



JEI Structural Engineering

Glazing Systems

Fast, Friendly, Affordable

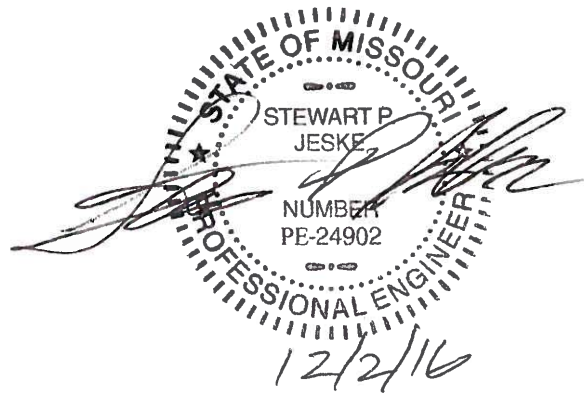
**Webster University
St. Louis, Missouri**

NGG

**Aluminum Curtainwall Calculation Package
(Wind Analysis)**

****EXCLUDES INTERIOR FRAMES: 1/201, 3/204, 4/204****

****EXCLUDES EXTERIOR FRAMES 1/216, 1/217, 1/218****



Project No. JE16059

December 2, 2016



**Webster University
St. Louis, Missouri**

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Webster University St. Louis, Missouri

Design Criteria

1. Scope of Work:

The calculations provided herein are limited to a review of proposed shop drawings and structural analysis for the main curtain wall systems on the Webster University building. The calculations pertain and are limited to the structural design of the following:

- a. Vertical and horizontal framing members
- b. Anchorage of the framing members to the main structure

2. Exclusions:

The following items are explicitly excluded from this calculation package unless otherwise noted and are the responsibility of the system manufacturers, material suppliers, installers or others to review, confirm and approve as required by the project contract documents and specifications.

- a. Structural design of
 - i. Interior frames; 1/201, 3/204, 4/204
 - ii. Exterior frames; 1/216, 1/217, 1/218
 - iii. Monolithic glazing and insulated glazing units (IGU)
 - iv. IGU spacers, sealants and associated components
 - v. System gaskets, glazing spacers, thermal isolators and setting blocks
- b. Dimensional accuracy of shop drawings provided to JEI Structural Engineering.
 - i. It is the responsibility of the installing contractor to confirm field dimensions of rough openings (RO) or to obtain confirmation of guaranteed rough opening sizes prior to assembly and installation.
- c. Means and methods to include but not limited to manufacture, assembly and installation of the glazing system(s) used on the project.
- d. Material quantities required for a complete installation of the glazing system based on the provided shop drawings.
- e. Design of air infiltration and water penetration prevention or thermal performance.
- f. Review and submittal of testing reports to include but not limited to:
 - i. Air infiltration, water penetration and thermal performance testing
 - ii. Large & Small Missile Impact Testing
 - iii. Blast Testing
 - iv. AAMA 501.4 & 501.6 Seismic Testing

It is the responsibility of the project Architect and/or Engineer of Record to review system testing reports and data to confirm system acceptability.



Designs contained within this calculation package assume appropriate material separation between dissimilar materials to prevent galvanic reaction (corrosion). Installer shall follow manufacturer's recommendations & code requirements for material separation.

3. Reference Standards:

Project Specifications;
International Building Code, 2009 Edition;
ASCE 7-05 – Minimum Design Loads for Buildings and Other Structures;
Aluminum Design Manual, 2010 Edition;
AISC Steel Construction Manual, 13th Edition;
AAMA TIR-A9-1991 – Metal Curtain Wall Fasteners;
Elcho Fastener Product Information;
Dow Corning Americas Technical Manual, June 2007

4. Reference Drawings:

The calculations herein are based upon the following drawings prepared by NGG:

Sheets: 001, 200-220, 300-360, 400-455
Dated: 8/10/2016

5. Design Loads:

Wind, Snow & Seismic Loads are as noted in the Structural General Notes, Sheet S0001

a. Dead Load:

Glass:	156 pcf	1" IGU and Aluminum Framing:	8.0 psf
Aluminum:	173 pcf	Steel:	490 pcf

b. Wind Load (ASCE 7-05):

Basic Wind Speed, $V = 90$ mph (3-Second Gust)

Wind Importance Factor, $I_w = 1.15$

Exposure Category B

Enclosed Building Condition

Topographic Factor, $K_t = 1.0$

Components and Cladding Design Pressure (Service, ASD)

Zone 4_{asd}: +20 / -20.0 psf

Zone 5_{asd}: +20 / -23.5 psf

Note: Zone 5 is located within 20' of a building corner.

**6. Deflection of Framing Members:****a. Wind Load (ASCE 7-05/10)**

Normal to Glazing Plane:

- i. $L/175$ of clear span (spans $\leq 13'-6"$)
- ii. $L/240 + \frac{1}{4}"$ of clear span (spans $> 13'-6"$)
- iii. $\frac{3}{4}"$ edge deflection of individual glazing lite, whichever is less

Parallel to Glazing Plane:

- i. Limited to amount not exceeding that which reduces glazing bite to less than 75% of design dimension and which reduces edge clearance between framing members and glazing or other fixed components to less than $\frac{1}{8}"$.

7. Material Basis of Design:

Project materials shall conform to the listed standards and minimum strengths unless otherwise noted or approved in writing by JEI Structural Engineering. Note all F_y and F_u values are minimums.

a. Aluminum

Bent Plate	5052-H32	$F_y = 21$ ksi, $F_u = 31$ ksi
Sheet, Bar, Flat Plate	6061-T6, T651	$F_y = 35$ ksi, $F_u = 42$ ksi
Misc Structural Extrusions & Pipe	6061-T6511	$F_y = 35$ ksi, $F_u = 38$ ksi
Architectural Extrusions (Framing)	6063-T5	$F_y = 16$ ksi, $F_u = 22$ ksi
	6063-T6	$F_y = 25$ ksi, $F_u = 30$ ksi

Brake metal covers, closures and flashing are non-structural and alloy selection is by the installer.

b. Steel

Sheet, Bent/Flat Plate & Bar	ASTM A1011 / A36	$F_y = 36$ ksi, $F_u = 58$ ksi
Angle & Channel	ASTM A36	$F_y = 36$ ksi, $F_u = 58$ ksi
HSS Tube (Rect.)	ASTM A500 Grade B	$F_y = 46$ ksi, $F_u = 58$ ksi
Light Gage Framing	ASTM A1003 / A653	$F_y = 33$ ksi, $F_u = 45$ ksi

c. Fasteners

300 Series Stainless Steel, Condition "A" (Annealed)	ASTM A193 / A194	$F_y = 30$ ksi, $F_u = 70$ ksi
---	------------------	--------------------------------



300 Series Stainless Steel ASTM F593 / F594 $F_y = 65 \text{ ksi}, F_u = 110 \text{ ksi}$
Condition "CW" (Cold Worked)

Zinc Plated Grade 5 Steel SAE J429 / J995 $F_u = 120 \text{ ksi}$

300 Series Stainless fasteners assume condition A unless otherwise specified. ASTM F593 annealed bolts may be substituted for A193 at installer option.

All bolts shall be installed snug tight unless otherwise specified. Provide standard washers and nylock nuts or other means which prevent loosening. All bolts shall protrude from the base material or fastening nut a minimum of 2 threads.

All shims at anchor locations shall be full depth of system T/F anchor, subsill or other bearing surface minus 1/4" allowance front and rear (1/2" total) for sealant joints.

Reference vendor product data for product specific installation procedures, torque requirements, etc.

d. Sealants

DOW 790 Silicone Sealant (High Movement) +100/-50% Movement Capacity
DOW 795 Silicone Sealant (Typical) +50/-50% Movement Capacity

Sealant joint width to thickness ratio shall be 2:1 for joints less than 1" wide and not less than 1/4" by 1/4". Joints 1" wide or greater shall be held to 3/8" to 1/2" thickness.

8. Concrete:

The analysis of anchors into normal weight concrete is based upon a 28-day concrete strength of $f'_c = 4000 \text{ psi}$ unless otherwise noted.

9. Reference ICC-ES Evaluation Reports:

Elco/Hilti

ESR-3332 Elco Dril-Flex Self-Drilling Structural Fasteners
Hilti Kwik-Flex Self-Drilling Structural Fasteners
(Reissued October 1, 2013)

10. Conflicts between Calculations and Drawings:

Where conflicts between the calculations and reference drawings occur, the calculations shall have precedence.



11. Construction:

JEI Structural Engineering is not responsible for any deviations from the calculations and reference drawings. Should the as-built conditions differ from those specified within the calculations or reference drawings, the client must inform JEI Structural Engineering so that the actual conditions may be reviewed for compliance with project specifications and design. It is assumed that all anchors will be installed in a dry environment and that the glazing system will be sealed properly to avoid any water infiltration.



Wind Design Criteria (per Structural General Notes Sheets S0001):

DESIGN CODES:

THE INTERNATIONAL BUILDING CODE/2009.

MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES.

ASCE 7-05

WIND LOAD:

BASIC WIND SPEED 90 MPH.

RISK CATEGORY III

WIND EXPOSURE B

DIRECTIONALITY FACTOR, $K_d = 0.85$

INTERNAL PRESSURE COEFFICIENT = $(+/-) 0.18$

WIND LOAD IMPORTANCE FACTOR: $I_w = 1.15$

COMPONENTS & CLADDING LOAD:

LOADS SHALL BE DETERMINED ACCORDING TO THE ASCE 7-05 REQUIREMENTS
BASED ON TRIB AREA, LOCATION OF BUILDING, AND ANY ADDITIONAL
PARAMETERS NOTED IN THE DESIGN CODE.

Building Dimensions:

Length: 524'

Width: 262'

Height: 47' Reference Architectural Elevations A0301





MecaWind Pro v2.2.7.0 per ASCE 7-05

Developed by MECA Enterprises, Inc. Copyright www.mecaenterprises.com

Date : 4/22/2016	Project No. : JE16059
Company Name : JEI Structural Engineering	Designed By : M. Gorny
Address : 11108 N. Oak Tfwy, Suite 208	Description : Webster University
City : Kansas City	Customer Name : NGG. Inc.
State : MO	Proj Location : Webster Groves, MO
File Location: C:\Users\User1\AppData\Roaming\MecaWind\Default.wnd	

Input Parameters: Detailed Wind Load Design (Method 2) per ASCE 7-05

Basic Wind Speed(V) = 90.00 mph	Structure Type = BUILDING
Structural Category = III	Exposure Category = B
Natural Frequency = N/A	Flexible Structure = No
Importance Factor = 1.15	Kd Directional Factor = 0.85
Alpha = 7.00	Zg = 1200.00 ft
At = 0.14	Bt = 0.84
Am = 0.25	Bm = 0.45
Cc = 0.30	l = 320.00 ft
Epsilon = 0.33	Zmin = 30.00 ft
Pitch of Roof = 0 : 12	Slope of Roof(Theta) = .00 Deg
h: Mean Roof Ht = 47.00 ft	Type of Roof = FLAT
RHt: Ridge Ht = 47.00 ft	Eht: Eave Height = 47.00 ft
OH: Roof Overhang at Eave = .00 ft	Overhead Type = No Overhang
Bldg Length Along Ridge = 524.00 ft	Bldg Width Across Ridge = 262.00 ft

Gust Factor Calculations

Gust Factor Category I Rigid Structures - Simplified Method

Gust1: For Rigid Structures (Nat. Freq.>1 Hz) use 0.85 = 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Zm: 0.6*Ht = 30.00 ft
 lz: Cc*(33/Zm)^0.167 = 0.30
 Lzm: 1*(Zm/33)^Epsilon = 309.99 ft
 Q: (1/(1+0.63*((B+Ht)/Lzm)^0.63))^0.5 = 0.78
 Gust2: 0.925*((1+1.7*1zm*3.4*Q)/(1+1.7*3.4*1zm)) = 0.80

Gust Factor Summary

Not a Flexible Structure use the Lessor of Gust1 or Gust2 = 0.80

Figure 6-5 Internal Pressure Coefficients for Buildings, GCpi

GCpi : Internal Pressure Coefficient = +/-0.18

Wind Pressure on Components and Cladding

All pressures shown are based upon ASD Design, with a Load Factor of 1

Width of Pressure Coefficient Zone "a" = 18.80 ft ← Use 20' corner wind zone

Description	Width ft	Span ft	Area Zone ft^2	Max GCp	Min GCp	Max P psf	Min P psf	
Glass 10	2.00	5.00	10.0 4	0.90	-0.99	17.44	-18.89	← Use 20psf non-corner wind pressure
Glass 20	4.00	5.00	20.0 4	0.85	-0.94	16.66	-18.12	
Glass 30	3.00	10.00	33.3 4	0.82	-0.91	16.09	-17.55	
Glass 40	4.00	10.00	40.0 4	0.80	-0.89	15.89	-17.34	
Glass 50	5.00	10.00	50.0 4	0.79	-0.88	15.64	-17.10	
Glass 60	6.00	10.00	60.0 4	0.78	-0.87	15.44	-16.89	
Glass 70	7.00	10.00	70.0 4	0.77	-0.86	15.27	-16.72	
Glass 80	8.00	10.00	80.0 4	0.76	-0.85	15.12	-16.57	
Glass 90	9.00	10.00	90.0 4	0.75	-0.84	14.99	-16.44	
Glass 100	10.00	10.00	100.0 4	0.74	-0.83	14.87	-16.32	
Glass 10	2.00	5.00	10.0 5	0.90	-1.26	17.44	-23.25	← Use 23.5psf corner wind pressure
Glass 20	4.00	5.00	20.0 5	0.85	-1.16	16.66	-21.70	
Glass 30	3.00	10.00	33.3 5	0.82	-1.09	16.09	-20.56	
Glass 40	4.00	10.00	40.0 5	0.80	-1.07	15.89	-20.16	
Glass 50	5.00	10.00	50.0 5	0.79	-1.04	15.64	-19.66	
Glass 60	6.00	10.00	60.0 5	0.78	-1.01	15.44	-19.25	
Glass 70	7.00	10.00	70.0 5	0.77	-0.99	15.27	-18.91	
Glass 80	8.00	10.00	80.0 5	0.76	-0.97	15.12	-18.61	
Glass 90	9.00	10.00	90.0 5	0.75	-0.96	14.99	-18.35	
Glass 100	10.00	10.00	100.0 5	0.74	-0.94	14.87	-18.12	

Khcc:Comp. & Clad. Table 6-3 Case 1 = 0.80

Qhcc:.00256*V^2*I*Khcc*Kht*Kd = 16.14 psf



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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Sealant Joint Allowable Movement

Date: 11/8/2016
Proj. #: JE16059
Designer: M. Gorny
INPUT CHECK

Sealant: DOW 795
Allowable Expansion: 50% Allowable Compression: 50%

a = joint width b = maximum joint deflection c = maximum sealant expansion

Allowable Shear Movement (Inches)								
Joint Width (in)	25%		35%		50%		100%	
	b	c	b	c	b	c	b	c
1/4	0.19	0.31	0.23	0.34	0.28	0.38	0.43	0.50
3/8	0.28	0.47	0.34	0.51	0.42	0.56	0.65	0.75
1/2	0.38	0.63	0.45	0.68	0.56	0.75	0.87	1.00
5/8	0.47	0.78	0.57	0.84	0.70	0.94	1.08	1.25
3/4	0.56	0.94	0.68	1.01	0.84	1.13	1.30	1.50
7/8	0.66	1.09	0.79	1.18	0.98	1.31	1.52	1.75
1	0.75	1.25	0.91	1.35	1.12	1.50	1.73	2.00

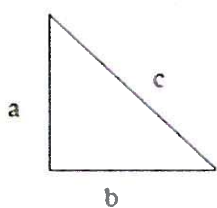
Values in **red** apply to the sealant listed above.

Allowable Expansion & Compression (Inches)				
Joint Width (in)	25%	35%	50%	100%
1/4	0.063	0.088	0.125	0.250
3/8	0.094	0.131	0.188	0.375
1/2	0.125	0.175	0.250	0.500
5/8	0.156	0.219	0.313	0.625
3/4	0.188	0.263	0.375	0.750
7/8	0.219	0.306	0.438	0.875
1	0.250	0.350	0.500	1.000
1 1/8	0.281	0.394	0.563	1.125
1 1/4	0.313	0.438	0.625	1.250
1 3/8	0.344	0.481	0.688	1.375
1 1/2	0.375	0.525	0.750	1.500

Note: 100% movement does not apply in compression.

Joint Movement in Shear

When joints move in shear, greater joint movement can be accommodated since actual movement on the sealant is less. The joint width required (a) for joint movement (b), as calculated below, or the allowable movement (b) for a particular joint width dimension (a), can be calculated using the Pythagorean theorem. The new joint width after movement (c) is limited by the movement capability of the sealant in shear in a weatherseal joint configuration. The calculation is as follows:



$$a^2 + b^2 = c^2$$

where a = original glueline
b = joint movement
c = new glueline after joint movement



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Sealant Joint Allowable Movement

Date: 11/8/2016
Proj. #: JE16059
Designer: M. Gorny
INPUT CHECK

Sealant: DOW 795

Allowable Expansion: 100% Allowable Compression: 50%

a = joint width b = maximum joint deflection c = maximum sealant expansion

Allowable Shear Movement (Inches)								
Joint Width (in)	25%		35%		50%		100%	
	b	c	b	c	b	c	b	c
1/4	0.19	0.31	0.23	0.34	0.28	0.38	0.43	0.50
3/8	0.28	0.47	0.34	0.51	0.42	0.56	0.65	0.75
1/2	0.38	0.63	0.45	0.68	0.56	0.75	0.87	1.00
5/8	0.47	0.78	0.57	0.84	0.70	0.94	1.08	1.25
3/4	0.56	0.94	0.68	1.01	0.84	1.13	1.30	1.50
7/8	0.66	1.09	0.79	1.18	0.98	1.31	1.52	1.75
1	0.75	1.25	0.91	1.35	1.12	1.50	1.73	2.00

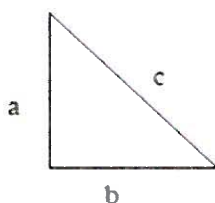
Values in **red** apply to the sealant listed above.

Allowable Expansion & Compression (Inches)				
Joint Width (in)	25%	35%	50%	100%
1/4	0.063	0.088	0.125	0.250
3/8	0.094	0.131	0.188	0.375
1/2	0.125	0.175	0.250	0.500
5/8	0.156	0.219	0.313	0.625
3/4	0.188	0.263	0.375	0.750
7/8	0.219	0.306	0.438	0.875
1	0.250	0.350	0.500	1.000
1 1/8	0.281	0.394	0.563	1.125
1 1/4	0.313	0.438	0.625	1.250
1 3/8	0.344	0.481	0.688	1.375
1 1/2	0.375	0.525	0.750	1.500

Note: 100% movement does not apply in compression.

Joint Movement in Shear

When joints move in shear, greater joint movement can be accommodated since actual movement on the sealant is less. The joint width required (a) for joint movement (b), as calculated below, or the allowable movement (b) for a particular joint width dimension (a), can be calculated using the Pythagorean theorem. The new joint width after movement (c) is limited by the movement capability of the sealant in shear in a weatherseal joint configuration. The calculation is as follows:



$$a^2 + b^2 = c^2$$

where a = original glueline
b = joint movement
c = new glueline after joint movement



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Client: NGG
Project: Webster University
Structure: YKK 750 Curtain Wall
Part of: Structural Silicone Design

Date: 11/8/2016
Proj. #: JE16059
Designer: M. Gorny

INPUT CHECK

Typical Wind Pressure (T) 20.0 psf
Corner Wind Pressure (C) 23.5 psf
Dead Load of Glass 8.0 psf
Glue Line Thickness = 0.25 in
Temperature at Construction = 45 deg

Silicone Design Strength Wind Load = 20.0 psi*
Silicone Design Strength Dead Load = 1.0 psi*
Glass Thermal Exp. Coefficient = 0.0000051 in/in°F
Aluminum Thermal Exp. Coefficient = 0.0000128 in/in°F
* Ref DOW Corning Technial Manual, DOW 995 assumed
Maximum Temp of Aluminum = 125 deg

Elevation Panel Areas & Bite Design						Wind Load		Dead Load		
Elevation	Wind Zone	DL supported by Silicone?	Width (in)	Height (in)	perimeter (in)	Wind Load (lb/in)	WL Bite Req (in)	Dead Load (lb/in)	DL Bite Req (in)	SSG Bite Required (in)
1/200	C	No	58.9375	140.5	398.88	4.81	0.24	1.2	1.15	0.240
1/201	C	No	53.75	140.5	388.50	4.39	0.22	1.1	1.08	0.219
1/202	C	No	57.5	129.375	373.75	4.69	0.23	1.1	1.11	0.235
1/203	C	No	55.375	129.375	369.50	4.52	0.23	1.1	1.08	0.226
1/204	C	No	57.5	129.375	373.75	4.69	0.23	1.1	1.11	0.235
2/204	C	No	74	45.5	239.00	3.71	0.19	0.8	0.78	0.186
1/205	C	No	60.5	106.75	334.50	4.94	0.25	1.1	1.07	0.247
1/208	C	No	70.0625	97.5	335.13	5.72	0.29	1.1	1.13	0.286
1/213	C	No	90	108.875	397.75	7.34	0.37	1.4	1.37	0.367
1/215	C	No	60.5	69.5	260.00	4.94	0.25	0.9	0.90	0.247
1/218	C	No	65.8125	92.1875	316.00	5.37	0.27	1.1	1.07	0.269
1/219	C	No	47.5	32	159.00	2.61	0.13	0.5	0.53	0.131
1/220	C	No	54.75	14	137.50	1.14	0.06	0.3	0.31	0.057
4/220	C	No	60.625	141.5	404.25	4.95	0.25	1.2	1.18	0.247
4/220	C	No	74	45.5	239.00	3.71	0.19	0.8	0.78	0.186
										Maximum Structural Bite Reqd = 0.367

Calculate Thermal Expansion of Member vs. Glass

Max Alum. Length =	141.50 in
Alum Δ temp =	0.14 in
Glass Δ temp =	0.06 in
Difference Δ temp =	0.09 in
glue line after expansion =	0.26 in
% Expansion =	5.90 % < 15% ? OK

Use minimum 3/8 " SSG bite
Thickness ratio 1.5:1 OK



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Client: NGG
Project: Webster University
Structure: YKK 750 Curtain Wall
Part of: Sizing of Joints @ Heac
Designer: M. Gorny

Date: 11/8/2016
Proj. No.: JE16059

Thermal Expansion coef =	0.00128
Temp. at Construction =	45 deg
Max. Temp. of Alum. =	120 deg

1/216, 1/217, 1/218 Total Height of Frame 13.83 ft
Deflection from Head (per SOR) = 0.44 in
 Δ temp = 0.16 in
Controlling Joint Size Factor DEFL. FROM HEAD
Total Vertical Δ = 0.44 in
Required Joint Size **0.88 in** ←

>>>Use 7/8" Joint

1/205-212 Total Height of Frame 48.83 ft
Deflection from Head (per SOR) = 0.60 in
 Δ temp = 0.56 in
Controlling Joint Size Factor DEFL. FROM HEAD
Total Vertical Δ = 0.60 in
Required Joint Size **1.200 in** ←

>>>Use 1-1/8" Joint

Joint ok for expansion when 3rd floor moves down
beneath cantilevered portion by inspection.

1/202-204 Total Height of Frame 11.24 ft
Deflection from Head (per SOR) = 0.70 in
 Δ temp = 0.13 in
Controlling Joint Size Factor BOTH CAN OCCUR AT SAME TIME, ADDITIVE
Total Vertical Δ = 0.83 in
Required Joint Size **1.66 in** ←

>>>Use 1-5/8" Joint

1/213 Total Height of Frame 36.57 ft
Deflection from Head (per SOR) = 0.00 in
 Δ temp = 0.42 in
Controlling Joint Size Factor Δ TEMP
Total Vertical Δ = 0.42 in
Required Joint Size **0.84 in** ←

>>>Use 7/8" Joint

1/200, 1/201 Total Height of Frame 12.17 ft
Deflection from Head (per SOR) = 0.46 in
 Δ temp = 0.14 in
Controlling Joint Size Factor BOTH CAN OCCUR AT SAME TIME, ADDITIVE
Total Vertical Δ = 0.60 in
Required Joint Size **1.20 in** ←

>>>Use 1-1/8" Joint

1/214, 1/215, 1/220, 3/220, 5/220 Total Height of Frame 12.00 ft
Deflection from Head (per SOR) = 0.00 in
 Δ temp = 0.14 in
Controlling Joint Size Factor Δ TEMP
Total Vertical Δ = 0.14 in
Required Joint Size **0.28 in** ←

>>>1/2" Joint OK

General Section Sets

	Label	Shape	Type	Material	A [in ²]	I _{yy} [in ⁴]	I _{zz} [in ⁴]	J [in ⁴]
1	E9-1225		Beam	gen_Alum	2.079	1.818	9.838	4.11
2	E9-1225 (HSS 4x2x0.375)		Beam	gen_Alum	2.083	1.814	26.078	4.107
3	E9-1225 (Channel 4x2x0.25)		Beam	gen_Alum	2.083	1.814	21.748	4.107
4	E9-8981		Beam	gen_Alum	2.477	2.954	11.81	6.349
5	E9-3402		Beam	gen_Alum	1.751	1.729	6.485	3.525
6	E9-3401		Beam	gen_Alum	2.254	2.213	8.555	4.596
7	E9-3401 (HSS 4x2x0.25)		Beam	gen_Alum	2.254	6.505	21.576	4.596
8	E9-3423		Beam	gen_Alum	1.482	1.333	2.835	2.156

Basic Load Cases

	BLC Description	Category	X Gra...	Y Gra...	Z Gra...	Joint	Point	Distributed	Area(M...Surface(Plate/W...
1	Negative Wind (Face A)	None							6
2	Positive Wind (Face A)	None							5
3	Negative Wind (Face B)	None							2
4	Positive Wind (Face B)	None							2
5	Negative Load (Face C)	None							2
6	Positive Load (Face C)	None							2
7	Dead	None						166	
8	BLC 1 Transient Area Loads	None						14089	
9	BLC 3 Transient Area Loads	None						8836	
10	BLC 5 Transient Area Loads	None						13518	
11	BLC 4 Transient Area Loads	None						8836	
12	BLC 2 Transient Area Loads	None						13547	
13	BLC 6 Transient Area Loads	None						13518	

Load Combinations

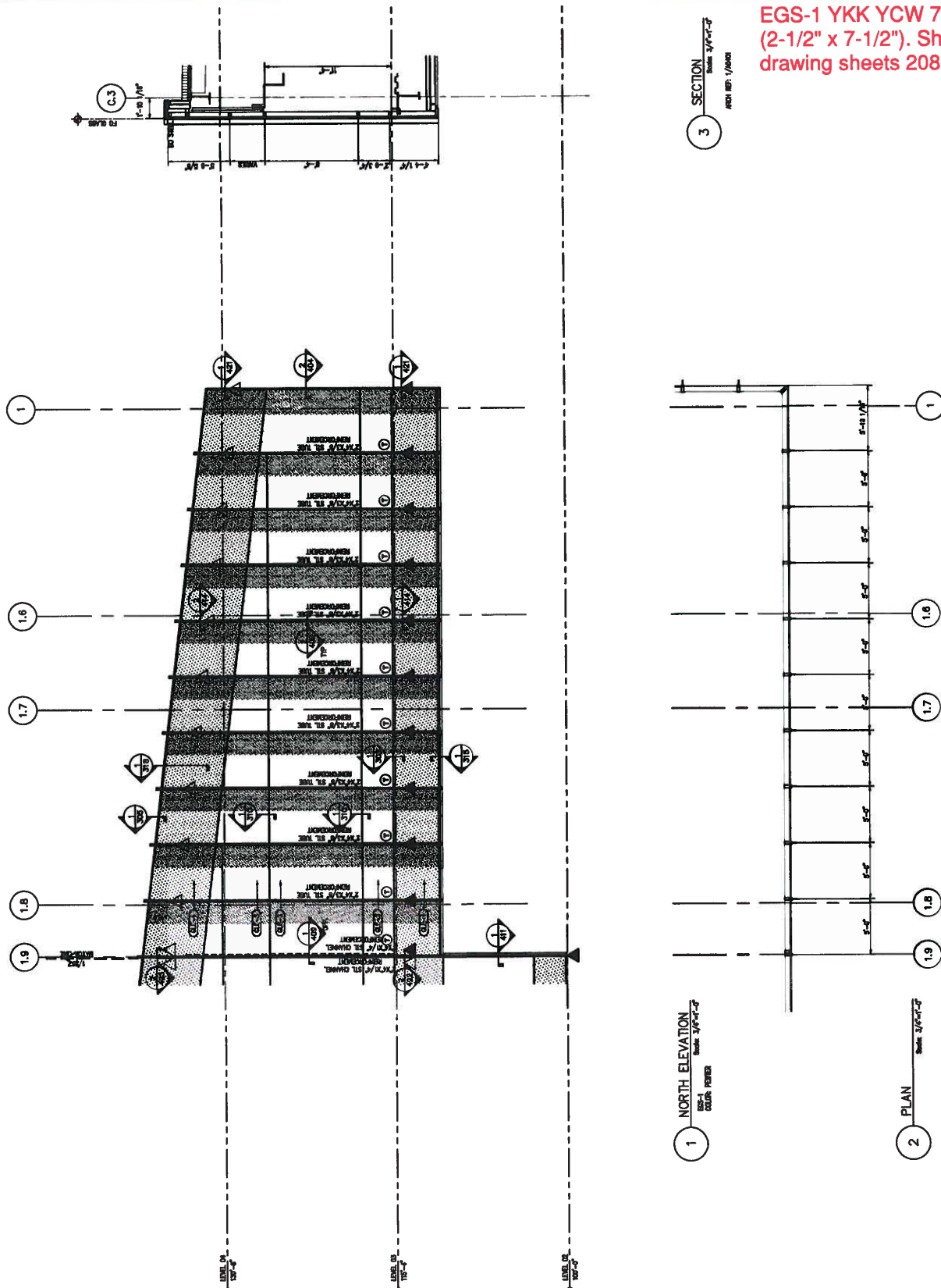
	Description	S...	PD...	S...	B...	Fa...	B...	Fa...	B...	Fa...
1	Negative Wind Face A	Yes	Y		1	1	7	1		
2	Negative Wind Face B	Yes	Y		3	1	7	1		
3	Negative Wind Face C	Yes	Y		5	1	7	1		
4	Dead + 75% Negative Wind Face A + 75% Positive Wind Face B	Yes	Y		1	.75	4	.75	7	1
5	Dead + 75% Negative Wind Face B + 75% Positive Wind Face A	Yes	Y		3	.75	2	.75	7	1
6	Dead + 75% Negative Wind Face C + 75% Positive Wind Face B	Yes	Y		5	.75	4	.75	7	1
7	Dead + 75% Negative Wind Face B + 75% Positive Wind Face C	Yes	Y		3	.75	6	.75	7	1
8	Dead + Negative Wind Face A + Positive Wind Face C	Yes	Y		1	1	6	1	7	1
9	Dead + Negative Wind Face C + Positive Wind Face A	Yes	Y		5	1	2	1	7	1

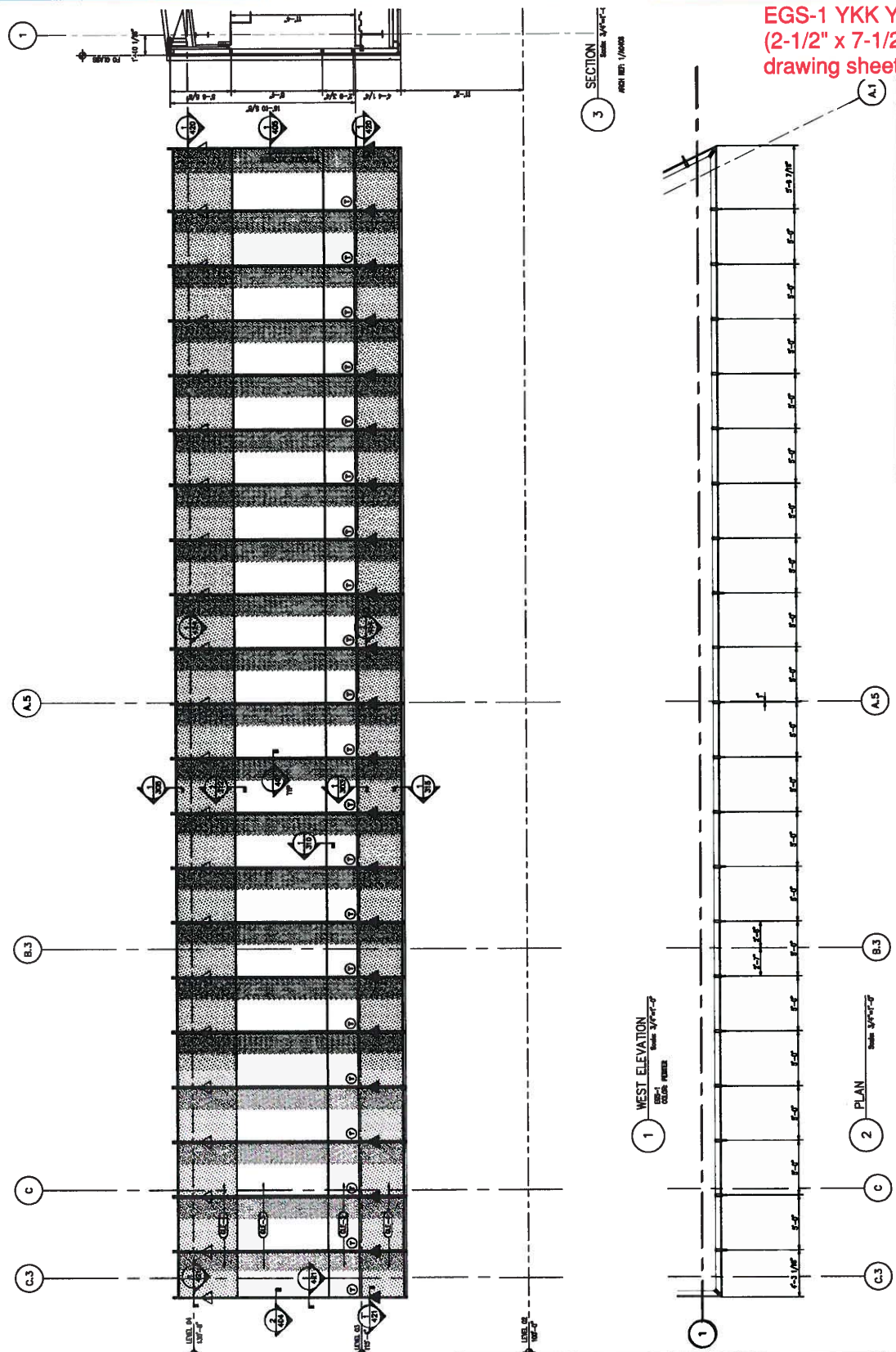
Risa analysis covers the following frames:
 EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 205-212

Analysis covers all vertical mullion associated with the above elevations,
 while extracting anchor loads to be used in later analysis.

JEI Structural Engineering	Webster University	SK - 4
M. Gorny		Nov 1, 2016 at 2:57 PM
JE16059		EGS-1 Preliminary.r3d

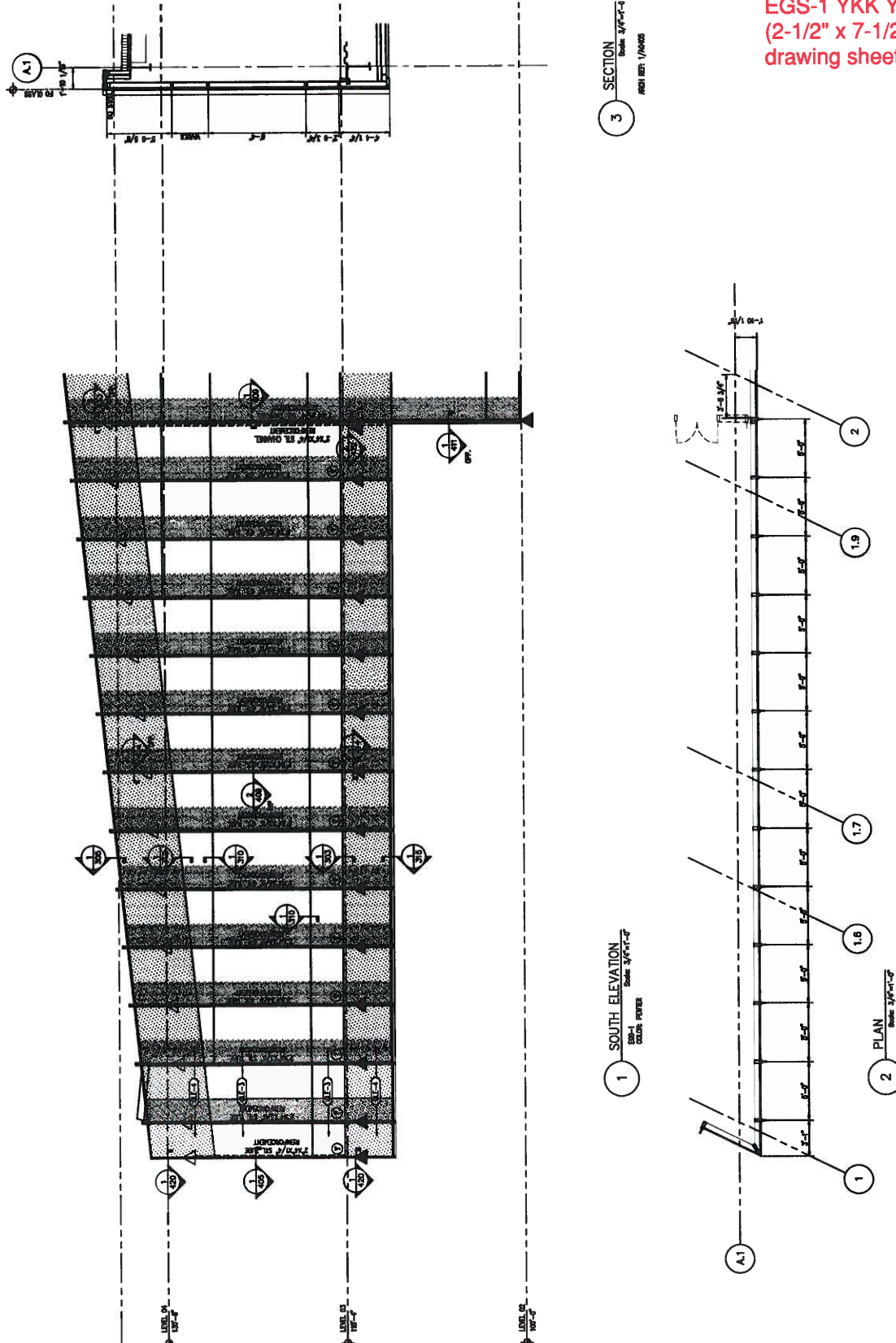
EGS-1 YKK YCW 750 SSG
(2-1/2" x 7-1/2"). Shop
drawing sheets 208





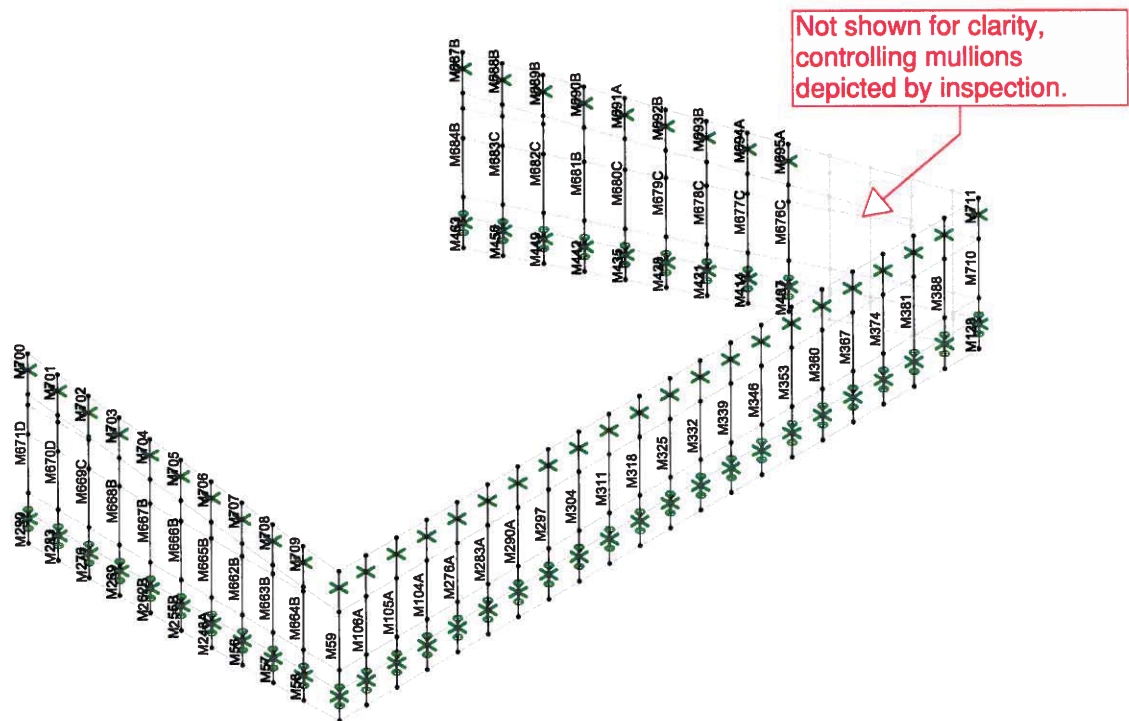


EGS-1 YKK YCW 750 SSG
(2-1/2" x 7-1/2"). Shop
drawing sheets 210





Member labels



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

JEI Structural Engineering

M. Gorny

JE16059

Webster University

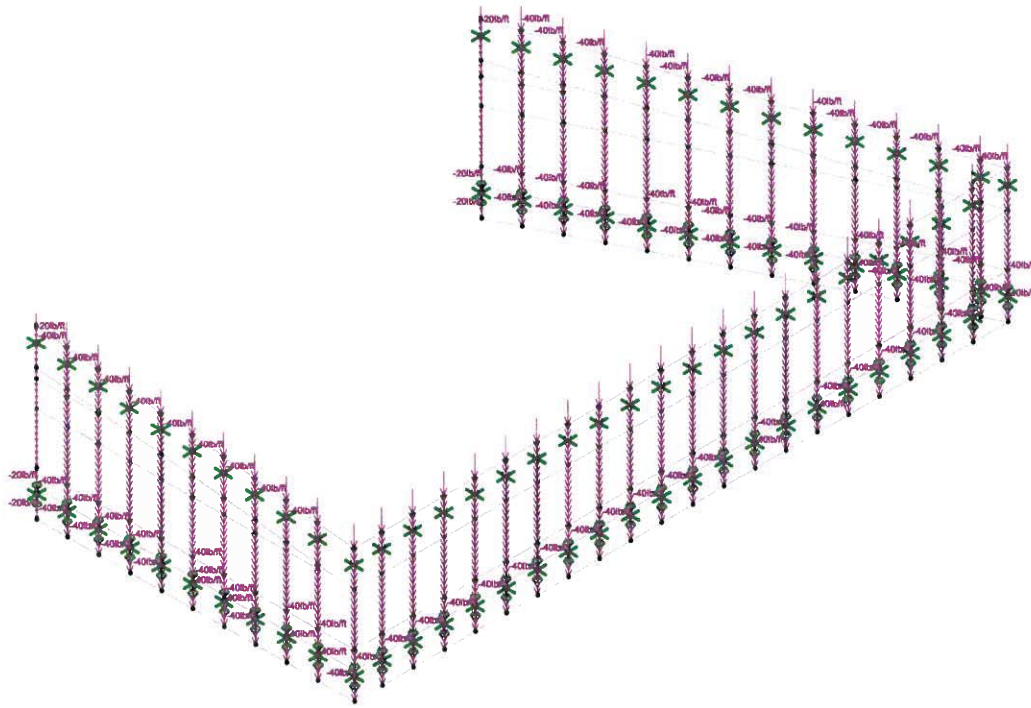
SK - 5

Nov 1, 2016 at 2:57 PM

EGS-1 Preliminary.r3d



Dead load
8psf (5') = 40lb/ft (20lb/ft at jambs)



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Loads: BLC 7, Dead

JEI Structural Engineering
M. Gorny
JE16059

Webster University

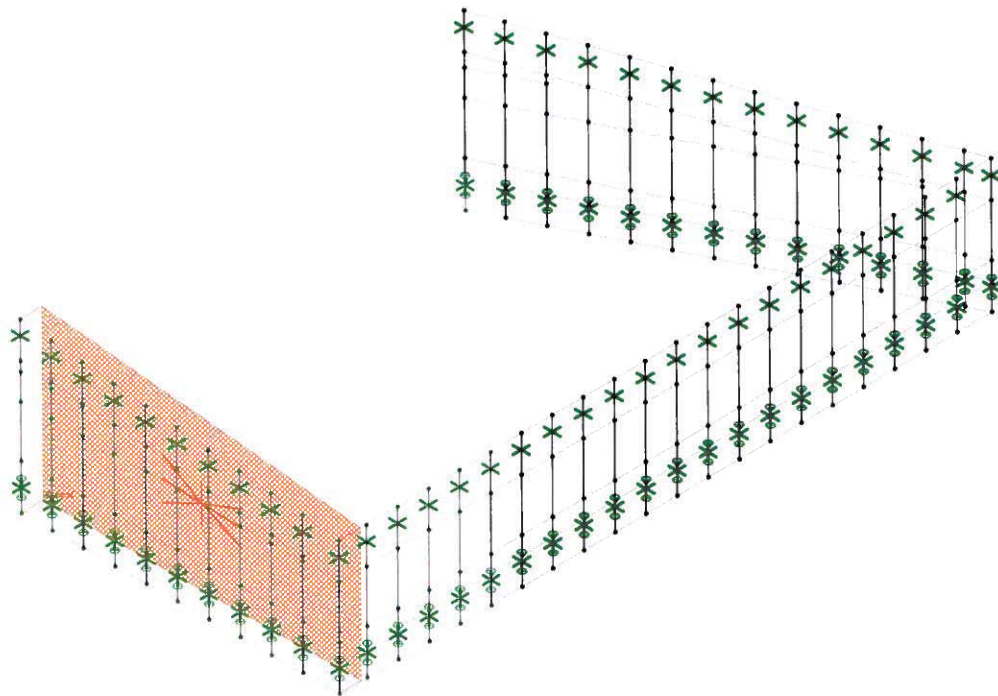
SK - 7

Nov 1, 2016 at 3:09 PM

EGS-1 Preliminary.r3d



Negative Wind - 23.5psf



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Load: BLC 1, Negative Wind (Face A)

JEI Structural Engineering

M. Gorny

JE16059

Webster University

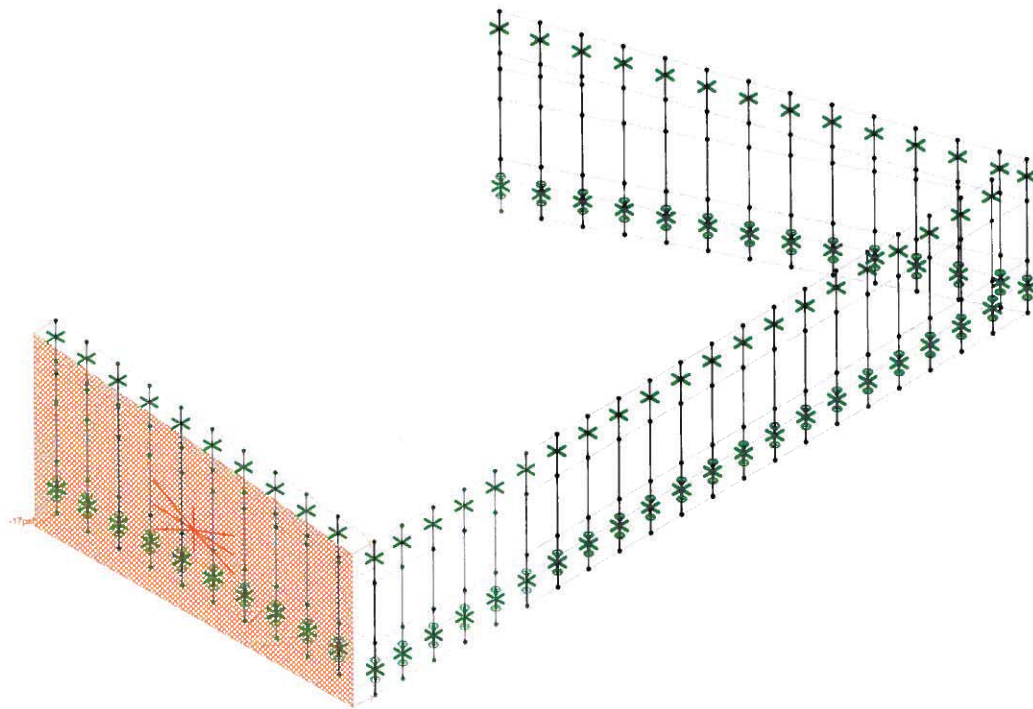
SK - 8

Nov 1, 2016 at 3:10 PM

EGS-1 Preliminary.r3d



Positive Wind - 17psf



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Loads: BLC 2, Positive Wind (Face A)

JEI Structural Engineering

M. Gorny

JE16059

Webster University

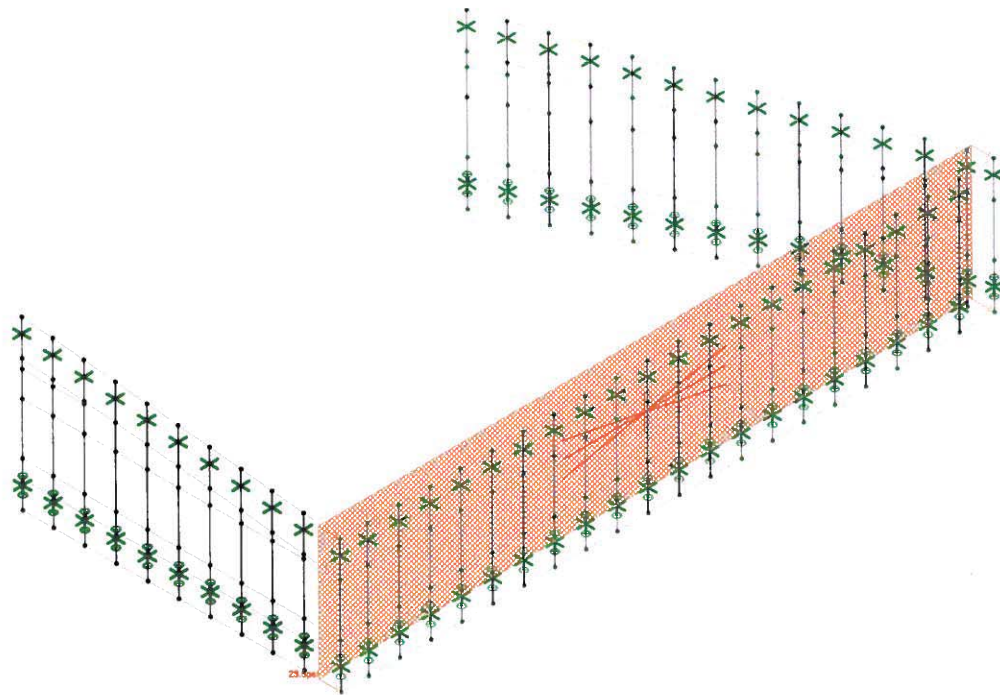
SK - 9

Nov 1, 2016 at 3:10 PM

EGS-1 Preliminary.r3d



Negative Wind - 23.5psf



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Load: BLC 3, Negative Wind (Face B)

JEI Structural Engineering

M. Gorny

JE16059

Webster University

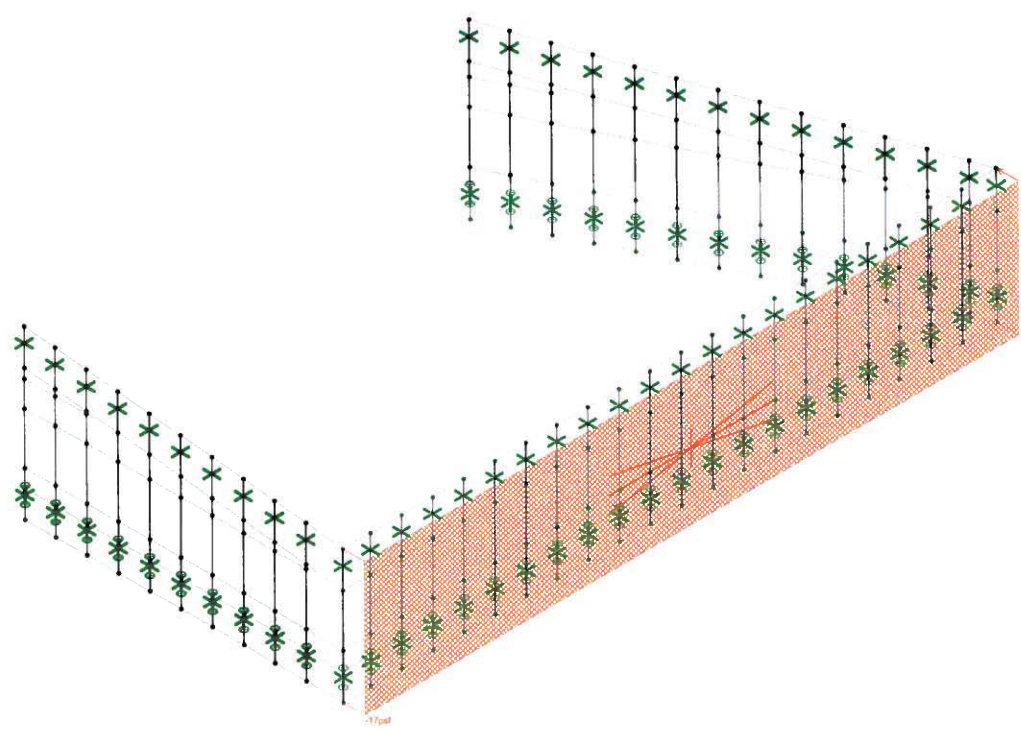
SK - 10

Nov 1, 2016 at 3:10 PM

EGS-1 Preliminary.r3d



Positive Wind - 17psf



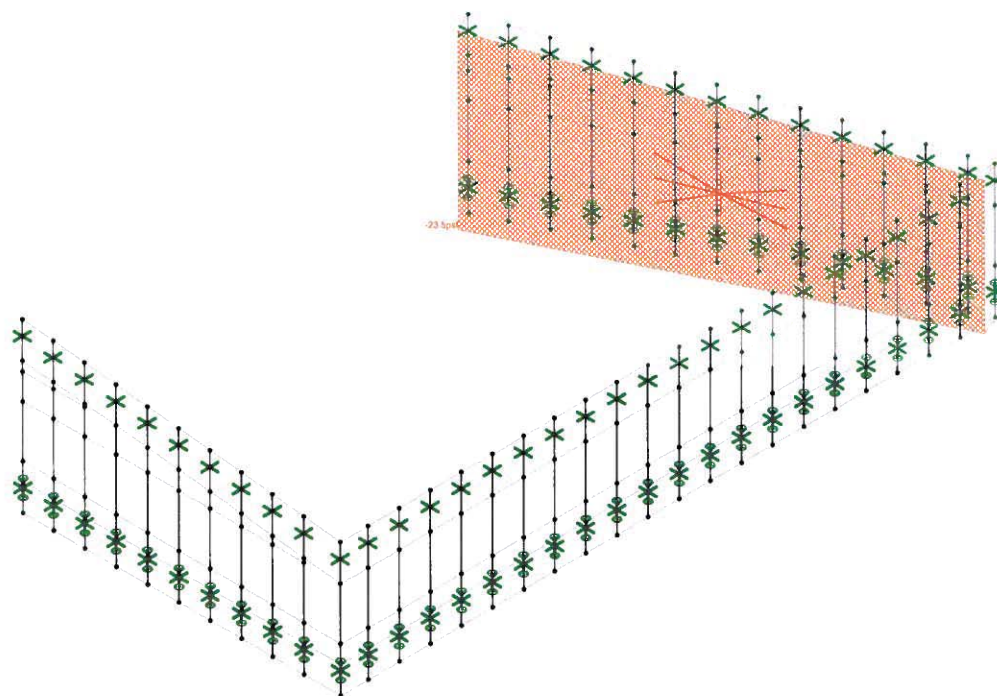
EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Loads: BLC 4, Positive Wind (Face B)

JEI Structural Engineering	Webster University	SK - 11
M. Gorny		Nov 1, 2016 at 3:10 PM
JE16059		EGS-1 Preliminary.r3d



Negative Wind - 23.5psf



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Loads: BLC 6, Negative Load (Force C)

JEI Structural Engineering

M. Gorny

JE16059

Webster University

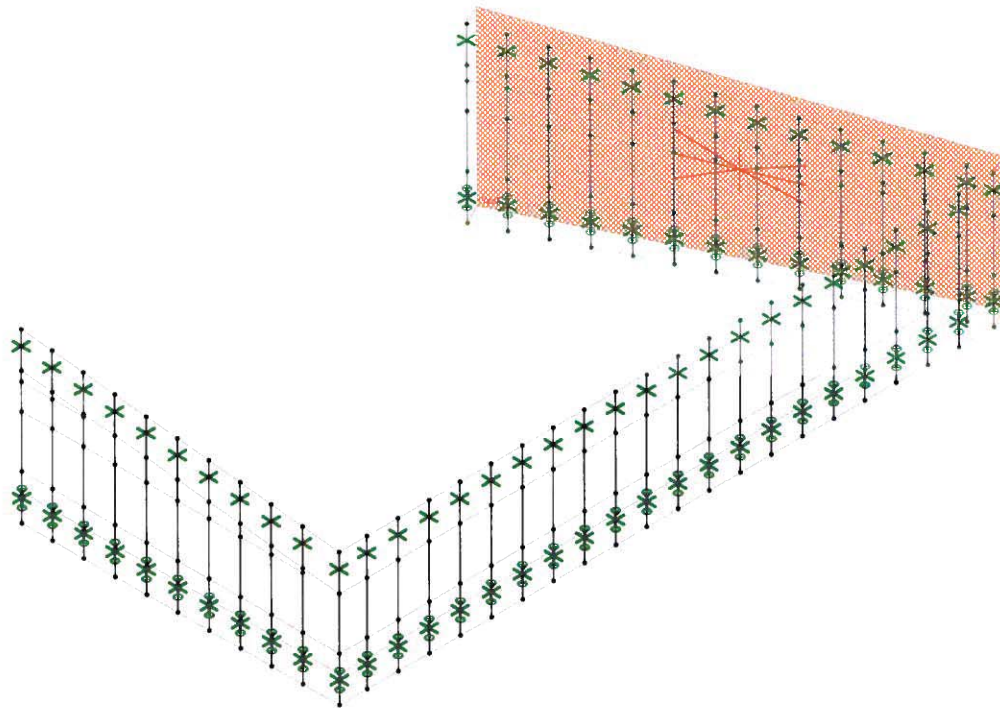
SK - 12

Nov 1, 2016 at 3:10 PM

EGS-1 Preliminary.r3d



Positive Wind - 17psf



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Loads: BLC 0, Positive Load (Face C)

JEI Structural Engineering

M. Gorny

JE16059

Webster University

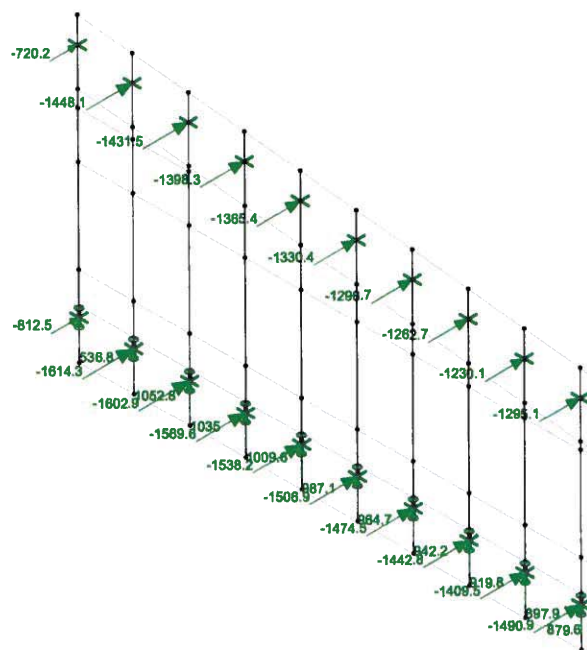
SK - 13

Nov 1, 2016 at 3:11 PM

EGS-1 Preliminary.r3d



Anchor Loads (1 of 2)
showing controlling vertical mullion anchor loads by inspection.



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Results for LC 1, Negative Wind Face A
Z-direction Reaction Units are lb and lb-ft

JEI Structural Engineering

M. Gorny

JE16059

Webster University

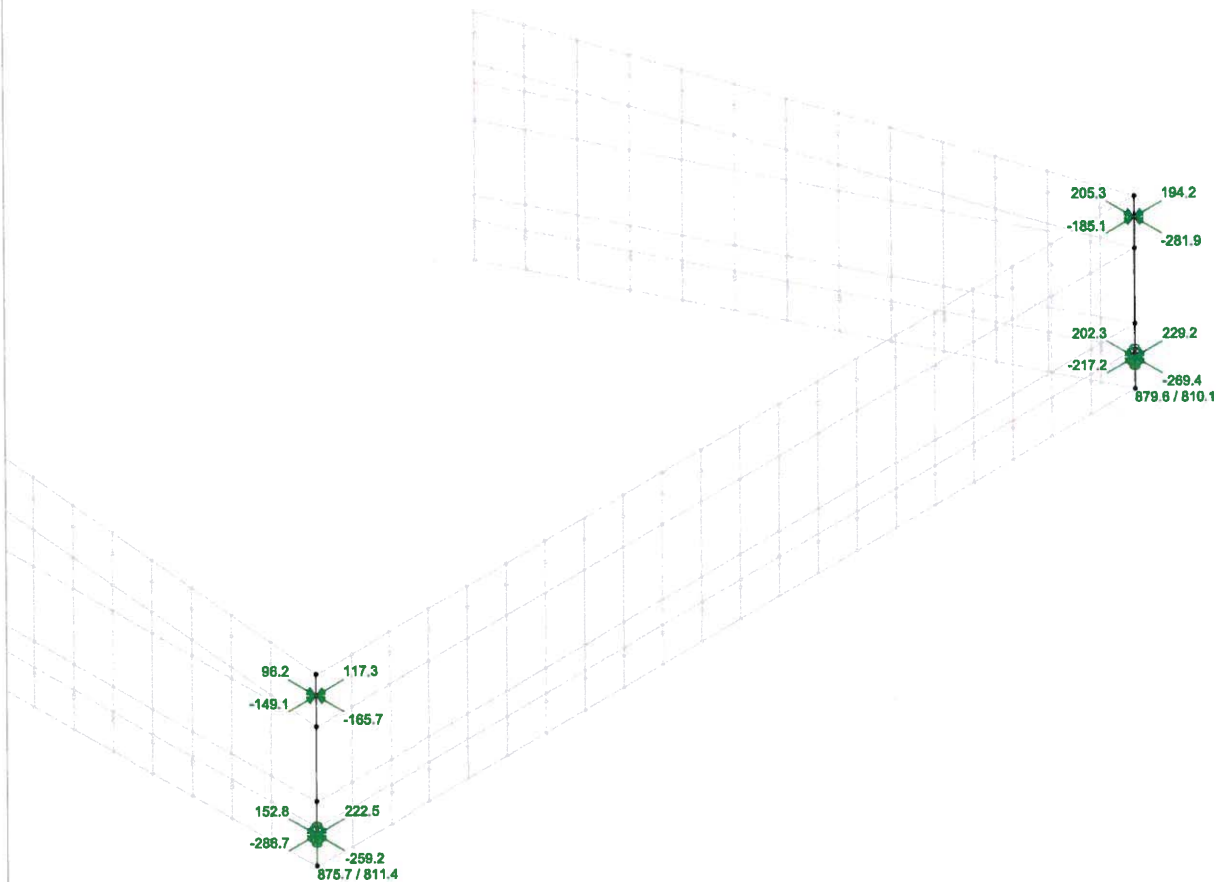
SK - 21

Nov 1, 2016 at 3:24 PM

EGS-1 Preliminary.r3d



Anchor Loads (2 of 2)
showing controlling corner vertical mullion anchor loads by inspection.



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Z-direction Reaction Units are lb and lb-ft (Enveloped)

JEI Structural Engineering

M. Gorny

JE16059

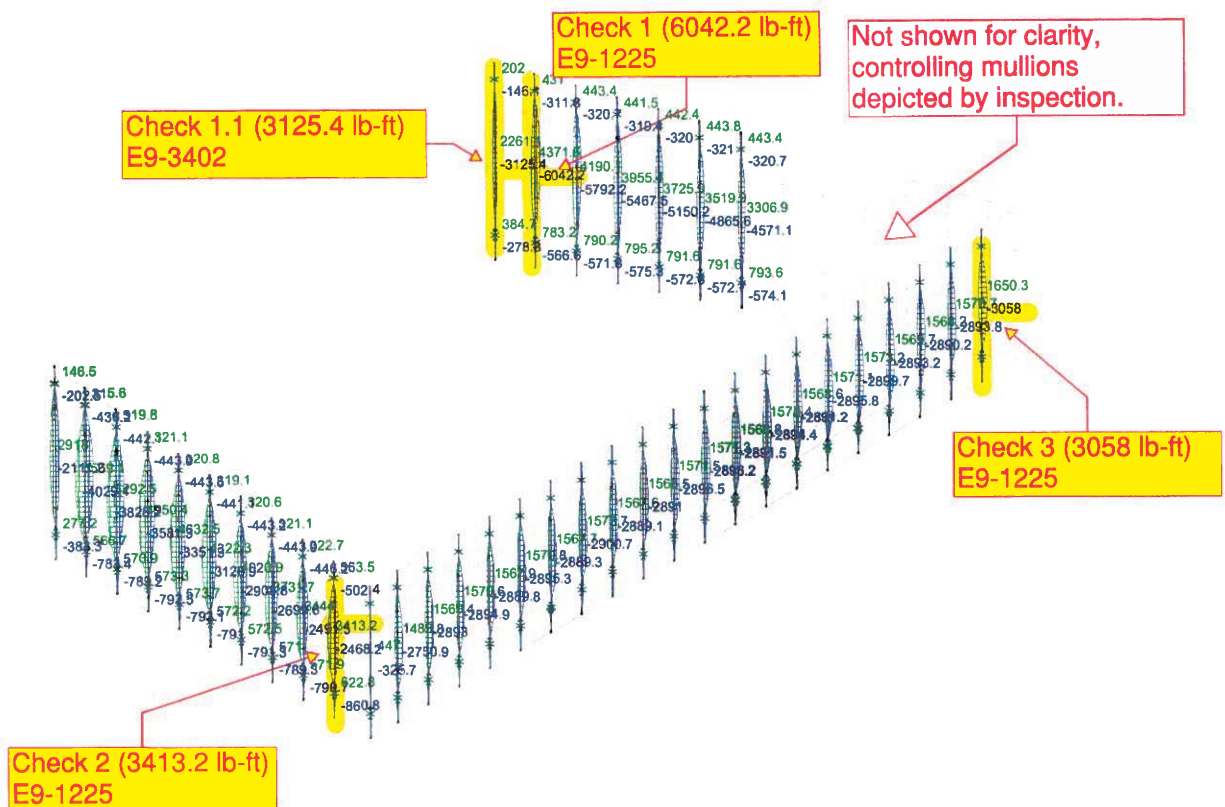
Webster University

SK - 20

Nov 1, 2016 at 3:23 PM

EGS-1 Preliminary.r3d

Moment diagram



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 208-210

Member z Bending Moments (lb-ft) (Enveloped)		
JEI Structural Engineering	Webster University	SK - 1
M. Gorny		Nov 7, 2016 at 9:36 AM
JE16059		EGS-1 Preliminary.r3d

Beam: **M683C**

Shape:

Material: **gen_Alum**

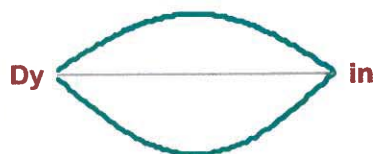
Length: **251.19 in**

I Joint: **N792D**

J Joint: **N791B**

Code Check: **No Calc**
Report Based On 97 Sections

1.271 at 125.595 in



-1.757 at 125.595 in

.176 at 104.662 in



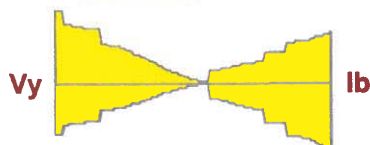
-.133 at 104.662 in

938.376 at 0 in



92.862 at 251.19 in

1311.893 at 0 in



-1221.081 at 251.19 in

36.235 at 211.941 in



-34.967 at 191.009 in

T lb-ft

Mz lb-ft

4371.593 at 138.678 in



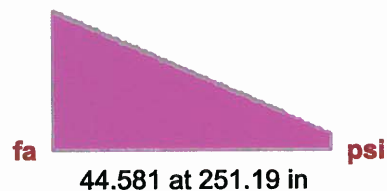
-6042.194 at 138.678 in

83.59 at 209.325 in

My lb-ft

-108.294 at 209.325 in

450.492 at 0 in



44.581 at 251.19 in

f(y) psi

f(z) psi

Check 1

YKK E9-1225 with 4x2x3/8 HSS tube

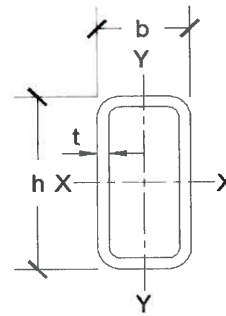
Using reduced pressure based on 70sf area to reduce deflection.

$Dy = 1.757'' (19\text{psf} / 23.5\text{psf}) = 1.42''$

JEI Structural Engineering
11108 N Oak Trfy, Suite 208
Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: HSS allowable flexural strength



Date: 11/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Shape: HSS 4 x 2 x 3/8 **Check 1**

h = 4 in
b = 2 in
t = 0.349 in
b/t = 2.73
h/t = 8.46

E = 29000 ksi
Material = A500 Gr B
F_y = 46 ksi

I_x = 5.600 in⁴
S_x = 2.800 in³
Z_x = 3.840 in³
I_y = 1.800 in⁴
S_y = 1.800 in³
Z_y = 2.310 in³

A = 3.390 in²
wt = 12.170 lb/ft

X-Axis Flange/Web Slenderness Limits		Y-Axis Flange/Web Slenderness Limits	
Flange (b/t)		Flange (h/t)	
$\lambda_p = 1.12(E/F_y)^{1/2} =$	28.12 Compact	$\lambda_p = 1.12(E/F_y)^{1/2} =$	28.12 Compact
$\lambda_r = 1.40(E/F_y)^{1/2} =$	35.15 X	$\lambda_r = 1.40(E/F_y)^{1/2} =$	35.15 X
Web (h/t)		Web (b/t)	
$\lambda_p = 2.42(E/F_y)^{1/2} =$	60.76 Compact	$\lambda_p = 2.42(E/F_y)^{1/2} =$	60.76 Compact
$\lambda_r = 5.70(E/F_y)^{1/2} =$	143.12 X	$\lambda_r = 5.70(E/F_y)^{1/2} =$	143.12 X

X-Axis Yielding (AISC F7.1)		Y-Axis Yielding (AISC F7.1)	
$M_n = M_p = F_y Z_x =$	176.64 kip-in	$M_n = M_p = F_y Z_y =$	106.26 kip-in

X-Axis Flange Local Buckling (AISC F7.2)		Y-Axis Flange Local Buckling (AISC F7.2)	
a) Compact sections: does not apply		a) Compact sections: does not apply	
b) Noncompact flanges: $M_n = M_p - (M_p - F_y S_x)(3.57 * b/t * (F_y/E)^{1/2} - 4.0) =$		b) Noncompact flanges: $M_n = M_p - (M_p - F_y S_y)(3.57 * h/t * (F_y/E)^{1/2} - 4.0) =$	
$M_n =$	N/A kip-in	$M_n =$	N/A kip-in
c) Slender flanges: $b_e = 1.92t(E/F_y)^{1/2} [1 - 0.38/(b/t) * (E/F_y)^{1/2}] =$		c) Slender flanges: $b_e = 1.92t(E/F_y)^{1/2} [1 - 0.38/(h/t) * (E/F_y)^{1/2}] =$	
$b_e =$	-41.98 in	$b_e =$	-2.15 in
$S_{eff,x} =$	-47.92 in ³	$S_{eff,y} =$	-0.91 in ³
$M_n = F_y S_{eff} =$	-2204.39 kip-in	$M_n = F_y S_{eff} =$	-41.84 kip-in
$M_n =$	N/A kip-in	$M_n =$	N/A kip-in

X-Axis Web Local Buckling (AISC F7.3)		Y-Axis Web Local Buckling (AISC F7.3)	
a) Compact sections: does not apply		a) Compact sections: does not apply	
b) Noncompact webs: $M_n = M_p - (M_p - F_y S_x)(0.305 * h/t * (F_y/E)^{1/2} - 0.738) =$		b) Noncompact webs: $M_n = M_p - (M_p - F_y S_y)(0.305 * b/t * (F_y/E)^{1/2} - 0.738) =$	
$M_n =$	N/A kip-in	$M_n =$	N/A kip-in

X-Axis Capacity $\Omega_b = 1.67$	
$M_n =$	176.64 kip-in
$M_n/\Omega_b =$	105.77 kip-in
$M_n/\Omega_b =$	8814 lb-ft

Y-Axis Capacity $\Omega_b = 1.67$	
$M_n =$	106.26 kip-in
$M_n/\Omega_b =$	63.63 kip-in
$M_n/\Omega_b =$	5302 lb-ft

JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/210
Detail: 2/409

Member M683C **Check 1**

Date: 11/1/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 5.00 ft $F_y = 25.0$ ksi
Height (h) 21.31 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 19.0 psf (Using reduced area load based on 70sf)
Panel Weight (p_{wt}) 8.0 psf (deflection only)

Manuf. / Part #: YKK E9-1225

$E = 10100$ ksi $r_{x, alum} = 2.176$ in
 $I_{x, alum} = 9.838$ in⁴ $r_{y, alum} = 0.935$ in
 $I_{y, alum} = 1.818$ in⁴ $A = 2.079$ in²
 $S_{x, alum} = 3.213$ in³ $J = 4.110$ in⁴
 $S_{y, alum} = 1.454$ in³ $wt = 2.498$ lb/ft
 $b/t_{web} = 52.71$ $b/t_{flange} = 22.33$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = N/A$ lb/ft
Shear Load $V = wL/2$ $V = 1311.9$ lb
Moment $M = wL^2/8$ $M = 6042.2$ lb-ft
 $M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$ $M_{alum} = 2279.4$ lb-ft
 $f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$ $f_{b-alum} = 8.51$ ksi

Applied Axial Compression

$P = p_{wt} \cdot t \cdot h + wt \cdot h$ $P = 938.4$ lb
 $f_{c-alum} = P/A$ $f_{c-alum} = 0.45$ ksi

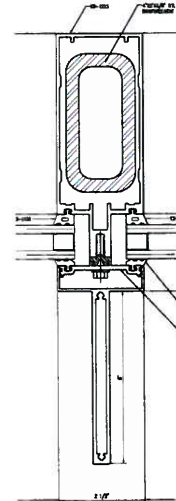
Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) = 1.421$ in
N/A $\pm$ movement cap. $\Delta_{allow} = 1.315$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$
Deflection Factor DF = #####

Steel Capacity

$M_{steel} = I_{x, steel} / I_{comb} =$ $M_{steel} = 3762.8$ lb-ft
 $Mb/\Omega =$ $Mb/\Omega = 8814$ lb-ft
 $Ms/(Mb/\Omega) = 0.427$



Reinforcing

HSS 2x4x3/8

$I_{x, steel} = 5.600$ in⁴
 $S_{x, steel} = 2.800$ in³
 $I_{combined} = 26.078$ in⁴

Load Share

Aluminum	Steel
0.377	0.623

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.92 ksi
E.3 - Axial Compression	4.49 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.60 ksi

Compression Interaction

Allowable Compression	$F_c = 4.49$ ksi
Compression Stress Interaction	$f_{c-alum}/F_c = 0.101$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure	
Allowable Flexural Compression	$F_b = 13.92$ ksi
Flexure Interaction	$f_{b-alum}/F_b = 0.612$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.712$

Mullion OK, $\leq 1/8"$ over allowable deflection.

