_{post} = 1.323\ in^3$ $I_y := I_{post} = 1.98\ in^4$

$C_b := 1.0$ So, $S := \frac{2 \cdot L_b \cdot S_c}{C_b \cdot \sqrt{I_y \cdot J}} = 67.61$ while $S_1 := 55$ & $S_2 := 1685$

When $S_1 < S < S_2$ (Aluminum Design Manual Table 2-17 to 2-19 6005A - T61 & 6061-T6)

$\sigma_{bending\_aluminumallowable} := (23.9 - 0.238 \cdot \sqrt{S}) \cdot 1\ ksi = 21.94\ ksi$

When $S < S_1$ consider $(39.3 - 2.702 \cdot \sqrt{S_1}) = 19.26$

$\sigma_{bendingpost\_1} := \frac{M_{post\_flexure\_1}}{S_c} = 14.52\ ksi$

$DCR_{post\_1} := \frac{\sigma_{bendingpost\_1}}{\sigma_{bending\_aluminumallowable}} = 0.66$ Acceptable.

4B. DESIGN CHECK FOR RESIDENTIAL USE

For one- and two-family dwellings, and for factory, industrial, and storage occupancies in areas that are not accessible to the public and that serve an occupant load not greater than 50:

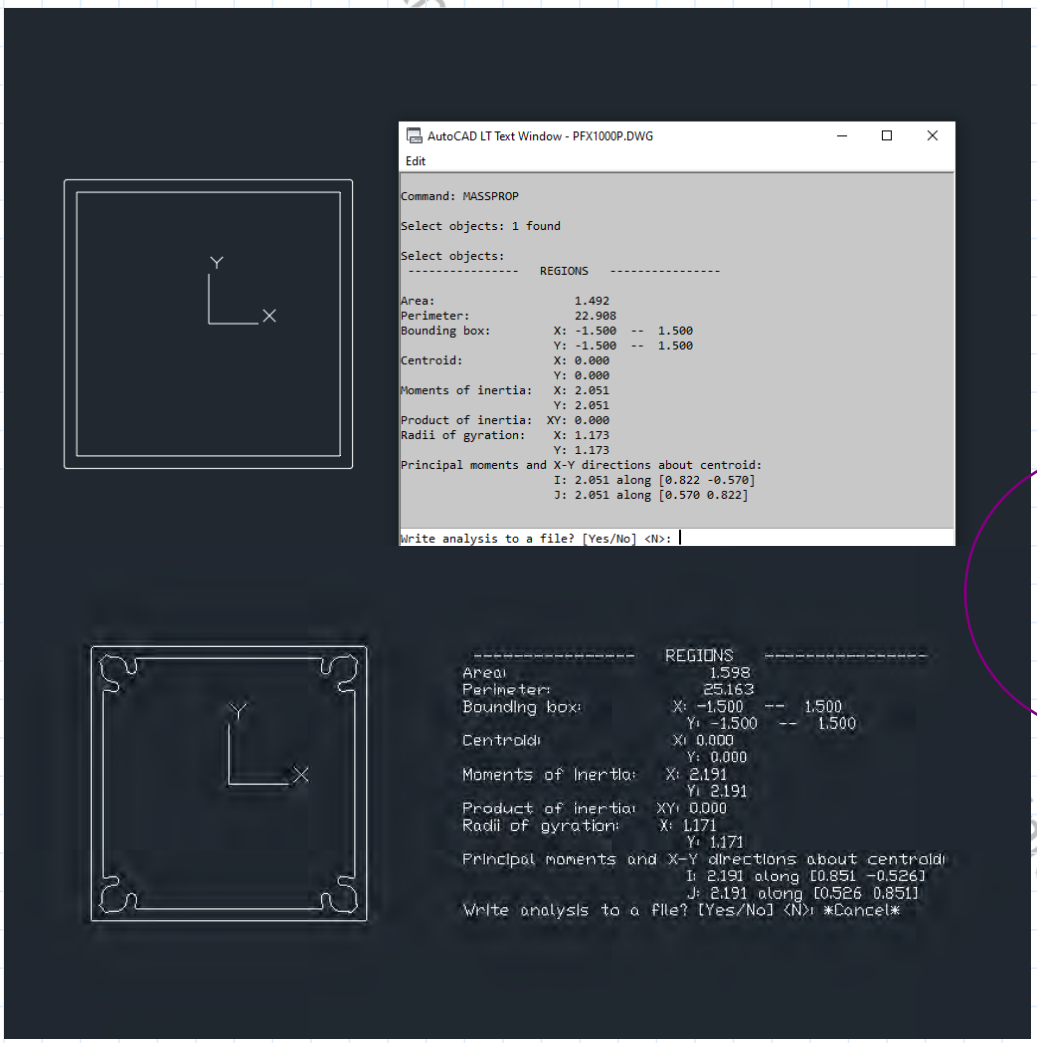
Consider 200 pounds concentrated load for top rail or 20 pound per foot of uniform load for top rail.

$P_{post\_load\_2} := \max\left(200\ \textit{lbf}, L_{panel\_length} \cdot 20\ \textit{plf}\right) = 200\ \textit{lbf}$

$M_{post\_flexure\_2} := \max\left(200\ \textit{lbf} \cdot H_{post\_length}, 20\ \textit{plf} \cdot L_{panel\_length} \cdot \left(H_{post\_length} - 6\ \textit{in}\right)\right) = 10.8\ \textit{kip} \cdot \textit{in}$

$\sigma_{bendingpost\_2} := \frac{M_{post\_flexure\_2}}{S_c} = 8.17\ \textit{ksi}$

$DCR_{post\_2} := \frac{\sigma_{bendingpost\_2}}{\sigma_{bending\_aluminumallowable}} = 0.37$ Acceptable.



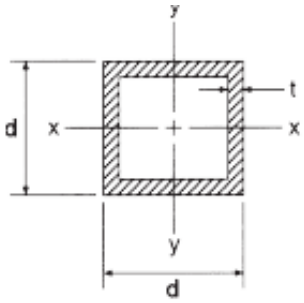


Table 23
SQUARE TUBES

Designation	Depth width d in.	Thickness t in.	Weight lb/ft	Area A in²	Axis x-x, y-y I_x, I_y in⁴	S_x, S_y in³	r_x, r_y in.	J in⁴
RT 1 × 1 × .065	1.000	0.065	0.286	0.243	0.0356	0.0712	0.383	0.0531
RT 1 × 1 × .095	1.000	0.095	0.404	0.344	0.0475	0.0949	0.371	0.0704
RT 1 × 1 × .125	1.000	0.125	0.515	0.438	0.0570	0.114	0.361	0.0837
RT 1.25 × 1.25 × .065	1.250	0.065	0.362	0.308	0.0723	0.116	0.485	0.108
RT 1.25 × 1.25 × .095	1.250	0.095	0.516	0.439	0.0982	0.157	0.473	0.146
RT 1.25 × 1.25 × .125	1.250	0.125	0.662	0.563	0.120	0.192	0.462	0.178
RT 1.375 × 1.375 × .125	1.375	0.125	0.735	0.625	0.164	0.239	0.513	0.244
RT 1.5 × 1.5 × .065	1.500	0.065	0.439	0.373	0.128	0.171	0.586	0.192
RT 1.5 × 1.5 × .078	1.500	0.078	0.522	0.444	0.150	0.200	0.581	0.224
RT 1.5 × 1.5 × .095	1.500	0.095	0.628	0.534	0.176	0.235	0.575	0.263
RT 1.5 × 1.5 × .125	1.500	0.125	0.809	0.688	0.218	0.291	0.564	0.325
RT 1.5 × 1.5 × .250	1.500	0.250	1.47	1.25	0.339	0.451	0.520	0.488
RT 1.75 × 1.75 × .125	1.750	0.125	0.956	0.813	0.360	0.411	0.665	0.536
RT 2 × 2 × .095	2.000	0.095	0.851	0.724	0.439	0.439	0.779	0.657
RT 2 × 2 × .125	2.000	0.125	1.10	0.938	0.552	0.552	0.767	0.824
RT 2 × 2 × .156	2.000	0.156	1.35	1.15	0.657	0.657	0.755	0.978
RT 2 × 2 × .188	2.000	0.188	1.60	1.36	0.754	0.754	0.744	1.12
RT 2 × 2 × .250	2.000	0.250	2.06	1.75	0.911	0.911	0.722	1.34
RT 2.25 × 2.25 × .125	2.250	0.125	1.25	1.06	0.802	0.713	0.869	1.20
RT 2.5 × 2.5 × .125	2.500	0.125	1.40	1.19	1.12	0.896	0.971	1.67
RT 2.5 × 2.5 × .188	2.500	0.188	2.04	1.74	1.56	1.25	0.947	2.32
RT 2.5 × 2.5 × .250	2.500	0.250	2.65	2.25	1.92	1.54	0.924	2.85
RT 2.75 × 2.75 × .125	2.750	0.125	1.54	1.31	1.51	1.10	1.07	2.26
RT 2.75 × 2.75 × .188	2.750	0.188	2.27	1.93	2.12	1.54	1.05	3.16
RT 3 × 3 × .095	3.000	0.095	1.30	1.10	1.55	1.04	1.19	2.33
RT 3 × 3 × .125	3.000	0.125	1.69	1.44	1.98	1.32	1.17	2.97
RT 3 × 3 × .188	3.000	0.188	2.49	2.11	2.80	1.87	1.15	4.18
RT 3 × 3 × .250	3.000	0.250	3.23	2.75	3.49	2.33	1.13	5.20
RT 3 × 3 × .375	3.000	0.375	4.63	3.94	4.61	3.08	1.08	6.78
RT 3.5 × 3.5 × .125	3.500	0.125	1.98	1.69	3.21	1.83	1.38	4.81
RT 3.5 × 3.5 × .250	3.500	0.250	3.82	3.25	5.76	3.29	1.33	8.58
RT 3.5 × 3.5 × .375	3.500	0.375	5.51	4.69	7.74	4.42	1.28	11.4
RT 4 × 4 × .125	4.000	0.125	2.28	1.94	4.85	2.43	1.58	7.27
RT 4 × 4 × .188	4.000	0.188	3.37	2.87	6.96	3.48	1.56	10.4
RT 4 × 4 × .250	4.000	0.250	4.41	3.75	8.83	4.41	1.53	13.2
RT 4 × 4 × .375	4.000	0.375	6.39	5.44	12.0	6.02	1.49	17.9
RT 4 × 4 × .500	4.000	0.500	8.23	7.00	14.6	7.29	1.44	21.4

Table 2-17
ALLOWABLE STRESSES FOR BUILDING-TYPE STRUCTURES (UNWELDED)

Allowable Stresses F/Ω (k/in²)	Section	F/Ω	6005A - T61 Extrusions (up through 1.000 in. thick)
Axial Tension			F_{ty} = 35 k/in² E = 10,100 k/in²
axial tension stress on net effective area	D.2b	19.5	F_{cy} = 35 k/in² k_t = 1
axial tension stress on gross area	D.2a	21.2	F_{tu} = 38 k/in²

Flexure		Tension	Compression
elements in uniform stress	F.8.1.1	19.5	see B.5.4.1 thru B.5.4.5 and E.4.2
elements in flexure	F.8.1.2, F.4.1	27.6	27.6 see also F.4.2
round tubes	F.6.1	24.2	24.8 see also F.6.2
rods	F.7	27.6	27.6
Bearing			
bolts or rivets on holes	J.3.7a, J.4.7	39.0	
bolts on slots, pins on holes, flat surfaces	J.3.7b, J.7	25.9	

Axial Compression		Slenderness S	F/Ω for $S \le S_1$	S_1	F/Ω for $S_1 < S < S_2$	S_2	F/Ω for $S \ge S_2$
all shapes member buckling	E.3	kL/r			$20.3 - 0.127\,S$	66	$51{,}352/S^2$
Flexural Compression							
open shapes lateral-torsional buckling	F.2.1	$L_b/(r_{ye}C_b^{1/2})$			$23.9 - 0.124\,S$	79	$86{,}996/S^2$
closed shapes lateral-torsional buckling	F.3.1	$2L_bS_c/(C_b(I_yJ)^{1/2})$			$23.9 - 0.238\,S^{1/2}$	1685	$23{,}599/S$
rectangular bars lateral-torsional buckling	F.4.2	$(d/t)(L_b/(C_bd))^{1/2}$			$40.5 - 0.928\,S$	29	$11{,}420/S^2$
round tubes local buckling	F.6.2	R_b/t	$39.3 - 2.702\,S^{1/2}$	55	$26.2 - 0.944\,S^{1/2}$	141	$3{,}776/[S(1+S^{1/2}/35)^2]$
Elements—Uniform Compression							
flat elements supported on one edge in columns whose buckling axis is not an axis of symmetry	B.5.4.1	b/t	21.2	6.7	$27.3 - 0.910\,S$	12	$2{,}417/S^2$
flat elements supported on one edge in all other columns and all beams	B.5.4.1	b/t	21.2	6.7	$27.3 - 0.910\,S$	10.5	$186/S$
flat elements supported on both edges	B.5.4.2	b/t	21.2	20.8	$27.3 - 0.291\,S$	33	$580/S$
flat elements supported on both edges and with an intermediate stiffener	B.5.4.4	λ_s	21.2	17.8	$23.9 - 0.149\,S$	66	$60{,}414/S^2$
curved elements supported on both edges	B.5.4.5	R_b/t	21.2	27.6	$26.2 - 0.944\,S^{1/2}$	141	$3{,}776/[S(1+S^{1/2}/35)^2]$
flat elements—alternate method	B.5.4.6	λ_{eq}	21.2	33.3	$27.3 - 0.182\,S$	52	$928/S$
Elements—Flexural Compression							
flat elements supported on both edges	B.5.5.1	b/t	27.6	49.3	$40.5 - 0.262\,S$	77	$1{,}563/S$
flat elements supported on tension edge, compression edge free	B.5.5.2	b/t	27.6	9.2	$40.5 - 1.412\,S$	19	$4{,}932/S^2$
flat elements supported on both edges and with a longitudinal stiffener	B.5.5.3	b/t	27.6	110.5	$40.5 - 0.117\,S$	173	$3{,}502/S$
flat elements—alternate method	B.5.5.4	λ_{eq}	27.6	32.0	$40.5 - 0.403\,S$	50	$1{,}016/S$
Elements—Shear							
flat elements supported on both edges	G.2	b/t	12.7	35.3	$16.5 - 0.107\,S$	63	$38{,}665/S^2$

5. CONNECTION OF RFXHCSP POST TO RFXHCSPB BASE PLATE

OPTION A

For commercial use or occupancies that are accessible to the public and area that serve an occupant load greater than 50:
Consider 200 pounds concentrated load for top rail or 50 pound per foot of uniform load for top rail.

