



KFS FRAMEMAKER 1622 SECTION PROPERTY MANUAL



Version 2025.1

 **SCOTTSDALE**
THE TRUSTED STEEL-FRAMING PARTNER

DISCLOSURES

The SCOTTSDALE CONSTRUCTION SYSTEMS mission is to take care of its customers by being the safest, highest quality, lowest cost, most productive and most profitable load bearing light gauge steel framing products company in the world.

This manual collects all the current practices, methods, tools and organization that SCOTTSDALE CONSTRUCTION SYSTEMS utilizes to ensure the quality of its products. These elements together with this manual constitute SCOTTSDALE CONSTRUCTION SYSTEMS Production Quality Assurance System for all of its manufacturing facilities. The information compiled here will be helpful for the purposes of training, audits, internal and external reviews.

The contents of this manual will be reviewed annually and updated as required by the Industrial Engineering function within the manufacturing organization for SCOTTSDALE CONSTRUCTION SYSTEMS, to assure accuracy and completeness of the information.

KFS FRAMEMAKER 1622

SECTION PROPERTY MANUAL

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SECTION I INTRODUCTION

KFS FRAMEMAKER 1622

The KFS FRAMEMAKER 1622 is ideally suited for load-bearing structural applications in both commercial and residential sectors. This manual details the section properties of the profiles that can be manufactured using the KFS FRAMEMAKER 1622. The profile shapes that can be produced with the KFS FRAMEMAKER 1622 are illustrated below.

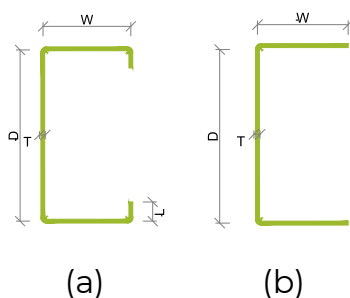


Figure 1 (a) Lipped Channel Section (b) Unlipped Channel Section

Legend

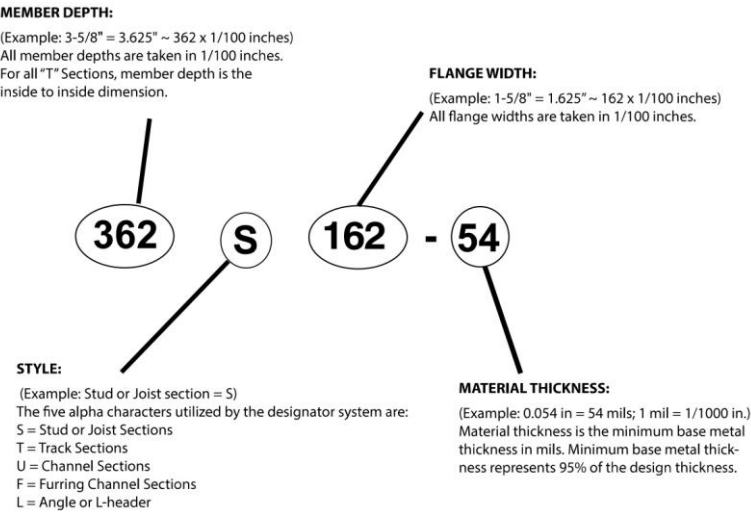
D = Section depth
 W = Section width
 L = Lip length
 T = Section thickness

Section properties are crucial parameters required for structural design purposes. The KFS FRAMEMAKER 1622 produces sections that comply with SFIA/CSSBI specifications. The section properties and strength, according to North American Specification for the Design of Cold-Formed Steel Structural Members (AISI S100-16) for stud and track sections that can be manufactured using the KFS FRAMEMAKER 1622 are computed and listed below.

SECTION II NAMING CONVENTIONS

SFIA NAMING CONVENTIONS

SFIA naming conventions are used throughout this manual. An example of the typical naming conventions and their corresponding explanations are shown below.



The table below also shows commonly used material thicknesses and stiffening length conversions.

Thickness Table

Designation Thickness (Mils)	Minimum Thickness ¹ (in)	Design Thickness (in)	Design Inside Corner Radii ² (in)	Reference Gauge No.
18	0.0179	0.0188	0.0844	25
27	0.0269	0.0283	0.0796	22
30	0.0296	0.0312	0.0782	20-Drywall
33	0.0329	0.0346	0.0765	20-Structural
43	0.0428	0.0451	0.0712	18
54	0.0538	0.0566	0.0849	16
68	0.0677	0.0713	0.1070	14
97	0.0966	0.1017	0.1526	12
118	0.1180	0.1242	0.1863	10

Stiffening Lip Length

Section	Flange Width	Design Stiffening Lip Length (in)
S125	1 1/4"	0.188
S137	1 3/8"	0.375
S162	1 5/8"	0.500
S200	2"	0.625
S250	2 1/2"	0.625
S300	3"	0.625
S350	3 1/2"	1.000

SECTION III STUD SECTION PROPERTY AND STRENGTH

350S162-27

Full Section Properties

Area	0.21157 in ²	Wt.	0.71933 lb/ft	Flat	7.4758 in
I _x	0.41889 in ⁴	r _x	1.4071 in	I _{xy}	0.00000 in ⁴
S _x (t)	0.23936 in ³	y(t)	1.7500 in	α	0.000 deg
S _x (b)	0.23936 in ³	y(b)	1.7500 in		
Z _x	0.27523 in ³	Height	3.5000 in		
I _y	0.08127 in ⁴	r _y	0.6198 in	x _o	-1.3298 in
S _y (l)	0.14898 in ³	x(l)	0.5455 in	y _o	0.0000 in
S _y (r)	0.07529 in ³	x(r)	1.0795 in	j _x	2.0405 in
Z _y	0.11066 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	0.41889 in ⁴	r ₁	1.4071 in	C _w	0.22059 in ⁶
I ₂	0.08127 in ⁴	r ₂	0.6198 in	J	0.00005648 in ⁴
I _c	0.50016 in ⁴	r _c	1.5376 in		
I _o	0.87428 in ⁴	r _o	2.0328 in		

Net Section Properties

I _x	0.41093 in ⁴	r _x	1.5588 in	Area	0.16912 in ²
S _x (t)	0.23482 in ³	y(t)	1.7500 in	I _{xy}	0.00000 in ⁴
S _x (b)	0.23482 in ³	y(b)	1.7500 in	α	0.000 deg
Z _x	0.25931 in ³				
I _y	0.06628 in ⁴	r _y	0.6260 in	x _o	-1.4786 in
S _y (l)	0.09762 in ³	x(l)	0.6789 in	y _o	0.0000 in
S _y (r)	0.07005 in ³	x(r)	0.9461 in	j _x	1.8136 in
Z _y	0.09534 in ³			j _y	0.0000 in
I _c	0.47720 in ⁴	r _c	1.6798 in	C _w	0.21542 in ⁶
I _o	0.84695 in ⁴	r _o	2.2379 in	J	0.00004515 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, $F_y=50$ ksi

Axial		Positive Bending		Positive Bending	
ϕP_n	4786.7 lb	ϕM_{nxo}	670.86 lb-ft	ϕM_{nyo}	244.41 lb-ft
A_e	0.11263 in ²	I_{xe}	0.35450 in ⁴	I_{ye}	0.06301 in ⁴
ϕT_n	8244.4 lb	$S_{xe(t)}$	0.17890 in ³	$S_{ye(l)}$	0.09574 in ³
		$S_{xe(b)}$	0.23347 in ³	$S_{ye(r)}$	0.06518 in ³
Shear		Negative Bending		Negative Bending	
ϕV_{ny}	319.5 lb	ϕM_{nxo}	670.86 lb-ft	ϕM_{nyo}	235.04 lb-ft
ϕV_{nx}	2032.1 lb	I_{xe}	0.35450 in ⁴	I_{ye}	0.05104 in ⁴
		$S_{xe(t)}$	0.23347 in ³	$S_{ye(l)}$	0.06268 in ³
		$S_{xe(b)}$	0.17890 in ³	$S_{ye(r)}$	0.06297 in ³
Torsion					
ϕB_n	3843 lb-in ²				

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=51.359$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=52.982$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=54.71$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.21157$ in², $F_y=51.359$ ksi

$T_n=10866$ lb

Eq. D2-1

$\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.16912$ in², $F_u=65$ ksi

$T_n=10993$ lb

Eq. D3-1

$\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2

$V_n=1128.9$ lb at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=897.9$ lb

Eq. G3-2

$k_v=0$

Eq. G3-8

$V_{crh}=258.19$ lb

Eq. G3-6

$V_n=354.97$ lb at 90 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1128.9$ lb at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3921$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.3255$ in (ineffective width= 0.066604 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00012135$ in⁴

Eq. 1.3-8

$I_s=0.00014217$ in⁴ > I_a (no lip reduction)

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.4092$ in

$f=50$ ksi, $k=0$

$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.98664$ in (ineffective width= 0.42256 in)	Eq. 1.1-1
$b_1=0.49332$ in, $b_2=0.49332$ in	
Element 3: Treat as two unstiffened elements	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.38325$ in (ineffective width= 0.50885 in)	Eq. 1.1-1
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.38325$ in (ineffective width= 0.50885 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3921$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.3255$ in (ineffective width= 0.066604 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00012135$ in ⁴	Eq. 1.3-8
$I_s=0.00014217$ in ⁴ > I_a (no lip reduction)	
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4092$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.98664$ in (ineffective width= 0.42256 in)	Eq. 1.1-1
$b_1=0.49332$ in, $b_2=0.49332$ in	
$A_e=0.11263$ in ² , $F_n=50$ ksi	
$P_n=5631.4$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.277$ ksi, $f_2=24.766$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.47521$ in (ineffective width= 0.41689 in)	Eq. 1.1-1

Element 5: Unstiffened, $w=0.3921$ in

$f_1=47.277$ ksi, $f_2=37.383$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.35096$ in (ineffective width= 0.041141 in)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00012092$ in⁴

Eq. 1.3-8

$I_s=0.00014217$ in⁴ > I_a (no lip reduction)

$k=0$

Table 1.3-1

Element 4: Partially stiffened, $w=1.4092$ in

$f=49.643$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.98935$ in (ineffective width= 0.41985 in)

Eq. 1.1-1

$b_1=0.49467$ in, $b_2=0.49467$ in

Center of gravity shift: $y=-0.23159$ in

$S_{xe}=0.1789$ in³, $F_y=50$ ksi

$M_{nl}=745.4$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3921$ in

$f_1=47.277$ ksi, $f_2=37.383$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.35096$ in (ineffective width= 0.041141 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00012092$ in⁴

Eq. 1.3-8

$I_s=0.00014217$ in⁴ > I_a (no lip reduction)

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.4092$ in

$f=49.643$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.98935$ in (ineffective width= 0.41985 in)

Eq. 1.1-1

$b_1=0.49467$ in, $b_2=0.49467$ in

Element 3: Treat as two unstiffened elements

$f_1=47.277$ ksi, $f_2=24.766$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.47521$ in (ineffective width= 0.41689 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.23159$ in

$S_x=0.1789$ in³, $F_y=50$ ksi

$M_{nl}=745.4$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3921$ in

$f_1=49.268$ ksi, $f_2=49.268$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.32714$ in (ineffective width= 0.064963 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.4092$ in

$f_1=44.42$ ksi, $f_2=-28.46$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.4092$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.38707$ in

Eq. 1.1.2-3

$b_2=0.7046$ in

Eq. 1.1.2-4

Compression width= 0.8589 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3921$ in

$f_1=49.268$ ksi, $f_2=49.268$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.32714$ in (ineffective width= 0.064963 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.4092$ in

$f_1=44.42$ ksi, $f_2=-28.46$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.4092$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.38707$ in

Eq. 1.1.2-3

$b_2=0.7046$ in

Eq. 1.1.2-4

Compression width= 0.8589 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.020713$ in

$S_y=0.065175$ in³, $F_y=50$ ksi

Mnl=271.56 lb-ft
 $\Omega b=1.67$, $\phi b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.4092$ in

$f_1=43.375$ ksi, $f_2=-43.151$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.4092$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$

$b_1=0.35276$ in

Eq. 1.1.2-3

$b_2=0.7046$ in

Eq. 1.1.2-4

Compression width=0.70643 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=49.131$ ksi, $f_2=49.131$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.38622$ in (ineffective width=0.50588 in)

Eq. 1.1-1

$f_1=49.131$ ksi, $f_2=49.131$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.38622$ in (ineffective width=0.50588 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.4092$ in

$f_1=43.375$ ksi, $f_2=-43.151$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.4092$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$

$b_1=0.35276$ in

Eq. 1.1.2-3

$b_2=0.7046$ in

Eq. 1.1.2-4

Compression width=0.70643 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.13549$ in

$S_{ye}=0.062676$ in³, $F_y=50$ ksi

Mnl=261.15 lb-ft

Eq. F3.1-1

$\Omega b=1.67$, $\phi b=0.9$

Bimoment Strength, Stud

$C_w=0.21542 \text{ in}^6$, $W_n=2.5225 \text{ in}^2$, $F_y=50 \text{ ksi}$
 $B_n=4270 \text{ lb-in}^2$
 $\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

350S162-30

Full Section Properties

Area	0.23289 in ²	Wt.	0.79182 lb/ft	Flat	7.4643 in
Ix	0.46026 in ⁴	rx	1.4058 in	Ixy	0.00000 in ⁴
Sx(t)	0.26301 in ³	y(t)	1.7500 in	α	0.000 deg
Sx(b)	0.26301 in ³	y(b)	1.7500 in		
Zx	0.30268 in ³	Height	3.5000 in		
Iy	0.08911 in ⁴	ry	0.6186 in	x _o	-1.3265 in
Sy(l)	0.16332 in ³	x(l)	0.5456 in	y _o	0.0000 in
Sy(r)	0.08255 in ³	x(r)	1.0794 in	jx	2.0378 in
Zy	0.12152 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	0.46026 in ⁴	r ₁	1.4058 in	Cw	0.24122 in ⁶
I ₂	0.08911 in ⁴	r ₂	0.6186 in	J	0.00007557 in ⁴
Ic	0.54937 in ⁴	rc	1.5359 in		
I _o	0.95916 in ⁴	r _o	2.0294 in		

Net Section Properties

Ix	0.45149 in ⁴	rx	1.5576 in	Area	0.18609 in ²
Sx(t)	0.25799 in ³	y(t)	1.7500 in	Ixy	0.00000 in ⁴
Sx(b)	0.25799 in ³	y(b)	1.7500 in	α	0.000 deg
Zx	0.28513 in ³				
Iy	0.07265 in ⁴	ry	0.6248 in	x _o	-1.4753 in
Sy(l)	0.10701 in ³	x(l)	0.6789 in	y _o	0.0000 in
Sy(r)	0.07679 in ³	x(r)	0.9461 in	jx	1.8105 in
Zy	0.10470 in ³			jy	0.0000 in
Ic	0.52414 in ⁴	rc	1.6783 in	Cw	0.23555 in ⁶
I _o	0.92914 in ⁴	r _o	2.2345 in	J	0.00006038 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	5561.9 lb	φMnxo	774.45 lb-ft	φMnyo	274.93 lb-ft
Ae	0.13087 in ²	Ixe	0.40087 in ⁴	Iye	0.07034 in ⁴
φTn	9071.8 lb	Sxe(t)	0.20652 in ³	Sye(l)	0.10569 in ³
		Sxe(b)	0.25715 in ³	Sye(r)	0.07331 in ³
Shear		Negative Bending		Negative Bending	
φVny	392.5 lb	φMnxo	774.45 lb-ft	φMnyo	261.95 lb-ft
φVnx	2328.1 lb	Ixe	0.40087 in ⁴	Iye	0.05754 in ⁴
Torsion		Sxe(t)	0.25715 in ³	Sye(l)	0.07181 in ³
φBn	4216.6 lb-in ²	Sxe(b)	0.20652 in ³	Sye(r)	0.06985 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.474$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=53.235$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=55.114$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.23289 \text{ in}^2$, $F_y=51.474 \text{ ksi}$
 $T_n=11988 \text{ lb}$ Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.18609 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=12096 \text{ lb}$ Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=1293.4 \text{ lb}$ at 180 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=987.46 \text{ lb}$ Eq. G3-2
 $k_v=0$ Eq. G3-8
 $V_{crh}=345.81 \text{ lb}$ Eq. G3-6
 $V_n=436.15 \text{ lb}$ at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=1293.4 \text{ lb}$ at 0 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3907 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.34676 \text{ in}$ (ineffective width= 0.043938 in) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=0$ Eq. 1.3-7
 $I_a=0.00016273 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00015506 \text{ in}^4$
 $d_s=0.33042 \text{ in}$ (lip ineffective width= 0.01634 in) Eq. 1.3-6
 $k=0$ Table 1.3-1

Element 2: Partially stiffened, $w=1.4064 \text{ in}$
 $f=50 \text{ ksi}$, $k=0$
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=1.0551 \text{ in}$ (ineffective width= 0.35127 in) Eq. 1.1-1
 $b_1=0.5027 \text{ in}$, $b_2=0.55242 \text{ in}$

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.41732 \text{ in}$ (ineffective width= 0.47338 in) Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.41732$ in (ineffective width= 0.47338 in)

Eq. 1.1-1

Element 5: Unstiffened, $w=0.3907$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.34676$ in (ineffective width= 0.043938 in)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00016273$ in⁴

Eq. 1.3-8

$I_s=0.00015506$ in⁴

$d_s=0.33042$ in (lip ineffective width= 0.016341 in)

Eq. 1.3-6

$k=0$

Table 1.3-1

Element 4: Partially stiffened, $w=1.4064$ in

$f=50$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=1.0551$ in (ineffective width= 0.35127 in)

Eq. 1.1-1

$b_1=0.5027$ in, $b_2=0.55242$ in

$A_e=0.13087$ in², $F_n=50$ ksi

$P_n=6543.4$ lb

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.184$ ksi, $f_2=24.24$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.51827$ in (ineffective width= 0.37243 in)

Eq. 1.1-1

Element 5: Unstiffened, $w=0.3907$ in

$f_1=47.184$ ksi, $f_2=37.12$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.37231$ in (ineffective width= 0.018386 in)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00016209$ in⁴

Eq. 1.3-8

$I_s=0.00015506 \text{ in}^4$	
$d_s=0.35616 \text{ in}$ (lip ineffective width=0.016152 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4064 \text{ in}$	
$f=49.598 \text{ ksi}$, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.0587 \text{ in}$ (ineffective width=0.34769 in)	Eq. 1.1-1
$b_1=0.50639 \text{ in}$, $b_2=0.55232 \text{ in}$	
Center of gravity shift: $y=-0.19108 \text{ in}$	
$S_{xe}=0.20652 \text{ in}^3$, $F_y=50 \text{ ksi}$	
$M_{nl}=860.5 \text{ lb-ft}$	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3907 \text{ in}$	
$f_1=47.184 \text{ ksi}$, $f_2=37.12 \text{ ksi}$	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.37231 \text{ in}$ (ineffective width=0.018386 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00016209 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00015506 \text{ in}^4$	
$d_s=0.35616 \text{ in}$ (lip ineffective width=0.016152 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 2: Partially stiffened, $w=1.4064 \text{ in}$	
$f=49.598 \text{ ksi}$, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.0587 \text{ in}$ (ineffective width=0.34769 in)	Eq. 1.1-1
$b_1=0.50639 \text{ in}$, $b_2=0.55232 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=47.184 \text{ ksi}$, $f_2=24.24 \text{ ksi}$	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.51827 \text{ in}$ (ineffective width=0.37243 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=0.19108 \text{ in}$	
$S_{xe}=0.20652 \text{ in}^3$, $F_y=50 \text{ ksi}$	
$M_{nl}=860.5 \text{ lb-ft}$	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3907$ in $f_1=49.187$ ksi, $f_2=49.187$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.34857$ in (ineffective width= 0.042127 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.4064$ in $f_1=44.304$ ksi, $f_2=-28.989$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.4064$ in

Eq. 1.1-1

 $h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$ $b_1=0.38486$ in

Eq. 1.1.2-3

 $b_2=0.7032$ in

Eq. 1.1.2-4

Compression width= 0.85014 in $b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3907$ in $f_1=49.187$ ksi, $f_2=49.187$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.34857$ in (ineffective width= 0.042127 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.4064$ in $f_1=44.304$ ksi, $f_2=-28.989$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.4064$ in

Eq. 1.1-1

 $h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$ $b_1=0.38486$ in

Eq. 1.1.2-3

 $b_2=0.7032$ in

Eq. 1.1.2-4

Compression width= 0.85014 in $b_1+b_2 >$ compression width (fully effective)Center of gravity shift: $x=-0.013333$ in $S_y=0.073314$ in³, $F_y=50$ ksi $M_n=305.47$ lb-ft

Eq. F3.1-1

 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.4064$ in $f_1=41.97$ ksi, $f_2=-43.368$ ksi

$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.4064$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$	
$b_1=0.3487$ in	Eq. 1.1.2-3
$b_2=0.7032$ in	Eq. 1.1.2-4
Compression width=0.69168 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.655$ ksi, $f_2=47.655$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.42609$ in (ineffective width=0.46461 in)	Eq. 1.1-1
$f_1=47.655$ ksi, $f_2=47.655$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.42609$ in (ineffective width=0.46461 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.4064$ in	
$f_1=41.97$ ksi, $f_2=-43.368$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.4064$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$	
$b_1=0.3487$ in	Eq. 1.1.2-3
$b_2=0.7032$ in	Eq. 1.1.2-4
Compression width=0.69168 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.12241$ in	
$S_{ye}=0.069853$ in ³ , $F_y=50$ ksi	
$M_{nl}=291.05$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.23555$ in ⁶ , $W_n=2.5138$ in ² , $F_y=50$ ksi	
$B_n=4685.1$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350S162-33

Full Section Properties

Area	0.25780 in ²	Wt.	0.87650 lb/ft	Flat	7.4507 in
I _x	0.5084 in ⁴	r _x	1.4043 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.29051 in ³	y(t)	1.7500 in	α	0.000 deg
S _x (b)	0.29051 in ³	y(b)	1.7500 in		
Z _x	0.33467 in ³	Height	3.5000 in		
I _y	0.0982 in ⁴	r _y	0.6171 in	x _o	-1.3227 in
S _y (l)	0.17990 in ³	x(l)	0.5457 in	y _o	0.0000 in
S _y (r)	0.09095 in ³	x(r)	1.0793 in	j _x	2.0346 in
Z _y	0.13414 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	0.5084 in ⁴	r ₁	1.4043 in	C _w	0.26495 in ⁶
I ₂	0.0982 in ⁴	r ₂	0.6171 in	J	0.00010287 in ⁴
I _c	0.6066 in ⁴	r _c	1.5339 in		
I _o	1.0576 in ⁴	r _o	2.0254 in		

Net Section Properties

I _x	0.4987 in ⁴	r _x	1.5563 in	Area	0.20590 in ²
S _x (t)	0.28495 in ³	y(t)	1.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.28495 in ³	y(b)	1.7500 in	α	0.000 deg
Z _x	0.31521 in ³				
I _y	0.0800 in ⁴	r _y	0.6234 in	x _o	-1.4713 in
S _y (l)	0.11787 in ³	x(l)	0.6789 in	y _o	0.0000 in
S _y (r)	0.08458 in ³	x(r)	0.9461 in	j _x	1.8070 in
Z _y	0.11557 in ³			j _y	0.0000 in
I _c	0.5787 in ⁴	r _c	1.6765 in	C _w	0.25869 in ⁶
I _o	1.0244 in ⁴	r _o	2.2306 in	J	0.00008216 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	6299 lb	φM _{nxo}	874.00 lb-ft	φM _{nyo}	310.90 lb-ft
A _e	0.14822 in ²	I _{xe}	0.44845 in ⁴	I _{ye}	0.07892 in ⁴
φT _n	10037 lb	S _{xe} (t)	0.23307 in ³	S _{ye} (l)	0.11725 in ³
		S _{xe} (b)	0.28458 in ³	S _{ye} (r)	0.08291 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	487 lb	φM _{nxo}	874.00 lb-ft	φM _{nyo}	292.34 lb-ft
φV _{nx}	2621 lb	I _{xe}	0.44845 in ⁴	I _{ye}	0.06538 in ⁴
Torsion		S _{xe} (t)	0.28458 in ³	S _{ye} (l)	0.08314 in ³
φB _n	4649.7 lb-in ²	S _{xe} (b)	0.23307 in ³	S _{ye} (r)	0.07796 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.602$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=53.516$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=55.565$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.2578 \text{ in}^2$, $F_y=51.602 \text{ ksi}$
 $T_n=13303 \text{ lb}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.2059 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=13383 \text{ lb}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1456.3 \text{ lb}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=1091.8 \text{ lb}$

Eq. G3-2

$k_v=0$

Eq. G3-8

$V_{crh}=471.36 \text{ lb}$

Eq. G3-6

$V_n=540.86 \text{ lb}$ at 90 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1456.3 \text{ lb}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.389 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.36869 \text{ in}$ (ineffective width=0.020315 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00022212 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00016972 \text{ in}^4$

$d_s=0.28171 \text{ in}$ (lip ineffective width=0.08697 in)

Eq. 1.3-6

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.403 \text{ in}$

$f=50 \text{ ksi}$, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=1.1099 \text{ in}$ (ineffective width=0.29313 in)

Eq. 1.1-1

$b_1=0.42403 \text{ in}$, $b_2=0.68584 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.456 \text{ in}$ (ineffective width=0.433 in)

Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.456$ in (ineffective width=0.433 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.36869$ in (ineffective width=0.020315 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00022212$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.28171$ in (lip ineffective width=0.08697 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.403$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.1099$ in (ineffective width=0.29313 in)	Eq. 1.1-1
$b_1=0.42403$ in, $b_2=0.68584$ in	
$A_e=0.14822$ in ² , $F_n=50$ ksi	
$P_n=7411.2$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.115$ ksi, $f_2=24.013$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.56482$ in (ineffective width=0.32418 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.389$ in	
$f_1=47.115$ ksi, $f_2=37.007$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00022115$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	

ds=0.29854 in (lip ineffective width=0.090461 in)	Eq. 1.3-6
k=0	Table 1.3-1
Element 4: Partially stiffened, w=1.403 in	
f=49.55 ksi, k=0	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
b=1.1139 in (ineffective width=0.28907 in)	Eq. 1.1-1
b ₁ =0.42744 in, b ₂ =0.68649 in	
Center of gravity shift: y=-0.17414 in	
S _{xe} =0.23307 in ³ , F _y =50 ksi	
M _{nl} =971.11 lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.389 in	
f ₁ =47.115 ksi, f ₂ =37.007 ksi	
$\psi=0$	Eq. 1.2.2-1
k=0	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=0	Eq. 1.3-7
I _a =0.00022115 in ⁴	Eq. 1.3-8
I _s =0.00016972 in ⁴	
ds=0.29854 in (lip ineffective width=0.090461 in)	Eq. 1.3-6
k=0	Table 1.3-1
Element 2: Partially stiffened, w=1.403 in	
f=49.55 ksi, k=0	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
b=1.1139 in (ineffective width=0.28907 in)	Eq. 1.1-1
b ₁ =0.42744 in, b ₂ =0.68649 in	
Element 3: Treat as two unstiffened elements	
f ₁ =47.115 ksi, f ₂ =24.013 ksi	
$\psi=0$	Eq. 1.2.2-1
k=0	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
b=0.56482 in (ineffective width=0.32418 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.17414 in	
S _{xe} =0.23307 in ³ , F _y =50 ksi	
M _{nl} =971.11 lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Positive Flexural Strength about Y-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.389 in	

$f_1=49.091$ ksi, $f_2=49.091$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.37064$ in (ineffective width= 0.018362 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.403$ in	
$f_1=44.17$ ksi, $f_2=-29.526$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.403$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$	
$b_1=0.38245$ in	Eq. 1.1.2-3
$b_2=0.7015$ in	Eq. 1.1.2-4
Compression width= 0.84089 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.389$ in	
$f_1=49.091$ ksi, $f_2=49.091$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.37064$ in (ineffective width= 0.018362 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.403$ in	
$f_1=44.17$ ksi, $f_2=-29.526$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.403$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$	
$b_1=0.38245$ in	Eq. 1.1.2-3
$b_2=0.7015$ in	Eq. 1.1.2-4
Compression width= 0.84089 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.0057676$ in	
$S_y=0.082906$ in ³ , $F_y=50$ ksi	
$M_{nl}=345.44$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.403$ in

$f_1=40.229$ ksi, $f_2=-43.385$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.403$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$	
$b_1=0.344$ in	Eq. 1.1.2-3
$b_2=0.7015$ in	Eq. 1.1.2-4
Compression width=0.67502 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=45.813$ ksi, $f_2=45.813$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.47321$ in (ineffective width=0.41579 in)	Eq. 1.1-1
$f_1=45.813$ ksi, $f_2=45.813$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.47321$ in (ineffective width=0.41579 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.403$ in	
$f_1=40.229$ ksi, $f_2=-43.385$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.403$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$	
$b_1=0.344$ in	Eq. 1.1.2-3
$b_2=0.7015$ in	Eq. 1.1.2-4
Compression width=0.67502 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.10747$ in	
$S_y=0.077957$ in ³ , $F_y=50$ ksi	
$M_n=324.82$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.25869$ in ⁶ , $W_n=2.5036$ in ² , $F_y=50$ ksi	
$B_n=5166.4$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350S162-43

Full Section Properties

Area	0.33413 in ²	Wt.	1.1360 lb/ft	Flat	7.4086 in
Ix	0.6546 in ⁴	rx	1.3997 in	Ixy	0.0000 in ⁴
Sx(t)	0.37405 in ³	y(t)	1.7500 in	α	0.000 deg
Sx(b)	0.37405 in ³	y(b)	1.7500 in		
Zx	0.43225 in ³	Height	3.5000 in		
Iy	0.1254 in ⁴	ry	0.6126 in	x _o	-1.3108 in
Sy(l)	0.22967 in ³	x(l)	0.5459 in	y _o	0.0000 in
Sy(r)	0.11620 in ³	x(r)	1.0791 in	jx	2.0249 in
Zy	0.17234 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	0.6546 in ⁴	r ₁	1.3997 in	Cw	0.33521 in ⁶
I ₂	0.1254 in ⁴	r ₂	0.6126 in	J	0.00022654 in ⁴
Ic	0.7800 in ⁴	rc	1.5279 in		
I _o	1.3541 in ⁴	r _o	2.0131 in		

Net Section Properties

Ix	0.6419 in ⁴	rx	1.5520 in	Area	0.26648 in ²
Sx(t)	0.36680 in ³	y(t)	1.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.36680 in ³	y(b)	1.7500 in	α	0.000 deg
Zx	0.40688 in ³				
Iy	0.1021 in ⁴	ry	0.6191 in	x _o	-1.4592 in
Sy(l)	0.15046 in ³	x(l)	0.6788 in	y _o	0.0000 in
Sy(r)	0.10794 in ³	x(r)	0.9462 in	jx	1.7960 in
Zy	0.14850 in ³			jy	0.0000 in
Ic	0.7440 in ⁴	rc	1.6710 in	Cw	0.32719 in ⁶
I _o	1.3115 in ⁴	r _o	2.2184 in	J	0.00018067 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	8746 lb	φMnxo	1192.6 lb-ft	φMnyo	460.2 lb-ft
Ae	0.20578 in ²	Ixe	0.59654 in ⁴	Iye	0.10214 in ⁴
φTn	12991 lb	Sxe(t)	0.31804 in ³	Sye(l)	0.15046 in ³
		Sxe(b)	0.36726 in ³	Sye(r)	0.10794 in ³
Shear		Negative Bending		Negative Bending	
φVny	828 lb	φMnxo	1192.6 lb-ft	φMnyo	385.8 lb-ft
φVnx	3391 lb	Ixe	0.59654 in ⁴	Iye	0.09052 in ⁴
Torsion		Sxe(t)	0.36726 in ³	Sye(l)	0.12148 in ³
φBn	5955.5 lb-in ²	Sxe(b)	0.31804 in ³	Sye(r)	0.10289 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.963$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=54.31$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=56.847$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.33413$ in², $F_y=51.963$ ksi

$T_n=17362$ lb
 $\Omega_t=1.67$, $\phi_t=0.9$ Eq. D2-1

$A_n=0.26648$ in², $F_u=65$ ksi
 $T_n=17321$ lb
 $\Omega_t=2$, $\phi_t=0.75$ Eq. D3-1

Shear Strength

Stud element 2
 $V_n=1883.9$ lb at 180 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=1409.7$ lb Eq. G3-2
 $k_v=0$ Eq. G3-8
 $V_{crh}=1042$ lb Eq. G3-6
 $V_n=920.36$ lb at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=1883.9$ lb at 0 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=0$ Eq. 1.3-7
 $I_a=0.00048546$ in⁴ Eq. 1.3-8
 $I_s=0.00021231$ in⁴
 $d_s=0.16781$ in (lip ineffective width=0.21589 in) Eq. 1.3-6
 $k=0$ Table 1.3-1

Element 2: Partially stiffened, $w=1.3924$ in
 $f=50$ ksi, $k=0$
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=1.2522$ in (ineffective width=0.1402 in) Eq. 1.1-1
 $b_1=0.27382$ in, $b_2=0.97838$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.56682$ in (ineffective width=0.31688 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1

$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.56682$ in (ineffective width=0.31688 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00048546$ in ⁴	Eq. 1.3-8
$I_s=0.00021231$ in ⁴	
$d_s=0.16781$ in (lip ineffective width=0.21589 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.3924$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.2522$ in (ineffective width=0.1402 in)	Eq. 1.1-1
$b_1=0.27382$ in, $b_2=0.97838$ in	
$A_e=0.20578$ in ² , $F_n=50$ ksi	
$P_n=10289$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.9$ ksi, $f_2=23.342$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.6946$ in (ineffective width=0.1891 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=46.9$ ksi, $f_2=36.671$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00047247$ in ⁴	Eq. 1.3-8
$I_s=0.00021231$ in ⁴	
$d_s=0.17242$ in (lip ineffective width=0.21128 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.3924$ in	

$f=49.399$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=1.2595$ in (ineffective width= 0.13286 in)

Eq. 1.1-1

$b_1=0.283$ in, $b_2=0.97655$ in

Center of gravity shift: $y=-0.12569$ in

$S_{xe}=0.31804$ in³, $F_y=50$ ksi

$M_{nl}=1325.2$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837$ in

$f_1=46.9$ ksi, $f_2=36.671$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\lambda<0.673$ (fully effective)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00047247$ in⁴

Eq. 1.3-8

$I_s=0.00021231$ in⁴

$ds=0.17242$ in (lip ineffective width= 0.21128 in)

Eq. 1.3-6

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.3924$ in

$f=49.399$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=1.2595$ in (ineffective width= 0.13286 in)

Eq. 1.1-1

$b_1=0.283$ in, $b_2=0.97655$ in

Element 3: Treat as two unstiffened elements

$f_1=46.9$ ksi, $f_2=23.342$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.6946$ in (ineffective width= 0.1891 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.12569$ in

$S_{xe}=0.31804$ in³, $F_y=50$ ksi

$M_{nl}=1325.2$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837$ in

$f_1=55.492$ ksi, $f_2=55.492$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$	Eq. 1.1-3
$\lambda < 0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.3924$ in	
$f_1=49.86$ ksi, $f_2=-33.795$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.3924$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$	
$b_1=0.3786$ in	Eq. 1.1.2-3
$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width= 0.82989 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=55.492$ ksi, $f_2=55.492$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\lambda < 0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.3924$ in	
$f_1=49.86$ ksi, $f_2=-33.795$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.3924$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$	
$b_1=0.3786$ in	Eq. 1.1.2-3
$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width= 0.82989 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_y=0.10794$ in ³ , $F_y=56.847$ ksi	
$M_{nl}=511.36$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.3924$ in

$f_1=35.717$ ksi, $f_2=-43.392$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.3924$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$

$b_1=0.33035$ in

Eq. 1.1.2-3

$b_2=0.6962$ in

Eq. 1.1.2-4

Compression width= 0.62866 in

$b_1 + b_2 > \text{compression width (fully effective)}$

Element 3: Treat as two unstiffened elements

$f_1 = 41.044 \text{ ksi}$, $f_2 = 41.044 \text{ ksi}$

$\psi = 0$

Eq. 1.2.2-1

$k = 0$

Eq. 1.2.2-3

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b = 0.61232 \text{ in}$ (ineffective width = 0.27138 in)

Eq. 1.1-1

$f_1 = 41.044 \text{ ksi}$, $f_2 = 41.044 \text{ ksi}$

$\psi = 0$

Eq. 1.2.2-1

$k = 0$

Eq. 1.2.2-3

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b = 0.61232 \text{ in}$ (ineffective width = 0.27138 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.3924 \text{ in}$

$f_1 = 35.717 \text{ ksi}$, $f_2 = -43.392 \text{ ksi}$

$\psi = 0$

Eq. 1.1.2-1

$k = 0$

Eq. 1.1.2-2

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b_e = 1.3924 \text{ in}$

Eq. 1.1-1

$h_o = 1.625 \text{ in}$, $b_o = 3.5 \text{ in}$, $h_o/b_o = 0$

$b_1 = 0.33035 \text{ in}$

Eq. 1.1.2-3

$b_2 = 0.6962 \text{ in}$

Eq. 1.1.2-4

Compression width = 0.62866 in

$b_1 + b_2 > \text{compression width (fully effective)}$

Center of gravity shift: $x = 0.06638 \text{ in}$

$S_y = 0.10289 \text{ in}^3$, $F_y = 50 \text{ ksi}$

$M_n = 428.71 \text{ lb-ft}$

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Bimoment Strength, Stud

$C_w = 0.32719 \text{ in}^6$, $W_n = 2.4723 \text{ in}^2$, $F_y = 50 \text{ ksi}$

$B_n = 6617.2 \text{ lb-in}^2$

G8.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

350S162-54

Full Section Properties

Area	0.41484 in ²	Wt.	1.4104 lb/ft	Flat	7.3293 in
I _x	0.8047 in ⁴	r _x	1.3927 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.45982 in ³	y(t)	1.7500 in	α	0.000 deg
S _x (b)	0.45982 in ³	y(b)	1.7500 in		
Z _x	0.53371 in ³	Height	3.5000 in		
I _y	0.1525 in ⁴	r _y	0.6063 in	x _o	-1.2958 in
S _y (l)	0.27978 in ³	x(l)	0.5450 in	y _o	0.0000 in
S _y (r)	0.14119 in ³	x(r)	1.0800 in	j _x	2.0153 in
Z _y	0.21134 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	0.8047 in ⁴	r ₁	1.3927 in	C _w	0.40282 in ⁶
I ₂	0.1525 in ⁴	r ₂	0.6063 in	J	0.0004430 in ⁴
I _c	0.9572 in ⁴	r _c	1.5190 in		
I _o	1.6537 in ⁴	r _o	1.9966 in		

Net Section Properties

I _x	0.7888 in ⁴	r _x	1.5462 in	Area	0.32994 in ²
S _x (t)	0.45072 in ³	y(t)	1.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.45072 in ³	y(b)	1.7500 in	α	0.000 deg
Z _x	0.50187 in ³				
I _y	0.1240 in ⁴	r _y	0.6130 in	x _o	-1.4445 in
S _y (l)	0.18284 in ³	x(l)	0.6780 in	y _o	0.0000 in
S _y (r)	0.13089 in ³	x(r)	0.9470 in	j _x	1.7845 in
Z _y	0.18190 in ³			j _y	0.0000 in
I _c	0.9127 in ⁴	r _c	1.6632 in	C _w	0.39296 in ⁶
I _o	1.6011 in ⁴	r _o	2.2029 in	J	0.00035232 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	12500 lb	φM _{nxo}	1630.2 lb-ft	φM _{nyo}	573.5 lb-ft
A _e	0.29412 in ²	I _{xe}	0.77541 in ⁴	I _{ye}	0.12396 in ⁴
φT _n	16084 lb	S _{xe} (t)	0.43472 in ³	S _{ye} (l)	0.18284 in ³
		S _{xe} (b)	0.45179 in ³	S _{ye} (r)	0.13089 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1234 lb	φM _{nxo}	1630.2 lb-ft	φM _{nyo}	481.8 lb-ft
φV _{nx}	4102 lb	I _{xe}	0.77541 in ⁴	I _{ye}	0.11826 in ⁴
Torsion		S _{xe} (t)	0.45179 in ³	S _{ye} (l)	0.16786 in ³
φB _n	7260.3 lb-in ²	S _{xe} (b)	0.43472 in ³	S _{ye} (r)	0.12848 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=52.463$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=55.318$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=58.416$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.41484$ in², $F_y=52.463$ ksi

$$T_n = 21764 \text{ lb} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.32994 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 21446 \text{ lb} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 2278.7 \text{ lb at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 1689.8 \text{ lb} \quad \text{Eq. G3-2}$$

$$k_v = 0 \quad \text{Eq. G3-8}$$

$$V_{crh} = 2041.3 \text{ lb} \quad \text{Eq. G3-6}$$

$$V_n = 1370.6 \text{ lb at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 2278.7 \text{ lb at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.3585 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 0 \quad \text{Eq. 1.2.2-1}$$

$$k = 0 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 2: Check for lip stiffener reduction

$$S = 0 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.00033614 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00021732 \text{ in}^4$$

$$d_s = 0.23177 \text{ in (lip ineffective width} = 0.12673 \text{ in)} \quad \text{Eq. 1.3-6}$$

$$k = 0 \quad \text{Table 1.3-1}$$

Element 2: Partially stiffened, $w = 1.342 \text{ in}$

$$f = 50 \text{ ksi}, k = 0$$

$$\lambda = 0 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 0 \quad \text{Eq. 1.2.2-1}$$

$$k = 0 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0 \quad \text{Eq. 1.1-3}$$

$$\rho = 0 \quad \text{Eq. 1.1-2}$$

$$b = 0.66883 \text{ in (ineffective width} = 0.18967 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 0 \quad \text{Eq. 1.2.2-1}$$

$$k = 0 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0 \quad \text{Eq. 1.1-3}$$

$\rho=0$	Eq. 1.1-2
$b=0.66883$ in (ineffective width= 0.18967 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00033614$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.23177$ in (lip ineffective width= 0.12673 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
$A_e=0.29412$ in ² , $F_n=50$ ksi	
$P_n=14706$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.032$ ksi, $f_2=21.959$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.80933$ in (ineffective width= 0.04917 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=46.032$ ksi, $f_2=35.98$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00032224$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.24177$ in (lip ineffective width= 0.11673 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=49.206$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Center of gravity shift: $y=-0.033691$ in	

$S_{xe}=0.43472 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_n I=1811.3 \text{ lb-ft}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585 \text{ in}$

$f_1=46.032 \text{ ksi}$, $f_2=35.98 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00032224 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00021732 \text{ in}^4$

$ds=0.24177 \text{ in}$ (lip ineffective width= 0.11673 in)

Eq. 1.3-6

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.342 \text{ in}$

$f=49.206 \text{ ksi}$, $k=0$

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=46.032 \text{ ksi}$, $f_2=21.959 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.80933 \text{ in}$ (ineffective width= 0.04917 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.033691 \text{ in}$

$S_{xe}=0.43472 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_n I=1811.3 \text{ lb-ft}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585 \text{ in}$

$f_1=56.67 \text{ ksi}$, $f_2=56.67 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=1.342 \text{ in}$

$f_1=49.688 \text{ ksi}$, $f_2=-33.092 \text{ ksi}$

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.342$ in Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.36607$ in Eq. 1.1.2-3

$b_2=0.671$ in Eq. 1.1.2-4

Compression width=0.80553 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3585$ in

$f_1=56.67$ ksi, $f_2=56.67$ ksi

$\psi=0$ Eq. 1.2.2-1

$k=0$ Eq. 1.2.2-3

$\lambda=0$ Eq. 1.1-3

$\lambda < 0.673$ (fully effective) Eq. 1.1-1

Element 4: Stiffened, $w=1.342$ in

$f_1=49.688$ ksi, $f_2=-33.092$ ksi

$\psi=0$ Eq. 1.1.2-1

$k=0$ Eq. 1.1.2-2

$\lambda=0$ Eq. 1.1-3

$\rho=0$ Eq. 1.1-2

$b_e=1.342$ in Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.36607$ in Eq. 1.1.2-3

$b_2=0.671$ in Eq. 1.1.2-4

Compression width=0.80553 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0$ in

$S_{ye}=0.13089$ in³, $F_y=58.416$ ksi

$M_{nl}=637.19$ lb-ft Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.342$ in

$f_1=30.539$ ksi, $f_2=-42.318$ ksi

$\psi=0$ Eq. 1.1.2-1

$k=0$ Eq. 1.1.2-2

$\lambda=0$ Eq. 1.1-3

$\rho=0$ Eq. 1.1-2

$b_e=1.342$ in Eq. 1.1-1

$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$

$b_1=0.30599$ in Eq. 1.1.2-3

$b_2=0.671$ in Eq. 1.1.2-4

Compression width=0.56252 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=36.684$ ksi, $f_2=36.684$ ksi

$\psi=0$ Eq. 1.2.2-1

$k=0$ Eq. 1.2.2-3

$\lambda=0$ Eq. 1.1-3

$\rho=0$	Eq. 1.1-2
$b=0.74403$ in (ineffective width= 0.11447 in)	Eq. 1.1-1
$f_1=36.684$ ksi, $f_2=36.684$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.74403$ in (ineffective width= 0.11447 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.342$ in	
$f_1=30.539$ ksi, $f_2=-42.318$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.5$ in, $h_o/b_o=0$	
$b_1=0.30599$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width= 0.56252 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.026558$ in	
$S_{ye}=0.12848$ in ³ , $F_y=50$ ksi	
$M_{nl}=535.34$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.39296$ in ⁶ , $W_n=2.4356$ in ² , $F_y=50$ ksi	
$B_n=8067$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350S200-27

Full Section Properties

Area	0.23987 in ²	Wt.	0.81555 lb/ft	Flat	8.4758 in
Ix	0.4928 in ⁴	rx	1.4334 in	Ixy	0.0000 in ⁴
Sx(t)	0.28162 in ³	y(t)	1.7500 in	α	0.000 deg
Sx(b)	0.28162 in ³	y(b)	1.7500 in		
Zx	0.32048 in ³	Height	3.5000 in		
Iy	0.1443 in ⁴	ry	0.7756 in	x _o	-1.7668 in
Sy(l)	0.19542 in ³	x(l)	0.7383 in	y _o	0.0000 in
Sy(r)	0.11435 in ³	x(r)	1.2617 in	jx	2.3180 in
Zy	0.16349 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	0.4928 in ⁴	r ₁	1.4334 in	Cw	0.43416 in ⁶
I ₂	0.1443 in ⁴	r ₂	0.7756 in	J	0.00006404 in ⁴
Ic	0.6371 in ⁴	rc	1.6298 in		
I _o	1.3859 in ⁴	r _o	2.4037 in		

Net Section Properties

Ix	0.4849 in ⁴	rx	1.5672 in	Area	0.19742 in ²
Sx(t)	0.27707 in ³	y(t)	1.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.27707 in ³	y(b)	1.7500 in	α	0.000 deg
Zx	0.30456 in ³				
Iy	0.1172 in ⁴	ry	0.7706 in	x _o	-1.9397 in
Sy(l)	0.13113 in ³	x(l)	0.8940 in	y _o	0.0000 in
Sy(r)	0.10599 in ³	x(r)	1.1060 in	jx	2.1526 in
Zy	0.13756 in ³			jy	0.0000 in
Ic	0.6021 in ⁴	rc	1.7464 in	Cw	0.42536 in ⁶
I _o	1.3448 in ⁴	r _o	2.6100 in	J	0.00005270 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	4970.4 lb	φMnxo	701.26 lb-ft	φMnyo	341.12 lb-ft
Ae	0.11695 in ²	Ixe	0.38810 in ⁴	Iye	0.10554 in ⁴
φTn	9624.1 lb	Sxe(t)	0.18700 in ³	Sye(l)	0.12567 in ³
		Sxe(b)	0.27243 in ³	Sye(r)	0.09096 in ³
Shear		Negative Bending		Negative Bending	
φVny	322.9 lb	φMnxo	701.26 lb-ft	φMnyo	327.96 lb-ft
φVnx	2201.3 lb	Ixe	0.38810 in ⁴	Iye	0.09126 in ⁴
Torsion		Sxe(t)	0.27243 in ³	Sye(l)	0.08745 in ³
φBn	5585.1 lb-in ²	Sxe(b)	0.18700 in ³	Sye(r)	0.09541 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=51.199$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=52.444$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=53.824$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.23987 \text{ in}^2$, $F_y=51.199 \text{ ksi}$
 $T_n=12281 \text{ lb}$ Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.19742 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=12832 \text{ lb}$ Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=1223 \text{ lb}$ at 180 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=897.9 \text{ lb}$ Eq. G3-2
 $k_v=3.5492$ Eq. G3-8
 $V_{crh}=263.01 \text{ lb}$ Eq. G3-6
 $V_n=358.72 \text{ lb}$ at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=1223 \text{ lb}$ at 0 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.2067$ Eq. 1.1-3
 $\rho=0.67763$ Eq. 1.1-2
 $b=0.3504 \text{ in}$ (ineffective width=0.1667 in) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.00015278 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00032608 \text{ in}^4 > I_a$ (no lip reduction)
 $k=3.4985$ Table 1.3-1

Element 2: Partially stiffened, $w=1.7842 \text{ in}$
 $f=50 \text{ ksi}$, $k=3.4985$
 $\lambda=1.4597$ Eq. 1.1-3
 $\rho=0.58184$ Eq. 1.1-2
 $b=1.0381 \text{ in}$ (ineffective width=0.74609 in) Eq. 1.1-1
 $b_1=0.51906 \text{ in}$, $b_2=0.51906 \text{ in}$

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=2.0817$ Eq. 1.1-3
 $\rho=0.4296$ Eq. 1.1-2
 $b=0.38325 \text{ in}$ (ineffective width=0.50885 in) Eq. 1.1-1
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0817$	Eq. 1.1-3
$\rho=0.4296$	Eq. 1.1-2
$b=0.38325$ in (ineffective width=0.50885 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2067$	Eq. 1.1-3
$\rho=0.67763$	Eq. 1.1-2
$b=0.3504$ in (ineffective width=0.1667 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00015278$ in ⁴	Eq. 1.3-8
$I_s=0.00032608$ in ⁴ > I_a (no lip reduction)	
$k=3.4985$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7842$ in	
$f=50$ ksi, $k=3.4985$	
$\lambda=1.4597$	Eq. 1.1-3
$\rho=0.58184$	Eq. 1.1-2
$b=1.0381$ in (ineffective width=0.74609 in)	Eq. 1.1-1
$b_1=0.51906$ in, $b_2=0.51906$ in	
$A_e=0.11695$ in ² , $F_n=50$ ksi	
$P_n=5847.6$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.4$ ksi, $f_2=25.906$ ksi	
$\psi=0.54654$	Eq. 1.2.2-1
$k=0.65198$	Eq. 1.2.2-2
$\lambda=1.6461$	Eq. 1.1-3
$\rho=0.52631$	Eq. 1.1-2
$b=0.46952$ in (ineffective width=0.42258 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=47.4$ ksi, $f_2=34.941$ ksi	
$\psi=0.73715$	Eq. 1.2.2-1
$k=0.5366$	Eq. 1.2.2-2
$\lambda=1.0517$	Eq. 1.1-3
$\rho=0.75192$	Eq. 1.1-2
$b=0.38882$ in (ineffective width=0.12828 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.198$	Eq. 1.3-7
$I_a=0.00015227$ in ⁴	Eq. 1.3-8
$I_s=0.00032608$ in ⁴ > I_a (no lip reduction)	
$k=3.4985$	Table 1.3-1

Element 4: Partially stiffened, $w=1.7842$ in
 $f=49.659$ ksi, $k=3.4985$

$$\lambda=1.4547$$

Eq. 1.1-3

$$\rho=0.58347$$

Eq. 1.1-2

$$b=1.041 \text{ in (ineffective width}=0.74317 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.52052 \text{ in, } b_2=0.52052 \text{ in}$$

Center of gravity shift: $y=-0.32539$ in

$$S_{xe}=0.187 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=779.18 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171$ in

$$f_1=47.4 \text{ ksi, } f_2=34.941 \text{ ksi}$$

$$\psi=0.73715$$

Eq. 1.2.2-1

$$k=0.5366$$

Eq. 1.2.2-2

$$\lambda=1.0517$$

Eq. 1.1-3

$$\rho=0.75192$$

Eq. 1.1-2

$$b=0.38882 \text{ in (ineffective width}=0.12828 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.198$$

Eq. 1.3-7

$$I_a=0.00015227 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00032608 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.4985$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.7842$ in

$$f=49.659 \text{ ksi, } k=3.4985$$

$$\lambda=1.4547$$

Eq. 1.1-3

$$\rho=0.58347$$

Eq. 1.1-2

$$b=1.041 \text{ in (ineffective width}=0.74317 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.52052 \text{ in, } b_2=0.52052 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1=47.4 \text{ ksi, } f_2=25.906 \text{ ksi}$$

$$\psi=0.54654$$

Eq. 1.2.2-1

$$k=0.65198$$

Eq. 1.2.2-2

$$\lambda=1.6461$$

Eq. 1.1-3

$$\rho=0.52631$$

Eq. 1.1-2

$$b=0.46952 \text{ in (ineffective width}=0.42258 \text{ in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.32539$ in

$$S_{xe}=0.187 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=779.18 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171$ in

$$f_1=49.39 \text{ ksi, } f_2=49.39 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=1.1993$	Eq. 1.1-3
$\rho=0.68087$	Eq. 1.1-2
$b=0.35208$ in (ineffective width=0.16502 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.7842$ in	
$f_1=45.35$ ksi, $f_2=-31.543$ ksi	
$\psi=0.69554$	Eq. 1.1.2-1
$k=17.14$	Eq. 1.1.2-2
$\lambda=0.62804$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7842$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.4828$ in	Eq. 1.1.2-3
$b_2=0.8921$ in	Eq. 1.1.2-4
Compression width=1.0523 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=49.39$ ksi, $f_2=49.39$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.1993$	Eq. 1.1-3
$\rho=0.68087$	Eq. 1.1-2
$b=0.35208$ in (ineffective width=0.16502 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.7842$ in	
$f_1=45.35$ ksi, $f_2=-31.543$ ksi	
$\psi=0.69554$	Eq. 1.1.2-1
$k=17.14$	Eq. 1.1.2-2
$\lambda=0.62804$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7842$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.4828$ in	Eq. 1.1.2-3
$b_2=0.8921$ in	Eq. 1.1.2-4
Compression width=1.0523 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.054224$ in	
$S_{ye}=0.090964$ in ³ , $F_y=50$ ksi	
$M_{nl}=379.02$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7842$ in

$f_1=44.83$ ksi, $f_2=-40.662$ ksi

$\psi=0.90704$

$k=21.685$

$\lambda=0.55515$

$\rho=1$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

be=1.7842 in	Eq. 1.1-1
h _o =2 in, b _o =3.5 in, h _o /b _o =0.57143	
b ₁ =0.45666 in	Eq. 1.1.2-3
b ₂ =0.8921 in	Eq. 1.1.2-4
Compression width=0.93559 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.322 ksi, f ₂ =49.322 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.0676	Eq. 1.1-3
ρ=0.43219	Eq. 1.1-2
b=0.38556 in (ineffective width=0.50654 in)	Eq. 1.1-1
f ₁ =49.322 ksi, f ₂ =49.322 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.0676	Eq. 1.1-3
ρ=0.43219	Eq. 1.1-2
b=0.38556 in (ineffective width=0.50654 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=1.7842 in	
f ₁ =44.83 ksi, f ₂ =-40.662 ksi	
ψ=0.90704	Eq. 1.1.2-1
k=21.685	Eq. 1.1.2-2
λ=0.55515	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=1.7842 in	Eq. 1.1-1
h _o =2 in, b _o =3.5 in, h _o /b _o =0.57143	
b ₁ =0.45666 in	Eq. 1.1.2-3
b ₂ =0.8921 in	Eq. 1.1.2-4
Compression width=0.93559 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.14949 in	
S _{ye} =0.087455 in ³ , F _y =50 ksi	
M _{nl} =364.4 lb-ft	Eq. F3.1-1
Ω _b =1.67, ϕ _b =0.9	
Bimoment Strength, Stud	
C _w =0.42536 in ⁶ , W _n =3.4272 in ² , F _y =50 ksi	
B _n =6205.7 lb-in ²	G8.1-1
Ω _b =1.67, ϕ _b =0.9	

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Full Section Properties

Area	0.26409 in ²	Wt.	0.89790 lb/ft	Flat	8.4643 in
I _x	0.5417 in ⁴	r _x	1.4322 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.30952 in ³	y(t)	1.7500 in	α	0.000 deg
S _x (b)	0.30952 in ³	y(b)	1.7500 in		
Z _x	0.35252 in ³	Height	3.5000 in		
I _y	0.1583 in ⁴	r _y	0.7743 in	x _o	-1.7635 in
S _y (l)	0.21446 in ³	x(l)	0.7383 in	y _o	0.0000 in
S _y (r)	0.12550 in ³	x(r)	1.2617 in	j _x	2.3149 in
Z _y	0.17969 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	0.5417 in ⁴	r ₁	1.4322 in	C _w	0.47527 in ⁶
I ₂	0.1583 in ⁴	r ₂	0.7743 in	J	0.00008569 in ⁴
I _c	0.7000 in ⁴	r _c	1.6281 in		
I _o	1.5213 in ⁴	r _o	2.4001 in		

Net Section Properties

I _x	0.5329 in ⁴	r _x	1.5660 in	Area	0.21729 in ²
S _x (t)	0.30451 in ³	y(t)	1.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.30451 in ³	y(b)	1.7500 in	α	0.000 deg
Z _x	0.33497 in ³				
I _y	0.1286 in ⁴	r _y	0.7694 in	x _o	-1.9363 in
S _y (l)	0.14388 in ³	x(l)	0.8940 in	y _o	0.0000 in
S _y (r)	0.11630 in ³	x(r)	1.1060 in	j _x	2.1494 in
Z _y	0.15117 in ³			j _y	0.0000 in
I _c	0.6615 in ⁴	r _c	1.7448 in	C _w	0.46561 in ⁶
I _o	1.4762 in ⁴	r _o	2.6065 in	J	0.00007051 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	5866 lb	φM _{nxo}	820.00 lb-ft	φM _{nyo}	384.88 lb-ft
A _e	0.13802 in ²	I _{xe}	0.44287 in ⁴	I _{ye}	0.11808 in ⁴
φT _n	10593 lb	S _{xe} (t)	0.21867 in ³	S _{ye} (l)	0.13901 in ³
		S _{xe} (b)	0.30031 in ³	S _{ye} (r)	0.10264 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	397 lb	φM _{nxo}	820.00 lb-ft	φM _{nyo}	372.46 lb-ft
φV _{nx}	2609 lb	I _{xe}	0.44287 in ⁴	I _{ye}	0.10243 in ⁴
Torsion		S _{xe} (t)	0.30031 in ³	S _{ye} (l)	0.09932 in ³
φB _n	6132.1 lb-in ²	S _{xe} (b)	0.21867 in ³	S _{ye} (r)	0.10573 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.3$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.65$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$$\begin{aligned} A_g &= 0.26409 \text{ in}^2, F_y = 51.3 \text{ ksi} \\ T_n &= 13548 \text{ lb} \\ \Omega_t &= 1.67, \phi_t = 0.9 \end{aligned} \quad \text{Eq. D2-1}$$

$$\begin{aligned} A_n &= 0.21729 \text{ in}^2, F_u = 65 \text{ ksi} \\ T_n &= 14124 \text{ lb} \\ \Omega_t &= 2, \phi_t = 0.75 \end{aligned} \quad \text{Eq. D3-1}$$

Shear Strength

$$\begin{aligned} \text{Stud element 2} \\ V_n &= 1449.2 \text{ lb at } 180 \text{ deg} \end{aligned} \quad \text{Eq. G2.1-2}$$

$$\begin{aligned} \Omega_v &= 1.67, \phi_v = 0.9 \\ \text{Stud element 3} \\ V_{yh} &= 987.46 \text{ lb} \\ k_v &= 3.5481 \\ V_{crh} &= 352.28 \text{ lb} \\ V_n &= 440.67 \text{ lb at } 90 \text{ deg} \end{aligned} \quad \begin{aligned} &\text{Eq. G3-2} \\ &\text{Eq. G3-8} \\ &\text{Eq. G3-6} \\ &\text{Eq. G2.1-2} \end{aligned}$$

$$\begin{aligned} \Omega_v &= 1.67, \phi_v = 0.9 \\ \text{Stud element 4} \\ V_n &= 1449.2 \text{ lb at } 0 \text{ deg} \\ \Omega_v &= 1.67, \phi_v = 0.9 \end{aligned} \quad \text{Eq. G2.1-2}$$

Axial Compression Strength

Effective width calculations for Stud

$$\begin{aligned} \text{Element 1: Unstiffened, } w &= 0.5157 \text{ in} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \\ \psi &= 1 \\ k &= 0.43 \\ \lambda &= 1.0916 \\ \rho &= 0.73148 \\ b &= 0.37723 \text{ in (ineffective width} = 0.13847 \text{ in)} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.2.2-1} \\ &\text{Eq. 1.2.2-3} \\ &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$$\begin{aligned} \text{Element 2: Check for lip stiffener reduction} \\ S &= 31.091 \\ I_a &= 0.00020486 \text{ in}^4 \\ I_s &= 0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)} \\ k &= 3.4958 \end{aligned} \quad \begin{aligned} &\text{Eq. 1.3-7} \\ &\text{Eq. 1.3-8} \\ &\text{Table 1.3-1} \end{aligned}$$

$$\begin{aligned} \text{Element 2: Partially stiffened, } w &= 1.7814 \text{ in} \\ f &= 50 \text{ ksi, } k = 3.4958 \\ \lambda &= 1.3224 \\ \rho &= 0.63039 \\ b &= 1.123 \text{ in (ineffective width} = 0.65843 \text{ in)} \\ b_1 &= 0.56148 \text{ in, } b_2 = 0.56148 \text{ in} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$$\begin{aligned} \text{Element 3: Treat as two unstiffened elements} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \\ \psi &= 1 \\ k &= 0.43 \\ \lambda &= 1.8853 \\ \rho &= 0.46853 \\ b &= 0.41732 \text{ in (ineffective width} = 0.47338 \text{ in)} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.2.2-1} \\ &\text{Eq. 1.2.2-3} \\ &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.8853$	Eq. 1.1-3
$\rho=0.46853$	Eq. 1.1-2
$b=0.41732$ in (ineffective width=0.47338 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723$ in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00020486$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.4958$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7814$ in	
$f=50$ ksi, $k=3.4958$	
$\lambda=1.3224$	Eq. 1.1-3
$\rho=0.63039$	Eq. 1.1-2
$b=1.123$ in (ineffective width=0.65843 in)	Eq. 1.1-1
$b_1=0.56148$ in, $b_2=0.56148$ in	
$A_e=0.13802$ in ² , $F_n=50$ ksi	
$P_n=6901.1$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.301$ ksi, $f_2=25.31$ ksi	
$\psi=0.53509$	Eq. 1.2.2-1
$k=0.6605$	Eq. 1.2.2-2
$\lambda=1.4795$	Eq. 1.1-3
$\rho=0.57539$	Eq. 1.1-2
$b=0.5125$ in (ineffective width=0.3782 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=47.301$ ksi, $f_2=34.569$ ksi	
$\psi=0.73082$	Eq. 1.2.2-1
$k=0.53977$	Eq. 1.2.2-2
$\lambda=0.9476$	Eq. 1.1-3
$\rho=0.81029$	Eq. 1.1-2
$b=0.41787$ in (ineffective width=0.097832 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.212$	Eq. 1.3-7
$I_a=0.00020408$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.4958$	Table 1.3-1

Element 4: Partially stiffened, $w=1.7814$ in

$f=49.615$ ksi, $k=3.4958$

$\lambda=1.3173$

Eq. 1.1-3

$\rho=0.63234$

Eq. 1.1-2

$b=1.1264$ in (ineffective width= 0.65495 in)

Eq. 1.1-1

$b_1=0.56322$ in, $b_2=0.56322$ in

Center of gravity shift: $y=-0.27531$ in

$S_{xe}=0.21867$ in³, $F_y=50$ ksi

$M_{nl}=911.11$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=47.301$ ksi, $f_2=34.569$ ksi

$\psi=0.73082$

Eq. 1.2.2-1

$k=0.53977$

Eq. 1.2.2-2

$\lambda=0.9476$

Eq. 1.1-3

$\rho=0.81029$

Eq. 1.1-2

$b=0.41787$ in (ineffective width= 0.097832 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.212$

Eq. 1.3-7

$I_a=0.00020408$ in⁴

Eq. 1.3-8

$I_s=0.00035659$ in⁴ > I_a (no lip reduction)

$k=3.4958$

Table 1.3-1

Element 2: Partially stiffened, $w=1.7814$ in

$f=49.615$ ksi, $k=3.4958$

$\lambda=1.3173$

Eq. 1.1-3

$\rho=0.63234$

Eq. 1.1-2

$b=1.1264$ in (ineffective width= 0.65495 in)

Eq. 1.1-1

$b_1=0.56322$ in, $b_2=0.56322$ in

Element 3: Treat as two unstiffened elements

$f_1=47.301$ ksi, $f_2=25.31$ ksi

$\psi=0.53509$

Eq. 1.2.2-1

$k=0.6605$

Eq. 1.2.2-2

$\lambda=1.4795$

Eq. 1.1-3

$\rho=0.57539$

Eq. 1.1-2

$b=0.5125$ in (ineffective width= 0.3782 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.27531$ in

$S_{xe}=0.21867$ in³, $F_y=50$ ksi

$M_{nl}=911.11$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.322$ ksi, $f_2=49.322$ ksi

$\psi=1$

Eq. 1.2.2-1

k=0.43	Eq. 1.2.2-3
$\lambda=1.0841$	Eq. 1.1-3
$\rho=0.73522$	Eq. 1.1-2
b=0.37915 in (ineffective width=0.13655 in)	Eq. 1.1-1
Element 2: Stiffened, w=1.7814 in	
$f_1=45.25$ ksi, $f_2=-32.169$ ksi	
$\psi=0.71093$	Eq. 1.1.2-1
k=17.439	Eq. 1.1.2-2
$\lambda=0.56326$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
be=1.7814 in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.48004$ in	Eq. 1.1.2-3
$b_2=0.8907$ in	Eq. 1.1.2-4
Compression width=1.0412 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, w=0.5157 in	
$f_1=49.322$ ksi, $f_2=49.322$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-2
$\lambda=1.0841$	Eq. 1.1-3
$\rho=0.73522$	Eq. 1.1-2
b=0.37915 in (ineffective width=0.13655 in)	Eq. 1.1-1
Element 4: Stiffened, w=1.7814 in	
$f_1=45.25$ ksi, $f_2=-32.169$ ksi	
$\psi=0.71093$	Eq. 1.1.2-1
k=17.439	Eq. 1.1.2-2
$\lambda=0.56326$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
be=1.7814 in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.48004$ in	Eq. 1.1.2-3
$b_2=0.8907$ in	Eq. 1.1.2-4
Compression width=1.0412 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: x=-0.044503 in	
S _{ye} =0.10264 in ³ , F _y =50 ksi	
M _{nl} =427.65 lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, w=1.7814 in

$f_1=44.701$ ksi, $f_2=-41.671$ ksi

$\psi=0.93223$

k=22.292

$\lambda=0.49515$

$\rho=1$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

be=1.7814 in	Eq. 1.1-1
h _o =2 in, b _o =3.5 in, h _o /b _o =0.57143	
b ₁ =0.45303 in	Eq. 1.1.2-3
b ₂ =0.8907 in	Eq. 1.1.2-4
Compression width=0.92194 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.244 ksi, f ₂ =49.244 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=1.871	Eq. 1.1-3
ρ=0.47163	Eq. 1.1-2
b=0.42008 in (ineffective width=0.47062 in)	Eq. 1.1-1
f ₁ =49.244 ksi, f ₂ =49.244 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=1.871	Eq. 1.1-3
ρ=0.47163	Eq. 1.1-2
b=0.42008 in (ineffective width=0.47062 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=1.7814 in	
f ₁ =44.701 ksi, f ₂ =-41.671 ksi	
ψ=0.93223	Eq. 1.1.2-1
k=22.292	Eq. 1.1.2-2
λ=0.49515	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=1.7814 in	Eq. 1.1-1
h _o =2 in, b _o =3.5 in, h _o /b _o =0.57143	
b ₁ =0.45303 in	Eq. 1.1.2-3
b ₂ =0.8907 in	Eq. 1.1.2-4
Compression width=0.92194 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.13727 in	
S _{ye} =0.099323 in ³ , F _y =50 ksi	
M _{nl} =413.85 lb-ft	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =0.46561 in ⁶ , W _n =3.4168 in ² , F _y =50 ksi	
B _n =6813.4 lb-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

350S200-33

Full Section Properties

Area	0.29240 in ²	Wt.	0.99414 lb/ft	Flat	8.4507 in
Ix	0.5985 in ⁴	rx	1.4307 in	Ixy	0.0000 in ⁴
Sx(t)	0.34201 in ³	y(t)	1.7500 in	α	0.000 deg
Sx(b)	0.34201 in ³	y(b)	1.7500 in		
Zx	0.38991 in ³	Height	3.5000 in		
Iy	0.1747 in ⁴	ry	0.7729 in	x _o	-1.7595 in
Sy(l)	0.23656 in ³	x(l)	0.7384 in	y _o	0.0000 in
Sy(r)	0.13844 in ³	x(r)	1.2616 in	jx	2.3113 in
Zy	0.19854 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	0.5985 in ⁴	r ₁	1.4307 in	Cw	0.52268 in ⁶
I ₂	0.1747 in ⁴	r ₂	0.7729 in	J	0.00011668 in ⁴
Ic	0.7732 in ⁴	rc	1.6261 in		
I _o	1.6784 in ⁴	r _o	2.3959 in		

Net Section Properties

Ix	0.5888 in ⁴	rx	1.5647 in	Area	0.24050 in ²
Sx(t)	0.33645 in ³	y(t)	1.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.33645 in ³	y(b)	1.7500 in	α	0.000 deg
Zx	0.37044 in ³				
Iy	0.1419 in ⁴	ry	0.7680 in	x _o	-1.9323 in
Sy(l)	0.15868 in ³	x(l)	0.8940 in	y _o	0.0000 in
Sy(r)	0.12825 in ³	x(r)	1.1060 in	jx	2.1456 in
Zy	0.16700 in ³			jy	0.0000 in
Ic	0.7306 in ⁴	rc	1.7430 in	Cw	0.51201 in ⁶
I _o	1.6286 in ⁴	r _o	2.6023 in	J	0.00009597 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	6982 lb	φMnxo	965.50 lb-ft	φMnyo	437.28 lb-ft
Ae	0.16429 in ²	Ixe	0.50803 in ⁴	Iye	0.13294 in ⁴
φTn	11724 lb	Sxe(t)	0.25747 in ³	Sye(l)	0.15459 in ³
		Sxe(b)	0.33274 in ³	Sye(r)	0.11661 in ³
Shear		Negative Bending		Negative Bending	
φVny	492 lb	φMnxo	965.50 lb-ft	φMnyo	426.63 lb-ft
φVnx	3083 lb	Ixe	0.50803 in ⁴	Iye	0.11578 in ⁴
Torsion		Sxe(t)	0.33274 in ³	Sye(l)	0.11377 in ³
φBn	6767.3 lb-in ²	Sxe(b)	0.25747 in ³	Sye(r)	0.11785 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.412$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.88$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.2924 \text{ in}^2$, $F_y=51.412 \text{ ksi}$
 $T_n=15033 \text{ lb}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.2405 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=15632 \text{ lb}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2
 $V_n=1712.9 \text{ lb}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3
 $V_{yh}=1091.8 \text{ lb}$
 $k_v=3.5467$
 $V_{crh}=480.19 \text{ lb}$
 $V_n=546.3 \text{ lb}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4
 $V_n=1712.9 \text{ lb}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=0.98104$
 $\rho=0.79074$
 $b=0.40644 \text{ in}$ (ineffective width= 0.10756 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$
 $I_a=0.00027958 \text{ in}^4$
 $I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)
 $k=3.4924$

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Element 2: Partially stiffened, $w=1.778 \text{ in}$

$f=50 \text{ ksi}$, $k=3.4924$
 $\lambda=1.1908$
 $\rho=0.68464$
 $b=1.2173 \text{ in}$ (ineffective width= 0.56072 in)
 $b_1=0.60864 \text{ in}$, $b_2=0.60864 \text{ in}$

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=1.6968$
 $\rho=0.51294$
 $b=0.456 \text{ in}$ (ineffective width= 0.433 in)
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.6968$	Eq. 1.1-3
$\rho=0.51294$	Eq. 1.1-2
$b=0.456$ in (ineffective width=0.433 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00027958$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.4924$	Table 1.3-1
Element 4: Partially stiffened, $w=1.778$ in	
$f=50$ ksi, $k=3.4924$	
$\lambda=1.1908$	Eq. 1.1-3
$\rho=0.68464$	Eq. 1.1-2
$b=1.2173$ in (ineffective width=0.56072 in)	Eq. 1.1-1
$b_1=0.60864$ in, $b_2=0.60864$ in	
$A_e=0.16429$ in ² , $F_n=50$ ksi	
$P_n=8214.4$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.187$ ksi, $f_2=24.659$ ksi	
$\psi=0.52257$	Eq. 1.2.2-1
$k=0.67009$	Eq. 1.2.2-2
$\lambda=1.3204$	Eq. 1.1-3
$\rho=0.63114$	Eq. 1.1-2
$b=0.56108$ in (ineffective width=0.32792 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=47.187$ ksi, $f_2=34.162$ ksi	
$\psi=0.72396$	Eq. 1.2.2-1
$k=0.54325$	Eq. 1.2.2-2
$\lambda=0.84791$	Eq. 1.1-3
$\rho=0.87337$	Eq. 1.1-2
$b=0.44891$ in (ineffective width=0.065087 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.228$	Eq. 1.3-7
$I_a=0.00027838$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.4924$	Table 1.3-1

Element 4: Partially stiffened, $w=1.778$ in

$f=49.562$ ksi, $k=3.4924$

$\lambda=1.1855$

Eq. 1.1-3

$\rho=0.68697$

Eq. 1.1-2

$b=1.2214$ in (ineffective width= 0.55657 in)

Eq. 1.1-1

$b_1=0.61072$ in, $b_2=0.61072$ in

Center of gravity shift: $y=-0.22319$ in

$S_{xe}=0.25747$ in³, $F_y=50$ ksi

$M_{nl}=1072.8$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=47.187$ ksi, $f_2=34.162$ ksi

$\psi=0.72396$

Eq. 1.2.2-1

$k=0.54325$

Eq. 1.2.2-2

$\lambda=0.84791$

Eq. 1.1-3

$\rho=0.87337$

Eq. 1.1-2

$b=0.44891$ in (ineffective width= 0.065087 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.228$

Eq. 1.3-7

$I_a=0.00027838$ in⁴

Eq. 1.3-8

$I_s=0.00039155$ in⁴ > I_a (no lip reduction)

$k=3.4924$

Table 1.3-1

Element 2: Partially stiffened, $w=1.778$ in

$f=49.562$ ksi, $k=3.4924$

$\lambda=1.1855$

Eq. 1.1-3

$\rho=0.68697$

Eq. 1.1-2

$b=1.2214$ in (ineffective width= 0.55657 in)

Eq. 1.1-1

$b_1=0.61072$ in, $b_2=0.61072$ in

Element 3: Treat as two unstiffened elements

$f_1=47.187$ ksi, $f_2=24.659$ ksi

$\psi=0.52257$

Eq. 1.2.2-1

$k=0.67009$

Eq. 1.2.2-2

$\lambda=1.3204$

Eq. 1.1-3

$\rho=0.63114$

Eq. 1.1-2

$b=0.56108$ in (ineffective width= 0.32792 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.22319$ in

$S_{xe}=0.25747$ in³, $F_y=50$ ksi

$M_{nl}=1072.8$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.241$ ksi, $f_2=49.241$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=0.97357$	Eq. 1.1-3
$\rho=0.79504$	Eq. 1.1-2
$b=0.40865$ in (ineffective width=0.10535 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.778$ in	
$f_1=45.132$ ksi, $f_2=-32.847$ ksi	
$\psi=0.72781$	Eq. 1.1.2-1
$k=17.772$	Eq. 1.1.2-2
$\lambda=0.50151$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.778$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.47696$ in	Eq. 1.1.2-3
$b_2=0.889$ in	Eq. 1.1.2-4
Compression width=1.029 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.514$ in	
$f_1=49.241$ ksi, $f_2=49.241$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=0.97357$	Eq. 1.1-3
$\rho=0.79504$	Eq. 1.1-2
$b=0.40865$ in (ineffective width=0.10535 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.778$ in	
$f_1=45.132$ ksi, $f_2=-32.847$ ksi	
$\psi=0.72781$	Eq. 1.1.2-1
$k=17.772$	Eq. 1.1.2-2
$\lambda=0.50151$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.778$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.47696$ in	Eq. 1.1.2-3
$b_2=0.889$ in	Eq. 1.1.2-4
Compression width=1.029 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.034035$ in	
$S_y=0.11661$ in ³ , $F_y=50$ ksi	
$M_n=485.86$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.778$ in

$f_1=44.546$ ksi, $f_2=-42.814$ ksi

$\psi=0.96113$

$k=23.007$

$\lambda=0.4379$

$\rho=1$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

be=1.778 in	Eq. 1.1-1
h _o =2 in, b _o =3.5 in, h _o /b _o =0.57143	
b ₁ =0.44886 in	Eq. 1.1.2-3
b ₂ =0.889 in	Eq. 1.1.2-4
Compression width=0.90662 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.15 ksi, f ₂ =49.15 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=1.6823	Eq. 1.1-3
ρ=0.51669	Eq. 1.1-2
b=0.45934 in (ineffective width=0.42966 in)	Eq. 1.1-1
f ₁ =49.15 ksi, f ₂ =49.15 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=1.6823	Eq. 1.1-3
ρ=0.51669	Eq. 1.1-2
b=0.45934 in (ineffective width=0.42966 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=1.778 in	
f ₁ =44.546 ksi, f ₂ =-42.814 ksi	
ψ=0.96113	Eq. 1.1.2-1
k=23.007	Eq. 1.1.2-2
λ=0.4379	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=1.778 in	Eq. 1.1-1
h _o =2 in, b _o =3.5 in, h _o /b _o =0.57143	
b ₁ =0.44886 in	Eq. 1.1.2-3
b ₂ =0.889 in	Eq. 1.1.2-4
Compression width=0.90662 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.12367 in	
S _{ye} =0.11377 in ³ , F _y =50 ksi	
M _{nl} =474.04 lb-ft	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =0.51201 in ⁶ , W _n =3.4047 in ² , F _y =50 ksi	
B _n =7519.3 lb-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

350S200-43

Full Section Properties

Area	0.37923 in ²	Wt.	1.2894 lb/ft	Flat	8.4086 in
I _x	0.7714 in ⁴	r _x	1.4263 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.44083 in ³	y(t)	1.7500 in	α	0.000 deg
S _x (b)	0.44083 in ³	y(b)	1.7500 in		
Z _x	0.50407 in ³	Height	3.5000 in		
I _y	0.2239 in ⁴	r _y	0.7685 in	x _o	-1.7474 in
S _y (l)	0.30326 in ³	x(l)	0.7385 in	y _o	0.0000 in
S _y (r)	0.17751 in ³	x(r)	1.2615 in	j _x	2.3003 in
Z _y	0.25588 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	0.7714 in ⁴	r ₁	1.4263 in	C _w	0.66391 in ⁶
I ₂	0.2239 in ⁴	r ₂	0.7685 in	J	0.0002571 in ⁴
I _c	0.9954 in ⁴	r _c	1.6201 in		
I _o	2.1533 in ⁴	r _o	2.3829 in		

Net Section Properties

I _x	0.7588 in ⁴	r _x	1.5605 in	Area	0.31158 in ²
S _x (t)	0.43358 in ³	y(t)	1.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.43358 in ³	y(b)	1.7500 in	α	0.000 deg
Z _x	0.47870 in ³				
I _y	0.1817 in ⁴	r _y	0.7637 in	x _o	-1.9201 in
S _y (l)	0.20330 in ³	x(l)	0.8939 in	y _o	0.0000 in
S _y (r)	0.16430 in ³	x(r)	1.1061 in	j _x	2.1338 in
Z _y	0.21512 in ³			j _y	0.0000 in
I _c	0.9405 in ⁴	r _c	1.7374 in	C _w	0.65018 in ⁶
I _o	2.0892 in ⁴	r _o	2.5894 in	J	0.00021125 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	10294 lb	φM _{nxo}	1391.4 lb-ft	φM _{nyo}	603.0 lb-ft
A _e	0.24222 in ²	I _{xe}	0.69830 in ⁴	I _{ye}	0.17910 in ⁴
φT _n	15190 lb	S _{xe} (t)	0.37103 in ³	S _{ye} (l)	0.20212 in ³
		S _{xe} (b)	0.43160 in ³	S _{ye} (r)	0.16079 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	836 lb	φM _{nxo}	1391.4 lb-ft	φM _{nyo}	583.4 lb-ft
φV _{nx}	4304 lb	I _{xe}	0.69830 in ⁴	I _{ye}	0.15914 in ⁴
Torsion		S _{xe} (t)	0.43160 in ³	S _{ye} (l)	0.16287 in ³
φB _n	8688.8 lb-in ²	S _{xe} (b)	0.37103 in ³	S _{ye} (r)	0.15557 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.729$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=53.526$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.37923 \text{ in}^2$, $F_y=51.729 \text{ ksi}$ $T_n=19617 \text{ lb}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.31158 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=20253 \text{ lb}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=2391.3 \text{ lb}$ at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=1409.7 \text{ lb}$	Eq. G3-2
$k_v=3.5424$	Eq. G3-8
$V_{crh}=1061.6 \text{ lb}$	Eq. G3-6
$V_n=928.64 \text{ lb}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=2391.3 \text{ lb}$ at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123 \text{ in}$ (ineffective width= 0.027474 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00062038 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00049474 \text{ in}^4$	
$d_s=0.38377 \text{ in}$ (lip ineffective width= 0.097452 in)	Eq. 1.3-6
$k=3.2601$	Table 1.3-1
Element 2: Partially stiffened, $w=1.7674 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.2601$	
$\lambda=0.93989$	Eq. 1.1-3
$\rho=0.81492$	Eq. 1.1-2
$b=1.4403 \text{ in}$ (ineffective width= 0.32712 in)	Eq. 1.1-1
$b_1=0.57431 \text{ in}$, $b_2=0.86598 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.294$	Eq. 1.1-3
$\rho=0.64142$	Eq. 1.1-2
$b=0.56682 \text{ in}$ (ineffective width= 0.31688 in)	Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.294$	Eq. 1.1-3
$\rho=0.64142$	Eq. 1.1-2
$b=0.56682$ in (ineffective width=0.31688 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123$ in (ineffective width=0.027474 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00062038$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.38377$ in (lip ineffective width=0.097452 in)	Eq. 1.3-6
$k=3.2601$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7674$ in	
$f=50$ ksi, $k=3.2601$	
$\lambda=0.93989$	Eq. 1.1-3
$\rho=0.81492$	Eq. 1.1-2
$b=1.4403$ in (ineffective width=0.32712 in)	Eq. 1.1-1
$b_1=0.57431$ in, $b_2=0.86598$ in	
$A_e=0.24222$ in ² , $F_n=50$ ksi	
$P_n=12111$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.91$ ksi, $f_2=23.433$ ksi	
$\psi=0.49953$	Eq. 1.2.2-1
$k=0.68848$	Eq. 1.2.2-2
$\lambda=0.99053$	Eq. 1.1-3
$\rho=0.78534$	Eq. 1.1-2
$b=0.694$ in (ineffective width=0.1897 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=46.91$ ksi, $f_2=33.396$ ksi	
$\psi=0.7119$	Eq. 1.2.2-1
$k=0.54948$	Eq. 1.2.2-2
$\lambda=0.63825$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.279$	Eq. 1.3-7
$I_a=0.00061677$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.40805$ in (lip ineffective width=0.10065 in)	Eq. 1.3-6

k=3.2656	Table 1.3-1
Element 4: Partially stiffened, w=1.7674 in	
f=49.401 ksi, k=3.2656	
$\lambda=0.93345$	Eq. 1.1-3
$\rho=0.81881$	Eq. 1.1-2
b=1.4472 in (ineffective width=0.32024 in)	Eq. 1.1-1
$b_1=0.58042$ in, $b_2=0.86674$ in	
Center of gravity shift: y=-0.13207 in	
$S_{xe}=0.37103$ in ³ , $F_y=50$ ksi	
$M_{nl}=1546$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, w=0.5087 in	
$f_1=46.91$ ksi, $f_2=33.396$ ksi	
$\psi=0.7119$	Eq. 1.2.2-1
k=0.54948	Eq. 1.2.2-2
$\lambda=0.63825$	Eq. 1.1-3
$\lambda < 0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.279	Eq. 1.3-7
$I_a=0.00061677$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
ds=0.40805 in (lip ineffective width=0.10065 in)	Eq. 1.3-6
k=3.2656	Table 1.3-1
Element 2: Partially stiffened, w=1.7674 in	
f=49.401 ksi, k=3.2656	
$\lambda=0.93345$	Eq. 1.1-3
$\rho=0.81881$	Eq. 1.1-2
b=1.4472 in (ineffective width=0.32024 in)	Eq. 1.1-1
$b_1=0.58042$ in, $b_2=0.86674$ in	
Element 3: Treat as two unstiffened elements	
$f_1=46.91$ ksi, $f_2=23.433$ ksi	
$\psi=0.49953$	Eq. 1.2.2-1
k=0.68848	Eq. 1.2.2-2
$\lambda=0.99053$	Eq. 1.1-3
$\rho=0.78534$	Eq. 1.1-2
b=0.694 in (ineffective width=0.1897 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.13207 in	
$S_{xe}=0.37103$ in ³ , $F_y=50$ ksi	
$M_{nl}=1546$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, w=0.5087 in	
$f_1=48.988$ ksi, $f_2=48.988$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3

$\lambda=0.7373$	Eq. 1.1-3
$\rho=0.9516$	Eq. 1.1-2
$b=0.48408$ in (ineffective width=0.024622 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.7674$ in	
$f_1=44.78$ ksi, $f_2=-34.555$ ksi	
$\psi=0.77168$	Eq. 1.1.2-1
$k=18.665$	Eq. 1.1.2-2
$\lambda=0.37173$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7674$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.4686$ in	Eq. 1.1.2-3
$b_2=0.8837$ in	Eq. 1.1.2-4
Compression width=0.99758 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=48.988$ ksi, $f_2=48.988$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.7373$	Eq. 1.1-3
$\rho=0.9516$	Eq. 1.1-2
$b=0.48408$ in (ineffective width=0.024622 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.7674$ in	
$f_1=44.78$ ksi, $f_2=-34.555$ ksi	
$\psi=0.77168$	Eq. 1.1.2-1
$k=18.665$	Eq. 1.1.2-2
$\lambda=0.37173$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7674$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.4686$ in	Eq. 1.1.2-3
$b_2=0.8837$ in	Eq. 1.1.2-4
Compression width=0.99758 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.007779$ in	
$S_y=0.16079$ in ³ , $F_y=50$ ksi	
$M_n=669.97$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7674$ in

$f_1=42.057$ ksi, $f_2=-44.316$ ksi

$\psi=1.0537$

$k=25.432$

$\lambda=0.30863$

$\rho=1$

$b_e=1.7674$ in

$h_o=2$ in, $b_o=3.5$ in, $h_o/b_o=0.57143$

$b_1=0.43599$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

$b_2=0.8837$ in	Eq. 1.1.2-4
Compression width=0.86058 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.638$ ksi, $f_2=46.638$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2497$	Eq. 1.1-3
$\rho=0.65931$	Eq. 1.1-2
$b=0.58263$ in (ineffective width=0.30107 in)	Eq. 1.1-1
$f_1=46.638$ ksi, $f_2=46.638$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2497$	Eq. 1.1-3
$\rho=0.65931$	Eq. 1.1-2
$b=0.58263$ in (ineffective width=0.30107 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.7674$ in	
$f_1=42.057$ ksi, $f_2=-44.316$ ksi	
$\psi=1.0537$	Eq. 1.1.2-1
$k=25.432$	Eq. 1.1.2-2
$\lambda=0.30863$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7674$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=3.5$ in, $h_o/b_o=0.57143$	
$b_1=0.43599$ in	Eq. 1.1.2-3
$b_2=0.8837$ in	Eq. 1.1.2-4
Compression width=0.86058 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.083193$ in	
$S_y=0.15557$ in ³ , $F_y=50$ ksi	
$M_n=648.23$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.65018$ in ⁶ , $W_n=3.3673$ in ² , $F_y=50$ ksi	
$B_n=9654.3$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350S200-54

Full Section Properties

Area	0.47144 in ²	Wt.	1.6029 lb/ft	Flat	8.3293 in
Ix	0.9505 in ⁴	rx	1.4199 in	Ixy	0.0000 in ⁴
Sx(t)	0.54314 in ³	y(t)	1.7500 in	α	0.000 deg
Sx(b)	0.54314 in ³	y(b)	1.7500 in		
Zx	0.62360 in ³	Height	3.5000 in		
Iy	0.2740 in ⁴	ry	0.7623 in	x _o	-1.7326 in
Sy(l)	0.37147 in ³	x(l)	0.7375 in	y _o	0.0000 in
Sy(r)	0.21700 in ³	x(r)	1.2625 in	jx	2.2885 in
Zy	0.31525 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	0.9505 in ⁴	r ₁	1.4199 in	Cw	0.80329 in ⁶
I ₂	0.2740 in ⁴	r ₂	0.7623 in	J	0.0005034 in ⁴
Ic	1.2245 in ⁴	rc	1.6116 in		
I _o	2.6397 in ⁴	r _o	2.3663 in		

Net Section Properties

Ix	0.9346 in ⁴	rx	1.5549 in	Area	0.38654 in ²
Sx(t)	0.53404 in ³	y(t)	1.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.53404 in ³	y(b)	1.7500 in	α	0.000 deg
Zx	0.59176 in ³				
Iy	0.2219 in ⁴	ry	0.7576 in	x _o	-1.9058 in
Sy(l)	0.24836 in ³	x(l)	0.8933 in	y _o	0.0000 in
Sy(r)	0.20046 in ³	x(r)	1.1067 in	jx	2.1211 in
Zy	0.26459 in ³			jy	0.0000 in
Ic	1.1564 in ⁴	rc	1.7297 in	Cw	0.78633 in ⁶
I _o	2.5604 in ⁴	r _o	2.5737 in	J	0.0004128 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	13591 lb	φMnxo	1803.4 lb-ft	φMnyo	854.4 lb-ft
Ae	0.31979 in ²	Ixe	0.88532 in ⁴	Iye	0.22186 in ⁴
φTn	18844 lb	Sxe(t)	0.48092 in ³	Sye(l)	0.24836 in ³
		Sxe(b)	0.53361 in ³	Sye(r)	0.20046 in ³
Shear		Negative Bending		Negative Bending	
φVny	1243 lb	φMnxo	1803.4 lb-ft	φMnyo	733.1 lb-ft
φVnx	5248 lb	Ixe	0.88532 in ⁴	Iye	0.20863 in ⁴
Torsion		Sxe(t)	0.53361 in ³	Sye(l)	0.22364 in ³
φBn	10646 lb-in ²	Sxe(b)	0.48092 in ³	Sye(r)	0.19550 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=52.168$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=54.356$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.47144$ in², $F_y=52.168$ ksi

$T_n=24594 \text{ lb}$
 $\Omega_t=1.67, \phi_t=0.9$ Eq. D2-1

$A_n=0.38654 \text{ in}^2, F_u=65 \text{ ksi}$
 $T_n=25125 \text{ lb}$ Eq. D3-1
 $\Omega_t=2, \phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=2915.5 \text{ lb at } 180 \text{ deg}$ Eq. G2.1-1
 $\Omega_v=1.67, \phi_v=0.9$

Stud element 3
 $V_{yh}=1689.8 \text{ lb}$ Eq. G3-2
 $k_v=3.5218$ Eq. G3-8
 $V_{crh}=2080.5 \text{ lb}$ Eq. G3-6
 $V_n=1380.8 \text{ lb at } 90 \text{ deg}$ Eq. G2.1-2
 $\Omega_v=1.67, \phi_v=0.9$

Stud element 4
 $V_n=2915.5 \text{ lb at } 0 \text{ deg}$ Eq. G2.1-1
 $\Omega_v=1.67, \phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56413$ Eq. 1.1-3
 $\lambda<0.673 \text{ (fully effective)}$ Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0011127 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00053312 \text{ in}^4$
 $d_s=0.23166 \text{ in (lip ineffective width=0.25184 in)}$ Eq. 1.3-6
 $k=2.7693$ Table 1.3-1

Element 2: Partially stiffened, $w=1.717 \text{ in}$
 $f=50 \text{ ksi}, k=2.7693$
 $\lambda=0.78941$ Eq. 1.1-3
 $\rho=0.91373$ Eq. 1.1-2
 $b=1.5689 \text{ in (ineffective width=0.14812 in)}$ Eq. 1.1-1
 $b_1=0.37585 \text{ in}, b_2=1.193 \text{ in}$

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.0017$ Eq. 1.1-3
 $\rho=0.77907$ Eq. 1.1-2
 $b=0.66883 \text{ in (ineffective width=0.18967 in)}$ Eq. 1.1-1
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0017$	Eq. 1.1-3
$\rho=0.77907$	Eq. 1.1-2
$b=0.66883$ in (ineffective width=0.18967 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0011127$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.23166$ in (lip ineffective width=0.25184 in)	Eq. 1.3-6
$k=2.7693$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	
$f=50$ ksi, $k=2.7693$	
$\lambda=0.78941$	Eq. 1.1-3
$\rho=0.91373$	Eq. 1.1-2
$b=1.5689$ in (ineffective width=0.14812 in)	Eq. 1.1-1
$b_1=0.37585$ in, $b_2=1.193$ in	
$A_e=0.31979$ in ² , $F_n=50$ ksi	
$P_n=15989$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.157$ ksi, $f_2=22.839$ ksi	
$\psi=0.49481$	Eq. 1.2.2-1
$k=0.69237$	Eq. 1.2.2-2
$\lambda=0.75844$	Eq. 1.1-3
$\rho=0.93604$	Eq. 1.1-2
$b=0.80359$ in (ineffective width=0.05491 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=46.157$ ksi, $f_2=33.024$ ksi	
$\psi=0.71548$	Eq. 1.2.2-1
$k=0.54762$	Eq. 1.2.2-2
$\lambda=0.4803$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.333$	Eq. 1.3-7
$I_a=0.0010743$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.23993$ in (lip ineffective width=0.24357 in)	Eq. 1.3-6
$k=2.7941$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	

$f=49.231$ ksi, $k=2.7941$
 $\lambda=0.77984$ Eq. 1.1-3
 $\rho=0.92056$ Eq. 1.1-2
 $b=1.5806$ in (ineffective width= 0.13639 in) Eq. 1.1-1
 $b_1=0.39218$ in, $b_2=1.1884$ in
 Center of gravity shift: $y=-0.090892$ in
 $S_{xe}=0.48092$ in³, $F_y=50$ ksi
 $M_{nl}=2003.8$ lb-ft Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=46.157$ ksi, $f_2=33.024$ ksi
 $\psi=0.71548$ Eq. 1.2.2-1
 $k=0.54762$ Eq. 1.2.2-2
 $\lambda=0.4803$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.333$ Eq. 1.3-7
 $I_a=0.0010743$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $ds=0.23993$ in (lip ineffective width= 0.24357 in) Eq. 1.3-6
 $k=2.7941$ Table 1.3-1

Element 2: Partially stiffened, $w=1.717$ in

$f=49.231$ ksi, $k=2.7941$
 $\lambda=0.77984$ Eq. 1.1-3
 $\rho=0.92056$ Eq. 1.1-2
 $b=1.5806$ in (ineffective width= 0.13639 in) Eq. 1.1-1
 $b_1=0.39218$ in, $b_2=1.1884$ in

Element 3: Treat as two unstiffened elements

$f_1=46.157$ ksi, $f_2=22.839$ ksi
 $\psi=0.49481$ Eq. 1.2.2-1
 $k=0.69237$ Eq. 1.2.2-2
 $\lambda=0.75844$ Eq. 1.1-3
 $\rho=0.93604$ Eq. 1.1-2
 $b=0.80359$ in (ineffective width= 0.05491 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.090892$ in

$S_{xe}=0.48092$ in³, $F_y=50$ ksi
 $M_{nl}=2003.8$ lb-ft Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=55.372$ ksi, $f_2=55.372$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3

$\lambda=0.59367$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.717$ in	
$f_1=49.56$ ksi, $f_2=-38.601$ ksi	
$\psi=0.77888$	Eq. 1.1.2-1
$k=18.816$	Eq. 1.1.2-2
$\lambda=0.30151$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.45437$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.96521 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=55.372$ ksi, $f_2=55.372$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.59367$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.717$ in	
$f_1=49.56$ ksi, $f_2=-38.601$ ksi	
$\psi=0.77888$	Eq. 1.1.2-1
$k=18.816$	Eq. 1.1.2-2
$\lambda=0.30151$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.45437$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.96521 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_{ye}=0.20046$ in ³ , $F_y=56.825$ ksi	
$M_n I=949.29$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about Y-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: Stiffened, $w=1.717$ in	
$f_1=37.025$ ksi, $f_2=-43.374$ ksi	
$\psi=1.1715$	Eq. 1.1.2-1
$k=28.822$	Eq. 1.1.2-2
$\lambda=0.21057$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=3.5$ in, $h_o/b_o=0.57143$	
$b_1=0.4116$ in	Eq. 1.1.2-3

$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.7907 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=42.325$ ksi, $f_2=42.325$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.92159$	Eq. 1.1-3
$\rho=0.82605$	Eq. 1.1-2
$b=0.70916$ in (ineffective width=0.14934 in)	Eq. 1.1-1
$f_1=42.325$ ksi, $f_2=42.325$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.92159$	Eq. 1.1-3
$\rho=0.82605$	Eq. 1.1-2
$b=0.70916$ in (ineffective width=0.14934 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.717$ in	
$f_1=37.025$ ksi, $f_2=-43.374$ ksi	
$\psi=1.1715$	Eq. 1.1.2-1
$k=28.822$	Eq. 1.1.2-2
$\lambda=0.21057$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=3.5$ in, $h_o/b_o=0.57143$	
$b_1=0.4116$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.7907 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.039559$ in	
$S_y=0.1955$ in ³ , $F_y=50$ ksi	
$M_n=814.57$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.78633$ in ⁶ , $W_n=3.3236$ in ² , $F_y=50$ ksi	
$B_n=11829$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350S250-27

Full Section Properties

Area	0.26817 in ²	Wt.	0.91177 lb/ft	Flat	9.4758 in
I _x	0.5781 in ⁴	r _x	1.4683 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.33035 in ³	y(t)	1.7500 in	α	0.000 deg
S _x (b)	0.33035 in ³	y(b)	1.7500 in		
Z _x	0.36960 in ³	Height	3.5000 in		
I _y	0.2439 in ⁴	r _y	0.9537 in	x _o	-2.2391 in
S _y (l)	0.25497 in ³	x(l)	0.9566 in	y _o	0.0000 in
S _y (r)	0.15802 in ³	x(r)	1.5434 in	j _x	2.7265 in
Z _y	0.22700 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	0.5781 in ⁴	r ₁	1.4683 in	C _w	0.72660 in ⁶
I ₂	0.2439 in ⁴	r ₂	0.9537 in	J	0.00007159 in ⁴
I _c	0.8220 in ⁴	r _c	1.7508 in		
I _o	2.1665 in ⁴	r _o	2.8424 in		

Net Section Properties

I _x	0.5701 in ⁴	r _x	1.5893 in	Area	0.22572 in ²
S _x (t)	0.32580 in ³	y(t)	1.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.32580 in ³	y(b)	1.7500 in	α	0.000 deg
Z _x	0.35368 in ³				
I _y	0.1991 in ⁴	r _y	0.9392 in	x _o	-2.4345 in
S _y (l)	0.17561 in ³	x(l)	1.1338 in	y _o	0.0000 in
S _y (r)	0.14573 in ³	x(r)	1.3662 in	j _x	2.6168 in
Z _y	0.19045 in ³			j _y	0.0000 in
I _c	0.7692 in ⁴	r _c	1.8461 in	C _w	0.71303 in ⁶
I _o	2.1070 in ⁴	r _o	3.0553 in	J	0.00006026 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	5186 lb	φM _{nxo}	738.61 lb-ft	φM _{nyo}	477.08 lb-ft
A _e	0.12203 in ²	I _{xe}	0.42541 in ⁴	I _{ye}	0.18125 in ⁴
φT _n	11004 lb	S _{xe} (t)	0.19696 in ³	S _{ye} (l)	0.16856 in ³
		S _{xe} (b)	0.31743 in ³	S _{ye} (r)	0.12722 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	327 lb	φM _{nxo}	738.61 lb-ft	φM _{nyo}	456.54 lb-ft
φV _{nx}	2263 lb	I _{xe}	0.42541 in ⁴	I _{ye}	0.15789 in ⁴
Torsion		S _{xe} (t)	0.31743 in ³	S _{ye} (l)	0.12174 in ³
φB _n	7438.4 lb-in ²	S _{xe} (b)	0.19696 in ³	S _{ye} (r)	0.13123 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=51.072$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=51.97$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=53.824$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.26817 \text{ in}^2$, $F_y=51.072 \text{ ksi}$ $T_n=13696 \text{ lb}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.22572 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=14672 \text{ lb}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1257.2 \text{ lb}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=897.9 \text{ lb}$	Eq. G3-2
$k_v=3.636$	Eq. G3-8
$V_{crh}=269.44 \text{ lb}$	Eq. G3-6
$V_n=363.67 \text{ lb}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1257.2 \text{ lb}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5171 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2067$	Eq. 1.1-3
$\rho=0.67763$	Eq. 1.1-2
$b=0.3504 \text{ in}$ (ineffective width=0.1667 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0001947 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00032608 \text{ in}^4 > I_a$ (no lip reduction)	
$k=3.8819$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2842 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.8819$	
$\lambda=1.774$	Eq. 1.1-3
$\rho=0.49378$	Eq. 1.1-2
$b=1.1279 \text{ in}$ (ineffective width=1.1563 in)	Eq. 1.1-1
$b_1=0.56395 \text{ in}$, $b_2=0.56395 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0817$	Eq. 1.1-3
$\rho=0.4296$	Eq. 1.1-2
$b=0.38325 \text{ in}$ (ineffective width=0.50885 in)	Eq. 1.1-1
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0817$	Eq. 1.1-3
$\rho=0.4296$	Eq. 1.1-2
$b=0.38325$ in (ineffective width=0.50885 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2067$	Eq. 1.1-3
$\rho=0.67763$	Eq. 1.1-2
$b=0.3504$ in (ineffective width=0.1667 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0001947$ in ⁴	Eq. 1.3-8
$I_s=0.00032608$ in ⁴ > I_a (no lip reduction)	
$k=3.8819$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2842$ in	
$f=50$ ksi, $k=3.8819$	
$\lambda=1.774$	Eq. 1.1-3
$\rho=0.49378$	Eq. 1.1-2
$b=1.1279$ in (ineffective width=1.1563 in)	Eq. 1.1-1
$b_1=0.56395$ in, $b_2=0.56395$ in	
$A_e=0.12203$ in ² , $F_n=50$ ksi	
$P_n=6101.7$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.502$ ksi, $f_2=26.848$ ksi	
$\psi=0.5652$	Eq. 1.2.2-1
$k=0.63853$	Eq. 1.2.2-2
$\lambda=1.6651$	Eq. 1.1-3
$\rho=0.52121$	Eq. 1.1-2
$b=0.46497$ in (ineffective width=0.42713 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=47.502$ ksi, $f_2=35.53$ ksi	
$\psi=0.74797$	Eq. 1.2.2-1
$k=0.53126$	Eq. 1.2.2-2
$\lambda=1.0581$	Eq. 1.1-3
$\rho=0.74857$	Eq. 1.1-2
$b=0.38709$ in (ineffective width=0.13001 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.193$	Eq. 1.3-7
$I_a=0.00019407$ in ⁴	Eq. 1.3-8
$I_s=0.00032608$ in ⁴ > I_a (no lip reduction)	
$k=3.8819$	Table 1.3-1