Beam: **M664B**

Shape:

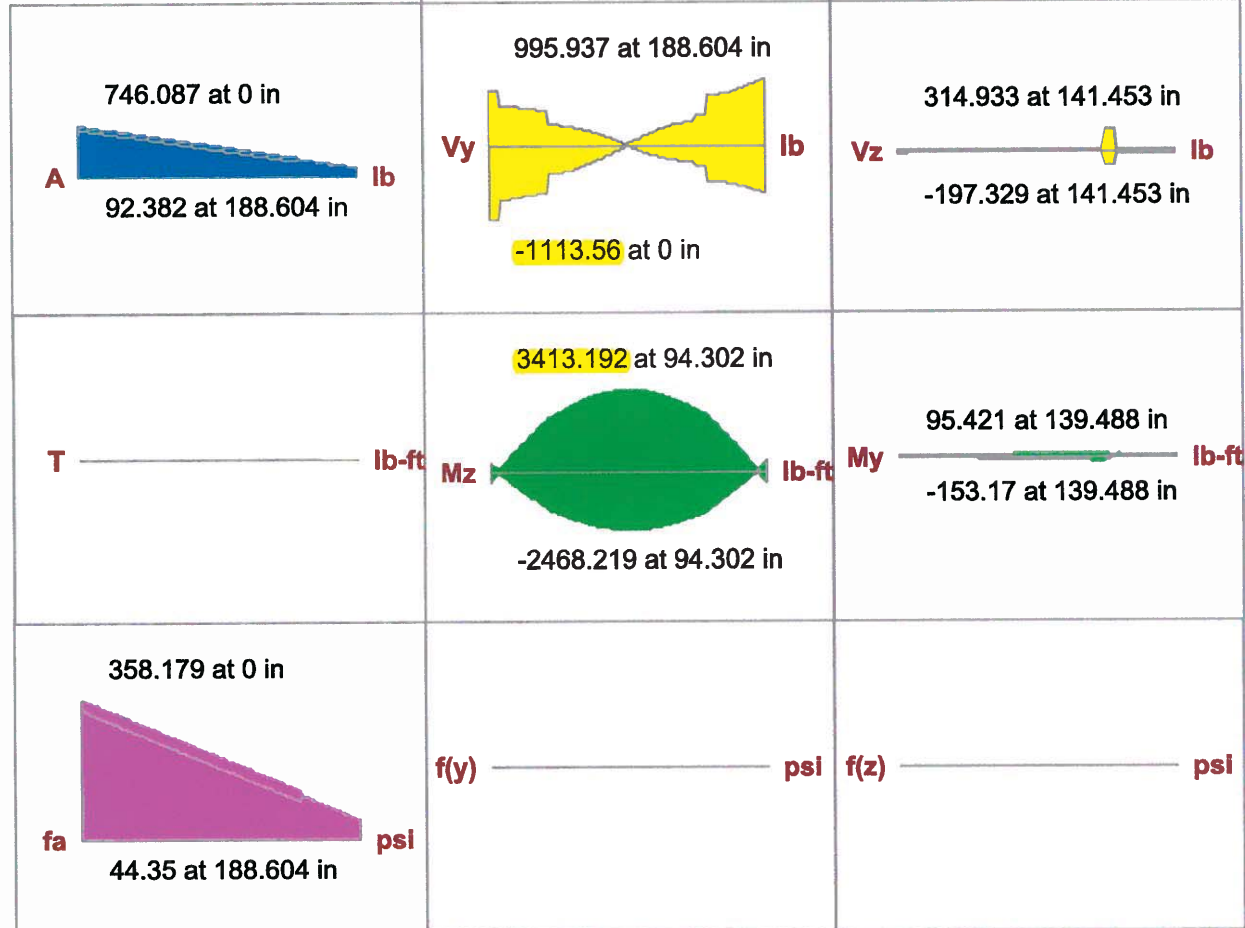
Material: **gen_Alum**

Length: **188.604 in**

I Joint: **N773**

J Joint: **N720A**

Code Check: **No Calc**
Report Based On 97 Sections



Check 2

YKK E9-1225 with 4x2x3/8 HSS tube

JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/208
Detail: 2/409

Member M683C

Check 2

Date: 11/1/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 5.42 ft $F_y = 25.0$ ksi
Height (h) 16.09 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 23.5 psf
Panel Weight (p_{wt}) 8.0 psf

Manuf. / Part #: YKK E9-1225

$E = 10100$ ksi $r_{x, alum} = 2.176$ in
 $I_{x, alum} = 9.838$ in⁴ $r_{y, alum} = 0.935$ in
 $I_{y, alum} = 1.818$ in⁴ $A = 2.079$ in²
 $S_{x, alum} = 3.213$ in³ $J = 4.110$ in⁴
 $S_{y, alum} = 1.454$ in³ $wt = 2.498$ lb/ft
 $b/t_{web} = 52.71$ $b/t_{flange} = 22.33$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

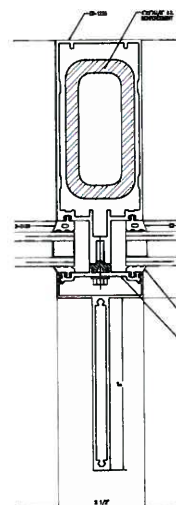
Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment	
$w = p \cdot t$	$w = N/A$ lb/ft
Shear Load $V = wL/2$	$V = 1113.6$ lb
Moment $M = wL^2/8$	$M = 3413.2$ lb-ft
$M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$	$M_{alum} = 1287.6$ lb-ft
$f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum} = 4.81$ ksi
Applied Axial Compression	
$P = p_{wt} \cdot t \cdot h + wt \cdot h$	$P = 746.1$ lb
$f_{c-alum} = P/A$	$f_{c-alum} = 0.36$ ksi

Check Deflection	Typical Vertical
N/A in. joint $\Delta = (5wL^4)/(384EI) =$	0.562 in
N/A $\pm$ movement cap. $\Delta_{allow} =$	1.055 in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = #####

Steel Capacity	
$M_{steel} = I_{x, steel} / I_{comb} =$	$M_{steel} = 2125.6$ lb-ft
$Mb/\Omega =$	$Mb/\Omega = 8814$ lb-ft
$Ms/(Mb/\Omega) = 0.241$	



Reinforcing HSS 2x4x3/8

$I_{x, \text{steel}} =$	5.600 in ⁴	Load Share	
$S_{x, \text{steel}} =$	2.800 in ³	<u>Aluminum</u>	<u>Steel</u>
$I_{\text{combined}} =$	26.078 in ⁴	0.377	0.623

Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		13.92 ksi
E.3 - Axial Compression		4.49 ksi
F.2.1 - Open Shape Flexure		N/A ksi
F.3.1 - Closed Shape Flexure		14.60 ksi

Compression Interaction	
Allowable Compression	$F_c = 4.49$ ksi
Compression Stress Interaction	$f_{c-alum}/F_c = 0.080$

Flexure Interaction	
Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure	
Allowable Flexural Compression	$F_b = 13.92$ ksi
Flexure Interaction	$f_{b-alum}/F_b = 0.346$

Check Combined Bending & Compression (ADM H.1)	
$f_a/F_a + f_b/F_b < 1.0$	$f_a/F_a + f_b/F_b = 0.425$

Mullion OK

Beam: **M388**

Shape:

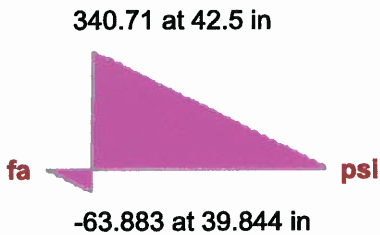
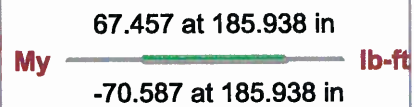
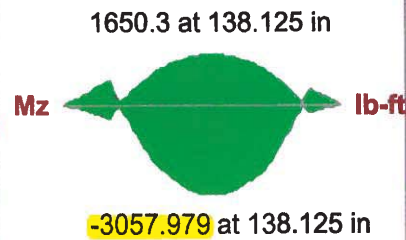
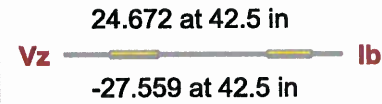
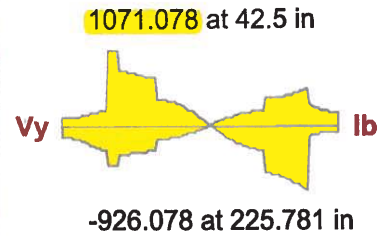
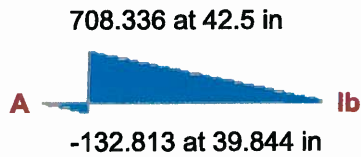
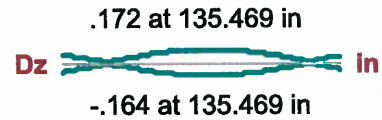
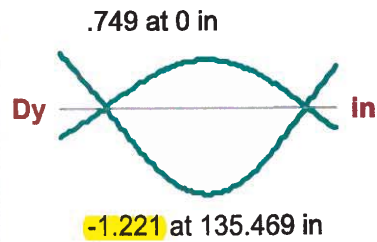
Material: **gen_Alum**

Length: **255 in**

I Joint: **N571**

J Joint: **N583**

Code Check: **No Calc**
Report Based On 97 Sections



f(y) **psi**

f(z) **psi**

Check 3

YKK E9-1225

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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/209
Detail: 1/407 **Check 3**

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 5.00 ft $F_y = 25.0$ ksi
Height (h) 15.44 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 19.0 psf (Using reduced area load based on 70sf)
Panel Weight (p_w) 8.0 psf (deflection only)

Manuf. / Part #: YKK E9-1225

$E = 10100$ ksi $r_{x, \text{alum}} = 2.176$ in
 $I_{x, \text{alum}} = 9.838$ in⁴ $r_{y, \text{alum}} = 0.935$ in
 $I_{y, \text{alum}} = 1.818$ in⁴ $A = 2.079$ in²
 $S_{x, \text{alum}} = 3.213$ in³ $J = 4.110$ in⁴
 $S_{y, \text{alum}} = 1.454$ in³ $wt = 2.498$ lb/ft
 $b/t_{web} = 52.71$ $b/t_{flange} = 22.33$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = \text{N/A}$ lb/ft
Shear Load $V = wL/2$ $V = 1071.1$ lb
Moment $M = wL^2/8$ $M = 3058.0$ lb-ft
 $M_{\text{alum}} = M \cdot I_{\text{alum}} \cdot \text{TRF}_i / I_{\text{comb}}$ $M_{\text{alum}} = 3058.0$ lb-ft
 $f_{b-\text{alum}} = M_{\text{alum}} / (S_{x, \text{alum}} \cdot \text{TRF}_s)$ $f_{b-\text{alum}} = 11.42$ ksi

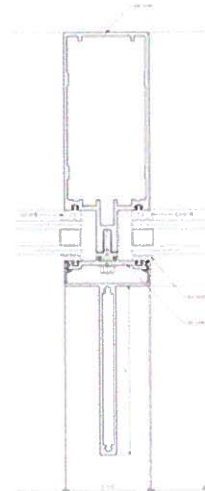
Applied Axial Compression

$P = p_w \cdot t \cdot h + wt \cdot h$ $P = 708.3$ lb
 $f_{c-\text{alum}} = P/A$ $f_{c-\text{alum}} = 0.34$ ksi

Check Deflection	Typical Vertical
N/A in. joint $\Delta = (5wL^4)/(384EI) =$	0.987 in
N/A $\pm$ movement cap. $\Delta_{\text{allow}} =$	1.022 in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = #####

Steel Capacity

$M_{\text{steel}} = I_{x, \text{steel}} / I_{\text{comb}} =$ $M_{\text{steel}} = 0.0$ lb-ft
 $M_b/\Omega =$ $M_b/\Omega = 0$ lb-ft
 $M_s/(M_b/\Omega) = \text{N/A}$



Reinforcing

No Reinforcing
 $I_{x, \text{steel}} = 0.000$ in⁴
 $S_{x, \text{steel}} = 0.000$ in³
 $I_{\text{combined}} = 9.838$ in⁴

Load Share

Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.92 ksi
E.3 - Axial Compression	4.49 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.60 ksi

Compression Interaction

Allowable Compression	$F_c = 4.49$ ksi
Compression Stress Interaction	$f_{c-\text{alum}}/F_c = 0.076$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure	
Allowable Flexural Compression	$F_b = 13.92$ ksi
Flexure Interaction	$f_{b-\text{alum}}/F_b = 0.821$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.896$

Mullion OK

Beam: **M684B**

Shape:

Material: **gen_Alum**

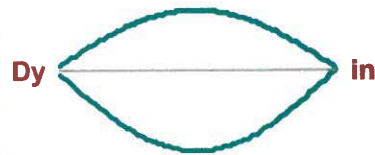
Length: **257.063 in**

I Joint: **N793C**

J Joint: **N792C**

Code Check: **No Calc**
Report Based On 97 Sections

.972 at 128.531 in



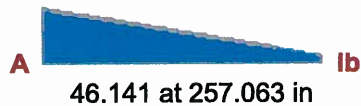
-1.343 at 128.531 in

.178 at 104.432 in



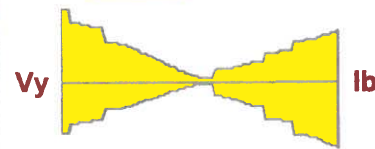
-.135 at 104.432 in

484.985 at 0 in



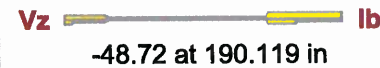
46.141 at 257.063 in

657.319 at 0 in



-612.975 at 257.063 in

41.515 at 216.896 in



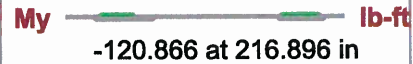
-48.72 at 190.119 in

2261.149 at 139.242 in



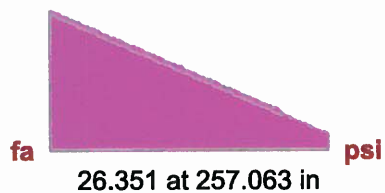
-3125.376 at 139.242 in

90.301 at 216.896 in



-120.866 at 216.896 in

276.976 at 0 in



26.351 at 257.063 in

f(y) ————— psi

f(z) ————— psi

Check 1.1

YKK E9-3402 with 4x2x1/4 bent steel channel

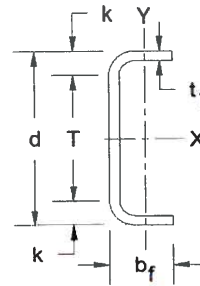
Using reduced pressure based on 70sf area to reduce deflection.

$Dy = 1.343" (17\text{psf} / 23.5\text{psf}) = 0.972"$

JEI Structural Engineering
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Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Channel allowable flexural strength



Date: 11/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Check 1.1

AISC Shape: 4" x 2" x 1/4"
Cust Dims: N/A
E = 29000 ksi
F_y = 36 ksi
Material = A36
L_b = 100 in

d = 4.000 in	t _f = 0.250 in	T = h = 2.500 in
b _f = 2.000 in	t _w = 0.250 in	J = 0.039 in ⁴
I _x = 4.107 in ⁴	I _y = 0.671 in ⁴	C _w = 1.494 in ⁶
S _x = 2.054 in ³	S _y = 0.485 in ³	h _o = 3.750 in
Z _x = 2.483 in ³	Z _y = 0.876 in ³	A = 1.795 in ²
r _x = 1.513 in	r _y = 0.611 in	wt = 6.108 lb/ft

<u>Flange Slenderness</u>		<u>Web Slenderness</u>
$r_{ts}^2 = (I_y C_w) / S_x = 0.49$	$\lambda_{pf} = 0.38(E/F_y)^{1/2} = 10.79$	$\lambda_{pw} = 3.76(E/F_y)^{1/2} = 106.72$
$c = h_o/2 * (I_y/C_w)^{1/2} = 1.26$	$\lambda_{rf} = 1.0(E/F_y)^{1/2} = 28.38$	$\lambda_{rw} = 5.70(E/F_y)^{1/2} = 161.78$

Flange Slenderness $\lambda = b_f/t_f = 8.00$ Flange Slenderness = Compact	Web Slenderness $\lambda = h/t_w = 10.00$ Web Slenderness = Compact
L _b = L _p = 1.76r _y (E/F _y) ^{1/2} = L _r = 1.95r _{ts} * E/(0.7F _y) * (Jc/(S _x h _o)) ^{1/2} (1+(1+6.76(0.7F _y /E * S _x h _o /(Jc)) ²) ^{1/2}) ^{1/2} =	L _b = 100 in L _p = 30.52 in L _r = 179.42 in

X-Axis Yielding (AISC F2.1) L _b <= L _p M _n = M _p = F _y Z _x = 89.39 kip-in	Y-Axis Yielding (AISC F6.1) M _n = M _p = F _y Z _y = 31.54 kip-in 1.6F _y S _y = 27.94 kip-in M _n = M _p ≤ 1.6F _y S _y = 27.94 kip-in
--	--

X-Axis Lateral-Torsional Buckling (AISC F2.2) AISC F2.2.b L _p < L _b ≤ L _r M _n = C _b [M _p - (M _p - 0.7F _y S _x)(L _b - L _p)/(L _r - L _p)] = M _n = 71.83 kip-in M _p = F _y Z _x = 89.39 kip-in M _n ≤ M _p = 71.83 kip-in	Y-Axis Flange Local Buckling (AISC F6.2) AISC F6.2b λ _{pf} < λ ≤ λ _{rf} M _n = [M _p - (M _p - 0.7F _y S _y)(λ - λ _p)/(λ _r - λ _p)] = M _n = 34.59 kip-in M _p = F _y Z _y = 31.54 kip-in M _n ≤ M _p = N/A kip-in
AISC F2.2.c L _b > L _r F _{cr} = C _b π ² E/(L _b /r _{ts}) ² (1+0.078Jc/(S _x h _o)*(L _b /r _{ts}) ²) ^{1/2} = F _{cr} = 46.65 ksi M _n = F _{cr} S _x = 95.82 kip-in M _p = F _y Z _x = 89.39 kip-in M _n ≤ M _p = N/A kip-in	AISC F6.2b λ > λ _{rf} F _{cr} = 0.69E/(b _f /2t _f) ² = F _{cr} = 1250.63 ksi M _n = F _{cr} S _y = 606.55 kip-in M _n = N/A kip-in

X-Axis Capacity	Ω_b = 1.67
M _n =	71.83 kip-in
M _n /Ω _b =	43.01 kip-in
M _r /Ω _b =	3584 lb-ft

Y-Axis Capacity	Ω_b = 1.67
M _n =	27.94 kip-in
M _n /Ω _b =	16.73 kip-in
M _r /Ω _b =	1394 lb-ft

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Kansas City, MO 64155

Voice: 816-734-8345
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/210
Detail: 1/409 **Member 684B**

Date: 11/1/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 2.44 ft $F_y = 25.0$ ksi
Height (h) 21.12 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 17.0 psf (Using reduced non corner winds, 50sf)
Panel Weight (p_w) 8.0 psf (deflection only)

Manuf. / Part #: YKK E9-3402

$E = 10100$ ksi $r_{x, \text{alum}} = 1.925$ in
 $I_{x, \text{alum}} = 6.485$ in⁴ $r_{y, \text{alum}} = 0.994$ in
 $I_{y, \text{alum}} = 1.729$ in⁴ $A = 1.751$ in²
 $S_{x, \text{alum}} = 2.197$ in³ $J = 3.525$ in⁴
 $S_{y, \text{alum}} = 1.383$ in³ $wt = 2.104$ lb/ft
 $b/t_{web} = 54.86$ $b/t_{flange} = 23.48$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = \text{N/A}$ lb/ft
Shear Load $V = wL/2$ $V = 657.3$ lb
Moment $M = wL^2/8$ $M = 3125.4$ lb-ft
 $M_{\text{alum}} = M \cdot I_{\text{alum}} \cdot \text{TRF}_i / I_{\text{comb}}$ $M_{\text{alum}} = 1101.8$ lb-ft
 $f_{b-\text{alum}} = M_{\text{alum}} / (S_{x, \text{alum}} \cdot \text{TRF}_s)$ $f_{b-\text{alum}} = 6.02$ ksi

Applied Axial Compression

$P = p_{wt} \cdot t \cdot h + wt \cdot h$ $P = 485.0$ lb
 $f_{c-\text{alum}} = P/A$ $f_{c-\text{alum}} = 0.28$ ksi

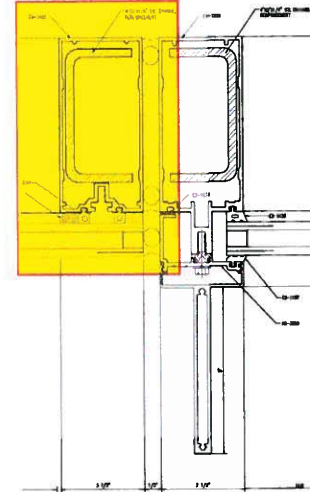
Check Deflection**Jamb Vertical**

1/2 in. joint $\Delta = (5wL^4)/(384EI) = 0.972$ in
100% $\pm$ movement cap. $\Delta_{\text{allow}} = 0.866$ in
See sealant joint calculation for allowable joint movement.

Deflection Factor
DF = #####

Steel Capacity

$M_{\text{steel}} = I_{x, \text{steel}} / I_{\text{comb}} =$ $M_{\text{steel}} = 2023.6$ lb-ft
 $Mb/\Omega =$ $Mb/\Omega = 3584$ lb-ft
 $Ms/(Mb/\Omega) = 0.565$

**Reinforcing****Channel 2x4x1/4**

$I_{x, \text{steel}} = 4.107$ in⁴
 $S_{x, \text{steel}} = 2.054$ in³
 $I_{\text{combined}} = 18.395$ in⁴

Load Share

Aluminum	Steel
0.353	0.647

Allowable Loads $\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.04 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.38 ksi
E.3 - Axial Compression	5.07 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.88 ksi

Compression Interaction

Allowable Compression	$F_c = 5.07$ ksi
Compression Stress Interaction	$f_{c-\text{alum}}/F_c = 0.055$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure	
Allowable Flexural Compression	$F_b = 13.38$ ksi
Flexure Interaction	$f_{b-\text{alum}}/F_b = 0.450$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.505$

Mullion OK, $\leq 1/8"$ over allowable deflection.

Joint needs to consider multi-directional movement. See page 55 for other half of double vertical analysis, and full joint analysis.

Beam: **M710**

Shape:

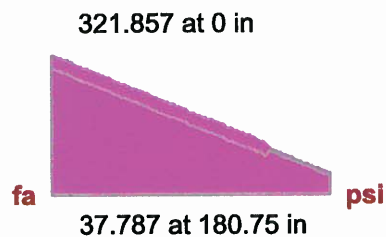
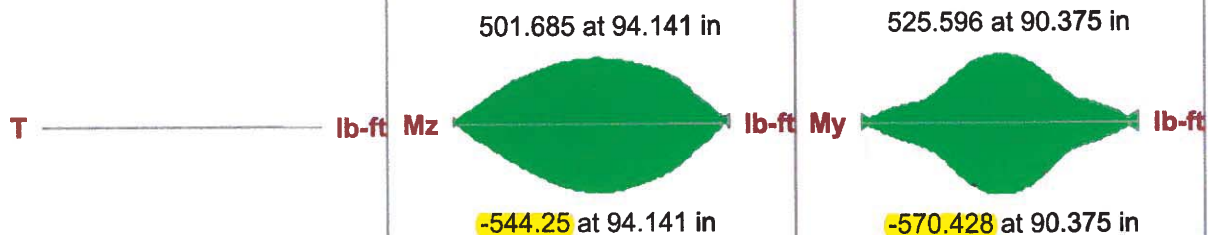
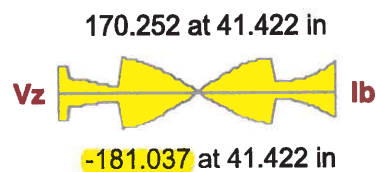
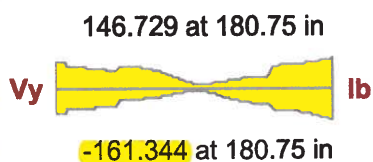
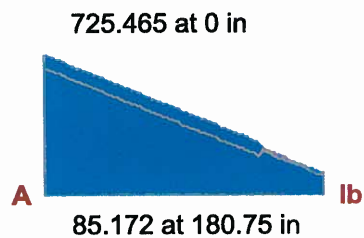
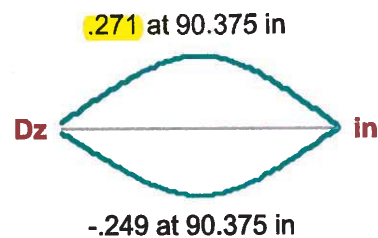
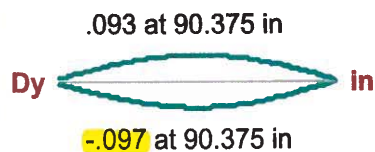
Material: **gen_Alum**

Length: **180.75 in**

I Joint: **N794B**

J Joint: **N724A**

Code Check: **No Calc**
Report Based On 97 Sections



f(y) **psi** **f(z)** **psi**

YKK E9-3401
64 deg corner

JEI Structural Engineering
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/210
Detail: 1/405 **Member M710**

Date: 11/1/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width A (t_{wA}) 2.80 ft **Comer Angle (θ)**
Tributary Width B (t_{wB}) 1.62 ft 64.00 °
Height (h) 15.44 ft
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure A (p_A) 17.63 psf
Design Pressure B (p_B) 12.75 psf
Panel Weight (p_{wt}) 8 psf

Manuf. / Part #: YKK E9-3401

E = 10100 ksi $r_{x, alum} = 1.948$ in
 $I_{x, alum} = 8.555$ in⁴ $r_{y, alum} = 0.991$ in
 $I_{y, alum} = 2.213$ in⁴ A = 2.254 in²
 $S_{x, alum} = 3.127$ in³ J = 4.596 in⁴
 $S_{y, alum} = 1.765$ in³ wt = 2.708 lb/ft

Thermal Reduction Factors (TRF_i, TRF_s)

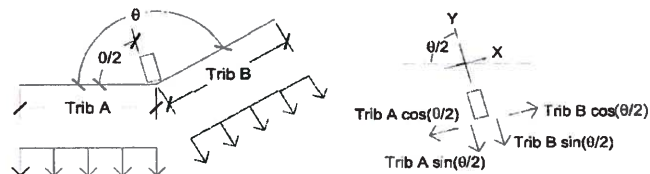
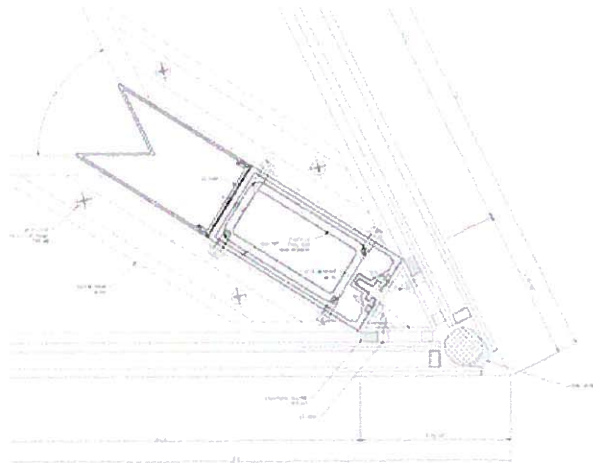
I_x Reduc. 1.00 S_x Reduc. 1.00

Reinforcing HSS 2x4x3/8

$I_{x, steel} = 5.600$ in⁴ $I_{y, steel} = 1.800$ in⁴
 $S_{x, steel} = 2.800$ in³ $S_{y, steel} = 1.800$ in³
 $I_{x, combined} = 24.795$ in⁴ $I_{y, combined} = 7.433$ in⁴

X-Axis Bending Stress (ADM F.2 & F.3)		$\Omega = 1.65$
$w = p \cdot t$	$w_y =$	N/A lb/ft
Shear Load $V = w/2$	$V_y =$	161.3 lb
Moment $M = w/2^2/8$	$M_x =$	544.3 lb-ft
$M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$	$M_{x, alum} =$	187.8 lb-ft
$L_n = (2 \cdot L_b \cdot S_x) / (I_y J)^{1/2}$	$L_n =$	196.1
$f_b = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b, alum-x} =$	0.72 ksi
$f_{b, alum-x} / F_{bx} =$	$F_{bx} / \Omega = F_{bx} =$	14.79 ksi
Y-Axis Bending Stress (ADM F.2 & F.3)		$\Omega = 1.65$
$w = p \cdot t$	$w_x =$	N/A lb/ft
Shear Load $V = w/2$	$V_x =$	181.0 lb
Moment $M = w/2^2/8$	$M_y =$	570.4 lb-ft
$M_{alum} = M \cdot I_{alum} / I_{comb}$	$M_{y, alum} =$	169.8 lb-ft
$L_n = (2 \cdot L_b \cdot S_x) / (I_y J)^{1/2}$	$L_n =$	110.7
$f_b = M_{alum} / (S_{y, alum})$	$f_{b, alum-y} =$	1.15 ksi
$f_{b, alum-y} / F_{by} =$	$F_{by} / \Omega = F_{by} =$	15.27 ksi
Combined Stress Ratio		$f_{bx} / F_{bx} + f_{by} / F_{by} = 0.12$
		OK

Check Combined Bending & Compression (ADM H.1)	
$f_a / F_a + f_b / F_b < 1.0$	$f_a / F_a + f_b / F_b = 0.176$
OK	



Mullion Resultant Forces			
Strong Axis Bending, $M_x, w_y =$		37.09 lb/ft	
Weak Axis Bending, $M_y, w_x =$		24.33 lb/ft	
Load Share			
Aluminum (x)	Steel (x)	Aluminum (y)	Steel (y)
0.345	0.655	0.298	0.702

Axial Load	
$P = p_{wt} \cdot t \cdot h + wt \cdot h$	$P = 587.6$ lb

Check Allowable Compression - ADM E.3	
$kL_y / r =$	$kL_y / r = 100.92$
F_{a1} (Allowable Compression)	$F_{a1} / \Omega = 5.04$ ksi
Check Allowable Compression - Flange element (ADM B.5.4.2)	
$b/t =$	$b/t = 12.36$
F_{a2} (Allowable Compression)	$F_{a2} / \Omega = 15.20$ ksi
Check Allowable Compression - Web element (ADM B.5.5.1)	
$b/t =$	$b/t = 37.72$
F_{a3} (Allowable Compression)	$F_{a3} / \Omega = 19.70$ ksi

$f_a = P/A$	$f_a = 0.26$ ksi
Lessor of F_{a1}, F_{a2}, F_{a3}	$F_a / \Omega = F_a = 5.04$ ksi
	$f_a / F_a = 0.052$
OK	

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Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/210
Detail: 1/405

Date: 11/1/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA

Strong Axis Deflection (M_x, w_y)		Typical Vertical	
$\Delta_y = (5w_y L^4)/(384EI)$	$\Delta_y =$	0.097 in	
within DLO (Conservative)	$\Delta_y =$	0.097 in	
Weak-Axis Deflection (w_x)			
$\Delta_x = (5w_x L^4)/(384EI_\Delta)$	$\Delta_x =$	0.271 in	
within DLO (Conservative)	$\Delta_x =$	0.271 in	
Resultant Deflection			
$\Delta_{total} = \sqrt{(\Delta_x^2 + \Delta_y^2)}$	$\Delta_{total} =$	0.288 in	
Angle Relative to X-Axis	$\theta_\Delta =$	19.7 °	
	$\Delta_{allow} =$	1.022 in	
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$		Deflection Factor	DF = #####
OK			

Steel Stress (X-axis)			
Moment to Steel = I_x steel/ I comb =		356.5 lb-ft	
$f_b = M/S_{x, steel}$	$f_b =$	0.8 ksi	
$M_r/\Omega_b =$	$M_r/\Omega_b =$	8814 lb-ft	
OK			

Deflection Along Glazing			
$\Delta_{y-glazing} = \Delta_y \sin((180-\theta)/2)$	$\Delta_{y-glazing} =$	0.082 in	
$\Delta_{x-glazing} = \Delta_x \cos((180-\theta)/2)$	$\Delta_{x-glazing} =$	0.144 in	
Tributary Area A			
$\Delta_{total-A} = \Delta_{x-glazing} + \Delta_{y-glazing}$	$\Delta_{total} =$	0.226 in	
Tributary Area B			
$\Delta_{total-B} = \Delta_{x-glazing} - \Delta_{y-glazing}$	$\Delta_{total} =$	0.061 in	

SSG Sealant Deflection	
1/4 in. joint	50% ± movement capacity
0.280 in. allowable deflection	SSG Sealant OK

Steel Stress (Y-axis)			
Moment to Steel = I_y steel/ I comb =		400.6 lb-ft	
$f_b = M/S_{y, steel}$	$f_b =$	2.7 ksi	
$M_r/\Omega_b =$	$M_r/\Omega_b =$	5302 lb-ft	
OK			

Beam: **M59**

Shape:

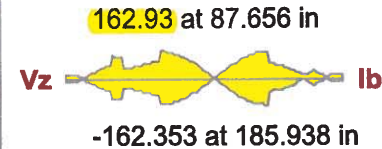
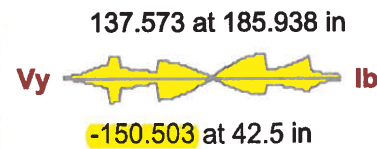
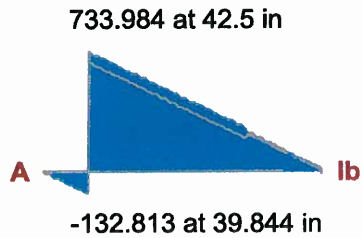
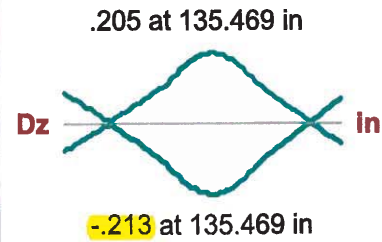
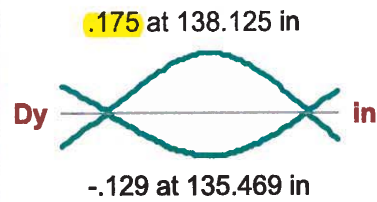
Material: **gen_Alum**

Length: **255 in**

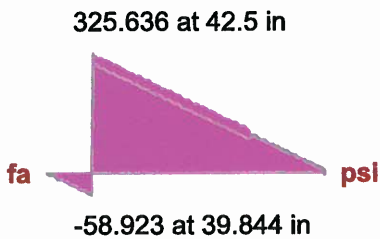
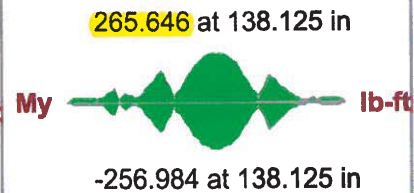
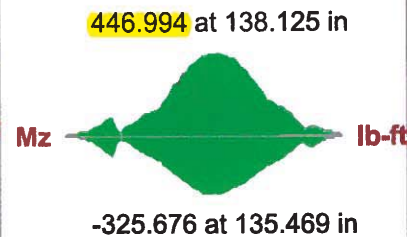
I Joint: **N83**

J Joint: **N128**

Code Check: **No Calc**
Report Based On 97 Sections



T **lb-ft**



f(y) **psi**

f(z) **psi**

YKK E9-3401
90 deg corner

$f_a = P/A$	$f_a =$	0.26 ksi
Lessor of F_{a1}, F_{a2}, F_{a3}	$F_a/\Omega = F_a$	5.04 ksi
	$f_a/F_a =$	0.052

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Client: NGG
 Project: Webster University
 Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
 Part of: Vertical Mullion Analysis
 Elevation: 1/208
 Detail: 2/404

Date: 11/1/2016
 Proj. No.: JE16059
 Designer: M. Gorny

INPUT CHECK RISA

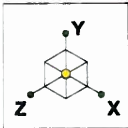
Strong Axis Deflection (M_x, w_y)		Typical Vertical	
$\Delta_y = (5w_y L^4)/(384EI)$	$\Delta_y =$	0.175 in	
within DLO (Conservative)	$\Delta_y =$	0.175 in	
Weak-Axis Deflection (w_x)			
$\Delta_x = (5w_x L^4)/(384EI_x)$	$\Delta_x =$	0.213 in	
within DLO (Conservative)	$\Delta_x =$	0.213 in	
Resultant Deflection			
$\Delta_{total} = \sqrt{(\Delta_x^2 + \Delta_y^2)}$	$\Delta_{total} =$	0.276 in	
Angle Relative to X-Axis	$\theta_{\Delta} =$	39.4 °	
	$\Delta_{allow} =$	1.022 in	
Allowable deflection = L/175 or if span > 13'-6" then allowable def = L/240 + 1/4"		Deflection Factor	DF = #####
OK			

Steel Stress (X-axis)			
Moment to Steel = I_x steel / I comb =		0.0 lb-ft	
$f_b = M/S_{x, steel}$	$f_b =$	N/A ksi	
$M_r/\Omega_b =$	$M_r/\Omega_b =$	0 lb-ft	
N/A			

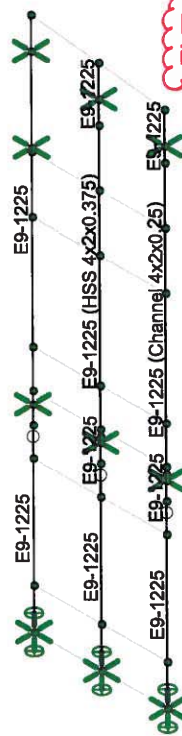
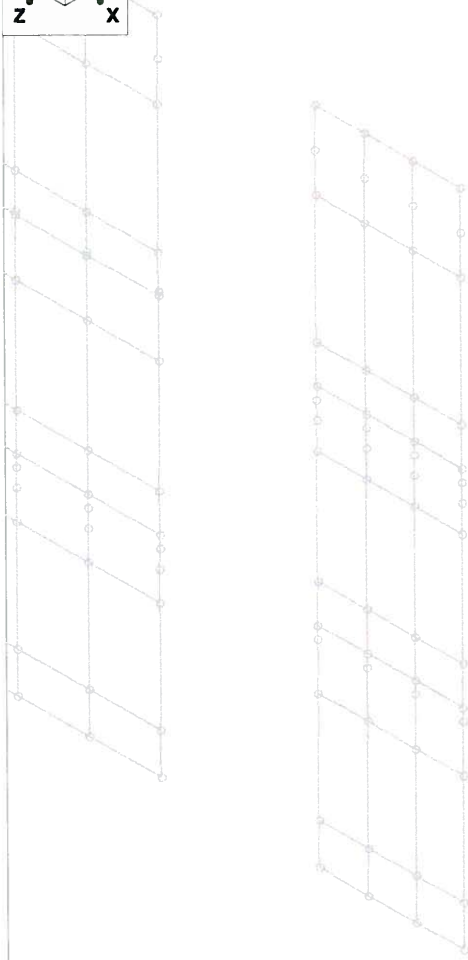
Deflection Along Glazing			
$\Delta_{y-glazing} = \Delta_y \sin((180-\theta)/2)$	$\Delta_{y-glazing} =$	0.124 in	
$\Delta_{x-glazing} = \Delta_x \cos((180-\theta)/2)$	$\Delta_{x-glazing} =$	0.151 in	
Tributary Area A			
$\Delta_{total-A} = \Delta_{x-glazing} + \Delta_{y-glazing}$	$\Delta_{total} =$	0.274 in	
Tributary Area B			
$\Delta_{total-B} = \Delta_{x-glazing} - \Delta_{y-glazing}$	$\Delta_{total} =$	0.027 in	

SSG Sealant Deflection	
1/4 in. joint	50% ± movement capacity
0.280 in. allowable deflection	SSG Sealant OK

Steel Stress (Y-axis)			
Moment to Steel = I_y steel / I comb =		0.0 lb-ft	
$f_b = M/S_{y, steel}$	$f_b =$	N/A ksi	
$M_r/\Omega_b =$	$M_r/\Omega_b =$	0 lb-ft	
N/A			



Section sets



Reinforcing added by inspection.

EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 207, 211

JEI Structural Engineering

M. Gorny

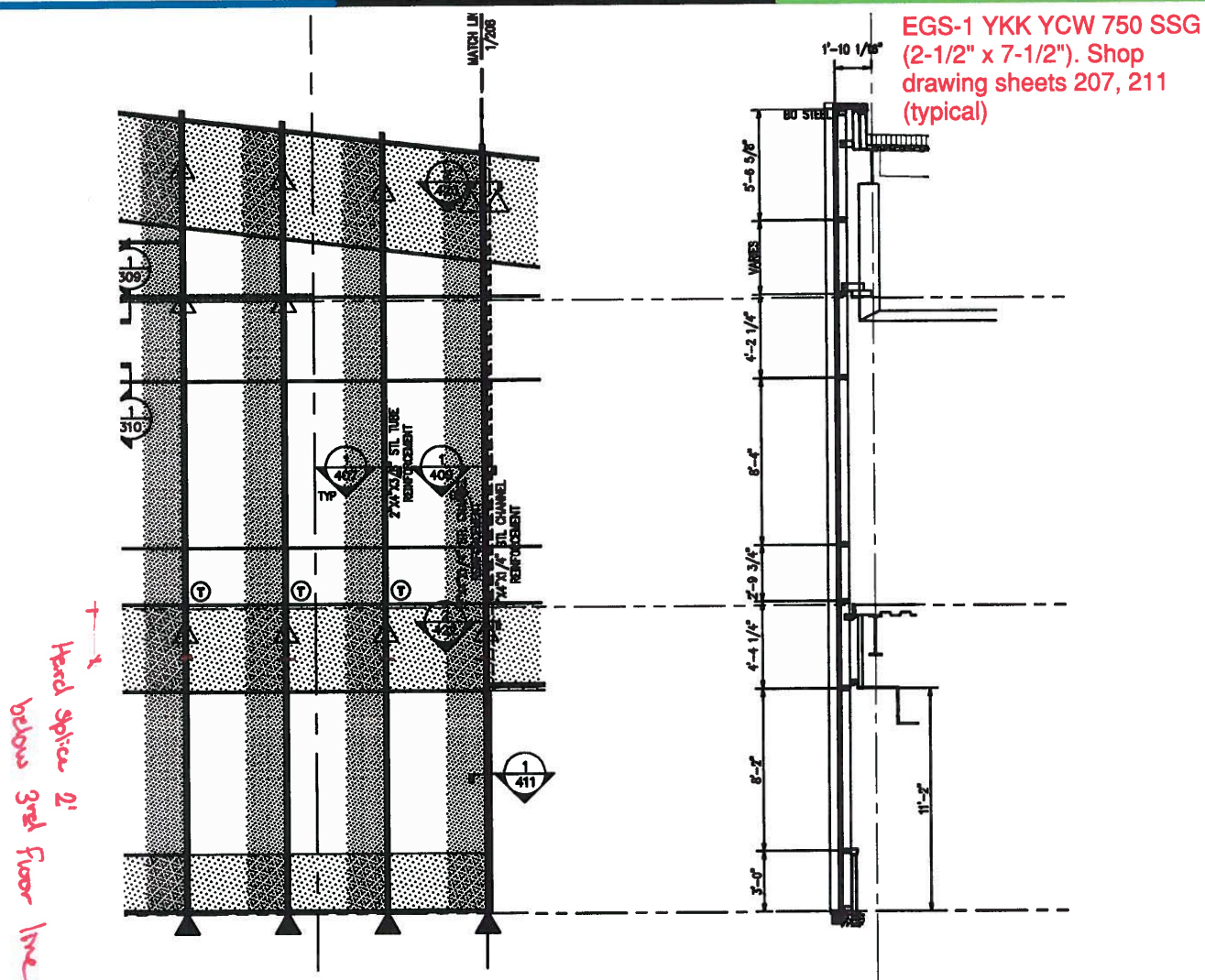
JE16059

Webster University

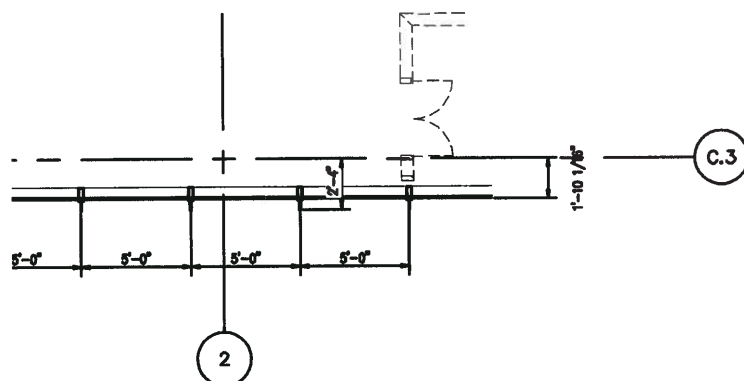
SK - 1

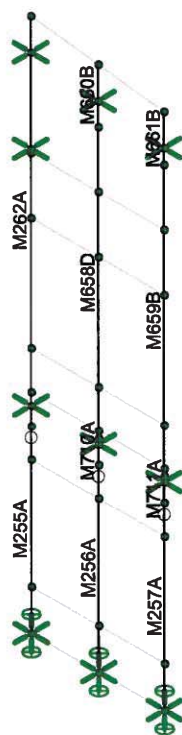
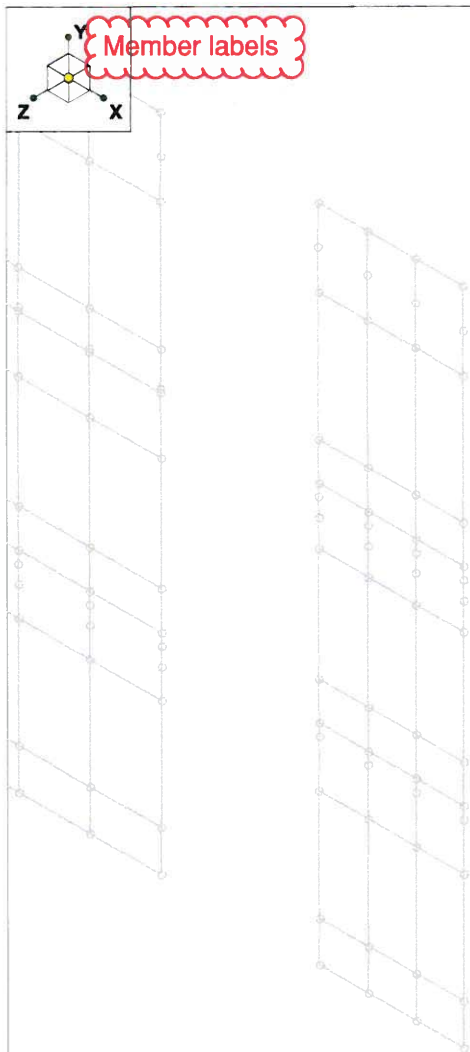
Nov 14, 2016 at 8:48 AM

EGS-1 Preliminary.r3d



3 SECTION
Scale: 3/4"=1'-0"
ARCH REF: 2/A0401





EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 207, 211

JEI Structural Engineering

M. Gorny

JE16059

Webster University

SK - 2

Nov 14, 2016 at 8:48 AM

EGS-1 Preliminary.r3d



Dead load
8psf (5' 3") = 42lb/ft (21lb/ft at jambs)



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 207, 211

Loads: BLC 7, Dead

JEI Structural Engineering

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JE16059

Webster University

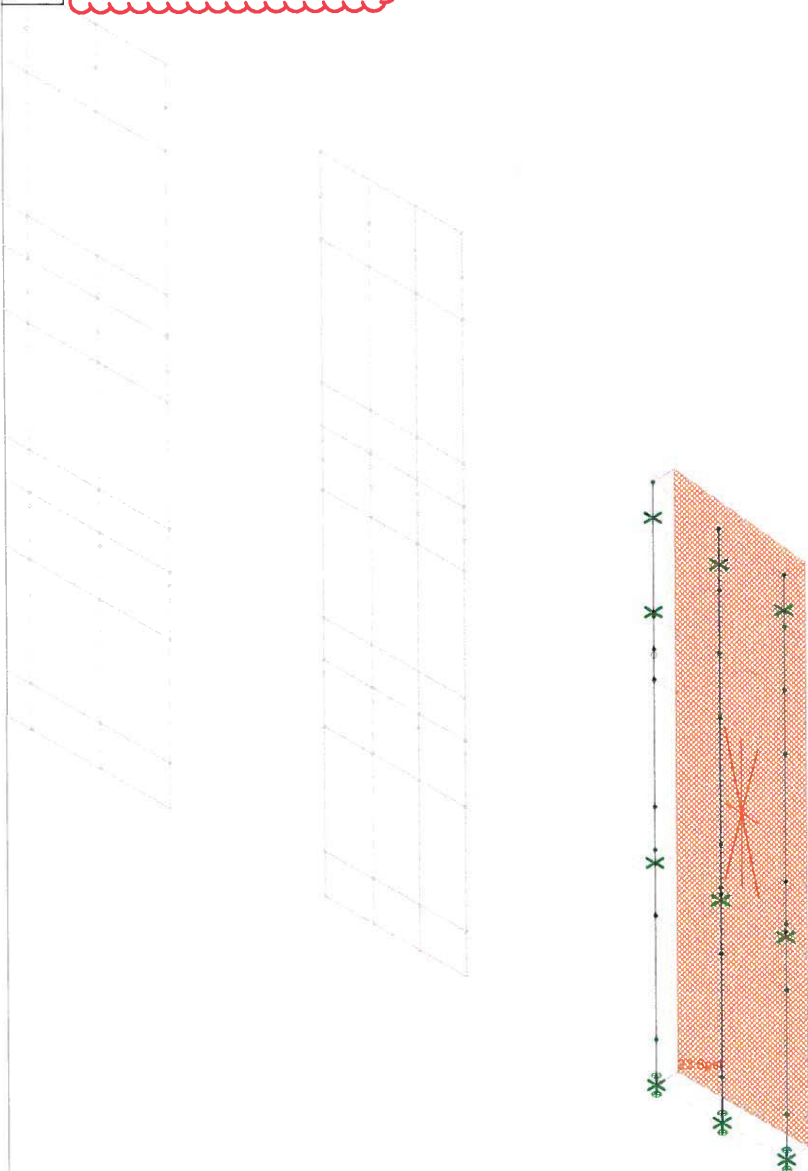
SK - 24

Nov 2, 2016 at 6:42 AM

EGS-1 Preliminary.r3d



Negative Wind - 23.5psf



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 207, 211

Loads: BLC 1, Negative Wind (Face A)

JEI Structural Engineering

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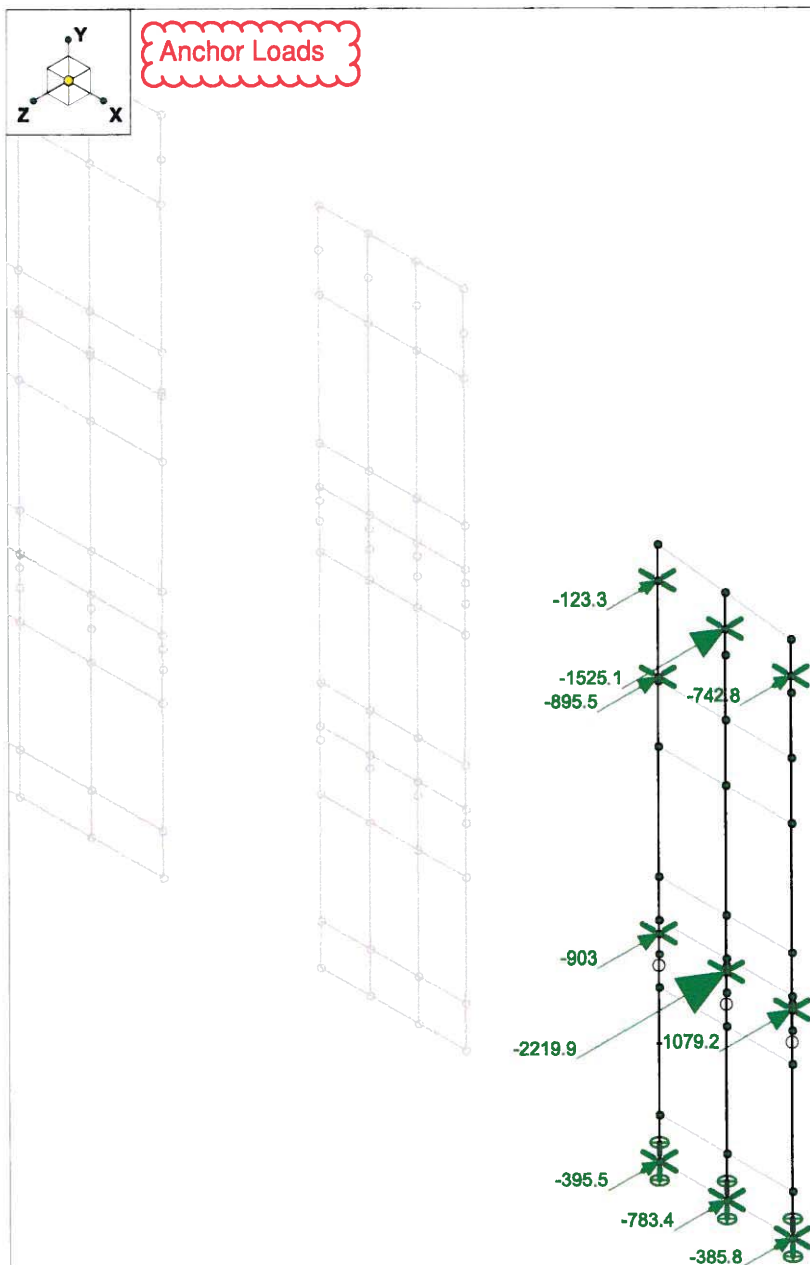
JE16059

Webster University

SK - 26

Nov 2, 2016 at 6:42 AM

EGS-1 Preliminary.r3d



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 207, 211

Results for LC 1, Negative Wind Face A
Z-direction Reaction Units are lb and lb-ft

JEI Structural Engineering

M. Gorny

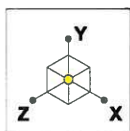
JE16059

Webster University

SK - 3

Nov 14, 2016 at 8:50 AM

EGS-1 Preliminary.r3d

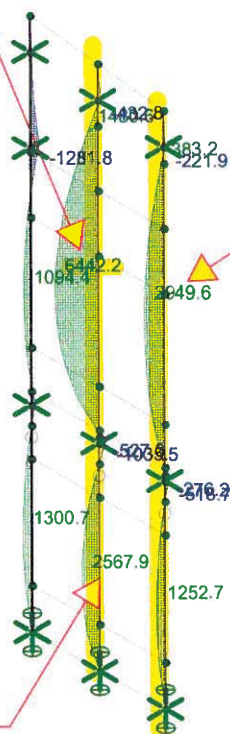


Moment diagram

Check 1.2 (6442.2lb-ft)
E9-1225

Check 4 (2949.6lb-ft)
E9-1225

E9-1225 Vertical mullion
OK by comparison to
previous analysis, Check 3



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 207, 211

Results for LC 1, Negative Wind Face A
Member z Bending Moments (lb-ft)

JEI Structural Engineering	Webster University	SK - 4
M. Gorny		Nov 14, 2016 at 8:51 AM
JE16059		EGS-1 Preliminary.r3d

Beam: **M658D**

Shape:

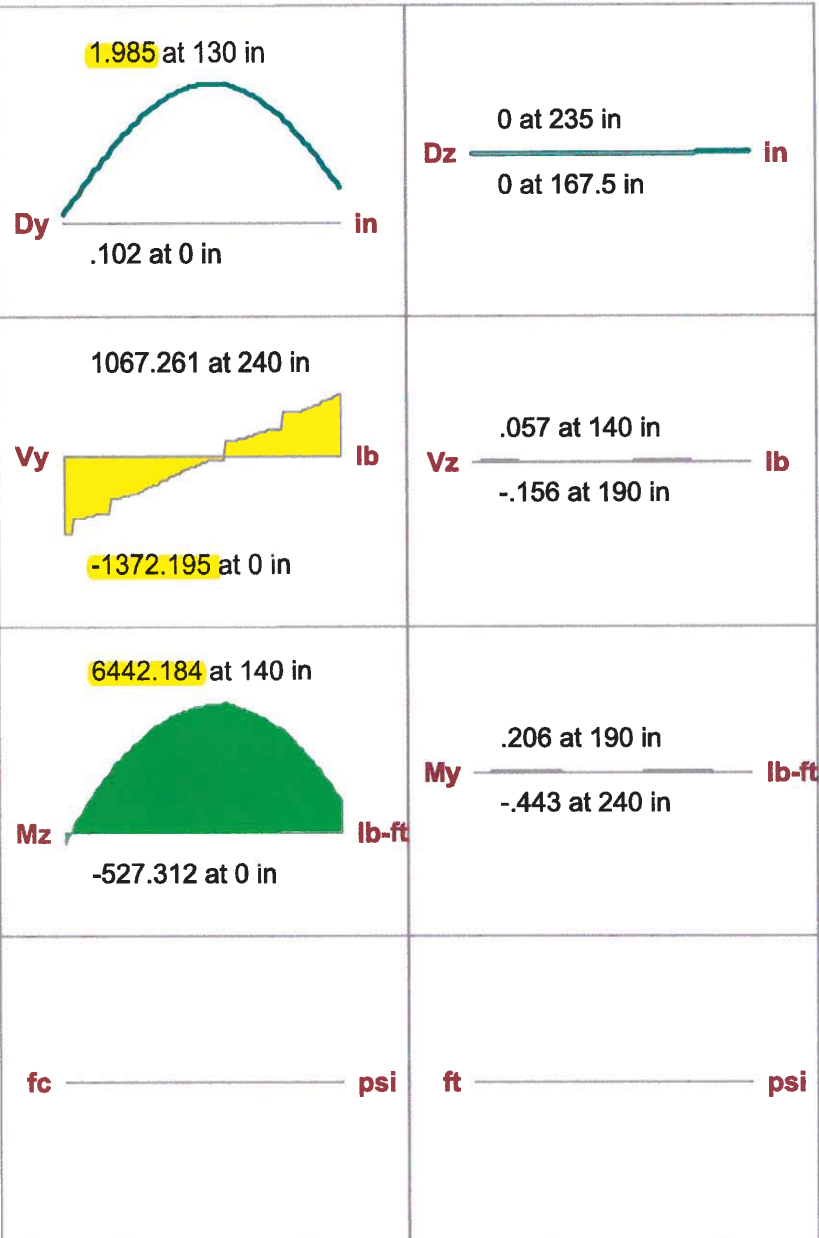
Material: **gen_Alum**

Length: **240 in**

I Joint: **N767**

J Joint: **N769A**

Code Check: **No Calc**
Report Based On 97 Sections



Check 1.2

E9-1225 Vertical mullion

Using reduced pressure based on 70sf area, non-corner winds to reduce deflection.

$D_y = 1.985'' (17\text{psf} / 23.5\text{psf}) = 1.436''$



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Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/207
Detail: 1/409

Member M658D

Check 1.2

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 4.94 ft $F_y = 25.0$ ksi
Height (h) 22.03 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 17.0 psf (Using reduced area load based on 70sf)
Panel Weight (p_w) 8.0 psf (non-corner, deflection only)

Manuf. / Part #: YKK E9-1225

$E = 10100$ ksi $r_{x, \text{alum}} = 2.176$ in
 $I_{x, \text{alum}} = 9.838$ in⁴ $r_{y, \text{alum}} = 0.935$ in
 $I_{y, \text{alum}} = 1.818$ in⁴ $A = 2.079$ in²
 $S_{x, \text{alum}} = 3.213$ in³ $J = 4.110$ in⁴
 $S_{y, \text{alum}} = 1.454$ in³ $wt = 2.498$ lb/ft
 $b/t_{web} = 52.71$ $b/t_{flange} = 22.33$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = \text{N/A lb/ft}$
Shear Load $V = wL/2$ $V = 1372.2$ lb
Moment $M = wL^2/8$ $M = 6442.2$ lb-ft
 $M_{\text{alum}} = M \cdot I_{\text{alum}} \cdot \text{TRF}_f / I_{\text{comb}}$ $M_{\text{alum}} = 2430.3$ lb-ft
 $f_{b-\text{alum}} = M_{\text{alum}} / (S_{x, \text{alum}} \cdot \text{TRF}_s)$ $f_{b-\text{alum}} = 9.08$ ksi

Applied Axial Compression

$P = p_w \cdot t \cdot h + w_t \cdot h$ $P = 1007.3$ lb
 $f_{c-\text{alum}} = P/A$ $f_{c-\text{alum}} = 0.48$ ksi

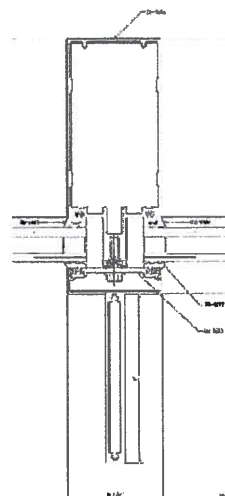
Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) = 1.436$ in
N/A $\pm$ movement cap. $\Delta_{\text{allow}} = 1.351$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$
Deflection Factor DF = #####

Steel Capacity

$M_{\text{steel}} = I_{x, \text{steel}} / I_{\text{comb}} =$ $M_{\text{steel}} = 4011.9$ lb-ft
 $Mb/\Omega =$ $Mb/\Omega = 8814$ lb-ft
 $M_s/(Mb/\Omega) = 0.455$



Reinforcing

HSS 2x4x3/8

$I_{x, \text{steel}} = 5.600$ in⁴
 $S_{x, \text{steel}} = 2.800$ in³
 $I_{\text{combined}} = 26.078$ in⁴

Load Share

Aluminum	Steel
0.377	0.623

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.92 ksi
E.3 - Axial Compression	4.49 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.60 ksi

Compression Interaction

Allowable Compression	$F_c = 4.49$ ksi
Compression Stress Interaction	$f_{c-\text{alum}}/F_c = 0.108$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure	
Allowable Flexural Compression	$F_b = 13.92$ ksi
Flexure Interaction	$f_{b-\text{alum}}/F_b = 0.652$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.760$

Mullion OK, $\leq 1/8"$ over allowable deflection.

Beam: **M659B**

Shape:

Material: **gen_Alum**

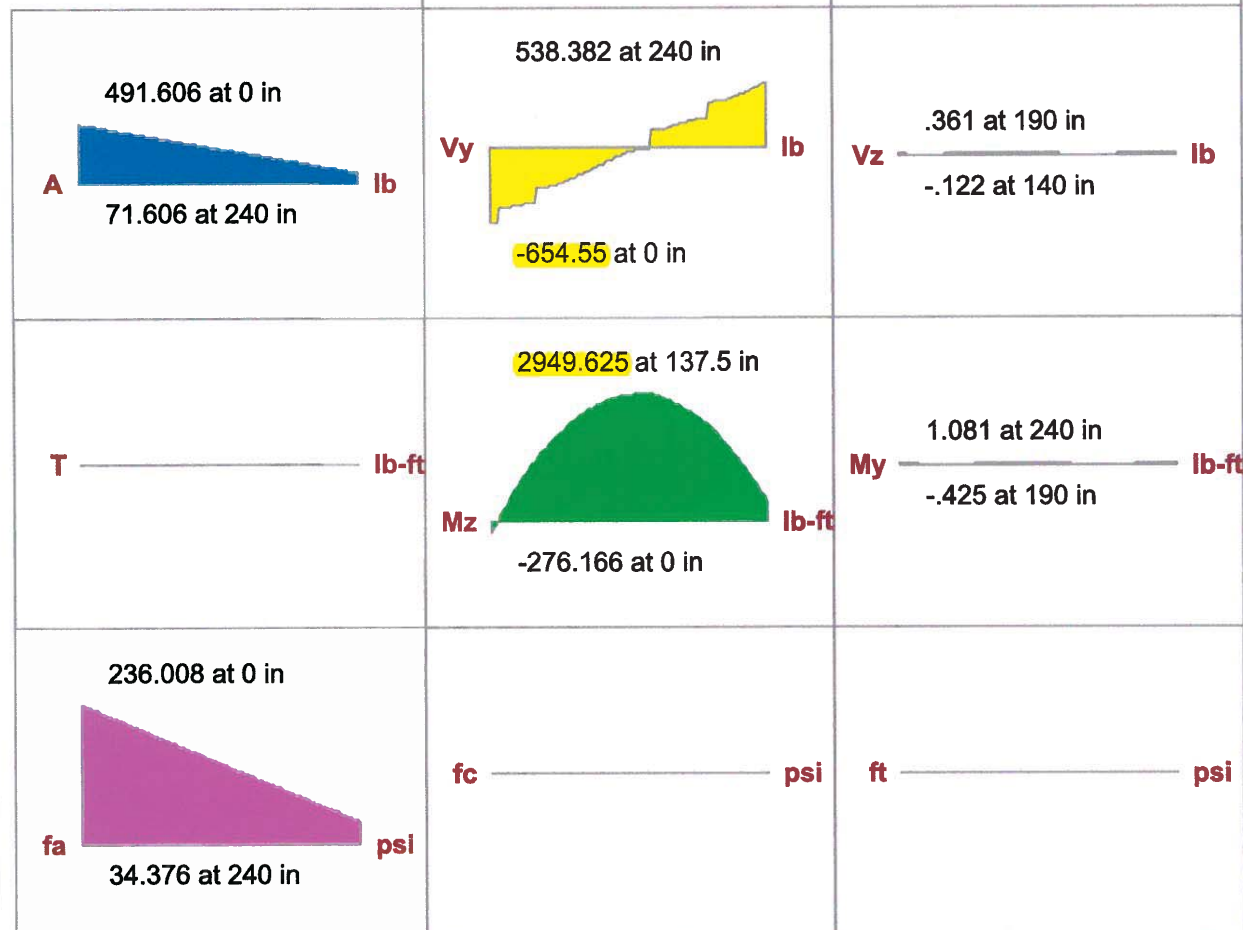
Length: **240 in**

I Joint: **N768A**

J Joint: **N770**

Code Check: **No Calc**

Report Based On 97 Sections



Check 4

YKK E9-1225 with 4x2x1/4 Steel Channel



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Kansas City, MO 64155

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www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/207
Detail: 1/409 **Member 659B**

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny

Check 4

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 2.44 ft $F_y = 25.0$ ksi
Height (h) 21.45 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 20.0 psf (Using non corner wind)
Panel Weight (p_w) 8.0 psf

Manuf. / Part #: YKK E9-1225

E = 10100 ksi $r_{x, \text{alum}} = 2.176$ in
 $I_{x, \text{alum}} = 9.838$ in⁴ $r_{y, \text{alum}} = 0.935$ in
 $I_{y, \text{alum}} = 1.818$ in⁴ A = 2.079 in²
 $S_{x, \text{alum}} = 3.213$ in³ J = 4.110 in⁴
 $S_{y, \text{alum}} = 1.454$ in³ wt = 2.498 lb/ft
b/t_{web} = 52.71 b/t_{flange} = 22.33
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ w = N/A lb/ft
Shear Load $V = wL/2$ V = 654.6 lb
Moment $M = wL^2/8$ M = 2949.6 lb-ft
 $M_{\text{alum}} = M \cdot I_{\text{alum}} \cdot \text{TRF}_i / I_{\text{comb}}$ $M_{\text{alum}} = 1334.3$ lb-ft
 $f_{b-\text{alum}} = M_{\text{alum}} / (S_{x, \text{alum}} \cdot \text{TRF}_s)$ $f_{b-\text{alum}} = 4.98$ ksi

Applied Axial Compression

$P = p_w \cdot t \cdot h + w_t \cdot h$ P = 491.6 lb
 $f_{c-\text{alum}} = P/A$ $f_{c-\text{alum}} = 0.24$ ksi

Check Deflection

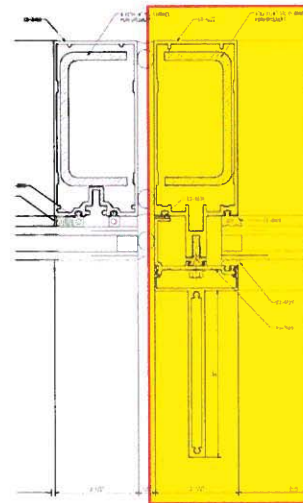
Jamb Vertical
1/2 in. joint $\Delta = (5wL^4)/(384EI) = 0.878$ in
100% $\pm$ movement cap. $\Delta_{\text{allow}} = 0.866$ in
See sealant joint calculation for allowable joint movement.
Deflection Factor DF = #####

Steel Capacity

$M_{\text{steel}} = I_{x, \text{steel}} / I_{\text{comb}} =$ $M_{\text{steel}} = 1615.3$ lb-ft
 $M_b / \Omega =$ $M_b / \Omega = 3584$ lb-ft
 $M_s / (M_b / \Omega) = 0.451$

See following pages for full joint analysis

INPUT CHECK RISA



Reinforcing

Channel 2x4x1/4
 $I_{x, \text{steel}} = 4.107$ in⁴
 $S_{x, \text{steel}} = 2.054$ in³
 $I_{\text{combined}} = 21.748$ in⁴

Load Share

Aluminum	Steel
0.452	0.548

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.92 ksi
E.3 - Axial Compression	4.49 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.60 ksi

Compression Interaction

Allowable Compression	$F_c = 4.49$ ksi
Compression Stress Interaction	$f_{c-\text{alum}} / F_c = 0.053$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure	
Allowable Flexural Compression	$F_b = 13.92$ ksi
Flexure Interaction	$f_{b-\text{alum}} / F_b = 0.358$

Check Combined Bending & Compression (ADM H.1)

$f_a / F_a + f_b / F_b < 1.0$ $f_a / F_a + f_b / F_b = 0.411$

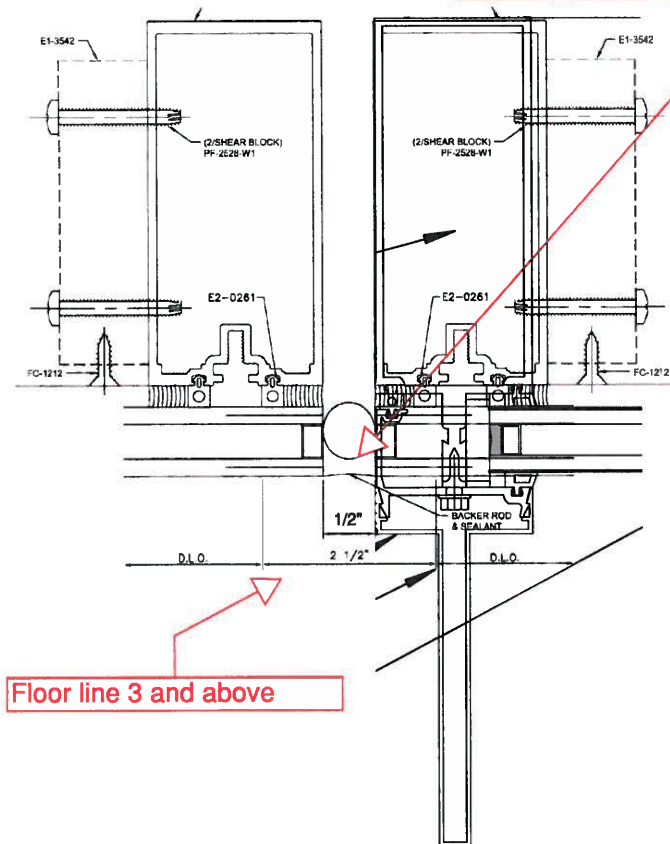
Mullion OK, $\leq 1/8"$ over allowable deflection.



New double mullion created at location highlighted in attached if EGS-1 is supported at floor line 2

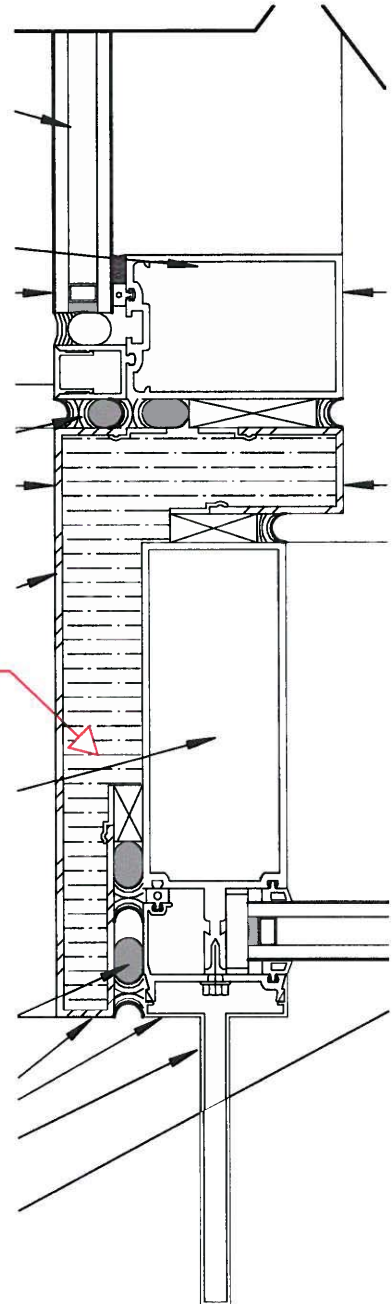
Mullions will grow at the same rate of expansion. Differential thermal movement is only between floor lines 2 - 3.

See thermal expansion calculation below, and full joint consideration of following page.