$H_{post\_length} := 38\ in = 3.17\ ft$ $L_{panel\_length} := 48\ in = 4\ ft$

$P_{live\_load} := \max\left(200\ lbf, 50\ plf \cdot L_{panel\_length}\right) = 200\ lbf$

$M_{overturning\_design} := P_{live\_load} \cdot \left(H_{post\_length} - 2\ in\right) = 7.2\ kip \cdot in$

$d_{screw\_dia} := \frac{5}{16}\ in$ $spacing_{screw} := 2.5\ in$ $screw_{length} := 2\ in$

$A_{root\_area} := 0.685 \cdot \left(\frac{\pi}{4} \cdot d_{screw\_dia}^{2}\right) = 0.0525\ in^2$

$\Omega_{screw} := 2$ $\Omega_{ADM} := 3$ Strength reduction factors

$F_{u\_SS304\_316} := 75\ ksi$ $F_{y\_SS304\_316} := 30\ ksi$

$F_{t\_SS304\_316} := 0.75\ F_{u\_SS304\_316} = 56.25\ ksi$ $F_{v\_SS304\_316} := 0.6\ F_{t\_SS304\_316} = 33.75\ ksi$

$Tension_{per\_screw} := \frac{M_{overturning\_design}}{2 \cdot spacing_{screw}} = 1.44\ kip$

$Shear_{per\_screw} := \frac{P_{live\_load}}{4} = 0.05\ kip$

$R_{allowable\_shear} := \frac{F_{v\_SS304\_316} \cdot A_{root\_area}}{\Omega_{screw}} = 0.89\ kip$

$R_{n\_tension} := F_{t\_SS304\_316} \cdot A_{root\_area} = 2.96\ kip$

For screw into screw slot in posts per ADM J5.5.1.2:

$R_{n\_withdrawal} := 0.29 \cdot d_{screw\_dia} \cdot \left(screw_{length} - 1\ in\right) \cdot F_{t\_SS304\_316} = 5.1\ kip$

$R_{allowable\_tension} := min\left(\frac{R_{n\_tension}}{\Omega_{screw}}, \frac{R_{n\_withdrawal}}{\Omega_{ADM}}\right) = 1.48\ kip$

$DCR_{T\_screw} := \frac{Tension_{per\_screw}}{R_{allowable\_tension}} = 0.97$ $DCR_{V\_screw} := \frac{Shear_{per\_screw}}{R_{allowable\_shear}} = 0.06$

$DCR_{screw} := DCR_{T\_screw}^{\frac{5}{3}} + DCR_{V\_screw}^{\frac{5}{3}} = 0.97$

OK to use 5/16 ϕ 304/316 SS screws only for max. 38" tall posts with max. 48" post spacing for all IBC compliant residential and commercial installations.

OPTION B

For commercial use or occupancies that are accessible to the public and area that serve an occupant load greater than 50:
Consider 200 pounds concentrated load for top rail or 50 pound per foot of uniform load for top rail.

$H_{post\_length} := 54\ in = 4.5\ ft$ $L_{panel\_length} := 54\ in = 4.5\ ft$

$P_{live\_load} := \max(200\ lbf, 50\ plf \cdot L_{panel\_length}) = 225\ lbf$

$M_{overturning\_design} := P_{live\_load} \cdot (H_{post\_length} - 2\ in) = 11.7\ kip \cdot in$

$d_{screw\_dia} := \frac{5}{16}\ in$ $spacing_{screw} := 2.5\ in$ $screw_{length} := 2\ in$

$A_{root\_area} := 0.685 \cdot \left(\frac{\pi}{4} \cdot d_{screw\_dia}^{2}\right) = 0.0525\ in^2$

$\Omega_{screw} := 2$ $\Omega_{ADM} := 3$ Strength reduction factors

$F_{u\_SS410} := 115\ ksi$ $F_{y\_SS410} := 85\ ksi$ Consider 410 hardened stainless steel screws
Unhardened 410 has values similar to 304/316

$F_{t\_SS410} := 0.75\ F_{u\_SS410} = 86.25\ ksi$ $F_{v\_SS410} := 0.6\ F_{t\_SS410} = 51.75\ ksi$

$Tension_{per\_screw} := \frac{M_{overturning\_design}}{2 \cdot spacing_{screw}} = 2.34\ kip$

$Shear_{per\_screw} := \frac{P_{live\_load}}{4} = 0.056\ kip$

$R_{allowable\_shear} := \frac{F_{v\_SS410} \cdot A_{root\_area}}{\Omega_{screw}} = 1.36\ kip$

$R_{n\_tension} := F_{t\_SS410} \cdot A_{root\_area} = 4.53\ kip$

For screw into screw slot in posts per ADM J5.5.1.2:

$R_{n\_withdrawal} := 0.29 \cdot d_{screw\_dia} \cdot (screw_{length} - 1\ in) \cdot F_{t\_SS410} = 7.82\ kip$

$R_{allowable\_tension} := min\left(\frac{R_{n\_tension}}{\Omega_{screw}}, \frac{R_{n\_withdrawal}}{\Omega_{ADM}}\right) = 2.27\ kip$

$DCR_{T\_screw} := \frac{Tension_{per\_screw}}{R_{allowable\_tension}} = 1.03$

$DCR_{V\_screw} := \frac{Shear_{per\_screw}}{R_{allowable\_shear}} = 0.04$

$DCR_{screw} := DCR_{T\_screw}^{\frac{5}{3}} + DCR_{V\_screw}^{\frac{5}{3}} = 1.06$

By Engineering Judgement the 6% overstress is acceptable for short term loads.

OK to use 5/16" ϕ hardened 410 stainless steel screws for max. 54" tall posts with max. 54" post spacing, for all IBC compliant residential and commercial installations.

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OPTION C

For one- and two-family dwellings, and for factory, industrial, and storage occupancies in areas that are not accessible to the public and that serve an occupant load not greater than 50:
Consider 200 pounds concentrated load for top rail or 20 pound per foot of uniform load for top rail.

$H_{post\_length} := 54\ in = 4.5\ ft$ $L_{panel\_length} := 96\ in = 8\ ft$

$P_{live\_load} := \max\left(200\ lbf, 20\ plf \cdot L_{panel\_length}\right) = 200\ lbf$

$M_{overturning\_design} := \max\left(200\ lbf \cdot H_{post\_length}, 20\ plf \cdot L_{panel\_length} \cdot \left(H_{post\_length} - 2\ in\right)\right) = 10.8\ kip \cdot in$

$d_{screw\_dia} := \frac{5}{16}\ in$ $spacing_{screw} := 2.5\ in$ $screw_{length} := 2\ in$

$A_{root\_area} := 0.685 \cdot \left(\frac{\pi}{4} \cdot d_{screw\_dia}^{2}\right) = 0.0525\ in^2$

$\Omega_{screw} := 2$ $\Omega_{ADM} := 3$ Strength reduction factors

$F_{u\_SS410} := 115\ ksi$ $F_{y\_SS410} := 85\ ksi$ Consider 410 hardened stainless steel screws
Unhardened 410 has values similar to 304/316

$F_{t\_SS410} := 0.75$ $F_{u\_SS410} = 86.25\ ksi$ $F_{v\_SS410} := 0.6$ $F_{t\_SS410} = 51.75\ ksi$

$Tension_{per\_screw} := \frac{M_{overturning\_design}}{2 \cdot spacing_{screw}} = 2.16\ kip$

$Shear_{per\_screw} := \frac{P_{live\_load}}{4} = 0.05\ kip$

$R_{allowable\_shear} := \frac{F_{v\_SS410} \cdot A_{root\_area}}{\Omega_{screw}} = 1.36\ kip$

$R_{n\_tension} := F_{t\_SS410} \cdot A_{root\_area} = 4.53\ kip$

For screw into screw slot in posts per ADM J5.5.1.2:

$R_{n\_withdrawal} := 0.29 \cdot d_{screw\_dia} \cdot \left(screw_{length} - 1\ in\right) \cdot F_{t\_SS410} = 7.82\ kip$

$R_{allowable\_tension} := min\left(\frac{R_{n\_tension}}{\Omega_{screw}}, \frac{R_{n\_withdrawal}}{\Omega_{ADM}}\right) = 2.27\ kip$

$DCR_{T\_screw} := \frac{Tension_{per\_screw}}{R_{allowable\_tension}} = 0.95$ $DCR_{V\_screw} := \frac{Shear_{per\_screw}}{R_{allowable\_shear}} = 0.04$

$DCR_{screw} := DCR_{T\_screw}^{\frac{5}{3}} + DCR_{V\_screw}^{\frac{5}{3}} = 0.93$

Ok to use 5/16" ϕ hardened 410 stainless steel screws for max. 54" tall posts with max. 96" post spacing, only for installations at IRC compliant one or two family dwellingsfor one and two family dwellings.

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6. SANDWICH ANCHOR CONNECTION

Anchorage design for post mounted on top of Wood Member (Douglas-Fir or Better):

Case 1: General use.

$P_1 := 50\ plf \cdot 8\ ft = 400\ lbf$

$H_1 := (42 + 6)\ in = 48\ in$

$M_1 := P_1 \cdot H_1 = 19.2\ kip \cdot in$

$Min_{anchor\_spacing} := 3.685\ in$

$T_{reaction\_1} := \frac{M_1}{2\ Min_{anchor\_spacing}} = 2.61\ kip$

$Shear_{reaction\_1} := \frac{P_1}{4} = 100\ lbf$

Case 2: Residential one or two family dwellings.

$P_2 := 200\ lbf$

$H_2 := 54\ in$

$M_2 := P_2 \cdot H_2 = 10.8\ kip \cdot in$

(Minimum spacing between lag bolts)

$T_{reaction\_2} := \frac{M_2}{2\ Min_{anchor\_spacing}} = 1.47\ kip$

$Shear_{reaction\_2} := \frac{P_2}{4} = 50\ lbf$

Provide 3/8" lag bolts or through bolts in 8x12 or larger wood member with appropriate edge distances / end distance per NDS.

Capacity check of the supporting structural members are not a part of this design.

Table 12.5.1A End Distance Requirements

Direction of Loading	End Distances: Minimum end distance for $C_\Delta = 0.5$	End Distances: Minimum end distance for $C_\Delta = 1.0$
Perpendicular to Grain	2D	4D
Parallel to Grain, Compression: (fastener bearing away from member end)	2D	4D
Parallel to Grain, Tension: (fastener bearing toward member end)		
for softwoods	3.5D	7D
for hardwoods	2.5D	5D

Table 12.5.1C Edge Distance Requirements[1,2]

Direction of Loading	Minimum Edge Distance
Parallel to Grain:	
where $\ell/D \le 6$	1.5D
where $\ell/D > 6$	1.5D or ½ the spacing between rows, whichever is greater
Perpendicular to Grain:[2]	
loaded edge	4D
unloaded edge	1.5D

1. The ℓ/D ratio used to determine the minimum edge distance shall be the lesser of:
   (a) length of fastener in wood main member/D = ℓ_m/D
   (b) total length of fastener in wood side member(s)/D = ℓ_s/D
2. Heavy or medium concentrated loads shall not be suspended below the neutral axis of a single sawn lumber or structural glued laminated timber beam except where mechanical or equivalent reinforcement is provided to resist tension stresses perpendicular to grain (see 3.8.2 and 11.1.3).

7. WOOD ANCHOR CONNECTION

Base Plate Anchorage design for Post mounted on top of Wood Member (Douglas-Fir or Better):

Case: Residential one or two family dwellings.