Element 4: Partially stiffened, $w=2.2842$ in

$f=49.672$ ksi, $k=3.8819$

$\lambda=1.7682$

Eq. 1.1-3

$\rho=0.49518$

Eq. 1.1-2

$b=1.1311$ in (ineffective width= 1.1531 in)

Eq. 1.1-1

$b_1=0.56554$ in, $b_2=0.56554$ in

Center of gravity shift: $y=-0.40984$ in

$S_{xe}=0.19696$ in³, $F_y=50$ ksi

$M_{nl}=820.68$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171$ in

$f_1=47.502$ ksi, $f_2=35.53$ ksi

$\psi=0.74797$

Eq. 1.2.2-1

$k=0.53126$

Eq. 1.2.2-2

$\lambda=1.0581$

Eq. 1.1-3

$\rho=0.74857$

Eq. 1.1-2

$b=0.38709$ in (ineffective width= 0.13001 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.193$

Eq. 1.3-7

$I_a=0.00019407$ in⁴

Eq. 1.3-8

$I_s=0.00032608$ in⁴ $> I_a$ (no lip reduction)

$k=3.8819$

Table 1.3-1

Element 2: Partially stiffened, $w=2.2842$ in

$f=49.672$ ksi, $k=3.8819$

$\lambda=1.7682$

Eq. 1.1-3

$\rho=0.49518$

Eq. 1.1-2

$b=1.1311$ in (ineffective width= 1.1531 in)

Eq. 1.1-1

$b_1=0.56554$ in, $b_2=0.56554$ in

Element 3: Treat as two unstiffened elements

$f_1=47.502$ ksi, $f_2=26.848$ ksi

$\psi=0.5652$

Eq. 1.2.2-1

$k=0.63853$

Eq. 1.2.2-2

$\lambda=1.6651$

Eq. 1.1-3

$\rho=0.52121$

Eq. 1.1-2

$b=0.46497$ in (ineffective width= 0.42713 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.40984$ in

$S_{xe}=0.19696$ in³, $F_y=50$ ksi

$M_{nl}=820.68$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171$ in

$f_1=49.503$ ksi, $f_2=49.503$ ksi

$\psi=1$

Eq. 1.2.2-1

k=0.43	Eq. 1.2.2-3
$\lambda=1.2007$	Eq. 1.1-3
$\rho=0.68026$	Eq. 1.1-2
b=0.35176 in (ineffective width=0.16534 in)	Eq. 1.1-1
Element 2: Stiffened, w=2.2842 in	
$f_1=46.213$ ksi, $f_2=-33.953$ ksi	
$\psi=0.7347$	Eq. 1.1.2-1
k=17.909	Eq. 1.1.2-2
$\lambda=0.79404$	Eq. 1.1-3
$\rho=0.91046$	Eq. 1.1-2
be=2.0797 in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.55685$ in	Eq. 1.1.2-3
$b_2=1.0398$ in	Eq. 1.1.2-4
Compression width=1.3168 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, w=0.5171 in	
$f_1=49.503$ ksi, $f_2=49.503$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=1.2007$	Eq. 1.1-3
$\rho=0.68026$	Eq. 1.1-2
b=0.35176 in (ineffective width=0.16534 in)	Eq. 1.1-1
Element 4: Stiffened, w=2.2842 in	
$f_1=46.213$ ksi, $f_2=-33.953$ ksi	
$\psi=0.7347$	Eq. 1.1.2-1
k=17.909	Eq. 1.1.2-2
$\lambda=0.79404$	Eq. 1.1-3
$\rho=0.91046$	Eq. 1.1-2
be=2.0797 in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.55685$ in	Eq. 1.1.2-3
$b_2=1.0398$ in	Eq. 1.1.2-4
Compression width=1.3168 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: x=-0.05848 in	
$S_{ye}=0.12722$ in ³ , $F_y=50$ ksi	
Mnl=530.09 lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, w=2.2842 in

$f_1=45.84$ ksi, $f_2=-42.227$ ksi

$\psi=0.92118$

k=22.024

$\lambda=0.71313$

$\rho=0.96967$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

be=2.2149 in	Eq. 1.1-1
h _o =2.5 in, b _o =3.5 in, h _o /b _o =0.71429	
b ₁ =0.56486 in	Eq. 1.1.2-3
b ₂ =1.1075 in	Eq. 1.1.2-4
Compression width=1.189 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.454 ksi, f ₂ =49.454 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.0704	Eq. 1.1-3
ρ=0.43168	Eq. 1.1-2
b=0.3851 in (ineffective width=0.507 in)	Eq. 1.1-1
f ₁ =49.454 ksi, f ₂ =49.454 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-2
λ=2.0704	Eq. 1.1-3
ρ=0.43168	Eq. 1.1-2
b=0.3851 in (ineffective width=0.507 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=2.2842 in	
f ₁ =45.84 ksi, f ₂ =-42.227 ksi	
ψ=0.92118	Eq. 1.1.2-1
k=22.024	Eq. 1.1.2-2
λ=0.71313	Eq. 1.1-3
ρ=0.96967	Eq. 1.1-2
be=2.2149 in	Eq. 1.1-1
h _o =2.5 in, b _o =3.5 in, h _o /b _o =0.71429	
b ₁ =0.56486 in	Eq. 1.1.2-3
b ₂ =1.1075 in	Eq. 1.1.2-4
Compression width=1.189 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.16307 in	
S _{ye} =0.12174 in ³ , F _y =50 ksi	
M _{nl} =507.27 lb-ft	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =0.71303 in ⁶ , W _n =4.3136 in ² , F _y =50 ksi	
B _n =8264.9 lb-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

350S250-30

Full Section Properties

Area	0.29529 in ²	Wt.	1.0040 lb/ft	Flat	9.4643 in
Ix	0.6355 in ⁴	rx	1.4670 in	Ixy	0.0000 in ⁴
Sx(t)	0.36316 in ³	y(t)	1.7500 in	α	0.000 deg
Sx(b)	0.36315 in ³	y(b)	1.7500 in		
Zx	0.40664 in ³	Height	3.5000 in		
Iy	0.2679 in ⁴	ry	0.9524 in	x _o	-2.2357 in
Sy(l)	0.28004 in ³	x(l)	0.9565 in	y _o	0.0000 in
Sy(r)	0.17355 in ³	x(r)	1.5435 in	jx	2.7232 in
Zy	0.24961 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	0.6355 in ⁴	r ₁	1.4670 in	Cw	0.79599 in ⁶
I ₂	0.2679 in ⁴	r ₂	0.9524 in	J	0.00009581 in ⁴
Ic	0.9034 in ⁴	rc	1.7491 in		
I _o	2.3794 in ⁴	r _o	2.8386 in		

Net Section Properties

Ix	0.6267 in ⁴	rx	1.5882 in	Area	0.24849 in ²
Sx(t)	0.35814 in ³	y(t)	1.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.35814 in ³	y(b)	1.7500 in	α	0.000 deg
Zx	0.38909 in ³				
Iy	0.2186 in ⁴	ry	0.9380 in	x _o	-2.4311 in
Sy(l)	0.19283 in ³	x(l)	1.1338 in	y _o	0.0000 in
Sy(r)	0.16002 in ³	x(r)	1.3662 in	jx	2.6134 in
Zy	0.20939 in ³			jy	0.0000 in
Ic	0.8454 in ⁴	rc	1.8445 in	Cw	0.78107 in ⁶
I _o	2.3139 in ⁴	r _o	3.0516 in	J	0.00008063 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	6136 lb	φMnxo	866.49 lb-ft	φMnyo	536.87 lb-ft
Ae	0.14439 in ²	Ixe	0.48716 in ⁴	Iye	0.20248 in ⁴
φTn	12114 lb	Sxe(t)	0.23106 in ³	Sye(l)	0.18651 in ³
		Sxe(b)	0.35005 in ³	Sye(r)	0.14317 in ³
Shear		Negative Bending		Negative Bending	
φVny	402 lb	φMnxo	866.49 lb-ft	φMnyo	516.81 lb-ft
φVnx	2734 lb	Ixe	0.48716 in ⁴	Iye	0.17693 in ⁴
Torsion		Sxe(t)	0.35005 in ³	Sye(l)	0.13782 in ³
φBn	8170.6 lb-in ²	Sxe(b)	0.23106 in ³	Sye(r)	0.14548 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.163$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.136$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.29529 \text{ in}^2$, $F_y=51.163 \text{ ksi}$ $T_n=15108 \text{ lb}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.24849 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=16152 \text{ lb}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1519 \text{ lb}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=987.46 \text{ lb}$	Eq. G3-2
$k_v=3.6349$	Eq. G3-8
$V_{crh}=360.9 \text{ lb}$	Eq. G3-6
$V_n=446.61 \text{ lb}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1519 \text{ lb}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5157 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723 \text{ in}$ (ineffective width= 0.13847 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00026103 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00035659 \text{ in}^4 > I_a$ (no lip reduction)	
$k=3.8802$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2814 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.8802$	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
$b=1.225 \text{ in}$ (ineffective width= 1.0564 in)	Eq. 1.1-1
$b_1=0.61249 \text{ in}$, $b_2=0.61249 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.8853$	Eq. 1.1-3
$\rho=0.46853$	Eq. 1.1-2
$b=0.41732 \text{ in}$ (ineffective width= 0.47338 in)	Eq. 1.1-1
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1

k=0.43	Eq. 1.2.2-3
$\lambda=1.8853$	Eq. 1.1-3
$\rho=0.46853$	Eq. 1.1-2
b=0.41732 in (ineffective width=0.47338 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.5157 in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
b=0.37723 in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.091	Eq. 1.3-7
$I_a=0.00026103$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
k=3.8802	Table 1.3-1
Element 4: Partially stiffened, w=2.2814 in	
f=50 ksi, k=3.8802	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
b=1.225 in (ineffective width=1.0564 in)	Eq. 1.1-1
$b_1=0.61249$ in, $b_2=0.61249$ in	
$A_e=0.14439$ in ² , $F_n=50$ ksi	
$P_n=7219.3$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.408$ ksi, $f_2=26.283$ ksi	
$\psi=0.5544$	Eq. 1.2.2-1
k=0.64625	Eq. 1.2.2-2
$\lambda=1.4975$	Eq. 1.1-3
$\rho=0.56969$	Eq. 1.1-2
b=0.50742 in (ineffective width=0.38328 in)	Eq. 1.1-1

Element 5: Unstiffened, w=0.5157 in

$f_1=47.408$ ksi, $f_2=35.177$ ksi	
$\psi=0.742$	Eq. 1.2.2-1
k=0.53419	Eq. 1.2.2-2
$\lambda=0.9536$	Eq. 1.1-3
$\rho=0.80673$	Eq. 1.1-2
b=0.41603 in (ineffective width=0.099672 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

S=31.207	Eq. 1.3-7
$I_a=0.00026008$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
k=3.8802	Table 1.3-1

Element 4: Partially stiffened, w=2.2814 in

f=49.63 ksi, k=3.8802	
$\lambda=1.6016$	Eq. 1.1-3

$\rho=0.53862$ Eq. 1.1-2
 $b=1.2288$ in (ineffective width=1.0526 in) Eq. 1.1-1
 $b_1=0.61441$ in, $b_2=0.61441$ in
 Center of gravity shift: $y=-0.35833$ in
 $S_{xe}=0.23106$ in³, $F_y=50$ ksi
 $M_{nl}=962.76$ lb-ft Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud
 Element 1: Unstiffened, $w=0.5157$ in
 $f_1=47.408$ ksi, $f_2=35.177$ ksi
 $\psi=0.742$ Eq. 1.2.2-1
 $k=0.53419$ Eq. 1.2.2-2
 $\lambda=0.9536$ Eq. 1.1-3
 $\rho=0.80673$ Eq. 1.1-2
 $b=0.41603$ in (ineffective width=0.099672 in) Eq. 1.1-1
 Element 2: Check for lip stiffener reduction
 $S=31.207$ Eq. 1.3-7
 $I_a=0.00026008$ in⁴ Eq. 1.3-8
 $I_s=0.00035659$ in⁴ > I_a (no lip reduction)
 $k=3.8802$ Table 1.3-1
 Element 2: Partially stiffened, $w=2.2814$ in
 $f=49.63$ ksi, $k=3.8802$
 $\lambda=1.6016$ Eq. 1.1-3
 $\rho=0.53862$ Eq. 1.1-2
 $b=1.2288$ in (ineffective width=1.0526 in) Eq. 1.1-1
 $b_1=0.61441$ in, $b_2=0.61441$ in
 Element 3: Treat as two unstiffened elements
 $f_1=47.408$ ksi, $f_2=26.283$ ksi
 $\psi=0.5544$ Eq. 1.2.2-1
 $k=0.64625$ Eq. 1.2.2-2
 $\lambda=1.4975$ Eq. 1.1-3
 $\rho=0.56969$ Eq. 1.1-2
 $b=0.50742$ in (ineffective width=0.38328 in) Eq. 1.1-1
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.35833$ in
 $S_{xe}=0.23106$ in³, $F_y=50$ ksi
 $M_{nl}=962.76$ lb-ft Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud
 Element 1: Unstiffened, $w=0.5157$ in
 $f_1=49.449$ ksi, $f_2=49.449$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.0855$ Eq. 1.1-3
 $\rho=0.73452$ Eq. 1.1-2
 $b=0.37879$ in (ineffective width=0.13691 in) Eq. 1.1-1
 Element 2: Stiffened, $w=2.2814$ in

$f_1=46.136$ ksi, $f_2=-34.518$ ksi
 $\psi=0.74818$ Eq. 1.1.2-1
 $k=18.182$ Eq. 1.1.2-2
 $\lambda=0.71334$ Eq. 1.1-3
 $\rho=0.96951$ Eq. 1.1-2
 $b_e=2.2118$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$
 $b_1=0.59011$ in Eq. 1.1.2-3
 $b_2=1.1059$ in Eq. 1.1.2-4
 Compression width=1.305 in
 $b_1+b_2 >$ compression width (fully effective)
 Element 3: No compressive stress (fully effective)
 Element 5: Unstiffened, $w=0.5157$ in
 $f_1=49.448$ ksi, $f_2=49.448$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-2
 $\lambda=1.0855$ Eq. 1.1-3
 $\rho=0.73452$ Eq. 1.1-2
 $b=0.37879$ in (ineffective width=0.13691 in) Eq. 1.1-1
 Element 4: Stiffened, $w=2.2814$ in
 $f_1=46.136$ ksi, $f_2=-34.518$ ksi
 $\psi=0.74818$ Eq. 1.1.2-1
 $k=18.182$ Eq. 1.1.2-2
 $\lambda=0.71334$ Eq. 1.1-3
 $\rho=0.96951$ Eq. 1.1-2
 $b_e=2.2118$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$
 $b_1=0.59011$ in Eq. 1.1.2-3
 $b_2=1.1059$ in Eq. 1.1.2-4
 Compression width=1.305 in
 $b_1+b_2 >$ compression width (fully effective)
 Center of gravity shift: $x=-0.048089$ in
 $S_y=0.14317$ in³, $F_y=50$ ksi
 $M_{nl}=596.53$ lb-ft Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2814$ in

$f_1=45.743$ ksi, $f_2=-43.11$ ksi
 $\psi=0.94244$ Eq. 1.1.2-1
 $k=22.543$ Eq. 1.1.2-2
 $\lambda=0.6379$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=2.2814$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=3.5$ in, $h_o/b_o=0.71429$
 $b_1=0.57868$ in Eq. 1.1.2-3
 $b_2=1.1407$ in Eq. 1.1.2-4
 Compression width=1.1745 in
 $b_1+b_2 >$ compression width (fully effective)
 Element 3: Treat as two unstiffened elements

$f_1=49.392$ ksi, $f_2=49.392$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.8738$

Eq. 1.1-3

$\rho=0.47102$

Eq. 1.1-2

$b=0.41953$ in (ineffective width= 0.47117 in)

Eq. 1.1-1

$f_1=49.392$ ksi, $f_2=49.392$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=1.8738$

Eq. 1.1-3

$\rho=0.47102$

Eq. 1.1-2

$b=0.41953$ in (ineffective width= 0.47117 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.2814$ in

$f_1=45.743$ ksi, $f_2=-43.11$ ksi

$\psi=0.94244$

Eq. 1.1.2-1

$k=22.543$

Eq. 1.1.2-2

$\lambda=0.6379$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2814$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=3.5$ in, $h_o/b_o=0.71429$

$b_1=0.57868$ in

Eq. 1.1.2-3

$b_2=1.1407$ in

Eq. 1.1.2-4

Compression width= 1.1745 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.15005$ in

$S_y=0.13782$ in³, $F_y=50$ ksi

$M_n=574.24$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=0.78107$ in⁶, $W_n=4.3018$ in², $F_y=50$ ksi

$B_n=9078.4$ lb-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

350S250-33

Full Section Properties

Area	0.32700 in ²	Wt.	1.1118 lb/ft	Flat	9.4507 in
I _x	0.7024 in ⁴	r _x	1.4656 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.40137 in ³	y(t)	1.7500 in	α	0.000 deg
S _x (b)	0.40137 in ³	y(b)	1.7500 in		
Z _x	0.44986 in ³	Height	3.5000 in		
I _y	0.2957 in ⁴	r _y	0.9510 in	x _o	-2.2317 in
S _y (l)	0.30917 in ³	x(l)	0.9565 in	y _o	0.0000 in
S _y (r)	0.19160 in ³	x(r)	1.5435 in	j _x	2.7194 in
Z _y	0.27597 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	0.7024 in ⁴	r ₁	1.4656 in	C _w	0.87616 in ⁶
I ₂	0.2957 in ⁴	r ₂	0.9510 in	J	0.0001305 in ⁴
I _c	0.9981 in ⁴	r _c	1.7471 in		
I _o	2.6267 in ⁴	r _o	2.8342 in		

Net Section Properties

I _x	0.6927 in ⁴	r _x	1.5868 in	Area	0.27510 in ²
S _x (t)	0.39581 in ³	y(t)	1.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.39581 in ³	y(b)	1.7500 in	α	0.000 deg
Z _x	0.43039 in ³				
I _y	0.2413 in ⁴	r _y	0.9366 in	x _o	-2.4271 in
S _y (l)	0.21285 in ³	x(l)	1.1337 in	y _o	0.0000 in
S _y (r)	0.17662 in ³	x(r)	1.3663 in	j _x	2.6095 in
Z _y	0.23145 in ³			j _y	0.0000 in
I _c	0.9340 in ⁴	r _c	1.8426 in	C _w	0.85968 in ⁶
I _o	2.5545 in ⁴	r _o	3.0472 in	J	0.00010978 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	7327 lb	φM _{nxo}	1024.3 lb-ft	φM _{nyo}	608.3 lb-ft
A _e	0.17239 in ²	I _{xe}	0.56105 in ⁴	I _{ye}	0.22762 in ⁴
φT _n	13411 lb	S _{xe} (t)	0.27314 in ³	S _{ye} (l)	0.20753 in ³
		S _{xe} (b)	0.38803 in ³	S _{ye} (r)	0.16222 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	498 lb	φM _{nxo}	1024.3 lb-ft	φM _{nyo}	590.0 lb-ft
φV _{nx}	3317 lb	I _{xe}	0.56105 in ⁴	I _{ye}	0.19968 in ⁴
Torsion		S _{xe} (t)	0.38803 in ³	S _{ye} (l)	0.15732 in ³
φB _n	9021.8 lb-in ²	S _{xe} (b)	0.27314 in ³	S _{ye} (r)	0.16224 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.263$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.32$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.327 \text{ in}^2$, $F_y=51.263 \text{ ksi}$
 $T_n=16763 \text{ lb}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.2751 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=17881 \text{ lb}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2
 $V_n=1843 \text{ lb}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3
 $V_{yh}=1091.8 \text{ lb}$
 $k_v=3.6336$
 $V_{crh}=491.96 \text{ lb}$
 $V_n=553.45 \text{ lb}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4
 $V_n=1843 \text{ lb}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.98104$

Eq. 1.1-3

$\rho=0.79074$

Eq. 1.1-2

$b=0.40644 \text{ in}$ (ineffective width=0.10756 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00035618 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)

$k=3.8782$

Table 1.3-1

Element 2: Partially stiffened, $w=2.278 \text{ in}$

$f=50 \text{ ksi}$, $k=3.8782$

$\lambda=1.4478$

Eq. 1.1-3

$\rho=0.58576$

Eq. 1.1-2

$b=1.3344 \text{ in}$ (ineffective width=0.94364 in)

Eq. 1.1-1

$b_1=0.66718 \text{ in}$, $b_2=0.66718 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.6968$

Eq. 1.1-3

$\rho=0.51294$

Eq. 1.1-2

$b=0.456 \text{ in}$ (ineffective width=0.433 in)

Eq. 1.1-1

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.6968$	Eq. 1.1-3
$\rho=0.51294$	Eq. 1.1-2
$b=0.456$ in (ineffective width=0.433 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00035618$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1
Element 4: Partially stiffened, $w=2.278$ in	
$f=50$ ksi, $k=3.8782$	
$\lambda=1.4478$	Eq. 1.1-3
$\rho=0.58576$	Eq. 1.1-2
$b=1.3344$ in (ineffective width=0.94364 in)	Eq. 1.1-1
$b_1=0.66718$ in, $b_2=0.66718$ in	
$A_e=0.17239$ in ² , $F_n=50$ ksi	
$P_n=8619.4$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.298$ ksi, $f_2=25.657$ ksi	
$\psi=0.54245$	Eq. 1.2.2-1
$k=0.655$	Eq. 1.2.2-2
$\lambda=1.3371$	Eq. 1.1-3
$\rho=0.62482$	Eq. 1.1-2
$b=0.55546$ in (ineffective width=0.33354 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=47.298$ ksi, $f_2=34.785$ ksi	
$\psi=0.73545$	Eq. 1.2.2-1
$k=0.53745$	Eq. 1.2.2-2
$\lambda=0.85347$	Eq. 1.1-3
$\rho=0.86966$	Eq. 1.1-2
$b=0.447$ in (ineffective width=0.066996 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.223$	Eq. 1.3-7
$I_a=0.00035471$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1

Element 4: Partially stiffened, $w=2.278$ in
 $f=49.579$ ksi, $k=3.8782$

$$\lambda=1.4417$$

Eq. 1.1-3

$$\rho=0.58779$$

Eq. 1.1-2

$$b=1.339 \text{ in (ineffective width}=0.939 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.6695 \text{ in, } b_2=0.6695 \text{ in}$$

Center of gravity shift: $y=-0.30409$ in

$$S_{xe}=0.27314 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1138.1 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$$f_1=47.298 \text{ ksi, } f_2=34.785 \text{ ksi}$$

$$\psi=0.73545$$

Eq. 1.2.2-1

$$k=0.53745$$

Eq. 1.2.2-2

$$\lambda=0.85347$$

Eq. 1.1-3

$$\rho=0.86966$$

Eq. 1.1-2

$$b=0.447 \text{ in (ineffective width}=0.066996 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.223$$

Eq. 1.3-7

$$I_a=0.00035471 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8782$$

Table 1.3-1

Element 2: Partially stiffened, $w=2.278$ in

$$f=49.579 \text{ ksi, } k=3.8782$$

$$\lambda=1.4417$$

Eq. 1.1-3

$$\rho=0.58779$$

Eq. 1.1-2

$$b=1.339 \text{ in (ineffective width}=0.93901 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.6695 \text{ in, } b_2=0.6695 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1=47.298 \text{ ksi, } f_2=25.657 \text{ ksi}$$

$$\psi=0.54245$$

Eq. 1.2.2-1

$$k=0.655$$

Eq. 1.2.2-2

$$\lambda=1.3371$$

Eq. 1.1-3

$$\rho=0.62482$$

Eq. 1.1-2

$$b=0.55546 \text{ in (ineffective width}=0.33354 \text{ in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.30409$ in

$$S_{xe}=0.27314 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1138.1 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$$f_1=49.384 \text{ ksi, } f_2=49.384 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

k=0.43	Eq. 1.2.2-3
$\lambda=0.97498$	Eq. 1.1-3
$\rho=0.79423$	Eq. 1.1-2
b=0.40823 in (ineffective width=0.10577 in)	Eq. 1.1-1
Element 2: Stiffened, w=2.278 in	
$f_1=46.045$ ksi, $f_2=-35.131$ ksi	
$\psi=0.76297$	Eq. 1.1.2-1
k=18.485	Eq. 1.1.2-2
$\lambda=0.63637$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
be=2.278 in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.60537$ in	Eq. 1.1.2-3
$b_2=1.139$ in	Eq. 1.1.2-4
Compression width=1.2921 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, w=0.514 in	
$f_1=49.384$ ksi, $f_2=49.384$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-2
$\lambda=0.97498$	Eq. 1.1-3
$\rho=0.79423$	Eq. 1.1-2
b=0.40823 in (ineffective width=0.10577 in)	Eq. 1.1-1
Element 4: Stiffened, w=2.278 in	
$f_1=46.045$ ksi, $f_2=-35.131$ ksi	
$\psi=0.76297$	Eq. 1.1.2-1
k=18.485	Eq. 1.1.2-2
$\lambda=0.63637$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
be=2.278 in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.60537$ in	Eq. 1.1.2-3
$b_2=1.139$ in	Eq. 1.1.2-4
Compression width=1.2921 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: x=-0.036871 in	
$S_{ye}=0.16222$ in ³ , $F_y=50$ ksi	
Mnl=675.93 lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, w=2.278 in

$f_1=45.627$ ksi, $f_2=-44.112$ ksi

$\psi=0.96679$

k=23.15

$\lambda=0.56607$

$\rho=1$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

be=2.278 in	Eq. 1.1-1
h _o =2.5 in, b _o =3.5 in, h _o /b _o =0.71429	
b ₁ =0.57427 in	Eq. 1.1.2-3
b ₂ =1.139 in	Eq. 1.1.2-4
Compression width=1.1582 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.318 ksi, f ₂ =49.318 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=1.6852	Eq. 1.1-3
ρ=0.51594	Eq. 1.1-2
b=0.45867 in (ineffective width=0.43033 in)	Eq. 1.1-1
f ₁ =49.318 ksi, f ₂ =49.318 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-2
λ=1.6852	Eq. 1.1-3
ρ=0.51594	Eq. 1.1-2
b=0.45867 in (ineffective width=0.43033 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=2.278 in	
f ₁ =45.627 ksi, f ₂ =-44.112 ksi	
ψ=0.96679	Eq. 1.1.2-1
k=23.15	Eq. 1.1.2-2
λ=0.56607	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=2.278 in	Eq. 1.1-1
h _o =2.5 in, b _o =3.5 in, h _o /b _o =0.71429	
b ₁ =0.57427 in	Eq. 1.1.2-3
b ₂ =1.139 in	Eq. 1.1.2-4
Compression width=1.1582 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.13552 in	
S _{ye} =0.15732 in ³ , F _y =50 ksi	
M _{nl} =655.52 lb-ft	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =0.85968 in ⁶ , W _n =4.288 in ² , F _y =50 ksi	
B _n =10024 lb-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

350S250-43

Full Section Properties

Area	0.42433 in ²	Wt.	1.4427 lb/ft	Flat	9.4086 in
Ix	0.9060 in ⁴	rx	1.4612 in	Ixy	0.0000 in ⁴
Sx(t)	0.51773 in ³	y(t)	1.7500 in	α	0.000 deg
Sx(b)	0.51774 in ³	y(b)	1.7500 in		
Zx	0.58198 in ³	Height	3.5000 in		
Iy	0.3802 in ⁴	ry	0.9465 in	x _o	-2.2193 in
Sy(l)	0.39748 in ³	x(l)	0.9565 in	y _o	0.0000 in
Sy(r)	0.24630 in ³	x(r)	1.5435 in	jx	2.7075 in
Zy	0.35632 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	0.9060 in ⁴	r ₁	1.4612 in	Cw	1.1159 in ⁶
I ₂	0.3802 in ⁴	r ₂	0.9465 in	J	0.0002877 in ⁴
Ic	1.2862 in ⁴	rc	1.7410 in		
I _o	3.3762 in ⁴	r _o	2.8207 in		

Net Section Properties

Ix	0.8934 in ⁴	rx	1.5826 in	Area	0.35668 in ²
Sx(t)	0.51049 in ³	y(t)	1.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.51049 in ³	y(b)	1.7500 in	α	0.000 deg
Zx	0.55661 in ³				
Iy	0.3100 in ⁴	ry	0.9322 in	x _o	-2.4147 in
Sy(l)	0.27344 in ³	x(l)	1.1336 in	y _o	0.0000 in
Sy(r)	0.22685 in ³	x(r)	1.3664 in	jx	2.5974 in
Zy	0.29866 in ³			jy	0.0000 in
Ic	1.2033 in ⁴	rc	1.8368 in	Cw	1.0947 in ⁶
I _o	3.2830 in ⁴	r _o	3.0339 in	J	0.0002418 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	10430 lb	φMnxo	1440.0 lb-ft	φMnyo	834.1 lb-ft
Ae	0.24541 in ²	Ixe	0.76265 in ⁴	Iye	0.30584 in ⁴
φTn	17388 lb	Sxe(t)	0.38399 in ³	Sye(l)	0.27186 in ³
		Sxe(b)	0.50376 in ³	Sye(r)	0.22243 in ³
Shear		Negative Bending		Negative Bending	
φVny	846 lb	φMnxo	1440.0 lb-ft	φMnyo	804.6 lb-ft
φVnx	5185 lb	Ixe	0.76265 in ⁴	Iye	0.27336 in ⁴
Torsion		Sxe(t)	0.50376 in ³	Sye(l)	0.22298 in ³
φBn	11603 lb-in ²	Sxe(b)	0.38399 in ³	Sye(r)	0.21456 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.546$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=52.838$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.42433 \text{ in}^2$, $F_y=51.546 \text{ ksi}$
 $T_n=21872 \text{ lb}$ Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.35668 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=23184 \text{ lb}$ Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=2880.7 \text{ lb}$ at 180 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=1409.7 \text{ lb}$ Eq. G3-2
 $k_v=3.6297$ Eq. G3-8
 $V_{crh}=1087.8 \text{ lb}$ Eq. G3-6
 $V_n=939.5 \text{ lb}$ at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=2880.7 \text{ lb}$ at 0 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.74488$ Eq. 1.1-3
 $\rho=0.94599$ Eq. 1.1-2
 $b=0.48123 \text{ in}$ (ineffective width= 0.027474 in) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.00079003 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00049474 \text{ in}^4$
 $d_s=0.30136 \text{ in}$ (lip ineffective width= 0.17987 in) Eq. 1.3-6
 $k=3.3746$ Table 1.3-1

Element 2: Partially stiffened, $w=2.2674 \text{ in}$
 $f=50 \text{ ksi}$, $k=3.3746$
 $\lambda=1.1852$ Eq. 1.1-3
 $\rho=0.68714$ Eq. 1.1-2
 $b=1.558 \text{ in}$ (ineffective width= 0.70937 in) Eq. 1.1-1
 $b_1=0.48785 \text{ in}$, $b_2=1.0702 \text{ in}$

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.294$ Eq. 1.1-3
 $\rho=0.64142$ Eq. 1.1-2
 $b=0.56682 \text{ in}$ (ineffective width= 0.31688 in) Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.294$

Eq. 1.1-3

$\rho=0.64142$

Eq. 1.1-2

$b=0.56682$ in (ineffective width= 0.31688 in)

Eq. 1.1-1

Element 5: Unstiffened, $w=0.5087$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.74488$

Eq. 1.1-3

$\rho=0.94599$

Eq. 1.1-2

$b=0.48123$ in (ineffective width= 0.027474 in)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00079003$ in⁴

Eq. 1.3-8

$I_s=0.00049474$ in⁴

$ds=0.30136$ in (lip ineffective width= 0.17987 in)

Eq. 1.3-6

$k=3.3746$

Table 1.3-1

Element 4: Partially stiffened, $w=2.2674$ in

$f=50$ ksi, $k=3.3746$

$\lambda=1.1852$

Eq. 1.1-3

$\rho=0.68714$

Eq. 1.1-2

$b=1.558$ in (ineffective width= 0.70937 in)

Eq. 1.1-1

$b_1=0.48785$ in, $b_2=1.0702$ in

$A_e=0.24541$ in², $F_n=50$ ksi

$P_n=12270$ lb

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.072$ ksi, $f_2=24.824$ ksi

$\psi=0.52736$

Eq. 1.2.2-1

$k=0.66639$

Eq. 1.2.2-2

$\lambda=1.0085$

Eq. 1.1-3

$\rho=0.77524$

Eq. 1.1-2

$b=0.68508$ in (ineffective width= 0.19862 in)

Eq. 1.1-1

Element 5: Unstiffened, $w=0.5087$ in

$f_1=47.072$ ksi, $f_2=34.265$ ksi

$\psi=0.72793$

Eq. 1.2.2-1

$k=0.54123$

Eq. 1.2.2-2

$\lambda=0.64421$

Eq. 1.1-3

$\lambda<0.673$ (fully effective)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=31.269$

Eq. 1.3-7

$I_a=0.00078565$ in⁴

Eq. 1.3-8

$I_s=0.00049474$ in⁴

ds=0.32034 in (lip ineffective width=0.18836 in)	Eq. 1.3-6
k=3.3801	Table 1.3-1
Element 4: Partially stiffened, w=2.2674 in	
f=49.432 ksi, k=3.3801	
$\lambda=1.1775$	Eq. 1.1-3
$\rho=0.6906$	Eq. 1.1-2
b=1.5659 in (ineffective width=0.70152 in)	Eq. 1.1-1
b ₁ =0.49304 in, b ₂ =1.0728 in	
Center of gravity shift: y=-0.23609 in	
S _{xe} =0.38399 in ³ , F _y =50 ksi	
M _{nl} =1600 lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.5087 in	
f ₁ =47.072 ksi, f ₂ =34.265 ksi	
$\psi=0.72793$	Eq. 1.2.2-1
k=0.54123	Eq. 1.2.2-2
$\lambda=0.64421$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.269	Eq. 1.3-7
I _a =0.00078565 in ⁴	Eq. 1.3-8
I _s =0.00049474 in ⁴	
ds=0.32034 in (lip ineffective width=0.18836 in)	Eq. 1.3-6
k=3.3801	Table 1.3-1
Element 2: Partially stiffened, w=2.2674 in	
f=49.432 ksi, k=3.3801	
$\lambda=1.1775$	Eq. 1.1-3
$\rho=0.6906$	Eq. 1.1-2
b=1.5659 in (ineffective width=0.70152 in)	Eq. 1.1-1
b ₁ =0.49304 in, b ₂ =1.0728 in	
Element 3: Treat as two unstiffened elements	
f ₁ =47.072 ksi, f ₂ =24.824 ksi	
$\psi=0.52736$	Eq. 1.2.2-1
k=0.66639	Eq. 1.2.2-2
$\lambda=1.0085$	Eq. 1.1-3
$\rho=0.77524$	Eq. 1.1-2
b=0.68508 in (ineffective width=0.19862 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.23609 in	
S _{xe} =0.38399 in ³ , F _y =50 ksi	
M _{nl} =1600 lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Positive Flexural Strength about Y-axis
Effective width calculations for Stud
Element 1: Unstiffened, w=0.5087 in

$$f_1=49.18 \text{ ksi}, f_2=49.18 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.73875$$

Eq. 1.1-3

$$\rho=0.95053$$

Eq. 1.1-2

$$b=0.48353 \text{ in (ineffective width}=0.025167 \text{ in)}$$

Eq. 1.1-1

Element 2: Stiffened, $w=2.2674 \text{ in}$

$$f_1=45.771 \text{ ksi}, f_2=-36.68 \text{ ksi}$$

$$\psi=0.80137$$

Eq. 1.1.2-1

$$k=19.293$$

Eq. 1.1.2-2

$$\lambda=0.47423$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=2.2674 \text{ in}$$

Eq. 1.1-1

$$h_o=2.5 \text{ in}, b_o=0.625 \text{ in}, h_o/b_o=4$$

$$b_1=0.59647 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.1337 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.2587 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087 \text{ in}$

$$f_1=49.18 \text{ ksi}, f_2=49.18 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.73875$$

Eq. 1.1-3

$$\rho=0.95053$$

Eq. 1.1-2

$$b=0.48353 \text{ in (ineffective width}=0.025167 \text{ in)}$$

Eq. 1.1-1

Element 4: Stiffened, $w=2.2674 \text{ in}$

$$f_1=45.771 \text{ ksi}, f_2=-36.68 \text{ ksi}$$

$$\psi=0.80138$$

Eq. 1.1.2-1

$$k=19.294$$

Eq. 1.1.2-2

$$\lambda=0.47423$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=2.2674 \text{ in}$$

Eq. 1.1-1

$$h_o=2.5 \text{ in}, b_o=0.625 \text{ in}, h_o/b_o=4$$

$$b_1=0.59647 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.1337 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.2587 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=-0.0086077 \text{ in}$

$$S_y=0.22243 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=926.78 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2674 \text{ in}$

$$f_1=43.459 \text{ ksi}, f_2=-45.44 \text{ ksi}$$

$$\psi=1.0456$$

Eq. 1.1.2-1

$$k=25.21$$

Eq. 1.1.2-2

$\lambda=0.40425$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.2674$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=3.5$ in, $h_o/b_o=0.71429$	
$b_1=0.56046$ in	Eq. 1.1.2-3
$b_2=1.1337$ in	Eq. 1.1.2-4
Compression width=1.1084 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.135$ ksi, $f_2=47.135$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2564$	Eq. 1.1-3
$\rho=0.65657$	Eq. 1.1-2
$b=0.58021$ in (ineffective width=0.30349 in)	Eq. 1.1-1
$f_1=47.135$ ksi, $f_2=47.135$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=1.2564$	Eq. 1.1-3
$\rho=0.65657$	Eq. 1.1-2
$b=0.58021$ in (ineffective width=0.30349 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=2.2674$ in	
$f_1=43.459$ ksi, $f_2=-45.44$ ksi	
$\psi=1.0456$	Eq. 1.1.2-1
$k=25.21$	Eq. 1.1.2-2
$\lambda=0.40426$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.2674$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=3.5$ in, $h_o/b_o=0.71429$	
$b_1=0.56046$ in	Eq. 1.1.2-3
$b_2=1.1337$ in	Eq. 1.1.2-4
Compression width=1.1084 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.09236$ in	
$S_y=0.21456$ in ³ , $F_y=50$ ksi	
$M_n=894.01$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.0947$ in ⁶ , $W_n=4.2455$ in ² , $F_y=50$ ksi	
$B_n=12892$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350S250-54

Full Section Properties

Area	0.52804 in ²	Wt.	1.7953 lb/ft	Flat	9.3293 in
I _x	1.1183 in ⁴	r _x	1.4553 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.63902 in ³	y(t)	1.7500 in	α	0.000 deg
S _x (b)	0.63902 in ³	y(b)	1.7500 in		
Z _x	0.72105 in ³	Height	3.5000 in		
I _y	0.4668 in ⁴	r _y	0.9402 in	x _o	-2.2042 in
S _y (l)	0.48859 in ³	x(l)	0.9554 in	y _o	0.0000 in
S _y (r)	0.30219 in ³	x(r)	1.5446 in	j _x	2.6944 in
Z _y	0.44018 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	1.1183 in ⁴	r ₁	1.4553 in	C _w	1.3554 in ⁶
I ₂	0.4668 in ⁴	r ₂	0.9402 in	J	0.0005639 in ⁴
I _c	1.5851 in ⁴	r _c	1.7326 in		
I _o	4.1506 in ⁴	r _o	2.8036 in		

Net Section Properties

I _x	1.1024 in ⁴	r _x	1.5772 in	Area	0.44314 in ²
S _x (t)	0.62992 in ³	y(t)	1.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.62992 in ³	y(b)	1.7500 in	α	0.000 deg
Z _x	0.68921 in ³				
I _y	0.3798 in ⁴	r _y	0.9258 in	x _o	-2.4003 in
S _y (l)	0.33523 in ³	x(l)	1.1330 in	y _o	0.0000 in
S _y (r)	0.27784 in ³	x(r)	1.3670 in	j _x	2.5838 in
Z _y	0.36830 in ³			j _y	0.0000 in
I _c	1.4822 in ⁴	r _c	1.8289 in	C _w	1.3291 in ⁶
I _o	4.0352 in ⁴	r _o	3.0176 in	J	0.0004732 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	14000 lb	φM _{nxo}	1888.9 lb-ft	φM _{nyo}	1184.1 lb-ft
A _e	0.32942 in ²	I _{xe}	0.97513 in ⁴	I _{ye}	0.37981 in ⁴
φT _n	21603 lb	S _{xe} (t)	0.50371 in ³	S _{ye} (l)	0.33523 in ³
		S _{xe} (b)	0.62345 in ³	S _{ye} (r)	0.27784 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1255 lb	φM _{nxo}	1888.9 lb-ft	φM _{nyo}	1014.3 lb-ft
φV _{nx}	6776 lb	I _{xe}	0.97513 in ⁴	I _{ye}	0.35736 in ⁴
Torsion		S _{xe} (t)	0.62345 in ³	S _{ye} (l)	0.30316 in ³
φB _n	14253 lb-in ²	S _{xe} (b)	0.50371 in ³	S _{ye} (r)	0.27049 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.935$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=53.509$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.52804$ in², $F_y=51.935$ ksi

$$T_n = 27424 \text{ lb} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.44314 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 28804 \text{ lb} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 3764.5 \text{ lb at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 1689.8 \text{ lb} \quad \text{Eq. G3-2}$$

$$k_v = 3.6104 \quad \text{Eq. G3-8}$$

$$V_{crh} = 2132.9 \text{ lb} \quad \text{Eq. G3-6}$$

$$V_n = 1394.2 \text{ lb at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 3764.5 \text{ lb at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.4835 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi} \quad \text{Eq. 1.2.2-1}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-3}$$

$$k = 0.43 \quad \text{Eq. 1.1-3}$$

$$\lambda = 0.56413 \quad \text{Eq. 1.1-1}$$

$$\lambda < 0.673 \text{ (fully effective)}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.0015382 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00053312 \text{ in}^4$$

$$d_s = 0.16757 \text{ in (lip ineffective width} = 0.31593 \text{ in)} \quad \text{Eq. 1.3-6}$$

$$k = 2.8256 \quad \text{Table 1.3-1}$$

Element 2: Partially stiffened, $w = 2.217 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.8256 \quad \text{Eq. 1.1-3}$$

$$\lambda = 1.0091 \quad \text{Eq. 1.1-2}$$

$$\rho = 0.77494 \quad \text{Eq. 1.1-1}$$

$$b = 1.718 \text{ in (ineffective width} = 0.49896 \text{ in)}$$

$$b_1 = 0.29773 \text{ in}, b_2 = 1.4203 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi} \quad \text{Eq. 1.2.2-1}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-3}$$

$$k = 0.43 \quad \text{Eq. 1.1-3}$$

$$\lambda = 1.0017 \quad \text{Eq. 1.1-2}$$

$$\rho = 0.77907 \quad \text{Eq. 1.1-1}$$

$$b = 0.66883 \text{ in (ineffective width} = 0.18967 \text{ in)}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi} \quad \text{Eq. 1.2.2-1}$$

$$\psi = 1$$

k=0.43	Eq. 1.2.2-3
$\lambda=1.0017$	Eq. 1.1-3
$\rho=0.77907$	Eq. 1.1-2
b=0.66883 in (ineffective width=0.18967 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.4835 in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.091	Eq. 1.3-7
Ia=0.0015382 in ⁴	Eq. 1.3-8
Is=0.00053312 in ⁴	
ds=0.16757 in (lip ineffective width=0.31593 in)	Eq. 1.3-6
k=2.8256	Table 1.3-1
Element 4: Partially stiffened, w=2.217 in	
f=50 ksi, k=2.8256	
$\lambda=1.0091$	Eq. 1.1-3
$\rho=0.77494$	Eq. 1.1-2
b=1.718 in (ineffective width=0.49896 in)	Eq. 1.1-1
b ₁ =0.29773 in, b ₂ =1.4203 in	
Ae=0.32942 in ² , Fn=50 ksi	
Pn=16471 lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.345$ ksi, $f_2=24.172$ ksi	
$\psi=0.52156$	Eq. 1.2.2-1
k=0.67088	Eq. 1.2.2-2
$\lambda=0.77207$	Eq. 1.1-3
$\rho=0.92615$	Eq. 1.1-2
b=0.7951 in (ineffective width=0.0634 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.4835 in	
$f_1=46.345$ ksi, $f_2=33.857$ ksi	
$\psi=0.73055$	Eq. 1.2.2-1
k=0.53991	Eq. 1.2.2-2
$\lambda=0.4847$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.321	Eq. 1.3-7
Ia=0.0015273 in ⁴	Eq. 1.3-8
Is=0.00053312 in ⁴	
ds=0.16877 in (lip ineffective width=0.31473 in)	Eq. 1.3-6
k=2.8313	Table 1.3-1
Element 4: Partially stiffened, w=2.217 in	

$$f=49.269 \text{ ksi}, k=2.8313$$

$$\lambda=1.0007$$

Eq. 1.1-3

$$\rho=0.77962$$

Eq. 1.1-2

$$b=1.7284 \text{ in (ineffective width}=0.48858 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.30166 \text{ in}, b_2=1.4268 \text{ in}$$

Center of gravity shift: $y=-0.1859 \text{ in}$

$$S_{xe}=0.50371 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=2098.8 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$

$$f_1=46.345 \text{ ksi}, f_2=33.857 \text{ ksi}$$

$$\psi=0.73054$$

Eq. 1.2.2-1

$$k=0.53991$$

Eq. 1.2.2-2

$$\lambda=0.4847$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.321$$

Eq. 1.3-7

$$I_a=0.0015273 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00053312 \text{ in}^4$$

$$d_s=0.16877 \text{ in (lip ineffective width}=0.31473 \text{ in)}$$

Eq. 1.3-6

$$k=2.8313$$

Table 1.3-1

Element 2: Partially stiffened, $w=2.217 \text{ in}$

$$f=49.269 \text{ ksi}, k=2.8313$$

$$\lambda=1.0007$$

Eq. 1.1-3

$$\rho=0.77962$$

Eq. 1.1-2

$$b=1.7284 \text{ in (ineffective width}=0.48858 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.30166 \text{ in}, b_2=1.4268 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1=46.345 \text{ ksi}, f_2=24.172 \text{ ksi}$$

$$\psi=0.52156$$

Eq. 1.2.2-1

$$k=0.67088$$

Eq. 1.2.2-2

$$\lambda=0.77207$$

Eq. 1.1-3

$$\rho=0.92615$$

Eq. 1.1-2

$$b=0.7951 \text{ in (ineffective width}=0.0634 \text{ in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.1859 \text{ in}$

$$S_{xe}=0.50371 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=2098.8 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$

$$f_1=55.649 \text{ ksi}, f_2=55.649 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$\lambda=0.59515$	Eq. 1.1-3
$\lambda < 0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=2.217$ in	
$f_1=50.943$ ksi, $f_2=-41.214$ ksi	
$\psi=0.80901$	Eq. 1.1.2-1
$k=19.458$	Eq. 1.1.2-2
$\lambda=0.38815$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.58204$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.2255 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=55.649$ ksi, $f_2=55.649$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.59515$	Eq. 1.1-3
$\lambda < 0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=2.217$ in	
$f_1=50.943$ ksi, $f_2=-41.214$ ksi	
$\psi=0.80901$	Eq. 1.1.2-1
$k=19.458$	Eq. 1.1.2-2
$\lambda=0.38814$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.58204$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.2255 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_{ye}=0.27784$ in ³ , $F_y=56.825$ ksi	
$M_n I=1315.7$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.217$ in

$f_1=39.217$ ksi, $f_2=-44.647$ ksi

$\psi=1.1385$

$k=27.836$

$\lambda=0.28473$

$\rho=1$

$b_e=2.217$ in

$h_o=2.5$ in, $b_o=3.5$ in, $h_o/b_o=0.71429$

$b_1=0.53571$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.0367 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=43.499$ ksi, $f_2=43.499$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.93429$	Eq. 1.1-3
$\rho=0.8183$	Eq. 1.1-2
$b=0.70251$ in (ineffective width=0.15599 in)	Eq. 1.1-1
$f_1=43.499$ ksi, $f_2=43.499$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=0.93429$	Eq. 1.1-3
$\rho=0.8183$	Eq. 1.1-2
$b=0.70251$ in (ineffective width=0.15599 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=2.217$ in	
$f_1=39.217$ ksi, $f_2=-44.647$ ksi	
$\psi=1.1385$	Eq. 1.1.2-1
$k=27.836$	Eq. 1.1.2-2
$\lambda=0.28473$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=3.5$ in, $h_o/b_o=0.71429$	
$b_1=0.53571$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.0367 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.045846$ in	
$S_{ye}=0.27049$ in ³ , $F_y=50$ ksi	
$M_n=1127$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.3291$ in ⁶ , $W_n=4.1962$ in ² , $F_y=50$ ksi	
$B_n=15837$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.21510 in ²	Wt.	0.73135 lb/ft	Flat	7.6008 in
Ix	0.45412 in ⁴	rx	1.4530 in	Ixy	0.00000 in ⁴
Sx(t)	0.25055 in ³	y(t)	1.8125 in	α	0.000 deg
Sx(b)	0.25055 in ³	y(b)	1.8125 in		
Zx	0.28857 in ³	Height	3.6250 in		
Iy	0.08226 in ⁴	ry	0.6184 in	x _o	-1.3137 in
Sy(l)	0.15324 in ³	x(l)	0.5368 in	y _o	0.0000 in
Sy(r)	0.07559 in ³	x(r)	1.0882 in	jx	2.0789 in
Zy	0.11122 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	0.45412 in ⁴	r ₁	1.4530 in	Cw	0.23664 in ⁶
I ₂	0.08226 in ⁴	r ₂	0.6184 in	J	0.00005742 in ⁴
Ic	0.53638 in ⁴	rc	1.5791 in		
I _o	0.90761 in ⁴	r _o	2.0541 in		

Net Section Properties

Ix	0.44616 in ⁴	rx	1.6075 in	Area	0.17265 in ²
Sx(t)	0.24616 in ³	y(t)	1.8125 in	Ixy	0.00000 in ⁴
Sx(b)	0.24616 in ³	y(b)	1.8125 in	α	0.000 deg
Zx	0.27265 in ³				
Iy	0.06781 in ⁴	ry	0.6267 in	x _o	-1.4563 in
Sy(l)	0.10192 in ³	x(l)	0.6653 in	y _o	0.0000 in
Sy(r)	0.07065 in ³	x(r)	0.9597 in	jx	1.8418 in
Zy	0.09722 in ³			jy	0.0000 in
Ic	0.51397 in ⁴	rc	1.7254 in	Cw	0.23157 in ⁶
I _o	0.88014 in ⁴	r _o	2.2578 in	J	0.00004609 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	4793.9 lb	φMnxo	698.16 lb-ft	φMnyo	246.54 lb-ft
Ae	0.11280 in ²	Ixe	0.38345 in ⁴	Iye	0.06445 in ⁴
φTn	8416.9 lb	Sxe(t)	0.18618 in ³	Sye(l)	0.09997 in ³
		Sxe(b)	0.24495 in ³	Sye(r)	0.06574 in ³
Shear		Negative Bending		Negative Bending	
φVny	338.0 lb	φMnxo	698.16 lb-ft	φMnyo	235.82 lb-ft
φVnx	2032.1 lb	Ixe	0.38345 in ⁴	Iye	0.05115 in ⁴
Torsion		Sxe(t)	0.24495 in ³	Sye(l)	0.06289 in ³
φBn	4034.5 lb-in ²	Sxe(b)	0.18618 in ³	Sye(r)	0.06303 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=51.337$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=52.982$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=54.71$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.2151 \text{ in}^2$, $F_y=51.337 \text{ ksi}$
 $T_n=11043 \text{ lb}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.17265 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=11223 \text{ lb}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1128.9 \text{ lb}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=998.38 \text{ lb}$

Eq. G3-2

$k_v=0$

Eq. G3-8

$V_{crh}=263.09 \text{ lb}$

Eq. G3-6

$V_n=375.5 \text{ lb}$ at 90 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1128.9 \text{ lb}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3921 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.3255 \text{ in}$ (ineffective width=0.066604 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00012135 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00014217 \text{ in}^4 > I_a$ (no lip reduction)

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.4092 \text{ in}$

$f=50 \text{ ksi}$, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.98664 \text{ in}$ (ineffective width=0.42256 in)

Eq. 1.1-1

$b_1=0.49332 \text{ in}$, $b_2=0.49332 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.38621 \text{ in}$ (ineffective width=0.56839 in)

Eq. 1.1-1

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.38621$ in (ineffective width= 0.56839 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3921$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.3255$ in (ineffective width= 0.066604 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00012135$ in ⁴	Eq. 1.3-8
$I_s=0.00014217$ in ⁴ > I_a (no lip reduction)	
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4092$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.98664$ in (ineffective width= 0.42256 in)	Eq. 1.1-1
$b_1=0.49332$ in, $b_2=0.49332$ in	
$A_e=0.1128$ in ² , $F_n=50$ ksi	
$P_n=5639.8$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.38$ ksi, $f_2=24.204$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.48276$ in (ineffective width= 0.47184 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3921$ in	
$f_1=47.38$ ksi, $f_2=37.861$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.3499$ in (ineffective width= 0.042198 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00012094$ in ⁴	Eq. 1.3-8
$I_s=0.00014217$ in ⁴ > I_a (no lip reduction)	
$k=0$	Table 1.3-1

Element 4: Partially stiffened, $w=1.4092$ in

$f=49.656$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.98924$ in (ineffective width= 0.41996 in)

Eq. 1.1-1

$b_1=0.49462$ in, $b_2=0.49462$ in

Center of gravity shift: $y=-0.24709$ in

$S_{xe}=0.18618$ in³, $F_y=50$ ksi

$M_{nl}=775.73$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3921$ in

$f_1=47.38$ ksi, $f_2=37.861$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.3499$ in (ineffective width= 0.042198 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00012094$ in⁴

Eq. 1.3-8

$I_s=0.00014217$ in⁴ > I_a (no lip reduction)

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.4092$ in

$f=49.656$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.98924$ in (ineffective width= 0.41996 in)

Eq. 1.1-1

$b_1=0.49462$ in, $b_2=0.49462$ in

Element 3: Treat as two unstiffened elements

$f_1=47.38$ ksi, $f_2=24.204$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.48276$ in (ineffective width= 0.47184 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.24709$ in

$S_{xe}=0.18618$ in³, $F_y=50$ ksi

$M_{nl}=775.73$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3921$ in

$f_1=49.278$ ksi, $f_2=49.278$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.32711$ in (ineffective width=0.064986 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.4092$ in	
$f_1=44.497$ ksi, $f_2=-27.38$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.4092$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$	
$b_1=0.38978$ in	Eq. 1.1.2-3
$b_2=0.7046$ in	Eq. 1.1.2-4
Compression width=0.87239 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.3921$ in	
$f_1=49.278$ ksi, $f_2=49.278$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.32711$ in (ineffective width=0.064986 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.4092$ in	
$f_1=44.497$ ksi, $f_2=-27.38$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.4092$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$	
$b_1=0.38978$ in	Eq. 1.1.2-3
$b_2=0.7046$ in	Eq. 1.1.2-4
Compression width=0.87239 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.020583$ in	
$S_y=0.065743$ in ³ , $F_y=50$ ksi	
$M_n=273.93$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.4092$ in

$f_1=43.365$ ksi, $f_2=-43.285$ ksi

$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2

be=1.4092 in	Eq. 1.1-1
h _o =1.625 in, b _o =3.625 in, h _o /b _o =0	
b ₁ =0.35246 in	Eq. 1.1.2-3
b ₂ =0.7046 in	Eq. 1.1.2-4
Compression width=0.70525 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.13 ksi, f ₂ =49.13 ksi	
ψ=0	Eq. 1.2.2-1
k=0	Eq. 1.2.2-3
λ=0	Eq. 1.1-3
ρ=0	Eq. 1.1-2
b=0.38924 in (ineffective width=0.56536 in)	Eq. 1.1-1
f ₁ =49.13 ksi, f ₂ =49.13 ksi	
ψ=0	Eq. 1.2.2-1
k=0	Eq. 1.2.2-3
λ=0	Eq. 1.1-3
ρ=0	Eq. 1.1-2
b=0.38924 in (ineffective width=0.56536 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=1.4092 in	
f ₁ =43.365 ksi, f ₂ =-43.285 ksi	
ψ=0	Eq. 1.1.2-1
k=0	Eq. 1.1.2-2
λ=0	Eq. 1.1-3
ρ=0	Eq. 1.1-2
be=1.4092 in	Eq. 1.1-1
h _o =1.625 in, b _o =3.625 in, h _o /b _o =0	
b ₁ =0.35246 in	Eq. 1.1.2-3
b ₂ =0.7046 in	Eq. 1.1.2-4
Compression width=0.70525 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.14814 in	
S _{ye} =0.062886 in ³ , F _y =50 ksi	
M _{nl} =262.02 lb-ft	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =0.23157 in ⁶ , W _n =2.5828 in ² , F _y =50 ksi	
B _n =4482.8 lb-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

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Full Section Properties

Area	0.23679 in ²	Wt.	0.00080508 k/ft	Flat	7.5893 in
I _x	0.49901 in ⁴	r _x	1.4517 in	I _{xy}	0.00000 in ⁴
S _x (t)	0.27532 in ³	y(t)	1.8125 in	α	0.000 deg
S _x (b)	0.27532 in ³	y(b)	1.8125 in		
Z _x	0.31735 in ³	Height	3.6250 in		
I _y	0.09018 in ⁴	r _y	0.6171 in	x _o	-1.3104 in
S _y (l)	0.16798 in ³	x(l)	0.5369 in	y _o	0.0000 in
S _y (r)	0.08288 in ³	x(r)	1.0881 in	j _x	2.0763 in
Z _y	0.12213 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	0.49901 in ⁴	r ₁	1.4517 in	C _w	0.25879 in ⁶
I ₂	0.09018 in ⁴	r ₂	0.6171 in	J	0.00007683 in ⁴
I _c	0.58920 in ⁴	r _c	1.5774 in		
I _o	0.99582 in ⁴	r _o	2.0507 in		

Net Section Properties

I _x	0.49024 in ⁴	r _x	1.6064 in	Area	0.18999 in ²
S _x (t)	0.27048 in ³	y(t)	1.8125 in	I _{xy}	0.00000 in ⁴
S _x (b)	0.27048 in ³	y(b)	1.8125 in	α	0.000 deg
Z _x	0.29980 in ³				
I _y	0.07433 in ⁴	r _y	0.6255 in	x _o	-1.4530 in
S _y (l)	0.11173 in ³	x(l)	0.6653 in	y _o	0.0000 in
S _y (r)	0.07745 in ³	x(r)	0.9597 in	j _x	1.8388 in
Z _y	0.10677 in ³			j _y	0.0000 in
I _c	0.56457 in ⁴	r _c	1.7238 in	C _w	0.25323 in ⁶
I _o	0.96566 in ⁴	r _o	2.2545 in	J	0.00006165 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	5.5714 k	φM _{nxo}	9.6753 k-in	φM _{nyo}	3.3278 k-in
A _e	0.13109 in ²	I _{xe}	0.43378 in ⁴	I _{ye}	0.07195 in ⁴
φT _n	9.2619 k	S _{xe} (t)	0.21501 in ³	S _{ye} (l)	0.11035 in ³
		S _{xe} (b)	0.26985 in ³	S _{ye} (r)	0.07395 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.4157 k	φM _{nxo}	9.6753 k-in	φM _{nyo}	3.1474 k-in
φV _{nx}	2.3281 k	I _{xe}	0.43378 in ⁴	I _{ye}	0.05771 in ⁴
Torsion		S _{xe} (t)	0.26985 in ³	S _{ye} (l)	0.07215 in ³
φB _n	4.427 k-in ²	S _{xe} (b)	0.21501 in ³	S _{ye} (r)	0.06994 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.45$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=53.235$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=55.114$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.23679 \text{ in}^2$, $F_y=51.45 \text{ ksi}$ $T_n=12.183 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.18999 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=12.349 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1.2934 \text{ k}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=1.0982 \text{ k}$	Eq. G3-2
$k_v=3.5335$	Eq. G3-8
$V_{crh}=0.35241 \text{ k}$	Eq. G3-6
$V_n=0.46194 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1.2934 \text{ k}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3907 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.82697$	Eq. 1.1-3
$\rho=0.88754$	Eq. 1.1-2
$b=0.34676 \text{ in}$ (ineffective width= 0.043938 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00016273 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00015506 \text{ in}^4$	
$d_s=0.33042 \text{ in}$ (lip ineffective width= 0.01634 in)	Eq. 1.3-6
$k=3.4239$	Table 1.3-1
Element 2: Partially stiffened, $w=1.4064 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.4239$	
$\lambda=1.055$	Eq. 1.1-3
$\rho=0.75023$	Eq. 1.1-2
$b=1.0551 \text{ in}$ (ineffective width= 0.35127 in)	Eq. 1.1-1
$b_1=0.5027 \text{ in}$, $b_2=0.55242 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0176$	Eq. 1.1-3
$\rho=0.4416$	Eq. 1.1-2
$b=0.42093 \text{ in}$ (ineffective width= 0.53227 in)	Eq. 1.1-1
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0176$	Eq. 1.1-3
$\rho=0.4416$	Eq. 1.1-2
$b=0.42093$ in (ineffective width=0.53227 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.82697$	Eq. 1.1-3
$\rho=0.88754$	Eq. 1.1-2
$b=0.34676$ in (ineffective width=0.043938 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00016273$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$d_s=0.33042$ in (lip ineffective width=0.016341 in)	Eq. 1.3-6
$k=3.4239$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4064$ in	
$f=50$ ksi, $k=3.4239$	
$\lambda=1.055$	Eq. 1.1-3
$\rho=0.75023$	Eq. 1.1-2
$b=1.0551$ in (ineffective width=0.35127 in)	Eq. 1.1-1
$b_1=0.5027$ in, $b_2=0.55242$ in	
$A_e=0.13109$ in ² , $F_n=50$ ksi	
$P_n=6.5546$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.291$ ksi, $f_2=23.667$ ksi

$\psi=0.50044$

Eq. 1.2.2-1

$k=0.68773$

Eq. 1.2.2-2

$\lambda=1.5515$

Eq. 1.1-3

$\rho=0.55313$

Eq. 1.1-2

$b=0.52725$ in (ineffective width=0.42595 in)

Eq. 1.1-1

Element 5: Unstiffened, $w=0.3907$ in

$f_1=47.291$ ksi, $f_2=37.608$ ksi

$\psi=0.79524$

Eq. 1.2.2-1

$k=0.50914$

Eq. 1.2.2-2

$\lambda=0.73911$

Eq. 1.1-3

$\rho=0.95026$

Eq. 1.1-2

$b=0.37127$ in (ineffective width=0.019434 in)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=31.212$

Eq. 1.3-7

$I_a=0.00016212$ in⁴

Eq. 1.3-8

$I_s=0.00015506$ in⁴

$d_s=0.35511$ in (lip ineffective width=0.01616 in)

Eq. 1.3-6

$k=3.4276$

Table 1.3-1

Element 4: Partially stiffened, $w=1.4064$ in
 $f=49.613$ ksi, $k=3.4276$
 $\lambda=1.0503$
 $\rho=0.75268$
 $b=1.0586$ in (ineffective width= 0.34783 in)
 $b_1=0.50625$ in, $b_2=0.55232$ in

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Center of gravity shift: $y=-0.20503$ in
 $S_{xe}=0.21501$ in³, $F_y=50$ ksi
 $M_{nl}=10.75$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3907$ in
 $f_1=47.291$ ksi, $f_2=37.608$ ksi
 $\psi=0.79524$
 $k=0.50914$
 $\lambda=0.73911$
 $\rho=0.95026$
 $b=0.37127$ in (ineffective width= 0.019434 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.212$
 $I_a=0.00016212$ in⁴
 $I_s=0.00015506$ in⁴
 $ds=0.35511$ in (lip ineffective width= 0.01616 in)
 $k=3.4276$

Eq. 1.3-7

Eq. 1.3-8

Eq. 1.3-6

Table 1.3-1

Element 2: Partially stiffened, $w=1.4064$ in
 $f=49.613$ ksi, $k=3.4276$
 $\lambda=1.0503$
 $\rho=0.75268$
 $b=1.0586$ in (ineffective width= 0.34783 in)
 $b_1=0.50625$ in, $b_2=0.55232$ in

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=47.291$ ksi, $f_2=23.667$ ksi
 $\psi=0.50044$
 $k=0.68773$
 $\lambda=1.5515$
 $\rho=0.55313$
 $b=0.52725$ in (ineffective width= 0.42595 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.20503$ in
 $S_{xe}=0.21501$ in³, $F_y=50$ ksi
 $M_{nl}=10.75$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3907$ in
 $f_1=49.198$ ksi, $f_2=49.198$ ksi
 $\psi=1$
 $k=0.43$

Eq. 1.2.2-1

Eq. 1.2.2-3

$\lambda=0.82031$	Eq. 1.1-3
$\rho=0.89211$	Eq. 1.1-2
$b=0.34855$ in (ineffective width=0.042153 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.4064$ in	
$f_1=44.383$ ksi, $f_2=-27.89$ ksi	
$\psi=0.62839$	Eq. 1.1.2-1
$k=15.893$	Eq. 1.1.2-2
$\lambda=0.46133$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.4064$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.38761$ in	Eq. 1.1.2-3
$b_2=0.7032$ in	Eq. 1.1.2-4
Compression width=0.86367 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.3907$ in	
$f_1=49.198$ ksi, $f_2=49.198$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.82031$	Eq. 1.1-3
$\rho=0.89211$	Eq. 1.1-2
$b=0.34855$ in (ineffective width=0.042153 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.4064$ in	
$f_1=44.383$ ksi, $f_2=-27.89$ ksi	
$\psi=0.62839$	Eq. 1.1.2-1
$k=15.893$	Eq. 1.1.2-2
$\lambda=0.46133$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.4064$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.38761$ in	Eq. 1.1.2-3
$b_2=0.7032$ in	Eq. 1.1.2-4
Compression width=0.86367 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.013255$ in	
$S_y=0.07395$ in ³ , $F_y=50$ ksi	
$M_{nl}=3.6975$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.4064$ in

$f_1=41.809$ ksi, $f_2=-43.38$ ksi

$\psi=1.0376$

$k=24.994$

$\lambda=0.35704$

$\rho=1$

$b_e=1.4064$ in

$h_o=1.625$ in, $b_o=3.625$ in, $h_o/b_o=0.44828$

$b_1=0.34833$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

$b_2=0.7032$ in	Eq. 1.1.2-4
Compression width=0.69023 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.484$ ksi, $f_2=47.484$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.9662$	Eq. 1.1-3
$\rho=0.45169$	Eq. 1.1-2
$b=0.43056$ in (ineffective width=0.52264 in)	Eq. 1.1-1
$f_1=47.484$ ksi, $f_2=47.484$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.9662$	Eq. 1.1-3
$\rho=0.45169$	Eq. 1.1-2
$b=0.43056$ in (ineffective width=0.52264 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.4064$ in	
$f_1=41.809$ ksi, $f_2=-43.38$ ksi	
$\psi=1.0376$	Eq. 1.1.2-1
$k=24.994$	Eq. 1.1.2-2
$\lambda=0.35704$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.4064$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.625$ in, $h_o/b_o=0.44828$	
$b_1=0.34833$ in	Eq. 1.1.2-3
$b_2=0.7032$ in	Eq. 1.1.2-4
Compression width=0.69023 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.13463$ in	
$S_y=0.069943$ in ³ , $F_y=50$ ksi	
$M_n=3.4972$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.25323$ in ⁶ , $W_n=2.5741$ in ² , $F_y=50$ ksi	
$B_n=4.9189$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.26212 in ²	Wt.	0.00089121 k/ft	Flat	7.5757 in
Ix	0.5512 in ⁴	rx	1.4502 in	Ixy	0.0000 in ⁴
Sx(t)	0.30414 in ³	y(t)	1.8125 in	α	0.000 deg
Sx(b)	0.30414 in ³	y(b)	1.8125 in		
Zx	0.35092 in ³	Height	3.6250 in		
Iy	0.0994 in ⁴	ry	0.6157 in	x _o	-1.3066 in
Sy(l)	0.18504 in ³	x(l)	0.5370 in	y _o	0.0000 in
Sy(r)	0.09132 in ³	x(r)	1.0880 in	jx	2.0732 in
Zy	0.13481 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	0.5512 in ⁴	r ₁	1.4502 in	Cw	0.28429 in ⁶
I ₂	0.0994 in ⁴	r ₂	0.6157 in	J	0.00010460 in ⁴
Ic	0.6506 in ⁴	rc	1.5755 in		
I _o	1.0981 in ⁴	r _o	2.0468 in		

Net Section Properties

Ix	0.5415 in ⁴	rx	1.6050 in	Area	0.21022 in ²
Sx(t)	0.29877 in ³	y(t)	1.8125 in	Ixy	0.0000 in ⁴
Sx(b)	0.29877 in ³	y(b)	1.8125 in	α	0.000 deg
Zx	0.33146 in ³				
Iy	0.0819 in ⁴	ry	0.6241 in	x _o	-1.4491 in
Sy(l)	0.12307 in ³	x(l)	0.6653 in	y _o	0.0000 in
Sy(r)	0.08531 in ³	x(r)	0.9597 in	jx	1.8353 in
Zy	0.11786 in ³			jy	0.0000 in
Ic	0.6234 in ⁴	rc	1.7220 in	Cw	0.27815 in ⁶
I _o	1.0648 in ⁴	r _o	2.2506 in	J	0.00008389 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	6.313 k	φMnxo	10.926 k-in	φMnyo	3.763 k-in
Ae	0.14853 in ²	Ixe	0.48545 in ⁴	Iye	0.08074 in ⁴
φTn	10.248 k	Sxe(t)	0.24279 in ³	Sye(l)	0.12242 in ³
		Sxe(b)	0.29865 in ³	Sye(r)	0.08363 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.516 k	φMnxo	10.926 k-in	φMnyo	3.513 k-in
φVnx	2.621 k	Ixe	0.48545 in ⁴	Iye	0.06562 in ⁴
Torsion		Sxe(t)	0.29865 in ³	Sye(l)	0.08363 in ³
φBn	4.8821 k-in ²	Sxe(b)	0.24279 in ³	Sye(r)	0.07808 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.575$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=53.516$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=55.565$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.26212 \text{ in}^2$, $F_y=51.575 \text{ ksi}$
 $T_n=13.519 \text{ k}$ Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.21022 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=13.664 \text{ k}$ Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=1.4563 \text{ k at } 180 \text{ deg}$ Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=1.2145 \text{ k}$ Eq. G3-2
 $k_v=3.5321$ Eq. G3-8
 $V_{crh}=0.4804 \text{ k}$ Eq. G3-6
 $V_n=0.5737 \text{ k at } 90 \text{ deg}$ Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=1.4563 \text{ k at } 0 \text{ deg}$ Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.389 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.74246$ Eq. 1.1-3
 $\rho=0.94778$ Eq. 1.1-2
 $b=0.36869 \text{ in (ineffective width=0.020315 in)}$ Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.00022212 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00016972 \text{ in}^4$
 $d_s=0.28171 \text{ in (lip ineffective width=0.086971 in)}$ Eq. 1.3-6
 $k=3.2075$ Table 1.3-1

Element 2: Partially stiffened, $w=1.403 \text{ in}$
 $f=50 \text{ ksi}$, $k=3.2075$
 $\lambda=0.98047$ Eq. 1.1-3
 $\rho=0.79107$ Eq. 1.1-2
 $b=1.1099 \text{ in (ineffective width=0.29313 in)}$ Eq. 1.1-1
 $b_1=0.42403 \text{ in}$, $b_2=0.68584 \text{ in}$

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.8161$ Eq. 1.1-3
 $\rho=0.48393$ Eq. 1.1-2
 $b=0.46046 \text{ in (ineffective width=0.49104 in)}$ Eq. 1.1-1

$$f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=1.8161$$

Eq. 1.1-3

$$\rho=0.48393$$

Eq. 1.1-2

$$b=0.46046 \text{ in (ineffective width}=0.49104 \text{ in)}$$

Eq. 1.1-1

Element 5: Unstiffened, $w=0.389 \text{ in}$

$$f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.74246$$

Eq. 1.1-3

$$\rho=0.94778$$

Eq. 1.1-2

$$b=0.36869 \text{ in (ineffective width}=0.020315 \text{ in)}$$

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.091$$

Eq. 1.3-7

$$I_a=0.00022212 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00016972 \text{ in}^4$$

$$d_s=0.28171 \text{ in (lip ineffective width}=0.086971 \text{ in)}$$

Eq. 1.3-6

$$k=3.2075$$

Table 1.3-1

Element 4: Partially stiffened, $w=1.403 \text{ in}$

$$f=50 \text{ ksi}, k=3.2075$$

$$\lambda=0.98047$$

Eq. 1.1-3

$$\rho=0.79107$$

Eq. 1.1-2

$$b=1.1099 \text{ in (ineffective width}=0.29313 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.42403 \text{ in}, b_2=0.68584 \text{ in}$$

$$A_e=0.14853 \text{ in}^2, F_n=50 \text{ ksi}$$

$$P_n=7.4266 \text{ k}$$

Eq. E3.1-1

$$\Omega_c=1.8, \phi_c=0.85$$

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$$f_1=47.224 \text{ ksi}, f_2=23.429 \text{ ksi}$$

$$\psi=0.49613$$

Eq. 1.2.2-1

$$k=0.69128$$

Eq. 1.2.2-2

$$\lambda=1.392$$

Eq. 1.1-3

$$\rho=0.60485$$

Eq. 1.1-2

$$b=0.57552 \text{ in (ineffective width}=0.37598 \text{ in)}$$

Eq. 1.1-1

Element 5: Unstiffened, $w=0.389 \text{ in}$

$$f_1=47.224 \text{ ksi}, f_2=37.496 \text{ ksi}$$

$$\psi=0.794$$

Eq. 1.2.2-1

$$k=0.5097$$

Eq. 1.2.2-2

$$\lambda=0.66275$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.226$$

Eq. 1.3-7

$$I_a=0.00022119 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00016972 \text{ in}^4$$

ds=0.29849 in (lip ineffective width=0.09051 in)	Eq. 1.3-6
k=3.2114	Table 1.3-1
Element 4: Partially stiffened, w=1.403 in	
f=49.567 ksi, k=3.2114	
$\lambda=0.97563$	Eq. 1.1-3
$\rho=0.79385$	Eq. 1.1-2
b=1.1138 in (ineffective width=0.28922 in)	Eq. 1.1-1
b ₁ =0.42731 in, b ₂ =0.68646 in	
Center of gravity shift: y=-0.18699 in	
S _{xe} =0.24279 in ³ , F _y =50 ksi	
M _{nl} =12.139 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.389 in	
f ₁ =47.224 ksi, f ₂ =37.496 ksi	
$\psi=0.794$	Eq. 1.2.2-1
k=0.5097	Eq. 1.2.2-2
$\lambda=0.66275$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.226	Eq. 1.3-7
I _a =0.00022119 in ⁴	Eq. 1.3-8
I _s =0.00016972 in ⁴	
ds=0.29849 in (lip ineffective width=0.09051 in)	Eq. 1.3-6
k=3.2114	Table 1.3-1
Element 2: Partially stiffened, w=1.403 in	
f=49.567 ksi, k=3.2114	
$\lambda=0.97563$	Eq. 1.1-3
$\rho=0.79385$	Eq. 1.1-2
b=1.1138 in (ineffective width=0.28922 in)	Eq. 1.1-1
b ₁ =0.42731 in, b ₂ =0.68646 in	
Element 3: Treat as two unstiffened elements	
f ₁ =47.224 ksi, f ₂ =23.429 ksi	
$\psi=0.49613$	Eq. 1.2.2-1
k=0.69128	Eq. 1.2.2-2
$\lambda=1.392$	Eq. 1.1-3
$\rho=0.60485$	Eq. 1.1-2
b=0.57552 in (ineffective width=0.37598 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.18699 in	
S _{xe} =0.24279 in ³ , F _y =50 ksi	
M _{nl} =12.139 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Positive Flexural Strength about Y-axis
Effective width calculations for Stud
Element 1: Unstiffened, w=0.389 in

$$f_1=49.104 \text{ ksi}, f_2=49.104 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.73578$$

Eq. 1.1-3

$$\rho=0.95273$$

Eq. 1.1-2

$$b=0.37061 \text{ in (ineffective width}=0.018389 \text{ in)}$$

Eq. 1.1-1

Element 2: Stiffened, $w=1.403 \text{ in}$

$$f_1=44.252 \text{ ksi}, f_2=-28.407 \text{ ksi}$$

$$\psi=0.64194$$

Eq. 1.1.2-1

$$k=16.137$$

Eq. 1.1.2-2

$$\lambda=0.41123$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.403 \text{ in}$$

Eq. 1.1-1

$$h_o=1.625 \text{ in}, b_o=0.5 \text{ in}, h_o/b_o=3.25$$

$$b_1=0.38523 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.7015 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.85448 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.389 \text{ in}$

$$f_1=49.104 \text{ ksi}, f_2=49.104 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.73578$$

Eq. 1.1-3

$$\rho=0.95273$$

Eq. 1.1-2

$$b=0.37061 \text{ in (ineffective width}=0.018389 \text{ in)}$$

Eq. 1.1-1

Element 4: Stiffened, $w=1.403 \text{ in}$

$$f_1=44.252 \text{ ksi}, f_2=-28.407 \text{ ksi}$$

$$\psi=0.64194$$

Eq. 1.1.2-1

$$k=16.137$$

Eq. 1.1.2-2

$$\lambda=0.41123$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.403 \text{ in}$$

Eq. 1.1-1

$$h_o=1.625 \text{ in}, b_o=0.5 \text{ in}, h_o/b_o=3.25$$

$$b_1=0.38523 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.7015 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.85448 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=-0.0057397 \text{ in}$

$$S_y=0.083625 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_n=4.1813 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.403 \text{ in}$

$$f_1=40.036 \text{ ksi}, f_2=-43.399 \text{ ksi}$$

$$\psi=1.084$$

Eq. 1.1.2-1

$$k=26.27$$

Eq. 1.1.2-2

$\lambda=0.30657$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.403$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.625$ in, $h_o/b_o=0.44828$	
$b_1=0.34354$ in	Eq. 1.1.2-3
$b_2=0.7015$ in	Eq. 1.1.2-4
Compression width=0.67323 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=45.609$ ksi, $f_2=45.609$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.7345$	Eq. 1.1-3
$\rho=0.50341$	Eq. 1.1-2
$b=0.479$ in (ineffective width=0.4725 in)	Eq. 1.1-1
$f_1=45.609$ ksi, $f_2=45.609$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.7345$	Eq. 1.1-3
$\rho=0.50341$	Eq. 1.1-2
$b=0.479$ in (ineffective width=0.4725 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.403$ in	
$f_1=40.036$ ksi, $f_2=-43.399$ ksi	
$\psi=1.084$	Eq. 1.1.2-1
$k=26.27$	Eq. 1.1.2-2
$\lambda=0.30657$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.403$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.625$ in, $h_o/b_o=0.44828$	
$b_1=0.34354$ in	Eq. 1.1.2-3
$b_2=0.7015$ in	Eq. 1.1.2-4
Compression width=0.67323 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.11935$ in	
$S_{ye}=0.078078$ in ³ , $F_y=50$ ksi	
$M_n=3.9039$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.27815$ in ⁶ , $W_n=2.5638$ in ² , $F_y=50$ ksi	
$B_n=5.4246$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.33977 in ²	Wt.	0.0011552 k/ft	Flat	7.5336 in
I _x	0.7099 in ⁴	r _x	1.4455 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.39169 in ³	y(t)	1.8125 in	α	0.000 deg
S _x (b)	0.39169 in ³	y(b)	1.8125 in		
Z _x	0.45331 in ³	Height	3.6250 in		
I _y	0.1269 in ⁴	r _y	0.6111 in	x _o	-1.2948 in
S _y (l)	0.23621 in ³	x(l)	0.5373 in	y _o	0.0000 in
S _y (r)	0.11667 in ³	x(r)	1.0877 in	j _x	2.0638 in
Z _y	0.17319 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	0.7099 in ⁴	r ₁	1.4455 in	C _w	0.35980 in ⁶
I ₂	0.1269 in ⁴	r ₂	0.6111 in	J	0.00023036 in ⁴
I _c	0.8368 in ⁴	r _c	1.5694 in		
I _o	1.4065 in ⁴	r _o	2.0346 in		

Net Section Properties

I _x	0.6972 in ⁴	r _x	1.6007 in	Area	0.27212 in ²
S _x (t)	0.38469 in ³	y(t)	1.8125 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.38469 in ³	y(b)	1.8125 in	α	0.000 deg
Z _x	0.42794 in ³				
I _y	0.1045 in ⁴	r _y	0.6197 in	x _o	-1.4369 in
S _y (l)	0.15712 in ³	x(l)	0.6652 in	y _o	0.0000 in
S _y (r)	0.10889 in ³	x(r)	0.9598 in	j _x	1.8246 in
Z _y	0.15146 in ³			j _y	0.0000 in
I _c	0.8018 in ⁴	r _c	1.7165 in	C _w	0.35194 in ⁶
I _o	1.3636 in ⁴	r _o	2.2386 in	J	0.00018450 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	8.775 k	φM _{nxo}	14.925 k-in	φM _{nyo}	5.571 k-in
A _e	0.20647 in ²	I _{xe}	0.64623 in ⁴	I _{ye}	0.10451 in ⁴
φT _n	13.266 k	S _{xe} (t)	0.33166 in ³	S _{ye} (l)	0.15712 in ³
		S _{xe} (b)	0.38546 in ³	S _{ye} (r)	0.10889 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.883 k	φM _{nxo}	14.925 k-in	φM _{nyo}	4.641 k-in
φV _{nx}	3.391 k	I _{xe}	0.64623 in ⁴	I _{ye}	0.09105 in ⁴
Torsion		S _{xe} (t)	0.38546 in ³	S _{ye} (l)	0.12268 in ³
φB _n	6.2544 k-in ²	S _{xe} (b)	0.33166 in ³	S _{ye} (r)	0.10314 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_y=51.93$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_y=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_y=54.31$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_y=50$ ksi

Max compression stress allowed for negative bending: $F_y=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_y=56.847$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_y=50$ ksi

Axial Tension Strength

$A_g=0.33977$ in², $F_y=51.93$ ksi

$$T_n = 17.644 \text{ k} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.27212 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 17.688 \text{ k} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 1.8839 \text{ k at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 1.5693 \text{ k} \quad \text{Eq. G3-2}$$

$$k_v = 3.528 \quad \text{Eq. G3-8}$$

$$V_{crh} = 1.0624 \text{ k} \quad \text{Eq. G3-6}$$

$$V_n = 0.98154 \text{ k at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 1.8839 \text{ k at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.3837 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.56184 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.00048546 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00021231 \text{ in}^4$$

$$d_s = 0.16781 \text{ in (lip ineffective width} = 0.21589 \text{ in)} \quad \text{Eq. 1.3-6}$$

$$k = 2.725 \quad \text{Table 1.3-1}$$

Element 2: Partially stiffened, $w = 1.3924 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.725$$

$$\lambda = 0.80992 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.89931 \quad \text{Eq. 1.1-2}$$

$$b = 1.2522 \text{ in (ineffective width} = 0.1402 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$b_1 = 0.27382 \text{ in}, b_2 = 0.97838 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 1.3855 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.60715 \quad \text{Eq. 1.1-2}$$

$$b = 0.57449 \text{ in (ineffective width} = 0.37171 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

k=0.43	Eq. 1.2.2-3
$\lambda=1.3855$	Eq. 1.1-3
$\rho=0.60715$	Eq. 1.1-2
b=0.57449 in (ineffective width=0.37171 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.3837 in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=0.56184$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.091	Eq. 1.3-7
Ia=0.00048546 in ⁴	Eq. 1.3-8
Is=0.00021231 in ⁴	
ds=0.16781 in (lip ineffective width=0.21589 in)	Eq. 1.3-6
k=2.725	Table 1.3-1
Element 4: Partially stiffened, w=1.3924 in	
f=50 ksi, k=2.725	
$\lambda=0.80992$	Eq. 1.1-3
$\rho=0.89931$	Eq. 1.1-2
b=1.2522 in (ineffective width=0.1402 in)	Eq. 1.1-1
b ₁ =0.27382 in, b ₂ =0.97838 in	
Ae=0.20647 in ² , Fn=50 ksi	
Pn=10.323 k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.016$ ksi, $f_2=22.734$ ksi	
$\psi=0.48355$	Eq. 1.2.2-1
k=0.70184	Eq. 1.2.2-2
$\lambda=1.0516$	Eq. 1.1-3
$\rho=0.75198$	Eq. 1.1-2
b=0.71153 in (ineffective width=0.23467 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.3837 in	
$f_1=47.016$ ksi, $f_2=37.169$ ksi	
$\psi=0.79057$	Eq. 1.2.2-1
k=0.51125	Eq. 1.2.2-2
$\lambda=0.49966$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.273	Eq. 1.3-7
Ia=0.00047295 in ⁴	Eq. 1.3-8
Is=0.00021231 in ⁴	
ds=0.17225 in (lip ineffective width=0.21145 in)	Eq. 1.3-6
k=2.7424	Table 1.3-1
Element 4: Partially stiffened, w=1.3924 in	

$$f=49.421 \text{ ksi}, k=2.7424$$

$$\lambda=0.80265$$

Eq. 1.1-3

$$\rho=0.90439$$

Eq. 1.1-2

$$b=1.2593 \text{ in (ineffective width}=0.13313 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.28265 \text{ in}, b_2=0.97662 \text{ in}$$

Center of gravity shift: $y=-0.13599 \text{ in}$

$$S_{xe}=0.33166 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=16.583 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837 \text{ in}$

$$f_1=47.016 \text{ ksi}, f_2=37.169 \text{ ksi}$$

$$\psi=0.79057$$

Eq. 1.2.2-1

$$k=0.51125$$

Eq. 1.2.2-2

$$\lambda=0.49966$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.273$$

Eq. 1.3-7

$$I_a=0.00047295 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00021231 \text{ in}^4$$

$$d_s=0.17225 \text{ in (lip ineffective width}=0.21145 \text{ in)}$$

Eq. 1.3-6

$$k=2.7424$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.3924 \text{ in}$

$$f=49.421 \text{ ksi}, k=2.7424$$

$$\lambda=0.80265$$

Eq. 1.1-3

$$\rho=0.90439$$

Eq. 1.1-2

$$b=1.2593 \text{ in (ineffective width}=0.13313 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.28265 \text{ in}, b_2=0.97662 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1=47.016 \text{ ksi}, f_2=22.734 \text{ ksi}$$

$$\psi=0.48355$$

Eq. 1.2.2-1

$$k=0.70184$$

Eq. 1.2.2-2

$$\lambda=1.0516$$

Eq. 1.1-3

$$\rho=0.75198$$

Eq. 1.1-2

$$b=0.71153 \text{ in (ineffective width}=0.23467 \text{ in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.13599 \text{ in}$

$$S_{xe}=0.33166 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=16.583 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837 \text{ in}$

$$f_1=55.511 \text{ ksi}, f_2=55.511 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$\lambda=0.592$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.3924$ in	
$f_1=49.959$ ksi, $f_2=-32.511$ ksi	
$\psi=0.65076$	Eq. 1.1.2-1
$k=16.298$	Eq. 1.1.2-2
$\lambda=0.33103$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.3924$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.3814$ in	Eq. 1.1.2-3
$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width=0.84349 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=55.511$ ksi, $f_2=55.511$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.592$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.3924$ in	
$f_1=49.959$ ksi, $f_2=-32.511$ ksi	
$\psi=0.65076$	Eq. 1.1.2-1
$k=16.298$	Eq. 1.1.2-2
$\lambda=0.33103$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.3924$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.3814$ in	Eq. 1.1.2-3
$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width=0.84349 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_{ye}=0.10889$ in ³ , $F_y=56.847$ ksi	
$M_{nl}=6.1903$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.3924$ in

$f_1=35.418$ ksi, $f_2=-43.415$ ksi

$\psi=1.2258$

$k=30.505$

$\lambda=0.20373$

$\rho=1$

$b_e=1.3924$ in

$h_o=1.625$ in, $b_o=3.625$ in, $h_o/b_o=0.44828$

$b_1=0.3295$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width=0.62557 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=40.726$ ksi, $f_2=40.726$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2504$	Eq. 1.1-3
$\rho=0.65902$	Eq. 1.1-2
$b=0.62357$ in (ineffective width=0.32263 in)	Eq. 1.1-1
$f_1=40.726$ ksi, $f_2=40.726$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2504$	Eq. 1.1-3
$\rho=0.65902$	Eq. 1.1-2
$b=0.62357$ in (ineffective width=0.32263 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.3924$ in	
$f_1=35.418$ ksi, $f_2=-43.415$ ksi	
$\psi=1.2258$	Eq. 1.1.2-1
$k=30.505$	Eq. 1.1.2-2
$\lambda=0.20373$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.3924$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.625$ in, $h_o/b_o=0.44828$	
$b_1=0.3295$ in	Eq. 1.1.2-3
$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width=0.62557 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.076959$ in	
$S_{ye}=0.10314$ in ³ , $F_y=50$ ksi	
$M_n I=5.1568$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.35194$ in ⁶ , $W_n=2.5322$ in ² , $F_y=50$ ksi	
$B_n=6.9493$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.42191 in ²	Wt.	0.0014345 k/ft	Flat	7.4543 in
Ix	0.8730 in ⁴	rx	1.4385 in	Ixy	0.0000 in ⁴
Sx(t)	0.48167 in ³	y(t)	1.8125 in	α	0.000 deg
Sx(b)	0.48167 in ³	y(b)	1.8125 in		
Zx	0.55986 in ³	Height	3.6250 in		
Iy	0.1543 in ⁴	ry	0.6048 in	x _o	-1.2798 in
Sy(l)	0.28777 in ³	x(l)	0.5363 in	y _o	0.0000 in
Sy(r)	0.14177 in ³	x(r)	1.0887 in	jx	2.0547 in
Zy	0.21235 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	0.8730 in ⁴	r ₁	1.4385 in	Cw	0.43256 in ⁶
I ₂	0.1543 in ⁴	r ₂	0.6048 in	J	0.0004505 in ⁴
Ic	1.0274 in ⁴	rc	1.5605 in		
I _o	1.7185 in ⁴	r _o	2.0182 in		

Net Section Properties

Ix	0.8571 in ⁴	rx	1.5948 in	Area	0.33701 in ²
Sx(t)	0.47288 in ³	y(t)	1.8125 in	Ixy	0.0000 in ⁴
Sx(b)	0.47288 in ³	y(b)	1.8125 in	α	0.000 deg
Zx	0.52802 in ³				
Iy	0.1269 in ⁴	ry	0.6136 in	x _o	-1.4222 in
Sy(l)	0.19100 in ³	x(l)	0.6643 in	y _o	0.0000 in
Sy(r)	0.13208 in ³	x(r)	0.9607 in	jx	1.8136 in
Zy	0.18557 in ³			jy	0.0000 in
Ic	0.9840 in ⁴	rc	1.7087 in	Cw	0.42290 in ⁶
I _o	1.6656 in ⁴	r _o	2.2231 in	J	0.00035988 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	12.562 k	φMnxo	20.437 k-in	φMnyo	6.944 k-in
Ae	0.29557 in ²	Ixe	0.84111 in ⁴	Iye	0.12689 in ⁴
φTn	16.429 k	Sxe(t)	0.45415 in ³	Sye(l)	0.19100 in ³
		Sxe(b)	0.47442 in ³	Sye(r)	0.13208 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.329 k	φMnxo	20.437 k-in	φMnyo	5.803 k-in
φVnx	4.102 k	Ixe	0.84111 in ⁴	Iye	0.11934 in ⁴
Torsion		Sxe(t)	0.47442 in ³	Sye(l)	0.17061 in ³
φBn	7.6264 k-in ²	Sxe(b)	0.45415 in ³	Sye(r)	0.12895 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=52.422$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=55.318$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=58.416$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.42191$ in², $F_y=52.422$ ksi

$T_n=22.117$ k
 $\Omega_t=1.67$, $\phi_t=0.9$ Eq. D2-1

$A_n=0.33701$ in², $F_u=65$ ksi
 $T_n=21.906$ k
 $\Omega_t=2$, $\phi_t=0.75$ Eq. D3-1

Shear Strength

Stud element 2
 $V_n=2.2787$ k at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$ Eq. G2.1-1

Stud element 3
 $V_{yh}=1.8881$ k
 $k_v=3.5079$
 $V_{crh}=2.0846$ k
 $V_n=1.4767$ k at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$
Eq. G3-2
Eq. G3-8
Eq. G3-6
Eq. G2.1-2

Stud element 4
 $V_n=2.2787$ k at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$ Eq. G2.1-1

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$
 $k=0.43$
 $\lambda=0.41829$
 $\lambda<0.673$ (fully effective)
Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$
 $I_a=0.00033614$ in⁴
 $I_s=0.00021732$ in⁴
 $d_s=0.23177$ in (lip ineffective width=0.12673 in)
 $k=2.9231$
Eq. 1.3-7
Eq. 1.3-8
Eq. 1.3-6
Table 1.3-1

Element 2: Partially stiffened, $w=1.342$ in
 $f=50$ ksi, $k=2.9231$
 $\lambda=0.60055$
 $\lambda<0.673$ (fully effective)
Eq. 1.1-3
Eq. 1.1-1

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$
 $k=0.43$
 $\lambda=1.0746$
 $\rho=0.74007$
 $b=0.6816$ in (ineffective width=0.2394 in)
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$
 $k=0.43$
 $\lambda=1.0746$
Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1
Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3

$\rho=0.74007$	Eq. 1.1-2
$b=0.6816$ in (ineffective width= 0.2394 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.41829$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00033614$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.23177$ in (lip ineffective width= 0.12673 in)	Eq. 1.3-6
$k=2.9231$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=50$ ksi, $k=2.9231$	
$\lambda=0.60055$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
$A_e=0.29557$ in ² , $F_n=50$ ksi	
$P_n=14.778$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.178$ ksi, $f_2=21.304$ ksi	
$\psi=0.46135$	Eq. 1.2.2-1
$k=0.72128$	Eq. 1.2.2-2
$\lambda=0.79737$	Eq. 1.1-3
$\rho=0.9081$	Eq. 1.1-2
$b=0.83636$ in (ineffective width= 0.084639 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=46.178$ ksi, $f_2=36.496$ ksi	
$\psi=0.79033$	Eq. 1.2.2-1
$k=0.51136$	Eq. 1.2.2-2
$\lambda=0.36862$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.331$	Eq. 1.3-7
$I_a=0.00032275$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.24139$ in (lip ineffective width= 0.11711 in)	Eq. 1.3-6
$k=2.9616$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=49.236$ ksi, $k=2.9616$	
$\lambda=0.59206$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Center of gravity shift: $y=-0.039569$ in	

$S_{xe}=0.45415 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_n I=22.707 \text{ k-in}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585 \text{ in}$

$f_1=46.178 \text{ ksi}$, $f_2=36.496 \text{ ksi}$

$\psi=0.79033$

Eq. 1.2.2-1

$k=0.51136$

Eq. 1.2.2-2

$\lambda=0.36862$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.331$

Eq. 1.3-7

$I_a=0.00032275 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00021732 \text{ in}^4$

$d_s=0.24139 \text{ in}$ (lip ineffective width= 0.11711 in)

Eq. 1.3-6

$k=2.9616$

Table 1.3-1

Element 2: Partially stiffened, $w=1.342 \text{ in}$

$f=49.236 \text{ ksi}$, $k=2.9616$

$\lambda=0.59206$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=46.178 \text{ ksi}$, $f_2=21.304 \text{ ksi}$

$\psi=0.46135$

Eq. 1.2.2-1

$k=0.72128$

Eq. 1.2.2-2

$\lambda=0.79737$

Eq. 1.1-3

$\rho=0.9081$

Eq. 1.1-2

$b=0.83636 \text{ in}$ (ineffective width= 0.084639 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.039569 \text{ in}$

$S_{xe}=0.45415 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_n I=22.707 \text{ k-in}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585 \text{ in}$

$f_1=56.695 \text{ ksi}$, $f_2=56.695 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.44541$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=1.342 \text{ in}$

$f_1=49.812 \text{ ksi}$, $f_2=-31.792 \text{ ksi}$

$\psi=0.63825$

Eq. 1.1.2-1

$k=16.07$

Eq. 1.1.2-2

$\lambda=0.25565$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$$b_e = 1.342 \text{ in}$$

Eq. 1.1-1

$$h_o = 1.625 \text{ in}, b_o = 0.5 \text{ in}, h_o/b_o = 3.25$$

$$b_1 = 0.36886 \text{ in}$$

Eq. 1.1.2-3

$$b_2 = 0.671 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width} = 0.81917 \text{ in}$$

$$b_1 + b_2 > \text{compression width (fully effective)}$$

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w = 0.3585 \text{ in}$

$$f_1 = 56.695 \text{ ksi}, f_2 = 56.695 \text{ ksi}$$

$$\psi = 1$$

Eq. 1.2.2-1

$$k = 0.43$$

Eq. 1.2.2-3

$$\lambda = 0.44541$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 4: Stiffened, $w = 1.342 \text{ in}$

$$f_1 = 49.812 \text{ ksi}, f_2 = -31.792 \text{ ksi}$$

$$\psi = 0.63825$$

Eq. 1.1.2-1

$$k = 16.07$$

Eq. 1.1.2-2

$$\lambda = 0.25565$$

Eq. 1.1-3

$$\rho = 1$$

Eq. 1.1-2

$$b_e = 1.342 \text{ in}$$

Eq. 1.1-1

$$h_o = 1.625 \text{ in}, b_o = 0.5 \text{ in}, h_o/b_o = 3.25$$

$$b_1 = 0.36886 \text{ in}$$

Eq. 1.1.2-3

$$b_2 = 0.671 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width} = 0.81917 \text{ in}$$

$$b_1 + b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x = 0 \text{ in}$

$$S_{ye} = 0.13208 \text{ in}^3, F_y = 58.416 \text{ ksi}$$

$$M_{nl} = 7.7156 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b = 1.67, \phi_b = 0.9$$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.342 \text{ in}$

$$f_1 = 30.081 \text{ ksi}, f_2 = -42.362 \text{ ksi}$$

$$\psi = 1.4082$$

Eq. 1.1.2-1

$$k = 36.751$$

Eq. 1.1.2-2

$$\lambda = 0.13137$$

Eq. 1.1-3

$$\rho = 1$$

Eq. 1.1-2

$$b_e = 1.342 \text{ in}$$

Eq. 1.1-1

$$h_o = 1.625 \text{ in}, b_o = 3.625 \text{ in}, h_o/b_o = 0.44828$$

$$b_1 = 0.30443 \text{ in}$$

Eq. 1.1.2-3

$$b_2 = 0.671 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width} = 0.55725 \text{ in}$$

$$b_1 + b_2 > \text{compression width (fully effective)}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 36.192 \text{ ksi}, f_2 = 36.192 \text{ ksi}$$

$$\psi = 1$$

Eq. 1.2.2-1

$$k = 0.43$$

Eq. 1.2.2-3

$$\lambda = 0.91425$$

Eq. 1.1-3

$\rho=0.83059$	Eq. 1.1-2
$b=0.76497$ in (ineffective width=0.15603 in)	Eq. 1.1-1
$f_1=36.192$ ksi, $f_2=36.192$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.91425$	Eq. 1.1-3
$\rho=0.83059$	Eq. 1.1-2
$b=0.76497$ in (ineffective width=0.15603 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.342$ in	
$f_1=30.081$ ksi, $f_2=-42.362$ ksi	
$\psi=1.4082$	Eq. 1.1.2-1
$k=36.751$	Eq. 1.1.2-2
$\lambda=0.13137$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=3.625$ in, $h_o/b_o=0.44828$	
$b_1=0.30443$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width=0.55725 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.035177$ in	
$S_y=0.12895$ in ³ , $F_y=50$ ksi	
$M_{nl}=6.4474$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.4229$ in ⁶ , $W_n=2.4953$ in ² , $F_y=50$ ksi	
$B_n=8.4738$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

362S200-30

Full Section Properties

Area	0.26799 in ²	Wt.	0.00091116 k/ft	Flat	8.5893 in
I _x	0.5868 in ⁴	r _x	1.4797 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.32373 in ³	y(t)	1.8125 in	α	0.000 deg
S _x (b)	0.32373 in ³	y(b)	1.8125 in		
Z _x	0.36915 in ³	Height	3.6250 in		
I _y	0.1604 in ⁴	r _y	0.7735 in	x _o	-1.7447 in
S _y (l)	0.22032 in ³	x(l)	0.7278 in	y _o	0.0000 in
S _y (r)	0.12604 in ³	x(r)	1.2722 in	j _x	2.3405 in
Z _y	0.18127 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	0.5868 in ⁴	r ₁	1.4797 in	C _w	0.50738 in ⁶
I ₂	0.1604 in ⁴	r ₂	0.7735 in	J	0.00008696 in ⁴
I _c	0.7471 in ⁴	r _c	1.6697 in		
I _o	1.5628 in ⁴	r _o	2.4149 in		

Net Section Properties

I _x	0.5780 in ⁴	r _x	1.6165 in	Area	0.22119 in ²
S _x (t)	0.31889 in ³	y(t)	1.8125 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.31889 in ³	y(b)	1.8125 in	α	0.000 deg
Z _x	0.35160 in ³				
I _y	0.1316 in ⁴	r _y	0.7713 in	x _o	-1.9110 in
S _y (l)	0.14978 in ³	x(l)	0.8785 in	y _o	0.0000 in
S _y (r)	0.11733 in ³	x(r)	1.1215 in	j _x	2.1652 in
Z _y	0.15422 in ³			j _y	0.0000 in
I _c	0.7096 in ⁴	r _c	1.7911 in	C _w	0.49789 in ⁶
I _o	1.5174 in ⁴	r _o	2.6192 in	J	0.00007177 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	5.875 k	φM _{nxo}	10.244 k-in	φM _{nyo}	4.661 k-in
A _e	0.13825 in ²	I _{xe}	0.47886 in ⁴	I _{ye}	0.12074 in ⁴
φT _n	10.783 k	S _{xe} (t)	0.22765 in ³	S _{ye} (l)	0.14475 in ³
		S _{xe} (b)	0.31473 in ³	S _{ye} (r)	0.10357 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.420 k	φM _{nxo}	10.244 k-in	φM _{nyo}	4.485 k-in
φV _{nx}	2.609 k	I _{xe}	0.47886 in ⁴	I _{ye}	0.10266 in ⁴
Torsion		S _{xe} (t)	0.31473 in ³	S _{ye} (l)	0.09967 in ³
φB _n	6.4284 k-in ²	S _{xe} (b)	0.22765 in ³	S _{ye} (r)	0.10584 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.281$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.65$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g = 0.26799 \text{ in}^2$, $F_y = 51.281 \text{ ksi}$
 $T_n = 13.743 \text{ k}$
 $\Omega_t = 1.67$, $\phi_t = 0.9$