Floor line 3 and above

Floor line 2 to 3



Maximum Thermal Expansion Floor Line 2-3

INPUT	CHECK
Max Heights (h)	11.17 ft
E =	10100 ksi
Aluminum Expansion Coef =	0.00128
Temp at Construction =	40 deg
Max Temp of Alum =	120 deg

Thermal Expansion Calculation

$$\Delta \text{ temp} = T \text{ change}(\text{Coef}) * h \quad 0.14 \text{ in}$$



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Glazing Systems

Fast, Friendly, Affordable

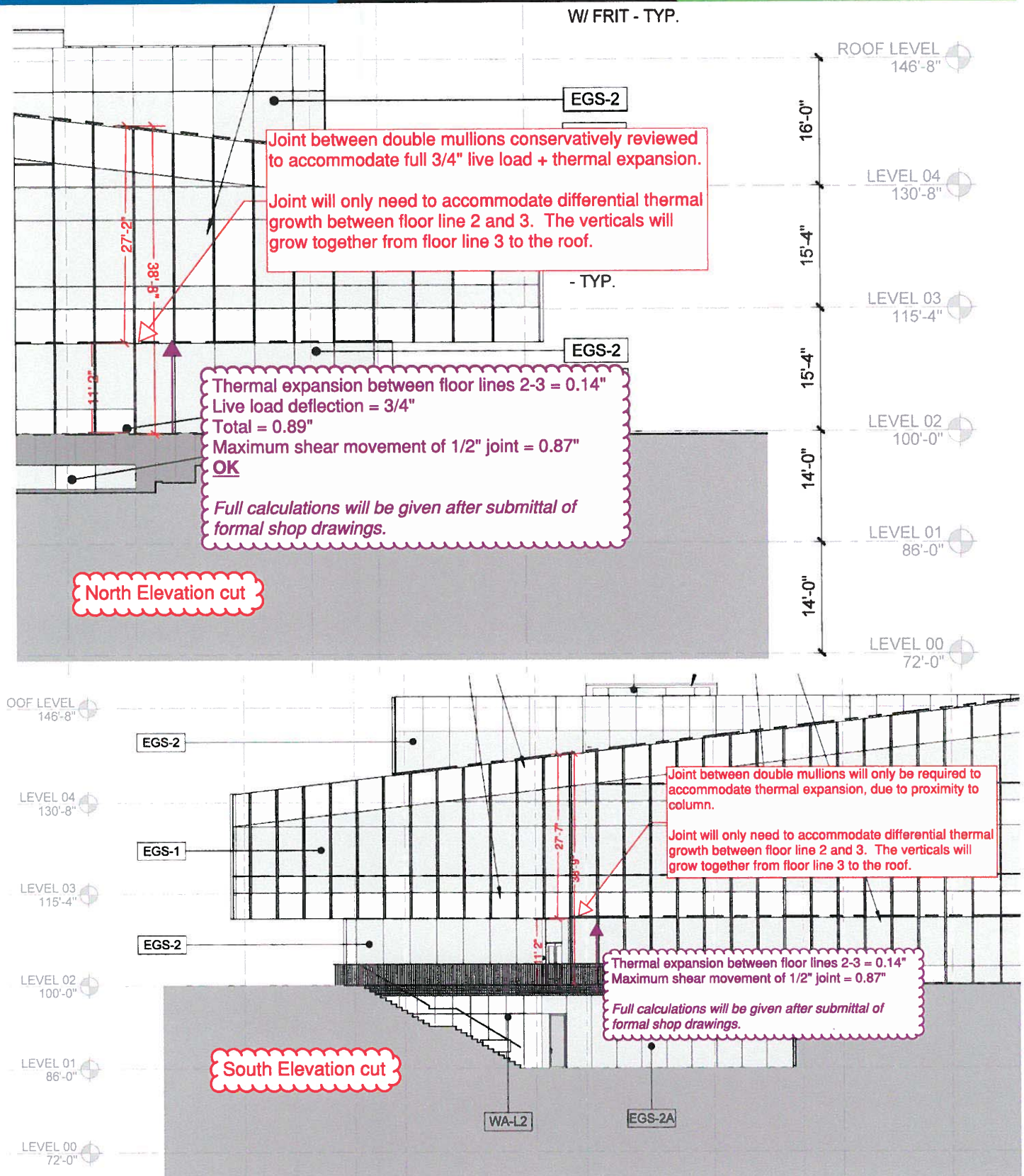
Webster University

Dan Ward

Project #JE16059

June 24, 2016

56



Office: 816-505-0987
info@jeistructural.com
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Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Allowable Extension:

100%

Allowable Compression:

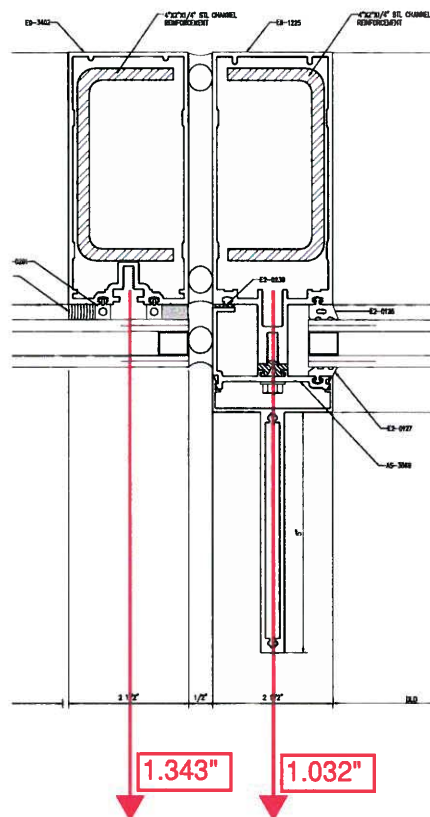
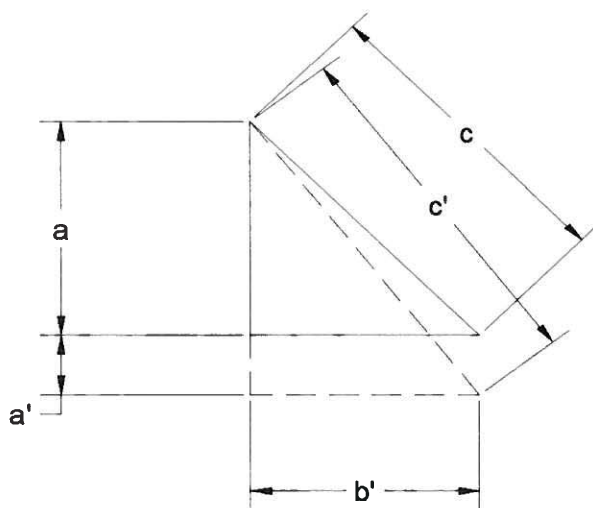
50%

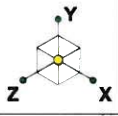
Full deflection from both, no reduction taken here

$$1.343'' - 1.032'' = 0.655''$$

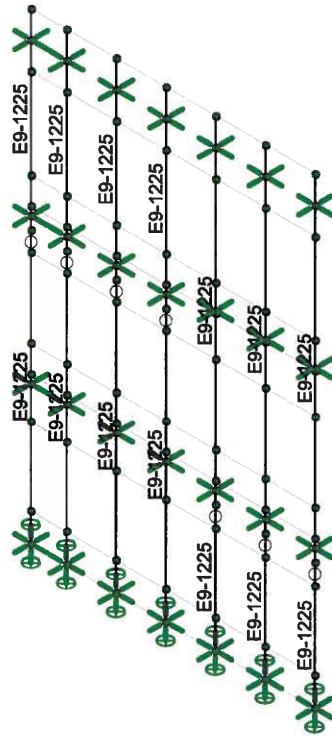
E9-3402 from previous analysis (Check 1.1)

OK
OK





Section sets



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 205, 207, 211

JEI Structural Engineering

M. Gorny

JE16059

Webster University

SK - 5

Nov 14, 2016 at 9:14 AM

EGS-1 Preliminary.r3d



JEI Structural Engineering

Glazing Systems

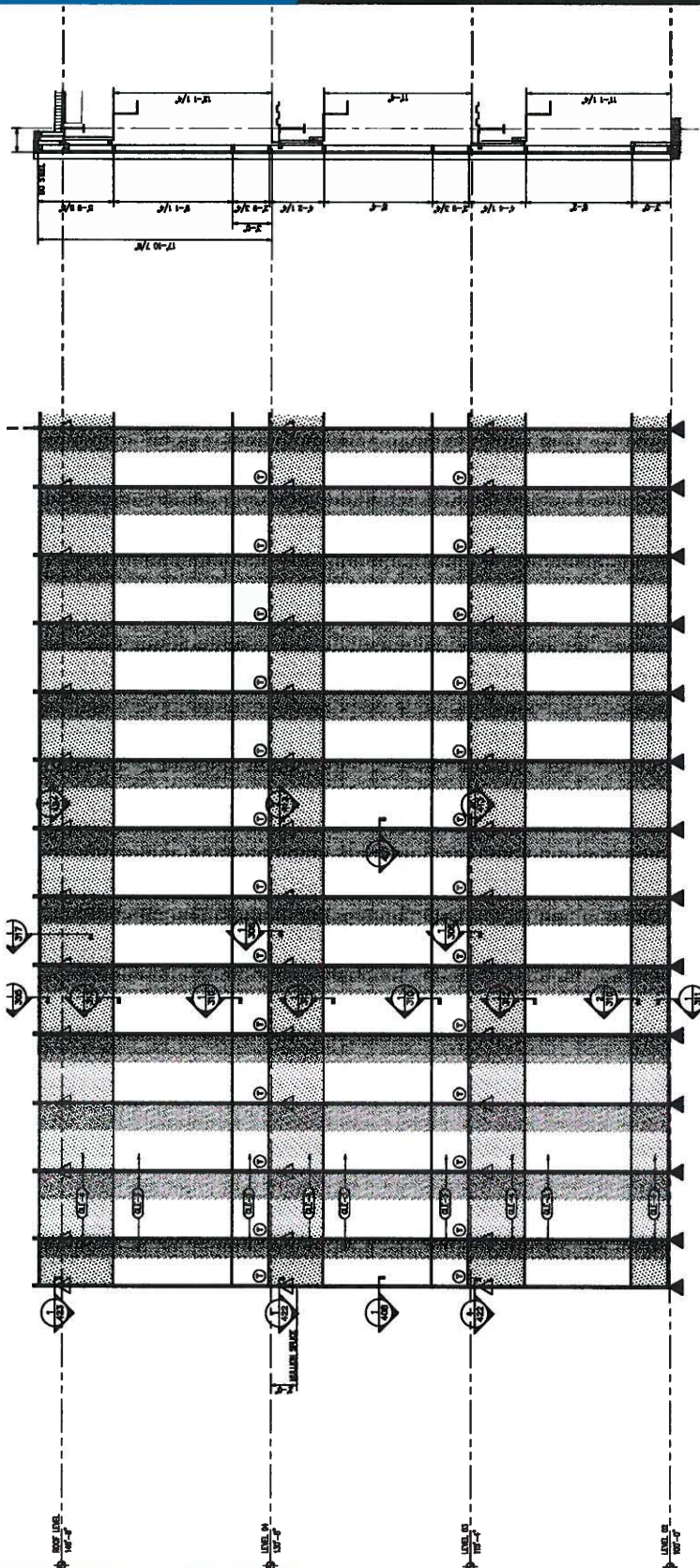
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NGG

Project #JE16059

November 7, 2016

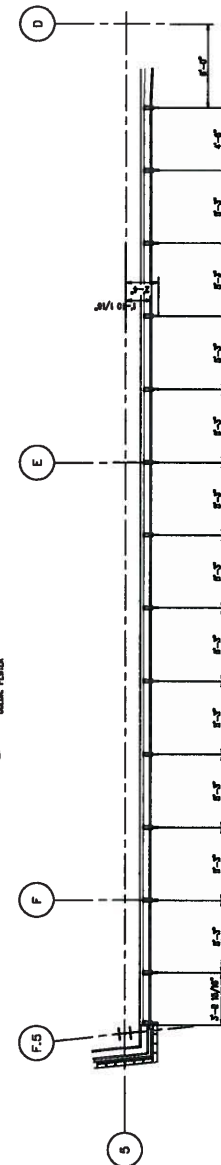


SECTION
Scale: 3/4"=1'-0"
ARCH REF: 1/10/2012

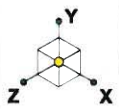
EGS-1 YKK YCW 750 SSG
(2-1/2" x 7-1/2"). Shop
drawing sheets 205, 207, 211

Sheet 205 used here to show
typical dimensions

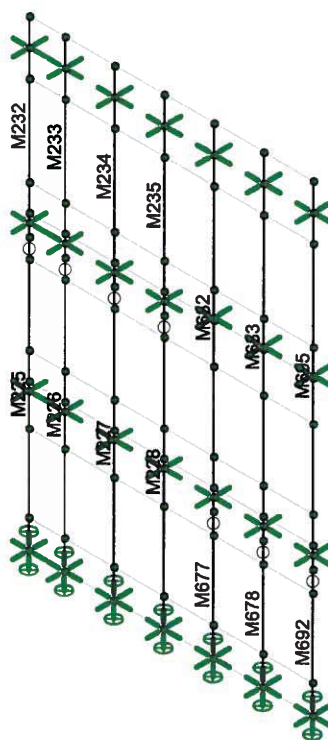
1 WEST ELEVATION
Scale: 3/4"=1'-0"
ARCH REF: 1/10/2012



2 PLAN
Scale: 3/4"=1'-0"
ARCH REF: 1/10/2012



Member labels



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 205, 207, 211

JEI Structural Engineering

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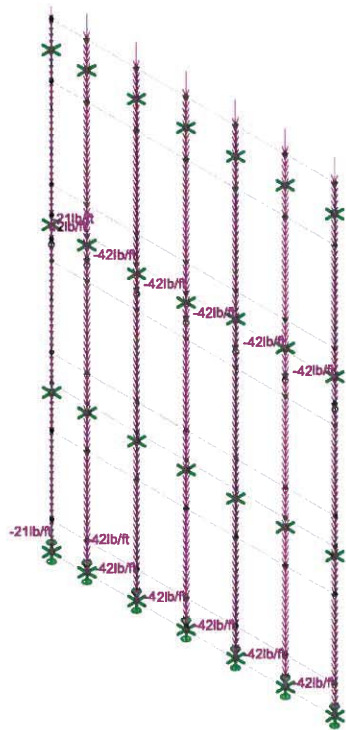
SK - 6

Nov 14, 2016 at 9:15 AM

EGS-1 Preliminary.r3d



Dead load
 $8\text{psf (5' 3)} = 42\text{lb/ft (21lb/ft at jambs)}$



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 205, 207, 211

Loads: BLC 7, Dead

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JE16059

Webster University

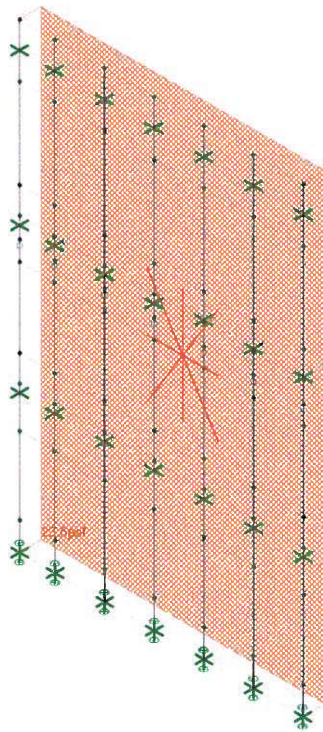
SK - 32

Nov 2, 2016 at 6:49 AM

EGS-1 Preliminary.r3d



Negative Wind - 23.5psf



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 205, 207, 211

Loads: BLC 1, Negative Wind (Face A)

JEI Structural Engineering

M. Gorny

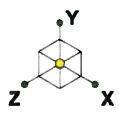
JE16059

Webster University

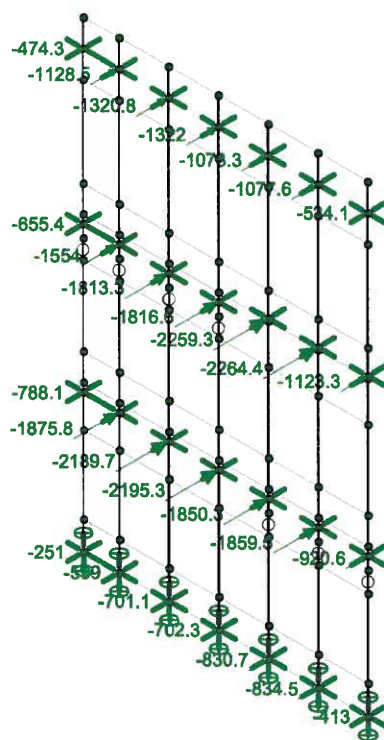
SK - 33

Nov 2, 2016 at 6:50 AM

EGS-1 Preliminary.r3d



Anchor Loads



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 205, 207, 211

Results for LC 1, Negative Wind Face A
Z-direction Reaction Units are lb and lb-ft

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M. Gorny

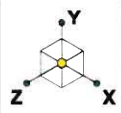
JE16059

Webster University

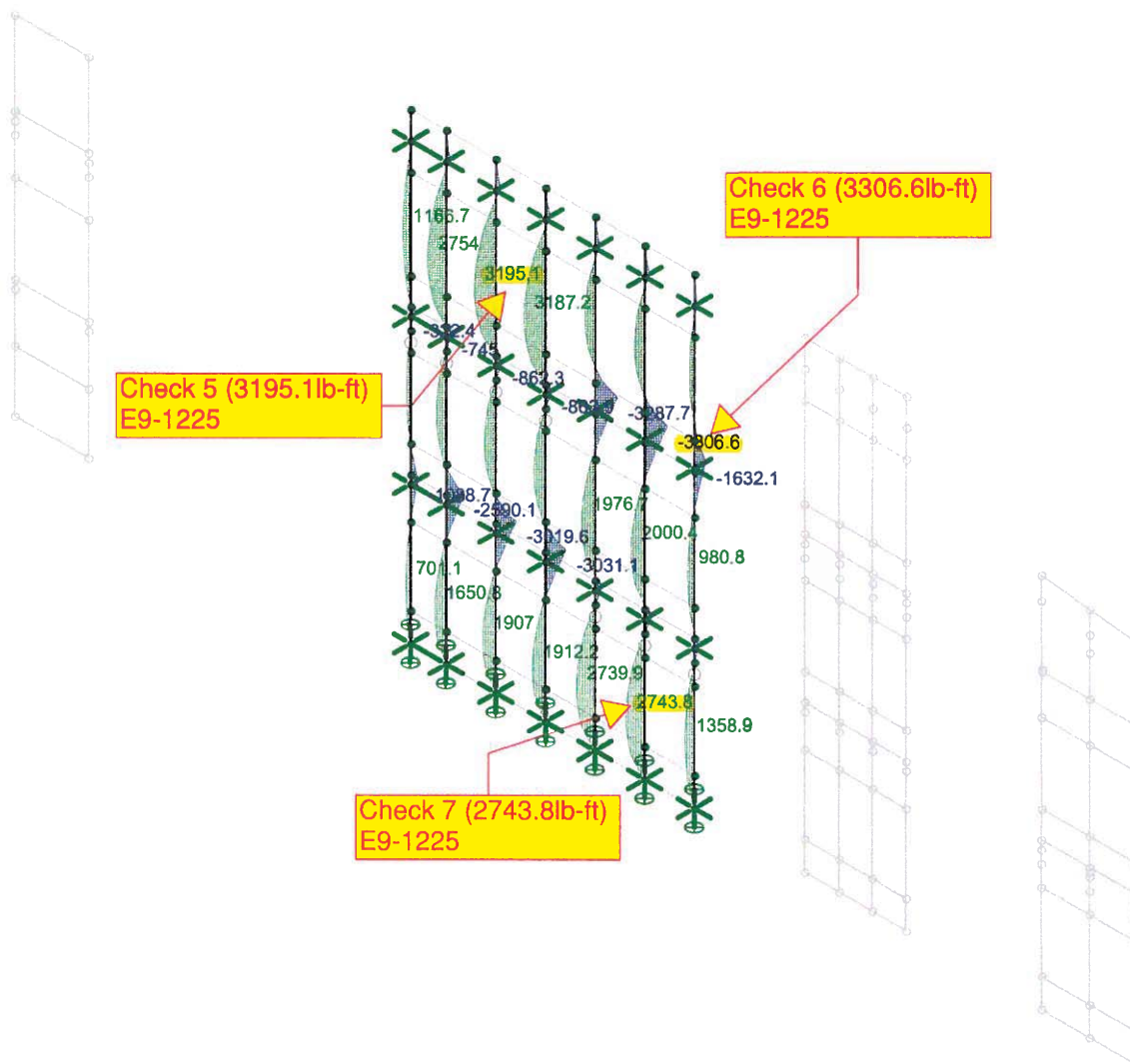
SK - 8

Nov 14, 2016 at 9:16 AM

EGS-1 Preliminary.r3d



Moment diagram



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 205, 207, 211

Results for LC 1, Negative Wind Face A
Member z Bending Moments (lb-ft)

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M. Gorny

JE16059

Webster University

SK - 9

Nov 14, 2016 at 10:12 AM

EGS-1 Preliminary.r3d

Beam: **M234**

Shape:

Material: **gen_Alum**

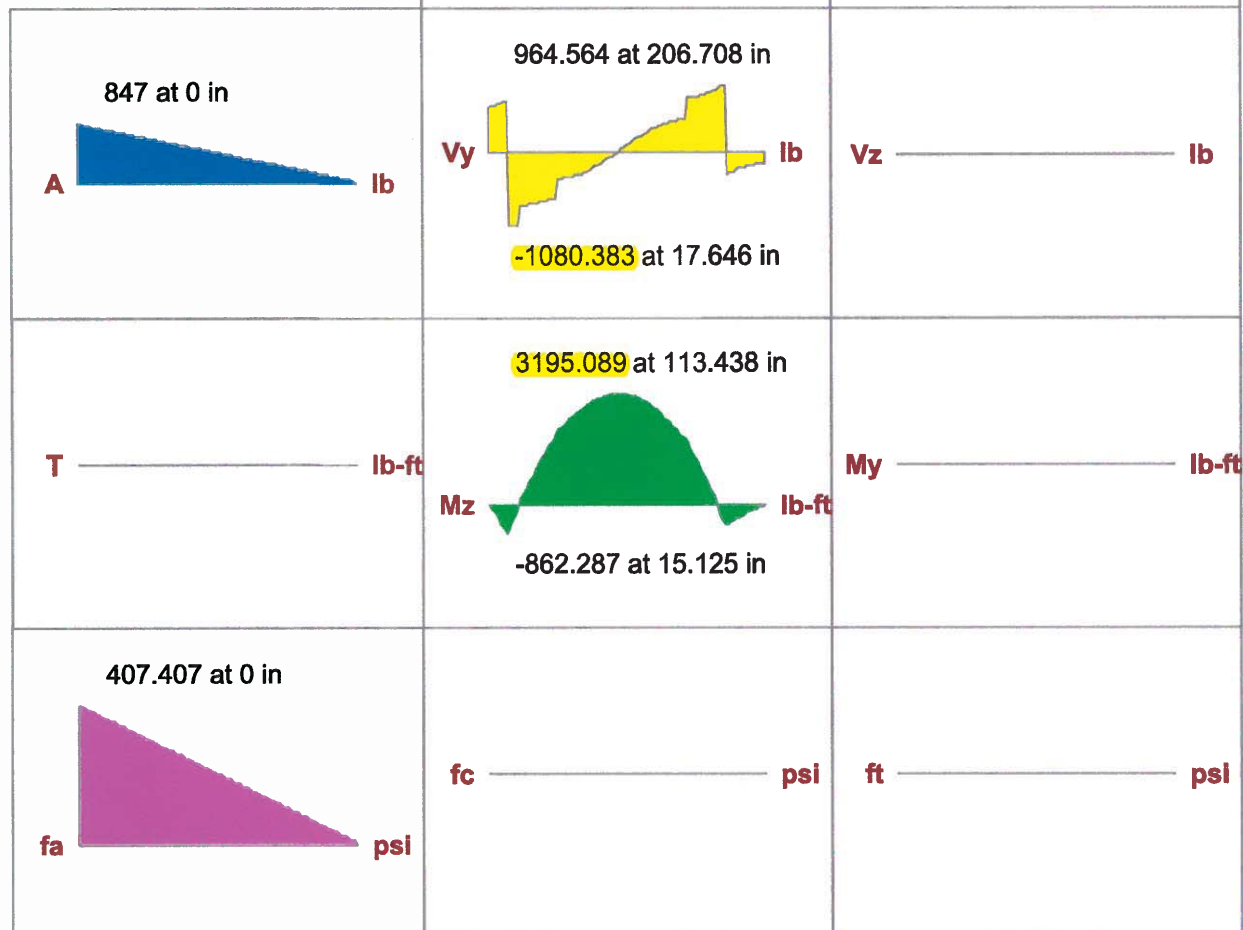
Length: **242 in**

I Joint: **N303**

J Joint: **N250**

Code Check: **No Calc**

Report Based On 97 Sections



Check 5

YKK E9-1225

Using reduced pressure based on 70sf area to reduce deflection.

$Dy = 1.358'' (17\text{psf} / 23.5\text{psf}) = 1.098''$

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Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/205
Detail: 1/407

Member M234

Check 5

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 5.25 ft $F_y = 25.0$ ksi
Height (h) 16.00 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 19.0 psf (Using reduced area load based on 70sf)
Panel Weight (p_{wt}) 8.0 psf (deflection only)

Manuf. / Part #: YKK E9-1225

$E = 10100$ ksi $r_{x, alum} = 2.176$ in
 $I_{x, alum} = 9.838$ in⁴ $r_{y, alum} = 0.935$ in
 $I_{y, alum} = 1.818$ in⁴ $A = 2.079$ in²
 $S_{x, alum} = 3.213$ in³ $J = 4.110$ in⁴
 $S_{y, alum} = 1.454$ in³ $wt = 2.498$ lb/ft
 $b/t_{web} = 52.71$ $b/t_{flange} = 22.33$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = N/A$ lb/ft
Shear Load $V = wL/2$ $V = 1080.4$ lb
Moment $M = wL^2/8$ $M = 3195.1$ lb-ft
 $M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$ $M_{alum} = 3195.1$ lb-ft
 $f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$ $f_{b-alum} = 11.93$ ksi

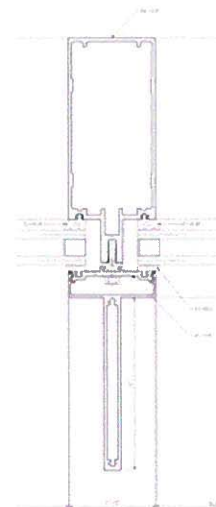
Applied Axial Compression

$P = p_{wt} \cdot t \cdot h + wt \cdot h$ $P = 847.0$ lb
 $f_{c-alum} = P/A$ $f_{c-alum} = 0.41$ ksi

Check Deflection	Typical Vertical
N/A in. joint $\Delta = (5wL^4)/(384EI) =$	1.098 in
N/A $\pm$ movement cap. $\Delta_{allow} =$	1.050 in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = #####

Steel Capacity

$M_{steel} = I_{x, steel} / I_{comb} =$ $M_{steel} = 0.0$ lb-ft
 $Mb/\Omega =$ $Mb/\Omega = 0$ lb-ft
 $Ms/(Mb/\Omega) =$ N/A



Reinforcing

$I_{x, steel} = 0.000$ in⁴
 $S_{x, steel} = 0.000$ in³
 $I_{combined} = 9.838$ in⁴

No Reinforcing

Load Share	
Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.92 ksi
E.3 - Axial Compression	4.49 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.60 ksi

Compression Interaction

Allowable Compression	$F_c = 4.49$ ksi
Compression Stress Interaction	$f_{c-alum}/F_c = 0.091$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure	
Allowable Flexural Compression	$F_b = 13.92$ ksi
Flexure Interaction	$f_{b-alum}/F_b = 0.857$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.948$

Mullion OK, $\leq 1/8"$ over allowable deflection.

Beam: **M683**

Shape:

Material: **gen_Alum**

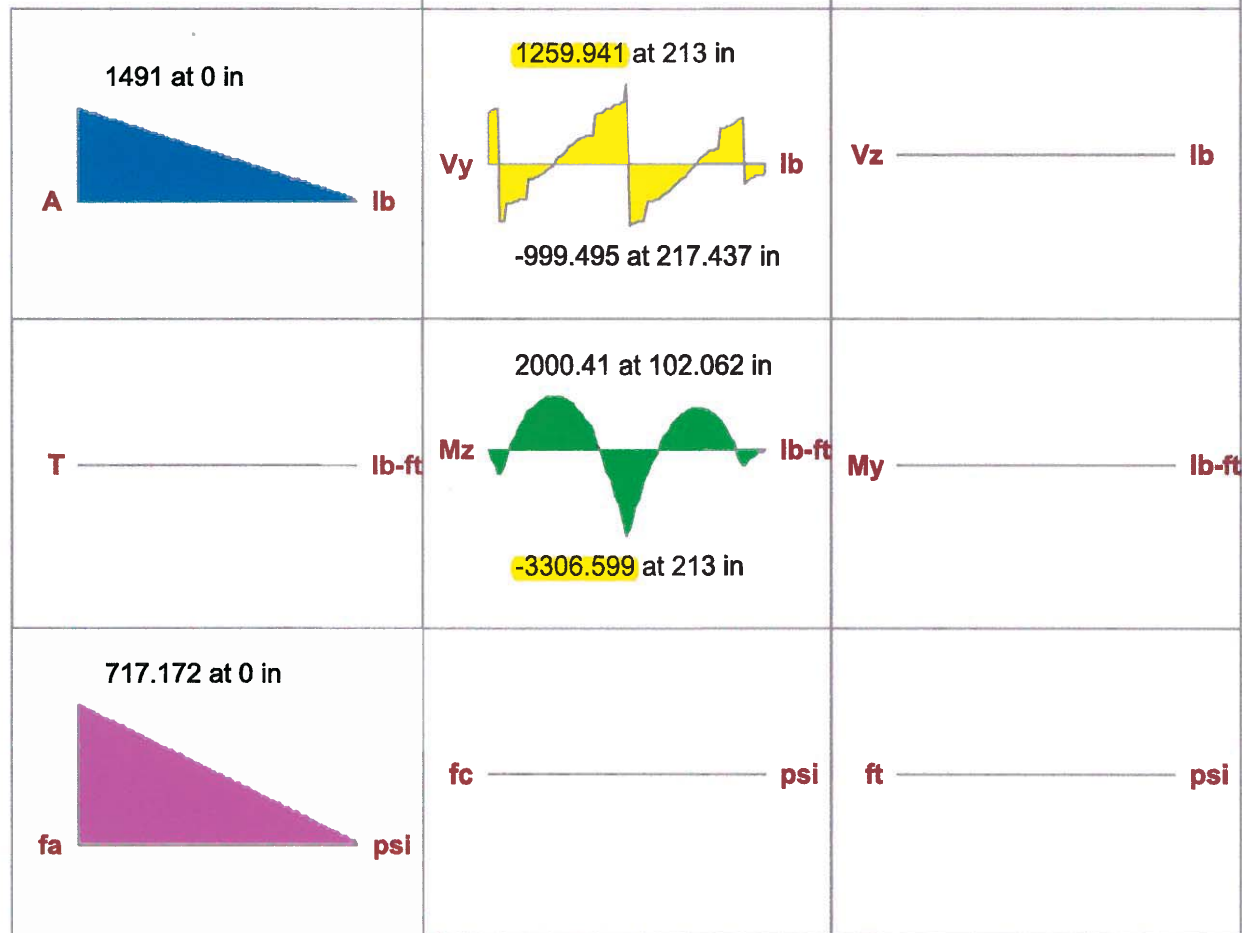
Length: **426 in**

I Joint: **N802**

J Joint: **N766**

Code Check: **No Calc**

Report Based On 97 Sections



Check 6

YKK E9-1225



JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/205
Detail: 1/407

Member M683

Check 6

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 5.25 ft $F_y = 25.0$ ksi
Height (h) 14.88 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 19.0 psf
Panel Weight (p_w) 8.0 psf

Manuf. / Part #: YKK E9-1225

$E = 10100$ ksi $r_{x, \text{alum}} = 2.176$ in
 $I_{x, \text{alum}} = 9.838$ in⁴ $r_{y, \text{alum}} = 0.935$ in
 $I_{y, \text{alum}} = 1.818$ in⁴ $A = 2.079$ in²
 $S_{x, \text{alum}} = 3.213$ in³ $J = 4.110$ in⁴
 $S_{y, \text{alum}} = 1.454$ in³ $wt = 2.498$ lb/ft
 $b/t_{\text{web}} = 52.71$ $b/t_{\text{flange}} = 22.33$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = \text{N/A}$ lb/ft
Shear Load $V = wL/2$ $V = 1259.9$ lb
Moment $M = wL^2/8$ $M = 3306.6$ lb-ft
 $M_{\text{alum}} = M \cdot I_{\text{alum}} \cdot \text{TRF}_i / I_{\text{comb}}$ $M_{\text{alum}} = 3306.6$ lb-ft
 $f_{b-\text{alum}} = M_{\text{alum}} / (S_{x, \text{alum}} \cdot \text{TRF}_s)$ $f_{b-\text{alum}} = 12.35$ ksi

Applied Axial Compression

$P = p_w \cdot t \cdot h + wt \cdot h$ $P = 847.0$ lb
 $f_{c-\text{alum}} = P/A$ $f_{c-\text{alum}} = 0.41$ ksi

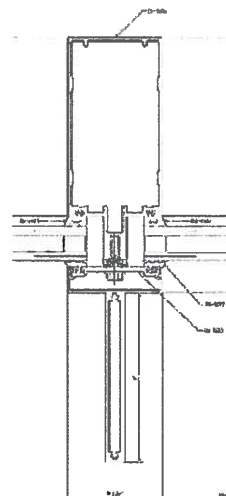
Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) = 0.716$ in
N/A $\pm$ movement cap. $\Delta_{\text{allow}} = 0.994$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$
Deflection Factor DF = #####

Steel Capacity

$M_{\text{steel}} = I_{x, \text{steel}} / I_{\text{comb}} =$ $M_{\text{steel}} = 0.0$ lb-ft
 $M_b/\Omega =$ $M_b/\Omega = 0$ lb-ft
 $M_s/(M_b/\Omega) = \text{N/A}$



Reinforcing

No Reinforcing

$I_{x, \text{steel}} = 0.000$ in⁴
 $S_{x, \text{steel}} = 0.000$ in³
 $I_{\text{combined}} = 9.838$ in⁴

Load Share

Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.92 ksi
E.3 - Axial Compression	4.49 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.60 ksi

Compression Interaction

Allowable Compression $F_c = 4.49$ ksi
Compression Stress Interaction $f_{c-\text{alum}}/F_c = 0.091$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure

Allowable Flexural Compression $F_b = 13.92$ ksi
Flexure Interaction $f_{b-\text{alum}}/F_b = 0.887$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.978$

Mullion OK

Beam: **M678**

Shape:

Material: **gen_Alum**

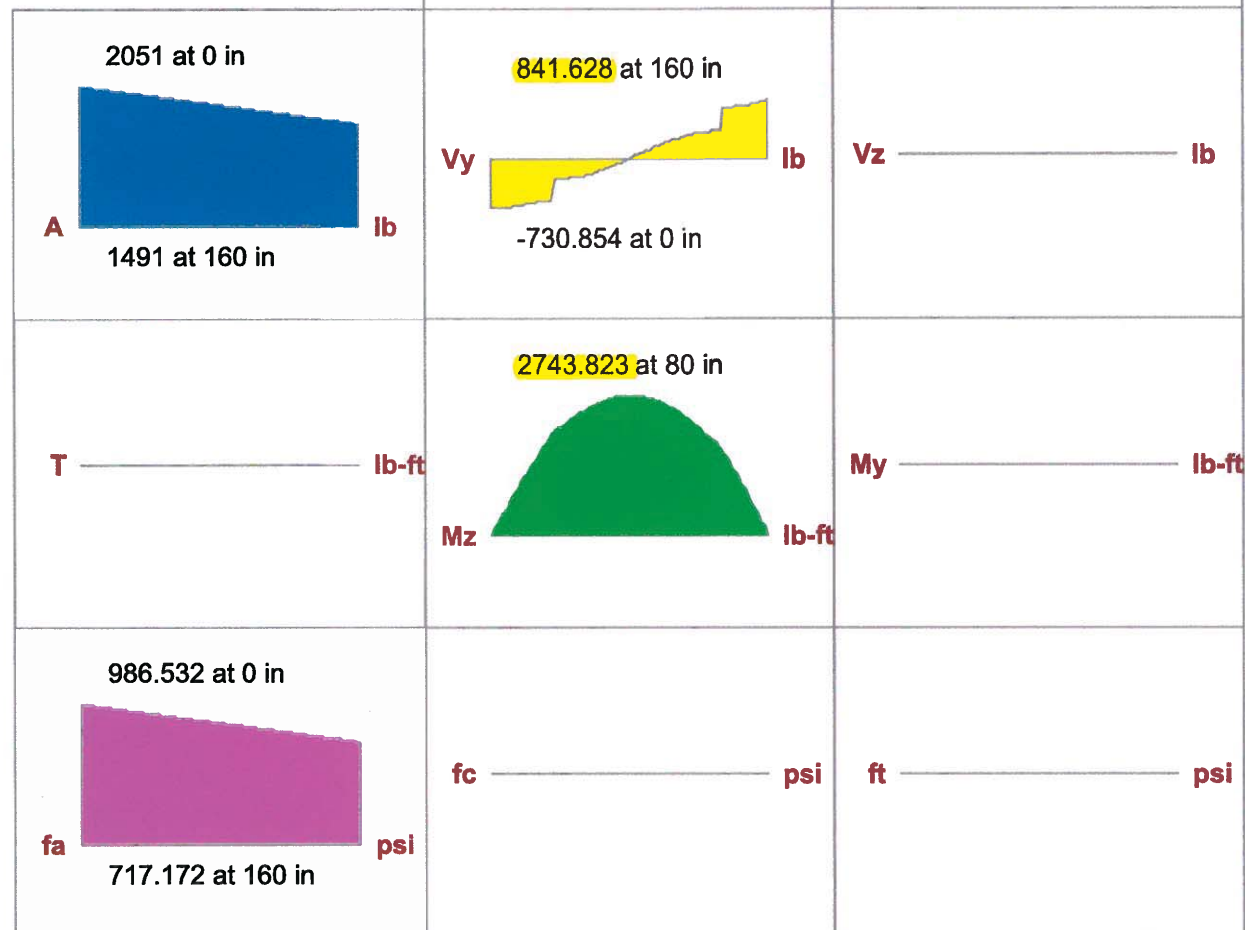
Length: **160 in**

I Joint: **N765**

J Joint: **N802**

Code Check: **No Calc**

Report Based On 97 Sections



Check 7

YKK E9-1225



JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/205
Detail: 1/407 **Member M678**

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Check 7

Load Design Code

ASCE7-05 ASD

Material Design Code

Aluminum Design Manual 2010

ADM 2010 Type Alloy-Temper

Closed Shape 6063-T6

Tributary Width (t) 5.25 ft $F_y = 25.0$ ksi
Height (h) 16.46 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 23.5 psf
Panel Weight (p_w) 8.0 psf

Manuf. / Part #: YKK E9-1225

$E = 10100$ ksi $r_{x, \text{alum}} = 2.176$ in
 $I_{x, \text{alum}} = 9.838$ in⁴ $r_{y, \text{alum}} = 0.935$ in
 $I_{y, \text{alum}} = 1.818$ in⁴ $A = 2.079$ in²
 $S_{x, \text{alum}} = 3.213$ in³ $J = 4.110$ in⁴
 $S_{y, \text{alum}} = 1.454$ in³ $wt = 2.498$ lb/ft
 $b/t_{web} = 52.71$ $b/t_{flange} = 22.33$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = \text{N/A}$ lb/ft
Shear Load $V = wL/2$ $V = 841.6$ lb
Moment $M = wL^2/8$ $M = 2743.8$ lb-ft
 $M_{\text{alum}} = M \cdot I_{\text{alum}} \cdot \text{TRF}_i / I_{\text{comb}}$ $M_{\text{alum}} = 2743.8$ lb-ft
 $f_{b-\text{alum}} = M_{\text{alum}} / (S_{x, \text{alum}} \cdot \text{TRF}_s)$ $f_{b-\text{alum}} = 10.25$ ksi

Applied Axial Compression

$P = p_w \cdot t \cdot h + wt \cdot h$ $P = 2051.0$ lb
 $f_{c-\text{alum}} = P/A$ $f_{c-\text{alum}} = 0.99$ ksi

Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) = 0.775$ in

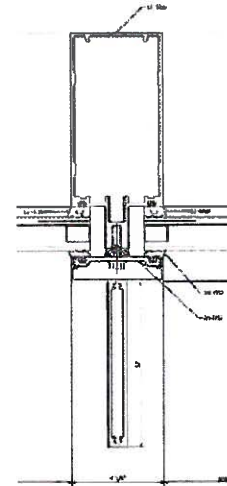
N/A $\pm$ movement cap. $\Delta_{\text{allow}} = 1.073$ in

Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$

Deflection Factor
DF = #####

Steel Capacity

$M_{\text{steel}} = I_{x, \text{steel}} / I_{\text{comb}} =$ $M_{\text{steel}} = 0.0$ lb-ft
 $Mb/\Omega =$ $Mb/\Omega = 0$ lb-ft
 $Ms/(Mb/\Omega) = \text{N/A}$



Reinforcing

No Reinforcing

$I_{x, \text{steel}} = 0.000$ in⁴
 $S_{x, \text{steel}} = 0.000$ in³
 $I_{\text{combined}} = 9.838$ in⁴

Load Share

Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.92 ksi
E.3 - Axial Compression	4.49 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.60 ksi

Compression Interaction

Allowable Compression	$F_c = 4.49$ ksi
Compression Stress Interaction	$f_{c-\text{alum}}/F_c = 0.220$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure	
Allowable Flexural Compression	$F_b = 13.92$ ksi
Flexure Interaction	$f_{b-\text{alum}}/F_b = 0.736$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.956$

Mullion OK

Beam: **M232**

Shape:

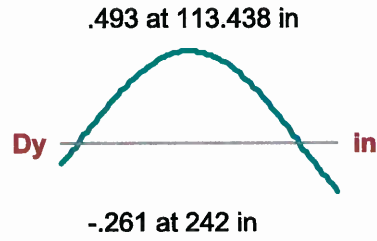
Material: **gen_Alum**

Length: **242 in**

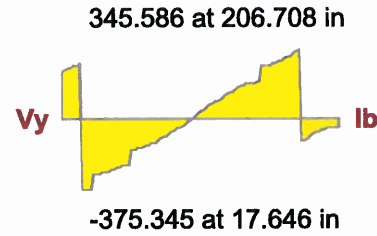
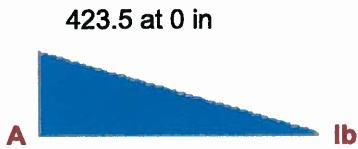
I Joint: **N301**

J Joint: **N246A**

Code Check: **No Calc**
Report Based On 97 Sections

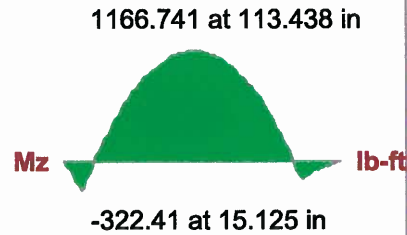


Dz _____ in

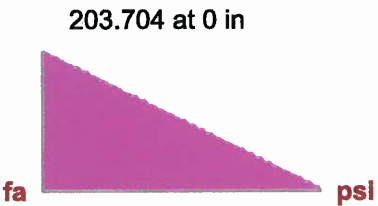


Vz _____ lb

T _____ lb-ft



My _____ lb-ft



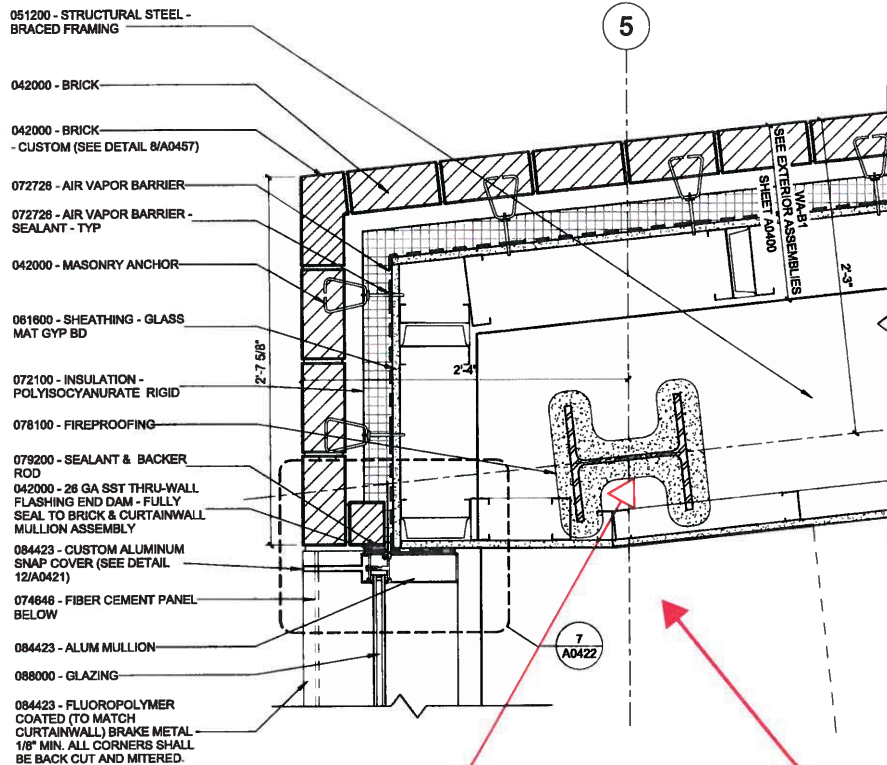
fc _____ psi

ft _____ psi

YKK E9-1225 jamb mullion

OK in terms of stress and deflection by comparison to Check 5

See following sheets for sealant joint analysis



1 PLAN DETAIL - NW CORNER - BRICK TO CW
1 1/2" = 1'-0"

1/A0421

Due to proximity to column.
This joint will not be
required to accommodate
live load deflection.

Maximum Thermal Expansion at roof

INPUT CHECK

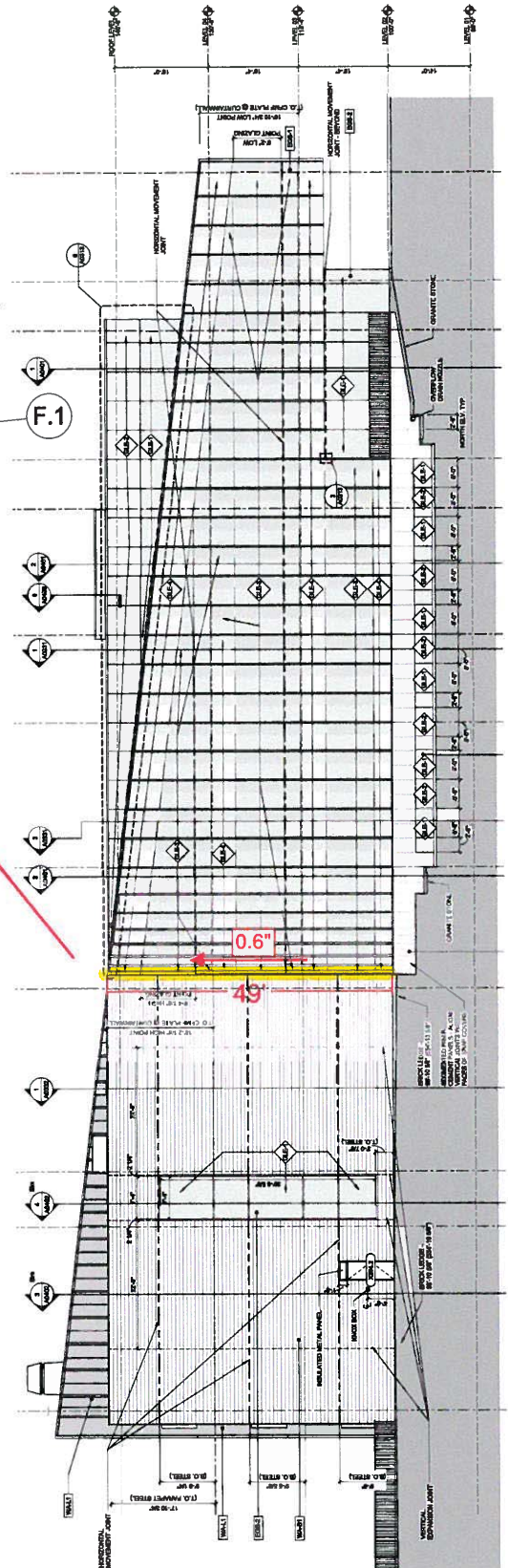
Max Heights (h) 49.00 ft
E = 10100 ksi
Aluminum Expansion Coef = 0.00128
Temp at Construction = 40 deg
Max Temp of Alum = 120 deg

Thermal Expansion Calculation

$\Delta \text{temp} = T \text{ change}(\text{Coef}) \cdot h$ 0.60 in

Use 1/2" Tremco Spectrum 1 silicone joint

See following page for maximum joint movement
in shear.





JEI Structural Engineering
7280 NW 87th Terrace, Suite C-208
Kansas City, MO 64153

Office: 816-505-0987
info@jeistructural.com
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Perimeter Sealant Joint Under Combined
In-Plane / Out-of-Plane Movement

Date: 11/7/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Sealant: Dow Corning 790 Silicone Building Sealant

Allowable Extension:

100%

Allowable Compression:

50%

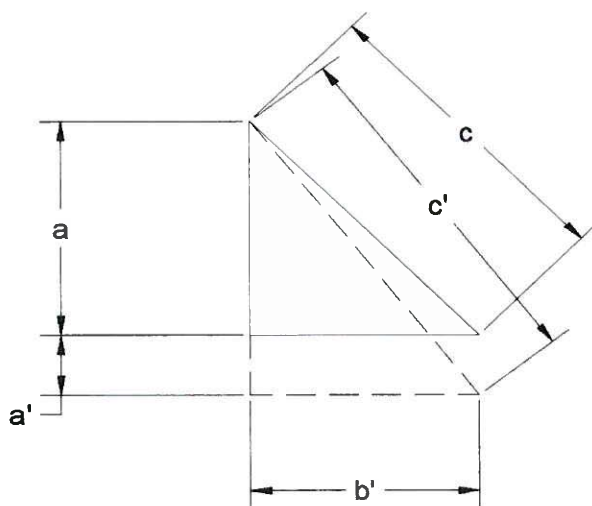
Joint Dimensions

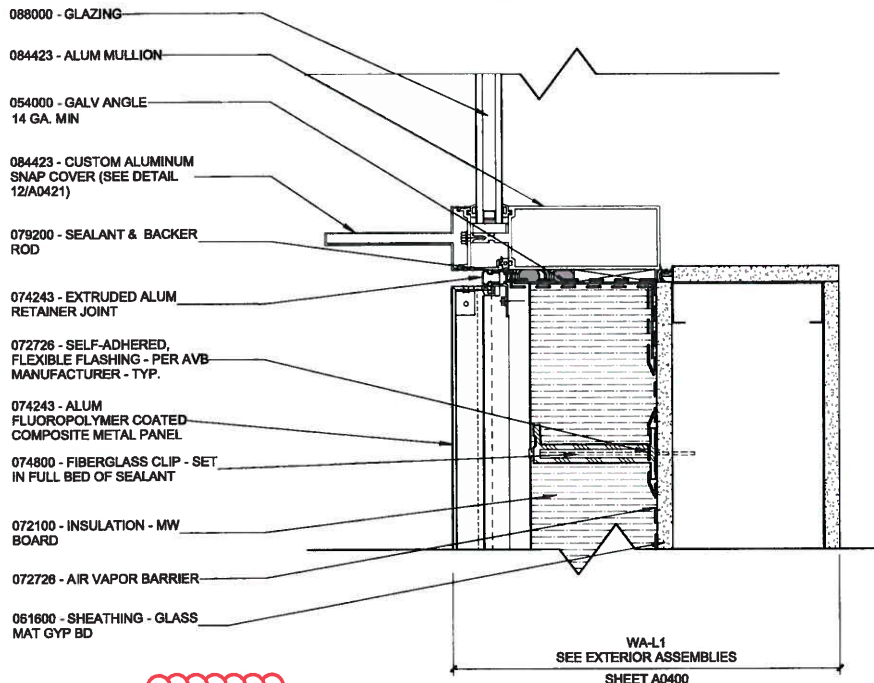
Nominal Joint Width:	$a =$	0.500 in
In-Plane Movement:	$a' =$	0.000 in
Out-of-Plane Movement:	$b' =$	0.493 in
Maximum thermal expansion	$c' =$	0.600 in

Joint Movements Checks

Allowable Expanded Length	$c'_{\text{allow}} =$	1.000 in
Allowable Compressed Length	$a_{\text{allow}} =$	0.250 in
Joint Compressed Length	$a - a' =$	0.500
Joint Expanded Length	$c' =$	0.924 in

OK
OK





3/A0421

3 PLAN DETAIL - CURTAINWALL JAMB @ METAL COMPOSITE PANEL 3" = 1'-0"

Maximum Thermal Expansion at roof

INPUT	CHECK
Max Heights (h)	49.00 ft
E =	10100 ksi
Aluminum Expansion Coef =	0.00128
Temp at Construction =	40 deg
Max Temp of Alum =	120 deg
Thermal Expansion Calculation	
$\Delta \text{ temp} = T \text{ change}(\text{Coef}) \cdot h$	0.60 in

Use 5/8" Tremco Spectrum 1 silicone joint

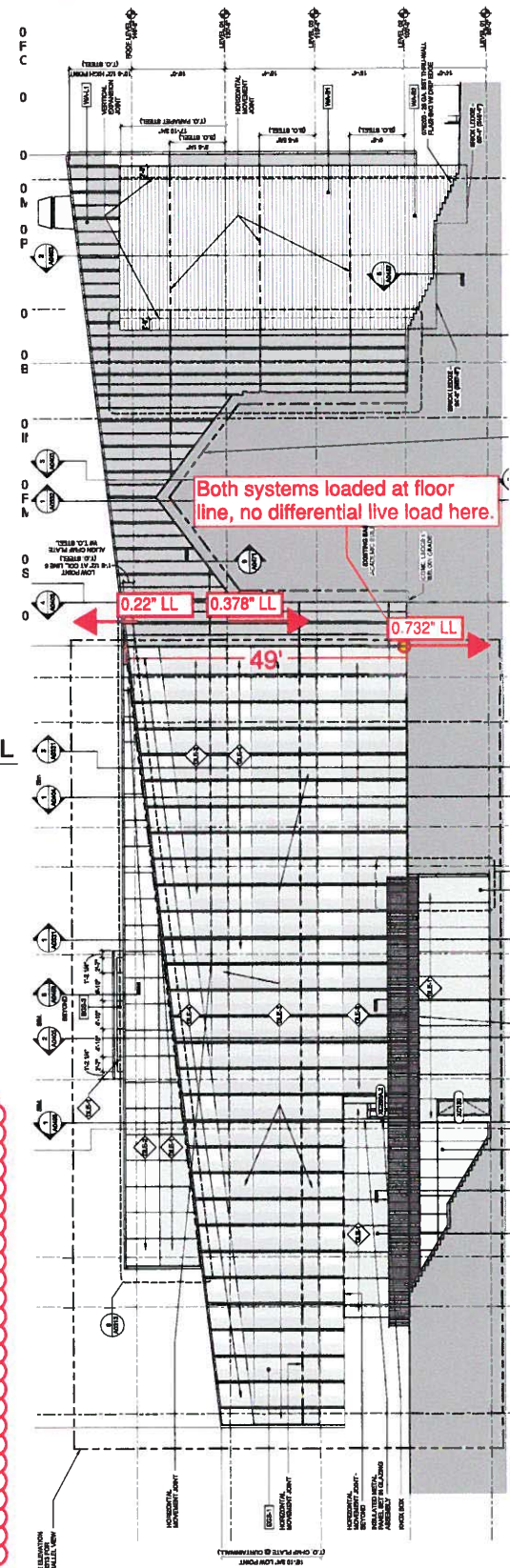
1) Maximum thermal expansion and live load movement at each floor line can occur simultaneously, since metal panel system is dead loaded at each level.
*Conservatively use maximum thermal expansion at roof with maximum live load movement provided for Level 4.

$0.6" + 0.378" \text{ (down, at level 4 per SOR)} = 0.978"$

2) Live Load at level 2 will drop EGS-1 down, while live load movement up at each level (per SOR of metal panel system) will lift the metal panel system. This could occur simultaneously.
*Worst case occurs at roof.

$0.732" \text{ (down, at level 2 per SOR)} + 0.22" \text{ (up, at roof per SOR)} = 0.952"$

Condition 1 controls. Maximum shear movement = 0.978"
See following page for maximum joint movement in shear.





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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Perimeter Sealant Joint Under Combined
In-Plane / Out-of-Plane Movement

Date: 11/7/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Sealant: Dow Corning 790 Silicone Building Sealant

Allowable Extension:

100%

Allowable Compression:

50%

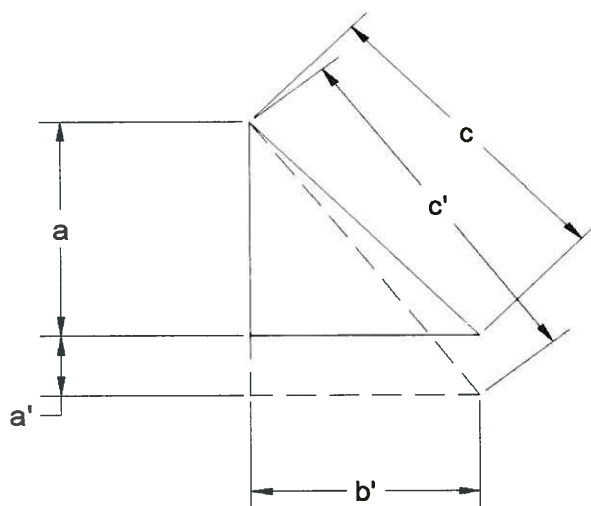
Joint Dimensions

Nominal Joint Width:	$a = 0.625$ in
In-Plane Movement:	$a' = 0.000$ in
Out-of-Plane Movement:	$b' = 0.493$ in
Maximum thermal expansion	$c' = 0.978$ in

Joint Movements Checks

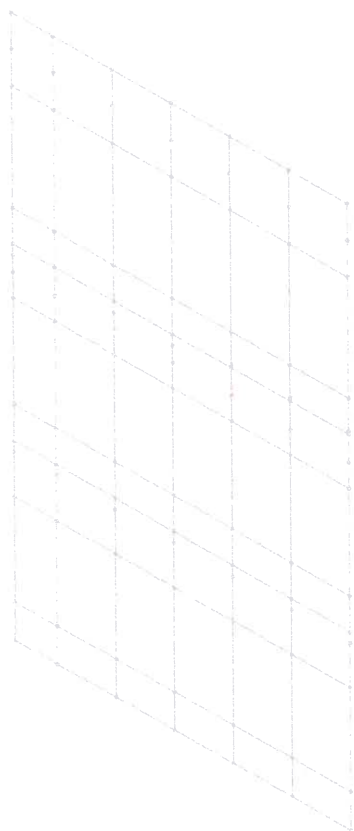
Allowable Expanded Length	$c'_{\text{allow}} = 1.250$ in
Allowable Compressed Length	$a_{\text{allow}} = 0.313$ in
Joint Compressed Length	$a - a' = 0.625$
Joint Expanded Length	$c' = 1.261$ in

OK
OK





Section sets



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 206, 212

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M. Gorny

JE16059

Webster University

SK - 36

Nov 2, 2016 at 7:06 AM

EGS-1 Preliminary.r3d



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Glazing Systems
Fast, Friendly, Affordable

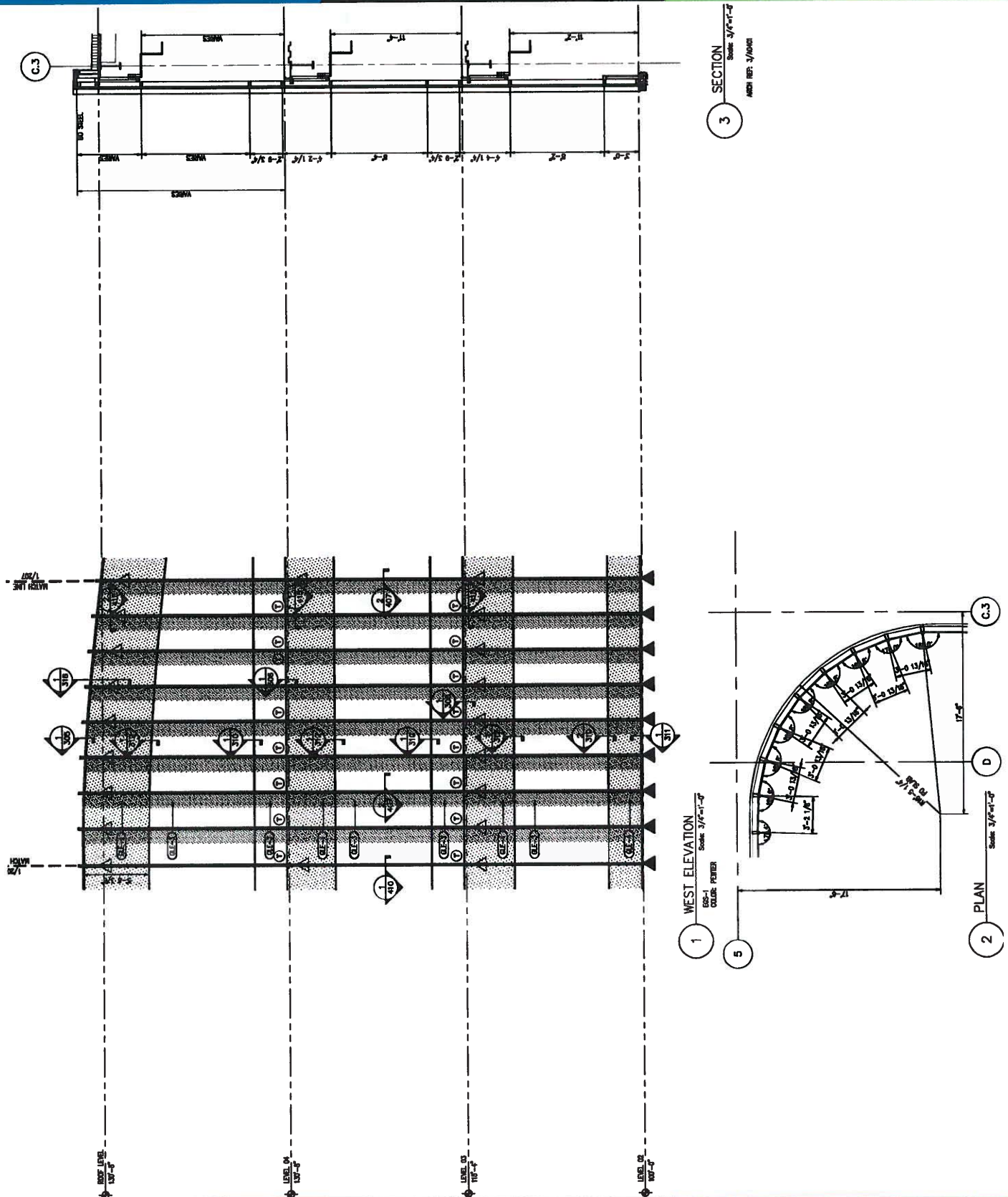
Webster University

NGG

Project #JE16059

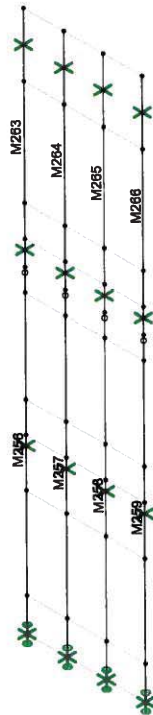
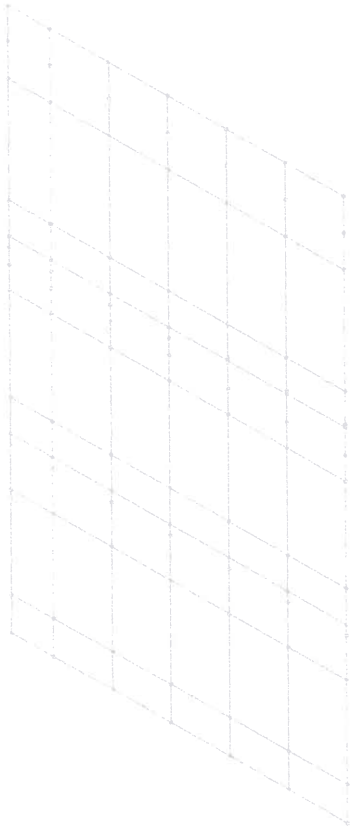
November 7, 2016

77





Member labels



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 206, 212

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M. Gorny

JE16059

Webster University

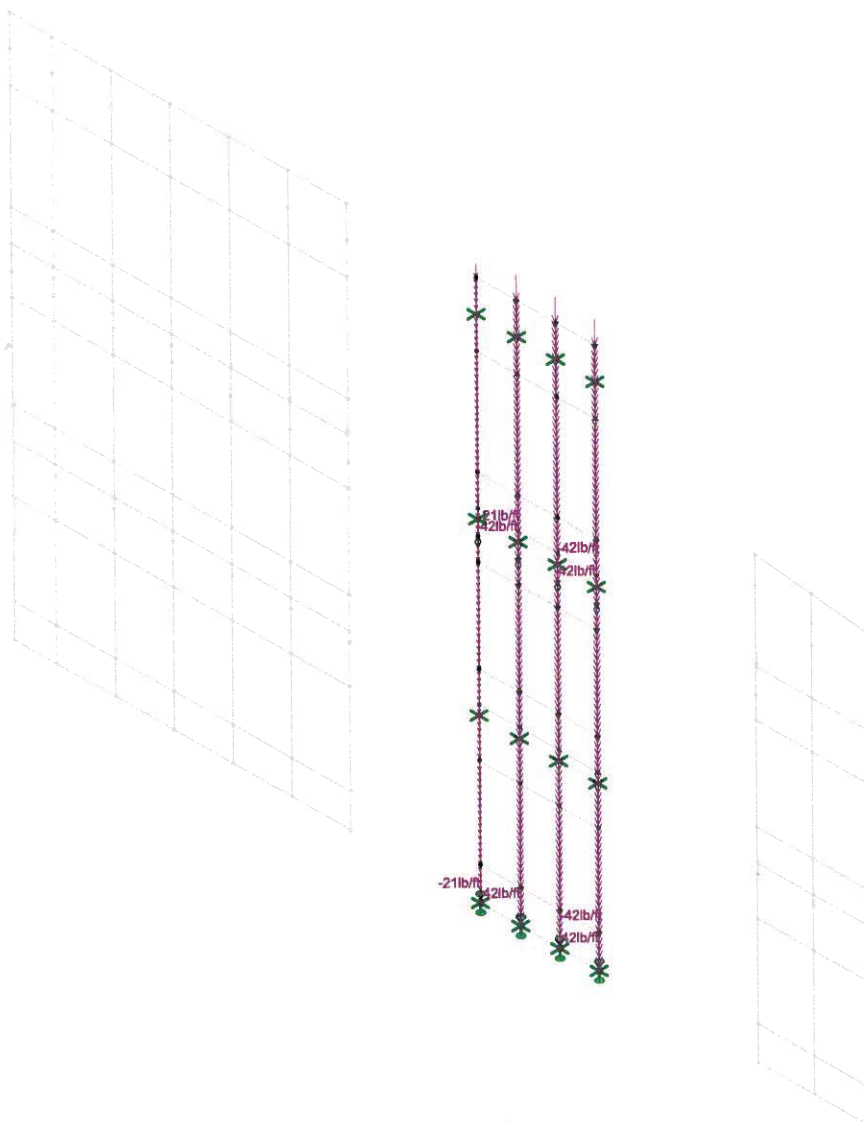
SK - 37

Nov 2, 2016 at 7:07 AM

EGS-1 Preliminary.r3d



Dead load
 $8\text{psf } (5' 3") = 42\text{lb/ft } (21\text{lb/ft at jambs})$



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 206, 212

Loads: BLC 7, Dead

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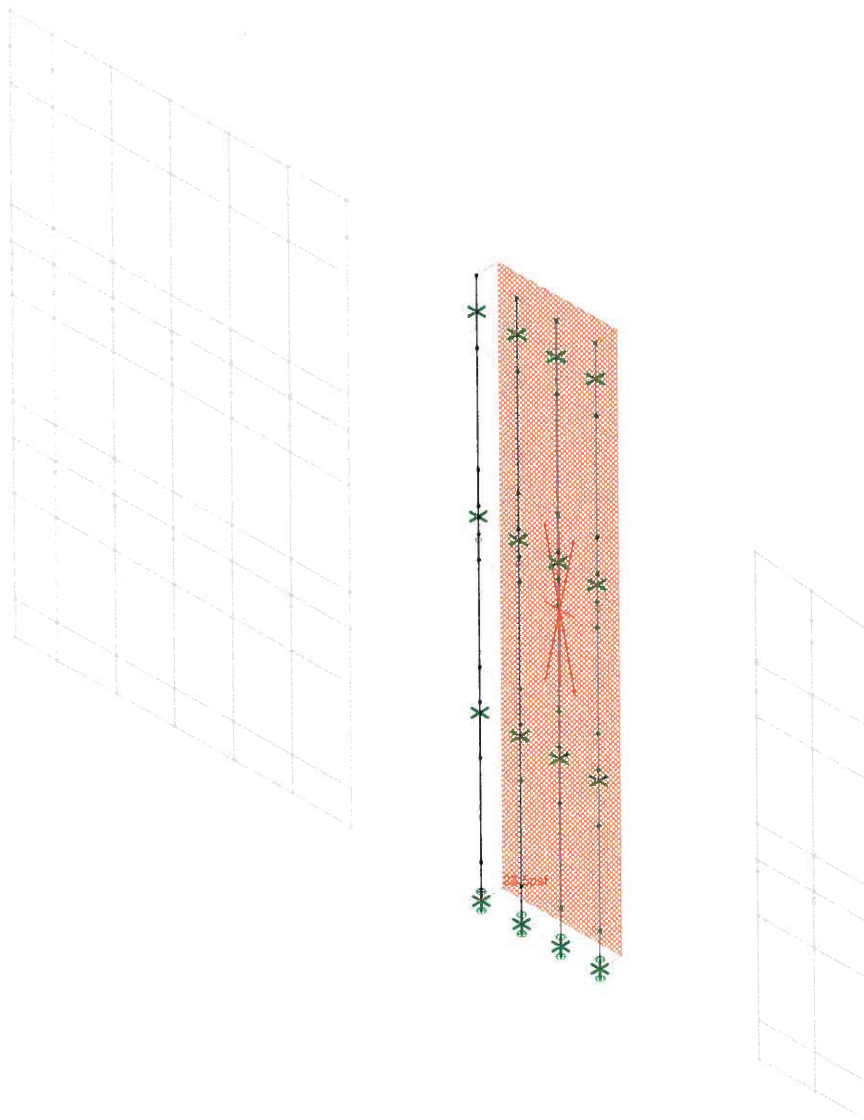
SK - 38

Nov 2, 2016 at 7:07 AM

EGS-1 Preliminary.r3d



Negative Wind - 23.5psf



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 206, 212

Loads: BLC 1, Negative Wind (Face A)

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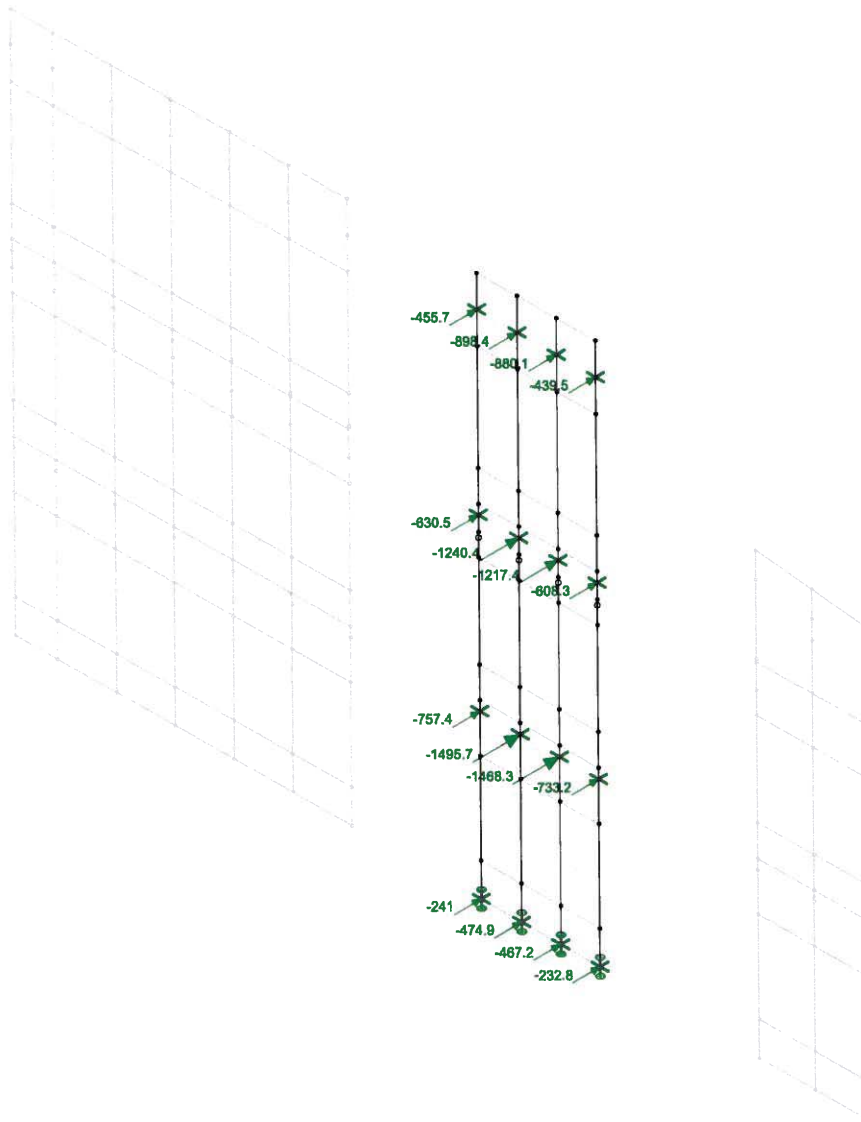
SK - 39

Nov 2, 2016 at 7:07 AM

EGS-1 Preliminary.r3d



Anchor Loads



EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 206, 212

Results for LC 1, Negative Wind Face A
Z-direction Reaction Units are lb and lb-ft

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M. Gorny

JE16059

Webster University

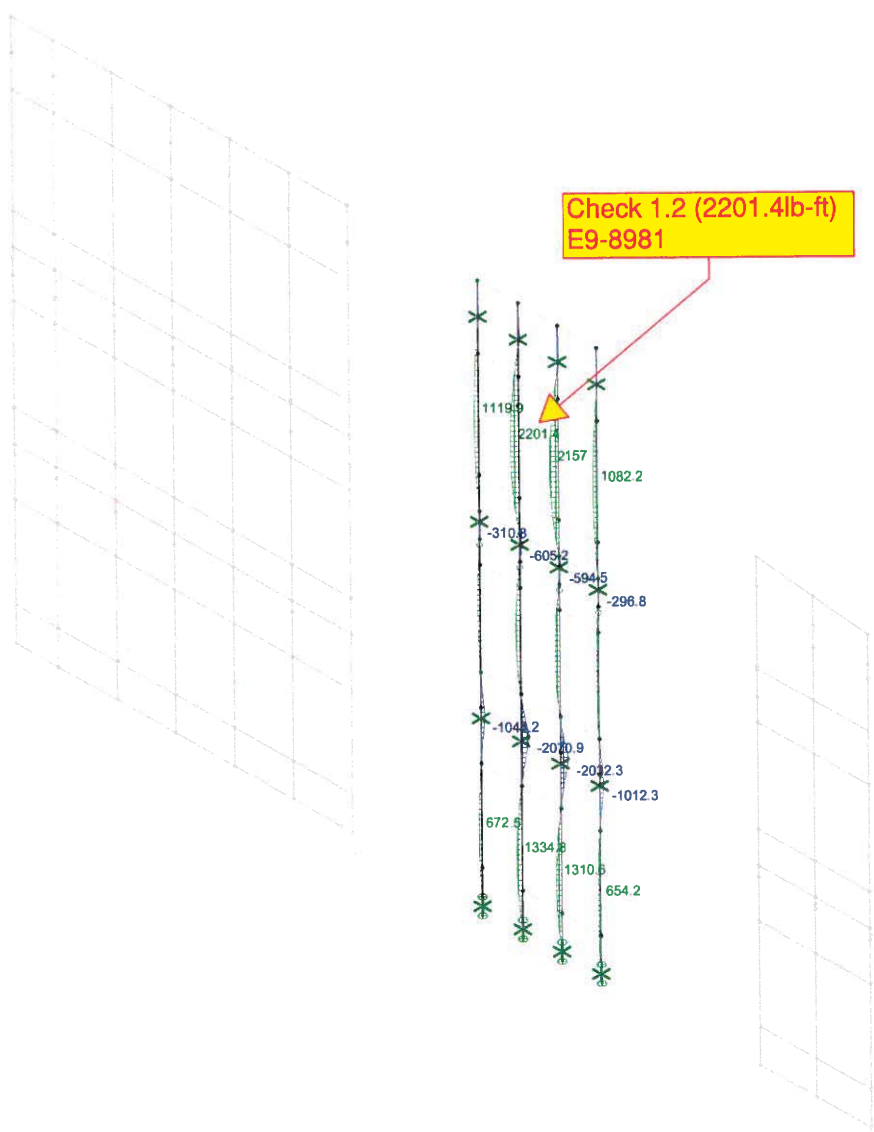
SK - 40

Nov 2, 2016 at 7:08 AM

EGS-1 Preliminary.r3d



Moment diagram



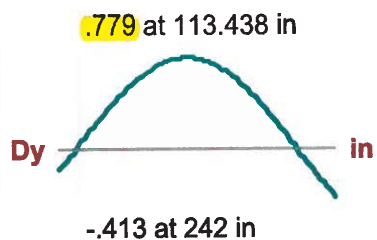
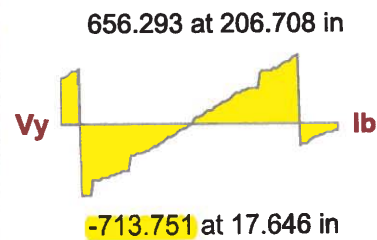
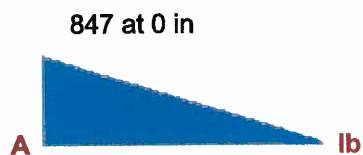
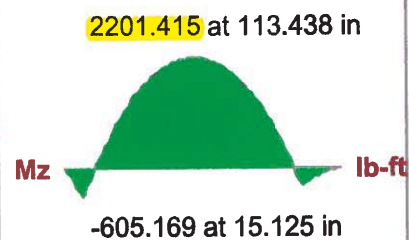
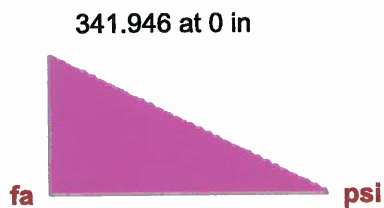
EGS-1 YKK YCW 750 SSG (2-1/2" x 7-1/2"). Shop drawing sheets 206, 212

Results for LC 1, Negative Wind Face A
Member z Bending Moments (lb-ft)

JEI Structural Engineering	Webster University	SK - 41
M. Gorny		Nov 2, 2016 at 7:09 AM
JE16059		EGS-1 Preliminary.r3d

Beam: **M264**

Shape:

Material: **gen_Alum**Length: **242 in**I Joint: **N346**J Joint: **N296**Code Check: **No Calc**
Report Based On 97 Sections**Dz** _____ **in****Vz** _____ **lb****T** _____ **lb-ft****My** _____ **lb-ft****fc** _____ **psi****ft** _____ **psi****Check 1.2**

YKK E9-8981

JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/206
Detail: 2/407 **Member M264**

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA

Check 1.2

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 3.57 ft $F_y = 25.0$ ksi
Height (h) 16.00 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 23.5 psf
Panel Weight (p_w) 8.0 psf

Manuf. / Part #: YKK E9-8981

$E = 10100$ ksi $r_{x, alum} = 2.184$ in
 $I_{x, alum} = 11.810$ in⁴ $r_{y, alum} = 1.092$ in
 $I_{y, alum} = 2.954$ in⁴ $A = 2.477$ in²
 $S_{x, alum} = 3.589$ in³ $J = 6.349$ in⁴
 $S_{y, alum} = 1.911$ in³ $wt = 2.976$ lb/ft
 $b/t_{web} = 38.25$ $b/t_{flange} = 22.25$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = N/A$ lb/ft
Shear Load $V = wL/2$ $V = 713.8$ lb
Moment $M = wL^2/8$ $M = 2201.4$ lb-ft
 $M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$ $M_{alum} = 2201.4$ lb-ft
 $f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$ $f_{b-alum} = 7.36$ ksi

Applied Axial Compression

$P = p_w \cdot t \cdot h + wt \cdot h$ $P = 2051.0$ lb
 $f_{c-alum} = P/A$ $f_{c-alum} = 0.83$ ksi

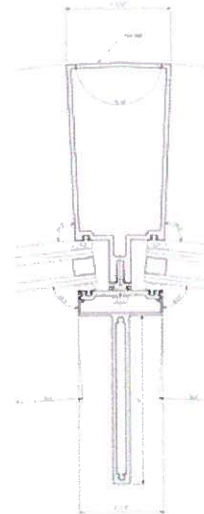
Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) = 0.779$ in
N/A $\pm$ movement cap. $\Delta_{allow} = 1.050$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$
Deflection Factor DF = #####

Steel Capacity

$M_{steel} = I_{x, steel} / I_{comb}$ $M_{steel} = 0.0$ lb-ft
 $Mb/\Omega =$ $Mb/\Omega = 0$ lb-ft
 $Ms/(Mb/\Omega) = N/A$



Reinforcing

No Reinforcing

$I_{x, steel} = 0.000$ in⁴
 $S_{x, steel} = 0.000$ in³
 $I_{combined} = 11.810$ in⁴

Load Share

Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	17.77 ksi
E.3 - Axial Compression	6.12 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.94 ksi

Compression Interaction

Allowable Compression	$F_c = 6.12$ ksi
Compression Stress Interaction	$f_{c-alum}/F_c = 0.135$

Flexure Interaction

Controls: F.3.1 - Closed Shape Flexure	
Allowable Flexural Compression	$F_b = 14.94$ ksi
Flexure Interaction	$f_{b-alum}/F_b = 0.493$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.628$

Mullion OK



JEI Structural Engineering
7280 NW 87th Terrace, Suite C-208
Kansas City, MO 64153

Office: 816-505-0987
info@jeistructural.com
www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Summary
Designer: M. Gorny

Manufacture: YKK
Part #: E9-1225
Alloy/Temper: 6063-T6

Typical Wind Pressure (T) = 20.0 psf
Corner Zone Wind Pressure (C) = 24.0 psf
Interior Pressure (INT) = 5.0 psf

Date: 11/2/2016
Proj: JE16059

INPUT CHECK RISA

Sheet	Elevation	Section	Part No	Wind Zone	Unbraced Length (L _u)	Trib Height (h) ft	Trib Width (t) ft	Trib Area (h)*(t) = (A)	Wind Pres (p)	linear load (w) (plf)	Deflection Factor (w) * (h)^4 (div by 10E7)	Stress Factor ((w)*(h)^2)/1000
214	1/214	1/407	E9-1225	T	6.07	6.49	5.25	34.1	20.0	105.0	6.0	4.4
Check 1)												

Mullion Design Summary

1: OK



JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Voice: 816-734-8345
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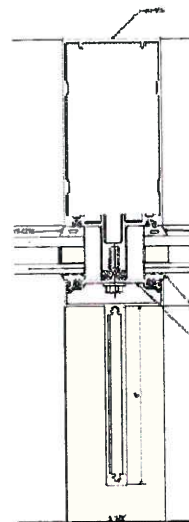
Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/241
Detail: 1/407

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA



Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t)	5.25 ft	$F_y =$	25.0 ksi
Height (h)	6.49 ft	$F_u =$	30.0 ksi
Unbraced Length (L)	6.07 ft		

Design Loads

Design Pressure (p)	20.0 psf
Panel Weight (p_{wt})	8.0 psf

Manuf. / Part #: YKK E9-1225

$E =$	10100 ksi	$r_{x, alum} =$	2.176 in
$I_{x, alum} =$	9.838 in ⁴	$r_{y, alum} =$	0.935 in
$I_{y, alum} =$	1.818 in ⁴	$A =$	2.079 in ²
$S_{x, alum} =$	3.213 in ³	$J =$	4.110 in ⁴
$S_{y, alum} =$	1.454 in ³	$wt =$	2.498 lb/ft
$b/t_{web} =$	52.71	$b/t_{flange} =$	22.33
Fixity _{web} =	2 end(s)	Fixity _{flange} =	2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc.	1.00	S_x Reduc.	1.00
--------------	------	--------------	------

Applied Bending Moment

$w = p \cdot t$	$w =$	105.0 lb/ft
Shear Load $V = wL/2$	$V =$	340.7 lb
Moment $M = wL^2/8$	$M =$	552.8 lb-ft
$M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$	$M_{alum} =$	552.8 lb-ft
$f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum} =$	2.06 ksi

Applied Axial Compression

$P = p_{wt} \cdot t \cdot h + wt \cdot h$	$P =$	288.8 lb
$f_{c-alum} = P/A$	$f_{c-alum} =$	0.14 ksi

Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) =$	0.042 in
N/A $\pm$ movement cap. $\Delta_{allow} =$	0.445 in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor
	DF = 6.0

Steel Capacity

$M_{steel} = I_{x, steel} \cdot TRF_i \cdot TRF_s =$	$M_{steel} =$	0.0 lb-ft
$Mb/\Omega =$	$Mb/\Omega =$	0 lb-ft
	$Ms/(Mb/\Omega) =$	N/A

Reinforcing

No Reinforcing

$I_{x, steel} =$	0.000 in ⁴
$S_{x, steel} =$	0.000 in ³
$I_{combined} =$	9.838 in ⁴

Load Share

Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.15 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.92 ksi
E.3 - Axial Compression	8.43 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.91 ksi

Compression Interaction

Allowable Compression	$F_c =$	8.43 ksi
Compression Stress Interaction	$f_{c-alum}/F_c =$	0.016

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure		
Allowable Flexural Compression	$F_b =$	13.92 ksi
Flexure Interaction	$f_{b-alum}/F_b =$	0.148

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$	$f_a/F_a + f_b/F_b =$	0.165
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Mullion OK

Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 7-1/2")
Part of: Jamb Mullion Summary
Designer: M. Gorny

Manufacture: YKK

Part #: E9-1225

Alloy/Temper: 6063-T6

Jamb $I_x = 9,838 \text{ in}^4$

Typical Wind Pressure (T) = 20.0 psf

Corner Zone Wind Pressure (C) = 24.0 psf

Interior Pressure (INT) = 5.0 psf

Date
Proj.