$P := 200\ \textbf{\textit{lbf}}$

$H := 54\ \textbf{\textit{in}}$

$M := P \cdot H = 10.8\ \textbf{\textit{kip}} \cdot \textbf{\textit{in}}$

$Min_{anchor\_spacing} := 3.685\ \textbf{\textit{in}}$ (Minimum spacing between lag screws)

$T_{reaction} := \frac{M}{2 \cdot Min_{anchor\_spacing}} = 1.47\ \textbf{\textit{kip}}$ (Tension on lag screws)

$G := 0.5$ (Specific Gravity of wood member)

$D := \frac{3}{8}$ (Diameter of Lag screw)

$C_D := 1.6 \qquad C_m := 0.7 \qquad C_t := 1.0 \qquad K_w := 1800$

$W_{3\_8\_screw} := K_w \cdot G^{\frac{3}{2}} \cdot D^{\frac{3}{4}}\ \frac{\textbf{\textit{lbf}}}{\textbf{\textit{in}}} = 304.97\ \frac{\textbf{\textit{lbf}}}{\textbf{\textit{in}}}$ (3/8" Lag Screw Withdrawal Value)

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 341.56\ \frac{\textbf{\textit{lbf}}}{\textbf{\textit{in}}}$

$Tension_{capacity} := 5\ \textbf{\textit{in}} \cdot W'_{3\_8\_screw} = 1.71\ \textbf{\textit{kip}}$

(Withdrawal Capacity for 5 inch embedment)
Use 3/8 x 10" long screws

$DCR_T := \frac{T_{reaction}}{Tension_{capacity}} = 0.86$

$Shear_{capacity} := 130\ \textbf{\textit{lbf}}$ (Minimum capacity of single shear 3/8" lag bolt per Table 12-K for Wood members of Specific gravity of 0.50)

$Shear_{reaction} := \frac{P}{4} = 50\ \textbf{\textit{lbf}}$

$DCR_V := \frac{Shear_{reaction}}{Shear_{capacity}} = 0.38$

$DCR_{V\&T\_1} := DCR_T^{\frac{5}{3}} + DCR_V^{\frac{5}{3}} = 0.98$ Approximate equation for combined check !

$$\alpha := \operatorname{atan}\left(\frac{T_{reaction}}{Shear_{reaction}}\right) = 88.046 \ \textit{deg}$$

Harkinsons formula should be used for combined check !

$$P_{resultantload} := \sqrt{Shear_{reaction}^{2} + T_{reaction}^{2}} = 1.466 \ \textit{kip}$$

$$Z_{\alpha} := \frac{Tension_{capacity} \cdot Shear_{capacity}}{Tension_{capacity} \cdot \cos(\alpha)^{2} + Shear_{capacity} \cdot \sin(\alpha)^{2}} = 1.684 \ \textit{kip}$$

$$DCR_{V\&T\_2} := \frac{P_{resultantload}}{Z_{\alpha}} = 0.871$$

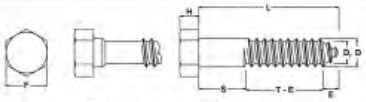
Provide 3/8 Lag Screws with min. 5" thread length and preferably 10" long screws

Table L2 Standard Hex Lag Screws[1]

A

APPENDIX

D = diameter, in.
D_r = root diameter, in.
S = unthreaded body length, in.
T = minimum thread length[2], in.



Reduced Body Diameter

Full-Body Diameter

E = length of tapered tip, in.
L = lag screw length, in.
N = number of threads/inch
F = width of head across flats, in.
H = height of head, in.

Length, L		Diameter, D										
		1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
	D_r	0.173	0.227	0.265	0.328	0.371	0.471	0.579	0.683	0.780	0.887	1.012
	E	5/32	3/16	7/32	9/32	5/16	13/32	1/2	19/32	11/16	25/32	7/8
	H	11/64	7/32	1/4	19/64	11/32	27/64	1/2	37/64	43/64	3/4	27/32
	F	7/16	1/2	9/16	5/8	3/4	15/16	1-1/8	1-5/16	1-1/2	1-11/16	1-7/8
	N	10	9	7	7	6	5	4-1/2	4	3-1/2	3-1/4	3-1/4
1	S	1/4	1/4	1/4	1/4	1/4						
	T	3/4	3/4	3/4	3/4	3/4						
	T-E	19/32	9/16	17/32	15/32	7/16						
1-1/2	S	1/4	1/4	1/4	1/4	1/4						
	T	1-1/4	1-1/4	1-1/4	1-1/4	1-1/4						
	T-E	1-3/32	1-1/16	1-1/32	31/32	15/16						
2	S	1/2	1/2	1/2	1/2	1/2	1/2					
	T	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2					
	T-E	1-11/32	1-5/16	1-9/32	1-7/32	1-3/16	1-3/32					
2-1/2	S	3/4	3/4	3/4	3/4	3/4	3/4					
	T	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4					
	T-E	1-19/32	1-9/16	1-17/32	1-15/32	1-7/16	1-11/32					
3	S	1	1	1	1	1	1	1	1	1		
	T	2	2	2	2	2	2	2	2	2		
	T-E	1-27/32	1-13/16	1-25/32	1-23/32	1-11/16	1-19/32	1-1/2	1-13/32	1-5/16		
4	S	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2
	T	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
	T-E	2-11/32	2-5/16	2-9/32	2-7/32	2-3/16	2-3/32	2	1-29/32	1-13/16	1-23/32	1-5/8
5	S	2	2	2	2	2	2	2	2	2	2	2
	T	3	3	3	3	3	3	3	3	3	3	3
	T-E	2-27/32	2-13/16	2-25/32	2-23/32	2-11/16	2-19/32	2-1/2	2-13/32	2-5/16	2-7/32	2-1/8
6	S	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
	T	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2
	T-E	3-11/32	3-5/16	3-9/32	3-7/32	3-3/16	3-3/32	3	2-29/32	2-13/16	2-23/32	2-5/8
7	S	3	3	3	3	3	3	3	3	3	3	3
	T	4	4	4	4	4	4	4	4	4	4	4
	T-E	3-27/32	3-13/16	3-25/32	3-23/32	3-11/16	3-19/32	3-1/2	3-13/32	3-5/16	3-7/32	3-1/8
8	S	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2
	T	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2
	T-E	4-11/32	4-5/16	4-9/32	4-7/32	4-3/16	4-3/32	4	3-29/32	3-13/16	3-23/32	3-5/8
9	S	4	4	4	4	4	4	4	4	4	4	4
	T	5	5	5	5	5	5	5	5	5	5	5
	T-E	4-27/32	4-13/16	4-25/32	4-23/32	4-11/16	4-19/32	4-1/2	4-13/32	4-5/16	4-7/32	4-1/8
10	S	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2	4-1/2
	T	5-1/2	5-1/2	5-1/2	5-1/2	5-1/2	5-1/2	5-1/2	5-1/2	5-1/2	5-1/2	5-1/2
	T-E	5-11/32	5-5/16	5-9/32	5-7/32	5-3/16	5-3/32	5	4-29/32	4-13/16	4-23/32	4-5/8
11	S	5	5	5	5	5	5	5	5	5	5	5
	T	6	6	6	6	6	6	6	6	6	6	6
	T-E	5-27/32	5-13/16	5-25/32	5-23/32	5-11/16	5-19/32	5-1/2	5-13/32	5-5/16	5-7/32	5-1/8
12	S	6	6	6	6	6	6	6	6	6	6	6
	T	6	6	6	6	6	6	6	6	6	6	6
	T-E	5-27/32	5-13/16	5-25/32	5-23/32	5-11/16	5-19/32	5-1/2	5-13/32	5-5/16	5-7/32	5-1/8

1. Tolerances are specified in ANSI/ASME B18.2.1. Full-body diameter and reduced body diameter lag screws are shown. For reduced body diameter lag screws, the unthreaded body diameter may be reduced to approximately the root diameter, D_r.
2. Minimum thread length (T) for lag screw lengths (L) is 6 or 1/2 the lag screw length plus 0.5, whichever is less. Thread lengths may exceed these minimums up to the full lag screw length (L).

Design Method	Allowable Stress Design (ASD)
Connection Type	Withdrawal loading
Fastener Type	Lag Screw
Loading Scenario	N/A

Main Member Type	Douglas Fir-Larch
Main Member Thickness	5.5 in.
Side Member Type	Steel
Side Member Thickness	12 gage
Washer Thickness	0 in.
Nominal Diameter	3/8 in.
Length	5 in.
Load Duration Factor	C_D = 1.6
Wet Service Factor	C_M = 0.7
End Grain Factor	C_eg = 1.0
Temperature Factor	C_t = 1.0

Adjusted ASD Capacity	**950 lbs.**

- The Adjusted ASD Capacity only applies to withdrawal of the fastener from the main member. It does not address head pull-through capacity of the fastener in the side member.

While every effort has been made to insure the accuracy of the information presented, and special effort has been made to assure that the information reflects the state-of-the-art, neither the American Wood Council nor its members assume any responsibility for any particular design prepared from this on-line Connection Calculator. Those using this on-line Connection Calculator assume all liability from its use.

The Connection Calculator was designed and created by Cameron Knudson, Michael Dodson and David Pollock at Washington State University. Support for development of the Connection Calculator was provided by American Wood Council.

SHEAR PARALLEL TO GRAIN

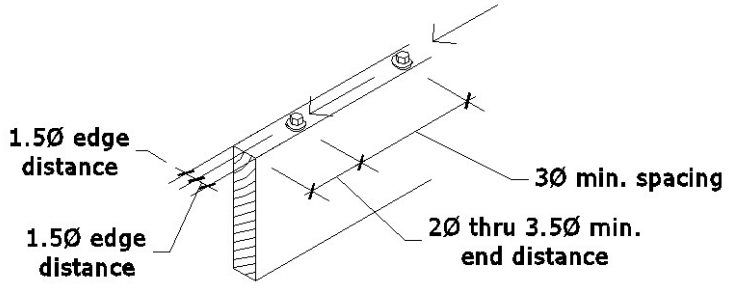


TABLE 12.5.1A / 12.5.1B / 12.5.1C

SHEAR PERPENDICULAR TO GRAIN

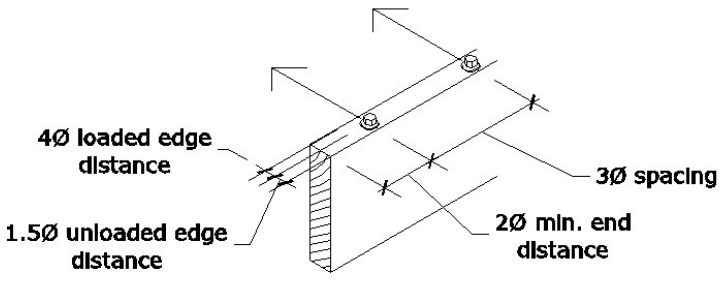


TABLE 12.5.1A / 12.5.1B / 12.5.1C

WITHDRAWAL

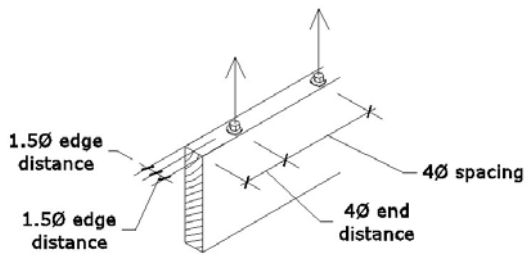


TABLE 12.5.1E (lag screws)

Design Method	Allowable Stress Design (ASD)
Connection Type	Lateral loading
Fastener Type	Lag Screw
Loading Scenario	Single Shear

Main Member Type	Douglas Fir-Larch
Main Member Thickness	5.5 in.
Main Member: Angle of Load to Grain	0
Side Member Type	Steel
Side Member Thickness	12 gage
Side Member: Angle of Load to Grain	0
Washer Thickness	0 in.
Nominal Diameter	3/8 in.
Length	5 in.
Load Duration Factor	C_D = 1.6
Wet Service Factor	C_M = 0.7
End Grain Factor	C_eg = 1.0
Temperature Factor	C_t = 1.0

Connection Yield Modes

Im	2034 lbs.
Is	482 lbs.
II	914 lbs.
IIIm	1040 lbs.
IIIs	229 lbs.
IV	305 lbs.

Adjusted ASD Capacity	**229 lbs.**

- Lag Screw bending yield strength of 45000 psi is assumed.
- The Adjusted ASD Capacity is only applicable for lag screws with adequate end distance, edge distance and spacing per NDS chapter 11.
- ASTM A36 Steel is assumed for steel side members 1/4 in. thick, and ASTM A653 Grade 33 Steel is assumed for steel side members less than 1/4 in. thick.

While every effort has been made to insure the accuracy of the information presented, and special effort has been made to assure that the information reflects the state-of-the-art, neither the American Wood Council nor its members assume any responsibility for any particular design prepared from this on-line Connection Calculator. Those using this on-line Connection Calculator assume all liability from its use.

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Design Method	Allowable Stress Design (ASD)
Connection Type	Lateral loading
Fastener Type	Lag Screw
Loading Scenario	Single Shear

Main Member Type	Douglas Fir-Larch
Main Member Thickness	5.5 in.
Main Member: Angle of Load to Grain	90
Side Member Type	Steel
Side Member Thickness	12 gage
Side Member: Angle of Load to Grain	0
Washer Thickness	0 in.
Nominal Diameter	3/8 in.
Length	5 in.
Load Duration Factor	C_D = 1.6
Wet Service Factor	C_M = 0.7
End Grain Factor	C_eg = 1.0
Temperature Factor	C_t = 1.0

Connection Yield Modes

Im	1061 lbs.
Is	385 lbs.
II	480 lbs.
IIIm	551 lbs.
IIIs	152 lbs.
IV	200 lbs.