Eq. D2-1

$A_n = 0.22119 \text{ in}^2$, $F_u = 65 \text{ ksi}$
 $T_n = 14.377 \text{ k}$
 $\Omega_t = 2$, $\phi_t = 0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n = 1.4492 \text{ k}$ at 180 deg

Eq. G2.1-2

$\Omega_v = 1.67$, $\phi_v = 0.9$

Stud element 3

$V_{yh} = 1.0982 \text{ k}$

Eq. G3-2

$k_v = 3.5962$

Eq. G3-8

$V_{crh} = 0.35866 \text{ k}$

Eq. G3-6

$V_n = 0.46652 \text{ k}$ at 90 deg

Eq. G2.1-2

$\Omega_v = 1.67$, $\phi_v = 0.9$

Stud element 4

$V_n = 1.4492 \text{ k}$ at 0 deg

Eq. G2.1-2

$\Omega_v = 1.67$, $\phi_v = 0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.5157 \text{ in}$

$f_1 = 50 \text{ ksi}$, $f_2 = 50 \text{ ksi}$

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 1.0916$

Eq. 1.1-3

$\rho = 0.73148$

Eq. 1.1-2

$b = 0.37723 \text{ in}$ (ineffective width = 0.13847 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S = 31.091$

Eq. 1.3-7

$I_a = 0.00020486 \text{ in}^4$

Eq. 1.3-8

$I_s = 0.00035659 \text{ in}^4 > I_a$ (no lip reduction)

$k = 3.4958$

Table 1.3-1

Element 2: Partially stiffened, $w = 1.7814 \text{ in}$

$f = 50 \text{ ksi}$, $k = 3.4958$

$\lambda = 1.3224$

Eq. 1.1-3

$\rho = 0.63039$

Eq. 1.1-2

$b = 1.123 \text{ in}$ (ineffective width = 0.65843 in)

Eq. 1.1-1

$b_1 = 0.56148 \text{ in}$, $b_2 = 0.56148 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1 = 50 \text{ ksi}$, $f_2 = 50 \text{ ksi}$

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 2.0176$

Eq. 1.1-3

$\rho = 0.4416$

Eq. 1.1-2

$b = 0.42093 \text{ in}$ (ineffective width = 0.53227 in)

Eq. 1.1-1

$f_1 = 50 \text{ ksi}$, $f_2 = 50 \text{ ksi}$

$\psi = 1$

Eq. 1.2.2-1

k=0.43	Eq. 1.2.2-3
$\lambda=2.0176$	Eq. 1.1-3
$\rho=0.4416$	Eq. 1.1-2
b=0.42093 in (ineffective width=0.53227 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.5157 in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
b=0.37723 in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.091	Eq. 1.3-7
Ia=0.00020486 in ⁴	Eq. 1.3-8
Is=0.00035659 in ⁴ > Ia (no lip reduction)	
k=3.4958	Table 1.3-1
Element 4: Partially stiffened, w=1.7814 in	
f=50 ksi, k=3.4958	
$\lambda=1.3224$	Eq. 1.1-3
$\rho=0.63039$	Eq. 1.1-2
b=1.123 in (ineffective width=0.65843 in)	Eq. 1.1-1
b ₁ =0.56148 in, b ₂ =0.56148 in	
Ae=0.13825 in ² , Fn=50 ksi	
Pn=6.9123 k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.402$ ksi, $f_2=24.742$ ksi

$\psi=0.52197$

k=0.67056

$\lambda=1.5731$

$\rho=0.54678$

b=0.52119 in (ineffective width=0.43201 in)

Element 5: Unstiffened, w=0.5157 in

$f_1=47.402$ ksi, $f_2=35.142$ ksi

$\psi=0.74138$

k=0.5345

$\lambda=0.95327$

$\rho=0.80692$

b=0.41613 in (ineffective width=0.099569 in)

Element 4: Check for lip stiffener reduction

S=31.207

Ia=0.00020411 in⁴

Is=0.00035659 in⁴ > Ia (no lip reduction)

k=3.4958

Element 4: Partially stiffened, w=1.7814 in

f=49.629 ksi, k=3.4958

$\lambda=1.3175$

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Eq. 1.1-3

$\rho=0.63227$ Eq. 1.1-2
 $b=1.1263$ in (ineffective width= 0.65508 in) Eq. 1.1-1
 $b_1=0.56316$ in, $b_2=0.56316$ in
 Center of gravity shift: $y=-0.29099$ in
 $S_{xe}=0.22765$ in³, $F_y=50$ ksi
 $M_{nl}=11.382$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=47.402$ ksi, $f_2=35.142$ ksi

$\psi=0.74138$ Eq. 1.2.2-1

$k=0.5345$ Eq. 1.2.2-2

$\lambda=0.95327$ Eq. 1.1-3

$\rho=0.80692$ Eq. 1.1-2

$b=0.41613$ in (ineffective width= 0.099569 in) Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.207$ Eq. 1.3-7

$I_a=0.00020411$ in⁴ Eq. 1.3-8

$I_s=0.00035659$ in⁴ > I_a (no lip reduction)

$k=3.4958$ Table 1.3-1

Element 2: Partially stiffened, $w=1.7814$ in

$f=49.629$ ksi, $k=3.4958$

$\lambda=1.3175$ Eq. 1.1-3

$\rho=0.63227$ Eq. 1.1-2

$b=1.1263$ in (ineffective width= 0.65508 in) Eq. 1.1-1

$b_1=0.56316$ in, $b_2=0.56316$ in

Element 3: Treat as two unstiffened elements

$f_1=47.402$ ksi, $f_2=24.742$ ksi

$\psi=0.52197$ Eq. 1.2.2-1

$k=0.67056$ Eq. 1.2.2-2

$\lambda=1.5731$ Eq. 1.1-3

$\rho=0.54678$ Eq. 1.1-2

$b=0.52119$ in (ineffective width= 0.43201 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.29099$ in

$S_{xe}=0.22765$ in³, $F_y=50$ ksi

$M_{nl}=11.382$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$ Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.331$ ksi, $f_2=49.331$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-3

$\lambda=1.0842$ Eq. 1.1-3

$\rho=0.73517$ Eq. 1.1-2

$b=0.37913$ in (ineffective width= 0.13657 in) Eq. 1.1-1

Element 2: Stiffened, $w=1.7814$ in

$f_1=45.312$ ksi, $f_2=-31.091$ ksi
 $\psi=0.68615$ Eq. 1.1.2-1
 $k=16.96$ Eq. 1.1.2-2
 $\lambda=0.57155$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=1.7814$ in Eq. 1.1-1
 $h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$
 $b_1=0.48327$ in Eq. 1.1.2-3
 $b_2=0.8907$ in Eq. 1.1.2-4
 Compression width= 1.0565 in
 $b_1+b_2 >$ compression width (fully effective)
 Element 3: No compressive stress (fully effective)
 Element 5: Unstiffened, $w=0.5157$ in
 $f_1=49.331$ ksi, $f_2=49.331$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-2
 $\lambda=1.0842$ Eq. 1.1-3
 $\rho=0.73517$ Eq. 1.1-2
 $b=0.37913$ in (ineffective width= 0.13657 in) Eq. 1.1-1
 Element 4: Stiffened, $w=1.7814$ in
 $f_1=45.312$ ksi, $f_2=-31.091$ ksi
 $\psi=0.68615$ Eq. 1.1.2-1
 $k=16.96$ Eq. 1.1.2-2
 $\lambda=0.57155$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=1.7814$ in Eq. 1.1-1
 $h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$
 $b_1=0.48327$ in Eq. 1.1.2-3
 $b_2=0.8907$ in Eq. 1.1.2-4
 Compression width= 1.0565 in
 $b_1+b_2 >$ compression width (fully effective)
 Center of gravity shift: $x=-0.044316$ in
 $S_y=0.10357$ in³, $F_y=50$ ksi
 $M_{nl}=5.1785$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7814$ in

$f_1=44.694$ ksi, $f_2=-41.781$ ksi

$\psi=0.93483$

$k=22.356$

$\lambda=0.49441$

$\rho=1$

$b_e=1.7814$ in

$h_o=2$ in, $b_o=3.625$ in, $h_o/b_o=0.55172$

$b_1=0.45273$ in

$b_2=0.8907$ in

Compression width= 0.9207 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

$f_1=49.243$ ksi, $f_2=49.243$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.0022$

Eq. 1.1-3

$\rho=0.44456$

Eq. 1.1-2

$b=0.42376$ in (ineffective width= 0.52944 in)

Eq. 1.1-1

$f_1=49.243$ ksi, $f_2=49.243$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.0022$

Eq. 1.1-3

$\rho=0.44456$

Eq. 1.1-2

$b=0.42376$ in (ineffective width= 0.52944 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.7814$ in

$f_1=44.694$ ksi, $f_2=-41.781$ ksi

$\psi=0.93483$

Eq. 1.1.2-1

$k=22.356$

Eq. 1.1.2-2

$\lambda=0.49441$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.7814$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=3.625$ in, $h_o/b_o=0.55172$

$b_1=0.45273$ in

Eq. 1.1.2-3

$b_2=0.8907$ in

Eq. 1.1.2-4

Compression width= 0.9207 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.15152$ in

$S_y=0.099672$ in³, $F_y=50$ ksi

$M_{n1}=4.9836$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=0.49789$ in⁶, $W_n=3.4853$ in², $F_y=50$ ksi

$B_n=7.1426$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

362S200-33

Full Section Properties

Area	0.29672 in ²	Wt.	0.0010088 k/ft	Flat	8.5757 in
I _x	0.6484 in ⁴	r _x	1.4783 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.35774 in ³	y(t)	1.8125 in	α	0.000 deg
S _x (b)	0.35774 in ³	y(b)	1.8125 in		
Z _x	0.40832 in ³	Height	3.6250 in		
I _y	0.1769 in ⁴	r _y	0.7721 in	x _o	-1.7408 in
S _y (l)	0.24302 in ³	x(l)	0.7278 in	y _o	0.0000 in
S _y (r)	0.13904 in ³	x(r)	1.2722 in	j _x	2.3369 in
Z _y	0.20029 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	0.6484 in ⁴	r ₁	1.4783 in	C _w	0.55806 in ⁶
I ₂	0.1769 in ⁴	r ₂	0.7721 in	J	0.00011841 in ⁴
I _c	0.8253 in ⁴	r _c	1.6677 in		
I _o	1.7244 in ⁴	r _o	2.4107 in		

Net Section Properties

I _x	0.6387 in ⁴	r _x	1.6152 in	Area	0.24482 in ²
S _x (t)	0.35237 in ³	y(t)	1.8125 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.35237 in ³	y(b)	1.8125 in	α	0.000 deg
Z _x	0.38885 in ³				
I _y	0.1451 in ⁴	r _y	0.7699 in	x _o	-1.9071 in
S _y (l)	0.16519 in ³	x(l)	0.8785 in	y _o	0.0000 in
S _y (r)	0.12939 in ³	x(r)	1.1215 in	j _x	2.1614 in
Z _y	0.17038 in ³			j _y	0.0000 in
I _c	0.7838 in ⁴	r _c	1.7893 in	C _w	0.54758 in ⁶
I _o	1.6742 in ⁴	r _o	2.6151 in	J	0.00009770 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	6.995 k	φM _n x _o	12.068 k-in	φM _n y _o	5.295 k-in
A _e	0.16460 in ²	I _x e	0.54959 in ⁴	I _y e	0.13595 in ⁴
φT _n	11.935 k	S _x e(t)	0.26818 in ³	S _y e(l)	0.16097 in ³
		S _x e(b)	0.34880 in ³	S _y e(r)	0.11767 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.521 k	φM _n x _o	12.068 k-in	φM _n y _o	5.141 k-in
φV _{nx}	3.083 k	I _x e	0.54959 in ⁴	I _y e	0.11609 in ⁴
Torsion		S _x e(t)	0.34880 in ³	S _y e(l)	0.11424 in ³
φB _n	7.0948 k-in ²	S _x e(b)	0.26818 in ³	S _y e(r)	0.11799 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.392$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.88$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.29672 \text{ in}^2$, $F_y=51.392 \text{ ksi}$
 $T_n=15.249 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.24482 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=15.913 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1.7129 \text{ k}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3

$V_{yh}=1.2145 \text{ k}$
 $k_v=3.5949$
 $V_{crh}=0.48895 \text{ k}$
 $V_n=0.57925 \text{ k}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2
Eq. G3-8
Eq. G3-6
Eq. G2.1-2

Stud element 4

$V_n=1.7129 \text{ k}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=0.98104$
 $\rho=0.79074$
 $b=0.40644 \text{ in}$ (ineffective width= 0.10756 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$
 $I_a=0.00027958 \text{ in}^4$
 $I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)
 $k=3.4924$

Eq. 1.3-7
Eq. 1.3-8
Table 1.3-1

Element 2: Partially stiffened, $w=1.778 \text{ in}$
 $f=50 \text{ ksi}$, $k=3.4924$
 $\lambda=1.1908$
 $\rho=0.68464$
 $b=1.2173 \text{ in}$ (ineffective width= 0.56072 in)
 $b_1=0.60864 \text{ in}$, $b_2=0.60864 \text{ in}$

Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=1.8161$
 $\rho=0.48393$
 $b=0.46046 \text{ in}$ (ineffective width= 0.49104 in)
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.8161$	Eq. 1.1-3
$\rho=0.48393$	Eq. 1.1-2
$b=0.46046$ in (ineffective width=0.49104 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00027958$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.4924$	Table 1.3-1
Element 4: Partially stiffened, $w=1.778$ in	
$f=50$ ksi, $k=3.4924$	
$\lambda=1.1908$	Eq. 1.1-3
$\rho=0.68464$	Eq. 1.1-2
$b=1.2173$ in (ineffective width=0.56072 in)	Eq. 1.1-1
$b_1=0.60864$ in, $b_2=0.60864$ in	
$A_e=0.1646$ in ² , $F_n=50$ ksi	
$P_n=8.2298$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.292$ ksi, $f_2=24.075$ ksi	
$\psi=0.50908$	Eq. 1.2.2-1
$k=0.68074$	Eq. 1.2.2-2
$\lambda=1.4037$	Eq. 1.1-3
$\rho=0.60074$	Eq. 1.1-2
$b=0.5716$ in (ineffective width=0.3799 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=47.292$ ksi, $f_2=34.75$ ksi	
$\psi=0.73481$	Eq. 1.2.2-1
$k=0.53777$	Eq. 1.2.2-2
$\lambda=0.85316$	Eq. 1.1-3
$\rho=0.86987$	Eq. 1.1-2
$b=0.44711$ in (ineffective width=0.066889 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.223$	Eq. 1.3-7
$I_a=0.00027842$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.4924$	Table 1.3-1

Element 4: Partially stiffened, $w=1.778$ in

$f=49.578$ ksi, $k=3.4924$

$\lambda=1.1857$

Eq. 1.1-3

$\rho=0.68688$

Eq. 1.1-2

$b=1.2213$ in (ineffective width= 0.55672 in)

Eq. 1.1-1

$b_1=0.61064$ in, $b_2=0.61064$ in

Center of gravity shift: $y=-0.23685$ in

$S_{xe}=0.26818$ in³, $F_y=50$ ksi

$M_{nl}=13.409$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=47.292$ ksi, $f_2=34.75$ ksi

$\psi=0.73481$

Eq. 1.2.2-1

$k=0.53777$

Eq. 1.2.2-2

$\lambda=0.85316$

Eq. 1.1-3

$\rho=0.86987$

Eq. 1.1-2

$b=0.44711$ in (ineffective width= 0.066889 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.223$

Eq. 1.3-7

$I_a=0.00027842$ in⁴

Eq. 1.3-8

$I_s=0.00039155$ in⁴ > I_a (no lip reduction)

$k=3.4924$

Table 1.3-1

Element 2: Partially stiffened, $w=1.778$ in

$f=49.578$ ksi, $k=3.4924$

$\lambda=1.1857$

Eq. 1.1-3

$\rho=0.68688$

Eq. 1.1-2

$b=1.2213$ in (ineffective width= 0.55672 in)

Eq. 1.1-1

$b_1=0.61064$ in, $b_2=0.61064$ in

Element 3: Treat as two unstiffened elements

$f_1=47.292$ ksi, $f_2=24.075$ ksi

$\psi=0.50908$

Eq. 1.2.2-1

$k=0.68074$

Eq. 1.2.2-2

$\lambda=1.4037$

Eq. 1.1-3

$\rho=0.60074$

Eq. 1.1-2

$b=0.5716$ in (ineffective width= 0.3799 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.23685$ in

$S_{xe}=0.26818$ in³, $F_y=50$ ksi

$M_{nl}=13.409$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.251$ ksi, $f_2=49.251$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=0.97367$	Eq. 1.1-3
$\rho=0.79498$	Eq. 1.1-2
$b=0.40862$ in (ineffective width=0.10538 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.778$ in	
$f_1=45.196$ ksi, $f_2=-31.747$ ksi	
$\psi=0.70241$	Eq. 1.1.2-1
$k=17.273$	Eq. 1.1.2-2
$\lambda=0.50907$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.778$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.48023$ in	Eq. 1.1.2-3
$b_2=0.889$ in	Eq. 1.1.2-4
Compression width=1.0444 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.514$ in	
$f_1=49.251$ ksi, $f_2=49.251$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=0.97367$	Eq. 1.1-3
$\rho=0.79498$	Eq. 1.1-2
$b=0.40862$ in (ineffective width=0.10538 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.778$ in	
$f_1=45.196$ ksi, $f_2=-31.747$ ksi	
$\psi=0.70241$	Eq. 1.1.2-1
$k=17.273$	Eq. 1.1.2-2
$\lambda=0.50907$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.778$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.48023$ in	Eq. 1.1.2-3
$b_2=0.889$ in	Eq. 1.1.2-4
Compression width=1.0444 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.0339$ in	
$S_y=0.11767$ in ³ , $F_y=50$ ksi	
$M_n=5.8833$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.778$ in

$f_1=44.538$ ksi, $f_2=-42.956$ ksi

$\psi=0.96448$

$k=23.091$

$\lambda=0.43706$

$\rho=1$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

be=1.778 in	Eq. 1.1-1
h _o =2 in, b _o =3.625 in, h _o /b _o =0.55172	
b ₁ =0.44848 in	Eq. 1.1.2-3
b ₂ =0.889 in	Eq. 1.1.2-4
Compression width=0.90508 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.149 ksi, f ₂ =49.149 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=1.8005	Eq. 1.1-3
ρ=0.48753	Eq. 1.1-2
b=0.46388 in (ineffective width=0.48762 in)	Eq. 1.1-1
f ₁ =49.149 ksi, f ₂ =49.149 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=1.8005	Eq. 1.1-3
ρ=0.48753	Eq. 1.1-2
b=0.46388 in (ineffective width=0.48762 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=1.778 in	
f ₁ =44.538 ksi, f ₂ =-42.956 ksi	
ψ=0.96448	Eq. 1.1.2-1
k=23.091	Eq. 1.1.2-2
λ=0.43706	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=1.778 in	Eq. 1.1-1
h _o =2 in, b _o =3.625 in, h _o /b _o =0.55172	
b ₁ =0.44848 in	Eq. 1.1.2-3
b ₂ =0.889 in	Eq. 1.1.2-4
Compression width=0.90508 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.13767 in	
S _{ye} =0.11424 in ³ , F _y =50 ksi	
M _{nl} =5.7122 k-in	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =0.54758 in ⁶ , W _n =3.4731 in ² , F _y =50 ksi	
B _n =7.8831 k-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

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Full Section Properties

Area	0.38487 in ²	Wt.	0.0013086 k/ft	Flat	8.5336 in
I _x	0.8359 in ⁴	r _x	1.4738 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.46121 in ³	y(t)	1.8125 in	α	0.000 deg
S _x (b)	0.46121 in ³	y(b)	1.8125 in		
Z _x	0.52795 in ³	Height	3.6250 in		
I _y	0.2268 in ⁴	r _y	0.7676 in	x _o	-1.7287 in
S _y (l)	0.31154 in ³	x(l)	0.7280 in	y _o	0.0000 in
S _y (r)	0.17829 in ³	x(r)	1.2720 in	j _x	2.3260 in
Z _y	0.25813 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	0.8359 in ⁴	r ₁	1.4738 in	C _w	0.70908 in ⁶
I ₂	0.2268 in ⁴	r ₂	0.7676 in	J	0.0002609 in ⁴
I _c	1.0627 in ⁴	r _c	1.6617 in		
I _o	2.2128 in ⁴	r _o	2.3978 in		

Net Section Properties

I _x	0.8233 in ⁴	r _x	1.6110 in	Area	0.31722 in ²
S _x (t)	0.45421 in ³	y(t)	1.8125 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.45421 in ³	y(b)	1.8125 in	α	0.000 deg
Z _x	0.50258 in ³				
I _y	0.1859 in ⁴	r _y	0.7656 in	x _o	-1.8949 in
S _y (l)	0.21168 in ³	x(l)	0.8784 in	y _o	0.0000 in
S _y (r)	0.16578 in ³	x(r)	1.1216 in	j _x	2.1498 in
Z _y	0.21949 in ³			j _y	0.0000 in
I _c	1.0092 in ⁴	r _c	1.7836 in	C _w	0.69560 in ⁶
I _o	2.1482 in ⁴	r _o	2.6023 in	J	0.0002151 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	10.324 k	φM _{nxo}	17.415 k-in	φM _{nyo}	7.301 k-in
A _e	0.24291 in ²	I _{xe}	0.75619 in ⁴	I _{ye}	0.18323 in ⁴
φT _n	15.464 k	S _{xe} (t)	0.38699 in ³	S _{ye} (l)	0.21045 in ³
		S _{xe} (b)	0.45254 in ³	S _{ye} (r)	0.16224 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.891 k	φM _{nxo}	17.415 k-in	φM _{nyo}	7.016 k-in
φV _{nx}	4.304 k	I _{xe}	0.75619 in ⁴	I _{ye}	0.15993 in ⁴
Torsion		S _{xe} (t)	0.45254 in ³	S _{ye} (l)	0.16417 in ³
φB _n	9.1112 k-in ²	S _{xe} (b)	0.38699 in ³	S _{ye} (r)	0.15590 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.704$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=53.526$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.38487 \text{ in}^2$, $F_y=51.704 \text{ ksi}$ $T_n=19.899 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.31722 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=20.619 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=2.3913 \text{ k}$ at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=1.5693 \text{ k}$	Eq. G3-2
$k_v=3.591$	Eq. G3-8
$V_{crh}=1.0813 \text{ k}$	Eq. G3-6
$V_n=0.99014 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=2.3913 \text{ k}$ at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123 \text{ in}$ (ineffective width=0.027474 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00062038 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00049474 \text{ in}^4$	
$d_s=0.38377 \text{ in}$ (lip ineffective width=0.097452 in)	Eq. 1.3-6
$k=3.2601$	Table 1.3-1
Element 2: Partially stiffened, $w=1.7674 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.2601$	
$\lambda=0.93989$	Eq. 1.1-3
$\rho=0.81492$	Eq. 1.1-2
$b=1.4403 \text{ in}$ (ineffective width=0.32712 in)	Eq. 1.1-1
$b_1=0.57431 \text{ in}$, $b_2=0.86598 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.3855$	Eq. 1.1-3
$\rho=0.60715$	Eq. 1.1-2
$b=0.57449 \text{ in}$ (ineffective width=0.37171 in)	Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.3855$	Eq. 1.1-3
$\rho=0.60715$	Eq. 1.1-2
$b=0.57449$ in (ineffective width=0.37171 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123$ in (ineffective width=0.027474 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00062038$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.38377$ in (lip ineffective width=0.097452 in)	Eq. 1.3-6
$k=3.2601$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7674$ in	
$f=50$ ksi, $k=3.2601$	
$\lambda=0.93989$	Eq. 1.1-3
$\rho=0.81492$	Eq. 1.1-2
$b=1.4403$ in (ineffective width=0.32712 in)	Eq. 1.1-1
$b_1=0.57431$ in, $b_2=0.86598$ in	
$A_e=0.24291$ in ² , $F_n=50$ ksi	
$P_n=12.146$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.024$ ksi, $f_2=22.812$ ksi	
$\psi=0.48511$	Eq. 1.2.2-1
$k=0.70052$	Eq. 1.2.2-2
$\lambda=1.0527$	Eq. 1.1-3
$\rho=0.75141$	Eq. 1.1-2
$b=0.71098$ in (ineffective width=0.23522 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=47.024$ ksi, $f_2=34.007$ ksi	
$\psi=0.72318$	Eq. 1.2.2-1
$k=0.54365$	Eq. 1.2.2-2
$\lambda=0.64244$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.272$	Eq. 1.3-7
$I_a=0.0006169$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	

ds=0.40797 in (lip ineffective width=0.10073 in)	Eq. 1.3-6
k=3.2654	Table 1.3-1
Element 4: Partially stiffened, w=1.7674 in	
f=49.423 ksi, k=3.2654	
$\lambda=0.93369$	Eq. 1.1-3
$\rho=0.81866$	Eq. 1.1-2
b=1.4469 in (ineffective width=0.3205 in)	Eq. 1.1-1
b ₁ =0.58019 in, b ₂ =0.86671 in	
Center of gravity shift: y=-0.14151 in	
S _{xe} =0.38699 in ³ , F _y =50 ksi	
M _{nl} =19.35 k-in	Eq. F3.1-1
$\Omega b=1.67$, $\phi b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.5087 in	
f ₁ =47.024 ksi, f ₂ =34.007 ksi	
$\psi=0.72318$	Eq. 1.2.2-1
k=0.54365	Eq. 1.2.2-2
$\lambda=0.64244$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.272	Eq. 1.3-7
I _a =0.0006169 in ⁴	Eq. 1.3-8
I _s =0.00049474 in ⁴	
ds=0.40797 in (lip ineffective width=0.10073 in)	Eq. 1.3-6
k=3.2654	Table 1.3-1
Element 2: Partially stiffened, w=1.7674 in	
f=49.423 ksi, k=3.2654	
$\lambda=0.93369$	Eq. 1.1-3
$\rho=0.81866$	Eq. 1.1-2
b=1.4469 in (ineffective width=0.3205 in)	Eq. 1.1-1
b ₁ =0.58019 in, b ₂ =0.86671 in	
Element 3: Treat as two unstiffened elements	
f ₁ =47.024 ksi, f ₂ =22.812 ksi	
$\psi=0.48511$	Eq. 1.2.2-1
k=0.70052	Eq. 1.2.2-2
$\lambda=1.0527$	Eq. 1.1-3
$\rho=0.75141$	Eq. 1.1-2
b=0.71098 in (ineffective width=0.23522 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.14151 in	
S _{xe} =0.38699 in ³ , F _y =50 ksi	
M _{nl} =19.35 k-in	Eq. F3.1-1
$\Omega b=1.67$, $\phi b=0.9$	

Positive Flexural Strength about Y-axis
Effective width calculations for Stud
Element 1: Unstiffened, w=0.5087 in

$f_1=49.002$ ksi, $f_2=49.002$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73741$

Eq. 1.1-3

$\rho=0.95152$

Eq. 1.1-2

$b=0.48404$ in (ineffective width= 0.024662 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.7674$ in

$f_1=44.851$ ksi, $f_2=-33.397$ ksi

$\psi=0.74463$

Eq. 1.1.2-1

$k=18.11$

Eq. 1.1.2-2

$\lambda=0.37769$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.7674$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.47198$ in

Eq. 1.1.2-3

$b_2=0.8837$ in

Eq. 1.1.2-4

Compression width= 1.0131 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=49.002$ ksi, $f_2=49.002$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73741$

Eq. 1.1-3

$\rho=0.95152$

Eq. 1.1-2

$b=0.48404$ in (ineffective width= 0.024662 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.7674$ in

$f_1=44.851$ ksi, $f_2=-33.397$ ksi

$\psi=0.74463$

Eq. 1.1.2-1

$k=18.11$

Eq. 1.1.2-2

$\lambda=0.37769$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.7674$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.47198$ in

Eq. 1.1.2-3

$b_2=0.8837$ in

Eq. 1.1.2-4

Compression width= 1.0131 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.0077614$ in

$S_y=0.16224$ in³, $F_y=50$ ksi

$M_{nl}=8.1121$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7674$ in

$f_1=41.791$ ksi, $f_2=-44.333$ ksi

$\psi=1.0608$

Eq. 1.1.2-1

$k=25.626$

Eq. 1.1.2-2

$\lambda=0.30648$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7674$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=3.625$ in, $h_o/b_o=0.55172$	
$b_1=0.43523$ in	Eq. 1.1.2-3
$b_2=0.8837$ in	Eq. 1.1.2-4
Compression width=0.85762 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.359$ ksi, $f_2=46.359$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.3341$	Eq. 1.1-3
$\rho=0.62596$	Eq. 1.1-2
$b=0.59228$ in (ineffective width=0.35392 in)	Eq. 1.1-1
$f_1=46.359$ ksi, $f_2=46.359$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.3341$	Eq. 1.1-3
$\rho=0.62596$	Eq. 1.1-2
$b=0.59228$ in (ineffective width=0.35392 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.7674$ in	
$f_1=41.791$ ksi, $f_2=-44.333$ ksi	
$\psi=1.0608$	Eq. 1.1.2-1
$k=25.626$	Eq. 1.1.2-2
$\lambda=0.30648$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7674$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=3.625$ in, $h_o/b_o=0.55172$	
$b_1=0.43523$ in	Eq. 1.1.2-3
$b_2=0.8837$ in	Eq. 1.1.2-4
Compression width=0.85762 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.095767$ in	
$S_y=0.1559$ in ³ , $F_y=50$ ksi	
$M_n=7.7952$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.6956$ in ⁶ , $W_n=3.4355$ in ² , $F_y=50$ ksi	
$B_n=10.124$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.47851 in ²	Wt.	0.0016269 k/ft	Flat	8.4543 in
I _x	1.0303 in ⁴	r _x	1.4674 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.56844 in ³	y(t)	1.8125 in	α	0.000 deg
S _x (b)	0.56844 in ³	y(b)	1.8125 in		
Z _x	0.65328 in ³	Height	3.6250 in		
I _y	0.2775 in ⁴	r _y	0.7615 in	x _o	-1.7139 in
S _y (l)	0.38165 in ³	x(l)	0.7270 in	y _o	0.0000 in
S _y (r)	0.21797 in ³	x(r)	1.2730 in	j _x	2.3146 in
Z _y	0.31803 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	1.0303 in ⁴	r ₁	1.4674 in	C _w	0.85827 in ⁶
I ₂	0.2775 in ⁴	r ₂	0.7615 in	J	0.0005110 in ⁴
I _c	1.3078 in ⁴	r _c	1.6532 in		
I _o	2.7133 in ⁴	r _o	2.3812 in		

Net Section Properties

I _x	1.0144 in ⁴	r _x	1.6053 in	Area	0.39361 in ²
S _x (t)	0.55965 in ³	y(t)	1.8125 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.55965 in ³	y(b)	1.8125 in	α	0.000 deg
Z _x	0.62145 in ³				
I _y	0.2271 in ⁴	r _y	0.7595 in	x _o	-1.8805 in
S _y (l)	0.25868 in ³	x(l)	0.8777 in	y _o	0.0000 in
S _y (r)	0.20232 in ³	x(r)	1.1223 in	j _x	2.1373 in
Z _y	0.27003 in ³			j _y	0.0000 in
I _c	1.2414 in ⁴	r _c	1.7759 in	C _w	0.84161 in ⁶
I _o	2.6334 in ⁴	r _o	2.5866 in	J	0.0004203 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	13.653 k	φM _{nxo}	22.592 k-in	φM _{nyo}	10.347 k-in
A _e	0.32124 in ²	I _{xe}	0.95919 in ⁴	I _{ye}	0.22706 in ⁴
φT _n	19.189 k	S _{xe} (t)	0.50203 in ³	S _{ye} (l)	0.25868 in ³
		S _{xe} (b)	0.55949 in ³	S _{ye} (r)	0.20232 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.339 k	φM _{nxo}	22.592 k-in	φM _{nyo}	8.826 k-in
φV _{nx}	5.248 k	I _{xe}	0.95919 in ⁴	I _{ye}	0.21027 in ⁴
Torsion		S _{xe} (t)	0.55949 in ³	S _{ye} (l)	0.22660 in ³
φB _n	11.166 k-in ²	S _{xe} (b)	0.50203 in ³	S _{ye} (r)	0.19613 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=52.136$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=54.356$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.47851$ in², $F_y=52.136$ ksi

$T_n=24.947$ k Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.39361$ in², $F_u=65$ ksi
 $T_n=25.585$ k Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=2.9155$ k at 180 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=1.8881$ k Eq. G3-2
 $k_v=3.5718$ Eq. G3-8
 $V_{crh}=2.1226$ k Eq. G3-6
 $V_n=1.4878$ k at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=2.9155$ k at 0 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56413$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0011127$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $d_s=0.23166$ in (lip ineffective width=0.25184 in) Eq. 1.3-6
 $k=2.7693$ Table 1.3-1

Element 2: Partially stiffened, $w=1.717$ in
 $f=50$ ksi, $k=2.7693$
 $\lambda=0.78941$ Eq. 1.1-3
 $\rho=0.91373$ Eq. 1.1-2
 $b=1.5689$ in (ineffective width=0.14812 in) Eq. 1.1-1
 $b_1=0.37585$ in, $b_2=1.193$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.0746$ Eq. 1.1-3
 $\rho=0.74007$ Eq. 1.1-2
 $b=0.6816$ in (ineffective width=0.2394 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0746$	Eq. 1.1-3
$\rho=0.74007$	Eq. 1.1-2
$b=0.6816$ in (ineffective width=0.2394 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0011127$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$ds=0.23166$ in (lip ineffective width=0.25184 in)	Eq. 1.3-6
$k=2.7693$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	
$f=50$ ksi, $k=2.7693$	
$\lambda=0.78941$	Eq. 1.1-3
$\rho=0.91373$	Eq. 1.1-2
$b=1.5689$ in (ineffective width=0.14812 in)	Eq. 1.1-1
$b_1=0.37585$ in, $b_2=1.193$ in	
$A_e=0.32124$ in ² , $F_n=50$ ksi	
$P_n=16.062$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.297$ ksi, $f_2=22.194$ ksi	
$\psi=0.47939$	Eq. 1.2.2-1
$k=0.70541$	Eq. 1.2.2-2
$\lambda=0.80733$	Eq. 1.1-3
$\rho=0.90112$	Eq. 1.1-2
$b=0.82993$ in (ineffective width=0.091072 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=46.297$ ksi, $f_2=33.644$ ksi	
$\psi=0.72669$	Eq. 1.2.2-1
$k=0.54186$	Eq. 1.2.2-2
$\lambda=0.48357$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.324$	Eq. 1.3-7
$I_a=0.0010757$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$ds=0.23962$ in (lip ineffective width=0.24388 in)	Eq. 1.3-6
$k=2.7932$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	

$f=49.259$ ksi, $k=2.7932$
 $\lambda=0.78019$ Eq. 1.1-3
 $\rho=0.92031$ Eq. 1.1-2
 $b=1.5802$ in (ineffective width= 0.13683 in) Eq. 1.1-1
 $b_1=0.39157$ in, $b_2=1.1886$ in
 Center of gravity shift: $y=-0.098098$ in
 $S_{xe}=0.50203$ in³, $F_y=50$ ksi
 $M_{nl}=25.102$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=46.297$ ksi, $f_2=33.644$ ksi
 $\psi=0.72669$ Eq. 1.2.2-1
 $k=0.54186$ Eq. 1.2.2-2
 $\lambda=0.48357$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.324$ Eq. 1.3-7
 $I_a=0.0010757$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $ds=0.23962$ in (lip ineffective width= 0.24388 in) Eq. 1.3-6
 $k=2.7932$ Table 1.3-1

Element 2: Partially stiffened, $w=1.717$ in

$f=49.259$ ksi, $k=2.7932$
 $\lambda=0.78019$ Eq. 1.1-3
 $\rho=0.92031$ Eq. 1.1-2
 $b=1.5802$ in (ineffective width= 0.13683 in) Eq. 1.1-1
 $b_1=0.39157$ in, $b_2=1.1886$ in

Element 3: Treat as two unstiffened elements

$f_1=46.297$ ksi, $f_2=22.194$ ksi
 $\psi=0.47939$ Eq. 1.2.2-1
 $k=0.70541$ Eq. 1.2.2-2
 $\lambda=0.80733$ Eq. 1.1-3
 $\rho=0.90112$ Eq. 1.1-2
 $b=0.82993$ in (ineffective width= 0.091072 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.098098$ in

$S_{xe}=0.50203$ in³, $F_y=50$ ksi
 $M_{nl}=25.102$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=55.392$ ksi, $f_2=55.392$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3

$\lambda=0.59377$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.717$ in	
$f_1=49.661$ ksi, $f_2=-37.279$ ksi	
$\psi=0.75068$	Eq. 1.1.2-1
$k=18.233$	Eq. 1.1.2-2
$\lambda=0.30661$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.45778$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.98076 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=55.392$ ksi, $f_2=55.392$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.59377$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.717$ in	
$f_1=49.661$ ksi, $f_2=-37.279$ ksi	
$\psi=0.75068$	Eq. 1.1.2-1
$k=18.233$	Eq. 1.1.2-2
$\lambda=0.30661$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.45778$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.98076 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_{ye}=0.20232$ in ³ , $F_y=56.825$ ksi	
$M_n I=11.497$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about Y-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: Stiffened, $w=1.717$ in	
$f_1=36.605$ ksi, $f_2=-43.406$ ksi	
$\psi=1.1858$	Eq. 1.1.2-1
$k=29.258$	Eq. 1.1.2-2
$\lambda=0.20781$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=3.625$ in, $h_o/b_o=0.55172$	
$b_1=0.4102$ in	Eq. 1.1.2-3

$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.78553 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=41.88$ ksi, $f_2=41.88$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98348$	Eq. 1.1-3
$\rho=0.78935$	Eq. 1.1-2
$b=0.72699$ in (ineffective width=0.19401 in)	Eq. 1.1-1
$f_1=41.88$ ksi, $f_2=41.88$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98348$	Eq. 1.1-3
$\rho=0.78935$	Eq. 1.1-2
$b=0.72699$ in (ineffective width=0.19401 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.717$ in	
$f_1=36.605$ ksi, $f_2=-43.406$ ksi	
$\psi=1.1858$	Eq. 1.1.2-1
$k=29.258$	Eq. 1.1.2-2
$\lambda=0.20781$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=3.625$ in, $h_o/b_o=0.55172$	
$b_1=0.4102$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.78553 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.050197$ in	
$S_y=0.19613$ in ³ , $F_y=50$ ksi	
$M_n=9.8067$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.84161$ in ⁶ , $W_n=3.3916$ in ² , $F_y=50$ ksi	
$B_n=12.407$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.29919 in ²	Wt.	0.0010172 k/ft	Flat	9.5893 in
Ix	0.6875 in ⁴	rx	1.5159 in	Ixy	0.0000 in ⁴
Sx(t)	0.37932 in ³	y(t)	1.8125 in	α	0.000 deg
Sx(b)	0.37932 in ³	y(b)	1.8125 in		
Zx	0.42522 in ³	Height	3.6250 in		
Iy	0.2713 in ⁴	ry	0.9522 in	x _o	-2.2147 in
Sy(l)	0.28728 in ³	x(l)	0.9443 in	y _o	0.0000 in
Sy(r)	0.17437 in ³	x(r)	1.5557 in	jx	2.7402 in
Zy	0.25217 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	0.6875 in ⁴	r ₁	1.5159 in	Cw	0.84992 in ⁶
I ₂	0.2713 in ⁴	r ₂	0.9522 in	J	0.0000971 in ⁴
Ic	0.9588 in ⁴	rc	1.7901 in		
I _o	2.4262 in ⁴	r _o	2.8477 in		

Net Section Properties

Ix	0.6787 in ⁴	rx	1.6399 in	Area	0.25239 in ²
Sx(t)	0.37447 in ³	y(t)	1.8125 in	Ixy	0.0000 in ⁴
Sx(b)	0.37447 in ³	y(b)	1.8125 in	α	0.000 deg
Zx	0.40767 in ³				
Iy	0.2234 in ⁴	ry	0.9409 in	x _o	-2.4035 in
Sy(l)	0.20012 in ³	x(l)	1.1165 in	y _o	0.0000 in
Sy(r)	0.16149 in ³	x(r)	1.3835 in	jx	2.6210 in
Zy	0.21341 in ³			jy	0.0000 in
Ic	0.9022 in ⁴	rc	1.8906 in	Cw	0.83523 in ⁶
I _o	2.3601 in ⁴	r _o	3.0580 in	J	0.00008189 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	6.146 k	φMnxo	10.822 k-in	φMnyo	6.503 k-in
Ae	0.14461 in ²	Ixe	0.52621 in ⁴	Iye	0.20688 in ⁴
φTn	12.304 k	Sxe(t)	0.24049 in ³	Sye(l)	0.19361 in ³
		Sxe(b)	0.36621 in ³	Sye(r)	0.14452 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.425 k	φMnxo	10.822 k-in	φMnyo	6.221 k-in
φVnx	2.734 k	Ixe	0.52621 in ⁴	Iye	0.17730 in ⁴
Torsion		Sxe(t)	0.36621 in ³	Sye(l)	0.13824 in ³
φBn	8.5688 k-in ²	Sxe(b)	0.24049 in ³	Sye(r)	0.14562 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.147$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.136$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.29919 \text{ in}^2$, $F_y=51.147 \text{ ksi}$ $T_n=15.303 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.25239 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=16.405 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1.519 \text{ k}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=1.0982 \text{ k}$	Eq. G3-2
$k_v=3.6799$	Eq. G3-8
$V_{crh}=0.36701 \text{ k}$	Eq. G3-6
$V_n=0.47257 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1.519 \text{ k}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5157 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723 \text{ in}$ (ineffective width= 0.13847 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00026103 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00035659 \text{ in}^4 > I_a$ (no lip reduction)	
$k=3.8802$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2814 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.8802$	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
$b=1.225 \text{ in}$ (ineffective width= 1.0564 in)	Eq. 1.1-1
$b_1=0.61249 \text{ in}$, $b_2=0.61249 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0176$	Eq. 1.1-3
$\rho=0.4416$	Eq. 1.1-2
$b=0.42093 \text{ in}$ (ineffective width= 0.53227 in)	Eq. 1.1-1
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1

k=0.43	Eq. 1.2.2-3
$\lambda=2.0176$	Eq. 1.1-3
$\rho=0.4416$	Eq. 1.1-2
b=0.42093 in (ineffective width=0.53227 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.5157 in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
b=0.37723 in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.091	Eq. 1.3-7
Ia=0.00026103 in ⁴	Eq. 1.3-8
Is=0.00035659 in ⁴ > Ia (no lip reduction)	
k=3.8802	Table 1.3-1
Element 4: Partially stiffened, w=2.2814 in	
f=50 ksi, k=3.8802	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
b=1.225 in (ineffective width=1.0564 in)	Eq. 1.1-1
b ₁ =0.61249 in, b ₂ =0.61249 in	
Ae=0.14461 in ² , Fn=50 ksi	
Pn=7.2306 k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.502$ ksi, $f_2=25.719$ ksi

$\psi=0.54143$

k=0.65576

$\lambda=1.5924$

$\rho=0.54121$

b=0.51588 in (ineffective width=0.43732 in)

Element 5: Unstiffened, w=0.5157 in

$f_1=47.502$ ksi, $f_2=35.717$ ksi

$\psi=0.7519$

k=0.52935

$\lambda=0.95891$

$\rho=0.80359$

b=0.41441 in (ineffective width=0.10129 in)

Element 4: Check for lip stiffener reduction

S=31.203

Ia=0.00026011 in⁴

Is=0.00035659 in⁴ > Ia (no lip reduction)

k=3.8802

Element 4: Partially stiffened, w=2.2814 in

f=49.643 ksi, k=3.8802

$\lambda=1.6018$

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Eq. 1.1-3

$\rho=0.53856$ Eq. 1.1-2
 $b=1.2287$ in (ineffective width=1.0527 in) Eq. 1.1-1
 $b_1=0.61434$ in, $b_2=0.61434$ in
 Center of gravity shift: $y=-0.3756$ in
 $S_{xe}=0.24049$ in³, $F_y=50$ ksi
 $M_{nl}=12.024$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=47.502$ ksi, $f_2=35.717$ ksi

$\psi=0.7519$ Eq. 1.2.2-1

$k=0.52935$ Eq. 1.2.2-2

$\lambda=0.95891$ Eq. 1.1-3

$\rho=0.80359$ Eq. 1.1-2

$b=0.41441$ in (ineffective width=0.10129 in) Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.203$ Eq. 1.3-7

$I_a=0.00026011$ in⁴ Eq. 1.3-8

$I_s=0.00035659$ in⁴ > I_a (no lip reduction)

$k=3.8802$ Table 1.3-1

Element 2: Partially stiffened, $w=2.2814$ in

$f=49.643$ ksi, $k=3.8802$

$\lambda=1.6018$ Eq. 1.1-3

$\rho=0.53856$ Eq. 1.1-2

$b=1.2287$ in (ineffective width=1.0527 in) Eq. 1.1-1

$b_1=0.61434$ in, $b_2=0.61434$ in

Element 3: Treat as two unstiffened elements

$f_1=47.502$ ksi, $f_2=25.719$ ksi

$\psi=0.54143$ Eq. 1.2.2-1

$k=0.65576$ Eq. 1.2.2-2

$\lambda=1.5924$ Eq. 1.1-3

$\rho=0.54121$ Eq. 1.1-2

$b=0.51588$ in (ineffective width=0.43732 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.3756$ in

$S_{xe}=0.24049$ in³, $F_y=50$ ksi

$M_{nl}=12.024$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$ Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.455$ ksi, $f_2=49.455$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-3

$\lambda=1.0856$ Eq. 1.1-3

$\rho=0.73448$ Eq. 1.1-2

$b=0.37877$ in (ineffective width=0.13693 in) Eq. 1.1-1

Element 2: Stiffened, $w=2.2814$ in

$f_1=46.182$ ksi, $f_2=-33.507$ ksi
 $\psi=0.72554$ Eq. 1.1.2-1
 $k=17.727$ Eq. 1.1.2-2
 $\lambda=0.7228$ Eq. 1.1-3
 $\rho=0.9624$ Eq. 1.1-2
 $b_e=2.1956$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$
 $b_1=0.58934$ in Eq. 1.1.2-3
 $b_2=1.0978$ in Eq. 1.1.2-4
 Compression width=1.3221 in
 $b_1+b_2 >$ compression width (fully effective)
 Element 3: No compressive stress (fully effective)
 Element 5: Unstiffened, $w=0.5157$ in
 $f_1=49.455$ ksi, $f_2=49.455$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-2
 $\lambda=1.0856$ Eq. 1.1-3
 $\rho=0.73448$ Eq. 1.1-2
 $b=0.37877$ in (ineffective width=0.13693 in) Eq. 1.1-1
 Element 4: Stiffened, $w=2.2814$ in
 $f_1=46.182$ ksi, $f_2=-33.507$ ksi
 $\psi=0.72554$ Eq. 1.1.2-1
 $k=17.727$ Eq. 1.1.2-2
 $\lambda=0.7228$ Eq. 1.1-3
 $\rho=0.9624$ Eq. 1.1-2
 $b_e=2.1956$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$
 $b_1=0.58934$ in Eq. 1.1.2-3
 $b_2=1.0978$ in Eq. 1.1.2-4
 Compression width=1.3221 in
 $b_1+b_2 >$ compression width (fully effective)
 Center of gravity shift: $x=-0.047932$ in
 $S_{ye}=0.14452$ in³, $F_y=50$ ksi
 $M_{nl}=7.2261$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2814$ in

$f_1=45.739$ ksi, $f_2=-43.206$ ksi

$\psi=0.94463$

$k=22.597$

$\lambda=0.63711$

$\rho=1$

$b_e=2.2814$ in

$h_o=2.5$ in, $b_o=3.625$ in, $h_o/b_o=0.68966$

$b_1=0.57836$ in

$b_2=1.1407$ in

Compression width=1.1732 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

$f_1=49.392$ ksi, $f_2=49.392$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.0053$

Eq. 1.1-3

$\rho=0.44397$

Eq. 1.1-2

$b=0.4232$ in (ineffective width=0.53 in)

Eq. 1.1-1

$f_1=49.392$ ksi, $f_2=49.392$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=2.0053$

Eq. 1.1-3

$\rho=0.44397$

Eq. 1.1-2

$b=0.4232$ in (ineffective width=0.53 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.2814$ in

$f_1=45.739$ ksi, $f_2=-43.206$ ksi

$\psi=0.94463$

Eq. 1.1.2-1

$k=22.597$

Eq. 1.1.2-2

$\lambda=0.63711$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2814$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=3.625$ in, $h_o/b_o=0.68966$

$b_1=0.57836$ in

Eq. 1.1.2-3

$b_2=1.1407$ in

Eq. 1.1.2-4

Compression width=1.1732 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.16601$ in

$S_y=0.13824$ in³, $F_y=50$ ksi

$M_n=6.9122$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=0.83523$ in⁶, $W_n=4.3863$ in², $F_y=50$ ksi

$B_n=9.5209$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

362S250-33

Full Section Properties

Area	0.33132 in ²	Wt.	0.0011265 k/ft	Flat	9.5757 in
Ix	0.7599 in ⁴	rx	1.5145 in	Ixy	0.0000 in ⁴
Sx(t)	0.41926 in ³	y(t)	1.8125 in	α	0.000 deg
Sx(b)	0.41926 in ³	y(b)	1.8125 in		
Zx	0.47043 in ³	Height	3.6250 in		
Iy	0.2995 in ⁴	ry	0.9508 in	x _o	-2.2107 in
Sy(l)	0.31718 in ³	x(l)	0.9443 in	y _o	0.0000 in
Sy(r)	0.19251 in ³	x(r)	1.5557 in	jx	2.7364 in
Zy	0.27880 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	0.7599 in ⁴	r ₁	1.5145 in	Cw	0.93563 in ⁶
I ₂	0.2995 in ⁴	r ₂	0.9508 in	J	0.0001322 in ⁴
Ic	1.0594 in ⁴	rc	1.7882 in		
I _o	2.6786 in ⁴	r _o	2.8433 in		

Net Section Properties

Ix	0.7502 in ⁴	rx	1.6385 in	Area	0.27942 in ²
Sx(t)	0.41390 in ³	y(t)	1.8125 in	Ixy	0.0000 in ⁴
Sx(b)	0.41390 in ³	y(b)	1.8125 in	α	0.000 deg
Zx	0.45097 in ³				
Iy	0.2466 in ⁴	ry	0.9395 in	x _o	-2.3995 in
Sy(l)	0.22089 in ³	x(l)	1.1164 in	y _o	0.0000 in
Sy(r)	0.17825 in ³	x(r)	1.3836 in	jx	2.6171 in
Zy	0.23591 in ³			jy	0.0000 in
Ic	0.9968 in ⁴	rc	1.8888 in	Cw	0.91939 in ⁶
I _o	2.6056 in ⁴	r _o	3.0537 in	J	0.00011150 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	7.340 k	φMnxo	12.798 k-in	φMnyo	7.369 k-in
Ae	0.17270 in ²	Ixe	0.60630 in ⁴	Iye	0.23258 in ⁴
φTn	13.622 k	Sxe(t)	0.28441 in ³	Sye(l)	0.21542 in ³
		Sxe(b)	0.40605 in ³	Sye(r)	0.16375 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.528 k	φMnxo	12.798 k-in	φMnyo	7.106 k-in
φVnx	3.317 k	Ixe	0.60630 in ⁴	Iye	0.20017 in ⁴
Torsion		Sxe(t)	0.40605 in ³	Sye(l)	0.15791 in ³
φBn	9.4622 k-in ²	Sxe(b)	0.28441 in ³	Sye(r)	0.16243 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.246$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.32$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.33132 \text{ in}^2$, $F_y=51.246 \text{ ksi}$
 $T_n=16.979 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.27942 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=18.162 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1.843 \text{ k at } 180 \text{ deg}$

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=1.2145 \text{ k}$

Eq. G3-2

$k_v=3.6787$

Eq. G3-8

$V_{crh}=0.50034 \text{ k}$

Eq. G3-6

$V_n=0.58656 \text{ k at } 90 \text{ deg}$

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1.843 \text{ k at } 0 \text{ deg}$

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.98104$

Eq. 1.1-3

$\rho=0.79074$

Eq. 1.1-2

$b=0.40644 \text{ in}$ (ineffective width= 0.10756 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00035618 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)

$k=3.8782$

Table 1.3-1

Element 2: Partially stiffened, $w=2.278 \text{ in}$

$f=50 \text{ ksi}$, $k=3.8782$

$\lambda=1.4478$

Eq. 1.1-3

$\rho=0.58576$

Eq. 1.1-2

$b=1.3344 \text{ in}$ (ineffective width= 0.94364 in)

Eq. 1.1-1

$b_1=0.66718 \text{ in}$, $b_2=0.66718 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.8161$

Eq. 1.1-3

$\rho=0.48393$

Eq. 1.1-2

$b=0.46046 \text{ in}$ (ineffective width= 0.49104 in)

Eq. 1.1-1

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.8161$	Eq. 1.1-3
$\rho=0.48393$	Eq. 1.1-2
$b=0.46046$ in (ineffective width=0.49104 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00035618$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1
Element 4: Partially stiffened, $w=2.278$ in	
$f=50$ ksi, $k=3.8782$	
$\lambda=1.4478$	Eq. 1.1-3
$\rho=0.58576$	Eq. 1.1-2
$b=1.3344$ in (ineffective width=0.94364 in)	Eq. 1.1-1
$b_1=0.66718$ in, $b_2=0.66718$ in	
$A_e=0.1727$ in ² , $F_n=50$ ksi	
$P_n=8.6349$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.396$ ksi, $f_2=25.078$ ksi	
$\psi=0.52911$	Eq. 1.2.2-1
$k=0.66505$	Eq. 1.2.2-2
$\lambda=1.4218$	Eq. 1.1-3
$\rho=0.59451$	Eq. 1.1-2
$b=0.56568$ in (ineffective width=0.38582 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=47.396$ ksi, $f_2=35.34$ ksi	
$\psi=0.74563$	Eq. 1.2.2-1
$k=0.53241$	Eq. 1.2.2-2
$\lambda=0.85839$	Eq. 1.1-3
$\rho=0.86639$	Eq. 1.1-2
$b=0.44533$ in (ineffective width=0.068673 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.218$	Eq. 1.3-7
$I_a=0.00035476$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1

Element 4: Partially stiffened, $w=2.278$ in

$f=49.594$ ksi, $k=3.8782$

$\lambda=1.4419$

Eq. 1.1-3

$\rho=0.58772$

Eq. 1.1-2

$b=1.3388$ in (ineffective width= 0.93917 in)

Eq. 1.1-1

$b_1=0.66941$ in, $b_2=0.66941$ in

Center of gravity shift: $y=-0.31932$ in

$S_{xe}=0.28441$ in³, $F_y=50$ ksi

$M_{nl}=14.22$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=47.396$ ksi, $f_2=35.34$ ksi

$\psi=0.74563$

Eq. 1.2.2-1

$k=0.53241$

Eq. 1.2.2-2

$\lambda=0.85839$

Eq. 1.1-3

$\rho=0.86639$

Eq. 1.1-2

$b=0.44533$ in (ineffective width= 0.068673 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.218$

Eq. 1.3-7

$I_a=0.00035476$ in⁴

Eq. 1.3-8

$I_s=0.00039155$ in⁴ $> I_a$ (no lip reduction)

$k=3.8782$

Table 1.3-1

Element 2: Partially stiffened, $w=2.278$ in

$f=49.594$ ksi, $k=3.8782$

$\lambda=1.4419$

Eq. 1.1-3

$\rho=0.58772$

Eq. 1.1-2

$b=1.3388$ in (ineffective width= 0.93918 in)

Eq. 1.1-1

$b_1=0.66941$ in, $b_2=0.66941$ in

Element 3: Treat as two unstiffened elements

$f_1=47.396$ ksi, $f_2=25.078$ ksi

$\psi=0.52911$

Eq. 1.2.2-1

$k=0.66505$

Eq. 1.2.2-2

$\lambda=1.4218$

Eq. 1.1-3

$\rho=0.59451$

Eq. 1.1-2

$b=0.56568$ in (ineffective width= 0.38582 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.31932$ in

$S_{xe}=0.28441$ in³, $F_y=50$ ksi

$M_{nl}=14.22$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.391$ ksi, $f_2=49.391$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=0.97505$	Eq. 1.1-3
$\rho=0.79419$	Eq. 1.1-2
$b=0.40821$ in (ineffective width=0.10579 in)	Eq. 1.1-1
Element 2: Stiffened, $w=2.278$ in	
$f_1=46.092$ ksi, $f_2=-34.102$ ksi	
$\psi=0.73986$	Eq. 1.1.2-1
$k=18.013$	Eq. 1.1.2-2
$\lambda=0.64498$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.278$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.60911$ in	Eq. 1.1.2-3
$b_2=1.139$ in	Eq. 1.1.2-4
Compression width=1.3093 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.514$ in	
$f_1=49.391$ ksi, $f_2=49.391$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=0.97505$	Eq. 1.1-3
$\rho=0.79419$	Eq. 1.1-2
$b=0.40821$ in (ineffective width=0.10579 in)	Eq. 1.1-1
Element 4: Stiffened, $w=2.278$ in	
$f_1=46.092$ ksi, $f_2=-34.102$ ksi	
$\psi=0.73986$	Eq. 1.1.2-1
$k=18.013$	Eq. 1.1.2-2
$\lambda=0.64498$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.278$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.60911$ in	Eq. 1.1.2-3
$b_2=1.139$ in	Eq. 1.1.2-4
Compression width=1.3093 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.036758$ in	
$S_{ye}=0.16375$ in ³ , $F_y=50$ ksi	
$M_n I=8.1876$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.278$ in

$f_1=45.622$ ksi, $f_2=-44.231$ ksi

$\psi=0.96951$

$k=23.218$

$\lambda=0.56519$

$\rho=1$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

be=2.278 in	Eq. 1.1-1
h _o =2.5 in, b _o =3.625 in, h _o /b _o =0.68966	
b ₁ =0.57387 in	Eq. 1.1.2-3
b ₂ =1.139 in	Eq. 1.1.2-4
Compression width=1.1566 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.318 ksi, f ₂ =49.318 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=1.8036	Eq. 1.1-3
ρ=0.48681	Eq. 1.1-2
b=0.4632 in (ineffective width=0.4883 in)	Eq. 1.1-1
f ₁ =49.318 ksi, f ₂ =49.318 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-2
λ=1.8036	Eq. 1.1-3
ρ=0.48681	Eq. 1.1-2
b=0.4632 in (ineffective width=0.4883 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=2.278 in	
f ₁ =45.622 ksi, f ₂ =-44.231 ksi	
ψ=0.96951	Eq. 1.1.2-1
k=23.218	Eq. 1.1.2-2
λ=0.56519	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=2.278 in	Eq. 1.1-1
h _o =2.5 in, b _o =3.625 in, h _o /b _o =0.68966	
b ₁ =0.57387 in	Eq. 1.1.2-3
b ₂ =1.139 in	Eq. 1.1.2-4
Compression width=1.1566 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.15121 in	
S _{ye} =0.15791 in ³ , F _y =50 ksi	
M _{nl} =7.8955 k-in	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =0.91939 in ⁶ , W _n =4.3724 in ² , F _y =50 ksi	
B _n =10.514 k-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

362S250-43

Full Section Properties

Area	0.42997 in ²	Wt.	0.0014619 k/ft	Flat	9.5336 in
I _x	0.9804 in ⁴	r _x	1.5101 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.54094 in ³	y(t)	1.8125 in	α	0.000 deg
S _x (b)	0.54094 in ³	y(b)	1.8125 in		
Z _x	0.60867 in ³	Height	3.6250 in		
I _y	0.3850 in ⁴	r _y	0.9463 in	x _o	-2.1983 in
S _y (l)	0.40777 in ³	x(l)	0.9442 in	y _o	0.0000 in
S _y (r)	0.24748 in ³	x(r)	1.5558 in	j _x	2.7247 in
Z _y	0.35998 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	0.9804 in ⁴	r ₁	1.5101 in	C _w	1.1921 in ⁶
I ₂	0.3850 in ⁴	r ₂	0.9463 in	J	0.0002915 in ⁴
I _c	1.3655 in ⁴	r _c	1.7821 in		
I _o	3.4433 in ⁴	r _o	2.8299 in		

Net Section Properties

I _x	0.9678 in ⁴	r _x	1.6343 in	Area	0.36232 in ²
S _x (t)	0.53394 in ³	y(t)	1.8125 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.53394 in ³	y(b)	1.8125 in	α	0.000 deg
Z _x	0.58330 in ³				
I _y	0.3168 in ⁴	r _y	0.9351 in	x _o	-2.3871 in
S _y (l)	0.28381 in ³	x(l)	1.1163 in	y _o	0.0000 in
S _y (r)	0.22897 in ³	x(r)	1.3837 in	j _x	2.6050 in
Z _y	0.30443 in ³			j _y	0.0000 in
I _c	1.2846 in ⁴	r _c	1.8829 in	C _w	1.1711 in ⁶
I _o	3.3492 in ⁴	r _o	3.0404 in	J	0.0002457 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	10.459 k	φM _{nxo}	18.012 k-in	φM _{nyo}	10.103 k-in
A _e	0.24610 in ²	I _{xe}	0.82476 in ⁴	I _{ye}	0.31258 in ⁴
φT _n	17.663 k	S _{xe} (t)	0.40026 in ³	S _{ye} (l)	0.28219 in ³
		S _{xe} (b)	0.52719 in ³	S _{ye} (r)	0.22451 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.901 k	φM _{nxo}	18.012 k-in	φM _{nyo}	9.675 k-in
φV _{nx}	5.185 k	I _{xe}	0.82476 in ⁴	I _{ye}	0.27459 in ⁴
Torsion		S _{xe} (t)	0.52719 in ³	S _{ye} (l)	0.22455 in ³
φB _n	12.172 k-in ²	S _{xe} (b)	0.40026 in ³	S _{ye} (r)	0.21500 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.525$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=52.838$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.42997 \text{ in}^2$, $F_y=51.525 \text{ ksi}$ $T_n=22.154 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.36232 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=23.551 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=2.8807 \text{ k}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=1.5693 \text{ k}$	Eq. G3-2
$k_v=3.675$	Eq. G3-8
$V_{crh}=1.1066 \text{ k}$	Eq. G3-6
$V_n=1.0014 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=2.8807 \text{ k}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123 \text{ in}$ (ineffective width= 0.027474 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00079003 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00049474 \text{ in}^4$	
$d_s=0.30136 \text{ in}$ (lip ineffective width= 0.17987 in)	Eq. 1.3-6
$k=3.3746$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2674 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.3746$	
$\lambda=1.1852$	Eq. 1.1-3
$\rho=0.68714$	Eq. 1.1-2
$b=1.558 \text{ in}$ (ineffective width= 0.70937 in)	Eq. 1.1-1
$b_1=0.48785 \text{ in}$, $b_2=1.0702 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.3855$	Eq. 1.1-3
$\rho=0.60715$	Eq. 1.1-2
$b=0.57449 \text{ in}$ (ineffective width= 0.37171 in)	Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.3855$	Eq. 1.1-3
$\rho=0.60715$	Eq. 1.1-2
$b=0.57449$ in (ineffective width= 0.37171 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123$ in (ineffective width= 0.027474 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00079003$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.30136$ in (lip ineffective width= 0.17987 in)	Eq. 1.3-6
$k=3.3746$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2674$ in	
$f=50$ ksi, $k=3.3746$	
$\lambda=1.1852$	Eq. 1.1-3
$\rho=0.68714$	Eq. 1.1-2
$b=1.558$ in (ineffective width= 0.70937 in)	Eq. 1.1-1
$b_1=0.48785$ in, $b_2=1.0702$ in	
$A_e=0.2461$ in ² , $F_n=50$ ksi	
$P_n=12.305$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.178$ ksi, $f_2=24.217$ ksi	
$\psi=0.51332$	Eq. 1.2.2-1
$k=0.67736$	Eq. 1.2.2-2
$\lambda=1.0723$	Eq. 1.1-3
$\rho=0.74124$	Eq. 1.1-2
$b=0.70136$ in (ineffective width= 0.24484 in)	Eq. 1.1-1

Element 5: Unstiffened, $w=0.5087$ in

$f_1=47.178$ ksi, $f_2=34.834$ ksi	
$\psi=0.73835$	Eq. 1.2.2-1
$k=0.536$	Eq. 1.2.2-2
$\lambda=0.64807$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=31.263$	Eq. 1.3-7
$I_a=0.00078581$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	

ds=0.32028 in (lip ineffective width=0.18842 in)	Eq. 1.3-6
k=3.3799	Table 1.3-1
Element 4: Partially stiffened, w=2.2674 in	
f=49.453 ksi, k=3.3799	
$\lambda=1.1777$	Eq. 1.1-3
$\rho=0.69048$	Eq. 1.1-2
b=1.5656 in (ineffective width=0.70181 in)	Eq. 1.1-1
b ₁ =0.49285 in, b ₂ =1.0727 in	
Center of gravity shift: y=-0.24807 in	
S _{xe} =0.40026 in ³ , F _y =50 ksi	
M _{nl} =20.013 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.5087 in	
f ₁ =47.178 ksi, f ₂ =34.834 ksi	
$\psi=0.73835$	Eq. 1.2.2-1
k=0.536	Eq. 1.2.2-2
$\lambda=0.64807$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.263	Eq. 1.3-7
I _a =0.00078581 in ⁴	Eq. 1.3-8
I _s =0.00049474 in ⁴	
ds=0.32028 in (lip ineffective width=0.18842 in)	Eq. 1.3-6
k=3.3799	Table 1.3-1
Element 2: Partially stiffened, w=2.2674 in	
f=49.453 ksi, k=3.3799	
$\lambda=1.1777$	Eq. 1.1-3
$\rho=0.69048$	Eq. 1.1-2
b=1.5656 in (ineffective width=0.70181 in)	Eq. 1.1-1
b ₁ =0.49285 in, b ₂ =1.0727 in	
Element 3: Treat as two unstiffened elements	
f ₁ =47.178 ksi, f ₂ =24.217 ksi	
$\psi=0.51332$	Eq. 1.2.2-1
k=0.67736	Eq. 1.2.2-2
$\lambda=1.0723$	Eq. 1.1-3
$\rho=0.74124$	Eq. 1.1-2
b=0.70136 in (ineffective width=0.24484 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.24807 in	
S _{xe} =0.40026 in ³ , F _y =50 ksi	
M _{nl} =20.013 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Positive Flexural Strength about Y-axis
Effective width calculations for Stud
Element 1: Unstiffened, w=0.5087 in

$f_1=49.19$ ksi, $f_2=49.19$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73882$

Eq. 1.1-3

$\rho=0.95047$

Eq. 1.1-2

$b=0.4835$ in (ineffective width= 0.025196 in)

Eq. 1.1-1

Element 2: Stiffened, $w=2.2674$ in

$f_1=45.823$ ksi, $f_2=-35.604$ ksi

$\psi=0.77699$

Eq. 1.1.2-1

$k=18.776$

Eq. 1.1.2-2

$\lambda=0.48099$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2674$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.60032$ in

Eq. 1.1.2-3

$b_2=1.1337$ in

Eq. 1.1.2-4

Compression width= 1.276 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=49.19$ ksi, $f_2=49.19$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73882$

Eq. 1.1-3

$\rho=0.95047$

Eq. 1.1-2

$b=0.4835$ in (ineffective width= 0.025196 in)

Eq. 1.1-1

Element 4: Stiffened, $w=2.2674$ in

$f_1=45.823$ ksi, $f_2=-35.604$ ksi

$\psi=0.77699$

Eq. 1.1.2-1

$k=18.776$

Eq. 1.1.2-2

$\lambda=0.48099$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2674$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.60032$ in

Eq. 1.1.2-3

$b_2=1.1337$ in

Eq. 1.1.2-4

Compression width= 1.276 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.0085918$ in

$S_y=0.22451$ in³, $F_y=50$ ksi

$M_{nl}=11.226$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2674$ in

$f_1=43.212$ ksi, $f_2=-45.452$ ksi

$\psi=1.0518$

Eq. 1.1.2-1

$k=25.38$

Eq. 1.1.2-2

$\lambda=0.40175$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.2674$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=3.625$ in, $h_o/b_o=0.68966$	
$b_1=0.5596$ in	Eq. 1.1.2-3
$b_2=1.1337$ in	Eq. 1.1.2-4
Compression width=1.1051 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.878$ ksi, $f_2=46.878$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.3416$	Eq. 1.1-3
$\rho=0.62317$	Eq. 1.1-2
$b=0.58964$ in (ineffective width=0.35656 in)	Eq. 1.1-1
$f_1=46.878$ ksi, $f_2=46.878$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=1.3416$	Eq. 1.1-3
$\rho=0.62317$	Eq. 1.1-2
$b=0.58964$ in (ineffective width=0.35656 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=2.2674$ in	
$f_1=43.212$ ksi, $f_2=-45.452$ ksi	
$\psi=1.0518$	Eq. 1.1.2-1
$k=25.38$	Eq. 1.1.2-2
$\lambda=0.40175$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.2674$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=3.625$ in, $h_o/b_o=0.68966$	
$b_1=0.5596$ in	Eq. 1.1.2-3
$b_2=1.1337$ in	Eq. 1.1.2-4
Compression width=1.1051 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.10655$ in	
$S_{ye}=0.215$ in ³ , $F_y=50$ ksi	
$M_n=10.75$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.1711$ in ⁶ , $W_n=4.3297$ in ² , $F_y=50$ ksi	
$B_n=13.524$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.53511 in ²	Wt.	0.0018194 k/ft	Flat	9.4543 in
Ix	1.2105 in ⁴	rx	1.5040 in	Ixy	0.0000 in ⁴
Sx(t)	0.66785 in ³	y(t)	1.8125 in	α	0.000 deg
Sx(b)	0.66785 in ³	y(b)	1.8125 in		
Zx	0.75427 in ³	Height	3.6250 in		
Iy	0.4728 in ⁴	ry	0.9400 in	x _o	-2.1832 in
Sy(l)	0.50131 in ³	x(l)	0.9431 in	y _o	0.0000 in
Sy(r)	0.30367 in ³	x(r)	1.5569 in	jx	2.7118 in
Zy	0.44474 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	1.2105 in ⁴	r ₁	1.5040 in	Cw	1.4484 in ⁶
I ₂	0.4728 in ⁴	r ₂	0.9400 in	J	0.0005714 in ⁴
Ic	1.6833 in ⁴	rc	1.7736 in		
I _o	4.2338 in ⁴	r _o	2.8128 in		

Net Section Properties

Ix	1.1946 in ⁴	rx	1.6289 in	Area	0.45021 in ²
Sx(t)	0.65907 in ³	y(t)	1.8125 in	Ixy	0.0000 in ⁴
Sx(b)	0.65907 in ³	y(b)	1.8125 in	α	0.000 deg
Zx	0.72243 in ³				
Iy	0.3883 in ⁴	ry	0.9287 in	x _o	-2.3726 in
Sy(l)	0.34807 in ³	x(l)	1.1156 in	y _o	0.0000 in
Sy(r)	0.28049 in ³	x(r)	1.3844 in	jx	2.5916 in
Zy	0.37550 in ³			jy	0.0000 in
Ic	1.5829 in ⁴	rc	1.8751 in	Cw	1.4225 in ⁶
I _o	4.1172 in ⁴	r _o	3.0241 in	J	0.0004808 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	14.062 k	φMnxo	23.652 k-in	φMnyo	14.345 k-in
Ae	0.33087 in ²	Ixe	1.0552 in ⁴	Iye	0.3883 in ⁴
φTn	21.948 k	Sxe(t)	0.52559 in ³	Sye(l)	0.34807 in ³
		Sxe(b)	0.65247 in ³	Sye(r)	0.28049 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.352 k	φMnxo	23.652 k-in	φMnyo	12.210 k-in
φVnx	6.776 k	Ixe	1.0552 in ⁴	Iye	0.3599 in ⁴
Torsion		Sxe(t)	0.65247 in ³	Sye(l)	0.30664 in ³
φBn	14.955 k-in ²	Sxe(b)	0.52559 in ³	Sye(r)	0.27134 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.91$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=53.509$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.53511$ in², $F_y=51.91$ ksi

$T_n=27.777$ k Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.45021$ in², $F_u=65$ ksi
 $T_n=29.264$ k Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=3.7645$ k at 180 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=1.8881$ k Eq. G3-2
 $k_v=3.6571$ Eq. G3-8
 $V_{crh}=2.1732$ k Eq. G3-6
 $V_n=1.5021$ k at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=3.7645$ k at 0 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56413$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0015382$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $d_s=0.16757$ in (lip ineffective width=0.31593 in) Eq. 1.3-6
 $k=2.8256$ Table 1.3-1

Element 2: Partially stiffened, $w=2.217$ in
 $f=50$ ksi, $k=2.8256$
 $\lambda=1.0091$ Eq. 1.1-3
 $\rho=0.77494$ Eq. 1.1-2
 $b=1.718$ in (ineffective width=0.49896 in) Eq. 1.1-1
 $b_1=0.29773$ in, $b_2=1.4203$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.0746$ Eq. 1.1-3
 $\rho=0.74007$ Eq. 1.1-2
 $b=0.6816$ in (ineffective width=0.2394 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0746$	Eq. 1.1-3
$\rho=0.74007$	Eq. 1.1-2
$b=0.6816$ in (ineffective width=0.2394 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0015382$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$ds=0.16757$ in (lip ineffective width=0.31593 in)	Eq. 1.3-6
$k=2.8256$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217$ in	
$f=50$ ksi, $k=2.8256$	
$\lambda=1.0091$	Eq. 1.1-3
$\rho=0.77494$	Eq. 1.1-2
$b=1.718$ in (ineffective width=0.49896 in)	Eq. 1.1-1
$b_1=0.29773$ in, $b_2=1.4203$ in	
$A_e=0.33087$ in ² , $F_n=50$ ksi	
$P_n=16.543$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.476$ ksi, $f_2=23.539$ ksi	
$\psi=0.50647$	Eq. 1.2.2-1
$k=0.68283$	Eq. 1.2.2-2
$\lambda=0.82215$	Eq. 1.1-3
$\rho=0.89085$	Eq. 1.1-2
$b=0.82047$ in (ineffective width=0.10053 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=46.476$ ksi, $f_2=34.435$ ksi	
$\psi=0.74091$	Eq. 1.2.2-1
$k=0.53473$	Eq. 1.2.2-2
$\lambda=0.48773$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.313$	Eq. 1.3-7
$I_a=0.0015277$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$ds=0.16873$ in (lip ineffective width=0.31477 in)	Eq. 1.3-6
$k=2.8311$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217$ in	

$f=49.295$ ksi, $k=2.8311$
 $\lambda=1.001$ Eq. 1.1-3
 $\rho=0.77945$ Eq. 1.1-2
 $b=1.728$ in (ineffective width= 0.48896 in) Eq. 1.1-1
 $b_1=0.30152$ in, $b_2=1.4265$ in
 Center of gravity shift: $y=-0.1952$ in
 $S_{xe}=0.52559$ in³, $F_y=50$ ksi
 $M_{nl}=26.28$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=46.476$ ksi, $f_2=34.435$ ksi
 $\psi=0.74091$ Eq. 1.2.2-1
 $k=0.53473$ Eq. 1.2.2-2
 $\lambda=0.48773$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.313$ Eq. 1.3-7
 $I_a=0.0015277$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $ds=0.16873$ in (lip ineffective width= 0.31477 in) Eq. 1.3-6
 $k=2.8311$ Table 1.3-1

Element 2: Partially stiffened, $w=2.217$ in

$f=49.295$ ksi, $k=2.8311$
 $\lambda=1.001$ Eq. 1.1-3
 $\rho=0.77945$ Eq. 1.1-2
 $b=1.728$ in (ineffective width= 0.48896 in) Eq. 1.1-1
 $b_1=0.30152$ in, $b_2=1.4265$ in

Element 3: Treat as two unstiffened elements

$f_1=46.476$ ksi, $f_2=23.539$ ksi
 $\psi=0.50647$ Eq. 1.2.2-1
 $k=0.68283$ Eq. 1.2.2-2
 $\lambda=0.82215$ Eq. 1.1-3
 $\rho=0.89085$ Eq. 1.1-2
 $b=0.82047$ in (ineffective width= 0.10053 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.1952$ in

$S_{xe}=0.52559$ in³, $F_y=50$ ksi
 $M_{nl}=26.28$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=55.664$ ksi, $f_2=55.664$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3

$\lambda=0.59523$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=2.217$ in	
$f_1=51.017$ ksi, $f_2=-39.984$ ksi	
$\psi=0.78374$	Eq. 1.1.2-1
$k=18.918$	Eq. 1.1.2-2
$\lambda=0.39393$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.58593$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.2429 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=55.664$ ksi, $f_2=55.664$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.59523$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=2.217$ in	
$f_1=51.017$ ksi, $f_2=-39.984$ ksi	
$\psi=0.78374$	Eq. 1.1.2-1
$k=18.918$	Eq. 1.1.2-2
$\lambda=0.39393$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.58593$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.2429 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_{ye}=0.28049$ in ³ , $F_y=56.825$ ksi	
$M_n I=15.939$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about Y-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: Stiffened, $w=2.217$ in	
$f_1=38.854$ ksi, $f_2=-44.669$ ksi	
$\psi=1.1497$	Eq. 1.1.2-1
$k=28.167$	Eq. 1.1.2-2
$\lambda=0.28174$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=3.625$ in, $h_o/b_o=0.68966$	
$b_1=0.53426$ in	Eq. 1.1.2-3

$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.0313 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=43.119$ ksi, $f_2=43.119$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.99791$	Eq. 1.1-3
$\rho=0.78117$	Eq. 1.1-2
$b=0.71946$ in (ineffective width=0.20154 in)	Eq. 1.1-1
$f_1=43.119$ ksi, $f_2=43.119$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=0.99791$	Eq. 1.1-3
$\rho=0.78117$	Eq. 1.1-2
$b=0.71946$ in (ineffective width=0.20154 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=2.217$ in	
$f_1=38.854$ ksi, $f_2=-44.669$ ksi	
$\psi=1.1497$	Eq. 1.1.2-1
$k=28.167$	Eq. 1.1.2-2
$\lambda=0.28174$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=3.625$ in, $h_o/b_o=0.68966$	
$b_1=0.53426$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.0313 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.058041$ in	
$S_y=0.27134$ in ³ , $F_y=50$ ksi	
$M_n=13.567$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.4225$ in ⁶ , $W_n=4.2802$ in ² , $F_y=50$ ksi	
$B_n=16.617$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400S162-30

Full Section Properties

Area	0.66630 in ²	Wt.	0.0022654 k/ft	Flat	9.3451 in
Ix	1.4912 in ⁴	rx	1.4960 in	Ixy	0.0000 in ⁴
Sx(t)	0.82272 in ³	y(t)	1.8125 in	α	0.000 deg
Sx(b)	0.82272 in ³	y(b)	1.8125 in		
Zx	0.93376 in ³	Height	3.6250 in		
Iy	0.5781 in ⁴	ry	0.9314 in	x _o	-2.1632 in
Sy(l)	0.61406 in ³	x(l)	0.9414 in	y _o	0.0000 in
Sy(r)	0.37088 in ³	x(r)	1.5586 in	jx	2.6950 in
Zy	0.54828 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	1.4912 in ⁴	r ₁	1.4960 in	Cw	1.7463 in ⁶
I ₂	0.5781 in ⁴	r ₂	0.9314 in	J	0.0011291 in ⁴
Ic	2.0693 in ⁴	rc	1.7623 in		
I _o	5.1872 in ⁴	r _o	2.7902 in		

Net Section Properties

Ix	1.4711 in ⁴	rx	1.6217 in	Area	0.55935 in ²
Sx(t)	0.81166 in ³	y(t)	1.8125 in	Ixy	0.0000 in ⁴
Sx(b)	0.81166 in ³	y(b)	1.8125 in	α	0.000 deg
Zx	0.89365 in ³				
Iy	0.4735 in ⁴	ry	0.9201 in	x _o	-2.3535 in
Sy(l)	0.42484 in ³	x(l)	1.1146 in	y _o	0.0000 in
Sy(r)	0.34178 in ³	x(r)	1.3854 in	jx	2.5741 in
Zy	0.46185 in ³			jy	0.0000 in
Ic	1.9446 in ⁴	rc	1.8646 in	Cw	1.7142 in ⁶
I _o	5.0430 in ⁴	r _o	3.0026 in	J	0.0009479 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	19.390 k	φMnxo	31.478 k-in	φMnyo	17.987 k-in
Ae	0.45624 in ²	Ixe	1.3581 in ⁴	Iye	0.4735 in ⁴
φTn	27.268 k	Sxe(t)	0.69950 in ³	Sye(l)	0.42484 in ³
		Sxe(b)	0.80678 in ³	Sye(r)	0.34178 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.898 k	φMnxo	31.478 k-in	φMnyo	15.292 k-in
φVnx	8.253 k	Ixe	1.3581 in ⁴	Iye	0.4673 in ⁴
Torsion		Sxe(t)	0.80678 in ³	Sye(l)	0.41548 in ³
φBn	18.297 k-in ²	Sxe(b)	0.69950 in ³	Sye(r)	0.33983 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

$F_{ya}=52.434$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

$F_{ya}=54.388$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0713$ in, $R=0.1069$ in, $A_c=0.015965$ in²

$F_{yc}=75.391$ ksi

Eq. A3.3.2-2

$F_{ya}=58.477$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.6663$ in², $F_y=52.434$ ksi

$$T_n = 34.937 \text{ k} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.55935 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 36.358 \text{ k} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 4.5852 \text{ k at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 2.231 \text{ k} \quad \text{Eq. G3-2}$$

$$k_v = 3.6301 \quad \text{Eq. G3-8}$$

$$V_{crh} = 4.2989 \text{ k} \quad \text{Eq. G3-6}$$

$$V_n = 2.1087 \text{ k at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 4.5852 \text{ k at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.4468 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.41383 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.0026903 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00052997 \text{ in}^4$$

$$d_s = 0.088017 \text{ in (lip ineffective width} = 0.35878 \text{ in)}$$

$$k = 2.3644 \quad \text{Eq. 1.3-6}$$

Table 1.3-1

Element 2: Partially stiffened, $w = 2.1436 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.3644$$

$$\lambda = 0.84669 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.87418 \quad \text{Eq. 1.1-2}$$

$$b = 1.8739 \text{ in (ineffective width} = 0.2697 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$b_1 = 0.18457 \text{ in}, b_2 = 1.6893 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.81905 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.89298 \quad \text{Eq. 1.1-2}$$

$$b = 0.78966 \text{ in (ineffective width} = 0.094638 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$k=0.43$	Eq. 1.2.2-3
$\lambda=0.81905$	Eq. 1.1-3
$\rho=0.89298$	Eq. 1.1-2
$b=0.78966$ in (ineffective width=0.094638 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4468$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.41383$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0026903$ in ⁴	Eq. 1.3-8
$I_s=0.00052997$ in ⁴	
$d_s=0.088017$ in (lip ineffective width=0.35878 in)	Eq. 1.3-6
$k=2.3644$	Table 1.3-1
Element 4: Partially stiffened, $w=2.1436$ in	
$f=50$ ksi, $k=2.3644$	
$\lambda=0.84669$	Eq. 1.1-3
$\rho=0.87418$	Eq. 1.1-2
$b=1.8739$ in (ineffective width=0.2697 in)	Eq. 1.1-1
$b_1=0.18457$ in, $b_2=1.6893$ in	
$A_e=0.45624$ in ² , $F_n=50$ ksi	
$P_n=22.812$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=45.41$ ksi, $f_2=22.633$ ksi	
$\psi=0.49841$	Eq. 1.2.2-1
$k=0.6894$	Eq. 1.2.2-2
$\lambda=0.61646$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4468$ in	
$f_1=45.41$ ksi, $f_2=33.902$ ksi	
$\psi=0.74657$	Eq. 1.2.2-1
$k=0.53195$	Eq. 1.2.2-2
$\lambda=0.35458$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.381$	Eq. 1.3-7
$I_a=0.0025792$ in ⁴	Eq. 1.3-8
$I_s=0.00052997$ in ⁴	
$d_s=0.091808$ in (lip ineffective width=0.35499 in)	Eq. 1.3-6
$k=2.3855$	Table 1.3-1
Element 4: Partially stiffened, $w=2.1436$ in	
$f=49.082$ ksi, $k=2.3855$	

$$\lambda=0.83517$$

Eq. 1.1-3

$$\rho=0.88195$$

Eq. 1.1-2

$$b=1.8905 \text{ in (ineffective width}=0.25305 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.19423 \text{ in, } b_2=1.6963 \text{ in}$$

Center of gravity shift: $y=-0.12909 \text{ in}$

$$S_{xe}=0.6995 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=34.975 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4468 \text{ in}$

$$f_1=45.41 \text{ ksi, } f_2=33.902 \text{ ksi}$$

$$\psi=0.74657$$

Eq. 1.2.2-1

$$k=0.53195$$

Eq. 1.2.2-2

$$\lambda=0.35458$$

Eq. 1.1-3

$$\lambda<0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.381$$

Eq. 1.3-7

$$I_a=0.0025792 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00052997 \text{ in}^4$$

$$d_s=0.091808 \text{ in (lip ineffective width}=0.35499 \text{ in)}$$

Eq. 1.3-6

$$k=2.3855$$

Table 1.3-1

Element 2: Partially stiffened, $w=2.1436 \text{ in}$

$$f=49.082 \text{ ksi, } k=2.3855$$

$$\lambda=0.83517$$

Eq. 1.1-3

$$\rho=0.88195$$

Eq. 1.1-2

$$b=1.8905 \text{ in (ineffective width}=0.25305 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.19423 \text{ in, } b_2=1.6963 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1=45.41 \text{ ksi, } f_2=22.633 \text{ ksi}$$

$$\psi=0.49841$$

Eq. 1.2.2-1

$$k=0.6894$$

Eq. 1.2.2-2

$$\lambda=0.61646$$

Eq. 1.1-3

$$\lambda<0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.12909 \text{ in}$

$$S_{xe}=0.6995 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=34.975 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4468 \text{ in}$

$$f_1=56.972 \text{ ksi, } f_2=56.972 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.44174$$

Eq. 1.1-3

$$\lambda<0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Stiffened, $w=2.1436$ in

$f_1=50.955$ ksi, $f_2=-39.522$ ksi

$\psi=0.77562$

Eq. 1.1.2-1

$k=18.748$

Eq. 1.1.2-2

$\lambda=0.30355$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.1436$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.56775$ in

Eq. 1.1.2-3

$b_2=1.0718$ in

Eq. 1.1.2-4

Compression width= 1.2072 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.4468$ in

$f_1=56.972$ ksi, $f_2=56.972$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.44174$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w=2.1436$ in

$f_1=50.955$ ksi, $f_2=-39.522$ ksi

$\psi=0.77562$

Eq. 1.1.2-1

$k=18.748$

Eq. 1.1.2-2

$\lambda=0.30355$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.1436$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.56775$ in

Eq. 1.1.2-3

$b_2=1.0718$ in

Eq. 1.1.2-4

Compression width= 1.2072 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0$ in

$S_{ye}=0.34178$ in³, $F_y=58.477$ ksi

$M_{nl}=19.986$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.1436$ in

$f_1=34.354$ ksi, $f_2=-43.526$ ksi

$\psi=1.267$

Eq. 1.1.2-1

$k=31.835$

Eq. 1.1.2-2

$\lambda=0.19127$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.1436$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=3.625$ in, $h_o/b_o=0.68966$

$b_1=0.50237$ in

Eq. 1.1.2-3

$b_2=1.0718$ in

Eq. 1.1.2-4

Compression width= 0.94558 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 39.533$ ksi, $f_2 = 39.533$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 0.72829$

Eq. 1.1-3

$\rho = 0.9583$

Eq. 1.1-2

$b = 0.84743$ in (ineffective width = 0.036875 in)

Eq. 1.1-1

$f_1 = 39.533$ ksi, $f_2 = 39.533$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-2

$\lambda = 0.72829$

Eq. 1.1-3

$\rho = 0.9583$

Eq. 1.1-2

$b = 0.84742$ in (ineffective width = 0.036875 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 2.1436$ in

$f_1 = 34.354$ ksi, $f_2 = -43.526$ ksi

$\psi = 1.267$

Eq. 1.1.2-1

$k = 31.835$

Eq. 1.1.2-2

$\lambda = 0.19127$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.1436$ in

Eq. 1.1-1

$h_o = 2.5$ in, $b_o = 3.625$ in, $h_o/b_o = 0.68966$

$b_1 = 0.50237$ in

Eq. 1.1.2-3

$b_2 = 1.0718$ in

Eq. 1.1.2-4

Compression width = 0.94558 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.010239$ in

$S_y = 0.33983$ in³, $F_y = 50$ ksi

$M_{nl} = 16.991$ k-in

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Bimoment Strength, Stud

$C_w = 1.7142$ in⁶, $W_n = 4.2157$ in², $F_y = 50$ ksi

$B_n = 20.331$ k-in²

G8.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

400S162-33

Full Section Properties

Area	0.27510 in ²	Wt.	0.00093532 k/ft	Flat	7.9507 in
Ix	0.6922 in ⁴	rx	1.5863 in	Ixy	0.0000 in ⁴
Sx(t)	0.34610 in ³	y(t)	2.0000 in	α	0.000 deg
Sx(b)	0.34610 in ³	y(b)	2.0000 in		
Zx	0.40128 in ³	Height	4.0000 in		
Iy	0.1027 in ⁴	ry	0.6110 in	x _o	-1.2611 in
Sy(l)	0.20040 in ³	x(l)	0.5125 in	y _o	0.0000 in
Sy(r)	0.09231 in ³	x(r)	1.1125 in	jx	2.2029 in
Zy	0.13600 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	0.6922 in ⁴	r ₁	1.5863 in	Cw	0.34752 in ⁶
I ₂	0.1027 in ⁴	r ₂	0.6110 in	J	0.00010978 in ⁴
Ic	0.7949 in ⁴	rc	1.6999 in		
I _o	1.2324 in ⁴	r _o	2.1166 in		

Net Section Properties

Ix	0.6825 in ⁴	rx	1.7486 in	Area	0.22320 in ²
Sx(t)	0.34124 in ³	y(t)	2.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.34124 in ³	y(b)	2.0000 in	α	0.000 deg
Zx	0.38182 in ³				
Iy	0.0870 in ⁴	ry	0.6244 in	x _o	-1.3871 in
Sy(l)	0.13864 in ³	x(l)	0.6276 in	y _o	0.0000 in
Sy(r)	0.08723 in ³	x(r)	0.9974 in	jx	1.9365 in
Zy	0.12392 in ³			jy	0.0000 in
Ic	0.7695 in ⁴	rc	1.8568 in	Cw	0.34173 in ⁶
I _o	1.1989 in ⁴	r _o	2.3177 in	J	0.00008907 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	6.343 k	φMnxo	12.240 k-in	φMnyo	3.848 k-in
Ae	0.14925 in ²	Ixe	0.60595 in ⁴	Iye	0.08577 in ⁴
φTn	10.881 k	Sxe(t)	0.27199 in ³	Sye(l)	0.13791 in ³
		Sxe(b)	0.34193 in ³	Sye(r)	0.08551 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.596 k	φMnxo	12.240 k-in	φMnyo	3.526 k-in
φVnx	2.621 k	Ixe	0.60595 in ⁴	Iye	0.06617 in ⁴
Torsion		Sxe(t)	0.34193 in ³	Sye(l)	0.08478 in ³
φBn	5.5956 k-in ²	Sxe(b)	0.27199 in ³	Sye(r)	0.07836 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.501$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=53.516$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=55.565$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.2751 \text{ in}^2$, $F_y=51.501 \text{ ksi}$
 $T_n=14.168 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.2232 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=14.508 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1.4563 \text{ k}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3

$V_{yh}=1.5984 \text{ k}$
 $k_v=3.6639$
 $V_{crh}=0.49872 \text{ k}$
 $V_n=0.6618 \text{ k}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2
Eq. G3-8
Eq. G3-6
Eq. G2.1-2

Stud element 4

$V_n=1.4563 \text{ k}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.389 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=0.74246$
 $\rho=0.94778$
 $b=0.36869 \text{ in}$ (ineffective width= 0.020315 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$
 $I_a=0.00022212 \text{ in}^4$
 $I_s=0.00016972 \text{ in}^4$
 $d_s=0.28171 \text{ in}$ (lip ineffective width= 0.086971 in)
 $k=3.2075$

Eq. 1.3-7
Eq. 1.3-8
Eq. 1.3-6
Table 1.3-1

Element 2: Partially stiffened, $w=1.403 \text{ in}$

$f=50 \text{ ksi}$, $k=3.2075$
 $\lambda=0.98047$
 $\rho=0.79107$
 $b=1.1099 \text{ in}$ (ineffective width= 0.29313 in)
 $b_1=0.42403 \text{ in}$, $b_2=0.68584 \text{ in}$

Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=2.1739$
 $\rho=0.41344$
 $b=0.47091 \text{ in}$ (ineffective width= 0.66809 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

$$f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=2.1739$$

Eq. 1.1-3

$$\rho=0.41344$$

Eq. 1.1-2

$$b=0.47091 \text{ in (ineffective width}=0.66809 \text{ in)}$$

Eq. 1.1-1

Element 5: Unstiffened, $w=0.389 \text{ in}$

$$f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.74246$$

Eq. 1.1-3

$$\rho=0.94778$$

Eq. 1.1-2

$$b=0.36869 \text{ in (ineffective width}=0.020315 \text{ in)}$$

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.091$$

Eq. 1.3-7

$$I_a=0.00022212 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00016972 \text{ in}^4$$

$$d_s=0.28171 \text{ in (lip ineffective width}=0.086971 \text{ in)}$$

Eq. 1.3-6

$$k=3.2075$$

Table 1.3-1

Element 4: Partially stiffened, $w=1.403 \text{ in}$

$$f=50 \text{ ksi}, k=3.2075$$

$$\lambda=0.98047$$

Eq. 1.1-3

$$\rho=0.79107$$

Eq. 1.1-2

$$b=1.1099 \text{ in (ineffective width}=0.29313 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.42403 \text{ in}, b_2=0.68584 \text{ in}$$

$$A_e=0.14925 \text{ in}^2, F_n=50 \text{ ksi}$$

$$P_n=7.4627 \text{ k}$$

Eq. E3.1-1

$$\Omega_c=1.8, \phi_c=0.85$$

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$$f_1=47.509 \text{ ksi}, f_2=21.944 \text{ ksi}$$

$$\psi=0.46189$$

Eq. 1.2.2-1

$$k=0.7208$$

Eq. 1.2.2-2

$$\lambda=1.6367$$

Eq. 1.1-3

$$\rho=0.52885$$

Eq. 1.1-2

$$b=0.60236 \text{ in (ineffective width}=0.53664 \text{ in)}$$

Eq. 1.1-1

Element 5: Unstiffened, $w=0.389 \text{ in}$

$$f_1=47.509 \text{ ksi}, f_2=38.778 \text{ ksi}$$

$$\psi=0.81622$$

Eq. 1.2.2-1

$$k=0.4999$$

Eq. 1.2.2-2

$$\lambda=0.67122$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.213$$

Eq. 1.3-7

$$I_a=0.00022128 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00016972 \text{ in}^4$$

ds=0.29836 in (lip ineffective width=0.090639 in)	Eq. 1.3-6
k=3.211	Table 1.3-1
Element 4: Partially stiffened, w=1.403 in	
f=49.612 ksi, k=3.211	
$\lambda=0.97612$	Eq. 1.1-3
$\rho=0.79357$	Eq. 1.1-2
b=1.1134 in (ineffective width=0.28963 in)	Eq. 1.1-1
b ₁ =0.42698 in, b ₂ =0.6864 in	
Center of gravity shift: y=-0.22783 in	
S _{xe} =0.27199 in ³ , F _y =50 ksi	
M _{nl} =13.6 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.389 in	
f ₁ =47.509 ksi, f ₂ =38.778 ksi	
$\psi=0.81622$	Eq. 1.2.2-1
k=0.4999	Eq. 1.2.2-2
$\lambda=0.67122$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.213	Eq. 1.3-7
I _a =0.00022128 in ⁴	Eq. 1.3-8
I _s =0.00016972 in ⁴	
ds=0.29836 in (lip ineffective width=0.090639 in)	Eq. 1.3-6
k=3.211	Table 1.3-1
Element 2: Partially stiffened, w=1.403 in	
f=49.612 ksi, k=3.211	
$\lambda=0.97612$	Eq. 1.1-3
$\rho=0.79357$	Eq. 1.1-2
b=1.1134 in (ineffective width=0.28963 in)	Eq. 1.1-1
b ₁ =0.42698 in, b ₂ =0.6864 in	
Element 3: Treat as two unstiffened elements	
f ₁ =47.509 ksi, f ₂ =21.944 ksi	
$\psi=0.46189$	Eq. 1.2.2-1
k=0.7208	Eq. 1.2.2-2
$\lambda=1.6367$	Eq. 1.1-3
$\rho=0.52885$	Eq. 1.1-2
b=0.60236 in (ineffective width=0.53664 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.22783 in	
S _{xe} =0.27199 in ³ , F _y =50 ksi	
M _{nl} =13.6 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Positive Flexural Strength about Y-axis
Effective width calculations for Stud
Element 1: Unstiffened, w=0.389 in

$$f_1=49.138 \text{ ksi}, f_2=49.138 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.73603$$

Eq. 1.1-3

$$\rho=0.95254$$

Eq. 1.1-2

$$b=0.37054 \text{ in (ineffective width}=0.018462 \text{ in)}$$

Eq. 1.1-1

Element 2: Stiffened, $w=1.403 \text{ in}$

$$f_1=44.467 \text{ ksi}, f_2=-25.47 \text{ ksi}$$

$$\psi=0.57279$$

Eq. 1.1.2-1

$$k=14.927$$

Eq. 1.1.2-2

$$\lambda=0.42862$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.403 \text{ in}$$

Eq. 1.1-1

$$h_o=1.625 \text{ in}, b_o=0.5 \text{ in}, h_o/b_o=3.25$$

$$b_1=0.39269 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.7015 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.89205 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.389 \text{ in}$

$$f_1=49.138 \text{ ksi}, f_2=49.138 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.73603$$

Eq. 1.1-3

$$\rho=0.95254$$

Eq. 1.1-2

$$b=0.37054 \text{ in (ineffective width}=0.018462 \text{ in)}$$

Eq. 1.1-1

Element 4: Stiffened, $w=1.403 \text{ in}$

$$f_1=44.467 \text{ ksi}, f_2=-25.47 \text{ ksi}$$

$$\psi=0.57279$$

Eq. 1.1.2-1

$$k=14.927$$

Eq. 1.1.2-2

$$\lambda=0.42862$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.403 \text{ in}$$

Eq. 1.1-1

$$h_o=1.625 \text{ in}, b_o=0.5 \text{ in}, h_o/b_o=3.25$$

$$b_1=0.39269 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.7015 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.89205 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=-0.0056424 \text{ in}$

$$S_y=0.085513 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=4.2756 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.403 \text{ in}$

$$f_1=39.58 \text{ ksi}, f_2=-43.432 \text{ ksi}$$

$$\psi=1.0973$$

Eq. 1.1.2-1

$$k=26.646$$

Eq. 1.1.2-2

$\lambda=0.30266$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.403$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=4$ in, $h_o/b_o=0.40625$	
$b_1=0.34242$ in	Eq. 1.1.2-3
$b_2=0.7015$ in	Eq. 1.1.2-4
Compression width=0.66894 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=45.124$ ksi, $f_2=45.124$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0652$	Eq. 1.1-3
$\rho=0.43263$	Eq. 1.1-2
$b=0.49276$ in (ineffective width=0.64624 in)	Eq. 1.1-1
$f_1=45.124$ ksi, $f_2=45.124$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0652$	Eq. 1.1-3
$\rho=0.43263$	Eq. 1.1-2
$b=0.49276$ in (ineffective width=0.64624 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.403$ in	
$f_1=39.58$ ksi, $f_2=-43.432$ ksi	
$\psi=1.0973$	Eq. 1.1.2-1
$k=26.646$	Eq. 1.1.2-2
$\lambda=0.30266$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.403$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=4$ in, $h_o/b_o=0.40625$	
$b_1=0.34242$ in	Eq. 1.1.2-3
$b_2=0.7015$ in	Eq. 1.1.2-4
Compression width=0.66894 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.15292$ in	
$S_y=0.07836$ in ³ , $F_y=50$ ksi	
$M_n=3.918$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.34173$ in ⁶ , $W_n=2.7482$ in ² , $F_y=50$ ksi	
$B_n=6.2173$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.35668 in ²	Wt.	0.0012127 k/ft	Flat	7.9086 in
I _x	0.8921 in ⁴	r _x	1.5815 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.44603 in ³	y(t)	2.0000 in	α	0.000 deg
S _x (b)	0.44603 in ³	y(b)	2.0000 in		
Z _x	0.51860 in ³	Height	4.0000 in		
I _y	0.1312 in ⁴	r _y	0.6064 in	x _o	-1.2494 in
S _y (l)	0.25578 in ³	x(l)	0.5128 in	y _o	0.0000 in
S _y (r)	0.11795 in ³	x(r)	1.1122 in	j _x	2.1944 in
Z _y	0.17466 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	0.8921 in ⁴	r ₁	1.5815 in	C _w	0.44025 in ⁶
I ₂	0.1312 in ⁴	r ₂	0.6064 in	J	0.00024183 in ⁴
I _c	1.0232 in ⁴	r _c	1.6938 in		
I _o	1.5800 in ⁴	r _o	2.1047 in		

