CD150201

Hilti Anchors

From PROFIS

$U = 3300/1.6 = 2063 \text{ lb}$

$P_1 = 1150/1.6 = 719 \text{ lb}$

Pullover $P_{cov} = 720 \text{ lb}$

$U = 4(770/2) = 1540 \text{ lb}$

Seismic

$U = 990(.7) = 693 \text{ lb}$

$P_1 = 340(.7) = 238 \text{ lb}$

Screws

$P_{as} = 205 \text{ lb}$ flat

$P_{as} = 121 \text{ lb}$ lip

$R_v = U = P_1 = 8(205+121) = 2608 \text{ lb}$

Clips

$T_a = 2303 \text{ lb}$

$P_a = 1379 \text{ lb}$

$V_a = 4347 \text{ lb}$

$M_a = 3447 \text{ lb}$

$U = 2(2303) = 4606 \text{ lb}$

$R_v = 2(1379) = 2758 \text{ lb}$

$P_1 \quad \frac{720}{2(4347)} + \frac{720(1.325)}{2(3447)} = 0.2264$

$R_v = 2600 \text{ lb}$

$U = 1540 \text{ lb}$

$P_1 = 719 \text{ lb}$

Seismic

$R_v = 2600 \text{ lb}$

$U = 693 \text{ lb}$

$P_1 = 238 \text{ lb}$

(A)

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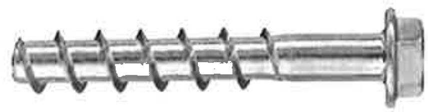
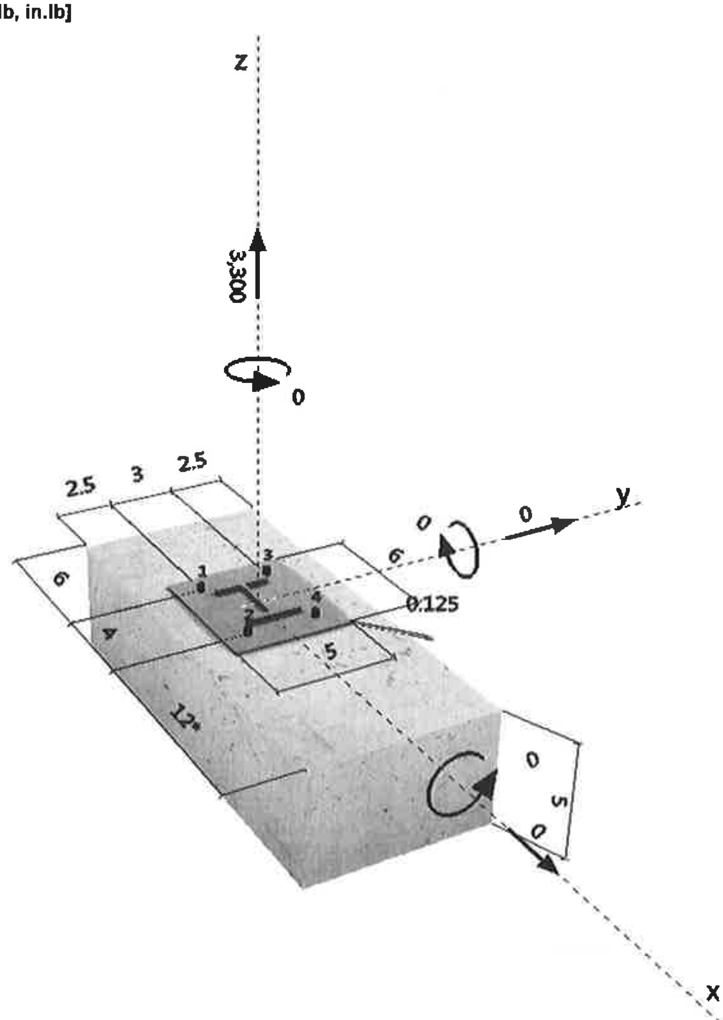
Specifier's comments:

1 Input data



Anchor type and diameter:	**KWIK HUS-EZ (KH-EZ) 1/4 (2 1/2)**
Effective embedment depth:	h_{ef} = 1.920 in., h_{nom} = 2.500 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-3027
Issued I Valid:	6/1/2014 | 12/1/2015
Proof:	Design method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.125 in.
Anchor plate:	l_x x l_y x t = 6.000 in. x 5.000 in. x 0.125 in.; (Recommended plate thickness: not calculated)
Profile:	S shape (AISC); (L x W x T x FT) = 3.000 in. x 2.330 in. x 0.170 in. x 0.260 in.
Base material:	cracked concrete, 3000, f_c' = 3000 psi; h = 5.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