Adjusted ASD Capacity	**152 lbs.**

- Lag Screw bending yield strength of 45000 psi is assumed.
- The Adjusted ASD Capacity is only applicable for lag screws with adequate end distance, edge distance and spacing per NDS chapter 11.
- ASTM A36 Steel is assumed for steel side members 1/4 in. thick, and ASTM A653 Grade 33 Steel is assumed for steel side members less than 1/4 in. thick.

The Connection Calculator was designed and created by Cameron Knudson, Michael Dodson and David Pollock at Washington State University. Support for development of the Connection Calculator was provided by American Wood Council.

RailFX® OASIS™ RAILING SYSTEM

INSTALLATION GUIDE

RailFX® Oasis™ Cable Railing System

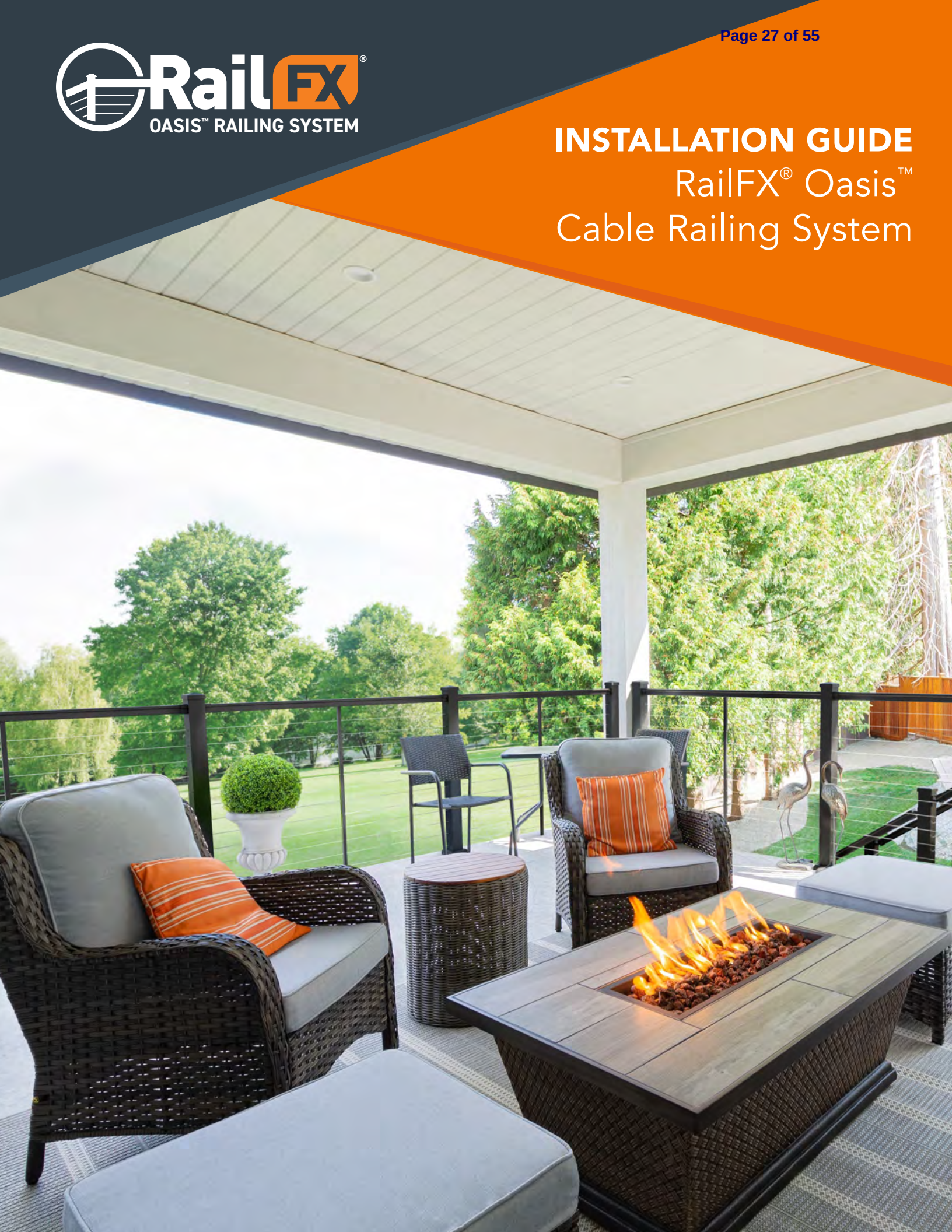
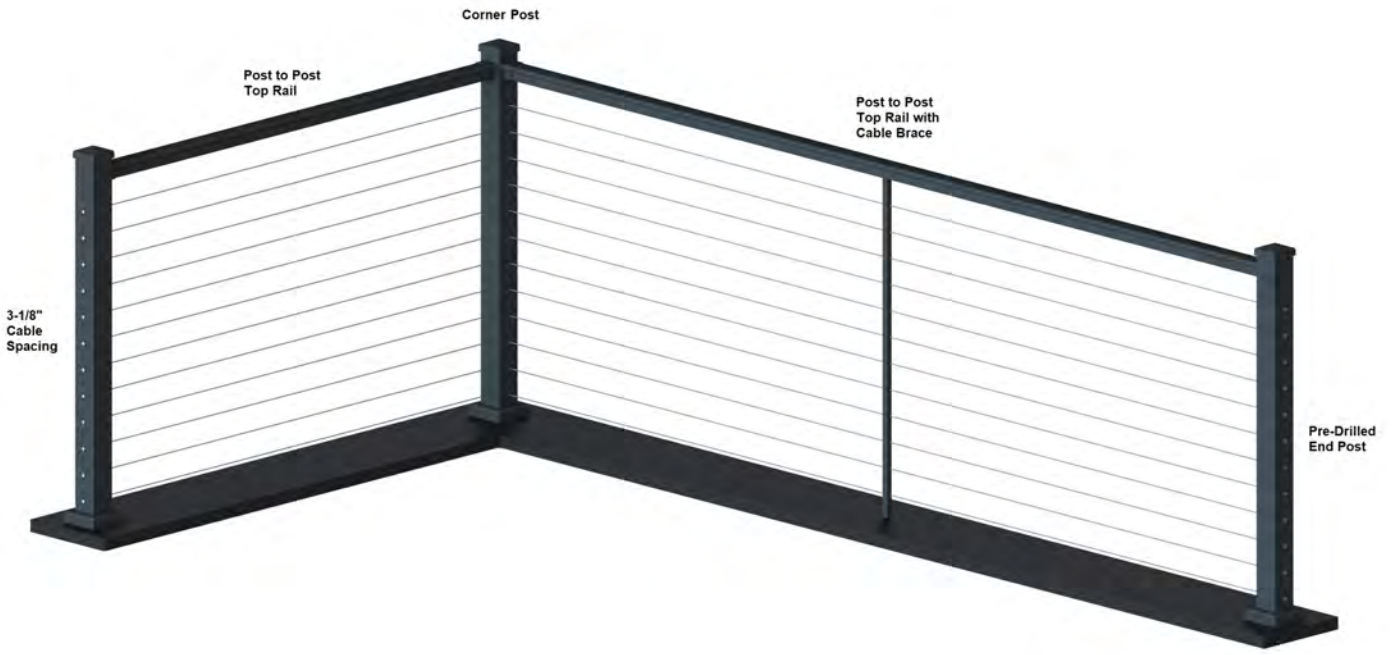


TABLE OF CONTENTS

RailFX® OASIS CABLE RAILING OVERVIEW



The RailFX® Oasis Aluminum Rail and Cable System has been designed, engineered and tested specifically for a cable application rail system. The aluminum framework and stainless-steel cable allows for railings to be lightweight while still retaining exceptional durability.

RAIL GUIDELINES

To comply with engineering and testing **posts must be spaced no more than 96" with a cable brace**. Unsupported cable span should not exceed 48". Cable brace included with top rail kit. Cables are spaced 3 1/8" on center to keep cable from deflecting beyond 4" to meet code. Cable can either terminate at the corner or run continuously through corners. Single corner posts can be used with cable running through the corner. Top rail is required for all railing installations.

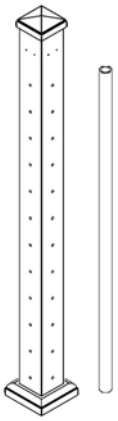
POSTS

RailFX® Oasis™ posts for level and stair railings are pre-drilled, and ready for cable installation. Posts for stairs come with a base plate unattached to maximize installation flexibility which allows the post to accommodate most stair applications. All posts are available for surface mount only and available for 36" and/or 42" rail heights.

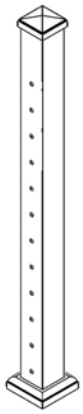
TOP RAIL

There is one top rail available for the RailFX® Oasis Cable Railing System (shown on page 4). The rail insert is designed to slide into the top rail for a finished look and is used to secure cable braces.

COMPONENT GUIDE

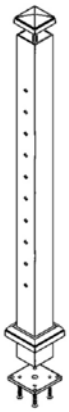


Corner Post and Conduit Kit

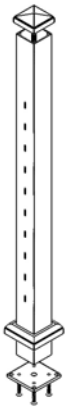


End Post Kit

Intermediate Post Kit



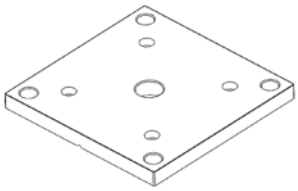
Stair End Post Kit



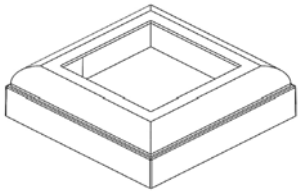
Stair Intermediate Post Kit

Top Rail with Rail Insert

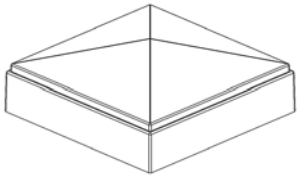
HARDWARE / ACCESSORIES



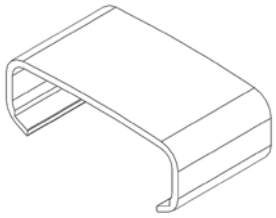
Post Base Plate



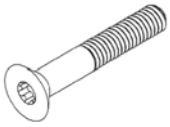
Base Trim



Post Cap



Saddle Bracket Cover

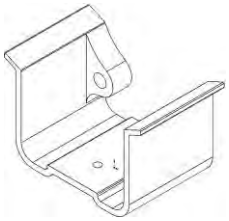


5/16" x 2" T-40 Self Tapping Stainless Steel Screws

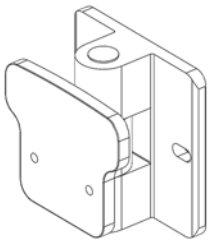
3/8" x 8" Stainless Steel Lag Bolt

Note: Min. 5" thread length

(Not included, user supplied)

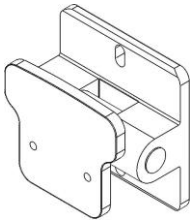


Saddle Bracket



Horizontal Pivot Bracket

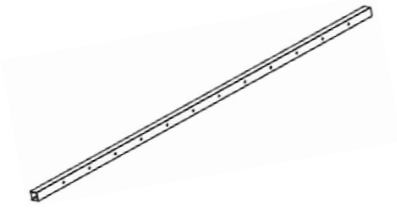
(Optional)



Stair Pivot Bracket

#8 x 1/2" Screw

#10 x 1" Screw



Cable Brace

RailFX Installation Kit for Classic and Low Profile Cable Kits

(Includes all tools necessary for cable kit installation)

*SCREW ATTACHMENT OF RFXHCSP TO RFXHCSPB IN LIEU OF PFX1000P WELDED TO PFX1000PB

A. It is structurally acceptable to use 5/16" Φ 304/316 SS screws only for max. 38" tall posts with max. 48" post spacing, for all IBC compliant residential and commercial installations.

B. It is structurally acceptable to use 5/16" Φ hardened 410 SS screws for max. 54" tall posts with max. 54" post spacing, for all IBC compliant residential and commercial installations.

C. It is structurally acceptable to use 5/16" Φ hardened 410 SS screws for max. 54" tall posts with max. 96" post spacing, only for installations at IRC compliant one or two family dwellings.

SURFACE MOUNT POST INSTALLATION

For 36" or 42" Oasis Aluminum Railing and Cable System

MATERIALS FOR INSTALLATION:

Surface Mount Post

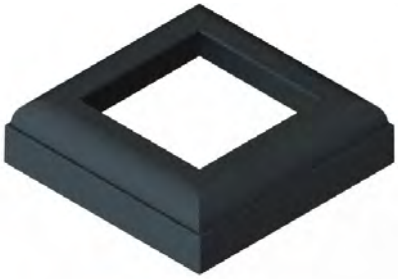
3/8" x 8" Lag Bolts

Note: Min. 5" thread length

(customer supplied)

Post Cap

(Included with Post Kit)



Post Base Trim

(Included with Post Kit)

It is the responsibility of the installer to meet all code and safety requirements and to obtain all required building permits. The deck and railing installer should determine and implement appropriate techniques for each installation situation. RailFX or its distributors shall not be held liable for improper or unsafe installations. Determine appropriate layout and post spacing. **Maximum post spacing is 96" with cable brace.** Ensure that proper blocking is in place prior to mounting post. 8" lag must be fully embedded into blocking.