Net Section Properties

I _x	0.8794 in ⁴	r _x	1.7443 in	Area	0.28903 in ²
S _x (t)	0.43969 in ³	y(t)	2.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.43969 in ³	y(b)	2.0000 in	α	0.000 deg
Z _x	0.49323 in ³				
I _y	0.1111 in ⁴	r _y	0.6200 in	x _o	-1.3751 in
S _y (l)	0.17701 in ³	x(l)	0.6276 in	y _o	0.0000 in
S _y (r)	0.11138 in ³	x(r)	0.9974 in	j _x	1.9266 in
Z _y	0.15927 in ³			j _y	0.0000 in
I _c	0.9905 in ⁴	r _c	1.8512 in	C _w	0.43284 in ⁶
I _o	1.5370 in ⁴	r _o	2.3061 in	J	0.00019596 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	8.844 k	φM _{nxo}	16.770 k-in	φM _{nyo}	5.699 k-in
A _e	0.20809 in ²	I _{xe}	0.80840 in ⁴	I _{ye}	0.11109 in ⁴
φT _n	14.090 k	S _{xe} (t)	0.37266 in ³	S _{ye} (l)	0.17701 in ³
		S _{xe} (b)	0.44158 in ³	S _{ye} (r)	0.11138 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.032 k	φM _{nxo}	16.770 k-in	φM _{nyo}	4.667 k-in
φV _{nx}	3.391 k	I _{xe}	0.80840 in ⁴	I _{ye}	0.09230 in ⁴
Torsion		S _{xe} (t)	0.44158 in ³	S _{ye} (l)	0.12557 in ³
φB _n	7.1719 k-in ²	S _{xe} (b)	0.37266 in ³	S _{ye} (r)	0.10371 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.839$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=54.31$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=56.847$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.35668$ in², $F_y=51.839$ ksi

$$T_n = 18.49 \text{ k} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.28903 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 18.787 \text{ k} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 1.8839 \text{ k at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 2.069 \text{ k} \quad \text{Eq. G3-2}$$

$$k_v = 3.6606 \quad \text{Eq. G3-8}$$

$$V_{crh} = 1.1037 \text{ k} \quad \text{Eq. G3-6}$$

$$V_n = 1.1467 \text{ k at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 1.8839 \text{ k at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.3837 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.56184 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.00048546 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00021231 \text{ in}^4$$

$$d_s = 0.16781 \text{ in (lip ineffective width} = 0.21589 \text{ in)}$$

$$k = 2.725 \quad \text{Eq. 1.3-6}$$

Table 1.3-1

Element 2: Partially stiffened, $w = 1.3924 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.725$$

$$\lambda = 0.80992 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.89931 \quad \text{Eq. 1.1-2}$$

$$b = 1.2522 \text{ in (ineffective width} = 0.1402 \text{ in)}$$

$$b_1 = 0.27382 \text{ in}, b_2 = 0.97838 \text{ in} \quad \text{Eq. 1.1-1}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 1.6601 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.52256 \quad \text{Eq. 1.1-2}$$

$$b = 0.59242 \text{ in (ineffective width} = 0.54128 \text{ in)}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi} \quad \text{Eq. 1.1-1}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

k=0.43	Eq. 1.2.2-3
$\lambda=1.6601$	Eq. 1.1-3
$\rho=0.52256$	Eq. 1.1-2
b=0.59242 in (ineffective width=0.54128 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.3837 in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=0.56184$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.091	Eq. 1.3-7
$I_a=0.00048546$ in ⁴	Eq. 1.3-8
$I_s=0.00021231$ in ⁴	
ds=0.16781 in (lip ineffective width=0.21589 in)	Eq. 1.3-6
k=2.725	Table 1.3-1
Element 4: Partially stiffened, w=1.3924 in	
f=50 ksi, k=2.725	
$\lambda=0.80992$	Eq. 1.1-3
$\rho=0.89931$	Eq. 1.1-2
b=1.2522 in (ineffective width=0.1402 in)	Eq. 1.1-1
$b_1=0.27382$ in, $b_2=0.97838$ in	
$A_e=0.20809$ in ² , $F_n=50$ ksi	
$P_n=10.404$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.319$ ksi, $f_2=21.187$ ksi	
$\psi=0.44775$	Eq. 1.2.2-1
k=0.73374	Eq. 1.2.2-2
$\lambda=1.2363$	Eq. 1.1-3
$\rho=0.66493$	Eq. 1.1-2
b=0.75383 in (ineffective width=0.37987 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.3837 in	
$f_1=47.319$ ksi, $f_2=38.475$ ksi	
$\psi=0.81309$	Eq. 1.2.2-1
k=0.50126	Eq. 1.2.2-2
$\lambda=0.50624$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.254	Eq. 1.3-7
$I_a=0.00047422$ in ⁴	Eq. 1.3-8
$I_s=0.00021231$ in ⁴	
ds=0.17179 in (lip ineffective width=0.21191 in)	Eq. 1.3-6
k=2.7406	Table 1.3-1
Element 4: Partially stiffened, w=1.3924 in	

$$f=49.48 \text{ ksi}, k=2.7406$$

$$\lambda=0.8034$$

Eq. 1.1-3

$$\rho=0.90387$$

Eq. 1.1-2

$$b=1.2585 \text{ in (ineffective width}=0.13386 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.28173 \text{ in}, b_2=0.97681 \text{ in}$$

Center of gravity shift: $y=-0.16929 \text{ in}$

$$S_{xe}=0.37266 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=18.633 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837 \text{ in}$

$$f_1=47.319 \text{ ksi}, f_2=38.475 \text{ ksi}$$

$$\psi=0.81309$$

Eq. 1.2.2-1

$$k=0.50126$$

Eq. 1.2.2-2

$$\lambda=0.50624$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.254$$

Eq. 1.3-7

$$I_a=0.00047422 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00021231 \text{ in}^4$$

$$d_s=0.17179 \text{ in (lip ineffective width}=0.21191 \text{ in)}$$

Eq. 1.3-6

$$k=2.7406$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.3924 \text{ in}$

$$f=49.48 \text{ ksi}, k=2.7406$$

$$\lambda=0.8034$$

Eq. 1.1-3

$$\rho=0.90387$$

Eq. 1.1-2

$$b=1.2585 \text{ in (ineffective width}=0.13386 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.28173 \text{ in}, b_2=0.97681 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1=47.319 \text{ ksi}, f_2=21.187 \text{ ksi}$$

$$\psi=0.44775$$

Eq. 1.2.2-1

$$k=0.73374$$

Eq. 1.2.2-2

$$\lambda=1.2363$$

Eq. 1.1-3

$$\rho=0.66493$$

Eq. 1.1-2

$$b=0.75383 \text{ in (ineffective width}=0.37987 \text{ in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.16929 \text{ in}$

$$S_{xe}=0.37266 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=18.633 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837 \text{ in}$

$$f_1=55.562 \text{ ksi}, f_2=55.562 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$\lambda=0.59227$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.3924$ in	
$f_1=50.218$ ksi, $f_2=-29.142$ ksi	
$\psi=0.58031$	Eq. 1.1.2-1
$k=15.054$	Eq. 1.1.2-2
$\lambda=0.34534$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.3924$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.38891$ in	Eq. 1.1.2-3
$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width=0.88109 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=55.562$ ksi, $f_2=55.562$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.59227$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.3924$ in	
$f_1=50.218$ ksi, $f_2=-29.142$ ksi	
$\psi=0.58031$	Eq. 1.1.2-1
$k=15.054$	Eq. 1.1.2-2
$\lambda=0.34534$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.3924$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.38891$ in	Eq. 1.1.2-3
$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width=0.88109 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_{ye}=0.11138$ in ³ , $F_y=56.847$ ksi	
$M_n I=6.3319$ k-in	Eq. F3.1-1
$\Omega b=1.67$, $\phi b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.3924$ in

$f_1=34.712$ ksi, $f_2=-43.47$ ksi

$\psi=1.2523$

$k=31.356$

$\lambda=0.19894$

$\rho=1$

$b_e=1.3924$ in

$h_o=1.625$ in, $b_o=4$ in, $h_o/b_o=0.40625$

$b_1=0.32745$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width=0.61821 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=39.976$ ksi, $f_2=39.976$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.4844$	Eq. 1.1-3
$\rho=0.57384$	Eq. 1.1-2
$b=0.65057$ in (ineffective width=0.48313 in)	Eq. 1.1-1
$f_1=39.976$ ksi, $f_2=39.976$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.4844$	Eq. 1.1-3
$\rho=0.57384$	Eq. 1.1-2
$b=0.65057$ in (ineffective width=0.48313 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.3924$ in	
$f_1=34.712$ ksi, $f_2=-43.47$ ksi	
$\psi=1.2523$	Eq. 1.1.2-1
$k=31.356$	Eq. 1.1.2-2
$\lambda=0.19894$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.3924$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=4$ in, $h_o/b_o=0.40625$	
$b_1=0.32745$ in	Eq. 1.1.2-3
$b_2=0.6962$ in	Eq. 1.1.2-4
Compression width=0.61821 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.10742$ in	
$S_y=0.10371$ in ³ , $F_y=50$ ksi	
$M_n=5.1856$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.43284$ in ⁶ , $W_n=2.7158$ in ² , $F_y=50$ ksi	
$B_n=7.9688$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400S162-54

Full Section Properties

Area	0.44314 in ²	Wt.	0.0015067 k/ft	Flat	7.8293 in
Ix	1.0980 in ⁴	rx	1.5741 in	Ixy	0.0000 in ⁴
Sx(t)	0.54902 in ³	y(t)	2.0000 in	α	0.000 deg
Sx(b)	0.54902 in ³	y(b)	2.0000 in		
Zx	0.64095 in ³	Height	4.0000 in		
Iy	0.1596 in ⁴	ry	0.6001 in	x _o	-1.2346 in
Sy(l)	0.31164 in ³	x(l)	0.5120 in	y _o	0.0000 in
Sy(r)	0.14337 in ³	x(r)	1.1130 in	jx	2.1870 in
Zy	0.21409 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	1.0980 in ⁴	r ₁	1.5741 in	Cw	0.52990 in ⁶
I ₂	0.1596 in ⁴	r ₂	0.6001 in	J	0.0004732 in ⁴
Ic	1.2576 in ⁴	rc	1.6846 in		
I _o	1.9330 in ⁴	r _o	2.0886 in		

Net Section Properties

Ix	1.0821 in ⁴	rx	1.7380 in	Area	0.35824 in ²
Sx(t)	0.54106 in ³	y(t)	2.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.54106 in ³	y(b)	2.0000 in	α	0.000 deg
Zx	0.60912 in ³				
Iy	0.1350 in ⁴	ry	0.6138 in	x _o	-1.3603 in
Sy(l)	0.21538 in ³	x(l)	0.6266 in	y _o	0.0000 in
Sy(r)	0.13519 in ³	x(r)	0.9984 in	jx	1.9170 in
Zy	0.19525 in ³			jy	0.0000 in
Ic	1.2171 in ⁴	rc	1.8432 in	Cw	0.52080 in ⁶
I _o	1.8799 in ⁴	r _o	2.2908 in	J	0.00038254 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	12.704 k	φMnxo	23.074 k-in	φMnyo	7.108 k-in
Ae	0.29893 in ²	Ixe	1.0562 in ⁴	Iye	0.1350 in ⁴
φTn	17.464 k	Sxe(t)	0.51276 in ³	Sye(l)	0.21538 in ³
		Sxe(b)	0.54436 in ³	Sye(r)	0.13519 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.589 k	φMnxo	23.074 k-in	φMnyo	5.850 k-in
φVnx	4.102 k	Ixe	1.0562 in ⁴	Iye	0.1218 in ⁴
Torsion		Sxe(t)	0.54436 in ³	Sye(l)	0.17711 in ³
φBn	8.75 k-in ²	Sxe(b)	0.51276 in ³	Sye(r)	0.13001 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=52.306$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=55.318$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=58.416$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.44314$ in², $F_y=52.306$ ksi

$T_n=23.179$ k Eq. D2-1
 $\Omega_t=1.67, \phi_t=0.9$

$A_n=0.35824$ in², $F_u=65$ ksi
 $T_n=23.285$ k Eq. D3-1
 $\Omega_t=2, \phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=2.2787$ k at 180 deg Eq. G2.1-1
 $\Omega_v=1.67, \phi_v=0.9$

Stud element 3
 $V_{yh}=2.5102$ k Eq. G3-2
 $k_v=3.6443$ Eq. G3-8
 $V_{crh}=2.1735$ k Eq. G3-6
 $V_n=1.7655$ k at 90 deg Eq. G2.1-2
 $\Omega_v=1.67, \phi_v=0.9$

Stud element 4
 $V_n=2.2787$ k at 0 deg Eq. G2.1-1
 $\Omega_v=1.67, \phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.41829$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.00033614$ in⁴ Eq. 1.3-8
 $I_s=0.00021732$ in⁴
 $d_s=0.23177$ in (lip ineffective width=0.12673 in) Eq. 1.3-6
 $k=2.9231$ Table 1.3-1

Element 2: Partially stiffened, $w=1.342$ in
 $f=50$ ksi, $k=2.9231$
 $\lambda=0.60055$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.2934$ Eq. 1.1-3
 $\rho=0.64166$ Eq. 1.1-2
 $b=0.71128$ in (ineffective width=0.39722 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.2934$ Eq. 1.1-3

$\rho=0.64166$	Eq. 1.1-2
$b=0.71128$ in (ineffective width= 0.39722 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.41829$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00033614$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.23177$ in (lip ineffective width= 0.12673 in)	Eq. 1.3-6
$k=2.9231$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=50$ ksi, $k=2.9231$	
$\lambda=0.60055$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
$A_e=0.29893$ in ² , $F_n=50$ ksi	
$P_n=14.946$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.565$ ksi, $f_2=19.656$ ksi	
$\psi=0.42213$	Eq. 1.2.2-1
$k=0.7584$	Eq. 1.2.2-2
$\lambda=0.93983$	Eq. 1.1-3
$\rho=0.81495$	Eq. 1.1-2
$b=0.90337$ in (ineffective width= 0.20513 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=46.565$ ksi, $f_2=37.863$ ksi	
$\psi=0.81311$	Eq. 1.2.2-1
$k=0.50125$	Eq. 1.2.2-2
$\lambda=0.37387$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.307$	Eq. 1.3-7
$I_a=0.00032409$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.24039$ in (lip ineffective width= 0.11811 in)	Eq. 1.3-6
$k=2.9576$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=49.313$ ksi, $k=2.9576$	
$\lambda=0.59292$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Center of gravity shift: $y=-0.059776$ in	

$S_{xe}=0.51276 \text{ in}^3$, $F_y=50 \text{ ksi}$
 $M_{nl}=25.638 \text{ k-in}$
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585 \text{ in}$
 $f_1=46.565 \text{ ksi}$, $f_2=37.863 \text{ ksi}$

$\psi=0.81311$

Eq. 1.2.2-1

$k=0.50125$

Eq. 1.2.2-2

$\lambda=0.37387$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.307$

Eq. 1.3-7

$I_a=0.00032409 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00021732 \text{ in}^4$

$d_s=0.24039 \text{ in}$ (lip ineffective width= 0.11811 in)

Eq. 1.3-6

$k=2.9576$

Table 1.3-1

Element 2: Partially stiffened, $w=1.342 \text{ in}$

$f=49.313 \text{ ksi}$, $k=2.9576$

$\lambda=0.59292$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=46.565 \text{ ksi}$, $f_2=19.656 \text{ ksi}$

$\psi=0.42213$

Eq. 1.2.2-1

$k=0.7584$

Eq. 1.2.2-2

$\lambda=0.93983$

Eq. 1.1-3

$\rho=0.81495$

Eq. 1.1-2

$b=0.90337 \text{ in}$ (ineffective width= 0.20513 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.059777 \text{ in}$

$S_{xe}=0.51276 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_{nl}=25.638 \text{ k-in}$

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585 \text{ in}$

$f_1=56.76 \text{ ksi}$, $f_2=56.76 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.44567$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=1.342 \text{ in}$

$f_1=50.137 \text{ ksi}$, $f_2=-28.387 \text{ ksi}$

$\psi=0.5662$

Eq. 1.1.2-1

$k=14.816$

Eq. 1.1.2-2

$\lambda=0.26711$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.342 \text{ in}$

Eq. 1.1-1

$h_o=1.625 \text{ in}$, $b_o=0.5 \text{ in}$, $h_o/b_o=3.25$

$b_1=0.37631$ in Eq. 1.1.2-3

$b_2=0.671$ in Eq. 1.1.2-4

Compression width=0.85685 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3585$ in

$f_1=56.76$ ksi, $f_2=56.76$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.44567$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w=1.342$ in

$f_1=50.137$ ksi, $f_2=-28.387$ ksi

$\psi=0.5662$

Eq. 1.1.2-1

$k=14.816$

Eq. 1.1.2-2

$\lambda=0.26711$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.342$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$

$b_1=0.37631$ in

Eq. 1.1.2-3

$b_2=0.671$ in

Eq. 1.1.2-4

Compression width=0.85685 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0$ in

$S_{ye}=0.13519$ in³, $F_y=58.416$ ksi

$M_{nl}=7.8974$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.342$ in

$f_1=29.127$ ksi, $f_2=-42.453$ ksi

$\psi=1.4575$

Eq. 1.1.2-1

$k=38.598$

Eq. 1.1.2-2

$\lambda=0.12614$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.342$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=4$ in, $h_o/b_o=0.40625$

$b_1=0.30107$ in

Eq. 1.1.2-3

$b_2=0.671$ in

Eq. 1.1.2-4

Compression width=0.54609 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=35.165$ ksi, $f_2=35.165$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.0847$

Eq. 1.1-3

$\rho=0.73495$

Eq. 1.1-2

$b=0.81469$ in (ineffective width=0.29381 in)

Eq. 1.1-1

$f_1=35.165$ ksi, $f_2=35.165$ ksi

$\psi=1$

Eq. 1.2.2-1

k=0.43	Eq. 1.2.2-3
$\lambda=1.0847$	Eq. 1.1-3
$\rho=0.73495$	Eq. 1.1-2
b=0.81469 in (ineffective width=0.29381 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=1.342 in	
$f_1=29.127$ ksi, $f_2=-42.453$ ksi	
$\psi=1.4575$	Eq. 1.1.2-1
k=38.598	Eq. 1.1.2-2
$\lambda=0.12614$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
be=1.342 in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=4$ in, $h_o/b_o=0.40625$	
$b_1=0.30107$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width=0.54609 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: x=0.061236 in	
$S_y=0.13001$ in ³ , $F_y=50$ ksi	
$M_n=6.5005$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.5208$ in ⁶ , $W_n=2.6784$ in ² , $F_y=50$ ksi	
$B_n=9.7223$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400S200-30

Full Section Properties

Area	0.27969 in ²	Wt.	0.00095094 k/ft	Flat	8.9643 in
I _x	0.7348 in ⁴	r _x	1.6208 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.36738 in ³	y(t)	2.0000 in	α	0.000 deg
S _x (b)	0.36738 in ³	y(b)	2.0000 in		
Z _x	0.42050 in ³	Height	4.0000 in		
I _y	0.1660 in ⁴	r _y	0.7705 in	x _o	-1.6909 in
S _y (l)	0.23787 in ³	x(l)	0.6980 in	y _o	0.0000 in
S _y (r)	0.12753 in ³	x(r)	1.3020 in	j _x	2.4284 in
Z _y	0.18529 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	0.7348 in ⁴	r ₁	1.6208 in	C _w	0.61214 in ⁶
I ₂	0.1660 in ⁴	r ₂	0.7705 in	J	0.0000908 in ⁴
I _c	0.9008 in ⁴	r _c	1.7946 in		
I _o	1.7005 in ⁴	r _o	2.4658 in		

Net Section Properties

I _x	0.7260 in ⁴	r _x	1.7656 in	Area	0.23289 in ²
S _x (t)	0.36299 in ³	y(t)	2.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.36299 in ³	y(b)	2.0000 in	α	0.000 deg
Z _x	0.40295 in ³				
I _y	0.1399 in ⁴	r _y	0.7750 in	x _o	-1.8402 in
S _y (l)	0.16747 in ³	x(l)	0.8351 in	y _o	0.0000 in
S _y (r)	0.12007 in ³	x(r)	1.1649 in	j _x	2.2267 in
Z _y	0.16262 in ³			j _y	0.0000 in
I _c	0.8658 in ⁴	r _c	1.9282 in	C _w	0.60310 in ⁶
I _o	1.6545 in ⁴	r _o	2.6654 in	J	0.00007557 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	5.898 k	φM _n x _o	11.457 k-in	φM _n y _o	4.772 k-in
A _e	0.13878 in ²	I _x e	0.59576 in ⁴	I _y e	0.12817 in ⁴
φT _n	11.353 k	S _x e(t)	0.25461 in ³	S _y e(l)	0.16194 in ³
		S _x e(b)	0.35887 in ³	S _y e(r)	0.10606 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.482 k	φM _n x _o	11.457 k-in	φM _n y _o	4.522 k-in
φV _{nx}	2.609 k	I _x e	0.59576 in ⁴	I _y e	0.10322 in ⁴
Torsion		S _x e(t)	0.35887 in ³	S _y e(l)	0.10049 in ³
φB _n	7.3436 k-in ²	S _x e(b)	0.25461 in ³	S _y e(r)	0.10609 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.227$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.65$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$$\begin{aligned}
 A_g &= 0.27969 \text{ in}^2, F_y = 51.227 \text{ ksi} \\
 T_n &= 14.328 \text{ k} \\
 \Omega_t &= 1.67, \phi_t = 0.9
 \end{aligned}$$

Eq. D2-1

$$\begin{aligned}
 A_n &= 0.23289 \text{ in}^2, F_u = 65 \text{ ksi} \\
 T_n &= 15.138 \text{ k} \\
 \Omega_t &= 2, \phi_t = 0.75
 \end{aligned}$$

Eq. D3-1

Shear Strength

Stud element 2

$$\begin{aligned}
 V_n &= 1.4492 \text{ k at } 180 \text{ deg} \\
 \Omega_v &= 1.67, \phi_v = 0.9
 \end{aligned}$$

Eq. G2.1-2

Stud element 3

$$\begin{aligned}
 V_{yh} &= 1.4446 \text{ k} \\
 k_v &= 3.7215 \\
 V_{crh} &= 0.3714 \text{ k} \\
 V_n &= 0.53568 \text{ k at } 90 \text{ deg} \\
 \Omega_v &= 1.67, \phi_v = 0.9
 \end{aligned}$$

Eq. G3-2
Eq. G3-8
Eq. G3-6
Eq. G2.1-2

Stud element 4

$$\begin{aligned}
 V_n &= 1.4492 \text{ k at } 0 \text{ deg} \\
 \Omega_v &= 1.67, \phi_v = 0.9
 \end{aligned}$$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.5157 \text{ in}$

$$\begin{aligned}
 f_1 &= 50 \text{ ksi}, f_2 = 50 \text{ ksi} \\
 \psi &= 1 \\
 k &= 0.43 \\
 \lambda &= 1.0916 \\
 \rho &= 0.73148 \\
 b &= 0.37723 \text{ in (ineffective width} = 0.13847 \text{ in)}
 \end{aligned}$$

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$\begin{aligned}
 S &= 31.091 \\
 I_a &= 0.00020486 \text{ in}^4 \\
 I_s &= 0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)} \\
 k &= 3.4958
 \end{aligned}$$

Eq. 1.3-7
Eq. 1.3-8

Element 2: Partially stiffened, $w = 1.7814 \text{ in}$

$$\begin{aligned}
 f &= 50 \text{ ksi}, k = 3.4958 \\
 \lambda &= 1.3224 \\
 \rho &= 0.63039 \\
 b &= 1.123 \text{ in (ineffective width} = 0.65843 \text{ in)} \\
 b_1 &= 0.56148 \text{ in}, b_2 = 0.56148 \text{ in}
 \end{aligned}$$

Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$$\begin{aligned}
 f_1 &= 50 \text{ ksi}, f_2 = 50 \text{ ksi} \\
 \psi &= 1 \\
 k &= 0.43 \\
 \lambda &= 2.4144 \\
 \rho &= 0.37643 \\
 b &= 0.4294 \text{ in (ineffective width} = 0.7113 \text{ in)} \\
 f_1 &= 50 \text{ ksi}, f_2 = 50 \text{ ksi}
 \end{aligned}$$

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.4144$	Eq. 1.1-3
$\rho=0.37643$	Eq. 1.1-2
$b=0.4294$ in (ineffective width=0.7113 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723$ in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00020486$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.4958$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7814$ in	
$f=50$ ksi, $k=3.4958$	
$\lambda=1.3224$	Eq. 1.1-3
$\rho=0.63039$	Eq. 1.1-2
$b=1.123$ in (ineffective width=0.65843 in)	Eq. 1.1-1
$b_1=0.56148$ in, $b_2=0.56148$ in	
$A_e=0.13878$ in ² , $F_n=50$ ksi	
$P_n=6.9388$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.664$ ksi, $f_2=23.287$ ksi	
$\psi=0.48855$	Eq. 1.2.2-1
$k=0.6976$	Eq. 1.2.2-2
$\lambda=1.8508$	Eq. 1.1-3
$\rho=0.47608$	Eq. 1.1-2
$b=0.54307$ in (ineffective width=0.59763 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=47.664$ ksi, $f_2=36.643$ ksi	
$\psi=0.76878$	Eq. 1.2.2-1
$k=0.52129$	Eq. 1.2.2-2
$\lambda=0.96794$	Eq. 1.1-3
$\rho=0.79831$	Eq. 1.1-2
$b=0.41169$ in (ineffective width=0.10401 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.195$	Eq. 1.3-7
$I_a=0.00020419$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.4958$	Table 1.3-1

Element 4: Partially stiffened, $w=1.7814$ in

$f=49.667$ ksi, $k=3.4958$

$\lambda=1.318$

Eq. 1.1-3

$\rho=0.63208$

Eq. 1.1-2

$b=1.126$ in (ineffective width= 0.65542 in)

Eq. 1.1-1

$b_1=0.56299$ in, $b_2=0.56299$ in

Center of gravity shift: $y=-0.3399$ in

$S_{xe}=0.25461$ in³, $F_y=50$ ksi

$M_{nl}=12.731$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=47.664$ ksi, $f_2=36.643$ ksi

$\psi=0.76878$

Eq. 1.2.2-1

$k=0.52129$

Eq. 1.2.2-2

$\lambda=0.96794$

Eq. 1.1-3

$\rho=0.79831$

Eq. 1.1-2

$b=0.41169$ in (ineffective width= 0.10401 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.195$

Eq. 1.3-7

$I_a=0.00020419$ in⁴

Eq. 1.3-8

$I_s=0.00035659$ in⁴ > I_a (no lip reduction)

$k=3.4958$

Table 1.3-1

Element 2: Partially stiffened, $w=1.7814$ in

$f=49.667$ ksi, $k=3.4958$

$\lambda=1.318$

Eq. 1.1-3

$\rho=0.63208$

Eq. 1.1-2

$b=1.126$ in (ineffective width= 0.65542 in)

Eq. 1.1-1

$b_1=0.56299$ in, $b_2=0.56299$ in

Element 3: Treat as two unstiffened elements

$f_1=47.664$ ksi, $f_2=23.287$ ksi

$\psi=0.48855$

Eq. 1.2.2-1

$k=0.6976$

Eq. 1.2.2-2

$\lambda=1.8508$

Eq. 1.1-3

$\rho=0.47608$

Eq. 1.1-2

$b=0.54307$ in (ineffective width= 0.59763 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.3399$ in

$S_{xe}=0.25461$ in³, $F_y=50$ ksi

$M_{nl}=12.731$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.355$ ksi, $f_2=49.355$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0845$	Eq. 1.1-3
$\rho=0.73504$	Eq. 1.1-2
$b=0.37906$ in (ineffective width=0.13664 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.7814$ in	
$f_1=45.478$ ksi, $f_2=-28.225$ ksi	
$\psi=0.62063$	Eq. 1.1.2-1
$k=15.754$	Eq. 1.1.2-2
$\lambda=0.5941$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7814$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.49201$ in	Eq. 1.1.2-3
$b_2=0.8907$ in	Eq. 1.1.2-4
Compression width=1.0992 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=49.355$ ksi, $f_2=49.355$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=1.0845$	Eq. 1.1-3
$\rho=0.73504$	Eq. 1.1-2
$b=0.37906$ in (ineffective width=0.13664 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.7814$ in	
$f_1=45.478$ ksi, $f_2=-28.225$ ksi	
$\psi=0.62063$	Eq. 1.1.2-1
$k=15.754$	Eq. 1.1.2-2
$\lambda=0.5941$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7814$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.49201$ in	Eq. 1.1.2-3
$b_2=0.8907$ in	Eq. 1.1.2-4
Compression width=1.0992 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.043675$ in	
$S_y=0.10606$ in ³ , $F_y=50$ ksi	
$M_n=5.3028$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7814$ in

$f_1=44.679$ ksi, $f_2=-42.04$ ksi

$\psi=0.94093$

$k=22.506$

$\lambda=0.49268$

$\rho=1$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

be=1.7814 in	Eq. 1.1-1
h _o =2 in, b _o =4 in, h _o /b _o =0.5	
b ₁ =0.45203 in	Eq. 1.1.2-3
b ₂ =0.8907 in	Eq. 1.1.2-4
Compression width=0.91781 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.241 ksi, f ₂ =49.241 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.396	Eq. 1.1-3
ρ=0.37903	Eq. 1.1-2
b=0.43236 in (ineffective width=0.70834 in)	Eq. 1.1-1
f ₁ =49.241 ksi, f ₂ =49.241 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.396	Eq. 1.1-3
ρ=0.37903	Eq. 1.1-2
b=0.43236 in (ineffective width=0.70834 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=1.7814 in	
f ₁ =44.679 ksi, f ₂ =-42.04 ksi	
ψ=0.94093	Eq. 1.1.2-1
k=22.506	Eq. 1.1.2-2
λ=0.49268	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=1.7814 in	Eq. 1.1-1
h _o =2 in, b _o =4 in, h _o /b _o =0.5	
b ₁ =0.45203 in	Eq. 1.1.2-3
b ₂ =0.8907 in	Eq. 1.1.2-4
Compression width=0.91781 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.19198 in	
S _{ye} =0.10049 in ³ , F _y =50 ksi	
M _{nl} =5.0244 k-in	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =0.6031 in ⁶ , W _n =3.6957 in ² , F _y =50 ksi	
B _n =8.1595 k-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

400S200-33

Full Section Properties

Area	0.30970 in ²	Wt.	0.0010530 k/ft	Flat	8.9507 in
I _x	0.8121 in ⁴	r _x	1.6193 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.40605 in ³	y(t)	2.0000 in	α	0.000 deg
S _x (b)	0.40605 in ³	y(b)	2.0000 in		
Z _x	0.46517 in ³	Height	4.0000 in		
I _y	0.1832 in ⁴	r _y	0.7690 in	x _o	-1.6870 in
S _y (l)	0.26238 in ³	x(l)	0.6981 in	y _o	0.0000 in
S _y (r)	0.14068 in ³	x(r)	1.3019 in	j _x	2.4251 in
Z _y	0.20473 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	0.8121 in ⁴	r ₁	1.6193 in	C _w	0.67347 in ⁶
I ₂	0.1832 in ⁴	r ₂	0.7690 in	J	0.0001236 in ⁴
I _c	0.9953 in ⁴	r _c	1.7927 in		
I _o	1.8767 in ⁴	r _o	2.4617 in		

Net Section Properties

I _x	0.8024 in ⁴	r _x	1.7642 in	Area	0.25780 in ²
S _x (t)	0.40119 in ³	y(t)	2.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.40119 in ³	y(b)	2.0000 in	α	0.000 deg
Z _x	0.44570 in ³				
I _y	0.1543 in ⁴	r _y	0.7735 in	x _o	-1.8363 in
S _y (l)	0.18471 in ³	x(l)	0.8351 in	y _o	0.0000 in
S _y (r)	0.13243 in ³	x(r)	1.1649 in	j _x	2.2230 in
Z _y	0.17968 in ³			j _y	0.0000 in
I _c	0.9566 in ⁴	r _c	1.9264 in	C _w	0.66350 in ⁶
I _o	1.8259 in ⁴	r _o	2.6614 in	J	0.00010287 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	7.026 k	φM _{nxo}	13.515 k-in	φM _{nyo}	5.421 k-in
A _e	0.16532 in ²	I _{xe}	0.68471 in ⁴	I _{ye}	0.14437 in ⁴
φT _n	12.568 k	S _{xe} (t)	0.30033 in ³	S _{ye} (l)	0.18008 in ³
		S _{xe} (b)	0.39804 in ³	S _{ye} (r)	0.12048 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.601 k	φM _{nxo}	13.515 k-in	φM _{nyo}	5.191 k-in
φV _{nx}	3.083 k	I _{xe}	0.68471 in ⁴	I _{ye}	0.11682 in ⁴
Torsion		S _{xe} (t)	0.39804 in ³	S _{ye} (l)	0.11536 in ³
φB _n	8.1063 k-in ²	S _{xe} (b)	0.30033 in ³	S _{ye} (r)	0.11832 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.333$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.88$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.3097 \text{ in}^2$, $F_y=51.333 \text{ ksi}$
 $T_n=15.898 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.2578 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=16.757 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1.7129 \text{ k}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=1.5984 \text{ k}$

Eq. G3-2

$k_v=3.7205$

Eq. G3-8

$V_{crh}=0.50642 \text{ k}$

Eq. G3-6

$V_n=0.66754 \text{ k}$ at 90 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1.7129 \text{ k}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.98104$

Eq. 1.1-3

$\rho=0.79074$

Eq. 1.1-2

$b=0.40644 \text{ in}$ (ineffective width=0.10756 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00027958 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)

$k=3.4924$

Table 1.3-1

Element 2: Partially stiffened, $w=1.778 \text{ in}$

$f=50 \text{ ksi}$, $k=3.4924$

$\lambda=1.1908$

Eq. 1.1-3

$\rho=0.68464$

Eq. 1.1-2

$b=1.2173 \text{ in}$ (ineffective width=0.56072 in)

Eq. 1.1-1

$b_1=0.60864 \text{ in}$, $b_2=0.60864 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.1739$

Eq. 1.1-3

$\rho=0.41344$

Eq. 1.1-2

$b=0.47091 \text{ in}$ (ineffective width=0.66809 in)

Eq. 1.1-1

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.1739$	Eq. 1.1-3
$\rho=0.41344$	Eq. 1.1-2
$b=0.47091$ in (ineffective width=0.66809 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00027958$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.4924$	Table 1.3-1
Element 4: Partially stiffened, $w=1.778$ in	
$f=50$ ksi, $k=3.4924$	
$\lambda=1.1908$	Eq. 1.1-3
$\rho=0.68464$	Eq. 1.1-2
$b=1.2173$ in (ineffective width=0.56072 in)	Eq. 1.1-1
$b_1=0.60864$ in, $b_2=0.60864$ in	
$A_e=0.16532$ in ² , $F_n=50$ ksi	
$P_n=8.2659$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.565$ ksi, $f_2=22.583$ ksi	
$\psi=0.47478$	Eq. 1.2.2-1
$k=0.7094$	Eq. 1.2.2-2
$\lambda=1.6508$	Eq. 1.1-3
$\rho=0.52503$	Eq. 1.1-2
$b=0.59801$ in (ineffective width=0.54099 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=47.565$ ksi, $f_2=36.291$ ksi	
$\psi=0.76298$	Eq. 1.2.2-1
$k=0.52403$	Eq. 1.2.2-2
$\lambda=0.86677$	Eq. 1.1-3
$\rho=0.86088$	Eq. 1.1-2
$b=0.44249$ in (ineffective width=0.071508 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.21$	Eq. 1.3-7
$I_a=0.00027854$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.4924$	Table 1.3-1

Element 4: Partially stiffened, $w=1.778$ in

$f=49.621$ ksi, $k=3.4924$

$\lambda=1.1862$

Eq. 1.1-3

$\rho=0.68665$

Eq. 1.1-2

$b=1.2209$ in (ineffective width= 0.55713 in)

Eq. 1.1-1

$b_1=0.61044$ in, $b_2=0.61044$ in

Center of gravity shift: $y=-0.27982$ in

$S_{xe}=0.30033$ in³, $F_y=50$ ksi

$M_{nl}=15.017$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=47.565$ ksi, $f_2=36.291$ ksi

$\psi=0.76298$

Eq. 1.2.2-1

$k=0.52403$

Eq. 1.2.2-2

$\lambda=0.86677$

Eq. 1.1-3

$\rho=0.86088$

Eq. 1.1-2

$b=0.44249$ in (ineffective width= 0.071508 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.21$

Eq. 1.3-7

$I_a=0.00027854$ in⁴

Eq. 1.3-8

$I_s=0.00039155$ in⁴ > I_a (no lip reduction)

$k=3.4924$

Table 1.3-1

Element 2: Partially stiffened, $w=1.778$ in

$f=49.621$ ksi, $k=3.4924$

$\lambda=1.1862$

Eq. 1.1-3

$\rho=0.68665$

Eq. 1.1-2

$b=1.2209$ in (ineffective width= 0.55713 in)

Eq. 1.1-1

$b_1=0.61044$ in, $b_2=0.61044$ in

Element 3: Treat as two unstiffened elements

$f_1=47.565$ ksi, $f_2=22.583$ ksi

$\psi=0.47478$

Eq. 1.2.2-1

$k=0.7094$

Eq. 1.2.2-2

$\lambda=1.6508$

Eq. 1.1-3

$\rho=0.52503$

Eq. 1.1-2

$b=0.59801$ in (ineffective width= 0.54099 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.27982$ in

$S_{xe}=0.30033$ in³, $F_y=50$ ksi

$M_{nl}=15.017$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.278$ ksi, $f_2=49.278$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=0.97394$	Eq. 1.1-3
$\rho=0.79483$	Eq. 1.1-2
$b=0.40854$ in (ineffective width=0.10546 in)	Eq. 1.1-1
Element 2: Stiffened, $w=1.778$ in	
$f_1=45.368$ ksi, $f_2=-28.821$ ksi	
$\psi=0.63528$	Eq. 1.1.2-1
$k=16.016$	Eq. 1.1.2-2
$\lambda=0.52966$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.778$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.4891$ in	Eq. 1.1.2-3
$b_2=0.889$ in	Eq. 1.1.2-4
Compression width=1.0873 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.514$ in	
$f_1=49.278$ ksi, $f_2=49.278$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=0.97394$	Eq. 1.1-3
$\rho=0.79483$	Eq. 1.1-2
$b=0.40854$ in (ineffective width=0.10546 in)	Eq. 1.1-1
Element 4: Stiffened, $w=1.778$ in	
$f_1=45.368$ ksi, $f_2=-28.821$ ksi	
$\psi=0.63528$	Eq. 1.1.2-1
$k=16.016$	Eq. 1.1.2-2
$\lambda=0.52966$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.778$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.4891$ in	Eq. 1.1.2-3
$b_2=0.889$ in	Eq. 1.1.2-4
Compression width=1.0873 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=-0.033432$ in	
$S_y=0.12048$ in ³ , $F_y=50$ ksi	
$M_n=6.0238$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about Y-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: Stiffened, $w=1.778$ in	
$f_1=44.519$ ksi, $f_2=-43.268$ ksi	
$\psi=0.97189$	Eq. 1.1.2-1
$k=23.279$	Eq. 1.1.2-2
$\lambda=0.43521$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2

be=1.778 in	Eq. 1.1-1
h _o =2 in, b _o =4 in, h _o /b _o =0.5	
b ₁ =0.44765 in	Eq. 1.1.2-3
b ₂ =0.889 in	Eq. 1.1.2-4
Compression width=0.90167 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.146 ksi, f ₂ =49.146 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.1553	Eq. 1.1-3
ρ=0.41661	Eq. 1.1-2
b=0.47452 in (ineffective width=0.66448 in)	Eq. 1.1-1
f ₁ =49.146 ksi, f ₂ =49.146 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.1553	Eq. 1.1-3
ρ=0.41661	Eq. 1.1-2
b=0.47452 in (ineffective width=0.66448 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=1.778 in	
f ₁ =44.519 ksi, f ₂ =-43.268 ksi	
ψ=0.97189	Eq. 1.1.2-1
k=23.279	Eq. 1.1.2-2
λ=0.43521	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=1.778 in	Eq. 1.1-1
h _o =2 in, b _o =4 in, h _o /b _o =0.5	
b ₁ =0.44765 in	Eq. 1.1.2-3
b ₂ =0.889 in	Eq. 1.1.2-4
Compression width=0.90167 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.17754 in	
S _{ye} =0.11536 in ³ , F _y =50 ksi	
M _{nl} =5.768 k-in	Eq. F3.1-1
Ω _b =1.67, ϕ _b =0.9	
Bimoment Strength, Stud	
C _w =0.6635 in ⁶ , W _n =3.6832 in ² , F _y =50 ksi	
B _n =9.007 k-in ²	G8.1-1
Ω _b =1.67, ϕ _b =0.9	

400S200-43

Full Section Properties

Area	0.40178 in ²	Wt.	0.0013661 k/ft	Flat	8.9086 in
I _x	1.0477 in ⁴	r _x	1.6148 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.52383 in ³	y(t)	2.0000 in	α	0.000 deg
S _x (b)	0.52383 in ³	y(b)	2.0000 in		
Z _x	0.60169 in ³	Height	4.0000 in		
I _y	0.2349 in ⁴	r _y	0.7645 in	x _o	-1.6751 in
S _y (l)	0.33634 in ³	x(l)	0.6983 in	y _o	0.0000 in
S _y (r)	0.18042 in ³	x(r)	1.3017 in	j _x	2.4148 in
Z _y	0.26383 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	1.0477 in ⁴	r ₁	1.6148 in	C _w	0.85649 in ⁶
I ₂	0.2349 in ⁴	r ₂	0.7645 in	J	0.0002724 in ⁴
I _c	1.2825 in ⁴	r _c	1.7866 in		
I _o	2.4098 in ⁴	r _o	2.4491 in		

Net Section Properties

I _x	1.0350 in ⁴	r _x	1.7600 in	Area	0.33413 in ²
S _x (t)	0.51748 in ³	y(t)	2.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.51748 in ³	y(b)	2.0000 in	α	0.000 deg
Z _x	0.57633 in ³				
I _y	0.1977 in ⁴	r _y	0.7692 in	x _o	-1.8241 in
S _y (l)	0.23674 in ³	x(l)	0.8351 in	y _o	0.0000 in
S _y (r)	0.16971 in ³	x(r)	1.1649 in	j _x	2.2119 in
Z _y	0.23153 in ³			j _y	0.0000 in
I _c	1.2327 in ⁴	r _c	1.9207 in	C _w	0.84367 in ⁶
I _o	2.3445 in ⁴	r _o	2.6489 in	J	0.0002265 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	10.393 k	φM _{nxo}	19.576 k-in	φM _{nyo}	7.474 k-in
A _e	0.24453 in ²	I _{xe}	0.94489 in ⁴	I _{ye}	0.19477 in ⁴
φT _n	16.289 k	S _{xe} (t)	0.43503 in ³	S _{ye} (l)	0.23540 in ³
		S _{xe} (b)	0.51691 in ³	S _{ye} (r)	0.16610 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.040 k	φM _{nxo}	19.576 k-in	φM _{nyo}	7.050 k-in
φV _{nx}	4.304 k	I _{xe}	0.94489 in ⁴	I _{ye}	0.16180 in ⁴
Torsion		S _{xe} (t)	0.51691 in ³	S _{ye} (l)	0.16727 in ³
φB _n	10.416 k-in ²	S _{xe} (b)	0.43503 in ³	S _{ye} (r)	0.15667 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.632$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=53.526$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$$\begin{aligned}
 A_g &= 0.40178 \text{ in}^2, F_y = 51.632 \text{ ksi} \\
 T_n &= 20.745 \text{ k} \\
 \Omega_t &= 1.67, \phi_t = 0.9
 \end{aligned}$$

Eq. D2-1

$$\begin{aligned}
 A_n &= 0.33413 \text{ in}^2, F_u = 65 \text{ ksi} \\
 T_n &= 21.718 \text{ k} \\
 \Omega_t &= 2, \phi_t = 0.75
 \end{aligned}$$

Eq. D3-1

Shear Strength

Stud element 2

$$V_n = 2.3913 \text{ k at } 180 \text{ deg}$$

Eq. G2.1-1

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 2.069 \text{ k}$$

Eq. G3-2

$$k_v = 3.7173$$

Eq. G3-8

$$V_{crh} = 1.1208 \text{ k}$$

Eq. G3-6

$$V_n = 1.1559 \text{ k at } 90 \text{ deg}$$

Eq. G2.1-2

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 2.3913 \text{ k at } 0 \text{ deg}$$

Eq. G2.1-1

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.5087 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1$$

Eq. 1.2.2-1

$$k = 0.43$$

Eq. 1.2.2-3

$$\lambda = 0.74488$$

Eq. 1.1-3

$$\rho = 0.94599$$

Eq. 1.1-2

$$b = 0.48123 \text{ in (ineffective width} = 0.027474 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S = 31.091$$

Eq. 1.3-7

$$I_a = 0.00062038 \text{ in}^4$$

Eq. 1.3-8

$$I_s = 0.00049474 \text{ in}^4$$

$$d_s = 0.38377 \text{ in (lip ineffective width} = 0.097452 \text{ in)}$$

Eq. 1.3-6

$$k = 3.2601$$

Table 1.3-1

Element 2: Partially stiffened, $w = 1.7674 \text{ in}$

$$f = 50 \text{ ksi}, k = 3.2601$$

$$\lambda = 0.93989$$

Eq. 1.1-3

$$\rho = 0.81492$$

Eq. 1.1-2

$$b = 1.4403 \text{ in (ineffective width} = 0.32712 \text{ in)}$$

Eq. 1.1-1

$$b_1 = 0.57431 \text{ in}, b_2 = 0.86598 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1$$

Eq. 1.2.2-1

$$k = 0.43$$

Eq. 1.2.2-3

$$\lambda = 1.6601$$

Eq. 1.1-3

$$\rho = 0.52256$$

Eq. 1.1-2

$$b = 0.59242 \text{ in (ineffective width} = 0.54128 \text{ in)}$$

Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.6601$	Eq. 1.1-3
$\rho=0.52256$	Eq. 1.1-2
$b=0.59242$ in (ineffective width=0.54128 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123$ in (ineffective width=0.027474 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00062038$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$ds=0.38377$ in (lip ineffective width=0.097452 in)	Eq. 1.3-6
$k=3.2601$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7674$ in	
$f=50$ ksi, $k=3.2601$	
$\lambda=0.93989$	Eq. 1.1-3
$\rho=0.81492$	Eq. 1.1-2
$b=1.4403$ in (ineffective width=0.32712 in)	Eq. 1.1-1
$b_1=0.57431$ in, $b_2=0.86598$ in	
$A_e=0.24453$ in ² , $F_n=50$ ksi	
$P_n=12.227$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.323$ ksi, $f_2=21.224$ ksi	
$\psi=0.44849$	Eq. 1.2.2-1
$k=0.73305$	Eq. 1.2.2-2
$\lambda=1.2369$	Eq. 1.1-3
$\rho=0.66467$	Eq. 1.1-2
$b=0.75353$ in (ineffective width=0.38017 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=47.323$ ksi, $f_2=35.612$ ksi	
$\psi=0.75253$	Eq. 1.2.2-1
$k=0.52905$	Eq. 1.2.2-2
$\lambda=0.65332$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.254$	Eq. 1.3-7
$I_a=0.00061725$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	

ds=0.40774 in (lip ineffective width=0.10096 in)	Eq. 1.3-6
k=3.2649	Table 1.3-1
Element 4: Partially stiffened, w=1.7674 in	
f=49.481 ksi, k=3.2649	
$\lambda=0.93431$	Eq. 1.1-3
$\rho=0.81828$	Eq. 1.1-2
b=1.4462 in (ineffective width=0.32117 in)	Eq. 1.1-1
b ₁ =0.5796 in, b ₂ =0.86664 in	
Center of gravity shift: y=-0.17202 in	
S _{xe} =0.43503 in ³ , F _y =50 ksi	
M _{nl} =21.752 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.5087 in	
f ₁ =47.323 ksi, f ₂ =35.612 ksi	
$\psi=0.75253$	Eq. 1.2.2-1
k=0.52905	Eq. 1.2.2-2
$\lambda=0.65332$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.254	Eq. 1.3-7
I _a =0.00061725 in ⁴	Eq. 1.3-8
I _s =0.00049474 in ⁴	
ds=0.40774 in (lip ineffective width=0.10096 in)	Eq. 1.3-6
k=3.2649	Table 1.3-1
Element 2: Partially stiffened, w=1.7674 in	
f=49.481 ksi, k=3.2649	
$\lambda=0.93431$	Eq. 1.1-3
$\rho=0.81828$	Eq. 1.1-2
b=1.4462 in (ineffective width=0.32117 in)	Eq. 1.1-1
b ₁ =0.5796 in, b ₂ =0.86664 in	
Element 3: Treat as two unstiffened elements	
f ₁ =47.323 ksi, f ₂ =21.224 ksi	
$\psi=0.44849$	Eq. 1.2.2-1
k=0.73305	Eq. 1.2.2-2
$\lambda=1.2369$	Eq. 1.1-3
$\rho=0.66467$	Eq. 1.1-2
b=0.75353 in (ineffective width=0.38017 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.17202 in	
S _{xe} =0.43503 in ³ , F _y =50 ksi	
M _{nl} =21.752 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Positive Flexural Strength about Y-axis
Effective width calculations for Stud
Element 1: Unstiffened, w=0.5087 in

$f_1=49.038$ ksi, $f_2=49.038$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73768$

Eq. 1.1-3

$\rho=0.95131$

Eq. 1.1-2

$b=0.48393$ in (ineffective width= 0.024766 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.7674$ in

$f_1=45.041$ ksi, $f_2=-30.321$ ksi

$\psi=0.6732$

Eq. 1.1.2-1

$k=16.715$

Eq. 1.1.2-2

$\lambda=0.39397$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.7674$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.48116$ in

Eq. 1.1.2-3

$b_2=0.8837$ in

Eq. 1.1.2-4

Compression width= 1.0563 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=49.038$ ksi, $f_2=49.038$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73768$

Eq. 1.1-3

$\rho=0.95131$

Eq. 1.1-2

$b=0.48393$ in (ineffective width= 0.024766 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.7674$ in

$f_1=45.041$ ksi, $f_2=-30.321$ ksi

$\psi=0.6732$

Eq. 1.1.2-1

$k=16.715$

Eq. 1.1.2-2

$\lambda=0.39397$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.7674$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.48116$ in

Eq. 1.1.2-3

$b_2=0.8837$ in

Eq. 1.1.2-4

Compression width= 1.0563 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.007689$ in

$S_y=0.1661$ in³, $F_y=50$ ksi

$M_{nl}=8.3048$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7674$ in

$f_1=41.164$ ksi, $f_2=-44.372$ ksi

$\psi=1.0779$

Eq. 1.1.2-1

$k=26.1$

Eq. 1.1.2-2

$\lambda=0.3014$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7674$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=4$ in, $h_o/b_o=0.5$	
$b_1=0.43341$ in	Eq. 1.1.2-3
$b_2=0.8837$ in	Eq. 1.1.2-4
Compression width=0.85056 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=45.701$ ksi, $f_2=45.701$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5871$	Eq. 1.1-3
$\rho=0.54274$	Eq. 1.1-2
$b=0.61531$ in (ineffective width=0.51839 in)	Eq. 1.1-1
$f_1=45.701$ ksi, $f_2=45.701$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5871$	Eq. 1.1-3
$\rho=0.54274$	Eq. 1.1-2
$b=0.61531$ in (ineffective width=0.51839 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.7674$ in	
$f_1=41.164$ ksi, $f_2=-44.372$ ksi	
$\psi=1.0779$	Eq. 1.1.2-1
$k=26.1$	Eq. 1.1.2-2
$\lambda=0.3014$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.7674$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=4$ in, $h_o/b_o=0.5$	
$b_1=0.43341$ in	Eq. 1.1.2-3
$b_2=0.8837$ in	Eq. 1.1.2-4
Compression width=0.85056 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.13221$ in	
$S_y=0.15667$ in ³ , $F_y=50$ ksi	
$M_n=7.8337$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=0.84367$ in ⁶ , $W_n=3.645$ in ² , $F_y=50$ ksi	
$B_n=11.573$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400S200-54

Full Section Properties

Area	0.49974 in ²	Wt.	0.0016991 k/ft	Flat	8.8293 in
Ix	1.2923 in ⁴	rx	1.6081 in	Ixy	0.0000 in ⁴
Sx(t)	0.64617 in ³	y(t)	2.0000 in	α	0.000 deg
Sx(b)	0.64617 in ³	y(b)	2.0000 in		
Zx	0.74499 in ³	Height	4.0000 in		
Iy	0.2874 in ⁴	ry	0.7584 in	x _o	-1.6603 in
Sy(l)	0.41213 in ³	x(l)	0.6974 in	y _o	0.0000 in
Sy(r)	0.22063 in ³	x(r)	1.3027 in	jx	2.4043 in
Zy	0.32506 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	1.2923 in ⁴	r ₁	1.6081 in	Cw	1.0378 in ⁶
I ₂	0.2874 in ⁴	r ₂	0.7584 in	J	0.0005336 in ⁴
Ic	1.5797 in ⁴	rc	1.7780 in		
I _o	2.9573 in ⁴	r _o	2.4326 in		

Net Section Properties

Ix	1.2764 in ⁴	rx	1.7541 in	Area	0.41484 in ²
Sx(t)	0.63821 in ³	y(t)	2.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.63821 in ³	y(b)	2.0000 in	α	0.000 deg
Zx	0.71316 in ³				
Iy	0.2416 in ⁴	ry	0.7631 in	x _o	-1.8096 in
Sy(l)	0.28958 in ³	x(l)	0.8343 in	y _o	0.0000 in
Sy(r)	0.20725 in ³	x(r)	1.1657 in	jx	2.2001 in
Zy	0.28501 in ³			jy	0.0000 in
Ic	1.5180 in ⁴	rc	1.9129 in	Cw	1.0219 in ⁶
I _o	2.8764 in ⁴	r _o	2.6332 in	J	0.0004430 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	13.795 k	φM _n x _o	25.457 k-in	φM _n y _o	10.599 k-in
A _e	0.32460 in ²	I _x e	1.2004 in ⁴	I _y e	0.2416 in ⁴
φT _n	20.223 k	S _x e(t)	0.56570 in ³	S _y e(l)	0.28958 in ³
		S _x e(b)	0.63916 in ³	S _y e(r)	0.20725 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.600 k	φM _n x _o	25.457 k-in	φM _n y _o	8.891 k-in
φV _{nx}	5.248 k	I _x e	1.2004 in ⁴	I _y e	0.2141 in ⁴
Torsion		S _x e(t)	0.63916 in ³	S _y e(l)	0.23354 in ³
φB _n	12.772 k-in ²	S _x e(b)	0.56570 in ³	S _y e(r)	0.19758 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=52.045$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=54.356$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.49974$ in², $F_y=52.045$ ksi

$T_n=26.009$ k
 $\Omega_t=1.67$, $\phi_t=0.9$ Eq. D2-1

$A_n=0.41484$ in², $F_u=65$ ksi
 $T_n=26.964$ k
 $\Omega_t=2$, $\phi_t=0.75$ Eq. D3-1

Shear Strength

Stud element 2
 $V_n=2.9155$ k at 180 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=2.5102$ k Eq. G3-2
 $k_v=3.7018$ Eq. G3-8
 $V_{crh}=2.2078$ k Eq. G3-6
 $V_n=1.7782$ k at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=2.9155$ k at 0 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56413$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0011127$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $d_s=0.23166$ in (lip ineffective width=0.25184 in) Eq. 1.3-6
 $k=2.7693$ Table 1.3-1

Element 2: Partially stiffened, $w=1.717$ in
 $f=50$ ksi, $k=2.7693$
 $\lambda=0.78941$ Eq. 1.1-3
 $\rho=0.91373$ Eq. 1.1-2
 $b=1.5689$ in (ineffective width=0.14812 in) Eq. 1.1-1
 $b_1=0.37585$ in, $b_2=1.193$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.2934$ Eq. 1.1-3
 $\rho=0.64166$ Eq. 1.1-2
 $b=0.71128$ in (ineffective width=0.39722 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2934$	Eq. 1.1-3
$\rho=0.64166$	Eq. 1.1-2
$b=0.71128$ in (ineffective width=0.39722 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0011127$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.23166$ in (lip ineffective width=0.25184 in)	Eq. 1.3-6
$k=2.7693$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	
$f=50$ ksi, $k=2.7693$	
$\lambda=0.78941$	Eq. 1.1-3
$\rho=0.91373$	Eq. 1.1-2
$b=1.5689$ in (ineffective width=0.14812 in)	Eq. 1.1-1
$b_1=0.37585$ in, $b_2=1.193$ in	
$A_e=0.3246$ in ² , $F_n=50$ ksi	
$P_n=16.23$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.666$ ksi, $f_2=20.545$ ksi	
$\psi=0.44025$	Eq. 1.2.2-1
$k=0.74078$	Eq. 1.2.2-2
$\lambda=0.95197$	Eq. 1.1-3
$\rho=0.80769$	Eq. 1.1-2
$b=0.89533$ in (ineffective width=0.21317 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=46.666$ ksi, $f_2=35.272$ ksi	
$\psi=0.75585$	Eq. 1.2.2-1
$k=0.52744$	Eq. 1.2.2-2
$\lambda=0.49209$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.301$	Eq. 1.3-7
$I_a=0.0010794$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.23881$ in (lip ineffective width=0.24469 in)	Eq. 1.3-6
$k=2.7907$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	

$f=49.333$ ksi, $k=2.7907$

$\lambda=0.78111$

Eq. 1.1-3

$\rho=0.91965$

Eq. 1.1-2

$b=1.579$ in (ineffective width= 0.13796 in)

Eq. 1.1-1

$b_1=0.38996$ in, $b_2=1.1891$ in

Center of gravity shift: $y=-0.12193$ in

$S_{xe}=0.5657$ in³, $F_y=50$ ksi

$M_{nl}=28.285$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=46.666$ ksi, $f_2=35.272$ ksi

$\psi=0.75585$

Eq. 1.2.2-1

$k=0.52744$

Eq. 1.2.2-2

$\lambda=0.49209$

Eq. 1.1-3

$\lambda<0.673$ (fully effective)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.301$

Eq. 1.3-7

$I_a=0.0010794$ in⁴

Eq. 1.3-8

$I_s=0.00053312$ in⁴

$d_s=0.23881$ in (lip ineffective width= 0.24469 in)

Eq. 1.3-6

$k=2.7907$

Table 1.3-1

Element 2: Partially stiffened, $w=1.717$ in

$f=49.333$ ksi, $k=2.7907$

$\lambda=0.78111$

Eq. 1.1-3

$\rho=0.91965$

Eq. 1.1-2

$b=1.579$ in (ineffective width= 0.13796 in)

Eq. 1.1-1

$b_1=0.38996$ in, $b_2=1.1891$ in

Element 3: Treat as two unstiffened elements

$f_1=46.666$ ksi, $f_2=20.545$ ksi

$\psi=0.44025$

Eq. 1.2.2-1

$k=0.74078$

Eq. 1.2.2-2

$\lambda=0.95197$

Eq. 1.1-3

$\rho=0.80769$

Eq. 1.1-2

$b=0.89533$ in (ineffective width= 0.21317 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.12193$ in

$S_{xe}=0.5657$ in³, $F_y=50$ ksi

$M_{nl}=28.285$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=55.446$ ksi, $f_2=55.446$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59406$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.717$ in	
$f_1=49.928$ ksi, $f_2=-33.771$ ksi	
$\psi=0.67639$	Eq. 1.1.2-1
$k=16.775$	Eq. 1.1.2-2
$\lambda=0.32051$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.46703$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=1.0242 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=55.446$ ksi, $f_2=55.446$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.59406$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.717$ in	
$f_1=49.928$ ksi, $f_2=-33.771$ ksi	
$\psi=0.67639$	Eq. 1.1.2-1
$k=16.775$	Eq. 1.1.2-2
$\lambda=0.32051$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$	
$b_1=0.46703$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=1.0242 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_{ye}=0.20725$ in ³ , $F_y=56.825$ ksi	
$M_n I=11.777$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.717$ in

$f_1=35.748$ ksi, $f_2=-43.471$ ksi

$\psi=1.2161$

$k=30.198$

$\lambda=0.20214$

$\rho=1$

$b_e=1.717$ in

$h_o=2$ in, $b_o=4$ in, $h_o/b_o=0.5$

$b_1=0.40725$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.7748 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=40.971$ ksi, $f_2=40.971$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.1708$	Eq. 1.1-3
$\rho=0.69364$	Eq. 1.1-2
$b=0.7689$ in (ineffective width=0.3396 in)	Eq. 1.1-1
$f_1=40.971$ ksi, $f_2=40.971$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.1708$	Eq. 1.1-3
$\rho=0.69364$	Eq. 1.1-2
$b=0.7689$ in (ineffective width=0.3396 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.717$ in	
$f_1=35.748$ ksi, $f_2=-43.471$ ksi	
$\psi=1.2161$	Eq. 1.1.2-1
$k=30.198$	Eq. 1.1.2-2
$\lambda=0.20214$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.717$ in	Eq. 1.1-1
$h_o=2$ in, $b_o=4$ in, $h_o/b_o=0.5$	
$b_1=0.40725$ in	Eq. 1.1.2-3
$b_2=0.8585$ in	Eq. 1.1.2-4
Compression width=0.7748 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.082319$ in	
$S_y=0.19758$ in ³ , $F_y=50$ ksi	
$M_n=9.879$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.0219$ in ⁶ , $W_n=3.6005$ in ² , $F_y=50$ ksi	
$B_n=14.191$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400S250-30

Full Section Properties

Area	0.31089 in ²	Wt.	0.0010570 k/ft	Flat	9.9643 in
I _x	0.8576 in ⁴	r _x	1.6609 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.42881 in ³	y(t)	2.0000 in	α	0.000 deg
S _x (b)	0.42881 in ³	y(b)	2.0000 in		
Z _x	0.48241 in ³	Height	4.0000 in		
I _y	0.2810 in ⁴	r _y	0.9507 in	x _o	-2.1542 in
S _y (l)	0.30901 in ³	x(l)	0.9093 in	y _o	0.0000 in
S _y (r)	0.17665 in ³	x(r)	1.5907 in	j _x	2.8009 in
Z _y	0.25912 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	0.8576 in ⁴	r ₁	1.6609 in	C _w	1.0257 in ⁶
I ₂	0.2810 in ⁴	r ₂	0.9507 in	J	0.0001009 in ⁴
I _c	1.1386 in ⁴	r _c	1.9138 in		
I _o	2.5812 in ⁴	r _o	2.8815 in		

Net Section Properties

I _x	0.8488 in ⁴	r _x	1.7928 in	Area	0.26409 in ²
S _x (t)	0.42442 in ³	y(t)	2.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.42442 in ³	y(b)	2.0000 in	α	0.000 deg
Z _x	0.46486 in ³				
I _y	0.2370 in ⁴	r _y	0.9473 in	x _o	-2.3256 in
S _y (l)	0.22195 in ³	x(l)	1.0677 in	y _o	0.0000 in
S _y (r)	0.16545 in ³	x(r)	1.4323 in	j _x	2.6561 in
Z _y	0.22475 in ³			j _y	0.0000 in
I _c	1.0858 in ⁴	r _c	2.0277 in	C _w	1.0116 in ⁶
I _o	2.5141 in ⁴	r _o	3.0854 in	J	0.0000857 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	6.168 k	φM _{nxo}	12.095 k-in	φM _{nyo}	6.668 k-in
A _e	0.14514 in ²	I _{xe}	0.65287 in ⁴	I _{ye}	0.21925 in ⁴
φT _n	12.874 k	S _{xe} (t)	0.26879 in ³	S _{ye} (l)	0.21488 in ³
		S _{xe} (b)	0.41557 in ³	S _{ye} (r)	0.14817 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.488 k	φM _{nxo}	12.095 k-in	φM _{nyo}	6.266 k-in
φV _{nx}	2.734 k	I _{xe}	0.65287 in ⁴	I _{ye}	0.17815 in ⁴
Torsion		S _{xe} (t)	0.41557 in ³	S _{ye} (l)	0.13925 in ³
φB _n	9.8006 k-in ²	S _{xe} (b)	0.26879 in ³	S _{ye} (r)	0.14596 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.104$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.136$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.31089 \text{ in}^2$, $F_y=51.104 \text{ ksi}$ $T_n=15.888 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.26409 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=17.166 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1.519 \text{ k}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=1.4446 \text{ k}$	Eq. G3-2
$k_v=3.7969$	Eq. G3-8
$V_{crh}=0.37892 \text{ k}$	Eq. G3-6
$V_n=0.54188 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1.519 \text{ k}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5157 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723 \text{ in}$ (ineffective width= 0.13847 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00026103 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00035659 \text{ in}^4 > I_a$ (no lip reduction)	
$k=3.8802$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2814 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.8802$	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
$b=1.225 \text{ in}$ (ineffective width= 1.0564 in)	Eq. 1.1-1
$b_1=0.61249 \text{ in}$, $b_2=0.61249 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.4144$	Eq. 1.1-3
$\rho=0.37643$	Eq. 1.1-2
$b=0.4294 \text{ in}$ (ineffective width= 0.7113 in)	Eq. 1.1-1
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1

k=0.43	Eq. 1.2.2-3
$\lambda=2.4144$	Eq. 1.1-3
$\rho=0.37643$	Eq. 1.1-2
b=0.4294 in (ineffective width=0.7113 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.5157 in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
b=0.37723 in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.091	Eq. 1.3-7
$I_a=0.00026103$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
k=3.8802	Table 1.3-1
Element 4: Partially stiffened, w=2.2814 in	
f=50 ksi, k=3.8802	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
b=1.225 in (ineffective width=1.0564 in)	Eq. 1.1-1
$b_1=0.61249$ in, $b_2=0.61249$ in	
$A_e=0.14514$ in ² , $F_n=50$ ksi	
$P_n=7.257$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.75$ ksi, $f_2=24.266$ ksi

$\psi=0.50819$

k=0.68145

$\lambda=1.8743$

$\rho=0.47091$

b=0.53717 in (ineffective width=0.60353 in)

Element 5: Unstiffened, w=0.5157 in

$f_1=47.75$ ksi, $f_2=37.133$ ksi

$\psi=0.77766$

k=0.51715

$\lambda=0.97268$

$\rho=0.79556$

b=0.41027 in (ineffective width=0.10543 in)

Element 4: Check for lip stiffener reduction

S=31.191

$I_a=0.0002602$ in⁴

$I_s=0.00035659$ in⁴ > I_a (no lip reduction)

k=3.8802

Element 4: Partially stiffened, w=2.2814 in

f=49.679 ksi, k=3.8802

$\lambda=1.6023$

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Eq. 1.1-3

$\rho=0.5384$ Eq. 1.1-2
 $b=1.2283$ in (ineffective width=1.0531 in) Eq. 1.1-1
 $b_1=0.61415$ in, $b_2=0.61415$ in
 Center of gravity shift: $y=-0.42897$ in
 $S_{xe}=0.26879$ in³, $F_y=50$ ksi
 $M_{nl}=13.439$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=47.75$ ksi, $f_2=37.133$ ksi

$\psi=0.77766$ Eq. 1.2.2-1

$k=0.51715$ Eq. 1.2.2-2

$\lambda=0.97268$ Eq. 1.1-3

$\rho=0.79556$ Eq. 1.1-2

$b=0.41027$ in (ineffective width=0.10543 in) Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.191$ Eq. 1.3-7

$I_a=0.0002602$ in⁴ Eq. 1.3-8

$I_s=0.00035659$ in⁴ > I_a (no lip reduction)

$k=3.8802$ Table 1.3-1

Element 2: Partially stiffened, $w=2.2814$ in

$f=49.679$ ksi, $k=3.8802$

$\lambda=1.6023$ Eq. 1.1-3

$\rho=0.5384$ Eq. 1.1-2

$b=1.2283$ in (ineffective width=1.0531 in) Eq. 1.1-1

$b_1=0.61415$ in, $b_2=0.61415$ in

Element 3: Treat as two unstiffened elements

$f_1=47.75$ ksi, $f_2=24.266$ ksi

$\psi=0.50819$ Eq. 1.2.2-1

$k=0.68145$ Eq. 1.2.2-2

$\lambda=1.8743$ Eq. 1.1-3

$\rho=0.47091$ Eq. 1.1-2

$b=0.53717$ in (ineffective width=0.60353 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.42897$ in

$S_{xe}=0.26878$ in³, $F_y=50$ ksi

$M_{nl}=13.439$ k-in Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.473$ ksi, $f_2=49.473$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-3

$\lambda=1.0858$ Eq. 1.1-3

$\rho=0.73438$ Eq. 1.1-2

$b=0.37872$ in (ineffective width=0.13698 in) Eq. 1.1-1

Element 2: Stiffened, $w=2.2814$ in

$f_1=46.307$ ksi, $f_2=-30.785$ ksi
 $\psi=0.66481$ Eq. 1.1.2-1
 $k=16.558$ Eq. 1.1.2-2
 $\lambda=0.74888$ Eq. 1.1-3
 $\rho=0.94304$ Eq. 1.1-2
 $b_e=2.1515$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$
 $b_1=0.58706$ in Eq. 1.1.2-3
 $b_2=1.0757$ in Eq. 1.1.2-4
 Compression width= 1.3704 in
 $b_1+b_2 >$ compression width (fully effective)
 Element 3: No compressive stress (fully effective)
 Element 5: Unstiffened, $w=0.5157$ in
 $f_1=49.473$ ksi, $f_2=49.473$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-2
 $\lambda=1.0858$ Eq. 1.1-3
 $\rho=0.73438$ Eq. 1.1-2
 $b=0.37872$ in (ineffective width= 0.13698 in) Eq. 1.1-1
 Element 4: Stiffened, $w=2.2814$ in
 $f_1=46.307$ ksi, $f_2=-30.785$ ksi
 $\psi=0.66481$ Eq. 1.1.2-1
 $k=16.558$ Eq. 1.1.2-2
 $\lambda=0.74888$ Eq. 1.1-3
 $\rho=0.94304$ Eq. 1.1-2
 $b_e=2.1515$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$
 $b_1=0.58706$ in Eq. 1.1.2-3
 $b_2=1.0757$ in Eq. 1.1.2-4
 Compression width= 1.3704 in
 $b_1+b_2 >$ compression width (fully effective)
 Center of gravity shift: $x=-0.047386$ in
 $S_y=0.14817$ in³, $F_y=50$ ksi
 $M_{nl}=7.4086$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2814$ in

$f_1=45.728$ ksi, $f_2=-43.431$ ksi

$\psi=0.94977$

$k=22.724$

$\lambda=0.63526$

$\rho=1$

$b_e=2.2814$ in

$h_o=2.5$ in, $b_o=4$ in, $h_o/b_o=0.625$

$b_1=0.5776$ in

$b_2=1.1407$ in

Compression width= 1.1701 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

$f_1=49.39$ ksi, $f_2=49.39$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.3997$

Eq. 1.1-3

$\rho=0.37852$

Eq. 1.1-2

$b=0.43177$ in (ineffective width= 0.70893 in)

Eq. 1.1-1

$f_1=49.39$ ksi, $f_2=49.39$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=2.3997$

Eq. 1.1-3

$\rho=0.37852$

Eq. 1.1-2

$b=0.43177$ in (ineffective width= 0.70893 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.2814$ in

$f_1=45.728$ ksi, $f_2=-43.431$ ksi

$\psi=0.94977$

Eq. 1.1.2-1

$k=22.724$

Eq. 1.1.2-2

$\lambda=0.63526$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2814$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=4$ in, $h_o/b_o=0.625$

$b_1=0.5776$ in

Eq. 1.1.2-3

$b_2=1.1407$ in

Eq. 1.1.2-4

Compression width= 1.1701 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.2117$ in

$S_y=0.13925$ in³, $F_y=50$ ksi

$M_{n1}=6.9624$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=1.0116$ in⁶, $W_n=4.645$ in², $F_y=50$ ksi

$B_n=10.89$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

400S250-33

Full Section Properties

Area	0.34430 in ²	Wt.	0.0011706 k/ft	Flat	9.9507 in
Ix	0.9481 in ⁴	rx	1.6595 in	Ixy	0.0000 in ⁴
Sx(t)	0.47406 in ³	y(t)	2.0000 in	α	0.000 deg
Sx(b)	0.47406 in ³	y(b)	2.0000 in		
Zx	0.53377 in ³	Height	4.0000 in		
Iy	0.3102 in ⁴	ry	0.9492 in	x _o	-2.1502 in
Sy(l)	0.34116 in ³	x(l)	0.9093 in	y _o	0.0000 in
Sy(r)	0.19503 in ³	x(r)	1.5907 in	jx	2.7973 in
Zy	0.28648 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	0.9481 in ⁴	r ₁	1.6595 in	Cw	1.1295 in ⁶
I ₂	0.3102 in ⁴	r ₂	0.9492 in	J	0.0001374 in ⁴
Ic	1.2584 in ⁴	rc	1.9118 in		
I _o	2.8501 in ⁴	r _o	2.8772 in		

Net Section Properties

Ix	0.9384 in ⁴	rx	1.7915 in	Area	0.29240 in ²
Sx(t)	0.46920 in ³	y(t)	2.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.46920 in ³	y(b)	2.0000 in	α	0.000 deg
Zx	0.51431 in ³				
Iy	0.2616 in ⁴	ry	0.9459 in	x _o	-2.3216 in
Sy(l)	0.24502 in ³	x(l)	1.0677 in	y _o	0.0000 in
Sy(r)	0.18264 in ³	x(r)	1.4323 in	jx	2.6523 in
Zy	0.24845 in ³			jy	0.0000 in
Ic	1.2000 in ⁴	rc	2.0258 in	Cw	1.1139 in ⁶
I _o	2.7759 in ⁴	r _o	3.0812 in	J	0.0001167 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	7.370 k	φMnxo	14.321 k-in	φMnyo	7.554 k-in
Ae	0.17342 in ²	Ixe	0.75316 in ⁴	Iye	0.24655 in ⁴
φTn	14.254 k	Sxe(t)	0.31824 in ³	Sye(l)	0.23907 in ³
		Sxe(b)	0.46113 in ³	Sye(r)	0.16787 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.608 k	φMnxo	14.321 k-in	φMnyo	7.168 k-in
φVnx	3.317 k	Ixe	0.75316 in ⁴	Iye	0.20132 in ⁴
Torsion		Sxe(t)	0.46113 in ³	Sye(l)	0.15928 in ³
φBn	10.824 k-in ²	Sxe(b)	0.31824 in ³	Sye(r)	0.16287 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.199$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.32$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.3443 \text{ in}^2$, $F_y=51.199 \text{ ksi}$
 $T_n=17.628 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.2924 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=19.006 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2
 $V_n=1.843 \text{ k}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3
 $V_{yh}=1.5984 \text{ k}$
 $k_v=3.7959$
 $V_{crh}=0.51669 \text{ k}$
 $V_n=0.67511 \text{ k}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4
 $V_n=1.843 \text{ k}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=0.98104$
 $\rho=0.79074$
 $b=0.40644 \text{ in}$ (ineffective width= 0.10756 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$
 $I_a=0.00035618 \text{ in}^4$
 $I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)
 $k=3.8782$

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Element 2: Partially stiffened, $w=2.278 \text{ in}$
 $f=50 \text{ ksi}$, $k=3.8782$
 $\lambda=1.4478$
 $\rho=0.58576$
 $b=1.3344 \text{ in}$ (ineffective width= 0.94364 in)
 $b_1=0.66718 \text{ in}$, $b_2=0.66718 \text{ in}$

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=2.1739$
 $\rho=0.41344$
 $b=0.47091 \text{ in}$ (ineffective width= 0.66809 in)
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.1739$	Eq. 1.1-3
$\rho=0.41344$	Eq. 1.1-2
$b=0.47091$ in (ineffective width=0.66809 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00035618$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1
Element 4: Partially stiffened, $w=2.278$ in	
$f=50$ ksi, $k=3.8782$	
$\lambda=1.4478$	Eq. 1.1-3
$\rho=0.58576$	Eq. 1.1-2
$b=1.3344$ in (ineffective width=0.94364 in)	Eq. 1.1-1
$b_1=0.66718$ in, $b_2=0.66718$ in	
$A_e=0.17342$ in ² , $F_n=50$ ksi	
$P_n=8.671$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=47.655$ ksi, $f_2=23.589$ ksi	
$\psi=0.495$	Eq. 1.2.2-1
$k=0.69221$	Eq. 1.2.2-2
$\lambda=1.6728$	Eq. 1.1-3
$\rho=0.51919$	Eq. 1.1-2
$b=0.59136$ in (ineffective width=0.54764 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=47.655$ ksi, $f_2=36.795$ ksi	
$\psi=0.77211$	Eq. 1.2.2-1
$k=0.51973$	Eq. 1.2.2-2
$\lambda=0.87116$	Eq. 1.1-3
$\rho=0.85801$	Eq. 1.1-2
$b=0.44102$ in (ineffective width=0.072985 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.205$	Eq. 1.3-7
$I_a=0.0003549$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1

Element 4: Partially stiffened, $w=2.278$ in

$f=49.634$ ksi, $k=3.8782$

$\lambda=1.4425$

Eq. 1.1-3

$\rho=0.58752$

Eq. 1.1-2

$b=1.3384$ in (ineffective width= 0.93962 in)

Eq. 1.1-1

$b_1=0.66919$ in, $b_2=0.66919$ in

Center of gravity shift: $y=-0.36669$ in

$S_{xe}=0.31824$ in³, $F_y=50$ ksi

$M_{nl}=15.912$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=47.655$ ksi, $f_2=36.795$ ksi

$\psi=0.77211$

Eq. 1.2.2-1

$k=0.51973$

Eq. 1.2.2-2

$\lambda=0.87116$

Eq. 1.1-3

$\rho=0.85801$

Eq. 1.1-2

$b=0.44102$ in (ineffective width= 0.072985 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.205$

Eq. 1.3-7

$I_a=0.0003549$ in⁴

Eq. 1.3-8

$I_s=0.00039155$ in⁴ $> I_a$ (no lip reduction)

$k=3.8782$

Table 1.3-1

Element 2: Partially stiffened, $w=2.278$ in

$f=49.634$ ksi, $k=3.8782$

$\lambda=1.4425$

Eq. 1.1-3

$\rho=0.58752$

Eq. 1.1-2

$b=1.3384$ in (ineffective width= 0.93962 in)

Eq. 1.1-1

$b_1=0.66919$ in, $b_2=0.66919$ in

Element 3: Treat as two unstiffened elements

$f_1=47.655$ ksi, $f_2=23.589$ ksi

$\psi=0.495$

Eq. 1.2.2-1

$k=0.69221$

Eq. 1.2.2-2

$\lambda=1.6728$

Eq. 1.1-3

$\rho=0.51919$

Eq. 1.1-2

$b=0.59136$ in (ineffective width= 0.54764 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.36669$ in

$S_{xe}=0.31824$ in³, $F_y=50$ ksi

$M_{nl}=15.912$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.411$ ksi, $f_2=49.411$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-3
 $\lambda=0.97525$ Eq. 1.1-3
 $\rho=0.79407$ Eq. 1.1-2
 $b=0.40815$ in (ineffective width=0.10585 in) Eq. 1.1-1

Element 2: Stiffened, $w=2.278$ in

$f_1=46.221$ ksi, $f_2=-31.332$ ksi
 $\psi=0.67786$ Eq. 1.1.2-1
 $k=16.803$ Eq. 1.1.2-2
 $\lambda=0.66874$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=2.278$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$
 $b_1=0.61938$ in Eq. 1.1.2-3
 $b_2=1.139$ in Eq. 1.1.2-4

Compression width=1.3577 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.514$ in

$f_1=49.411$ ksi, $f_2=49.411$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-2
 $\lambda=0.97525$ Eq. 1.1-3
 $\rho=0.79407$ Eq. 1.1-2
 $b=0.40815$ in (ineffective width=0.10585 in) Eq. 1.1-1

Element 4: Stiffened, $w=2.278$ in

$f_1=46.221$ ksi, $f_2=-31.332$ ksi
 $\psi=0.67786$ Eq. 1.1.2-1
 $k=16.803$ Eq. 1.1.2-2
 $\lambda=0.66874$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=2.278$ in Eq. 1.1-1
 $h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$
 $b_1=0.61938$ in Eq. 1.1.2-3
 $b_2=1.139$ in Eq. 1.1.2-4

Compression width=1.3577 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.036358$ in

$S_y=0.16787$ in³, $F_y=50$ ksi

$M_n I=8.3936$ k-in Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.278$ in

$f_1=45.609$ ksi, $f_2=-44.508$ ksi
 $\psi=0.97585$ Eq. 1.1.2-1
 $k=23.379$ Eq. 1.1.2-2
 $\lambda=0.56317$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2

be=2.278 in	Eq. 1.1-1
h _o =2.5 in, b _o =4 in, h _o /b _o =0.625	
b ₁ =0.57296 in	Eq. 1.1.2-3
b ₂ =1.139 in	Eq. 1.1.2-4
Compression width=1.1529 in	
b ₁ +b ₂ > compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
f ₁ =49.316 ksi, f ₂ =49.316 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.159	Eq. 1.1-3
ρ=0.41598	Eq. 1.1-2
b=0.4738 in (ineffective width=0.6652 in)	Eq. 1.1-1
f ₁ =49.316 ksi, f ₂ =49.316 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-2
λ=2.159	Eq. 1.1-3
ρ=0.41598	Eq. 1.1-2
b=0.4738 in (ineffective width=0.6652 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, w=2.278 in	
f ₁ =45.609 ksi, f ₂ =-44.508 ksi	
ψ=0.97585	Eq. 1.1.2-1
k=23.379	Eq. 1.1.2-2
λ=0.56317	Eq. 1.1-3
ρ=1	Eq. 1.1-2
be=2.278 in	Eq. 1.1-1
h _o =2.5 in, b _o =4 in, h _o /b _o =0.625	
b ₁ =0.57296 in	Eq. 1.1.2-3
b ₂ =1.139 in	Eq. 1.1.2-4
Compression width=1.1529 in	
b ₁ +b ₂ > compression width (fully effective)	
Center of gravity shift: x=0.19626 in	
S _{ye} =0.15928 in ³ , F _y =50 ksi	
M _{nl} =7.964 k-in	Eq. F3.1-1
Ω _b =1.67, φ _b =0.9	
Bimoment Strength, Stud	
C _w =1.1139 in ⁶ , W _n =4.6309 in ² , F _y =50 ksi	
B _n =12.027 k-in ²	G8.1-1
Ω _b =1.67, φ _b =0.9	

400S250-43

Full Section Properties

Area	0.44688 in ²	Wt.	0.0015194 k/ft	Flat	9.9086 in
I _x	1.2240 in ⁴	r _x	1.6550 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.61201 in ³	y(t)	2.0000 in	α	0.000 deg
S _x (b)	0.61201 in ³	y(b)	2.0000 in		
Z _x	0.69088 in ³	Height	4.0000 in		
I _y	0.3989 in ⁴	r _y	0.9447 in	x _o	-2.1379 in
S _y (l)	0.43862 in ³	x(l)	0.9093 in	y _o	0.0000 in
S _y (r)	0.25075 in ³	x(r)	1.5907 in	j _x	2.7859 in
Z _y	0.36991 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	1.2240 in ⁴	r ₁	1.6550 in	C _w	1.4403 in ⁶
I ₂	0.3989 in ⁴	r ₂	0.9447 in	J	0.0003030 in ⁴
I _c	1.6229 in ⁴	r _c	1.9057 in		
I _o	3.6654 in ⁴	r _o	2.8639 in		

Net Section Properties

I _x	1.2113 in ⁴	r _x	1.7872 in	Area	0.37923 in ²
S _x (t)	0.60567 in ³	y(t)	2.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.60567 in ³	y(b)	2.0000 in	α	0.000 deg
Z _x	0.66551 in ³				
I _y	0.3362 in ⁴	r _y	0.9415 in	x _o	-2.3092 in
S _y (l)	0.31489 in ³	x(l)	1.0675 in	y _o	0.0000 in
S _y (r)	0.23467 in ³	x(r)	1.4325 in	j _x	2.6404 in
Z _y	0.32070 in ³			j _y	0.0000 in
I _c	1.5475 in ⁴	r _c	2.0200 in	C _w	1.4203 in ⁶
I _o	3.5697 in ⁴	r _o	3.0681 in	J	0.0002571 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	10.528 k	φM _{nxo}	20.213 k-in	φM _{nyo}	10.355 k-in
A _e	0.24772 in ²	I _{xe}	1.0268 in ⁴	I _{ye}	0.3316 in ⁴
φT _n	18.487 k	S _{xe} (t)	0.44919 in ³	S _{ye} (l)	0.31312 in ³
		S _{xe} (b)	0.59898 in ³	S _{ye} (r)	0.23011 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.051 k	φM _{nxo}	20.213 k-in	φM _{nyo}	9.720 k-in
φV _{nx}	5.185 k	I _{xe}	1.0268 in ⁴	I _{ye}	0.2774 in ⁴
Torsion		S _{xe} (t)	0.59898 in ³	S _{ye} (l)	0.22814 in ³
φB _n	13.932 k-in ²	S _{xe} (b)	0.44919 in ³	S _{ye} (r)	0.21600 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.468$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=52.838$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.44688 \text{ in}^2$, $F_y=51.468 \text{ ksi}$ $T_n=23 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.37923 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=24.65 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=2.8807 \text{ k}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=2.069 \text{ k}$	Eq. G3-2
$k_v=3.793$	Eq. G3-8
$V_{crh}=1.1436 \text{ k}$	Eq. G3-6
$V_n=1.168 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=2.8807 \text{ k}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123 \text{ in}$ (ineffective width=0.027474 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00079003 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00049474 \text{ in}^4$	
$d_s=0.30136 \text{ in}$ (lip ineffective width=0.17987 in)	Eq. 1.3-6
$k=3.3746$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2674 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.3746$	
$\lambda=1.1852$	Eq. 1.1-3
$\rho=0.68714$	Eq. 1.1-2
$b=1.558 \text{ in}$ (ineffective width=0.70937 in)	Eq. 1.1-1
$b_1=0.48785 \text{ in}$, $b_2=1.0702 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.6601$	Eq. 1.1-3
$\rho=0.52256$	Eq. 1.1-2
$b=0.59242 \text{ in}$ (ineffective width=0.54128 in)	Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.6601$	Eq. 1.1-3
$\rho=0.52256$	Eq. 1.1-2
$b=0.59242$ in (ineffective width=0.54128 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123$ in (ineffective width=0.027474 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00079003$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.30136$ in (lip ineffective width=0.17987 in)	Eq. 1.3-6
$k=3.3746$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2674$ in	
$f=50$ ksi, $k=3.3746$	
$\lambda=1.1852$	Eq. 1.1-3
$\rho=0.68714$	Eq. 1.1-2
$b=1.558$ in (ineffective width=0.70937 in)	Eq. 1.1-1
$b_1=0.48785$ in, $b_2=1.0702$ in	
$A_e=0.24772$ in ² , $F_n=50$ ksi	
$P_n=12.386$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=47.456$ ksi, $f_2=22.656$ ksi	
$\psi=0.47741$	Eq. 1.2.2-1
$k=0.70711$	Eq. 1.2.2-2
$\lambda=1.2612$	Eq. 1.1-3
$\rho=0.6546$	Eq. 1.1-2
$b=0.74212$ in (ineffective width=0.39158 in)	Eq. 1.1-1

Element 5: Unstiffened, $w=0.5087$ in

$f_1=47.456$ ksi, $f_2=36.328$ ksi	
$\psi=0.76551$	Eq. 1.2.2-1
$k=0.52284$	Eq. 1.2.2-2
$\lambda=0.65811$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=31.246$	Eq. 1.3-7
$I_a=0.00078622$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	

ds=0.32011 in (lip ineffective width=0.18859 in)	Eq. 1.3-6
k=3.3794	Table 1.3-1
Element 4: Partially stiffened, w=2.2674 in	
f=49.507 ksi, k=3.3794	
$\lambda=1.1785$	Eq. 1.1-3
$\rho=0.69015$	Eq. 1.1-2
b=1.5648 in (ineffective width=0.70256 in)	Eq. 1.1-1
b ₁ =0.49235 in, b ₂ =1.0725 in	
Center of gravity shift: y=-0.28582 in	
S _{xe} =0.44919 in ³ , F _y =50 ksi	
M _{nl} =22.459 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.5087 in	
f ₁ =47.456 ksi, f ₂ =36.328 ksi	
$\psi=0.76551$	Eq. 1.2.2-1
k=0.52284	Eq. 1.2.2-2
$\lambda=0.65811$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.246	Eq. 1.3-7
I _a =0.00078622 in ⁴	Eq. 1.3-8
I _s =0.00049474 in ⁴	
ds=0.32011 in (lip ineffective width=0.18859 in)	Eq. 1.3-6
k=3.3794	Table 1.3-1
Element 2: Partially stiffened, w=2.2674 in	
f=49.507 ksi, k=3.3794	
$\lambda=1.1785$	Eq. 1.1-3
$\rho=0.69015$	Eq. 1.1-2
b=1.5648 in (ineffective width=0.70256 in)	Eq. 1.1-1
b ₁ =0.49235 in, b ₂ =1.0725 in	
Element 3: Treat as two unstiffened elements	
f ₁ =47.456 ksi, f ₂ =22.656 ksi	
$\psi=0.47741$	Eq. 1.2.2-1
k=0.70711	Eq. 1.2.2-2
$\lambda=1.2612$	Eq. 1.1-3
$\rho=0.6546$	Eq. 1.1-2
b=0.74212 in (ineffective width=0.39158 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: y=0.28582 in	
S _{xe} =0.44919 in ³ , F _y =50 ksi	
M _{nl} =22.459 k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Positive Flexural Strength about Y-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.5087 in	

$f_1=49.218$ ksi, $f_2=49.218$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73903$

Eq. 1.1-3

$\rho=0.95032$

Eq. 1.1-2

$b=0.48343$ in (ineffective width= 0.025274 in)

Eq. 1.1-1

Element 2: Stiffened, $w=2.2674$ in

$f_1=45.965$ ksi, $f_2=-32.71$ ksi

$\psi=0.71164$

Eq. 1.1.2-1

$k=17.453$

Eq. 1.1.2-2

$\lambda=0.49967$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2674$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.61089$ in

Eq. 1.1.2-3

$b_2=1.1337$ in

Eq. 1.1.2-4

Compression width= 1.3247 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=49.218$ ksi, $f_2=49.218$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73903$

Eq. 1.1-3

$\rho=0.95032$

Eq. 1.1-2

$b=0.48343$ in (ineffective width= 0.025274 in)

Eq. 1.1-1

Element 4: Stiffened, $w=2.2674$ in

$f_1=45.965$ ksi, $f_2=-32.71$ ksi

$\psi=0.71165$

Eq. 1.1.2-1

$k=17.453$

Eq. 1.1.2-2

$\lambda=0.49967$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2674$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.61089$ in

Eq. 1.1.2-3

$b_2=1.1337$ in

Eq. 1.1.2-4

Compression width= 1.3247 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.0085267$ in

$S_y=0.23011$ in³, $F_y=50$ ksi

$M_n=11.506$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2674$ in

$f_1=42.788$ ksi, $f_2=-45.473$ ksi

$\psi=1.0628$

Eq. 1.1.2-1

$k=25.68$

Eq. 1.1.2-2

$\lambda=0.39744$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.2674$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=4$ in, $h_o/b_o=0.625$	
$b_1=0.55809$ in	Eq. 1.1.2-3
$b_2=1.1337$ in	Eq. 1.1.2-4
Compression width=1.0992 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.437$ ksi, $f_2=46.437$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5998$	Eq. 1.1-3
$\rho=0.53912$	Eq. 1.1-2
$b=0.6112$ in (ineffective width=0.5225 in)	Eq. 1.1-1
$f_1=46.437$ ksi, $f_2=46.437$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=1.5998$	Eq. 1.1-3
$\rho=0.53912$	Eq. 1.1-2
$b=0.6112$ in (ineffective width=0.5225 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=2.2674$ in	
$f_1=42.788$ ksi, $f_2=-45.473$ ksi	
$\psi=1.0628$	Eq. 1.1.2-1
$k=25.68$	Eq. 1.1.2-2
$\lambda=0.39744$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.2674$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=4$ in, $h_o/b_o=0.625$	
$b_1=0.55809$ in	Eq. 1.1.2-3
$b_2=1.1337$ in	Eq. 1.1.2-4
Compression width=1.0992 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.1483$ in	
$S_y=0.216$ in ³ , $F_y=50$ ksi	
$M_n=10.8$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.4203$ in ⁶ , $W_n=4.5876$ in ² , $F_y=50$ ksi	
$B_n=15.479$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400S250-54

Full Section Properties

Area	0.55634 in ²	Wt.	0.0018915 k/ft	Flat	9.8293 in
Ix	1.5124 in ⁴	rx	1.6488 in	Ixy	0.0000 in ⁴
Sx(t)	0.75620 in ³	y(t)	2.0000 in	α	0.000 deg
Sx(b)	0.75620 in ³	y(b)	2.0000 in		
Zx	0.85659 in ³	Height	4.0000 in		
Iy	0.4899 in ⁴	ry	0.9384 in	x _o	-2.1228 in
Sy(l)	0.53939 in ³	x(l)	0.9082 in	y _o	0.0000 in
Sy(r)	0.30775 in ³	x(r)	1.5918 in	jx	2.7736 in
Zy	0.45707 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	1.5124 in ⁴	r ₁	1.6488 in	Cw	1.7518 in ⁶
I ₂	0.4899 in ⁴	r ₂	0.9384 in	J	0.0005941 in ⁴
Ic	2.0023 in ⁴	rc	1.8971 in		
I _o	4.5092 in ⁴	r _o	2.8470 in		

Net Section Properties

Ix	1.4965 in ⁴	rx	1.7817 in	Area	0.47144 in ²
Sx(t)	0.74824 in ³	y(t)	2.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.74824 in ³	y(b)	2.0000 in	α	0.000 deg
Zx	0.82475 in ³				
Iy	0.4123 in ⁴	ry	0.9352 in	x _o	-2.2944 in
Sy(l)	0.38652 in ³	x(l)	1.0667 in	y _o	0.0000 in
Sy(r)	0.28763 in ³	x(r)	1.4333 in	jx	2.6274 in
Zy	0.39580 in ³			jy	0.0000 in
Ic	1.9088 in ⁴	rc	2.0122 in	Cw	1.7270 in ⁶
I _o	4.3906 in ⁴	r _o	3.0518 in	J	0.0005034 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	14.205 k	φM _n x _o	26.619 k-in	φM _n y _o	14.710 k-in
A _e	0.33423 in ²	I _x e	1.3162 in ⁴	I _y e	0.4123 in ⁴
φT _n	22.983 k	S _x e(t)	0.59154 in ³	S _y e(l)	0.38652 in ³
		S _x e(b)	0.74155 in ³	S _y e(r)	0.28763 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.615 k	φM _n x _o	26.619 k-in	φM _n y _o	12.300 k-in
φV _{nx}	6.776 k	I _x e	1.3162 in ⁴	I _y e	0.3659 in ⁴
Torsion		S _x e(t)	0.74155 in ³	S _y e(l)	0.31501 in ³
φB _n	17.127 k-in ²	S _x e(b)	0.59154 in ³	S _y e(r)	0.27333 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.837$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=53.509$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.55634$ in², $F_y=51.837$ ksi

$T_n=28.839$ k
 $\Omega_t=1.67$, $\phi_t=0.9$ Eq. D2-1

$A_n=0.47144$ in², $F_u=65$ ksi
 $T_n=30.643$ k Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=3.7645$ k at 180 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=2.5102$ k Eq. G3-2
 $k_v=3.7785$ Eq. G3-8
 $V_{crh}=2.2535$ k Eq. G3-6
 $V_n=1.7948$ k at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=3.7645$ k at 0 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56413$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0015382$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $d_s=0.16757$ in (lip ineffective width=0.31593 in) Eq. 1.3-6
 $k=2.8256$ Table 1.3-1

Element 2: Partially stiffened, $w=2.217$ in
 $f=50$ ksi, $k=2.8256$
 $\lambda=1.0091$ Eq. 1.1-3
 $\rho=0.77494$ Eq. 1.1-2
 $b=1.718$ in (ineffective width=0.49896 in) Eq. 1.1-1
 $b_1=0.29773$ in, $b_2=1.4203$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.2934$ Eq. 1.1-3
 $\rho=0.64166$ Eq. 1.1-2
 $b=0.71128$ in (ineffective width=0.39722 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2934$	Eq. 1.1-3
$\rho=0.64166$	Eq. 1.1-2
$b=0.71128$ in (ineffective width=0.39722 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0015382$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.16757$ in (lip ineffective width=0.31593 in)	Eq. 1.3-6
$k=2.8256$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217$ in	
$f=50$ ksi, $k=2.8256$	
$\lambda=1.0091$	Eq. 1.1-3
$\rho=0.77494$	Eq. 1.1-2
$b=1.718$ in (ineffective width=0.49896 in)	Eq. 1.1-1
$b_1=0.29773$ in, $b_2=1.4203$ in	
$A_e=0.33423$ in ² , $F_n=50$ ksi	
$P_n=16.711$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=46.82$ ksi, $f_2=21.91$ ksi	
$\psi=0.46795$	Eq. 1.2.2-1
$k=0.71539$	Eq. 1.2.2-2
$\lambda=0.97032$	Eq. 1.1-3
$\rho=0.79692$	Eq. 1.1-2
$b=0.88339$ in (ineffective width=0.22511 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=46.82$ ksi, $f_2=35.955$ ksi	
$\psi=0.76793$	Eq. 1.2.2-1
$k=0.52169$	Eq. 1.2.2-2
$\lambda=0.49561$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.291$	Eq. 1.3-7
$I_a=0.0015287$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.16861$ in (lip ineffective width=0.31489 in)	Eq. 1.3-6
$k=2.8305$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217$ in	

$f=49.364$ ksi, $k=2.8305$
 $\lambda=1.0018$ Eq. 1.1-3
 $\rho=0.77901$ Eq. 1.1-2
 $b=1.7271$ in (ineffective width= 0.48994 in) Eq. 1.1-1
 $b_1=0.30115$ in, $b_2=1.4259$ in
 Center of gravity shift: $y=-0.22505$ in
 $S_{xe}=0.59154$ in³, $F_y=50$ ksi
 $M_{nl}=29.577$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=46.82$ ksi, $f_2=35.955$ ksi
 $\psi=0.76793$ Eq. 1.2.2-1
 $k=0.52169$ Eq. 1.2.2-2
 $\lambda=0.49561$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.291$ Eq. 1.3-7
 $I_a=0.0015287$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $ds=0.16861$ in (lip ineffective width= 0.31489 in) Eq. 1.3-6
 $k=2.8305$ Table 1.3-1

Element 2: Partially stiffened, $w=2.217$ in

$f=49.364$ ksi, $k=2.8305$
 $\lambda=1.0018$ Eq. 1.1-3
 $\rho=0.77901$ Eq. 1.1-2
 $b=1.7271$ in (ineffective width= 0.48994 in) Eq. 1.1-1
 $b_1=0.30115$ in, $b_2=1.4259$ in

Element 3: Treat as two unstiffened elements

$f_1=46.82$ ksi, $f_2=21.91$ ksi
 $\psi=0.46795$ Eq. 1.2.2-1
 $k=0.71539$ Eq. 1.2.2-2
 $\lambda=0.97032$ Eq. 1.1-3
 $\rho=0.79692$ Eq. 1.1-2
 $b=0.88339$ in (ineffective width= 0.22511 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.22505$ in

$S_{xe}=0.59154$ in³, $F_y=50$ ksi
 $M_{nl}=29.577$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in

$f_1=55.703$ ksi, $f_2=55.703$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3

$\lambda=0.59544$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=2.217$ in	
$f_1=51.216$ ksi, $f_2=-36.678$ ksi	
$\psi=0.71615$	Eq. 1.1.2-1
$k=17.541$	Eq. 1.1.2-2
$\lambda=0.4099$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.59659$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.2918 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=55.703$ ksi, $f_2=55.703$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.59544$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=2.217$ in	
$f_1=51.216$ ksi, $f_2=-36.678$ ksi	
$\psi=0.71615$	Eq. 1.1.2-1
$k=17.541$	Eq. 1.1.2-2
$\lambda=0.4099$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.59659$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.2918 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_{ye}=0.28763$ in ³ , $F_y=56.825$ ksi	
$M_n I=16.345$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.217$ in

$f_1=37.99$ ksi, $f_2=-44.721$ ksi

$\psi=1.1772$

$k=28.995$

$\lambda=0.27458$

$\rho=1$

$b_e=2.217$ in

$h_o=2.5$ in, $b_o=4$ in, $h_o/b_o=0.625$

$b_1=0.53074$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.0183 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=42.213$ ksi, $f_2=42.213$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.1884$	Eq. 1.1-3
$\rho=0.6857$	Eq. 1.1-2
$b=0.7601$ in (ineffective width=0.3484 in)	Eq. 1.1-1
$f_1=42.213$ ksi, $f_2=42.213$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=1.1884$	Eq. 1.1-3
$\rho=0.6857$	Eq. 1.1-2
$b=0.7601$ in (ineffective width=0.3484 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=2.217$ in	
$f_1=37.99$ ksi, $f_2=-44.721$ ksi	
$\psi=1.1772$	Eq. 1.1.2-1
$k=28.995$	Eq. 1.1.2-2
$\lambda=0.27458$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=2.217$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=4$ in, $h_o/b_o=0.625$	
$b_1=0.53074$ in	Eq. 1.1.2-3
$b_2=1.1085$ in	Eq. 1.1.2-4
Compression width=1.0183 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.094797$ in	
$S_{ye}=0.27333$ in ³ , $F_y=50$ ksi	
$M_n=13.666$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.727$ in ⁶ , $W_n=4.5375$ in ² , $F_y=50$ ksi	
$B_n=19.03$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

550S162-27

Full Section Properties

Area	0.26817 in ²	Wt.	0.91177 lb/ft	Flat	9.4758 in
I _x	1.1998 in ⁴	r _x	2.1152 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.43629 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.43629 in ³	y(b)	2.7500 in		
Z _x	0.51510 in ³	Height	5.5000 in		
I _y	0.0939 in ⁴	r _y	0.5917 in	x _o	-1.1165 in
S _y (l)	0.21664 in ³	x(l)	0.4334 in	y _o	0.0000 in
S _y (r)	0.07879 in ³	x(r)	1.1916 in	j _x	2.9266 in
Z _y	0.11285 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	1.1998 in ⁴	r ₁	2.1152 in	C _w	0.56776 in ⁶
I ₂	0.0939 in ⁴	r ₂	0.5917 in	J	0.00007159 in ⁴
I _c	1.2937 in ⁴	r _c	2.1964 in		
I _o	1.6280 in ⁴	r _o	2.4639 in		