11/2/2016
JE16059

Sealant Joint Size & Expansion
1/2" Joint (50% Expandable)
Allowable Movement = 0.560 in

INPUT CHECK RISA

Sheet	Elevation	Section	Part No	Wind Zone	Unbraced Length (L_u)	Trib Height (h) ft	Trib Width (t) ft	Trib Area (h)(t) = (A)	Wind Pres (p)	linear load (w) (plf)	Unreinforced Deflection (in)	Stress Factor $((w)(h)^2)/L/1000$	Deflection > 0.56 in.?
214	1/214	1/419	E9-1225	T	6.07	6.49	2.63	17.0	20.0	52.5	0.02	2.2	OK
													Check 1)

Mullion Design Summary

1: OK by comparison to Vertical Mullion Check 1



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Client: NGG

Project: Webster University

Structure: YKK 750 SSG (2-1/2" x 7-1/2")

Part of: Horizontal Mullion Summary

Designer: M. Gorny

Manufacturer: YKK

Part #: E9-3403

Alloy/Temper: 6063-T6

Typical Wind Pressure (T) = 20.0 psf

Corner Zone Wind Pressure (C) = 24.0 psf

Interior Pressure (INT) = 5.0 psf

Date: 11/3/2016
Proj: JE16059

INPUT CHECK

Sheet	Elevation	Section	Part No	Wind Zone	Unbraced Length (Lb)	Total Length (L)	Trib Width (tw)	DL Trib (t)	Trib Area (h)*(t) = (A)	Wind Pres (p)	linear load (w) (plf)	Def. Factor (w) * (h)^4 (div. By 10E7)	Stress Factor ((w)*(h)^2)/L	DL Factor (t)*(L)^4
205	1/205	1/310	E9-3403	C	5.25	5.25	7.40	5.49	38.9	24.0	177.6	5.33	4.15	4170.4
205	1/205	1/310	E9-3403	C	5.25	5.25	5.96	8.90	31.3	24.0	143.0	4.29	3.34	6758.1
208	1/208	1/308	E9-3403	C	5.84	5.84	5.57	8.13	32.5	24.0	133.8	5.52	3.82	9441.5
216	1/216	1/312	E9-3403	C	5.00	5.00	6.79	5.54	33.9	24.0	162.9	4.22	3.47	3463.5

Mullion Design Summary

1: Use 1/8 point blocking

2: OK

3) OK



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 7-1/2")
Part of: Horizontal Mullion Analysis
Elevation: 1/208
Detail: 1/310

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	Material Design Code
ASCE7-05 ASD	ADM 2010
ADM 2010 Type	Alloy-Temper
Open Shape	6063-T6

Wind Tributary Width (t_{WL})	5.57 ft	$F_y =$	25.0 ksi
Dead Load Trib. Height (t_{DL})	8.13 ft	$F_u =$	30.0 ksi
Length (L)	5.84 ft		
Unbraced Length (L_b)	5.84 ft		

Design Loads

Design Pressure (p)	24.0 psf
Infill Weight (p_{wt})	6.5 psf

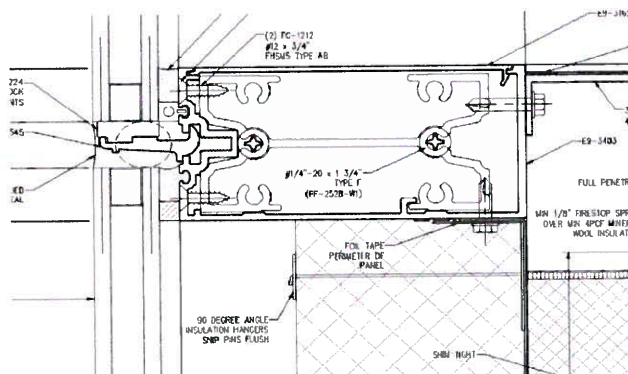
Manuf. / Part #:

YKK E9-3403

E =	10100 ksi	$r_{x, alum} =$	2.090 in
$I_{x, alum} =$	6.100 in ⁴	$r_{y, alum} =$	0.801 in
$I_{y, alum} =$	0.893 in ⁴	A =	1.392 in ²
$S_{x, alum} =$	2.092 in ³	J =	0.007 in ⁴
$S_{y, alum} =$	0.536 in ³	wt =	1.672 lb/ft
$b/t_{web} =$	54.50	$b/t_{flange} =$	17.67
Fixity _{web} =	2 end(s)	Fixity _{flange} =	1 end(s)

Thermal Reduction Factors (TRF, TRF_s)

I_x Reduc.	1.00	S_x Reduc.	1.00
--------------	------	--------------	------



Setting Block Locations (s) =	1/8	points
Setting Block Load (P) =	154.2	lb/setting block

Reinforcing

$I_{x, steel} =$	0.000 in ⁴	$I_{y, steel} =$	0.000 in ⁴
$S_{x, steel} =$	0.000 in ³	$S_{y, steel} =$	0.000 in ³
$I_{x, combined} =$	6.100 in ⁴	$I_{y, combined} =$	0.893 in ⁴
$A_{steel} =$	0.00 in ²	$wt_{steel} =$	0.00 lb/ft
$A_{alum-total} =$	1.392 in ²	$wt_{total} =$	1.672 lb/ft

X-Axis Applied Bending Moment (Wind Load)		Load Share = 100%
$w_{WL} = p \cdot t_{WL}$	$w =$	133.8 lb/ft
Shear Load $V = wL/2$	$V =$	390.5 lb
Moment $M = wL^2/8$	$M =$	569.9 lb-ft
$M_{alum} = M \cdot I_{alum} \cdot TRF / I_{comb}$	$M_{alum} =$	569.9 lb-ft
$f_b = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum-x} =$	3.27 ksi
Y-Axis Applied Bending Moment (Dead Load)		Load Share = 100%
Shear $V = P + w_{total} \cdot L/2$	$V =$	159.1 lb
Moment $M = w_{total} \cdot L^2/8 + P \cdot L \cdot s$	$M =$	119.6 lb-ft
$M_{alum} = M \cdot I_{alum} / I_{comb}$	$M_{alum} =$	119.6 lb-ft
$f_b = M_{alum} / (S_{y, alum})$	$f_{b-alum-y} =$	2.68 ksi
Applied Axial Compression		
$P =$	0.0 lb	
$f_{c-alum} = P/A$	$f_{c-alum} =$	0.00 ksi

X-axis Deflection (Wind Load)		Typical Horizontal	
N/A in. joint $\Delta_x = (5wL^4)/(384EI_d) =$		0.057 in	
N/A $\pm$ movement cap. $\Delta_{x-allow} =$		0.400 in	
Allowable deflection = L/175 or if span > 13'-6" then allowable def = L/240 + 1/4"		Deflection Factor	DF = 32.2
Y-axis Deflection (Dead Load)		Typical Horizontal	
$\Delta = ((P_{ab}Ls)/(24EI)) \cdot (3L^2 - 4(Ls)^2) + 5w_{total}L^4/(384EI)$		$\Delta =$	0.095 in
		$\Delta_{y-allow} =$	0.1250 in

Steel Capacity (X-Axis)		Load Share = 0%
$M_{steel} = I_{x, steel} / I_{comb} =$	$M_{steel} =$	0.0 lb-ft
$Mb/\Omega =$	$Mb/\Omega =$	0 lb-ft
	$Ms/(Mb/\Omega) =$	N/A
Steel Capacity (Y-Axis)		Load Share = 0%
$M_{steel} = I_{y, steel} / I_{comb} =$	$M_{steel} =$	0.0 lb-ft
$\Phi \cdot Mb =$	$Mb/\Omega =$	0 lb-ft
	$Ms/(Mb/\Omega) =$	N/A

X-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		8.76 ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		N/A ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		13.46 ksi
F.2.1 - Open Shape Flexure		10.36 ksi
F.3.1 - Closed Shape Flexure		N/A ksi
X-Axis Bending Interaction		
Allowable X-Axis Bending	$F_{bx} =$	8.76 ksi
X-Axis Interaction	$f_{b-alum-x}/F_{bx} =$	0.373

Y-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		8.88 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		13.64 ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		N/A ksi
F.2.1	F.2.1	10.36 ksi
F.3.1	F.3.1	N/A ksi
Y-Axis Bending Interaction		
Allowable Y-Axis Bending	$F_{by} =$	8.88 ksi
Y-Axis Interaction	$f_{b-alum-y}/F_{by} =$	0.301

Axial Allowable Load		
Allowable Axial Compression		6.71 ksi
Compression Interaction	$f_{c-alum}/F_c =$	0.000

Combined Interaction Ratio	
$f_{c-alum}/F_c + f_{b-alum-x}/F_{bx} + f_{b-alum-y}/F_{by} =$	0.674
Stress OK. Use 1/8 point setting blocks.	



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 7-1/2")
Part of: Horizontal Mullion Analysis
Elevation: 1/205
Detail: 1/310

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	Material Design Code
ASCE7-05 ASD	ADM 2010
ADM 2010 Type	Alloy-Temper
Open Shape	6083-T6

Wind Tributary Width (t_{WL}) 5.96 ft $F_y = 25.0$ ksi
Dead Load Trib. Height (t_{DL}) 8.90 ft $F_u = 30.0$ ksi
Length (L) 5.25 ft
Unbraced Length (L_b) 5.25 ft

Design Loads

Design Pressure (p) 24.0 psf
Infill Weight (P_{wI}) 6.5 psf

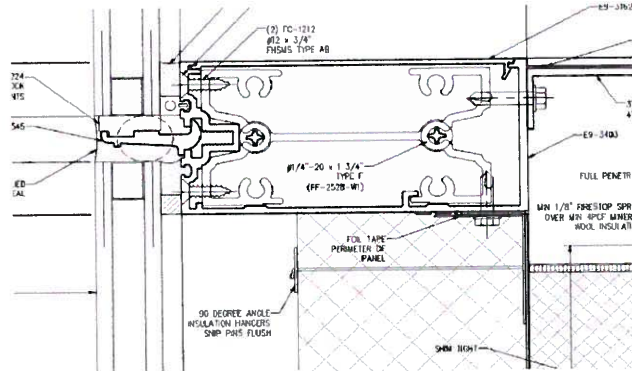
Manuf. / Part #:

YKK E9-3403

E = 10100 ksi $r_{x, alum} = 2.090$ in
 $I_{x, alum} = 6.100$ in⁴ $r_{y, alum} = 0.801$ in
 $I_{y, alum} = 0.893$ in⁴ A = 1.392 in²
 $S_{x, alum} = 2.092$ in³ J = 0.007 in⁴
 $S_{y, alum} = 0.536$ in³ wt = 1.672 lb/ft
b/ $t_{web} = 54.50$ b/ $t_{flange} = 17.67$
Fixity $_{web} = 2$ end(s) Fixity $_{flange} = 1$ end(s)

Thermal Reduction Factors (TRF, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00



Setting Block Locations (s) = 1/4 points
Setting Block Load (P) = 151.8 lb/setting block

Reinforcing

No Reinforcing
 $I_{x, steel} = 0.000$ in⁴ $I_{y, steel} = 0.000$ in⁴
 $S_{x, steel} = 0.000$ in³ $S_{y, steel} = 0.000$ in³
 $I_{x, combined} = 6.100$ in⁴ $I_{y, combined} = 0.893$ in⁴
 $A_{steel} = 0.00$ in² $wt_{steel} = 0.00$ lb/ft
 $A_{alum-total} = 1.392$ in² $wt_{total} = 1.672$ lb/ft

X-Axis Applied Bending Moment (Wind Load)		Load Share = 100%
$W_{WL} = P \cdot t_{WL}$	w =	143.0 lb/ft
Shear Load $V = wL/2$	V =	375.4 lb
Moment $M = wL^2/8$	M =	492.7 lb-ft
$M_{alum} = M \cdot I_{alum} \cdot TRF / I_{comb}$	$M_{alum} =$	492.7 lb-ft
$f_b = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum-x} =$	2.83 ksi
Y-Axis Applied Bending Moment (Dead Load)		Load Share = 100%
Shear $V = P + wt_{total} \cdot L/2$	V =	156.2 lb
Moment $M = wt_{total} \cdot L^2/8 + P \cdot L \cdot s$	M =	205.0 lb-ft
$M_{alum} = M \cdot I_{alum} / I_{comb}$	$M_{alum} =$	205.0 lb-ft
$f_b = M_{alum} / (S_{y, alum})$	$f_{b-alum-y} =$	4.59 ksi
Applied Axial Compression		
$f_{c-alum} = P/A$	P =	0.0 lb
	$f_{c-alum} =$	0.00 ksi

X-axis Deflection (Wind Load)	Typical Horizontal
N/A in. joint $\Delta_x = (5wL^4)/(384EI_d) =$	0.040 in
N/A $\pm$ movement cap. $\Delta_{x-allow} =$	0.360 in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = 22.5
Y-axis Deflection (Dead Load)	Typical Horizontal
$\Delta = ((P_{ab}Ls)/(24EI)) \cdot (3L^2 - 4(Ls)^2) + 5wt_{total}L^4/(384EI)$	$\Delta = 0.124$ in
	$\Delta_{y-allow} = 0.1250$ in

Steel Capacity (X-Axis)		Load Share = 0%
$M_{steel} = I_{x, steel} / I_{comb} =$	$M_{steel} =$	0.0 lb-ft
$Mb/\Omega =$	$Mb/\Omega =$	0 lb-ft
	$Ms/(Mb/\Omega) =$	N/A
Steel Capacity (Y-Axis)		Load Share = 0%
$M_{steel} = I_{y, steel} / I_{comb} =$	$M_{steel} =$	0.0 lb-ft
$\Phi \cdot Mb =$	$Mb/\Omega =$	0 lb-ft
	$Ms/(Mb/\Omega) =$	N/A

X-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		8.76 ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		N/A ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		13.46 ksi
F.2.1 - Open Shape Flexure		11.01 ksi
F.3.1 - Closed Shape Flexure		N/A ksi
X-Axis Bending Interaction		
Allowable X-Axis Bending	$F_{bx} =$	8.76 ksi
X-Axis Interaction	$f_{b-alum-x}/F_{bx} =$	0.322

Y-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		8.88 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		13.64 ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		N/A ksi
F.2.1	F.2.1	11.01 ksi
F.3.1	F.3.1	N/A ksi
Y-Axis Bending Interaction		
Allowable Y-Axis Bending	$F_{by} =$	8.88 ksi
Y-Axis Interaction	$f_{b-alum-y}/F_{by} =$	0.516

Axial Allowable Load	
Allowable Axial Compression	8.30 ksi
Compression Interaction	$f_{c-alum}/F_c = 0.000$

Combined Interaction Ratio	
$f_{c-alum}/F_c + f_{b-alum-x}/F_{bx} + f_{b-alum-y}/F_{by} =$	0.839
Stress OK. Use 1/4 point setting blocks.	



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 7-1/2")
Part of: Horizontal Mullion Analysis
Elevation: 1/205
Detail: 1/310

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT

CHECK

RISA

Load Design Code	Material Design Code
ASCE7-05 ASD	ADM 2010
ADM 2010 Type	Alloy-Temper
Open Shape	6063-T6

Wind Tributary Width (t_{WL})	7.40 ft	$F_y =$	25.0 ksi
Dead Load Trib. Height (t_{DL})	5.49 ft	$F_u =$	30.0 ksi
Length (L)	5.25 ft		
Unbraced Length (L_b)	5.25 ft		

Design Loads

Design Pressure (p)	24.0 psf
Infill Weight (p_{wi})	6.5 psf

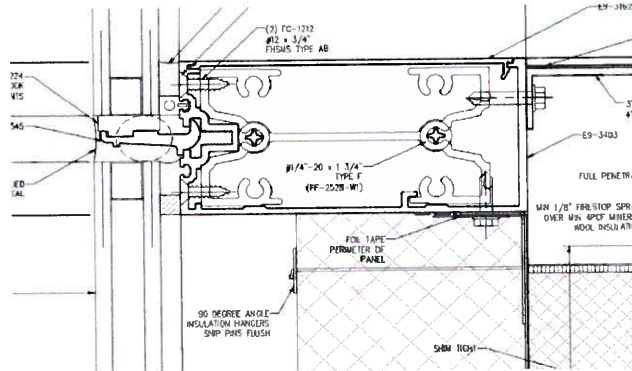
Manuf. / Part #:

YKK E9-3403

E =	10100 ksi	$r_{x, alum} =$	2.090 in
$I_{x, alum} =$	6.100 in ⁴	$r_{y, alum} =$	0.801 in
$I_{y, alum} =$	0.893 in ⁴	A =	1.392 in ²
$S_{x, alum} =$	2.092 in ³	J =	0.007 in ⁴
$S_{y, alum} =$	0.536 in ³	wt =	1.672 lb/ft
$b/t_{web} =$	54.50	$b/t_{flange} =$	17.67
Fixity _{web} =	2 end(s)	Fixity _{flange} =	1 end(s)

Thermal Reduction Factors (TRF, TRF_s)

I_x Reduc.	1.00	S_x Reduc.	1.00
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Setting Block Locations (s) =	1/4	points
Setting Block Load (P) =	93.7	lb/setting block

Reinforcing

$I_{x, steel} =$	0.000 in ⁴	$I_{y, steel} =$	0.000 in ⁴
$S_{x, steel} =$	0.000 in ³	$S_{y, steel} =$	0.000 in ³
$I_{x, combined} =$	6.100 in ⁴	$I_{y, combined} =$	0.893 in ⁴
$A_{steel} =$	0.00 in ²	$wf_{steel} =$	0.00 lb/ft
$A_{alum-total} =$	1.392 in ²	$wf_{total} =$	1.672 lb/ft

X-Axis Applied Bending Moment (Wind Load)	Load Share = 100%
$w_{WL} = p \cdot t_{WL}$	$w = 177.6$ lb/ft
Shear Load $V = wL/2$	$V = 466.3$ lb
Moment $M = wL^2/8$	$M = 612.0$ lb-ft
$M_{alum} = M \cdot I_{alum} / (I_{alum} + I_{steel})$	$M_{alum} = 612.0$ lb-ft
$f_b = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum-x} = 3.51$ ksi
Y-Axis Applied Bending Moment (Dead Load)	Load Share = 100%
Shear $V = P + w_{total} \cdot L/2$	$V = 98.1$ lb
Moment $M = w_{total} \cdot L^2/8 + P \cdot L \cdot s$	$M = 128.7$ lb-ft
$M_{alum} = M \cdot I_{alum} / (I_{alum} + I_{steel})$	$M_{alum} = 128.7$ lb-ft
$f_b = M_{alum} / (S_{y, alum})$	$f_{b-alum-y} = 2.88$ ksi
Applied Axial Compression	
$P =$	0.0 lb
$f_{c-alum} = P/A$	$f_{c-alum} = 0.00$ ksi

X-axis Deflection (Wind Load)	Typical Horizontal
N/A in. joint	$\Delta_x = (5wL^4)/(384EI_d) = 0.049$ in
N/A $\pm$ movement cap.	$\Delta_{x-allow} = 0.360$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = 28.0
Y-axis Deflection (Dead Load)	Typical Horizontal
$\Delta = ((P_{ab}Ls)/(24EI)) + (3L^2 - 4(Ls)^2) / (384EI)$	$\Delta = 0.078$ in
$+ 5w_{total}L^4 / (384EI)$	$\Delta_{y-allow} = 0.1250$ in

Steel Capacity (X-Axis)	Load Share = 0%
$M_{steel} = I_{x, steel} / I_{comb} =$	$M_{steel} = 0.0$ lb-ft
$Mb/\Omega =$	$Mb/\Omega = 0$ lb-ft
$Ms/(Mb/\Omega) =$	N/A
Steel Capacity (Y-Axis)	Load Share = 0%
$M_{steel} = I_{y, steel} / I_{comb} =$	$M_{steel} = 0.0$ lb-ft
$\Phi \cdot Mb =$	$Mb/\Omega = 0$ lb-ft
$Ms/(Mb/\Omega) =$	N/A

X-Axis Allowable Loads	$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.	8.76 ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	N/A ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.46 ksi
F.2.1 - Open Shape Flexure	11.01 ksi
F.3.1 - Closed Shape Flexure	N/A ksi
X-Axis Bending Interaction	
Allowable X-Axis Bending	$F_{bx} = 8.76$ ksi
X-Axis Interaction	$f_{b-alum-x}/F_{bx} = 0.400$

Y-Axis Allowable Loads	$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	8.88 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	13.64 ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	N/A ksi
F.2.1	F.2.1 11.01 ksi
F.3.1	F.3.1 N/A ksi
Y-Axis Bending Interaction	
Allowable Y-Axis Bending	$F_{by} = 8.88$ ksi
Y-Axis Interaction	$f_{b-alum-y}/F_{by} = 0.324$

Axial Allowable Load	
Allowable Axial Compression	8.30 ksi
Compression Interaction	$f_{c-alum}/F_c = 0.000$

Combined Interaction Ratio	
$f_{c-alum}/F_c + f_{b-alum-x}/F_{bx} + f_{b-alum-y}/F_{by} =$	0.725
Stress OK. Use 1/4 point setting blocks.	



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 7-1/2")
Part of: Horizontal Mullion Analysis
Elevation: 2/204
Detail: 1/308

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK RISA

Load Design Code	Material Design Code
ASCE7-05 ASD	ADM 2010
ADM 2010 Type	Alloy-Temper
Open Shape	6063-T6

Wind Tributary Width (t_{WL})	5.62 ft	$F_y =$	25.0 ksi
Dead Load Trib. Height (t_{DL})	3.79 ft	$F_u =$	30.0 ksi
Length (L)	6.17 ft		
Unbraced Length (L_b)	6.17 ft		

Design Loads

Design Pressure (p)	24.0 psf
Infill Weight (p_{wt})	6.5 psf

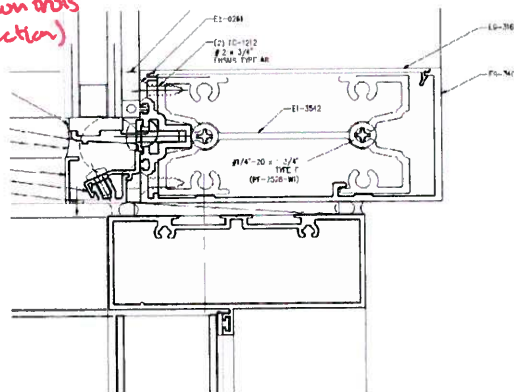
Manuf. / Part #:

YKK E9-3403

E =	10100 ksi	$r_{x, alum} =$	2.090 in
$I_{x, alum} =$	6.100 in ⁴	$r_{y, alum} =$	0.801 in
$I_{y, alum} =$	0.893 in ⁴	A =	1.392 in ²
$S_{x, alum} =$	2.092 in ³	J =	0.007 in ⁴
$S_{y, alum} =$	0.536 in ³	wt =	1.672 lb/ft
$b/t_{web} =$	54.50	$b/t_{flange} =$	17.67
Fixity _{web} =	2 end(s)	Fixity _{flange} =	1 end(s)

Thermal Reduction Factors (TRF, TRF_s)

I_x Reduc.	1.00	S_x Reduc.	1.00
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Setting Block Locations (s) =	1/8	points
Setting Block Load (P) =	76.0	lb/setting block

Reinforcing

No Reinforcing

$I_{x, steel} =$	0.000 in ⁴	$I_{y, steel} =$	0.000 in ⁴
$S_{x, steel} =$	0.000 in ³	$S_{y, steel} =$	0.000 in ³
$I_{x, combined} =$	6.100 in ⁴	$I_{y, combined} =$	0.893 in ⁴
$A_{steel} =$	0.00 in ²	$wt_{steel} =$	0.00 lb/ft
$A_{alum-total} =$	1.392 in ²	$wt_{total} =$	1.672 lb/ft

X-Axis Applied Bending Moment (Wind Load)		Load Share = 100%
$w_{WL} = p \cdot t_{WL}$	$w =$	134.9 lb/ft
Shear Load $V = wL/2$	$V =$	415.9 lb
Moment $M = wL^2/8$	$M =$	641.1 lb-ft
$M_{alum} = M \cdot I_{alum} / (I_{alum} + I_{steel})$	$M_{alum} =$	641.1 lb-ft
$f_b = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum-x} =$	3.68 ksi
Y-Axis Applied Bending Moment (Dead Load)		Load Share = 100%
Shear $V = P + wt_{total} \cdot L/2$	$V =$	81.1 lb
Moment $M = wt_{total} \cdot L^2/8 + P \cdot L \cdot s$	$M =$	66.5 lb-ft
$M_{alum} = M \cdot I_{alum} / (I_{alum} + I_{steel})$	$M_{alum} =$	66.5 lb-ft
$f_b = M_{alum} / (S_{y, alum})$	$f_{b-alum-y} =$	1.49 ksi
Applied Axial Compression		
$P =$	0.0 lb	
$f_{c-alum} = P/A$	$f_{c-alum} =$	0.00 ksi

X-axis Deflection (Wind Load)		Typical Horizontal	
N/A in. joint $\Delta_x = (5wL^4)/(384EI_d) =$		0.071 in	
N/A $\pm$ movement cap. $\Delta_{x-allow} =$		0.423 in	
Allowable deflection = L/175 or if span > 13'-6" then allowable def = L/240 + 1/4"		Deflection Factor DF = 40.4	
Y-axis Deflection (Dead Load)		Door Header	
$\Delta = ((P_{ab}Ls)/(24EI)) + (3L^2 \cdot 4(Ls)^2) + 5w_{total}L^4/(384EI)$		$\Delta =$ 0.058 in	
		$\Delta_{y-allow} =$ 0.0625 in	

Steel Capacity (X-Axis)		Load Share = 0%
$M_{steel} = I_{x, steel} / I_{comb} =$	$M_{steel} =$	0.0 lb-ft
$Mb/\Omega =$	$Mb/\Omega =$	0 lb-ft
	$Ms/(Mb/\Omega) =$	N/A
Steel Capacity (Y-Axis)		Load Share = 0%
$M_{steel} = I_{y, steel} / I_{comb} =$	$M_{steel} =$	0.0 lb-ft
$\Phi \cdot Mb =$	$Mb/\Omega =$	0 lb-ft
	$Ms/(Mb/\Omega) =$	N/A

X-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		8.76 ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		N/A ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		13.46 ksi
F.2.1 - Open Shape Flexure		10.00 ksi
F.3.1 - Closed Shape Flexure		N/A ksi
X-Axis Bending Interaction		
Allowable X-Axis Bending	$F_{bx} =$	8.76 ksi
X-Axis Interaction	$f_{b-alum-x}/F_{bx} =$	0.420

Y-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		8.88 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		13.64 ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		N/A ksi
F.2.1	F.2.1	10.00 ksi
F.3.1	F.3.1	N/A ksi
Y-Axis Bending Interaction		
Allowable Y-Axis Bending	$F_{by} =$	8.88 ksi
Y-Axis Interaction	$f_{b-alum-y}/F_{by} =$	0.168

Axial Allowable Load		
Allowable Axial Compression		6.02 ksi
Compression Interaction	$f_{c-alum}/F_c =$	0.000

Combined Interaction Ratio	
$f_{c-alum}/F_c + f_{b-alum-x}/F_{bx} + f_{b-alum-y}/F_{by} =$	0.587
Stress OK. Use 1/8 point setting blocks.	



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 7-1/2")
Part of: Horizontal Mullion Analysis
Elevation: 1/202
Detail: 1/308

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT	CHECK
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CHECK

RISA

Load Design Code	Material Design Code
ASCE7-05 ASD	ADM 2010
ADM 2010 Type	Alloy-Temper
Open Shape	6063-T6

Wind Tributary Width (t_{WL})	5.62 ft	$F_y =$	25.0 ksi
Dead Load Trib. Height (t_{DL})	3.79 ft	$F_u =$	30.0 ksi
Length (L)	3.33 ft		
Unbraced Length (L_b)	3.33 ft		

Design Loads

Design Pressure (p)	24.0 psf
Infill Weight (p_{wt})	6.5 psf

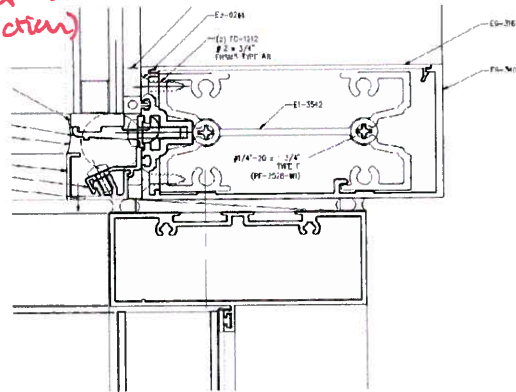
Manuf. / Part #:

YKK E9-3403

E =	10100 ksi	r _{x, alum} =	2.090 in
I _{x, alum} =	6.100 in ⁴	r _{y, alum} =	0.801 in
I _{y, alum} =	0.893 in ⁴	A =	1.392 in ²
S _{x, alum} =	2.092 in ³	J =	0.007 in ⁴
S _{y, alum} =	0.536 in ³	wt =	1.672 lb/ft
b/t _{web}	54.50	b/t _{flange} =	17.67
Fixity _{web}	2 end(s)	Fixity _{flange} =	1 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I _x Reduc.	1.00	S _x Reduc.	1.00
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Setting Block Locations (s) = 1/4 points

Setting Block Load (P) = 41.1 lb/setting block

Reinforcing

$I_{x, \text{steel}} =$	0.000 in ⁴	$I_{y, \text{steel}} =$	0.000 in ⁴
$S_{x, \text{steel}} =$	0.000 in ³	$S_{y, \text{steel}} =$	0.000 in ³
$I_{x, \text{combined}} =$	6.100 in ⁴	$I_{y, \text{combined}} =$	0.893 in ⁴
$A_{\text{steel}} =$	0.00 in ²	$w_{\text{steel}} =$	0.00 lb/ft
$A_{\text{column-total}} =$	1.392 in ²	$w_{\text{total}} =$	1.672 lb/ft

X-Axis Applied Bending Moment (Wind Load)		Load Share =	100%
$w_{WL} = p \cdot t_{WL}$		w =	134.9 lb/ft
Shear Load $V = wL/2$		V =	224.8 lb
Moment $M = wL^2/8$		M =	187.3 lb-ft
$M_{alum} = M \cdot I_{alum} \cdot \text{TRF}_x / I_{comb}$		M_{alum} =	187.3 lb-ft
$f_b = M_{alum} / (S_{x, alum} \cdot \text{TRF}_x)$		$f_{b-alum-x}$ =	1.07 ksi
Y-Axis Applied Bending Moment (Dead Load)		Load Share =	100%
Shear $V = P + w_{total} \cdot L/2$		V =	43.9 lb
Moment $M = w_{total} \cdot L^2/8 + P \cdot L \cdot s$		M =	36.6 lb-ft
$M_{alum} = M \cdot I_{alum} / I_{comb}$		M_{alum} =	36.6 lb-ft
$f_b = M_{alum} / (S_{y, alum})$		$f_{b-alum-y}$ =	0.82 ksi
Applied Axial Compression			
		P =	0.0 lb
$f_{c-alum} = P/A$		f_{c-alum} =	0.00 ksi

X-axis Deflection (Wind Load)		Typical Horizontal	
N/A in. joint	$\Delta_x = (5wL^4)/(384EI_x) =$	0.006 in	
N/A $\pm$ movement cap.	$\Delta_{x\text{-allow}} =$	0.229 in	
Allowable deflection = L/175 or if span > 13'-6" then allowable def = L/240 + 1/4"		Deflection Factor DF = 3.5	
Y-axis Deflection (Dead Load)		Door Header	
$\Delta = ((P_{ss}L_s)/(24EI)) * (3L^2 - 4(Ls)^2)$		$\Delta =$	0.009 in
$+ 5wL_{\text{total}}^4/(384EI)$		$\Delta_{y\text{-allow}} =$	0.0625 in

Steel Capacity (X-Axis)		Load Share = 0%
$M_{steel} = k_x \cdot steel / l_{comb} =$	$M_{steel} =$	0.0 lb-ft
$M_b / \Omega =$	$M_b / \Omega =$	0 lb-ft
	$M_s / (M_b / \Omega) =$	N/A
Steel Capacity (Y-Axis)		Load Share = 0%
$M_{steel} = k_y \cdot steel / l_{comb} =$	$M_{steel} =$	0.0 lb-ft
$\Phi^* M_b =$	$M_b / \Omega =$	0 lb-ft
	$M_s / (M_b / \Omega) =$	N/A

X-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		8.76 ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		N/A ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		13.48 ksi
F.2.1 - Open Shape Flexure		13.10 ksi
F.3.1 - Closed Shape Flexure		N/A ksi
X-Axis Bending Interaction		
Allowable X-Axis Bending	$F_{bx} =$	8.76 ksi
X-Axis Interaction	$f_{b-colum-x}/F_{bx} =$	0.123

Y-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		8.88 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		13.64 ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		N/A ksi
F.2.1	F.2.1	13.10 ksi
F.3.1	F.3.1	N/A ksi
Y-Axis Bending Interaction		
Allowable Y-Axis Bending	$F_{by} =$	8.88 ksi
Y-Axis Interaction	$f_{b\text{-elem-}y}/F_{by} =$	0.092

Axial Allowable Load	
Allowable Axial Compression	10.52 ksi
Compression Interaction	$f_{c-allow}/F_c = 0.000$

Combined Interaction Ratio	
$f_{c\text{-alum}}/F_c + f_{b\text{-alum-x}}F_{bx} + f_{b\text{-alum-y}}F_{by} =$	0.215
Stress OK. Use 1/4 point setting blocks.	



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 6-9/16")
Part of: Vertical Mullion Summary
Designer: M. Gorny

Manufacture: YKK
Part #: E9-3402
Alloy/Temper: 6063-T6

Typical Wind Pressure (T) = 20.0 psf
Corner Zone Wind Pressure (C) = 24.0 psf
Interior Pressure (INT) = 5.0 psf

Date: 11/2/2016
Proj: JE16059

INPUT CHECK RISA

Sheet	Elevation	Section	Part No	Wind Zone	Unbraced Length (L _u)	Trib Height (h) ft	Trib Width (t) ft	Trib Area (h)*t = (A)	Wind Pres (p)	linear load (w) (plf)	Deflection Factor (w) * (h) ⁴ (div by 10E7)	Stress Factor ((w)*(h) ²)/1000
202	1/202	1/401	E9-3402	C	10.78	11.24	3.01	33.8	24.0	72.3	21.3	9.1
202, 204	2/202, 1/204	1/400	E9-3402	C	10.78	11.24	5.00	56.2	24.0	120.0	35.3	15.2
203	1/203	1/400	E9-3402	C	10.78	11.24	4.56	51.2	24.0	109.4	32.2	13.8
204	2/204	1/401	E9-3402	C	10.78	11.24	4.30	48.3	24.0	103.2	30.4	13.0

1)
Check

Mullion Design Summary

1: OK



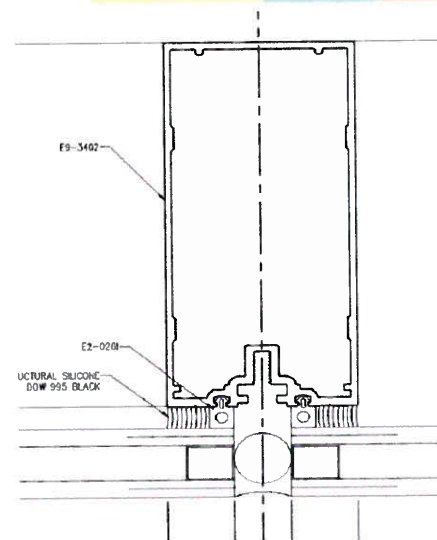
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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 6-9/16")
Part of: Vertical Mullion Analysis
Elevation: 1/202, 1/204
Detail: 1/400

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA



Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 5.00 ft $F_y = 25.0$ ksi
Height (h) 11.24 ft $F_u = 30.0$ ksi
Unbraced Length (L) 10.78 ft

Design Loads

Design Pressure (p) 24.0 psf
Panel Weight (p_{wt}) 8.0 psf

Manuf. / Part #: YKK E9-3402

$E = 10100$ ksi $r_{x, alum} = 1.925$ in
 $I_{x, alum} = 6.485$ in⁴ $r_{y, alum} = 0.994$ in
 $I_{y, alum} = 1.729$ in⁴ $A = 1.751$ in²
 $S_{x, alum} = 2.197$ in³ $J = 3.525$ in⁴
 $S_{y, alum} = 1.383$ in³ $wt = 2.104$ lb/ft
 $b/t_{web} = 54.86$ $b/t_{flange} = 23.48$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = 120.0$ lb/ft
Shear Load $V = wL/2$ $V = 674.4$ lb
Moment $M = wL^2/8$ $M = 1894.9$ lb-ft
 $M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$ $M_{alum} = 1894.9$ lb-ft
 $f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$ $f_{b-alum} = 10.35$ ksi

Applied Axial Compression

$P = p_{wt} \cdot t \cdot h + wt \cdot h$ $P = 473.2$ lb
 $f_{c-alum} = P/A$ $f_{c-alum} = 0.27$ ksi

Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) = 0.658$ in
N/A $\pm$ movement cap. $\Delta_{allow} = 0.771$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$
Deflection Factor DF = 35.3

Steel Capacity

$M_{steel} = I_{x, steel} \cdot f_{b-steel} / I_{comb}$ $M_{steel} = 0.0$ lb-ft
 $Mb/\Omega = 0$ lb-ft
 $Ms/(Mb/\Omega) = N/A$

Reinforcing

No Reinforcing

$I_{x, steel} = 0.000$ in⁴
 $S_{x, steel} = 0.000$ in³
 $I_{combined} = 6.485$ in⁴

Load Share

Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.04 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	13.38 ksi
E.3 - Axial Compression	3.03 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.62 ksi

Compression Interaction

Allowable Compression $F_c = 3.03$ ksi
Compression Stress Interaction $f_{c-alum}/F_c = 0.089$

Flexure Interaction

Controls: B.5.5.1 - Flat Elem. 2 End Support Flexure
Allowable Flexural Compression $F_b = 13.38$ ksi
Flexure Interaction $f_{b-alum}/F_b = 0.774$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.863$

Mullion OK



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 6-9/16")
Part of: Jamb Mullion Summary
Designer: M. Gorny

Manufacture: Kawneer
Part #: E9-3402
Alloy/Temper: 6063-T6
Jamb $I_x = 6.485 \text{ in}^4$
Typical Wind Pressure (T) = 20.0 psf
Corner Zone Wind Pressure (C) = 24.0 psf
Interior Pressure (INT) = 5.0 psf

Sealant Joint Size & Expansion
1/2" Joint (50% Expandable)
Allowable Movement = 0.560 in

Date: 11/2/2016
Proj: JE16059

INPUT CHECK RISA

Sheet	Elevation	Section	Part No	Wind Zone	Unbraced Length (L_u)	Trib Height (h) ft	Trib Width (t) ft	Trib Area (h)(t) = (A)	Wind Pres (p)	linear load (w) (plf)	Unreinforced Deflection (in)	Stress Factor $((w)(h)^2)/1000$	Deflection > 0.56 in.?
202, 204	2/202, 1/204	1/403	E9-3402	T	10.78	11.24	2.39	26.8	20.0	47.7	0.26	6.0	OK
													Check 1)

Mullion Design Summary

1: OK by comparison to Vertical Mullion Check 1



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/203
Detail: 1/406

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width A (t_{wLA}) 4.15 ft Corner Angle (θ)
Tributary Width B (t_{wLB}) 2.38 ft 64.00 °
Height (h) 11.24 ft
Unbraced Length (L) 10.78 ft

Design Loads

Design Pressure A (p_A) 24 psf
Design Pressure B (p_B) 0 psf
Panel Weight (p_{wt}) 8 psf

Manuf. / Part #: YKK E9-3401

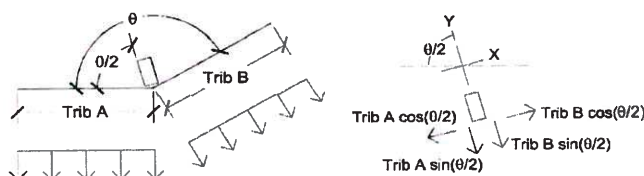
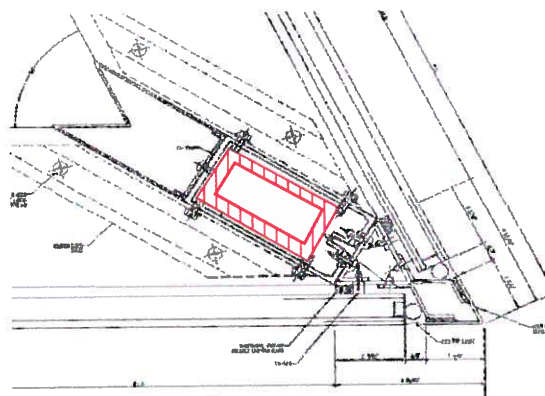
E = 10100 ksi $r_{x, alum} = 1.948$ in
 $I_{x, alum} = 8.555$ in⁴ $r_{y, alum} = 0.991$ in
 $I_{y, alum} = 2.213$ in⁴ A = 2.254 in²
 $S_{x, alum} = 3.127$ in³ J = 4.596 in⁴
 $S_{y, alum} = 1.765$ in³ wt = 2.708 lb/ft

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Reinforcing HSS 2x4x3/8

$I_{x, steel} = 5.600$ in⁴ $I_{y, steel} = 1.800$ in⁴
 $S_{x, steel} = 2.800$ in³ $S_{y, steel} = 1.800$ in³
 $I_{x, combined} = 24.795$ in⁴ $I_{y, combined} = 7.433$ in⁴



X-Axis Bending Stress (ADM F.2 & F.3)		$\Omega = 1.65$
$w = p \cdot t$	$w_y = 52.7$ lb/ft	
Shear Load $V = w/2$	$V_y = 296.3$ lb	
Moment $M = w/2 \cdot L$	$M_x = 832.6$ lb-ft	
$M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$	$M_{x-alum} = 287.3$ lb-ft	
$L_n = (2 \cdot L_b \cdot S_x) / (I_y J)^{1/2}$	$L_n = 253.7$	
$f_b = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum-x} = 1.10$ ksi	
$f_{b-alum-x} / F_{bx} = 0.076$	$F_{bx} / \Omega = F_{bx} = 14.52$ ksi	
Y-Axis Bending Stress (ADM F.2 & F.3)		$\Omega = 1.65$
$w = p \cdot t$	$w_x = 84.4$ lb/ft	
Shear Load $V = w/2$	$V_x = 474.2$ lb	
Moment $M = w/2 \cdot L$	$M_y = 1332.5$ lb-ft	
$M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$	$M_{y-alum} = 396.7$ lb-ft	
$L_n = (2 \cdot L_b \cdot S_y) / (I_x J)^{1/2}$	$L_n = 143.2$	
$f_b = M_{alum} / (S_{y, alum})$	$f_{b-alum-y} = 2.70$ ksi	
$f_{b-alum-y} / F_{by} = 0.179$	$F_{by} / \Omega = F_{by} = 15.07$ ksi	
Combined Stress Ratio		$f_{bx} / F_{bx} + f_{by} / F_{by} = 0.25$
		OK

Check Combined Bending & Compression (ADM H.1)	
$f_a / F_a + f_b / F_b < 1.0$	$f_a / F_a + f_b / F_b = 0.346$
OK	

Mullion Resultant Forces			
Strong Axis Bending, $M_x, w_y =$		52.73 lb/ft	
Weak Axis Bending, $M_y, w_x =$		84.38 lb/ft	
Load Share			
Aluminum (x)	Steel (x)	Aluminum (y)	Steel (y)
0.345	0.655	0.298	0.702

Axial Load	
$P = p_{wt} \cdot t \cdot h + w_t \cdot h$	$P = 617.2$ lb

Check Allowable Compression - ADM E.3	
$kL_y / r =$	$kL_y / r = 130.56$
F_{a1} (Allowable Compression)	$F_{a1} / \Omega = 3.01$ ksi
Check Allowable Compression - Flange element (ADM B.5.4.2)	
$b/t =$	$b/t = 12.36$
F_{a2} (Allowable Compression)	$F_{a2} / \Omega = 15.20$ ksi
Check Allowable Compression - Web element (ADM B.5.5.1)	
$b/t =$	$b/t = 37.72$
F_{a3} (Allowable Compression)	$F_{a3} / \Omega = 19.70$ ksi

$f_a = P/A$	$f_a = 0.27$ ksi
Lessor of F_{a1}, F_{a2}, F_{a3}	$F_a / \Omega = F_a = 3.01$ ksi
	$f_a / F_a = 0.091$
OK	



JEI Structural Engineering
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Kansas City, MO 64155

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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/203
Detail: 1/406

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Strong Axis Deflection (M_x, w_y)	Typical Vertical
$\Delta_y = (5w_y L^4)/(384EI)$	$\Delta_y = 0.076$ in

Weak-Axis Deflection (w_x)	
$\Delta_x = (5w_x L^4)/(384EI_\Delta)$	$\Delta_x = 0.404$ in

Resultant Deflection	
$\Delta_{total} = \sqrt{(\Delta_x^2 + \Delta_y^2)}$	$\Delta_{total} = 0.411$ in
Angle Relative to X-Axis	$\theta_\Delta = 10.6^\circ$
	$\Delta_{allow} = 0.771$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = 15.5
OK	

Steel Stress (X-axis)	
Moment to Steel = I_x steel/ I comb =	545.3 lb-ft
$f_b = M/S_{x, steel}$	$f_b = 1.2$ ksi
$M_r/\Omega_b =$	$M_r/\Omega_b = 8814$ lb-ft
OK	

Deflection Along Glazing	
$\Delta_{y-glazing} = \Delta_y \sin((180-\theta)/2)$	$\Delta_{y-glazing} = 0.064$ in
$\Delta_{x-glazing} = \Delta_x \cos((180-\theta)/2)$	$\Delta_{x-glazing} = 0.214$ in
Tributary Area A	
$\Delta_{total-A} = \Delta_{x-glazing} + \Delta_{y-glazing}$	$\Delta_{total} = 0.278$ in
Tributary Area B	
$\Delta_{total-B} = \Delta_{x-glazing} - \Delta_{y-glazing}$	$\Delta_{total} = 0.150$ in

SSG Sealant Deflection	
1/4 in. joint	50% $\pm$ movement capacity
0.280 in. allowable deflection	SSG Sealant OK

Steel Stress (Y-axis)	
Moment to Steel = I_y steel/ I comb =	935.8 lb-ft
$f_b = M/S_{y, steel}$	$f_b = 6.2$ ksi
$M_r/\Omega_b =$	$M_r/\Omega_b = 5302$ lb-ft
OK	



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 7-1/2")
Part of: Vertical Mullion Analysis
Elevation: 1/203
Detail: 1/406

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Strong Axis Deflection (M_x, w_y)	Typical Vertical
$\Delta_y = (5w_y L^4)/(384EI)$	$\Delta_y = 0.112$ in

Weak-Axis Deflection (w_x)	
$\Delta_x = (5w_x L^4)/(384EI_\Delta)$	$\Delta_x = 0.375$ in

Resultant Deflection	
$\Delta_{total} = \sqrt{(\Delta_x^2 + \Delta_y^2)}$	$\Delta_{total} = 0.391$ in
Angle Relative to X-Axis	$\theta_\Delta = 16.7^\circ$
	$\Delta_{allow} = 0.771$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = 23.1
OK	

Steel Stress (X-axis)	
Moment to Steel = I_x steel/ I comb =	810.0 lb-ft
$f_b = M/S_{x, steel}$	$f_b = 1.7$ ksi
$M_u/\Omega_b =$	$M_u/\Omega_b = 8814$ lb-ft
OK	

Deflection Along Glazing	
$\Delta_{y-glazing} = \Delta_y \sin((180-\theta)/2)$	$\Delta_{y-glazing} = 0.079$ in
$\Delta_{x-glazing} = \Delta_x \cos((180-\theta)/2)$	$\Delta_{x-glazing} = 0.265$ in
Tributary Area A	
$\Delta_{total-A} = \Delta_{x-glazing} + \Delta_{y-glazing}$	$\Delta_{total} = 0.344$ in
Tributary Area B	
$\Delta_{total-B} = \Delta_{x-glazing} - \Delta_{y-glazing}$	$\Delta_{total} = 0.185$ in

SSG Sealant Deflection	
1/4 in. joint	50% $\pm$ movement capacity
0.280 in. allowable deflection	SSG Sealant OK

Steel Stress (Y-axis)	
Moment to Steel = I_y steel/ I comb =	868.5 lb-ft
$f_b = M/S_{y, steel}$	$f_b = 5.8$ ksi
$M_u/\Omega_b =$	$M_u/\Omega_b = 5302$ lb-ft
OK	

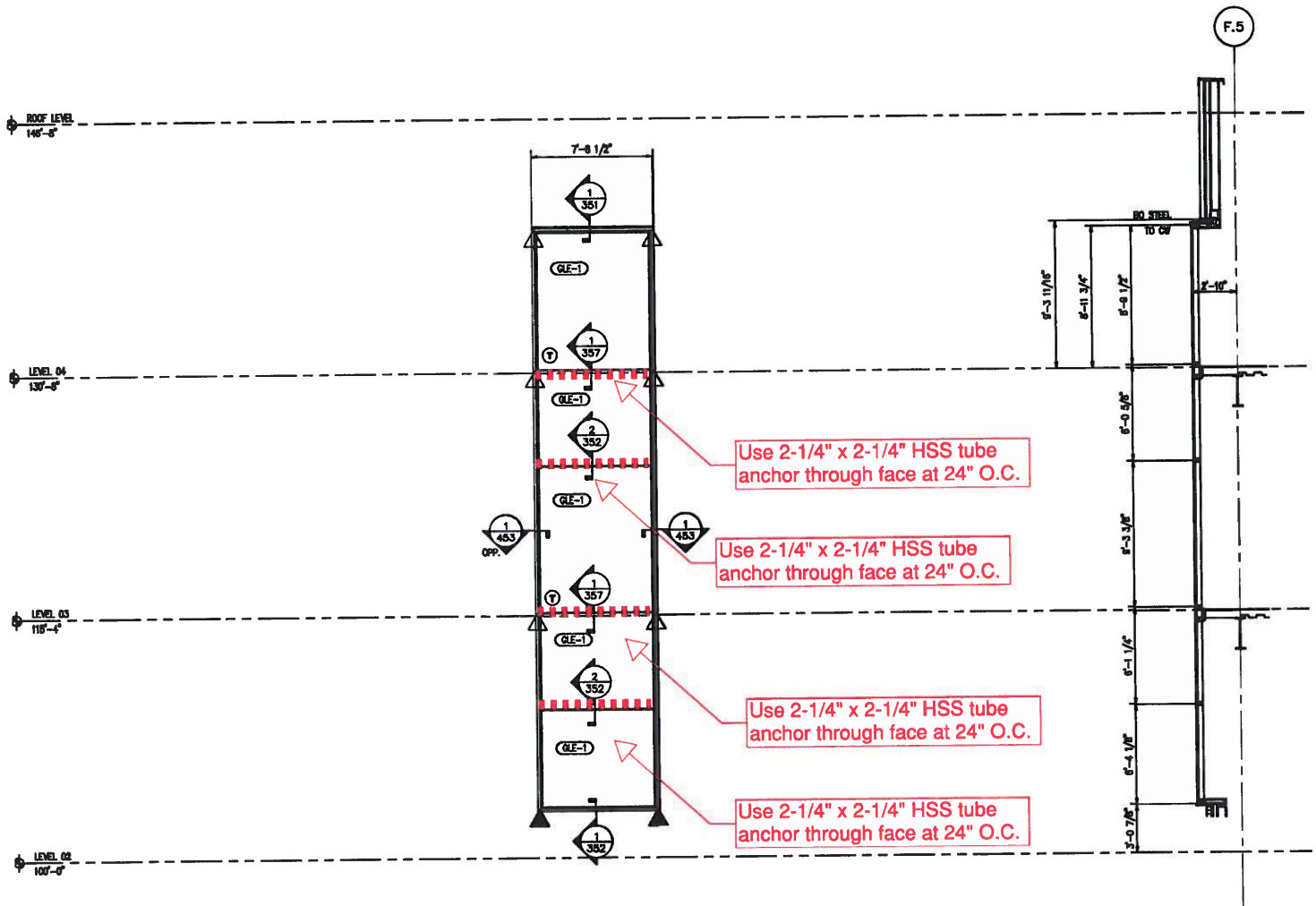


Section sets



EGS-3 YKK YCW 750 SSG (2-1/2 x 5-1/16"). Shop drawing sheets 213

JEI Structural Engineering	Webster University	SK - 43
M. Gorny		Nov 2, 2016 at 7:13 AM
JE16059		EGS-1 Preliminary.r3d



1 NORTH ELEVATION
Scale: 3/4"=1'-0"
E88-3
COLOR: PENTON

2 SECTION
Scale: 3/4"=1'-0"
ARCH REF: 4/A0402

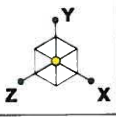


Member labels

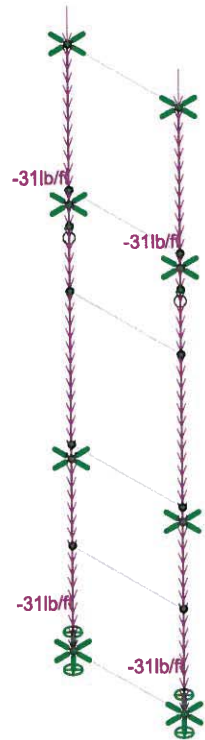


EGS-3 YKK YCW 750 SSG (2-1/2" x 5-1/16"). Shop drawing sheets 213

JEI Structural Engineering	Webster University	SK - 44
M. Gorny		Nov 2, 2016 at 7:14 AM
JE16059		EGS-1 Preliminary.r3d



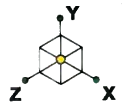
Dead load
 $8\text{psf } (7' 8\text{-}1/2") / 2 = 31\text{lb/ft}$



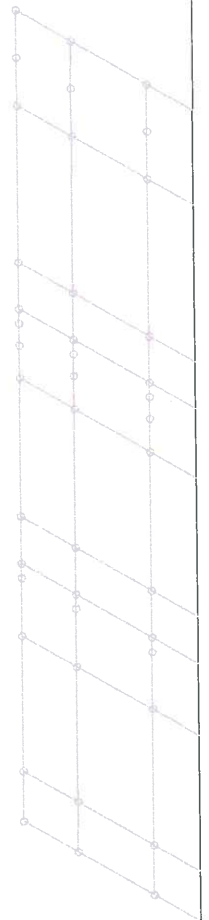
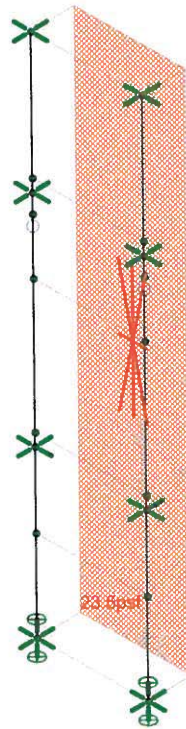
EGS-3 YKK YCW 750 SSG (2-1/2" x 5-1/16"). Shop drawing sheets 213

Loads: BLC 7, Dead

JEI Structural Engineering	Webster University	SK - 4
M. Gorny		Nov 7, 2016 at 2:31 PM
JE16059		EGS-1 Preliminary.r3d



Negative Wind - 23.5psf



EGS-3 YKK YCW 750 SSG (2-1/2" x 5-1/16"). Shop drawing sheets 213

Loads: BLC 1, Negative Wind (Face A)

JEI Structural Engineering

M. Gorny

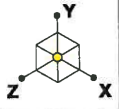
JE16059

Webster University

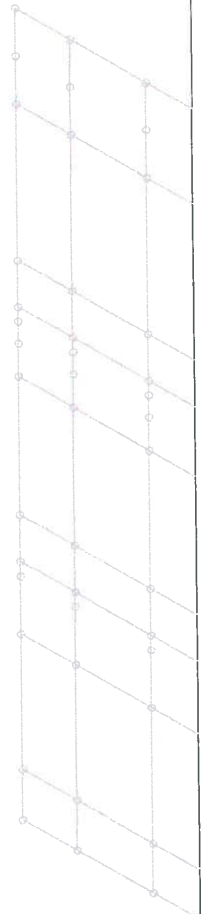
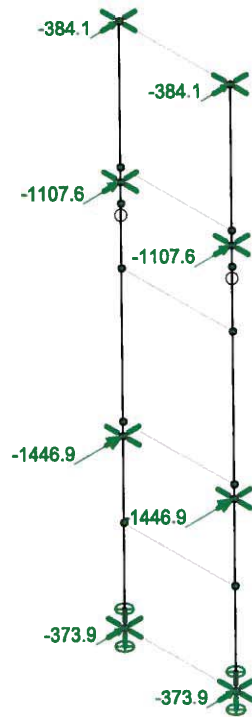
SK - 5

Nov 7, 2016 at 2:32 PM

EGS-1 Preliminary.r3d



Anchor Loads



EGS-3 YKK YCW 750 SSG (2-1/2" x 5-1/16"). Shop drawing sheets 213
 Results for LC 1, Negative Wind Face A
 Z-direction Reaction Units are lb and lb-ft

JEI Structural Engineering

M. Gorny

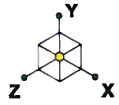
JE16059

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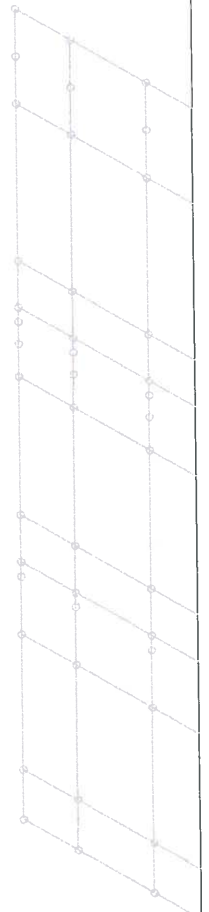
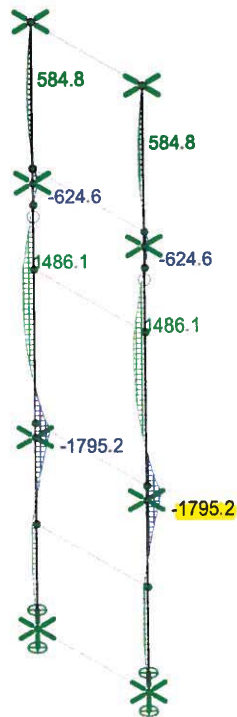
SK - 6

Nov 7, 2016 at 2:33 PM

EGS-1 Preliminary.r3d



Moment diagram



EGS-3 YKK YCW 750 SSG (2-1/2" x 5-1/16"). Shop drawing sheets 213

Results for LC 1, Negative Wind Face A
Member z Bending Moments (lb-ft)

JEI Structural Engineering

M. Gorny

JE16059

Webster University

SK - 7

Nov 7, 2016 at 2:34 PM

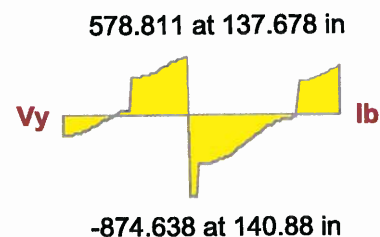
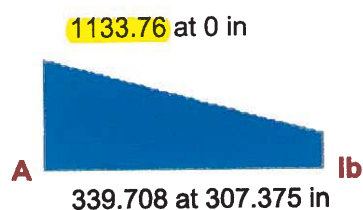
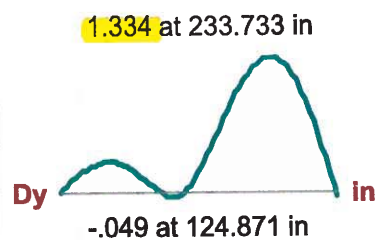
EGS-1 Preliminary.r3d

Beam: **M676B**

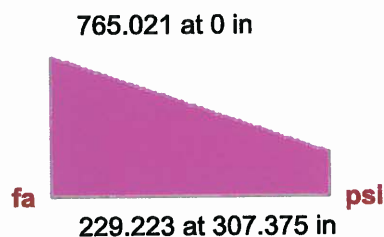
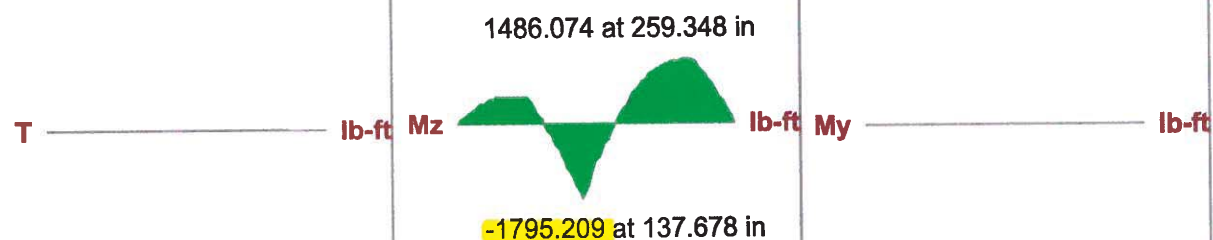
Shape:

Material: **gen_Alum**Length: **307.375 in**I Joint: **N751**J Joint: **N766A**Code Check: **No Calc**

Report Based On 97 Sections



Vz _____ lb



fc _____ psi ft _____ psi

YKK E9-3423

Using reduced pressure based on non-corner wind condition to reduce stress and deflection.

$$M_z = 1795.209 \text{ lb-ft} (19 \text{ psf} / 23.5 \text{ psf}) = 1451.4 \text{ lb-ft}$$

$$D_y = 1.334" (19 \text{ psf} / 23.5 \text{ psf}) = 1.079"$$



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG (2-1/2" x 5-1/16")
Part of: Vertical Mullion Analysis
Elevation: 1/213
Detail: 1/453 **Member M676B**

Date: 11/7/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 3.85 ft $F_y = 25.0$ ksi
Height (h) 15.33 ft $F_u = 30.0$ ksi
Unbraced Length (L) 8.33 ft

Design Loads

Design Pressure (p) 19.0 psf (reduced deflection, using non-corner winds)
Panel Weight (p_w) 8.0 psf

Manuf. / Part #: YKK E9-3423

E = 10100 ksi $r_{x, alum} = 1.383$ in
 $I_{x, alum} = 2.835$ in⁴ $r_{y, alum} = 0.949$ in
 $I_{y, alum} = 1.333$ in⁴ A = 1.482 in²
 $S_{x, alum} = 1.331$ in³ J = 2.156 in⁴
 $S_{y, alum} = 1.066$ in³ wt = 1.780 lb/ft
b/t_{web} = 38.37 b/t_{flange} = 23.48
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ w = N/A lb/ft
Shear Load V = wL/2 V = N/A lb
Moment M = wL²/8 M = 1451.4 lb-ft
 $M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$ $M_{alum} = 1451.4$ lb-ft
 $f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$ $f_{b-alum} = 13.09$ ksi

Applied Axial Compression

$P = p_w \cdot t \cdot h + wt \cdot h$ P = 1133.8 lb
 $f_{c-alum} = P/A$ $f_{c-alum} = 0.77$ ksi

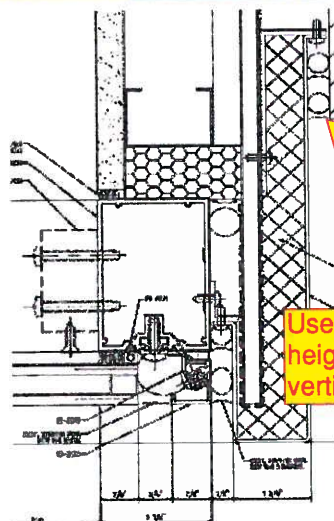
Check Deflection

Jamb Vertical

5/8 in. joint $\Delta = (5wL^4)/(384EI) = 1.079$ in
100% $\pm$ movement cap. $\Delta_{allow} = 1.017$ in
Allowable deflection = L/175 or if span > 13'-6"
then allowable def = L/240 + 1/4" Deflection Factor
DF = #####

Steel Capacity

$M_{steel} = I_{x, steel} / I_{comb} =$ $M_{steel} = 0.0$ lb-ft
 $M_b/\Omega =$ $M_b/\Omega = 0$ lb-ft
 $M_s/(M_b/\Omega) =$ N/A



Use 5/8" silicone joint, full height of hight of this jamb vertical

Reinforcing

No Reinforcing

$I_{x, steel} = 0.000$ in⁴
 $S_{x, steel} = 0.000$ in³
 $I_{combined} = 2.835$ in⁴

Load Share

Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.04 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	17.74 ksi
E.3 - Axial Compression	4.62 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.99 ksi

Compression Interaction

Allowable Compression	$F_c = 4.62$ ksi
Compression Stress Interaction	$f_{c-alum}/F_c = 0.166$

Flexure Interaction

Controls: F.3.1 - Closed Shape Flexure	
Allowable Flexural Compression	$F_b = 14.99$ ksi
Flexure Interaction	$f_{b-alum}/F_b = 0.873$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 1.038$

Mullion OK, $\leq 4\%$ over allowable stress.



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Office: 816-505-0987
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www.jeistructural.com

Client: NGG

Project: Webster University

Structure: YKK 750 SSG (2-1/2" x 5-1/16")

Part of: Vertical Mullion Summary

Designer: M. Gorny

Manufacture: YKK

Part #: E9-3423

Alloy/Temper: 6063-T6

Typical Wind Pressure (T) = 20.0 psf

Cornet Zone Wind Pressure (C) = 24.0 psf

Interior Pressure (INT) = 5.0 psf

Date: 11/2/2016
Proj: JE16059

INPUT CHECK RISA

Sheet	Elevation	Section	Part No	Wind Zone	Unbraced Length (L _u)	Trib Height (h) ft	Trib Width (t) ft	Trib Area (h)*(t) = (A)	Wind Pres (p)	linear load (w) (plf)	Deflection Factor (w) * (h) ⁴ (div by 10E7)	Stress Factor ((w)*(h) ²)/1000
200	1/200	1/418	E9-3423	T	11.71	12.17	5.53	67.3	20.0	110.6	41.3	16.4
200	1/200	1/417	E9-3423	T	11.71	12.17	3.92	47.7	20.0	78.3	29.3	11.6
201	1/201	1/451	E9-3423	T	11.71	12.17	4.69	57.0	20.0	93.8	35.0	13.9
201	1/201	1/454	E9-3423	T	11.71	12.17	2.38	29.0	20.0	47.6	17.8	7.0
215	1/215	1/451	E9-3423	C	5.79	6.21	5.25	32.6	24.0	126.0	6.3	4.9
219	1/219	2/452	E9-3423	C	3.08	3.50	5.00	17.5	24.0	120.0	1.1	1.5
220	1/220	2/452	E9-3423	T	1.58	2.00	4.56	9.1	20.0	91.3	0.2	0.4
220, 220	3/220, 5/220	2/416	E9-3423	T	11.58	12.00	5.82	69.8	20.0	116.4	41.7	16.8

Mullion Design Summary

1: Use 4" x 2" x 1/4" A36 Steel Channel Reinforcing

2: OK



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 5-1/16")
Part of: Vertical Mullion Analysis
Elevation: 3/220, 5/220
Detail: 2/416

Check 1

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 5.82 ft $F_y = 25.0$ ksi
Height (h) 12.00 ft $F_u = 30.0$ ksi
Unbraced Length (L) 11.58 ft

Design Loads

Design Pressure (p) 20.0 psf
Panel Weight (p_w) 8.0 psf

Manuf. / Part #: YKK E9-3423

$E = 10100$ ksi $r_{x, \text{alum}} = 1.383$ in
 $I_{x, \text{alum}} = 2.835$ in⁴ $r_{y, \text{alum}} = 0.949$ in
 $I_{y, \text{alum}} = 1.333$ in⁴ $A = 1.482$ in²
 $S_{x, \text{alum}} = 1.331$ in³ $J = 2.156$ in⁴
 $S_{y, \text{alum}} = 1.066$ in³ $wt = 1.780$ lb/ft
 $b/t_{web} = 38.37$ $b/t_{flange} = 23.48$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = 116.4$ lb/ft
Shear Load $V = wL/2$ $V = 698.1$ lb
Moment $M = wL^2/8$ $M = 2094.4$ lb-ft
 $M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$ $M_{alum} = 2094.4$ lb-ft
 $f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$ $f_{b-alum} = 18.88$ ksi

Applied Axial Compression

$P = p_w \cdot t \cdot h + wt \cdot h$ $P = 579.9$ lb
 $f_{c-alum} = P/A$ $f_{c-alum} = 0.39$ ksi

Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) = 1.896$ in
N/A $\pm$ movement cap. $\Delta_{allow} = 0.823$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$
Deflection Factor $DF = 41.7$

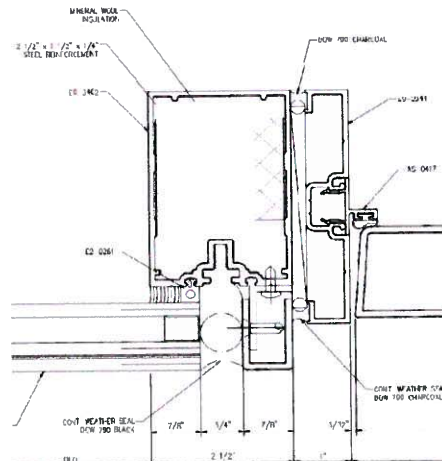
Steel Capacity

$M_{steel} = I_{x, steel} / I_{comb} =$ $M_{steel} = 0.0$ lb-ft
 $M_b/\Omega =$ $M_b/\Omega = 0$ lb-ft
 $M_s/(M_b/\Omega) = N/A$

INPUT

CHECK

RISA



Reinforcing

No Reinforcing

$I_{x, steel} = 0.000$ in⁴
 $S_{x, steel} = 0.000$ in³
 $I_{combined} = 2.835$ in⁴

Load Share

Aluminum	Steel
1.000	0.000

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.04 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	17.74 ksi
E.3 - Axial Compression	2.39 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.68 ksi

Compression Interaction

Allowable Compression	$F_c = 2.39$ ksi
Compression Stress Interaction	$f_{c-alum}/F_c = 0.164$

Flexure Interaction

Controls: F.3.1 - Closed Shape Flexure	
Allowable Flexural Compression	$F_b = 14.68$ ksi
Flexure Interaction	$f_{b-alum}/F_b = 1.286$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 1.450$

Mullion deflection exceeds limits! Reinforcing or heavier mullion required.

REINFORCE!!!!

