8/6/2024

Christie Lites Coventry
40 Sayer Dr
Coventry, CV5 9PF
Attn: Ryan Brown

RE: B Truss Vertical Loading
CRE Project #: 24.915.06

Dear Ryan:

At your request, Clark Reder Engineering has reviewed the Christie Lites Type B aluminum box truss for allowable vertical loading with the Type B aluminum box truss being oriented in a vertical tower position. Load tables have been created for spans of 8' up to 40' and with K values of 1.0 and 2.1 per the requirements set forth in the 2020 Aluminum Design Manual as well as ANSI E1.2-2021, Entertainment Technology, Design, Manufacture and Use of Aluminum Truss and Towers. Attached please find the allowable loading tables for your use.

We trust this information is suitable for your needs at this time. If you have any questions, please do not hesitate to contact our office.

Regards,
Clark-Reder Engineering, Inc.

STATE OF OHIO
JEFFREY M. REDER
E-67450
08/06/2024
REGISTERED PROFESSIONAL ENGINEER

Jeffrey M. Reder, P.E.

Brett Hoog, E.I.

Clark Reder Engineering
10091 Mosteller Lane
West Chester, OH 45069

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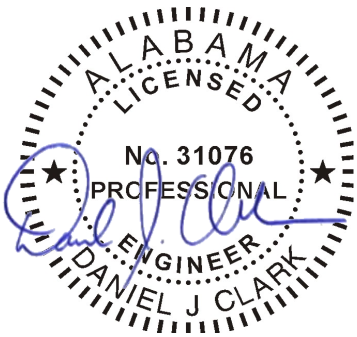
Fax: (513) 297-0934
www.clarkreder.com

Alabama	Alaska	Arizona
		
Daniel J. Clark, P.E. P.E. #: 31076	Daniel J. Clark, S.E. P.E. # SE14360	Jeffrey M. Reder, P.E. P.E. # 50654
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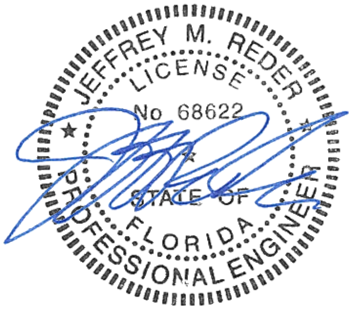

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P.E. # PE034581

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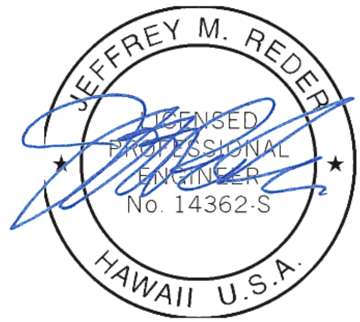

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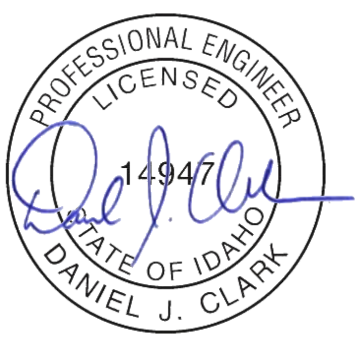

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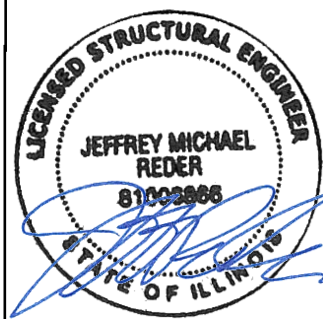

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Daniel J. Clark, P.E.
P.E. # 21809

Kentucky

Jeffrey M. Reder, P.E.
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Project: B Truss Vertical Loading
Client: Christie Lites

CRE Project #: 24.915.06
Date: 08/06/2024
Engineer: BJH

Louisiana

Jeffrey M. Reder, P.E.
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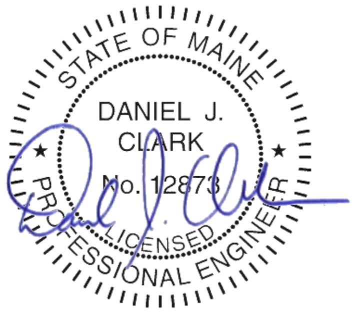
Maine



Daniel J. Clark, P.E.
P.E. # 12873

Maryland

Professional Certification: I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License # 38421,