Net Section Properties

I _x	1.1918 in ⁴	r _x	2.2979 in	Area	0.22572 in ²
S _x (t)	0.43339 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.43339 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	0.49918 in ³				
I _y	0.0850 in ⁴	r _y	0.6137 in	x _o	-1.2000 in
S _y (l)	0.16599 in ³	x(l)	0.5122 in	y _o	0.0000 in
S _y (r)	0.07640 in ³	x(r)	1.1128 in	j _x	2.5654 in
Z _y	0.11223 in ³			j _y	0.0000 in
I _c	1.2768 in ⁴	r _c	2.3784 in	C _w	0.56386 in ⁶
I _o	1.6019 in ⁴	r _o	2.6640 in	J	0.00006026 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	4844 lb	φM _{nxo}	1148.4 lb-ft	φM _{nyo}	266.9 lb-ft
A _e	0.11398 in ²	I _{xe}	0.98629 in ⁴	I _{ye}	0.08049 in ⁴
φT _n	11004 lb	S _{xe} (t)	0.30623 in ³	S _{ye} (l)	0.16295 in ³
		S _{xe} (b)	0.43273 in ³	S _{ye} (r)	0.07117 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	517 lb	φM _{nxo}	1148.4 lb-ft	φM _{nyo}	238.1 lb-ft
φV _{nx}	2032 lb	I _{xe}	0.98629 in ⁴	I _{ye}	0.05204 in ⁴
Torsion		S _{xe} (t)	0.43273 in ³	S _{ye} (l)	0.06461 in ³
φB _n	7133.3 lb-in ²	S _{xe} (b)	0.30623 in ³	S _{ye} (r)	0.06350 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=51.072$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=52.982$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=54.71$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.26817 \text{ in}^2$, $F_y=51.072 \text{ ksi}$ $T_n=13696 \text{ lb}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.22572 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=14672 \text{ lb}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1128.9 \text{ lb}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=2692.1 \text{ lb}$	Eq. G3-2
$k_v=0$	Eq. G3-8
$V_{crh}=273.6 \text{ lb}$	Eq. G3-6
$V_n=574.61 \text{ lb}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1128.9 \text{ lb}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3921 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.3255 \text{ in}$ (ineffective width=0.066604 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00012135 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00014217 \text{ in}^4 > I_a$ (no lip reduction)	
$k=0$	Table 1.3-1
Element 2: Partially stiffened, $w=1.4092 \text{ in}$	
$f=50 \text{ ksi}$, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.98664 \text{ in}$ (ineffective width=0.42256 in)	Eq. 1.1-1
$b_1=0.49332 \text{ in}$, $b_2=0.49332 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.40718 \text{ in}$ (ineffective width=1.4849 in)	Eq. 1.1-1
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	

$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.40718$ in (ineffective width=1.4849 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3921$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.3255$ in (ineffective width=0.066604 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00012135$ in ⁴	Eq. 1.3-8
$I_s=0.00014217$ in ⁴ > I_a (no lip reduction)	
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4092$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.98664$ in (ineffective width=0.42256 in)	Eq. 1.1-1
$b_1=0.49332$ in, $b_2=0.49332$ in	
$A_e=0.11398$ in ² , $F_n=50$ ksi	
$P_n=5699.2$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=5.2842$ in

$f_1=48.324$ ksi, $f_2=-33.733$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=2.4397$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=1.625$ in, $h_o/b_o=0$	
$b_1=0.65973$ in	Eq. 1.1.2-3
$b_2=1.2199$ in	Eq. 1.1.2-4
Compression width=3.1119 in	
Ineffective width=1.2323 in	
Element 5: Unstiffened, $w=0.3921$ in	
$f_1=48.324$ ksi, $f_2=42.236$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.34063$ in (ineffective width=0.051466 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=0$$

Eq. 1.3-7

$$I_a=0.00012109 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00014217 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=0$$

Table 1.3-1

Element 4: Partially stiffened, $w=1.4092 \text{ in}$

$$f=49.78 \text{ ksi}, k=0$$

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=0.9883 \text{ in (ineffective width}=0.4209 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.49415 \text{ in}, b_2=0.49415 \text{ in}$$

Center of gravity shift: $y=-0.47077 \text{ in}$

$$S_{xe}=0.30623 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1275.9 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3921 \text{ in}$

$$f_1=48.324 \text{ ksi}, f_2=42.236 \text{ ksi}$$

$$\psi=0$$

Eq. 1.2.2-1

$$k=0$$

Eq. 1.2.2-2

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=0.34063 \text{ in (ineffective width}=0.051466 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=0$$

Eq. 1.3-7

$$I_a=0.00012109 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00014217 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=0$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.4092 \text{ in}$

$$f=49.78 \text{ ksi}, k=0$$

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=0.9883 \text{ in (ineffective width}=0.4209 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.49415 \text{ in}, b_2=0.49415 \text{ in}$$

Element 3: Stiffened, $w=5.2842 \text{ in}$

$$f_1=48.324 \text{ ksi}, f_2=-33.733 \text{ ksi}$$

$$\psi=0$$

Eq. 1.1.2-1

$$k=0$$

Eq. 1.1.2-2

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b_e=2.4397 \text{ in}$$

Eq. 1.1-1

$$h_o=5.5 \text{ in}, b_o=1.625 \text{ in}, h_o/b_o=0$$

$$b_1=0.65973 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.2199 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.1119 \text{ in}$$

$$\text{Ineffective width}=1.2323 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.47077$ in

$S_{xe}=0.30623$ in³, $F_y=50$ ksi

$M_{nl}=1275.9$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3921$ in

$f_1=49.374$ ksi, $f_2=49.374$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.3269$ in (ineffective width= 0.065203 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.4092$ in

$f_1=45.23$ ksi, $f_2=-17.066$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.4092$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.41725$ in

Eq. 1.1.2-3

$b_2=0.7046$ in

Eq. 1.1.2-4

Compression width= 1.0231 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3921$ in

$f_1=49.374$ ksi, $f_2=49.374$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.3269$ in (ineffective width= 0.065203 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.4092$ in

$f_1=45.23$ ksi, $f_2=-17.066$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.4092$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.41725$ in

Eq. 1.1.2-3

$b_2=0.7046$ in

Eq. 1.1.2-4

Compression width= 1.0231 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.018261$ in

$S_{ye}=0.071165$ in³, $F_y=50$ ksi

$M_{nl}=296.52$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.4092$ in $f_1=42.546$ ksi, $f_2=-43.418$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.4092$ in

Eq. 1.1-1

 $h_o=1.625$ in, $b_o=5.5$ in, $h_o/b_o=0$ $b_1=0.3505$ in

Eq. 1.1.2-3

 $b_2=0.7046$ in

Eq. 1.1.2-4

Compression width= 0.69745 in $b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

 $f_1=48.265$ ksi, $f_2=48.265$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.41405$ in (ineffective width= 1.4781 in)

Eq. 1.1-1

 $f_1=48.265$ ksi, $f_2=48.265$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.41405$ in (ineffective width= 1.4781 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.4092$ in $f_1=42.546$ ksi, $f_2=-43.418$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.4092$ in

Eq. 1.1-1

 $h_o=1.625$ in, $b_o=5.5$ in, $h_o/b_o=0$ $b_1=0.3505$ in

Eq. 1.1.2-3

 $b_2=0.7046$ in

Eq. 1.1.2-4

Compression width= 0.69745 in $b_1+b_2 >$ compression width (fully effective)Center of gravity shift: $x=0.29331$ in $S_{ye}=0.063504$ in³, $F_y=50$ ksi $M_{nl}=264.6$ lb-ft

Eq. F3.1-1

 $\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

 $C_w=0.56386$ in⁶, $W_n=3.5571$ in², $F_y=50$ ksi $B_n=7925.8$ lb-in²

G8.1-1

$\Omega_b=1.67, \phi_b=0.9$

550S162-30

Full Section Properties

Area	0.29529 in ²	Wt.	1.0040 lb/ft	Flat	9.4643 in
I _x	1.3193 in ⁴	r _x	2.1137 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.47975 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.47975 in ³	y(b)	2.7500 in		
Z _x	0.56676 in ³	Height	5.5000 in		
I _y	0.1029 in ⁴	r _y	0.5904 in	x _o	-1.1135 in
S _y (l)	0.23740 in ³	x(l)	0.4336 in	y _o	0.0000 in
S _y (r)	0.08640 in ³	x(r)	1.1914 in	j _x	2.9257 in
Z _y	0.12396 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	1.3193 in ⁴	r ₁	2.1137 in	C _w	0.62152 in ⁶
I ₂	0.1029 in ⁴	r ₂	0.5904 in	J	0.0000958 in ⁴
I _c	1.4222 in ⁴	r _c	2.1946 in		
I _o	1.7884 in ⁴	r _o	2.4610 in		

Net Section Properties

I _x	1.3105 in ⁴	r _x	2.2965 in	Area	0.24849 in ²
S _x (t)	0.47656 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.47656 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	0.54921 in ³				
I _y	0.0932 in ⁴	r _y	0.6125 in	x _o	-1.1969 in
S _y (l)	0.18194 in ³	x(l)	0.5123 in	y _o	0.0000 in
S _y (r)	0.08377 in ³	x(r)	1.1127 in	j _x	2.5639 in
Z _y	0.12323 in ³			j _y	0.0000 in
I _c	1.4037 in ⁴	r _c	2.3768 in	C _w	0.61724 in ⁶
I _o	1.7597 in ⁴	r _o	2.6612 in	J	0.00008063 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	5639 lb	φM _{nxo}	1369.4 lb-ft	φM _{nyo}	300.1 lb-ft
A _e	0.13269 in ²	I _{xe}	1.1338 in ⁴	I _{ye}	0.0900 in ⁴
φT _n	12114 lb	S _{xe} (t)	0.36518 in ³	S _{ye} (l)	0.17980 in ³
		S _{xe} (b)	0.47340 in ³	S _{ye} (r)	0.08003 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	642 lb	φM _{nxo}	1369.4 lb-ft	φM _{nyo}	264.7 lb-ft
φV _{nx}	2328 lb	I _{xe}	1.1338 in ⁴	I _{ye}	0.0589 in ⁴
Torsion		S _{xe} (t)	0.47340 in ³	S _{ye} (l)	0.07459 in ³
φB _n	7830.4 lb-in ²	S _{xe} (b)	0.36518 in ³	S _{ye} (r)	0.07058 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.163$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=53.235$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=55.114$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.29529 \text{ in}^2$, $F_y=51.163 \text{ ksi}$ $T_n=15108 \text{ lb}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.24849 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=16152 \text{ lb}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1293.4 \text{ lb}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=2965 \text{ lb}$	Eq. G3-2
$k_v=0$	Eq. G3-8
$V_{crh}=366.67 \text{ lb}$	Eq. G3-6
$V_n=713.09 \text{ lb}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1293.4 \text{ lb}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3907 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.34676 \text{ in}$ (ineffective width=0.043938 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00016273 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00015506 \text{ in}^4$	
$d_s=0.33042 \text{ in}$ (lip ineffective width=0.01634 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 2: Partially stiffened, $w=1.4064 \text{ in}$	
$f=50 \text{ ksi}$, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.0551 \text{ in}$ (ineffective width=0.35127 in)	Eq. 1.1-1
$b_1=0.5027 \text{ in}$, $b_2=0.55242 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.44648 \text{ in}$ (ineffective width=1.4442 in)	Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.44648$ in (ineffective width= 1.4442 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.34676$ in (ineffective width= 0.043938 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00016273$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$d_s=0.33042$ in (lip ineffective width= 0.016341 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4064$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.0551$ in (ineffective width= 0.35127 in)	Eq. 1.1-1
$b_1=0.5027$ in, $b_2=0.55242$ in	
$A_e=0.13269$ in ² , $F_n=50$ ksi	
$P_n=6634.3$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.2814$ in	
$f_1=48.239$ ksi, $f_2=-36.837$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=2.7402$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=1.625$ in, $h_o/b_o=0$	
$b_1=0.72808$ in	Eq. 1.1.2-3
$b_2=1.3701$ in	Eq. 1.1.2-4
Compression width= 2.9946 in	
Ineffective width= 0.89643 in	
Element 5: Unstiffened, $w=0.3907$ in	
$f_1=48.239$ ksi, $f_2=41.946$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3

$\rho=0$	Eq. 1.1-2
$b=0.36228$ in (ineffective width= 0.028417 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00016233$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$d_s=0.34606$ in (lip ineffective width= 0.016227 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4064$ in	
$f=49.749$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.0574$ in (ineffective width= 0.34904 in)	Eq. 1.1-1
$b_1=0.505$ in, $b_2=0.55236$ in	
Center of gravity shift: $y=-0.35489$ in	
$S_{xe}=0.36518$ in ³ , $F_y=50$ ksi	
$M_{nl}=1521.6$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3907$ in	
$f_1=48.239$ ksi, $f_2=41.946$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.36228$ in (ineffective width= 0.028417 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00016233$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$d_s=0.34606$ in (lip ineffective width= 0.016227 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 2: Partially stiffened, $w=1.4064$ in	
$f=49.749$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.0574$ in (ineffective width= 0.34904 in)	Eq. 1.1-1
$b_1=0.505$ in, $b_2=0.55236$ in	
Element 3: Stiffened, $w=5.2814$ in	
$f_1=48.239$ ksi, $f_2=-36.837$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=2.7402$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=1.625$ in, $h_o/b_o=0$	
$b_1=0.72808$ in	Eq. 1.1.2-3
$b_2=1.3701$ in	Eq. 1.1.2-4

Compression width=2.9946 in
 Ineffective width=0.89643 in
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.35489$ in
 $S_{xe}=0.36518$ in³, $F_y=50$ ksi
 $M_{nl}=1521.6$ lb-ft
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3907$ in

$f_1=49.306$ ksi, $f_2=49.306$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.34831$ in (ineffective width=0.042395 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.4064$ in

$f_1=45.14$ ksi, $f_2=-17.396$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.4064$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.41543$ in

Eq. 1.1.2-3

$b_2=0.7032$ in

Eq. 1.1.2-4

Compression width=1.0152 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3907$ in

$f_1=49.306$ ksi, $f_2=49.306$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.34831$ in (ineffective width=0.042395 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.4064$ in

$f_1=45.14$ ksi, $f_2=-17.396$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.4064$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.41543$ in

Eq. 1.1.2-3

$b_2=0.7032$ in

Eq. 1.1.2-4

Compression width=1.0152 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x = -0.011805$ in
 $S_y = 0.080032 \text{ in}^3$, $F_y = 50 \text{ ksi}$
 $M_n I = 333.47 \text{ lb-ft}$
 $\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.4064$ in

$f_1 = 40.744 \text{ ksi}$, $f_2 = -43.456 \text{ ksi}$

$\psi = 0$

Eq. 1.1.2-1

$k = 0$

Eq. 1.1.2-2

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b_e = 1.4064$ in

Eq. 1.1-1

$h_o = 1.625$ in, $b_o = 5.5$ in, $h_o/b_o = 0$

$b_1 = 0.34584$ in

Eq. 1.1.2-3

$b_2 = 0.7032$ in

Eq. 1.1.2-4

Compression width = 0.68055 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 46.354 \text{ ksi}$, $f_2 = 46.354 \text{ ksi}$

$\psi = 0$

Eq. 1.2.2-1

$k = 0$

Eq. 1.2.2-3

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b = 0.46266$ in (ineffective width = 1.428 in)

Eq. 1.1-1

$f_1 = 46.354 \text{ ksi}$, $f_2 = 46.354 \text{ ksi}$

$\psi = 0$

Eq. 1.2.2-1

$k = 0$

Eq. 1.2.2-3

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b = 0.46266$ in (ineffective width = 1.428 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.4064$ in

$f_1 = 40.744 \text{ ksi}$, $f_2 = -43.456 \text{ ksi}$

$\psi = 0$

Eq. 1.1.2-1

$k = 0$

Eq. 1.1.2-2

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b_e = 1.4064$ in

Eq. 1.1-1

$h_o = 1.625$ in, $b_o = 5.5$ in, $h_o/b_o = 0$

$b_1 = 0.34584$ in

Eq. 1.1.2-3

$b_2 = 0.7032$ in

Eq. 1.1.2-4

Compression width = 0.68055 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.27772$ in

$S_y = 0.070575 \text{ in}^3$, $F_y = 50 \text{ ksi}$

$M_n I = 294.06 \text{ lb-ft}$

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Bimoment Strength, Stud

$C_w=0.61724 \text{ in}^6$, $W_n=3.5472 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=8700.5 \text{ lb-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

550S162-33

Full Section Properties

Area	0.32700 in ²	Wt.	1.1118 lb/ft	Flat	9.4507 in
I _x	1.4586 in ⁴	r _x	2.1120 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.53040 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.53040 in ³	y(b)	2.7500 in		
Z _x	0.62707 in ³	Height	5.5000 in		
I _y	0.1134 in ⁴	r _y	0.5889 in	x _o	-1.1100 in
S _y (l)	0.26139 in ³	x(l)	0.4339 in	y _o	0.0000 in
S _y (r)	0.09521 in ³	x(r)	1.1911 in	j _x	2.9246 in
Z _y	0.13688 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	1.4586 in ⁴	r ₁	2.1120 in	C _w	0.68351 in ⁶
I ₂	0.1134 in ⁴	r ₂	0.5889 in	J	0.0001305 in ⁴
I _c	1.5720 in ⁴	r _c	2.1926 in		
I _o	1.9749 in ⁴	r _o	2.4575 in		

Net Section Properties

I _x	1.4489 in ⁴	r _x	2.2950 in	Area	0.27510 in ²
S _x (t)	0.52686 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.52686 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	0.60760 in ³				
I _y	0.1027 in ⁴	r _y	0.6110 in	x _o	-1.1932 in
S _y (l)	0.20040 in ³	x(l)	0.5125 in	y _o	0.0000 in
S _y (r)	0.09231 in ³	x(r)	1.1125 in	j _x	2.5623 in
Z _y	0.13600 in ³			j _y	0.0000 in
I _c	1.5516 in ⁴	r _c	2.3749 in	C _w	0.67880 in ⁶
I _o	1.9433 in ⁴	r _o	2.6578 in	J	0.00010978 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	6405 lb	φM _{nxo}	1600.1 lb-ft	φM _{nyo}	339.3 lb-ft
A _e	0.15071 in ²	I _{xe}	1.2899 in ⁴	I _{ye}	0.1011 in ⁴
φT _n	13411 lb	S _{xe} (t)	0.42669 in ³	S _{ye} (l)	0.19938 in ³
		S _{xe} (b)	0.52078 in ³	S _{ye} (r)	0.09049 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	806 lb	φM _{nxo}	1600.1 lb-ft	φM _{nyo}	295.9 lb-ft
φV _{nx}	2621 lb	I _{xe}	1.2899 in ⁴	I _{ye}	0.0673 in ⁴
Torsion		S _{xe} (t)	0.52078 in ³	S _{ye} (l)	0.08714 in ³
φB _n	8639.7 lb-in ²	S _{xe} (b)	0.42669 in ³	S _{ye} (r)	0.07892 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.263$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=53.516$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=55.565$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.327 \text{ in}^2$, $F_y=51.263 \text{ ksi}$
 $T_n=16763 \text{ lb}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.2751 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=17881 \text{ lb}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1456.3 \text{ lb}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=3284.1 \text{ lb}$

Eq. G3-2

$k_v=0$

Eq. G3-8

$V_{crh}=500.14 \text{ lb}$

Eq. G3-6

$V_n=895.3 \text{ lb}$ at 90 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1456.3 \text{ lb}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.389 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.36869 \text{ in}$ (ineffective width=0.020315 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00022212 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00016972 \text{ in}^4$

$d_s=0.28171 \text{ in}$ (lip ineffective width=0.086971 in)

Eq. 1.3-6

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.403 \text{ in}$

$f=50 \text{ ksi}$, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=1.1099 \text{ in}$ (ineffective width=0.29313 in)

Eq. 1.1-1

$b_1=0.42403 \text{ in}$, $b_2=0.68584 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.49196 \text{ in}$ (ineffective width=1.397 in)

Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.49196$ in (ineffective width=1.397 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.36869$ in (ineffective width=0.020315 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00022212$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.28171$ in (lip ineffective width=0.086971 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.403$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.1099$ in (ineffective width=0.29313 in)	Eq. 1.1-1
$b_1=0.42403$ in, $b_2=0.68584$ in	
$A_e=0.15071$ in ² , $F_n=50$ ksi	
$P_n=7535.6$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.278$ in	
$f_1=48.163$ ksi, $f_2=-39.162$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=3.0592$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=1.625$ in, $h_o/b_o=0$	
$b_1=0.8023$ in	Eq. 1.1.2-3
$b_2=1.5296$ in	Eq. 1.1.2-4
Compression width=2.911 in	
Ineffective width=0.5791 in	
Element 5: Unstiffened, $w=0.389$ in	
$f_1=48.163$ ksi, $f_2=41.727$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3

$\rho=0$	Eq. 1.1-2
$b=0.38392$ in (ineffective width= 0.0050828 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.0002215$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.29417$ in (lip ineffective width= 0.089748 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.403$ in	
$f=49.714$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.1124$ in (ineffective width= 0.29055 in)	Eq. 1.1-1
$b_1=0.4262$ in, $b_2=0.68625$ in	
Center of gravity shift: $y=-0.27308$ in	
$S_{xe}=0.42669$ in ³ , $F_y=50$ ksi	
$M_{nl}=1777.9$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.389$ in	
$f_1=48.163$ ksi, $f_2=41.727$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.38392$ in (ineffective width= 0.0050828 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.0002215$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.29417$ in (lip ineffective width= 0.089748 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 2: Partially stiffened, $w=1.403$ in	
$f=49.714$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.1124$ in (ineffective width= 0.29055 in)	Eq. 1.1-1
$b_1=0.4262$ in, $b_2=0.68625$ in	
Element 3: Stiffened, $w=5.278$ in	
$f_1=48.163$ ksi, $f_2=-39.162$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=3.0592$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=1.625$ in, $h_o/b_o=0$	
$b_1=0.8023$ in	Eq. 1.1.2-3
$b_2=1.5296$ in	Eq. 1.1.2-4

Compression width=2.911 in
 Ineffective width=0.57909 in
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.27308$ in
 $S_x=0.42669$ in³, $F_y=50$ ksi
 $M_{nl}=1777.9$ lb-ft
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.389$ in
 $f_1=49.226$ ksi, $f_2=49.226$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.37035$ in (ineffective width=0.018653 in) Eq. 1.1-1

Element 2: Stiffened, $w=1.403$ in
 $f_1=45.034$ ksi, $f_2=-17.728$ ksi
 $\psi=0$ Eq. 1.1.2-1
 $k=0$ Eq. 1.1.2-2
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b_e=1.403$ in Eq. 1.1-1
 $h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$
 $b_1=0.41342$ in Eq. 1.1.2-3
 $b_2=0.7015$ in Eq. 1.1.2-4

Compression width=1.0067 in
 $b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.389$ in
 $f_1=49.226$ ksi, $f_2=49.226$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-2
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.37035$ in (ineffective width=0.018653 in) Eq. 1.1-1

Element 4: Stiffened, $w=1.403$ in
 $f_1=45.034$ ksi, $f_2=-17.728$ ksi
 $\psi=0$ Eq. 1.1.2-1
 $k=0$ Eq. 1.1.2-2
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b_e=1.403$ in Eq. 1.1-1
 $h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$

$b_1=0.41342$ in Eq. 1.1.2-3
 $b_2=0.7015$ in Eq. 1.1.2-4

Compression width=1.0067 in
 $b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x = -0.0051633$ in

$S_y = 0.09049$ in³, $F_y = 50$ ksi

$M_{nl} = 377.04$ lb-ft

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.403$ in

$f_1 = 38.751$ ksi, $f_2 = -43.493$ ksi

$\psi = 0$

Eq. 1.1.2-1

$k = 0$

Eq. 1.1.2-2

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b_e = 1.403$ in

Eq. 1.1-1

$h_o = 1.625$ in, $b_o = 5.5$ in, $h_o/b_o = 0$

$b_1 = 0.34034$ in

Eq. 1.1.2-3

$b_2 = 0.7015$ in

Eq. 1.1.2-4

Compression width = 0.66105 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 44.244$ ksi, $f_2 = 44.244$ ksi

$\psi = 0$

Eq. 1.2.2-1

$k = 0$

Eq. 1.2.2-3

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b = 0.52084$ in (ineffective width = 1.3682 in)

Eq. 1.1-1

$f_1 = 44.244$ ksi, $f_2 = 44.244$ ksi

$\psi = 0$

Eq. 1.2.2-1

$k = 0$

Eq. 1.2.2-3

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b = 0.52084$ in (ineffective width = 1.3682 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.403$ in

$f_1 = 38.751$ ksi, $f_2 = -43.493$ ksi

$\psi = 0$

Eq. 1.1.2-1

$k = 0$

Eq. 1.1.2-2

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b_e = 1.403$ in

Eq. 1.1-1

$h_o = 1.625$ in, $b_o = 5.5$ in, $h_o/b_o = 0$

$b_1 = 0.34034$ in

Eq. 1.1.2-3

$b_2 = 0.7015$ in

Eq. 1.1.2-4

Compression width = 0.66105 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.25984$ in

$S_y = 0.078918$ in³, $F_y = 50$ ksi

$M_{nl} = 328.82$ lb-ft

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Bimoment Strength, Stud

$C_w=0.6788 \text{ in}^6$, $W_n=3.5356 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=9599.6 \text{ lb-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

550S162-43

Full Section Properties

Area	0.42433 in ²	Wt.	1.4427 lb/ft	Flat	9.4086 in
I _x	1.8833 in ⁴	r _x	2.1067 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.68483 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.68483 in ³	y(b)	2.7500 in		
Z _x	0.81148 in ³	Height	5.5000 in		
I _y	0.1449 in ⁴	r _y	0.5843 in	x _o	-1.0991 in
S _y (l)	0.33325 in ³	x(l)	0.4347 in	y _o	0.0000 in
S _y (r)	0.12169 in ³	x(r)	1.1903 in	j _x	2.9214 in
Z _y	0.17604 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	1.8833 in ⁴	r ₁	2.1067 in	C _w	0.86814 in ⁶
I ₂	0.1449 in ⁴	r ₂	0.5843 in	J	0.0002877 in ⁴
I _c	2.0281 in ⁴	r _c	2.1862 in		
I _o	2.5407 in ⁴	r _o	2.4469 in		

Net Section Properties

I _x	1.8706 in ⁴	r _x	2.2901 in	Area	0.35668 in ²
S _x (t)	0.68022 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.68022 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	0.78611 in ³				
I _y	0.1312 in ⁴	r _y	0.6064 in	x _o	-1.1819 in
S _y (l)	0.25578 in ³	x(l)	0.5128 in	y _o	0.0000 in
S _y (r)	0.11795 in ³	x(r)	1.1122 in	j _x	2.5571 in
Z _y	0.17466 in ³			j _y	0.0000 in
I _c	2.0018 in ⁴	r _c	2.3690 in	C _w	0.86211 in ⁶
I _o	2.5000 in ⁴	r _o	2.6475 in	J	0.0002418 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	8982 lb	φM _{nxo}	2313.0 lb-ft	φM _{nyo}	502.9 lb-ft
A _e	0.21134 in ²	I _{xe}	1.7673 in ⁴	I _{ye}	0.1312 in ⁴
φT _n	17388 lb	S _{xe} (t)	0.61681 in ³	S _{ye} (l)	0.25578 in ³
		S _{xe} (b)	0.67075 in ³	S _{ye} (r)	0.11795 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1432 lb	φM _{nxo}	2313.0 lb-ft	φM _{nyo}	393.2 lb-ft
φV _{nx}	3391 lb	I _{xe}	1.7673 in ⁴	I _{ye}	0.0948 in ⁴
Torsion		S _{xe} (t)	0.67075 in ³	S _{ye} (l)	0.13162 in ³
φB _n	11085 lb-in ²	S _{xe} (b)	0.61681 in ³	S _{ye} (r)	0.10485 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.546$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=54.31$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=56.847$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.42433$ in², $F_y=51.546$ ksi

$T_n=21872$ lb
 $\Omega_t=1.67$, $\phi_t=0.9$ Eq. D2-1

$A_n=0.35668$ in², $F_u=65$ ksi
 $T_n=23184$ lb
 $\Omega_t=2$, $\phi_t=0.75$ Eq. D3-1

Shear Strength

Stud element 2
 $V_n=1883.9$ lb at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$ Eq. G2.1-1

Stud element 3
 $V_{yh}=4264.5$ lb
 $k_v=0$
 $V_{crh}=1108.1$ lb
 $V_n=1591$ lb at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$
 Eq. G3-2
 Eq. G3-8
 Eq. G3-6
 Eq. G2.1-2

Stud element 4
 $V_n=1883.9$ lb at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$ Eq. G2.1-1

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=0$ Eq. 1.3-7
 $I_a=0.00048546$ in⁴ Eq. 1.3-8
 $I_s=0.00021231$ in⁴
 $d_s=0.16781$ in (lip ineffective width=0.21589 in) Eq. 1.3-6
 $k=0$ Table 1.3-1

Element 2: Partially stiffened, $w=1.3924$ in
 $f=50$ ksi, $k=0$
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=1.2522$ in (ineffective width=0.1402 in) Eq. 1.1-1
 $b_1=0.27382$ in, $b_2=0.97838$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.62846$ in (ineffective width=1.2552 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1

$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.62846$ in (ineffective width=1.2552 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00048546$ in ⁴	Eq. 1.3-8
$I_s=0.00021231$ in ⁴	
$d_s=0.16781$ in (lip ineffective width=0.21589 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.3924$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.2522$ in (ineffective width=0.1402 in)	Eq. 1.1-1
$b_1=0.27382$ in, $b_2=0.97838$ in	
$A_e=0.21134$ in ² , $F_n=50$ ksi	
$P_n=10567$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.2674$ in	
$f_1=47.97$ ksi, $f_2=-43.954$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=3.9421$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=1.625$ in, $h_o/b_o=0$	
$b_1=1.0066$ in	Eq. 1.1.2-3
$b_2=1.9711$ in	Eq. 1.1.2-4
Compression width=2.7488 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=47.97$ ksi, $f_2=41.274$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7

$I_a=0.00047694 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00021231 \text{ in}^4$	
$d_s=0.17081 \text{ in}$ (lip ineffective width=0.21289 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.3924 \text{ in}$	
$f=49.606 \text{ ksi}$, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.257 \text{ in}$ (ineffective width=0.13541 in)	Eq. 1.1-1
$b_1=0.27978 \text{ in}$, $b_2=0.97722 \text{ in}$	
Center of gravity shift: $y=-0.1152 \text{ in}$	
$S_{xe}=0.61681 \text{ in}^3$, $F_y=50 \text{ ksi}$	
$M_{nl}=2570 \text{ lb-ft}$	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3837 \text{ in}$	
$f_1=47.97 \text{ ksi}$, $f_2=41.274 \text{ ksi}$	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00047694 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00021231 \text{ in}^4$	
$d_s=0.17081 \text{ in}$ (lip ineffective width=0.21289 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 2: Partially stiffened, $w=1.3924 \text{ in}$	
$f=49.606 \text{ ksi}$, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.257 \text{ in}$ (ineffective width=0.1354 in)	Eq. 1.1-1
$b_1=0.27978 \text{ in}$, $b_2=0.97722 \text{ in}$	
Element 3: Stiffened, $w=5.2674 \text{ in}$	
$f_1=47.97 \text{ ksi}$, $f_2=-43.954 \text{ ksi}$	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=3.9421 \text{ in}$	Eq. 1.1-1
$h_o=5.5 \text{ in}$, $b_o=1.625 \text{ in}$, $h_o/b_o=0$	
$b_1=1.0066 \text{ in}$	Eq. 1.1.2-3
$b_2=1.9711 \text{ in}$	Eq. 1.1.2-4
Compression width=2.7488 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=0.1152 \text{ in}$	

$S_{xe}=0.61681 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_n I=2570 \text{ lb-ft}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837 \text{ in}$

$f_1=55.694 \text{ ksi}$, $f_2=55.694 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=1.3924 \text{ in}$

$f_1=50.902 \text{ ksi}$, $f_2=-20.269 \text{ ksi}$

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.3924 \text{ in}$

Eq. 1.1-1

$h_o=1.625 \text{ in}$, $b_o=0.5 \text{ in}$, $h_o/b_o=0$

$b_1=0.40975 \text{ in}$

Eq. 1.1.2-3

$b_2=0.6962 \text{ in}$

Eq. 1.1.2-4

Compression width= 0.99585 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3837 \text{ in}$

$f_1=55.694 \text{ ksi}$, $f_2=55.694 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w=1.3924 \text{ in}$

$f_1=50.902 \text{ ksi}$, $f_2=-20.269 \text{ ksi}$

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.3924 \text{ in}$

Eq. 1.1-1

$h_o=1.625 \text{ in}$, $b_o=0.5 \text{ in}$, $h_o/b_o=0$

$b_1=0.40975 \text{ in}$

Eq. 1.1.2-3

$b_2=0.6962 \text{ in}$

Eq. 1.1.2-4

Compression width= 0.99585 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0 \text{ in}$

$S_{ye}=0.11795 \text{ in}^3$, $F_y=56.847 \text{ ksi}$

$M_n I=558.74 \text{ lb-ft}$

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.3924$ in

$f_1=33.374$ ksi, $f_2=-43.573$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.3924$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=5.5$ in, $h_o/b_o=0$

$b_1=0.32339$ in

Eq. 1.1.2-3

$b_2=0.6962$ in

Eq. 1.1.2-4

Compression width= 0.60392 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=38.554$ ksi, $f_2=38.554$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.70708$ in (ineffective width= 1.1766 in)

Eq. 1.1-1

$f_1=38.554$ ksi, $f_2=38.554$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.70708$ in (ineffective width= 1.1766 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.3924$ in

$f_1=33.374$ ksi, $f_2=-43.573$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.3924$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=5.5$ in, $h_o/b_o=0$

$b_1=0.32339$ in

Eq. 1.1.2-3

$b_2=0.6962$ in

Eq. 1.1.2-4

Compression width= 0.60392 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.20769$ in

$S_y=0.10485$ in³, $F_y=50$ ksi

$M_n=436.89$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=0.86211$ in⁶, $W_n=3.4998$ in², $F_y=50$ ksi

$B_n=12317$ lb-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

550S162-54

Full Section Properties

Area	0.52804 in ²	Wt.	1.7953 lb/ft	Flat	9.3293 in
Ix	2.3247 in ⁴	rx	2.0982 in	Ixy	0.0000 in ⁴
Sx(t)	0.8453 in ³	y(t)	2.7500 in	α	0.000 deg
Sx(b)	0.8453 in ³	y(b)	2.7500 in		
Zx	1.0051 in ³	Height	5.5000 in		
Iy	0.1763 in ⁴	ry	0.5778 in	x _o	-1.0847 in
Sy(l)	0.4059 in ³	x(l)	0.4342 in	y _o	0.0000 in
Sy(r)	0.1480 in ³	x(r)	1.1908 in	jx	2.9226 in
Zy	0.2162 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	2.3247 in ⁴	r ₁	2.0982 in	Cw	1.0484 in ⁶
I ₂	0.1763 in ⁴	r ₂	0.5778 in	J	0.0005639 in ⁴
Ic	2.5009 in ⁴	rc	2.1763 in		
I _o	3.1222 in ⁴	r _o	2.4316 in		

Net Section Properties

Ix	2.3087 in ⁴	rx	2.2825 in	Area	0.44314 in ²
Sx(t)	0.8395 in ³	y(t)	2.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.8395 in ³	y(b)	2.7500 in	α	0.000 deg
Zx	0.9733 in ³				
Iy	0.1596 in ⁴	ry	0.6001 in	x _o	-1.1672 in
Sy(l)	0.3116 in ³	x(l)	0.5120 in	y _o	0.0000 in
Sy(r)	0.1434 in ³	x(r)	1.1130 in	jx	2.5555 in
Zy	0.2141 in ³			jy	0.0000 in
Ic	2.4683 in ⁴	rc	2.3601 in	Cw	1.0410 in ⁶
I _o	3.0720 in ⁴	r _o	2.6329 in	J	0.0004732 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	12987 lb	φMnxo	3057.8 lb-ft	φMnyo	628.1 lb-ft
Ae	0.30559 in ²	Ixe	2.2718 in ⁴	Iye	0.1596 in ⁴
φTn	21603 lb	Sxe(t)	0.81541 in ³	Sye(l)	0.31164 in ³
		Sxe(b)	0.83709 in ³	Sye(r)	0.14337 in ³
Shear		Negative Bending		Negative Bending	
φVny	2301 lb	φMnxo	3057.8 lb-ft	φMnyo	495.5 lb-ft
φVnx	4102 lb	Ixe	2.2718 in ⁴	Iye	0.1270 in ⁴
Torsion		Sxe(t)	0.83709 in ³	Sye(l)	0.19140 in ³
φBn	13540 lb-in ²	Sxe(b)	0.81541 in ³	Sye(r)	0.13214 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.935$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=55.318$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=58.416$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.52804$ in², $F_y=51.935$ ksi

$T_n=27424 \text{ lb}$ Eq. D2-1
 $\Omega_t=1.67, \phi_t=0.9$

$A_n=0.44314 \text{ in}^2, F_u=65 \text{ ksi}$
 $T_n=28804 \text{ lb}$ Eq. D3-1
 $\Omega_t=2, \phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=2278.7 \text{ lb at } 180 \text{ deg}$ Eq. G2.1-1
 $\Omega_v=1.67, \phi_v=0.9$

Stud element 3
 $V_{yh}=5255.1 \text{ lb}$ Eq. G3-2
 $k_v=0$ Eq. G3-8
 $V_{crh}=2194.2 \text{ lb}$ Eq. G3-6
 $V_n=2556.6 \text{ lb at } 90 \text{ deg}$ Eq. G2.1-2
 $\Omega_v=1.67, \phi_v=0.9$

Stud element 4
 $V_n=2278.7 \text{ lb at } 0 \text{ deg}$ Eq. G2.1-1
 $\Omega_v=1.67, \phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585 \text{ in}$
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\lambda < 0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=0$ Eq. 1.3-7
 $I_a=0.00033614 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00021732 \text{ in}^4$
 $d_s=0.23177 \text{ in}$ (lip ineffective width= 0.12673 in) Eq. 1.3-6
 $k=0$ Table 1.3-1

Element 2: Partially stiffened, $w=1.342 \text{ in}$
 $f=50 \text{ ksi}, k=0$
 $\lambda=0$ Eq. 1.1-3
 $\lambda < 0.673$ (fully effective) Eq. 1.1-1

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.77011 \text{ in}$ (ineffective width= 1.0884 in) Eq. 1.1-1
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3

$\rho=0$	Eq. 1.1-2
$b=0.77011$ in (ineffective width= 1.0884 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00033614$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.23177$ in (lip ineffective width= 0.12673 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
$A_e=0.30559$ in ² , $F_n=50$ ksi	
$P_n=15279$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.217$ in	
$f_1=47.461$ ksi, $f_2=-46.166$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=4.7073$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=1.625$ in, $h_o/b_o=0$	
$b_1=1.1849$ in	Eq. 1.1.2-3
$b_2=2.3536$ in	Eq. 1.1.2-4
Compression width= 2.6446 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=47.461$ ksi, $f_2=41.027$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00032721$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.2381$ in (lip ineffective width= 0.1204 in)	Eq. 1.3-6
$k=0$	Table 1.3-1

Element 4: Partially stiffened, $w=1.342$ in

$f=49.492$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Center of gravity shift: $y=-0.036082$ in

$S_{xe}=0.81541$ in³, $F_y=50$ ksi

$M_{nl}=3397.5$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585$ in

$f_1=47.461$ ksi, $f_2=41.027$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00032721$ in⁴

Eq. 1.3-8

$I_s=0.00021732$ in⁴

$ds=0.2381$ in (lip ineffective width= 0.1204 in)

Eq. 1.3-6

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.342$ in

$f=49.492$ ksi, $k=0$

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 3: Stiffened, $w=5.217$ in

$f_1=47.461$ ksi, $f_2=-46.166$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=4.7073$ in

Eq. 1.1-1

$h_o=5.5$ in, $b_o=1.625$ in, $h_o/b_o=0$

$b_1=1.1849$ in

Eq. 1.1.2-3

$b_2=2.3536$ in

Eq. 1.1.2-4

Compression width= 2.6446 in

$b_1+b_2 >$ compression width (fully effective)

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.036082$ in

$S_{xe}=0.81541$ in³, $F_y=50$ ksi

$M_{nl}=3397.5$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585$ in

$f_1=56.931$ ksi, $f_2=56.931$ ksi

$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\lambda < 0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.342$ in	
$f_1=50.989$ ksi, $f_2=-19.447$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$	
$b_1=0.39688$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width= 0.97149 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=56.931$ ksi, $f_2=56.931$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\lambda < 0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.342$ in	
$f_1=50.989$ ksi, $f_2=-19.447$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=0$	
$b_1=0.39688$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width= 0.97149 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_y=0.14336$ in ³ , $F_y=58.416$ ksi	
$M_{nl}=697.9$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.342$ in

$f_1=27.048$ ksi, $f_2=-42.651$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.342$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=5.5$ in, $h_o/b_o=0$

$b_1=0.29322$ in

Eq. 1.1.2-3

$b_2=0.671$ in	Eq. 1.1.2-4
Compression width=0.52079 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=32.928$ ksi, $f_2=32.927$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.9241$ in (ineffective width=0.9344 in)	Eq. 1.1-1
$f_1=32.928$ ksi, $f_2=32.928$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.9241$ in (ineffective width=0.9344 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.342$ in	
$f_1=27.048$ ksi, $f_2=-42.651$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=5.5$ in, $h_o/b_o=0$	
$b_1=0.29322$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width=0.52079 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.15166$ in	
$S_y=0.13214$ in ³ , $F_y=50$ ksi	
$M_n=550.57$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.041$ in ⁶ , $W_n=3.4598$ in ² , $F_y=50$ ksi	
$B_n=15045$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

550S200-27

Full Section Properties

Area	0.29647 in ²	Wt.	1.0080 lb/ft	Flat	10.476 in
I _x	1.3925 in ⁴	r _x	2.1673 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.50637 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.50637 in ³	y(b)	2.7500 in		
Z _x	0.58864 in ³	Height	5.5000 in		
I _y	0.1683 in ⁴	r _y	0.7534 in	x _o	-1.5122 in
S _y (l)	0.28047 in ³	x(l)	0.6000 in	y _o	0.0000 in
S _y (r)	0.12021 in ³	x(r)	1.4000 in	j _x	2.9505 in
Z _y	0.17379 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	1.3925 in ⁴	r ₁	2.1673 in	C _w	1.0631 in ⁶
I ₂	0.1683 in ⁴	r ₂	0.7534 in	J	0.0000791 in ⁴
I _c	1.5608 in ⁴	r _c	2.2945 in		
I _o	2.2388 in ⁴	r _o	2.7480 in		

Net Section Properties

I _x	1.3846 in ⁴	r _x	2.3347 in	Area	0.25402 in ²
S _x (t)	0.50348 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.50348 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	0.57272 in ³				
I _y	0.1513 in ⁴	r _y	0.7717 in	x _o	-1.6155 in
S _y (l)	0.21675 in ³	x(l)	0.6980 in	y _o	0.0000 in
S _y (r)	0.11619 in ³	x(r)	1.3020 in	j _x	2.6634 in
Z _y	0.16860 in ³			j _y	0.0000 in
I _c	1.5358 in ⁴	r _c	2.4589 in	C _w	1.0563 in ⁶
I _o	2.1988 in ⁴	r _o	2.9421 in	J	0.0000678 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	5028 lb	φM _{nxo}	1198.9 lb-ft	φM _{nyo}	375.1 lb-ft
A _e	0.11831 in ²	I _{xe}	1.0686 in ⁴	I _{ye}	0.1352 in ⁴
φT _n	12383 lb	S _{xe} (t)	0.31972 in ³	S _{ye} (l)	0.20837 in ³
		S _{xe} (b)	0.49530 in ³	S _{ye} (r)	0.10004 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	520 lb	φM _{nxo}	1198.9 lb-ft	φM _{nyo}	335.8 lb-ft
φV _{nx}	2201 lb	I _{xe}	1.0686 in ⁴	I _{ye}	0.0927 in ⁴
Torsion		S _{xe} (t)	0.49530 in ³	S _{ye} (l)	0.08955 in ³
φB _n	10307 lb-in ²	S _{xe} (b)	0.31972 in ³	S _{ye} (r)	0.09608 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=50.97$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=52.444$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=53.824$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.29647 \text{ in}^2$, $F_y=50.97 \text{ ksi}$
 $T_n=15111 \text{ lb}$ Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.25402 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=16511 \text{ lb}$ Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=1223 \text{ lb}$ at 180 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$
 Stud element 3
 $V_{yh}=2692.1 \text{ lb}$ Eq. G3-2
 $k_v=0$ Eq. G3-8
 $V_{crh}=276.37 \text{ lb}$ Eq. G3-6
 $V_n=578.15 \text{ lb}$ at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$
 Stud element 4
 $V_n=1223 \text{ lb}$ at 0 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud
 Element 1: Unstiffened, $w=0.5171 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.3504 \text{ in}$ (ineffective width=0.1667 in) Eq. 1.1-1
 Element 2: Check for lip stiffener reduction
 $S=0$ Eq. 1.3-7
 $I_a=0.00015278 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00032608 \text{ in}^4 > I_a$ (no lip reduction)
 $k=0$ Table 1.3-1
 Element 2: Partially stiffened, $w=1.7842 \text{ in}$
 $f=50 \text{ ksi}$, $k=0$
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=1.0381 \text{ in}$ (ineffective width=0.74609 in) Eq. 1.1-1
 $b_1=0.51906 \text{ in}$, $b_2=0.51906 \text{ in}$
 Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.40718 \text{ in}$ (ineffective width=1.4849 in) Eq. 1.1-1
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.40718$ in (ineffective width=1.4849 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.3504$ in (ineffective width=0.1667 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00015278$ in ⁴	Eq. 1.3-8
$I_s=0.00032608$ in ⁴ > I_a (no lip reduction)	
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7842$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.0381$ in (ineffective width=0.74609 in)	Eq. 1.1-1
$b_1=0.51906$ in, $b_2=0.51906$ in	
$A_e=0.11831$ in ² , $F_n=50$ ksi	
$P_n=5915.3$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=5.2842$ in

$f_1=48.386$ ksi, $f_2=-30.674$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=2.3628$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2$ in, $h_o/b_o=0$	
$b_1=0.65021$ in	Eq. 1.1.2-3
$b_2=1.1814$ in	Eq. 1.1.2-4
Compression width=3.234 in	
Ineffective width=1.4024 in	
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=48.386$ ksi, $f_2=40.649$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.37296$ in (ineffective width=0.14414 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=0$$

Eq. 1.3-7

$$I_a=0.00015247 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00032608 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=0$$

Table 1.3-1

Element 4: Partially stiffened, $w=1.7842 \text{ in}$

$$f=49.788 \text{ ksi}, k=0$$

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=1.0399 \text{ in (ineffective width}=0.74428 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.51996 \text{ in}, b_2=0.51996 \text{ in}$$

Center of gravity shift: $y=-0.59243 \text{ in}$

$$S_{xe}=0.31972 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1332.2 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171 \text{ in}$

$$f_1=48.386 \text{ ksi}, f_2=40.649 \text{ ksi}$$

$$\psi=0$$

Eq. 1.2.2-1

$$k=0$$

Eq. 1.2.2-2

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=0.37296 \text{ in (ineffective width}=0.14414 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=0$$

Eq. 1.3-7

$$I_a=0.00015247 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00032608 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=0$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.7842 \text{ in}$

$$f=49.788 \text{ ksi}, k=0$$

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=1.0399 \text{ in (ineffective width}=0.74428 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.51996 \text{ in}, b_2=0.51996 \text{ in}$$

Element 3: Stiffened, $w=5.2842 \text{ in}$

$$f_1=48.386 \text{ ksi}, f_2=-30.674 \text{ ksi}$$

$$\psi=0$$

Eq. 1.1.2-1

$$k=0$$

Eq. 1.1.2-2

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b_e=2.3628 \text{ in}$$

Eq. 1.1-1

$$h_o=5.5 \text{ in}, b_o=2 \text{ in}, h_o/b_o=0$$

$$b_1=0.65021 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.1814 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.234 \text{ in}$$

$$\text{Ineffective width}=1.4024 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.59243$ in

$S_{xe}=0.31972$ in³, $F_y=50$ ksi

$M_{nl}=1332.2$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171$ in

$f_1=49.476$ ksi, $f_2=49.476$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.35184$ in (ineffective width= 0.16526 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.7842$ in

$f_1=46.007$ ksi, $f_2=-20.012$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.7041$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=0$

$b_1=0.4961$ in

Eq. 1.1.2-3

$b_2=0.85204$ in

Eq. 1.1.2-4

Compression width= 1.2434 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5171$ in

$f_1=49.476$ ksi, $f_2=49.476$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.35184$ in (ineffective width= 0.16526 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.7842$ in

$f_1=46.007$ ksi, $f_2=-20.012$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.7041$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=0$

$b_1=0.4961$ in

Eq. 1.1.2-3

$b_2=0.85204$ in

Eq. 1.1.2-4

Compression width= 1.2434 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.049238$ in

$S_{ye}=0.10004$ in³, $F_y=50$ ksi

$M_{nl}=416.81$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7842$ in $f_1=44.788$ ksi, $f_2=-41.39$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.7842$ in

Eq. 1.1-1

 $h_o=2$ in, $b_o=5.5$ in, $h_o/b_o=0$ $b_1=0.45467$ in

Eq. 1.1.2-3

 $b_2=0.8921$ in

Eq. 1.1.2-4

Compression width= 0.92728 in $b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

 $f_1=49.317$ ksi, $f_2=49.317$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.40984$ in (ineffective width= 1.4823 in)

Eq. 1.1-1

 $f_1=49.317$ ksi, $f_2=49.317$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.40984$ in (ineffective width= 1.4823 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.7842$ in $f_1=44.788$ ksi, $f_2=-41.39$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.7842$ in

Eq. 1.1-1

 $h_o=2$ in, $b_o=5.5$ in, $h_o/b_o=0$ $b_1=0.45467$ in

Eq. 1.1.2-3

 $b_2=0.8921$ in

Eq. 1.1.2-4

Compression width= 0.92728 in $b_1+b_2 >$ compression width (fully effective)Center of gravity shift: $x=0.33722$ in $S_{ye}=0.089553$ in³, $F_y=50$ ksi $M_{nl}=373.14$ lb-ft

Eq. F3.1-1

 $\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

 $C_w=1.0563$ in⁶, $W_n=4.6114$ in², $F_y=50$ ksi $B_n=11453$ lb-in²

G8.1-1

$\Omega_b=1.67, \phi_b=0.9$

550S200-30

Full Section Properties

Area	0.32649 in ²	Wt.	1.1101 lb/ft	Flat	10.464 in
I _x	1.5316 in ⁴	r _x	2.1659 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.55695 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.55695 in ³	y(b)	2.7500 in		
Z _x	0.64781 in ³	Height	5.5000 in		
I _y	0.1847 in ⁴	r _y	0.7522 in	x _o	-1.5091 in
S _y (l)	0.30775 in ³	x(l)	0.6002 in	y _o	0.0000 in
S _y (r)	0.13196 in ³	x(r)	1.3998 in	j _x	2.9485 in
Z _y	0.19098 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	1.5316 in ⁴	r ₁	2.1659 in	C _w	1.1650 in ⁶
I ₂	0.1847 in ⁴	r ₂	0.7522 in	J	0.0001059 in ⁴
I _c	1.7163 in ⁴	r _c	2.2928 in		
I _o	2.4598 in ⁴	r _o	2.7449 in		

Net Section Properties

I _x	1.5228 in ⁴	r _x	2.3334 in	Area	0.27969 in ²
S _x (t)	0.55375 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.55376 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	0.63026 in ³				
I _y	0.1660 in ⁴	r _y	0.7705 in	x _o	-1.6122 in
S _y (l)	0.23787 in ³	x(l)	0.6980 in	y _o	0.0000 in
S _y (r)	0.12753 in ³	x(r)	1.3020 in	j _x	2.6611 in
Z _y	0.18529 in ³			j _y	0.0000 in
I _c	1.6889 in ⁴	r _c	2.4573 in	C _w	1.1574 in ⁶
I _o	2.4159 in ⁴	r _o	2.9390 in	J	0.0000908 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	5943 lb	φM _n x _o	1415.0 lb-ft	φM _n y _o	423.1 lb-ft
A _e	0.13984 in ²	I _x e	1.2279 in ⁴	I _y e	0.1515 in ⁴
φT _n	13635 lb	S _x e(t)	0.37733 in ³	S _y e(l)	0.23036 in ³
		S _x e(b)	0.54672 in ³	S _y e(r)	0.11282 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	646 lb	φM _n x _o	1415.0 lb-ft	φM _n y _o	383.0 lb-ft
φV _{nx}	2609 lb	I _x e	1.2279 in ⁴	I _y e	0.1043 in ⁴
Torsion		S _x e(t)	0.54672 in ³	S _y e(l)	0.10214 in ³
φB _n	11323 lb-in ²	S _x e(b)	0.37733 in ³	S _y e(r)	0.10659 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.052$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.65$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.32649 \text{ in}^2$, $F_y=51.052 \text{ ksi}$

$T_n=16668 \text{ lb}$

$\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.27969 \text{ in}^2$, $F_u=65 \text{ ksi}$

$T_n=18180 \text{ lb}$

$\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1449.2 \text{ lb}$ at 180 deg

$\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3

$V_{yh}=2965 \text{ lb}$

$k_v=0$

$V_{crh}=370.37 \text{ lb}$

$V_n=717.44 \text{ lb}$ at 90 deg

$\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4

$V_n=1449.2 \text{ lb}$ at 0 deg

$\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

$k=0$

$\lambda=0$

$\rho=0$

$b=0.37723 \text{ in}$ (ineffective width= 0.13847 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

$I_a=0.00020486 \text{ in}^4$

$I_s=0.00035659 \text{ in}^4 > I_a$ (no lip reduction)

$k=0$

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Element 2: Partially stiffened, $w=1.7814 \text{ in}$

$f=50 \text{ ksi}$, $k=0$

$\lambda=0$

$\rho=0$

$b=1.123 \text{ in}$ (ineffective width= 0.65843 in)

$b_1=0.56148 \text{ in}$, $b_2=0.56148 \text{ in}$

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

$k=0$

$\lambda=0$

$\rho=0$

$b=0.44648 \text{ in}$ (ineffective width= 1.4442 in)

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.44648$ in (ineffective width=1.4442 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.37723$ in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00020486$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7814$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.123$ in (ineffective width=0.65843 in)	Eq. 1.1-1
$b_1=0.56148$ in, $b_2=0.56148$ in	
$A_e=0.13984$ in ² , $F_n=50$ ksi	
$P_n=6992$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=5.2814$ in

$f_1=48.32$ ksi, $f_2=-32.851$ ksi

$\psi=0$ Eq. 1.1.2-1

$k=0$ Eq. 1.1.2-2

$\lambda=0$ Eq. 1.1-3

$\rho=0$ Eq. 1.1-2

$b_e=2.6308$ in Eq. 1.1-1

$h_o=5.5$ in, $b_o=2$ in, $h_o/b_o=0$

$b_1=0.71492$ in Eq. 1.1.2-3

$b_2=1.3154$ in Eq. 1.1.2-4

Compression width=3.1439 in

Ineffective width=1.1136 in

Element 5: Unstiffened, $w=0.5157$ in

$f_1=48.32$ ksi, $f_2=40.394$ ksi

$\psi=0$ Eq. 1.2.2-1

$k=0$ Eq. 1.2.2-2

$\lambda=0$ Eq. 1.1-3

$\rho=0$ Eq. 1.1-2

$b=0.40119$ in (ineffective width=0.11451 in) Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=0$$

Eq. 1.3-7

$$I_a=0.00020438 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=0$$

Table 1.3-1

Element 4: Partially stiffened, $w=1.7814 \text{ in}$

$$f=49.76 \text{ ksi}, k=0$$

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=1.1251 \text{ in (ineffective width}=0.65627 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.56257 \text{ in}, b_2=0.56257 \text{ in}$$

Center of gravity shift: $y=-0.50409 \text{ in}$

$$S_{xe}=0.37733 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1572.2 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157 \text{ in}$

$$f_1=48.32 \text{ ksi}, f_2=40.394 \text{ ksi}$$

$$\psi=0$$

Eq. 1.2.2-1

$$k=0$$

Eq. 1.2.2-2

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=0.40119 \text{ in (ineffective width}=0.11451 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=0$$

Eq. 1.3-7

$$I_a=0.00020438 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=0$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.7814 \text{ in}$

$$f=49.76 \text{ ksi}, k=0$$

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=1.1251 \text{ in (ineffective width}=0.65627 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.56257 \text{ in}, b_2=0.56257 \text{ in}$$

Element 3: Stiffened, $w=5.2814 \text{ in}$

$$f_1=48.32 \text{ ksi}, f_2=-32.851 \text{ ksi}$$

$$\psi=0$$

Eq. 1.1.2-1

$$k=0$$

Eq. 1.1.2-2

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b_e=2.6308 \text{ in}$$

Eq. 1.1-1

$$h_o=5.5 \text{ in}, b_o=2 \text{ in}, h_o/b_o=0$$

$$b_1=0.71492 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.3154 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.1439 \text{ in}$$

$$\text{Ineffective width}=1.1136 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.50409$ in

$S_{xe}=0.37733$ in³, $F_y=50$ ksi

$M_{nl}=1572.2$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.419$ ksi, $f_2=49.419$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.37888$ in (ineffective width= 0.13682 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.7814$ in

$f_1=45.929$ ksi, $f_2=-20.418$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.7814$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=0$

$b_1=0.51716$ in

Eq. 1.1.2-3

$b_2=0.8907$ in

Eq. 1.1.2-4

Compression width= 1.2332 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5157$ in

$f_1=49.419$ ksi, $f_2=49.419$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.37888$ in (ineffective width= 0.13682 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.7814$ in

$f_1=45.929$ ksi, $f_2=-20.418$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.7814$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=0$

$b_1=0.51716$ in

Eq. 1.1.2-3

$b_2=0.8907$ in

Eq. 1.1.2-4

Compression width= 1.2332 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.040505$ in

$S_{ye}=0.11282$ in³, $F_y=50$ ksi

$M_{nl}=470.1$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7814$ in $f_1=44.649$ ksi, $f_2=-42.559$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.7814$ in

Eq. 1.1-1

 $h_o=2$ in, $b_o=5.5$ in, $h_o/b_o=0$ $b_1=0.45062$ in

Eq. 1.1.2-3

 $b_2=0.8907$ in

Eq. 1.1.2-4

Compression width=0.91205 in

 $b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

 $f_1=49.236$ ksi, $f_2=49.236$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.44972$ in (ineffective width=1.441 in)

Eq. 1.1-1

 $f_1=49.236$ ksi, $f_2=49.236$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.44972$ in (ineffective width=1.441 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.7814$ in $f_1=44.649$ ksi, $f_2=-42.559$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.7814$ in

Eq. 1.1-1

 $h_o=2$ in, $b_o=5.5$ in, $h_o/b_o=0$ $b_1=0.45062$ in

Eq. 1.1.2-3

 $b_2=0.8907$ in

Eq. 1.1.2-4

Compression width=0.91205 in

 $b_1+b_2 >$ compression width (fully effective)Center of gravity shift: $x=0.32334$ in $S_{ye}=0.10214$ in³, $F_y=50$ ksi $M_{nl}=425.57$ lb-ft

Eq. F3.1-1

 $\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

 $C_w=1.1574$ in⁶, $W_n=4.5999$ in², $F_y=50$ ksi $B_n=12581$ lb-in²

G8.1-1

$\Omega_b=1.67, \phi_b=0.9$

550S200-33

Full Section Properties

Area	0.36160 in ²	Wt.	1.2294 lb/ft	Flat	10.451 in
I _x	1.6938 in ⁴	r _x	2.1643 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.61592 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.61592 in ³	y(b)	2.7500 in		
Z _x	0.71690 in ³	Height	5.5000 in		
I _y	0.2038 in ⁴	r _y	0.7507 in	x _o	-1.5054 in
S _y (l)	0.33940 in ³	x(l)	0.6004 in	y _o	0.0000 in
S _y (r)	0.14558 in ³	x(r)	1.3996 in	j _x	2.9462 in
Z _y	0.21099 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	1.6938 in ⁴	r ₁	2.1643 in	C _w	1.2827 in ⁶
I ₂	0.2038 in ⁴	r ₂	0.7507 in	J	0.0001443 in ⁴
I _c	1.8976 in ⁴	r _c	2.2908 in		
I _o	2.7170 in ⁴	r _o	2.7412 in		

Net Section Properties

I _x	1.6841 in ⁴	r _x	2.3319 in	Area	0.30970 in ²
S _x (t)	0.61239 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.61239 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	0.69744 in ³				
I _y	0.1832 in ⁴	r _y	0.7690 in	x _o	-1.6084 in
S _y (l)	0.26238 in ³	x(l)	0.6981 in	y _o	0.0000 in
S _y (r)	0.14068 in ³	x(r)	1.3019 in	j _x	2.6584 in
Z _y	0.20473 in ³			j _y	0.0000 in
I _c	1.8672 in ⁴	r _c	2.4554 in	C _w	1.2744 in ⁶
I _o	2.6684 in ⁴	r _o	2.9353 in	J	0.0001236 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	7088 lb	φM _{nxo}	1727.9 lb-ft	φM _{nyo}	480.5 lb-ft
A _e	0.16678 in ²	I _{xe}	1.4354 in ⁴	I _{ye}	0.1708 in ⁴
φT _n	15098 lb	S _{xe} (t)	0.46077 in ³	S _{ye} (l)	0.25607 in ³
		S _{xe} (b)	0.60193 in ³	S _{ye} (r)	0.12813 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	811 lb	φM _{nxo}	1727.9 lb-ft	φM _{nyo}	441.0 lb-ft
φV _{nx}	3083 lb	I _{xe}	1.4354 in ⁴	I _{ye}	0.1183 in ⁴
Torsion		S _{xe} (t)	0.60193 in ³	S _{ye} (l)	0.11761 in ³
φB _n	12504 lb-in ²	S _{xe} (b)	0.46077 in ³	S _{ye} (r)	0.11897 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.142$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.88$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.3616 \text{ in}^2$, $F_y=51.142 \text{ ksi}$
 $T_n=18493 \text{ lb}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.3097 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=20130 \text{ lb}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1712.9 \text{ lb}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=3284.1 \text{ lb}$

Eq. G3-2

$k_v=0$

Eq. G3-8

$V_{crh}=505.2 \text{ lb}$

Eq. G3-6

$V_n=900.71 \text{ lb}$ at 90 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1712.9 \text{ lb}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.40644 \text{ in}$ (ineffective width= 0.10756 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=0$

Eq. 1.3-7

$I_a=0.00027958 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)

$k=0$

Table 1.3-1

Element 2: Partially stiffened, $w=1.778 \text{ in}$

$f=50 \text{ ksi}$, $k=0$

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=1.2173 \text{ in}$ (ineffective width= 0.56072 in)

Eq. 1.1-1

$b_1=0.60864 \text{ in}$, $b_2=0.60864 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.49196 \text{ in}$ (ineffective width= 1.397 in)

Eq. 1.1-1

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.49196$ in (ineffective width=1.397 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00027958$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.778$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.2173$ in (ineffective width=0.56072 in)	Eq. 1.1-1
$b_1=0.60864$ in, $b_2=0.60864$ in	
$A_e=0.16678$ in ² , $F_n=50$ ksi	
$P_n=8338.8$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=5.278$ in

$f_1=48.218$ ksi, $f_2=-36.517$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=2.9802$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2$ in, $h_o/b_o=0$	
$b_1=0.79318$ in	Eq. 1.1.2-3
$b_2=1.4901$ in	Eq. 1.1.2-4

Compression width=3.0034 in

Ineffective width=0.72011 in

Element 5: Unstiffened, $w=0.514$ in

$f_1=48.218$ ksi, $f_2=39.966$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.43203$ in (ineffective width=0.081967 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=0$$

Eq. 1.3-7

$$I_a=0.00027882 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=0$$

Table 1.3-1

Element 4: Partially stiffened, $w=1.778 \text{ in}$

$$f=49.722 \text{ ksi}, k=0$$

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=1.2199 \text{ in (ineffective width}=0.55809 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.60995 \text{ in}, b_2=0.60995 \text{ in}$$

Center of gravity shift: $y=-0.36526 \text{ in}$

$$S_{xe}=0.46077 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1919.9 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$$f_1=48.218 \text{ ksi}, f_2=39.966 \text{ ksi}$$

$$\psi=0$$

Eq. 1.2.2-1

$$k=0$$

Eq. 1.2.2-2

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=0.43203 \text{ in (ineffective width}=0.081967 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=0$$

Eq. 1.3-7

$$I_a=0.00027882 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=0$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.778 \text{ in}$

$$f=49.722 \text{ ksi}, k=0$$

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b=1.2199 \text{ in (ineffective width}=0.55809 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.60995 \text{ in}, b_2=0.60995 \text{ in}$$

Element 3: Stiffened, $w=5.278 \text{ in}$

$$f_1=48.218 \text{ ksi}, f_2=-36.517 \text{ ksi}$$

$$\psi=0$$

Eq. 1.1.2-1

$$k=0$$

Eq. 1.1.2-2

$$\lambda=0$$

Eq. 1.1-3

$$\rho=0$$

Eq. 1.1-2

$$b_e=2.9802 \text{ in}$$

Eq. 1.1-1

$$h_o=5.5 \text{ in}, b_o=2 \text{ in}, h_o/b_o=0$$

$$b_1=0.79318 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.4901 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.0034 \text{ in}$$

$$\text{Ineffective width}=0.72011 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.36526$ in
 $S_{xe}=0.46077$ in³, $F_y=50$ ksi
 $M_{nl}=1919.9$ lb-ft
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.351$ ksi, $f_2=49.351$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.40833$ in (ineffective width= 0.10567 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.778$ in

$f_1=45.836$ ksi, $f_2=-20.857$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.778$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=0$

$b_1=0.51461$ in

Eq. 1.1.2-3

$b_2=0.889$ in

Eq. 1.1.2-4

Compression width= 1.222 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.514$ in

$f_1=49.351$ ksi, $f_2=49.351$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.40833$ in (ineffective width= 0.10567 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.778$ in

$f_1=45.836$ ksi, $f_2=-20.857$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.778$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=0$

$b_1=0.51461$ in

Eq. 1.1.2-3

$b_2=0.889$ in

Eq. 1.1.2-4

Compression width= 1.222 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.031066$ in

$S_{ye}=0.12813$ in³, $F_y=50$ ksi

$M_{nl}=533.89$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.778$ in $f_1=44.481$ ksi, $f_2=-43.927$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.778$ in

Eq. 1.1-1

 $h_o=2$ in, $b_o=5.5$ in, $h_o/b_o=0$ $b_1=0.44589$ in

Eq. 1.1.2-3

 $b_2=0.889$ in

Eq. 1.1.2-4

Compression width=0.89457 in

 $b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

 $f_1=49.14$ ksi, $f_2=49.14$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.49597$ in (ineffective width=1.393 in)

Eq. 1.1-1

 $f_1=49.14$ ksi, $f_2=49.14$ ksi $\psi=0$

Eq. 1.2.2-1

 $k=0$

Eq. 1.2.2-3

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b=0.49597$ in (ineffective width=1.393 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.778$ in $f_1=44.481$ ksi, $f_2=-43.927$ ksi $\psi=0$

Eq. 1.1.2-1

 $k=0$

Eq. 1.1.2-2

 $\lambda=0$

Eq. 1.1-3

 $\rho=0$

Eq. 1.1-2

 $b_e=1.778$ in

Eq. 1.1-1

 $h_o=2$ in, $b_o=5.5$ in, $h_o/b_o=0$ $b_1=0.44589$ in

Eq. 1.1.2-3

 $b_2=0.889$ in

Eq. 1.1.2-4

Compression width=0.89457 in

 $b_1+b_2 >$ compression width (fully effective)Center of gravity shift: $x=0.30767$ in $S_{ye}=0.11761$ in³, $F_y=50$ ksi $M_{nl}=490.02$ lb-ft

Eq. F3.1-1

 $\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

 $C_w=1.2744$ in⁶, $W_n=4.5864$ in², $F_y=50$ ksi $B_n=13893$ lb-in²

G8.1-1

$\Omega_b=1.67, \phi_b=0.9$

550S200-43

Full Section Properties

Area	0.46943 in ²	Wt.	1.5961 lb/ft	Flat	10.409 in
I _x	2.1889 in ⁴	r _x	2.1594 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.79596 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.79596 in ³	y(b)	2.7500 in		
Z _x	0.92840 in ³	Height	5.5000 in		
I _y	0.2613 in ⁴	r _y	0.7461 in	x _o	-1.4940 in
S _y (l)	0.43486 in ³	x(l)	0.6009 in	y _o	0.0000 in
S _y (r)	0.18676 in ³	x(r)	1.3991 in	j _x	2.9390 in
Z _y	0.27180 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	2.1889 in ⁴	r ₁	2.1594 in	C _w	1.6354 in ⁶
I ₂	0.2613 in ⁴	r ₂	0.7461 in	J	0.0003183 in ⁴
I _c	2.4502 in ⁴	r _c	2.2846 in		
I _o	3.4979 in ⁴	r _o	2.7297 in		

Net Section Properties

I _x	2.1762 in ⁴	r _x	2.3273 in	Area	0.40178 in ²
S _x (t)	0.79134 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.79134 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	0.90303 in ³				
I _y	0.2349 in ⁴	r _y	0.7645 in	x _o	-1.5967 in
S _y (l)	0.33634 in ³	x(l)	0.6983 in	y _o	0.0000 in
S _y (r)	0.18042 in ³	x(r)	1.3017 in	j _x	2.6500 in
Z _y	0.26383 in ³			j _y	0.0000 in
I _c	2.4110 in ⁴	r _c	2.4497 in	C _w	1.6247 in ⁶
I _o	3.4354 in ⁴	r _o	2.9241 in	J	0.0002724 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	10531 lb	φM _{nxo}	2655.7 lb-ft	φM _{nyo}	662.2 lb-ft
A _e	0.24778 in ²	I _{xe}	2.0396 in ⁴	I _{ye}	0.2311 in ⁴
φT _n	19587 lb	S _{xe} (t)	0.70818 in ³	S _{ye} (l)	0.33448 in ³
		S _{xe} (b)	0.77847 in ³	S _{ye} (r)	0.17658 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1440 lb	φM _{nxo}	2655.7 lb-ft	φM _{nyo}	593.4 lb-ft
φV _{nx}	4304 lb	I _{xe}	2.0396 in ⁴	I _{ye}	0.1656 in ⁴
Torsion		S _{xe} (t)	0.77847 in ³	S _{ye} (l)	0.17380 in ³
φB _n	16086 lb-in ²	S _{xe} (b)	0.70818 in ³	S _{ye} (r)	0.15823 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.397$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=53.526$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$$A_g = 0.46943 \text{ in}^2, F_y = 51.397 \text{ ksi}$$

$$T_n = 24127 \text{ lb}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

Eq. D2-1

$$A_n = 0.40178 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 26116 \text{ lb}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Eq. D3-1

Shear Strength

Stud element 2

$$V_n = 2391.3 \text{ lb at } 180 \text{ deg}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Eq. G2.1-1

Stud element 3

$$V_{yh} = 4264.5 \text{ lb}$$

$$k_v = 0$$

$$V_{crh} = 1119.3 \text{ lb}$$

$$V_n = 1600.3 \text{ lb at } 90 \text{ deg}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4

$$V_n = 2391.3 \text{ lb at } 0 \text{ deg}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Eq. G2.1-1

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.5087 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 0$$

$$k = 0$$

$$\lambda = 0$$

$$\rho = 0$$

$$b = 0.48123 \text{ in (ineffective width} = 0.027474 \text{ in)}$$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S = 0$$

$$I_a = 0.00062038 \text{ in}^4$$

$$I_s = 0.00049474 \text{ in}^4$$

$$d_s = 0.38377 \text{ in (lip ineffective width} = 0.097452 \text{ in)}$$

$$k = 0$$

Eq. 1.3-7

Eq. 1.3-8

Eq. 1.3-6

Table 1.3-1

Element 2: Partially stiffened, $w = 1.7674 \text{ in}$

$$f = 50 \text{ ksi}, k = 0$$

$$\lambda = 0$$

$$\rho = 0$$

$$b = 1.4403 \text{ in (ineffective width} = 0.32712 \text{ in)}$$

$$b_1 = 0.57431 \text{ in}, b_2 = 0.86598 \text{ in}$$

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 0$$

$$k = 0$$

$$\lambda = 0$$

$$\rho = 0$$

$$b = 0.62846 \text{ in (ineffective width} = 1.2552 \text{ in)}$$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.62846$ in (ineffective width= 1.2552 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.48123$ in (ineffective width= 0.027474 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00062038$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.38377$ in (lip ineffective width= 0.097452 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7674$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.4403$ in (ineffective width= 0.32712 in)	Eq. 1.1-1
$b_1=0.57431$ in, $b_2=0.86598$ in	
$A_e=0.24778$ in ² , $F_n=50$ ksi	
$P_n=12389$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.2674$ in	
$f_1=47.981$ ksi, $f_2=-43.478$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=3.9257$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2$ in, $h_o/b_o=0$	
$b_1=1.005$ in	Eq. 1.1.2-3
$b_2=1.9628$ in	Eq. 1.1.2-4
Compression width= 2.7634 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=47.981$ ksi, $f_2=39.148$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3

$\rho=0$	Eq. 1.1-2
$b=0.50736$ in (ineffective width= 0.001341 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00061802$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.40615$ in (lip ineffective width= 0.1012 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7674$ in	
$f=49.608$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.4448$ in (ineffective width= 0.32263 in)	Eq. 1.1-1
$b_1=0.57829$ in, $b_2=0.86648$ in	
Center of gravity shift: $y=-0.13003$ in	
$S_{xe}=0.70818$ in ³ , $F_y=50$ ksi	
$M_{nl}=2950.7$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087$ in	
$f_1=47.981$ ksi, $f_2=39.148$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.50736$ in (ineffective width= 0.001341 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.00061802$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.40615$ in (lip ineffective width= 0.1012 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 2: Partially stiffened, $w=1.7674$ in	
$f=49.608$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.4448$ in (ineffective width= 0.32263 in)	Eq. 1.1-1
$b_1=0.57829$ in, $b_2=0.86648$ in	
Element 3: Stiffened, $w=5.2674$ in	
$f_1=47.981$ ksi, $f_2=-43.478$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=3.9257$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2$ in, $h_o/b_o=0$	
$b_1=1.005$ in	Eq. 1.1.2-3
$b_2=1.9628$ in	Eq. 1.1.2-4

Compression width=2.7634 in
 $b_1+b_2 >$ compression width (fully effective)
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.13003$ in
 $S_{xe}=0.70818$ in³, $F_y=50$ ksi
 $M_{nl}=2950.7$ lb-ft
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087$ in
 $f_1=49.139$ ksi, $f_2=49.139$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.48365$ in (ineffective width=0.02505 in) Eq. 1.1-1

Element 2: Stiffened, $w=1.7674$ in
 $f_1=45.558$ ksi, $f_2=-21.954$ ksi
 $\psi=0$ Eq. 1.1.2-1
 $k=0$ Eq. 1.1.2-2
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b_e=1.7674$ in Eq. 1.1-1
 $h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=0$
 $b_1=0.5076$ in Eq. 1.1.2-3
 $b_2=0.8837$ in Eq. 1.1.2-4

Compression width=1.1927 in
 $b_1+b_2 >$ compression width (fully effective)
 Element 3: No compressive stress (fully effective)
 Element 5: Unstiffened, $w=0.5087$ in
 $f_1=49.139$ ksi, $f_2=49.139$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.48365$ in (ineffective width=0.02505 in) Eq. 1.1-1

Element 4: Stiffened, $w=1.7674$ in
 $f_1=45.558$ ksi, $f_2=-21.954$ ksi
 $\psi=0$ Eq. 1.1.2-1
 $k=0$ Eq. 1.1.2-2
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b_e=1.7674$ in Eq. 1.1-1
 $h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=0$
 $b_1=0.5076$ in Eq. 1.1.2-3
 $b_2=0.8837$ in Eq. 1.1.2-4
 Compression width=1.1927 in
 $b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x = -0.0072345$ in

$S_y = 0.17658$ in³, $F_y = 50$ ksi

$M_n I = 735.75$ lb-ft

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.7674$ in

$f_1 = 39.858$ ksi, $f_2 = -44.452$ ksi

$\psi = 0$

Eq. 1.1.2-1

$k = 0$

Eq. 1.1.2-2

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b_e = 1.7674$ in

Eq. 1.1-1

$h_o = 2$ in, $b_o = 5.5$ in, $h_o/b_o = 0$

$b_1 = 0.42947$ in

Eq. 1.1.2-3

$b_2 = 0.8837$ in

Eq. 1.1.2-4

Compression width = 0.83554 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 44.33$ ksi, $f_2 = 44.33$ ksi

$\psi = 0$

Eq. 1.2.2-1

$k = 0$

Eq. 1.2.2-3

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b = 0.66385$ in (ineffective width = 1.2198 in)

Eq. 1.1-1

$f_1 = 44.33$ ksi, $f_2 = 44.33$ ksi

$\psi = 0$

Eq. 1.2.2-1

$k = 0$

Eq. 1.2.2-3

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b = 0.66385$ in (ineffective width = 1.2198 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.7674$ in

$f_1 = 39.858$ ksi, $f_2 = -44.452$ ksi

$\psi = 0$

Eq. 1.1.2-1

$k = 0$

Eq. 1.1.2-2

$\lambda = 0$

Eq. 1.1-3

$\rho = 0$

Eq. 1.1-2

$b_e = 1.7674$ in

Eq. 1.1-1

$h_o = 2$ in, $b_o = 5.5$ in, $h_o/b_o = 0$

$b_1 = 0.42947$ in

Eq. 1.1.2-3

$b_2 = 0.8837$ in

Eq. 1.1.2-4

Compression width = 0.83554 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.25484$ in

$S_y = 0.15823$ in³, $F_y = 50$ ksi

$M_n I = 659.29$ lb-ft

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Bimoment Strength, Stud

$C_w=1.6247 \text{ in}^6$, $W_n=4.545 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=17874 \text{ lb-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

550S200-54

Full Section Properties

Area	0.58464 in ²	Wt.	1.9878 lb/ft	Flat	10.329 in
I _x	2.7069 in ⁴	r _x	2.1517 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.9843 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.9843 in ³	y(b)	2.7500 in		
Z _x	1.1516 in ³	Height	5.5000 in		
I _y	0.3199 in ⁴	r _y	0.7397 in	x _o	-1.4794 in
S _y (l)	0.5330 in ³	x(l)	0.6002 in	y _o	0.0000 in
S _y (r)	0.2285 in ³	x(r)	1.3998 in	j _x	2.9339 in
Z _y	0.3349 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	2.7069 in ⁴	r ₁	2.1517 in	C _w	1.9875 in ⁶
I ₂	0.3199 in ⁴	r ₂	0.7397 in	J	0.0006243 in ⁴
I _c	3.0268 in ⁴	r _c	2.2753 in		
I _o	4.3064 in ⁴	r _o	2.7140 in		

Net Section Properties

I _x	2.6909 in ⁴	r _x	2.3205 in	Area	0.49974 in ²
S _x (t)	0.9785 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.9785 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	1.1198 in ³				
I _y	0.2874 in ⁴	r _y	0.7584 in	x _o	-1.5820 in
S _y (l)	0.4121 in ³	x(l)	0.6974 in	y _o	0.0000 in
S _y (r)	0.2206 in ³	x(r)	1.3027 in	j _x	2.6431 in
Z _y	0.3251 in ³			j _y	0.0000 in
I _c	2.9783 in ⁴	r _c	2.4413 in	C _w	1.9743 in ⁶
I _o	4.2290 in ⁴	r _o	2.9090 in	J	0.0005336 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	14078 lb	φM _{nxo}	3349.6 lb-ft	φM _{nyo}	940.3 lb-ft
A _e	0.33126 in ²	I _{xe}	2.5555 in ⁴	I _{ye}	0.2874 in ⁴
φT _n	24362 lb	S _{xe} (t)	0.89322 in ³	S _{ye} (l)	0.41213 in ³
		S _{xe} (b)	0.96835 in ³	S _{ye} (r)	0.22063 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2314 lb	φM _{nxo}	3349.6 lb-ft	φM _{nyo}	751.8 lb-ft
φV _{nx}	5248 lb	I _{xe}	2.5555 in ⁴	I _{ye}	0.2219 in ⁴
Torsion		S _{xe} (t)	0.96835 in ³	S _{ye} (l)	0.24850 in ³
φB _n	19751 lb-in ²	S _{xe} (b)	0.89322 in ³	S _{ye} (r)	0.20049 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=0$

Eq. A3.3.2-3

$m=0$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.748$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=54.356$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.58464$ in², $F_y=51.748$ ksi

$T_n=30254$ lb
 $\Omega_t=1.67$, $\phi_t=0.9$ Eq. D2-1

$A_n=0.49974$ in², $F_u=65$ ksi
 $T_n=32483$ lb
 $\Omega_t=2$, $\phi_t=0.75$ Eq. D3-1

Shear Strength

Stud element 2
 $V_n=2915.5$ lb at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$ Eq. G2.1-1

Stud element 3
 $V_{yh}=5255.1$ lb
 $k_v=0$ Eq. G3-2
 $V_{crh}=2216.7$ lb Eq. G3-8
 $V_n=2570.8$ lb at 90 deg Eq. G3-6
 $\Omega_v=1.67$, $\phi_v=0.9$ Eq. G2.1-2

Stud element 4
 $V_n=2915.5$ lb at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$ Eq. G2.1-1

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=0$ Eq. 1.3-7
 $I_a=0.0011127$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $d_s=0.23166$ in (lip ineffective width=0.25184 in) Eq. 1.3-6
 $k=0$ Table 1.3-1

Element 2: Partially stiffened, $w=1.717$ in
 $f=50$ ksi, $k=0$
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=1.5689$ in (ineffective width=0.14812 in) Eq. 1.1-1
 $b_1=0.37585$ in, $b_2=1.193$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1
 $k=0$ Eq. 1.2.2-3
 $\lambda=0$ Eq. 1.1-3
 $\rho=0$ Eq. 1.1-2
 $b=0.77011$ in (ineffective width=1.0884 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=0$ Eq. 1.2.2-1

$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=0.77011$ in (ineffective width= 1.0884 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-3
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7
$I_a=0.0011127$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.23166$ in (lip ineffective width= 0.25184 in)	Eq. 1.3-6
$k=0$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	
$f=50$ ksi, $k=0$	
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b=1.5689$ in (ineffective width= 0.14812 in)	Eq. 1.1-1
$b_1=0.37585$ in, $b_2=1.193$ in	
$A_e=0.33126$ in ² , $F_n=50$ ksi	
$P_n=16563$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.217$ in	
$f_1=47.527$ ksi, $f_2=-43.653$ ksi	
$\psi=0$	Eq. 1.1.2-1
$k=0$	Eq. 1.1.2-2
$\lambda=0$	Eq. 1.1-3
$\rho=0$	Eq. 1.1-2
$b_e=4.6179$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2$ in, $h_o/b_o=0$	
$b_1=1.1785$ in	Eq. 1.1.2-3
$b_2=2.3089$ in	Eq. 1.1.2-4
Compression width= 2.7193 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=47.527$ ksi, $f_2=39.077$ ksi	
$\psi=0$	Eq. 1.2.2-1
$k=0$	Eq. 1.2.2-2
$\lambda=0$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=0$	Eq. 1.3-7

$$I_a = 0.0010879 \text{ in}^4$$

Eq. 1.3-8

$$I_s = 0.00053312 \text{ in}^4$$

$$d_s = 0.23693 \text{ in (lip ineffective width} = 0.24657 \text{ in)}$$

Eq. 1.3-6

$$k = 0$$

Table 1.3-1

Element 4: Partially stiffened, $w = 1.717 \text{ in}$

$$f = 49.505 \text{ ksi, } k = 0$$

$$\lambda = 0$$

Eq. 1.1-3

$$\rho = 0$$

Eq. 1.1-2

$$b = 1.5764 \text{ in (ineffective width} = 0.1406 \text{ in)}$$

Eq. 1.1-1

$$b_1 = 0.38624 \text{ in, } b_2 = 1.1902 \text{ in}$$

Center of gravity shift: $y = -0.111 \text{ in}$

$$S_{xe} = 0.89322 \text{ in}^3, F_y = 50 \text{ ksi}$$

$$M_{nl} = 3721.7 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b = 1.67, \phi_b = 0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.4835 \text{ in}$

$$f_1 = 47.527 \text{ ksi, } f_2 = 39.077 \text{ ksi}$$

$$\psi = 0$$

Eq. 1.2.2-1

$$k = 0$$

Eq. 1.2.2-2

$$\lambda = 0$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S = 0$$

Eq. 1.3-7

$$I_a = 0.0010879 \text{ in}^4$$

Eq. 1.3-8

$$I_s = 0.00053312 \text{ in}^4$$

$$d_s = 0.23693 \text{ in (lip ineffective width} = 0.24657 \text{ in)}$$

Eq. 1.3-6

$$k = 0$$

Table 1.3-1

Element 2: Partially stiffened, $w = 1.717 \text{ in}$

$$f = 49.505 \text{ ksi, } k = 0$$

$$\lambda = 0$$

Eq. 1.1-3

$$\rho = 0$$

Eq. 1.1-2

$$b = 1.5764 \text{ in (ineffective width} = 0.1406 \text{ in)}$$

Eq. 1.1-1

$$b_1 = 0.38624 \text{ in, } b_2 = 1.1902 \text{ in}$$

Element 3: Stiffened, $w = 5.217 \text{ in}$

$$f_1 = 47.527 \text{ ksi, } f_2 = -43.653 \text{ ksi}$$

$$\psi = 0$$

Eq. 1.1.2-1

$$k = 0$$

Eq. 1.1.2-2

$$\lambda = 0$$

Eq. 1.1-3

$$\rho = 0$$

Eq. 1.1-2

$$b_e = 4.6179 \text{ in}$$

Eq. 1.1-1

$$h_o = 5.5 \text{ in, } b_o = 2 \text{ in, } h_o/b_o = 0$$

$$b_1 = 1.1785 \text{ in}$$

Eq. 1.1.2-3

$$b_2 = 2.3089 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width} = 2.7193 \text{ in}$$

$$b_1 + b_2 > \text{compression width (fully effective)}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y = 0.111 \text{ in}$

$S_{xe}=0.89322 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_{nl}=3721.7 \text{ lb-ft}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$

$f_1=55.591 \text{ ksi}$, $f_2=55.591 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=1.717 \text{ in}$

$f_1=50.653 \text{ ksi}$, $f_2=-24.248 \text{ ksi}$

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.717 \text{ in}$

Eq. 1.1-1

$h_o=2 \text{ in}$, $b_o=0.625 \text{ in}$, $h_o/b_o=0$

$b_1=0.49357 \text{ in}$

Eq. 1.1.2-3

$b_2=0.8585 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.1611 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.4835 \text{ in}$

$f_1=55.591 \text{ ksi}$, $f_2=55.591 \text{ ksi}$

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w=1.717 \text{ in}$

$f_1=50.653 \text{ ksi}$, $f_2=-24.248 \text{ ksi}$

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.717 \text{ in}$

Eq. 1.1-1

$h_o=2 \text{ in}$, $b_o=0.625 \text{ in}$, $h_o/b_o=0$

$b_1=0.49357 \text{ in}$

Eq. 1.1.2-3

$b_2=0.8585 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.1611 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0 \text{ in}$

$S_{ye}=0.22063 \text{ in}^3$, $F_y=56.825 \text{ ksi}$

$M_{nl}=1044.8 \text{ lb-ft}$

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.717$ in

$f_1=33.853$ ksi, $f_2=-43.616$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.717$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=5.5$ in, $h_o/b_o=0$

$b_1=0.40038$ in

Eq. 1.1.2-3

$b_2=0.8585$ in

Eq. 1.1.2-4

Compression width= 0.75031 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=38.961$ ksi, $f_2=38.961$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.85934$ in (ineffective width= 0.99916 in)

Eq. 1.1-1

$f_1=38.961$ ksi, $f_2=38.961$ ksi

$\psi=0$

Eq. 1.2.2-1

$k=0$

Eq. 1.2.2-3

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b=0.85934$ in (ineffective width= 0.99917 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.717$ in

$f_1=33.853$ ksi, $f_2=-43.616$ ksi

$\psi=0$

Eq. 1.1.2-1

$k=0$

Eq. 1.1.2-2

$\lambda=0$

Eq. 1.1-3

$\rho=0$

Eq. 1.1-2

$b_e=1.717$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=5.5$ in, $h_o/b_o=0$

$b_1=0.40038$ in

Eq. 1.1.2-3

$b_2=0.8585$ in

Eq. 1.1.2-4

Compression width= 0.75031 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.19572$ in

$S_y=0.20049$ in³, $F_y=50$ ksi

$M_n=835.37$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=1.9743$ in⁶, $W_n=4.4981$ in², $F_y=50$ ksi

$B_n=21946$ lb-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

550S250-27

Full Section Properties

Area	0.32477 in ²	Wt.	1.1042 lb/ft	Flat	11.476 in
Ix	1.6043 in ⁴	rx	2.2226 in	Ixy	0.0000 in ⁴
Sx(t)	0.58340 in ³	y(t)	2.7500 in	α	0.000 deg
Sx(b)	0.58340 in ³	y(b)	2.7500 in		
Zx	0.66607 in ³	Height	5.5000 in		
Iy	0.2854 in ⁴	ry	0.9374 in	x _o	-1.9493 in
Sy(l)	0.36022 in ³	x(l)	0.7923 in	y _o	0.0000 in
Sy(r)	0.16713 in ³	x(r)	1.7077 in	jx	3.1871 in
Zy	0.25096 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	1.6043 in ⁴	r ₁	2.2226 in	Cw	1.7805 in ⁶
I ₂	0.2854 in ⁴	r ₂	0.9374 in	J	0.0000867 in ⁴
Ic	1.8897 in ⁴	rc	2.4122 in		
I _o	3.1238 in ⁴	r _o	3.1014 in		

Net Section Properties

Ix	1.5964 in ⁴	rx	2.3779 in	Area	0.28232 in ²
Sx(t)	0.58050 in ³	y(t)	2.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.58050 in ³	y(b)	2.7500 in	α	0.000 deg
Zx	0.65015 in ³				
Iy	0.2558 in ⁴	ry	0.9519 in	x _o	-2.0722 in
Sy(l)	0.28134 in ³	x(l)	0.9093 in	y _o	0.0000 in
Sy(r)	0.16083 in ³	x(r)	1.5907 in	jx	2.9628 in
Zy	0.23564 in ³			jy	0.0000 in
Ic	1.8522 in ⁴	rc	2.5614 in	Cw	1.7695 in ⁶
I _o	3.0645 in ⁴	r _o	3.2947 in	J	0.0000754 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	5244 lb	φMnxo	1258.7 lb-ft	φMnyo	515.9 lb-ft
Ae	0.12339 in ²	Ixe	1.1578 in ⁴	Iye	0.2282 in ⁴
φTn	13763 lb	Sxe(t)	0.33566 in ³	Sye(l)	0.27112 in ³
		Sxe(b)	0.56462 in ³	Sye(r)	0.13757 in ³
Shear		Negative Bending		Negative Bending	
φVny	525 lb	φMnxo	1258.7 lb-ft	φMnyo	466.2 lb-ft
φVnx	2263 lb	Ixe	1.1578 in ⁴	Iye	0.1601 in ⁴
Torsion		Sxe(t)	0.56462 in ³	Sye(l)	0.12432 in ³
φBn	13816 lb-in ²	Sxe(b)	0.33566 in ³	Sye(r)	0.13212 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=50.885$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=51.97$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in²

$F_{yc}=67.251$ ksi

Eq. A3.3.2-2

$F_{ya}=53.824$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.32477 \text{ in}^2$, $F_y=50.885 \text{ ksi}$
 $T_n=16526 \text{ lb}$ Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.28232 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=18351 \text{ lb}$ Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=1257.2 \text{ lb}$ at 180 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=2692.1 \text{ lb}$ Eq. G3-2
 $k_v=4.0992$ Eq. G3-8
 $V_{crh}=280.05 \text{ lb}$ Eq. G3-6
 $V_n=582.85 \text{ lb}$ at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=1257.2 \text{ lb}$ at 0 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=1.2067$ Eq. 1.1-3
 $\rho=0.67763$ Eq. 1.1-2
 $b=0.3504 \text{ in}$ (ineffective width=0.1667 in) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0001947 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00032608 \text{ in}^4 > I_a$ (no lip reduction)
 $k=3.8819$ Table 1.3-1

Element 2: Partially stiffened, $w=2.2842 \text{ in}$
 $f=50 \text{ ksi}$, $k=3.8819$
 $\lambda=1.774$ Eq. 1.1-3
 $\rho=0.49378$ Eq. 1.1-2
 $b=1.1279 \text{ in}$ (ineffective width=1.1563 in) Eq. 1.1-1
 $b_1=0.56395 \text{ in}$, $b_2=0.56395 \text{ in}$

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=4.4153$ Eq. 1.1-3
 $\rho=0.2152$ Eq. 1.1-2
 $b=0.40718 \text{ in}$ (ineffective width=1.4849 in) Eq. 1.1-1
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.4153$	Eq. 1.1-3
$\rho=0.2152$	Eq. 1.1-2
$b=0.40718$ in (ineffective width=1.4849 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.2067$	Eq. 1.1-3
$\rho=0.67763$	Eq. 1.1-2
$b=0.3504$ in (ineffective width=0.1667 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0001947$ in ⁴	Eq. 1.3-8
$I_s=0.00032608$ in ⁴ > I_a (no lip reduction)	
$k=3.8819$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2842$ in	
$f=50$ ksi, $k=3.8819$	
$\lambda=1.774$	Eq. 1.1-3
$\rho=0.49378$	Eq. 1.1-2
$b=1.1279$ in (ineffective width=1.1563 in)	Eq. 1.1-1
$b_1=0.56395$ in, $b_2=0.56395$ in	
$A_e=0.12339$ in ² , $F_n=50$ ksi	
$P_n=6169.4$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.2842$ in	
$f_1=48.436$ ksi, $f_2=-28.164$ ksi	
$\psi=0.58146$	Eq. 1.1.2-1
$k=15.073$	Eq. 1.1.2-2
$\lambda=2.0498$	Eq. 1.1-3
$\rho=0.43548$	Eq. 1.1-2
$b_e=2.3012$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2.5$ in, $h_o/b_o=2.2$	
$b_1=0.64253$ in	Eq. 1.1.2-3
$b_2=1.1506$ in	Eq. 1.1.2-4
Compression width=3.3413 in	
Ineffective width=1.5482 in	
Element 5: Unstiffened, $w=0.5171$ in	
$f_1=48.436$ ksi, $f_2=40.94$ ksi	
$\psi=0.84524$	Eq. 1.2.2-1
$k=0.48766$	Eq. 1.2.2-2
$\lambda=1.1152$	Eq. 1.1-3
$\rho=0.71979$	Eq. 1.1-2
$b=0.37221$ in (ineffective width=0.14489 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.155$$

Eq. 1.3-7

$$I_a=0.00019431 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00032608 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8819$$

Table 1.3-1

Element 4: Partially stiffened, $w=2.2842 \text{ in}$

$$f=49.795 \text{ ksi}, k=3.8819$$

$$\lambda=1.7704$$

Eq. 1.1-3

$$\rho=0.49466$$

Eq. 1.1-2

$$b=1.1299 \text{ in (ineffective width}=1.1543 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.56495 \text{ in}, b_2=0.56495 \text{ in}$$

Center of gravity shift: $y=-0.69937 \text{ in}$

$$S_{xe}=0.33566 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1398.6 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171 \text{ in}$

$$f_1=48.436 \text{ ksi}, f_2=40.94 \text{ ksi}$$

$$\psi=0.84524$$

Eq. 1.2.2-1

$$k=0.48766$$

Eq. 1.2.2-2

$$\lambda=1.1152$$

Eq. 1.1-3

$$\rho=0.71979$$

Eq. 1.1-2

$$b=0.37221 \text{ in (ineffective width}=0.14489 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.155$$

Eq. 1.3-7

$$I_a=0.00019431 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00032608 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8819$$

Table 1.3-1

Element 2: Partially stiffened, $w=2.2842 \text{ in}$

$$f=49.795 \text{ ksi}, k=3.8819$$

$$\lambda=1.7704$$

Eq. 1.1-3

$$\rho=0.49466$$

Eq. 1.1-2

$$b=1.1299 \text{ in (ineffective width}=1.1543 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.56495 \text{ in}, b_2=0.56495 \text{ in}$$

Element 3: Stiffened, $w=5.2842 \text{ in}$

$$f_1=48.436 \text{ ksi}, f_2=-28.164 \text{ ksi}$$

$$\psi=0.58146$$

Eq. 1.1.2-1

$$k=15.073$$

Eq. 1.1.2-2

$$\lambda=2.0498$$

Eq. 1.1-3

$$\rho=0.43548$$

Eq. 1.1-2

$$b_e=2.3012 \text{ in}$$

Eq. 1.1-1

$$h_o=5.5 \text{ in}, b_o=2.5 \text{ in}, h_o/b_o=2.2$$

$$b_1=0.64253 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.1506 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.3413 \text{ in}$$

$$\text{Ineffective width}=1.5482 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.69937$ in
 $S_{xe}=0.33566$ in³, $F_y=50$ ksi
 $M_{nl}=1398.6$ lb-ft
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5171$ in

$f_1=49.573$ ksi, $f_2=49.573$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.2015$

Eq. 1.1-3

$\rho=0.67989$

Eq. 1.1-2

$b=0.35157$ in (ineffective width= 0.16553 in)

Eq. 1.1-1

Element 2: Stiffened, $w=2.2842$ in

$f_1=46.747$ ksi, $f_2=-22.127$ ksi

$\psi=0.47334$

Eq. 1.1.2-1

$k=13.343$

Eq. 1.1.2-2

$\lambda=0.92522$

Eq. 1.1-3

$\rho=0.82382$

Eq. 1.1-2

$b_e=1.8818$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.54178$ in

Eq. 1.1.2-3

$b_2=0.94089$ in

Eq. 1.1.2-4

Compression width= 1.5504 in

Ineffective width= 0.067687 in

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5171$ in

$f_1=49.573$ ksi, $f_2=49.573$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.2015$

Eq. 1.1-3

$\rho=0.67989$

Eq. 1.1-2

$b=0.35157$ in (ineffective width= 0.16553 in)

Eq. 1.1-1

Element 4: Stiffened, $w=2.2842$ in

$f_1=46.747$ ksi, $f_2=-22.127$ ksi

$\psi=0.47334$

Eq. 1.1.2-1

$k=13.343$

Eq. 1.1.2-2

$\lambda=0.92522$

Eq. 1.1-3

$\rho=0.82383$

Eq. 1.1-2

$b_e=1.8818$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.54178$ in

Eq. 1.1.2-3

$b_2=0.94089$ in

Eq. 1.1.2-4

Compression width= 1.5504 in

Ineffective width= 0.067687 in

Center of gravity shift: $x=-0.067799$ in

$S_{ye}=0.13757$ in³, $F_y=50$ ksi

$M_{nl}=573.2$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2842$ in

$$f_1=45.811 \text{ ksi}, f_2=-42.861 \text{ ksi}$$

$$\psi=0.9356$$

Eq. 1.1.2-1

$$k=22.375$$

Eq. 1.1.2-2

$$\lambda=0.7073$$

Eq. 1.1-3

$$\rho=0.97407$$

Eq. 1.1-2

$$b_e=2.225 \text{ in}$$

Eq. 1.1-1

$$h_o=2.5 \text{ in}, b_o=5.5 \text{ in}, h_o/b_o=0.45455$$

$$b_1=0.56534 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.1125 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.1801 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: Treat as two unstiffened elements

$$f_1=49.451 \text{ ksi}, f_2=49.451 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=4.391$$

Eq. 1.1-3

$$\rho=0.21633$$

Eq. 1.1-2

$$b=0.40932 \text{ in (ineffective width}=1.4828 \text{ in)}$$

Eq. 1.1-1

$$f_1=49.451 \text{ ksi}, f_2=49.451 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-2

$$\lambda=4.391$$

Eq. 1.1-3

$$\rho=0.21633$$

Eq. 1.1-2

$$b=0.40932 \text{ in (ineffective width}=1.4828 \text{ in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.2842$ in

$$f_1=45.811 \text{ ksi}, f_2=-42.861 \text{ ksi}$$

$$\psi=0.9356$$

Eq. 1.1.2-1

$$k=22.375$$

Eq. 1.1.2-2

$$\lambda=0.7073$$

Eq. 1.1-3

$$\rho=0.97407$$

Eq. 1.1-2

$$b_e=2.225 \text{ in}$$

Eq. 1.1-1

$$h_o=2.5 \text{ in}, b_o=5.5 \text{ in}, h_o/b_o=0.45455$$

$$b_1=0.56534 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.1125 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.1801 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=0.37868$ in

$$S_{ye}=0.12432 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=518 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Bimoment Strength, Stud

$$C_w=1.7695 \text{ in}^6, W_n=5.7633 \text{ in}^2, F_y=50 \text{ ksi}$$

$$B_n=15351 \text{ lb-in}^2$$

G8.1-1

III-368

$\Omega_b=1.67$, $\phi_b=0.9$

550S250-30

Full Section Properties

Area	0.35769 in ²	Wt.	1.2161 lb/ft	Flat	11.464 in
Ix	1.7649 in ⁴	rx	2.2213 in	Ixy	0.0000 in ⁴
Sx(t)	0.64178 in ³	y(t)	2.7500 in	α	0.000 deg
Sx(b)	0.64178 in ³	y(b)	2.7500 in		
Zx	0.73313 in ³	Height	5.5000 in		
Iy	0.3135 in ⁴	ry	0.9362 in	x _o	-1.9461 in
Sy(l)	0.39562 in ³	x(l)	0.7924 in	y _o	0.0000 in
Sy(r)	0.18358 in ³	x(r)	1.7076 in	jx	3.1845 in
Zy	0.27594 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	1.7649 in ⁴	r ₁	2.2213 in	Cw	1.9525 in ⁶
I ₂	0.3135 in ⁴	r ₂	0.9362 in	J	0.0001161 in ⁴
Ic	2.0784 in ⁴	rc	2.4105 in		
I _o	3.4330 in ⁴	r _o	3.0980 in		

Net Section Properties

Ix	1.7561 in ⁴	rx	2.3767 in	Area	0.31089 in ²
Sx(t)	0.63859 in ³	y(t)	2.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.63859 in ³	y(b)	2.7500 in	α	0.000 deg
Zx	0.71558 in ³				
Iy	0.2810 in ⁴	ry	0.9507 in	x _o	-2.0689 in
Sy(l)	0.30901 in ³	x(l)	0.9093 in	y _o	0.0000 in
Sy(r)	0.17665 in ³	x(r)	1.5907 in	jx	2.9600 in
Zy	0.25912 in ³			jy	0.0000 in
Ic	2.0371 in ⁴	rc	2.5598 in	Cw	1.9404 in ⁶
I _o	3.3678 in ⁴	r _o	3.2913 in	J	0.0001009 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	6214 lb	φMnxo	1480.2 lb-ft	φMnyo	594.3 lb-ft
Ae	0.14621 in ²	Ixe	1.3306 in ⁴	Iye	0.2592 in ⁴
φTn	15156 lb	Sxe(t)	0.39471 in ³	Sye(l)	0.29969 in ³
		Sxe(b)	0.62494 in ³	Sye(r)	0.15848 in ³
Shear		Negative Bending		Negative Bending	
φVny	651 lb	φMnxo	1480.2 lb-ft	φMnyo	529.8 lb-ft
φVnx	2734 lb	Ixe	1.3306 in ⁴	Iye	0.1799 in ⁴
Torsion		Sxe(t)	0.62494 in ³	Sye(l)	0.14127 in ³
φBn	15185 lb-in ²	Sxe(b)	0.39471 in ³	Sye(r)	0.14662 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=50.96$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.136$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.35769 \text{ in}^2$, $F_y=50.96 \text{ ksi}$
 $T_n=18228 \text{ lb}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.31089 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=20208 \text{ lb}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1519 \text{ lb}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3

$V_{yh}=2965 \text{ lb}$
 $k_v=4.0988$
 $V_{crh}=375.31 \text{ lb}$
 $V_n=723.22 \text{ lb}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2
Eq. G3-8
Eq. G3-6
Eq. G2.1-2