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



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2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	Proof	Load	Capacity	β_N / β_V [%]	Status
Tension	Pullout Strength	825	830	100 / -	OK
Shear	-	-	-	- / -	-

Loading	β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
Combined tension and shear loads	-	-	-	-	-

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

4 Remarks; Your Cooperation Duties

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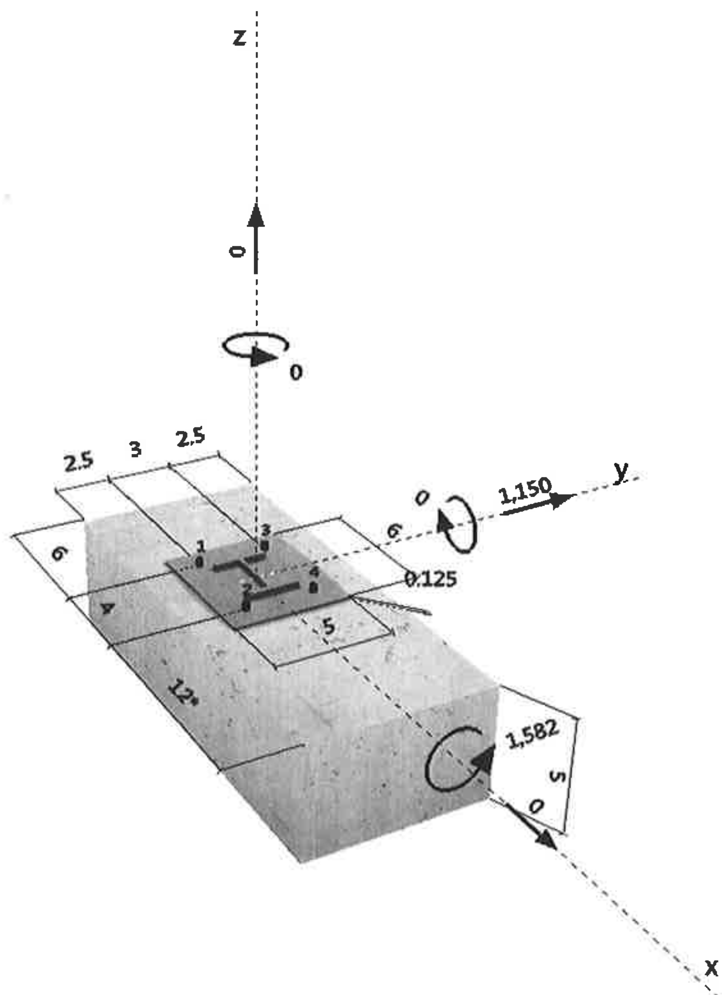
Base material:	cracked concrete, 3000, f_c' = 3000 psi; h = 5.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

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



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2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	Proof	Load	Capacity	β_N / β_V [%]	Status
Tension	Pullout Strength	210	830	26 / -	OK
Shear	Concrete edge failure in direction y+	1150	1223	- / 95	OK

Loading	β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
Combined tension and shear loads	0.253	0.940	1.0	100	OK

3 Warnings

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Fastening meets the design criteria!