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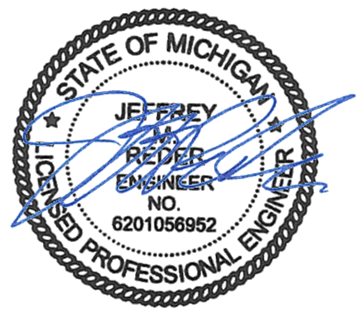
P.E. # 38421

Massachusetts

Jeffrey M. Reder, P.E.
P.E. # 48535

Michigan



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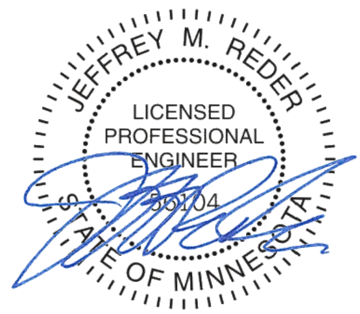

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

Date: 6/30/2024 License #: 56104

Jeffrey M. Reder, P.E.
P.E. # 56104

Mississippi

Daniel J. Clark, P.E.
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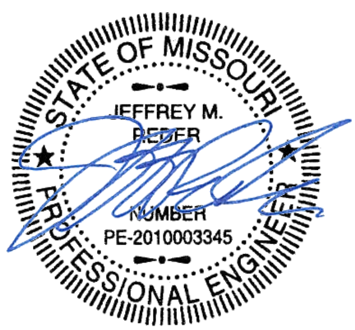
Missouri



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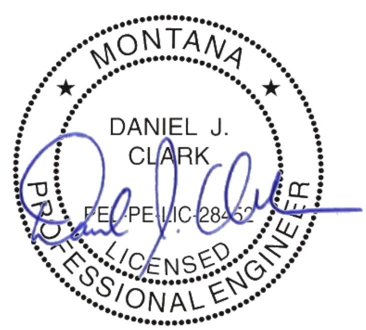

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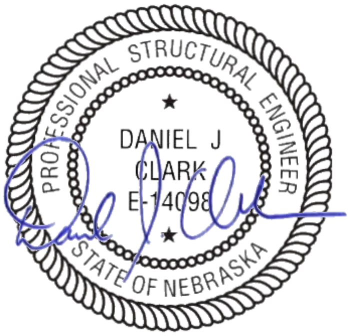

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P.E. # E-14098

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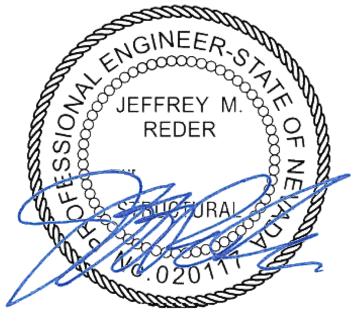

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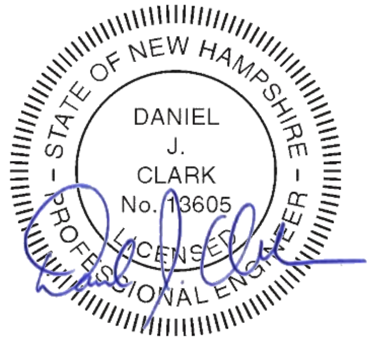
New Hampshire



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P.E. # 24GE05300600

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Jeffrey M. Reder, P.E.
P.E. # E-67450

Project: B Truss Vertical Loading
Client: Christie Lites

CRE Project #: 24.915.06
Date: 08/06/2024
Engineer: BJH

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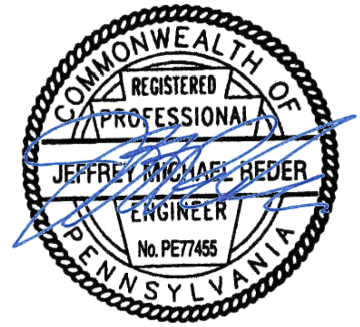
Pennsylvania



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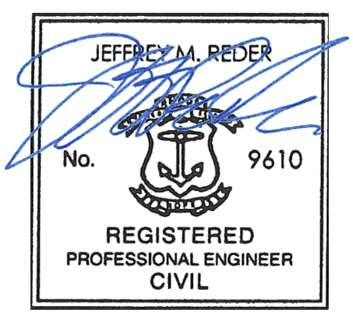

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South Carolina

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Clark Reder Engineering
F-12154

Jeffrey M. Reder, P.E.
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Project: B Truss Vertical Loading
Client: Christie Lites