Stud element 4

$V_n=1519 \text{ lb}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=1.0916$
 $\rho=0.73148$
 $b=0.37723 \text{ in}$ (ineffective width= 0.13847 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$
 $I_a=0.00026103 \text{ in}^4$
 $I_s=0.00035659 \text{ in}^4 > I_a$ (no lip reduction)
 $k=3.8802$

Eq. 1.3-7
Eq. 1.3-8
Table 1.3-1

Element 2: Partially stiffened, $w=2.2814 \text{ in}$

$f=50 \text{ ksi}$, $k=3.8802$
 $\lambda=1.6075$
 $\rho=0.53694$
 $b=1.225 \text{ in}$ (ineffective width= 1.0564 in)
 $b_1=0.61249 \text{ in}$, $b_2=0.61249 \text{ in}$

Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=4.0019$
 $\rho=0.23614$
 $b=0.44648 \text{ in}$ (ineffective width= 1.4442 in)
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.0019$	Eq. 1.1-3
$\rho=0.23614$	Eq. 1.1-2
$b=0.44648$ in (ineffective width=1.4442 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723$ in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00026103$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.8802$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2814$ in	
$f=50$ ksi, $k=3.8802$	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
$b=1.225$ in (ineffective width=1.0564 in)	Eq. 1.1-1
$b_1=0.61249$ in, $b_2=0.61249$ in	
$A_e=0.14621$ in ² , $F_n=50$ ksi	
$P_n=7310.3$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.2814$ in	
$f_1=48.378$ ksi, $f_2=-29.981$ ksi	
$\psi=0.61972$	Eq. 1.1.2-1
$k=15.738$	Eq. 1.1.2-2
$\lambda=1.8176$	Eq. 1.1-3
$\rho=0.48359$	Eq. 1.1-2
$b_e=2.554$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2.5$ in, $h_o/b_o=2.2$	
$b_1=0.70558$ in	Eq. 1.1.2-3
$b_2=1.277$ in	Eq. 1.1.2-4
Compression width=3.2607 in	
Ineffective width=1.2781 in	
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=48.378$ ksi, $f_2=40.727$ ksi	
$\psi=0.84184$	Eq. 1.2.2-1
$k=0.48907$	Eq. 1.2.2-2
$\lambda=1.0068$	Eq. 1.1-3
$\rho=0.77622$	Eq. 1.1-2
$b=0.4003$ in (ineffective width=0.1154 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.163$$

Eq. 1.3-7

$$I_a=0.00026043 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8802$$

Table 1.3-1

Element 4: Partially stiffened, $w=2.2814 \text{ in}$

$$f=49.769 \text{ ksi}, k=3.8802$$

$$\lambda=1.6038$$

Eq. 1.1-3

$$\rho=0.53799$$

Eq. 1.1-2

$$b=1.2274 \text{ in (ineffective width}=1.054 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.61369 \text{ in}, b_2=0.61369 \text{ in}$$

Center of gravity shift: $y=-0.62092 \text{ in}$

$$S_{xe}=0.39471 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1644.6 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157 \text{ in}$

$$f_1=48.378 \text{ ksi}, f_2=40.727 \text{ ksi}$$

$$\psi=0.84184$$

Eq. 1.2.2-1

$$k=0.48907$$

Eq. 1.2.2-2

$$\lambda=1.0068$$

Eq. 1.1-3

$$\rho=0.77622$$

Eq. 1.1-2

$$b=0.4003 \text{ in (ineffective width}=0.1154 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.163$$

Eq. 1.3-7

$$I_a=0.00026043 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8802$$

Table 1.3-1

Element 2: Partially stiffened, $w=2.2814 \text{ in}$

$$f=49.769 \text{ ksi}, k=3.8802$$

$$\lambda=1.6038$$

Eq. 1.1-3

$$\rho=0.53799$$

Eq. 1.1-2

$$b=1.2274 \text{ in (ineffective width}=1.054 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.61369 \text{ in}, b_2=0.61369 \text{ in}$$

Element 3: Stiffened, $w=5.2814 \text{ in}$

$$f_1=48.378 \text{ ksi}, f_2=-29.981 \text{ ksi}$$

$$\psi=0.61972$$

Eq. 1.1.2-1

$$k=15.738$$

Eq. 1.1.2-2

$$\lambda=1.8176$$

Eq. 1.1-3

$$\rho=0.48359$$

Eq. 1.1-2

$$b_e=2.554 \text{ in}$$

Eq. 1.1-1

$$h_o=5.5 \text{ in}, b_o=2.5 \text{ in}, h_o/b_o=2.2$$

$$b_1=0.70558 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.277 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.2607 \text{ in}$$

$$\text{Ineffective width}=1.2781 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.62092$ in

$S_{xe}=0.39471$ in³, $F_y=50$ ksi

$M_{nl}=1644.6$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.523$ ksi, $f_2=49.523$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.0863$

Eq. 1.1-3

$\rho=0.73411$

Eq. 1.1-2

$b=0.37858$ in (ineffective width= 0.13712 in)

Eq. 1.1-1

Element 2: Stiffened, $w=2.2814$ in

$f_1=46.658$ ksi, $f_2=-23.099$ ksi

$\psi=0.49508$

Eq. 1.1.2-1

$k=13.674$

Eq. 1.1.2-2

$\lambda=0.82721$

Eq. 1.1-3

$\rho=0.88738$

Eq. 1.1-2

$b_e=2.0245$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.57923$ in

Eq. 1.1.2-3

$b_2=1.0122$ in

Eq. 1.1.2-4

Compression width= 1.5259 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5157$ in

$f_1=49.523$ ksi, $f_2=49.523$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=1.0863$

Eq. 1.1-3

$\rho=0.73411$

Eq. 1.1-2

$b=0.37858$ in (ineffective width= 0.13712 in)

Eq. 1.1-1

Element 4: Stiffened, $w=2.2814$ in

$f_1=46.658$ ksi, $f_2=-23.099$ ksi

$\psi=0.49508$

Eq. 1.1.2-1

$k=13.674$

Eq. 1.1.2-2

$\lambda=0.82721$

Eq. 1.1-3

$\rho=0.88738$

Eq. 1.1-2

$b_e=2.0245$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.57923$ in

Eq. 1.1.2-3

$b_2=1.0122$ in

Eq. 1.1.2-4

Compression width= 1.5259 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.044577$ in

$S_{ye}=0.15848$ in³, $F_y=50$ ksi

$M_{nl}=660.34$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2814$ in

$f_1=45.708$ ksi, $f_2=-43.884$ ksi

$\psi=0.96009$

Eq. 1.1.2-1

$k=22.981$

Eq. 1.1.2-2

$\lambda=0.63155$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2814$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=5.5$ in, $h_o/b_o=0.45455$

$b_1=0.5761$ in

Eq. 1.1.2-3

$b_2=1.1407$ in

Eq. 1.1.2-4

Compression width= 1.1639 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=49.387$ ksi, $f_2=49.387$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=3.9773$

Eq. 1.1-3

$\rho=0.23752$

Eq. 1.1-2

$b=0.44907$ in (ineffective width= 1.4416 in)

Eq. 1.1-1

$f_1=49.387$ ksi, $f_2=49.387$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=3.9773$

Eq. 1.1-3

$\rho=0.23752$

Eq. 1.1-2

$b=0.44907$ in (ineffective width= 1.4416 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.2814$ in

$f_1=45.708$ ksi, $f_2=-43.884$ ksi

$\psi=0.96009$

Eq. 1.1.2-1

$k=22.981$

Eq. 1.1.2-2

$\lambda=0.63155$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2814$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=5.5$ in, $h_o/b_o=0.45455$

$b_1=0.5761$ in

Eq. 1.1.2-3

$b_2=1.1407$ in

Eq. 1.1.2-4

Compression width= 1.1639 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.3639$ in

$S_{ye}=0.14127$ in³, $F_y=50$ ksi

$M_{nl}=588.63$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=1.9404$ in⁶, $W_n=5.7505$ in², $F_y=50$ ksi

$B_n=16872$ lb-in²

G8.1-1

III-376

$\Omega_b=1.67$, $\phi_b=0.9$

550S250-33

Full Section Properties

Area	0.39620 in ²	Wt.	1.3471 lb/ft	Flat	11.451 in
Ix	1.9522 in ⁴	rx	2.2198 in	Ixy	0.0000 in ⁴
Sx(t)	0.70988 in ³	y(t)	2.7500 in	α	0.000 deg
Sx(b)	0.70988 in ³	y(b)	2.7500 in		
Zx	0.81145 in ³	Height	5.5000 in		
Iy	0.3461 in ⁴	ry	0.9347 in	x _o	-1.9423 in
Sy(l)	0.43676 in ³	x(l)	0.7925 in	y _o	0.0000 in
Sy(r)	0.20270 in ³	x(r)	1.7075 in	jx	3.1815 in
Zy	0.30504 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	1.9522 in ⁴	r ₁	2.2198 in	Cw	2.1517 in ⁶
I ₂	0.3461 in ⁴	r ₂	0.9347 in	J	0.0001581 in ⁴
Ic	2.2983 in ⁴	rc	2.4085 in		
I _o	3.7929 in ⁴	r _o	3.0941 in		

Net Section Properties

Ix	1.9424 in ⁴	rx	2.3752 in	Area	0.34430 in ²
Sx(t)	0.70634 in ³	y(t)	2.7500 in	Ixy	0.0000 in ⁴
Sx(b)	0.70634 in ³	y(b)	2.7500 in	α	0.000 deg
Zx	0.79199 in ³				
Iy	0.3102 in ⁴	ry	0.9492 in	x _o	-2.0650 in
Sy(l)	0.34116 in ³	x(l)	0.9093 in	y _o	0.0000 in
Sy(r)	0.19503 in ³	x(r)	1.5907 in	jx	2.9567 in
Zy	0.28648 in ³			jy	0.0000 in
Ic	2.2527 in ⁴	rc	2.5579 in	Cw	2.1384 in ⁶
I _o	3.7208 in ⁴	r _o	3.2874 in	J	0.0001374 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	7432 lb	φMnxo	1785.7 lb-ft	φMnyo	673.1 lb-ft
Ae	0.17488 in ²	Ixe	1.5503 in ⁴	Iye	0.2917 in ⁴
φTn	16784 lb	Sxe(t)	0.47618 in ³	Sye(l)	0.33331 in ³
		Sxe(b)	0.69080 in ³	Sye(r)	0.17950 in ³
Shear		Negative Bending		Negative Bending	
φVny	817 lb	φMnxo	1785.7 lb-ft	φMnyo	607.6 lb-ft
φVnx	3317 lb	Ixe	1.5503 in ⁴	Iye	0.2036 in ⁴
Torsion		Sxe(t)	0.69080 in ³	Sye(l)	0.16204 in ³
φBn	16778 lb-in ²	Sxe(b)	0.47618 in ³	Sye(r)	0.16373 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.042$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.32$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.3962 \text{ in}^2$, $F_y=51.042 \text{ ksi}$
 $T_n=20223 \text{ lb}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.3443 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=22379 \text{ lb}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1843 \text{ lb}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=3284.1 \text{ lb}$

Eq. G3-2

$k_v=4.0983$

Eq. G3-8

$V_{crh}=511.94 \text{ lb}$

Eq. G3-6

$V_n=907.88 \text{ lb}$ at 90 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1843 \text{ lb}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.98104$

Eq. 1.1-3

$\rho=0.79074$

Eq. 1.1-2

$b=0.40644 \text{ in}$ (ineffective width=0.10756 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00035618 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)

$k=3.8782$

Table 1.3-1

Element 2: Partially stiffened, $w=2.278 \text{ in}$

$f=50 \text{ ksi}$, $k=3.8782$

$\lambda=1.4478$

Eq. 1.1-3

$\rho=0.58576$

Eq. 1.1-2

$b=1.3344 \text{ in}$ (ineffective width=0.94364 in)

Eq. 1.1-1

$b_1=0.66718 \text{ in}$, $b_2=0.66718 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=3.6054$

Eq. 1.1-3

$\rho=0.26044$

Eq. 1.1-2

$b=0.49196 \text{ in}$ (ineffective width=1.397 in)

Eq. 1.1-1

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=3.6054$	Eq. 1.1-3
$\rho=0.26044$	Eq. 1.1-2
$b=0.49196$ in (ineffective width=1.397 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00035618$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1
Element 4: Partially stiffened, $w=2.278$ in	
$f=50$ ksi, $k=3.8782$	
$\lambda=1.4478$	Eq. 1.1-3
$\rho=0.58576$	Eq. 1.1-2
$b=1.3344$ in (ineffective width=0.94364 in)	Eq. 1.1-1
$b_1=0.66718$ in, $b_2=0.66718$ in	
$A_e=0.17488$ in ² , $F_n=50$ ksi	
$P_n=8743.9$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.278$ in	
$f_1=48.295$ ksi, $f_2=-32.78$ ksi	
$\psi=0.67875$	Eq. 1.1.2-1
$k=16.82$	Eq. 1.1.2-2
$\lambda=1.583$	Eq. 1.1-3
$\rho=0.54391$	Eq. 1.1-2
$b_e=2.8708$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2.5$ in, $h_o/b_o=2.2$	
$b_1=0.78037$ in	Eq. 1.1.2-3
$b_2=1.4354$ in	Eq. 1.1.2-4
Compression width=3.144 in	
Ineffective width=0.92826 in	
Element 5: Unstiffened, $w=0.514$ in	
$f_1=48.295$ ksi, $f_2=40.399$ ksi	
$\psi=0.83651$	Eq. 1.2.2-1
$k=0.49128$	Eq. 1.2.2-2
$\lambda=0.90203$	Eq. 1.1-3
$\rho=0.83822$	Eq. 1.1-2
$b=0.43085$ in (ineffective width=0.083153 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.174$$

Eq. 1.3-7

$$I_a=0.00035525 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8782$$

Table 1.3-1

Element 4: Partially stiffened, $w=2.278 \text{ in}$

$$f=49.734 \text{ ksi}, k=3.8782$$

$$\lambda=1.4439$$

Eq. 1.1-3

$$\rho=0.58704$$

Eq. 1.1-2

$$b=1.3373 \text{ in (ineffective width}=0.94072 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.66864 \text{ in}, b_2=0.66864 \text{ in}$$

Center of gravity shift: $y=-0.50576 \text{ in}$

$$S_{xe}=0.47618 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=1984.1 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$$f_1=48.295 \text{ ksi}, f_2=40.399 \text{ ksi}$$

$$\psi=0.83651$$

Eq. 1.2.2-1

$$k=0.49128$$

Eq. 1.2.2-2

$$\lambda=0.90203$$

Eq. 1.1-3

$$\rho=0.83822$$

Eq. 1.1-2

$$b=0.43085 \text{ in (ineffective width}=0.083153 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.174$$

Eq. 1.3-7

$$I_a=0.00035525 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8782$$

Table 1.3-1

Element 2: Partially stiffened, $w=2.278 \text{ in}$

$$f=49.734 \text{ ksi}, k=3.8782$$

$$\lambda=1.4439$$

Eq. 1.1-3

$$\rho=0.58704$$

Eq. 1.1-2

$$b=1.3373 \text{ in (ineffective width}=0.94072 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.66864 \text{ in}, b_2=0.66864 \text{ in}$$

Element 3: Stiffened, $w=5.278 \text{ in}$

$$f_1=48.295 \text{ ksi}, f_2=-32.78 \text{ ksi}$$

$$\psi=0.67875$$

Eq. 1.1.2-1

$$k=16.82$$

Eq. 1.1.2-2

$$\lambda=1.583$$

Eq. 1.1-3

$$\rho=0.54391$$

Eq. 1.1-2

$$b_e=2.8708 \text{ in}$$

Eq. 1.1-1

$$h_o=5.5 \text{ in}, b_o=2.5 \text{ in}, h_o/b_o=2.2$$

$$b_1=0.78037 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.4354 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.144 \text{ in}$$

$$\text{Ineffective width}=0.92826 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.50576$ in
 $S_{xe}=0.47618$ in³, $F_y=50$ ksi
 $M_{nl}=1984.1$ lb-ft
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.468$ ksi, $f_2=49.468$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.97581$

Eq. 1.1-3

$\rho=0.79375$

Eq. 1.1-2

$b=0.40799$ in (ineffective width= 0.10601 in)

Eq. 1.1-1

Element 2: Stiffened, $w=2.278$ in

$f_1=46.584$ ksi, $f_2=-23.512$ ksi

$\psi=0.50471$

Eq. 1.1.2-1

$k=13.823$

Eq. 1.1.2-2

$\lambda=0.74019$

Eq. 1.1-3

$\rho=0.94946$

Eq. 1.1-2

$b_e=2.1629$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.61713$ in

Eq. 1.1.2-3

$b_2=1.0814$ in

Eq. 1.1.2-4

Compression width= 1.5139 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.514$ in

$f_1=49.468$ ksi, $f_2=49.468$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=0.97581$

Eq. 1.1-3

$\rho=0.79375$

Eq. 1.1-2

$b=0.40799$ in (ineffective width= 0.10601 in)

Eq. 1.1-1

Element 4: Stiffened, $w=2.278$ in

$f_1=46.584$ ksi, $f_2=-23.512$ ksi

$\psi=0.50471$

Eq. 1.1.2-1

$k=13.823$

Eq. 1.1.2-2

$\lambda=0.74019$

Eq. 1.1-3

$\rho=0.94946$

Eq. 1.1-2

$b_e=2.1629$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.61713$ in

Eq. 1.1.2-3

$b_2=1.0814$ in

Eq. 1.1.2-4

Compression width= 1.5139 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.034255$ in

$S_{ye}=0.1795$ in³, $F_y=50$ ksi

$M_{nl}=747.91$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.278$ in

$$f_1=45.583 \text{ ksi}, f_2=-45.067 \text{ ksi}$$

$$\psi=0.98869$$

Eq. 1.1.2-1

$$k=23.707$$

Eq. 1.1.2-2

$$\lambda=0.5591$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=2.278 \text{ in}$$

Eq. 1.1-1

$$h_o=2.5 \text{ in}, b_o=5.5 \text{ in}, h_o/b_o=0.45455$$

$$b_1=0.57112 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.139 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.1455 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: Treat as two unstiffened elements

$$f_1=49.312 \text{ ksi}, f_2=49.312 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=3.5805$$

Eq. 1.1-3

$$\rho=0.26213$$

Eq. 1.1-2

$$b=0.49516 \text{ in (ineffective width)=1.3938 in}$$

Eq. 1.1-1

$$f_1=49.312 \text{ ksi}, f_2=49.312 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-2

$$\lambda=3.5805$$

Eq. 1.1-3

$$\rho=0.26213$$

Eq. 1.1-2

$$b=0.49516 \text{ in (ineffective width)=1.3938 in}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.278$ in

$$f_1=45.583 \text{ ksi}, f_2=-45.067 \text{ ksi}$$

$$\psi=0.98869$$

Eq. 1.1.2-1

$$k=23.707$$

Eq. 1.1.2-2

$$\lambda=0.5591$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=2.278 \text{ in}$$

Eq. 1.1-1

$$h_o=2.5 \text{ in}, b_o=5.5 \text{ in}, h_o/b_o=0.45455$$

$$b_1=0.57112 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.139 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.1455 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=0.34716$ in

$$S_{ye}=0.16204 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=675.16 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Bimoment Strength, Stud

$$C_w=2.1384 \text{ in}^6, W_n=5.7354 \text{ in}^2, F_y=50 \text{ ksi}$$

$$B_n=18642 \text{ lb-in}^2$$

G8.1-1

III-384

$\Omega_b=1.67$, $\phi_b=0.9$

550S250-43

Full Section Properties

Area	0.51453 in ²	Wt.	1.7494 lb/ft	Flat	11.409 in
I _x	2.5244 in ⁴	r _x	2.2150 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.9180 in ³	y(t)	2.7500 in	α	0.000 deg
S _x (b)	0.9180 in ³	y(b)	2.7500 in		
Z _x	1.0514 in ³	Height	5.5000 in		
I _y	0.4451 in ⁴	r _y	0.9301 in	x _o	-1.9304 in
S _y (l)	0.5614 in ³	x(l)	0.7927 in	y _o	0.0000 in
S _y (r)	0.2607 in ³	x(r)	1.7073 in	j _x	3.1721 in
Z _y	0.3938 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	2.5244 in ⁴	r ₁	2.2150 in	C _w	2.7507 in ⁶
I ₂	0.4451 in ⁴	r ₂	0.9301 in	J	0.0003489 in ⁴
I _c	2.9695 in ⁴	r _c	2.4023 in		
I _o	4.8869 in ⁴	r _o	3.0818 in		

Net Section Properties

I _x	2.5117 in ⁴	r _x	2.3708 in	Area	0.44688 in ²
S _x (t)	0.9133 in ³	y(t)	2.7500 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.9133 in ³	y(b)	2.7500 in	α	0.000 deg
Z _x	1.0260 in ³				
I _y	0.3989 in ⁴	r _y	0.9447 in	x _o	-2.0529 in
S _y (l)	0.4386 in ³	x(l)	0.9093 in	y _o	0.0000 in
S _y (r)	0.2507 in ³	x(r)	1.5907 in	j _x	2.9466 in
Z _y	0.3699 in ³			j _y	0.0000 in
I _c	2.9106 in ⁴	r _c	2.5521 in	C _w	2.7335 in ⁶
I _o	4.7939 in ⁴	r _o	3.2753 in	J	0.0003030 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	10666 lb	φM _{nxo}	2742.9 lb-ft	φM _{nyo}	922.2 lb-ft
A _e	0.25097 in ²	I _{xe}	2.2036 in ⁴	I _{ye}	0.3932 in ⁴
φT _n	21785 lb	S _{xe} (t)	0.73145 in ³	S _{ye} (l)	0.43626 in ³
		S _{xe} (b)	0.88589 in ³	S _{ye} (r)	0.24592 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1451 lb	φM _{nxo}	2742.9 lb-ft	φM _{nyo}	817.7 lb-ft
φV _{nx}	5185 lb	I _{xe}	2.2036 in ⁴	I _{ye}	0.2832 in ⁴
Torsion		S _{xe} (t)	0.88589 in ³	S _{ye} (l)	0.23583 in ³
φB _n	21622 lb-in ²	S _{xe} (b)	0.73145 in ³	S _{ye} (r)	0.21805 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.275$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=52.838$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.51453 \text{ in}^2$, $F_y=51.275 \text{ ksi}$
 $T_n=26382 \text{ lb}$ Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.44688 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=29047 \text{ lb}$ Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=2880.7 \text{ lb}$ at 180 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=4264.5 \text{ lb}$ Eq. G3-2
 $k_v=4.0968$ Eq. G3-8
 $V_{crh}=1134.3 \text{ lb}$ Eq. G3-6
 $V_n=1612.5 \text{ lb}$ at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=2880.7 \text{ lb}$ at 0 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087 \text{ in}$
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.74488$ Eq. 1.1-3
 $\rho=0.94599$ Eq. 1.1-2
 $b=0.48123 \text{ in}$ (ineffective width= 0.027474 in) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.00079003 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00049474 \text{ in}^4$
 $d_s=0.30136 \text{ in}$ (lip ineffective width= 0.17987 in) Eq. 1.3-6
 $k=3.3746$ Table 1.3-1

Element 2: Partially stiffened, $w=2.2674 \text{ in}$
 $f=50 \text{ ksi}$, $k=3.3746$
 $\lambda=1.1852$ Eq. 1.1-3
 $\rho=0.68714$ Eq. 1.1-2
 $b=1.558 \text{ in}$ (ineffective width= 0.70937 in) Eq. 1.1-1
 $b_1=0.48785 \text{ in}$, $b_2=1.0702 \text{ in}$

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=2.7583$ Eq. 1.1-3
 $\rho=0.33363$ Eq. 1.1-2
 $b=0.62846 \text{ in}$ (ineffective width= 1.2552 in) Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.7583$

Eq. 1.1-3

$\rho=0.33363$

Eq. 1.1-2

$b=0.62846$ in (ineffective width= 1.2552 in)

Eq. 1.1-1

Element 5: Unstiffened, $w=0.5087$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.74488$

Eq. 1.1-3

$\rho=0.94599$

Eq. 1.1-2

$b=0.48123$ in (ineffective width= 0.027474 in)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00079003$ in⁴

Eq. 1.3-8

$I_s=0.00049474$ in⁴

$ds=0.30136$ in (lip ineffective width= 0.17987 in)

Eq. 1.3-6

$k=3.3746$

Table 1.3-1

Element 4: Partially stiffened, $w=2.2674$ in

$f=50$ ksi, $k=3.3746$

$\lambda=1.1852$

Eq. 1.1-3

$\rho=0.68714$

Eq. 1.1-2

$b=1.558$ in (ineffective width= 0.70937 in)

Eq. 1.1-1

$b_1=0.48785$ in, $b_2=1.0702$ in

$A_e=0.25097$ in², $F_n=50$ ksi

$P_n=12548$ lb

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=5.2674$ in

$f_1=48.069$ ksi, $f_2=-39.377$ ksi

$\psi=0.81918$

Eq. 1.1.2-1

$k=19.679$

Eq. 1.1.2-2

$\lambda=1.1179$

Eq. 1.1-3

$\rho=0.7185$

Eq. 1.1-2

$b_e=3.7846$ in

Eq. 1.1-1

$h_o=5.5$ in, $b_o=2.5$ in, $h_o/b_o=2.2$

$b_1=0.99095$ in

Eq. 1.1.2-3

$b_2=1.8923$ in

Eq. 1.1.2-4

Compression width= 2.8955 in

Ineffective width= 0.012226 in

Element 5: Unstiffened, $w=0.5087$ in

$f_1=48.069$ ksi, $f_2=39.624$ ksi

$\psi=0.82431$

Eq. 1.2.2-1

$k=0.49643$

Eq. 1.2.2-2

$\lambda=0.67974$

Eq. 1.1-3

$\rho=0.99501$	Eq. 1.1-2
$b=0.50616$ in (ineffective width= 0.0025377 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.208$	Eq. 1.3-7
$I_a=0.00078714$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.31814$ in (lip ineffective width= 0.18802 in)	Eq. 1.3-6
$k=3.3782$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2674$ in	
$f=49.626$ ksi, $k=3.3782$	
$\lambda=1.1801$	Eq. 1.1-3
$\rho=0.68942$	Eq. 1.1-2
$b=1.5632$ in (ineffective width= 0.70421 in)	Eq. 1.1-1
$b_1=0.49126$ in, $b_2=1.0719$ in	
Center of gravity shift: $y=-0.2626$ in	
$S_{xe}=0.73145$ in ³ , $F_y=50$ ksi	
$M_{nl}=3047.7$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087$ in	
$f_1=48.069$ ksi, $f_2=39.624$ ksi	
$\psi=0.82431$	Eq. 1.2.2-1
$k=0.49643$	Eq. 1.2.2-2
$\lambda=0.67974$	Eq. 1.1-3
$\rho=0.99501$	Eq. 1.1-2
$b=0.50616$ in (ineffective width= 0.0025377 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.208$	Eq. 1.3-7
$I_a=0.00078714$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.31814$ in (lip ineffective width= 0.18802 in)	Eq. 1.3-6
$k=3.3782$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2674$ in	
$f=49.626$ ksi, $k=3.3782$	
$\lambda=1.1801$	Eq. 1.1-3
$\rho=0.68942$	Eq. 1.1-2
$b=1.5632$ in (ineffective width= 0.70421 in)	Eq. 1.1-1
$b_1=0.49126$ in, $b_2=1.0719$ in	
Element 3: Stiffened, $w=5.2674$ in	
$f_1=48.069$ ksi, $f_2=-39.377$ ksi	
$\psi=0.81918$	Eq. 1.1.2-1
$k=19.679$	Eq. 1.1.2-2
$\lambda=1.1179$	Eq. 1.1-3
$\rho=0.7185$	Eq. 1.1-2
$b_e=3.7846$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2.5$ in, $h_o/b_o=2.2$	
$b_1=0.99095$ in	Eq. 1.1.2-3
$b_2=1.8923$ in	Eq. 1.1.2-4

Compression width=2.8955 in

Ineffective width=0.012225 in

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.2626$ in

$S_{xe}=0.73145$ in³, $F_y=50$ ksi

$M_{nl}=3047.7$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087$ in

$f_1=49.295$ ksi, $f_2=49.295$ ksi

$\psi=1$

$k=0.43$

$\lambda=0.73961$

$\rho=0.94989$

$b=0.48321$ in (ineffective width=0.025492 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Stiffened, $w=2.2674$ in

$f_1=46.363$ ksi, $f_2=-24.548$ ksi

$\psi=0.52948$

$k=14.215$

$\lambda=0.55605$

$\rho=1$

$b_e=2.2674$ in

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.64242$ in

$b_2=1.1337$ in

Compression width=1.4825 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=49.295$ ksi, $f_2=49.295$ ksi

$\psi=1$

$k=0.43$

$\lambda=0.73961$

$\rho=0.94989$

$b=0.48321$ in (ineffective width=0.025492 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 4: Stiffened, $w=2.2674$ in

$f_1=46.363$ ksi, $f_2=-24.548$ ksi

$\psi=0.52948$

$k=14.215$

$\lambda=0.55605$

$\rho=1$

$b_e=2.2674$ in

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.64242$ in

$b_2=1.1337$ in

Compression width=1.4825 in

$b_1+b_2 >$ compression width (fully effective)

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Center of gravity shift: $x = -0.0081103$ in

$S_y = 0.24592$ in³, $F_y = 50$ ksi

$M_{nl} = 1024.7$ lb-ft

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 2.2674$ in

$f_1 = 41.685$ ksi, $f_2 = -45.527$ ksi

$\psi = 1.0922$

Eq. 1.1.2-1

$k = 26.5$

Eq. 1.1.2-2

$\lambda = 0.38617$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.2674$ in

Eq. 1.1-1

$h_o = 2.5$ in, $b_o = 5.5$ in, $h_o/b_o = 0.45455$

$b_1 = 0.55408$ in

Eq. 1.1.2-3

$b_2 = 1.1337$ in

Eq. 1.1.2-4

Compression width = 1.0838 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 45.291$ ksi, $f_2 = 45.291$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 2.6252$

Eq. 1.1-3

$\rho = 0.349$

Eq. 1.1-2

$b = 0.65742$ in (ineffective width = 1.2263 in)

Eq. 1.1-1

$f_1 = 45.291$ ksi, $f_2 = 45.291$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-2

$\lambda = 2.6252$

Eq. 1.1-3

$\rho = 0.349$

Eq. 1.1-2

$b = 0.65742$ in (ineffective width = 1.2263 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 2.2674$ in

$f_1 = 41.685$ ksi, $f_2 = -45.527$ ksi

$\psi = 1.0922$

Eq. 1.1.2-1

$k = 26.5$

Eq. 1.1.2-2

$\lambda = 0.38617$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.2674$ in

Eq. 1.1-1

$h_o = 2.5$ in, $b_o = 5.5$ in, $h_o/b_o = 0.45455$

$b_1 = 0.55408$ in

Eq. 1.1.2-3

$b_2 = 1.1337$ in

Eq. 1.1.2-4

Compression width = 1.0838 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.2917$ in

$S_y = 0.21805$ in³, $F_y = 50$ ksi

$M_{nl} = 908.54$ lb-ft

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Bimoment Strength, Stud

$C_w=2.7335 \text{ in}^6$, $W_n=5.6891 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=24024 \text{ lb-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

550S250-54

Full Section Properties

Area	0.64124 in ²	Wt.	2.1802 lb/ft	Flat	11.329 in
Ix	3.1261 in ⁴	rx	2.2080 in	Ixy	0.0000 in ⁴
Sx(t)	1.1368 in ³	y(t)	2.7500 in	α	0.000 deg
Sx(b)	1.1368 in ³	y(b)	2.7500 in		
Zx	1.3057 in ³	Height	5.5000 in		
Iy	0.5469 in ⁴	ry	0.9235 in	x _o	-1.9154 in
Sy(l)	0.6908 in ³	x(l)	0.7917 in	y _o	0.0000 in
Sy(r)	0.3202 in ³	x(r)	1.7083 in	jx	3.1635 in
Zy	0.4865 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	3.1261 in ⁴	r ₁	2.2080 in	Cw	3.3553 in ⁶
I ₂	0.5469 in ⁴	r ₂	0.9235 in	J	0.0006847 in ⁴
Ic	3.6731 in ⁴	rc	2.3933 in		
I _o	6.0256 in ⁴	r _o	3.0654 in		

Net Section Properties

Ix	3.1102 in ⁴	rx	2.3644 in	Area	0.55634 in ²
Sx(t)	1.1310 in ³	y(t)	2.7500 in	Ixy	0.0000 in ⁴
Sx(b)	1.1310 in ³	y(b)	2.7500 in	α	0.000 deg
Zx	1.2738 in ³				
Iy	0.4899 in ⁴	ry	0.9384 in	x _o	-2.0378 in
Sy(l)	0.5394 in ³	x(l)	0.9082 in	y _o	0.0000 in
Sy(r)	0.3077 in ³	x(r)	1.5918 in	jx	2.9367 in
Zy	0.4571 in ³			jy	0.0000 in
Ic	3.6001 in ⁴	rc	2.5438 in	Cw	3.3340 in ⁶
I _o	5.9103 in ⁴	r _o	3.2594 in	J	0.0005941 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	14488 lb	φMnxo	3505.6 lb-ft	φMnyo	1311.6 lb-ft
Ae	0.34089 in ²	Ixe	2.7842 in ⁴	Iye	0.4899 in ⁴
φTn	27121 lb	Sxe(t)	0.9348 in ³	Sye(l)	0.5394 in ³
		Sxe(b)	1.1040 in ³	Sye(r)	0.3077 in ³
Shear		Negative Bending		Negative Bending	
φVny	2331 lb	φMnxo	3505.6 lb-ft	φMnyo	1039.5 lb-ft
φVnx	6776 lb	Ixe	2.7842 in ⁴	Iye	0.3778 in ⁴
Torsion		Sxe(t)	1.1040 in ³	Sye(l)	0.3322 in ³
φBn	26617 lb-in ²	Sxe(b)	0.9348 in ³	Sye(r)	0.2772 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.594$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=53.509$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.64124$ in², $F_y=51.594$ ksi

$T_n=33084 \text{ lb}$
 $\Omega_t=1.67, \phi_t=0.9$ Eq. D2-1

$A_n=0.55634 \text{ in}^2, F_u=65 \text{ ksi}$
 $T_n=36162 \text{ lb}$ Eq. D3-1
 $\Omega_t=2, \phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=3764.5 \text{ lb at } 180 \text{ deg}$ Eq. G2.1-1
 $\Omega_v=1.67, \phi_v=0.9$

Stud element 3
 $V_{yh}=5255.1 \text{ lb}$ Eq. G3-2
 $k_v=4.0894$ Eq. G3-8
 $V_{crh}=2246.7 \text{ lb}$ Eq. G3-6
 $V_n=2589.6 \text{ lb at } 90 \text{ deg}$ Eq. G2.1-2
 $\Omega_v=1.67, \phi_v=0.9$

Stud element 4
 $V_n=3764.5 \text{ lb at } 0 \text{ deg}$ Eq. G2.1-1
 $\Omega_v=1.67, \phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56413$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0015382 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00053312 \text{ in}^4$
 $d_s=0.16757 \text{ in}$ (lip ineffective width= 0.31593 in) Eq. 1.3-6
 $k=2.8256$ Table 1.3-1

Element 2: Partially stiffened, $w=2.217 \text{ in}$
 $f=50 \text{ ksi}, k=2.8256$
 $\lambda=1.0091$ Eq. 1.1-3
 $\rho=0.77494$ Eq. 1.1-2
 $b=1.718 \text{ in}$ (ineffective width= 0.49896 in) Eq. 1.1-1
 $b_1=0.29773 \text{ in}, b_2=1.4203 \text{ in}$

Element 3: Treat as two unstiffened elements
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=2.1684$ Eq. 1.1-3
 $\rho=0.41437$ Eq. 1.1-2
 $b=0.77011 \text{ in}$ (ineffective width= 1.0884 in) Eq. 1.1-1
 $f_1=50 \text{ ksi}, f_2=50 \text{ ksi}$
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=2.1684$	Eq. 1.1-3
$\rho=0.41437$	Eq. 1.1-2
$b=0.77011$ in (ineffective width=1.0884 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0015382$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.16757$ in (lip ineffective width=0.31593 in)	Eq. 1.3-6
$k=2.8256$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217$ in	
$f=50$ ksi, $k=2.8256$	
$\lambda=1.0091$	Eq. 1.1-3
$\rho=0.77494$	Eq. 1.1-2
$b=1.718$ in (ineffective width=0.49896 in)	Eq. 1.1-1
$b_1=0.29773$ in, $b_2=1.4203$ in	
$A_e=0.34089$ in ² , $F_n=50$ ksi	
$P_n=17044$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.217$ in	
$f_1=47.624$ ksi, $f_2=-39.967$ ksi	
$\psi=0.83922$	Eq. 1.1.2-1
$k=20.122$	Eq. 1.1.2-2
$\lambda=0.86844$	Eq. 1.1-3
$\rho=0.85979$	Eq. 1.1-2
$b_e=4.4855$ in	Eq. 1.1-1
$h_o=5.5$ in, $b_o=2.5$ in, $h_o/b_o=2.2$	
$b_1=1.1683$ in	Eq. 1.1.2-3
$b_2=2.2428$ in	Eq. 1.1.2-4
Compression width=2.8365 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=47.624$ ksi, $f_2=39.506$ ksi	
$\psi=0.82955$	Eq. 1.2.2-1
$k=0.49421$	Eq. 1.2.2-2
$\lambda=0.51356$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.24$	Eq. 1.3-7

$I_a=0.0015311 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00053312 \text{ in}^4$	
$d_s=0.16835 \text{ in}$ (lip ineffective width=0.31515 in)	Eq. 1.3-6
$k=2.8293$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217 \text{ in}$	
$f=49.525 \text{ ksi}$, $k=2.8293$	
$\lambda=1.0036$	Eq. 1.1-3
$\rho=0.77797$	Eq. 1.1-2
$b=1.7248 \text{ in}$ (ineffective width=0.49223 in)	Eq. 1.1-1
$b_1=0.30027 \text{ in}$, $b_2=1.4245 \text{ in}$	
Center of gravity shift: $y=-0.22823 \text{ in}$	
$S_{xe}=0.93484 \text{ in}^3$, $F_y=50 \text{ ksi}$	
$M_{nl}=3895.1 \text{ lb-ft}$	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.4835 \text{ in}$	
$f_1=47.624 \text{ ksi}$, $f_2=39.506 \text{ ksi}$	
$\psi=0.82955$	Eq. 1.2.2-1
$k=0.49421$	Eq. 1.2.2-2
$\lambda=0.51356$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.24$	Eq. 1.3-7
$I_a=0.0015311 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00053312 \text{ in}^4$	
$d_s=0.16835 \text{ in}$ (lip ineffective width=0.31515 in)	Eq. 1.3-6
$k=2.8293$	Table 1.3-1
Element 2: Partially stiffened, $w=2.217 \text{ in}$	
$f=49.525 \text{ ksi}$, $k=2.8293$	
$\lambda=1.0036$	Eq. 1.1-3
$\rho=0.77797$	Eq. 1.1-2
$b=1.7248 \text{ in}$ (ineffective width=0.49223 in)	Eq. 1.1-1
$b_1=0.30027 \text{ in}$, $b_2=1.4245 \text{ in}$	
Element 3: Stiffened, $w=5.217 \text{ in}$	
$f_1=47.624 \text{ ksi}$, $f_2=-39.967 \text{ ksi}$	
$\psi=0.83922$	Eq. 1.1.2-1
$k=20.122$	Eq. 1.1.2-2
$\lambda=0.86844$	Eq. 1.1-3
$\rho=0.85979$	Eq. 1.1-2
$b_e=4.4855 \text{ in}$	Eq. 1.1-1
$h_o=5.5 \text{ in}$, $b_o=2.5 \text{ in}$, $h_o/b_o=2.2$	
$b_1=1.1683 \text{ in}$	Eq. 1.1.2-3
$b_2=2.2428 \text{ in}$	Eq. 1.1.2-4
Compression width=2.8365 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=0.22823 \text{ in}$	

$S_{xe}=0.93484 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_n I=3895.1 \text{ lb-ft}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$

$f_1=55.815 \text{ ksi}$, $f_2=55.815 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59604$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=2.217 \text{ in}$

$f_1=51.774 \text{ ksi}$, $f_2=-27.37 \text{ ksi}$

$\psi=0.52865$

Eq. 1.1.2-1

$k=14.201$

Eq. 1.1.2-2

$\lambda=0.45803$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.217 \text{ in}$

Eq. 1.1-1

$h_o=2.5 \text{ in}$, $b_o=0.625 \text{ in}$, $h_o/b_o=4$

$b_1=0.62829 \text{ in}$

Eq. 1.1.2-3

$b_2=1.1085 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.4503 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.4835 \text{ in}$

$f_1=55.815 \text{ ksi}$, $f_2=55.815 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59604$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w=2.217 \text{ in}$

$f_1=51.774 \text{ ksi}$, $f_2=-27.37 \text{ ksi}$

$\psi=0.52865$

Eq. 1.1.2-1

$k=14.201$

Eq. 1.1.2-2

$\lambda=0.45802$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.217 \text{ in}$

Eq. 1.1-1

$h_o=2.5 \text{ in}$, $b_o=0.625 \text{ in}$, $h_o/b_o=4$

$b_1=0.62829 \text{ in}$

Eq. 1.1.2-3

$b_2=1.1085 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.4503 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0 \text{ in}$

$S_{ye}=0.30775 \text{ in}^3$, $F_y=56.825 \text{ ksi}$

$M_n I=1457.3 \text{ lb-ft}$

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.217$ in

$f_1=36.459$ ksi, $f_2=-44.813$ ksi

$\psi=1.2291$

Eq. 1.1.2-1

$k=30.611$

Eq. 1.1.2-2

$\lambda=0.2618$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.217$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=5.5$ in, $h_o/b_o=0.45455$

$b_1=0.52422$ in

Eq. 1.1.2-3

$b_2=1.1085$ in

Eq. 1.1.2-4

Compression width=0.99456 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=40.609$ ksi, $f_2=40.609$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.9542$

Eq. 1.1-3

$\rho=0.45411$

Eq. 1.1-2

$b=0.84396$ in (ineffective width=1.0145 in)

Eq. 1.1-1

$f_1=40.609$ ksi, $f_2=40.609$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=1.9542$

Eq. 1.1-3

$\rho=0.45411$

Eq. 1.1-2

$b=0.84396$ in (ineffective width=1.0145 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.217$ in

$f_1=36.459$ ksi, $f_2=-44.813$ ksi

$\psi=1.2291$

Eq. 1.1.2-1

$k=30.611$

Eq. 1.1.2-2

$\lambda=0.2618$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.217$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=5.5$ in, $h_o/b_o=0.45455$

$b_1=0.52422$ in

Eq. 1.1.2-3

$b_2=1.1085$ in

Eq. 1.1.2-4

Compression width=0.99456 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.22889$ in

$S_y=0.2772$ in³, $F_y=50$ ksi

$M_{nl}=1155$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=3.334$ in⁶, $W_n=5.6367$ in², $F_y=50$ ksi

$B_n=29575$ lb-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

600S162-30

Full Section Properties

Area	0.31089 in ²	Wt.	0.0010570 k/ft	Flat	9.9643 in
I _x	1.6215 in ⁴	r _x	2.2838 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.54049 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	0.54049 in ³	y(b)	3.0000 in		
Z _x	0.64254 in ³	Height	6.0000 in		
I _y	0.1055 in ⁴	r _y	0.5826 in	x _o	-1.0717 in
S _y (l)	0.25574 in ³	x(l)	0.4126 in	y _o	0.0000 in
S _y (r)	0.08704 in ³	x(r)	1.2124 in	j _x	3.2365 in
Z _y	0.12415 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	1.6215 in ⁴	r ₁	2.2838 in	C _w	0.75162 in ⁶
I ₂	0.1055 in ⁴	r ₂	0.5826 in	J	0.0001009 in ⁴
I _c	1.7270 in ⁴	r _c	2.3569 in		
I _o	2.0840 in ⁴	r _o	2.5891 in		

Net Section Properties

I _x	1.6127 in ⁴	r _x	2.4712 in	Area	0.26409 in ²
S _x (t)	0.53756 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.53756 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	0.62499 in ³				
I _y	0.0968 in ⁴	r _y	0.6055 in	x _o	-1.1457 in
S _y (l)	0.20050 in ³	x(l)	0.4830 in	y _o	0.0000 in
S _y (r)	0.08479 in ³	x(r)	1.1420 in	j _x	2.8460 in
Z _y	0.12355 in ³			j _y	0.0000 in
I _c	1.7095 in ⁴	r _c	2.5443 in	C _w	0.74760 in ⁶
I _o	2.0562 in ⁴	r _o	2.7903 in	J	0.00008569 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	5.647 k	φM _{nxo}	17.824 k-in	φM _{nyo}	3.646 k-in
A _e	0.13288 in ²	I _{xe}	1.3665 in ⁴	I _{ye}	0.0934 in ⁴
φT _n	12.874 k	S _{xe} (t)	0.39608 in ³	S _{ye} (l)	0.19815 in ³
		S _{xe} (b)	0.53593 in ³	S _{ye} (r)	0.08101 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.676 k	φM _{nxo}	17.824 k-in	φM _{nyo}	3.179 k-in
φV _{nx}	2.328 k	I _{xe}	1.3665 in ⁴	I _{ye}	0.0591 in ⁴
Torsion		S _{xe} (t)	0.53593 in ³	S _{ye} (l)	0.07489 in ³
φB _n	8.7948 k-in ²	S _{xe} (b)	0.39608 in ³	S _{ye} (r)	0.07065 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=51.104$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=53.235$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=55.114$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.31089 \text{ in}^2$, $F_y=51.104 \text{ ksi}$ $T_n=15.888 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.26409 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=17.166 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1.2934 \text{ k}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=3.5005 \text{ k}$	Eq. G3-2
$k_v=4.0784$	Eq. G3-8
$V_{crh}=0.35872 \text{ k}$	Eq. G3-6
$V_n=0.75095 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1.2934 \text{ k}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3907 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.82697$	Eq. 1.1-3
$\rho=0.88754$	Eq. 1.1-2
$b=0.34676 \text{ in}$ (ineffective width= 0.043938 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00016273 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00015506 \text{ in}^4$	
$d_s=0.33042 \text{ in}$ (lip ineffective width= 0.01634 in)	Eq. 1.3-6
$k=3.4239$	Table 1.3-1
Element 2: Partially stiffened, $w=1.4064 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.4239$	
$\lambda=1.055$	Eq. 1.1-3
$\rho=0.75023$	Eq. 1.1-2
$b=1.0551 \text{ in}$ (ineffective width= 0.35127 in)	Eq. 1.1-1
$b_1=0.5027 \text{ in}$, $b_2=0.55242 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.5311$	Eq. 1.1-3
$\rho=0.20998$	Eq. 1.1-2
$b=0.44951 \text{ in}$ (ineffective width= 1.6912 in)	Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.5311$	Eq. 1.1-3
$\rho=0.20998$	Eq. 1.1-2
$b=0.44951$ in (ineffective width=1.6912 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.82697$	Eq. 1.1-3
$\rho=0.88754$	Eq. 1.1-2
$b=0.34676$ in (ineffective width=0.043938 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00016273$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$d_s=0.33042$ in (lip ineffective width=0.016341 in)	Eq. 1.3-6
$k=3.4239$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4064$ in	
$f=50$ ksi, $k=3.4239$	
$\lambda=1.055$	Eq. 1.1-3
$\rho=0.75023$	Eq. 1.1-2
$b=1.0551$ in (ineffective width=0.35127 in)	Eq. 1.1-1
$b_1=0.5027$ in, $b_2=0.55242$ in	
$A_e=0.13288$ in ² , $F_n=50$ ksi	
$P_n=6.6438$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.7814$ in	
$f_1=48.416$ ksi, $f_2=-35.394$ ksi	
$\psi=0.73105$	Eq. 1.1.2-1
$k=17.836$	Eq. 1.1.2-2
$\lambda=1.8697$	Eq. 1.1-3
$\rho=0.47192$	Eq. 1.1-2
$b_e=2.7283$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=1.625$ in, $h_o/b_o=3.6923$	
$b_1=0.73125$ in	Eq. 1.1.2-3
$b_2=1.3642$ in	Eq. 1.1.2-4
Compression width=3.3398 in	
Ineffective width=1.2444 in	
Element 5: Unstiffened, $w=0.3907$ in	
$f_1=48.416$ ksi, $f_2=42.752$ ksi	
$\psi=0.88302$	Eq. 1.2.2-1
$k=0.4726$	Eq. 1.2.2-2
$\lambda=0.77622$	Eq. 1.1-3

$\rho=0.92316$	Eq. 1.1-2
$b=0.36068$ in (ineffective width= 0.030021 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.162$	Eq. 1.3-7
$I_a=0.00016237$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$ds=0.34444$ in (lip ineffective width= 0.016239 in)	Eq. 1.3-6
$k=3.426$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4064$ in	
$f=49.774$ ksi, $k=3.426$	
$\lambda=1.0522$	Eq. 1.1-3
$\rho=0.75166$	Eq. 1.1-2
$b=1.0571$ in (ineffective width= 0.34926 in)	Eq. 1.1-1
$b_1=0.50477$ in, $b_2=0.55237$ in	
Center of gravity shift: $y=-0.45015$ in	
$S_{xe}=0.39608$ in ³ , $F_y=50$ ksi	
$M_n I=19.804$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3907$ in	
$f_1=48.416$ ksi, $f_2=42.752$ ksi	
$\psi=0.88302$	Eq. 1.2.2-1
$k=0.4726$	Eq. 1.2.2-2
$\lambda=0.77622$	Eq. 1.1-3
$\rho=0.92316$	Eq. 1.1-2
$b=0.36068$ in (ineffective width= 0.030021 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.162$	Eq. 1.3-7
$I_a=0.00016237$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$ds=0.34444$ in (lip ineffective width= 0.016239 in)	Eq. 1.3-6
$k=3.426$	Table 1.3-1
Element 2: Partially stiffened, $w=1.4064$ in	
$f=49.774$ ksi, $k=3.426$	
$\lambda=1.0522$	Eq. 1.1-3
$\rho=0.75166$	Eq. 1.1-2
$b=1.0571$ in (ineffective width= 0.34926 in)	Eq. 1.1-1
$b_1=0.50477$ in, $b_2=0.55237$ in	
Element 3: Stiffened, $w=5.7814$ in	
$f_1=48.416$ ksi, $f_2=-35.394$ ksi	
$\psi=0.73105$	Eq. 1.1.2-1
$k=17.836$	Eq. 1.1.2-2
$\lambda=1.8697$	Eq. 1.1-3
$\rho=0.47192$	Eq. 1.1-2
$b_e=2.7283$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=1.625$ in, $h_o/b_o=3.6923$	
$b_1=0.73125$ in	Eq. 1.1.2-3
$b_2=1.3642$ in	Eq. 1.1.2-4

Compression width=3.3398 in
 Ineffective width=1.2444 in
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.45015$ in
 $S_{xe}=0.39608$ in³, $F_y=50$ ksi
 $M_{nl}=19.804$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3907$ in

$f_1=49.324$ ksi, $f_2=49.324$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.82136$

Eq. 1.1-3

$\rho=0.89139$

Eq. 1.1-2

$b=0.34827$ in (ineffective width=0.042434 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.4064$ in

$f_1=45.262$ ksi, $f_2=-15.704$ ksi

$\psi=0.34697$

Eq. 1.1.2-1

$k=11.582$

Eq. 1.1.2-2

$\lambda=0.54574$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.4064$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$

$b_1=0.4202$ in

Eq. 1.1.2-3

$b_2=0.7032$ in

Eq. 1.1.2-4

Compression width=1.0441 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3907$ in

$f_1=49.324$ ksi, $f_2=49.324$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=0.82136$

Eq. 1.1-3

$\rho=0.89139$

Eq. 1.1-2

$b=0.34827$ in (ineffective width=0.042434 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.4064$ in

$f_1=45.262$ ksi, $f_2=-15.704$ ksi

$\psi=0.34697$

Eq. 1.1.2-1

$k=11.582$

Eq. 1.1.2-2

$\lambda=0.54574$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.4064$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$

$b_1=0.4202$ in

Eq. 1.1.2-3

$b_2=0.7032$ in

Eq. 1.1.2-4

Compression width=1.0441 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x = -0.011408$ in
 $S_y = 0.081013$ in³, $F_y = 50$ ksi
 $M_n I = 4.0506$ k-in
 $\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.4064$ in

$f_1 = 40.61$ ksi, $f_2 = -43.466$ ksi

$\psi = 1.0703$

Eq. 1.1.2-1

$k = 25.888$

Eq. 1.1.2-2

$\lambda = 0.34576$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 1.4064$ in

Eq. 1.1-1

$h_o = 1.625$ in, $b_o = 6$ in, $h_o/b_o = 0.27083$

$b_1 = 0.34553$ in

Eq. 1.1.2-3

$b_2 = 0.7032$ in

Eq. 1.1.2-4

Compression width = 0.67931 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 46.212$ ksi, $f_2 = 46.212$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 4.3561$

Eq. 1.1-3

$\rho = 0.21797$

Eq. 1.1-2

$b = 0.46661$ in (ineffective width = 1.6741 in)

Eq. 1.1-1

$f_1 = 46.212$ ksi, $f_2 = 46.212$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 4.3561$

Eq. 1.1-3

$\rho = 0.21797$

Eq. 1.1-2

$b = 0.46661$ in (ineffective width = 1.6741 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.4064$ in

$f_1 = 40.61$ ksi, $f_2 = -43.466$ ksi

$\psi = 1.0703$

Eq. 1.1.2-1

$k = 25.888$

Eq. 1.1.2-2

$\lambda = 0.34576$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 1.4064$ in

Eq. 1.1-1

$h_o = 1.625$ in, $b_o = 6$ in, $h_o/b_o = 0.27083$

$b_1 = 0.34553$ in

Eq. 1.1.2-3

$b_2 = 0.7032$ in

Eq. 1.1.2-4

Compression width = 0.67931 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.30587$ in

$S_y = 0.070651$ in³, $F_y = 50$ ksi

$M_n I = 3.5325$ k-in

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Bimoment Strength, Stud

$C_w=0.7476 \text{ in}^6$, $W_n=3.8252 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=9.772 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

600S162-33

Full Section Properties

Area	0.34430 in ²	Wt.	0.0011706 k/ft	Flat	9.9507 in
I _x	1.7929 in ⁴	r _x	2.2820 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.59764 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	0.59764 in ³	y(b)	3.0000 in		
Z _x	0.71098 in ³	Height	6.0000 in		
I _y	0.1163 in ⁴	r _y	0.5811 in	x _o	-1.0682 in
S _y (l)	0.28155 in ³	x(l)	0.4129 in	y _o	0.0000 in
S _y (r)	0.09592 in ³	x(r)	1.2121 in	j _x	3.2362 in
Z _y	0.13710 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	1.7929 in ⁴	r ₁	2.2820 in	C _w	0.82674 in ⁶
I ₂	0.1163 in ⁴	r ₂	0.5811 in	J	0.0001374 in ⁴
I _c	1.9092 in ⁴	r _c	2.3548 in		
I _o	2.3021 in ⁴	r _o	2.5858 in		

Net Section Properties

I _x	1.7832 in ⁴	r _x	2.4695 in	Area	0.29240 in ²
S _x (t)	0.59440 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.59440 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	0.69151 in ³				
I _y	0.1067 in ⁴	r _y	0.6041 in	x _o	-1.1421 in
S _y (l)	0.22082 in ³	x(l)	0.4832 in	y _o	0.0000 in
S _y (r)	0.09344 in ³	x(r)	1.1418 in	j _x	2.8450 in
Z _y	0.13637 in ³			j _y	0.0000 in
I _c	1.8899 in ⁴	r _c	2.5423 in	C _w	0.82231 in ⁶
I _o	2.2713 in ⁴	r _o	2.7871 in	J	0.0001167 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	6.416 k	φM _{nxo}	20.770 k-in	φM _{nyo}	4.122 k-in
A _e	0.15097 in ²	I _{xe}	1.5531 in ⁴	I _{ye}	0.1050 in ⁴
φT _n	14.254 k	S _{xe} (t)	0.46155 in ³	S _{ye} (l)	0.21969 in ³
		S _{xe} (b)	0.58941 in ³	S _{ye} (r)	0.09160 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.850 k	φM _{nxo}	20.770 k-in	φM _{nyo}	3.556 k-in
φV _{nx}	2.621 k	I _{xe}	1.5531 in ⁴	I _{ye}	0.0675 in ⁴
Torsion		S _{xe} (t)	0.58941 in ³	S _{ye} (l)	0.08757 in ³
φB _n	9.7042 k-in ²	S _{xe} (b)	0.46155 in ³	S _{ye} (r)	0.07902 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.199$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=53.516$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=55.565$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.3443 \text{ in}^2$, $F_y=51.199 \text{ ksi}$ $T_n=17.628 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.2924 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=19.006 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=1.4563 \text{ k}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=3.8779 \text{ k}$	Eq. G3-2
$k_v=4.0779$	Eq. G3-8
$V_{crh}=0.48931 \text{ k}$	Eq. G3-6
$V_n=0.94407 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=1.4563 \text{ k}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.389 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74246$	Eq. 1.1-3
$\rho=0.94778$	Eq. 1.1-2
$b=0.36869 \text{ in}$ (ineffective width= 0.020315 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00022212 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00016972 \text{ in}^4$	
$d_s=0.28171 \text{ in}$ (lip ineffective width= 0.086971 in)	Eq. 1.3-6
$k=3.2075$	Table 1.3-1
Element 2: Partially stiffened, $w=1.403 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.2075$	
$\lambda=0.98047$	Eq. 1.1-3
$\rho=0.79107$	Eq. 1.1-2
$b=1.1099 \text{ in}$ (ineffective width= 0.29313 in)	Eq. 1.1-1
$b_1=0.42403 \text{ in}$, $b_2=0.68584 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.0826$	Eq. 1.1-3
$\rho=0.23174$	Eq. 1.1-2
$b=0.4957 \text{ in}$ (ineffective width= 1.6433 in)	Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.0826$	Eq. 1.1-3
$\rho=0.23174$	Eq. 1.1-2
$b=0.4957$ in (ineffective width=1.6433 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74246$	Eq. 1.1-3
$\rho=0.94778$	Eq. 1.1-2
$b=0.36869$ in (ineffective width=0.020315 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00022212$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.28171$ in (lip ineffective width=0.086971 in)	Eq. 1.3-6
$k=3.2075$	Table 1.3-1
Element 4: Partially stiffened, $w=1.403$ in	
$f=50$ ksi, $k=3.2075$	
$\lambda=0.98047$	Eq. 1.1-3
$\rho=0.79107$	Eq. 1.1-2
$b=1.1099$ in (ineffective width=0.29313 in)	Eq. 1.1-1
$b_1=0.42403$ in, $b_2=0.68584$ in	
$A_e=0.15097$ in ² , $F_n=50$ ksi	
$P_n=7.5485$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.778$ in	
$f_1=48.35$ ksi, $f_2=-37.536$ ksi	
$\psi=0.77633$	Eq. 1.1.2-1
$k=18.763$	Eq. 1.1.2-2
$\lambda=1.6417$	Eq. 1.1-3
$\rho=0.52749$	Eq. 1.1-2
$b_e=3.0478$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=1.625$ in, $h_o/b_o=3.6923$	
$b_1=0.80708$ in	Eq. 1.1.2-3
$b_2=1.5239$ in	Eq. 1.1.2-4
Compression width=3.2528 in	
Ineffective width=0.92177 in	
Element 5: Unstiffened, $w=0.389$ in	
$f_1=48.35$ ksi, $f_2=42.568$ ksi	
$\psi=0.88041$	Eq. 1.2.2-1
$k=0.47361$	Eq. 1.2.2-2
$\lambda=0.69568$	Eq. 1.1-3

$\rho=0.98287$	Eq. 1.1-2
$b=0.38234$ in (ineffective width=0.0066646 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.171$	Eq. 1.3-7
$I_a=0.00022157$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.29287$ in (lip ineffective width=0.089461 in)	Eq. 1.3-6
$k=3.2098$	Table 1.3-1
Element 4: Partially stiffened, $w=1.403$ in	
$f=49.743$ ksi, $k=3.2098$	
$\lambda=0.97759$	Eq. 1.1-3
$\rho=0.79272$	Eq. 1.1-2
$b=1.1122$ in (ineffective width=0.29081 in)	Eq. 1.1-1
$b_1=0.42598$ in, $b_2=0.68621$ in	
Center of gravity shift: $y=-0.36496$ in	
$S_{xe}=0.46155$ in ³ , $F_y=50$ ksi	
$M_n I=23.078$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.389$ in	
$f_1=48.35$ ksi, $f_2=42.568$ ksi	
$\psi=0.88041$	Eq. 1.2.2-1
$k=0.47361$	Eq. 1.2.2-2
$\lambda=0.69568$	Eq. 1.1-3
$\rho=0.98287$	Eq. 1.1-2
$b=0.38234$ in (ineffective width=0.0066646 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.171$	Eq. 1.3-7
$I_a=0.00022157$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.29287$ in (lip ineffective width=0.089461 in)	Eq. 1.3-6
$k=3.2098$	Table 1.3-1
Element 2: Partially stiffened, $w=1.403$ in	
$f=49.743$ ksi, $k=3.2098$	
$\lambda=0.97759$	Eq. 1.1-3
$\rho=0.79272$	Eq. 1.1-2
$b=1.1122$ in (ineffective width=0.29081 in)	Eq. 1.1-1
$b_1=0.42598$ in, $b_2=0.68621$ in	
Element 3: Stiffened, $w=5.778$ in	
$f_1=48.35$ ksi, $f_2=-37.536$ ksi	
$\psi=0.77633$	Eq. 1.1.2-1
$k=18.763$	Eq. 1.1.2-2
$\lambda=1.6417$	Eq. 1.1-3
$\rho=0.52749$	Eq. 1.1-2
$b_e=3.0478$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=1.625$ in, $h_o/b_o=3.6923$	
$b_1=0.80708$ in	Eq. 1.1.2-3
$b_2=1.5239$ in	Eq. 1.1.2-4

Compression width=3.2528 in
 Ineffective width=0.92177 in
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.36496$ in
 $S_{xe}=0.46155$ in³, $F_y=50$ ksi
 $M_{nl}=23.078$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.389$ in
 $f_1=49.246$ ksi, $f_2=49.246$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.73684$ Eq. 1.1-3
 $\rho=0.95194$ Eq. 1.1-2
 $b=0.3703$ in (ineffective width=0.018696 in) Eq. 1.1-1

Element 2: Stiffened, $w=1.403$ in
 $f_1=45.161$ ksi, $f_2=-16.007$ ksi
 $\psi=0.35446$ Eq. 1.1.2-1
 $k=11.679$ Eq. 1.1.2-2
 $\lambda=0.48833$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=1.403$ in Eq. 1.1-1
 $h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$
 $b_1=0.41825$ in Eq. 1.1.2-3
 $b_2=0.7015$ in Eq. 1.1.2-4

Compression width=1.0358 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.389$ in
 $f_1=49.246$ ksi, $f_2=49.246$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-2
 $\lambda=0.73684$ Eq. 1.1-3
 $\rho=0.95194$ Eq. 1.1-2
 $b=0.3703$ in (ineffective width=0.018696 in) Eq. 1.1-1

Element 4: Stiffened, $w=1.403$ in

$f_1=45.161$ ksi, $f_2=-16.007$ ksi
 $\psi=0.35446$ Eq. 1.1.2-1
 $k=11.679$ Eq. 1.1.2-2
 $\lambda=0.48833$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=1.403$ in Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$

$b_1=0.41825$ in Eq. 1.1.2-3

$b_2=0.7015$ in Eq. 1.1.2-4

Compression width=1.0358 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x = -0.0049978$ in
 $S_y = 0.091596$ in³, $F_y = 50$ ksi
 $M_n I = 4.5798$ k-in
 $\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.403$ in

$f_1 = 38.591$ ksi, $f_2 = -43.505$ ksi

$\psi = 1.1273$

Eq. 1.1.2-1

$k = 27.51$

Eq. 1.1.2-2

$\lambda = 0.29412$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 1.403$ in

Eq. 1.1-1

$h_o = 1.625$ in, $b_o = 6$ in, $h_o/b_o = 0.27083$

$b_1 = 0.33993$ in

Eq. 1.1.2-3

$b_2 = 0.7015$ in

Eq. 1.1.2-4

Compression width = 0.65951 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 44.073$ ksi, $f_2 = 44.073$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 3.833$

Eq. 1.1-3

$\rho = 0.24592$

Eq. 1.1-2

$b = 0.52602$ in (ineffective width = 1.613 in)

Eq. 1.1-1

$f_1 = 44.073$ ksi, $f_2 = 44.073$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 3.833$

Eq. 1.1-3

$\rho = 0.24592$

Eq. 1.1-2

$b = 0.52602$ in (ineffective width = 1.613 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.403$ in

$f_1 = 38.591$ ksi, $f_2 = -43.505$ ksi

$\psi = 1.1273$

Eq. 1.1.2-1

$k = 27.51$

Eq. 1.1.2-2

$\lambda = 0.29412$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 1.403$ in

Eq. 1.1-1

$h_o = 1.625$ in, $b_o = 6$ in, $h_o/b_o = 0.27083$

$b_1 = 0.33993$ in

Eq. 1.1.2-3

$b_2 = 0.7015$ in

Eq. 1.1.2-4

Compression width = 0.65951 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.28764$ in

$S_y = 0.079018$ in³, $F_y = 50$ ksi

$M_n I = 3.9509$ k-in

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Bimoment Strength, Stud

$C_w=0.82231 \text{ in}^6$, $W_n=3.8132 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=10.782 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

600S162-43

Full Section Properties

Area	0.44688 in ²	Wt.	0.0015194 k/ft	Flat	9.9086 in
I _x	2.3160 in ⁴	r _x	2.2765 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.77200 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	0.77200 in ³	y(b)	3.0000 in		
Z _x	0.92038 in ³	Height	6.0000 in		
I _y	0.1485 in ⁴	r _y	0.5765 in	x _o	-1.0575 in
S _y (l)	0.35879 in ³	x(l)	0.4139 in	y _o	0.0000 in
S _y (r)	0.12261 in ³	x(r)	1.2111 in	j _x	3.2351 in
Z _y	0.17642 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	2.3160 in ⁴	r ₁	2.2765 in	C _w	1.0506 in ⁶
I ₂	0.1485 in ⁴	r ₂	0.5765 in	J	0.0003030 in ⁴
I _c	2.4645 in ⁴	r _c	2.3484 in		
I _o	2.9643 in ⁴	r _o	2.5755 in		

Net Section Properties

I _x	2.3033 in ⁴	r _x	2.4645 in	Area	0.37923 in ²
S _x (t)	0.76778 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.76778 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	0.89501 in ³				
I _y	0.1363 in ⁴	r _y	0.5995 in	x _o	-1.1310 in
S _y (l)	0.28174 in ³	x(l)	0.4837 in	y _o	0.0000 in
S _y (r)	0.11940 in ³	x(r)	1.1413 in	j _x	2.8418 in
Z _y	0.17519 in ³			j _y	0.0000 in
I _c	2.4396 in ⁴	r _c	2.5363 in	C _w	1.0450 in ⁶
I _o	2.9247 in ⁴	r _o	2.7771 in	J	0.0002571 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	9.006 k	φM _{nxo}	31.430 k-in	φM _{nyo}	6.109 k-in
A _e	0.21191 in ²	I _{xe}	2.1785 in ⁴	I _{ye}	0.1363 in ⁴
φT _n	18.487 k	S _{xe} (t)	0.69845 in ³	S _{ye} (l)	0.28174 in ³
		S _{xe} (b)	0.75620 in ³	S _{ye} (r)	0.11940 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.517 k	φM _{nxo}	31.430 k-in	φM _{nyo}	4.728 k-in
φV _{nx}	3.391 k	I _{xe}	2.1785 in ⁴	I _{ye}	0.0953 in ⁴
Torsion		S _{xe} (t)	0.75620 in ³	S _{ye} (l)	0.13274 in ³
φB _n	12.453 k-in ²	S _{xe} (b)	0.69845 in ³	S _{ye} (r)	0.10506 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.468$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=54.31$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=56.847$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.44688$ in², $F_y=51.468$ ksi

$$T_n = 23 \text{ k} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.37923 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 24.65 \text{ k} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 1.8839 \text{ k at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 5.0382 \text{ k} \quad \text{Eq. G3-2}$$

$$k_v = 4.0765 \quad \text{Eq. G3-8}$$

$$V_{crh} = 1.0842 \text{ k} \quad \text{Eq. G3-6}$$

$$V_n = 1.6852 \text{ k at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 1.8839 \text{ k at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.3837 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.56184 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.00048546 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00021231 \text{ in}^4$$

$$d_s = 0.16781 \text{ in (lip ineffective width} = 0.21589 \text{ in)} \quad \text{Eq. 1.3-6}$$

$$k = 2.725 \quad \text{Table 1.3-1}$$

Element 2: Partially stiffened, $w = 1.3924 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.725$$

$$\lambda = 0.80992 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.89931 \quad \text{Eq. 1.1-2}$$

$$b = 1.2522 \text{ in (ineffective width} = 0.1402 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$b_1 = 0.27382 \text{ in}, b_2 = 0.97838 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 3.1243 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.29753 \quad \text{Eq. 1.1-2}$$

$$b = 0.63484 \text{ in (ineffective width} = 1.4989 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

k=0.43	Eq. 1.2.2-3
$\lambda=3.1243$	Eq. 1.1-3
$\rho=0.29753$	Eq. 1.1-2
b=0.63484 in (ineffective width=1.4989 in)	Eq. 1.1-1
Element 5: Unstiffened, w=0.3837 in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
$\lambda=0.56184$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.091	Eq. 1.3-7
$I_a=0.00048546$ in ⁴	Eq. 1.3-8
$I_s=0.00021231$ in ⁴	
ds=0.16781 in (lip ineffective width=0.21589 in)	Eq. 1.3-6
k=2.725	Table 1.3-1
Element 4: Partially stiffened, w=1.3924 in	
f=50 ksi, k=2.725	
$\lambda=0.80992$	Eq. 1.1-3
$\rho=0.89931$	Eq. 1.1-2
b=1.2522 in (ineffective width=0.1402 in)	Eq. 1.1-1
$b_1=0.27382$ in, $b_2=0.97838$ in	
$A_e=0.21191$ in ² , $F_n=50$ ksi	
$P_n=10.596$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, w=5.7674 in	
$f_1=48.136$ ksi, $f_2=-44.321$ ksi	
$\psi=0.92074$	Eq. 1.1.2-1
k=22.014	Eq. 1.1.2-2
$\lambda=1.1581$	Eq. 1.1-3
$\rho=0.69946$	Eq. 1.1-2
be=4.034 in	Eq. 1.1-1
$h_o=6$ in, $b_o=1.625$ in, $h_o/b_o=3.6923$	
$b_1=1.0289$ in	Eq. 1.1.2-3
$b_2=2.017$ in	Eq. 1.1.2-4
Compression width=3.0027 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, w=0.3837 in	
$f_1=48.136$ ksi, $f_2=41.985$ ksi	
$\psi=0.87221$	Eq. 1.2.2-1
k=0.47681	Eq. 1.2.2-2
$\lambda=0.52351$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.204	Eq. 1.3-7

$I_a=0.00047763 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00021231 \text{ in}^4$	
$d_s=0.17056 \text{ in}$ (lip ineffective width=0.21314 in)	Eq. 1.3-6
$k=2.7358$	Table 1.3-1
Element 4: Partially stiffened, $w=1.3924 \text{ in}$	
$f=49.639 \text{ ksi}$, $k=2.7358$	
$\lambda=0.80539$	Eq. 1.1-3
$\rho=0.90247$	Eq. 1.1-2
$b=1.2566 \text{ in}$ (ineffective width=0.1358 in)	Eq. 1.1-1
$b_1=0.27929 \text{ in}$, $b_2=0.97732 \text{ in}$	
Center of gravity shift: $y=-0.1191 \text{ in}$	
$S_{xe}=0.69845 \text{ in}^3$, $F_y=50 \text{ ksi}$	
$M_{nl}=34.922 \text{ k-in}$	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3837 \text{ in}$	
$f_1=48.136 \text{ ksi}$, $f_2=41.985 \text{ ksi}$	
$\psi=0.87221$	Eq. 1.2.2-1
$k=0.47681$	Eq. 1.2.2-2
$\lambda=0.52351$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.204$	Eq. 1.3-7
$I_a=0.00047763 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00021231 \text{ in}^4$	
$d_s=0.17056 \text{ in}$ (lip ineffective width=0.21314 in)	Eq. 1.3-6
$k=2.7358$	Table 1.3-1
Element 2: Partially stiffened, $w=1.3924 \text{ in}$	
$f=49.639 \text{ ksi}$, $k=2.7358$	
$\lambda=0.80539$	Eq. 1.1-3
$\rho=0.90247$	Eq. 1.1-2
$b=1.2566 \text{ in}$ (ineffective width=0.1358 in)	Eq. 1.1-1
$b_1=0.27929 \text{ in}$, $b_2=0.97732 \text{ in}$	
Element 3: Stiffened, $w=5.7674 \text{ in}$	
$f_1=48.136 \text{ ksi}$, $f_2=-44.321 \text{ ksi}$	
$\psi=0.92074$	Eq. 1.1.2-1
$k=22.014$	Eq. 1.1.2-2
$\lambda=1.1581$	Eq. 1.1-3
$\rho=0.69946$	Eq. 1.1-2
$b_e=4.034 \text{ in}$	Eq. 1.1-1
$h_o=6 \text{ in}$, $b_o=1.625 \text{ in}$, $h_o/b_o=3.6923$	
$b_1=1.0289 \text{ in}$	Eq. 1.1.2-3
$b_2=2.017 \text{ in}$	Eq. 1.1.2-4
Compression width=3.0027 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=0.1191 \text{ in}$	

$S_{xe}=0.69845 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_n I=34.922 \text{ k-in}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837 \text{ in}$

$f_1=55.724 \text{ ksi}$, $f_2=55.724 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59313$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=1.3924 \text{ in}$

$f_1=51.054 \text{ ksi}$, $f_2=-18.299 \text{ ksi}$

$\psi=0.35843$

Eq. 1.1.2-1

$k=11.73$

Eq. 1.1.2-2

$\lambda=0.39446$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.3924 \text{ in}$

Eq. 1.1-1

$h_o=1.625 \text{ in}$, $b_o=0.5 \text{ in}$, $h_o/b_o=3.25$

$b_1=0.4146 \text{ in}$

Eq. 1.1.2-3

$b_2=0.6962 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.025 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3837 \text{ in}$

$f_1=55.724 \text{ ksi}$, $f_2=55.724 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59313$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w=1.3924 \text{ in}$

$f_1=51.054 \text{ ksi}$, $f_2=-18.299 \text{ ksi}$

$\psi=0.35843$

Eq. 1.1.2-1

$k=11.73$

Eq. 1.1.2-2

$\lambda=0.39446$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.3924 \text{ in}$

Eq. 1.1-1

$h_o=1.625 \text{ in}$, $b_o=0.5 \text{ in}$, $h_o/b_o=3.25$

$b_1=0.4146 \text{ in}$

Eq. 1.1.2-3

$b_2=0.6962 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.025 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0 \text{ in}$

$S_{ye}=0.1194 \text{ in}^3$, $F_y=56.847 \text{ ksi}$

$M_n I=6.7877 \text{ k-in}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.3924$ in

$f_1=33.124$ ksi, $f_2=-43.592$ ksi

$\psi=1.316$

Eq. 1.1.2-1

$k=33.479$

Eq. 1.1.2-2

$\lambda=0.18807$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.3924$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=6$ in, $h_o/b_o=0.27083$

$b_1=0.32261$ in

Eq. 1.1.2-3

$b_2=0.6962$ in

Eq. 1.1.2-4

Compression width=0.6012 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=38.289$ ksi, $f_2=38.289$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.7341$

Eq. 1.1-3

$\rho=0.33632$

Eq. 1.1-2

$b=0.71761$ in (ineffective width=1.4161 in)

Eq. 1.1-1

$f_1=38.289$ ksi, $f_2=38.289$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.7341$

Eq. 1.1-3

$\rho=0.33632$

Eq. 1.1-2

$b=0.71761$ in (ineffective width=1.4161 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.3924$ in

$f_1=33.124$ ksi, $f_2=-43.592$ ksi

$\psi=1.316$

Eq. 1.1.2-1

$k=33.479$

Eq. 1.1.2-2

$\lambda=0.18807$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.3924$ in

Eq. 1.1-1

$h_o=1.625$ in, $b_o=6$ in, $h_o/b_o=0.27083$

$b_1=0.32261$ in

Eq. 1.1.2-3

$b_2=0.6962$ in

Eq. 1.1.2-4

Compression width=0.6012 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.2342$ in

$S_y=0.10506$ in³, $F_y=50$ ksi

$M_n=5.2528$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=1.045$ in⁶, $W_n=3.7762$ in², $F_y=50$ ksi

$B_n=13.836$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

600S162-54

Full Section Properties

Area	0.55634 in ²	Wt.	0.0018915 k/ft	Flat	9.8293 in
I _x	2.8608 in ⁴	r _x	2.2677 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.9536 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	0.9536 in ³	y(b)	3.0000 in		
Z _x	1.1407 in ³	Height	6.0000 in		
I _y	0.1807 in ⁴	r _y	0.5699 in	x _o	-1.0434 in
S _y (l)	0.4369 in ³	x(l)	0.4136 in	y _o	0.0000 in
S _y (r)	0.1492 in ³	x(r)	1.2114 in	j _x	3.2398 in
Z _y	0.2168 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	2.8608 in ⁴	r ₁	2.2677 in	C _w	1.2698 in ⁶
I ₂	0.1807 in ⁴	r ₂	0.5699 in	J	0.0005941 in ⁴
I _c	3.0415 in ⁴	r _c	2.3382 in		
I _o	3.6472 in ⁴	r _o	2.5604 in		

Net Section Properties

I _x	2.8449 in ⁴	r _x	2.4565 in	Area	0.47144 in ²
S _x (t)	0.9483 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.9483 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	1.1089 in ³				
I _y	0.1658 in ⁴	r _y	0.5930 in	x _o	-1.1164 in
S _y (l)	0.3433 in ³	x(l)	0.4830 in	y _o	0.0000 in
S _y (r)	0.1452 in ³	x(r)	1.1420 in	j _x	2.8436 in
Z _y	0.2149 in ³			j _y	0.0000 in
I _c	3.0107 in ⁴	r _c	2.5271 in	C _w	1.2628 in ⁶
I _o	3.5983 in ⁴	r _o	2.7627 in	J	0.0005034 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	13.037 k	φM _{nxo}	41.469 k-in	φM _{nyo}	7.633 k-in
A _e	0.30675 in ²	I _{xe}	2.7994 in ⁴	I _{ye}	0.1658 in ⁴
φT _n	22.983 k	S _{xe} (t)	0.92153 in ³	S _{ye} (l)	0.34328 in ³
		S _{xe} (b)	0.94500 in ³	S _{ye} (r)	0.14518 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2.454 k	φM _{nxo}	41.469 k-in	φM _{nyo}	5.962 k-in
φV _{nx}	4.102 k	I _{xe}	2.7994 in ⁴	I _{ye}	0.1279 in ⁴
Torsion		S _{xe} (t)	0.94500 in ³	S _{ye} (l)	0.19387 in ³
φB _n	15.214 k-in ²	S _{xe} (b)	0.92153 in ³	S _{ye} (r)	0.13248 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.837$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=55.318$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=58.416$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.55634$ in², $F_y=51.837$ ksi

$$T_n = 28.839 \text{ k} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.47144 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 30.643 \text{ k} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 2.2787 \text{ k at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 6.2242 \text{ k} \quad \text{Eq. G3-2}$$

$$k_v = 4.0696 \quad \text{Eq. G3-8}$$

$$V_{crh} = 2.1483 \text{ k} \quad \text{Eq. G3-6}$$

$$V_n = 2.7271 \text{ k at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 2.2787 \text{ k at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.3585 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi} \quad \text{Eq. 1.2.2-1}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-3}$$

$$k = 0.43 \quad \text{Eq. 1.1-3}$$

$$\lambda = 0.41829 \quad \text{Eq. 1.1-1}$$

$$\lambda < 0.673 \text{ (fully effective)}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.00033614 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00021732 \text{ in}^4$$

$$d_s = 0.23177 \text{ in (lip ineffective width} = 0.12673 \text{ in)} \quad \text{Eq. 1.3-6}$$

$$k = 2.9231 \quad \text{Table 1.3-1}$$

Element 2: Partially stiffened, $w = 1.342 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.9231 \quad \text{Eq. 1.1-3}$$

$$\lambda = 0.60055 \quad \text{Eq. 1.1-1}$$

$$\lambda < 0.673 \text{ (fully effective)}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi} \quad \text{Eq. 1.2.2-1}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-3}$$

$$k = 0.43 \quad \text{Eq. 1.1-3}$$

$$\lambda = 2.4601 \quad \text{Eq. 1.1-2}$$

$$\rho = 0.37013 \quad \text{Eq. 1.1-1}$$

$$b = 0.78042 \text{ in (ineffective width} = 1.3281 \text{ in)}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi} \quad \text{Eq. 1.2.2-1}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-3}$$

$$k = 0.43 \quad \text{Eq. 1.1-3}$$

$$\lambda = 2.4601$$

$\rho=0.37013$	Eq. 1.1-2
$b=0.78042$ in (ineffective width=1.3281 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.41829$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00033614$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.23177$ in (lip ineffective width=0.12673 in)	Eq. 1.3-6
$k=2.9231$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=50$ ksi, $k=2.9231$	
$\lambda=0.60055$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
$A_e=0.30675$ in ² , $F_n=50$ ksi	
$P_n=15.338$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.717$ in	
$f_1=47.671$ ksi, $f_2=-46.43$ ksi	
$\psi=0.97397$	Eq. 1.1.2-1
$k=23.331$	Eq. 1.1.2-2
$\lambda=0.88422$	Eq. 1.1-3
$\rho=0.84955$	Eq. 1.1-2
$b_e=4.8569$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=1.625$ in, $h_o/b_o=3.6923$	
$b_1=1.2222$ in	Eq. 1.1.2-3
$b_2=2.4285$ in	Eq. 1.1.2-4
Compression width=2.8962 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=47.671$ ksi, $f_2=41.77$ ksi	
$\psi=0.87622$	Eq. 1.2.2-1
$k=0.47524$	Eq. 1.2.2-2
$\lambda=0.3885$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.237$	Eq. 1.3-7
$I_a=0.00032795$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.23757$ in (lip ineffective width=0.12093 in)	Eq. 1.3-6
$k=2.9464$	Table 1.3-1

Element 4: Partially stiffened, $w=1.342$ in

$f=49.534$ ksi, $k=2.9464$

$\lambda=0.59538$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Center of gravity shift: $y=-0.037724$ in

$S_{xe}=0.92153$ in³, $F_y=50$ ksi

$M_{nl}=46.077$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585$ in

$f_1=47.671$ ksi, $f_2=41.77$ ksi

$\psi=0.87622$

Eq. 1.2.2-1

$k=0.47524$

Eq. 1.2.2-2

$\lambda=0.3885$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.237$

Eq. 1.3-7

$I_a=0.00032795$ in⁴

Eq. 1.3-8

$I_s=0.00021732$ in⁴

$d_s=0.23757$ in (lip ineffective width=0.12093 in)

Eq. 1.3-6

$k=2.9464$

Table 1.3-1

Element 2: Partially stiffened, $w=1.342$ in

$f=49.534$ ksi, $k=2.9464$

$\lambda=0.59538$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 3: Stiffened, $w=5.717$ in

$f_1=47.671$ ksi, $f_2=-46.43$ ksi

$\psi=0.97397$

Eq. 1.1.2-1

$k=23.331$

Eq. 1.1.2-2

$\lambda=0.88422$

Eq. 1.1-3

$\rho=0.84955$

Eq. 1.1-2

$b_e=4.8569$ in

Eq. 1.1-1

$h_o=6$ in, $b_o=1.625$ in, $h_o/b_o=3.6923$

$b_1=1.2222$ in

Eq. 1.1.2-3

$b_2=2.4285$ in

Eq. 1.1.2-4

Compression width=2.8962 in

$b_1+b_2 >$ compression width (fully effective)

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.037724$ in

$S_{xe}=0.92153$ in³, $F_y=50$ ksi

$M_{nl}=46.077$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585$ in

$f_1=56.969$ ksi, $f_2=56.969$ ksi

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.44648$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.342$ in	
$f_1=51.178$ ksi, $f_2=-17.467$ ksi	
$\psi=0.3413$	Eq. 1.1.2-1
$k=11.509$	Eq. 1.1.2-2
$\lambda=0.30621$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.40164$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width=1.0005 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=56.969$ ksi, $f_2=56.969$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.44648$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.342$ in	
$f_1=51.178$ ksi, $f_2=-17.467$ ksi	
$\psi=0.3413$	Eq. 1.1.2-1
$k=11.509$	Eq. 1.1.2-2
$\lambda=0.30621$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.40164$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width=1.0005 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_y=0.14518$ in ³ , $F_y=58.416$ ksi	
$M_n=8.4807$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.342$ in

$f_1=26.806$ ksi, $f_2=-42.674$ ksi

$\psi=1.592$

$k=44.011$

$\lambda=0.11332$

$\rho=1$

$b_e=1.342$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

$h_o=1.625$ in, $b_o=6$ in, $h_o/b_o=0.27083$	
$b_1=0.29225$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width= 0.51775 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=32.666$ ksi, $f_2=32.666$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.9885$	Eq. 1.1-3
$\rho=0.44725$	Eq. 1.1-2
$b=0.94304$ in (ineffective width= 1.1655 in)	Eq. 1.1-1
$f_1=32.666$ ksi, $f_2=32.666$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.9885$	Eq. 1.1-3
$\rho=0.44725$	Eq. 1.1-2
$b=0.94304$ in (ineffective width= 1.1655 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.342$ in	
$f_1=26.806$ ksi, $f_2=-42.674$ ksi	
$\psi=1.592$	Eq. 1.1.2-1
$k=44.011$	Eq. 1.1.2-2
$\lambda=0.11332$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=6$ in, $h_o/b_o=0.27083$	
$b_1=0.29225$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width= 0.51775 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.17668$ in	
$S_{ye}=0.13248$ in ³ , $F_y=50$ ksi	
$M_{nl}=6.624$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=1.2628$ in ⁶ , $W_n=3.7352$ in ² , $F_y=50$ ksi	
$B_n=16.905$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

600S200-30

Full Section Properties

Area	0.34209 in ²	Wt.	0.0011631 k/ft	Flat	10.964 in
Ix	1.8762 in ⁴	rx	2.3419 in	Ixy	0.0000 in ⁴
Sx(t)	0.62541 in ³	y(t)	3.0000 in	α	0.000 deg
Sx(b)	0.62541 in ³	y(b)	3.0000 in		
Zx	0.73138 in ³	Height	6.0000 in		
Iy	0.1898 in ⁴	ry	0.7449 in	x _o	-1.4580 in
Sy(l)	0.33093 in ³	x(l)	0.5735 in	y _o	0.0000 in
Sy(r)	0.13306 in ³	x(r)	1.4265 in	jx	3.1803 in
Zy	0.19120 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	1.8762 in ⁴	r ₁	2.3419 in	Cw	1.3998 in ⁶
I ₂	0.1898 in ⁴	r ₂	0.7449 in	J	0.0001110 in ⁴
Ic	2.0660 in ⁴	rc	2.4575 in		
I _o	2.7932 in ⁴	r _o	2.8575 in		

Net Section Properties

Ix	1.8675 in ⁴	rx	2.5148 in	Area	0.29529 in ²
Sx(t)	0.62249 in ³	y(t)	3.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.62249 in ³	y(b)	3.0000 in	α	0.000 deg
Zx	0.71383 in ³				
Iy	0.1729 in ⁴	ry	0.7652 in	x _o	-1.5506 in
Sy(l)	0.26122 in ³	x(l)	0.6620 in	y _o	0.0000 in
Sy(r)	0.12923 in ³	x(r)	1.3380 in	jx	2.8680 in
Zy	0.18895 in ³			jy	0.0000 in
Ic	2.0404 in ⁴	rc	2.6287 in	Cw	1.3926 in ⁶
I _o	2.7504 in ⁴	r _o	3.0519 in	J	0.0000958 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	5.951 k	φMnxo	18.546 k-in	φMnyo	5.147 k-in
Ae	0.14003 in ²	Ixe	1.4813 in ⁴	Iye	0.1575 in ⁴
φTn	14.395 k	Sxe(t)	0.41213 in ³	Sye(l)	0.25304 in ³
		Sxe(b)	0.61571 in ³	Sye(r)	0.11437 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.680 k	φMnxo	18.546 k-in	φMnyo	4.609 k-in
φVnx	2.609 k	Ixe	1.4813 in ⁴	Iye	0.1045 in ⁴
Torsion		Sxe(t)	0.61571 in ³	Sye(l)	0.10243 in ³
φBn	12.737 k-in ²	Sxe(b)	0.41213 in ³	Sye(r)	0.10668 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_y=51.004$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_y=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_y=52.65$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_y=50$ ksi

Max compression stress allowed for negative bending: $F_y=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_y=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_y=50$ ksi

Max compression stress allowed for negative bending: $F_y=50$ ksi

Axial Tension Strength

$A_g=0.34209 \text{ in}^2$, $F_y=51.004 \text{ ksi}$
 $T_n=17.448 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.29529 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=19.194 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1.4492 \text{ k at } 180 \text{ deg}$

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=3.5005 \text{ k}$

Eq. G3-2

$k_v=4.1154$

Eq. G3-8

$V_{crh}=0.36197 \text{ k}$

Eq. G3-6

$V_n=0.7551 \text{ k at } 90 \text{ deg}$

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4

$V_n=1.4492 \text{ k at } 0 \text{ deg}$

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.0916$

Eq. 1.1-3

$\rho=0.73148$

Eq. 1.1-2

$b=0.37723 \text{ in (ineffective width}=0.13847 \text{ in)}$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00020486 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00035659 \text{ in}^4 > I_a$ (no lip reduction)

$k=3.4958$

Table 1.3-1

Element 2: Partially stiffened, $w=1.7814 \text{ in}$

$f=50 \text{ ksi}$, $k=3.4958$

$\lambda=1.3224$

Eq. 1.1-3

$\rho=0.63039$

Eq. 1.1-2

$b=1.123 \text{ in (ineffective width}=0.65843 \text{ in)}$

Eq. 1.1-1

$b_1=0.56148 \text{ in}$, $b_2=0.56148 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=4.5311$

Eq. 1.1-3

$\rho=0.20998$

Eq. 1.1-2

$b=0.44951 \text{ in (ineffective width}=1.6912 \text{ in)}$

Eq. 1.1-1

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.5311$	Eq. 1.1-3
$\rho=0.20998$	Eq. 1.1-2
$b=0.44951$ in (ineffective width=1.6912 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723$ in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00020486$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.4958$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7814$ in	
$f=50$ ksi, $k=3.4958$	
$\lambda=1.3224$	Eq. 1.1-3
$\rho=0.63039$	Eq. 1.1-2
$b=1.123$ in (ineffective width=0.65843 in)	Eq. 1.1-1
$b_1=0.56148$ in, $b_2=0.56148$ in	
$A_e=0.14003$ in ² , $F_n=50$ ksi	
$P_n=7.0015$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.7814$ in	
$f_1=48.479$ ksi, $f_2=-31.954$ ksi	
$\psi=0.65913$	Eq. 1.1.2-1
$k=16.452$	Eq. 1.1.2-2
$\lambda=1.948$	Eq. 1.1-3
$\rho=0.45537$	Eq. 1.1-2
$b_e=2.6327$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2$ in, $h_o/b_o=3$	
$b_1=0.71948$ in	Eq. 1.1.2-3
$b_2=1.3163$ in	Eq. 1.1.2-4
Compression width=3.4846 in	
Ineffective width=1.4488 in	
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=48.479$ ksi, $f_2=41.305$ ksi	
$\psi=0.85201$	Eq. 1.2.2-1
$k=0.4849$	Eq. 1.2.2-2
$\lambda=1.0122$	Eq. 1.1-3
$\rho=0.77324$	Eq. 1.1-2
$b=0.39876$ in (ineffective width=0.11694 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.159$$

Eq. 1.3-7

$$I_a=0.00020442 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.4958$$

Table 1.3-1

Element 4: Partially stiffened, $w=1.7814 \text{ in}$

$$f=49.783 \text{ ksi}, k=3.4958$$

$$\lambda=1.3196$$

Eq. 1.1-3

$$\rho=0.63148$$

Eq. 1.1-2

$$b=1.1249 \text{ in (ineffective width}=0.65647 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.56246 \text{ in}, b_2=0.56246 \text{ in}$$

Center of gravity shift: $y=-0.59419 \text{ in}$

$$S_{xe}=0.41213 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=20.607 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157 \text{ in}$

$$f_1=48.479 \text{ ksi}, f_2=41.305 \text{ ksi}$$

$$\psi=0.85201$$

Eq. 1.2.2-1

$$k=0.4849$$

Eq. 1.2.2-2

$$\lambda=1.0122$$

Eq. 1.1-3

$$\rho=0.77324$$

Eq. 1.1-2

$$b=0.39876 \text{ in (ineffective width}=0.11694 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.159$$

Eq. 1.3-7

$$I_a=0.00020442 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.4958$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.7814 \text{ in}$

$$f=49.783 \text{ ksi}, k=3.4958$$

$$\lambda=1.3196$$

Eq. 1.1-3

$$\rho=0.63148$$

Eq. 1.1-2

$$b=1.1249 \text{ in (ineffective width}=0.65647 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.56246 \text{ in}, b_2=0.56246 \text{ in}$$

Element 3: Stiffened, $w=5.7814 \text{ in}$

$$f_1=48.479 \text{ ksi}, f_2=-31.954 \text{ ksi}$$

$$\psi=0.65912$$

Eq. 1.1.2-1

$$k=16.452$$

Eq. 1.1.2-2

$$\lambda=1.948$$

Eq. 1.1-3

$$\rho=0.45537$$

Eq. 1.1-2

$$b_e=2.6327 \text{ in}$$

Eq. 1.1-1

$$h_o=6 \text{ in}, b_o=2 \text{ in}, h_o/b_o=3$$

$$b_1=0.71948 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.3163 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.4846 \text{ in}$$

$$\text{Ineffective width}=1.4488 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.59419$ in

$S_{xe}=0.41213$ in³, $F_y=50$ ksi

$M_{nl}=20.607$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.434$ ksi, $f_2=49.434$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.0854$

Eq. 1.1-3

$\rho=0.7346$

Eq. 1.1-2

$b=0.37883$ in (ineffective width= 0.13687 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.7814$ in

$f_1=46.032$ ksi, $f_2=-18.632$ ksi

$\psi=0.40477$

Eq. 1.1.2-1

$k=12.354$

Eq. 1.1.2-2

$\lambda=0.67498$

Eq. 1.1-3

$\rho=0.99865$

Eq. 1.1-2

$b_e=1.779$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.5225$ in

Eq. 1.1.2-3

$b_2=0.88949$ in

Eq. 1.1.2-4

Compression width= 1.2681 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5157$ in

$f_1=49.434$ ksi, $f_2=49.434$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=1.0854$

Eq. 1.1-3

$\rho=0.7346$

Eq. 1.1-2

$b=0.37883$ in (ineffective width= 0.13687 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.7814$ in

$f_1=46.032$ ksi, $f_2=-18.632$ ksi

$\psi=0.40477$

Eq. 1.1.2-1

$k=12.354$

Eq. 1.1.2-2

$\lambda=0.67498$

Eq. 1.1-3

$\rho=0.99865$

Eq. 1.1-2

$b_e=1.779$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.5225$ in

Eq. 1.1.2-3

$b_2=0.88949$ in

Eq. 1.1.2-4

Compression width= 1.2681 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.039387$ in

$S_{ye}=0.11437$ in³, $F_y=50$ ksi

$M_{nl}=5.7186$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7814$ in

$$f_1=44.644 \text{ ksi}, f_2=-42.651 \text{ ksi}$$

$$\psi=0.95537$$

Eq. 1.1.2-1

$$k=22.863$$

Eq. 1.1.2-2

$$\lambda=0.48862$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.7814 \text{ in}$$

Eq. 1.1-1

$$h_o=2 \text{ in}, b_o=6 \text{ in}, h_o/b_o=0.33333$$

$$b_1=0.45038 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.8907 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.91103 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: Treat as two unstiffened elements

$$f_1=49.236 \text{ ksi}, f_2=49.236 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=4.4963$$

Eq. 1.1-3

$$\rho=0.21152$$

Eq. 1.1-2

$$b=0.45281 \text{ in (ineffective width}=1.6879 \text{ in)}$$

Eq. 1.1-1

$$f_1=49.236 \text{ ksi}, f_2=49.236 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=4.4963$$

Eq. 1.1-3

$$\rho=0.21152$$

Eq. 1.1-2

$$b=0.45281 \text{ in (ineffective width}=1.6879 \text{ in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.7814$ in

$$f_1=44.644 \text{ ksi}, f_2=-42.651 \text{ ksi}$$

$$\psi=0.95537$$

Eq. 1.1.2-1

$$k=22.863$$

Eq. 1.1.2-2

$$\lambda=0.48862$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.7814 \text{ in}$$

Eq. 1.1-1

$$h_o=2 \text{ in}, b_o=6 \text{ in}, h_o/b_o=0.33333$$

$$b_1=0.45038 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.8907 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.91103 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=0.35837$ in

$$S_{ye}=0.10243 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=5.1214 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Bimoment Strength, Stud

$$C_w=1.3926 \text{ in}^6, W_n=4.9204 \text{ in}^2, F_y=50 \text{ ksi}$$

$$B_n=14.152 \text{ k-in}^2$$

G8.1-1

III-438

$\Omega_b=1.67$, $\phi_b=0.9$

600S200-33

Full Section Properties

Area	0.37890 in ²	Wt.	0.0012882 k/ft	Flat	10.951 in
I _x	2.0752 in ⁴	r _x	2.3403 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.69173 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	0.69173 in ³	y(b)	3.0000 in		
Z _x	0.80946 in ³	Height	6.0000 in		
I _y	0.2094 in ⁴	r _y	0.7434 in	x _o	-1.4543 in
S _y (l)	0.36494 in ³	x(l)	0.5737 in	y _o	0.0000 in
S _y (r)	0.14680 in ³	x(r)	1.4263 in	j _x	3.1784 in
Z _y	0.21126 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	2.0752 in ⁴	r ₁	2.3403 in	C _w	1.5416 in ⁶
I ₂	0.2094 in ⁴	r ₂	0.7434 in	J	0.0001512 in ⁴
I _c	2.2846 in ⁴	r _c	2.4555 in		
I _o	3.0860 in ⁴	r _o	2.8539 in		

Net Section Properties

I _x	2.0655 in ⁴	r _x	2.5133 in	Area	0.32700 in ²
S _x (t)	0.68849 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.68849 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	0.79000 in ³				
I _y	0.1908 in ⁴	r _y	0.7638 in	x _o	-1.5469 in
S _y (l)	0.28812 in ³	x(l)	0.6621 in	y _o	0.0000 in
S _y (r)	0.14257 in ³	x(r)	1.3379 in	j _x	2.8657 in
Z _y	0.20876 in ³			j _y	0.0000 in
I _c	2.2562 in ⁴	r _c	2.6268 in	C _w	1.5337 in ⁶
I _o	3.0387 in ⁴	r _o	3.0484 in	J	0.0001305 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	7.099 k	φM _{nxo}	22.528 k-in	φM _{nyo}	5.845 k-in
A _e	0.16703 in ²	I _{xe}	1.7289 in ⁴	I _{ye}	0.1777 in ⁴
φT _n	15.941 k	S _{xe} (t)	0.50062 in ³	S _{ye} (l)	0.28125 in ³
		S _{xe} (b)	0.67891 in ³	S _{ye} (r)	0.12988 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.854 k	φM _{nxo}	22.528 k-in	φM _{nyo}	5.310 k-in
φV _{nx}	3.083 k	I _{xe}	1.7289 in ⁴	I _{ye}	0.1185 in ⁴
Torsion		S _{xe} (t)	0.67891 in ³	S _{ye} (l)	0.11800 in ³
φB _n	14.066 k-in ²	S _{xe} (b)	0.50062 in ³	S _{ye} (r)	0.11908 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=51.09$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.88$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.3789 \text{ in}^2$, $F_y=51.09 \text{ ksi}$
 $T_n=19.358 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.327 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=21.255 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1.7129 \text{ k}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3

$V_{yh}=3.8779 \text{ k}$
 $k_v=4.1149$
 $V_{crh}=0.49375 \text{ k}$
 $V_n=0.94924 \text{ k}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2
Eq. G3-8
Eq. G3-6
Eq. G2.1-2

Stud element 4

$V_n=1.7129 \text{ k}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=0.98104$
 $\rho=0.79074$
 $b=0.40644 \text{ in}$ (ineffective width= 0.10756 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$
 $I_a=0.00027958 \text{ in}^4$
 $I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)
 $k=3.4924$

Eq. 1.3-7
Eq. 1.3-8
Table 1.3-1

Element 2: Partially stiffened, $w=1.778 \text{ in}$

$f=50 \text{ ksi}$, $k=3.4924$
 $\lambda=1.1908$
 $\rho=0.68464$
 $b=1.2173 \text{ in}$ (ineffective width= 0.56072 in)
 $b_1=0.60864 \text{ in}$, $b_2=0.60864 \text{ in}$

Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=4.0826$
 $\rho=0.23174$
 $b=0.4957 \text{ in}$ (ineffective width= 1.6433 in)
 $f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.0826$	Eq. 1.1-3
$\rho=0.23174$	Eq. 1.1-2
$b=0.4957$ in (ineffective width=1.6433 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00027958$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.4924$	Table 1.3-1
Element 4: Partially stiffened, $w=1.778$ in	
$f=50$ ksi, $k=3.4924$	
$\lambda=1.1908$	Eq. 1.1-3
$\rho=0.68464$	Eq. 1.1-2
$b=1.2173$ in (ineffective width=0.56072 in)	Eq. 1.1-1
$b_1=0.60864$ in, $b_2=0.60864$ in	
$A_e=0.16703$ in ² , $F_n=50$ ksi	
$P_n=8.3517$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.778$ in	
$f_1=48.392$ ksi, $f_2=-35.285$ ksi	
$\psi=0.72915$	Eq. 1.1.2-1
$k=17.798$	Eq. 1.1.2-2
$\lambda=1.6864$	Eq. 1.1-3
$\rho=0.51563$	Eq. 1.1-2
$b_e=2.9793$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2$ in, $h_o/b_o=3$	
$b_1=0.79893$ in	Eq. 1.1.2-3
$b_2=1.4897$ in	Eq. 1.1.2-4
Compression width=3.3415 in	
Ineffective width=1.0529 in	
Element 5: Unstiffened, $w=0.514$ in	
$f_1=48.392$ ksi, $f_2=40.949$ ksi	
$\psi=0.84618$	Eq. 1.2.2-1
$k=0.48728$	Eq. 1.2.2-2
$\lambda=0.90665$	Eq. 1.1-3
$\rho=0.83533$	Eq. 1.1-2
$b=0.42936$ in (ineffective width=0.084641 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.169$$