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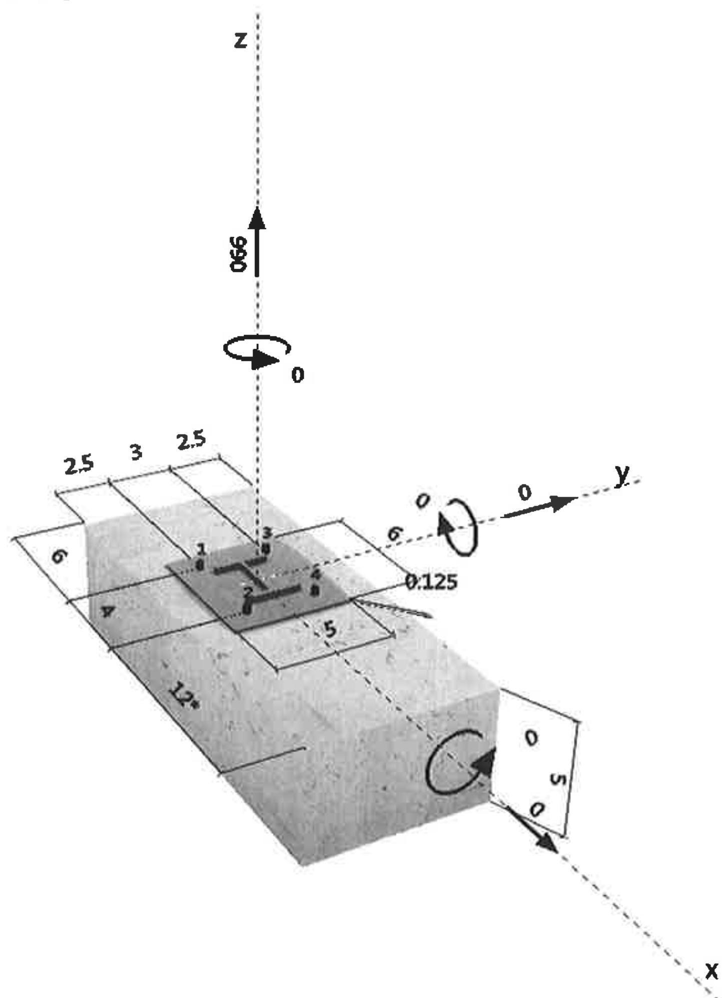
Base material:	cracked concrete, 3000, f_c' = 3000 psi; h = 5.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	yes (D.3.3.6)

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



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2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Pullout Strength	248	249	100 / -	OK
Shear	-	-	-	- / -	-

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	-	-	-	-	-

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Fastening meets the design criteria!

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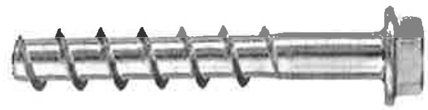

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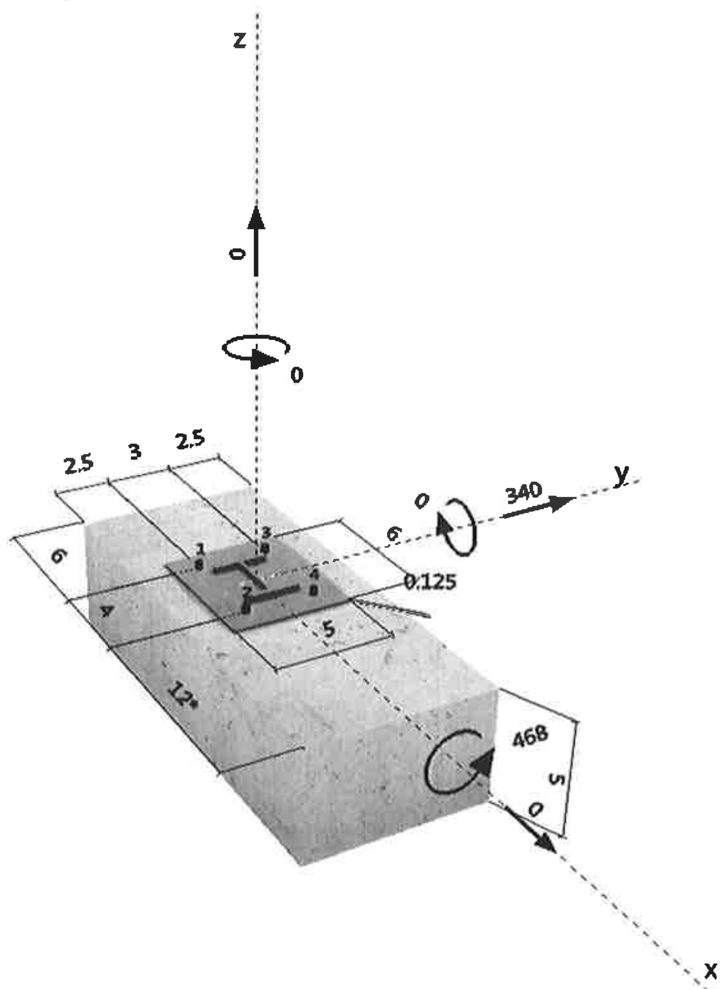
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	yes (D.3.3.6)

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



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2 Proof I Utilization (Governing Cases)

Loading	Proof	Design values [lb] Load	Capacity	Utilization β_N / β_V [%]	Status
Tension	Pullout Strength	62	249	25 / -	OK
Shear	Concrete edge failure in direction y+	340	367	- / 93	OK

Loading	β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
Combined tension and shear loads	0.249	0.927	5/3	98	OK

3 Warnings

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TrusSteel®
Division of ITW Building Components Group, Inc.