CRE Project #: 24.915.06
Date: 08/06/2024
Engineer: BJH

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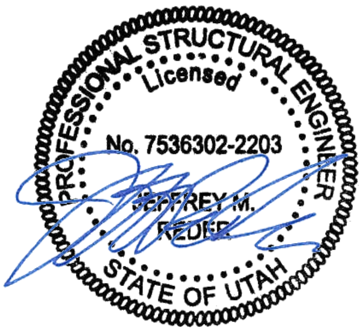	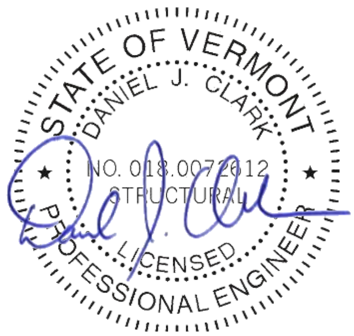	
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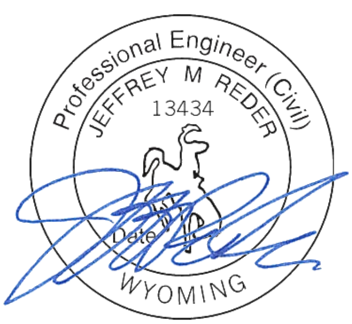		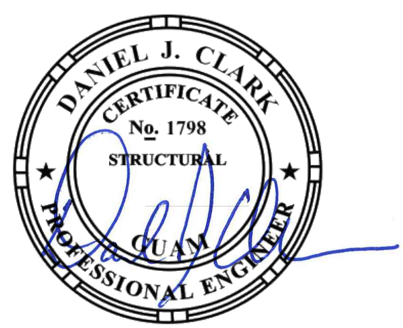
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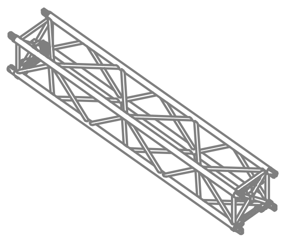
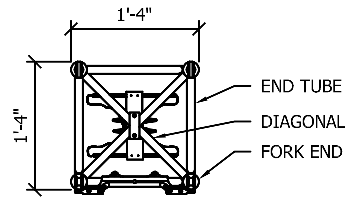
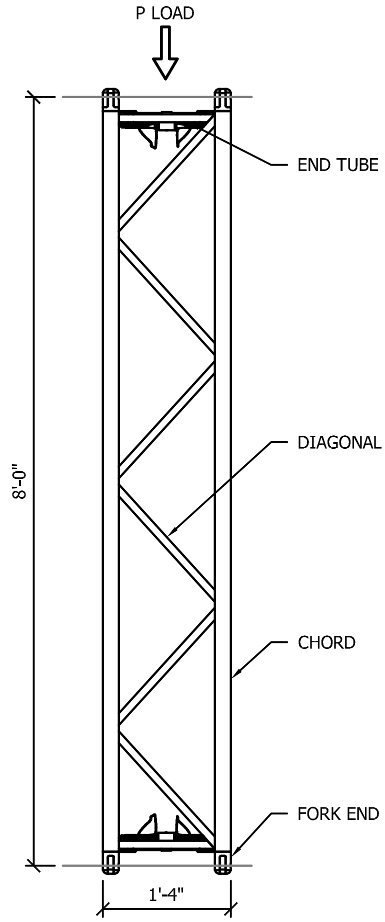


ISOMETRIC



END VIEW



ELEVATION

PARTS LIST

DIAGONALS	1"Øx1/8" TUBE
CHORDS	2"Øx1/8" TUBE
END TUBE	1"Øx1/8" TUBE
FORK ENDS	ALUMINUM

NOTES:
1. ALL ALUMINUM IS 6082-T6 OR 6061-T6
2. ALL WELD FILLER IS 4043

CHRISTIE LITES 16"x16" B-TYPE TRUSS TOWER AXIAL CAPACITY TABLE

COLUMN LENGTH	AXIAL LOAD (LBS) K = 1.0*	AXIAL LOAD (LBS) K = 2.1**
8'-0"	16,340 lbs	16,340 lbs
16'-0"	16,340 lbs	15,640 lbs
24'-0"	16,340 lbs	6,950 lbs
32'-0"	16,340 lbs	3,910 lbs
40'-0"	11,030 lbs	2,500 lbs

* ROTATION FREE AT BOTH ENDS AND TRANSLATION FIXED (TYPICAL COLUMN)

** ONE END IS FREE AND THE OTHER END IS FIXED (CANTILEVER COLUMN)

TABLE USAGE NOTES:
1. ALL CAPACITIES ASSUME NO OTHER SHEAR, FLEXURE, OR TORSIONAL FORCES ARE APPLIED TO THE COLUMN.
2. IF A POINT IS "HELD IN POSITION, BUT NOT RESTRAINED IN DIRECTION" THEN IT CAN BE CONSIDERED AS "PINNED".
3. IF A POINT IS "HELD IN POSITION AND RESTRAINED IN DIRECTION", THEN I CAN BE CONSIDERED AS "FIXED".
4. ALLOWABLE LOADS BASED ON 2020 ALUMINUM DESIGN MANUAL.