Eq. 1.3-7

$$I_a=0.00027889 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.4924$$

Table 1.3-1

Element 4: Partially stiffened, $w=1.778$ in

$$f=49.749 \text{ ksi}, k=3.4924$$

$$\lambda=1.1878$$

Eq. 1.1-3

$$\rho=0.68597$$

Eq. 1.1-2

$$b=1.2196 \text{ in (ineffective width}=0.55835 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.60982 \text{ in}, b_2=0.60982 \text{ in}$$

Center of gravity shift: $y=-0.45345$ in

$$S_{xe}=0.50062 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=25.031 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$$f_1=48.392 \text{ ksi}, f_2=40.949 \text{ ksi}$$

$$\psi=0.84618$$

Eq. 1.2.2-1

$$k=0.48728$$

Eq. 1.2.2-2

$$\lambda=0.90665$$

Eq. 1.1-3

$$\rho=0.83533$$

Eq. 1.1-2

$$b=0.42936 \text{ in (ineffective width}=0.084641 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.169$$

Eq. 1.3-7

$$I_a=0.00027889 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.4924$$

Table 1.3-1

Element 2: Partially stiffened, $w=1.778$ in

$$f=49.749 \text{ ksi}, k=3.4924$$

$$\lambda=1.1878$$

Eq. 1.1-3

$$\rho=0.68597$$

Eq. 1.1-2

$$b=1.2196 \text{ in (ineffective width}=0.55835 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.60982 \text{ in}, b_2=0.60982 \text{ in}$$

Element 3: Stiffened, $w=5.778$ in

$$f_1=48.392 \text{ ksi}, f_2=-35.285 \text{ ksi}$$

$$\psi=0.72915$$

Eq. 1.1.2-1

$$k=17.798$$

Eq. 1.1.2-2

$$\lambda=1.6864$$

Eq. 1.1-3

$$\rho=0.51563$$

Eq. 1.1-2

$$b_e=2.9793 \text{ in}$$

Eq. 1.1-1

$$h_o=6 \text{ in}, b_o=2 \text{ in}, h_o/b_o=3$$

$$b_1=0.79893 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.4897 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.3415 \text{ in}$$

$$\text{Ineffective width}=1.0529 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.45345$ in
 $S_{xe}=0.50062$ in³, $F_y=50$ ksi
 $M_{nl}=25.031$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.368$ ksi, $f_2=49.368$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.97482$

Eq. 1.1-3

$\rho=0.79432$

Eq. 1.1-2

$b=0.40828$ in (ineffective width= 0.10572 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.778$ in

$f_1=45.943$ ksi, $f_2=-19.035$ ksi

$\psi=0.41431$

Eq. 1.1.2-1

$k=12.487$

Eq. 1.1.2-2

$\lambda=0.60366$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.778$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.52075$ in

Eq. 1.1.2-3

$b_2=0.889$ in

Eq. 1.1.2-4

Compression width= 1.2572 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.514$ in

$f_1=49.368$ ksi, $f_2=49.368$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=0.97482$

Eq. 1.1-3

$\rho=0.79432$

Eq. 1.1-2

$b=0.40828$ in (ineffective width= 0.10572 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.778$ in

$f_1=45.943$ ksi, $f_2=-19.035$ ksi

$\psi=0.41431$

Eq. 1.1.2-1

$k=12.487$

Eq. 1.1.2-2

$\lambda=0.60366$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.778$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.52075$ in

Eq. 1.1.2-3

$b_2=0.889$ in

Eq. 1.1.2-4

Compression width= 1.2571 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.030223$ in

$S_{ye}=0.12988$ in³, $F_y=50$ ksi

$M_{nl}=6.4942$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.778$ in

$$f_1=44.475 \text{ ksi}, f_2=-44.024 \text{ ksi}$$

$$\psi=0.98986$$

Eq. 1.1.2-1

$$k=23.738$$

Eq. 1.1.2-2

$$\lambda=0.43077$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.778 \text{ in}$$

Eq. 1.1-1

$$h_o=2 \text{ in}, b_o=6 \text{ in}, h_o/b_o=0.33333$$

$$b_1=0.44563 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.889 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.89353 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: Treat as two unstiffened elements

$$f_1=49.139 \text{ ksi}, f_2=49.139 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=4.0473$$

Eq. 1.1-3

$$\rho=0.23365$$

Eq. 1.1-2

$$b=0.49977 \text{ in (ineffective width)=1.6392 in)}$$

Eq. 1.1-1

$$f_1=49.139 \text{ ksi}, f_2=49.139 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=4.0473$$

Eq. 1.1-3

$$\rho=0.23365$$

Eq. 1.1-2

$$b=0.49977 \text{ in (ineffective width)=1.6392 in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.778$ in

$$f_1=44.475 \text{ ksi}, f_2=-44.024 \text{ ksi}$$

$$\psi=0.98986$$

Eq. 1.1.2-1

$$k=23.738$$

Eq. 1.1.2-2

$$\lambda=0.43077$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.778 \text{ in}$$

Eq. 1.1-1

$$h_o=2 \text{ in}, b_o=6 \text{ in}, h_o/b_o=0.33333$$

$$b_1=0.44563 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.889 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.89353 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=0.34247$ in

$$S_{ye}=0.118 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=5.9002 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Bimoment Strength, Stud

$$C_w=1.5337 \text{ in}^6, W_n=4.9065 \text{ in}^2, F_y=50 \text{ ksi}$$

$$B_n=15.629 \text{ k-in}^2$$

G8.1-1

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$\Omega_b=1.67$, $\phi_b=0.9$

600S200-43

Full Section Properties

Area	0.49198 in ²	Wt.	0.0016727 k/ft	Flat	10.909 in
Ix	2.6829 in ⁴	rx	2.3352 in	Ixy	0.0000 in ⁴
Sx(t)	0.8943 in ³	y(t)	3.0000 in	α	0.000 deg
Sx(b)	0.8943 in ³	y(b)	3.0000 in		
Zx	1.0486 in ³	Height	6.0000 in		
Iy	0.2685 in ⁴	ry	0.7388 in	x _o	-1.4431 in
Sy(l)	0.4675 in ³	x(l)	0.5744 in	y _o	0.0000 in
Sy(r)	0.1883 in ³	x(r)	1.4256 in	jx	3.1726 in
Zy	0.2723 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	2.6829 in ⁴	r ₁	2.3352 in	Cw	1.9665 in ⁶
I ₂	0.2685 in ⁴	r ₂	0.7388 in	J	0.0003336 in ⁴
Ic	2.9514 in ⁴	rc	2.4493 in		
I _o	3.9760 in ⁴	r _o	2.8428 in		

Net Section Properties

Ix	2.6702 in ⁴	rx	2.5085 in	Area	0.42433 in ²
Sx(t)	0.8901 in ³	y(t)	3.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.8901 in ³	y(b)	3.0000 in	α	0.000 deg
Zx	1.0232 in ³				
Iy	0.2446 in ⁴	ry	0.7592 in	x _o	-1.5353 in
Sy(l)	0.3693 in ³	x(l)	0.6624 in	y _o	0.0000 in
Sy(r)	0.1829 in ³	x(r)	1.3376 in	jx	2.8587 in
Zy	0.2690 in ³			jy	0.0000 in
Ic	2.9148 in ⁴	rc	2.6209 in	Cw	1.9564 in ⁶
I _o	3.9150 in ⁴	r _o	3.0375 in	J	0.0002877 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	10.555 k	φM _n x _o	35.966 k-in	φM _n y _o	8.054 k-in
A _e	0.24836 in ²	I _x e	2.5059 in ⁴	I _y e	0.2407 in ⁴
φT _n	20.686 k	S _x e(t)	0.79925 in ³	S _y e(l)	0.36726 in ³
		S _x e(b)	0.87475 in ³	S _y e(r)	0.17898 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.525 k	φM _n x _o	35.966 k-in	φM _n y _o	7.132 k-in
φV _{nx}	4.304 k	I _x e	2.5059 in ⁴	I _y e	0.1663 in ⁴
Torsion		S _x e(t)	0.87475 in ³	S _y e(l)	0.17488 in ³
φB _n	18.1 k-in ²	S _x e(b)	0.79925 in ³	S _y e(r)	0.15848 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.333$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=53.526$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.49198 \text{ in}^2$, $F_y=51.333 \text{ ksi}$
 $T_n=25.255 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.42433 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=27.581 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=2.3913 \text{ k}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-1

Stud element 3

$V_{yh}=5.0382 \text{ k}$
 $k_v=4.1136$
 $V_{crh}=1.0941 \text{ k}$
 $V_n=1.6941 \text{ k}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2
Eq. G3-8
Eq. G3-6
Eq. G2.1-2

Stud element 4

$V_n=2.3913 \text{ k}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-1

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=0.74488$
 $\rho=0.94599$
 $b=0.48123 \text{ in}$ (ineffective width= 0.027474 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$
 $I_a=0.00062038 \text{ in}^4$
 $I_s=0.00049474 \text{ in}^4$
 $d_s=0.38377 \text{ in}$ (lip ineffective width= 0.097452 in)
 $k=3.2601$

Eq. 1.3-7
Eq. 1.3-8
Eq. 1.3-6
Table 1.3-1

Element 2: Partially stiffened, $w=1.7674 \text{ in}$

$f=50 \text{ ksi}$, $k=3.2601$
 $\lambda=0.93989$
 $\rho=0.81492$
 $b=1.4403 \text{ in}$ (ineffective width= 0.32712 in)
 $b_1=0.57431 \text{ in}$, $b_2=0.86598 \text{ in}$

Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=3.1243$
 $\rho=0.29753$
 $b=0.63484 \text{ in}$ (ineffective width= 1.4989 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=3.1243$

Eq. 1.1-3

$\rho=0.29753$

Eq. 1.1-2

$b=0.63484$ in (ineffective width= 1.4989 in)

Eq. 1.1-1

Element 5: Unstiffened, $w=0.5087$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.74488$

Eq. 1.1-3

$\rho=0.94599$

Eq. 1.1-2

$b=0.48123$ in (ineffective width= 0.027474 in)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00062038$ in⁴

Eq. 1.3-8

$I_s=0.00049474$ in⁴

$ds=0.38377$ in (lip ineffective width= 0.097452 in)

Eq. 1.3-6

$k=3.2601$

Table 1.3-1

Element 4: Partially stiffened, $w=1.7674$ in

$f=50$ ksi, $k=3.2601$

$\lambda=0.93989$

Eq. 1.1-3

$\rho=0.81492$

Eq. 1.1-2

$b=1.4403$ in (ineffective width= 0.32712 in)

Eq. 1.1-1

$b_1=0.57431$ in, $b_2=0.86598$ in

$A_e=0.24836$ in², $F_n=50$ ksi

$P_n=12.418$ k

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=5.7674$ in

$f_1=48.145$ ksi, $f_2=-43.84$ ksi

$\psi=0.91058$

Eq. 1.1.2-1

$k=21.77$

Eq. 1.1.2-2

$\lambda=1.1647$

Eq. 1.1-3

$\rho=0.69642$

Eq. 1.1-2

$b_e=4.0165$ in

Eq. 1.1-1

$h_o=6$ in, $b_o=2$ in, $h_o/b_o=3$

$b_1=1.0271$ in

Eq. 1.1.2-3

$b_2=2.0083$ in

Eq. 1.1.2-4

Compression width= 3.0187 in

$b_1+b_2 >$ compression width (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=48.145$ ksi, $f_2=40.032$ ksi

$\psi=0.83148$

Eq. 1.2.2-1

$k=0.49339$

Eq. 1.2.2-2

$\lambda=0.68236$

Eq. 1.1-3

$\rho=0.99301$	Eq. 1.1-2
$b=0.50514$ in (ineffective width= 0.0035576 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.204$	Eq. 1.3-7
$I_a=0.00061821$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$ds=0.40425$ in (lip ineffective width= 0.10089 in)	Eq. 1.3-6
$k=3.2634$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7674$ in	
$f=49.64$ ksi, $k=3.2634$	
$\lambda=0.93603$	Eq. 1.1-3
$\rho=0.81724$	Eq. 1.1-2
$b=1.4444$ in (ineffective width= 0.323 in)	Eq. 1.1-1
$b_1=0.57796$ in, $b_2=0.86644$ in	
Center of gravity shift: $y=-0.13531$ in	
$S_{xe}=0.79925$ in ³ , $F_y=50$ ksi	
$M_n I=39.962$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087$ in	
$f_1=48.145$ ksi, $f_2=40.032$ ksi	
$\psi=0.83148$	Eq. 1.2.2-1
$k=0.49339$	Eq. 1.2.2-2
$\lambda=0.68236$	Eq. 1.1-3
$\rho=0.99301$	Eq. 1.1-2
$b=0.50514$ in (ineffective width= 0.0035576 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.204$	Eq. 1.3-7
$I_a=0.00061821$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$ds=0.40425$ in (lip ineffective width= 0.10089 in)	Eq. 1.3-6
$k=3.2634$	Table 1.3-1
Element 2: Partially stiffened, $w=1.7674$ in	
$f=49.64$ ksi, $k=3.2634$	
$\lambda=0.93603$	Eq. 1.1-3
$\rho=0.81724$	Eq. 1.1-2
$b=1.4444$ in (ineffective width= 0.323 in)	Eq. 1.1-1
$b_1=0.57796$ in, $b_2=0.86644$ in	
Element 3: Stiffened, $w=5.7674$ in	
$f_1=48.145$ ksi, $f_2=-43.84$ ksi	
$\psi=0.91058$	Eq. 1.1.2-1
$k=21.77$	Eq. 1.1.2-2
$\lambda=1.1647$	Eq. 1.1-3
$\rho=0.69642$	Eq. 1.1-2
$b_e=4.0165$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2$ in, $h_o/b_o=3$	
$b_1=1.0271$ in	Eq. 1.1.2-3
$b_2=2.0083$ in	Eq. 1.1.2-4

Compression width=3.0187 in

$b_1 + b_2 >$ compression width (fully effective)

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.13531$ in

$S_{xe}=0.79925$ in³, $F_y=50$ ksi

$M_{nl}=39.962$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087$ in

$f_1=49.162$ ksi, $f_2=49.162$ ksi

$\psi=1$

$k=0.43$

$\lambda=0.73861$

$\rho=0.95063$

$b=0.48359$ in (ineffective width=0.025115 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Stiffened, $w=1.7674$ in

$f_1=45.676$ ksi, $f_2=-20.042$ ksi

$\psi=0.43879$

$k=12.835$

$\lambda=0.45275$

$\rho=1$

$b_e=1.7674$ in

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.51396$ in

$b_2=0.8837$ in

Compression width=1.2284 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=49.161$ ksi, $f_2=49.161$ ksi

$\psi=1$

$k=0.43$

$\lambda=0.73861$

$\rho=0.95063$

$b=0.48359$ in (ineffective width=0.025115 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 4: Stiffened, $w=1.7674$ in

$f_1=45.676$ ksi, $f_2=-20.042$ ksi

$\psi=0.43879$

$k=12.835$

$\lambda=0.45275$

$\rho=1$

$b_e=1.7674$ in

$h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$

$b_1=0.51396$ in

$b_2=0.8837$ in

Compression width=1.2284 in

$b_1 + b_2 >$ compression width (fully effective)

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Center of gravity shift: $x = -0.0070585$ in
 $S_y = 0.17898$ in³, $F_y = 50$ ksi
 $M_n I = 8.9488$ k-in
 $\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.7674$ in

$f_1 = 39.745$ ksi, $f_2 = -44.459$ ksi

$\psi = 1.1186$

Eq. 1.1.2-1

$k = 27.256$

Eq. 1.1.2-2

$\lambda = 0.28982$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 1.7674$ in

Eq. 1.1-1

$h_o = 2$ in, $b_o = 6$ in, $h_o/b_o = 0.33333$

$b_1 = 0.42913$ in

Eq. 1.1.2-3

$b_2 = 0.8837$ in

Eq. 1.1.2-4

Compression width = 0.83423 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 44.212$ ksi, $f_2 = 44.212$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 2.9379$

Eq. 1.1-3

$\rho = 0.31489$

Eq. 1.1-2

$b = 0.67187$ in (ineffective width = 1.4618 in)

Eq. 1.1-1

$f_1 = 44.212$ ksi, $f_2 = 44.212$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 2.9379$

Eq. 1.1-3

$\rho = 0.31489$

Eq. 1.1-2

$b = 0.67187$ in (ineffective width = 1.4618 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.7674$ in

$f_1 = 39.745$ ksi, $f_2 = -44.459$ ksi

$\psi = 1.1186$

Eq. 1.1.2-1

$k = 27.256$

Eq. 1.1.2-2

$\lambda = 0.28982$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 1.7674$ in

Eq. 1.1-1

$h_o = 2$ in, $b_o = 6$ in, $h_o/b_o = 0.33333$

$b_1 = 0.42913$ in

Eq. 1.1.2-3

$b_2 = 0.8837$ in

Eq. 1.1.2-4

Compression width = 0.83423 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.28845$ in

$S_y = 0.15848$ in³, $F_y = 50$ ksi

$M_n I = 7.9239$ k-in

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Bimoment Strength, Stud

$C_w=1.9564 \text{ in}^6$, $W_n=4.864 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=20.111 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

600S200-54

Full Section Properties

Area	0.61294 in ²	Wt.	0.0020840 k/ft	Flat	10.829 in
I _x	3.3198 in ⁴	r _x	2.3273 in	I _{xy}	0.0000 in ⁴
S _x (t)	1.1066 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	1.1066 in ³	y(b)	3.0000 in		
Z _x	1.3013 in ³	Height	6.0000 in		
I _y	0.3287 in ⁴	r _y	0.7324 in	x _o	-1.4287 in
S _y (l)	0.5729 in ³	x(l)	0.5738 in	y _o	0.0000 in
S _y (r)	0.2305 in ³	x(r)	1.4262 in	j _x	3.1697 in
Z _y	0.3356 in ³	Width	2.0000 in	j _y	0.0000 in
I ₁	3.3198 in ⁴	r ₁	2.3273 in	C _w	2.3915 in ⁶
I ₂	0.3287 in ⁴	r ₂	0.7324 in	J	0.0006545 in ⁴
I _c	3.6485 in ⁴	r _c	2.4398 in		
I _o	4.8996 in ⁴	r _o	2.8273 in		

Net Section Properties

I _x	3.3039 in ⁴	r _x	2.5014 in	Area	0.52804 in ²
S _x (t)	1.1013 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	1.1013 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	1.2695 in ³				
I _y	0.2994 in ⁴	r _y	0.7530 in	x _o	-1.5206 in
S _y (l)	0.4526 in ³	x(l)	0.6615 in	y _o	0.0000 in
S _y (r)	0.2237 in ³	x(r)	1.3385 in	j _x	2.8538 in
Z _y	0.3313 in ³			j _y	0.0000 in
I _c	3.6033 in ⁴	r _c	2.6123 in	C _w	2.3791 in ⁶
I _o	4.8243 in ⁴	r _o	3.0226 in	J	0.0005639 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	14.128 k	φM _{nxo}	45.335 k-in	φM _{nyo}	11.439 k-in
A _e	0.33242 in ²	I _{xe}	3.1391 in ⁴	I _{ye}	0.2994 in ⁴
φT _n	25.742 k	S _{xe} (t)	1.0074 in ³	S _{ye} (l)	0.4526 in ³
		S _{xe} (b)	1.0885 in ³	S _{ye} (r)	0.2237 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2.467 k	φM _{nxo}	45.335 k-in	φM _{nyo}	9.045 k-in
φV _{nx}	5.248 k	I _{xe}	3.1391 in ⁴	I _{ye}	0.2234 in ⁴
Torsion		S _{xe} (t)	1.0885 in ³	S _{ye} (l)	0.2513 in ³
φB _n	22.229 k-in ²	S _{xe} (b)	1.0074 in ³	S _{ye} (r)	0.2010 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.667$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=54.356$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.61294$ in², $F_y=51.667$ ksi

$T_n=31.669$ k
 $\Omega_t=1.67$, $\phi_t=0.9$ Eq. D2-1

$A_n=0.52804$ in², $F_u=65$ ksi
 $T_n=34.322$ k
 $\Omega_t=2$, $\phi_t=0.75$ Eq. D3-1

Shear Strength

Stud element 2
 $V_n=2.9155$ k at 180 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=6.2242$ k Eq. G3-2
 $k_v=4.107$ Eq. G3-8
 $V_{crh}=2.168$ k Eq. G3-6
 $V_n=2.741$ k at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=2.9155$ k at 0 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56413$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0011127$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $d_s=0.23166$ in (lip ineffective width=0.25184 in) Eq. 1.3-6
 $k=2.7693$ Table 1.3-1

Element 2: Partially stiffened, $w=1.717$ in
 $f=50$ ksi, $k=2.7693$
 $\lambda=0.78941$ Eq. 1.1-3
 $\rho=0.91373$ Eq. 1.1-2
 $b=1.5689$ in (ineffective width=0.14812 in) Eq. 1.1-1
 $b_1=0.37585$ in, $b_2=1.193$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=2.4601$ Eq. 1.1-3
 $\rho=0.37013$ Eq. 1.1-2
 $b=0.78042$ in (ineffective width=1.3281 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=2.4601$	Eq. 1.1-3
$\rho=0.37013$	Eq. 1.1-2
$b=0.78042$ in (ineffective width=1.3281 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0011127$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.23166$ in (lip ineffective width=0.25184 in)	Eq. 1.3-6
$k=2.7693$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	
$f=50$ ksi, $k=2.7693$	
$\lambda=0.78941$	Eq. 1.1-3
$\rho=0.91373$	Eq. 1.1-2
$b=1.5689$ in (ineffective width=0.14812 in)	Eq. 1.1-1
$b_1=0.37585$ in, $b_2=1.193$ in	
$A_e=0.33242$ in ² , $F_n=50$ ksi	
$P_n=16.621$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.717$ in	
$f_1=47.729$ ksi, $f_2=-44.012$ ksi	
$\psi=0.92213$	Eq. 1.1.2-1
$k=22.047$	Eq. 1.1.2-2
$\lambda=0.91016$	Eq. 1.1-3
$\rho=0.83313$	Eq. 1.1-2
$b_e=4.763$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2$ in, $h_o/b_o=3$	
$b_1=1.2144$ in	Eq. 1.1.2-3
$b_2=2.3815$ in	Eq. 1.1.2-4
Compression width=2.9743 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=47.729$ ksi, $f_2=39.971$ ksi	
$\psi=0.83744$	Eq. 1.2.2-1
$k=0.49089$	Eq. 1.2.2-2
$\lambda=0.51586$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.233$	Eq. 1.3-7

$I_a=0.0010899 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00053312 \text{ in}^4$	
$ds=0.23649 \text{ in}$ (lip ineffective width=0.24701 in)	Eq. 1.3-6
$k=2.7838$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717 \text{ in}$	
$f=49.546 \text{ ksi}$, $k=2.7838$	
$\lambda=0.78377$	Eq. 1.1-3
$\rho=0.91775$	Eq. 1.1-2
$b=1.5758 \text{ in}$ (ineffective width=0.14122 in)	Eq. 1.1-1
$b_1=0.38538 \text{ in}$, $b_2=1.1904 \text{ in}$	
Center of gravity shift: $y=-0.11596 \text{ in}$	
$S_{xe}=1.0074 \text{ in}^3$, $F_y=50 \text{ ksi}$	
$M_{nl}=50.372 \text{ k-in}$	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.4835 \text{ in}$	
$f_1=47.729 \text{ ksi}$, $f_2=39.97 \text{ ksi}$	
$\psi=0.83744$	Eq. 1.2.2-1
$k=0.49089$	Eq. 1.2.2-2
$\lambda=0.51586$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.233$	Eq. 1.3-7
$I_a=0.0010899 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00053312 \text{ in}^4$	
$ds=0.23649 \text{ in}$ (lip ineffective width=0.24701 in)	Eq. 1.3-6
$k=2.7838$	Table 1.3-1
Element 2: Partially stiffened, $w=1.717 \text{ in}$	
$f=49.546 \text{ ksi}$, $k=2.7838$	
$\lambda=0.78377$	Eq. 1.1-3
$\rho=0.91775$	Eq. 1.1-2
$b=1.5758 \text{ in}$ (ineffective width=0.14122 in)	Eq. 1.1-1
$b_1=0.38538 \text{ in}$, $b_2=1.1904 \text{ in}$	
Element 3: Stiffened, $w=5.717 \text{ in}$	
$f_1=47.729 \text{ ksi}$, $f_2=-44.012 \text{ ksi}$	
$\psi=0.92213$	Eq. 1.1.2-1
$k=22.047$	Eq. 1.1.2-2
$\lambda=0.91016$	Eq. 1.1-3
$\rho=0.83313$	Eq. 1.1-2
$b_e=4.763 \text{ in}$	Eq. 1.1-1
$h_o=6 \text{ in}$, $b_o=2 \text{ in}$, $h_o/b_o=3$	
$b_1=1.2144 \text{ in}$	Eq. 1.1.2-3
$b_2=2.3815 \text{ in}$	Eq. 1.1.2-4
Compression width=2.9743 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=0.11596 \text{ in}$	

$$S_{xe}=1.0074 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_n I=50.372 \text{ k-in}$$

$$\Omega_b=1.67, \phi_b=0.9$$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$

$$f_1=55.624 \text{ ksi}, f_2=55.624 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.59501$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Stiffened, $w=1.717 \text{ in}$

$$f_1=50.818 \text{ ksi}, f_2=-22.076 \text{ ksi}$$

$$\psi=0.43441$$

Eq. 1.1.2-1

$$k=12.772$$

Eq. 1.1.2-2

$$\lambda=0.37059$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.717 \text{ in}$$

Eq. 1.1-1

$$h_o=2 \text{ in}, b_o=0.625 \text{ in}, h_o/b_o=3.2$$

$$b_1=0.49994 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.8585 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.197 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.4835 \text{ in}$

$$f_1=55.624 \text{ ksi}, f_2=55.624 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.59501$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 4: Stiffened, $w=1.717 \text{ in}$

$$f_1=50.818 \text{ ksi}, f_2=-22.076 \text{ ksi}$$

$$\psi=0.43441$$

Eq. 1.1.2-1

$$k=12.772$$

Eq. 1.1.2-2

$$\lambda=0.37059$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.717 \text{ in}$$

Eq. 1.1-1

$$h_o=2 \text{ in}, b_o=0.625 \text{ in}, h_o/b_o=3.2$$

$$b_1=0.49994 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.8585 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.197 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=0 \text{ in}$

$$S_{ye}=0.22368 \text{ in}^3, F_y=56.825 \text{ ksi}$$

$$M_n I=12.711 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.717$ in

$f_1=33.505$ ksi, $f_2=-43.642$ ksi

$\psi=1.3026$

Eq. 1.1.2-1

$k=33.021$

Eq. 1.1.2-2

$\lambda=0.18714$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.717$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=6$ in, $h_o/b_o=0.33333$

$b_1=0.39906$ in

Eq. 1.1.2-3

$b_2=0.8585$ in

Eq. 1.1.2-4

Compression width= 0.74569 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=38.591$ ksi, $f_2=38.591$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.1613$

Eq. 1.1-3

$\rho=0.41559$

Eq. 1.1-2

$b=0.87627$ in (ineffective width= 1.2322 in)

Eq. 1.1-1

$f_1=38.591$ ksi, $f_2=38.591$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.1613$

Eq. 1.1-3

$\rho=0.41559$

Eq. 1.1-2

$b=0.87627$ in (ineffective width= 1.2322 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.717$ in

$f_1=33.505$ ksi, $f_2=-43.642$ ksi

$\psi=1.3026$

Eq. 1.1.2-1

$k=33.021$

Eq. 1.1.2-2

$\lambda=0.18714$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.717$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=6$ in, $h_o/b_o=0.33333$

$b_1=0.39906$ in

Eq. 1.1.2-3

$b_2=0.8585$ in

Eq. 1.1.2-4

Compression width= 0.74569 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.22732$ in

$S_y=0.201$ in³, $F_y=50$ ksi

$M_{nl}=10.05$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=2.3791$ in⁶, $W_n=4.8162$ in², $F_y=50$ ksi

$B_n=24.699$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

600S250-30

Full Section Properties

Area	0.37329 in ²	Wt.	0.0012692 k/ft	Flat	11.964 in
I _x	2.1541 in ⁴	r _x	2.4022 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.71804 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	0.71804 in ³	y(b)	3.0000 in		
Z _x	0.82450 in ³	Height	6.0000 in		
I _y	0.3225 in ⁴	r _y	0.9295 in	x _o	-1.8866 in
S _y (l)	0.42439 in ³	x(l)	0.7599 in	y _o	0.0000 in
S _y (r)	0.18534 in ³	x(r)	1.7401 in	j _x	3.3611 in
Z _y	0.27764 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	2.1541 in ⁴	r ₁	2.4022 in	C _w	2.3461 in ⁶
I ₂	0.3225 in ⁴	r ₂	0.9295 in	J	0.0001211 in ⁴
I _c	2.4766 in ⁴	r _c	2.5758 in		
I _o	3.8053 in ⁴	r _o	3.1928 in		

Net Section Properties

I _x	2.1454 in ⁴	r _x	2.5634 in	Area	0.32649 in ²
S _x (t)	0.71512 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	0.71512 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	0.80695 in ³				
I _y	0.2929 in ⁴	r _y	0.9471 in	x _o	-1.9980 in
S _y (l)	0.33793 in ³	x(l)	0.8666 in	y _o	0.0000 in
S _y (r)	0.17929 in ³	x(r)	1.6334 in	j _x	3.1143 in
Z _y	0.26667 in ³			j _y	0.0000 in
I _c	2.4382 in ⁴	r _c	2.7328 in	C _w	2.3346 in ⁶
I _o	3.7416 in ⁴	r _o	3.3853 in	J	0.0001059 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	6.222 k	φM _{nxo}	19.521 k-in	φM _{nyo}	7.241 k-in
A _e	0.14640 in ²	I _{xe}	1.6062 in ⁴	I _{ye}	0.2699 in ⁴
φT _n	15.916 k	S _{xe} (t)	0.43380 in ³	S _{ye} (l)	0.32786 in ³
		S _{xe} (b)	0.69920 in ³	S _{ye} (r)	0.16092 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.685 k	φM _{nxo}	19.521 k-in	φM _{nyo}	6.373 k-in
φV _{nx}	2.734 k	I _{xe}	1.6062 in ⁴	I _{ye}	0.1802 in ⁴
Torsion		S _{xe} (t)	0.69920 in ³	S _{ye} (l)	0.14163 in ³
φB _n	17.108 k-in ²	S _{xe} (b)	0.43380 in ³	S _{ye} (r)	0.14674 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=50.92$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.136$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$$\begin{aligned} A_g &= 0.37329 \text{ in}^2, F_y = 50.92 \text{ ksi} \\ T_n &= 19.008 \text{ k} \\ \Omega_t &= 1.67, \phi_t = 0.9 \end{aligned} \quad \text{Eq. D2-1}$$

$$\begin{aligned} A_n &= 0.32649 \text{ in}^2, F_u = 65 \text{ ksi} \\ T_n &= 21.222 \text{ k} \\ \Omega_t &= 2, \phi_t = 0.75 \end{aligned} \quad \text{Eq. D3-1}$$

Shear Strength

$$\begin{aligned} \text{Stud element 2} \\ V_n &= 1.519 \text{ k at } 180 \text{ deg} \end{aligned} \quad \text{Eq. G2.1-2}$$

$$\begin{aligned} \Omega_v &= 1.67, \phi_v = 0.9 \\ \text{Stud element 3} \\ V_{yh} &= 3.5005 \text{ k} \\ k_v &= 4.1647 \\ V_{crh} &= 0.3663 \text{ k} \\ V_n &= 0.7606 \text{ k at } 90 \text{ deg} \end{aligned} \quad \begin{aligned} &\text{Eq. G3-2} \\ &\text{Eq. G3-8} \\ &\text{Eq. G3-6} \\ &\text{Eq. G2.1-2} \end{aligned}$$

$$\begin{aligned} \Omega_v &= 1.67, \phi_v = 0.9 \\ \text{Stud element 4} \\ V_n &= 1.519 \text{ k at } 0 \text{ deg} \\ \Omega_v &= 1.67, \phi_v = 0.9 \end{aligned} \quad \text{Eq. G2.1-2}$$

Axial Compression Strength

Effective width calculations for Stud

$$\begin{aligned} \text{Element 1: Unstiffened, } w &= 0.5157 \text{ in} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \\ \psi &= 1 \\ k &= 0.43 \\ \lambda &= 1.0916 \\ \rho &= 0.73148 \\ b &= 0.37723 \text{ in (ineffective width} = 0.13847 \text{ in)} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.2.2-1} \\ &\text{Eq. 1.2.2-3} \\ &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$$\begin{aligned} \text{Element 2: Check for lip stiffener reduction} \\ S &= 31.091 \\ I_a &= 0.00026103 \text{ in}^4 \\ I_s &= 0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)} \\ k &= 3.8802 \end{aligned} \quad \begin{aligned} &\text{Eq. 1.3-7} \\ &\text{Eq. 1.3-8} \\ &\text{Table 1.3-1} \end{aligned}$$

$$\begin{aligned} \text{Element 2: Partially stiffened, } w &= 2.2814 \text{ in} \\ f &= 50 \text{ ksi, } k = 3.8802 \\ \lambda &= 1.6075 \\ \rho &= 0.53694 \\ b &= 1.225 \text{ in (ineffective width} = 1.0564 \text{ in)} \\ b_1 &= 0.61249 \text{ in, } b_2 = 0.61249 \text{ in} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$$\begin{aligned} \text{Element 3: Treat as two unstiffened elements} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \\ \psi &= 1 \\ k &= 0.43 \\ \lambda &= 4.5311 \\ \rho &= 0.20998 \\ b &= 0.44951 \text{ in (ineffective width} = 1.6912 \text{ in)} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.2.2-1} \\ &\text{Eq. 1.2.2-3} \\ &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.5311$	Eq. 1.1-3
$\rho=0.20998$	Eq. 1.1-2
$b=0.44951$ in (ineffective width=1.6912 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723$ in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00026103$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.8802$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2814$ in	
$f=50$ ksi, $k=3.8802$	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
$b=1.225$ in (ineffective width=1.0564 in)	Eq. 1.1-1
$b_1=0.61249$ in, $b_2=0.61249$ in	
$A_e=0.1464$ in ² , $F_n=50$ ksi	
$P_n=7.3198$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=5.7814$ in

$f_1=48.524$ ksi, $f_2=-29.558$ ksi	
$\psi=0.60915$	Eq. 1.1.2-1
$k=15.552$	Eq. 1.1.2-2
$\lambda=2.0046$	Eq. 1.1-3
$\rho=0.44411$	Eq. 1.1-2
$b_e=2.5676$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2.5$ in, $h_o/b_o=2.4$	
$b_1=0.71141$ in	Eq. 1.1.2-3
$b_2=1.2838$ in	Eq. 1.1.2-4
Compression width=3.5928 in	
Ineffective width=1.5976 in	
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=48.524$ ksi, $f_2=41.559$ ksi	
$\psi=0.85646$	Eq. 1.2.2-1
$k=0.48309$	Eq. 1.2.2-2
$\lambda=1.0145$	Eq. 1.1-3
$\rho=0.77195$	Eq. 1.1-2
$b=0.39809$ in (ineffective width=0.11761 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.157$$

Eq. 1.3-7

$$I_a=0.00026048 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8802$$

Table 1.3-1

Element 4: Partially stiffened, $w=2.2814$ in

$$f=49.789 \text{ ksi}, k=3.8802$$

$$\lambda=1.6041$$

Eq. 1.1-3

$$\rho=0.5379$$

Eq. 1.1-2

$$b=1.2272 \text{ in (ineffective width}=1.0542 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.61358 \text{ in}, b_2=0.61358 \text{ in}$$

$$\text{Center of gravity shift: } \gamma=-0.70275 \text{ in}$$

$$S_{xe}=0.4338 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=21.69 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$$f_1=48.524 \text{ ksi}, f_2=41.559 \text{ ksi}$$

$$\psi=0.85646$$

Eq. 1.2.2-1

$$k=0.48309$$

Eq. 1.2.2-2

$$\lambda=1.0145$$

Eq. 1.1-3

$$\rho=0.77195$$

Eq. 1.1-2

$$b=0.39809 \text{ in (ineffective width}=0.11761 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.157$$

Eq. 1.3-7

$$I_a=0.00026048 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8802$$

Table 1.3-1

Element 2: Partially stiffened, $w=2.2814$ in

$$f=49.789 \text{ ksi}, k=3.8802$$

$$\lambda=1.6041$$

Eq. 1.1-3

$$\rho=0.5379$$

Eq. 1.1-2

$$b=1.2272 \text{ in (ineffective width}=1.0542 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.61358 \text{ in}, b_2=0.61358 \text{ in}$$

Element 3: Stiffened, $w=5.7814$ in

$$f_1=48.524 \text{ ksi}, f_2=-29.558 \text{ ksi}$$

$$\psi=0.60915$$

Eq. 1.1.2-1

$$k=15.552$$

Eq. 1.1.2-2

$$\lambda=2.0046$$

Eq. 1.1-3

$$\rho=0.44411$$

Eq. 1.1-2

$$b_e=2.5676 \text{ in}$$

Eq. 1.1-1

$$h_o=6 \text{ in}, b_o=2.5 \text{ in}, h_o/b_o=2.4$$

$$b_1=0.71141 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.2838 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.5928 \text{ in}$$

$$\text{Ineffective width}=1.5976 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.70275$ in

$S_{xe}=0.4338$ in³, $F_y=50$ ksi

$M_{nl}=21.69$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157$ in

$f_1=49.535$ ksi, $f_2=49.535$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.0865$

$\rho=0.73404$

$b=0.37855$ in (ineffective width= 0.13715 in)

Element 2: Stiffened, $w=2.2814$ in

$f_1=46.741$ ksi, $f_2=-21.283$ ksi

$\psi=0.45533$

$k=13.075$

$\lambda=0.84668$

$\rho=0.87419$

$b_e=1.9944$ in

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.57719$ in

$b_2=0.99719$ in

Compression width= 1.5676 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5157$ in

$f_1=49.535$ ksi, $f_2=49.535$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.0865$

$\rho=0.73404$

$b=0.37855$ in (ineffective width= 0.13715 in)

Element 4: Stiffened, $w=2.2814$ in

$f_1=46.741$ ksi, $f_2=-21.283$ ksi

$\psi=0.45533$

$k=13.075$

$\lambda=0.84668$

$\rho=0.87419$

$b_e=1.9944$ in

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.57719$ in

$b_2=0.99719$ in

Compression width= 1.5676 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.04355$ in

$S_{ye}=0.16092$ in³, $F_y=50$ ksi

$M_{nl}=8.046$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2814$ in $f_1=45.704$ ksi, $f_2=-43.964$ ksi $\psi=0.96193$

Eq. 1.1.2-1

 $k=23.027$

Eq. 1.1.2-2

 $\lambda=0.63089$

Eq. 1.1-3

 $\rho=1$

Eq. 1.1-2

 $b_e=2.2814$ in

Eq. 1.1-1

 $h_o=2.5$ in, $b_o=6$ in, $h_o/b_o=0.41667$ $b_1=0.57583$ in

Eq. 1.1.2-3

 $b_2=1.1407$ in

Eq. 1.1.2-4

Compression width= 1.1628 in $b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

 $f_1=49.387$ ksi, $f_2=49.387$ ksi $\psi=1$

Eq. 1.2.2-1

 $k=0.43$

Eq. 1.2.2-3

 $\lambda=4.5032$

Eq. 1.1-3

 $\rho=0.21121$

Eq. 1.1-2

 $b=0.45215$ in (ineffective width= 1.6886 in)

Eq. 1.1-1

 $f_1=49.387$ ksi, $f_2=49.387$ ksi $\psi=1$

Eq. 1.2.2-1

 $k=0.43$

Eq. 1.2.2-2

 $\lambda=4.5032$

Eq. 1.1-3

 $\rho=0.21121$

Eq. 1.1-2

 $b=0.45215$ in (ineffective width= 1.6886 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.2814$ in $f_1=45.704$ ksi, $f_2=-43.964$ ksi $\psi=0.96193$

Eq. 1.1.2-1

 $k=23.027$

Eq. 1.1.2-2

 $\lambda=0.63089$

Eq. 1.1-3

 $\rho=1$

Eq. 1.1-2

 $b_e=2.2814$ in

Eq. 1.1-1

 $h_o=2.5$ in, $b_o=6$ in, $h_o/b_o=0.41667$ $b_1=0.57583$ in

Eq. 1.1.2-3

 $b_2=1.1407$ in

Eq. 1.1.2-4

Compression width= 1.1628 in $b_1+b_2 >$ compression width (fully effective)Center of gravity shift: $x=0.40552$ in $S_y=0.14163$ in³, $F_y=50$ ksi $M_n=7.0815$ k-in

Eq. F3.1-1

 $\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

 $C_w=2.3346$ in⁶, $W_n=6.1407$ in², $F_y=50$ ksi $B_n=19.009$ k-in²

G8.1-1

$\Omega_b=1.67, \phi_b=0.9$

600S250-33

Full Section Properties

Area	0.41350 in ²	Wt.	0.0014059 k/ft	Flat	11.951 in
Ix	2.3830 in ⁴	rx	2.4007 in	Ixy	0.0000 in ⁴
Sx(t)	0.79434 in ³	y(t)	3.0000 in	α	0.000 deg
Sx(b)	0.79434 in ³	y(b)	3.0000 in		
Zx	0.91266 in ³	Height	6.0000 in		
Iy	0.3561 in ⁴	ry	0.9280 in	x _o	-1.8829 in
Sy(l)	0.46850 in ³	x(l)	0.7600 in	y _o	0.0000 in
Sy(r)	0.20465 in ³	x(r)	1.7400 in	jx	3.3583 in
Zy	0.30691 in ³	Width	2.5000 in	jy	0.0000 in
I ₁	2.3830 in ⁴	r ₁	2.4007 in	Cw	2.5859 in ⁶
I ₂	0.3561 in ⁴	r ₂	0.9280 in	J	0.0001650 in ⁴
Ic	2.7391 in ⁴	rc	2.5738 in		
I _o	4.2050 in ⁴	r _o	3.1890 in		

Net Section Properties

Ix	2.3733 in ⁴	rx	2.5619 in	Area	0.36160 in ²
Sx(t)	0.79110 in ³	y(t)	3.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.79110 in ³	y(b)	3.0000 in	α	0.000 deg
Zx	0.89320 in ³				
Iy	0.3233 in ⁴	ry	0.9456 in	x _o	-1.9942 in
Sy(l)	0.37309 in ³	x(l)	0.8667 in	y _o	0.0000 in
Sy(r)	0.19796 in ³	x(r)	1.6333 in	jx	3.1113 in
Zy	0.29483 in ³			jy	0.0000 in
Ic	2.6966 in ⁴	rc	2.7309 in	Cw	2.5732 in ⁶
I _o	4.1346 in ⁴	r _o	3.3815 in	J	0.0001443 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi					
Axial		Positive Bending		Positive Bending	
φPno	7.443 k	φMnxo	23.347 k-in	φMnyo	8.201 k-in
Ae	0.17514 in ²	Ixe	1.8657 in ⁴	Iye	0.3038 in ⁴
φTn	17.628 k	Sxe(t)	0.51882 in ³	Sye(l)	0.36460 in ³
		Sxe(b)	0.77611 in ³	Sye(r)	0.18225 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.860 k	φMnxo	23.347 k-in	φMnyo	7.314 k-in
φVnx	3.317 k	Ixe	1.8657 in ⁴	Iye	0.2040 in ⁴
Torsion		Sxe(t)	0.77611 in ³	Sye(l)	0.16253 in ³
φBn	18.904 k-in ²	Sxe(b)	0.51882 in ³	Sye(r)	0.16388 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=50.999$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.32$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$$\begin{aligned} A_g &= 0.4135 \text{ in}^2, F_y = 50.999 \text{ ksi} \\ T_n &= 21.088 \text{ k} \\ \Omega_t &= 1.67, \phi_t = 0.9 \end{aligned} \quad \text{Eq. D2-1}$$

$$\begin{aligned} A_n &= 0.3616 \text{ in}^2, F_u = 65 \text{ ksi} \\ T_n &= 23.504 \text{ k} \\ \Omega_t &= 2, \phi_t = 0.75 \end{aligned} \quad \text{Eq. D3-1}$$

Shear Strength

$$\begin{aligned} \text{Stud element 2} \\ V_n &= 1.843 \text{ k at } 180 \text{ deg} \end{aligned} \quad \text{Eq. G2.1-2}$$

$$\begin{aligned} \Omega_v &= 1.67, \phi_v = 0.9 \\ \text{Stud element 3} \\ V_{yh} &= 3.8779 \text{ k} \\ k_v &= 4.1643 \\ V_{crh} &= 0.49967 \text{ k} \\ V_n &= 0.9561 \text{ k at } 90 \text{ deg} \end{aligned} \quad \begin{aligned} &\text{Eq. G3-2} \\ &\text{Eq. G3-8} \\ &\text{Eq. G3-6} \\ &\text{Eq. G2.1-2} \end{aligned}$$

$$\begin{aligned} \Omega_v &= 1.67, \phi_v = 0.9 \\ \text{Stud element 4} \\ V_n &= 1.843 \text{ k at } 0 \text{ deg} \\ \Omega_v &= 1.67, \phi_v = 0.9 \end{aligned} \quad \text{Eq. G2.1-2}$$

Axial Compression Strength

Effective width calculations for Stud

$$\begin{aligned} \text{Element 1: Unstiffened, } w &= 0.514 \text{ in} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \\ \psi &= 1 \\ k &= 0.43 \\ \lambda &= 0.98104 \\ \rho &= 0.79074 \\ b &= 0.40644 \text{ in (ineffective width} = 0.10756 \text{ in)} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.2.2-1} \\ &\text{Eq. 1.2.2-3} \\ &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$$\begin{aligned} \text{Element 2: Check for lip stiffener reduction} \\ S &= 31.091 \\ I_a &= 0.00035618 \text{ in}^4 \\ I_s &= 0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)} \\ k &= 3.8782 \end{aligned} \quad \begin{aligned} &\text{Eq. 1.3-7} \\ &\text{Eq. 1.3-8} \\ &\text{Table 1.3-1} \end{aligned}$$

$$\begin{aligned} \text{Element 2: Partially stiffened, } w &= 2.278 \text{ in} \\ f &= 50 \text{ ksi, } k = 3.8782 \\ \lambda &= 1.4478 \\ \rho &= 0.58576 \\ b &= 1.3344 \text{ in (ineffective width} = 0.94364 \text{ in)} \\ b_1 &= 0.66718 \text{ in, } b_2 = 0.66718 \text{ in} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$$\begin{aligned} \text{Element 3: Treat as two unstiffened elements} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \\ \psi &= 1 \\ k &= 0.43 \\ \lambda &= 4.0826 \\ \rho &= 0.23174 \\ b &= 0.4957 \text{ in (ineffective width} = 1.6433 \text{ in)} \\ f_1 &= 50 \text{ ksi, } f_2 = 50 \text{ ksi} \end{aligned} \quad \begin{aligned} &\text{Eq. 1.2.2-1} \\ &\text{Eq. 1.2.2-3} \\ &\text{Eq. 1.1-3} \\ &\text{Eq. 1.1-2} \\ &\text{Eq. 1.1-1} \end{aligned}$$

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.0826$	Eq. 1.1-3
$\rho=0.23174$	Eq. 1.1-2
$b=0.4957$ in (ineffective width=1.6433 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00035618$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1
Element 4: Partially stiffened, $w=2.278$ in	
$f=50$ ksi, $k=3.8782$	
$\lambda=1.4478$	Eq. 1.1-3
$\rho=0.58576$	Eq. 1.1-2
$b=1.3344$ in (ineffective width=0.94364 in)	Eq. 1.1-1
$b_1=0.66718$ in, $b_2=0.66718$ in	
$A_e=0.17514$ in ² , $F_n=50$ ksi	
$P_n=8.7568$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.778$ in	
$f_1=48.456$ ksi, $f_2=-31.898$ ksi	
$\psi=0.65829$	Eq. 1.1.2-1
$k=16.437$	Eq. 1.1.2-2
$\lambda=1.756$	Eq. 1.1-3
$\rho=0.49814$	Eq. 1.1-2
$b_e=2.8782$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2.5$ in, $h_o/b_o=2.4$	
$b_1=0.78677$ in	Eq. 1.1.2-3
$b_2=1.4391$ in	Eq. 1.1.2-4
Compression width=3.4843 in	
Ineffective width=1.2584 in	
Element 5: Unstiffened, $w=0.514$ in	
$f_1=48.456$ ksi, $f_2=41.308$ ksi	
$\psi=0.85248$	Eq. 1.2.2-1
$k=0.4847$	Eq. 1.2.2-2
$\lambda=0.90965$	Eq. 1.1-3
$\rho=0.83345$	Eq. 1.1-2
$b=0.42839$ in (ineffective width=0.085606 in)	Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$$S=31.166$$

Eq. 1.3-7

$$I_a=0.00035534 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8782$$

Table 1.3-1

Element 4: Partially stiffened, $w=2.278 \text{ in}$

$$f=49.759 \text{ ksi}, k=3.8782$$

$$\lambda=1.4443$$

Eq. 1.1-3

$$\rho=0.58692$$

Eq. 1.1-2

$$b=1.337 \text{ in (ineffective width}=0.941 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.6685 \text{ in}, b_2=0.6685 \text{ in}$$

Center of gravity shift: $y=-0.59607 \text{ in}$

$$S_{xe}=0.51882 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=25.941 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$$f_1=48.456 \text{ ksi}, f_2=41.308 \text{ ksi}$$

$$\psi=0.85248$$

Eq. 1.2.2-1

$$k=0.4847$$

Eq. 1.2.2-2

$$\lambda=0.90965$$

Eq. 1.1-3

$$\rho=0.83345$$

Eq. 1.1-2

$$b=0.42839 \text{ in (ineffective width}=0.085606 \text{ in)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S=31.166$$

Eq. 1.3-7

$$I_a=0.00035534 \text{ in}^4$$

Eq. 1.3-8

$$I_s=0.00039155 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k=3.8782$$

Table 1.3-1

Element 2: Partially stiffened, $w=2.278 \text{ in}$

$$f=49.759 \text{ ksi}, k=3.8782$$

$$\lambda=1.4443$$

Eq. 1.1-3

$$\rho=0.58692$$

Eq. 1.1-2

$$b=1.337 \text{ in (ineffective width}=0.941 \text{ in)}$$

Eq. 1.1-1

$$b_1=0.6685 \text{ in}, b_2=0.6685 \text{ in}$$

Element 3: Stiffened, $w=5.778 \text{ in}$

$$f_1=48.456 \text{ ksi}, f_2=-31.898 \text{ ksi}$$

$$\psi=0.65829$$

Eq. 1.1.2-1

$$k=16.437$$

Eq. 1.1.2-2

$$\lambda=1.756$$

Eq. 1.1-3

$$\rho=0.49814$$

Eq. 1.1-2

$$b_e=2.8782 \text{ in}$$

Eq. 1.1-1

$$h_o=6 \text{ in}, b_o=2.5 \text{ in}, h_o/b_o=2.4$$

$$b_1=0.78677 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.4391 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=3.4843 \text{ in}$$

$$\text{Ineffective width}=1.2584 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.59607$ in
 $S_{xe}=0.51882$ in³, $F_y=50$ ksi
 $M_{nl}=25.941$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.481$ ksi, $f_2=49.481$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.97594$

Eq. 1.1-3

$\rho=0.79367$

Eq. 1.1-2

$b=0.40795$ in (ineffective width= 0.10605 in)

Eq. 1.1-1

Element 2: Stiffened, $w=2.278$ in

$f_1=46.67$ ksi, $f_2=-21.664$ ksi

$\psi=0.46418$

Eq. 1.1.2-1

$k=13.206$

Eq. 1.1.2-2

$\lambda=0.75798$

Eq. 1.1-3

$\rho=0.93638$

Eq. 1.1-2

$b_e=2.1331$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.61575$ in

Eq. 1.1.2-3

$b_2=1.0665$ in

Eq. 1.1.2-4

Compression width= 1.5558 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.514$ in

$f_1=49.481$ ksi, $f_2=49.481$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=0.97594$

Eq. 1.1-3

$\rho=0.79367$

Eq. 1.1-2

$b=0.40795$ in (ineffective width= 0.10605 in)

Eq. 1.1-1

Element 4: Stiffened, $w=2.278$ in

$f_1=46.67$ ksi, $f_2=-21.664$ ksi

$\psi=0.46418$

Eq. 1.1.2-1

$k=13.206$

Eq. 1.1.2-2

$\lambda=0.75798$

Eq. 1.1-3

$\rho=0.93638$

Eq. 1.1-2

$b_e=2.1331$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.61575$ in

Eq. 1.1.2-3

$b_2=1.0665$ in

Eq. 1.1.2-4

Compression width= 1.5558 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=-0.033478$ in

$S_{ye}=0.18225$ in³, $F_y=50$ ksi

$M_{nl}=9.1123$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.278$ in $f_1=45.577$ ksi, $f_2=-45.184$ ksi $\psi=0.99136$

Eq. 1.1.2-1

 $k=23.776$

Eq. 1.1.2-2

 $\lambda=0.55825$

Eq. 1.1-3

 $\rho=1$

Eq. 1.1-2

 $b_e=2.278$ in

Eq. 1.1-1

 $h_o=2.5$ in, $b_o=6$ in, $h_o/b_o=0.41667$ $b_1=0.57073$ in

Eq. 1.1.2-3

 $b_2=1.139$ in

Eq. 1.1.2-4

Compression width= 1.1439 in $b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

 $f_1=49.311$ ksi, $f_2=49.311$ ksi $\psi=1$

Eq. 1.2.2-1

 $k=0.43$

Eq. 1.2.2-3

 $\lambda=4.0544$

Eq. 1.1-3

 $\rho=0.23326$

Eq. 1.1-2

 $b=0.49895$ in (ineffective width= 1.64 in)

Eq. 1.1-1

 $f_1=49.311$ ksi, $f_2=49.311$ ksi $\psi=1$

Eq. 1.2.2-1

 $k=0.43$

Eq. 1.2.2-2

 $\lambda=4.0544$

Eq. 1.1-3

 $\rho=0.23326$

Eq. 1.1-2

 $b=0.49895$ in (ineffective width= 1.64 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.278$ in $f_1=45.577$ ksi, $f_2=-45.184$ ksi $\psi=0.99136$

Eq. 1.1.2-1

 $k=23.776$

Eq. 1.1.2-2

 $\lambda=0.55825$

Eq. 1.1-3

 $\rho=1$

Eq. 1.1-2

 $b_e=2.278$ in

Eq. 1.1-1

 $h_o=2.5$ in, $b_o=6$ in, $h_o/b_o=0.41667$ $b_1=0.57073$ in

Eq. 1.1.2-3

 $b_2=1.139$ in

Eq. 1.1.2-4

Compression width= 1.1439 in $b_1+b_2 >$ compression width (fully effective)Center of gravity shift: $x=0.38852$ in $S_{ye}=0.16253$ in³, $F_y=50$ ksi $M_{nl}=8.1265$ k-in

Eq. F3.1-1

 $\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

 $C_w=2.5732$ in⁶, $W_n=6.1253$ in², $F_y=50$ ksi $B_n=21.005$ k-in²

G8.1-1

$\Omega_b=1.67, \phi_b=0.9$

600S250-43

Full Section Properties

Area	0.53708 in ²	Wt.	0.0018261 k/ft	Flat	11.909 in
I _x	3.0827 in ⁴	r _x	2.3958 in	I _{xy}	0.0000 in ⁴
S _x (t)	1.0276 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	1.0276 in ³	y(b)	3.0000 in		
Z _x	1.1829 in ³	Height	6.0000 in		
I _y	0.4579 in ⁴	r _y	0.9233 in	x _o	-1.8712 in
S _y (l)	0.6022 in ³	x(l)	0.7604 in	y _o	0.0000 in
S _y (r)	0.2632 in ³	x(r)	1.7396 in	j _x	3.3499 in
Z _y	0.3961 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	3.0827 in ⁴	r ₁	2.3958 in	C _w	3.3076 in ⁶
I ₂	0.4579 in ⁴	r ₂	0.9233 in	J	0.0003641 in ⁴
I _c	3.5406 in ⁴	r _c	2.5676 in		
I _o	5.4211 in ⁴	r _o	3.1771 in		

Net Section Properties

I _x	3.0700 in ⁴	r _x	2.5573 in	Area	0.46943 in ²
S _x (t)	1.0233 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	1.0233 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	1.1575 in ³				
I _y	0.4157 in ⁴	r _y	0.9411 in	x _o	-1.9822 in
S _y (l)	0.4797 in ³	x(l)	0.8667 in	y _o	0.0000 in
S _y (r)	0.2545 in ³	x(r)	1.6333 in	j _x	3.1020 in
Z _y	0.3807 in ³			j _y	0.0000 in
I _c	3.4858 in ⁴	r _c	2.7250 in	C _w	3.2912 in ⁶
I _o	5.3302 in ⁴	r _o	3.3697 in	J	0.0003183 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	10.691 k	φM _{nxo}	35.681 k-in	φM _{nyo}	11.234 k-in
A _e	0.25155 in ²	I _{xe}	2.6464 in ⁴	I _{ye}	0.4097 in ⁴
φT _n	22.885 k	S _{xe} (t)	0.79291 in ³	S _{ye} (l)	0.47710 in ³
		S _{xe} (b)	0.99400 in ³	S _{ye} (r)	0.24965 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.535 k	φM _{nxo}	35.681 k-in	φM _{nyo}	9.829 k-in
φV _{nx}	5.185 k	I _{xe}	2.6464 in ⁴	I _{ye}	0.2843 in ⁴
Torsion		S _{xe} (t)	0.99400 in ³	S _{ye} (l)	0.23724 in ³
φB _n	24.368 k-in ²	S _{xe} (b)	0.79291 in ³	S _{ye} (r)	0.21842 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.221$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=52.838$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.53708 \text{ in}^2$, $F_y=51.221 \text{ ksi}$ $T_n=27.51 \text{ k}$ $\Omega_t=1.67$, $\phi_t=0.9$	Eq. D2-1
$A_n=0.46943 \text{ in}^2$, $F_u=65 \text{ ksi}$ $T_n=30.513 \text{ k}$ $\Omega_t=2$, $\phi_t=0.75$	Eq. D3-1
Shear Strength	
Stud element 2	
$V_n=2.8807 \text{ k}$ at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 3	
$V_{yh}=5.0382 \text{ k}$	Eq. G3-2
$k_v=4.163$	Eq. G3-8
$V_{crh}=1.1072 \text{ k}$	Eq. G3-6
$V_n=1.706 \text{ k}$ at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Stud element 4	
$V_n=2.8807 \text{ k}$ at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087 \text{ in}$	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123 \text{ in}$ (ineffective width= 0.027474 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00079003 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00049474 \text{ in}^4$	
$d_s=0.30136 \text{ in}$ (lip ineffective width= 0.17987 in)	Eq. 1.3-6
$k=3.3746$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2674 \text{ in}$	
$f=50 \text{ ksi}$, $k=3.3746$	
$\lambda=1.1852$	Eq. 1.1-3
$\rho=0.68714$	Eq. 1.1-2
$b=1.558 \text{ in}$ (ineffective width= 0.70937 in)	Eq. 1.1-1
$b_1=0.48785 \text{ in}$, $b_2=1.0702 \text{ in}$	
Element 3: Treat as two unstiffened elements	
$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=3.1243$	Eq. 1.1-3
$\rho=0.29753$	Eq. 1.1-2
$b=0.63484 \text{ in}$ (ineffective width= 1.4989 in)	Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=3.1243$	Eq. 1.1-3
$\rho=0.29753$	Eq. 1.1-2
$b=0.63484$ in (ineffective width=1.4989 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123$ in (ineffective width=0.027474 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00079003$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.30136$ in (lip ineffective width=0.17987 in)	Eq. 1.3-6
$k=3.3746$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2674$ in	
$f=50$ ksi, $k=3.3746$	
$\lambda=1.1852$	Eq. 1.1-3
$\rho=0.68714$	Eq. 1.1-2
$b=1.558$ in (ineffective width=0.70937 in)	Eq. 1.1-1
$b_1=0.48785$ in, $b_2=1.0702$ in	
$A_e=0.25155$ in ² , $F_n=50$ ksi	
$P_n=12.577$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.7674$ in	
$f_1=48.257$ ksi, $f_2=-38.157$ ksi	
$\psi=0.7907$	Eq. 1.1.2-1
$k=19.066$	Eq. 1.1.2-2
$\lambda=1.246$	Eq. 1.1-3
$\rho=0.66087$	Eq. 1.1-2
$b_e=3.8115$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2.5$ in, $h_o/b_o=2.4$	
$b_1=1.0055$ in	Eq. 1.1.2-3
$b_2=1.9058$ in	Eq. 1.1.2-4
Compression width=3.2207 in	
Ineffective width=0.3095 in	
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=48.257$ ksi, $f_2=40.635$ ksi	
$\psi=0.84206$	Eq. 1.2.2-1
$k=0.48898$	Eq. 1.2.2-2
$\lambda=0.68623$	Eq. 1.1-3

$\rho=0.99005$	Eq. 1.1-2
$b=0.50364$ in (ineffective width= 0.0050592 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.197$	Eq. 1.3-7
$I_a=0.00078742$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.31644$ in (lip ineffective width= 0.1872 in)	Eq. 1.3-6
$k=3.3779$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2674$ in	
$f=49.662$ ksi, $k=3.3779$	
$\lambda=1.1806$	Eq. 1.1-3
$\rho=0.6892$	Eq. 1.1-2
$b=1.5627$ in (ineffective width= 0.70471 in)	Eq. 1.1-1
$b_1=0.49092$ in, $b_2=1.0718$ in	
Center of gravity shift: $y=-0.33761$ in	
$S_{xe}=0.79291$ in ³ , $F_y=50$ ksi	
$M_{nl}=39.645$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087$ in	
$f_1=48.257$ ksi, $f_2=40.635$ ksi	
$\psi=0.84206$	Eq. 1.2.2-1
$k=0.48898$	Eq. 1.2.2-2
$\lambda=0.68623$	Eq. 1.1-3
$\rho=0.99005$	Eq. 1.1-2
$b=0.50364$ in (ineffective width= 0.0050592 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.197$	Eq. 1.3-7
$I_a=0.00078742$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.31644$ in (lip ineffective width= 0.1872 in)	Eq. 1.3-6
$k=3.3779$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2674$ in	
$f=49.662$ ksi, $k=3.3779$	
$\lambda=1.1806$	Eq. 1.1-3
$\rho=0.6892$	Eq. 1.1-2
$b=1.5627$ in (ineffective width= 0.70471 in)	Eq. 1.1-1
$b_1=0.49092$ in, $b_2=1.0718$ in	
Element 3: Stiffened, $w=5.7674$ in	
$f_1=48.257$ ksi, $f_2=-38.157$ ksi	
$\psi=0.7907$	Eq. 1.1.2-1
$k=19.066$	Eq. 1.1.2-2
$\lambda=1.246$	Eq. 1.1-3
$\rho=0.66087$	Eq. 1.1-2
$b_e=3.8115$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2.5$ in, $h_o/b_o=2.4$	
$b_1=1.0055$ in	Eq. 1.1.2-3
$b_2=1.9058$ in	Eq. 1.1.2-4

Compression width=3.2207 in
 Ineffective width=0.30951 in
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.33761$ in
 $S_{xe}=0.79291$ in³, $F_y=50$ ksi
 $M_{nl}=39.645$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087$ in

$f_1=49.313$ ksi, $f_2=49.313$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73975$

Eq. 1.1-3

$\rho=0.94979$

Eq. 1.1-2

$b=0.48316$ in (ineffective width=0.025543 in)

Eq. 1.1-1

Element 2: Stiffened, $w=2.2674$ in

$f_1=46.457$ ksi, $f_2=-22.621$ ksi

$\psi=0.48692$

Eq. 1.1.2-1

$k=13.549$

Eq. 1.1.2-2

$\lambda=0.57013$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2674$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.65026$ in

Eq. 1.1.2-3

$b_2=1.1337$ in

Eq. 1.1.2-4

Compression width=1.5249 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=49.313$ ksi, $f_2=49.313$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.73975$

Eq. 1.1-3

$\rho=0.94979$

Eq. 1.1-2

$b=0.48316$ in (ineffective width=0.025543 in)

Eq. 1.1-1

Element 4: Stiffened, $w=2.2674$ in

$f_1=46.457$ ksi, $f_2=-22.621$ ksi

$\psi=0.48692$

Eq. 1.1.2-1

$k=13.549$

Eq. 1.1.2-2

$\lambda=0.57013$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2674$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.65026$ in

Eq. 1.1.2-3

$b_2=1.1337$ in

Eq. 1.1.2-4

Compression width=1.5249 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x = -0.0079445$ in
 $S_y = 0.24965 \text{ in}^3$, $F_y = 50 \text{ ksi}$
 $M_n I = 12.483 \text{ k-in}$
 $\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 2.2674$ in

$f_1 = 41.481 \text{ ksi}$, $f_2 = -45.537 \text{ ksi}$

$\psi = 1.0978$

Eq. 1.1.2-1

$k = 26.659$

Eq. 1.1.2-2

$\lambda = 0.38407$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.2674$ in

Eq. 1.1-1

$h_o = 2.5$ in, $b_o = 6$ in, $h_o/b_o = 0.41667$

$b_1 = 0.55333$ in

Eq. 1.1.2-3

$b_2 = 1.1337$ in

Eq. 1.1.2-4

Compression width = 1.0809 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 45.079 \text{ ksi}$, $f_2 = 45.079 \text{ ksi}$

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 2.9666$

Eq. 1.1-3

$\rho = 0.31209$

Eq. 1.1-2

$b = 0.6659$ in (ineffective width = 1.4678 in)

Eq. 1.1-1

$f_1 = 45.079 \text{ ksi}$, $f_2 = 45.079 \text{ ksi}$

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-2

$\lambda = 2.9666$

Eq. 1.1-3

$\rho = 0.31209$

Eq. 1.1-2

$b = 0.6659$ in (ineffective width = 1.4678 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 2.2674$ in

$f_1 = 41.481 \text{ ksi}$, $f_2 = -45.537 \text{ ksi}$

$\psi = 1.0978$

Eq. 1.1.2-1

$k = 26.659$

Eq. 1.1.2-2

$\lambda = 0.38407$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.2674$ in

Eq. 1.1-1

$h_o = 2.5$ in, $b_o = 6$ in, $h_o/b_o = 0.41667$

$b_1 = 0.55333$ in

Eq. 1.1.2-3

$b_2 = 1.1337$ in

Eq. 1.1.2-4

Compression width = 1.0809 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.33162$ in

$S_y = 0.21842 \text{ in}^3$, $F_y = 50 \text{ ksi}$

$M_n I = 10.921 \text{ k-in}$

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Bimoment Strength, Stud

$C_w=3.2912 \text{ in}^6$, $W_n=6.0779 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=27.075 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

600S250-54

Full Section Properties

Area	0.66954 in ²	Wt.	0.0022764 k/ft	Flat	11.829 in
I _x	3.8197 in ⁴	r _x	2.3885 in	I _{xy}	0.0000 in ⁴
S _x (t)	1.2732 in ³	y(t)	3.0000 in	α	0.000 deg
S _x (b)	1.2732 in ³	y(b)	3.0000 in		
Z _x	1.4695 in ³	Height	6.0000 in		
I _y	0.5627 in ⁴	r _y	0.9168 in	x _o	-1.8562 in
S _y (l)	0.7410 in ³	x(l)	0.7594 in	y _o	0.0000 in
S _y (r)	0.3233 in ³	x(r)	1.7406 in	j _x	3.3427 in
Z _y	0.4893 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	3.8197 in ⁴	r ₁	2.3885 in	C _w	4.0375 in ⁶
I ₂	0.5627 in ⁴	r ₂	0.9168 in	J	0.0007150 in ⁴
I _c	4.3824 in ⁴	r _c	2.5584 in		
I _o	6.6893 in ⁴	r _o	3.1609 in		

Net Section Properties

I _x	3.8037 in ⁴	r _x	2.5507 in	Area	0.58464 in ²
S _x (t)	1.2679 in ³	y(t)	3.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	1.2679 in ³	y(b)	3.0000 in	α	0.000 deg
Z _x	1.4377 in ³				
I _y	0.5107 in ⁴	r _y	0.9347 in	x _o	-1.9671 in
S _y (l)	0.5900 in ³	x(l)	0.8656 in	y _o	0.0000 in
S _y (r)	0.3125 in ³	x(r)	1.6344 in	j _x	3.0935 in
Z _y	0.4704 in ³			j _y	0.0000 in
I _c	4.3145 in ⁴	r _c	2.7166 in	C _w	4.0172 in ⁶
I _o	6.5767 in ⁴	r _o	3.3540 in	J	0.0006243 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	14.537 k	φM _n x _o	47.429 k-in	φM _n y _o	15.981 k-in
A _e	0.34205 in ²	I _x e	3.4124 in ⁴	I _y e	0.5107 in ⁴
φT _n	28.501 k	S _x e(t)	1.0540 in ³	S _y e(l)	0.5900 in ³
		S _x e(b)	1.2353 in ³	S _y e(r)	0.3125 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2.483 k	φM _n x _o	47.429 k-in	φM _n y _o	12.505 k-in
φV _{nx}	6.776 k	I _x e	3.4124 in ⁴	I _y e	0.3800 in ⁴
Torsion		S _x e(t)	1.2353 in ³	S _y e(l)	0.3355 in ³
φB _n	30.006 k-in ²	S _x e(b)	1.0540 in ³	S _y e(r)	0.2779 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.526$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=53.509$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.66954$ in², $F_y=51.526$ ksi

$$T_n = 34.499 \text{ k} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.58464 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 38.001 \text{ k} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 3.7645 \text{ k at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 6.2242 \text{ k} \quad \text{Eq. G3-2}$$

$$k_v = 4.1568 \quad \text{Eq. G3-8}$$

$$V_{crh} = 2.1944 \text{ k} \quad \text{Eq. G3-6}$$

$$V_n = 2.7594 \text{ k at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 3.7645 \text{ k at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.4835 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.56413 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.0015382 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00053312 \text{ in}^4$$

$$d_s = 0.16757 \text{ in (lip ineffective width} = 0.31593 \text{ in)} \quad \text{Eq. 1.3-6}$$

$$k = 2.8256 \quad \text{Table 1.3-1}$$

Element 2: Partially stiffened, $w = 2.217 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.8256$$

$$\lambda = 1.0091 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.77494 \quad \text{Eq. 1.1-2}$$

$$b = 1.718 \text{ in (ineffective width} = 0.49896 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$b_1 = 0.29773 \text{ in}, b_2 = 1.4203 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 2.4601 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.37013 \quad \text{Eq. 1.1-2}$$

$$b = 0.78042 \text{ in (ineffective width} = 1.3281 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$k=0.43$	Eq. 1.2.2-3
$\lambda=2.4601$	Eq. 1.1-3
$\rho=0.37013$	Eq. 1.1-2
$b=0.78042$ in (ineffective width=1.3281 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0015382$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.16757$ in (lip ineffective width=0.31593 in)	Eq. 1.3-6
$k=2.8256$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217$ in	
$f=50$ ksi, $k=2.8256$	
$\lambda=1.0091$	Eq. 1.1-3
$\rho=0.77494$	Eq. 1.1-2
$b=1.718$ in (ineffective width=0.49896 in)	Eq. 1.1-1
$b_1=0.29773$ in, $b_2=1.4203$ in	
$A_e=0.34205$ in ² , $F_n=50$ ksi	
$P_n=17.103$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=5.717$ in	
$f_1=47.815$ ksi, $f_2=-40.48$ ksi	
$\psi=0.8466$	Eq. 1.1.2-1
$k=20.287$	Eq. 1.1.2-2
$\lambda=0.94968$	Eq. 1.1-3
$\rho=0.80906$	Eq. 1.1-2
$b_e=4.6254$ in	Eq. 1.1-1
$h_o=6$ in, $b_o=2.5$ in, $h_o/b_o=2.4$	
$b_1=1.2025$ in	Eq. 1.1.2-3
$b_2=2.3127$ in	Eq. 1.1.2-4
Compression width=3.096 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=47.815$ ksi, $f_2=40.347$ ksi	
$\psi=0.84383$	Eq. 1.2.2-1
$k=0.48825$	Eq. 1.2.2-2
$\lambda=0.51772$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.228$	Eq. 1.3-7

$$I_a = 0.0015317 \text{ in}^4$$

Eq. 1.3-8

$$I_s = 0.00053312 \text{ in}^4$$

$$d_s = 0.16829 \text{ in (lip ineffective width} = 0.31521 \text{ in)}$$

Eq. 1.3-6

$$k = 2.829$$

Table 1.3-1

Element 4: Partially stiffened, $w = 2.217 \text{ in}$

$$f = 49.563 \text{ ksi, } k = 2.829$$

$$\lambda = 1.0041$$

Eq. 1.1-3

$$\rho = 0.77773$$

Eq. 1.1-2

$$b = 1.7242 \text{ in (ineffective width} = 0.49278 \text{ in)}$$

Eq. 1.1-1

$$b_1 = 0.30007 \text{ in, } b_2 = 1.4242 \text{ in}$$

Center of gravity shift: $y = -0.23765 \text{ in}$

$$S_{xe} = 1.054 \text{ in}^3, F_y = 50 \text{ ksi}$$

$$M_{nl} = 52.699 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b = 1.67, \phi_b = 0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.4835 \text{ in}$

$$f_1 = 47.815 \text{ ksi, } f_2 = 40.347 \text{ ksi}$$

$$\psi = 0.84383$$

Eq. 1.2.2-1

$$k = 0.48825$$

Eq. 1.2.2-2

$$\lambda = 0.51772$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S = 31.228$$

Eq. 1.3-7

$$I_a = 0.0015317 \text{ in}^4$$

Eq. 1.3-8

$$I_s = 0.00053312 \text{ in}^4$$

$$d_s = 0.16829 \text{ in (lip ineffective width} = 0.31521 \text{ in)}$$

Eq. 1.3-6

$$k = 2.829$$

Table 1.3-1

Element 2: Partially stiffened, $w = 2.217 \text{ in}$

$$f = 49.563 \text{ ksi, } k = 2.829$$

$$\lambda = 1.0041$$

Eq. 1.1-3

$$\rho = 0.77773$$

Eq. 1.1-2

$$b = 1.7242 \text{ in (ineffective width} = 0.49278 \text{ in)}$$

Eq. 1.1-1

$$b_1 = 0.30007 \text{ in, } b_2 = 1.4242 \text{ in}$$

Element 3: Stiffened, $w = 5.717 \text{ in}$

$$f_1 = 47.815 \text{ ksi, } f_2 = -40.48 \text{ ksi}$$

$$\psi = 0.8466$$

Eq. 1.1.2-1

$$k = 20.287$$

Eq. 1.1.2-2

$$\lambda = 0.94968$$

Eq. 1.1-3

$$\rho = 0.80906$$

Eq. 1.1-2

$$b_e = 4.6254 \text{ in}$$

Eq. 1.1-1

$$h_o = 6 \text{ in, } b_o = 2.5 \text{ in, } h_o/b_o = 2.4$$

$$b_1 = 1.2025 \text{ in}$$

Eq. 1.1.2-3

$$b_2 = 2.3127 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width} = 3.096 \text{ in}$$

$$b_1 + b_2 > \text{compression width (fully effective)}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y = 0.23765 \text{ in}$

$S_{xe}=1.054 \text{ in}^3$, $F_y=50 \text{ ksi}$

$M_n I=52.699 \text{ k-in}$

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$

$f_1=55.841 \text{ ksi}$, $f_2=55.841 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59618$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=2.217 \text{ in}$

$f_1=51.906 \text{ ksi}$, $f_2=-25.176 \text{ ksi}$

$\psi=0.48503$

Eq. 1.1.2-1

$k=13.52$

Eq. 1.1.2-2

$\lambda=0.47002$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.217 \text{ in}$

Eq. 1.1-1

$h_o=2.5 \text{ in}$, $b_o=0.625 \text{ in}$, $h_o/b_o=4$

$b_1=0.63615 \text{ in}$

Eq. 1.1.2-3

$b_2=1.1085 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.4929 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.4835 \text{ in}$

$f_1=55.841 \text{ ksi}$, $f_2=55.841 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59618$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w=2.217 \text{ in}$

$f_1=51.906 \text{ ksi}$, $f_2=-25.176 \text{ ksi}$

$\psi=0.48503$

Eq. 1.1.2-1

$k=13.52$

Eq. 1.1.2-2

$\lambda=0.47002$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.217 \text{ in}$

Eq. 1.1-1

$h_o=2.5 \text{ in}$, $b_o=0.625 \text{ in}$, $h_o/b_o=4$

$b_1=0.63615 \text{ in}$

Eq. 1.1.2-3

$b_2=1.1085 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.4929 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0 \text{ in}$

$S_{ye}=0.31249 \text{ in}^3$, $F_y=56.825 \text{ ksi}$

$M_n I=17.757 \text{ k-in}$

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.217$ in

$$f_1=36.16 \text{ ksi}, f_2=-44.831 \text{ ksi}$$

$$\psi=1.2398$$

Eq. 1.1.2-1

$$k=30.952$$

Eq. 1.1.2-2

$$\lambda=0.25928$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=2.217 \text{ in}$$

Eq. 1.1-1

$$h_o=2.5 \text{ in}, b_o=6 \text{ in}, h_o/b_o=0.41667$$

$$b_1=0.52291 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.1085 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.98983 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: Treat as two unstiffened elements

$$f_1=40.296 \text{ ksi}, f_2=40.296 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=2.2085$$

Eq. 1.1-3

$$\rho=0.40769$$

Eq. 1.1-2

$$b=0.85961 \text{ in (ineffective width}=1.2489 \text{ in)}$$

Eq. 1.1-1

$$f_1=40.296 \text{ ksi}, f_2=40.296 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-2

$$\lambda=2.2085$$

Eq. 1.1-3

$$\rho=0.40769$$

Eq. 1.1-2

$$b=0.85961 \text{ in (ineffective width}=1.2489 \text{ in)}$$

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.217$ in

$$f_1=36.16 \text{ ksi}, f_2=-44.831 \text{ ksi}$$

$$\psi=1.2398$$

Eq. 1.1.2-1

$$k=30.952$$

Eq. 1.1.2-2

$$\lambda=0.25928$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=2.217 \text{ in}$$

Eq. 1.1-1

$$h_o=2.5 \text{ in}, b_o=6 \text{ in}, h_o/b_o=0.41667$$

$$b_1=0.52291 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.1085 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=0.98983 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=0.26705$ in

$$S_{ye}=0.27788 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=13.894 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Bimoment Strength, Stud

$$C_w=4.0172 \text{ in}^6, W_n=6.0247 \text{ in}^2, F_y=50 \text{ ksi}$$

$$B_n=33.339 \text{ k-in}^2$$

G8.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

800S162-30

Full Section Properties

Area	0.37329 in ²	Wt.	0.0012692 k/ft	Flat	11.964 in
Ix	3.2382 in ⁴	rx	2.9453 in	Ixy	0.0000 in ⁴
Sx(t)	0.80956 in ³	y(t)	4.0000 in	α	0.000 deg
Sx(b)	0.80956 in ³	y(b)	4.0000 in		
Zx	0.98462 in ³	Height	8.0000 in		
Iy	0.1137 in ⁴	ry	0.5519 in	x _o	-0.9339 in
Sy(l)	0.32843 in ³	x(l)	0.3463 in	y _o	0.0000 in
Sy(r)	0.08893 in ³	x(r)	1.2787 in	jx	4.8270 in
Zy	0.12481 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	3.2382 in ⁴	r ₁	2.9453 in	Cw	1.4239 in ⁶
I ₂	0.1137 in ⁴	r ₂	0.5519 in	J	0.0001211 in ⁴
Ic	3.3519 in ⁴	rc	2.9966 in		
I _o	3.6775 in ⁴	r _o	3.1388 in		

Net Section Properties

Ix	3.2295 in ⁴	rx	3.1451 in	Area	0.32649 in ²
Sx(t)	0.80736 in ³	y(t)	4.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.80736 in ³	y(b)	4.0000 in	α	0.000 deg
Zx	0.96707 in ³				
Iy	0.1079 in ⁴	ry	0.5748 in	x _o	-0.9830 in
Sy(l)	0.27402 in ³	x(l)	0.3937 in	y _o	0.0000 in
Sy(r)	0.08760 in ³	x(r)	1.2313 in	jx	4.3279 in
Zy	0.12432 in ³			jy	0.0000 in
Ic	3.3373 in ⁴	rc	3.1972 in	Cw	1.4207 in ⁶
I _o	3.6528 in ⁴	r _o	3.3449 in	J	0.0001059 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	5.667 k	φMnxo	21.230 k-in	φMnyo	3.767 k-in
Ae	0.13333 in ²	Ixe	2.5563 in ⁴	Iye	0.1039 in ⁴
φTn	15.916 k	Sxe(t)	0.53076 in ³	Sye(l)	0.27082 in ³
		Sxe(b)	0.80293 in ³	Sye(r)	0.08371 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.673 k	φMnxo	21.230 k-in	φMnyo	3.188 k-in
φVnx	2.328 k	Ixe	2.5563 in ⁴	Iye	0.0594 in ⁴
Torsion		Sxe(t)	0.80293 in ³	Sye(l)	0.07562 in ³
φBn	12.792 k-in ²	Sxe(b)	0.53076 in ³	Sye(r)	0.07083 in ³

Stud element 3 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=50.92$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=53.235$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=55.114$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.37329 \text{ in}^2$, $F_y=50.92 \text{ ksi}$

$T_n=19.008 \text{ k}$

Eq. D2-1

$\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.32649 \text{ in}^2$, $F_u=65 \text{ ksi}$

$T_n=21.222 \text{ k}$

Eq. D3-1

$\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2

$V_n=1.2934 \text{ k}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=5.7137 \text{ k}$

Eq. G3-2

$k_v=4.2793$

Eq. G3-8

$V_{crh}=0.31856 \text{ k}$

Eq. G3-6

h/t exceeds 200 (rational analysis)

$V_n=0.84148 \text{ k}$ at 90 deg

Eq. G2.1-2

$\Omega_v=2$, $\phi_v=0.8$ (rational analysis)

Stud element 4

$V_n=1.2934 \text{ k}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3907 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.82697$

Eq. 1.1-3

$\rho=0.88754$

Eq. 1.1-2

$b=0.34676 \text{ in}$ (ineffective width= 0.043938 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00016273 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00015506 \text{ in}^4$

$d_s=0.33042 \text{ in}$ (lip ineffective width= 0.01634 in)

Eq. 1.3-6

$k=3.4239$

Table 1.3-1

Element 2: Partially stiffened, $w=1.4064 \text{ in}$

$f=50 \text{ ksi}$, $k=3.4239$

$\lambda=1.055$

Eq. 1.1-3

$\rho=0.75023$

Eq. 1.1-2

$b=1.0551 \text{ in}$ (ineffective width= 0.35127 in)

Eq. 1.1-1

$b_1=0.5027 \text{ in}$, $b_2=0.55242 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=6.6477$	Eq. 1.1-3
$\rho=0.14545$	Eq. 1.1-2
$b=0.45681$ in (ineffective width=2.6839 in)	Eq. 1.1-1
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=6.6477$	Eq. 1.1-3
$\rho=0.14545$	Eq. 1.1-2
$b=0.45681$ in (ineffective width=2.6839 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.82697$	Eq. 1.1-3
$\rho=0.88754$	Eq. 1.1-2
$b=0.34676$ in (ineffective width=0.043938 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00016273$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$d_s=0.33042$ in (lip ineffective width=0.016341 in)	Eq. 1.3-6
$k=3.4239$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4064$ in	
$f=50$ ksi, $k=3.4239$	
$\lambda=1.055$	Eq. 1.1-3
$\rho=0.75023$	Eq. 1.1-2
$b=1.0551$ in (ineffective width=0.35127 in)	Eq. 1.1-1
$b_1=0.5027$ in, $b_2=0.55242$ in	
$A_e=0.13333$ in ² , $F_n=50$ ksi	
$P_n=6.6666$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=7.7814$ in

h/t greater than 200, treat as rational analysis

$f_1=48.865$ ksi, $f_2=-31.942$ ksi

$\psi=0.65368$ Eq. 1.1.2-1

$k=16.352$ Eq. 1.1.2-2

$\lambda=2.6404$ Eq. 1.1-3

$\rho=0.34718$ Eq. 1.1-2

$b_e=2.7015$ in Eq. 1.1-1

$h_o=8$ in, $b_o=1.625$ in, $h_o/b_o=4.9231$

$b_1=0.73939$ in Eq. 1.1.2-6

$b_2=0.89424$ in Eq. 1.1.2-7

Compression width=4.7055 in

Ineffective width=3.0719 in

Element 5: Unstiffened, $w=0.3907$ in

$f_1=48.865$ ksi, $f_2=44.808$ ksi	
$\psi=0.91697$	Eq. 1.2.2-1
$k=0.45984$	Eq. 1.2.2-2
$\lambda=0.79056$	Eq. 1.1-3
$\rho=0.91292$	Eq. 1.1-2
$b=0.35668$ in (ineffective width=0.034024 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.142$	Eq. 1.3-7
$I_a=0.00016247$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$ds=0.3404$ in (lip ineffective width=0.016272 in)	Eq. 1.3-6
$k=3.4254$	Table 1.3-1
Element 4: Partially stiffened, $w=1.4064$ in	
$f=49.838$ ksi, $k=3.4254$	
$\lambda=1.053$	Eq. 1.1-3
$\rho=0.75126$	Eq. 1.1-2
$b=1.0566$ in (ineffective width=0.34983 in)	Eq. 1.1-1
$b_1=0.50418$ in, $b_2=0.55238$ in	
Center of gravity shift: $y=-0.81631$ in	
$S_{xe}=0.53076$ in ³ , $F_y=50$ ksi	
$M_n I=26.538$ k-in	Eq. F3.1-1
$\Omega_b=2$, $\phi_b=0.8$ (rational analysis)	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.3907$ in	
$f_1=48.865$ ksi, $f_2=44.808$ ksi	
$\psi=0.91697$	Eq. 1.2.2-1
$k=0.45984$	Eq. 1.2.2-2
$\lambda=0.79056$	Eq. 1.1-3
$\rho=0.91292$	Eq. 1.1-2
$b=0.35668$ in (ineffective width=0.034024 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.142$	Eq. 1.3-7
$I_a=0.00016247$ in ⁴	Eq. 1.3-8
$I_s=0.00015506$ in ⁴	
$ds=0.3404$ in (lip ineffective width=0.016272 in)	Eq. 1.3-6
$k=3.4254$	Table 1.3-1
Element 2: Partially stiffened, $w=1.4064$ in	
$f=49.838$ ksi, $k=3.4254$	
$\lambda=1.053$	Eq. 1.1-3
$\rho=0.75126$	Eq. 1.1-2
$b=1.0566$ in (ineffective width=0.34983 in)	Eq. 1.1-1
$b_1=0.50418$ in, $b_2=0.55238$ in	
Element 3: Stiffened, $w=7.7814$ in	
h/t greater than 200, treat as rational analysis	
$f_1=48.865$ ksi, $f_2=-31.942$ ksi	
$\psi=0.65368$	Eq. 1.1.2-1
$k=16.352$	Eq. 1.1.2-2
$\lambda=2.6404$	Eq. 1.1-3

$\rho=0.34718$	Eq. 1.1-2
$be=2.7015$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=1.625$ in, $h_o/b_o=4.9231$	
$b_1=0.73939$ in	Eq. 1.1.2-6
$b_2=0.89424$ in	Eq. 1.1.2-7
Compression width=4.7055 in	
Ineffective width=3.0719 in	
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=0.81631$ in	
$S_{xe}=0.53076$ in ³ , $F_y=50$ ksi	
$M_{nl}=26.538$ k-in	Eq. F3.1-1
$\Omega_b=2$, $\phi_b=0.8$ (rational analysis)	

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3907$ in

$f_1=49.372$ ksi, $f_2=49.372$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.82176$	Eq. 1.1-3
$\rho=0.89112$	Eq. 1.1-2
$b=0.34816$ in (ineffective width=0.042541 in)	Eq. 1.1-1

Element 2: Stiffened, $w=1.4064$ in

$f_1=45.597$ ksi, $f_2=-11.052$ ksi	
$\psi=0.24239$	Eq. 1.1.2-1
$k=10.32$	Eq. 1.1.2-2
$\lambda=0.58027$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$be=1.4064$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.43375$ in	Eq. 1.1.2-3
$b_2=0.7032$ in	Eq. 1.1.2-4

Compression width=1.132 in

 $b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3907$ in

$f_1=49.372$ ksi, $f_2=49.372$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=0.82176$	Eq. 1.1-3
$\rho=0.89112$	Eq. 1.1-2
$b=0.34816$ in (ineffective width=0.042541 in)	Eq. 1.1-1

Element 4: Stiffened, $w=1.4064$ in

$f_1=45.597$ ksi, $f_2=-11.052$ ksi	
$\psi=0.24239$	Eq. 1.1.2-1
$k=10.32$	Eq. 1.1.2-2
$\lambda=0.58027$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$be=1.4064$ in	Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$
 $b_1=0.43375$ in Eq. 1.1.2-3
 $b_2=0.7032$ in Eq. 1.1.2-4
 Compression width=1.132 in
 $b_1+b_2 >$ compression width (fully effective)
 Center of gravity shift: $x=-0.0099659$ in
 $S_y=0.083711$ in³, $F_y=50$ ksi
 $M_{nl}=4.1855$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.4064$ in

$f_1=40.281$ ksi, $f_2=-43.49$ ksi

$\psi=1.0796$ Eq. 1.1.2-1

$k=26.148$ Eq. 1.1.2-2

$\lambda=0.34264$ Eq. 1.1-3

$\rho=1$ Eq. 1.1-2

$b_e=1.4064$ in Eq. 1.1-1

$h_o=1.625$ in, $b_o=8$ in, $h_o/b_o=0.20313$

$b_1=0.34474$ in Eq. 1.1.2-3

$b_2=0.7032$ in Eq. 1.1.2-4

Compression width=0.67627 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=45.863$ ksi, $f_2=45.863$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-3

$\lambda=6.3667$ Eq. 1.1-3

$\rho=0.15164$ Eq. 1.1-2

$b=0.47625$ in (ineffective width=2.6644 in) Eq. 1.1-1

$f_1=45.863$ ksi, $f_2=45.863$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-2

$\lambda=6.3667$ Eq. 1.1-3

$\rho=0.15164$ Eq. 1.1-2

$b=0.47625$ in (ineffective width=2.6644 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.4064$ in

$f_1=40.281$ ksi, $f_2=-43.49$ ksi

$\psi=1.0796$ Eq. 1.1.2-1

$k=26.148$ Eq. 1.1.2-2

$\lambda=0.34264$ Eq. 1.1-3

$\rho=1$ Eq. 1.1-2

$b_e=1.4064$ in Eq. 1.1-1

$h_o=1.625$ in, $b_o=8$ in, $h_o/b_o=0.20313$

$b_1=0.34474$ in Eq. 1.1.2-3

$b_2=0.7032$ in Eq. 1.1.2-4

Compression width=0.67627 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.3923$ in

$S_y=0.070833$ in³, $F_y=50$ ksi

$M_n=3.5417$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Bimoment Strength, Stud

$C_w=1.4207$ in⁶, $W_n=4.9977$ in², $F_y=50$ ksi

$B_n=14.214$ k-in²

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

800S162-33

Full Section Properties

Area	0.41350 in ²	Wt.	0.0014059 k/ft	Flat	11.951 in
Ix	3.5823 in ⁴	rx	2.9434 in	Ixy	0.0000 in ⁴
Sx(t)	0.8956 in ³	y(t)	4.0000 in	α	0.000 deg
Sx(b)	0.8956 in ³	y(b)	4.0000 in		
Zx	1.0899 in ³	Height	8.0000 in		
Iy	0.1253 in ⁴	ry	0.5504 in	x _o	-0.9307 in
Sy(l)	0.3613 in ³	x(l)	0.3467 in	y _o	0.0000 in
Sy(r)	0.0980 in ³	x(r)	1.2783 in	jx	4.8302 in
Zy	0.1379 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	3.5823 in ⁴	r ₁	2.9434 in	Cw	1.5670 in ⁶
I ₂	0.1253 in ⁴	r ₂	0.5504 in	J	0.0001650 in ⁴
Ic	3.7075 in ⁴	rc	2.9944 in		
I _o	4.0657 in ⁴	r _o	3.1357 in		

Net Section Properties

Ix	3.5725 in ⁴	rx	3.1432 in	Area	0.36160 in ²
Sx(t)	0.8931 in ³	y(t)	4.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.8931 in ³	y(b)	4.0000 in	α	0.000 deg
Zx	1.0704 in ³				
Iy	0.1188 in ⁴	ry	0.5733 in	x _o	-0.9797 in
Sy(l)	0.3016 in ³	x(l)	0.3940 in	y _o	0.0000 in
Sy(r)	0.0965 in ³	x(r)	1.2310 in	jx	4.3302 in
Zy	0.1373 in ³			jy	0.0000 in
Ic	3.6914 in ⁴	rc	3.1951 in	Cw	1.5635 in ⁶
I _o	4.0384 in ⁴	r _o	3.3419 in	J	0.0001443 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	6.443 k	φMnxo	24.153 k-in	φMnyo	4.259 k-in
Ae	0.15159 in ²	Ixe	2.8803 in ⁴	Iye	0.1169 in ⁴
φTn	17.628 k	Sxe(t)	0.60382 in ³	Sye(l)	0.30008 in ³
		Sxe(b)	0.89176 in ³	Sye(r)	0.09464 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.849 k	φMnxo	24.153 k-in	φMnyo	3.567 k-in
φVnx	2.621 k	Ixe	2.8803 in ⁴	Iye	0.0680 in ⁴
Torsion		Sxe(t)	0.89176 in ³	Sye(l)	0.08863 in ³
φBn	14.117 k-in ²	Sxe(b)	0.60382 in ³	Sye(r)	0.07926 in ³

Stud element 3 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=50.999$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=53.516$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=55.565$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.4135 \text{ in}^2$, $F_y=50.999 \text{ ksi}$

$T_n=21.088 \text{ k}$

Eq. D2-1

$\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.3616 \text{ in}^2$, $F_u=65 \text{ ksi}$

$T_n=23.504 \text{ k}$

Eq. D3-1

$\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2

$V_n=1.4563 \text{ k}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=6.3321 \text{ k}$

Eq. G3-2

$k_v=4.279$

Eq. G3-8

$V_{crh}=0.43457 \text{ k}$

Eq. G3-6

h/t exceeds 200 (rational analysis)

$V_n=1.0613 \text{ k}$ at 90 deg

Eq. G2.1-2

$\Omega_v=2$, $\phi_v=0.8$ (rational analysis)

Stud element 4

$V_n=1.4563 \text{ k}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.389 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.74246$

Eq. 1.1-3

$\rho=0.94778$

Eq. 1.1-2

$b=0.36869 \text{ in}$ (ineffective width= 0.020315 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00022212 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00016972 \text{ in}^4$

$d_s=0.28171 \text{ in}$ (lip ineffective width= 0.086971 in)

Eq. 1.3-6

$k=3.2075$

Table 1.3-1

Element 2: Partially stiffened, $w=1.403 \text{ in}$

$f=50 \text{ ksi}$, $k=3.2075$

$\lambda=0.98047$

Eq. 1.1-3

$\rho=0.79107$

Eq. 1.1-2

$b=1.1099 \text{ in}$ (ineffective width= 0.29313 in)

Eq. 1.1-1

$b_1=0.42403 \text{ in}$, $b_2=0.68584 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=5.9912$	Eq. 1.1-3
$\rho=0.16078$	Eq. 1.1-2
$b=0.50469$ in (ineffective width=2.6343 in)	Eq. 1.1-1
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=5.9912$	Eq. 1.1-3
$\rho=0.16078$	Eq. 1.1-2
$b=0.50469$ in (ineffective width=2.6343 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74246$	Eq. 1.1-3
$\rho=0.94778$	Eq. 1.1-2
$b=0.36869$ in (ineffective width=0.020315 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00022212$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.28171$ in (lip ineffective width=0.086971 in)	Eq. 1.3-6
$k=3.2075$	Table 1.3-1
Element 4: Partially stiffened, $w=1.403$ in	
$f=50$ ksi, $k=3.2075$	
$\lambda=0.98047$	Eq. 1.1-3
$\rho=0.79107$	Eq. 1.1-2
$b=1.1099$ in (ineffective width=0.29313 in)	Eq. 1.1-1
$b_1=0.42403$ in, $b_2=0.68584$ in	
$A_e=0.15159$ in ² , $F_n=50$ ksi	
$P_n=7.5796$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=7.778$ in	
h/t greater than 200, treat as rational analysis	
$f_1=48.836$ ksi, $f_2=-32.693$ ksi	
$\psi=0.66944$	Eq. 1.1.2-1
$k=16.644$	Eq. 1.1.2-2
$\lambda=2.3582$	Eq. 1.1-3
$\rho=0.38449$	Eq. 1.1-2
$b_e=2.9906$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=1.625$ in, $h_o/b_o=4.9231$	
$b_1=0.815$ in	Eq. 1.1.2-6
$b_2=0.97637$ in	Eq. 1.1.2-7
Compression width=4.659 in	
Ineffective width=2.8677 in	
Element 5: Unstiffened, $w=0.389$ in	

$f_1=48.836$ ksi, $f_2=44.759$ ksi	
$\psi=0.91651$	Eq. 1.2.2-1
$k=0.46001$	Eq. 1.2.2-2
$\lambda=0.70944$	Eq. 1.1-3
$\rho=0.97245$	Eq. 1.1-2
$b=0.37828$ in (ineffective width=0.010716 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.148$	Eq. 1.3-7
$I_a=0.00022173$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.28956$ in (lip ineffective width=0.088726 in)	Eq. 1.3-6
$k=3.2091$	Table 1.3-1
Element 4: Partially stiffened, $w=1.403$ in	
$f=49.819$ ksi, $k=3.2091$	
$\lambda=0.97844$	Eq. 1.1-3
$\rho=0.79223$	Eq. 1.1-2
$b=1.1115$ in (ineffective width=0.2915 in)	Eq. 1.1-1
$b_1=0.4254$ in, $b_2=0.6861$ in	
Center of gravity shift: $y=-0.77011$ in	
$S_{xe}=0.60382$ in ³ , $F_y=50$ ksi	
$M_{nl}=30.191$ k-in	Eq. F3.1-1
$\Omega_b=2$, $\phi_b=0.8$ (rational analysis)	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.389$ in	
$f_1=48.836$ ksi, $f_2=44.759$ ksi	
$\psi=0.91651$	Eq. 1.2.2-1
$k=0.46001$	Eq. 1.2.2-2
$\lambda=0.70944$	Eq. 1.1-3
$\rho=0.97245$	Eq. 1.1-2
$b=0.37828$ in (ineffective width=0.010716 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.148$	Eq. 1.3-7
$I_a=0.00022173$ in ⁴	Eq. 1.3-8
$I_s=0.00016972$ in ⁴	
$d_s=0.28956$ in (lip ineffective width=0.088726 in)	Eq. 1.3-6
$k=3.2091$	Table 1.3-1
Element 2: Partially stiffened, $w=1.403$ in	
$f=49.819$ ksi, $k=3.2091$	
$\lambda=0.97844$	Eq. 1.1-3
$\rho=0.79223$	Eq. 1.1-2
$b=1.1115$ in (ineffective width=0.2915 in)	Eq. 1.1-1
$b_1=0.4254$ in, $b_2=0.6861$ in	
Element 3: Stiffened, $w=7.778$ in	
h/t greater than 200, treat as rational analysis	
$f_1=48.836$ ksi, $f_2=-32.693$ ksi	
$\psi=0.66944$	Eq. 1.1.2-1
$k=16.644$	Eq. 1.1.2-2
$\lambda=2.3582$	Eq. 1.1-3

$$\rho=0.38449$$

Eq. 1.1-2

$$be=2.9906 \text{ in}$$

Eq. 1.1-1

$$h_o=8 \text{ in}, b_o=1.625 \text{ in}, h_o/b_o=4.9231$$

$$b_1=0.815 \text{ in}$$

Eq. 1.1.2-6

$$b_2=0.97637 \text{ in}$$

Eq. 1.1.2-7

$$\text{Compression width}=4.659 \text{ in}$$

$$\text{Ineffective width}=2.8677 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.77011 \text{ in}$

$$S_{xe}=0.60382 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=30.191 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=2, \phi_b=0.8 \text{ (rational analysis)}$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.389 \text{ in}$

$$f_1=49.3 \text{ ksi}, f_2=49.3 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.73725$$

Eq. 1.1-3

$$\rho=0.95164$$

Eq. 1.1-2

$$b=0.37019 \text{ in (ineffective width}=0.018812 \text{ in)}$$

Eq. 1.1-1

Element 2: Stiffened, $w=1.403 \text{ in}$

$$f_1=45.507 \text{ ksi}, f_2=-11.277 \text{ ksi}$$

$$\psi=0.2478$$

Eq. 1.1.2-1

$$k=10.381$$

Eq. 1.1.2-2

$$\lambda=0.51993$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$be=1.403 \text{ in}$$

Eq. 1.1-1

$$h_o=1.625 \text{ in}, b_o=0.5 \text{ in}, h_o/b_o=3.25$$

$$b_1=0.43199 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.7015 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.1244 \text{ in}$$

 $b_1+b_2 > \text{compression width}$ (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.389 \text{ in}$

$$f_1=49.3 \text{ ksi}, f_2=49.3 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-2

$$\lambda=0.73725$$

Eq. 1.1-3

$$\rho=0.95164$$

Eq. 1.1-2

$$b=0.37019 \text{ in (ineffective width}=0.018812 \text{ in)}$$

Eq. 1.1-1

Element 4: Stiffened, $w=1.403 \text{ in}$

$$f_1=45.507 \text{ ksi}, f_2=-11.277 \text{ ksi}$$

$$\psi=0.2478$$

Eq. 1.1.2-1

$$k=10.381$$

Eq. 1.1.2-2

$$\lambda=0.51993$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$be=1.403 \text{ in}$$

Eq. 1.1-1

$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$
 $b_1=0.43198$ in Eq. 1.1.2-3
 $b_2=0.7015$ in Eq. 1.1.2-4
 Compression width= 1.1244 in
 $b_1+b_2 >$ compression width (fully effective)
 Center of gravity shift: $x=-0.0043853$ in
 $S_y=0.094639$ in³, $F_y=50$ ksi
 $M_{nl}=4.7319$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.403$ in

$f_1=38.196$ ksi, $f_2=-43.534$ ksi

$\psi=1.1397$ Eq. 1.1.2-1

$k=27.873$ Eq. 1.1.2-2

$\lambda=0.29071$ Eq. 1.1-3

$\rho=1$ Eq. 1.1-2

$b_e=1.403$ in Eq. 1.1-1

$h_o=1.625$ in, $b_o=8$ in, $h_o/b_o=0.20313$

$b_1=0.33891$ in Eq. 1.1.2-3

$b_2=0.7015$ in Eq. 1.1.2-4

Compression width= 0.65569 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=43.655$ ksi, $f_2=43.655$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-3