POST MOUNTING OPTIONS

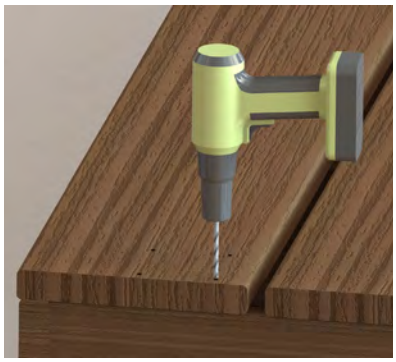
- Wood blocking must be constructed with treated dimensional lumber.
- Secure wood blocking to deck frame on all four sides – using #10-3-1/2" deck screws.
- Wood blocking must be constructed with a minimum thickness of 1-1/2".
- Base plate edge MUST be positioned a minimum 1-1/2" from the edge of the deck framing.
- Use only 3/8" diameter lag screws to attach post.*
- Secure each post with four lag screws.

SURFACE MOUNT POST INSTALLATION

36" or 42" RailFX Oasis Aluminum Railing and Cable System

Step 1

Determine location of post and mark hole locations.



Step 2

Remove post and pre-drill pilot holes (5/16" dia.) to accept 3/8" diameter lag bolts.

Step 3

Install and drive lag bolt fasteners into blocking.

Step 4

Ensure post is plumb. If not adjust as needed utilizing composite shims or stainless steel washers. Tighten fasteners and ensure proper engagement of lag screws.

Step 5

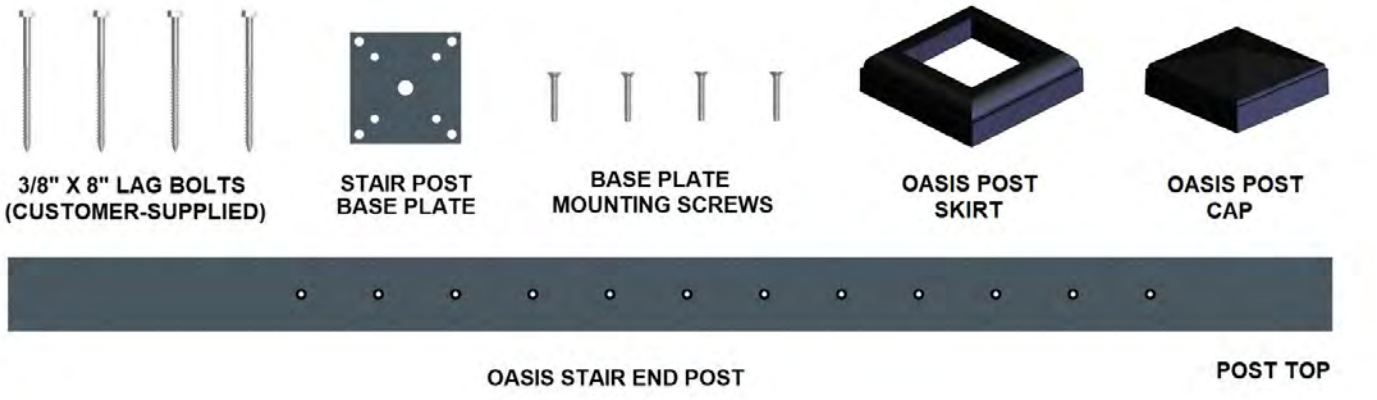
Slide post base trim over the top of the post and seat it over the post base plate.

Step 6

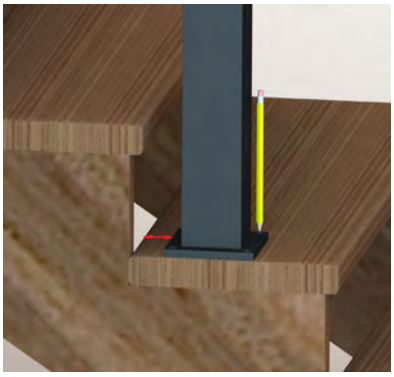
Post installation complete.

SURFACE MOUNT STAIR END POST

NOTE: Post comes long on top and bottom and will require trimming prior to installation.



PRE-MOUNT INSTRUCTIONS Attach base plate to bottom of post (post bottom) temporarily using 2 mounting screws located diagonally from each other. This will aid in aligning the post-base plate assembly to the stair tread, in order to lay out the post holes to the correct angle of the stair.



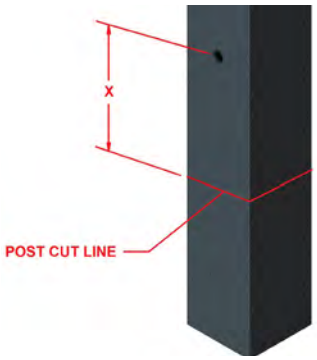
Step 1

Locate end post on bottom stair tread in desired position. Mark hole locations.

Step 2

Insert cable into the first hole of top end post (previously mounted) and pull tightly alongside the end post. Ensure that cable is evenly spaced above the nose of the treads, then mark the post, using masking tape, where the cable intersects the post. This measures the bottom hole on the post to the new post bottom.

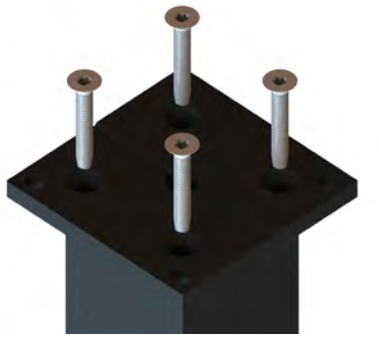
NOTE: Ensure that post slots on downside of post are positioned downward on the post.



Step 3

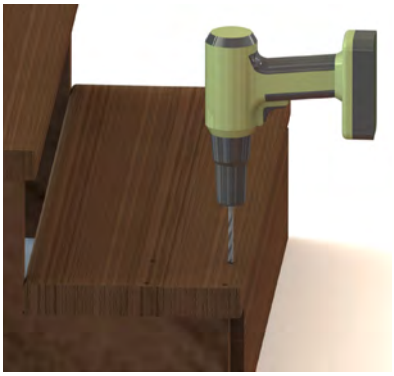
Disassemble base plate from post. Mark X dimension on Step 2 from bottom hole and mark post cut line. Cut post bottom at cut line. Cut top of post to desired finished post height.

SURFACE MOUNT STAIR END POST (continued)



Step 4

Reassemble base plate to post bottom using all four Torx screws (Use beeswax for easier install).

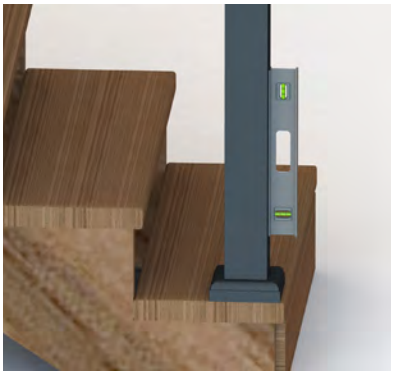


Step 5

At marked hole locations for stair intermediate post, pre-drill pilot holes with a 5/16" drill bit to accept 3/8" diameter lag bolts.

Step 6

Mount post, ensuring lower slots on post are on downward side of stair. Install and drive 3/8" lag bolt fasteners into stair step and blocking.



Step 7

Ensure post is plumb. If not, adjust as needed utilizing composite shims or stainless steel washers. Tighten fasteners and ensure proper engagement of lag screws.

Step 8

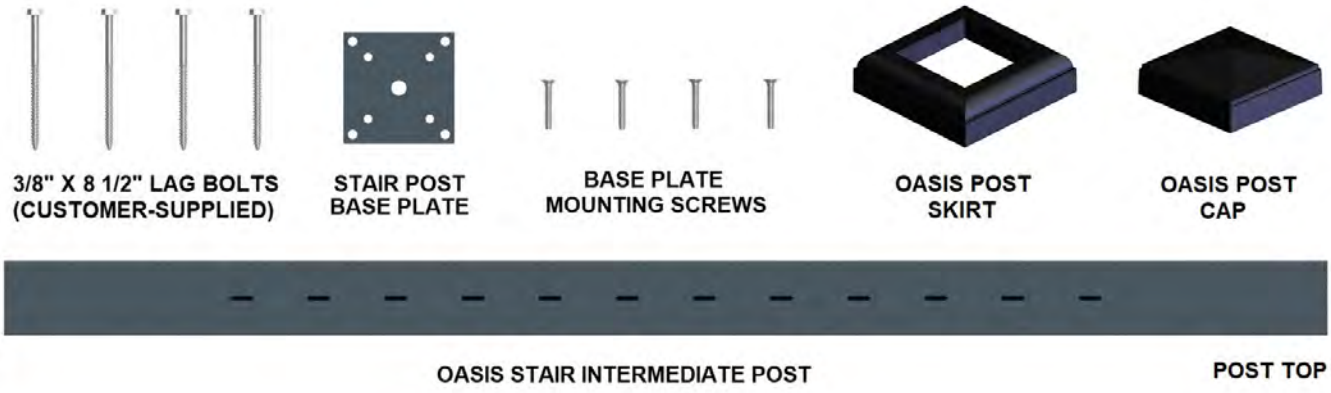
Slide post base trim over the top of the post and seat it over the post base plate.

Step 9

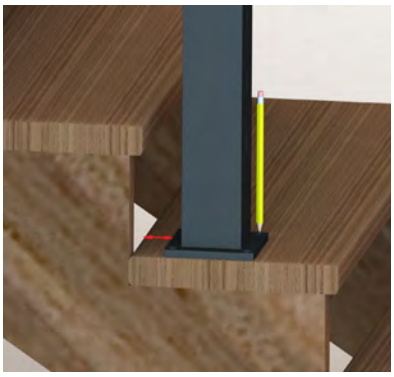
End post installation complete.

SURFACE MOUNT STAIR INTERMEDIATE POST

NOTE: Post comes long on top and bottom and will require trimming prior to installation.



PRE-MOUNT INSTRUCTIONS Attach base plate to post bottom temporarily using 2 mounting screws located diagonally from each other. This will aid in aligning the post-base plate assembly to the stair tread, in order to lay out the post slots to the correct angle of the stair.



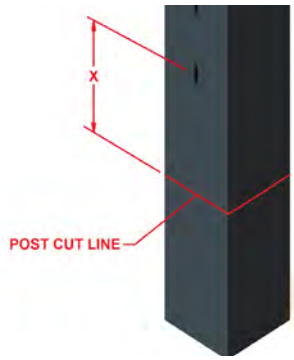
Step 1

Locate intermediate post on bottom stair tread in desired position. Mark hole locations.

Step 2

Insert cable into the first hole of top end post (previously mounted) and pull tightly alongside the intermediate post. Ensure that cable is evenly spaced above the nose of the treads, then mark the post, using masking tape, where the cable intersects the post. This measures the bottom slot on the post to the new post bottom.

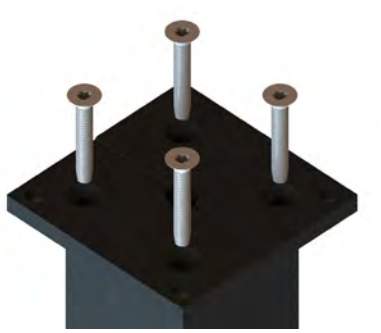
NOTE: Ensure that post slots on downside of post are positioned downward on the post.



Step 3

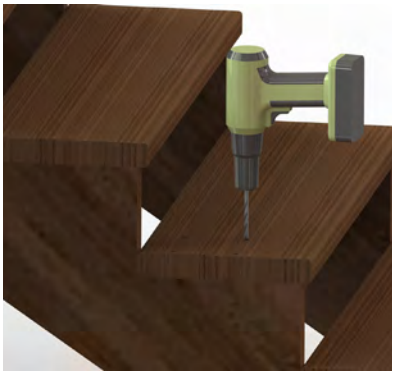
Disassemble base plate from post. Mark X dimension on Step 2 from bottom slot and mark post cut line. Cut post bottom at cut line. Cut top of post to desired finished post height.

SURFACE MOUNT STAIR INTERMEDIATE POST (continued)



Step 4

Reassemble base plate to post bottom using all four Torx screws (Use beeswax for easier install).



Step 5

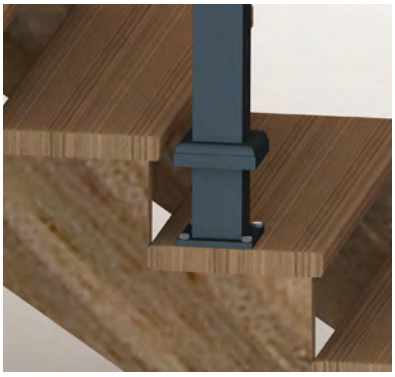
At marked hole locations for stair end post, pre-drill pilot holes to accept 3/8" diameter lag bolts.

Step 6

Mount post, ensuring large holes on post are on outside of stair. Install and drive 3/8" lag bolt fasteners into stair step and blocking.

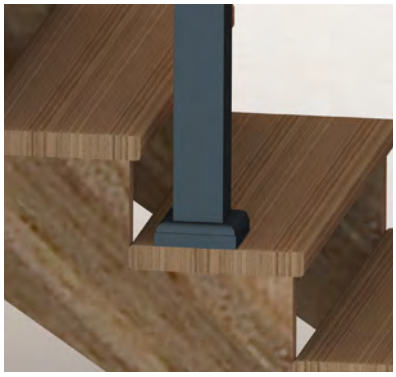
Step 7

Ensure post is plumb. If not, adjust as needed utilizing composite shims or stainless steel washers. Tighten fasteners and ensure proper engagement of lag screws.