CHRISTIE LITES B-TYPE TRUSS

CLARK REDER ENGINEERING
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Cincinnati, OH 45069
513 851 1223

VERTICAL LOADING TRUSS TABLE

DATE: 8/6/2024
CRE PROJECT NO: 24.915.06
DRAWN BY: BJH/MAL

ST1.1

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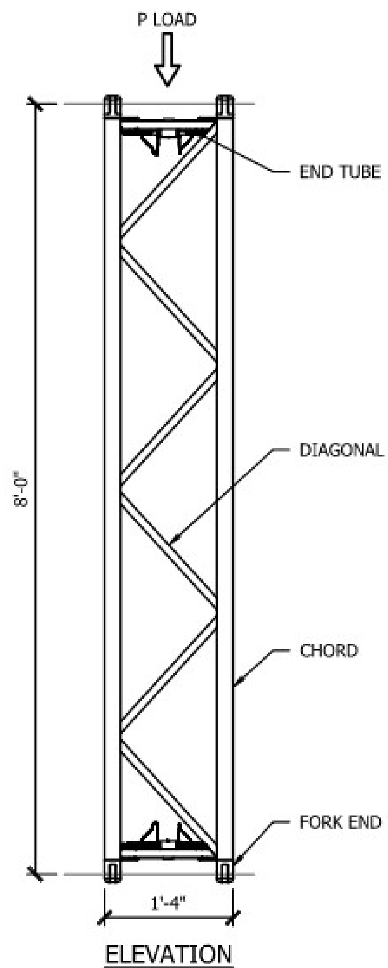
B Truss Vertical Loading

Codes and Referenced Standards

- 2021 International Building Code
- Aluminum Design Manual, 2020 ed.
- American Institute of Steel Construction, Steel Construction Manual 15th Edition
- American Society of Civil Engineers 7-16 (ASCE 7-16) *"Minimum Design Loads for Buildings and Other Structures"*
- American Society of Civil Engineers 37-14 (ASCE 37-14) *"Design Loads on Structures During Construction"*
- ANSI E 1.2-2021 *"Manufacture and Use of Aluminum Trusses and Towers"*

Project Description

Structural review of Christie Lites B Type Truss in vertical tower orientation for allowable loading.



Conceptual Image Reference

General Design - Applies To All Assemblies

Steel/Aluminum Factors of Safety

Note: The following factors/design criteria applies to all assemblies and will be used throughout design package (U.N.O).

AISC Typical Factors of Safety (U.N.O.): $\Omega_{y.AISC} := 1.67$ $\Omega_{r.AISC} := 2.0$

ADM Typical Factors of Safety (U.N.O.): $\Omega_{y.ADM} := 1.65$ $\Omega_{r.ADM} := 1.95$