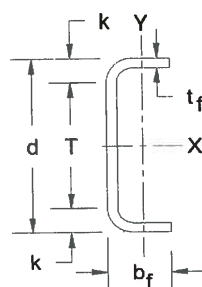


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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Channel allowable flexural strength

Check 1



Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

AISC Shape: 2-1/2" x 1-1/2" x 1/4"
Cust Dims: N/A
E = 29000 ksi
F_y = 36 ksi
Material = A36
L_b = 140 in

d = 2.500 in
b_f = 1.500 in
t_f = 0.250 in
t_w = 0.250 in
T = h = 1.000 in
J = 0.023 in⁴
C_w = 0.183 in⁶
h_o = 2.250 in
A = 1.170 in²
wt = 3.981 lb/ft
I_x = 1.004 in⁴
S_x = 0.803 in³
Z_x = 0.997 in³
r_x = 0.926 in
I_y = 0.243 in⁴
S_y = 0.251 in³
Z_y = 0.449 in³
r_y = 0.456 in

Flange Slenderness
r_{ts}² = (I_yC_w)^{1/2}/S_x = 0.26
c = h_o/2 * (I_y/C_w)^{1/2} = 1.30
λ_{pf} = 0.38(E/F_y)^{1/2} = 10.79
λ_{rf} = 1.0(E/F_y)^{1/2} = 28.38
Web Slenderness
λ_{pw} = 3.76(E/F_y)^{1/2} = 106.72
λ_{rw} = 5.70(E/F_y)^{1/2} = 161.78

Flange Slenderness λ = b _f /t _f = 6.00 Flange Slenderness = Compact	Web Slenderness λ = h/t _w = 4.00 Web Slenderness = Compact
L _b =	L _b = 140 in
L _p = 1.76r _y (E/F _y) ^{1/2} =	L _p = 22.78 in
L _r = 1.95r _{ts} * E/(0.7F _y) * (Jc/(S _x h _o)) ^{1/2} * (1 + (1 + 6.76(0.7F _y /E * S _x h _o /(Jc)) ²) ^{1/2}) ^{1/2} =	L _r = 211.29 in

X-Axis Yielding (AISC F2.1) L _b ≤ L _p M _n = M _p = F _y Z _x = 35.89 kip-in	Y-Axis Yielding (AISC F6.1) M _n = M _p = F _y Z _y = 16.18 kip-in 1.6F _y S _y = 14.46 kip-in M _n = M _p ≤ 1.6F _y S _y = 14.46 kip-in
---	--

X-Axis Lateral-Torsional Buckling (AISC F2.2) AISC F2.2.b L _p < L _b ≤ L _r M _n = C _b [M _p - (M _p - 0.7F _y S _x)((L _b - L _p)/(L _r - L _{p}))] = M_n = 26.16 kip-in M_p = F_yZ_x = 35.89 kip-in M_n ≤ M_p = 26.16 kip-in}	Y-Axis Flange Local Buckling (AISC F6.2) AISC F6.2b λ _{pf} < λ ≤ λ _{rf} M _n = [M _p - (M _p - 0.7F _y S _y)(λ - λ _p)/(λ _r - λ _p)] = M _n = 18.86 kip-in M _p = F _y Z _y = 16.18 kip-in M _n ≤ M _p = N/A kip-in
AISC F2.2.c L _b > L _r F _{cr} = C _b π ² E/(L _b /r _{ts}) ² (1 + 0.078Jc/(S _x h _o)(L _b /r _{ts}) ²) ^{1/2} = F _{cr} = 38.12 ksi M _n = F _{cr} S _x = 30.61 kip-in M _p = F _y Z _x = 35.89 kip-in M _n ≤ M _p = N/A kip-in	AISC F6.2b λ > λ _{rf} F _{cr} = 0.69E/(b _f /2t _f) ² = F _{cr} = 2223.33 ksi M _n = F _{cr} S _y = 558.06 kip-in M _n = N/A kip-in

X-Axis Capacity	Ω_b = 1.67
M _n =	26.16 kip-in
M _n /Ω _b =	15.66 kip-in
M _n /Ω _b =	1305 lb-ft

Y-Axis Capacity	Ω_b = 1.67
M _n =	14.46 kip-in
M _n /Ω _b =	8.66 kip-in
M _n /Ω _b =	721 lb-ft



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 5-1/16")
Part of: Vertical Mullion Analysis
Elevation: 3/220, 5/220
Detail: 2/416

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 5.82 ft $F_y = 25.0$ ksi
Height (h) 12.00 ft $F_u = 30.0$ ksi
Unbraced Length (L) 11.58 ft

Design Loads

Design Pressure (p) 20.0 psf
Panel Weight (p_{wt}) 8.0 psf

Manuf. / Part #: YKK E9-3423

$E = 10100$ ksi $r_{x, alum} = 1.383$ in
 $I_{x, alum} = 2.835$ in⁴ $r_{y, alum} = 0.949$ in
 $I_{y, alum} = 1.333$ in⁴ $A = 1.482$ in²
 $S_{x, alum} = 1.331$ in³ $J = 2.156$ in⁴
 $S_{y, alum} = 1.066$ in³ $wt = 1.780$ lb/ft
 $b/t_{web} = 38.37$ $b/t_{flange} = 23.48$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment

$w = p \cdot t$ $w = 116.4$ lb/ft
Shear Load $V = wL/2$ $V = 698.1$ lb
Moment $M = wL^2/8$ $M = 2094.4$ lb-ft
 $M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$ $M_{alum} = 1035.3$ lb-ft
 $f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$ $f_{b-alum} = 9.33$ ksi

Applied Axial Compression

$P = p_{wt} \cdot t \cdot h + wt \cdot h$ $P = 579.9$ lb
 $f_{c-alum} = P/A$ $f_{c-alum} = 0.39$ ksi

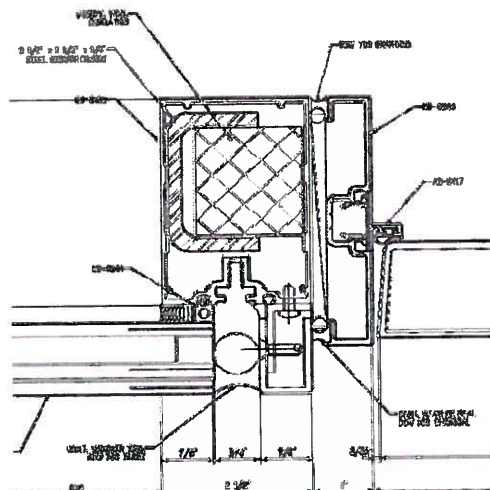
Check Deflection

Typical Vertical

N/A in. joint $\Delta = (5wL^4)/(384EI) = 0.937$ in
N/A $\pm$ movement cap. $\Delta_{allow} = 0.823$ in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$
Deflection Factor DF = 41.7

Steel Capacity

$M_{steel} = I_{x, steel} / I_{comb} =$ $M_{steel} = 1059.1$ lb-ft
 $Mb/\Omega =$ $Mb/\Omega = 1305$ lb-ft
 $Ms/(Mb/\Omega) = 0.812$



Reinforcing

2x4x1/4 A36 Steel Channel

$I_{x, steel} = 1.000$ in⁴
 $S_{x, steel} = 0.803$ in³
 $I_{combined} = 5.735$ in⁴

Load Share

Aluminum	Steel
0.494	0.506

Allowable Loads

$\Omega = 1.65$

B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.04 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	17.74 ksi
E.3 - Axial Compression	2.39 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.68 ksi

Compression Interaction

Allowable Compression	$F_c = 2.39$ ksi
Compression Stress Interaction	$f_{c-alum}/F_c = 0.164$

Flexure Interaction

Controls: F.3.1 - Closed Shape Flexure	
Allowable Flexural Compression	$F_b = 14.68$ ksi
Flexure Interaction	$f_{b-alum}/F_b = 0.636$

Check Combined Bending & Compression (ADM H.1)

$f_a/F_a + f_b/F_b < 1.0$ $f_a/F_a + f_b/F_b = 0.800$

Mullion OK, $\leq 1/8"$ over allowable deflection.



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 5-1/16")
Part of: Vertical Mullion Analysis
Elevation: 1/201
Detail: 1/454 **Check 2**

Date: 11/2/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Load Design Code	
ASCE7-05 ASD	
Material Design Code	
Aluminum Design Manual 2010	
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Tributary Width (t) 2.38 ft $F_y = 25.0$ ksi
Height (h) 12.17 ft $F_u = 30.0$ ksi
Unbraced Length (L) 11.71 ft

Design Loads

Design Pressure (p) 20.0 psf
Panel Weight (p_{wt}) 8.0 psf

Manuf. / Part #: YKK E9-3423

E = 10100 ksi $r_{x, alum} = 1.383$ in
 $I_{x, alum} = 2.835$ in⁴ $r_{y, alum} = 0.949$ in
 $I_{y, alum} = 1.333$ in⁴ A = 1.482 in²
 $S_{x, alum} = 1.331$ in³ J = 2.156 in⁴
 $S_{y, alum} = 1.066$ in³ wt = 1.780 lb/ft
 $b/t_{web} = 38.37$ $b/t_{flange} = 23.48$
Fixity_{web} = 2 end(s) Fixity_{flange} = 2 end(s)

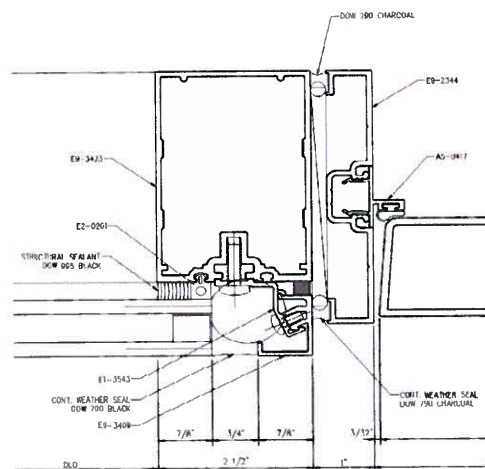
Thermal Reduction Factors (TRF_t, TRF_s)

I_x Reduc. 1.00 S_x Reduc. 1.00

Applied Bending Moment			
$w = p \cdot t$	$w = 47.6$ lb/ft		
Shear Load $V = wL/2$	$V = 289.6$ lb		
Moment $M = wL^2/8$	$M = 880.8$ lb-ft		
$M_{alum} = M \cdot I_{alum} \cdot TRF_t / I_{comb}$	$M_{alum} = 880.8$ lb-ft		
$f_{b-alum} = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum} = 7.94$ ksi		
Applied Axial Compression			
$P = p_{wt} \cdot t \cdot h + wt \cdot h$	$P = 253.3$ lb		
$f_{c-alum} = P/A$	$f_{c-alum} = 0.17$ ksi		

Check Deflection	Typical Vertical
N/A in. joint $\Delta = (5wL^4)/(384EI) =$	0.820 in
N/A $\pm$ movement cap. $\Delta_{allow} =$	0.834 in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = 17.8

Steel Capacity	
$M_{steel} = I_{x, steel} / I_{comb} =$	$M_{steel} = 0.0$ lb-ft
$Mb/\Omega =$	$Mb/\Omega = 0$ lb-ft
$Ms/(Mb/\Omega) =$	N/A



Reinforcing	No Reinforcing	Load Share	
$I_{x, steel} =$	0.000 in ⁴	Aluminum	Steel
$S_{x, steel} =$	0.000 in ³	1.000	0.000
$I_{combined} =$	2.835 in ⁴		

Allowable Loads	$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.	N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.	15.04 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure	N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure	17.74 ksi
E.3 - Axial Compression	2.34 ksi
F.2.1 - Open Shape Flexure	N/A ksi
F.3.1 - Closed Shape Flexure	14.67 ksi

Compression Interaction	
Allowable Compression	$F_c = 2.34$ ksi
Compression Stress Interaction	$f_{c-alum}/F_c = 0.073$

Flexure Interaction	
Controls: F.3.1 - Closed Shape Flexure	
Allowable Flexural Compression	$F_b = 14.67$ ksi
Flexure Interaction	$f_{b-alum}/F_b = 0.541$

Check Combined Bending & Compression (ADM H.1)	
$f_a/F_a + f_b/F_b < 1.0$	$f_a/F_a + f_b/F_b = 0.614$

Mullion OK



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Client: NGG

Project: Webster University

Structure: YKK 750 SSG (2-1/2" x 5-1/16")

Part of: Jamb Mullion Summary

Designer: M. Gorny

Manufacturer: Kawneer

Part #: E9-3423

Alloy/Temper: 6063-T6

Jamb $I_x = 2.835 \text{ in}^4$

Typical Wind Pressure (T) = 20.0 psf

Corner Zone Wind Pressure (C) = 24.0 psf

Interior Pressure (INT) = 5.0 psf

Date: 11/2/2016
Proj: JE16059

Sealant Joint Size & Expansion

1/2" Joint (50% Expandable)

Allowable Movement = 0.560 in

INPUT CHECK RISA

Sheet	Elevation	Section	Part No	Wind Zone	Unbraced Length (L_u)	Trib Height (h) ft	Trib Width (t) ft	Trib Area (h)*(t) = (A)	Wind Pres (p)	linear load (w) (plf)	Unreinforced Deflection (in)	Stress Factor $((w)*(h)^2)/1000$	Deflection > 0.56 in.?	
200	1/200	2/417	E9-3423	T	11.71	12.17	2.34	28.5	20.0	46.9	0.82	6.9	Reinforce	Check 1)
201	1/201	2/400	E9-3423	T	11.71	12.17	0.69	8.4	20.0	13.9	0.24	2.1	OK	Check 2)
215	1/215	2/451	E9-3423	C	5.79	6.21	2.63	16.3	24.0	63.0	0.07	2.4	OK	Check 2)
219	1/219	1/452	E9-3423	C	3.08	3.50	2.50	8.8	24.0	60.0	0.01	0.7	OK	Check 2)
220	1/220	1/452	E9-3423	T	1.58	2.00	2.28	4.6	20.0	45.6	0.00	0.2	OK	Check 2)
220	3/220, 5/220	1/452	E9-3423	T	11.58	12.00	2.63	31.6	20.0	52.6	0.87	7.6	Reinforce	Check 1)

Mullion Design Summary

1: OK by comparison to Vertical Mullion Check 2. Use DOW 790 (or similar 100% expandable sealant)

2: OK by comparison to Vertical Mullion Check 2.



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 5-1/2")
Part of: Horizontal Mullion Analysis
Elevation: 1/200
Detail: 1/324

Check 1 (Door Header)

Load Design Code	Material Design Code
ASCE7-05 ASD	ADM 2010
ADM 2010 Type	Alloy-Temper
Closed Shape	6063-T6

Wind Tributary Width (t_{WL})	6.08 ft	$F_y =$	25.0 ksi
Dead Load Trib. Height (t_{DL})	2.72 ft	$F_u =$	30.0 ksi
Length (L)	6.17 ft		
Unbraced Length (L_b)	6.17 ft		

Design Loads

Design Pressure (p)	24.0 psf
Infill Weight (P_{wi})	6.5 psf

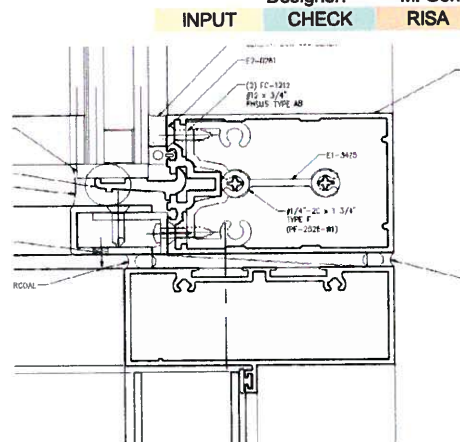
Manuf. / Part #:

YKK E9-3423

E =	10100 ksi	$r_{x, alum} =$	1.383 in
$I_{x, alum} =$	2.835 in ⁴	$r_{y, alum} =$	0.949 in
$I_{y, alum} =$	1.333 in ⁴	A =	1.482 in ²
$S_{x, alum} =$	1.331 in ³	J =	2.156 in ⁴
$S_{y, alum} =$	1.066 in ³	wt =	1.780 lb/ft
$b/t_{web} =$	38.37	$b/t_{flange} =$	23.48
Fixity _{web} =	2 end(s)	Fixity _{flange} =	2 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc.	1.00	S_x Reduc.	1.00
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Setting Block Locations (s) =	1/4	points
Setting Block Load (P) =	54.5	lb/setting block

Reinforcing

Reinforcing		No Reinforcing	
$I_{x, steel} =$	0.000 in ⁴	$I_{y, steel} =$	0.000 in ⁴
$S_{x, steel} =$	0.000 in ³	$S_{y, steel} =$	0.000 in ³
$I_{x, combined} =$	2.835 in ⁴	$I_{y, combined} =$	1.333 in ⁴
$A_{steel} =$	0.00 in ²	$wt_{steel} =$	0.00 lb/ft
$A_{alum-total} =$	1.482 in ²	$wt_{total} =$	1.780 lb/ft

X-Axis Applied Bending Moment (Wind Load)		Load Share = 100%
$W_{WL} = p \cdot t_{WL}$	$w =$	146.0 lb/ft
Shear Load $V = wL/2$	$V =$	450.2 lb
Moment $M = wL^2/8$	$M =$	694.0 lb-ft
$M_{alum} = M \cdot I_{alum} \cdot TRF_i / I_{comb}$	$M_{alum} =$	694.0 lb-ft
$f_b = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum-x} =$	6.26 ksi
Y-Axis Applied Bending Moment (Dead Load)		Load Share = 100%
Shear $V = P + wt_{total} \cdot L/2$	$V =$	60.0 lb
Moment $M = wt_{total} \cdot L^2/8 + P \cdot L \cdot s$	$M =$	92.5 lb-ft
$M_{alum} = M \cdot I_{alum} / I_{comb}$	$M_{alum} =$	92.5 lb-ft
$f_b = M_{alum} / (S_{y, alum})$	$f_{b-alum-y} =$	1.04 ksi
Applied Axial Compression		
$P =$	0.0 lb	
$f_{c-alum} = P/A$	$f_{c-alum} =$	0.00 ksi

X-axis Deflection (Wind Load)		Typical Horizontal	
N/A in. joint $\Delta_x = (5wL^4)/(384EI_d) =$		0.166 in	
N/A $\pm$ movement cap. $\Delta_{x-allow} =$		0.423 in	
Allowable deflection = L/175 or if span > 13'-6" then allowable def = L/240 + 1/4"		Deflection Factor DF = 43.8	
Y-axis Deflection (Dead Load)		Door Header	
$\Delta = ((P_{ab}Ls)/(24EI)) + (3L^2 \cdot 4(Ls)^2) + 5w_{total}L^4/(384EI)$		$\Delta =$ 0.051 in	
		$\Delta_{y-allow} =$ 0.0625 in	

Steel Capacity (X-Axis)		Load Share = 0%
$M_{steel} = I_{x, steel} / I_{comb} =$	$M_{steel} =$	0.0 lb-ft
$Mb/\Omega =$	$Mb/\Omega =$	0 lb-ft
$Ms/(Mb/\Omega) =$	$Ms/(Mb/\Omega) =$	N/A
Steel Capacity (Y-Axis)		Load Share = 0%
$M_{steel} = I_{y, steel} / I_{comb} =$	$M_{steel} =$	0.0 lb-ft
$\Phi \cdot Mb =$	$Mb/\Omega =$	0 lb-ft
$Ms/(Mb/\Omega) =$	$Ms/(Mb/\Omega) =$	N/A

X-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		15.04 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		17.74 ksi
F.2.1 - Open Shape Flexure		N/A ksi
F.3.1 - Closed Shape Flexure		15.24 ksi
X-Axis Bending Interaction		
Allowable X-Axis Bending	$F_{bx} =$	15.04 ksi
X-Axis Interaction	$f_{b-alum-x}/F_{bx} =$	0.416

Y-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		12.51 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		19.70 ksi
F.2.1	F.2.1	N/A ksi
F.3.1	F.3.1	15.40 ksi
Y-Axis Bending Interaction		
Allowable Y-Axis Bending	$F_{by} =$	12.51 ksi
Y-Axis Interaction	$f_{b-alum-y}/F_{by} =$	0.083

Axial Allowable Load		
Allowable Axial Compression		8.43 ksi
Compression Interaction	$f_{c\text{-alum}}/F_c =$	0.000

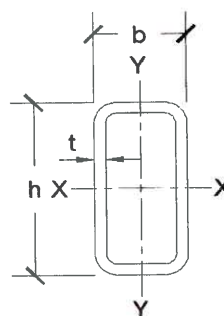
Combined Interaction Ratio	
$f_{c-alum}/F_c + f_{b-alum-x}/F_{bx} + f_{b-alum-y}/F_{by} =$	0.499
Stress OK. Use 1/4 point setting blocks.	



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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: HSS allowable flexural strength



Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Shape: HSS 2-1/4 x 2-1/4 x 1/4

h = 2.25 in
b = 2.25 in
t = 0.233 in

b/t = 6.66
h/t = 6.66

E = 29000 ksi
Material = A500 Gr B
F_y = 46 ksi

I_x = 1.130 in⁴
S_x = 1.010 in³
Z_x = 1.280 in³

I_y = 1.130 in⁴
S_y = 1.010 in³
Z_y = 1.280 in³

A = 1.740 in²
wt = 6.260 lb/ft

X-Axis Flange/Web Slenderness Limits	Y-Axis Flange/Web Slenderness Limits
Flange (b/t) $\lambda_p = 1.12(E/F_y)^{1/2} = 28.12$ Compact $\lambda_r = 1.40(E/F_y)^{1/2} = 35.15$ X	Flange (h/t) $\lambda_p = 1.12(E/F_y)^{1/2} = 28.12$ Compact $\lambda_r = 1.40(E/F_y)^{1/2} = 35.15$ X
Web (h/t) $\lambda_p = 2.42(E/F_y)^{1/2} = 60.76$ Compact $\lambda_r = 5.70(E/F_y)^{1/2} = 143.12$ X	Web (b/t) $\lambda_p = 2.42(E/F_y)^{1/2} = 60.76$ Compact $\lambda_r = 5.70(E/F_y)^{1/2} = 143.12$ X

X-Axis Yielding (AISC F7.1)	Y-Axis Yielding (AISC F7.1)
$M_n = M_p = F_y Z_x = 58.88$ kip-in	$M_n = M_p = F_y Z_y = 58.88$ kip-in

X-Axis Flange Local Buckling (AISC F7.2)	Y-Axis Flange Local Buckling (AISC F7.2)
a) Compact sections: does not apply	a) Compact sections: does not apply
b) Noncompact flanges: $M_n = M_p - (M_p - F_y S_x)(3.57 b/t^* (F_y/E)^{1/2} - 4.0) =$ $M_n =$ N/A kip-in	b) Noncompact flanges: $M_n = M_p - (M_p - F_y S_y)(3.57 h/t^* (F_y/E)^{1/2} - 4.0) =$ $M_n =$ N/A kip-in
c) Slender flanges: $b_e = 1.92 t (E/F_y)^{1/2} [1 - 0.38 (b/t) * (E/F_y)^{1/2}] =$ $b_e = -4.86$ in $S_{eff,x} = -1.86$ in ³ $M_n = F_y S_{eff} = -85.58$ kip-in $M_n =$ N/A kip-in	c) Slender flanges: $b_e = 1.92 t (E/F_y)^{1/2} [1 - 0.38 (h/t) * (E/F_y)^{1/2}] =$ $b_e = -4.86$ in $S_{eff,y} = -1.86$ in ³ $M_n = F_y S_{eff} = -85.58$ kip-in $M_n =$ N/A kip-in

X-Axis Web Local Buckling (AISC F7.3)	Y-Axis Web Local Buckling (AISC F7.3)
a) Compact sections: does not apply	a) Compact sections: does not apply
b) Noncompact webs: $M_n = M_p - (M_p - F_y S_x)(0.305 h/t^* (F_y/E)^{1/2} - 0.738) =$ $M_n =$ N/A kip-in	b) Noncompact webs: $M_n = M_p - (M_p - F_y S_y)(0.305 b/t^* (F_y/E)^{1/2} - 0.738) =$ $M_n =$ N/A kip-in

X-Axis Capacity	$\Omega_b = 1.67$
$M_n =$	58.88 kip-in
$M_n/\Omega_b =$	35.26 kip-in
$M_n/\Omega_b =$	2938 lb-ft

Y-Axis Capacity	$\Omega_b = 1.67$
$M_n =$	58.88 kip-in
$M_n/\Omega_b =$	35.26 kip-in
$M_n/\Omega_b =$	2938 lb-ft



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG (2-1/2" x 5'-5 1/2")
Part of: Horizontal Mullion Analysis
Elevation: 1/200
Detail: 1/357

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Check 1 (Typical)

Load Design Code	Material Design Code
ASCE7-05 ASD	ADM 2010
ADM 2010 Type	Alloy-Temper
Open Shape	6063-T6

Wind Tributary Width (t_{WL})	7.69 ft	$F_y =$	25.0 ksi
Dead Load Trib. Height (t_{DL})	9.07 ft	$F_u =$	30.0 ksi
Length (L)	7.29 ft		
Unbraced Length (L_b)	7.29 ft		

Design Loads

Design Pressure (p)	24.0 psf
Infill Weight (p_{wt})	6.5 psf

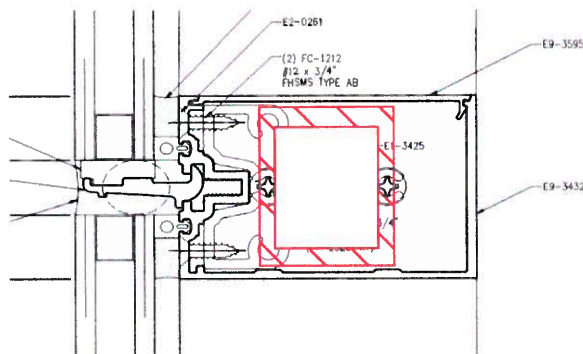
Manuf. / Part #:

YKK E9-3432

E =	10100 ksi	$r_{x, alum} =$	1.504 in
$I_{x, alum} =$	2.712 in ⁴	$r_{y, alum} =$	0.786 in
$I_{y, alum} =$	0.740 in ⁴	A =	1.198 in ²
$S_{x, alum} =$	1.276 in ³	J =	0.008 in ⁴
$S_{y, alum} =$	0.469 in ³	wt =	1.780 lb/ft
$b/t_{web} =$	38.05	$b/t_{flange} =$	17.67
Fixity _{web} =	2 end(s)	Fixity _{flange} =	1 end(s)

Thermal Reduction Factors (TRF_i, TRF_s)

I_x Reduc.	1.00	S_x Reduc.	1.00
--------------	------	--------------	------



Setting Block Locations (s) =	1/4	points
Setting Block Load (P) =	215.0	lb/setting block

Reinforcing 2-1/2" x 2-1/2" x 1/4" HSS tube

$I_{x, steel} =$	1.130 in ⁴	$I_{y, steel} =$	1.130 in ⁴
$S_{x, steel} =$	1.010 in ³	$S_{y, steel} =$	1.010 in ³
$I_{x, combined} =$	5.989 in ⁴	$I_{y, combined} =$	4.017 in ⁴
$A_{steel} =$	0.00 in ²	$wt_{steel} =$	0.00 lb/ft
$A_{alum-total} =$	1.198 in ²	$wt_{total} =$	1.780 lb/ft

X-Axis Applied Bending Moment (Wind Load)		Load Share = 45%
$w_{WL} = p \cdot t_{WL}$	$w =$	184.6 lb/ft
Shear Load $V = wL/2$	$V =$	673.1 lb
Moment $M = wL^2/8$	$M =$	1227.0 lb-ft
$M_{alum} = M \cdot I_{alum} / I_{comb}$	$M_{alum} =$	555.6 lb-ft
$f_b = M_{alum} / (S_{x, alum} \cdot TRF_s)$	$f_{b-alum-x} =$	5.23 ksi
Y-Axis Applied Bending Moment (Dead Load)		Load Share = 18%
Shear $V = P + wt_{total} \cdot L/2$	$V =$	221.5 lb
Moment $M = wt_{total} \cdot L^2/8 + P \cdot L \cdot s$	$M =$	403.8 lb-ft
$M_{alum} = M \cdot I_{alum} / I_{comb}$	$M_{alum} =$	74.4 lb-ft
$f_b = M_{alum} / (S_{y, alum})$	$f_{b-alum-y} =$	1.90 ksi
Applied Axial Compression		
$P =$	0.0 lb	
$f_{c-alum} = P/A$	$f_{c-alum} =$	0.00 ksi

X-axis Deflection (Wind Load)	Typical Horizontal
N/A in. joint $\Delta_x = (5wL^4)/(384EI_x)$	0.194 in
N/A $\pm$ movement cap. $\Delta_{x-allow} =$	0.500 in
Allowable deflection = $L/175$ or if span > 13'-6" then allowable def = $L/240 + 1/4"$	Deflection Factor DF = 108.2
Y-axis Deflection (Dead Load)	Typical Horizontal
$\Delta = ((P_{ab}L_s)/(24EI)) \cdot (3L^2 - 4(Ls)^2) + 5wt_{total}L^4/(384EI)$	$\Delta =$ 0.104 in
	$\Delta_{y-allow} =$ 0.1250 in

Steel Capacity (X-Axis)		Load Share = 55%
$M_{steel} = I_{x, steel} / I_{comb} =$	$M_{steel} =$	671.4 lb-ft
$Mb/\Omega =$	$Mb/\Omega =$	2938 lb-ft
	$Ms/(Mb/\Omega) =$	0.229
Steel Capacity (Y-Axis)		Load Share = 82%
$M_{steel} = I_{y, steel} / I_{comb} =$	$M_{steel} =$	329.4 lb-ft
$\Phi^*Mb =$	$Mb/\Omega =$	2938 lb-ft
	$Ms/(Mb/\Omega) =$	0.112

X-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		8.76 ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		N/A ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		N/A ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		17.83 ksi
F.2.1 - Open Shape Flexure		7.02 ksi
F.3.1 - Closed Shape Flexure		N/A ksi
X-Axis Bending Interaction		
Allowable X-Axis Bending	$F_{bx} =$	7.02 ksi
X-Axis Interaction	$f_{b-alum-x}/F_{bx} =$	0.745

Y-Axis Allowable Loads		$\Omega = 1.65$
B.5.4.1 - Flat Elem. 1 End Support Comp.		N/A ksi
B.5.4.2 - Flat Elem. 2 End Support Comp.		12.57 ksi
B.5.5.2 - Flat Elem. 1 End Support Flexure		13.64 ksi
B.5.5.1 - Flat Elem. 2 End Support Flexure		N/A ksi
F.2.1	F.2.1	7.02 ksi
F.3.1	F.3.1	N/A ksi
Y-Axis Bending Interaction		
Allowable Y-Axis Bending	$F_{by} =$	7.02 ksi
Y-Axis Interaction	$f_{b-alum-y}/F_{by} =$	0.271

Axial Allowable Load	
Allowable Axial Compression	4.14 ksi
Compression Interaction	$f_{c-alum}/F_c =$ 0.000

Combined Interaction Ratio	
$f_{c-alum}/F_c + f_{b-alum-x}/F_{bx} + f_{b-alum-y}/F_{by} =$	1.016
Stress OK, $\leq 4\%$ over allowable stress. Use 1/4 point setting blocks.	



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x7-1/2")
Part of: Anchor Summary Sheet
Designer: M. Gorny

Date: 11/14/2016
Proj. No.: JE16059

Typical Wind Pressure (T) = 20.0 psf
Corner Zone Wind Pressure (C) = 24.0 psf
Interior Pressure (INT) = 5.0 psf

INPUT CHECK RISA

Anchor Type
Point

Location	Substrate	Sheet	Elevation	Section	Wind Zone	Mullion Length (ft)	Trib. Width (ft)	Wind Pres. (psf)	Anchor Load (lb)	
Head (T)	Steel	214	1/214	1/313	C	6.49	5.25	24.0	408.8	Check 1)
Head (F)	Steel	214	1/214	1/313	C	6.49	2.63	24.0	204.4	Check 2)
Sill (T)	CFS	214	1/214	1/314	C	6.49	5.25	24.0	408.8	Check 3)
---	Concrete	205	1/205	1/311		Refer to RISA-3D Model			834.5	Check 4)
Sill (F)	CFS	214	1/214	1/314	C	6.49	2.63	24.0	204.4	Check 5)
---	Concrete	205	1/205	1/311		Refer to RISA-3D Model			385.8	Check 6)

Anchor Design Summary:

- 1: Use (2) 1/4"(min) Elco Driflex into minimum 1/8" thick steel
- 2: Use (2) 1/4"(min) Elco Driflex into minimum 1/8" thick steel
- 3: Use (4) 1/4"(min) Elco Driflex into minimum 16ga, 50ksi CFS
- 4: Use (2) 3/8" Elco Conflex into 4,000psi concrete, minimum embedment = 2-1/2", minimum edge distance = 2-5/8"
- 5: Use (4) 1/4"(min) Elco Driflex into minimum 16ga, 50ksi CFS
- 6: Use (1) 3/8" Elco Conflex into 4,000psi concrete, minimum embedment = 2-1/2", minimum edge distance = 2-5/8"



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 7-1/2")
Part of: Anchors to Steel
Elevation: 1/214
Detail: 1/313

Check 1

Use 1/4" Elco Drillflex into minimum 1/8" thick steel

(2) per T anchor

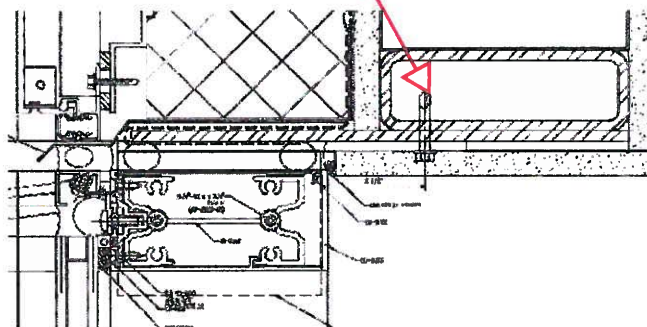
Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Elco Drillflex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

☐ Top Hole ☐ Base Hole
☒ Standard Hole ☒ Standard Hole
☐ Long Slotted Hole ☐ Long Slotted Hole
☐ Eccentric Shear Design
☐ Eccentric Tension Design
☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

Design Pressure 24.00 psf
Design Shear Load (V) 408.80 lb
Design Tension Load (T) 0.00 lb
Number of Screws 2.00 screws
Screw Selection (D) 1/4" 0.2500 in
F_{ty1}, F_{tu1} (Top Material) 6063-T5 16, 22 ksi
F_{ty2}, F_{tu2} (Base Material) A36 36, 58 ksi
Thickness of top material (t₁) 0.1875 in
Thickness base material (t₂) 0.1250 in
Distance to edge of top material (d_{e1}) 0.5000 in
Distance to edge of bottom material (d_{e2}) 0.5000 in

Manufacturer Allowable Shear = 0.0 lb
Manufacturer Allowable Tension = 0.0 lb



Moment Arm for screw (L) 0.00 in
Screw Section Modulus (S) 0.001534 in³
Screw Ultimate Tensile 120 ksi
Bending Moment mod (αM) 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

Factored Fastener Loads (per fastener)

Fastener Shear (V_{fas}) V / fastener = 204.4 lb
Fastener Tension (T_{fas}) T / fastener = 0.0 lb

Fastened Material Shear Design

Bearing (ADM J3.7, J.5.6.1, AISC J4.10)

Top Mat.: R_n = d_{e1}*t₁*F_{tu1} ≤ 2*D*t₁*F_{tu1}
Ω = 3 (Aluminum) R_n/Ω = 687.5 lb

Base Mat.: R_n = 1.2*d_{e2}*t₂*F_{tu2} ≤ 2.4*D*t₂*F_{tu2}
Ω = 2 (Steel) R_n/Ω = 2175.0 lb

Tilting (ADM J.5.6.2) Ω = 3 ≤ t₁? YES
R_n = 4.2(t₂³D)^{1/2}F_{tu2} R_n/Ω = 1794.3 lb

Shear load associated with bolt bending (ref Hilti)

M_{uM,5%} = 1.2Sf(1 - T/Ta) M_{uM,5%} = N/A lb-in
V_{rec} = (α_M*M_{uM,5%})/(1.7L) V_{rec} = N/A lb

AISI Cold-Formed Steel Design (Tbl IV-8a) Ω = 3

LGM Shear of sheet P_{ns} = N/A k
P_{ns}*1000/Ω = N/A lb

Allowable Shear / Fastener (V_{allowable}) = 687.5 lb
V_{fas} / V_{allowable} = 0.30 ≤ 1.0

OK.

Fastened Material Tension Design

Pull-Out (ADM J.5.5.1.1)

R_n = 1.2*D*Le*F_{ty2} Ω = 3
R_n/Ω = 450.0 lb

Pull-Over (ADM J.5.5.2)

R_n = (1.0+1.7*t₁/Dws)Dws*t₁*F_{ty1} Ω = 3
R_n/Ω = 798.8 lb

AISI Cold-Formed Steel Design IV-12 Ω = 3

LGM Pull-Out P_{not} = N/A k
P_{not}*1000/Ω = N/A lb

Allowable Tension / Fastener (T_{allowable}) = 450.0 lb
T_{fas} / T_{allowable} = 0.00 ≤ 1.0

OK.

Fastener Interaction Check

Ω = 3

Screw Shear (V_{TIR}) (AAMA TIR A9 Table 20.3) 646.0 lb
Screw Tension (T_{TIR}) (AAMA TIR A9 Table 20.3) 1273.0 lb

Typical: V_{fas} / V_{TIR} + T_{fas} / T_{TIR} = 0.32 ≤ 1.0
TIR A9-91: (V_{fas} / V_{TIR})² + (T_{fas} / T_{TIR})² = N/A ≤ 1.0

OK.

Use (2) 1/4" Elco Drillflex Screws.



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 7-1/2")
Part of: Anchors to Steel
Elevation: 1/214
Detail: 1/313

Use 1/4" Elco Drillflex into minimum 1/8" thick steel

(2) per F anchor, see sketch below

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

Check 2

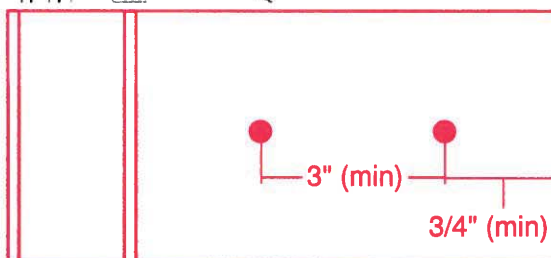
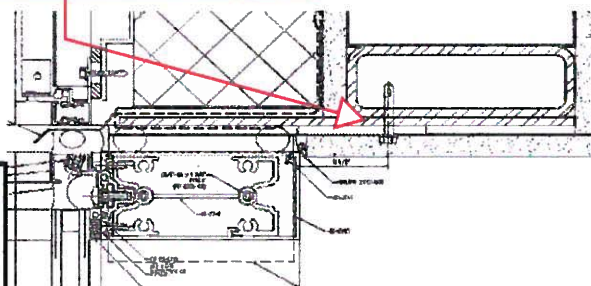
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = Elco Drill Flex
Fastener Size = 1/4-14
Nominal Diameter, D = 0.250 in
Area, A = 0.049 in²
Allowable Shear per Spec, V_a = 687.5 lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 204.40 lb
Design Moment, M_{c.g.} = 0.00 lb-in
Angle of Load, θ = 90.00 deg
Horz. Dist. from Centroid, x = 0.00 in
Vert. Dist. From Centroid, y = 3.81 in



FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

2

Fasteners per Row

N_{R1} = 1
N_{R2} = 1
N_{R3} =
N_{R4} =
N_{R5} =

Fasteners per Column

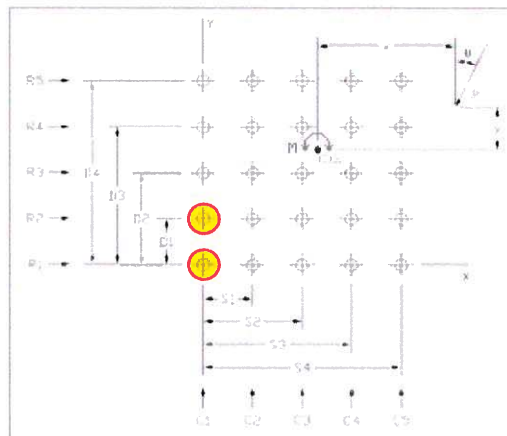
N_{C1} = 2
N_{C2} =
N_{C3} =
N_{C4} =
N_{C5} =

Row Dimensions

D₁ = 3.00 in
D₂ = in
D₃ = in
D₄ = in

Column Dimensions

S₁ = in
S₂ = in
S₃ = in
S₄ = in



Centroid, x = 0.00 in
Centroid, y = 1.50 in

FASTENER CALCULATIONS:

$\sum x^2 = 0.00 \text{ in}^2$
 $\sum y^2 = 4.50 \text{ in}^2$
 $\sum x^2 + \sum y^2 = 4.50 \text{ in}^2$
M = -779.28 lb-in

f_y = 0.00 ksi
f_{sy} = 0.00 psi
f_x = 5291.75 psi
f_{sx} = 2082.00 psi

← Vert Stress Due to Eccentric Shear
← Vert Stress Due to Direct Shear
← Horiz Stress Due to Eccentric Shear
← Horiz Stress Due to Direct Shear

f = 7373.75 psi
V = 361.96 lb
V_a = 687.500 lb

← Maximum Bolt Stress
← Maximum Bolt Load

OK



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 7-1/2")
Part of: Anchors to CFS
Elevation: 1/214
Detail: 1/314

Check 3

Use 1/4" Elco Drillflex into minimum
16ga, 50ksi steel

(4) per T anchor, see sketch below

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

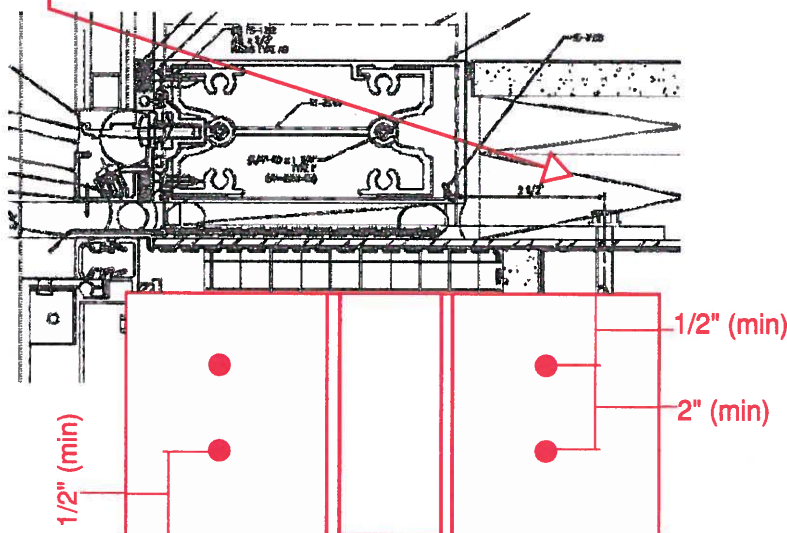
Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Elco Drillflex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

Top Hole: ☒ Standard Hole ☐ Long Slotted Hole
Base Hole: ☒ Standard Hole ☐ Long Slotted Hole
☐ Eccentric Shear Design
☐ Eccentric Tension Design

☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

Design Pressure: 24.00 psf
Design Shear Load (V): 408.80 lb
Design Tension Load (T): 0.00 lb
Number of Screws: 4.00 screws
Screw Selection (D): 1/4" 0.2500 in
F_{ty1}, F_{tu1} (Top Material): 6063-T5 16, 22 ksi
F_{ty2}, F_{tu2} (Base Material): A653 Gr. 50 50, 65 ksi
Thickness of top material (t₁): 0.1875 in
Thickness base material (t₂): 0.0566 in
Distance to edge of top material (d_{e1}): 0.5000 in
Distance to edge of bottom material (d_{e2}): 0.5000 in

Manufacturer Allowable Shear = 560.3 lb
Manufacturer Allowable Tension = 176.7 lb



Moment Arm for screw (L): 0.00 in
Screw Section Modulus (S): 0.001534 in³
Screw Ultimate Tensile: 120 ksi
Bending Moment mod (αM): 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

Factored Fastener Loads (per fastener)

Fastener Shear (V_{fas}): V / fastener = 102.2 lb
Fastener Tension (T_{fas}): T / fastener = 0.0 lb

Fastened Material Shear Design

Bearing (ADM J3.7, J.5.6.1, AISC J4.10)

Top Mat.: R_n = d_{e1}*t₁*F_{tu1} ≤ 2*D*t₁*F_{tu1}
Ω = 3 (Aluminum) R_n/Ω = 687.5 lb

Base Mat.: R_n = 1.2*d_{e2}*t₂*F_{tu2} ≤ 2.4*D*t₂*F_{tu2}
Ω = 2 (Steel) R_n/Ω = 1103.7 lb

Tilting (ADM J.5.6.2) Ω = 3 ≤ t₁? YES
R_n = 4.2(t₂³D)^{1/2}F_{tu2} R_n/Ω = 612.7 lb

Shear load associated with bolt bending (ref Hilti)

M_{uM,5%} = 1.2Sf(1 - T/Ta) M_{uM,5%} = N/A lb-in
V_{rec} = (α_M * M_{uM,5%}) / (1.7L) V_{rec} = N/A lb

AISI Cold-Formed Steel Design (Tbl IV-8a) Ω = 3

LGM Shear of sheet P_{rs} = 1.840 k
Using 0.0566" LGM P_{ns}*1000/Ω = 613.3 lb

Allowable Shear / Fastener (V_{allowable}) = 560.3 lb
V_{fas} / V_{allowable} = 0.18 ≤ 1.0

OK.

Fastened Material Tension Design

Pull-Out (ADM J.5.5.1) Ω = 3
R_n = 1.01*D*Le*F_{ty2} R_n/Ω = N/A lb

Pull-Over (ADM J.5.5.2) Ω = 3
R_n = (1.0+1.7*t₁/Dws)Dws*t₁*F_{ty1} R_n/Ω = 798.8 lb

AISI Cold-Formed Steel Design IV-12 Ω = 3
LGM Pull-Out P_{not} = 0.782 k
Using 0.0566" LGM P_{not}*1000/Ω = 260.7 lb

Allowable Tension / Fastener (T_{allowable}) = 176.7 lb
T_{fas} / T_{allowable} = 0.00 ≤ 1.0

OK.

Fastener Interaction Check

Ω = 3

Screw Shear (V_{TIR}) (AAMA TIR A9 Table 20.3) 646.0 lb
Screw Tension (T_{TIR}) (AAMA TIR A9 Table 20.3) 1273.0 lb
Typical: V_{fas} / V_{TIR} + T_{fas} / T_{TIR} = 0.16 ≤ 1.0
TIR A9-91: (V_{fas} / V_{TIR})² + (T_{fas} / T_{TIR})² = N/A ≤ 1.0

OK.

Use (4) 1/4" Elco Drillflex Screws.



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 7- 1/2")
Part of: Anchors to Concrete
Elevation: 1/205
Detail: 1/311

Check 4

Use 3/8" Elco Conflex into 4000psi concrete
minimum embedment = 2-1/2"
minimum spacing = 2-5/8"
minimum concrete edge distance = 2-5/8"
(2) per T anchors

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK

Design Criteria: ADM 2010 / AAMA TIR A9-91
Design Basis: N/A

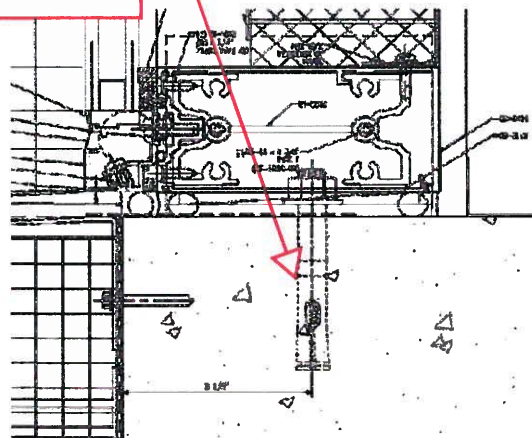
Fastener Type: Elco Conflex

Design Wind Pressure 24.00 psf
Design Shear Load (V) 834.50 lb
Design Tension Load (T) 0.00 lb
Number of Screws 1 screws
Screw Selection (D) 3/8-in 0.3750 in
F_{tu1} of top material 22 ksi
Thickness of top material (t₁) 0.188 in
Distance to edge of part (d_a) 0.750 in
Embedment 2.5 in
Concrete Strength 4000 psi

Published Load Values:

Elco Conflex Allowable Shear 820 lb
Elco Conflex Allowable Tension 905 lb

Moment arm for screw (L) 0.00 in
Screw Section Modulus (S) 0.00518 in³
Screw Ultimate Tensile Strength 163 ksi
Bending Moment mod (αM) 1 (bolt fixity at standoff α_M=1 free to rotate and =2 rotation restrained)



Calculated Reduction Factors			
	Edge		
	Spacing	Distance	
Shear	1.00	1.00	
Tension	1.00	1.00	
Number of reductions (due to group geometry)			
	Edge		Final Allowable Capacity (lb)
	Spacing	Distance	
Shear	1.0	1.0	820
Tension	1.0	1.0	905

Capacity = Allowable Load * Shear Factor ^ (num. reduc.)

* Tension Factor ^ (num. reduc.)

Capacity = Allowable Load * Shear Factor ^ (num. reduc.) * Tension Factor ^ (num. reduc.)

Screw Attachment Design		Ω = 3
Bearing (ADM J.5.6.1)		
$R_n/\Omega = d_e t_1 F_{tu1}/\Omega \leq 2D t_1 F_{tu1}/\Omega$	$R_n/\Omega =$	1031.3 lb
Shear load associated with bolt bending (2011 Hilti Anchor Guide)		
$M_{uM,5\%} = 1.2S_f(1 - T/T_a)$	$M_{uM,5\%} =$	1012.7 lb-in
$V_{rec} = (\alpha_M * M_{uM,5\%})/(1.7L)$	$V_{rec} =$	N/A lb
Screw Shear (AAMA TIR A9)		1937.0 lb
Allowable Fastener Shear V _a =		819.7 lb
Pull-Over (ADM J.5.5.2)		
$R_n/\Omega = C_{pov} t_1 F_{tu1} (D_{ws} - D_h)/\Omega$	$R_n/\Omega =$	343.8 lb
Screw Tension (AAMA TIR A9)		3720.0 lb
Allowable Fastener Tension T _a =		343.8 lb
V/screw =		834.50 lb
T/screw =		0.00 lb
Interaction Formula < 1.0		1.02 < 1.0
Use (1) 3/8-in Elco Conflex		

	Spacing	Edge Dist.
Installed Dist.	2.63	2.63
Shear Factors		
Critical Dist.	2.63	2.63
Minimum Dist.	2.63	2.63
Load Factor @ Minimum	1.00	1.00
Tension Factors		
Critical Dist.	2.63	2.63
Minimum Dist.	2.63	2.63
Load Factor @ Minimum	1.00	1.00

OK



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 7-1/2")
Part of: Anchors to CFS
Elevation: 1/214
Detail: 1/314

Use 1/4" Elco Drillflex into minimum
16ga, 50ksi steel

(4) per F anchor, see sketch below

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

Check 5

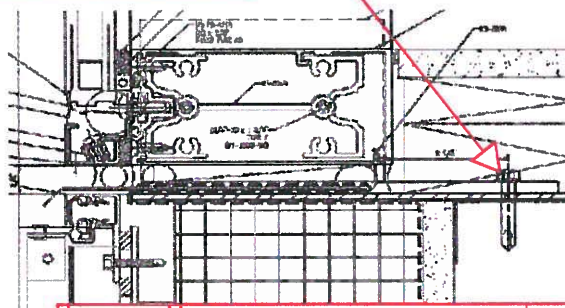
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = Elco Drill Flex
Fastener Size = 1/4-14
Nominal Diameter, D = 0.250 in
Area, A = 0.049 in²
Allowable Shear per Spec, V_a = 560.3 lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 204.40 lb
Design Moment, M_{c.g.} = 0.00 lb-in
Angle of Load, θ = 90.00 deg
Horz. Dist. from Centroid, x = 0.00 in
Vert. Dist. From Centroid, y = 3.81 in



1/2" (min)

1/2" (min)

3" (min)

3/4" (min)

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners: 4

Fasteners per Row

N_{R1} = 2
N_{R2} = 2
N_{R3} =
N_{R4} =
N_{R5} =

Fasteners per Column

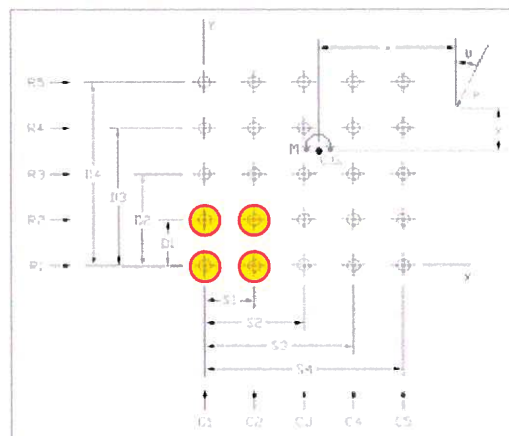
N_{C1} = 2
N_{C2} = 2
N_{C3} =
N_{C4} =
N_{C5} =

Row Dimensions

D₁ = 3.00 in
D₂ = in
D₃ = in
D₄ = in

Column Dimensions

S₁ = 2.00 in
S₂ = in
S₃ = in
S₄ = in



Centroid, x = 1.00 in
Centroid, y = 1.50 in

FASTENER CALCULATIONS:

$\sum x^2 = 4.00 \text{ in}^2$
 $\sum y^2 = 9.00 \text{ in}^2$
 $\sum x^2 + \sum y^2 = 13.00 \text{ in}^2$
M = -779.28 lb-in

f_y = 1221.17 ksi
f_{sy} = 0.00 psi
f_x = 1831.76 psi
f_{sx} = 1041.00 psi

← Vert Stress Due to Eccentric Shear
← Vert Stress Due to Direct Shear
← Horiz Stress Due to Eccentric Shear
← Horiz Stress Due to Direct Shear

f = 3121.54 psi
V = 153.23 lb
V_a = 560.300 lb

← Maximum Bolt Stress
← Maximum Bolt Load

OK



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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 7-1/2")
Part of: Anchors to Concrete
Elevation: 1/205
Detail: 1/311

Use 3/8" Elco Conflex into 4000psi concrete
minimum embedment = 2-1/2"
minimum spacing = 2-5/8"
minimum concrete edge distance = 2-5/8"

(2) per F anchors, see sketch below for
F-anchor layout

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny

Check 6

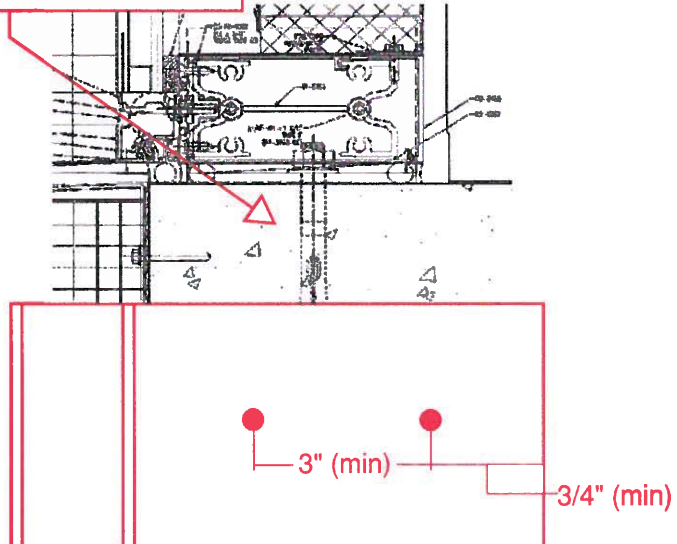
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = Elco Conflex
Fastener Size = 3/8-in
Nominal Diameter, D = 0.375 in
Area, A = 0.110 in²
Allowable Shear per Spec, V_a = 820.0 lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 385.80 lb
Design Moment, M_{c.g.} = 0.00 lb-in
Angle of Load, θ = 90.00 deg
Horz. Dist. from Centroid, x = 0.00 in
Vert. Dist. From Centroid, y = 3.81 in



FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

2

Fasteners per Row

N_{R1} = 1
N_{R2} = 1
N_{R3} =
N_{R4} =
N_{R5} =

Fasteners per Column

N_{C1} = 2
N_{C2} =
N_{C3} =
N_{C4} =
N_{C5} =

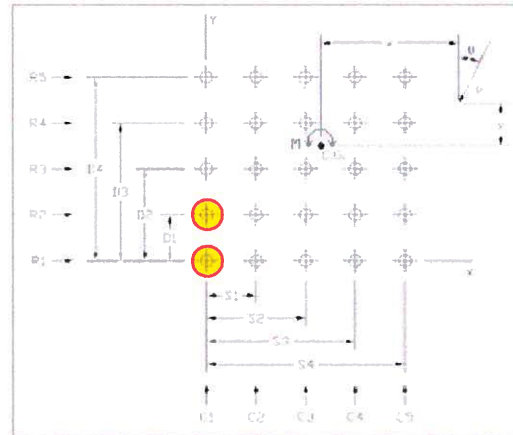
Row Dimensions

D₁ = 3.00 in
D₂ = in
D₃ = in
D₄ = in

Column Dimensions

S₁ = in
S₂ = in
S₃ = in
S₄ = in

Centroid, x = 0.00 in
Centroid, y = 1.50 in



FASTENER CALCULATIONS:

$\sum x^2 = 0.00 \text{ in}^2$
 $\sum y^2 = 4.50 \text{ in}^2$
 $\sum x^2 + \sum y^2 = 4.50 \text{ in}^2$
M = -1470.86 lb-in

f_y = 0.00 ksi
f_{sy} = 0.00 psi
f_x = 4439.14 psi
f_{sx} = 1746.55 psi

← Vert Stress Due to Eccentric Shear
← Vert Stress Due to Direct Shear
← Horiz Stress Due to Eccentric Shear
← Horiz Stress Due to Direct Shear

f = 6185.68 psi
V = 683.19 lb
V_a = 820.000 lb

← Maximum Bolt Stress
← Maximum Bolt Load
OK



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Client: NGG

Project: Webster University

Structure: YKK 750 (2-1/2" x 6-9/16")

Part of: Anchor Summary Sheet

Designer: M. Gorny

Date: 11/3/2016

Proj. No.: JE16059

Typical Wind Pressure (T) = 20.0 psf
Corner Zone Wind Pressure (C) = 24.0 psf
Interior Pressure (INT) = 5.0 psf

Anchor Type
Point

INPUT CHECK RISA

Location	Substrate	Sheet	Elevation	Section	Wind Zone	Mullion Length (ft)	Trib. Width (ft)	Wind Pres. (psf)	Anchor Load (lb)
Head (T)	CFS	202	1/202	1/302	C	11.24	3.01	24.0	406.0
---	---	202, 204	2/202, 1/204	1/302	C	11.24	5.00	24.0	674.4
---	---	203	1/203	1/302	C	11.24	4.56	24.0	614.7
---	---	204	2/204	1/302	C	11.24	4.30	24.0	579.9
Head (F)	CFS	202, 204	2/202, 1/204	1/302	C	11.24	2.39	24.0	321.7
---	CFS	210	1/210	1/310	C	11.24	5.00	24.0	674.4
---	Concrete	202, 204	2/202, 1/204	1/300	C	11.24	5.00	24.0	674.4
---	---	203	1/203	1/300	C	11.24	4.56	24.0	614.7
---	CFS	217	1/217	1/317	C	11.24	2.39	24.0	321.7
---	Concrete	202, 204	2/202, 1/204	1/300	C	11.24	3.01	24.0	406.0
Sill (U)	Concrete	202	1/202	1/401	C	11.24	3.01	24.0	406.0
---	---	204	2/204	1/401	C	12.17	2.38	20.0	289.6

Anchor Design Summary:

- 1: Use (8) 1/4" (min) Elco Drillflex into minimum 16ga, 50ksi CFS
- 2: Use (4) 1/4" (min) Elco Drillflex into minimum 16ga, 50ksi CFS
- 3: Use (4) 1/4" (min) Elco Drillflex into minimum 16ga, 50ksi CFS
- 4: Use (2) 3/8" Elco Conflex into 4,000psi concrete, minimum embedment = 2-1/2", minimum edge distance = 2-5/8", minimum spacing = 2-5/8"

(by comparison to 7-1/2" anchor analysis, Check 4)

- 5: Use (4) 1/4" (min) Elco Drillflex into minimum 16ga, 50ksi CFS (by comparison to 7-1/2" anchor analysis, Check 5)
- 6: Use (2) 3/8" Elco Conflex into 4,000psi concrete, minimum embedment = 2-1/2", minimum edge distance = 2-5/8", minimum spacing = 2-5/8"
- 7: Use (1) 3/8" Elco Conflex into 4,000psi concrete, minimum embedment = 2-1/2", minimum edge distance = 1-7/8", minimum spacing = 1-7/8"



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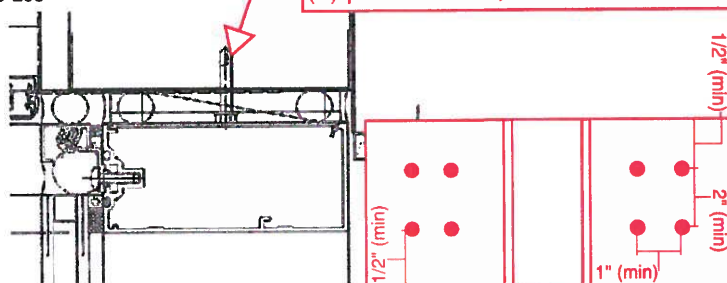
Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 6-9/16")
Part of: Anchors to CFS
Elevation: 2/202, 1/204
Detail: 1/302 **Check 1**

Use 1/4" Elco Drilflex into minimum
16ga, 50ksi steel
(8) per T anchor, see sketch below

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Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK



FASTENER PROPERTIES:

Fastener Type = Elco Drilflex
Fastener Size = 1/4-in
Nominal Diameter, D = 0.25 in
Area, A = 0.05 in²
Allowable Shear per Spec, V_a = 560.30 lb
Allowable Tension per Spec, T_a = 176.70 lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 674.40 lb
Design Moment, M_{c.g.} = 0.00 lb-in
Angle of Load, θ = 90.00 deg
Horz. Dist. from Centroid, x = 0.00 in
Vert. Dist. From Centroid, y = 3.13 in
Load Eccentricity from Bolt Plane, z = 1.63 in
Fastener Edge Distance, E = 0.50 in
Axis of Rotation for Tension Analysis = Y Axis

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

8

Fasteners per Row

N_{R1} = 2
N_{R2} = 2
N_{R3} = 2
N_{R4} = 2
N_{R5} = 0

Fasteners per Column

N_{C1} = 4
N_{C2} = 4
N_{C3} = 0
N_{C4} = 0
N_{C5} = 0

Row Dimensions

D₁ = 1.000 in
D₂ = 5.250 in
D₃ = 6.250 in
D₄ = 0.000 in

Column Dimensions

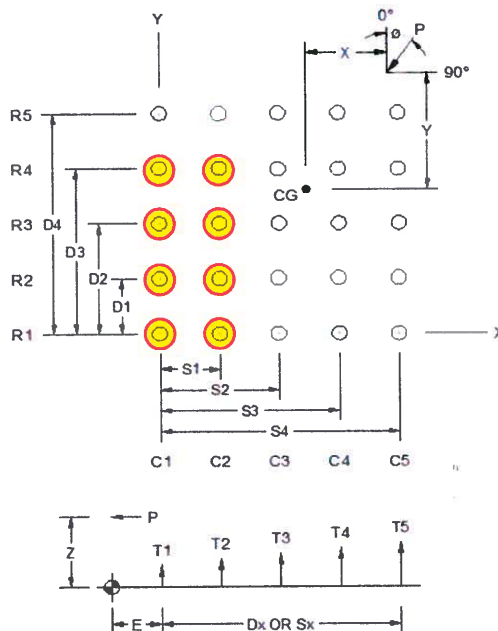
S₁ = 2.000 in
S₂ = 0.000 in
S₃ = 0.000 in
S₄ = 0.000 in

Bolt Group Centroid (CG)

Centroid, x = 1.000 in
Centroid, y = 3.125 in

Design Load Components

Design Load, P_x = 674.40 lb
Design Load, P_y = 0.00 lb



FASTENER CALCULATIONS:

$\Sigma x^2 = 8.00 \text{ in}^2$
 $\Sigma y^2 = 57.13 \text{ in}^2$
 $\Sigma x^2 + \Sigma y^2 = 65.13 \text{ in}^2$
M = -2107.50 lb-in

$f_y = 659.25 \text{ ksi}$
 $f_{sy} = 0.00 \text{ psi}$
 $f_x = 2060.16 \text{ psi}$
 $f_{sx} = 1717.35 \text{ psi}$

← Vert Stress Due to Eccentric Shear
← Vert Stress Due to Direct Shear
← Horiz Stress Due to Eccentric Shear
← Horiz Stress Due to Direct Shear

Bolt Tension by Column

T₁ = 21.08 lb/bolt
T₂ = 105.38 lb/bolt
T₃ = 0 lb/bolt
T₄ = 0 lb/bolt
T₅ = 0 lb/bolt

f = 3834.60 psi

V = 188.23 lb
V_a = 560.30 lb

T = 105.38 lb
T_a = 176.70 lb

← Maximum Bolt Shear Stress
← Maximum Bolt Shear
OK
← Maximum Bolt Tension
OK

Interaction Values

Standard Bolts

V/V_a + T/T_a

0.932 < 1.0 **OK**

TIR Fasteners

(V/V_a)² + (T/T_a)²

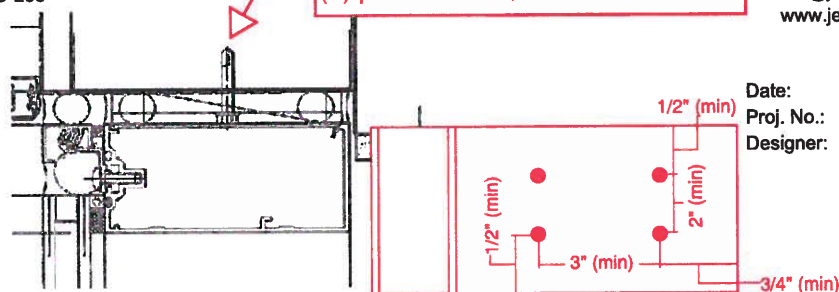
0.468 < 1.0 **OK**



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 6-9/16")
Part of: Anchors to CFS
Elevation: 2/202, 1/204
Detail: 1/302 **Check 2**



Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = Elco Drillflex
Fastener Size = 1/4-in
Nominal Diameter, D = 0.25 in
Area, A = 0.05 in²
Allowable Shear per Spec, V_a = 560.30 lb
Allowable Tension per Spec, T_a = 176.70 lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 321.70 lb
Design Moment, M_{cg} = 0.00 lb-in
Angle of Load, θ = 90.00 deg
Horz. Dist. from Centroid, x = 0.00 in
Vert. Dist. From Centroid, y = 3.81 in
Load Eccentricity from Bolt Plane, z = 1.63 in
Fastener Edge Distance, E = 0.50 in
Axis of Rotation for Tension Analysis = Y Axis

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

4

Fasteners per Row

N_{R1} = 2
N_{R2} = 2
N_{R3} = 0
N_{R4} = 0
N_{R5} = 0

Fasteners per Column

N_{C1} = 2
N_{C2} = 2
N_{C3} = 0
N_{C4} = 0
N_{C5} = 0

Row Dimensions

D₁ = 3.000 in
D₂ = 0.000 in
D₃ = 0.000 in
D₄ = 0.000 in

Column Dimensions

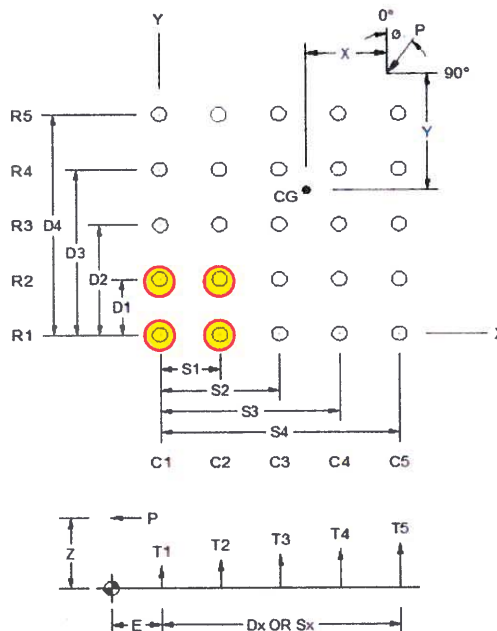
S₁ = 2.000 in
S₂ = 0.000 in
S₃ = 0.000 in
S₄ = 0.000 in

Bolt Group Centroid (CG)

Centroid, x = 1.000 in
Centroid, y = 1.500 in

Design Load Components

Design Load, P_x = 321.70 lb
Design Load, P_y = 0.00 lb



FASTENER CALCULATIONS:

$\Sigma x^2 = 4.00 \text{ in}^2$
 $\Sigma y^2 = 9.00 \text{ in}^2$
 $\Sigma x^2 + \Sigma y^2 = 13.00 \text{ in}^2$
M = -1226.48 lb-in

$f_y = 1921.97 \text{ ksi}$ ← Vert Stress Due to Eccentric Shear
 $f_{sy} = 0.00 \text{ psi}$ ← Vert Stress Due to Direct Shear
 $f_x = 2882.96 \text{ psi}$ ← Horiz Stress Due to Eccentric Shear
 $f_{sx} = 1638.40 \text{ psi}$ ← Horiz Stress Due to Direct Shear

Bolt Tension by Column

T₁ = 20.11 lb/bolt
T₂ = 100.53 lb/bolt
T₃ = 0 lb/bolt
T₄ = 0 lb/bolt
T₅ = 0 lb/bolt

f = 4912.92 psi ← Maximum Bolt Shear Stress
V = 241.16 lb ← Maximum Bolt Shear
V_a = 560.30 lb **OK**
T = 100.53 lb ← Maximum Bolt Tension
T_a = 176.70 lb **OK**

Interaction Values

Standard Bolts

$V/V_a + T/T_a$
0.999 < 1.0 **OK**

TIR Fasteners

$(V/V_a)^2 + (T/T_a)^2$
0.509 < 1.0 **OK**



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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 6-9/16")
Part of: Anchors to Concrete
Elevation: 2/202, 1/204
Detail: 1/300

Check 6

Use 3/8" Elco Conflex into 4000psi concrete
minimum embedment = 2-1/2"
minimum spacing = 2-5/8"
minimum concrete edge distance = 2-5/8"

(2) per F anchors, see sketch below for F-anchor layout

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

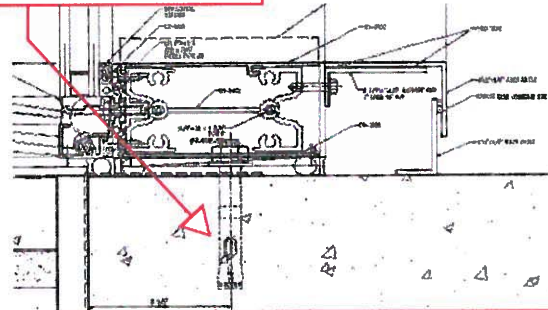
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type =	Elco Conflex
Fastener Size =	3/8-in
Nominal Diameter, D =	0.375 in
Area, A =	0.110 in ²
Allowable Shear per Spec, V _a =	820.0 lb

DESIGN LOADING / ORIENTATION:

Design Load, P =	321.70 lb
Design Moment, M _{c.g.} =	0.00 lb-in
Angle of Load, θ =	90.00 deg
Horz. Dist. from Centroid, x =	0.00 in
Vert. Dist. From Centroid, y =	3.81 in



3" (min)
3/4" (min)

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners: 2

Fasteners per Row

N _{R1} =	1
N _{R2} =	1
N _{R3} =	
N _{R4} =	
N _{R5} =	

Fasteners per Column

N _{C1} =	2
N _{C2} =	
N _{C3} =	
N _{C4} =	
N _{C5} =	

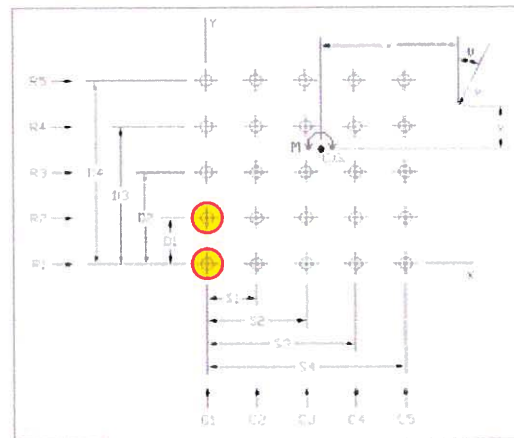
Row Dimensions

D ₁ =	3.00 in
D ₂ =	
D ₃ =	
D ₄ =	

Column Dimensions

S ₁ =		in
S ₂ =		in
S ₃ =		in
S ₄ =		in

Centroid, x =	0.00 in
Centroid, y =	1.50 in



FASTENER CALCULATIONS:

$\sum x^2 =$	0.00 in ²	$f_y =$	0.00 ksi	← Vert Stress Due to Eccentric Shear
$\sum y^2 =$	4.50 in ²	$f_{sy} =$	0.00 psi	← Vert Stress Due to Direct Shear
$\sum x^2 + \sum y^2 =$	4.50 in ²	$f_x =$	3701.58 psi	← Horiz Stress Due to Eccentric Shear
M =	-1226.48 lb-in	$f_{sx} =$	1456.36 psi	← Horiz Stress Due to Direct Shear
		$f =$	5157.94 psi	← Maximum Bolt Stress
		V =	569.68 lb	← Maximum Bolt Load
		V _a =	820.000 lb	OK



JEI Structural Engineering
7280 NW 87th Terrace, Suite C-208
Kansas City, MO 64153

Use 3/8" Elco Conflex into 4000psi concrete
minimum embedment = 2-1/2"
minimum spacing = 2-5/8"
minimum concrete edge distance = 2-5/8"

(1) per U anchors
miter off leg of F-anchor

Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 6-9/16")
Part of: Anchors to Concrete
Elevation: 1/202
Detail: 1/401 **Check 7**

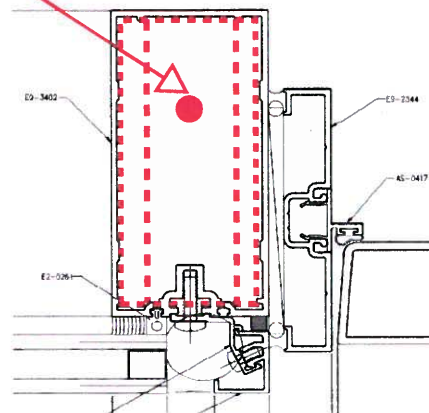
Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK

Design Criteria: ADM 2010 / AAMA TIR A9-91
Design Basis: N/A

Fastener Type: Elco Conflex

Design Wind Pressure	24.00 psf
Design Shear Load (V)	406.00 lb
Design Tension Load (T)	0.00 lb
Number of Screws	1 screws
Screw Selection (D)	3/8-in 0.3750 in
F_{tu1} of top material	22 ksi
Thickness of top material (t_1)	0.188 in
Distance to edge of part (d_e)	0.750 in
Embedment	2.5 in
Concrete Strength	4000 psi
Published Load Values:	
Elco Conflex Allowable Shear	820 lb
Elco Conflex Allowable Tension	905 lb
Moment arm for screw (L)	0.00 in
Screw Section Modulus (S)	0.00518 in ³
Screw Ultimate Tensile Strength	163 ksi
Bending Moment mod (αM)	1 (bolt fixity at standoff $\alpha_M=1$ free to rotate and =2 rotation restrained)



Calculated Reduction Factors			
	Edge		
	Spacing	Distance	
Shear	1.00	1.00	
Tension	1.00	1.00	
Number of reductions (due to group geometry)			
	Edge		Final Allowable Capacity (lb)
	Spacing	Distance	
Shear	1.0	1.0	820
Tension	1.0	1.0	905

Capacity = Allowable Load * Shear Factor ^ (num. reduc.)

* Tension Factor ^ (num. reduc.)

Capacity = Allowable Load * Shear Factor ^ (num. reduc.) * Tension Factor ^ (num. reduc.)