Step 8

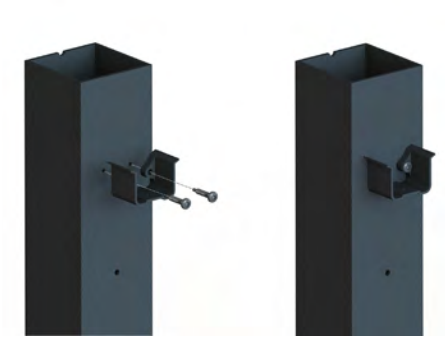
Slide post base trim over the top of the post and seat it over the post base plate.



Step 9

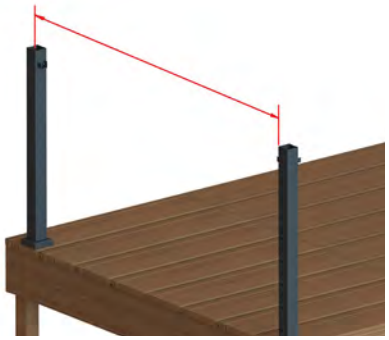
Intermediate post installation complete.

TOP RAIL LEVEL INSTALLATION



Rail Saddle Bracket

Install Saddle Brackets on the 2 horizontally positioned holes at the top of the post using provided #10 x 1" self-drilling screws. Assemble brackets on all remaining level posts.



Cutting Top Rail & Rail Insert

Remove the Rail Insert from the Top Rail. Measure the distance between posts, subtract 7/8", and cut Top Rail squarely using a saw to this length. Next, using the distance between posts previously measured, subtract 1/4" and cut Rail Insert to this length.

Locating Top Rail – Insert

Slide Rail Insert back into Top Rail once cut to the correct length. Slide Saddle Bracket Covers over the top of the rail (approx. 3"- 4"). Ensure Rail Insert is centered within Top Rail.

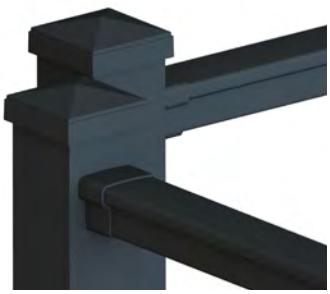
IMPORTANT: Post spans greater than 48" require a cable brace. Before securing top rails, follow Cable Brace Installation Instructions on page 15.

Securing Top Rails

Drop Top Rail and Rail Insert into the Saddle Bracket and slide Saddle Bracket Cover to lock Top Rail and insert onto Saddle Bracket. Install #10 x 1" self-drilling screw through Saddle Bracket hole to fasten securely onto Saddle Bracket.

Finish Top Rail Install

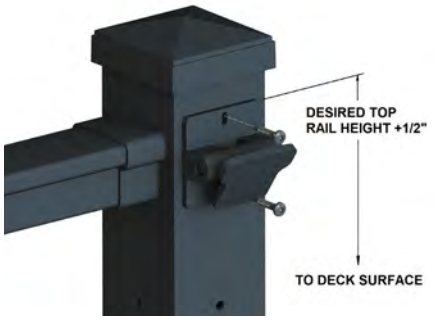
Continue top rail installation on all remaining level posts.



Install Post Caps

Place Post Caps over remaining level posts. Lightly tap with a soft hammer to ensure caps are fully seated on post.

TOP RAIL STAIR INSTALLATION

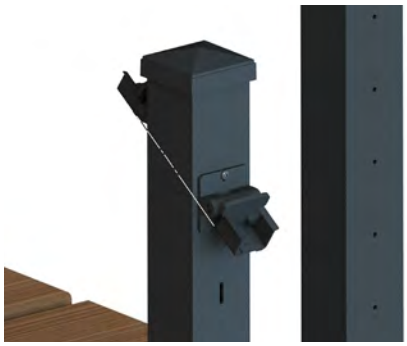


Stair Pivot Bracket

Measure from the surface of your deck to the desired rail height and add 1/2". At this location, center Stair Pivot Bracket on post and mark location. Top of bracket base should be located at desired rail height +1/2". Secure bracket to post using 2 ea. #10 x 1" self-drilling screws.

Attach Saddle Brackets

Attach Saddle Bracket to Stair Pivot Bracket using 2 #10-24 x 7/16" screws. Rotate Stair Pivot Bracket so mounting plate is perpendicular to stair angle.



Saddle Brackets - Int Posts

Continue attaching remaining Stair Pivot Brackets and Saddle Brackets to Stair Intermediate and Stair End Posts.

NOTE: Ensure Stair Pivot Bracket on backside of StairIntermediate Post is in line with front side of post.

Measuring Stair Rail Length

Remove the Rail Insert from the Top Rail. Measure the distance between Stair Pivot Bracket mounting plates, subtract 7/8", and cut Top Rail squarely using a saw to this length. Next, using the distance between Stair Pivot Bracket mounting plate previously measured, subtract 1/4" and cut Rail Insert to this length.

Locating Top Rail - Rail Insert

Slide Rail Insert back into Top Rail once cut to the correct length. Slide Saddle Bracket covers 3-4" over cut Top Rail and Rail Insert. Drop the Top Rail and Rail Insert into Saddle Brackets.

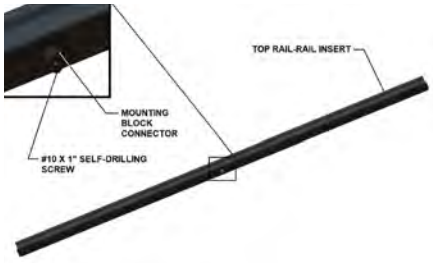
Securing Top Rails

Slide Saddle Bracket Cover to lock Top Rail and Rail Insert onto Saddle Bracket. Install #10 x 1" self-drilling screw to fasten Rail Insert securely onto Saddle Bracket.

CABLE BRACE INSTALLATION

#10 x 1-1/4" FLAT HEAD WOOD SCREW | **#10 x 1" SELF-DRILLING SCREW** | **MOUNTING BLOCK CONNECTORS** | **#8 x 5/8" SELF-DRILLING SCREW**

BRACE TOP — **42" OASIS CABLE BRACE**



Step 1

Locate center of Top Rail-Rail Insert assembly and fasten the Mounting Block Connector to underside of assembly using one #10 x 1" self-drilling screw (supplied). Ensure screw head bottoms out on the inside of the Mounting Block Connector.

CAUTION: Do not overtighten.

Step 2

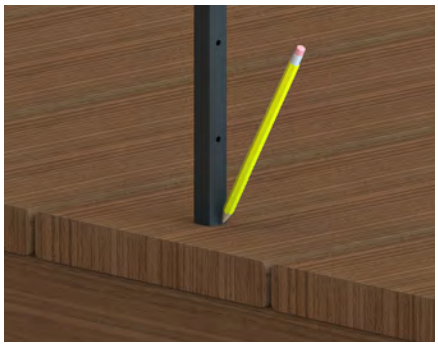
Push Cable Brace onto Mounting Block Connector and ensure that the Cable Brace is seated firmly, and cable holes are oriented in the direction of the cable run.

NOTE: Ensure that the Cable Brace Top is inserted into the Connector. First hole spacing is greater at the top than the bottom.

Step 3

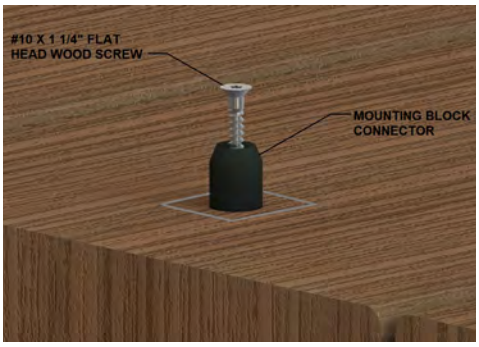
Drop Top Rail-Rail Insert with Cable Brace onto Saddle Brackets between Posts. Use level to ensure that Cable Brace is squared and in proper alignment with cable run direction. Once Cable Brace is squared, hold bottom of brace in position and move to Step 4.

CABLE BRACE INSTALLATION (continued)



Step 4

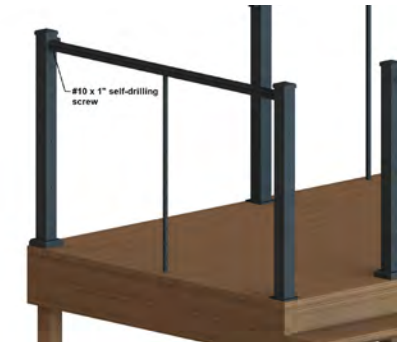
With pencil, mark around the 4 sides of the Cable Brace. This will ensure the correct placement of the Mounting Block Connector. Once the position of the Cable Brace is marked, remove the Top Rail-Rail Insert with Cable Brace from the Saddle Brackets.



Step 5

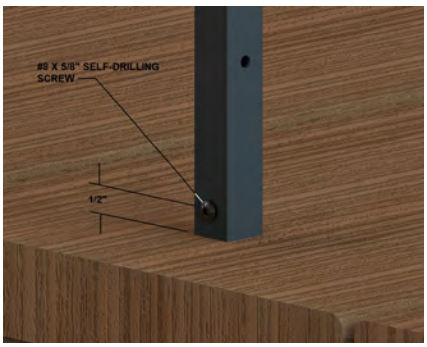
Center Mounting Block Connector within the pencil marks locating the Cable Brace. Secure the connector using one #10 x 1 ¼" flat head wood screw. Ensure screw head bottoms out on the inside of the Mounting Block Connector.

CAUTION: Do not overtighten.



Step 6

Drop Top Rail-Rail Insert with Cable Brace onto Saddle Brackets between Posts, ensuring bottom of Cable Brace is inserted into the Mounting Block Connector on deck surface. Secure Top Rail assembly using one #10 x 1" self-drilling screw through Saddle Bracket bottom on each post. Slide Saddle Bracket Covers on both posts over the Saddle Brackets.



Step 7

With supplied #8 x 5/8" self-drilling screws, secure Cable Brace to bottom Mounting Block Connector. Screw should be centered on Cable Brace and located ½" from bottom of Cable Brace.

Step 8

With supplied #8 x 5/8" self-drilling screws, secure Cable Brace to top Mounting Block Connector. Screw should be centered on Cable Brace and located ½" from top of Cable Brace.

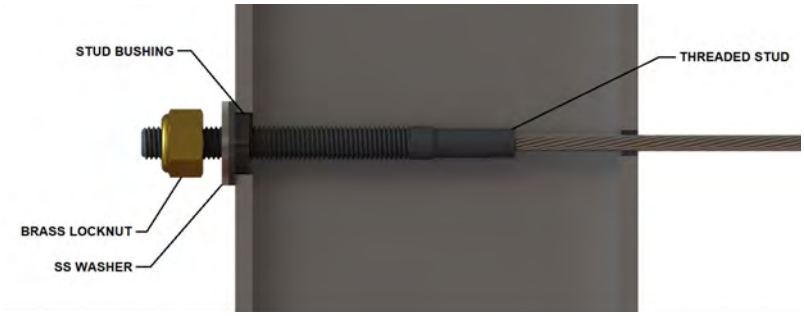
Step 9

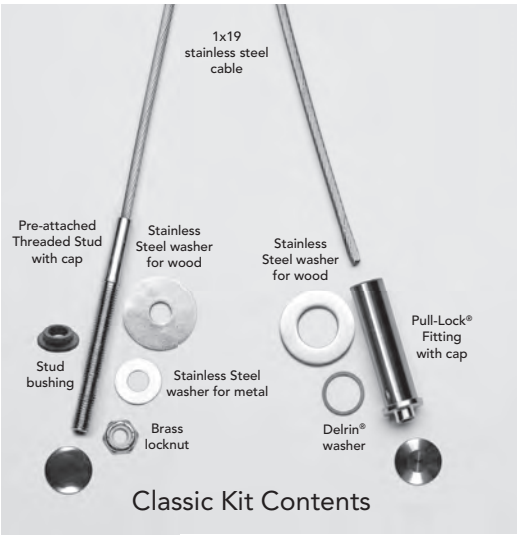
Upon completion of Cable Brace installation, follow steps to secure the top rail as shown on page 13 and 14.

RAILFX® OASIS™ CABLE INSTALLATION GUIDE

Install Tensioning Terminal

Install the Threaded Stud end first. Feed the cable and stud through the end post. Start by inserting the plastic stud bushing into the pre-drilled hole in the post. Slide the stainless-steel washer onto the Threaded Stud and start the brass locknut onto the threads as far as possible by hand.

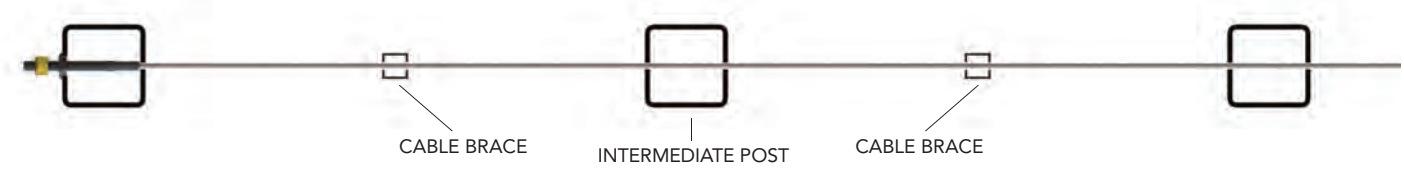




NOTE: Parts must be kept clean and free of debris before installation for best results.