ASTM A36 Mechanical Properties

Yield Strength: $F_{y.A36} := 36 \cdot ksi$

Tensile Strength: $F_{u.A36} := 58 \cdot ksi$

ASTM A572 Mechanical Properties

Yield Strength: $F_{y.A572} := 50 \cdot ksi$

Tensile Strength: $F_{u.A572} := 65 \cdot ksi$

ASTM A500 GR. B (Rectangular) Mechanical Properties

Yield Strength: $F_{y.A500.rect} := 46 \cdot ksi$

Tensile Strength: $F_{u.A500.rect} := 58 \cdot ksi$

ASTM A500 GR. B (Round) Mechanical Properties

Yield Strength: $F_{y.A500.rd} := 42 \cdot ksi$

Tensile Strength: $F_{u.A500.rd} := 58 \cdot ksi$

ASTM A992 Mechanical Properties

Yield Strength: $F_{y.A992} := 50 \cdot ksi$

Tensile Strength: $F_{u.A992} := 65 \cdot ksi$

Weld (Steel) Mechanical Properties

Weld Strength: $F_{weld} := 70 \cdot ksi \cdot 0.6 = 42.00\ ksi$

Grade 8 Bolt Mechanical Properties

Tensile Strength of Bolt: $F_{u.bolt} := 150 \cdot ksi$

6061-T6 Mechanical Properties	Unwelded	Welded
Tension Ultimate Stress:	$F_{tu.6061} := 38 \cdot ksi$	$F_{tuw.6061} := 24 \cdot ksi$
Tension Yield Stress:	$F_{ty.6061} := 35 \cdot ksi$	$F_{tyw.6061} := 15 \cdot ksi$
Compression Yield Stress:	$F_{cy.6061} := 35 \cdot ksi$	$F_{cyw.6061} := 15 \cdot ksi$
Shear yield stress:	$F_{sy.6061} := 0.6 \cdot F_{ty.6061} = 21.00\ ksi$	$F_{syw.6061} := 0.6 \cdot F_{tyw.6061} = 9.00\ ksi$
Ultimate shear stress:	$F_{su.6061} := 24 \cdot ksi$	$F_{suw.6061} := 15 \cdot ksi$
Tension coefficient:	$k_{t.6061} := 1.0$	$k_{tw.6061} := 1.0$

Buckling Constants

Table B.4.1 & B.4.2

$\kappa := 1 \cdot ksi$

Member buckling:

$$B_c := F_{cy.6061} \cdot \left(1 + \sqrt{\frac{F_{cy.6061}}{2250 \cdot \kappa}}\right) = 39.37\ ksi$$

$$D_c := \frac{B_c}{10} \cdot \sqrt{\frac{B_c}{E_a}} = 0.25\ ksi$$

$$C_c := 0.41 \cdot \frac{B_c}{D_c} = 65.67$$

$$B_{cw} := F_{cyw.6061} \cdot \left(1 + \sqrt{\frac{F_{cyw.6061}}{2250 \cdot \kappa}}\right) = 16.22\ ksi$$

$$D_{cw} := \frac{B_{cw}}{10} \cdot \sqrt{\frac{B_{cw}}{E_a}} = 0.07\ ksi$$

$$C_{cw} := 0.41 \cdot \frac{B_{cw}}{D_{cw}} = 102.30$$

Axial Load Checks - 16" Tower

Chords - 2" diameter x 0.125 tubes

Outside Diameter of Chord: $OD_c := 2 \cdot in$

Thickness of Chord: $t_c := 0.125 \cdot in$

Inside Diameter of Chord: $ID_c := OD_c - 2 \cdot t_c = 1.75\ in$

Area of Chord: $A_c := \pi \cdot \frac{\left(OD_c^{\,2} - ID_c^{\,2}\right)}{4} = 0.74\ in^2$

Moment of Inertia of Chord: $I_c := \pi \cdot \frac{\left(OD_c^{\,4} - ID_c^{\,4}\right)}{64} = 0.33\ in^4$

Section Modulus of Chord: $S_c := \pi \cdot \frac{\left(OD_c^{\,4} - ID_c^{\,4}\right)}{32 \cdot OD_c} = 0.33\ in^3$

Radius of Gyration of Chord: $r_c := \sqrt{\frac{I_c}{A_c}} = 0.66\ in$

Plastic Section Modulus of Chord: $Z_c := \frac{OD_c^{\,3}}{6} - \frac{ID_c^{\,3}}{6} = 0.44\ in^3$

D/t Ratio of Chord: $D\_t := \frac{OD_c}{t_c} = 16.00$

Slenderness Ratio of Chord: $R\_t_c := \frac{\frac{OD_c}{2} - \frac{t_c}{2}}{t_c} = 7.50$

Global Truss Properties

Truss center of chord to center of chord depth: $d_{tr} := 14 \cdot in$

Truss center of chord to center of chord width: $b_{tr} := 14 \cdot in$

Area of truss: $A_{tr} := 4 \cdot A_c = 2.95\ in^2$

Moment of inertia of truss: $I_{tr} := 4 \cdot \left(I_c + A_c \cdot \left(\frac{d_{tr}}{2} \right)^2 \right) \cdot 0.4 = 58.25\ in^4$

Radius of gyration of truss: $r_{tr} := \sqrt{\frac{I_{tr}}{A_{tr}}} = 4.45\ in$

Modulus of Elasticity of truss: $E_{tr} := 10100 \cdot ksi$

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Tower Chords

The chords are 6061-T6 aluminum.