Screw Attachment Design		$\Omega = 3$
Bearing (ADM J.5.6.1)		
$R_n/\Omega = d_e t_1 F_{tu1}/\Omega \leq 2 D t_1 F_{tu1}/\Omega$	$R_n/\Omega =$	1031.3 lb
Shear load associated with bolt bending (2011 Hilti Anchor Guide)		
$M_{uM,5\%} = 1.2 S_t (1 - T/T_a)$	$M_{uM,5\%} =$	1012.7 lb-in
$V_{rec} = (\alpha_M * M_{uM,5\%})/(1.7L)$	$V_{rec} =$	N/A lb
Screw Shear (AAMA TIR A9)		1937.0 lb
Allowable Fastener Shear $V_a =$		819.7 lb
Pull-Over (ADM J.5.5.2)		
$R_n/\Omega = C_{pov} t_1 F_{tu1} (D_{ws} - D_h)/\Omega$	$R_n/\Omega =$	343.8 lb
Screw Tension (AAMA TIR A9)		3720.0 lb
Allowable Fastener Tension $T_a =$		343.8 lb
V/screw =		406.00 lb
T/screw =		0.00 lb
Interaction Formula < 1.0		0.50 < 1.0
Use (1) 3/8-in Elco Conflex		

	Spacing	Edge Dist.
Installed Dist.	2.63	2.63
Shear Factors		
Critical. Dist.	2.63	2.63
Minimum Dist.	2.63	2.63
Load Factor @ Minimum	1.00	1.00
Tension Factors		
Critical. Dist.	2.63	2.63
Minimum Dist.	2.63	2.63
Load Factor @ Minimum	1.00	1.00

OK



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 5-1/16")
Part of: T/U Anchor Summary Sheet
Designer: M. Gorny

Date: 11/3/2016
Proj. No.: JE16059

Typical Wind Pressure (T) = 20.0 psf
Corner Zone Wind Pressure (C) = 24.0 psf
Interior Pressure (INT) = 5.0 psf

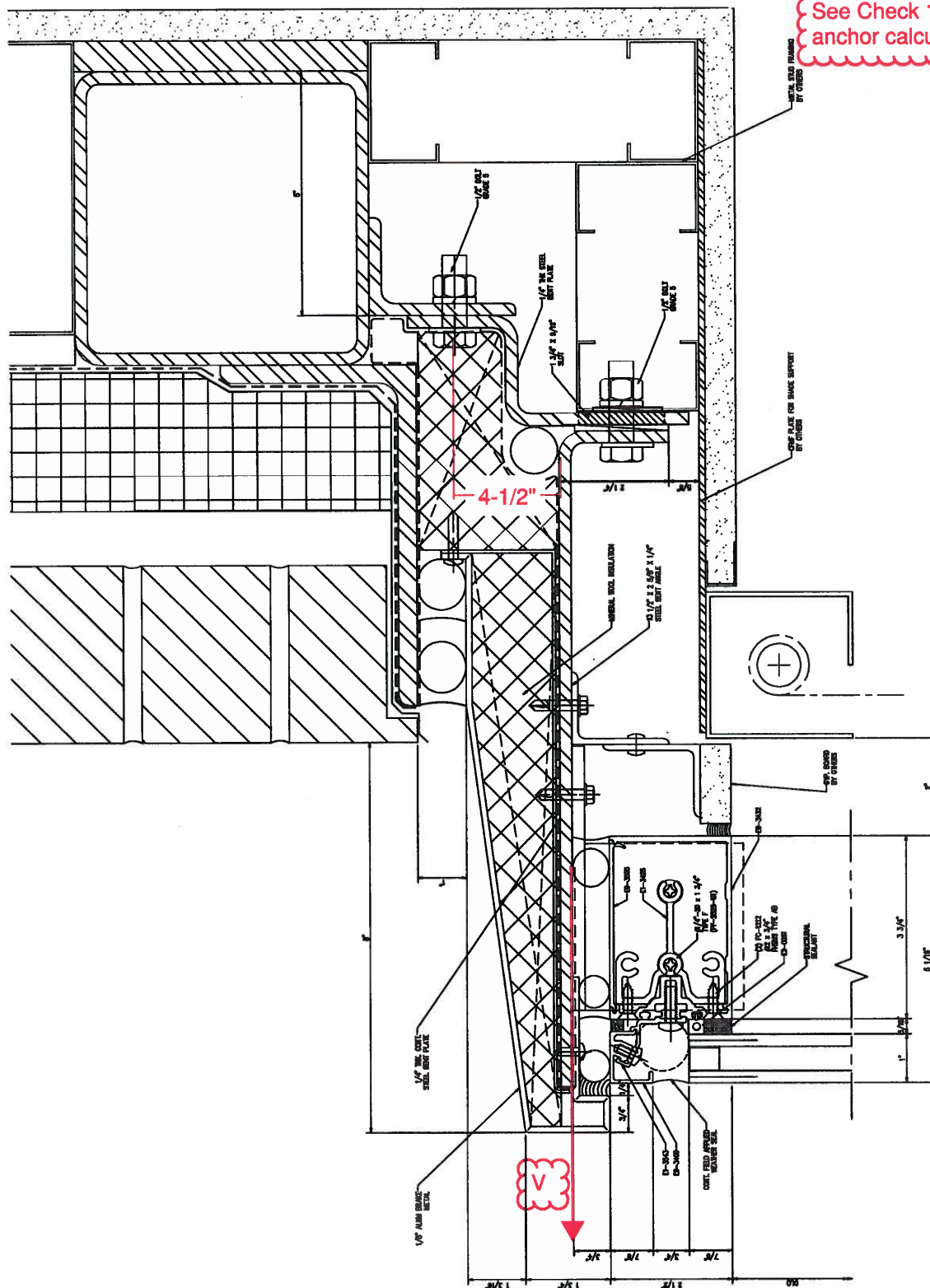
INPUT CHECK RISA

Anchor Type
Point

Location	Substrate	Sheet	Elevation	Section	Wind Zone	Mullion Length (ft)	Trib. Width (ft)	Wind Pres. (psf)	Anchor Load (lb)	
Head (T)	Steel Slotted	215	1/215	1/351	C	6.21	5.25	24.0	391.1	Check 1-1)
---	Steel (Angle)	200	1/200	1/323	T	12.17	5.53	20.0	673.0	Check 1-2)
---	---	201	1/201	1/301	T	12.17	4.69	20.0	570.3	Check 1-3)
---	Steel	220	1/220	1/320	T	2.00	4.56	20.0	91.3	Check 1)
---	CFS	220	3/220, 5/220	N/A	T	12.00	5.82	20.0	698.1	Check 2)
---	Concrete	219	1/219	1/354, 1/356	C	3.50	5.00	24.0	210.0	Check 3)
Sill (T)	Steel	215	1/215	1/352	C	6.21	5.25	24.0	391.1	Check 1)
---	---	219	1/219	1/353, 1/355	C	3.50	5.00	24.0	210.0	
---	CFS	220	1/220	1/316	T	2.00	4.56	20.0	91.3	Check 2)
---	Concrete	200	1/200	1/322	T	12.17	3.92	20.0	476.5	
---	---	201	1/201	1/360	T	12.17	4.69	20.0	570.3	Check 3)
Sill (U)	Concrete	200	1/200	1/418	T	12.17	5.53	20.0	673.0	
---	---	201	1/201	1/545	T	12.17	2.38	20.0	289.6	
---	---	220, 220	3/220, 5/220	2/416	T	12.00	5.82	20.0	698.1	Check 4)

Anchor Design Summary:

- 1: Use (4) 1/4"(min) Elco Drillflex into minimum 1/8" thick steel
- 2: Use (4) 1/4"(min) Elco Drillflex into minimum 16ga, 50ksi CFS
- 3: Use (2) 3/8" Elco Conflex into 4,000psi concrete, minimum embedment = 2-1/2", minimum edge distance = 2-5/8"
(by comparison to 7-1/2" anchor analysis, Check 4)
- 4: Use (1) 3/8" Elco Conflex into 4,000psi concrete, minimum embedment = 2-1/2", minimum edge distance = 1-7/8"



Check 1-1
See Check 1-2 for controlling
anchor calculations

1 HEAD DETAIL



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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Bar Allowable Flexural Strength

Check 1-1
See Check 1-2 for controlling
anchor calculations

Date: 11/9/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Shape: 9" (wide) x 7-1/2" (tall) x 1/4" (thick) clip

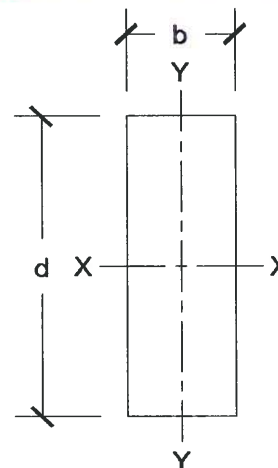
Unbraced Length (L_b) = 7.5 in
Depth (d) = 0.25 in
Width (b) = 9 in

Modulus of Elasticity (E) = 29000 ksi
Yield Strength (F_y) = 36 ksi

Material
A36

$I_x = 0.0117 \text{ in}^4$
 $S_x = 0.0938 \text{ in}^3$
 $Z_x = 0.1406 \text{ in}^3$

$I_y = 15.1875 \text{ in}^4$
 $S_y = 3.3750 \text{ in}^3$
 $Z_y = 5.0625 \text{ in}^3$



X-Axis Lateral Torsional Buckling Limits

$L_b d/t^2 =$	0.02314815	$L_b d/t^2 \leq 0.08E/F_y$	1 applies
$0.08E/F_y =$	64.44	$0.08E/F_y < L_b d/t^2 \leq 1.9E/F_y$	X
$1.9E/F_y =$	1530.56	$L_b d/t^2 > 1.9E/F_y$	X

X-Axis Yielding (AISC F11.1)

$M_n = M_p = F_y Z_x = 5.06 \text{ kip-in}$
 $M_n \leq 1.6M_y = 1.6F_y S_x = 5.40 \text{ kip-in}$
 $M_n = 5.06 \text{ kip-in}$

Y-Axis Yielding (AISC F11.1)

$M_n = M_p = F_y Z_y = 182.25 \text{ kip-in}$
 $M_n \leq 1.6M_y = 1.6F_y S_y = 194.40 \text{ kip-in}$
 $M_n = 182.25 \text{ kip-in}$

X-Axis Lateral-Torsional Buckling (AISC F11.2)

AISC F11.2.a $0.08E/F_y < L_b d/t^2 \leq 1.9E/F_y$

$M_n = C_b [1.52 - 0.274(L_b d/t^2) F_y / E] M_y =$

$M_n = \text{N/A kip-in}$

$M_p =$

$M_p = \text{N/A kip-in}$

$M_n =$

$M_n = \text{N/A kip-in}$

AISC F11.2.b $L_b d/t^2 > 1.9E/F_y$

$F_{cr} = 1.9EC_b / (L_b d/t^2) =$

$F_{cr} = \text{N/A ksi}$

$M_n = F_{cr} S_x =$

$M_n = \text{N/A kip-in}$

$M_p =$

$M_p = \text{N/A kip-in}$

$M_n =$

$M_n = \text{N/A kip-in}$

X-Axis Capacity $\Omega_b = 1.67$	
$M_n =$	5.06 kip-in
$M_n / \Omega_b =$	3.03 kip-in
$M_n / \Omega_b =$	253 lb-ft

Y-Axis Capacity $\Omega_b = 1.67$	
$M_n =$	182.25 kip-in
$M_n / \Omega_b =$	109.13 kip-in
$M_n / \Omega_b =$	9094 lb-ft

$M_u = 391.1 \text{ lb} \times (7-1/2" / 12) = 244 \text{ lb-ft}$

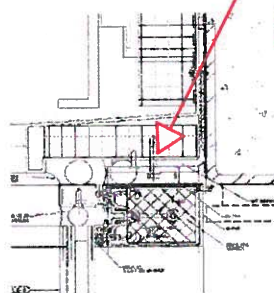
OK for 7-1/2" maximum
bending leg



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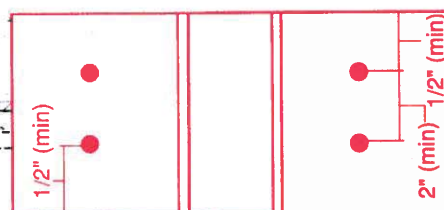
Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 5-1/16")
Part of: Anchors to Steel
Elevation: 1/200
Detail: 1/323 **Check 1-2**



Use 1/4" Elco Driflex into minimum
1/8" thick steel

(4) per T anchor, see sketch below



Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = Elco Driflex
Fastener Size = 1/4-in
Nominal Diameter, D = 0.25 in
Area, A = 0.05 in²
Allowable Shear per Spec, V_a = 687.50 lb
Allowable Tension per Spec, T_a = 450.00 lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 673.00 lb
Design Moment, M_{c.g.} = 0.00 lb-in
Angle of Load, θ = 90.00 deg
Horz. Dist. from Centroid, x = 0.00 in
Vert. Dist. From Centroid, y = 3.13 in
Load Eccentricity from Bolt Plane, z = 1.13 in
Fastener Edge Distance, E = 0.50 in
Axis of Rotation for Tension Analysis = Y Axis

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

4

Fasteners per Row

N_{R1} = 2
N_{R2} = 2
N_{R3} = 0
N_{R4} = 0
N_{R5} = 0

Fasteners per Column

N_{C1} = 2
N_{C2} = 2
N_{C3} = 0
N_{C4} = 0
N_{C5} = 0

Row Dimensions

D₁ = 6.250 in
D₂ = 0.000 in
D₃ = 0.000 in
D₄ = 0.000 in

Column Dimensions

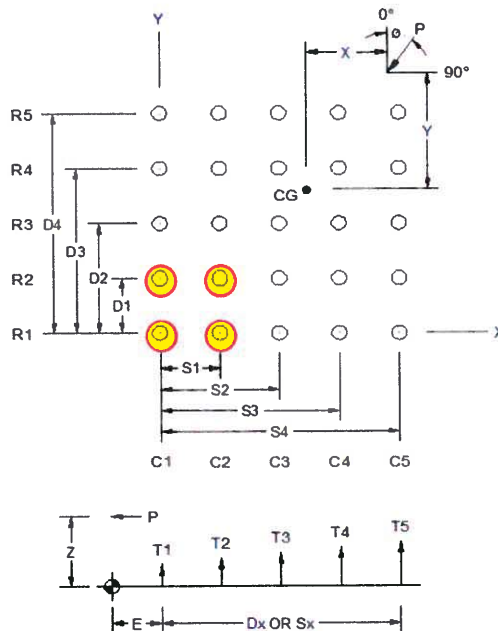
S₁ = 2.000 in
S₂ = 0.000 in
S₃ = 0.000 in
S₄ = 0.000 in

Bolt Group Centroid (CG)

Centroid, x = 1.000 in
Centroid, y = 3.125 in

Design Load Components

Design Load, P_x = 673.00 lb
Design Load, P_y = 0.00 lb



FASTENER CALCULATIONS:

$$\begin{aligned}\sum x^2 &= 4.00 \text{ in}^2 \\ \sum y^2 &= 39.06 \text{ in}^2 \\ \sum x^2 + \sum y^2 &= 43.06 \text{ in}^2 \\ M &= -2103.13 \text{ lb-in}\end{aligned}$$

$$\begin{aligned}f_y &= 994.94 \text{ ksi} \\ f_{sy} &= 0.00 \text{ psi} \\ f_x &= 3109.18 \text{ psi} \\ f_{sx} &= 3427.56 \text{ psi}\end{aligned}$$

← Vert Stress Due to Eccentric Shear
← Vert Stress Due to Direct Shear
← Horiz Stress Due to Eccentric Shear
← Horiz Stress Due to Direct Shear

Bolt Tension by Column

T₁ = 29.12 lb/bolt
T₂ = 145.60 lb/bolt
T₃ = 0 lb/bolt
T₄ = 0 lb/bolt
T₅ = 0 lb/bolt

$$\begin{aligned}f &= 6612.03 \text{ psi} \\ V &= 324.57 \text{ lb} \\ V_a &= 687.50 \text{ lb} \\ T &= 145.60 \text{ lb} \\ T_a &= 450.00 \text{ lb}\end{aligned}$$

← Maximum Bolt Shear Stress
← Maximum Bolt Shear
OK
← Maximum Bolt Tension
OK

Interaction Values

Standard Bolts

$$V/V_a + T/T_a$$

0.796 < 1.0 **OK**

TIR Fasteners

$$(V/V_a)^2 + (T/T_a)^2$$

0.328 < 1.0 **OK**



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/200
Detail: 1-323 **Check 1-2**

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Design Wind Pressure 23.50 psf
Weld Filler Metal Yield (F_{yw}) 70 ksi

Design Loads		
	Design Loads	Load Location Relative to Origin
X-axis	lb (V_x)	0.00 in (X_v)
Y-axis (DL)	lb (V_y)	0.00 in (Y_v)
Z-axis (WL)	673.2 lb (V_z)	0.00 in (Z_v)

Weld Group Layout				
Weld Line	Parallel Axis (X or Y)	Length (in) (A_n)	Vert Dist from X-Axis (in) (y_n)	Horz Dist from Y-Axis (in) (x_n)
1	X	4	0	0
2				
3				
4				
5				
6				

Note: Load location & magnitude must use proper pos/neg values based on the origin. x_n & y_n are measured from the same origin as the applied load

Design Moments		
X-axis	0.0 lb-in	Note: Design moments are taken about the weld centroidal axis.
Y-axis	0.0 lb-in	
Z-axis	0.0 lb-in	

Weld Group Centroid		
$e_x = \sum A_n \cdot y_n / \sum A_n$	$e_x =$	0.000 in
$e_y = \sum A_n \cdot x_n / \sum A_n$	$e_y =$	0.000 in

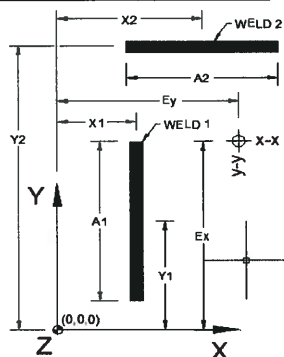
Weld Group Moment of Inertia				
Weld Line	I_{nx-x}	$A_{wn} \cdot y_{bar}^2$	I_{ny-y}	$A_{wn} \cdot x_{bar}^2$
1	0.0000	0.0000	5.3333	0.0000
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
$I_{x-x} = \sum (I_{nx-x} + A_{wn} y_{bar}^2)$			$I_{x-x} =$	0.000 in ³
$I_{y-y} = \sum (I_{ny-y} + A_{wn} x_{bar}^2)$			$I_{y-y} =$	5.333 in ³
$J_z = I_{x-x} + I_{y-y}$			$J_z =$	5.333 in ³

$$y_{bar} = \text{abs}(y_n - e_y), x_{bar} = \text{abs}(x_n - e_x)$$

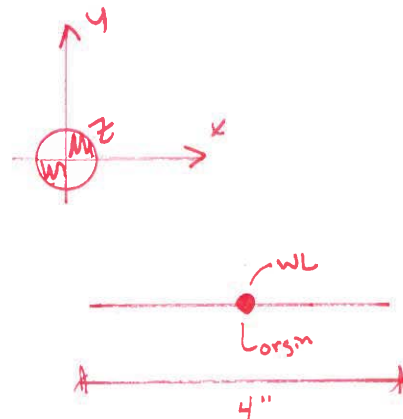
I_{x-x} & I_{y-y} are about weld group centroidal axis

Weld Extreme Fiber Dimensions		
Weld Line	e_{w-x} (in)	e_{w-y} (in)
1	2.000	0.000
2	N/A	N/A
3	N/A	N/A
4	N/A	N/A
5	N/A	N/A
6	N/A	N/A

Extreme Fiber is the weld point furthest from the centroidal axis of the weld group



NOTE: LOCATION OF X & Y AXIS IS ARBITRARY BUT MUST BE TAKEN AT THE SAME LOCATION FOR ALL WELDS IN THE GROUP AS SHOWN ABOVE.



X-Axis Weld Design		
<u>X-Axis Shear</u>		
$f_{wx} V_x = V_x / \sum A_n$	$f_{wx} V_x =$	0.00 lb/in
<u>Z-Axis Moment</u>		
$f_{wx} M_z = M_z \cdot e_{w-y} / J_w$	$f_{wx} M_z =$	0.00 lb/in
$f_{wx} = f_{wx} V_x + f_{wx} M_z$	$f_{wx} =$	0.00 lb/in

Y-Axis Forces		
<u>Y-Axis Shear</u>		
$f_{wy} V_y = V_y / \sum A_n$	$f_{wy} V_y =$	0.00 lb/in
<u>Z-Axis Moment</u>		
$f_{wy} M_z = M_z \cdot e_{w-x} / J_w$	$f_{wy} M_z =$	0.00 lb/in
$f_{wy} = f_{wy} V_y + f_{wy} M_z$	$f_{wy} =$	0.00 lb/in

Z-Axis Forces		
<u>Z-Axis Shear</u>		
$f_{wz} V_z = V_z / \sum A_n$	$f_{wz} V_z =$	168.30 lb/in
<u>X-Axis Moment</u>		
$f_{wz} M_x = M_x \cdot e_{w-y} / I_{x-x}$	$f_{wz} M_x =$	0.00 lb/in
<u>Y-Axis Moment</u>		
$f_{wz} M_y = M_y \cdot e_{w-x} / I_{y-y}$	$f_{wz} M_y =$	0.00 lb/in
$f_{wz} = f_{wy} V_z + f_{wy} M_x + f_{wy} M_y$	$f_{wz} =$	168.30 lb/in

Weld Design		
$f_w = \sqrt{f_{wx}^2 + f_{wy}^2 + f_{wz}^2}$	$f_w =$	168.30 lb/in
$t_{req} = f_w / (0.707 \cdot F_{yw} / 3.33)$	$t_{req} =$	0.0113 in
Use 3/16" (0.1875") fillet weld		



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Use 3/8" Elco Conflex into 4000psi concrete
minimum embedment = 2-1/2"
minimum spacing = 2-5/8"
minimum concrete edge distance = 2-5/8"
(3) per each vertical mullion

Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 5-1/16")
Part of: Anchors to Concrete
Elevation: 1/201
Detail: 1/301

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny

Check 1-3

See Check 1-2 for controlling anchor calculations

INPUT CHECK

Design Criteria: ADM 2010 / AAMA TIR A9-91
Design Basis: N/A

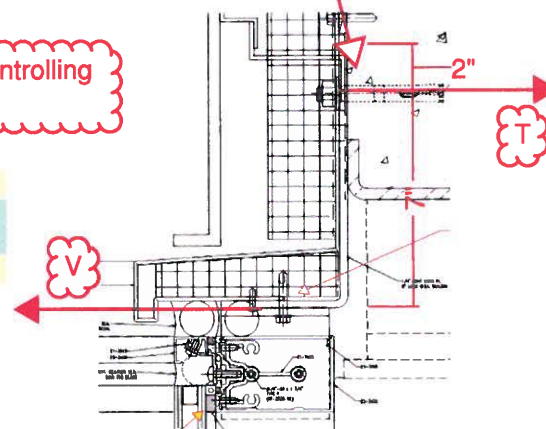
Fastener Type: Elco Conflex

Design Wind Pressure 24.00 psf
Design Shear Load (V) 0.00 lb
Design Tension Load (T) 2566.35 lb
Number of Screws 3 screws
Screw Selection (D) 3/8-in 0.3750 in
F_{tu1} of top material 58 ksi
Thickness of top material (t) 0.250 in
Distance to edge of part (d) 0.750 in
Embedment 2.5 in
Concrete Strength 4000 psi

Published Load Values:

Elco Conflex Allowable Shear 820 lb
Elco Conflex Allowable Tension 905 lb

Moment arm for screw (L) 0.00 in
Screw Section Modulus (S) 0.00518 in³
Screw Ultimate Tensile Strength 163 ksi
Bending Moment mod (μM) 1 (bolt fixity at standoff q_m=1 free to rotate and =2 rotation restrained)



Calculated Reduction Factors			
	Edge		
	Spacing	Distance	
Shear	1.00	1.00	
Tension	1.00	1.00	
Number of reductions (due to group geometry)			
	Spacing	Edge Distance	Final Allowable Capacity (lb)
	1.0	1.0	820
Shear	1.0	1.0	905
Tension	1.0	1.0	

Capacity = Allowable Load * Shear Factor ^ (num. reduc.)

* Tension Factor ^ (num. reduc.)

Screw Attachment Design		Ω = 3
Bearing (ADM J.5.6.1)		
$R_n/\Omega = d_e t_1 F_{tu1}/\Omega \leq 2 D t_1 F_{tu1}/\Omega$	$R_n/\Omega =$	3625.0 lb
Shear load associated with bolt bending (2011 Hilti Anchor Guide)		
$M_{UM,5\%} = 1.2 S_f (1 - T/T_a)$	$M_{UM,5\%} =$	55.4 lb-in
$V_{rec} = (\alpha_M * M_{UM,5\%}) / (1.7L)$	$V_{rec} =$	N/A lb
Screw Shear (AAMA TIR A9)		1937.0 lb
Allowable Fastener Shear V _a =		819.7 lb
Pull-Over (ADM J.5.5.2)		
$R_n/\Omega = C_{pov} t_1 F_{tu1} (D_{ws} - D_h) / \Omega$	$R_n/\Omega =$	N/A lb
Screw Tension (AAMA TIR A9)		3720.0 lb
Allowable Fastener Tension T _a =		905.0 lb
V/screw =		0.00 lb
T/screw =		855.45 lb
Interaction Formula < 1.0		0.95 < 1.0
Use (3) 3/8-in Elco Conflex		

	Spacing	Edge Dist.
Installed Dist.	2.63	2.63
Shear Factors		
Critical. Dist.	2.63	2.63
Minimum Dist.	2.63	2.63
Load Factor @ Minimum	1.00	1.00
Tension Factors		
Critical. Dist.	2.63	2.63
Minimum Dist.	2.63	2.63
Load Factor @ Minimum	1.00	1.00

OK

*** T = 570.3lb (9" / 2") = 2998lb



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 5-1/16")
Part of: Anchors to CFS
Elevation: 3/220, 5/220
Detail: **N/A (verify) Check 2**

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Elco Drilflex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

Top Hole		Base Hole		☐ Eccentric Shear Design ☐ Eccentric Tension Design
☒ Standard Hole	☐ Long Slotted Hole	☒ Standard Hole	☐ Long Slotted Hole	

☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

Design Pressure	24.00 psf
Design Shear Load (V)	698.10 lb
Design Tension Load (T)	0.00 lb
Number of Screws	4.00 screws
Screw Selection (D)	1/4" 0.2500 in
F _{ty1} , F _{tu1} (Top Material)	6063-T5 16, 22 ksi
F _{ty2} , F _{tu2} (Base Material)	A653 Gr. 50 50, 65 ksi
Thickness of top material (t ₁)	0.1875 in
Thickness base material (t ₂)	0.0566 in
Distance to edge of top material (d _{e1})	0.5000 in
Distance to edge of bottom material (d _{e2})	0.5000 in
Manufacturer Allowable Shear =	560.3 lb
Manufacturer Allowable Tension =	176.7 lb

Moment Arm for screw (L)	0.00 in
Screw Section Modulus (S)	0.001534 in ³
Screw Ultimate Tensile	120 ksi
Bending Moment mod (αM)	1

(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

Factored Fastener Loads (per fastener)		
Fastener Shear (V _{fas})	V / fastener =	174.5 lb
Fastener Tension (T _{fas})	T / fastener =	0.0 lb

Fastened Material Shear Design		
Bearing (ADM J3.7, J.5.6.1, AISC J4.10)		
Top Mat.: R _n = d _e t ₁ F _{tu1} ≤ 2D*t ₁ F _{tu1}		
Ω = 3 (Aluminum)	R _n /Ω =	687.5 lb
Base Mat.: R_n = 1.2d_et₂F_{tu2} ≤ 2.4D*t₂F_{tu2}		
Ω = 2 (Steel)	R _n /Ω =	1103.7 lb
Tilting (ADM J.5.6.2)		
Ω = 3 ≤ t ₁ ? YES		
R _n = 4.2(t ₂ ³ D) ^{1/2} F _{tu2}	R _n /Ω =	612.7 lb
Shear load associated with bolt bending (ref Hilti)		
M _{uM,5%} = 1.2Sf(1 - T/Ta)	M _{uM,5%} =	N/A lb-in
V _{rec} = (α _M * M _{uM,5%})/(1.7L)	V _{rec} =	N/A lb
AISI Cold-Formed Steel Design (Tbl IV-8a)		
Ω = 3		
LGM Shear of sheet	P _{ns} =	1.840 k
Using 0.0566" LGM	P _{ns} *1000/Ω =	613.3 lb
Allowable Shear / Fastener (V_{allowable}) =		
V _{fas} / V _{allowable} =		0.31 ≤ 1.0
OK.		

Fastened Material Tension Design		
Pull-Out (ADM J.5.5.1.1)		
Ω = 3		
R _n = 1.01*D*Le*F _{ty2}	R _n /Ω =	N/A lb
Pull-Over (ADM J.5.5.2)		
Ω = 3		
R _n = (1.0+1.7*t ₁ /Dws)Dws*t ₁ F _{ty1}	R _n /Ω =	798.8 lb
AISI Cold-Formed Steel Design IV-12		
Ω = 3		
LGM Pull-Out	P _{not} =	0.782 k
Using 0.0566" LGM	P _{not} *1000/Ω =	260.7 lb
Allowable Tension / Fastener (T_{allowable}) =		
T _{fas} / T _{allowable} =		0.00 ≤ 1.0
OK.		

Fastener Interaction Check		
Ω = 3		
Screw Shear (V _{TIR})	(AAMA TIR A9 Table 20.3)	646.0 lb
Screw Tension (T _{TIR})	(AAMA TIR A9 Table 20.3)	1273.0 lb
Typical:		
V _{fas} / V _{TIR} + T _{fas} / T _{TIR} =		0.27 ≤ 1.0
TIR A9-91:		
(V _{fas} / V _{TIR}) ² + (T _{fas} / T _{TIR}) ² =		N/A ≤ 1.0
OK.		

Use (4) 1/4" Elco Drilflex Screws.



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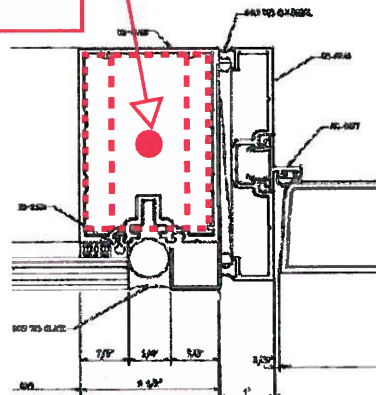
Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 5-1/16")
Part of: Anchors to Concrete
Elevation: 3/220, 5/220
Detail: 2/416 **Check 4**

Use 3/8" Elco Conflex into 4000psi concrete
minimum embedment = 2-1/2"
minimum spacing = 2-5/8"
minimum concrete edge distance = 2-5/8"

(1) per U anchors
miter off leg of F-anchor

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny



INPUT CHECK

Design Criteria: ADM 2010 / AAMA TIR A9-91
Design Basis: N/A

Fastener Type: Elco Conflex

Design Wind Pressure 24.00 psf
Design Shear Load (V) 698.10 lb
Design Tension Load (T) 0.00 lb
Number of Screws 1 screws
Screw Selection (D) 3/8-in 0.3750 in
 F_{tu1} of top material 22 ksi
Thickness of top material (t_1) 0.188 in
Distance to edge of part (d_e) 0.750 in
Embedment 2.5 in
Concrete Strength 4000 psi
Published Load Values:
Elco Conflex Allowable Shear 820 lb
Elco Conflex Allowable Tension 905 lb

Moment arm for screw (L) 0.00 in
Screw Section Modulus (S) 0.00518 in³
Screw Ultimate Tensile Strength 163 ksi
Bending Moment mod (αM) 1 (bolt fixity at standoff $\alpha_M=1$ free to rotate and =2 rotation restrained)

Calculated Reduction Factors			
	Edge		
	Spacing	Distance	
Shear	1.00	1.00	
Tension	1.00	1.00	
Number of reductions (due to group geometry)			
	Edge		Final Allowable Capacity (lb)
	Spacing	Distance	
Shear	1.0	1.0	820
Tension	1.0	1.0	905

Capacity = Allowable Load * Shear Factor ^ (num. reduc.)

* Tension Factor ^ (num. reduc.)

(bolt fixity at standoff $\alpha_M=1$ free to rotate and =2 rotation restrained)

Screw Attachment Design		$\Omega = 3$
Bearing (ADM J.5.6.1)		
$R_n/\Omega = d_e t_1 F_{tu1}/\Omega \leq 2 D t_1 F_{tu1}/\Omega$	$R_n/\Omega =$	1031.3 lb
Shear load associated with bolt bending (2011 Hilti Anchor Guide)		
$M_{uM,5\%} = 1.2 S (1 - T/T_a)$	$M_{uM,5\%} =$	1012.7 lb-in
$V_{rec} = (\alpha_M * M_{uM,5\%})/(1.7L)$	$V_{rec} =$	N/A lb
Screw Shear (AAMA TIR A9)		1937.0 lb
Allowable Fastener Shear $V_a =$		819.7 lb
Pull-Over (ADM J.5.5.2)		
$R_n/\Omega = C_{pov} t_1 F_{tu1} (D_{ws} - D_h)/\Omega$	$R_n/\Omega =$	343.8 lb
Screw Tension (AAMA TIR A9)		3720.0 lb
Allowable Fastener Tension $T_a =$		343.8 lb
$V/\text{screw} =$		698.10 lb
$T/\text{screw} =$		0.00 lb
Interaction Formula < 1.0		0.85 < 1.0
Use (1) 3/8-in Elco Conflex		

	Spacing	Edge Dist.
Installed Dist.	2.63	2.63
Shear Factors		
Critical. Dist.	2.63	2.63
Minimum Dist.	2.63	2.63
Load Factor @ Minimum	1.00	1.00
Tension Factors		
Critical. Dist.	2.63	2.63
Minimum Dist.	2.63	2.63
Load Factor @ Minimum	1.00	1.00

OK

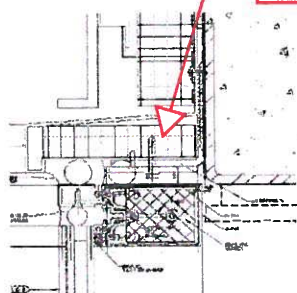


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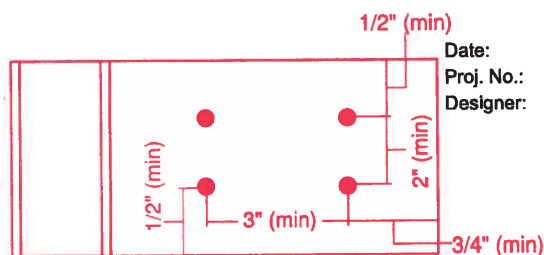
Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 5-1/16")
Part of: Anchors to Steel
Elevation: 1/200
Detail: 1/323 **Check 5**

INPUT CHECK



Use 1/4" Elco Drillflex into minimum
1/8" thick steel

(4) per F anchor, see sketch below



Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

FASTENER PROPERTIES:

Fastener Type = Elco Drillflex
Fastener Size = 1/4-in
Nominal Diameter, D = 0.25 in
Area, A = 0.05 in²
Allowable Shear per Spec, V_a = 687.50 lb
Allowable Tension per Spec, T_a = 450.00 lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 307.00 lb
Design Moment, M_{cg} = 0.00 lb-in
Angle of Load, θ = 90.00 deg
Horz. Dist. from Centroid, x = 0.00 in
Vert. Dist. From Centroid, y = 3.81 in
Load Eccentricity from Bolt Plane, z = 1.13 in
Fastener Edge Distance, E = 0.50 in
Axis of Rotation for Tension Analysis = Y Axis

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

4

Fasteners per Row

N_{R1} = 2
N_{R2} = 2
N_{R3} = 0
N_{R4} = 0
N_{R5} = 0

Fasteners per Column

N_{C1} = 2
N_{C2} = 2
N_{C3} = 0
N_{C4} = 0
N_{C5} = 0

Row Dimensions

D₁ = 3.000 in
D₂ = 0.000 in
D₃ = 0.000 in
D₄ = 0.000 in

Column Dimensions

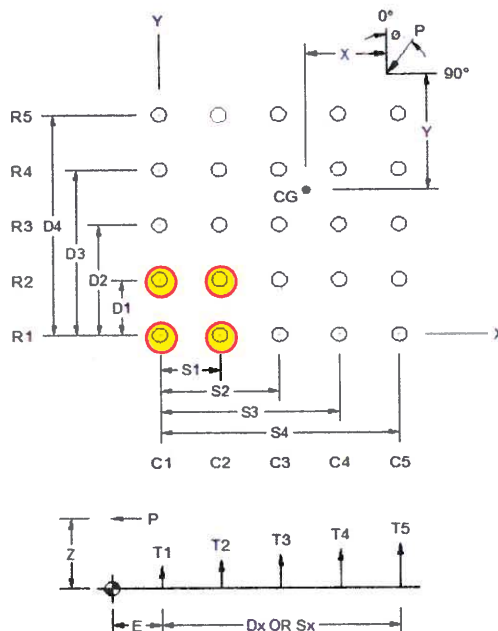
S₁ = 2.000 in
S₂ = 0.000 in
S₃ = 0.000 in
S₄ = 0.000 in

Bolt Group Centroid (CG)

Centroid, x = 1.000 in
Centroid, y = 1.500 in

Design Load Components

Design Load, P_x = 307.00 lb
Design Load, P_y = 0.00 lb



FASTENER CALCULATIONS:

$$\begin{aligned}\Sigma x^2 &= 4.00 \text{ in}^2 \\ \Sigma y^2 &= 9.00 \text{ in}^2 \\ \Sigma x^2 + \Sigma y^2 &= 13.00 \text{ in}^2 \\ M &= -1170.44 \text{ lb-in}\end{aligned}$$

$$\begin{aligned}f_y &= 1834.15 \text{ ksi} \\ f_{sy} &= 0.00 \text{ psi} \\ f_x &= 2751.23 \text{ psi} \\ f_{sx} &= 1563.54 \text{ psi}\end{aligned}$$

← Vert Stress Due to Eccentric Shear
← Vert Stress Due to Direct Shear
← Horiz Stress Due to Eccentric Shear
← Horiz Stress Due to Direct Shear

Bolt Tension by Column

T₁ = 13.28 lb/bolt
T₂ = 66.42 lb/bolt
T₃ = 0 lb/bolt
T₄ = 0 lb/bolt
T₅ = 0 lb/bolt

$$\begin{aligned}f &= 4688.42 \text{ psi} \\ V &= 230.14 \text{ lb} \\ V_a &= 687.50 \text{ lb} \\ T &= 66.42 \text{ lb} \\ T_a &= 450.00 \text{ lb}\end{aligned}$$

← Maximum Bolt Shear Stress
← Maximum Bolt Shear
OK
← Maximum Bolt Tension
OK

Interaction Values

Standard Bolts

$$V/V_a + T/T_a$$

0.482 < 1.0 **OK**

TIR Fasteners

$$(V/V_a)^2 + (T/T_a)^2$$

0.134 < 1.0 **OK**



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Client: NGG
Project: Webster University
Structure: YKK 750 (2-1/2" x 5-1/16")
Part of: Anchors to CFS
Elevation: 3/220, 5/220
Detail: **N/A (verify) Check 6**

Date: 11/3/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = Elco Driflex
Fastener Size = 1/4-14
Nominal Diameter, D = 0.250 in
Area, A = 0.049 in²
Allowable Shear per Spec, V_a = 560.3 lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 315.60 lb
Design Moment, M_{c.g.} = 0.00 lb-in
Angle of Load, θ = 90.00 deg
Horz. Dist. from Centroid, x = 0.00 in
Vert. Dist. From Centroid, y = 3.81 in

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners: 4

Fasteners per Row

N_{R1} = 2
N_{R2} = 2
N_{R3} =
N_{R4} =
N_{R5} =

Fasteners per Column

N_{C1} = 2
N_{C2} = 2
N_{C3} =
N_{C4} =
N_{C5} =

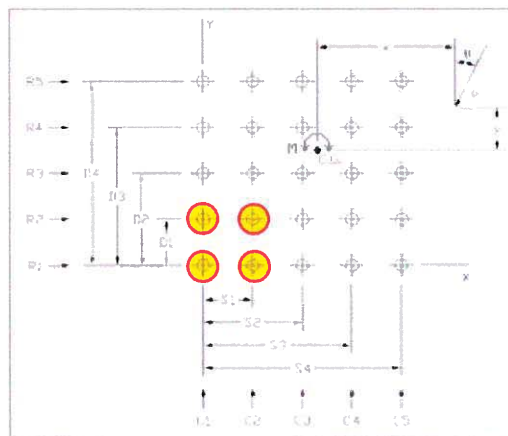
Row Dimensions

D₁ = 3.00 in
D₂ = in
D₃ = in
D₄ = in

Column Dimensions

S₁ = 2.00 in
S₂ = in
S₃ = in
S₄ = in

Centroid, x = 1.00 in
Centroid, y = 1.50 in



FASTENER CALCULATIONS:

$\sum x^2 = 4.00 \text{ in}^2$	$f_y = 1885.53 \text{ ksi}$	← Vert Stress Due to Eccentric Shear
$\sum y^2 = 9.00 \text{ in}^2$	$f_{sy} = 0.00 \text{ psi}$	← Vert Stress Due to Direct Shear
$\sum x^2 + \sum y^2 = 13.00 \text{ in}^2$	$f_x = 2828.30 \text{ psi}$	← Horiz Stress Due to Eccentric Shear
$M = -1203.23 \text{ lb-in}$	$f_{sx} = 1607.34 \text{ psi}$	← Horiz Stress Due to Direct Shear
	$f = 4819.76 \text{ psi}$	← Maximum Bolt Stress
	$V = 236.59 \text{ lb}$	← Maximum Bolt Load
	$V_a = 560.300 \text{ lb}$	OK



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Client: NGG
Project: Webster University
Structure: YKK 750 SSG
Part of: Intermediate Anchor Summary Sheet
Designer: M. Gorny

Date: 12/11/2016
Proj. No.: JE16059

Typical Wind Pressure (T) = 20.0 psf
Corner Zone Wind Pressure (C) = 23.5 psf
Interior Pressure (INT) = 5.0 psf
Typical Dead Load = 8.0 psf

Anchor Type
Point

INPUT CHECK RISA

Location	Substrate	Sheet	Elevation	Section	Wind Zone	Mullion Length (ft)	Trib. Width (ft)	Wind Pres. (psf)	Lateral Load (lb)	Gravity Load (lb)	
WL (only)	Vertical (J-hook)	205 (typ)	1/205 (typ)	1/306	C	Refer to RISA-3D		23.5	2195.3	N/A	a.1) N/A b.1) c.1) d.1)
		207	1/207	1/306	C	Refer to RISA-3D		23.5	2219.9	N/A	a.1) N/A b.1) c.1) d.1)
		208	1/208	1/318	C	Refer to RISA-3D		23.5	1448.1	N/A	a.1) N/A b.1) c.1) d.1)
	Vertical (Standard)	205	1/205	1/309	C	Refer to RISA-3D		23.5	2264.4	N/A	a.2) N/A N/A N/A N/A
	Jamb (J-hook)	205 (typ)	1/205 (typ)	1/306	C	Refer to RISA-3D		23.5	788.1	N/A	a.1) N/A b.1) c.1) d.2)
		208	1/208	1/318	C	Refer to RISA-3D		23.5	720.4	N/A	a.1) N/A b.1) c.1) d.2)
	Jamb (Standard)	213	1/213	1/357	C	Refer to RISA-3D		23.5	1446.9	N/A	a.2) a.1) N/A N/A N/A
		207	1/207	1/309	C	Refer to RISA-3D		23.5	895.5	N/A	a.2) N/A N/A N/A N/A
	Corner (90deg) (J-hook)	208	1/208	1/318	C	Refer to RISA-3D		23.5	167.5	N/A	a.3) N/A b.2) c.1) d.3)
	Corner (64deg) (J-hook)	208	1/208	1/318	C	Refer to RISA-3D		23.5	281.9	N/A	a.3) N/A b.3) c.1) d.3)
DLWL	Vertical (J-hook)	208	1/208	1/303	C	Refer to RISA-3D		23.5	1614.3	1292.8	a.4.1) N/A b.4) c.1) d.1)
		216	1/216	1/318	C	Refer to RISA-3D		23.5	1076.0	612.3	a.4.1) N/A b.4) c.1) d.1)
	Jamb (J-hook)	208	1/208	1/303	C	Refer to RISA-3D		23.5	812.5	616.8	a.4.2) N/A b.4) c.1) d.2)
	Corner (90deg) (J-hook)	208	1/208	1/303	C	Refer to RISA-3D		23.5	286.7	975.7	a.5) N/A b.5) c.1) d.3)
	Corner (64deg) (J-hook)	208	1/208	1/303	C	Refer to RISA-3D		23.5	269.4	1009.6	a.5) N/A b.6) c.1) d.3)

In highlighted checks above, worst case dead and wind load were conservatively combined

Check a: Mullion to Intermediate Anchor Clip Connection and Intermediate Anchor Clip

Check a': Weld to Structure

Check b: Bolt to Pour Stop Clip

Check c: Pour Stop Clip

Check d: Self Drilling Fasteners to Structure

** Added 240lb to vertical dead weight to account for 2x4x3/8 HSS tube reinforcing

** Added 130lb to 64deg corner vertical dead weight to account for 2x4x1/4 HSS tube reinforcing

** Added 80lb to jamb vertical dead weight to account for 2x4x1/4 channel reinforcing

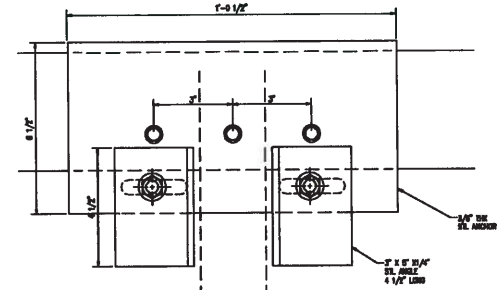
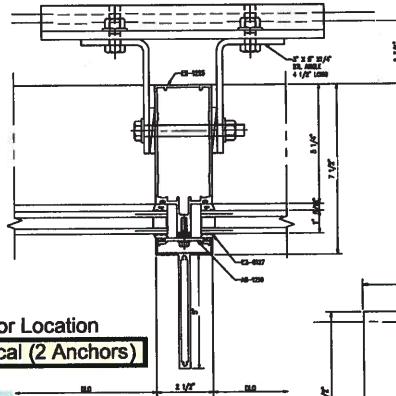


JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/207
Detail: 1/306 **Check a.1**

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Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK



Alloy-Temper	Anchor Type	Anchor Location
6063-T6	Wind Load	Typ Vertical (2 Anchors)

Wind Load (V_{WL}) 2219.90 lb $\rightarrow V_{W/LA} = 1109.95$ lb per anchor
Dead Load (V_{DL}) 0.00 lb $\rightarrow V_{D/LA} = 0.00$ lb per anchor

Z (in)	X (in)	t (in)	Y (in)
5.50	4.00	0.25	4.50

Thermal Expansion Clear Span = 31.10 ft
Span of Spandrel Beam = N/A ft
Max Spandrel Deflection = 0.750 in (RFI to EOR)

Bolt Diameter (D) = 0.500 in
Number of Bolts (n) = 1 bolts @ 1 bolt(s)/slot

Alum. Thickness (t_m) = 0.090 in
Alum. F_{tu} = 30 ksi
Alum. Edge Dist. (d_{emul}) = 1.00 in

Steel F_y = 36 ksi
Steel F_{tu} = 58 ksi
Steel E = 29000 ksi

Bolt Edge Distance (L_e) = 1.250 in (AISC J3.4)
Anchor L_b = 4.000 in

Weak Axis Eccentricity (e) = 1.00 in

Bolt Shear (Grade 5 Bolt)

$V_1 = V_{W/LA}$ $V_1 = 1109.95$ lb
 $V_2 = V_{D/LA}$ $V_2 = 0.00$ lb
 $V_{TOTAL} = \sqrt{(V_1^2 + V_2^2)}$ $V_{TOTAL} = 1109.95$ lb
AAMA TIR A9-91 Table 6 $V_a = 3580.00$ lb
 $V_{TOTAL}/V_a = 0.310$ **OK**

Aluminum Bearing @ Bolt Connection; $\Omega = 1.95$

2010 Aluminum Design Manual Section J.5.6.1

$V_a = R_n/\Omega = d_{emul} t_m F_{tumul}/\Omega$ $V_a = 1384.62$ lb
 $\leq 2D t_m F_{tumul}/\Omega$ $V_{TOTAL}/V_a = 0.802$ **OK**

Slot Size

$\Delta_{temp} = T_{change}(\text{Coef})h$ $\Delta_{temp} = 0.38$ in
 $L_s = (2\Delta_{temp}) + (D \cdot n) + (2 \cdot \text{Spandrel Deflection}) + (n-1)(1.25 \text{ in})$
Minimum Slot Length (L_s) $L_s = 2.76$ in
Actual Slot Length to Use = $L_s = 2.75$ in

Major Axis Steel Bending - Dead Load; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed. Chapter F

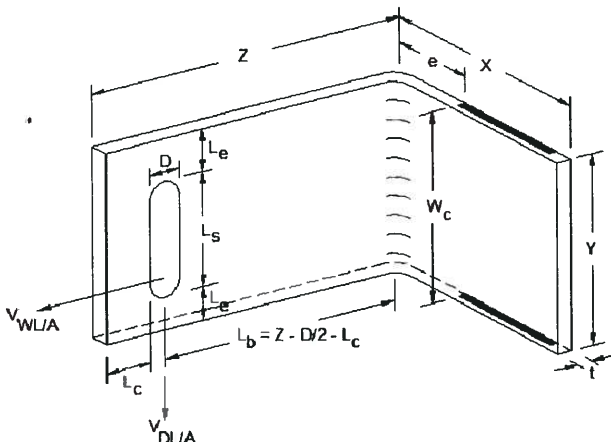
F11.2.a Lateral-Torsional Buckling Applies

CHECK DOES NOT APPLY TO WIND LOAD ANCHORS

$L_b Y/t^2$ 288.00
 $0.08 E/F_y$ 64.44
 $1.90 E/F_y$ 1530.56
 $Z_x = 1.266$ in³
 $S_x = 0.844$ in³

$M_p = F_y Z_x$ $M_p = \text{N/A}$ lb-in
 $M_y = F_y S_x$ $M_y = \text{N/A}$ lb-in
 $M_n = C_b [1.52 - 0.274 (L_b Y/t^2) (F_y/E)] M_y \leq M_p$ $M_n = \text{N/A}$ lb-in

$M_{bx} = M_n/\Omega_b$ $M_{bx} = \text{N/A}$ lb-in
 $M_x = V_{D/LA} \cdot L_b$ $M_x = \text{N/A}$ lb-in
 $M_x / M_{bx} = \text{N/A}$ **OK**



Weak Axis Bending; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed. Chapter F11.1

$W_c = Y$ $W_c = 4.500$ in
 $Z = (W_c^3 t^2)/4$ $Z = 0.0703$ in³
 $S = (W_c^3 t^2)/6$ $S = 0.0469$ in³

$M_n = M_p = F_y Z/\Omega_b = 1515.72$ lb-in
 $1.6 M_y/\Omega_b = 1616.77$ lb-in
 $M_a = M_n/\Omega_b \leq 1.6 M_y/\Omega_b = 1515.72$ lb-in
 $M = V_{W/LA} \cdot e = 1109.95$ lb-in
 $M_y/M_{ay} = 0.73$ **OK**

Combined Bending

$M_x/M_{bx} + M_y/M_{ay} \leq 1.0 = 0.73$ **OK**



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/213
Detail: 1/357 **Check a.2**

Date: 11/8/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Alloy-Temper	Anchor Type	Anchor Location
6063-T6	Wind Load	Typ Jamb (1 Anchor)

Wind Load (V_{WL}) 1446.90 lb $\rightarrow V_{WL/A} = 1446.90$ lb per anchor
Dead Load (V_{DL}) 0.00 lb $\rightarrow V_{DL/A} = 0.00$ lb per anchor

Z (in)	X (in)	t (in)	Y (in)
5.50	4.00	0.25	4.50

Thermal Expansion Clear Span = 26.91 ft
Span of Spandrel Beam = N/A ft
Max Spandrel Deflection = 0.000 in (RFI to EOR)

Bolt Diameter (D) = 0.500 in
Number of Bolts (n) = 1 bolts @ 1 bolt(s)/slot

Alum. Thickness (t_m) = 0.090 in
Alum. F_{tu} = 30 ksi
Alum. Edge Dist. (d_{emul}) = 1.00 in

Bolt Shear (Grade 5 Bolt)

$V_1 = V_{WL/A}$ $V_1 = 1446.90$ lb
 $V_2 = V_{DL/A}$ $V_2 = 0.00$ lb
 $V_{TOTAL} = \sqrt{V_1^2 + V_2^2}$ $V_{TOTAL} = 1446.90$ lb
AAMA TIR A9-91 Table 6 $V_a = 3580.00$ lb
 $V_{TOTAL}/V_a = 0.404$ **OK**

Aluminum Bearing @ Bolt Connection; $\Omega = 1.95$

2010 Aluminum Design Manual Section J.5.6.1

$V_a = R_n/\Omega = d_{emul} t_m F_{tumul}/\Omega$ $V_a = 1384.62$ lb
 $\leq 2D t_m F_{tumul}/\Omega$ $V_{TOTAL}/V_a = 1.045$ **OK**

Slot Size

$\Delta_{temp} = T_{change}(\text{Coef})h$ $\Delta_{temp} = 0.33$ in
 $L_s = (2\Delta_{temp}) + (D \cdot n) + (2 \cdot \text{Spandrel Deflection}) + (n-1)(1.25)$
Minimum Slot Length (L_s) $L_s = 1.16$ in
Actual Slot Length to Use = $L_s = 1.25$ in

Major Axis Steel Bending - Dead Load; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed, Chapter F

F11.2.a Lateral-Torsional Buckling Applies

**CHECK DOES NOT
APPLY TO WIND LOAD
ANCHORS**

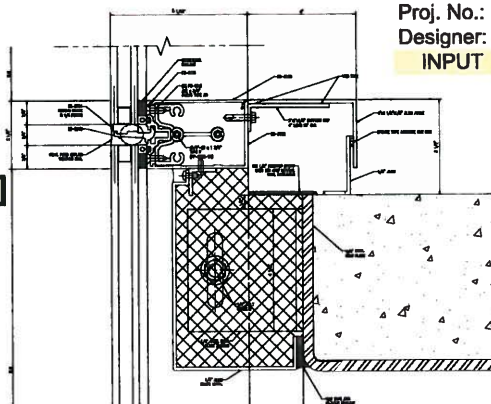
$L_b Y/t^2$ 288.00
0.08 E/F_y 64.44
1.90 E/F_y 1530.56
 $Z_x = 1.266$ in³
 $S_x = 0.844$ in³

$M_p = F_y Z_x$ $M_p =$ N/A lb-in
 $M_y = F_y S_x$ $M_y =$ N/A lb-in

$M_n = C_b [1.52 - 0.274(L_b Y/t^2)(F_y/E)] M_y \leq M_p$

$M_{ax} = M_n/\Omega_b$ $M_{ax} =$ N/A lb-in
 $M_x = V_{DL/A} \cdot L_b$ $M_x =$ N/A lb-in

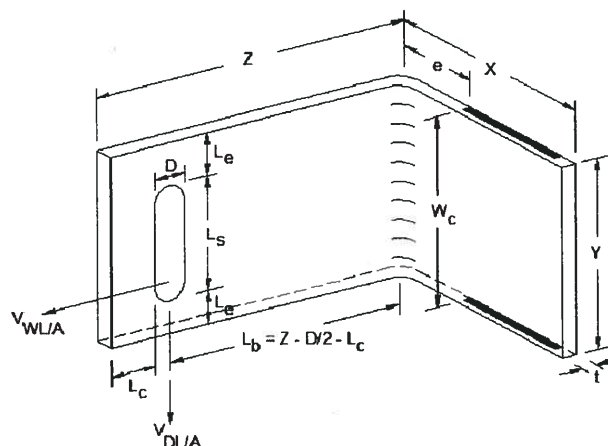
$M_x/M_{ax} =$ N/A **OK**



Steel $F_y = 36$ ksi
Steel $F_{tu} = 58$ ksi
Steel $E = 29000$ ksi

Bolt Edge Distance (L_c) = 1.250 in (AISC J3.4)
Anchor $L_b = 4.000$ in

Weak Axis Eccentricity (e) = 1.00 in



<<< Use 2-3/4" to be conservative

Weak Axis Bending; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed, Chapter F11.1

$W_c = Y$ $W_c = 4.500$ in
 $Z = (W_c \cdot t^2)/4$ $Z = 0.0703$ in³
 $S = (W_c \cdot t^2)/6$ $S = 0.0469$ in³

$M_n = M_p = F_y \cdot Z/\Omega_b =$ $M_n = 1515.72$ lb-in
 $1.6 \cdot M_y/\Omega_b =$ $1.6 \cdot M_y/\Omega_b = 1616.77$ lb-in
 $M_a = M_n/\Omega_b \leq 1.6 \cdot M_y/\Omega_b =$ $M_a = 1515.72$ lb-in
 $M = V_{WL/A} \cdot e =$ $M = 1446.90$ lb-in
 $M_y/M_{ay} =$ $M_y/M_{ay} = 0.95$ **OK**

Combined Bending

$M_x/M_{ax} + M_y/M_{ay} \leq 1.0 =$ 0.95 **OK**





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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/208
Detail: 1/318 **Check a.3**

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT **CHECK**

Alloy-Temper	Anchor Type	Anchor Location
6063-T6	Wind Load	Typ Jamb (1 Anchor)

Wind Load (V_{WL}) 281.90 lb $\rightarrow V_{WL/A} = 281.90$ lb per anchor
Dead Load (V_{DL}) 0.00 lb $\rightarrow V_{DL/A} = 0.00$ lb per anchor

Z (in)	X (in)	t (in)	Y (in)
10.75	16.25	0.38	5.00

Thermal Expansion Clear Span = 26.91 ft
Span of Spandrel Beam = N/A ft
Max Spandrel Deflection = 0.000 in (RFI to EOR)

Bolt Diameter (D) = 0.500 in
Number of Bolts (n) = 1 bolts @ 1 bolt(s)/slot

Alum. Thickness (t_m) = 0.090 in
Alum. F_{tu} = 30 ksi
Alum. Edge Dist. (d_{emul}) = 1.00 in

Steel F_y = 36 ksi
Steel F_{tu} = 58 ksi
Steel E = 29000 ksi

Bolt Edge Distance (L_e) = 1.250 in (AISC J3.4)
Anchor L_b = 9.250 in

Weak Axis Eccentricity (e) = 13.50 in

Bolt Shear (Grade 5 Bolt)

$V_1 = V_{WL/A}$ $V_1 = 281.90$ lb
 $V_2 = V_{DL/A}$ $V_2 = 0.00$ lb
 $V_{TOTAL} = \sqrt{(V_1^2 + V_2^2)}$ $V_{TOTAL} = 281.90$ lb
AAMA TIR A9-91 Table 6 $V_a = 3580.00$ lb
 $V_{TOTAL}/V_a = 0.079$ **OK**

Aluminum Bearing @ Bolt Connection; $\Omega = 1.95$

2010 Aluminum Design Manual Section J.5.6.1

$V_a = R_n/\Omega = d_{emul} t_m F_{tumul}/\Omega$ $V_a = 1384.62$ lb
 $\leq 2D t_m F_{tumul}/\Omega$ $V_{TOTAL}/V_a = 0.204$ **OK**

Slot Size

$\Delta_{temp} = T_{change}(\text{Coef}) \cdot h$ $\Delta_{temp} = 0.33$ in
 $L_s = (2\Delta_{temp}) + (D \cdot n) + (2 \cdot \text{Spandrel Deflection}) + (n-1)(1.25 \text{ in})$
Minimum Slot Length (L_s) $L_s = 1.16$ in
Actual Slot Length to Use = $L_s = 1.25$ in

Major Axis Steel Bending - Dead Load; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed, Chapter F

F11.2.a Lateral-Torsional Buckling Applies

**CHECK DOES NOT
APPLY TO WIND LOAD
ANCHORS**

$L_b Y/t^2$ 328.89
0.08 E/ F_y 64.44
1.90 E/ F_y 1530.56

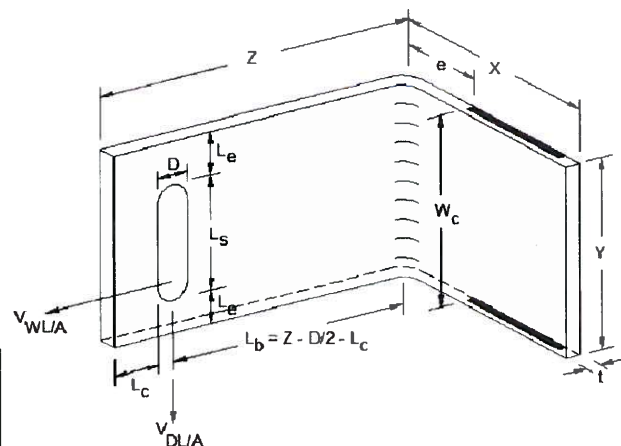
$Z_x = 2.344$ in³
 $S_x = 1.563$ in³

$M_p = F_y Z_x$
 $M_y = F_y S_x$
 $M_n = C_b [1.52 - 0.274 (L_b Y/t^2) (F_y/E)] M_y \leq M_p$

$M_p = \text{N/A}$ lb-in
 $M_y = \text{N/A}$ lb-in
 $M_n = \text{N/A}$ lb-in

$M_{ax} = M_n/\Omega_b$
 $M_x = V_{DL/A} \cdot L_b$

$M_a = \text{N/A}$ lb-in
 $M_x = \text{N/A}$ lb-in
 $M_x / M_{ax} = \text{N/A}$ **OK**



Weak Axis Bending; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed, Chapter F11.1

$W_c = Y$ $W_c = 5.000$ in
 $Z = (W_c \cdot t^2)/4$ $Z = 0.1758$ in³
 $S = (W_c \cdot t^2)/6$ $S = 0.1172$ in³

$M_n = M_p = F_y \cdot Z/\Omega_b = 3789.30$ lb-in
 $1.6 \cdot M_y/\Omega_b = 4041.92$ lb-in
 $M_a = M_n/\Omega_b \leq 1.6 \cdot M_y/\Omega_b = 3789.30$ lb-in
 $M = V_{WL/A} \cdot e = 3805.65$ lb-in
 $M_y/M_{ay} = 1.00$ **OK**

Combined Bending

$M_x/M_{ax} + M_y/M_{ay} \leq 1.0 =$

1.00 **OK**



JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/208
Detail: 1/303 **Check a.4.1**

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Alloy-Temper	Anchor Type	Anchor Location
6063-T6	Dead Load	Typ Vertical (2 Anchors)

Wind Load (V_{WL}) 1614.30 lb $\rightarrow V_{WL/A} = 807.15$ lb per anchor
Dead Load (V_{DL}) 1292.80 lb $\rightarrow V_{DL/A} = 646.40$ lb per anchor

Z (in)	X (in)	t (in)	Y (in)
5.50	4.00	0.25	3.00

Thermal Expansion Clear Span = N/A ft
Span of Spandrel Beam = N/A ft
Max Spandrel Deflection = 0.000 in (RFI to EOR)

Bolt Diameter (D) = 0.500 in
Number of Bolts (n) = 1 bolts @ 1 bolt(s)/slot

Alum. Thickness (t_m) = 0.090 in
Alum. F_{tu} = 30 ksi
Alum. Edge Dist. (d_{emul}) = 1.00 in

Bolt Shear (Grade 5 Bolt)

$V_1 = V_{WL/A}$ $V_1 = 807.15$ lb
 $V_2 = V_{DL/A}$ $V_2 = 646.40$ lb
 $V_{TOTAL} = \sqrt{V_1^2 + V_2^2}$ $V_{TOTAL} = 1034.08$ lb
AAMA TIR A9-91 Table 6 $V_a = 3580.00$ lb
 $V_{TOTAL}/V_a = 0.289$ **OK**

Aluminum Bearing @ Bolt Connection; $\Omega = 1.95$

2010 Aluminum Design Manual Section J.5.6.1

$V_a = R_n/\Omega = d_{emul} t_m F_{tumul}/\Omega$ $V_a = 1384.62$ lb
 $\leq 2D t_m F_{tumul}/\Omega$ $V_{TOTAL}/V_a = 0.747$ **OK**

Slot Size

$\Delta_{temp} = T_{change}(\text{Coef}) \cdot h$ $\Delta_{temp} = \text{N/A}$ in
 $L_s = (2\Delta_{temp}) + (D \cdot n) + (2 \cdot \text{Spandrel Deflection}) + (n-1)(1.25)$ in
Minimum Slot Length (L_s) $L_s = 0.00$ in
Actual Slot Length to Use = $L_s = 0.00$ in

Major Axis Steel Bending - Dead Load; $\Omega_b = 1.67$

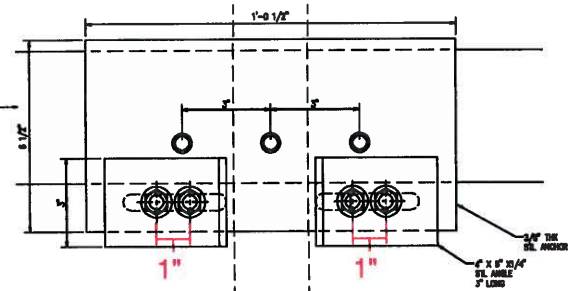
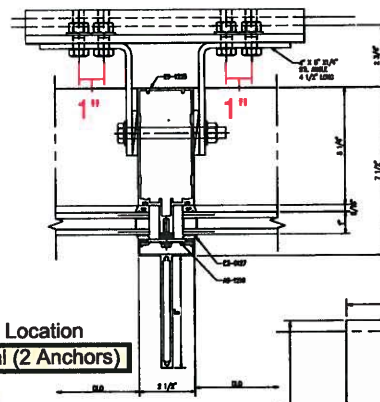
AISC Steel Manual 13th Ed, Chapter F

F11.2.a Lateral-Torsional Buckling Applies

$L_b Y/t^2$ 210.00
 $0.08 E/F_y$ 64.44 $Z_x = 0.563$ in³
 $1.90 E/F_y$ 1530.56 $S_x = 0.375$ in³

$M_p = F_y Z_x$ $M_p = 20250.00$ lb-in
 $M_y = F_y S_x$ $M_y = 13500.00$ lb-in
 $M_n = C_b [1.52 - 0.274 (L_b Y/t^2) (F_y/E)] M_y \leq M_p$ $M_n = 19555.71$ lb-in

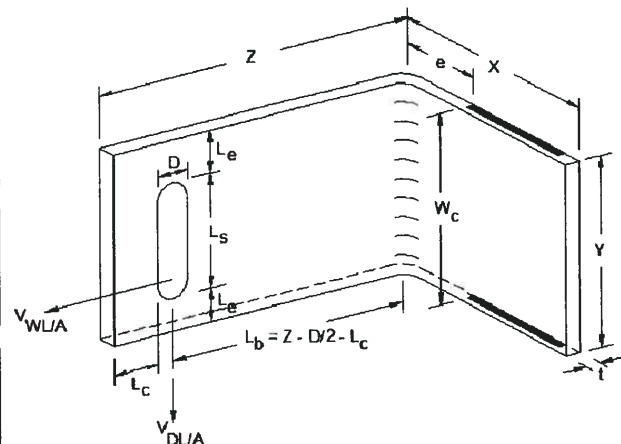
$M_{ax} = M_n/\Omega_b$ $M_{ax} = 11710.01$ lb-in
 $M_x = V_{DL/A} \cdot L_b$ $M_x = 2828.00$ lb-in
 $M_x/M_{ax} = 0.24$ **OK**



Steel $F_y = 36$ ksi
Steel $F_{tu} = 58$ ksi
Steel $E = 29000$ ksi

Bolt Edge Distance (L_c) = 0.875 in (AISC J3.4)
Anchor $L_b = 4.375$ in

Weak Axis Eccentricity (e) = 1.00 in



Weak Axis Bending; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed, Chapter F11.1

$W_c = Y$ $W_c = 3.000$ in
 $Z = (W_c \cdot t^2)/4$ $Z = 0.0469$ in³
 $S = (W_c \cdot t^2)/6$ $S = 0.0313$ in³

$M_n = M_p = F_y \cdot Z/\Omega_b = 1010.48$ lb-in
 $1.6 \cdot M_y/\Omega_b = 1077.84$ lb-in
 $M_a = M_n/\Omega_b \leq 1.6 \cdot M_y/\Omega_b = 1010.48$ lb-in
 $M = V_{WL/A} \cdot e = 807.15$ lb-in
 $M_y/M_{ay} = 0.80$ **OK**

Combined Bending

$M_x/M_{ax} + M_y/M_{ay} \leq 1.0 = 1.04$ **OK**



JEI Structural Engineering
11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/208
Detail: 1/303 **Check a.4.2**

Voice: 816-734-8345
Fax: 816-734-7013
www.jeistructural.com

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

Alloy-Temper	Anchor Type	Anchor Location
6063-T6	Dead Load	Typ Jamb (1 Anchor)

Wind Load (V_{WL}) 812.50 lb $\rightarrow V_{WL/A} = 812.50$ lb per anchor
Dead Load (V_{DL}) 616.80 lb $\rightarrow V_{DL/A} = 616.80$ lb per anchor

Z (in)	X (in)	t (in)	Y (in)
5.50	4.00	0.25	3.00

Thermal Expansion Clear Span = N/A ft
Span of Spandrel Beam = N/A ft
Max Spandrel Deflection = 0.000 in (RFI to EOR)

Bolt Diameter (D) = 0.500 in
Number of Bolts (n) = 1 bolts @ 1 bolt(s)/slot

Alum. Thickness (t_m) = 0.090 in
Alum. F_{tu} = 30 ksi
Alum. Edge Dist. (d_{emul}) = 1.00 in

Bolt Shear (Grade 5 Bolt)

$V_1 = V_{WL/A}$ $V_1 = 812.50$ lb
 $V_2 = V_{DL/A}$ $V_2 = 616.80$ lb
 $V_{TOTAL} = \sqrt{V_1^2 + V_2^2}$ $V_{TOTAL} = 1020.10$ lb
AAMA TIR A9-91 Table 6 $V_a = 3580.00$ lb
 $V_{TOTAL}/V_a = 0.285$ **OK**

Aluminum Bearing @ Bolt Connection; $\Omega = 1.95$

2010 Aluminum Design Manual Section J.5.6.1

$V_a = R_n/\Omega = d_{emul} t_m F_{tumul}/\Omega$ $V_a = 1384.62$ lb
 $\leq 2d_{emul} F_{tumul}/\Omega$ $V_{TOTAL}/V_a = 0.737$ **OK**

Slot Size

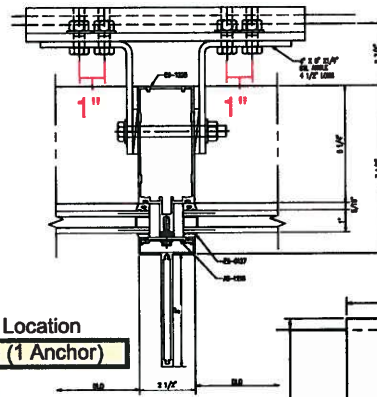
$\Delta_{temp} = T_{change}(\text{Coef})h$ $\Delta_{temp} = \text{N/A}$ in
 $L_s = (2\Delta_{temp}) + (D \cdot n) + (2 \cdot \text{Spandrel Deflection}) + (n-1)(1.25)$ in
Minimum Slot Length (L_s) $L_s = 0.00$ in
Actual Slot Length to Use = $L_s = 0.00$ in

Major Axis Steel Bending - Dead Load; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed, Chapter F

F11.2.a Lateral-Torsional Buckling Applies

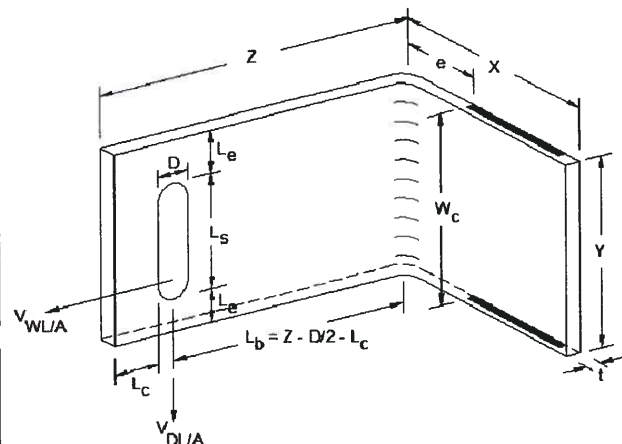
$L_b Y/I^2$ 210.00
 $0.08 E/F_y$ 64.44
 $1.90 E/F_y$ 1530.56
 $Z_x = 0.563$ in³
 $S_x = 0.375$ in³
 $M_p = F_y Z_x$ $M_p = 20250.00$ lb-in
 $M_y = F_y S_x$ $M_y = 13500.00$ lb-in
 $M_n = C_b [1.52 - 0.274 (L_b Y/I^2) (F_y/E)] M_y \leq M_p$ $M_n = 19555.71$ lb-in
 $M_{ax} = M_n/\Omega_b$ $M_{ax} = 11710.01$ lb-in
 $M_x = V_{DL/A} \cdot L_b$ $M_x = 2698.50$ lb-in
 $M_x/M_{ax} = 0.23$ **OK**



Steel $F_y = 36$ ksi
Steel $F_{tu} = 58$ ksi
Steel $E = 29000$ ksi

Bolt Edge Distance (L_c) = 0.875 in (AISC J3.4)
Anchor $L_b = 4.375$ in

Weak Axis Eccentricity (e) = 1.00 in



Weak Axis Bending; $\Omega_b = 1.67$

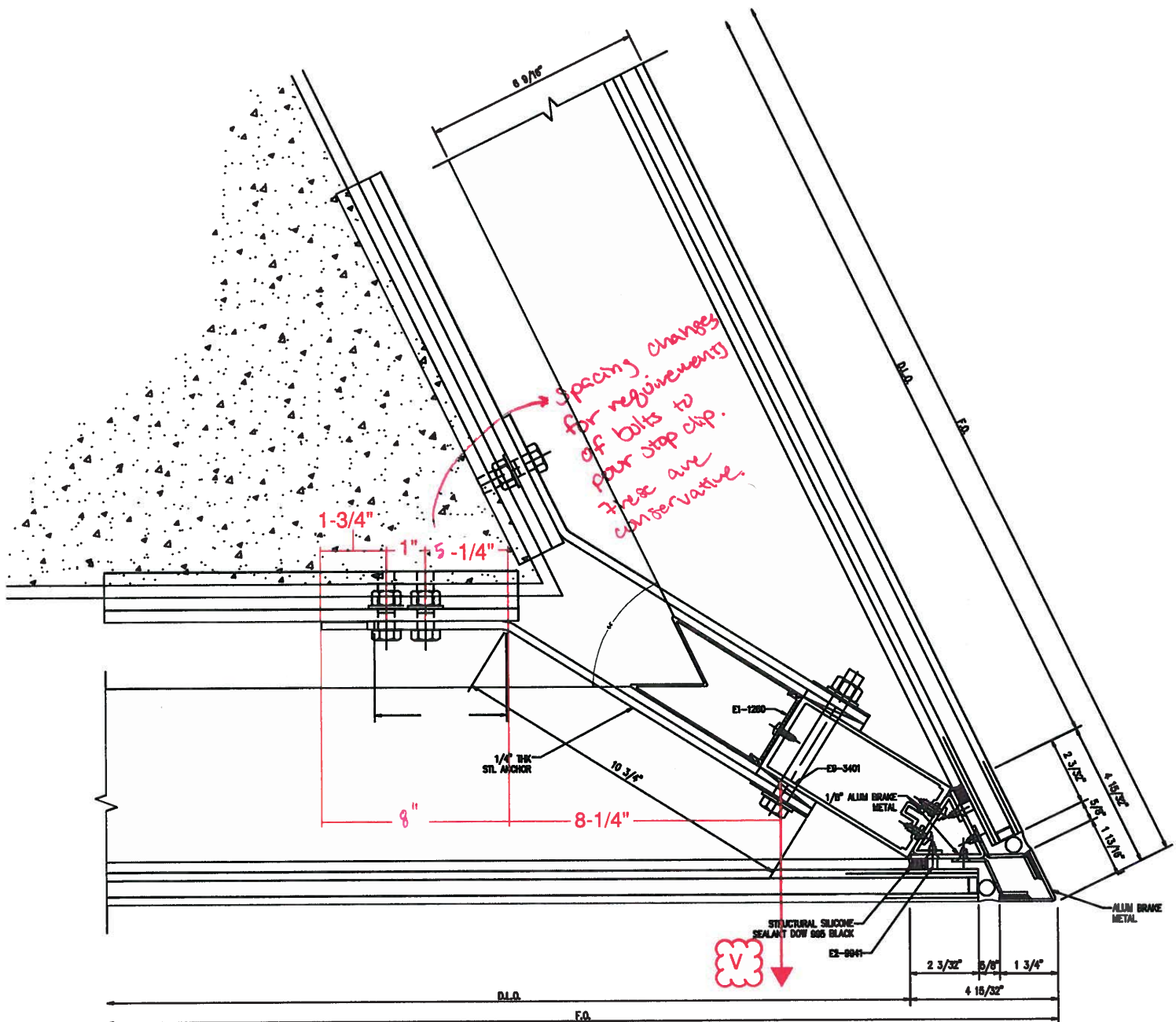
AISC Steel Manual 13th Ed, Chapter F11.1