Feed Cable Through Intermediate Posts

Feed the bare end of the cable through all intermediate posts/cable braces and through the end post where you will be installing the Pull-Lock® fitting.



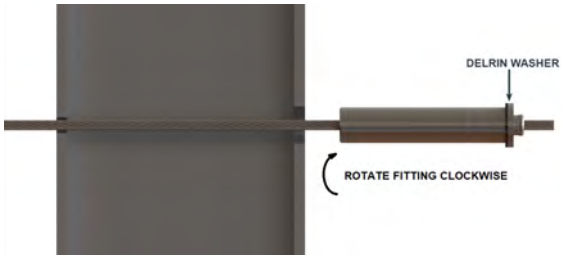
Feed Cable Through Corner Posts

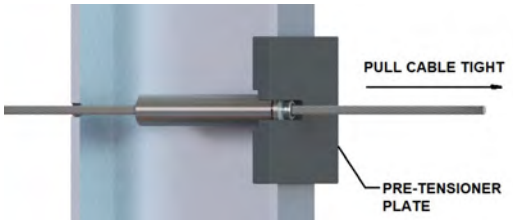
Instructions for going through corners can be found on page 18.

Install Swageless Terminal

Slip the Delrin washer over the body of the Pull-Lock® fitting. At the terminal end post, rotate the Pull-Lock® fitting clockwise as you push it onto the cable. If the cable begins to "unravel," you are rotating the fitting in the wrong direction. Once the cable is through the fitting, pull the cable while using the Pre-Tensioning Block to hold the Pull-Lock® fitting firmly in the hole on the post. With the Pre-Tensioning Block holding the fitting, pull the cable with pliers as tightly as possible.

NOTE: Longer runs of cable and cables that go around corners need to be pretensioned.

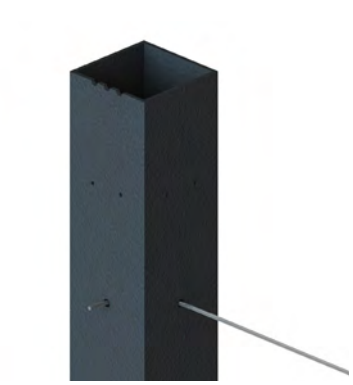




SINGLE CORNER POST CABLE INSTALLATION

Step 1: Bend and Insert Cable

Create a bend in cable to allow for easier insertion into post. Do not fray cable end.



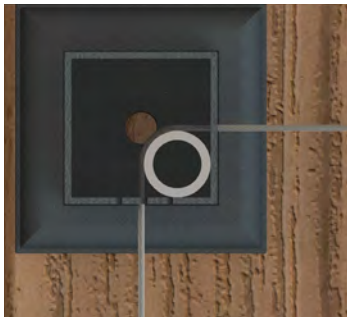
Step 2: Run Cable

Insert and pull through on all cables on post.

NOTE: Cables must be pushed through as well as pulled.

Step 3: Create a Loop

Push cable back into post creating a loop.



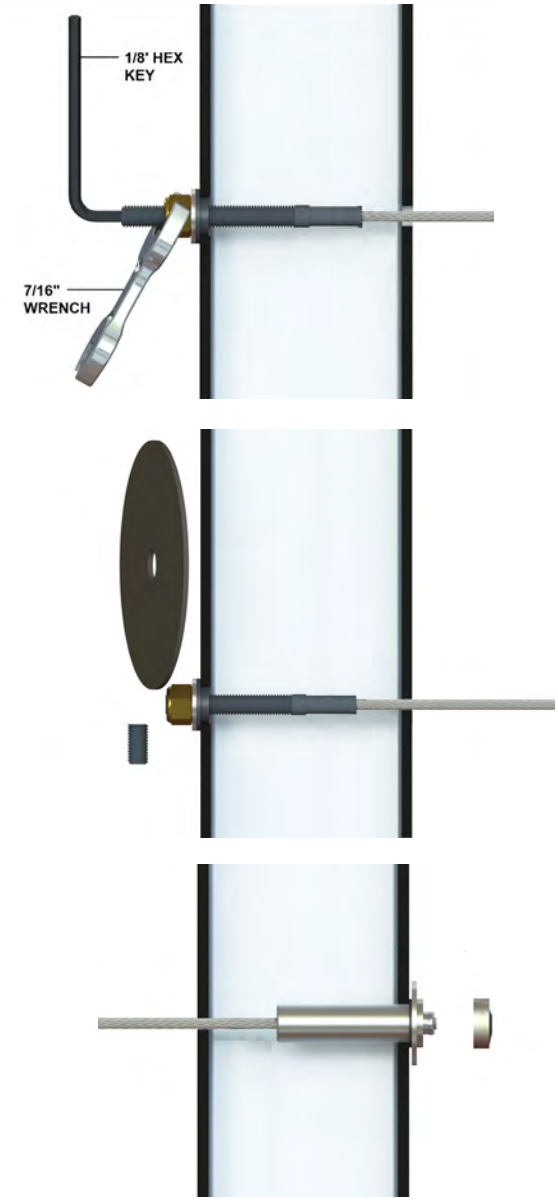
Step 4: Insert Conduit

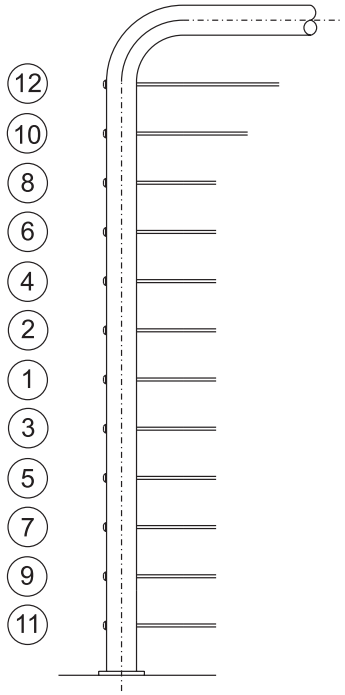
Insert conduit into post and align to inside corner. Pull cables tight to conduit.

RAILFX® OASIS™ CABLE INSTALLATION GUIDE (continued)

Tension Cables

Return to the Threaded Stud end post. Insert an 1/8" hex wrench into broached opening on the tip of the stud. Tighten the locknut with a 7/16" wrench while holding the hex wrench to prevent the stud from turning.





RECOMMENDED TENSIONING SEQUENCE

Tension all cables to 225 lbs. of tension in sequence, beginning with the center cables, moving up and down toward the top and bottom. As you tension each cable, give it a sharp pull downward mid-span to help set the wedges, then re-tension as necessary in the same sequence. Be aware that the cable may move as much as 3/16" toward the tension terminal as the wedges seat.

NOTE: Cut excess thread from threaded stud so end is flush with the end of the Ny-Lock hex nut. Cut the cable flush with the hole in the back of the Pull-Lock® fitting using a cut-off wheel, then press cap onto fitting.

RailFX®
OASIS™ RAILING SYSTEM

LEARN MORE ABOUT
THE RAILFX® OASIS™
RAILING SYSTEM

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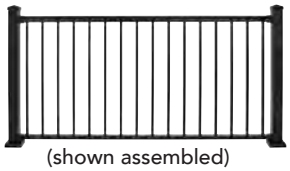
Aluminum Picket Installation Instructions

RailFX® Oasis™ Picket Level Rail

KNOCK-DOWN (KD) PICKET PANEL PARTS:

A KD Picket Panel Parts

• Top Rail • Bottom Rail • Balusters



(shown assembled)

B Saddle Bracket (2)

C Bracket Cover (2)

D Bottom Bracket (2)

E 10" Support Block (1)

F 3 1/2" Driver Bit (1)

G Support Block Connector (2)

H 10x1" Self Drilling Screw (12)

I Adhesive Tab (1)

J Level Hinge Bracket Set (1) *Optional**

**See supplemental installation instructions included with horizontal pivot.*

NOTES:

- Posts and picket panels packaged separately.
- An optional RailFX-Tool is available to simplify locating, pre-drilling and installation of brackets.

MATERIALS REQUIRED:

- 3/8" x 8" Lag Bolt with 5" min. thread length (customer supplied)

TOOLS REQUIRED:

- Drill bit 5/32" (.156")
- Drill (with adjustable clutch, recommended)
- Miter Saw (with carbide, 80-tooth or more blade)
- Level
- Rubber mallet
- Tape measure
- Touch-up paint (optional)

FOR A SUCCESSFUL INSTALLATION:

Read the instructions completely before beginning the installation.

- Plan your railing project. Sketch your project with the actual measurements of your deck or balcony complete with post locations.
- Check local building codes to ensure compliance.
- Check package(s) to determine part count is complete.
- After cutting rails or posts, paint exposed metal for maximum protection against the elements.
- Installation is best completed with two people.
- Wear safety glasses while installing.
- Use care not to over-torque the screws. Pre-drilling is recommended.
- Saddle bracket and bottom bracket are intended for RailFX® posts. If installing to other post types, the necessary fasteners will need to be purchased.

Level Rail Installation Instructions

POSTS INSTALLATION:

1. Measure and locate the position of the post(s) based on the project layout.
2. Install the post by attaching the aluminum mounting flange to the surface of the deck or balcony. Position the post so the fastener will go into the floor joist, and make sure the decking is firmly attached to the joist at the location of the post. If necessary, use wood blocking as reinforcement underneath the decking where the posts are located. Post mounting fasteners should be able to secure into the joist or reinforcement braces, not just the decking itself. When installing RailFX® Oasis™ posts, 5" of threading must be fully embedded into blocking. Deck boards sized 5/4" or 1½" do not provide sufficient material for a safe installation.

SCREW ATTACHMENT OF RFXHCSP TO RFXHCSPB IN LIEU OF PFX1000P WELDED TO PFX1000PB

a. It is structurally acceptable to use 5/16" Φ 304/316 SS screws only for max. 38" tall posts with max. 48"post spacing, for all IBC compliant residential and commercial installations.

b. It is structurally acceptable to use 5/16" Φ hardened 410 SS screws for max. 54" tall posts with max. 54" post spacing, for all IBC compliant residential and commercial installations.

c. It is structurally acceptable to use 5/16" Φ hardened 410 SS screws for max. 54" tall posts with max. 96" post spacing, only for installations at IRC compliant one or two family dwellings.

3. Position the post to the deck surface. Four 3/8" diameter mounting holes are provided on the mounting flange. Mark the mounting flange hole locations and remove the post. Drill the marked locations into the decking and reinforcement. Remount the post. Insert the appropriate fasteners to secure the mounting flange to the deck structure.

Finish by sliding the base trim to the bottom of the post to cover the mounting flange.

4. To install the post cap, set post cap in place on top of the post and tap lightly with a rubber mallet to drive the post cap onto the post. Silicone or water based caulking may be used to secure the post cap and base trim.

LEVEL RAIL INSTALLATION:

1. Carefully measure the opening between posts or walls and calculate the length of rail that needs to be cut. Divide the trim length amount in half, and starting with the Bottom Rail, transfer and mark the measurement to each end of the rail. For the sake of baluster spacing or personal preference, all of the trim length could be cut from one end of both rails. Make this determination before cutting the rails. Always refer to local building code requirements to determine the baluster spacing requirements in your area (4" maximum is typical). Carefully cut the rail. Mark Top Rail and cut. For clearance purposes the top rail is precut ¾" shorter than the bottom rail.

2. To assemble rail, begin with Top Rail and insert balusters into each baluster hole. Use a rubber mallet to tap the balusters into place until fully seated into the Top Rail.

Level Rail Installation Instructions (continued)

3. Insert balusters in the Bottom Rail the same as in Step 1, beginning at one end and working to the opposite end. Stand the assembly upside down on the surface of the box and tap the Bottom Rail with a rubber mallet to secure the balusters in place. Stand assembly upright.

4. Install Support Block Connectors (G) using #10x1" Self Drilling Screw (H) to the underside of Bottom Rail. The Support Block will be installed in Step 9.

NOTE: One Support Block, cut from Support Block Material (E), is recommended for rails measuring 72" in length or less; two Support Blocks for longer lengths. If one Support Block is required, install the Support Block Connector (G) at center point of Bottom Rail. If two Support Blocks are required, install Support Block Connectors (G) equal distance from each end of the Bottom Rail.

5. Slide Bottom Brackets (D) with screw holes down and counter bore holes facing toward the balusters, over each end of the Bottom Rail.

6. Slide Bracket Covers (C) at least 3-4 inches inward over each end of the Top Rail. A small piece of tape may be needed to hold the bracket covers in place.

7. Place a piece of masking tape on posts measure from the top of the post down 3" and mark a level horizontal line. If using the post drilling / rail installation tool, hold rail installation tool flush with top of post and using the holes on the template labeled "level" mark post. This will give you a 36 1/4" or 42 1/4" net rail height.

8. Align screw holes in Saddle Bracket (B) on the horizontal line making certain the Saddle Bracket (B) is centered on the post. Mark screw locations. Repeat process at opposite end.

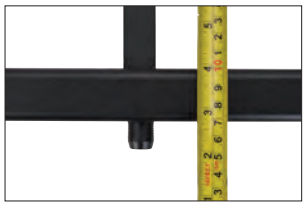
9. Attach both Saddle brackets (B) with #10x1" Self Drilling Screws (H) at the marked screw locations completed in Step 8. Pre-drilling is recommended.