Unbraced length of chords: $L_c := 28.58 \cdot in$

Axial Capacity

Axial tension - D.2

Allowable stress (Yield) (weld affected): $F_{t\_haz.y} := \dfrac{F_{tyw.6061}}{\Omega_{y.ADM}} = 9.09\ ksi$

Allowable stress (Rupture) (weld affected): $F_{t\_haz.r} := \dfrac{F_{tuw.6061}}{\Omega_{r.ADM}} = 12.31\ ksi$

Governing Tensile Stress: $F_{t\_haz} := min\left(F_{t\_haz.y}, F_{t\_haz.r}\right) = 9.09\ ksi$

Compression in chord - E.2

Slenderness: $\lambda_{E2.Crd} := \frac{1.0 \cdot L_c}{r_c} = 43.02$

LAMBDA 1: $\lambda_{1\_E2.Crd} := \frac{(B_c - F_{cy.6061})}{D_c} = 17.76$

LAMBDA 2: $\lambda_{2\_E2.Crd} := C_c = 66$

Allowable stress:

$$F_{c\_E2.Crd} := \frac{1}{1.65} \cdot \begin{cases} F_{cy.6061} & \text{if } \lambda_{E2.Crd} < \lambda_{1\_E2.Crd} \\ (B_c - D_c \cdot \lambda_{E2.Crd}) \cdot \left(0.85 + 0.15 \cdot \left(\frac{C_c - \lambda_{E2.Crd}}{C_c - \lambda_{1\_E2.Crd}}\right)\right) & \text{if } \lambda_{1\_E2.Crd} \le \lambda_{E2.Crd} < \lambda_{2\_E2.Crd} \\ \frac{0.85 \cdot \pi^2 \cdot E_a}{\lambda_{E2.Crd}^2} & \text{if } \lambda_{E2.Crd} > \lambda_{2\_E2.Crd} \end{cases} = 16.07 \ \mathbf{ksi}$$

$F_{c\_E2.Crd} = 16.1 \ ksi$

Compression in chord (weld affected) - E.2

Slenderness: $\lambda_{E2.Crd} := \dfrac{1.0 \cdot L_c}{r_c} = 43.02$

LAMBDA 1 $\lambda_{1\_E2.Crd.w} := \dfrac{\left(B_{cw} - F_{cyw.6061}\right)}{D_{cw}} = 18.83$

LAMBDA 2 $\lambda_{2\_E2.Crd.w} := C_{cw} = 102$

Allowable stress (weld affected):

$$F_{c\_E2.Crd.w} := \frac{1}{1.65} \cdot \begin{cases} F_{cyw.6061} & \text{if } \lambda_{E2.Crd} < \lambda_{1\_E2.Crd.w} \\ \left(B_{cw} - D_{cw} \cdot \lambda_{2\_E2.Crd.w}\right) \cdot \left(0.85 + 0.15 \cdot \left(\dfrac{C_{cw} - \lambda_{E2.Crd}}{C_{cw} - \lambda_{1\_E2.Crd.w}}\right)\right) & \text{if } \lambda_{1\_E2.Crd.w} \le \lambda_{E2.Crd} < \lambda_{2\_E2.Crd.w} \\ \dfrac{0.85 \cdot \pi^2 \cdot E_a}{\lambda_{E2.Crd}^{\ 2}} & \text{if } \lambda_{E2.Crd} > \lambda_{2\_E2.Crd.w} \end{cases} = 5.55 \ \textbf{ksi}$$

$F_{c\_E2.Crd.w} = 5.5 \ ksi$

Chord tension capacity: $T_c := A_c \cdot F_{t\_haz}$ $T_c = 6.69 \ kip$

Chord compression capacity: $C_c := A_c \cdot min\left(F_{c\_E2.Crd}, F_{c\_E2.Crd.w}\right)$ $C_c = 4.09 \ kip$

Tower capacity based on chord local buckling: $P_{c\_tower\_local} := 4 \cdot C_c$ $P_{c\_tower\_local} = 16.34 \ kip$

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Aluminum Forked End

6061-T6 Extrusion Mechanical Properties

	Unwelded	Welded
Tension Yield Stress:	$F_{ty} := 35 \cdot ksi$	$F_{tyw} := 15 \cdot ksi$
Ultimate Tensile Stress:	$F_{tu} := 38 \cdot ksi$	$F_{tuw} := 24 \cdot ksi$
Compression Yield Stress:	$F_{cy} := 35 \cdot ksi$	$F_{cyw} := 15 \cdot ksi$
Shear yield stress:	$F_{sy} := 0.6 \cdot F_{ty} = 21.00\ ksi$	$F_{syw} := 0.6 \cdot F_{tyw} = 9.00\ ksi$
Ultimate shear stress:	$F_{su} := 24 \cdot ksi$	$F_{suw} := 15 \cdot ksi$
Tension coefficient:	$k_t := 1.0$	
Thickness of fork:	$t_m := .69 \cdot in$	
Center of hole to edge:	$L_m := 1 \cdot in$	
Center of hole to end:	$L_{m\_end} := 1.732 \cdot in$	
Height of plate:	$h_m := 2 \cdot in$	
Diameter of hole:	$d_{m\_hole} := .625 \cdot in$	