Allowable Pullover and Pullout Values for Screws per AISI NASpec (2004, 2001, 1986/89)

Variables to be Entered by User:

t1 (in) =	**0.0713**	Thickness of member in contact with screw head
tc (in) =	**0.0346**	Lesser of depth of penetration and thickness of member NOT in contact with screw head
dw (in) =	**0.48**	Larger of screw head diameter and washer diameter
Fu1 (psi) =	**45000**	Tensile strength of member in contact with screw head
Fu2 (psi) =	**55000**	Tensile strength of member NOT in contact with screw head
d (in) =	**0.25**	Nominal screw diameter
Ω =	3	Safety factor

Allowable Pullover

770.04

Pa ov = 770 *

Allowable Pullout

134.7958

Pa ot = 135 *

* TrusSteel recommends to not exceed the maximum fastener values given below:

Fastener Type	Allowable Tensile Value for Fastener (lbs)
# 8 SDS generic	441
#10 SDS generic	470
#12 SDS generic	1008 ♦
#14 SDS generic	1418 ♦
#14 Alpine fastener	927

- Generic SDS values are based on Section E4.4.3 of the AISI 2004 North American Specification
- Alpine fastener value is based on Section F1.2 of the AISI 2004 North American Specification
- The values given above are maximum allowable values for tensile failure of the fastener itself
- See additional sheets for test data and other applicable notes.

♦ **TrusSteel does not recommend exceeding 927 lbs. (tension limit for AMS fasteners), since hardness data for non-Alpine fasteners is not known.**

#8	441
#10	470
#12	927
#14	927

TrusSteel®
Division of ITW Building Components Group, Inc.

Allowable Shear Values for Screws per AISI North American Specification (2010, 2007, 2004, 2001, 1986/89)

t1 (in) =	0.0713	*Thickness of member in contact with the screw head*
t2 (in) =	0.0299	*Thickness of member not in contact with the screw head*
d (in) =	0.1900	*Nominal screw diameter*
Fu1 (ksi) =	45	*Tensile strength of member in contact with the screw head*
Fu2 (ksi) =	65	*Tensile strength of member not in contact with the screw head*

Calculate Pas for Reduced End Distance?	yes	yes or no
reduced end distance =	0.1875	inches
t1 or t2 has reduced end dist?	t2	

Per Section E4 amd E4.3 of AISI S100-2007:

t2/t1= 0.4194 ratio of material thicknesses

For t2/t1 <= 1.0

P_{ns1} =	0.61524	kips (tilting failure)
P_{ns2} =	1.64596	kips (bearing failure)
P_{ns3} =	0.99702	kips (bearing failure)
minimum P_{ns} =	0.61524	kips

For t2/t1 >= 2.5

P_{ns4} =	1.64596	kips (bearing failure)
P_{ns5} =	0.99702	kips (bearing failure)
minimum P_{ns} =	N/A	kips

For 1.0 < t2/t1 < 2.5

Linearvalue =	0.46746	kips (linearly interpolated value)
P_{ns} =	N/A	kips

P_{ns} = 0.61524

Ω = 3.00

P_{as} = 205.080787 lbs per screw (for full end distance of 3d)

Per Section E4.3.2 of AISI S100-2007:

$$P_{ns} = teF_u$$

Where:

t =	0.0299	in
e =	0.1875	in
Fu =	65	ksi

Ω = 3.00

Reduced P_{as} = 121.469 lbs per screw
(for reduced end distance of 0.19 inches)

TRUSSTEEL RECOMMENDS NOT TO EXCEED THE MAXIMUM SHEAR VALUES GIVEN IN TABLE 1

Table 1.