10. Set the rail assembly into the Saddle Brackets (B) letting the Bottom Rail hang freely between the posts.

NOTE: Check for level.

Level Rail Installation Instructions (continued)

11. At the point(s) where you installed Support Block Connector(s) (step 4), carefully measure the distance from the underside of the Bottom Rail to the floor. Cut Support Block Material (E) to fit. Remove rail assembly from the Saddle Brackets (B). Slip Support Block(s) over Support Block Connectors (G). Slide the rail back into place and make certain the rail is level.

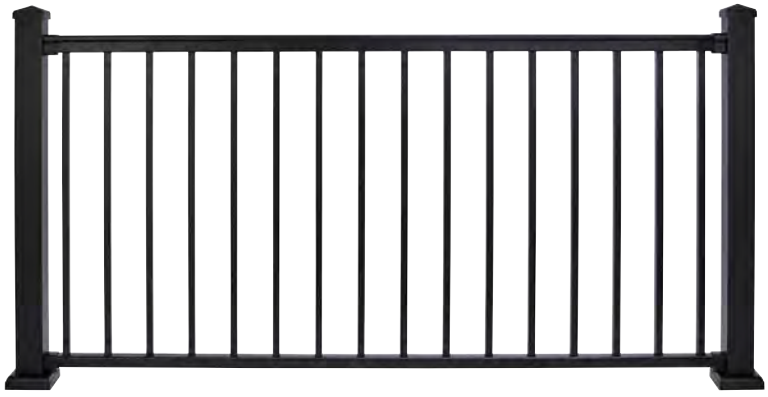


12. Apply Adhesive Tab (I) to flat, top surface of Top Rail, near the post. Slide Bracket Cover (C) to interlock with flange on the Saddle Bracket (B). if needed tap the edge of the cover using a block of wood and hammer to engage slide cover.

13. Screw #10x1" Self Drilling Screws (H) into the Top Rail from the underside of each Saddle Bracket (B) through the provided locating hole to securely fasten the rail.

1. Slide and hold the Bottom Bracket (D) firmly against the post or wall. Secure the bracket with #10x1" Self Drilling Screws (H). Repeat the process at the other side.

NOTE: Screw holes in Bottom Bracket (D) are angled to make mounting the brackets easier.



INSTALLED VIEW

Horizontal Hinge Bracket Installation Recommendations

RailFX® Oasis™ Picket Level Rail

- Read the installation instructions included with the picket panel kit thoroughly before starting the installation.
- For your safety, RailFX® recommends wearing personal protection equipment before, and during the installation process.
- The hardware included in the picket panel kit is intended to use with the RailFX® posts. If installing to another surface, you must acquire the appropriate hardware needed for a proper installation.

TOP HINGE

BOTTOM HINGE

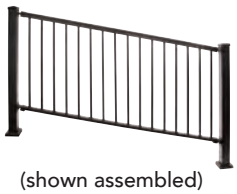
1. Install posts per the instructions provided with the Level Rail Kit.
2. Place a piece of masking tape on posts and measure from the top of the post down 2 5/8" and mark a level horizontal line. If using the post drilling / rail installation tool, hold rail installation tool flush with top of post and using the holes on the template labeled “Horizontal pivot” mark post. This will give you a 36 1/4" or 42 1/4" net rail height.
3. At each of the marks in Step 2, from the centerline of the post measure both left and right of the centerline 1". Place a mark on the horizontal line at both locations.
   NOTE: The RailFX Tool is available to aid and guide the placement of the hole location for the top bracket assembly only.
4. At the locations marked in Step 3, on both sides of the centerline, pre-drill the two holes at both locations for both the top and bottom brackets. If using the RailFX Tool position the tool so the holes marked “HORZ PIVOT” are centered on the horizontal reference marks in step 1. Use the tool as a guide to mark or to pre-drill the holes.
5. Using the painted head screws provided, install both the top and bottom bracket assemblies to the post. Once the brackets are installed refer to the Level Rail Installation to complete the installation of the rail kit.
6. Level rail hardware that is included with the level KD rail kit attaches directly to the horizontal hinge bracket.

Aluminum Picket Installation Instructions

RailFX® Oasis™ Stair Rail

KNOCK-DOWN (KD) PICKET PANEL PARTS:

A KD Picket Panel Parts
• Top Rail • Bottom Rail • Balusters



(shown assembled)

B Top Rail Hinge Assembly (2)

C Bottom Rail Hinge Assembly (2)

D Saddle Bracket (2)

E Saddle Bracket Cover (2)

F Bottom Bracket (2)

G 10" Support Block (1)

H Support Block Connector

I 10x1" Black Self Drilling Screw (8)

J 10-24 x 7/16" Machine Screws (8)

K 3 1/2" Driver Bit (1)

L Adhesive Tab

FOR A SUCCESSFUL INSTALLATION:

- Read the instructions completely before beginning the installation.
- Plan your railing project. Sketch your project with the actual measurements of your deck or balcony complete with post locations.
- Check local building codes to ensure compliance.
- Check packages(s) to determine part count is complete.
- After cutting rails, balusters, or posts, paint exposed metal for maximum protection against the elements.
- Installation is best accomplished with two people.
- Wear personal protection equipment; safety glasses, etc.
- Use care not to over-torque the screws. Pre-drilling is recommended.
- Saddle bracket and bottom bracket are intended for RailFX posts. If installing to other post types, the necessary hardware will need to be purchased.

NOTES:

- Posts and balusters packaged separately.
- Images shown are in white finish for clarity. RailFX® only offers textured black finish.

MATERIALS REQUIRED:

- Post installation attachment hardware

TOOLS REQUIRED:

- Drill bit 5/32" (.156")
- Drill (with adjustable clutch, recommended)
- Miter Saw (with carbide, 80-tooth or more blade)
- Level
- Phillips Screw Driver
- Rubber mallet
- Tape measure
- Touch-up paint (optional)

Stair Rail Installation Instructions

POSTS INSTALLATION:

1. Determine the location and position of the upper and lower post based on the project layout. Mark the desired location of the posts. To ensure post location is compatible with railing prior to securing to the deck surface, place both posts in position, and lay the bottom rail along the nose of the stairs from top to bottom adjacent to both posts (see photo). On the rail side of the post, measure up from the top of the rail and ensure there is a minimum of 35½" for the 36" rail height and a minimum of 41½" for the 42" rail height to the top of the post. Post location may have to be adjusted to ensure minimum is obtained. Repeat this step for the bottom post.
   - For railing mounted 36" high use a 44" post at the bottom of the stairs.
   - For railing mounted 42" high use a 54" post at the bottom of the stairs.

   All post mounting hardware must be embedded into stair stringers or solid wood blocking.

2. When the final position is determined for the post, mark the hole locations of the four 3/8" diameter mounting holes provided on the base and remove the post assembly. Drill the marked locations into the decking and reinforcement using the proper size drill required for the fasteners being used.

3. Remount the post assembly. Insert the appropriate fasteners, then secure the base to the deck structure. Make certain the posts are plumb. If the post requires adjustment, add shims or stainless steel washers under the base plate. Do not re-install the base post trim until step 2 of the rail installation.

STAIR RAIL INSTALLATION:

1. Lay the Picket Panel (A) on the stair from top to bottom and adjacent to the posts previously installed. Make a level reference mark with a pencil on the bracket side of both the upper and lower posts at the point where the top of the rail meets the post.
   NOTE: Illustration photo shown is the upper post.

Disassembly not required

2. Install the base post trim on both the upper and lower posts.

3. Locate the Bottom Rail Hinge Assembly (C) first by measuring up from the reference marks placed on the posts in Step 1 based on the chart below and place mark at those locations on the bracket side of the post from the Bottom Hinge Assembly only. This will be the centerline mounting point for the bottom hinge assemblies. (NOTE: Centerline mark must be a minimum of 2-5/8" from the deck surface to allow for the base trim to be installed.) From the centerline marks of the Bottom Rail Hinge Assemblies measure up the distance indicated on the chart to locate the centerline of the Top Rail Hinge Assemblies.

	UPPER POST		LOWER POST	
	Bottom Rail Hinge	**Top Rail Hinge**	**Bottom Rail Hinge**	**Top Rail Hinge**
36" Rail	Up ½"	33"	Up 1½"	33"
42" Rail	Up ½"	39"	Up 1½"	39"

Stair Rail Installation Instructions (continued)

4. To locate the mounting hole locations of Top Rail Hinge Assembly (B) and the Bottom Rail Hinge Assembly (C), place a mark 1" above and below each of the level line marks centered on the posts from Step 3 (see photo) This will be the location of the fasteners to attach the Hinge Assemblies to the post.
   NOTE: Pre-drilling is recommended at these locations for the fasteners.

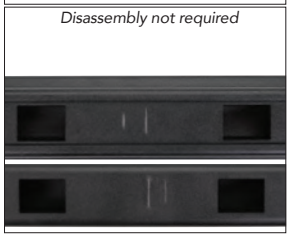
5. Use the #10-1" Self Drilling Screws (I) secure the Top Rail Hinge Assembly (B) and the Bottom Rail Hinge Assembly (C) to the upper and lower posts through the marked and/or pre-drilled hole locations. (Mounting holes are elongated to allow a small amount of adjustment if necessary to properly align the hinge assemble with the rail.)
   NOTE: Two screws are required to mount each bracket to properly secure in place. Depending on the post location, it may be necessary to temporarily remove the post or disassemble the hinge for adequate access to install the fasteners.

6. Attach the Saddle Brackets (D) to the Top Rail Hinge Assembly (B) using the #10-24 x 7/16" Machine Screws (J).
   NOTE: Two screws are required to mount each bracket to properly secure in place.

7. On a flat surface (use the box as a pad to protect painted surfaces), align the holes of both the Picket Panel (A). Place a mark at the determined midpoint of the Bottom Rail (A) (Either baluster on center, or the space between the baluster centered as shown) Transfer that mark to the Top Rail (A).
   NOTE: There must be at least 2" between the cut ends and the center of the first baluster holes for proper clearance of the mounting brackets.

Disassembly not required

8. From the centerlines marked on both the Top Rail and Bottom Rail in Step 7, place a mark 1/2" to the left of the centerline on the Top Rail (A) and 3/8" to the right of the centerline on the Bottom Rail (A). These marked locations will become the new centerline mark of both rails to determine cutting locations.
   NOTE: When viewed as the photo shown, the right side of both the Top Rail and Bottom Rail will be installed to the lower side of the stair.



Shown without baluster for illustrative purposes

9. To determine rail length measure the distance between the parallel faces of the Bottom Rail hinge assembly brackets installed in step 5. From the new determined centerlines of Picket Panel (A) completed in Steps 7 & 8, measure half the distance of the determined bottom rail length and place a mark both right and left of the centerlines. This will be the cut marks for the Bottom Rail (A) only. Shorten the Top Rail (A) by an additional 3/8" from each mark previously placed at the ends of the rail to accommodate bracket clearance. This will be the cut marks for the Top Rail (A).

10. Install Support Block Connectors (H) using Mill Finish #10-1" Self Drilling Screw (I) to the underside of Picket Panel (A). NOTE: One Support Block, cut from Support Block material (G), is recommended for rails measuring 72" in length or less; use two Support Blocks for longer lengths. If one Support Block is required, install Support Block Connector (H) at center point of Picket Panel (A). If two Support Blocks are required, install Support Block Connector (H) equal distance from each end of the Picket Panel (A).

Stair Rail Installation Instructions (continued)

11. To assemble rail, begin with Top Rail (A) and insert balusters into each baluster hole. Use a rubber mallet to tap the balusters into place until fully seated into the Top Rail. NOTE: It is recommended to use the box as a pad to prevent scuffing of the painted finish.

12. Insert balusters in the Bottom Rail (A) the same as in Step 1, beginning at one end and working to the opposite end. Stand the assembly upside down on the surface of the box and tap the Bottom Rail (A) with a rubber mallet to secure the balusters in place. Stand assembly upright. NOTE: Notches are provided on the front of the box to help align balusters and aid in the assembly of the rail in this step.

13. Slide Saddle Bracket Covers (E) over each end of the Top Rail at least 3-4" inward over each end of the rail. Covers will secured in final position later. NOTE: A small piece of tape may be required to hold the bracket covers in place.

14. Slide Bottom Brackets (F) with the counter bore holes facing down and toward the balusters, over each end of the Bottom Rail. A small piece of tape may be required to hold lower bottom brackets in place. Next, set the rail assembly into the Saddle Brackets (D) previously installed (Step 6) letting the Bottom Rail hang freely between the posts.

15. At the point(s) where you installed Support Block Connector(s) (step 11), carefully measure the distance from the underside of the bottom rail to the floor or step. Cut support block material (G) to fit. Slip the Support Block(s) over Support Block Connector(s) (H). Slide the rail back into place and make certain the rail is plumb.

16. Slide and hold the Bottom Brackets (F) against the Bottom Rail Hinge Assembly (C) attached to the upper and lower post and secure with the #10-24 x 7/16" Phillips Screws (J). NOTE: Two screws are required to mount each bracket to properly secure in place.

17. Apply Adhesive Tab (L) to flat, top surface of the Top Rail, near the post. Slide Bracket Covers (E) to interlock with flange on the Saddle Brackets (D). if needed tap the edge of the cover using a block of wood and hammer to engage slide cover.

18. Screw Mill Finish #10-1" Self Drilling Screws (I) into the Top Rail from the underside of Saddle Brackets (D) through the provided locating hole to securely fasten the rail in place.