$W_c = Y$ $W_c = 3.000$ in
 $Z = (W_c \cdot t^2)/4$ $Z = 0.0469$ in³
 $S = (W_c \cdot t^2)/6$ $S = 0.0313$ in³
 $M_n = M_p = F_y \cdot Z/\Omega_b = 1010.48$ lb-in
 $1.6 \cdot M_y/\Omega_b = 1077.84$ lb-in
 $M_a = M_n/\Omega_b \leq 1.6 \cdot M_y/\Omega_b = 1010.48$ lb-in
 $M = V_{WL/A} \cdot e = 812.50$ lb-in
 $M_y/M_{ay} = 0.80$ **OK**

Combined Bending

$M_x/M_{ax} + M_y/M_{ay} \leq 1.0 = 1.03$ **OK**

64deg corner conditlon





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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/208
Detail: 1/303 **Check a.5**

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT **CHECK**

Alloy-Temper	Anchor Type	Anchor Location
6063-T6	Dead Load	Typ Vertical (2 Anchors)

Wind Load (V_{WL}) 143.35 lb $\rightarrow V_{WL/A} = 71.68$ lb per anchor
Dead Load (V_{DL}) 1059.60 lb $\rightarrow V_{DL/A} = 529.80$ lb per anchor

Z (in)	X (in)	t (in)	Y (in)
10.75	16.25	0.38	3.00

Thermal Expansion Clear Span = N/A ft
Span of Spandrel Beam = N/A ft
Max Spandrel Deflection = 0.000 in (RFI to EOR)

Bolt Diameter (D) = 0.500 in
Number of Bolts (n) = 1 bolts @ 1 bolt(s)/slot

Alum. Thickness (t_m) = 0.090 in
Alum. F_u = 30 ksi
Alum. Edge Dist. (d_{emul}) = 1.00 in

Steel F_y = 36 ksi
Steel F_{tu} = 58 ksi
Steel E = 29000 ksi

Bolt Edge Distance (L_c) = 0.875 in (AISC J3.4)
Anchor L_b = 9.625 in

Weak Axis Eccentricity (e) = 13.50 in

Bolt Shear (Grade 5 Bolt)

$V_1 = V_{WL/A}$ $V_1 = 71.68$ lb
 $V_2 = V_{DL/A}$ $V_2 = 529.80$ lb
 $V_{TOTAL} = \sqrt{V_1^2 + V_2^2}$ $V_{TOTAL} = 534.63$ lb
AAMA TIR A9-91 Table 6 $V_a = 3580.00$ lb
 $V_{TOTAL}/V_a = 0.149$ **OK**

Aluminum Bearing @ Bolt Connection; $\Omega = 1.95$

2010 Aluminum Design Manual Section J.5.6.1

$V_a = R_n/\Omega = d_{emul} t_m F_{tumul}/\Omega$ $V_a = 1384.62$ lb
 $\leq 2D t_m F_{tumul}/\Omega$ $V_{TOTAL}/V_a = 0.386$ **OK**

Slot Size

$\Delta_{temp} = T_{change}(\text{Coef}) \cdot h$ $\Delta_{temp} = \text{N/A}$ in
 $L_s = (2\Delta_{temp}) + (D \cdot n) + (2 \cdot \text{Spandrel Deflection}) + (n-1)(1.25 \text{ in})$
Minimum Slot Length (L_s) $L_s = 0.00$ in
Actual Slot Length to Use = $L_s = 0.00$ in

Major Axis Steel Bending - Dead Load; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed, Chapter F

F11.2.a Lateral-Torsional Buckling Applies

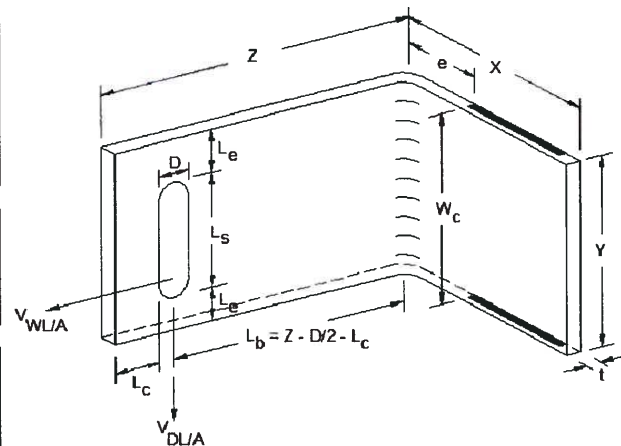
$L_b Y/t^2$ 205.33
0.08 E/F_y 64.44 $Z_x = 0.844$ in³
1.90 E/F_y 1530.56 $S_x = 0.563$ in³

$M_p = F_y Z_x$ $M_p = 30375.00$ lb-in
 $M_y = F_y S_x$ $M_y = 20250.00$ lb-in

$M_n = C_b [1.52 - 0.274 (L_b Y/t^2) (F_y/E)] M_y \leq M_p$ $M_n = 29365.71$ lb-in

$M_{ax} = M_n/\Omega_b$ $M_{ax} = 17584.26$ lb-in
 $M_x = V_{DL/A} \cdot L_b$ $M_x = 5099.33$ lb-in

$M_x / M_{ax} = 0.29$ **OK**



Weak Axis Bending; $\Omega_b = 1.67$

AISC Steel Manual 13th Ed, Chapter F11.1

$W_c = Y$ $W_c = 3.000$ in
 $Z = (W_c \cdot t^2)/4$ $Z = 0.1055$ in³
 $S = (W_c \cdot t^2)/6$ $S = 0.0703$ in³

$M_n = M_p = F_y \cdot Z/\Omega_b =$ $M_n = 2273.58$ lb-in

$1.6 \cdot M_y/\Omega_b =$ $1.6 \cdot M_y/\Omega_b = 2425.15$ lb-in

$M_a = M_n/\Omega_b \leq 1.6 \cdot M_y/\Omega_b =$ $M_a = 2273.58$ lb-in

$M = V_{WL/A} \cdot e =$ $M = 967.61$ lb-in

$M_y/M_{ay} =$ $M_y/M_{ay} = 0.43$ **OK**

Combined Bending

$M_x/M_{ax} + M_y/M_{ay} \leq 1.0 =$ **0.72** **OK**

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Kansas City, MO 64153

Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/213
Detail: 1/357

Date: 11/8/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

Design Wind Pressure 23.50 psf
Weld Filler Metal Yield (F_{yw}) 70 ksi

Design Loads		
	Design Loads	Load Location Relative to Origin
X-axis	lb (V_x)	in (X_v)
Y-axis (DL)	lb (V_y)	1.125 in (Y_v)
Z-axis (WL)	1446.9 lb (V_z)	4.00 in (Z_v)

Weld Group Layout				
Weld Line	Parallel Axis (X or Y)	Length (in) (A_n)	Vert Dist from X-Axis (in) (y_n)	Horz Dist from Y-Axis (in) (x_n)
1	X	3	4.5	2.25
2	X	3	0	2.25
3				
4				
5				
6				

Note: Load location & magnitude must use proper pos/neg values based on the origin. x_n & y_n are measured from the same origin as the applied load

Design Moments		
X-axis	1627.8 lb-in	Note: Design moments are taken about the weld centroidal axis.
Y-axis	3255.5 lb-in	
Z-axis	0.0 lb-in	

Weld Group Centroid		
$e_x = \Sigma A_n \cdot y_n / \Sigma A_n$	$e_x =$	2.250 in
$e_y = \Sigma A_n \cdot x_n / \Sigma A_n$	$e_y =$	2.250 in

Weld Group Moment of Inertia				
Weld Line	I_{wx-x}	$A_n \cdot y_{bar}^2$	I_{ny-y}	$A_n \cdot x_{bar}^2$
1	0.0000	15.1875	2.2500	0.0000
2	0.0000	15.1875	2.2500	0.0000
3	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A

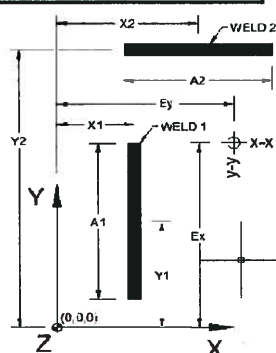
$I_{xx} = \Sigma (I_{wx-x} + A_n y_{bar}^2)$	$I_{xx} =$	30.375 in ⁴
$I_{yy} = \Sigma (I_{ny-y} + A_n x_{bar}^2)$	$I_{yy} =$	4.500 in ⁴
$J_z = I_{xx} + I_{yy}$	$J_z =$	34.875 in ⁴

$y_{bar} = \text{abs}(y_n - e_x)$, $x_{bar} = \text{abs}(x_n - e_y)$

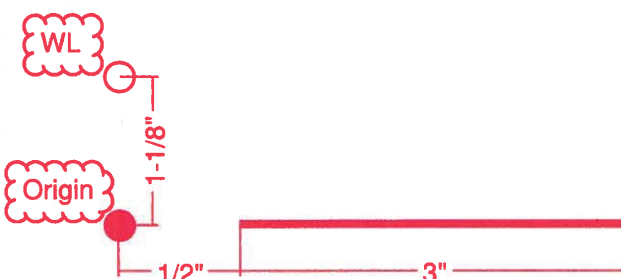
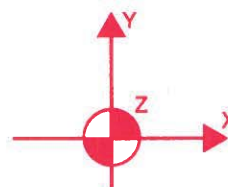
I_{xx} & I_{yy} are about weld group centroidal axis

Weld Extreme Fiber Dimensions		
Weld Line	e_{w-x} (in)	e_{w-y} (in)
1	1.500	2.250
2	1.500	2.250
3	N/A	N/A
4	N/A	N/A
5	N/A	N/A
6	N/A	N/A

Extreme Fiber is the weld point furthest from the centroidal axis of the weld group



NOTE: LOCATION OF X & Y AXIS IS ARBITRARY BUT MUST BE TAKEN AT THE SAME LOCATION FOR ALL WELDS IN THE GROUP AS SHOWN ABOVE



X-Axis Weld Design		
<u>X-Axis Shear</u>		
$f_{wx} V_x = V_x / \Sigma A_n$	$f_{wx} V_x =$	0.00 lb/in
<u>Z-Axis Moment</u>		
$f_{wx} M_z = M_z \cdot e_{w-x} / J_w$	$f_{wx} M_z =$	0.00 lb/in
$f_{wx} = f_{wx} V_x + f_{wx} M_z$	$f_{wx} =$	0.00 lb/in

Y-Axis Forces		
<u>Y-Axis Shear</u>		
$f_{wy} V_y = V_y / \Sigma A_n$	$f_{wy} V_y =$	0.00 lb/in
<u>Z-Axis Moment</u>		
$f_{wy} M_z = M_z \cdot e_{w-y} / J_w$	$f_{wy} M_z =$	0.00 lb/in
$f_{wy} = f_{wy} V_y + f_{wy} M_z$	$f_{wy} =$	0.00 lb/in

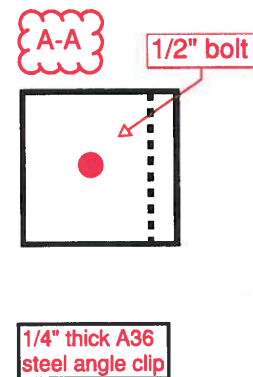
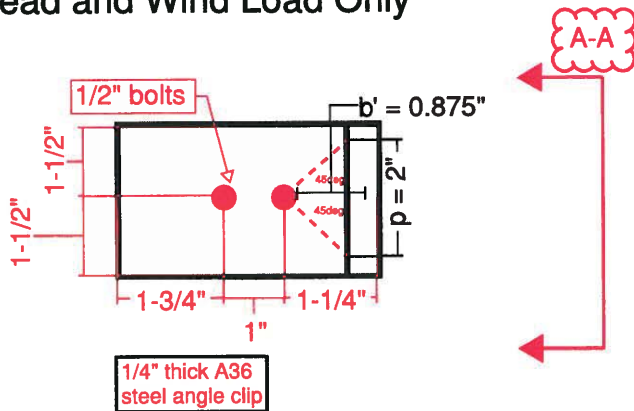
Z-Axis Forces		
<u>Z-Axis Shear</u>		
$f_{wz} V_z = V_z / \Sigma A_n$	$f_{wz} V_z =$	241.15 lb/in
<u>X-Axis Moment</u>		
$f_{wz} M_x = M_x \cdot e_{w-x} / I_{xx}$	$f_{wz} M_x =$	120.58 lb/in
<u>Y-Axis Moment</u>		
$f_{wz} M_y = M_y \cdot e_{w-y} / I_{yy}$	$f_{wz} M_y =$	1085.18 lb/in
$f_{wz} = f_{wy} V_z + f_{wy} M_x + f_{wy} M_y$	$f_{wz} =$	1446.90 lb/in

Weld Design		
$f_w = \sqrt{(f_{wx}^2 + f_{wy}^2 + f_{wz}^2)}$	$f_w =$	1446.90 lb/in
$t_{req} = f_w / (0.707 \cdot F_{yw} / 3.33)$	$t_{req} =$	0.0974 in
Use 3/16" (0.1875") fillet weld		



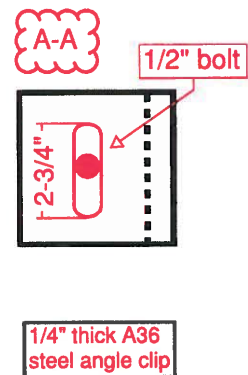
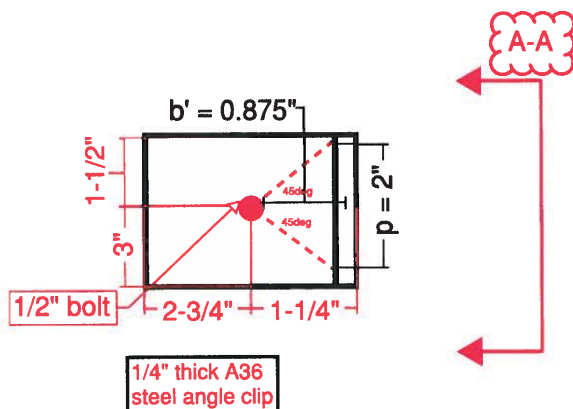
Dead Load Clip to be used with Pour Stop Anchors

Vertical Mullions
Dead and Wind Load Only



Wind Load Clip to be used with Pour Stop Anchors

Vertical Mullions
Wind Load Only



Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Bolts to pour stop clip
Elevation: 1/207
Detail: 1/306

Check b.1

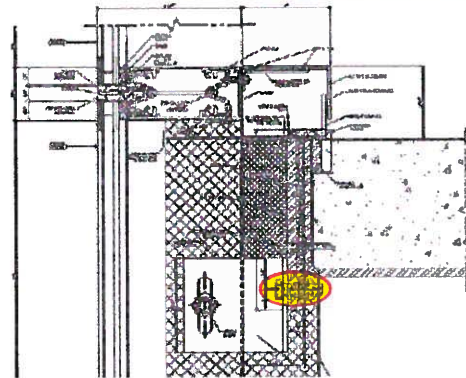
Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Hilti KwikFlex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

Top Hole: ☒ Standard Hole ☐ Long Slotted Hole
Base Hole: ☒ Standard Hole ☐ Long Slotted Hole
☐ Eccentric Shear Design
☐ Eccentric Tension Design
☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

Design Pressure: 23.50 psf
Design Shear Load (V): 0.00 lb
Design Tension Load (T): 2219.90 lb
Number of Screws: 2.00 screws
Screw Selection (D): 1/2" 0.5000 in
F_{ty1}, F_{tu1} (Top Material): A36 36, 58 ksi
F_{ty2}, F_{tu2} (Base Material): A36 36, 58 ksi
Thickness of top material (t₁): 0.2500 in
Thickness base material (t₂): 0.3750 in
Distance to edge of top material (d_{e1}): 1.0000 in
Distance to edge of bottom material (d_{e2}): 1.0000 in

Manufacturer Allowable Shear = 0.0 lb
Manufacturer Allowable Tension = 0.0 lb

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK



Minimum thickness to eliminate pryout

T = 1.11
b' = 0.88
p = 2.00

$t_{min} = \sqrt{[(\Omega/4) T b'] / (p F_u)}$ = 0.236 1/4" thick plate, no prying

Moment Arm for screw (L): 0.00 in
Screw Section Modulus (S): 0.012272 in³
Screw Ultimate Tensile: 120 ksi
Bending Moment mod (αM): 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

Factored Fastener Loads (per fastener)		
Fastener Shear (V _{fas})	V / fastener =	0.0 lb
Fastener Tension (T _{fas})	T / fastener =	1110.0 lb

Fastened Material Shear Design		
Bearing (ADM J3.7, J5.6.1, AISC J4.10)		
Top Mat.: R _n = 1.2*de1*t1*F _{tu1} ≤ 2.4*D*t1*F _{tu1}		
Ω = 2 (Steel)	R _n /Ω =	8700.0 lb
Base Mat.: R _n = 1.2*de2*t2*F _{tu2} ≤ 2.4*D*t2*F _{tu2}		
Ω = 2 (Steel)	R _n /Ω =	13050.0 lb
Tilting (ADM J5.6.2)		
R _n = 4.2(t ₂ ³ D) ^{1/2} F _{tu2}	R _n /Ω =	13185.2 lb
Ω = 3 ≤ t ₁ ?		NO
Shear load associated with bolt bending (ref Hilti)		
M _{UM,5%} = 1.2Sf(1 - T/Ta)	M _{UM,5%} =	N/A lb-in
V _{rec} = (α _M * M _{UM,5%}) / (1.7L)	V _{rec} =	N/A lb
AISI Cold-Formed Steel Design (Tbl IV-8a)		
LGM Shear of sheet	P _{ns} =	N/A k
P _{ns} *1000/Ω =		N/A lb
Allowable Shear / Fastener (V_{allowable}) =		
V _{fas} / V _{allowable} =		0.00 ≤ 1.0
OK.		

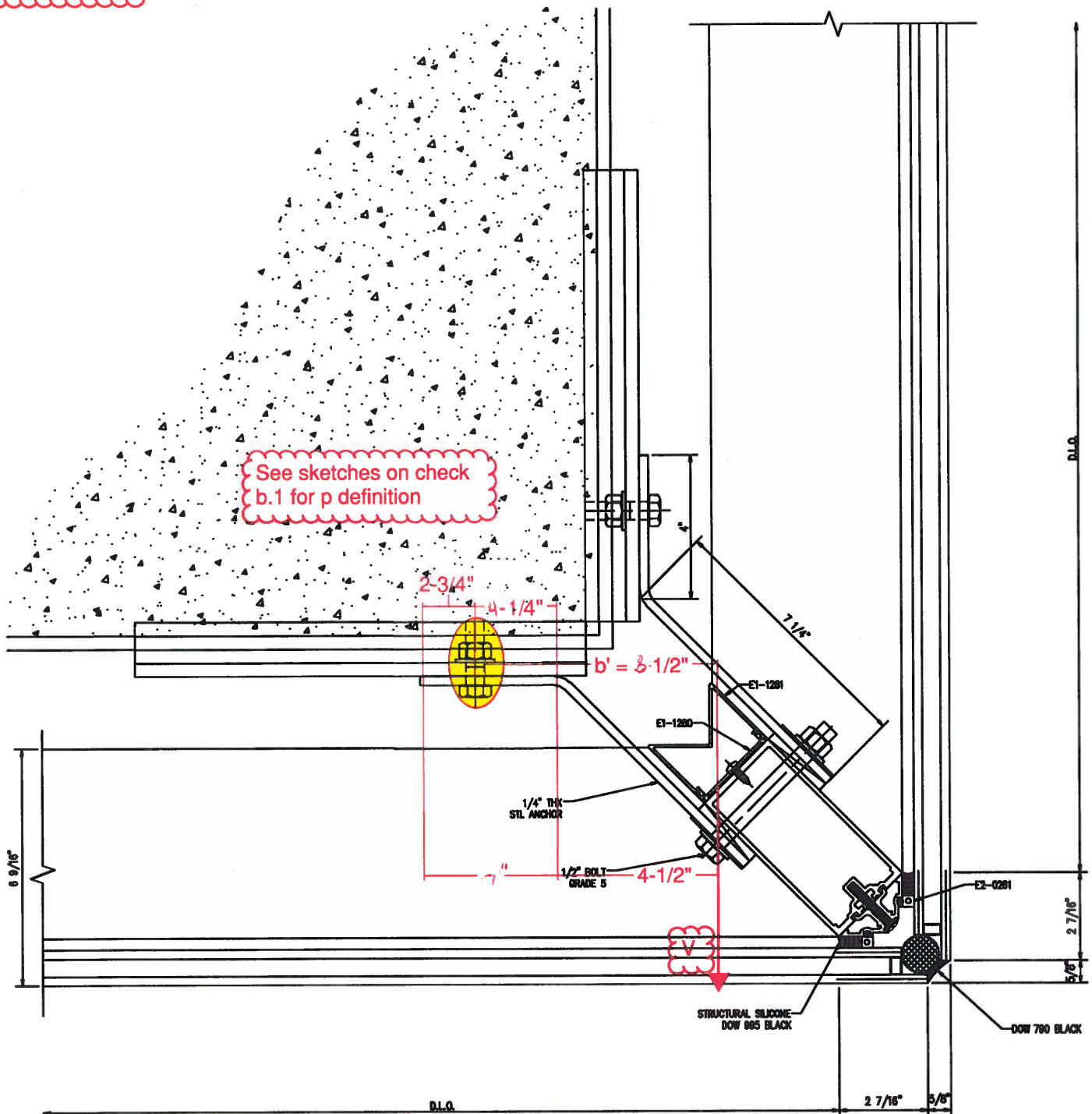
Fastened Material Tension Design		
Pull-Out (ADM J5.5.1.1)		
R _n = 0.58*Asn*Le*F _{tu2}	R _n /Ω =	7062.7 lb
Pull-Over (ADM J5.5.2)		
R _n = (1.0+1.7*t1/Dws)Dws*t1*F _{ty1}	R _n /Ω =	4155.0 lb
AISI Cold-Formed Steel Design IV-12		
LGM Pull-Out	P _{not} =	N/A k
P _{not} *1000/Ω =		N/A lb
Allowable Tension / Fastener (T_{allowable}) =		
T _{fas} / T _{allowable} =		0.27 ≤ 1.0
OK.		

Fastener Interaction Check		
Ω = 2.5		
Screw Shear (V _{TIR})	(AAMA TIR A9 Table 20.3)	3581.0 lb
Screw Tension (T _{TIR})	(AAMA TIR A9 Table 20.3)	6811.0 lb
Typical: V _{fas} / V _{TIR} + T _{fas} / T _{TIR} =		
0.16 ≤ 1.0		
TIR A9-91: (V _{fas} / V _{TIR}) ² + (T _{fas} / T _{TIR}) ² =		
N/A ≤ 1.0		
OK.		

Use (2) 1/2" Hilti KwikFlex Screws.



90deg corner





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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Bolts to pour stop clip
Elevation: 1/208
Detail: 1/303 **Check b.2**
(90deg corner)

Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Hilti KwikFlex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

Top Hole: ☒ Standard Hole ☐ Long Slotted Hole
Base Hole: ☒ Standard Hole ☐ Long Slotted Hole
☐ Eccentric Shear Design
☐ Eccentric Tension Design

☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

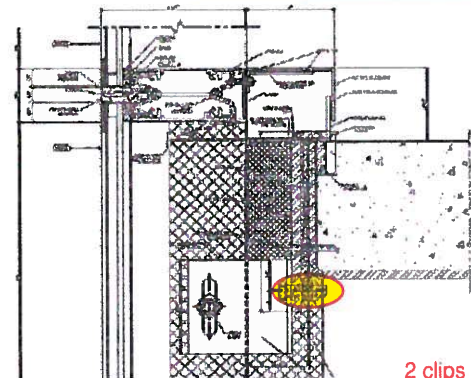
Design Pressure: 23.50 psf
Design Shear Load (V): 0.00 lb
Design Tension Load (T): 83.75 lb
Number of Screws: 1.00 screw
Screw Selection (D): 1/2" 0.5000 in
F_{ty1}, F_{tu1} (Top Material): A36 36, 58 ksi
F_{ty2}, F_{tu2} (Base Material): A36 36, 58 ksi
Thickness of top material (t₁): 0.3750 in
Thickness base material (t₂): 0.3750 in
Distance to edge of top material (d_{e1}): 1.0000 in
Distance to edge of bottom material (d_{e2}): 1.0000 in

Manufacturer Allowable Shear = 0.0 lb
Manufacturer Allowable Tension = 0.0 lb

Factored Fastener Loads (per fastener)			
Fastener Shear (V _{fas})	V / fastener =	0.0 lb	
Fastener Tension (T _{fas})	T / fastener =	83.8 lb	

Fastened Material Shear Design			
<u>Bearing (ADM J3.7, J.5.6.1, AISC J4.10)</u>			
Top Mat.: R _n = 1.2*d _{e1} *t ₁ *F _{tu1} <= 2.4*D*t ₁ *F _{tu1}			
Ω = 2 (Steel)	R _n /Ω =	13050.0 lb	
Base Mat.: R _n = 1.2*d _{e2} *t ₂ *F _{tu2} <= 2.4*D*t ₂ *F _{tu2}			
Ω = 2 (Steel)	R _n /Ω =	13050.0 lb	
<u>Tilting (ADM J.5.6.2)</u>			
Ω = 3	≤ t ₁ ?	YES	
R _n = 4.2(t ₂ ³ D) ^{1/2} F _{tu2}	R _n /Ω =	13185.2 lb	
<u>Shear load associated with bolt bending (ref Hilti)</u>			
M _{uM,5%} = 1.2Sf(1 - T/Ta)	M _{uM,5%} =	N/A lb-in	
V _{rec} = (α _M * M _{uM,5%}) / (1.7L)	V _{rec} =	N/A lb	
<u>AISI Cold-Formed Steel Design (Tbl IV-8a)</u>			
Ω = 3			
LGM Shear of sheet	P _{ns} =	N/A k	
	P _{ns} *1000/Ω =	N/A lb	
<u>Allowable Shear / Fastener (V_{allowable}) = 13050.0 lb</u>			
V _{fas} / V _{allowable} =	0.00 ≤ 1.0		
OK.			

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK



Minimum thickness to eliminate pryout

T = 0.08
b' = 8.50
p = 2.00
167.5lb / 2000

t_{min} = sqrt[(Ω 4 T b') / (p F_u)] = **0.202 3/8" thick plate, no prying**

Moment Arm for screw (L): 0.00 in
Screw Section Modulus (S): 0.012272 in³
Screw Ultimate Tensile: 120 ksi
Bending Moment mod (αM): 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

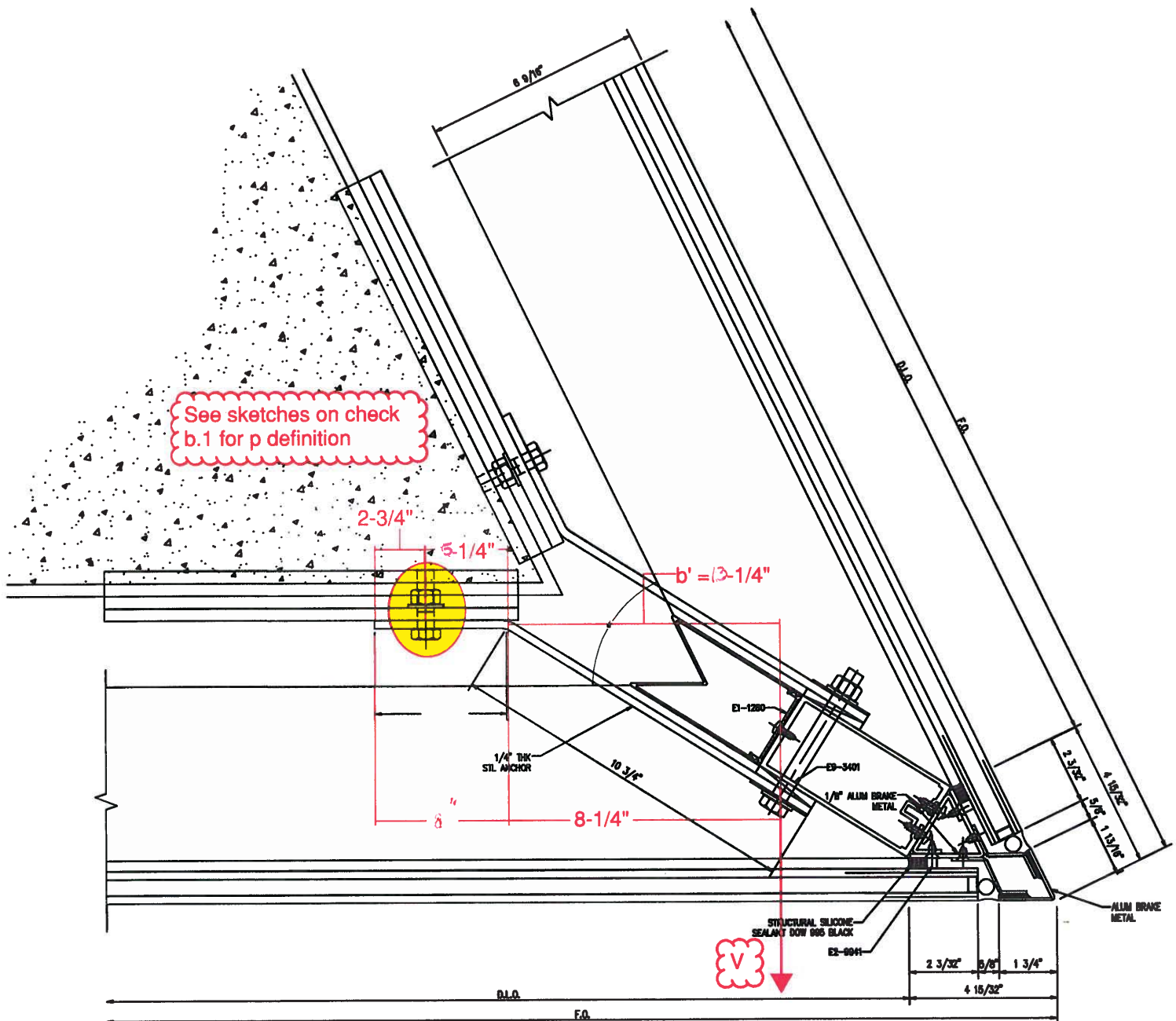
Fastened Material Tension Design			
<u>Pull-Out (ADM J.5.5.1.1)</u>			
R _n = 0.58*As _n *Le*F _{tu2}	Ω = 3	R _n /Ω =	7062.7 lb
<u>Pull-Over (ADM J.5.5.2)</u>			
R _n = (1.0+1.7*t ₁ /Dws)Dws*t ₁ *F _{ty1}	Ω = 3	R _n /Ω =	7188.8 lb
<u>AISI Cold-Formed Steel Design IV-12</u>			
LGM Pull-Out	P _{not} =	N/A k	
	P _{not} *1000/Ω =	N/A lb	
<u>Allowable Tension / Fastener (T_{allowable}) = 7062.7 lb</u>			
T _{fas} / T _{allowable} =	0.01 ≤ 1.0		
OK.			

Fastener Interaction Check			
Ω = 2.5			
Screw Shear (V _{TIR})	(AAMA TIR A9 Table 20.3)	3581.0 lb	
Screw Tension (T _{TIR})	(AAMA TIR A9 Table 20.3)	6811.0 lb	
Typical: V _{fas} / V _{TIR} + T _{fas} / T _{TIR} = 0.01 ≤ 1.0			
TIR A9-91: (V _{fas} / V _{TIR}) ² + (T _{fas} / T _{TIR}) ² =	N/A ≤ 1.0		
OK.			

Use (1) 1/2" Hilti KwikFlex Screw.



64deg corner condition





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11108 N. Oak Tfwy, Suite 208
Kansas City, MO 64155

Voice: 816-734-8345
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www.jeistructural.com

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Bolts to pour stop clip
Elevation: 1/208
Detail: 1/303 **Check b.3**
(65deg corner)

Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Hilti KwikFlex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

Top Hole: ☐ Standard Hole ☐ Long Slotted Hole
Base Hole: ☐ Standard Hole ☐ Long Slotted Hole
☐ Eccentric Shear Design
☐ Eccentric Tension Design

☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

Design Pressure: 23.50 psf
Design Shear Load (V): 0.00 lb
Design Tension Load (T): 140.95 lb
Number of Screws: 1.00 screw
Screw Selection (D): 1/2" 0.5000 in
F_{ty1}, F_{tu1} (Top Material): A36 36, 58 ksi
F_{ty2}, F_{tu2} (Base Material): A36 36, 58 ksi
Thickness of top material (t₁): 0.3750 in
Thickness base material (t₂): 0.3750 in
Distance to edge of top material (d_{e1}): 1.0000 in
Distance to edge of bottom material (d_{e2}): 1.0000 in

Manufacturer Allowable Shear = 0.0 lb
Manufacturer Allowable Tension = 0.0 lb

Factored Fastener Loads (per fastener)

Fastener Shear (V_{fas}): V / fastener = 0.0 lb
Fastener Tension (T_{fas}): T / fastener = 141.0 lb

Fastened Material Shear Design

Bearing (ADM J3.7, J.5.6.1, AISC J4.10)

Top Mat.: R_n = 1.2*de1*t1*Ftu1 <= 2.4*D*t1*Ftu1
Ω = 2 (Steel) R_n/Ω = 13050.0 lb

Base Mat.: R_n = 1.2*de2*t2*Ftu2 <= 2.4*D*t2*Ftu2
Ω = 2 (Steel) R_n/Ω = 13050.0 lb

Tilting (ADM J.5.6.2) Ω = 3 ≤ t₁? **YES**
R_n = 4.2(t₂³D)^{1/2}F_{tu2} R_n/Ω = 13185.2 lb

Shear load associated with bolt bending (ref Hilti)

M_{uM,5%} = 1.2Sf(1 - T/Ta) M_{uM,5%} = N/A lb-in
V_{rec} = (α_M * M_{uM,5%}) / (1.7L) V_{rec} = N/A lb

AISI Cold-Formed Steel Design (Tbl IV-8a)

LGM Shear of sheet Ω = 3
P_{ns} = N/A k
P_{ns}*1000/Ω = N/A lb

Allowable Shear / Fastener (V_{allowable}) = 13050.0 lb
V_{fas} / V_{allowable} = 0.00 ≤ 1.0

OK.

Fastened Material Tension Design

Pull-Out (ADM J.5.5.1.1) Ω = 3
R_n = 0.58*Asn*Le*Ftu2 R_n/Ω = 7062.7 lb

Pull-Over (ADM J.5.5.2) Ω = 3
R_n = (1.0+1.7*t1/Dws)Dws*t1*Fty1 R_n/Ω = 7188.8 lb

AISI Cold-Formed Steel Design IV-12

LGM Pull-Out Ω = 3
P_{not} = N/A k
P_{not}*1000/Ω = N/A lb

Allowable Tension / Fastener (T_{allowable}) = 7062.7 lb

T_{fas} / T_{allowable} = 0.02 ≤ 1.0

OK.

Fastener Interaction Check

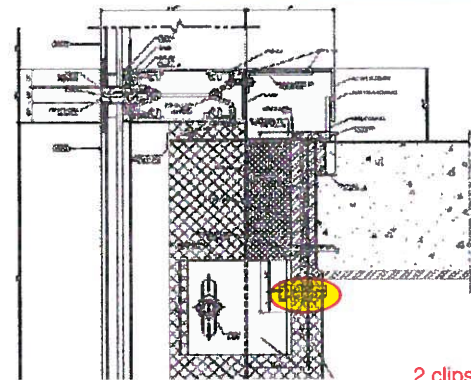
Ω = 2.5
Screw Shear (V_{TIR}) (AAMA TIR A9 Table 20.3) 3581.0 lb
Screw Tension (T_{TIR}) (AAMA TIR A9 Table 20.3) 6811.0 lb

Typical: V_{fas} / V_{TIR} + T_{fas} / T_{TIR} = 0.02 ≤ 1.0
TIR A9-91: (V_{fas} / V_{TIR})² + (T_{fas} / T_{TIR})² = N/A ≤ 1.0

OK.

Use (1) 1/2" Hilti KwikFlex Screw.

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

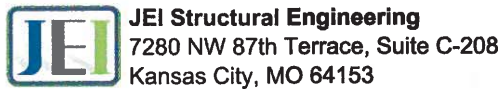


Minimum thickness to eliminate pryout

T = 0.14
b' = 13.25
p = 2.00
281.9lb / 2000

t_{min} = sqrt[(Ω 4 T b') / (p F_u)] = **0.328 3/8" thick plate, no prying**

Moment Arm for screw (L): 0.00 in
Screw Section Modulus (S): 0.012272 in³
Screw Ultimate Tensile: 120 ksi
Bending Moment mod (αM): 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)



Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/208
Detail: 1/303

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny

Check b.4
***** Used only to find shear on bolt *****

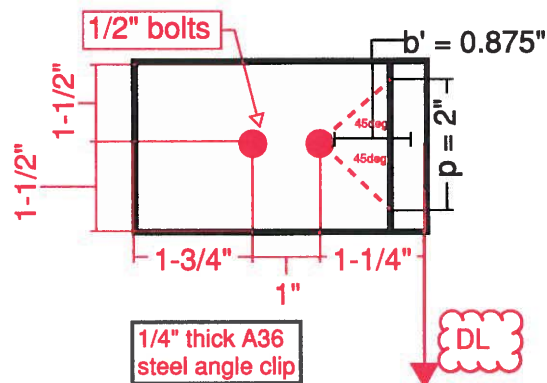
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = Grade 5 Screw
Fastener Size = 1/2-in
Nominal Diameter, D = 0.500 in
Area, A = 0.196 in²
Allowable Shear per Spec, V_a = N/A lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 646.40 lb
Design Moment, M_{ed} = 0.00 lb-in
Angle of Load, θ = 0.00 deg
Horz. Dist. from Centroid, x = 1.75 in
Vert. Dist. From Centroid, y = 0.00 in



FASTENER PATTERN GEOMETRY:

Total No. of Fasteners: 2

Fasteners per Row

N_{R1} = 2
N_{R2} =
N_{R3} =
N_{R4} =
N_{R5} =

Fasteners per Column

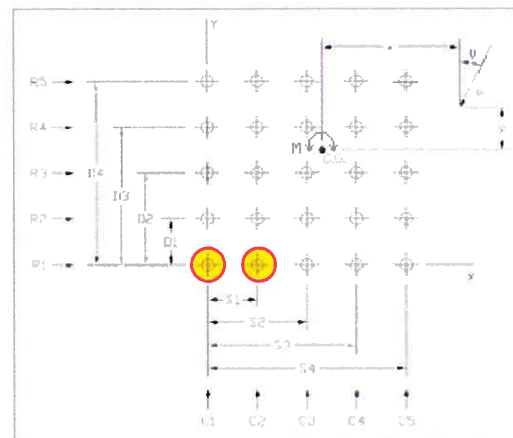
N_{C1} = 1
N_{C2} = 1
N_{C3} =
N_{C4} =
N_{C5} =

Row Dimensions

D₁ = in
D₂ = in
D₃ = in
D₄ = in

Column Dimensions

S₁ = 1.00 in
S₂ = in
S₃ = in
S₄ = in



Centroid, x = 0.50 in
Centroid, y = 0.00 in

FASTENER CALCULATIONS:

$\sum x^2 = 0.50 \text{ in}^2$
 $\sum y^2 = 0.00 \text{ in}^2$
 $\sum x^2 + \sum y^2 = 0.50 \text{ in}^2$
M = 1131.20 lb-in

f_y = 5761.15 ksi
f_{sy} = 1646.04 psi
f_x = 0.00 psi
f_{sx} = 0.00 psi

← Vert Stress Due to Eccentric Shear
← Vert Stress Due to Direct Shear
← Horiz Stress Due to Eccentric Shear
← Horiz Stress Due to Direct Shear

f = 7407.20 psi
V = 1454.40 lb
V_a = N/A lb

← Maximum Bolt Stress
← Maximum Bolt Load
#VALUE!



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Bolts to pour stop clip
Elevation: 1/208
Detail: 1/303

Check b.4

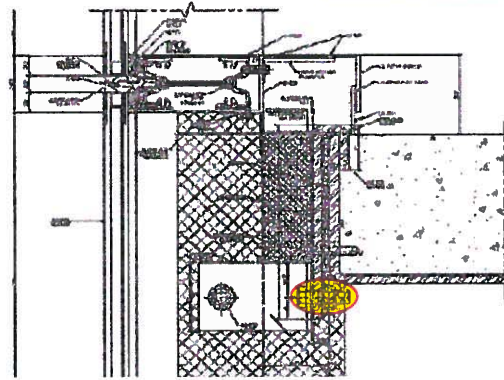
Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Hilti KwikFlex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

Top Hole: ☐ Standard Hole ☐ Long Slotted Hole
Base Hole: ☒ Standard Hole ☐ Long Slotted Hole
☒ Eccentric Shear Design
☐ Eccentric Tension Design

☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

Design Pressure: 23.50 psf
Design Shear Load (V): 1454.40 lb
Design Tension Load (T): 812.50 lb
Number of Screws: 2.00 screws
Screw Selection (D): 1/2" 0.5000 in
F_{ty1}, F_{tu1} (Top Material): A36 36, 58 ksi
F_{ty2}, F_{tu2} (Base Material): A36 36, 58 ksi
Thickness of top material (t₁): 0.2500 in
Thickness base material (t₂): 0.3750 in
Distance to edge of top material (d_{e1}): 1.0000 in
Distance to edge of bottom material (d_{e2}): 1.0000 in

Manufacturer Allowable Shear = 0.0 lb
Manufacturer Allowable Tension = 0.0 lb



Minimum thickness to eliminate pryout

T = 0.81
b' = 0.88
p = 2.00
812.5lb / 1000

$t_{min} = \sqrt{[(\Omega/4) T b'] / (p F_u)} = 0.202$ **1/4" thick plate, no prying**

Moment Arm for screw (L): 0.00 in
Screw Section Modulus (S): 0.012272 in³
Screw Ultimate Tensile: 120 ksi
Bending Moment mod (αM): 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

Factored Fastener Loads (per fastener)			
Fastener Shear (V _{fas})	V / fastener =	1454.4	lb
Fastener Tension (T _{fas})	T / fastener =	406.3	lb

Fastened Material Shear Design			
Bearing (ADM J3.7, J.5.6.1, AISC J4.10)			
Top Mat.: R _n = 1.2*d _{e1} *t ₁ *F _{tu1} ≤ 2.4*D*t ₁ *F _{tu1}			
Ω = 2 (Steel)	R _n /Ω =	8700.0	lb
Base Mat.: R _n = 1.2*d _{e2} *t ₂ *F _{tu2} ≤ 2.4*D*t ₂ *F _{tu2}			
Ω = 2 (Steel)	R _n /Ω =	13050.0	lb
Tilting (ADM J.5.6.2)	Ω = 3 ≤ t ₁ ?	NO	
R _n = 4.2(t ₂ ³ D) ^{1/2} F _{tu2}	R _n /Ω =	13185.2	lb
Shear load associated with bolt bending (ref Hilti)			
M _{uM,5%} = 1.2Sf(1 - T/Ta)	M _{uM,5%} =	N/A	lb-in
V _{rec} = (α _M * M _{uM,5%})/(1.7L)	V _{rec} =	N/A	lb
AISI Cold-Formed Steel Design (Tbl IV-8a)			
LGM Shear of sheet	P _{ns} =	N/A	k
	P _{ns} *1000/Ω =	N/A	lb
Allowable Shear / Fastener (V _{allowable}) =	8700.0	lb	
V _{fas} / V _{allowable} =	0.17	≤ 1.0	
OK.			

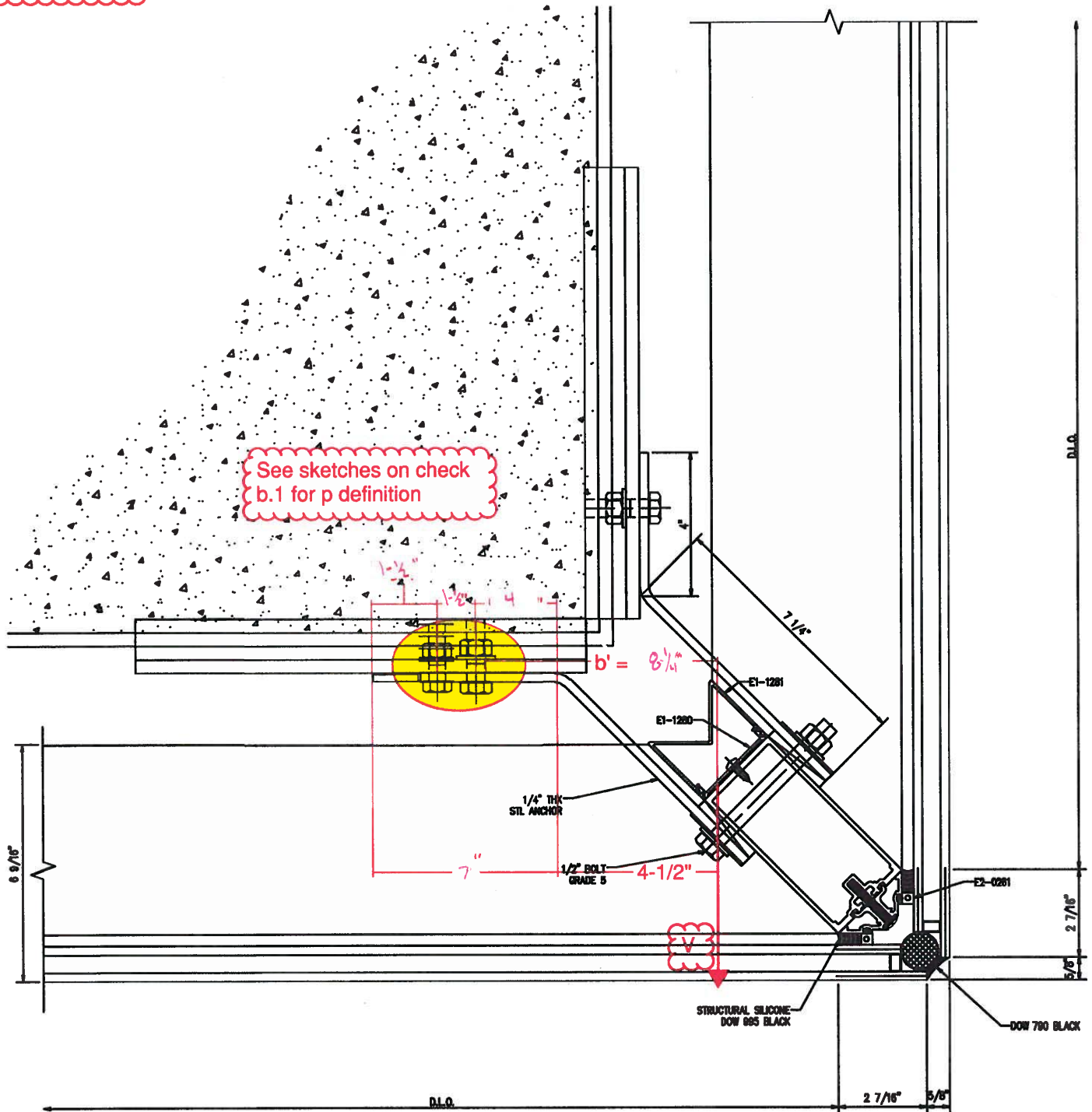
Fastened Material Tension Design			
Pull-Out (ADM J.5.5.1.1)			
R _n = 0.58*As _n *L _e *F _{tu2}	R _n /Ω =	7062.7	lb
Pull-Over (ADM J.5.5.2)			
R _n = (1.0+1.7*t ₁ /D _{ws})D _{ws} *t ₁ *F _{ty1}	R _n /Ω =	4155.0	lb
AISI Cold-Formed Steel Design IV-12			
LGM Pull-Out	P _{not} =	N/A	k
	P _{not} *1000/Ω =	N/A	lb
Allowable Tension / Fastener (T _{allowable}) =	4155.0	lb	
T _{fas} / T _{allowable} =	0.10	≤ 1.0	
OK.			

Fastener Interaction Check			
Ω = 2.5			
Screw Shear (V _{TIR})	(AAMA TIR A9 Table 20.3)	3581.0	lb
Screw Tension (T _{TIR})	(AAMA TIR A9 Table 20.3)	6811.0	lb
Typical:	V _{fas} / V _{TIR} + T _{fas} / T _{TIR} =	0.47	≤ 1.0
TIR A9-91:	(V _{fas} / V _{TIR}) ² + (T _{fas} / T _{TIR}) ² =	N/A	≤ 1.0
OK.			

Use (2) 1/2" Hilti KwikFlex Screws.



90deg corner





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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/208
Detail: 1/303 **Check b.5**

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny

*** Used only to find shear on bolt ***

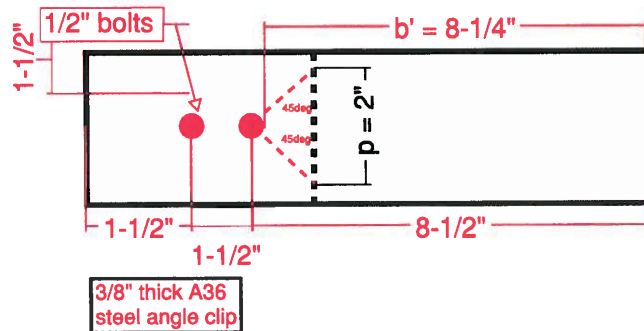
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = Grade 5 Screw
Fastener Size = 1/2-in
Nominal Diameter, D = 0.500 in
Area, A = 0.196 in²
Allowable Shear per Spec, V_a = N/A lb

DESIGN LOADING / ORIENTATION:

Design Load, P = 487.85 lb
Design Moment, M_{c.g.} = 0.00 lb-in
Angle of Load, θ = 0.00 deg
Horz. Dist. from Centroid, x = 9.25 in
Vert. Dist. From Centroid, y = 0.00 in



FASTENER PATTERN GEOMETRY:

Total No. of Fasteners: 2

Fasteners per Row

N_{R1} = 2
N_{R2} =
N_{R3} =
N_{R4} =
N_{R5} =

Fasteners per Column

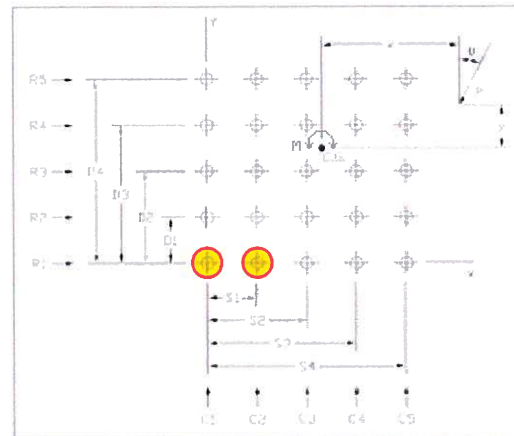
N_{C1} = 1
N_{C2} = 1
N_{C3} =
N_{C4} =
N_{C5} =

Row Dimensions

D₁ = in
D₂ = in
D₃ = in
D₄ = in

Column Dimensions

S₁ = 1.50 in
S₂ = in
S₃ = in
S₄ = in



Centroid, x = 0.75 in
Centroid, y = 0.00 in

FASTENER CALCULATIONS:

$\sum x^2 = 1.13 \text{ in}^2$
 $\sum y^2 = 0.00 \text{ in}^2$
 $\sum x^2 + \sum y^2 = 1.13 \text{ in}^2$
M = 4512.61 lb-in

f_y = 15321.70 ksi
f_{sy} = 1242.30 psi
f_x = 0.00 psi
f_{sx} = 0.00 psi

← Vert Stress Due to Eccentric Shear
← Vert Stress Due to Direct Shear
← Horiz Stress Due to Eccentric Shear
← Horiz Stress Due to Direct Shear

f = 16564.00 psi
V = 3252.33 lb
V_a = N/A lb

← Maximum Bolt Stress
← Maximum Bolt Load
#VALUE!



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Bolts to pour stop clip
Elevation: 1/208
Detail: 1/303

Check b.5

(90deg corner)

Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Hilti KwikFlex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

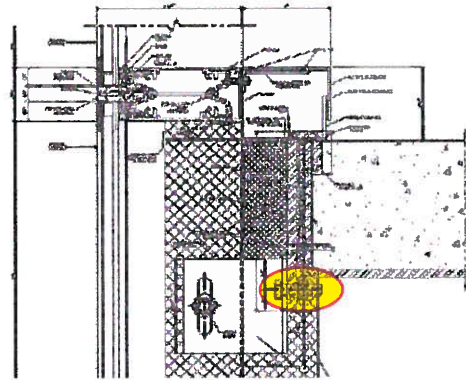
Top Hole: ☒ Standard Hole ☐ Long Slotted Hole
Base Hole: ☒ Standard Hole ☐ Long Slotted Hole
☒ Eccentric Shear Design
☐ Eccentric Tension Design

☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

Design Pressure: 23.50 psf
Design Shear Load (V): 3252.33 lb
Design Tension Load (T): 286.70 lb
Number of Screws: 2.00 screws
Screw Selection (D): 1/2" 0.5000 in
F_{ty1}, F_{tu1} (Top Material): A36 36, 58 ksi
F_{ty2}, F_{tu2} (Base Material): A36 36, 58 ksi
Thickness of top material (t₁): 0.3750 in
Thickness base material (t₂): 0.3750 in
Distance to edge of top material (d_{e1}): 1.0000 in
Distance to edge of bottom material (d_{e2}): 1.0000 in

Manufacturer Allowable Shear = 0.0 lb
Manufacturer Allowable Tension = 0.0 lb

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK



Minimum thickness to eliminate pryout

T = 0.29
b' = 8.25
p = 2.00

$t_{min} = \sqrt{(\Omega \cdot 4 \cdot T \cdot b') / (p \cdot F_u)}$ = **0.369 3/8" thick plate, no prying**

Moment Arm for screw (L): 0.00 in
Screw Section Modulus (S): 0.012272 in³
Screw Ultimate Tensile: 120 ksi
Bending Moment mod (αM): 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

Factored Fastener Loads (per fastener)

Fastener Shear (V_{fas}): V / fastener = 3252.3 lb
Fastener Tension (T_{fas}): T / fastener = 143.4 lb

Fastened Material Shear Design

Bearing (ADM J3.7, J.5.6.1, AISC J4.10)

Top Mat.: R_n = 1.2*de1*t1*Ftu1 <= 2.4*D*t1*Ftu1

Ω = 2 (Steel) R_n/Ω = 13050.0 lb

Base Mat.: R_n = 1.2*de2*t2*Ftu2 <= 2.4*D*t2*Ftu2

Ω = 2 (Steel) R_n/Ω = 13050.0 lb

Tilting (ADM J.5.6.2) Ω = 3 ≤ t₁? **YES**

R_n = 4.2(t₂³D)^{1/2}F_{tu2} R_n/Ω = 13185.2 lb

Shear load associated with bolt bending (ref Hilti)

M_{UM,5%} = 1.2Sf(1 - T/Ta) M_{UM,5%} = N/A lb-in

V_{rec} = (α_M * M_{UM,5%}) / (1.7L) V_{rec} = N/A lb

AISI Cold-Formed Steel Design (Tbl IV-8a) Ω = 3

LGM Shear of sheet P_{ns} = N/A k

P_{ns}*1000/Ω = N/A lb

Allowable Shear / Fastener (V_{allowable}) = 13050.0 lb

V_{fas} / V_{allowable} = 0.25 ≤ 1.0

OK.

Fastened Material Tension Design

Pull-Out (ADM J.5.5.1.1)

R_n = 0.58*Asn*Le*Ftu2 R_n/Ω = 7062.7 lb

Pull-Over (ADM J.5.5.2)

R_n = (1.0+1.7*t1/Dws)Dws*t1*Fty1 R_n/Ω = 7188.8 lb

AISI Cold-Formed Steel Design IV-12

LGM Pull-Out P_{not} = N/A k

P_{not}*1000/Ω = N/A lb

Allowable Tension / Fastener (T_{allowable}) = 7062.7 lb

T_{fas} / T_{allowable} = 0.02 ≤ 1.0

OK.

Fastener Interaction Check

Ω = 2.5

Screw Shear (V_{TIR}) (AAMA TIR A9 Table 20.3) 3581.0 lb

Screw Tension (T_{TIR}) (AAMA TIR A9 Table 20.3) 6811.0 lb

Typical: V_{fas} / V_{TIR} + T_{fas} / T_{TIR} = 0.93 ≤ 1.0

TIR A9-91: (V_{fas} / V_{TIR})² + (T_{fas} / T_{TIR})² = N/A ≤ 1.0

OK.

Use (2) 1/2" Hilti KwikFlex Screws.

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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/208
Detail: 1/303 **Check b.6**

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny

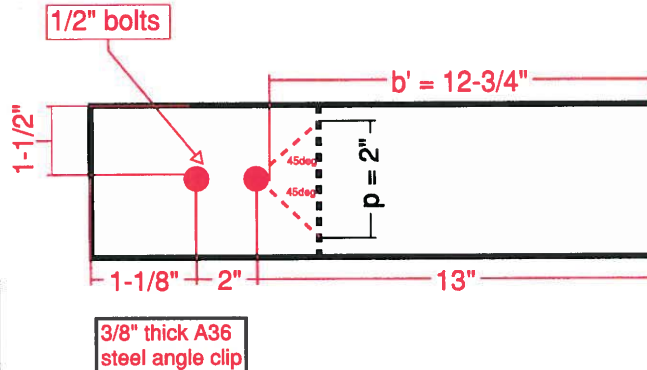
INPUT	CHECK
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FASTENER PROPERTIES:

Fastener Type =	Grade 5 Screw
Fastener Size =	1/2-in
Nominal Diameter, D =	0.500 in
Area, A =	0.196 in ²
Allowable Shear per Spec, V _a =	N/A lb

DESIGN LOADING / ORIENTATION:

Design Load, P =	505.00 lb
Design Moment, $M_{c.g.}$ =	0.00 lb-in
Angle of Load, θ =	0.00 deg
Horz. Dist. from Centroid, x =	14.00 in
Vert. Dist. From Centroid, y =	0.00 in



FASTENER PATTERN GEOMETRY:

Total No. of Fasteners: 2

Fasteners per Row

$$\begin{aligned} N_{R1} &= 2 \\ N_{R2} &= \\ N_{R3} &= \\ N_{R4} &= \\ N_{R5} &= \end{aligned}$$

Fasteners per Column

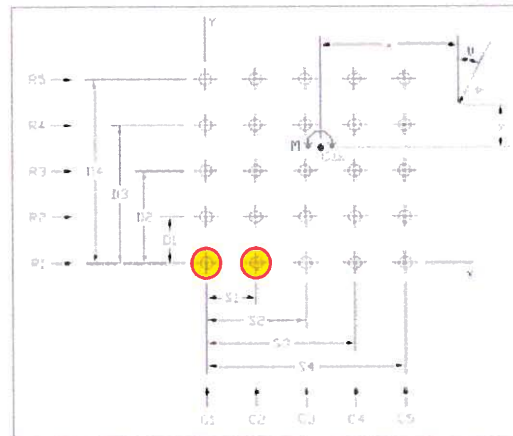
$$\begin{aligned} N_{C1} &= 1 \\ N_{C2} &= 1 \\ N_{C3} &= \\ N_{C4} &= \\ N_{C5} &= \end{aligned}$$

Row Dimensions.

$D_1 =$	in
$D_2 =$	in
$D_3 =$	in
$D_4 =$	in

Column Dimensions

$S_1 =$	2.25	in
$S_2 =$		in
$S_3 =$		in
$S_4 =$		in



Centroid, $x = 1.13$ in
Centroid, $y = 0.00$ in

FASTENER CALCULATIONS:

$\Sigma x^2 =$	2.53	in ²
$\Sigma y^2 =$	0.00	in ²
$\Sigma x^2 + \Sigma y^2 =$	2.53	in ²
M =	7070.00	lb-in

fy =	16003.21	ksi
fsy =	1285.97	psi
fx =	0.00	psi
fsx =	0.00	psi

- ← Vert Stress Due to Eccentric Shear
- ← Vert Stress Due to Direct Shear
- ← Horiz Stress Due to Eccentric Shear
- ← Horiz Stress Due to Direct Shear

f = 17289.18 psi
V = 3394.72 lb
V₀ = N/A lb

- ← Maximum Bolt Stress
- ← Maximum Bolt Load

#VALUE!

Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Bolts to pour stop clip
Elevation: 1/208
Detail: 1/303 **Check b.6**
(65deg corner)

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

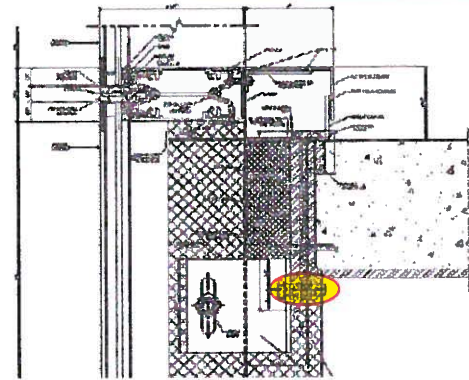
Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Hilti KwikFlex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Bolt

Top Hole: ☒ Standard Hole ☐ Long Slotted Hole
Base Hole: ☒ Standard Hole ☐ Long Slotted Hole
☒ Eccentric Shear Design
☐ Eccentric Tension Design

☐ Generic Fastener (TIR A9-91) ☐ Countersunk Screw

Design Pressure 23.50 psf
Design Shear Load (V) 3394.70 lb
Design Tension Load (T) 134.70 lb
Number of Screws 2.00 screws
Screw Selection (D) 1/2" 0.5000 in
F_{ty1}, F_{tu1} (Top Material) A36 36, 58 ksi
F_{ty2}, F_{tu2} (Base Material) A36 36, 58 ksi
Thickness of top material (t₁) 0.3750 in
Thickness base material (t₂) 0.3750 in
Distance to edge of top material (d_{e1}) 1.0000 in
Distance to edge of bottom material (d_{e2}) 1.0000 in

Manufacturer Allowable Shear = 0.0 lb
Manufacturer Allowable Tension = 0.0 lb



Minimum thickness to eliminate pryout

$$T = 0.13$$

$$b' = 12.75$$

$$p = 2.00$$

$$t_{min} = \sqrt{[(\Omega T b') / (p F_u)]} = 0.314 \text{ 3/8" thick plate, no prying}$$

Moment Arm for screw (L) 0.00 in
Screw Section Modulus (S) 0.012272 in³
Screw Ultimate Tensile 120 ksi
Bending Moment mod (αM) 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

Factored Fastener Loads (per fastener)

Fastener Shear (V_{fas}) V / fastener = 3394.7 lb
Fastener Tension (T_{fas}) T / fastener = 67.4 lb

Fastened Material Shear Design

Bearing (ADM J3.7, J.5.6.1, AISC J4.10)

Top Mat.: R_n = 1.2*de1*t1*F_{tu1} ≤ 2.4*D*t1*F_{tu1}

Ω = 2 (Steel) R_n/Ω = 13050.0 lb

Base Mat.: R_n = 1.2*de2*t2*F_{tu2} ≤ 2.4*D*t2*F_{tu2}

Ω = 2 (Steel) R_n/Ω = 13050.0 lb

Tilting (ADM J.5.6.2)

Ω = 1.95 ≤ t₁? **YES**

R_n = 4.2(t₂³D)^{1/2}F_{tu2} R_n/Ω = 20285.0 lb

Shear load associated with bolt bending (ref Hilti)

M_{UM,5%} = 1.2Sf(1 - T/Ta) M_{UM,5%} = N/A lb-in

V_{rec} = (α_M * M_{UM,5%}) / (1.7L) V_{rec} = N/A lb

AISI Cold-Formed Steel Design (Tbl IV-8a)

Ω = 1.95

LGM Shear of sheet P_{ns} = N/A k

P_{ns}*1000/Ω = N/A lb

Allowable Shear / Fastener (V_{allowable}) = 13050.0 lb

V_{fas} / V_{allowable} = 0.26 ≤ 1.0

OK.

Fastened Material Tension Design

Pull-Out (ADM J.5.5.1.1) Ω = 1.95
R_n = 0.58*As_n*Le*F_{tu2} R_n/Ω = 10865.7 lb

Pull-Over (ADM J.5.5.2)

R_n = (1.0+1.7*t1/Dws)Dws*t1*F_{ty1} Ω = 1.95
R_n/Ω = 11059.6 lb

AISI Cold-Formed Steel Design IV-12

LGM Pull-Out P_{not} = N/A k
P_{not}*1000/Ω = N/A lb

Allowable Tension / Fastener (T_{allowable}) = 10865.7 lb

T_{fas} / T_{allowable} = 0.01 ≤ 1.0

OK.

Fastener Interaction Check

Ω = 2.5

Screw Shear (V_{TIR}) (AAMA TIR A9 Table 20.3) 3581.0 lb

Screw Tension (T_{TIR}) (AAMA TIR A9 Table 20.3) 6811.0 lb

Typical: V_{fas} / V_{TIR} + T_{fas} / T_{TIR} = 0.96 ≤ 1.0

TIR A9-91: (V_{fas} / V_{TIR})² + (T_{fas} / T_{TIR})² = N/A ≤ 1.0

OK.

Use (2) 1/2" Hilti KwikFlex Bolts.



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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Bar Allowable Flexural Strength *Check C.I*

Date: 11/14/2016
Proj. No. JE16059
Designer M. Gorny
INPUT CHECK

Shape: 12-1/2" (wide) x 8-1/2" (tall) x 3/8" (thick) clip

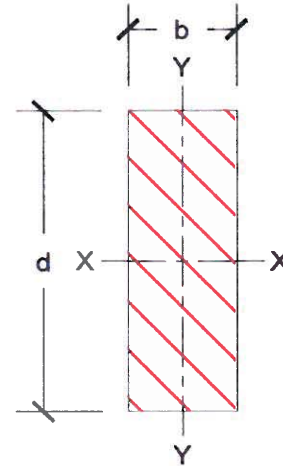
Unbraced Length (L_b) = 2 in
Depth (d) = 0.375 in
Width (b) = 12.5 in

Modulus of Elasticity (E) = 29000 ksi
Yield Strength (F_y) = 36 ksi

Material
A36

$I_x = 0.0549 \text{ in}^4$
 $S_x = 0.2930 \text{ in}^3$
 $Z_x = 0.4395 \text{ in}^3$

$I_y = 61.0352 \text{ in}^4$
 $S_y = 9.7656 \text{ in}^3$
 $Z_y = 14.6484 \text{ in}^3$



X-Axis Lateral Torsional Buckling Limits

$L_b d/t^2 =$	0.0048	$L_b d/t^2 \leq 0.08E/F_y$	1 applies
$0.08E/F_y =$	64.44	$0.08E/F_y < L_b d/t^2 \leq 1.9E/F_y$	X
$1.9E/F_y =$	1530.56	$L_b d/t^2 > 1.9E/F_y$	X

X-Axis Yielding (AISC F11.1)

$M_n = M_p = F_y Z_x = 15.82 \text{ kip-in}$
 $M_n \leq 1.6M_y = 1.6F_y S_x = 16.88 \text{ kip-in}$
 $M_n = 15.82 \text{ kip-in}$

Y-Axis Yielding (AISC F11.1)

$M_n = M_p = F_y Z_y = 527.34 \text{ kip-in}$
 $M_n \leq 1.6M_y = 1.6F_y S_y = 562.50 \text{ kip-in}$
 $M_n = 527.34 \text{ kip-in}$

X-Axis Lateral-Torsional Buckling (AISC F11.2)

AISC F11.2.a $0.08E/F_y < L_b d/t^2 \leq 1.9E/F_y$

$M_n = C_b [1.52 - 0.274(L_b d/t^2) F_y / E] M_y =$
 $M_p =$
 $M_n =$

$M_n = \text{N/A kip-in}$
 $M_p = \text{N/A kip-in}$
 $M_n = \text{N/A kip-in}$

AISC F11.2.b $L_b d/t^2 > 1.9E/F_y$

$F_{cr} = 1.9EC_b / (L_b d/t^2) =$
 $M_n = F_{cr} S_x =$
 $M_p =$
 $M_n =$

$F_{cr} = \text{N/A ksi}$
 $M_n = \text{N/A kip-in}$
 $M_p = \text{N/A kip-in}$
 $M_n = \text{N/A kip-in}$

X-Axis Capacity $\Omega_b = 1.67$	
$M_n =$	15.82 kip-in
$M_n / \Omega_b =$	9.47 kip-in
$M_n / \Omega_b =$	789 lb-ft

Y-Axis Capacity $\Omega_b = 1.67$	
$M_n =$	527.34 kip-in
$M_n / \Omega_b =$	315.77 kip-in
$M_n / \Omega_b =$	26315 lb-ft

$M_u = 2219.9 \text{ lb} \times (3-3/4" / 12) = 694 \text{ lb-ft}$

OK

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Office: 816-505-0987
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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Intermediate Anchor Analysis
Elevation: 1/213
Detail: 1/357

Date: 12/1/2016
Proj. No.: JE16059
Designer: M. Gorny

INPUT CHECK RISA

**Check weld to see if it can support dead load
Corner (64deg) controls by inspection**

Design Wind Pressure 23.50 psf
Weld Filler Metal Yield (F_{yw}) 70 ksi

Design Loads		
	Design Loads	Load Location Relative to Origin
X-axis	lb (V_x)	10.75 in (X_v)
Y-axis (DL)	lb (V_y)	0.00 in (Y_v)
Z-axis (WL)	1009.6 lb (V_z)	0.00 in (Z_v)
Weld Group Layout		
Weld Line	Parallel Axis (X or Y)	Length (in) (A_n)
1	X	6
2		
3		
4		
5		
6		

Note: Load location & magnitude must use proper pos/neg values based on the origin. x_n & y_n are measured from the same origin as the applied load

Design Moments		
X-axis	0.0 lb-in	Note: Design moments are taken about the weld centroidal axis.
Y-axis	10853.2 lb-in	
Z-axis	0.0 lb-in	

Weld Group Centroid		
$e_x = \sum A_n \cdot y_n / \sum A_n$	$e_x =$	0.000 in
$e_y = \sum A_n \cdot x_n / \sum A_n$	$e_y =$	0.000 in

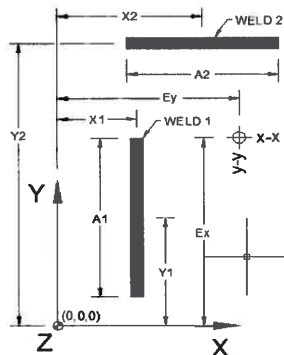
Weld Group Moment of Inertia				
Weld Line	I_{nx-x}	$A_{wn} \cdot y_{bar}^2$	I_{ny-y}	$A_{wn} \cdot x_{bar}^2$
1	0.0000	0.0000	18.0000	0.0000
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
$I_{x-x} = \sum (I_{nx-x} + A_{wn} y_{bar}^2)$			$I_{x-x} =$	0.000 in ³
$I_{y-y} = \sum (I_{ny-y} + A_{wn} x_{bar}^2)$			$I_{y-y} =$	18.000 in ³
$J_z = I_{x-x} + I_{y-y}$			$J_z =$	18.000 in ³

$$y_{bar} = \text{abs}(y_n - e_y), x_{bar} = \text{abs}(x_n - e_x)$$

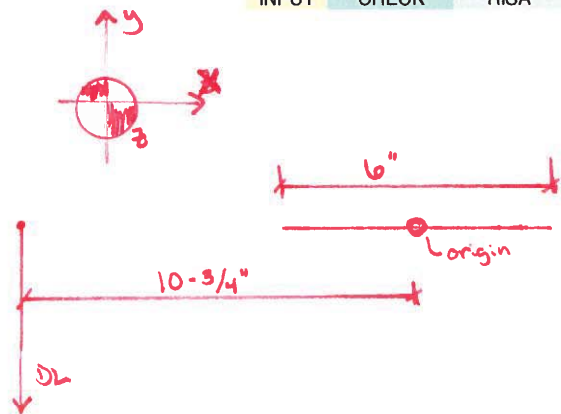
I_{x-x} & I_{y-y} are about weld group centroidal axis

Weld Extreme Fiber Dimensions		
Weld Line	e_{w-x} (in)	e_{w-y} (in)
1	3.000	0.000
2	N/A	N/A
3	N/A	N/A
4	N/A	N/A
5	N/A	N/A
6	N/A	N/A

Extreme Fiber is the weld point furthest from the centroidal axis of the weld group



NOTE: LOCATION OF X & Y AXIS IS ARBITRARY BUT MUST BE TAKEN AT THE SAME LOCATION FOR ALL WELDS IN THE GROUP AS SHOWN ABOVE.

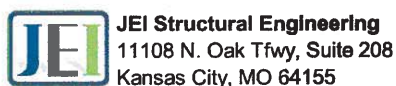


X-Axis Weld Design		
<u>X-Axis Shear</u>		
$f_{wx} V_x = V_x / \sum A_n$	$f_{wx} V_x =$	0.00 lb/in
<u>Z-Axis Moment</u>		
$f_{wx} M_z = M_z \cdot e_{w-y} / J_w$	$f_{wx} M_z =$	0.00 lb/in
$f_{wx} = f_{wx} V_x + f_{wx} M_z$	$f_{wx} =$	0.00 lb/in

Y-Axis Forces		
<u>Y-Axis Shear</u>		
$f_{wy} V_y = V_y / \sum A_n$	$f_{wy} V_y =$	0.00 lb/in
<u>Z-Axis Moment</u>		
$f_{wy} M_z = M_z \cdot e_{w-x} / J_w$	$f_{wy} M_z =$	0.00 lb/in
$f_{wy} = f_{wy} V_y + f_{wy} M_z$	$f_{wy} =$	0.00 lb/in

Z-Axis Forces		
<u>Z-Axis Shear</u>		
$f_{wz} V_z = V_z / \sum A_n$	$f_{wz} V_z =$	168.27 lb/in
<u>X-Axis Moment</u>		
$f_{wz} M_x = M_x \cdot e_{w-y} / I_{x-x}$	$f_{wz} M_x =$	0.00 lb/in
<u>Y-Axis Moment</u>		
$f_{wz} M_y = M_y \cdot e_{w-x} / I_{y-y}$	$f_{wz} M_y =$	1808.87 lb/in
$f_{wz} = f_{wy} V_z + f_{wy} M_x + F_{wy} M_z$	$f_{wz} =$	1977.13 lb/in

Weld Design		
$f_w = \sqrt{(f_{wx}^2 + f_{wy}^2 + f_{wz}^2)}$	$f_w =$	1977.13 lb/in
$f_{req} = f_w / (0.707 \cdot F_{yw} / 3.33)$	$f_{req} =$	0.1330 in
Use 3/16" (0.1875") fillet weld		



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Self drilling screws to pour stop angle
Elevation: N/A
Detail: N/A

Date: 11/9/2016
Proj. No.: JE16059
Designer: M. Gorny
INPUT CHECK

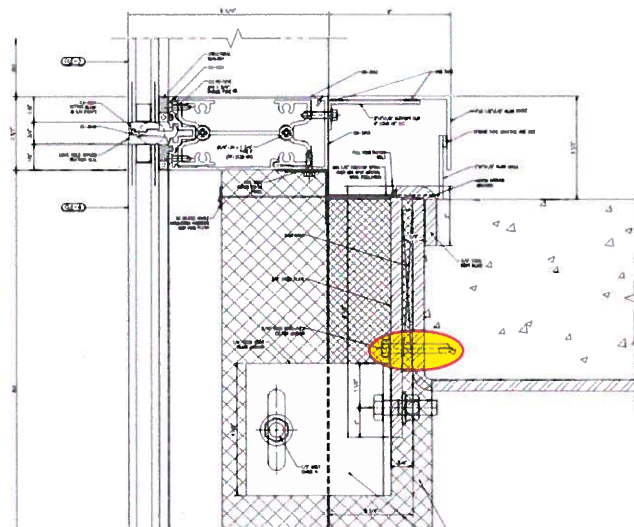
*** Sheet used to find allowable fastener loads ***

Load Design Criteria: ASCE7-05 ASD
Material Design Criteria: Aluminum Design Manual 2010
Fastener Name: Elco DrillFlex
Fastener Material: SAE Grade 5 (SAE J429)
Fastener Type: Screw

Top Hole		Base Hole		☐ Eccentric Shear Design
☒ Standard Hole	☒ Long Slotted Hole	☒ Standard Hole	☒ Long Slotted Hole	
☐ Generic Fastener (TIR A9-91)		☐ Countersunk Screw		

Design Pressure		0.00 psf
Design Shear Load (V)		0.00 lb
Design Tension Load (T)		0.00 lb
Number of Screws		1.00 screw
Screw Selection (D)	5/16"	0.3125 in
F _{ty1} , F _{tu1} (Top Material)	A36	36, 58 ksi
F _{ty2} , F _{tu2} (Base Material)	A36	36, 58 ksi
Thickness of top material (t ₁)		0.3750 in
Thickness base material (t ₂)		0.3750 in
Distance to edge of top material (d _{e1})		0.7500 in
Distance to edge of bottom material (d _{e2})		0.7500 in

Manufacturer Allowable Shear = 0.0 lb
Manufacturer Allowable Tension = 0.0 lb



Moment Arm for screw (L) 0.00 in
Screw Section Modulus (S) 0.002996 in³
Screw Ultimate Tensile 120 ksi
Bending Moment mod (αM) 1
(bolt fixity α_M=1 free to rotate and =2 rotation restrained)

Factored Fastener Loads (per fastener)			
Fastener Shear (V _{fas})	V / fastener =	0.0	lb
Fastener Tension (T _{fas})	T / fastener =	0.0	lb

Fastened Material Shear Design			
Bearing (ADM J3.7, J.5.6.1, AISI J4.10)			
Top Mat.: R _n = 1.2*de1*t1*Ftu1 <= 2.4*D*t1*Ftu1			
Ω = 2	(Steel)	Rn/Ω =	8156.3 lb
Base Mat.: R _n = 1.2*de2*t2*Ftu2 <= 2.4*D*t2*Ftu2			
Ω = 2	(Steel)	Rn/Ω =	8156.3 lb
Tilting (ADM J.5.6.2)			
Ω = 3	≤ t ₁ ?	YES	
R _n = 4.2(t ₂ ³ D) ^{1/2} F _{tu2}	Rn/Ω =	10423.8 lb	
Shear load associated with bolt bending (ref Hilti)			
M _{UM,5%} = 1.2Sf(1 - T/Ta)	M _{UM,5%} =	N/A	lb-in
V _{rec} = (α _M * M _{UM,5%})/(1.7L)	V _{rec} =	N/A	lb
AISI Cold-Formed Steel Design (Tbl IV-8a)			
Ω = 3			
LGM Shear of sheet	P _{rs} =	N/A	k
	Pns*1000/Ω =	N/A	lb
Allowable Shear / Fastener (V _{allowable}) =			
	V _{fas} / V _{allowable} =	0.00	≤ 1.0
OK.			