Fastener Type	Allowable Shear Value for Fastener (lbs)
# 8 SDS generic	390
#10 SDS generic	523
#12 SDS generic	692
#14 SDS generic	864
#14 Alpine fastener	971

- Generic SDS values are based on Section E4.3.3 of the AISI 2004 North American Specification
- Alpine fastener value is based on Section F1.2 of the AISI 2004 North American Specification
- The values given above are maximum allowable values for shear failure of the fastener, itself; This is only one limit state. Tilting (if applicable) and bearing failures must also be checked for connections of fasteners.
- See additional sheets for test data and other applicable notes.

Calculating Allowable Shear Per AISI NASpec (2012, 2007, 2004, 2001)

User Entered Values:

E (psi) =	29500000
Fy (psi) =	33000
h (in) =	5
t des (in) =	0.0713
kv =	5.34
Design Method	ASD

Aw (in²) =	0.3565
h/t =	70.12622721
√E(kv)/Fy =	69.09150717
1.51√E(kv)/Fy =	104.3281758

Determining Fv for all 3 cases; S100 C3.2.1

h/t ≤ √E(kv)/Fy

Fv (psi) = **19800.00000** *steel yielding/ripping*

√E(kv)/Fy < h/t ≤ 1.51√E(kv)/Fy

Fv (psi) = **19507.84887** *inelastic shear buckling*

h/t > 1.51√E(kv)/Fy

Fv (psi) = **28958.14607** *elastic shear buckling*

ASD	0.625
LSD	0.8
LRFD	0.95

Choose Fv;

Fv (psi) =	19507.84887
Vn (lbs) for 1 sheet =	6954.548121
Va (lbs) for 1 sheet =	**4346.59258**

TrusSteel®
An ITW Company

Allowable Tension of a Steel Sheet per AISI NASpec

AISI S100 2007/S2-10, S100-2012

User input variables:

Design Method:	ASD	
t(des) (in) =	0.0713	*plate design thickness*
width (in) =	5.00	*plate dimention perpendicular to tension load*
Fy (psi) =	33000	*Yield Strength of plate*
Fu (psi) =	45000	*Ultimate Strength of plate*
fastener type:	DS/Bolt	*SS, DS, Bolt or Weld*
d (in) =	0.3750	*fastener diameter*
L (in) =	0.0000	*total weld length*
# holes =	2	*number of holes in tension cross section*
Enet =	1.00	*clear distance between end of material and hole*
Us1 =	0.3750	*shear lag factor Table E5.2-1* — 0.375 = 2.5d/s where
Ag (in^2) =	0.356500	*Gross Area* — s = width/# of fasteners

a) Yielding in the gross section - C2.1 Ωt = 1.67 Φ= 0.90

$T_n = A_g F_y$ T_n = 11764.500 lbs

$T_a = \frac{T_n}{\Omega}$ **T_a = 7045.000** lbs

b) Fracture away from connections - C2.2 Ω = 2.00 Φ= 0.75

number of holes in steel plate = 2

$An = Ag - [(\text{\# of holes})(d)(t_{des})]$ or $(\text{weld length})(t_{des})$

A_n = 0.3030 in2

$T_n = A_n F_u$ T_n = 13636.125 lbs

$T_a = \frac{T_n}{\Omega}$ **T_a = 6818.000** lbs

c) Tension Rupture - E6.2 of AISI S100 2012

Us1 = 0.3750 $A_e = U_{s1}A_n$ = 0.1136 in^2

$T_n = F_u A_e$ Ω = 2.22

T_n = 5113.55 lbs Φ= *0.45*

Ta = 2303.40 lbs

d) Shear Rupture - E6.1 of AISI S100 2012

Enet 1.0000 $A_{nv} = 2nte_{net}$ = 0.2852 in^2

$T_n = 0.6F_u A_{nv}$ Ω = 2.22

T_n = 7700.40 lbs Φ= *0.45*

Ta = 3468.65 lbs

Allowable Tension = 2303 lbs

TrusSteel® An ITW Company

Allowable Tension of a Steel Sheet per AISI NASpec

AISI S100 2007/S2-10, S100-2012

User input variables:

Design Method:	ASD	
t(des) (in) =	0.0713	*plate design thickness*
width (in) =	5.00	*plate dimention perpendicular to tension load*
Fy (psi) =	33000	*Yield Strength of plate*
Fu (psi) =	45000	*Ultimate Strength of plate*
fastener type:	SS	*SS, DS, Bolt or Weld*
d (in) =	0.1900	*fastener diameter*
L (in) =	0.0000	*total weld length*
# holes =	4	*number of holes in tension cross section*
Enet =	1.00	*clear distance between end of material and hole*
Us1 =	1.0000	*shear lag factor Table E5.2-1* 0.380 = 2.5d/s where
Ag (in^2) =	0.356500	*Gross Area* s = width/# of fasteners

a) Yielding in the gross section - C2.1 Ωt = 1.67 Φ= 0.90

$T_n = A_g F_y$ T_n = 11764.500 lbs

$T_a = \frac{T_n}{\Omega}$ **T_a = 7045.000** lbs

b) Fracture away from connections - C2.2 Ω = 2.00 Φ= 0.75

number of holes in steel plate = 4

$An = Ag - [(\#\text{ of holes})(d)(t_{des})]\text{ or }(\text{weld length})(t_{des})$

A_n = 0.3023 in2

$T_n = A_n F_u$ T_n = 13604.040 lbs

$T_a = \frac{T_n}{\Omega}$ **T_a = 6802.000** lbs

c) Tension Rupture - E6.2 of AISI S100 2012

Us1 = 1.0000 $A_e = U_{s1}A_n$ = 0.3023 in^2

$T_n = F_u A_e$ Ω = 3

T_n = 13604.04 lbs Φ= *0.33*

Ta = 4534.68 lbs

d) Shear Rupture - E6.1 of AISI S100 2012

Enet 1.0000 $A_{nv} = 2nte_{net}$ = 0.5704 in^2

$T_n = 0.6F_u A_{nv}$ Ω = 3

T_n = 15400.80 lbs Φ= *0.33*

Ta = 5133.60 lbs

Allowable Tension = 4535 lbs

CFS Version 8.0.1
Section: 10 GAGE PLATE.sct
SM CHORD - CUT BACK SECTION

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Section Inputs

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Material: A653 SS Grade 33
No strength increase from cold work of forming.
Modulus of Elasticity, E        29500000 psi
Yield Strength, Fy                 33000 psi
Tensile Strength, Fu               45000 psi
Warping Constant Override, Cw          0 in^6
Torsion Constant Override, J           0 in^4

Part 1, Thickness 0.0713 in (14 Gage)
Placement of Part from Origin:
X to center of gravity          0 in
Y to center of gravity          0 in
Outside dimensions, Open shape
        Length      Angle     Radius  Web      k     Hole Size    Distance
          (in)      (deg)       (in)         Coef.        (in)        (in)
  1     5.0000     90.000    0.10690 None    2.000      0.0000      2.5000
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Member Check - 2010 North American Specification - US (ASD)

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Material Type: A653 SS Grade 33, Fy=33000 psi
Design Parameters:
Lx          3.00 in     Ly          3.00 in     Lt          3.00 in
Kx        1.0000        Ky        1.0000        Kt        1.0000
Cbx       1.0000        Cby       1.0000        ex        0.0000 in
Cmx       1.0000        Cmy       1.0000        ey        0.0000 in
Braced Flange: None     kφ             0 lb
Red. Factor, R: 0       Lm        240.00 in

Loads:            P          Mx          Vy         My          Vx
                (lb)     (lb-in)        (lb)     (lb-in)       (lb)
Entered          0.0         0.0         0.0        0.0         0.0
Applied          0.0         0.0         0.0        0.0         0.0
Strength      1378.9      3447.0         0.0       83.7         0.0

Effective section properties at applied loads:
Ae       0.35650 in^2   Ixe      0.74271 in^4   Iye      0.00015 in^4
                        Sxe(t)   0.29708 in^3   Sye(l)   0.00424 in^3
                        Sxe(b)   0.29708 in^3   Sye(r)   0.00424 in^3

Interaction Equations
NAS Eq. C5.2.1-1  (P, Mx, My)  0.000 + 0.000 + 0.000 = 0.000 <= 1.0
NAS Eq. C5.2.1-2  (P, Mx, My)  0.000 + 0.000 + 0.000 = 0.000 <= 1.0
NAS Eq. C3.3.1-1     (Mx, Vy)     Sqrt(0.000 + 9.999)= 3.162 >  1.0
NAS Eq. C3.3.1-1     (My, Vx)     Sqrt(0.000 + 9.999)= 3.162 >  1.0

Section contains no web elements for vertical shear.
Section contains no web elements for horizontal shear.
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