Axial tension - D.2a/b

Allowable stress gross section: $F_{t\_D.2\_a} := 21.2 \cdot ksi$

Allowable gross tension: $P_{m\_gross} := F_{t\_D.2\_a} \cdot t_m \cdot h_m$ $\quad P_{m\_gross} = 29.26\ kip$

Allowable stress net section: $F_{t\_D.2\_b} := 19.5 \cdot ksi$

Allowable net tension: $P_{m\_net} := F_{t\_D.2\_b} \cdot t_m \cdot \left(h_m - d_{m\_hole} + \frac{1}{32} \cdot in\right)$ $\quad P_{m\_net} = 18.92\ kip$

Bearing - J.6.5

Allowable stress bearing:

$$F_{t\_J.3.7} := 25.9 \cdot ksi$$

Allowable bearing:

$$P_{m\_brg} := \frac{L_m \cdot t_m \cdot F_{tu}}{1.5} = 17480.00\ lbf \qquad P_{m\_brg} = 17.48\ kip$$

Allowable Bearing Check

$$Limit := 1.33 \cdot d_{m\_hole} \cdot t_m \cdot F_{tu} = 21795.38\ lbf$$

Check to see if J.6.5 Conditions are met

$$Check := \begin{Vmatrix} \text{if } P_{m\_brg} < Limit \\ \quad \Vert \text{"VALID"} \\ \text{else} \\ \quad \Vert \text{"NOT VALID"} \end{Vmatrix} = \text{"VALID"}$$

Compression - E.3:

Unbraced length: $L_c := L_{m\_end}$

Plate moment of inertia: $Iy_m := \frac{1}{12} \cdot h_m \cdot t_m^{\ 3}$ $\qquad Iy_m = 0.05\ in^4$

Area of plate: $A_m := t_m \cdot h_m$ $\qquad A_m = 1.38\ in^2$

Radius of gyration: $ry_m := \sqrt{\frac{Iy_m}{A_m}}$ $\qquad ry_m = 0.20\ in$

Slenderness: $S_{E.3} := \frac{2.1 \cdot L_{m\_end}}{ry_m}$ $\qquad S_{E.3} = 18.26$

Allowable stress:

$$F_{vert\_E.3} := \begin{cases} \text{if } S_{E.3} \le 17.8 \\ \quad (21.2 \cdot ksi) \\ \text{if } (0 < S_{E.3}) \wedge (66 > S_{E.3}) \\ \quad \left(0.00047 \cdot S_{E.3}^{\ 2} - 0.232 \cdot S_{E.3} + 25.2\right) \cdot ksi \\ \text{if } 66 < S_{E.3} \\ \quad \left(\frac{51352}{S_{E.3}^{\ 2}}\right) \cdot ksi \end{cases}$$

$F_{vert\_E.3} = 21.1\ ksi$

Allowable compression:

$P_{m\_comp} := F_{vert\_E.3} \cdot t_m \cdot h_m$ $\qquad P_{m\_comp} = 29.15\ kip$

Allowable axial force in fork:

$P_{allow\_fork} := min\left(P_{m\_gross}, P_{m\_net}, P_{m\_brg}, P_{m\_comp}\right)$

$P_{allow\_fork} = 17.48\ kip$

Diameter of pin: $d_{pin} := .625 \cdot in$

Pin yield strength: $Fy_{pin} := 50 \cdot ksi$

Pin tensile strength: $Fu_{pin} := 65 \cdot ksi$

Pin shear capacity:

The pin will be in double shear. Use Table J3.2 for nominal stress of fasteners.

Nominal shear stress: $F_{nv\_pin} := 0.5 \cdot Fu_{pin}$ $\quad F_{nv\_pin} = 32.50\ ksi$

Area of pin: $A_{pin} := \dfrac{\pi \cdot {d_{pin}}^2}{4}$ $\quad A_{pin} = 0.31\ in^2$

Available double shear capacity of pin: $V_{a\_pin} := \dfrac{F_{nv\_pin} \cdot A_{pin}}{2} \cdot 2$ $\quad V_{a\_pin} = 9.97\ kip$

Split Pins

The forks are connected to the aluminum with Split Pins. The Spirol pins are coiled 3/8" diameter pins Use a factor of safety of 2 on the coil pins.