Fastened Material Tension Design			
Pull-Out (ADM J.5.5.1.1)			
Rn = 0.58*Asn*Le*Ftu2	Rn/Ω =	3549.9 lb	Ω = 3
Pull-Over (ADM J.5.5.2)			
Rn = (1.0+1.7*t1/Dws)Dws*t1*Fty1	Rn/Ω =	5676.8 lb	Ω = 3
AISI Cold-Formed Steel Design IV-12			
LGM Pull-Out	P _{not} =	N/A	k
	Pnot*1000/Ω =	N/A	lb
Allowable Tension / Fastener (T _{allowable}) =			
	T _{fas} / T _{allowable} =	0.00	≤ 1.0
OK.			

Fastener Interaction Check			
Ω = 2.5			
Screw Shear (V _{TIR})	(AAMA TIR A9 Table 20.3)	1299.0 lb	
Screw Tension (T _{TIR})	(AAMA TIR A9 Table 20.3)	2517.0 lb	
Typical:			
	V _{fas} / V _{TIR} + T _{fas} / T _{TIR} =	0.00	≤ 1.0
TIR A9-91:	(V _{fas} / V _{TIR}) ² + (T _{fas} / T _{TIR}) ² =	N/A	≤ 1.0
OK.			

Use (1) 5/16" Elco DrillFlex Screw.



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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Self drilling screws to pour stop angle
Elevation: 1/205
Detail: 1/306 **Check d.1**

Date: 11/14/2016
Proj. No.: JE16059
Designer: M. Gorny

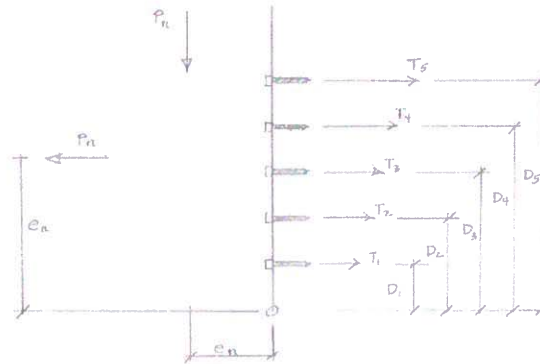
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = **Hilti Kwik Flex**
Fastener Size = **5/16"**
Nominal Diameter, D = **0.313 in**
Area, A = **0.077 in²**
Allowable Tension per Spec, T_a = **2517.0 lb**

DESIGN LOAD - ECCENTRIC ABOUT ROTATION POINT "O"

Design Load, P1 = **2219.90 lb**
Eccentric distance e1 = **9.25 in**
Design Load P2 = **0.00 lb**
Eccentric distance e2 = **0.00 in**
Design Load P3 = **0.00 lb**
Eccentric distance e3 = **0.00 in**
Design Load P3 = **0.00 lb**
Eccentric distance e3 = **0.00 in**



Design Moment about "o"

M = **20534.08 lb-in**

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

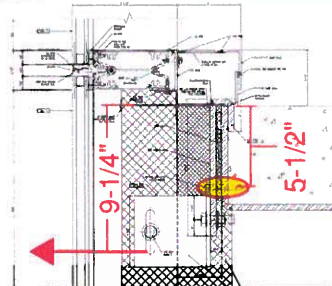
3

Fasteners per Row

N_{R1} = **3**
N_{R2} =
N_{R3} =
N_{R4} =
N_{R5} =

Row Dimensions

D₁ = **5.500**
D₂ =
D₃ =
D₄ =
D₅ =



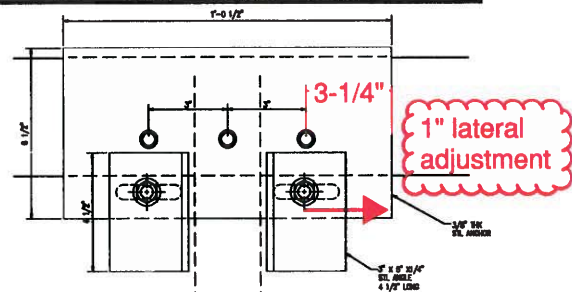
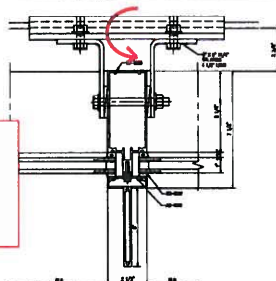
FASTENER CALCULATIONS:

Tension T1 = **1244.49 lb** ← Tension per anchor
Tension T2 = **240.00 lb** ← Tension per anchor
Tension T3 = **240.00 lb** ← Tension per anchor
Tension T4 = **240.00 lb** ← Tension per anchor
Tension T5 = **240.00 lb** ← Tension per anchor

Te1 = **1244.49 lb** ← Maximum Bolt/anchor Load
Te2 = **240.00 lb** ← Maximum Bolt/anchor Load
Ttotal = **1484.49 lb**
T_a = **2517.000 lb** **OK**

Te1: Calculated by sheet
Te2: 2219.9lb (1") / 9.25" = 240lb
Ttotal: Te1+Te2

Moment includes lateral adjustment capabilities. Conservatively places full tension on a single fastener.





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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Self drilling screws to pour stop angle
Elevation: 1/207
Detail: 1/306 **Check d2**

Date: 11/9/2016
Proj. No.: JE16059
Designer: M. Gorny

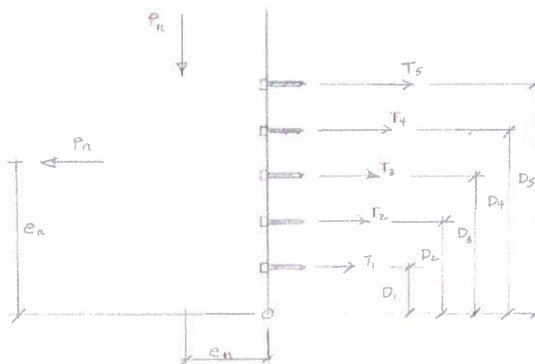
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = **Hilti Kwik Flex**
Fastener Size = **5/16"**
Nominal Diameter, D = **0.313 in**
Area, A = **0.077 in²**
Allowable Tension per Spec, T_a = **2517.0 lb**

DESIGN LOAD - ECCENTRIC ABOUT ROTATION POINT "O"

Design Load, P1 = **788.10 lb**
Eccentric distance e1 = **9.25 in**
Design Load P2 = **0.00 lb**
Eccentric distance e2 = **0.00 in**
Design Load P3 = **0.00 lb**
Eccentric distance e3 = **0.00 in**
Design Load P3 = **0.00 lb**
Eccentric distance e3 = **0.00 in**



Design Moment about "o"

M = **7289.925 lb-in**

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

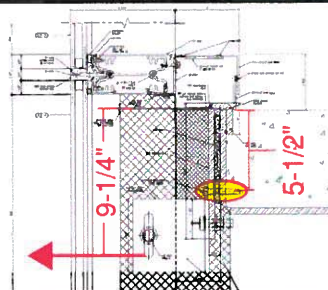
2

Fasteners per Row

N_{R1} = **2**
N_{R2} =
N_{R3} =
N_{R4} =
N_{R5} =

Row Dimensions

D₁ = **5.500**
D₂ =
D₃ =
D₄ =
D₅ =



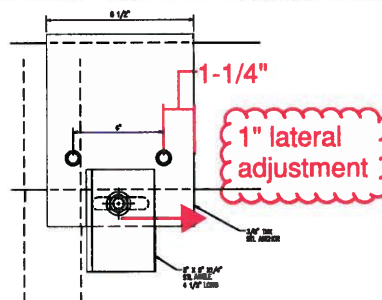
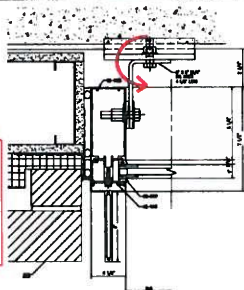
FASTENER CALCULATIONS:

Tension T1 = **662.72 lb** ← Tension per anchor
Tension T2 = **lb** ← Tension per anchor
Tension T3 = **lb** ← Tension per anchor
Tension T4 = **lb** ← Tension per anchor
Tension T5 = **lb** ← Tension per anchor

Te1 = **662.72 lb** ← Maximum Bolt/anchor Load
Te2 = **638.00 lb** ← Maximum Bolt/anchor Load
Ttotal = **1300.72 lb**
T_a = **2517.000 lb** **OK**

Te1: Calculated by sheet
Te2: $788.1\text{lb} (4.25") / 5.25" = 638\text{lb}$
Ttotal: Te1+Te2

Moment includes lateral adjustment capabilities. Conservatively places full tension on a single fastener.





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Client: NGG
Project: Webster University
Structure: YKK YCW 750 SSG
Part of: Self drilling screws to pour stop angle
Elevation: 1/207
Detail: 1/306 **Check d3**

Date: 11/9/2016
Proj. No.: JE16059
Designer: M. Gorny

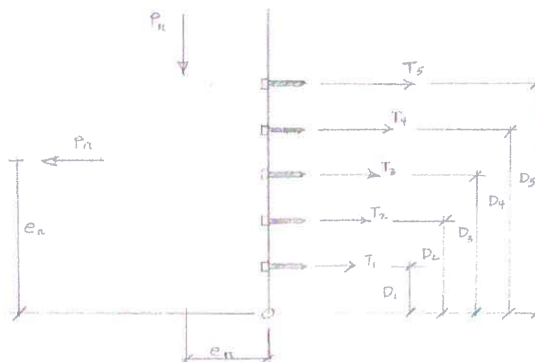
INPUT CHECK

FASTENER PROPERTIES:

Fastener Type = **Hilti Kwik Flex**
Fastener Size = **5/16"**
Nominal Diameter, D = **0.313** in
Area, A = **0.077** in²
Allowable Tension per Spec, T_a = **2517.0** lb

DESIGN LOAD - ECCENTRIC ABOUT ROTATION POINT "O"

Design Load, P1 = **281.90** lb
Eccentric distance e1 = **9.25** in
Design Load P2 = **0.00** lb
Eccentric distance e2 = **0.00** in
Design Load P3 = **0.00** lb
Eccentric distance e3 = **0.00** in
Design Load P3 = **0.00** lb
Eccentric distance e3 = **0.00** in



Design Moment about "o"

M = **2607.575** lb-in

FASTENER PATTERN GEOMETRY:

Total No. of Fasteners:

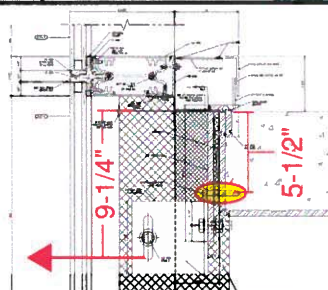
2

Fasteners per Row

N_{R1} = **2**
N_{R2} =
N_{R3} =
N_{R4} =
N_{R5} =

Row Dimensions

D₁ = **5.500**
D₂ =
D₃ =
D₄ =
D₅ =



FASTENER CALCULATIONS:

Tension T1 = **237.05** lb ← Tension per anchor
Tension T2 = **0.00** lb ← Tension per anchor
Tension T3 = **0.00** lb ← Tension per anchor
Tension T4 = **0.00** lb ← Tension per anchor
Tension T5 = **0.00** lb ← Tension per anchor

T_{e1} = **237.05** lb ← Maximum Bolt/anchor Load
T_{e2} = **752.00** lb ← Maximum Bolt/anchor Load
T_{total} = **989.05** lb
T_a = **2517.000** lb **OK**

T_{e1}: Calculated by sheet

T_{e2}: 281.9lb (14") / 5.25" = 752lb

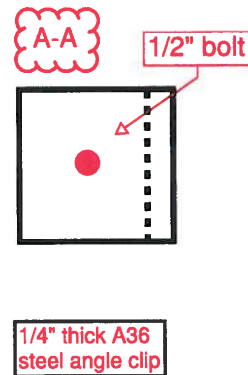
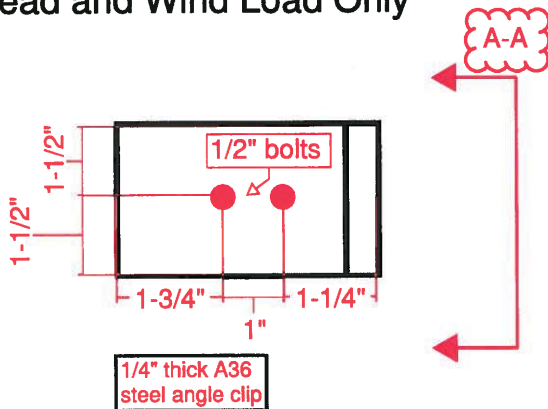
T_{total}: T_{e1}+T_{e2}

Moment includes lateral adjustment capabilities. Conservatively places full tension on a single fastener.



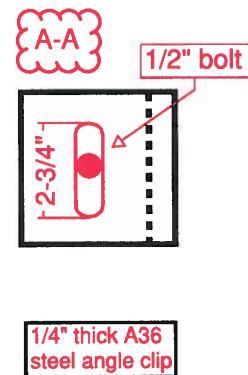
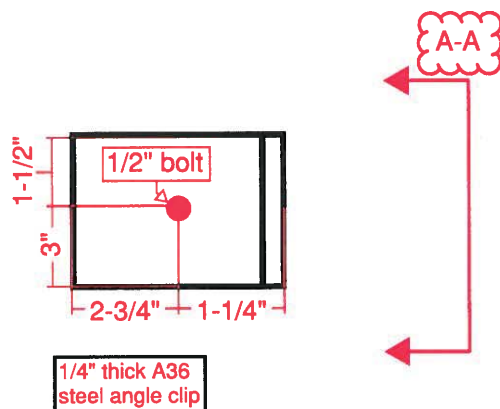
Dead Load Clip to be used with Pour Stop Anchors

Vertical Mullions
Dead and Wind Load Only



Wind Load Clip to be used with Pour Stop Anchors

Vertical Mullions
Wind Load Only

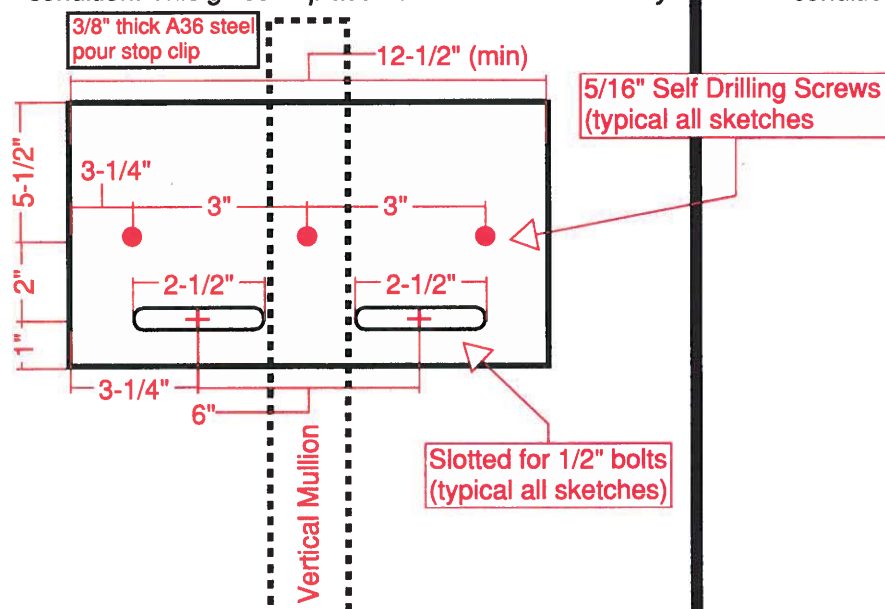




Pour Stop Clip (1)

Vertical Mullions Wind Load Only

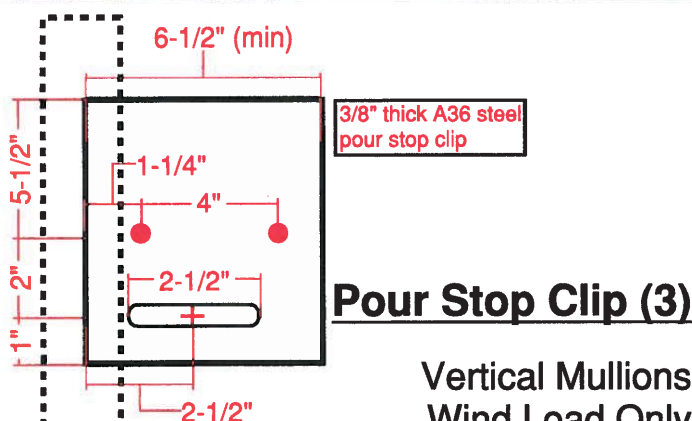
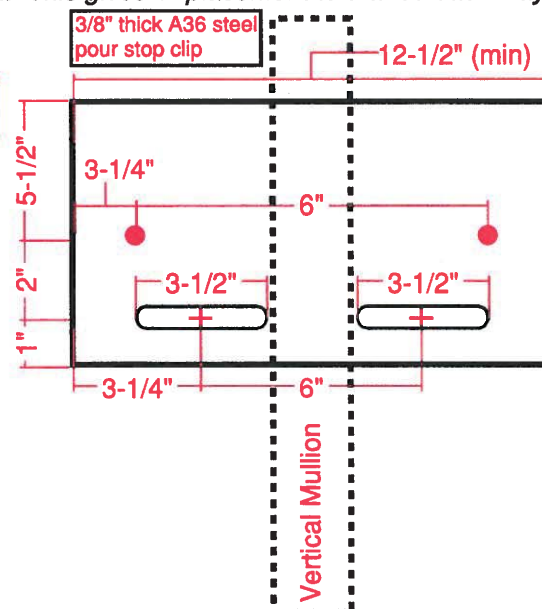
**Ideal placement shown below with vertical mullion centered on clip. Angle clips will be bolted to pour stop clip. Bolt will be centered horizontally in slot in ideal condition. This gives 1" placement tolerance each way.*



Pour Stop Clip (2)

Vertical Mullions Dead and Wind Load

**Ideal placement shown below with vertical mullion centered on clip. Angle clips will be bolted to pour stop clip. Bolt will be centered horizontally in slot in ideal condition. This gives 1" placement tolerance each way.*



Pour Stop Clip (3)

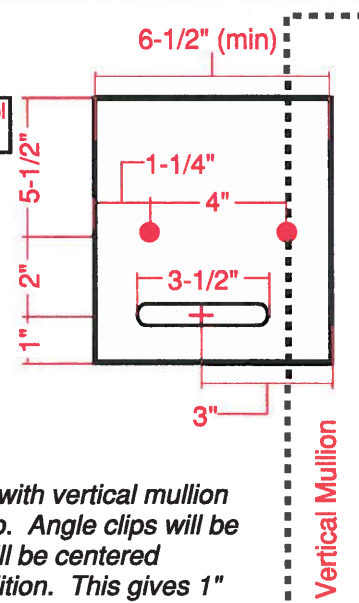
Vertical Mullions Wind Load Only

**Ideal placement shown below with vertical mullion centered on vertical edge of clip. Angle clips will be bolted to pour stop clip. Bolt will be centered horizontally in slot in ideal condition. This gives 1" placement tolerance each way.*

Pour Stop Clip (4)

Vertical Mullions Dead and Wind Load

**Ideal placement shown below with vertical mullion centered on vertical edge of clip. Angle clips will be bolted to pour stop clip. Bolt will be centered horizontally in slot in ideal condition. This gives 1" placement tolerance each way.*



Stewart Jeske

E9-1225

Dimensions

Depth	6.5 in
Width	2.5 in
Perimeter	20.62 in

Geometric

Area	2.079 in ²
Ix	9.838 in ⁴
Iy	1.818 in ⁴
Ixy	0.0012 in ⁴
rx	2.176 in
ry	0.9351 in
Sx+	2.861 in ³
Sx-	3.213 in ³
Sy+	1.454 in ³
Sy-	1.454 in ³
Xc	22.55 in
Yc	3.64 in

Principal

I1	9.838 in ⁴
I2	1.818 in ⁴
α	-0.0087 deg
r1	2.176 in
r2	0.9351 in
S1+	2.861 in ³
S1-	3.213 in ³
S2+	1.454 in ³
S2-	1.453 in ³

Polar

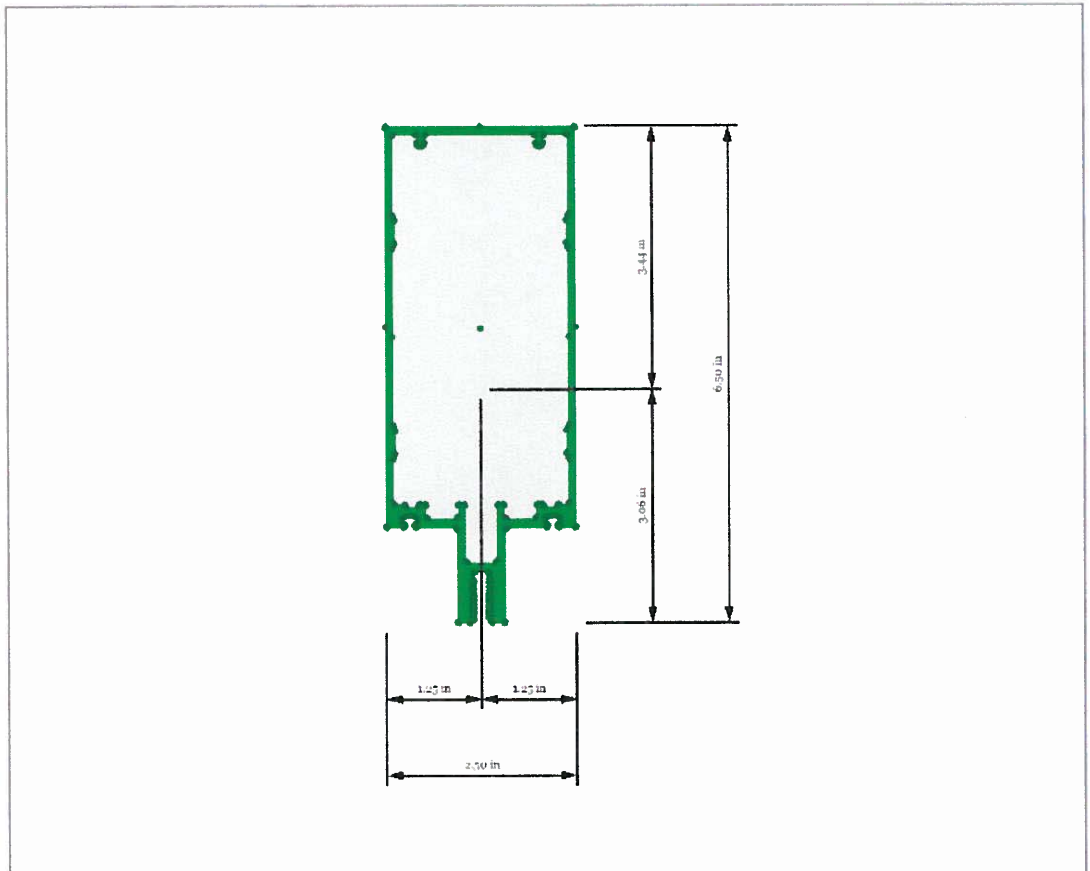
I _p	11.66 in ⁴
r _p	2.368 in

Minimum Results

Warping	-1.474 in ²
Function	

Maximum Results

Warping	1.468 in ²
Function	

**Plastic**

Z _x	3.985 in ³
Z _y	1.724 in ³
PNA X	22.54 in
PNA Y	3.021 in

Part Materials

All	ASTM A36
-----	----------

FEA Mesh

Nodes	3644
Elements	3087
Largest Element	0.0831 in ²

Torsion

r _o	2.476 in
H	0.9145
X _{sc}	22.54 in
Y _{sc}	4.364 in
C _w	0.9432 in ⁶
J	4.11 in ⁴
B ₁	-0.5806 in



Stewart Jeske

Eg-8981

Dimensions

Depth	6.566 in
Width	3.09 in
Perimeter	21.12 in

Geometric

Area	2.477 in ²
Ix	11.81 in ⁴
Iy	2.954 in ⁴
Ixy	0.0044 in ⁴
rx	2.184 in
ry	1.092 in
Sx+	3.607 in ³
Sx-	3.589 in ³
Sy+	1.912 in ³
Sy-	1.911 in ³
Xc	27.95 in
Yc	11.08 in

Principal

I1	11.81 in ⁴
I2	2.954 in ⁴
α	-0.0282 deg
r1	2.184 in
r2	1.092 in
S1+	3.607 in ³
S1-	3.589 in ³
S2+	1.914 in ³
S2-	1.909 in ³

Polar

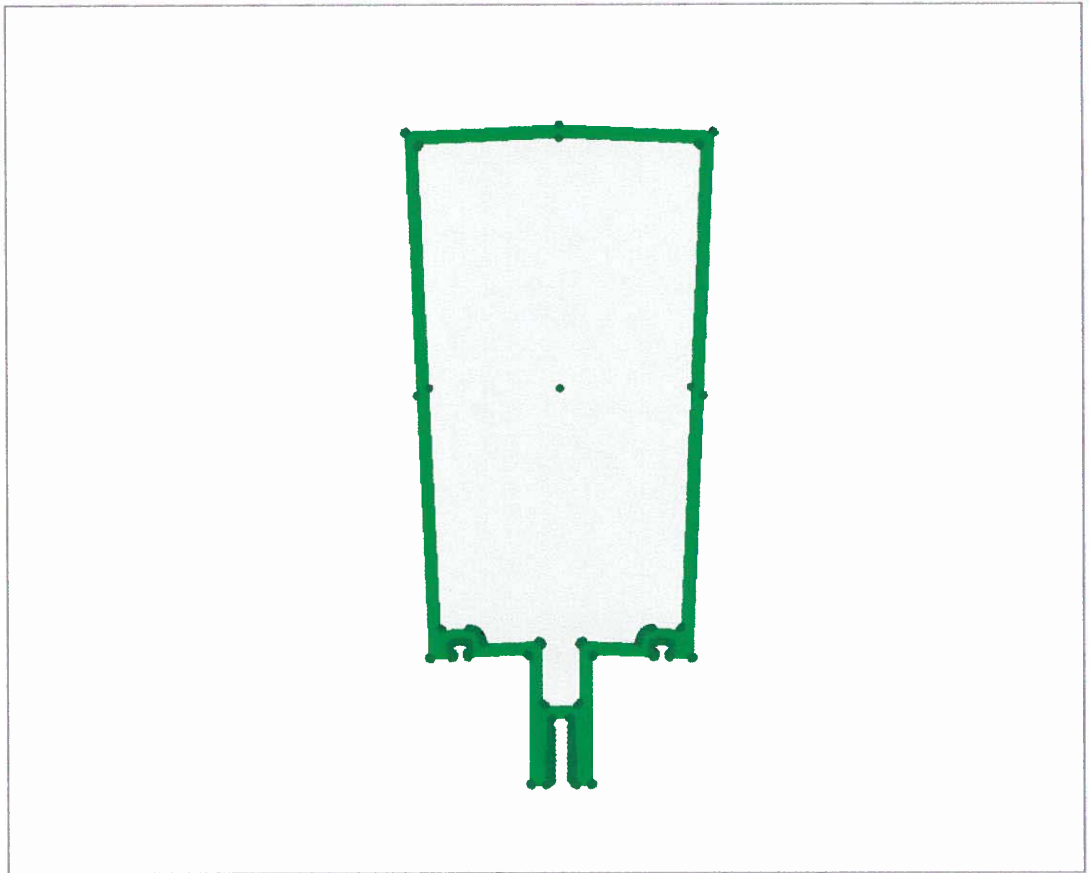
Ip	14.77 in ⁴
rp	2.441 in

Minimum Results

Warping	-1.093 in ²
Function	

Maximum Results

Warping	1.087 in ²
Function	

**Plastic**

Zx	4.836 in ³
Zy	2.404 in ³
PNA X	27.95 in
PNA Y	10.78 in

Part Materials

All	ASTM A36
-----	----------

FEA Mesh

Nodes	2590
Elements	2199
Largest	0.0991 in ²
Element	

Torsion

ro	2.592 in
H	0.8875
Xsc	27.95 in
Ysc	11.95 in
Cw	0.6482 in ⁶
J	6.349 in ⁴
B1	-1.143 in



Stewart Jeske

E9-3401

Dimensions

Depth	5.25 in
Width	2.5 in
Perimeter	18.41 in

Geometric

Area	2.254 in ²
Ix	8.555 in ⁴
Iy	2.213 in ⁴
Ixy	-0.0005 in ⁴
rx	1.948 in
ry	0.9909 in
Sx+	3.127 in ³
Sx-	3.403 in ³
Sy+	1.775 in ³
Sy-	1.765 in ³
Xc	104.1 in
Yc	43.27 in

Principal

I1	8.555 in ⁴
I2	2.213 in ⁴
α	0.0045 deg
r1	1.948 in
r2	0.9909 in
S1+	3.127 in ³
S1-	3.403 in ³
S2+	1.775 in ³
S2-	1.766 in ³

Polar

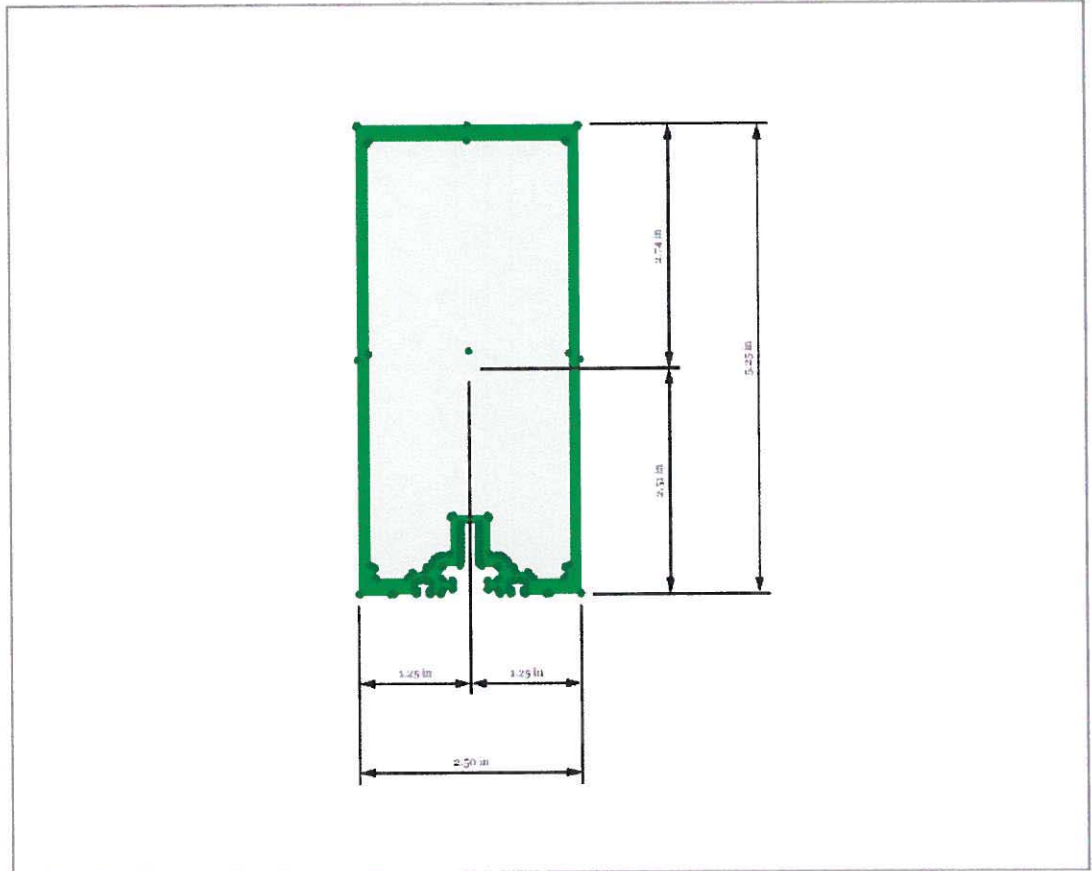
Ip	10.77 in ⁴
rp	2.186 in

Minimum Results

Warping	-1.212 in ²
Function	

Maximum Results

Warping	1.21 in ²
Function	

**Plastic**

Zx	3.984 in ³
Zy	2.054 in ³
PNA X	104.1 in
PNA Y	43.1 in

Part Materials

All	ASTM A36
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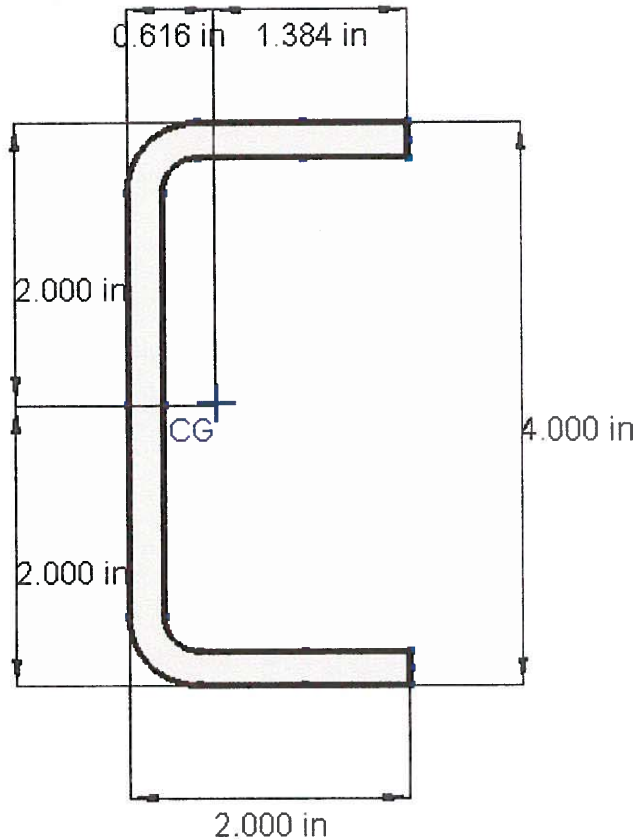
FEA Mesh

Nodes	2582
Elements	2172
Largest Element	0.0902 in ²

Torsion

ro	2.343 in
H	0.8703
Xsc	104.1 in
Ysc	44.12 in
Cw	0.6573 in ⁶
J	4.596 in ⁴
B1	-1.403 in



**Overall Dimensions**

Width	2.000 in
Height	4.000 in
Perimeter	14.855 in

Geometric Properties

Iy	0.671 in ⁴
Ix	4.107 in ⁴
J	0.039 in ⁴
ry	0.611 in
rx	1.513 in
A	1.795 in ²
Sy Right	0.485 in ³
Sy Left	1.088 in ³
Sx Bottom	2.054 in ³
Sx Top	2.054 in ³
Centroid Y	-0.370 in
Centroid X	-0.651 in

Material Properties

E	29000.000 Ksi
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Plastic Properties

Zy	0.876 in ³
Zx	2.483 in ³
PNA-Y	-0.370 in
PNA-X	-1.019 in

Polar Properties

Ip	4.778 in ⁴
rp	1.632 in

Principal Properties

I2	0.671 in ⁴
I1	4.107 in ⁴
Ixy	-0.000 in ⁴
Theta	0.000 deg

Shear Properties

SC Y	-0.370 in
SC X	-1.866 in

Torsion Properties

H	0.854
ro	1.765 in
Cw	1.494 in ⁶

Advanced Properties

Elements	366.000
Mesh Curve %	2.000
Mesh Size #	0.070
Nodes	491.000

Bent Channel

Width	2.000 in
Height	4.000 in
Iy	0.671 in ⁴

Ix	4.107 in ⁴
A	1.795 in ²
Sy Right	0.485 in ³
Sy Left	1.088 in ³
Sx Bottom	2.054 in ³
Sx Top	2.054 in ³

Stewart Jeske

E9-3402

Dimensions

Depth	5.25 in
Width	2.5 in
Perimeter	18.56 in

Geometric

Area	1.751 in ²
Ix	6.485 in ⁴
Iy	1.729 in ⁴
Ixy	0.0015 in ⁴
rx	1.925 in
ry	0.9938 in
Sx+	2.197 in ³
Sx-	2.821 in ³
Sy+	1.383 in ³
Sy-	1.383 in ³
Xc	19.76 in
Yc	43.23 in

Principal

I1	6.485 in ⁴
I2	1.729 in ⁴
α	-0.0181 deg
r1	1.925 in
r2	0.9938 in
S1+	2.197 in ³
S1-	2.821 in ³
S2+	1.383 in ³
S2-	1.382 in ³

Polar

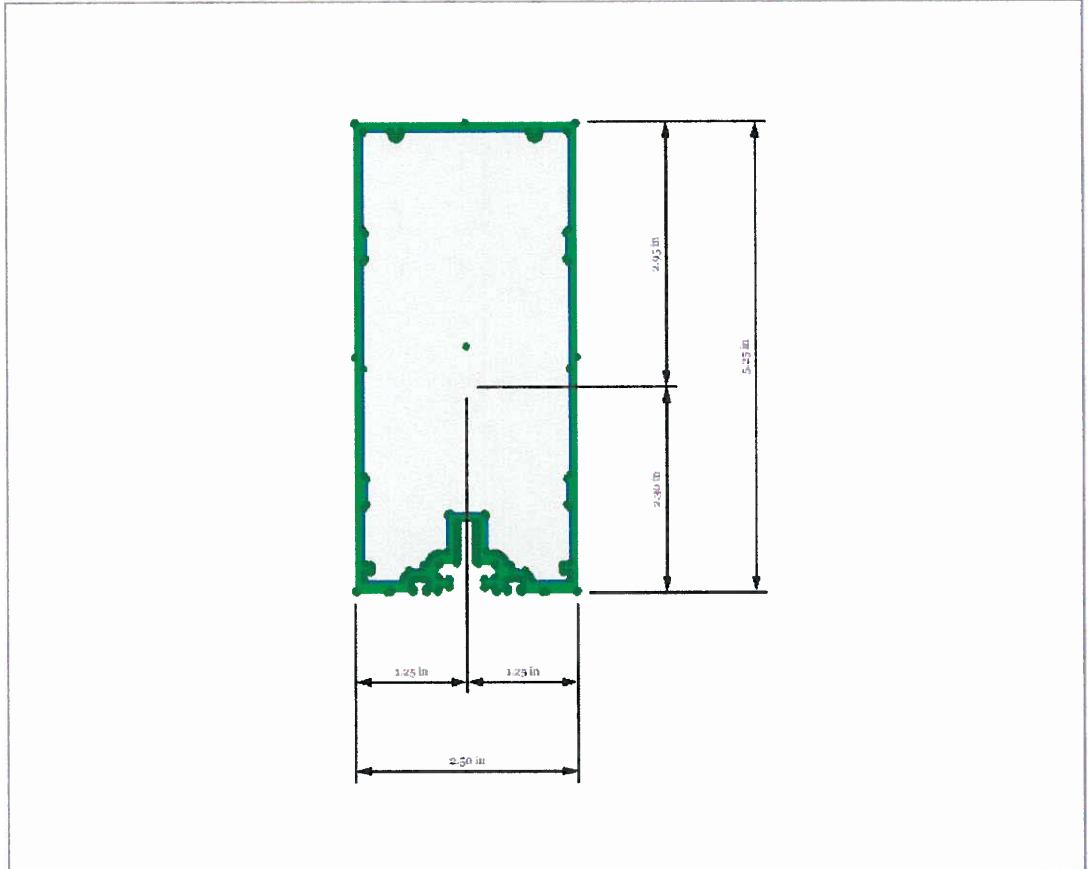
Ip	8.214 in ⁴
rp	2.166 in

Minimum Results

Warping	-1.054 in ²
Function	

Maximum Results

Warping	1.049 in ²
Function	



Plastic

Zx	3.024 in ³
Zy	1.591 in ³
PNA X	19.76 in
PNA Y	42.82 in

FEA Mesh

Nodes	3612
Elements	3030
Largest Element	0.07 in ²

Torsion

ro	2.275 in
H	0.9066
Xsc	19.76 in
Ysc	43.92 in
Cw	0.4367 in ⁶
J	3.525 in ⁴
B1	-0.7399 in

Part Materials

All	ASTM A36
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Stewart Jeske

E9-3403

Dimensions

Depth	5.25 in
Width	2.5 in
Perimeter	26.16 in

Geometric

Area	1.392 in ²
Ix	6.1 in ⁴
Iy	0.8929 in ⁴
Ixy	-0.1839 in ⁴
rx	2.093 in
ry	0.8009 in
Sx+	2.614 in ³
Sx-	2.092 in ³
Sy+	1.07 in ³
Sy-	0.5361 in ³
Xc	143.5 in
Yc	29.21 in

Principal

I1	6.107 in ⁴
I2	0.8864 in ⁴
α	2.02 deg
r1	2.094 in
r2	0.798 in
S1+	2.554 in ³
S1-	2.075 in ³
S2+	0.968 in ³
S2-	0.5017 in ³

Polar

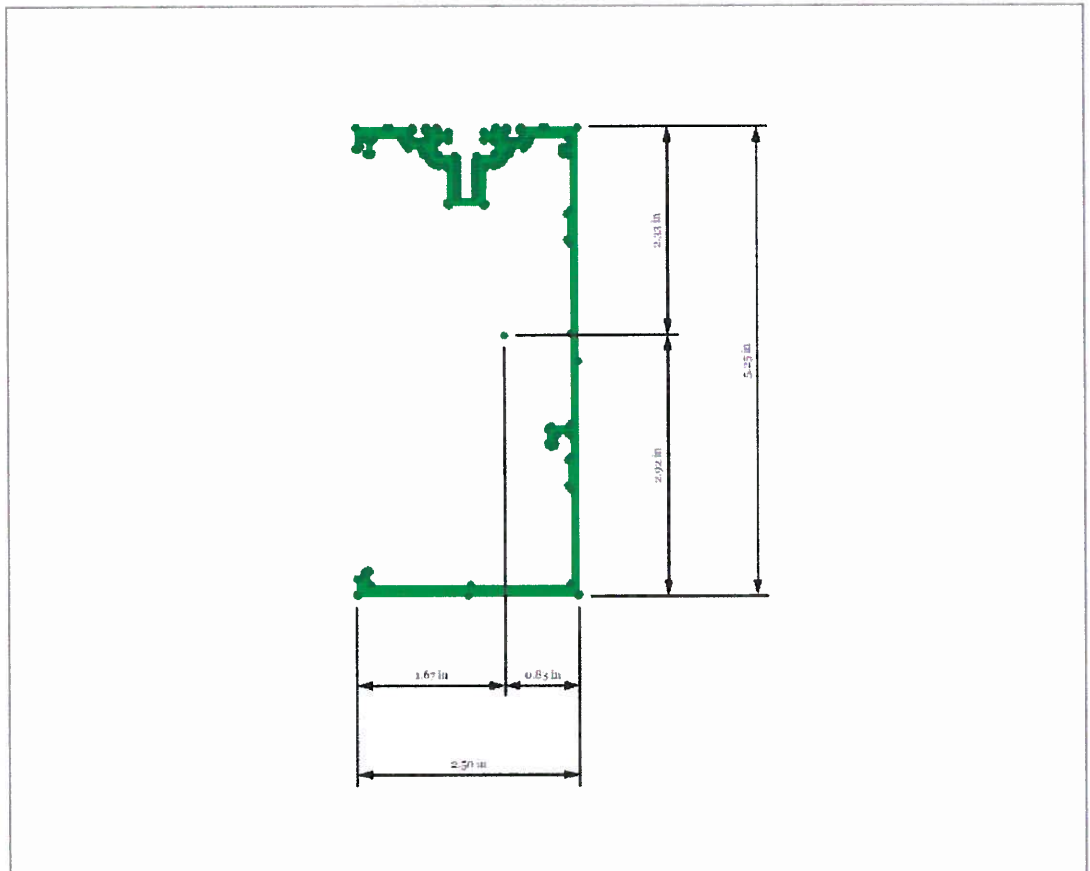
I _p	6.993 in ⁴
r _p	2.241 in

Minimum Results

Warping	-3.27 in ²
Function	

Maximum Results

Warping	4.158 in ²
Function	

**Plastic**

Z _x	2.671 in ³
Z _y	0.9766 in ³
PNA X	143.7 in
PNA Y	29.89 in

FEA Mesh

Nodes	3073
Elements	2586
Largest Element	0.0557 in ²

Torsion

r _o	2.903 in
H	0.5963
X _{sc}	145.3 in
Y _{sc}	28.9 in
C _w	3.672 in ⁶
J	0.0066 in ⁴
B ₁	0.1407 in

Part Materials

Import 1	ASTM A36
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Stewart Jeske

E9-3423

Dimensions

Depth	3.75 in
Width	2.5 in
Perimeter	15.46 in

Geometric

Area	1.482 in ²
Ix	2.835 in ⁴
Iy	1.333 in ⁴
Ixy	0.0015 in ⁴
rx	1.383 in
ry	0.9486 in
Sx+	1.331 in ³
Sx-	1.749 in ³
Sy+	1.066 in ³
Sy-	1.067 in ³
Xc	12.1 in
Yc	27.78 in

Principal

I1	2.835 in ⁴
I2	1.333 in ⁴
α	-0.0564 deg
r1	1.383 in
r2	0.9486 in
S1+	1.331 in ³
S1-	1.748 in ³
S2+	1.065 in ³
S2-	1.065 in ³

Polar

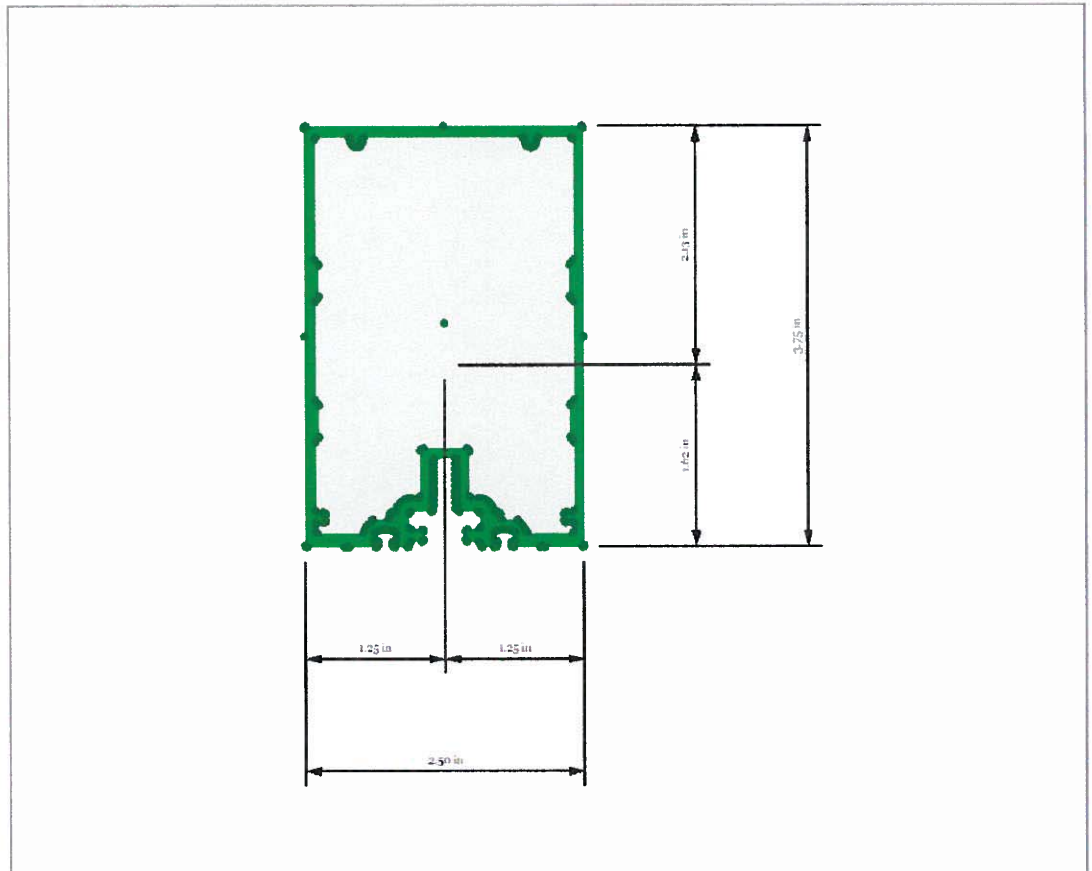
I _p	4.168 in ⁴
r _p	1.677 in

Minimum Results

Warping	-0.9264 in ²
Function	

Maximum Results

Warping	0.9254 in ²
Function	

**Plastic**

Zx	1.817 in ³
Zy	1.263 in ³
PNA X	12.1 in
PNA Y	27.34 in

FEA Mesh

Nodes	3406
Elements	2865
Largest	0.0593 in ²
Element	

Torsion

r _o	1.789 in
H	0.8787
X _{sc}	12.1 in
Y _{sc}	28.41 in
C _w	0.0869 in ⁶
J	2.156 in ⁴
B ₁	-0.6486 in

Part Materials

All	ASTM A36
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ConFlex® Large Diameter Masonry Screws

Conflex fasteners are a new generation of masonry screws from Elco Construction Products. The design combines our 25 years of experience in manufacturing the highest quality masonry screws with our unique Flex Technology® heat treat process used in our Drill-Flex® drill screws. The result is a large diameter masonry screw that is virtually immune to brittle failures, allowing use in exterior applications.

High Performance

The major feature of the ConFlex design is the Flex Technology heat treatment, which provides dual hardness zones on the screw shank:

- The lead threads are extremely hard for more efficient and effective thread tapping
- The lower hardness of the rest of the fastener renders it virtually immune to brittle failures

Brittle failures occur when high hardness fasteners, under high loads (including that from installation torque), are used in applications where moisture is present. The chance of failure is greatly enhanced when aluminum is in contact with such a fastener. This type of metallurgical reaction is usually referred to as Hydrogen-Assisted Stress Corrosion Cracking (HASCC).

Other Features and Benefits

- Installs using standard ANSI masonry drill bits
 - 3/8" masonry drill bit for 3/8" ConFlex fastener
 - 7/16" masonry drill bit for 1/2" ConFlex fastener
- Silver Stalgard® finish provides exceptional corrosion resistance (1,000 hours without red rust in salt spray testing per ASTM B117)
- Double-lead threads allow rapid fastener advancement into the pilot hole – twice as fast as a standard single-lead thread
- Locking serrations under the head provide back-out resistance
- Provides high pull-out and shear values
- Low installation torque
- Head markings allow easy inspection

Specifications

Sizes: 3/8" and 1/2" diameters

Actual thread O.D. is greater than nominal screw anchor diameter designation (see thread diameter information on following page)

Material: Alloy steel

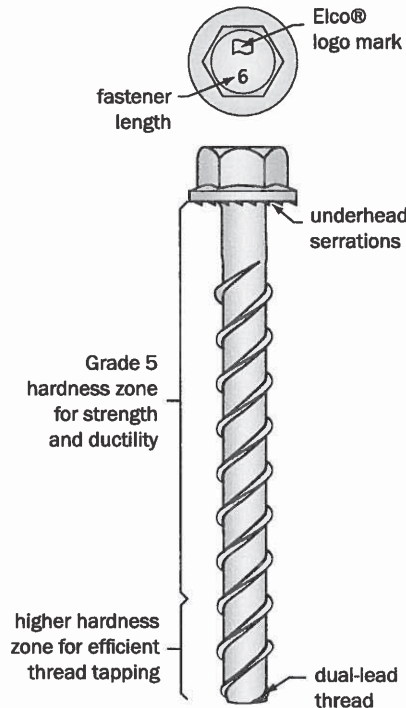
Mechanical Properties

Tensile Yield: 92,000 KSI min. (Grade 5)

Tensile Ultimate: 120,000 KSI min. (Grade 5)

Finish: Silver Stalgard corrosion-resistant coating

Corrosion Resistance: 1,000 hours in salt spray testing without red rust (per ASTM B117)



Applications

- Curtain wall and glazing
- Blast- and impact-resistant window systems
- Accordion and pull-down hurricane shutter tracks
- Racking and shelving
- Maintenance and repairs
- Window and door frames
- Fencing
- Mudsills and ledgers
- Material handling
- Pool enclosures

ConFlex® Large Diameter Masonry Anchors

ConFlex® Large Diameter Masonry Screws

ConFlex® Selection Guide

3/8" Diameter				1/2" Diameter			
Length	Thread Length	Part No.	Quantity Per Box	Length	Thread Length	Part No.	Quantity Per Box
2-1/2"	2-1/4"	EMR215	50	2-1/2"	2-1/4"	EMR320	50
3"	2-1/4"	EMR235	50	3"	2-1/4"	EMR340	50
4"	3-1/2"	EMR255	50	4"	3-1/2"	EMR360	50
5"	3-1/2"	EMR265	25	5"	3-1/2"	EMR370	25
7-1/2"	3-1/2"	EMR295	25	6"	3-1/2"	EMR380	25
Recommended min. embedment: 2"				Recommended min. embedment: 2"			
Installation: • Standard 3/8" ANSI masonry drill bit (.398" +.000"/-.010") • Recommended functional masonry drill bit length: minimum 1" more than fastener length				Installation: • Standard 7/16" ANSI masonry drill bit (.468" +.000"/-.010") • Recommended functional masonry drill bit length: minimum 1" more than fastener length			

Dimensional Properties

3/8" Diameter	1/2" Diameter
Drive system: 9/16" hex	Drive system: 3/4" hex
Washer diameter: 11/16"	Washer diameter: 1.0"
Thread O.D.: .430"	Thread O.D.: .525"
Thread root: .345"	Thread root: .405"
Unthreaded shank dia.: .360"	Unthreaded shank dia.: .426"
Head mark: Elco® logo mark and length in inches	Head mark: Elco® logo mark and length in inches

† Note: Indicated pull-out and shear values listed are ultimate values and were obtained in tests conducted by HETI/ Miami, FL, an independent test lab. These figures are offered only as a guide and are not guaranteed in any way by Elco Construction Products. A safety factor of 4:1 or 25% of ultimate values are generally accepted as a safe working load.

Testing was done per ASTM E 488 - 96. Additional technical data is available upon request.



For more information, please contact:



Elco Construction Products

1301 Kerr Drive • Decorah, IA 52101

1.800.435.7213 • Fax: 563.387.3540

www.elcoconstruction.com



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ConFlex Performance Data† Ultimate Value (Lbs) in Concrete

1,819 PSI					
Dia .	Edge Distance	Embedment	Pull-out	Shear	
3/8"	1-7/8" (5d)	1-1/2"	1,364	X	
		2"	2,995	X	
		2-1/2"	3,226	1,534	
		3-1/2"	5,379	2,170	
	2-5/8"	1-1/2"	X	X	
		2"	X	X	
		2-1/2"	3,620	2,459	
		3-1/2"	6,070	3,902	
	3-3/4" (10d)	1-1/2"	1,232	4,766	
		2"	3,296	5,658	
		2-1/2"	3,936	6,419	
		3-1/2"	6,493	7,047	
1/2"	2	1-3/4"	X	X	
		2"	X	X	
		3"	X	X	
		4"	X	X	
	2-1/2" (5d)	1-3/4"	2,266	X	
		2"	2,706	X	
		3"	4,666	4,549	
		4"	7,058	6,960	
	3-1/2"	1-3/4"	X	X	
		2"	X	X	
		3"	5,483	5,739	
		4"	8,656	8,028	
	4	1-3/4"	X	X	
		2"	X	X	
		3"	X	X	
		4"	X	X	
	5" (10d)	1-3/4"	2,090	6,081	
		2"	2,875	7,167	
		3"	6,042	9,148	
		4"	8,732	9,631	
	4,510 PSI				
	Dia.	Edge Distance	Embedment	Pull-out	Shear
	3/8"	1-7/8" (5d)	1-1/2	2,497	X
			2	3,169	X
2-1/2			5,063	2,111	
3-1/2			9,288	2,732	
2-5/8"		1-1/2			
		2			
		2-1/2	5,111	2,667	
		3-1/2	8,438	4,046	
3-1/2"		1-1/2	2,055	X	
		2	X	5,810	
		2-1/2	4,778	X	
		3-1/2	X	X	
3-3/4" (10d)	1-1/2	2,055	3,414		
	2	X	5,810		
	2-1/2	5,111	7,309		
	3-1/2	9,508	8,339		
1/2"	2"	1-3/4	3,515	X	
		2	4,388	X	
		3	6,719	2,229	
		4	11,076	3,860	
	3" (6d)	1-3/4	X	X	
		2	X	X	
		3	X	X	
		4	X	X	
	3-1/2"	1-3/4	X	X	
		2	X	X	
		3	7,646	X	
		4	10,234	X	
	4"	1-3/4	2,887	6,787	
		2	4,310	6,678	
		3	8,169	8,489	
		4	11,111	10,942	
	5" (10d)	1-3/4	X	X	
		2	X	X	
		3	X	X	
		4	X	X	

Dril-Flex® Structural Self-Drilling Fasteners

Offers virtual immunity to hydrogen-assisted stress corrosion cracking for maximum performance in the field

Dril-Flex fasteners are specially designed and processed to help prevent hydrogen-induced brittle failures. Each fastener undergoes the unique Flex Technology® dual-hardening process to ensure the optimal combination of ductility and hardness required for maximum performance in the field.

Testing of this product, in accordance with ASTM standards, has proven that Dril-Flex fasteners provide the same resistance to hydrogen-assisted cracking (HAC) as a Grade 5 fastener.

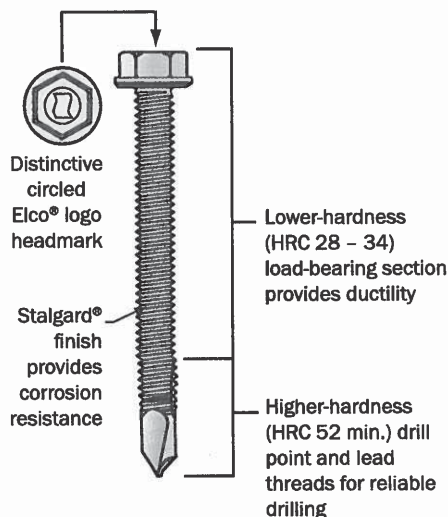
Unique Hardening and Finishing Processes Provide High Performance

Hydrogen-Assisted Stress Corrosion Cracking (HASCC) refers to a time-delayed failure that is aggravated or accelerated by hydrogen generated in the application. This is most often encountered and associated with dissimilar metal applications through the galvanic corrosion process. Most self-drilling fasteners, including 410 fasteners, are case or similarly hardened, which provides the necessary hardness for drilling and tapping, but leaves the screws vulnerable to HASCC due to their high surface or core hardness.

Dril-Flex fasteners offer the unique Flex Technology dual-hardening process. The self-drilling point and lead tapping threads are selectively hardened to a minimum of HRC 52. The load-bearing portion of the screw is held at or below the critical HRC 34 level. This reduced hardness level also meets SAE J429 Grade 5 and ASTM A449 strength and ductility standards.

Dril-Flex fasteners are then coated with silver Stalgard finish to provide superior corrosion resistance and enhanced galvanic compatibility. Fasteners coated with Stalgard finish typically show no red rust or other base metal corrosion on significant surfaces even after 1000 hours of 5% neutral salt spray exposure (ASTM B117).

The combination of this unique dual-hardening process and Stalgard finish results in a strong, reliable fastener that can be used where other self-drillers would fail. Dril-Flex self-drilling fasteners are the ideal fastening solution for demanding construction applications.



Features

- Self-drilling point
- Higher hardness (HRC 52 min.) point and lead threads
- Lower-hardness (HRC 28 – 34) load-bearing threads
- Silver Stalgard multi-layered corrosion resistant finish

Benefits

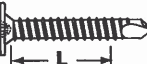
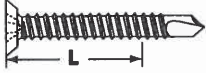
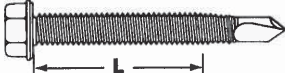
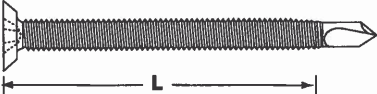
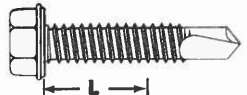
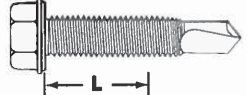
- Virtually immune to delayed HASCC brittle failures found with other hardened fasteners
- Provides the same high resistance to hydrogen-assisted failure as a Grade 5 fastener
- Precision self-drilling point ensures consistent, reliable drilling and tapping
- Eliminates separate drilling and tapping operations
- Corrosion resistance superior to zinc- or cadmium-based finishes
- Provides enhanced galvanic compatibility in dissimilar metal applications
- Approvals: ICC ES ER-4780 Legacy Report; COLA (City of Los Angeles) Research Report #25095

Product Information

Dril-Flex® Structural Self-Drilling Fasteners



Selection Guide

	Catalog No.	Description	Point	L Load-Bearing Area	Finish	Carton Qty.	Carton Weight
#10-16 With 5/16" Hex Washer Head							
	EA430	10-16 x 3/4"	#3	.500"	Stalgard	6,000	48
	EA460	10-16 x 1-1/2"	#3	1.00"	Stalgard	2,500	30
	EA470	10-16 x 2"	#3	1.50"	Stalgard	2,000	28
	EA480	10-16 x 2-1/2"	#3	1.83"	Stalgard	1,500	25
#10-16 With #2 Phillips Pan Head							
	EDX445	10-16 x 3/4"	#2	.500"	Stalgard	6,000	36
#10-24 With #2 Phillips Wafer Head							
	EBL530	10-24 x 1-1/4"	#3	.750"	Stalgard	5,000	44
#12-14 With 5/16" Hex Washer Head							
	EA621*	12-14 x 7/8"	#3	.470"	Stalgard	5,000	54
	EA641	12-14 x 1"	#3	.500"	Stalgard	4,000	44
	EA681	12-14 x 1-1/2"	#3	1.00"	Stalgard	2,500	38
	EA755	12-24 x 1-3/4"	#5	.800"	Stalgard	2,500	48
	EA690	12-14 x 2"	#3	1.50"	Stalgard	2,000	37
	EA715	12-14 x 3"	#3	2.50"	Stalgard	1,000	27
#12-14 With #3 Phillips Undercut Flat Head							
	EBL215	12-14 x 1"	#3	.500"	Stalgard	4,000	36
	EBL223	12-14 x 1-1/2"	#3	1.00"	Stalgard	2,500	26
1/4-14 With 3/8" Hex Washer Head							
	EA816	1/4-14 x 1"	#3	.450"	Stalgard	3,000	54
	EA841	1/4-14 x 1-1/2"	#3	.950"	Stalgard	2,000	45
	EA846	1/4-14 x 2"	#3	1.45"	Stalgard	1,500	41
1/4-20 With 3/8" Hex Washer Head							
	EA876	1/4-20 x 1-1/2"	#4	.830"	Stalgard	2,000	48
	EA886	1/4-20 x 2"	#4	1.33"	Stalgard	1,500	45
	EA865	1/4-20 x 1-1/8"	#4	.500"	Stalgard	2,500	51
	EA888	1/4-20 x 1-3/4"	#5	.800"	Stalgard	1,000	27
	EA890	1/4-20 x 2-1/2"	#4	1.830"	Stalgard	1,000	45
	EA900	1/4-20 x 3-3/8"	#4	2.70"	Stalgard	500	22
	EA910	1/4-20 x 4"	#4	3.50"	Stalgard	500	23
1/4-20 With #3 Phillips Undercut Flat Head							
	EBL330	1/4-20 x 3"	#4	2.50"	Stalgard	500	20
	EBL340	1/4-20 x 4"	#4	3.50"	Stalgard	500	23
5/16-18 With 3/8" Hex Washer Head							
	EA940	5/16-18 x 1-1/2"	#3	.850"	Stalgard	1,000	37
5/16-24 With 3/8" Hex Washer Head							
	EA960	5/16-24 x 1-1/2"	#4	.850"	Stalgard	1,000	40
	EA970	5/16-24 x 2"	#4	1.35"	Stalgard	1,000	49

* EAF621 is for aluminum applications ONLY.

Fasteners shown are in-stock. Other head styles, threads, lengths and drilling capabilities can be produced to meet specific application needs.

IMPORTANT: to ensure proper performance, only the load-bearing area should be engaged in the material being fastened.

COMPARISON TO STAINLESS STEEL FASTENERS

300 series stainless steel fasteners will not rust, and, because of their low hardness, they also provide high resistance to hydrogen embrittlement failures. However, because plain-finished stainless steel is galvanically incompatible with certain building materials – including steel and aluminum – it can cause other problems (see chart) when combined with these materials. Stainless steel fasteners trigger a sacrificial action in the aluminum or steel panel, which can lead to degradation of the panel and loosening of the fastener.

The dual-hardening process allows Dril-Flex® fasteners to provide high strength and resistance to hydrogen embrittlement failures. Their unique Stalgard® finish provides corrosion resistance several times greater than other commonly-used finishes. Fasteners coated with Stalgard finish typically show no red rust or other base metal corrosion on significant surfaces even after 1000 hours of 5% neutral salt spray exposure (ASTM B117).

If the environment is corrosive enough to significantly affect the Stalgard finish, the potential for significant degradation of the aluminum/stainless steel assembly would also exist.

Galvanic Series

Anodic End	
Metal/Alloy	EMF (V)
Magnesium.....	-1.60
Zinc.....	-1.10
Alum (5000, 6000, 7000).....	-.75
Iron, Low Alloy Steels.....	-.70
Alum (2000).....	-.60
Lead.....	-.55
18% Chromium Steel.....	-.35
Naval Brass.....	-.30
Brass, Bronze.....	-.25
Austenitic Stainless (300 Series)....	-.20
Nickel.....	-.15
Silver.....	0
Gold.....	+15
Cathodic End	

In the presence of moisture, materials higher on the list will be sacrificial to materials lower on the list. The greater the EMF differential, the greater the sacrificial action of the anode to the cathode in a galvanic cell.

EMBRITTLMENT TESTING

Embrittlement testing of Dril-Flex fasteners was performed in accordance to ASTM F1624-06, "Standard Test Method for Measurement of Hydrogen Embrittlement in Steel by the Incremental Loading Method". Fastener lots were tested to determine their Threshold Stress Limits for both Internal Hydrogen Embrittlement and Environmental Hydrogen Embrittlement. Threshold Stress Limit is the stress level below which no time-dependent cracking will occur. Above this level, subcritical cracking that leads to time-delayed fracture or embrittlement may occur if the fastener is exposed to a hydrogen environment.

Embrittlement Test Results

- Dril-Flex fasteners have a hardness range of HRC 28 – 34, which is roughly equivalent to a SAE Grade 5 fastener (HRC 25 – 34).
- Dril-Flex fasteners showed resistance to the effect of hydrogen-assisted cracking when loaded to 75% of their tensile strength. This is within accepted industry guidelines for in-service loading conditions.
- Dril-Flex fasteners showed no degradation or failures in tensile strength below their Ultimate Tensile Strength.

SHEAR AND PULL-OUT VALUES

Pull-out Tests – Steel

Pull-out values shown are in lbs.

Screw Size	Point Type	Drill Cap.	Steel							
			18	16	14	12	1/8	3/16	1/4	5/16
10-16	3	.150	396	501	634	1595	1693			
12-14	3	.187	396	527	710	1678	2061	2898		
1/4-14	3	.187	398	530	686	1950	2264	3919		
1/4-20	4	.312		516	649	1912	2296	2928	3561	4488
5/16-24	4	.312				2148	2573	4226	5424	6622

Shear Tests – Steel

Shear values shown are in lbs.

Screw Size	Point Type	Drill Cap.	Steel						
			18-18 gage	18-14 gage	16-16 gage	14-14 gage	1/8"-3/16"	3/16"-1/4"	1/4"-12 gage
10-16	3	.150	1362	1733	1462				
12-14	3	.187	1315	2118	1655	1816			
1/4-14	3	.187	1395	2313	1681	2417	2600		
1/4-20	4	.312	1350	2086	1582	2450	2814	2810	2706
5/16-24	4	.312					5486	5283	4761

Pull-out Tests – Aluminum

Pull-out values shown are in lbs.

Screw Size	Point Type	Drill Cap.	Aluminum 6063-T5		
			1/8"	1/4"	3/8"
10-16	3	.150			
12-14	3	.187	939	2286	
1/4-14	3	.187	1003	2424	
1/4-20	4	.312	897	2075	3683
5/16-24	4	.312	1043	2566	

Shear Tests – Aluminum

Shear values shown are in lbs.

Screw Size	Point Type	Drill Cap.	Aluminum 6063-T5	
			1/8" - 1/8"	1/8" - 1/4"
10-16	3	.150	1466	
12-14	3	.187	1797	2483
1/4-14	3	.187	1996	2883
1/4-20	4	.312	2006	2926
5/16-24	4	.312	1849	2926

NOTE: All test setups and dimensions were as limited and outlined in AISI Test Method for Mechanically Fastened Cold-Formed Steel Connections (CF92-1) document. Performance values listed are ultimate values obtained under laboratory conditions. Appropriate safety factors should be applied for design purposes.

SPECIFICATIONS

Applications:

Metal (including aluminum) to steel structurals like those found in curtainwall and solar panel systems

Short Form Specification:

Dual-hardened fastener with self-drilling point and self-tapping thread that meets SAE J429 Grade 5 and ASTM A449 strength and ductility requirements, which provides a maximum load-bearing area of _____.

Approvals/Listings:

- ICC ES ER-4780 Legacy Report
- COLA (City of Los Angeles) Research Report #25095

Diameters:

#10, #12, 1/4", 5/16"

Head Styles:

Hex washer, undercut flat, pan and wafer; custom heads styles available

Thread Form:

Self-tapping

Point Type:

Self-drilling

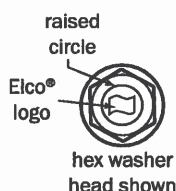
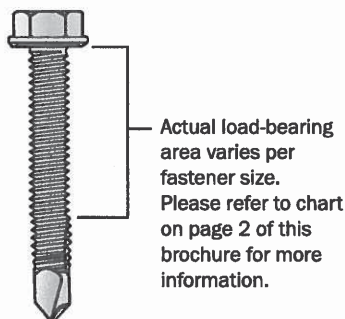
Material:

Special alloy steel

Finish:

Silver-colored

Stalgard® corrosion-resistant finish withstands a minimum of 1000 hours salt spray per ASTM B117 standards



Inspection

In-place inspection can be made by identifying the special Dril-Flex headmarking. This is a combination of two markings: an Elco® logo surrounded by a raised circle.

Installation Tools:

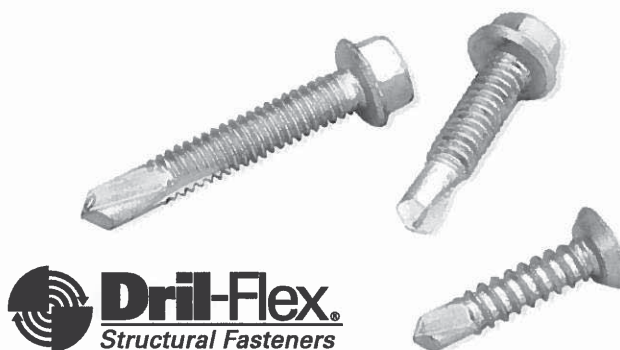
Standard 4.5 min. amp screw gun that has a torque-limiting and/or depth-sensitive nose piece

DESIGNING WITH DRIL-FLEX® FASTENERS

Download CAD files from our web site at www.elcoconstruction.com or contact Elco Construction Products for a free disk containing CAD drawings and specifications.

QUALITY CONTROL

Dril-Flex fasteners are produced under lot control conditions. Each production run is sampled and checked for two key conditions. First, that the lower hardness zone extends down the shank to the length specified, and second, that the hardness in that zone is per the specifications. Documentation is retained for a period of five years. Lot numbers are marked on every box of product.



QUALITY FLEX TECHNOLOGY® PRODUCTS

- Bi-Flex™ bi-metal self-drilling fasteners with Stalgard GB coating for metal applications, including aluminum, in demanding environments
- Aggre-gator® bi-metal anchors with Stalgard GB coating for concrete applications, including exposed/wet areas
- ConFlex® large diameter masonry fasteners with Stalgard coating in 3/8" and 1/2" diameters
- AllFlex™ stainless steel thread-forming and thread-cutting screws with Stalgard GB coating
- Alumi-Flex™ 302 stainless steel drill screws with Stalgard GB coating

Visit www.elcoconstruction.com for more information on these and other quality fastening systems from Elco Construction Products.



Elco Construction Products

1301 Kerr Drive • Decorah, IA 52101

• 800.435.7213 • Fax: 563.387.3540

www.elcoconstruction.com



SUBMITTAL IDENTIFICATION SHEET

To be completed by Contractor/CM

WEBSTER UNIVERSITY ISB

PROJECT NAME

8274 BIG BEND BLVD

ADDRESS

NUMBER

WEBSTER UNIVERSITY

OWNER

CANNON DESIGN

ARCHITECT / ENGINEER

DEVIN D GATES

SUBMITTED BY

084423-022 REV 1

CONTRACTOR / CM SUBMITTAL NO.

CANNON DESIGN SUBMITTAL NO.

DRAWING / DETAIL REFERENCE

084423

SPECIFICATION SECTION / PARAGRAPH

MANUFACTURER / SUPPLIER

ITEM / PRODUCT ID

REQUIRED DATE

PRIORITY

CRITICAL

ITEM BEING SUBMITTED (check only one)

- ☐ Shop Drawings
 ☐ Certification / Qualifications
 ☐ Coordination Drawing
 ☒ Samples (____ copies)
 ☐ Record Documents
 ☐ Calculations
 ☐ LEED Submittal
 ☐ Product Data
 ☐ Schedules
 ☐ O&M Manuals
 ☐ Other Calcs

ITEM BEING SUBMITTED FOR (check only one)

- ☒ Action
 ☐ Information Only
 ☐ Record

REMARKS OR DEVIATIONS

Sealed by JET.

CONTRACTOR / CM CERTIFICATION
(SUBMITTALS NOT CERTIFIED WILL BE RETURNED WITHOUT REVIEW)



PARIC CORPORATION
SUBMITTAL STAMP

THIS SHOP DRAWING HAS BEEN REVIEWED BY PARIC CORPORATION

Subcontractor remains responsible for dimensions, quantities, coordination with other trades and compliance with contract documents.

By:

Devin D. Gates

To be completed by Reviewer

08 4423-022 REV002

CANNON DESIGN SUBMITTAL NUMBER

12/8/16

RECEIVED DATE

- ☐ A. No Exceptions Taken
No further review of submittal is required.
 ☐ B. Make Corrections Noted
Incorporate corrections in work; resubmission is not required.
 ☐ C. Revise and Resubmit
Revise as noted, and resubmit for review.
 ☐ D. Rejected
Submittal is not in compliance with Contract Documents; provide new submittal.
 ☒ E. For Record / Information Only
Submittal was reviewed for Record / Information purposes only.
 ☐ F. Not Required for Review
Submittal is not required by Contract Documents and has not been reviewed.

Review is for conformance with the design concept of this project and for general compliance with contract documents. Contractor is responsible for quantities, dimensions and compliance with contract documents and for information that pertains to fabrication processes, construction techniques and coordination of this work with all trades which will be affected thereby. This review is null and void if submittal deviates from contract documents and does not indicate or note deviations.

A/E COMMENTS

☐ See attached sheet(s) for additional comments

DEVIN D GATES

REVIEWED BY

12/8/16

DATE

Kathy Williams

REVIEWED BY

12/14/18

DATE