Capacity of coiled spirol pin in double shear: $P_{allow\_split\_pin} := 16 \cdot kip$

There are two pins therefore allowable load is: $P_{allow\_split} := \frac{(2 \cdot P_{allow\_split\_pin})}{2}$ $P_{allow\_split} = 16.00\ kip$

Aluminum Bearing

The aluminum chord to split pin bearing shall be checked. There are (4) bearing surfaces.

Thickness of truss chord: $t_{chord} := t_c$

Diameter of coil pin: $d_{split\_pin} := 0.375 \cdot in$

Allowable pin bearing strength in aluminum: $P_{brg\_al} := 4 \cdot t_{chord} \cdot d_{split\_pin} \cdot 39 \cdot ksi$ $P_{brg\_al} = 7.31\ kip$

assumes non-weld affected areas

Truss Allowable Capacity

The allowable moment and shear capacity of the truss will be determined from the capacities determined above.

Minimum axial force in chord: $P_{chord\_min} := min(T_c, C_c, P_{brg\_al}, P_{allow\_fork})$ $P_{chord\_min} = 4.09\ kip$

Allowable truss moment capacity: $M_{truss} := min(2 \cdot d_{tr} \cdot P_{chord\_min})$ $M_{truss} = 9.53\ ft \cdot kip$

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Overall Tower Buckling (Global Check) - K = 1.0

At member lengths longer than Lc, the global buckling will control the compressive capacity of the tower.

Effective Length Factor: $K_{eff} := 1.0$

Length of Colum Lc: $L_{column} := \frac{r_{tr}}{K_{eff}} \cdot \sqrt{\frac{0.85 \cdot 51352 \cdot ksi}{min\left(F_{c\_E2.Crd}, F_{c\_E2.Crd.w}\right)}} = 32.87\ ft$

Length of Column: $L_{col} := \begin{bmatrix} 8 \\ 16 \\ 24 \\ 32 \\ 40 \end{bmatrix} \cdot ft$ $\qquad i2 := 1 .. 5$

Overall Global Strength: $P_{allow_{i2}} := \frac{0.85 \cdot 51352 \cdot ksi}{\left(\frac{\left(K_{eff} \cdot L_{col}\right)_{i2,1}}{r_{tr}}\right)^2} \cdot A_{tr}$ $\qquad P_{allow} = \begin{bmatrix} 275.87 \\ 68.97 \\ 30.65 \\ 17.24 \\ 11.03 \end{bmatrix} kip$

Controlling Compressive Strength: $P_{all.tower_{i2}} := min\left(P_{allow_{i2}}, P_{c\_tower\_local}\right)$

$$P_{all.tower} = \begin{bmatrix} 16.34 \\ 16.34 \\ 16.34 \\ 16.34 \\ 11.03 \end{bmatrix} kip$$

Overall Tower Buckling (Global Check) - K = 2.1

At member lengths longer than Lc, the global buckling will control the compressive capacity of the tower.

Effective Length Factor: $K_{eff} := 2.1$

Length of Colum Lc: $L_{column} := \frac{r_{tr}}{K_{eff}} \cdot \sqrt{\frac{0.85 \cdot 51352 \cdot ksi}{min\left(F_{c\_E2.Crd}, F_{c\_E2.Crd.w}\right)}} = 15.65\ ft$

Length of Column: $L_{col} := \begin{bmatrix} 8 \\ 16 \\ 24 \\ 32 \\ 40 \end{bmatrix} \cdot ft$

$i2 := 1 \,..\, 5$

Overall Global Strength: $P_{allow_{i2}} := \frac{0.85 \cdot 51352 \cdot ksi}{\left(\frac{\left(K_{eff} \cdot L_{col}\right)_{i2,1}}{r_{tr}}\right)^2} \cdot A_{tr}$

$P_{allow} = \begin{bmatrix} 62.56 \\ 15.64 \\ 6.95 \\ 3.91 \\ 2.50 \end{bmatrix} kip$

Controlling Compressive Strength: $P_{all.tower_{i2}} := min\left(P_{allow_{i2}}, P_{c\_tower\_local}\right)$

$P_{all.tower} = \begin{bmatrix} 16.34 \\ 15.64 \\ 6.95 \\ 3.91 \\ 2.50 \end{bmatrix} kip$