$\lambda=5.5982$ Eq. 1.1-3

$\rho=0.17161$ Eq. 1.1-2

$b=0.53868$ in (ineffective width= 2.6003 in) Eq. 1.1-1

$f_1=43.655$ ksi, $f_2=43.655$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-2

$\lambda=5.5982$ Eq. 1.1-3

$\rho=0.17161$ Eq. 1.1-2

$b=0.53868$ in (ineffective width= 2.6003 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.403$ in

$f_1=38.197$ ksi, $f_2=-43.534$ ksi

$\psi=1.1397$ Eq. 1.1.2-1

$k=27.873$ Eq. 1.1.2-2

$\lambda=0.29071$ Eq. 1.1-3

$\rho=1$ Eq. 1.1-2

$b_e=1.403$ in Eq. 1.1-1

$h_o=1.625$ in, $b_o=8$ in, $h_o/b_o=0.20313$

$b_1=0.33891$ in Eq. 1.1.2-3

$b_2=0.7015$ in Eq. 1.1.2-4

Compression width= 0.65569 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.37315$ in

$S_y=0.079261$ in³, $F_y=50$ ksi

$M_n=3.963$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Bimoment Strength, Stud

$C_w=1.5635$ in⁶, $W_n=4.9839$ in², $F_y=50$ ksi

$B_n=15.685$ k-in²

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

800S162-43

Full Section Properties

Area	0.53708 in ²	Wt.	0.0018261 k/ft	Flat	11.909 in
Ix	4.6337 in ⁴	rx	2.9373 in	Ixy	0.0000 in ⁴
Sx(t)	1.1584 in ³	y(t)	4.0000 in	α	0.000 deg
Sx(b)	1.1584 in ³	y(b)	4.0000 in		
Zx	1.4124 in ³	Height	8.0000 in		
Iy	0.1600 in ⁴	ry	0.5458 in	x _o	-0.9209 in
Sy(l)	0.4596 in ³	x(l)	0.3482 in	y _o	0.0000 in
Sy(r)	0.1253 in ³	x(r)	1.2768 in	jx	4.8401 in
Zy	0.1778 in ³	Width	1.6250 in	jy	0.0000 in
I ₁	4.6337 in ⁴	r ₁	2.9373 in	Cw	1.9944 in ⁶
I ₂	0.1600 in ⁴	r ₂	0.5458 in	J	0.0003641 in ⁴
Ic	4.7937 in ⁴	rc	2.9876 in		
I _o	5.2492 in ⁴	r _o	3.1263 in		

Net Section Properties

Ix	4.6210 in ⁴	rx	3.1375 in	Area	0.46943 in ²
Sx(t)	1.1553 in ³	y(t)	4.0000 in	Ixy	0.0000 in ⁴
Sx(b)	1.1553 in ³	y(b)	4.0000 in	α	0.000 deg
Zx	1.3870 in ³				
Iy	0.1518 in ⁴	ry	0.5686 in	x _o	-0.9694 in
Sy(l)	0.3842 in ³	x(l)	0.3951 in	y _o	0.0000 in
Sy(r)	0.1234 in ³	x(r)	1.2299 in	jx	4.3374 in
Zy	0.1768 in ³			jy	0.0000 in
Ic	4.7728 in ⁴	rc	3.1886 in	Cw	1.9898 in ⁶
I _o	5.2140 in ⁴	r _o	3.3327 in	J	0.0003183 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	9.065 k	φMnxo	37.960 k-in	φMnyo	6.314 k-in
Ae	0.21330 in ²	Ixe	3.9122 in ⁴	Iye	0.1518 in ⁴
φTn	22.885 k	Sxe(t)	0.8436 in ³	Sye(l)	0.3842 in ³
		Sxe(b)	1.1636 in ³	Sye(r)	0.1234 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.723 k	φMnxo	37.960 k-in	φMnyo	4.750 k-in
φVnx	3.391 k	Ixe	3.9122 in ⁴	Iye	0.0964 in ⁴
Torsion		Sxe(t)	1.1636 in ³	Sye(l)	0.1355 in ³
φBn	18.12 k-in ²	Sxe(b)	0.8436 in ³	Sye(r)	0.1055 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.221$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=54.31$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=56.847$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.53708$ in², $F_y=51.221$ ksi

$T_n=27.51$ k Eq. D2-1
 $\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.46943$ in², $F_u=65$ ksi
 $T_n=30.513$ k Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=1.8839$ k at 180 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=8.2364$ k Eq. G3-2
 $k_v=4.2782$ Eq. G3-8
 $V_{crh}=0.96306$ k Eq. G3-6
 $V_n=1.9147$ k at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=1.8839$ k at 0 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56184$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.00048546$ in⁴ Eq. 1.3-8
 $I_s=0.00021231$ in⁴
 $d_s=0.16781$ in (lip ineffective width=0.21589 in) Eq. 1.3-6
 $k=2.725$ Table 1.3-1

Element 2: Partially stiffened, $w=1.3924$ in
 $f=50$ ksi, $k=2.725$
 $\lambda=0.80992$ Eq. 1.1-3
 $\rho=0.89931$ Eq. 1.1-2
 $b=1.2522$ in (ineffective width=0.1402 in) Eq. 1.1-1
 $b_1=0.27382$ in, $b_2=0.97838$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=4.5886$ Eq. 1.1-3
 $\rho=0.20748$ Eq. 1.1-2
 $b=0.65019$ in (ineffective width=2.4835 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=4.5886$	Eq. 1.1-3
$\rho=0.20748$	Eq. 1.1-2
$b=0.65019$ in (ineffective width=2.4835 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56184$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00048546$ in ⁴	Eq. 1.3-8
$I_s=0.00021231$ in ⁴	
$d_s=0.16781$ in (lip ineffective width=0.21589 in)	Eq. 1.3-6
$k=2.725$	Table 1.3-1
Element 4: Partially stiffened, $w=1.3924$ in	
$f=50$ ksi, $k=2.725$	
$\lambda=0.80992$	Eq. 1.1-3
$\rho=0.89931$	Eq. 1.1-2
$b=1.2522$ in (ineffective width=0.1402 in)	Eq. 1.1-1
$b_1=0.27382$ in, $b_2=0.97838$ in	
$A_e=0.2133$ in ² , $F_n=50$ ksi	
$P_n=10.665$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=7.7674$ in	
$f_1=48.746$ ksi, $f_2=-34.998$ ksi	
$\psi=0.71796$	Eq. 1.1.2-1
$k=17.577$	Eq. 1.1.2-2
$\lambda=1.7565$	Eq. 1.1-3
$\rho=0.498$	Eq. 1.1-2
$b_e=3.8682$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=1.625$ in, $h_o/b_o=4.9231$	
$b_1=1.0404$ in	Eq. 1.1.2-6
$b_2=1.2112$ in	Eq. 1.1.2-7
Compression width=4.5213 in	
Ineffective width=2.2697 in	
Element 5: Unstiffened, $w=0.3837$ in	
$f_1=48.746$ ksi, $f_2=44.609$ ksi	
$\psi=0.91513$	Eq. 1.2.2-1
$k=0.46051$	Eq. 1.2.2-2
$\lambda=0.53606$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.167$	Eq. 1.3-7

$I_a=0.00048019 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00021231 \text{ in}^4$
 $ds=0.16965 \text{ in}$ (lip ineffective width=0.21405 in) Eq. 1.3-6
 $k=2.7322$ Table 1.3-1
 Element 4: Partially stiffened, $w=1.3924 \text{ in}$
 $f=49.757 \text{ ksi}$, $k=2.7322$
 $\lambda=0.80687$ Eq. 1.1-3
 $\rho=0.90143$ Eq. 1.1-2
 $b=1.2552 \text{ in}$ (ineffective width=0.13724 in) Eq. 1.1-1
 $b_1=0.27748 \text{ in}$, $b_2=0.97768 \text{ in}$
 Center of gravity shift: $y=-0.63772 \text{ in}$
 $S_{xe}=0.84356 \text{ in}^3$, $F_y=50 \text{ ksi}$
 $M_{nl}=42.178 \text{ k-in}$ Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837 \text{ in}$
 $f_1=48.746 \text{ ksi}$, $f_2=44.609 \text{ ksi}$
 $\psi=0.91513$ Eq. 1.2.2-1
 $k=0.46051$ Eq. 1.2.2-2
 $\lambda=0.53606$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.167$ Eq. 1.3-7
 $I_a=0.00048019 \text{ in}^4$ Eq. 1.3-8
 $I_s=0.00021231 \text{ in}^4$
 $ds=0.16965 \text{ in}$ (lip ineffective width=0.21405 in) Eq. 1.3-6
 $k=2.7322$ Table 1.3-1

Element 2: Partially stiffened, $w=1.3924 \text{ in}$

$f=49.757 \text{ ksi}$, $k=2.7322$
 $\lambda=0.80687$ Eq. 1.1-3
 $\rho=0.90143$ Eq. 1.1-2
 $b=1.2552 \text{ in}$ (ineffective width=0.13724 in) Eq. 1.1-1
 $b_1=0.27748 \text{ in}$, $b_2=0.97768 \text{ in}$

Element 3: Stiffened, $w=7.7674 \text{ in}$

$f_1=48.746 \text{ ksi}$, $f_2=-34.998 \text{ ksi}$
 $\psi=0.71796$ Eq. 1.1.2-1
 $k=17.577$ Eq. 1.1.2-2
 $\lambda=1.7565$ Eq. 1.1-3
 $\rho=0.49801$ Eq. 1.1-2
 $b_e=3.8682 \text{ in}$ Eq. 1.1-1
 $h_o=8 \text{ in}$, $b_o=1.625 \text{ in}$, $h_o/b_o=4.9231$
 $b_1=1.0404 \text{ in}$ Eq. 1.1.2-6
 $b_2=1.2112 \text{ in}$ Eq. 1.1.2-7
 Compression width=4.5213 in
 Ineffective width=2.2697 in

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.63772 \text{ in}$

$S_{xe}=0.84356 \text{ in}^3$, $F_y=50 \text{ ksi}$
 $M_{nl}=42.178 \text{ k-in}$
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3837 \text{ in}$
 $f_1=55.805 \text{ ksi}$, $f_2=55.805 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59356$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=1.3924 \text{ in}$

$f_1=51.472 \text{ ksi}$, $f_2=-12.886 \text{ ksi}$

$\psi=0.25034$

Eq. 1.1.2-1

$k=10.41$

Eq. 1.1.2-2

$\lambda=0.42043$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.3924 \text{ in}$

Eq. 1.1-1

$h_o=1.625 \text{ in}$, $b_o=0.5 \text{ in}$, $h_o/b_o=3.25$

$b_1=0.42839 \text{ in}$

Eq. 1.1.2-3

$b_2=0.6962 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.1136 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.3837 \text{ in}$

$f_1=55.805 \text{ ksi}$, $f_2=55.805 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.59356$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w=1.3924 \text{ in}$

$f_1=51.472 \text{ ksi}$, $f_2=-12.886 \text{ ksi}$

$\psi=0.25034$

Eq. 1.1.2-1

$k=10.41$

Eq. 1.1.2-2

$\lambda=0.42043$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.3924 \text{ in}$

Eq. 1.1-1

$h_o=1.625 \text{ in}$, $b_o=0.5 \text{ in}$, $h_o/b_o=3.25$

$b_1=0.42839 \text{ in}$

Eq. 1.1.2-3

$b_2=0.6962 \text{ in}$

Eq. 1.1.2-4

Compression width= 1.1136 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0 \text{ in}$

$S_{ye}=0.12341 \text{ in}^3$, $F_y=56.847 \text{ ksi}$

$M_{nl}=7.0156 \text{ k-in}$

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.3924 \text{ in}$

$f_1=32.511$ ksi, $f_2=-43.64$ ksi
 $\psi=1.3423$ Eq. 1.1.2-1
 $k=34.387$ Eq. 1.1.2-2
 $\lambda=0.18385$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=1.3924$ in Eq. 1.1-1
 $h_o=1.625$ in, $b_o=8$ in, $h_o/b_o=0.20313$
 $b_1=0.32066$ in Eq. 1.1.2-3
 $b_2=0.6962$ in Eq. 1.1.2-4

Compression width= 0.59445 in
 $b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=37.638$ ksi, $f_2=37.638$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=3.9811$ Eq. 1.1-3
 $\rho=0.2373$ Eq. 1.1-2
 $b=0.74364$ in (ineffective width= 2.3901 in) Eq. 1.1-1
 $f_1=37.638$ ksi, $f_2=37.638$ ksi

$\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-2
 $\lambda=3.9811$ Eq. 1.1-3
 $\rho=0.2373$ Eq. 1.1-2
 $b=0.74364$ in (ineffective width= 2.3901 in) Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.3924$ in

$f_1=32.511$ ksi, $f_2=-43.64$ ksi
 $\psi=1.3423$ Eq. 1.1.2-1
 $k=34.387$ Eq. 1.1.2-2
 $\lambda=0.18385$ Eq. 1.1-3
 $\rho=1$ Eq. 1.1-2
 $b_e=1.3924$ in Eq. 1.1-1
 $h_o=1.625$ in, $b_o=8$ in, $h_o/b_o=0.20313$
 $b_1=0.32066$ in Eq. 1.1.2-3
 $b_2=0.6962$ in Eq. 1.1.2-4

Compression width= 0.59445 in
 $b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.31638$ in

$S_{ye}=0.10555$ in³, $F_y=50$ ksi

$M_{nl}=5.2774$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=1.9898$ in⁶, $W_n=4.9416$ in², $F_y=50$ ksi

$B_n=20.134$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

800S162-54

Full Section Properties

Area	0.66954 in ²	Wt.	0.0022764 k/ft	Flat	11.829 in
I _x	5.7363 in ⁴	r _x	2.9270 in	I _{xy}	0.0000 in ⁴
S _x (t)	1.4341 in ³	y(t)	4.0000 in	α	0.000 deg
S _x (b)	1.4341 in ³	y(b)	4.0000 in		
Z _x	1.7536 in ³	Height	8.0000 in		
I _y	0.1947 in ⁴	r _y	0.5392 in	x _o	-0.9075 in
S _y (l)	0.5587 in ³	x(l)	0.3484 in	y _o	0.0000 in
S _y (r)	0.1525 in ³	x(r)	1.2766 in	j _x	4.8623 in
Z _y	0.2189 in ³	Width	1.6250 in	j _y	0.0000 in
I ₁	5.7363 in ⁴	r ₁	2.9270 in	C _w	2.4153 in ⁶
I ₂	0.1947 in ⁴	r ₂	0.5392 in	J	0.0007150 in ⁴
I _c	5.9310 in ⁴	r _c	2.9763 in		
I _o	6.4824 in ⁴	r _o	3.1116 in		

Net Section Properties

I _x	5.7204 in ⁴	r _x	3.1280 in	Area	0.58464 in ²
S _x (t)	1.4301 in ³	y(t)	4.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	1.4301 in ³	y(b)	4.0000 in	α	0.000 deg
Z _x	1.7218 in ³				
I _y	0.1847 in ⁴	r _y	0.5621 in	x _o	-0.9557 in
S _y (l)	0.4677 in ³	x(l)	0.3949 in	y _o	0.0000 in
S _y (r)	0.1502 in ³	x(r)	1.2301 in	j _x	4.3559 in
Z _y	0.2174 in ³			j _y	0.0000 in
I _c	5.9051 in ⁴	r _c	3.1781 in	C _w	2.4098 in ⁶
I _o	6.4390 in ⁴	r _o	3.3187 in	J	0.0006243 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	13.156 k	φM _{nxo}	54.221 k-in	φM _{nyo}	7.894 k-in
A _e	0.30954 in ²	I _{xe}	5.2650 in ⁴	I _{ye}	0.1847 in ⁴
φT _n	28.501 k	S _{xe} (t)	1.2049 in ³	S _{ye} (l)	0.4677 in ³
		S _{xe} (b)	1.4503 in ³	S _{ye} (r)	0.1502 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2.833 k	φM _{nxo}	54.221 k-in	φM _{nyo}	6.001 k-in
φV _{nx}	4.102 k	I _{xe}	5.2650 in ⁴	I _{ye}	0.1301 in ⁴
Torsion		S _{xe} (t)	1.4503 in ³	S _{ye} (l)	0.2005 in ³
φB _n	22.147 k-in ²	S _{xe} (b)	1.2049 in ³	S _{ye} (r)	0.1334 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.526$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=55.318$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=58.416$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.66954$ in², $F_y=51.526$ ksi

$$T_n = 34.499 \text{ k} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.58464 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 38.001 \text{ k} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 2.2787 \text{ k at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 10.234 \text{ k} \quad \text{Eq. G3-2}$$

$$k_v = 4.2744 \quad \text{Eq. G3-8}$$

$$V_{crh} = 1.9098 \text{ k} \quad \text{Eq. G3-6}$$

$$V_n = 3.1482 \text{ k at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 2.2787 \text{ k at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.3585 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.41829 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.00033614 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00021732 \text{ in}^4$$

$$d_s = 0.23177 \text{ in (lip ineffective width} = 0.12673 \text{ in)}$$

$$k = 2.9231 \quad \text{Eq. 1.3-6}$$

Table 1.3-1

Element 2: Partially stiffened, $w = 1.342 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.9231$$

$$\lambda = 0.60055 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 3.6269 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.25899 \quad \text{Eq. 1.1-2}$$

$$b = 0.80508 \text{ in (ineffective width} = 2.3034 \text{ in)}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi} \quad \text{Eq. 1.1-1}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 3.6269 \quad \text{Eq. 1.1-3}$$

$\rho=0.25899$	Eq. 1.1-2
$b=0.80508$ in (ineffective width=2.3034 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.41829$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00033614$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.23177$ in (lip ineffective width=0.12673 in)	Eq. 1.3-6
$k=2.9231$	Table 1.3-1
Element 4: Partially stiffened, $w=1.342$ in	
$f=50$ ksi, $k=2.9231$	
$\lambda=0.60055$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
$A_e=0.30954$ in ² , $F_n=50$ ksi	
$P_n=15.477$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=7.717$ in	
$f_1=48.38$ ksi, $f_2=-39.95$ ksi	
$\psi=0.82575$	Eq. 1.1.2-1
$k=19.823$	Eq. 1.1.2-2
$\lambda=1.3045$	Eq. 1.1-3
$\rho=0.63731$	Eq. 1.1-2
$b_e=4.9182$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=1.625$ in, $h_o/b_o=4.9231$	
$b_1=1.2855$ in	Eq. 1.1.2-6
$b_2=1.4082$ in	Eq. 1.1.2-7
Compression width=4.2267 in	
Ineffective width=1.533 in	
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=48.38$ ksi, $f_2=44.277$ ksi	
$\psi=0.91518$	Eq. 1.2.2-1
$k=0.46049$	Eq. 1.2.2-2
$\lambda=0.3976$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.192$	Eq. 1.3-7
$I_a=0.00033044$ in ⁴	Eq. 1.3-8
$I_s=0.00021732$ in ⁴	
$d_s=0.23578$ in (lip ineffective width=0.12272 in)	Eq. 1.3-6
$k=2.9392$	Table 1.3-1

Element 4: Partially stiffened, $w=1.342$ in

$f=49.676$ ksi, $k=2.9392$

$\lambda=0.59696$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Center of gravity shift: $y=-0.36967$ in

$S_{xe}=1.2049$ in³, $F_y=50$ ksi

$M_{nl}=60.245$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585$ in

$f_1=48.38$ ksi, $f_2=44.277$ ksi

$\psi=0.91518$

Eq. 1.2.2-1

$k=0.46049$

Eq. 1.2.2-2

$\lambda=0.3976$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.192$

Eq. 1.3-7

$I_a=0.00033044$ in⁴

Eq. 1.3-8

$I_s=0.00021732$ in⁴

$ds=0.23578$ in (lip ineffective width= 0.12272 in)

Eq. 1.3-6

$k=2.9392$

Table 1.3-1

Element 2: Partially stiffened, $w=1.342$ in

$f=49.676$ ksi, $k=2.9392$

$\lambda=0.59696$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 3: Stiffened, $w=7.717$ in

$f_1=48.38$ ksi, $f_2=-39.95$ ksi

$\psi=0.82575$

Eq. 1.1.2-1

$k=19.823$

Eq. 1.1.2-2

$\lambda=1.3045$

Eq. 1.1-3

$\rho=0.63731$

Eq. 1.1-2

$b_e=4.9182$ in

Eq. 1.1-1

$h_o=8$ in, $b_o=1.625$ in, $h_o/b_o=4.9231$

$b_1=1.2855$ in

Eq. 1.1.2-6

$b_2=1.4082$ in

Eq. 1.1.2-7

Compression width= 4.2267 in

Ineffective width= 1.533 in

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

Center of gravity shift: $y=0.36967$ in

$S_{xe}=1.2049$ in³, $F_y=50$ ksi

$M_{nl}=60.245$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.3585$ in

$f_1=57.072$ ksi, $f_2=57.072$ ksi

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.44689$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=1.342$ in	
$f_1=51.696$ ksi, $f_2=-12.036$ ksi	
$\psi=0.23282$	Eq. 1.1.2-1
$k=10.213$	Eq. 1.1.2-2
$\lambda=0.32669$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.41512$ in	Eq. 1.1.2-3
$b_2=0.92688$ in	Eq. 1.1.2-5
Compression width=1.0886 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.3585$ in	
$f_1=57.072$ ksi, $f_2=57.072$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.44689$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Stiffened, $w=1.342$ in	
$f_1=51.696$ ksi, $f_2=-12.036$ ksi	
$\psi=0.23282$	Eq. 1.1.2-1
$k=10.213$	Eq. 1.1.2-2
$\lambda=0.32669$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=0.5$ in, $h_o/b_o=3.25$	
$b_1=0.41512$ in	Eq. 1.1.2-3
$b_2=0.92688$ in	Eq. 1.1.2-5
Compression width=1.0886 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0$ in	
$S_y=0.15015$ in ³ , $F_y=58.416$ ksi	
$M_n=8.7713$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.342$ in

$f_1=25.945$ ksi, $f_2=-42.756$ ksi

$\psi=1.6479$

$k=46.428$

$\lambda=0.10855$

$\rho=1$

$b_e=1.342$ in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

$h_o=1.625$ in, $b_o=8$ in, $h_o/b_o=0.20313$	
$b_1=0.28873$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width=0.50681 in	
$b_1+b_2 >$ compression width (fully effective)	
Element 3: Treat as two unstiffened elements	
$f_1=31.74$ ksi, $f_2=31.74$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.8897$	Eq. 1.1-3
$\rho=0.31971$	Eq. 1.1-2
$b=0.99381$ in (ineffective width=2.1147 in)	Eq. 1.1-1
$f_1=31.741$ ksi, $f_2=31.741$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=2.8897$	Eq. 1.1-3
$\rho=0.31971$	Eq. 1.1-2
$b=0.99381$ in (ineffective width=2.1147 in)	Eq. 1.1-1
Element 5: No compressive stress (fully effective)	
Element 4: Stiffened, $w=1.342$ in	
$f_1=25.945$ ksi, $f_2=-42.756$ ksi	
$\psi=1.6479$	Eq. 1.1.2-1
$k=46.428$	Eq. 1.1.2-2
$\lambda=0.10855$	Eq. 1.1-3
$\rho=1$	Eq. 1.1-2
$b_e=1.342$ in	Eq. 1.1-1
$h_o=1.625$ in, $b_o=8$ in, $h_o/b_o=0.20313$	
$b_1=0.28873$ in	Eq. 1.1.2-3
$b_2=0.671$ in	Eq. 1.1.2-4
Compression width=0.50681 in	
$b_1+b_2 >$ compression width (fully effective)	
Center of gravity shift: $x=0.25421$ in	
$S_{ye}=0.13336$ in ³ , $F_y=50$ ksi	
$M_{nl}=6.6681$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Stud	
$C_w=2.4098$ in ⁶ , $W_n=4.8964$ in ² , $F_y=50$ ksi	
$B_n=24.608$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

800S200-30

Full Section Properties

Area	0.40449 in ²	Wt.	0.0013753 k/ft	Flat	12.964 in
Ix	3.7019 in ⁴	rx	3.0252 in	Ixy	0.0000 in ⁴
Sx(t)	0.9255 in ³	y(t)	4.0000 in	α	0.000 deg
Sx(b)	0.9255 in ³	y(b)	4.0000 in		
Zx	1.1047 in ³	Height	8.0000 in		
Iy	0.2062 in ⁴	ry	0.7140 in	x _o	-1.2871 in
Sy(l)	0.4231 in ³	x(l)	0.4875 in	y _o	0.0000 in
Sy(r)	0.1364 in ³	x(r)	1.5125 in	jx	4.3924 in
Zy	0.1920 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	3.7019 in ⁴	r ₁	3.0252 in	Cw	2.6118 in ⁶
I ₂	0.2062 in ⁴	r ₂	0.7140 in	J	0.0001312 in ⁴
Ic	3.9081 in ⁴	rc	3.1084 in		
I _o	4.5782 in ⁴	r _o	3.3643 in		

Net Section Properties

Ix	3.6931 in ⁴	rx	3.2133 in	Area	0.35769 in ²
Sx(t)	0.9233 in ³	y(t)	4.0000 in	Ixy	0.0000 in ⁴
Sx(b)	0.9233 in ³	y(b)	4.0000 in	α	0.000 deg
Zx	1.0871 in ³				
Iy	0.1944 in ⁴	ry	0.7373 in	x _o	-1.3508 in
Sy(l)	0.3541 in ³	x(l)	0.5492 in	y _o	0.0000 in
Sy(r)	0.1340 in ³	x(r)	1.4508 in	jx	3.9885 in
Zy	0.1914 in ³			jy	0.0000 in
Ic	3.8876 in ⁴	rc	3.2968 in	Cw	2.6059 in ⁶
I _o	4.5402 in ⁴	r _o	3.5628 in	J	0.0001161 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	5.971 k	φMnxo	22.467 k-in	φMnyo	5.342 k-in
Ae	0.14049 in ²	Ixe	2.7726 in ⁴	Iye	0.1764 in ⁴
φTn	17.437 k	Sxe(t)	0.56168 in ³	Sye(l)	0.34316 in ³
		Sxe(b)	0.90499 in ³	Sye(r)	0.11872 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.676 k	φMnxo	22.467 k-in	φMnyo	4.641 k-in
φVnx	2.609 k	Ixe	2.7726 in ⁴	Iye	0.1050 in ⁴
Torsion		Sxe(t)	0.90498 in ³	Sye(l)	0.10313 in ³
φBn	18.677 k-in ²	Sxe(b)	0.56168 in ³	Sye(r)	0.10689 in ³

Stud element 3 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=50.849$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=52.65$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in²

$F_{yc}=68.69$ ksi

Eq. A3.3.2-2

$F_{ya}=54.15$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.40449 \text{ in}^2$, $F_y=50.849 \text{ ksi}$

$T_n=20.568 \text{ k}$

$\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.35769 \text{ in}^2$, $F_u=65 \text{ ksi}$

$T_n=23.25 \text{ k}$

$\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1.4492 \text{ k}$ at 180 deg

$\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3

$V_{yh}=5.7137 \text{ k}$

$k_v=4.3068$

$V_{crh}=0.32061 \text{ k}$

h/t exceeds 200 (rational analysis)

$V_n=0.84485 \text{ k}$ at 90 deg

$\Omega_v=2$, $\phi_v=0.8$ (rational analysis)

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4

$V_n=1.4492 \text{ k}$ at 0 deg

$\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5157 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

$k=0.43$

$\lambda=1.0916$

$\rho=0.73148$

$b=0.37723 \text{ in}$ (ineffective width= 0.13847 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

$I_a=0.00020486 \text{ in}^4$

$I_s=0.00035659 \text{ in}^4 > I_a$ (no lip reduction)

$k=3.4958$

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Element 2: Partially stiffened, $w=1.7814 \text{ in}$

$f=50 \text{ ksi}$, $k=3.4958$

$\lambda=1.3224$

$\rho=0.63039$

$b=1.123 \text{ in}$ (ineffective width= 0.65843 in)

$b_1=0.56148 \text{ in}$, $b_2=0.56148 \text{ in}$

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

$k=0.43$

$\lambda=6.6477$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

$\rho=0.14545$	Eq. 1.1-2
$b=0.45681$ in (ineffective width=2.6839 in)	Eq. 1.1-1
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=6.6477$	Eq. 1.1-3
$\rho=0.14545$	Eq. 1.1-2
$b=0.45681$ in (ineffective width=2.6839 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723$ in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00020486$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.4958$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7814$ in	
$f=50$ ksi, $k=3.4958$	
$\lambda=1.3224$	Eq. 1.1-3
$\rho=0.63039$	Eq. 1.1-2
$b=1.123$ in (ineffective width=0.65843 in)	Eq. 1.1-1
$b_1=0.56148$ in, $b_2=0.56148$ in	
$A_e=0.14049$ in ² , $F_n=50$ ksi	
$P_n=7.0243$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=7.7814$ in h/t greater than 200, treat as rational analysis $f_1=48.893$ ksi, $f_2=-29.929$ ksi $\psi=0.61214$ Eq. 1.1.2-1 $k=15.604$ Eq. 1.1.2-2 $\lambda=2.7037$ Eq. 1.1-3 $\rho=0.33977$ Eq. 1.1-2 $b_e=2.6439$ in Eq. 1.1-1 $h_o=8$ in, $b_o=2$ in, $h_o/b_o=4$ $b_1=0.73194$ in Eq. 1.1.2-3 $b_2=1.3219$ in Eq. 1.1.2-4

Compression width=4.8267 in

Ineffective width=2.7729 in

Element 5: Unstiffened, $w=0.5157$ in $f_1=48.893$ ksi, $f_2=43.669$ ksi $\psi=0.89316$ Eq. 1.2.2-1

k=0.46872	Eq. 1.2.2-2
$\lambda=1.0339$	Eq. 1.1-3
$\rho=0.76142$	Eq. 1.1-2
b=0.39267 in (ineffective width=0.12303 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.14	Eq. 1.3-7
Ia=0.00020454 in ⁴	Eq. 1.3-8
Is=0.00035659 in ⁴ > Ia (no lip reduction)	
k=3.4958	Table 1.3-1
Element 4: Partially stiffened, w=1.7814 in	
f=49.842 ksi, k=3.4958	
$\lambda=1.3203$	Eq. 1.1-3
$\rho=0.63119$	Eq. 1.1-2
b=1.1244 in (ineffective width=0.65701 in)	Eq. 1.1-1
b ₁ =0.5622 in, b ₂ =0.5622 in	
Center of gravity shift: y=-0.93628 in	
S _{xe} =0.56168 in ³ , F _y =50 ksi	
M _{nl} =28.084 k-in	Eq. F3.1-1
$\Omega b=2$, $\phi b=0.8$ (rational analysis)	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.5157 in	
f ₁ =48.893 ksi, f ₂ =43.669 ksi	
$\psi=0.89316$	Eq. 1.2.2-1
k=0.46872	Eq. 1.2.2-2
$\lambda=1.0339$	Eq. 1.1-3
$\rho=0.76142$	Eq. 1.1-2
b=0.39267 in (ineffective width=0.12303 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.14	Eq. 1.3-7
Ia=0.00020454 in ⁴	Eq. 1.3-8
Is=0.00035659 in ⁴ > Ia (no lip reduction)	
k=3.4958	Table 1.3-1
Element 2: Partially stiffened, w=1.7814 in	
f=49.842 ksi, k=3.4958	
$\lambda=1.3203$	Eq. 1.1-3
$\rho=0.63119$	Eq. 1.1-2
b=1.1244 in (ineffective width=0.65701 in)	Eq. 1.1-1
b ₁ =0.5622 in, b ₂ =0.5622 in	
Element 3: Stiffened, w=7.7814 in	
h/t greater than 200, treat as rational analysis	
f ₁ =48.893 ksi, f ₂ =-29.929 ksi	
$\psi=0.61214$	Eq. 1.1.2-1
k=15.604	Eq. 1.1.2-2
$\lambda=2.7037$	Eq. 1.1-3
$\rho=0.33977$	Eq. 1.1-2
b _e =2.6439 in	Eq. 1.1-1
h _o =8 in, b _o =2 in, h _o /b _o =4	
b ₁ =0.73194 in	Eq. 1.1.2-3

$$b_2 = 1.3219 \text{ in} \quad \text{Eq. 1.1.2-4}$$

$$\text{Compression width} = 4.8267 \text{ in}$$

$$\text{Ineffective width} = 2.7729 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

$$\text{Center of gravity shift: } y = 0.93628 \text{ in}$$

$$S_{xe} = 0.56168 \text{ in}^3, F_y = 50 \text{ ksi}$$

$$M_{nl} = 28.084 \text{ k-in} \quad \text{Eq. F3.1-1}$$

$$\Omega_b = 2, \phi_b = 0.8 \text{ (rational analysis)}$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.5157 \text{ in}$

$$f_1 = 49.475 \text{ ksi}, f_2 = 49.475 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 1.0858 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.73437 \quad \text{Eq. 1.1-2}$$

$$b = 0.37872 \text{ in (ineffective width} = 0.13698 \text{ in)} \quad \text{Eq. 1.1-1}$$

Element 2: Stiffened, $w = 1.7814 \text{ in}$

$$f_1 = 46.322 \text{ ksi}, f_2 = -13.62 \text{ ksi}$$

$$\psi = 0.29403 \quad \text{Eq. 1.1.2-1}$$

$$k = 10.922 \quad \text{Eq. 1.1.2-2}$$

$$\lambda = 0.72012 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.96442 \quad \text{Eq. 1.1-2}$$

$$b_e = 1.718 \text{ in} \quad \text{Eq. 1.1-1}$$

$$h_o = 2 \text{ in}, b_o = 0.625 \text{ in}, h_o/b_o = 3.2$$

$$b_1 = 0.52155 \text{ in} \quad \text{Eq. 1.1.2-3}$$

$$b_2 = 0.85901 \text{ in} \quad \text{Eq. 1.1.2-4}$$

$$\text{Compression width} = 1.3766 \text{ in}$$

$b_1 + b_2 > \text{compression width}$ (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w = 0.5157 \text{ in}$

$$f_1 = 49.475 \text{ ksi}, f_2 = 49.475 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-2}$$

$$\lambda = 1.0858 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.73437 \quad \text{Eq. 1.1-2}$$

$$b = 0.37872 \text{ in (ineffective width} = 0.13698 \text{ in)} \quad \text{Eq. 1.1-1}$$

Element 4: Stiffened, $w = 1.7814 \text{ in}$

$$f_1 = 46.322 \text{ ksi}, f_2 = -13.62 \text{ ksi}$$

$$\psi = 0.29403 \quad \text{Eq. 1.1.2-1}$$

$$k = 10.922 \quad \text{Eq. 1.1.2-2}$$

$$\lambda = 0.72012 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.96442 \quad \text{Eq. 1.1-2}$$

$$b_e = 1.718 \text{ in} \quad \text{Eq. 1.1-1}$$

$$h_o = 2 \text{ in}, b_o = 0.625 \text{ in}, h_o/b_o = 3.2$$

$$b_1 = 0.52155 \text{ in} \quad \text{Eq. 1.1.2-3}$$

$$b_2 = 0.85901 \text{ in} \quad \text{Eq. 1.1.2-4}$$

$$\text{Compression width} = 1.3766 \text{ in}$$

$b_1 + b_2 > \text{compression width (fully effective)}$

Center of gravity shift: $x = -0.035137$ in

$S_y = 0.11872 \text{ in}^3$, $F_y = 50 \text{ ksi}$

$M_n I = 5.936 \text{ k-in}$

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.7814$ in

$f_1 = 44.631 \text{ ksi}$, $f_2 = -42.874 \text{ ksi}$

$\psi = 0.96064$

$k = 22.995$

$\lambda = 0.48714$

$\rho = 1$

$b_e = 1.7814$ in

$h_o = 2$ in, $b_o = 8$ in, $h_o/b_o = 0.25$

$b_1 = 0.44978$ in

$b_2 = 0.8907$ in

Compression width = 0.90858 in

$b_1 + b_2 > \text{compression width (fully effective)}$

Element 3: Treat as two unstiffened elements

$f_1 = 49.234 \text{ ksi}$, $f_2 = 49.234 \text{ ksi}$

$\psi = 1$

$k = 0.43$

$\lambda = 6.5966$

$\rho = 0.14654$

$b = 0.46023$ in (ineffective width = 2.6805 in)

$f_1 = 49.234 \text{ ksi}$, $f_2 = 49.234 \text{ ksi}$

$\psi = 1$

$k = 0.43$

$\lambda = 6.5966$

$\rho = 0.14654$

$b = 0.46023$ in (ineffective width = 2.6805 in)

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.7814$ in

$f_1 = 44.631 \text{ ksi}$, $f_2 = -42.874 \text{ ksi}$

$\psi = 0.96064$

$k = 22.995$

$\lambda = 0.48715$

$\rho = 1$

$b_e = 1.7814$ in

$h_o = 2$ in, $b_o = 8$ in, $h_o/b_o = 0.25$

$b_1 = 0.44978$ in

$b_2 = 0.8907$ in

Compression width = 0.90858 in

$b_1 + b_2 > \text{compression width (fully effective)}$

Center of gravity shift: $x = 0.46869$ in

$S_y = 0.10313 \text{ in}^3$, $F_y = 50 \text{ ksi}$

$M_n I = 5.1566 \text{ k-in}$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

III-530

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=2.6059 \text{ in}^6$, $W_n=6.2787 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=20.752 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

800S200-33

Full Section Properties

Area	0.44810 in ²	Wt.	0.0015235 k/ft	Flat	12.951 in
Ix	4.0961 in ⁴	rx	3.0234 in	Ixy	0.0000 in ⁴
Sx(t)	1.0240 in ³	y(t)	4.0000 in	α	0.000 deg
Sx(b)	1.0240 in ³	y(b)	4.0000 in		
Zx	1.2230 in ³	Height	8.0000 in		
Iy	0.2275 in ⁴	ry	0.7125 in	x _o	-1.2837 in
Sy(l)	0.4664 in ³	x(l)	0.4878 in	y _o	0.0000 in
Sy(r)	0.1504 in ³	x(r)	1.5122 in	jx	4.3928 in
Zy	0.2122 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	4.0961 in ⁴	r ₁	3.0234 in	Cw	2.8778 in ⁶
I ₂	0.2275 in ⁴	r ₂	0.7125 in	J	0.0001788 in ⁴
Ic	4.3236 in ⁴	rc	3.1063 in		
I _o	5.0620 in ⁴	r _o	3.3611 in		

Net Section Properties

Ix	4.0864 in ⁴	rx	3.2115 in	Area	0.39620 in ²
Sx(t)	1.0216 in ³	y(t)	4.0000 in	Ixy	0.0000 in ⁴
Sx(b)	1.0216 in ³	y(b)	4.0000 in	α	0.000 deg
Zx	1.2035 in ³				
Iy	0.2145 in ⁴	ry	0.7358 in	x _o	-1.3473 in
Sy(l)	0.3904 in ³	x(l)	0.5494 in	y _o	0.0000 in
Sy(r)	0.1479 in ³	x(r)	1.4506 in	jx	3.9883 in
Zy	0.2115 in ³			jy	0.0000 in
Ic	4.3009 in ⁴	rc	3.2948 in	Cw	2.8713 in ⁶
I _o	5.0200 in ⁴	r _o	3.5596 in	J	0.0001581 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi					
Axial		Positive Bending		Positive Bending	
φPno	7.125 k	φMnxo	26.621 k-in	φMnyo	6.066 k-in
Ae	0.16766 in ²	Ixe	3.2114 in ⁴	Iye	0.1992 in ⁴
φTn	19.315 k	Sxe(t)	0.6655 in ³	Sye(l)	0.3812 in ³
		Sxe(b)	1.0116 in ³	Sye(r)	0.1348 in ³
Shear		Negative Bending		Negative Bending	
φVny	0.852 k	φMnxo	26.621 k-in	φMnyo	5.353 k-in
φVnx	3.083 k	Ixe	3.2114 in ⁴	Iye	0.1192 in ⁴
Torsion		Sxe(t)	1.0116 in ³	Sye(l)	0.1190 in ³
φBn	20.63 k-in ²	Sxe(b)	0.6655 in ³	Sye(r)	0.1193 in ³

Stud element 3 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=50.922$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=52.88$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in²

$F_{yc}=70.273$ ksi

Eq. A3.3.2-2

$F_{ya}=54.513$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.4481 \text{ in}^2$, $F_y=50.922 \text{ ksi}$

$T_n=22.818 \text{ k}$

Eq. D2-1

$\Omega_t=1.67$, $\phi_t=0.9$

$A_n=0.3962 \text{ in}^2$, $F_u=65 \text{ ksi}$

$T_n=25.753 \text{ k}$

Eq. D3-1

$\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2

$V_n=1.7129 \text{ k}$ at 180 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3

$V_{yh}=6.3321 \text{ k}$

Eq. G3-2

$k_v=4.3065$

Eq. G3-8

$V_{crh}=0.43736 \text{ k}$

Eq. G3-6

h/t exceeds 200 (rational analysis)

$V_n=1.0655 \text{ k}$ at 90 deg

Eq. G2.1-2

$\Omega_v=2$, $\phi_v=0.8$ (rational analysis)

Stud element 4

$V_n=1.7129 \text{ k}$ at 0 deg

Eq. G2.1-2

$\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.98104$

Eq. 1.1-3

$\rho=0.79074$

Eq. 1.1-2

$b=0.40644 \text{ in}$ (ineffective width= 0.10756 in)

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00027958 \text{ in}^4$

Eq. 1.3-8

$I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)

$k=3.4924$

Table 1.3-1

Element 2: Partially stiffened, $w=1.778 \text{ in}$

$f=50 \text{ ksi}$, $k=3.4924$

$\lambda=1.1908$

Eq. 1.1-3

$\rho=0.68464$

Eq. 1.1-2

$b=1.2173 \text{ in}$ (ineffective width= 0.56072 in)

Eq. 1.1-1

$b_1=0.60864 \text{ in}$, $b_2=0.60864 \text{ in}$

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=5.9912$

Eq. 1.1-3

$\rho=0.16078$	Eq. 1.1-2
$b=0.50469$ in (ineffective width=2.6343 in)	Eq. 1.1-1
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=5.9912$	Eq. 1.1-3
$\rho=0.16078$	Eq. 1.1-2
$b=0.50469$ in (ineffective width=2.6343 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00027958$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.4924$	Table 1.3-1
Element 4: Partially stiffened, $w=1.778$ in	
$f=50$ ksi, $k=3.4924$	
$\lambda=1.1908$	Eq. 1.1-3
$\rho=0.68464$	Eq. 1.1-2
$b=1.2173$ in (ineffective width=0.56072 in)	Eq. 1.1-1
$b_1=0.60864$ in, $b_2=0.60864$ in	
$A_e=0.16766$ in ² , $F_n=50$ ksi	
$P_n=8.3828$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=7.778$ in h/t greater than 200, treat as rational analysis $f_1=48.849$ ksi, $f_2=-31.772$ ksi $\psi=0.65041$ Eq. 1.1.2-1 $k=16.292$ Eq. 1.1.2-2 $\lambda=2.3839$ Eq. 1.1-3 $\rho=0.38077$ Eq. 1.1-2 $b_e=2.9616$ in Eq. 1.1-1 $h_o=8$ in, $b_o=2$ in, $h_o/b_o=4$ $b_1=0.81131$ in Eq. 1.1.2-3 $b_2=1.4808$ in Eq. 1.1.2-4

Compression width=4.7128 in

Ineffective width=2.4207 in

Element 5: Unstiffened, $w=0.514$ in $f_1=48.849$ ksi, $f_2=43.522$ ksi $\psi=0.89093$ Eq. 1.2.2-1

k=0.46956	Eq. 1.2.2-2
$\lambda=0.92794$	Eq. 1.1-3
$\rho=0.82216$	Eq. 1.1-2
b=0.42259 in (ineffective width=0.09141 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
S=31.147	Eq. 1.3-7
Ia=0.00027909 in ⁴	Eq. 1.3-8
Is=0.00039155 in ⁴ > Ia (no lip reduction)	
k=3.4924	Table 1.3-1
Element 4: Partially stiffened, w=1.778 in	
f=49.821 ksi, k=3.4924	
$\lambda=1.1886$	Eq. 1.1-3
$\rho=0.68559$	Eq. 1.1-2
b=1.219 in (ineffective width=0.55902 in)	Eq. 1.1-1
b ₁ =0.60949 in, b ₂ =0.60949 in	
Center of gravity shift: y=-0.82548 in	
S _{xe} =0.66551 in ³ , F _y =50 ksi	
M _{nl} =33.276 k-in	Eq. F3.1-1
$\Omega_b=2$, $\phi_b=0.8$ (rational analysis)	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, w=0.514 in	
f ₁ =48.849 ksi, f ₂ =43.522 ksi	
$\psi=0.89093$	Eq. 1.2.2-1
k=0.46956	Eq. 1.2.2-2
$\lambda=0.92794$	Eq. 1.1-3
$\rho=0.82216$	Eq. 1.1-2
b=0.42259 in (ineffective width=0.09141 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
S=31.147	Eq. 1.3-7
Ia=0.00027909 in ⁴	Eq. 1.3-8
Is=0.00039155 in ⁴ > Ia (no lip reduction)	
k=3.4924	Table 1.3-1
Element 2: Partially stiffened, w=1.778 in	
f=49.821 ksi, k=3.4924	
$\lambda=1.1886$	Eq. 1.1-3
$\rho=0.68559$	Eq. 1.1-2
b=1.219 in (ineffective width=0.55902 in)	Eq. 1.1-1
b ₁ =0.60949 in, b ₂ =0.60949 in	
Element 3: Stiffened, w=7.778 in	
h/t greater than 200, treat as rational analysis	
f ₁ =48.849 ksi, f ₂ =-31.772 ksi	
$\psi=0.65041$	Eq. 1.1.2-1
k=16.292	Eq. 1.1.2-2
$\lambda=2.3839$	Eq. 1.1-3
$\rho=0.38077$	Eq. 1.1-2
be=2.9616 in	Eq. 1.1-1
h _o =8 in, b _o =2 in, h _o /b _o =4	
b ₁ =0.81131 in	Eq. 1.1.2-3

$$b_2 = 1.4808 \text{ in} \quad \text{Eq. 1.1.2-4}$$

$$\text{Compression width} = 4.7128 \text{ in}$$

$$\text{Ineffective width} = 2.4207 \text{ in}$$

Element 5: No compressive stress (fully effective)

Element 4: No compressive stress (fully effective)

$$\text{Center of gravity shift: } y = 0.82548 \text{ in}$$

$$S_{xe} = 0.66551 \text{ in}^3, F_y = 50 \text{ ksi}$$

$$M_{nl} = 33.276 \text{ k-in} \quad \text{Eq. F3.1-1}$$

$$\Omega_b = 2, \phi_b = 0.8 \text{ (rational analysis)}$$

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.514 \text{ in}$

$$f_1 = 49.415 \text{ ksi}, f_2 = 49.415 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.97528 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.79405 \quad \text{Eq. 1.1-2}$$

$$b = 0.40814 \text{ in (ineffective width} = 0.10586 \text{ in)} \quad \text{Eq. 1.1-1}$$

Element 2: Stiffened, $w = 1.778 \text{ in}$

$$f_1 = 46.244 \text{ ksi}, f_2 = -13.924 \text{ ksi}$$

$$\psi = 0.30109 \quad \text{Eq. 1.1.2-1}$$

$$k = 11.007 \quad \text{Eq. 1.1.2-2}$$

$$\lambda = 0.64505 \quad \text{Eq. 1.1-3}$$

$$\rho = 1 \quad \text{Eq. 1.1-2}$$

$$b_e = 1.778 \text{ in} \quad \text{Eq. 1.1-1}$$

$$h_o = 2 \text{ in}, b_o = 0.625 \text{ in}, h_o/b_o = 3.2$$

$$b_1 = 0.53861 \text{ in} \quad \text{Eq. 1.1.2-3}$$

$$b_2 = 0.889 \text{ in} \quad \text{Eq. 1.1.2-4}$$

$$\text{Compression width} = 1.3665 \text{ in}$$

$b_1 + b_2 > \text{compression width}$ (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w = 0.514 \text{ in}$

$$f_1 = 49.415 \text{ ksi}, f_2 = 49.415 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-2}$$

$$\lambda = 0.97528 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.79405 \quad \text{Eq. 1.1-2}$$

$$b = 0.40814 \text{ in (ineffective width} = 0.10586 \text{ in)} \quad \text{Eq. 1.1-1}$$

Element 4: Stiffened, $w = 1.778 \text{ in}$

$$f_1 = 46.244 \text{ ksi}, f_2 = -13.924 \text{ ksi}$$

$$\psi = 0.30109 \quad \text{Eq. 1.1.2-1}$$

$$k = 11.007 \quad \text{Eq. 1.1.2-2}$$

$$\lambda = 0.64505 \quad \text{Eq. 1.1-3}$$

$$\rho = 1 \quad \text{Eq. 1.1-2}$$

$$b_e = 1.778 \text{ in} \quad \text{Eq. 1.1-1}$$

$$h_o = 2 \text{ in}, b_o = 0.625 \text{ in}, h_o/b_o = 3.2$$

$$b_1 = 0.53861 \text{ in} \quad \text{Eq. 1.1.2-3}$$

$$b_2 = 0.889 \text{ in} \quad \text{Eq. 1.1.2-4}$$

$$\text{Compression width} = 1.3665 \text{ in}$$

$b_1 + b_2 > \text{compression width (fully effective)}$

Center of gravity shift: $x = -0.026999$ in

$S_y = 0.1348$ in³, $F_y = 50$ ksi

$M_n I = 6.7399$ k-in

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 1.778$ in

$f_1 = 44.459$ ksi, $f_2 = -44.304$ ksi

$\psi = 0.99652$

$k = 23.91$

$\lambda = 0.42914$

$\rho = 1$

$b_e = 1.778$ in

$h_o = 2$ in, $b_o = 8$ in, $h_o/b_o = 0.25$

$b_1 = 0.44489$ in

$b_2 = 0.889$ in

Compression width = 0.89055 in

$b_1 + b_2 > \text{compression width (fully effective)}$

Element 3: Treat as two unstiffened elements

$f_1 = 49.136$ ksi, $f_2 = 49.136$ ksi

$\psi = 1$

$k = 0.43$

$\lambda = 5.9393$

$\rho = 0.16213$

$b = 0.50894$ in (ineffective width = 2.6301 in)

$f_1 = 49.136$ ksi, $f_2 = 49.136$ ksi

$\psi = 1$

$k = 0.43$

$\lambda = 5.9393$

$\rho = 0.16213$

$b = 0.50894$ in (ineffective width = 2.6301 in)

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 1.778$ in

$f_1 = 44.459$ ksi, $f_2 = -44.304$ ksi

$\psi = 0.99652$

$k = 23.91$

$\lambda = 0.42914$

$\rho = 1$

$b_e = 1.778$ in

$h_o = 2$ in, $b_o = 8$ in, $h_o/b_o = 0.25$

$b_1 = 0.44489$ in

$b_2 = 0.889$ in

Compression width = 0.89055 in

$b_1 + b_2 > \text{compression width (fully effective)}$

Center of gravity shift: $x = 0.45216$ in

$S_y = 0.11896$ in³, $F_y = 50$ ksi

$M_n I = 5.9482$ k-in

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

III-538

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=2.8713 \text{ in}^6$, $W_n=6.2633 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=22.922 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

800S200-43

Full Section Properties

Area	0.58218 in ²	Wt.	0.0019794 k/ft	Flat	12.909 in
Ix	5.3021 in ⁴	rx	3.0178 in	Ixy	0.0000 in ⁴
Sx(t)	1.3255 in ³	y(t)	4.0000 in	α	0.000 deg
Sx(b)	1.3255 in ³	y(b)	4.0000 in		
Zx	1.5857 in ³	Height	8.0000 in		
Iy	0.2917 in ⁴	ry	0.7079 in	x _o	-1.2733 in
Sy(l)	0.5967 in ³	x(l)	0.4889 in	y _o	0.0000 in
Sy(r)	0.1931 in ³	x(r)	1.5111 in	jx	4.3939 in
Zy	0.2738 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	5.3021 in ⁴	r ₁	3.0178 in	Cw	3.6767 in ⁶
I ₂	0.2917 in ⁴	r ₂	0.7079 in	J	0.0003947 in ⁴
Ic	5.5938 in ⁴	rc	3.0997 in		
I _o	6.5376 in ⁴	r _o	3.3511 in		

Net Section Properties

Ix	5.2894 in ⁴	rx	3.2063 in	Area	0.51453 in ²
Sx(t)	1.3224 in ³	y(t)	4.0000 in	Ixy	0.0000 in ⁴
Sx(b)	1.3223 in ³	y(b)	4.0000 in	α	0.000 deg
Zx	1.5603 in ³				
Iy	0.2751 in ⁴	ry	0.7312 in	x _o	-1.3365 in
Sy(l)	0.5000 in ³	x(l)	0.5502 in	y _o	0.0000 in
Sy(r)	0.1897 in ³	x(r)	1.4498 in	jx	3.9877 in
Zy	0.2727 in ³			jy	0.0000 in
Ic	5.5645 in ⁴	rc	3.2886 in	Cw	3.6684 in ⁶
I _o	6.4835 in ⁴	r _o	3.5498 in	J	0.0003489 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	10.614 k	φMnxo	46.591 k-in	φMnyo	8.356 k-in
Ae	0.24974 in ²	Ixe	4.6207 in ⁴	Iye	0.2704 in ⁴
φTn	25.083 k	Sxe(t)	1.0354 in ³	Sye(l)	0.4972 in ³
		Sxe(b)	1.3063 in ³	Sye(r)	0.1857 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.730 k	φMnxo	46.591 k-in	φMnyo	7.161 k-in
φVnx	4.304 k	Ixe	4.6207 in ⁴	Iye	0.1679 in ⁴
Torsion		Sxe(t)	1.3063 in ³	Sye(l)	0.1778 in ³
φBn	26.558 k-in ²	Sxe(b)	1.0354 in ³	Sye(r)	0.1591 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.127$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=53.526$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.58218 \text{ in}^2$, $F_y=51.127 \text{ ksi}$
 $T_n=29.765 \text{ k}$
 $\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.51453 \text{ in}^2$, $F_u=65 \text{ ksi}$
 $T_n=33.444 \text{ k}$
 $\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=2.3913 \text{ k}$ at 180 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-1

Stud element 3

$V_{yh}=8.2364 \text{ k}$
 $k_v=4.3058$
 $V_{crh}=0.96926 \text{ k}$
 $V_n=1.9222 \text{ k}$ at 90 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G3-2
Eq. G3-8
Eq. G3-6
Eq. G2.1-2

Stud element 4

$V_n=2.3913 \text{ k}$ at 0 deg
 $\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-1

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=0.74488$
 $\rho=0.94599$
 $b=0.48123 \text{ in}$ (ineffective width= 0.027474 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$
 $I_a=0.00062038 \text{ in}^4$
 $I_s=0.00049474 \text{ in}^4$
 $d_s=0.38377 \text{ in}$ (lip ineffective width= 0.097452 in)
 $k=3.2601$

Eq. 1.3-7
Eq. 1.3-8
Eq. 1.3-6
Table 1.3-1

Element 2: Partially stiffened, $w=1.7674 \text{ in}$

$f=50 \text{ ksi}$, $k=3.2601$
 $\lambda=0.93989$
 $\rho=0.81492$
 $b=1.4403 \text{ in}$ (ineffective width= 0.32712 in)
 $b_1=0.57431 \text{ in}$, $b_2=0.86598 \text{ in}$

Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$
 $\psi=1$
 $k=0.43$
 $\lambda=4.5886$
 $\rho=0.20748$
 $b=0.65019 \text{ in}$ (ineffective width= 2.4835 in)

Eq. 1.2.2-1
Eq. 1.2.2-3
Eq. 1.1-3
Eq. 1.1-2
Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=4.5886$

Eq. 1.1-3

$\rho=0.20748$

Eq. 1.1-2

$b=0.65019$ in (ineffective width=2.4835 in)

Eq. 1.1-1

Element 5: Unstiffened, $w=0.5087$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.74488$

Eq. 1.1-3

$\rho=0.94599$

Eq. 1.1-2

$b=0.48123$ in (ineffective width=0.027474 in)

Eq. 1.1-1

Element 4: Check for lip stiffener reduction

$S=31.091$

Eq. 1.3-7

$I_a=0.00062038$ in⁴

Eq. 1.3-8

$I_s=0.00049474$ in⁴

$ds=0.38377$ in (lip ineffective width=0.097452 in)

Eq. 1.3-6

$k=3.2601$

Table 1.3-1

Element 4: Partially stiffened, $w=1.7674$ in

$f=50$ ksi, $k=3.2601$

$\lambda=0.93989$

Eq. 1.1-3

$\rho=0.81492$

Eq. 1.1-2

$b=1.4403$ in (ineffective width=0.32712 in)

Eq. 1.1-1

$b_1=0.57431$ in, $b_2=0.86598$ in

$A_e=0.24974$ in², $F_n=50$ ksi

$P_n=12.487$ k

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: No compressive stress (fully effective)

Element 3: Stiffened, $w=7.7674$ in

$f_1=48.697$ ksi, $f_2=-38.351$ ksi

$\psi=0.78755$

Eq. 1.1.2-1

$k=18.999$

Eq. 1.1.2-2

$\lambda=1.6886$

Eq. 1.1-3

$\rho=0.51504$

Eq. 1.1-2

$b_e=4.0005$ in

Eq. 1.1-1

$h_o=8$ in, $b_o=2$ in, $h_o/b_o=4$

$b_1=1.0562$ in

Eq. 1.1.2-3

$b_2=2.0003$ in

Eq. 1.1.2-4

Compression width=4.3453 in

Ineffective width=1.2888 in

Element 5: Unstiffened, $w=0.5087$ in

$f_1=48.697$ ksi, $f_2=42.996$ ksi

$\psi=0.88293$

Eq. 1.2.2-1

$k=0.47264$

Eq. 1.2.2-2

$\lambda=0.70117$

Eq. 1.1-3

$\rho=0.97871$	Eq. 1.1-2
$b=0.49787$ in (ineffective width=0.010832 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.17$	Eq. 1.3-7
$I_a=0.00061886$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.39802$ in (lip ineffective width=0.099849 in)	Eq. 1.3-6
$k=3.2624$	Table 1.3-1
Element 4: Partially stiffened, $w=1.7674$ in	
$f=49.747$ ksi, $k=3.2624$	
$\lambda=0.93718$	Eq. 1.1-3
$\rho=0.81655$	Eq. 1.1-2
$b=1.4432$ in (ineffective width=0.32423 in)	Eq. 1.1-1
$b_1=0.57687$ in, $b_2=0.8663$ in	
Center of gravity shift: $y=-0.46286$ in	
$S_{xe}=1.0354$ in ³ , $F_y=50$ ksi	
$M_{nl}=51.768$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

Negative Flexural Strength about X-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087$ in

$f_1=48.697$ ksi, $f_2=42.996$ ksi

$\psi=0.88293$

$k=0.47264$

$\lambda=0.70117$

$\rho=0.97871$

$b=0.49787$ in (ineffective width=0.010832 in)

Element 2: Check for lip stiffener reduction

$S=31.17$

$I_a=0.00061886$ in⁴

$I_s=0.00049474$ in⁴

$d_s=0.39802$ in (lip ineffective width=0.099849 in)

$k=3.2624$

Element 2: Partially stiffened, $w=1.7674$ in

$f=49.747$ ksi, $k=3.2624$

$\lambda=0.93718$

$\rho=0.81655$

$b=1.4432$ in (ineffective width=0.32423 in)

$b_1=0.57687$ in, $b_2=0.8663$ in

Element 3: Stiffened, $w=7.7674$ in

$f_1=48.697$ ksi, $f_2=-38.351$ ksi

$\psi=0.78755$

$k=18.999$

$\lambda=1.6886$

$\rho=0.51504$

$b_e=4.0005$ in

$h_o=8$ in, $b_o=2$ in, $h_o/b_o=4$

$b_1=1.0562$ in

$b_2=2.0003$ in

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.3-7

Eq. 1.3-8

Eq. 1.3-6

Table 1.3-1

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Compression width=4.3453 in
 Ineffective width=1.2888 in
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.46286$ in
 $S_{xe}=1.0354$ in³, $F_y=50$ ksi
 $M_{nl}=51.768$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087$ in $f_1=49.226$ ksi, $f_2=49.226$ ksi $\psi=1$

Eq. 1.2.2-1

 $k=0.43$

Eq. 1.2.2-3

 $\lambda=0.73909$

Eq. 1.1-3

 $\rho=0.95027$

Eq. 1.1-2

 $b=0.4834$ in (ineffective width= 0.025297 in)

Eq. 1.1-1

Element 2: Stiffened, $w=1.7674$ in $f_1=46.007$ ksi, $f_2=-14.681$ ksi $\psi=0.3191$

Eq. 1.1.2-1

 $k=11.229$

Eq. 1.1.2-2

 $\lambda=0.4858$

Eq. 1.1-3

 $\rho=1$

Eq. 1.1-2

 $b_e=1.7674$ in

Eq. 1.1-1

 $h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$ $b_1=0.53249$ in

Eq. 1.1.2-3

 $b_2=0.8837$ in

Eq. 1.1.2-4

Compression width= 1.3399 in $b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in $f_1=49.226$ ksi, $f_2=49.226$ ksi $\psi=1$

Eq. 1.2.2-1

 $k=0.43$

Eq. 1.2.2-3

 $\lambda=0.73909$

Eq. 1.1-3

 $\rho=0.95027$

Eq. 1.1-2

 $b=0.4834$ in (ineffective width= 0.025297 in)

Eq. 1.1-1

Element 4: Stiffened, $w=1.7674$ in $f_1=46.007$ ksi, $f_2=-14.681$ ksi $\psi=0.3191$

Eq. 1.1.2-1

 $k=11.229$

Eq. 1.1.2-2

 $\lambda=0.4858$

Eq. 1.1-3

 $\rho=1$

Eq. 1.1-2

 $b_e=1.7674$ in

Eq. 1.1-1

 $h_o=2$ in, $b_o=0.625$ in, $h_o/b_o=3.2$ $b_1=0.53249$ in

Eq. 1.1.2-3

 $b_2=0.8837$ in

Eq. 1.1.2-4

Compression width= 1.3399 in $b_1+b_2 >$ compression width (fully effective)Center of gravity shift: $x=-0.0063575$ in $S_{ye}=0.1857$ in³, $F_y=50$ ksi

Mn1=9.2849 k-in
 $\Omega b=1.67$, $\phi b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.7674$ in

$f_1=39.205$ ksi, $f_2=-44.492$ ksi

$\psi=1.1349$

$k=27.73$

$\lambda=0.28537$

$\rho=1$

$b_e=1.7674$ in

$h_o=2$ in, $b_o=8$ in, $h_o/b_o=0.25$

$b_1=0.42744$ in

$b_2=0.8837$ in

Compression width=0.82787 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=43.645$ ksi, $f_2=43.645$ ksi

$\psi=1$

$k=0.43$

$\lambda=4.2871$

$\rho=0.22129$

$b=0.69345$ in (ineffective width=2.4402 in)

$f_1=43.645$ ksi, $f_2=43.645$ ksi

$\psi=1$

$k=0.43$

$\lambda=4.2871$

$\rho=0.22129$

$b=0.69345$ in (ineffective width=2.4402 in)

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.7674$ in

$f_1=39.205$ ksi, $f_2=-44.492$ ksi

$\psi=1.1349$

$k=27.73$

$\lambda=0.28537$

$\rho=1$

$b_e=1.7674$ in

$h_o=2$ in, $b_o=8$ in, $h_o/b_o=0.25$

$b_1=0.42744$ in

$b_2=0.8837$ in

Compression width=0.82787 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.39448$ in

$S_y=0.15914$ in³, $F_y=50$ ksi

Mn1=7.9568 k-in

$\Omega b=1.67$, $\phi b=0.9$

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Bimoment Strength, Stud

$C_w=3.6684$ in⁶, $W_n=6.2158$ in², $F_y=50$ ksi

$B_n=29.509$ k-in²

G8.1-1

III-546

$\Omega_b=1.67$, $\phi_b=0.9$

800S200-54

Full Section Properties

Area	0.72614 in ²	Wt.	0.0024689 k/ft	Flat	12.829 in
Ix	6.5731 in ⁴	rx	3.0087 in	Ixy	0.0000 in ⁴
Sx(t)	1.6433 in ³	y(t)	4.0000 in	α	0.000 deg
Sx(b)	1.6433 in ³	y(b)	4.0000 in		
Zx	1.9709 in ³	Height	8.0000 in		
Iy	0.3572 in ⁴	ry	0.7014 in	x _o	-1.2594 in
Sy(l)	0.7309 in ³	x(l)	0.4887 in	y _o	0.0000 in
Sy(r)	0.2364 in ³	x(r)	1.5113 in	jx	4.4020 in
Zy	0.3380 in ³	Width	2.0000 in	jy	0.0000 in
I ₁	6.5731 in ⁴	r ₁	3.0087 in	Cw	4.4805 in ⁶
I ₂	0.3572 in ⁴	r ₂	0.7014 in	J	0.0007754 in ⁴
Ic	6.9303 in ⁴	rc	3.0894 in		
I _o	8.0821 in ⁴	r _o	3.3362 in		

Net Section Properties

Ix	6.5572 in ⁴	rx	3.1978 in	Area	0.64124 in ²
Sx(t)	1.6393 in ³	y(t)	4.0000 in	Ixy	0.0000 in ⁴
Sx(b)	1.6393 in ³	y(b)	4.0000 in	α	0.000 deg
Zx	1.9390 in ³				
Iy	0.3368 in ⁴	ry	0.7247 in	x _o	-1.3223 in
Sy(l)	0.6127 in ³	x(l)	0.5497 in	y _o	0.0000 in
Sy(r)	0.2322 in ³	x(r)	1.4503 in	jx	3.9934 in
Zy	0.3362 in ³			jy	0.0000 in
Ic	6.8940 in ⁴	rc	3.2789 in	Cw	4.4703 in ⁶
I _o	8.0152 in ⁴	r _o	3.5355 in	J	0.0006847 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	14.247 k	φMnxo	66.742 k-in	φMnyo	11.877 k-in
Ae	0.33521 in ²	Ixe	6.1846 in ⁴	Iye	0.3368 in ⁴
φTn	31.260 k	Sxe(t)	1.4831 in ³	Sye(l)	0.6127 in ³
		Sxe(b)	1.6147 in ³	Sye(r)	0.2322 in ³
Shear		Negative Bending		Negative Bending	
φVny	2.844 k	φMnxo	66.742 k-in	φMnyo	9.098 k-in
φVnx	5.248 k	Ixe	6.1846 in ⁴	Iye	0.2266 in ⁴
Torsion		Sxe(t)	1.6147 in ³	Sye(l)	0.2578 in ³
φBn	32.634 k-in ²	Sxe(b)	1.4831 in ³	Sye(r)	0.2022 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=51.407$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=54.356$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_{ya}=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$A_g=0.72614$ in², $F_y=51.407$ ksi

$T_n=37.329$ k
 $\Omega_t=1.67$, $\phi_t=0.9$ Eq. D2-1

$A_n=0.64124$ in², $F_u=65$ ksi
 $T_n=41.68$ k Eq. D3-1
 $\Omega_t=2$, $\phi_t=0.75$

Shear Strength

Stud element 2
 $V_n=2.9155$ k at 180 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 3
 $V_{yh}=10.234$ k Eq. G3-2
 $k_v=4.3021$ Eq. G3-8
 $V_{crh}=1.9221$ k Eq. G3-6
 $V_n=3.1602$ k at 90 deg Eq. G2.1-2
 $\Omega_v=1.67$, $\phi_v=0.9$

Stud element 4
 $V_n=2.9155$ k at 0 deg Eq. G2.1-1
 $\Omega_v=1.67$, $\phi_v=0.9$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835$ in
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=0.56413$ Eq. 1.1-3
 $\lambda<0.673$ (fully effective) Eq. 1.1-1

Element 2: Check for lip stiffener reduction
 $S=31.091$ Eq. 1.3-7
 $I_a=0.0011127$ in⁴ Eq. 1.3-8
 $I_s=0.00053312$ in⁴
 $d_s=0.23166$ in (lip ineffective width=0.25184 in) Eq. 1.3-6
 $k=2.7693$ Table 1.3-1

Element 2: Partially stiffened, $w=1.717$ in
 $f=50$ ksi, $k=2.7693$
 $\lambda=0.78941$ Eq. 1.1-3
 $\rho=0.91373$ Eq. 1.1-2
 $b=1.5689$ in (ineffective width=0.14812 in) Eq. 1.1-1
 $b_1=0.37585$ in, $b_2=1.193$ in

Element 3: Treat as two unstiffened elements
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1
 $k=0.43$ Eq. 1.2.2-3
 $\lambda=3.6269$ Eq. 1.1-3
 $\rho=0.25899$ Eq. 1.1-2
 $b=0.80508$ in (ineffective width=2.3034 in) Eq. 1.1-1
 $f_1=50$ ksi, $f_2=50$ ksi
 $\psi=1$ Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=3.6269$	Eq. 1.1-3
$\rho=0.25899$	Eq. 1.1-2
$b=0.80508$ in (ineffective width=2.3034 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0011127$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.23166$ in (lip ineffective width=0.25184 in)	Eq. 1.3-6
$k=2.7693$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717$ in	
$f=50$ ksi, $k=2.7693$	
$\lambda=0.78941$	Eq. 1.1-3
$\rho=0.91373$	Eq. 1.1-2
$b=1.5689$ in (ineffective width=0.14812 in)	Eq. 1.1-1
$b_1=0.37585$ in, $b_2=1.193$ in	
$A_e=0.33521$ in ² , $F_n=50$ ksi	
$P_n=16.761$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=7.717$ in	
$f_1=48.303$ ksi, $f_2=-44.262$ ksi	
$\psi=0.91635$	Eq. 1.1.2-1
$k=21.908$	Eq. 1.1.2-2
$\lambda=1.2398$	Eq. 1.1-3
$\rho=0.66344$	Eq. 1.1-2
$b_e=5.1197$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=2$ in, $h_o/b_o=4$	
$b_1=1.3073$ in	Eq. 1.1.2-3
$b_2=2.5599$ in	Eq. 1.1.2-4
Compression width=4.0269 in	
Ineffective width=0.15979 in	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=48.303$ ksi, $f_2=42.503$ ksi	
$\psi=0.87993$	Eq. 1.2.2-1
$k=0.4738$	Eq. 1.2.2-2
$\lambda=0.52823$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.197$	Eq. 1.3-7

$I_a=0.0010957 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00053312 \text{ in}^4$	
$d_s=0.23526 \text{ in}$ (lip ineffective width=0.24824 in)	Eq. 1.3-6
$k=2.7801$	Table 1.3-1
Element 4: Partially stiffened, $w=1.717 \text{ in}$	
$f=49.661 \text{ ksi}$, $k=2.7801$	
$\lambda=0.7852$	Eq. 1.1-3
$\rho=0.91673$	Eq. 1.1-2
$b=1.574 \text{ in}$ (ineffective width=0.14297 in)	Eq. 1.1-1
$b_1=0.38294 \text{ in}$, $b_2=1.1911 \text{ in}$	
Center of gravity shift: $y=-0.16991 \text{ in}$	
$S_{xe}=1.4831 \text{ in}^3$, $F_y=50 \text{ ksi}$	
$M_{nl}=74.157 \text{ k-in}$	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.4835 \text{ in}$	
$f_1=48.303 \text{ ksi}$, $f_2=42.503 \text{ ksi}$	
$\psi=0.87993$	Eq. 1.2.2-1
$k=0.4738$	Eq. 1.2.2-2
$\lambda=0.52823$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.197$	Eq. 1.3-7
$I_a=0.0010957 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00053312 \text{ in}^4$	
$d_s=0.23526 \text{ in}$ (lip ineffective width=0.24824 in)	Eq. 1.3-6
$k=2.7801$	Table 1.3-1
Element 2: Partially stiffened, $w=1.717 \text{ in}$	
$f=49.661 \text{ ksi}$, $k=2.7801$	
$\lambda=0.7852$	Eq. 1.1-3
$\rho=0.91673$	Eq. 1.1-2
$b=1.574 \text{ in}$ (ineffective width=0.14297 in)	Eq. 1.1-1
$b_1=0.38294 \text{ in}$, $b_2=1.1911 \text{ in}$	
Element 3: Stiffened, $w=7.717 \text{ in}$	
$f_1=48.303 \text{ ksi}$, $f_2=-44.262 \text{ ksi}$	
$\psi=0.91635$	Eq. 1.1.2-1
$k=21.908$	Eq. 1.1.2-2
$\lambda=1.2398$	Eq. 1.1-3
$\rho=0.66344$	Eq. 1.1-2
$b_e=5.1197 \text{ in}$	Eq. 1.1-1
$h_o=8 \text{ in}$, $b_o=2 \text{ in}$, $h_o/b_o=4$	
$b_1=1.3073 \text{ in}$	Eq. 1.1.2-3
$b_2=2.5599 \text{ in}$	Eq. 1.1.2-4
Compression width=4.0269 in	
Ineffective width=0.15979 in	
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=0.16991 \text{ in}$	

$$S_{xe}=1.4831 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_n I=74.157 \text{ k-in}$$

$$\Omega_b=1.67, \phi_b=0.9$$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.4835 \text{ in}$

$$f_1=55.716 \text{ ksi}, f_2=55.716 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.59551$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 2: Stiffened, $w=1.717 \text{ in}$

$$f_1=51.281 \text{ ksi}, f_2=-15.995 \text{ ksi}$$

$$\psi=0.3119$$

Eq. 1.1.2-1

$$k=11.14$$

Eq. 1.1.2-2

$$\lambda=0.39861$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.717 \text{ in}$$

Eq. 1.1-1

$$h_o=2 \text{ in}, b_o=0.625 \text{ in}, h_o/b_o=3.2$$

$$b_1=0.51843 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.8585 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.3088 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.4835 \text{ in}$

$$f_1=55.716 \text{ ksi}, f_2=55.716 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-3

$$\lambda=0.59551$$

Eq. 1.1-3

$$\lambda < 0.673 \text{ (fully effective)}$$

Eq. 1.1-1

Element 4: Stiffened, $w=1.717 \text{ in}$

$$f_1=51.281 \text{ ksi}, f_2=-15.995 \text{ ksi}$$

$$\psi=0.3119$$

Eq. 1.1.2-1

$$k=11.14$$

Eq. 1.1.2-2

$$\lambda=0.39861$$

Eq. 1.1-3

$$\rho=1$$

Eq. 1.1-2

$$b_e=1.717 \text{ in}$$

Eq. 1.1-1

$$h_o=2 \text{ in}, b_o=0.625 \text{ in}, h_o/b_o=3.2$$

$$b_1=0.51843 \text{ in}$$

Eq. 1.1.2-3

$$b_2=0.8585 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=1.3088 \text{ in}$$

$$b_1+b_2 > \text{compression width (fully effective)}$$

Center of gravity shift: $x=0 \text{ in}$

$$S_{ye}=0.23223 \text{ in}^3, F_y=56.825 \text{ ksi}$$

$$M_n I=13.196 \text{ k-in}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=1.717$ in

$f_1=32.844$ ksi, $f_2=-43.693$ ksi

$\psi=1.3303$

Eq. 1.1.2-1

$k=33.969$

Eq. 1.1.2-2

$\lambda=0.18268$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.717$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=8$ in, $h_o/b_o=0.25$

$b_1=0.39651$ in

Eq. 1.1.2-3

$b_2=0.8585$ in

Eq. 1.1.2-4

Compression width= 0.73682 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=37.89$ ksi, $f_2=37.89$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=3.1573$

Eq. 1.1-3

$\rho=0.29466$

Eq. 1.1-2

$b=0.91594$ in (ineffective width= 2.1926 in)

Eq. 1.1-1

$f_1=37.89$ ksi, $f_2=37.89$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=3.1573$

Eq. 1.1-3

$\rho=0.29466$

Eq. 1.1-2

$b=0.91594$ in (ineffective width= 2.1926 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=1.717$ in

$f_1=32.844$ ksi, $f_2=-43.692$ ksi

$\psi=1.3303$

Eq. 1.1.2-1

$k=33.969$

Eq. 1.1.2-2

$\lambda=0.18268$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=1.717$ in

Eq. 1.1-1

$h_o=2$ in, $b_o=8$ in, $h_o/b_o=0.25$

$b_1=0.39651$ in

Eq. 1.1.2-3

$b_2=0.8585$ in

Eq. 1.1.2-4

Compression width= 0.73682 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.32926$ in

$S_y=0.20217$ in³, $F_y=50$ ksi

$M_{nl}=10.109$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=4.4703$ in⁶, $W_n=6.1642$ in², $F_y=50$ ksi

$B_n=36.26$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

800S250-30

Full Section Properties

Area	0.43569 in ²	Wt.	0.0014813 k/ft	Flat	13.964 in
I _x	4.1972 in ⁴	r _x	3.1038 in	I _{xy}	0.0000 in ⁴
S _x (t)	1.0493 in ³	y(t)	4.0000 in	α	0.000 deg
S _x (b)	1.0493 in ³	y(b)	4.0000 in		
Z _x	1.2290 in ³	Height	8.0000 in		
I _y	0.3521 in ⁴	r _y	0.8990 in	x _o	-1.6851 in
S _y (l)	0.5390 in ³	x(l)	0.6533 in	y _o	0.0000 in
S _y (r)	0.1907 in ³	x(r)	1.8467 in	j _x	4.3035 in
Z _y	0.2786 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	4.1972 in ⁴	r ₁	3.1038 in	C _w	4.3798 in ⁶
I ₂	0.3521 in ⁴	r ₂	0.8990 in	J	0.0001414 in ⁴
I _c	4.5493 in ⁴	r _c	3.2314 in		
I _o	5.7865 in ⁴	r _o	3.6444 in		

Net Section Properties

I _x	4.1884 in ⁴	r _x	3.2818 in	Area	0.38889 in ²
S _x (t)	1.0471 in ³	y(t)	4.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	1.0471 in ³	y(b)	4.0000 in	α	0.000 deg
Z _x	1.2114 in ³				
I _y	0.3308 in ⁴	r _y	0.9223 in	x _o	-1.7641 in
S _y (l)	0.4531 in ³	x(l)	0.7301 in	y _o	0.0000 in
S _y (r)	0.1869 in ³	x(r)	1.7699 in	j _x	3.9768 in
Z _y	0.2780 in ³			j _y	0.0000 in
I _c	4.5192 in ⁴	r _c	3.4090 in	C _w	4.3701 in ⁶
I _o	5.7294 in ⁴	r _o	3.8383 in	J	0.0001262 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	6.241 k	φM _{nxo}	23.638 k-in	φM _{nyo}	7.024 k-in
A _e	0.14685 in ²	I _{xe}	2.9871 in ⁴	I _{ye}	0.2886 in ⁴
φT _n	18.958 k	S _{xe} (t)	0.5909 in ³	S _{ye} (l)	0.4431 in ³
		S _{xe} (b)	1.0142 in ³	S _{ye} (r)	0.1561 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.679 k	φM _{nxo}	23.638 k-in	φM _{nyo}	6.412 k-in
φV _{nx}	2.734 k	I _{xe}	2.9871 in ⁴	I _{ye}	0.1809 in ⁴
Torsion		S _{xe} (t)	1.0142 in ³	S _{ye} (l)	0.1425 in ³
φB _n	25.241 k-in ²	S _{xe} (b)	0.5909 in ³	S _{ye} (r)	0.1470 in ³

Stud element 3 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Stud corner 2

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Stud corner 3

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Stud corner 4

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Stud corner 5

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Fya=50.788 ksi

Eq. A3.3.2-1

Max compression stress allowed: Fya=50 ksi

Bending about X-axis

Stud corner 2

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Stud corner 3

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Stud corner 4

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Stud corner 5

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Fya=52.136 ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: Fya=50 ksi

Max compression stress allowed for negative bending: Fya=50 ksi

Bending about Y-axis

Stud corner 2

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Stud corner 5

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Fya=54.15 ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: Fya=50 ksi

Max compression stress allowed for negative bending: Fya=50 ksi

Axial Tension Strength

$$A_g = 0.43569 \text{ in}^2, F_y = 50.788 \text{ ksi}$$

$$T_n = 22.128 \text{ k}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

Eq. D2-1

$$A_n = 0.38889 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 25.278 \text{ k}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Eq. D3-1

Shear Strength

Stud element 2

$$V_n = 1.519 \text{ k at } 180 \text{ deg}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Eq. G2.1-2

Stud element 3

$$V_{yh} = 5.7137 \text{ k}$$

$$k_v = 4.3434$$

$$V_{crh} = 0.32334 \text{ k}$$

h/t exceeds 200 (rational analysis)

$$V_n = 0.84933 \text{ k at } 90 \text{ deg}$$

$$\Omega_v = 2, \phi_v = 0.8 \text{ (rational analysis)}$$

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4

$$V_n = 1.519 \text{ k at } 0 \text{ deg}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.5157 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1$$

$$k = 0.43$$

$$\lambda = 1.0916$$

$$\rho = 0.73148$$

$$b = 0.37723 \text{ in (ineffective width} = 0.13847 \text{ in)}$$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S = 31.091$$

$$I_a = 0.00026103 \text{ in}^4$$

$$I_s = 0.00035659 \text{ in}^4 > I_a \text{ (no lip reduction)}$$

$$k = 3.8802$$

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Element 2: Partially stiffened, $w = 2.2814 \text{ in}$

$$f = 50 \text{ ksi}, k = 3.8802$$

$$\lambda = 1.6075$$

$$\rho = 0.53694$$

$$b = 1.225 \text{ in (ineffective width} = 1.0564 \text{ in)}$$

$$b_1 = 0.61249 \text{ in}, b_2 = 0.61249 \text{ in}$$

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1$$

$$k = 0.43$$

$$\lambda = 6.6477$$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

$\rho=0.14545$	Eq. 1.1-2
$b=0.45681$ in (ineffective width=2.6839 in)	Eq. 1.1-1
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=6.6477$	Eq. 1.1-3
$\rho=0.14545$	Eq. 1.1-2
$b=0.45681$ in (ineffective width=2.6839 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0916$	Eq. 1.1-3
$\rho=0.73148$	Eq. 1.1-2
$b=0.37723$ in (ineffective width=0.13847 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00026103$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.8802$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2814$ in	
$f=50$ ksi, $k=3.8802$	
$\lambda=1.6075$	Eq. 1.1-3
$\rho=0.53694$	Eq. 1.1-2
$b=1.225$ in (ineffective width=1.0564 in)	Eq. 1.1-1
$b_1=0.61249$ in, $b_2=0.61249$ in	
$A_e=0.14685$ in ² , $F_n=50$ ksi	
$P_n=7.3426$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=7.7814$ in	
h/t greater than 200, treat as rational analysis	
$f_1=48.919$ ksi, $f_2=-28.055$ ksi	
$\psi=0.57351$	Eq. 1.1.2-1
$k=14.939$	Eq. 1.1.2-2
$\lambda=2.764$	Eq. 1.1-3
$\rho=0.333$	Eq. 1.1-2
$b_e=2.5912$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=2.5$ in, $h_o/b_o=3.2$	
$b_1=0.72512$ in	Eq. 1.1.2-3
$b_2=1.2956$ in	Eq. 1.1.2-4
Compression width=4.9453 in	
Ineffective width=2.9245 in	
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=48.919$ ksi, $f_2=43.817$ ksi	
$\psi=0.89572$	Eq. 1.2.2-1

$k=0.46774$	Eq. 1.2.2-2
$\lambda=1.0352$	Eq. 1.1-3
$\rho=0.7607$	Eq. 1.1-2
$b=0.39229$ in (ineffective width=0.12341 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.139$	Eq. 1.3-7
$I_a=0.00026063$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.8802$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2814$ in	
$f=49.846$ ksi, $k=3.8802$	
$\lambda=1.605$	Eq. 1.1-3
$\rho=0.53764$	Eq. 1.1-2
$b=1.2266$ in (ineffective width=1.0548 in)	Eq. 1.1-1
$b_1=0.61329$ in, $b_2=0.61329$ in	
Center of gravity shift: $y=-1.0547$ in	
$S_{xe}=0.59094$ in ³ , $F_y=50$ ksi	
$M_n I=29.547$ k-in	Eq. F3.1-1
$\Omega b=2$, $\phi b=0.8$ (rational analysis)	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5157$ in	
$f_1=48.919$ ksi, $f_2=43.817$ ksi	
$\psi=0.89572$	Eq. 1.2.2-1
$k=0.46774$	Eq. 1.2.2-2
$\lambda=1.0352$	Eq. 1.1-3
$\rho=0.7607$	Eq. 1.1-2
$b=0.39229$ in (ineffective width=0.12341 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.139$	Eq. 1.3-7
$I_a=0.00026063$ in ⁴	Eq. 1.3-8
$I_s=0.00035659$ in ⁴ > I_a (no lip reduction)	
$k=3.8802$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2814$ in	
$f=49.846$ ksi, $k=3.8802$	
$\lambda=1.605$	Eq. 1.1-3
$\rho=0.53764$	Eq. 1.1-2
$b=1.2266$ in (ineffective width=1.0548 in)	Eq. 1.1-1
$b_1=0.61329$ in, $b_2=0.61329$ in	
Element 3: Stiffened, $w=7.7814$ in	
h/t greater than 200, treat as rational analysis	
$f_1=48.919$ ksi, $f_2=-28.055$ ksi	
$\psi=0.57351$	Eq. 1.1.2-1
$k=14.939$	Eq. 1.1.2-2
$\lambda=2.764$	Eq. 1.1-3
$\rho=0.333$	Eq. 1.1-2
$b_e=2.5912$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=2.5$ in, $h_o/b_o=3.2$	
$b_1=0.72512$ in	Eq. 1.1.2-3

$b_2=1.2956$ in	Eq. 1.1.2-4
Compression width=4.9453 in	
Ineffective width=2.9245 in	
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=1.0547$ in	
$S_{xe}=0.59094$ in ³ , $F_y=50$ ksi	
$M_{nl}=29.547$ k-in	Eq. F3.1-1
$\Omega_b=2$, $\phi_b=0.8$ (rational analysis)	
Positive Flexural Strength about Y-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5157$ in	
$f_1=49.578$ ksi, $f_2=49.578$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.0869$	Eq. 1.1-3
$\rho=0.7338$	Eq. 1.1-2
$b=0.37842$ in (ineffective width=0.13728 in)	Eq. 1.1-1
Element 2: Stiffened, $w=2.2814$ in	
$f_1=47.044$ ksi, $f_2=-14.663$ ksi	
$\psi=0.31169$	Eq. 1.1.2-1
$k=11.137$	Eq. 1.1.2-2
$\lambda=0.92037$	Eq. 1.1-3
$\rho=0.8268$	Eq. 1.1-2
$b_e=1.8863$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.56958$ in	Eq. 1.1.2-3
$b_2=0.94313$ in	Eq. 1.1.2-4
Compression width=1.7393 in	
Ineffective width=0.22657 in	
Element 3: No compressive stress (fully effective)	
Element 5: Unstiffened, $w=0.5157$ in	
$f_1=49.578$ ksi, $f_2=49.578$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-2
$\lambda=1.0869$	Eq. 1.1-3
$\rho=0.7338$	Eq. 1.1-2
$b=0.37842$ in (ineffective width=0.13728 in)	Eq. 1.1-1
Element 4: Stiffened, $w=2.2814$ in	
$f_1=47.044$ ksi, $f_2=-14.663$ ksi	
$\psi=0.31169$	Eq. 1.1.2-1
$k=11.137$	Eq. 1.1.2-2
$\lambda=0.92037$	Eq. 1.1-3
$\rho=0.8268$	Eq. 1.1-2
$b_e=1.8863$ in	Eq. 1.1-1
$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$	
$b_1=0.56958$ in	Eq. 1.1.2-3
$b_2=0.94313$ in	Eq. 1.1.2-4
Compression width=1.7393 in	

Ineffective width=0.22657 in
 Center of gravity shift: $x=-0.07879$ in
 $S_y=0.1561$ in³, $F_y=50$ ksi
 $M_n=7.805$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.2814$ in

$f_1=45.695$ ksi, $f_2=-44.158$ ksi

$\psi=0.96636$

Eq. 1.1.2-1

$k=23.139$

Eq. 1.1.2-2

$\lambda=0.6293$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2814$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=8$ in, $h_o/b_o=0.3125$

$b_1=0.57519$ in

Eq. 1.1.2-3

$b_2=1.1407$ in

Eq. 1.1.2-4

Compression width=1.1602 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=49.386$ ksi, $f_2=49.386$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=6.6068$

Eq. 1.1-3

$\rho=0.14632$

Eq. 1.1-2

$b=0.45955$ in (ineffective width=2.6812 in)

Eq. 1.1-1

$f_1=49.386$ ksi, $f_2=49.386$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=6.6068$

Eq. 1.1-3

$\rho=0.14632$

Eq. 1.1-2

$b=0.45955$ in (ineffective width=2.6812 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.2814$ in

$f_1=45.695$ ksi, $f_2=-44.158$ ksi

$\psi=0.96636$

Eq. 1.1.2-1

$k=23.139$

Eq. 1.1.2-2

$\lambda=0.6293$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2814$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=8$ in, $h_o/b_o=0.3125$

$b_1=0.57519$ in

Eq. 1.1.2-3

$b_2=1.1407$ in

Eq. 1.1.2-4

Compression width=1.1602 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.53945$ in

$S_y=0.1425$ in³, $F_y=50$ ksi

$M_n=7.1248$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=4.3701 \text{ in}^6$, $W_n=7.7913 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=28.045 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

800S250-33

Full Section Properties

Area	0.48270 in ²	Wt.	0.0016412 k/ft	Flat	13.951 in
I _x	4.6449 in ⁴	r _x	3.1021 in	I _{xy}	0.0000 in ⁴
S _x (t)	1.1612 in ³	y(t)	4.0000 in	α	0.000 deg
S _x (b)	1.1612 in ³	y(b)	4.0000 in		
Z _x	1.3608 in ³	Height	8.0000 in		
I _y	0.3888 in ⁴	r _y	0.8975 in	x _o	-1.6815 in
S _y (l)	0.5949 in ³	x(l)	0.6536 in	y _o	0.0000 in
S _y (r)	0.2106 in ³	x(r)	1.8464 in	j _x	4.3022 in
Z _y	0.3081 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	4.6449 in ⁴	r ₁	3.1021 in	C _w	4.8300 in ⁶
I ₂	0.3888 in ⁴	r ₂	0.8975 in	J	0.0001926 in ⁴
I _c	5.0337 in ⁴	r _c	3.2293 in		
I _o	6.3986 in ⁴	r _o	3.6409 in		

Net Section Properties

I _x	4.6352 in ⁴	r _x	3.2802 in	Area	0.43080 in ²
S _x (t)	1.1588 in ³	y(t)	4.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	1.1588 in ³	y(b)	4.0000 in	α	0.000 deg
Z _x	1.3413 in ³				
I _y	0.3652 in ⁴	r _y	0.9208 in	x _o	-1.7604 in
S _y (l)	0.5002 in ³	x(l)	0.7302 in	y _o	0.0000 in
S _y (r)	0.2064 in ³	x(r)	1.7698 in	j _x	3.9752 in
Z _y	0.3073 in ³			j _y	0.0000 in
I _c	5.0004 in ⁴	r _c	3.4070 in	C _w	4.8193 in ⁶
I _o	6.3355 in ⁴	r _o	3.8349 in	J	0.0001719 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	7.470 k	φM _n x _o	28.087 k-in	φM _n y _o	8.368 k-in
A _e	0.17576 in ²	I _x e	3.4693 in ⁴	I _y e	0.3370 in ⁴
φT _n	21.001 k	S _x e(t)	0.7022 in ³	S _y e(l)	0.4899 in ³
		S _x e(b)	1.1340 in ³	S _y e(r)	0.1860 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	0.857 k	φM _n x _o	28.087 k-in	φM _n y _o	7.367 k-in
φV _{nx}	3.317 k	I _x e	3.4693 in ⁴	I _y e	0.2050 in ⁴
Torsion		S _x e(t)	1.1340 in ³	S _y e(l)	0.1637 in ³
φB _n	27.895 k-in ²	S _x e(b)	0.7022 in ³	S _y e(r)	0.1642 in ³

Stud element 3 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Stud corner 2

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Stud corner 3

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Stud corner 4

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Stud corner 5

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Fya=50.856 ksi

Eq. A3.3.2-1

Max compression stress allowed: Fya=50 ksi

Bending about X-axis

Stud corner 2

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Stud corner 3

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Stud corner 4

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Stud corner 5

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Fya=52.32 ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: Fya=50 ksi

Max compression stress allowed for negative bending: Fya=50 ksi

Bending about Y-axis

Stud corner 2

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Stud corner 5

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Fya=54.513 ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: Fya=50 ksi

Max compression stress allowed for negative bending: Fya=50 ksi

Axial Tension Strength

$A_g=0.4827 \text{ in}^2$, $F_y=50.856 \text{ ksi}$

$T_n=24.548 \text{ k}$

$\Omega_t=1.67$, $\phi_t=0.9$

Eq. D2-1

$A_n=0.4308 \text{ in}^2$, $F_u=65 \text{ ksi}$

$T_n=28.002 \text{ k}$

$\Omega_t=2$, $\phi_t=0.75$

Eq. D3-1

Shear Strength

Stud element 2

$V_n=1.843 \text{ k}$ at 180 deg

$\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Stud element 3

$V_{yh}=6.3321 \text{ k}$

$k_v=4.3432$

$V_{crh}=0.44108 \text{ k}$

h/t exceeds 200 (rational analysis)

$V_n=1.0711 \text{ k}$ at 90 deg

$\Omega_v=2$, $\phi_v=0.8$ (rational analysis)

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4

$V_n=1.843 \text{ k}$ at 0 deg

$\Omega_v=1.67$, $\phi_v=0.9$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514 \text{ in}$

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

$k=0.43$

$\lambda=0.98104$

$\rho=0.79074$

$b=0.40644 \text{ in}$ (ineffective width= 0.10756 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$S=31.091$

$I_a=0.00035618 \text{ in}^4$

$I_s=0.00039155 \text{ in}^4 > I_a$ (no lip reduction)

$k=3.8782$

Eq. 1.3-7

Eq. 1.3-8

Table 1.3-1

Element 2: Partially stiffened, $w=2.278 \text{ in}$

$f=50 \text{ ksi}$, $k=3.8782$

$\lambda=1.4478$

$\rho=0.58576$

$b=1.3344 \text{ in}$ (ineffective width= 0.94364 in)

$b_1=0.66718 \text{ in}$, $b_2=0.66718 \text{ in}$

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$f_1=50 \text{ ksi}$, $f_2=50 \text{ ksi}$

$\psi=1$

$k=0.43$

$\lambda=5.9912$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

$\rho=0.16078$	Eq. 1.1-2
$b=0.50469$ in (ineffective width=2.6343 in)	Eq. 1.1-1
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=5.9912$	Eq. 1.1-3
$\rho=0.16078$	Eq. 1.1-2
$b=0.50469$ in (ineffective width=2.6343 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.514$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.98104$	Eq. 1.1-3
$\rho=0.79074$	Eq. 1.1-2
$b=0.40644$ in (ineffective width=0.10756 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00035618$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1
Element 4: Partially stiffened, $w=2.278$ in	
$f=50$ ksi, $k=3.8782$	
$\lambda=1.4478$	Eq. 1.1-3
$\rho=0.58576$	Eq. 1.1-2
$b=1.3344$ in (ineffective width=0.94364 in)	Eq. 1.1-1
$b_1=0.66718$ in, $b_2=0.66718$ in	
$A_e=0.17576$ in ² , $F_n=50$ ksi	
$P_n=8.7879$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=7.778$ in	
h/t greater than 200, treat as rational analysis	
$f_1=48.877$ ksi, $f_2=-29.848$ ksi	
$\psi=0.61069$	Eq. 1.1.2-1
$k=15.579$	Eq. 1.1.2-2
$\lambda=2.4385$	Eq. 1.1-3
$\rho=0.37309$	Eq. 1.1-2
$b_e=2.9019$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=2.5$ in, $h_o/b_o=3.2$	
$b_1=0.80369$ in	Eq. 1.1.2-3
$b_2=1.4509$ in	Eq. 1.1.2-4
Compression width=4.829 in	
Ineffective width=2.5744 in	
Element 5: Unstiffened, $w=0.514$ in	
$f_1=48.877$ ksi, $f_2=43.674$ ksi	
$\psi=0.89356$	Eq. 1.2.2-1

$k=0.46856$	Eq. 1.2.2-2
$\lambda=0.92919$	Eq. 1.1-3
$\rho=0.8214$	Eq. 1.1-2
$b=0.4222$ in (ineffective width=0.091801 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.146$	Eq. 1.3-7
$I_a=0.00035557$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1
Element 4: Partially stiffened, $w=2.278$ in	
$f=49.825$ ksi, $k=3.8782$	
$\lambda=1.4452$	Eq. 1.1-3
$\rho=0.5866$	Eq. 1.1-2
$b=1.3363$ in (ineffective width=0.94172 in)	Eq. 1.1-1
$b_1=0.66814$ in, $b_2=0.66814$ in	
Center of gravity shift: $y=-0.94066$ in	
$S_{xe}=0.70219$ in ³ , $F_y=50$ ksi	
$M_n I=35.109$ k-in	Eq. F3.1-1
$\Omega b=2$, $\phi b=0.8$ (rational analysis)	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.514$ in	
$f_1=48.877$ ksi, $f_2=43.674$ ksi	
$\psi=0.89356$	Eq. 1.2.2-1
$k=0.46856$	Eq. 1.2.2-2
$\lambda=0.92919$	Eq. 1.1-3
$\rho=0.8214$	Eq. 1.1-2
$b=0.4222$ in (ineffective width=0.091801 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.146$	Eq. 1.3-7
$I_a=0.00035557$ in ⁴	Eq. 1.3-8
$I_s=0.00039155$ in ⁴ > I_a (no lip reduction)	
$k=3.8782$	Table 1.3-1
Element 2: Partially stiffened, $w=2.278$ in	
$f=49.825$ ksi, $k=3.8782$	
$\lambda=1.4452$	Eq. 1.1-3
$\rho=0.5866$	Eq. 1.1-2
$b=1.3363$ in (ineffective width=0.94172 in)	Eq. 1.1-1
$b_1=0.66814$ in, $b_2=0.66814$ in	
Element 3: Stiffened, $w=7.778$ in	
h/t greater than 200, treat as rational analysis	
$f_1=48.877$ ksi, $f_2=-29.848$ ksi	
$\psi=0.61069$	Eq. 1.1.2-1
$k=15.579$	Eq. 1.1.2-2
$\lambda=2.4385$	Eq. 1.1-3
$\rho=0.37309$	Eq. 1.1-2
$b_e=2.9019$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=2.5$ in, $h_o/b_o=3.2$	
$b_1=0.80369$ in	Eq. 1.1.2-3

$b_2=1.4509$ in Eq. 1.1.2-4
 Compression width=4.829 in
 Ineffective width=2.5744 in
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.94066$ in
 $S_{xe}=0.70219$ in³, $F_y=50$ ksi
 $M_{nl}=35.109$ k-in Eq. F3.1-1
 $\Omega b=2$, $\phi b=0.8$ (rational analysis)

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.514$ in

$f_1=49.523$ ksi, $f_2=49.523$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-3

$\lambda=0.97635$ Eq. 1.1-3

$\rho=0.79344$ Eq. 1.1-2

$b=0.40783$ in (ineffective width=0.10617 in) Eq. 1.1-1

Element 2: Stiffened, $w=2.278$ in

$f_1=46.937$ ksi, $f_2=-15.928$ ksi

$\psi=0.33935$ Eq. 1.1.2-1

$k=11.484$ Eq. 1.1.2-2

$\lambda=0.81515$ Eq. 1.1-3

$\rho=0.89568$ Eq. 1.1-2

$b_e=2.0403$ in Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.611$ in Eq. 1.1.2-3

$b_2=1.0202$ in Eq. 1.1.2-4

Compression width=1.7008 in

Ineffective width=0.069646 in

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.514$ in

$f_1=49.523$ ksi, $f_2=49.523$ ksi

$\psi=1$ Eq. 1.2.2-1

$k=0.43$ Eq. 1.2.2-2

$\lambda=0.97635$ Eq. 1.1-3

$\rho=0.79344$ Eq. 1.1-2

$b=0.40783$ in (ineffective width=0.10617 in) Eq. 1.1-1

Element 4: Stiffened, $w=2.278$ in

$f_1=46.937$ ksi, $f_2=-15.928$ ksi

$\psi=0.33935$ Eq. 1.1.2-1

$k=11.484$ Eq. 1.1.2-2

$\lambda=0.81515$ Eq. 1.1-3

$\rho=0.89568$ Eq. 1.1-2

$b_e=2.0403$ in Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.611$ in Eq. 1.1.2-3

$b_2=1.0202$ in Eq. 1.1.2-4

Compression width=1.7008 in

Ineffective width=0.069645 in
 Center of gravity shift: $x=-0.042419$ in
 $S_y=0.18595$ in³, $F_y=50$ ksi
 $M_n=9.2975$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.278$ in

$f_1=45.567$ ksi, $f_2=-45.405$ ksi

$\psi=0.99644$

Eq. 1.1.2-1

$k=23.908$

Eq. 1.1.2-2

$\lambda=0.55665$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.278$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=8$ in, $h_o/b_o=0.3125$

$b_1=0.57001$ in

Eq. 1.1.2-3

$b_2=1.139$ in

Eq. 1.1.2-4

Compression width=1.141 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=49.309$ ksi, $f_2=49.309$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=5.9497$

Eq. 1.1-3

$\rho=0.16186$

Eq. 1.1-2

$b=0.50808$ in (ineffective width=2.6309 in)

Eq. 1.1-1

$f_1=49.309$ ksi, $f_2=49.309$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=5.9497$

Eq. 1.1-3

$\rho=0.16186$

Eq. 1.1-2

$b=0.50808$ in (ineffective width=2.6309 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.278$ in

$f_1=45.567$ ksi, $f_2=-45.405$ ksi

$\psi=0.99644$

Eq. 1.1.2-1

$k=23.908$

Eq. 1.1.2-2

$\lambda=0.55665$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.278$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=8$ in, $h_o/b_o=0.3125$

$b_1=0.57001$ in

Eq. 1.1.2-3

$b_2=1.139$ in

Eq. 1.1.2-4

Compression width=1.141 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.52181$ in

$S_y=0.16371$ in³, $F_y=50$ ksi

$M_n=8.1854$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=4.8193 \text{ in}^6$, $W_n=7.7744 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=30.995 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

800S250-43

Full Section Properties

Area	0.62728 in ²	Wt.	0.0021328 k/ft	Flat	13.909 in
I _x	6.0156 in ⁴	r _x	3.0968 in	I _{xy}	0.0000 in ⁴
S _x (t)	1.5039 in ³	y(t)	4.0000 in	α	0.000 deg
S _x (b)	1.5039 in ³	y(b)	4.0000 in		
Z _x	1.7650 in ³	Height	8.0000 in		
I _y	0.5000 in ⁴	r _y	0.8928 in	x _o	-1.6705 in
S _y (l)	0.7641 in ³	x(l)	0.6543 in	y _o	0.0000 in
S _y (r)	0.2709 in ³	x(r)	1.8457 in	j _x	4.2983 in
Z _y	0.3979 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	6.0156 in ⁴	r ₁	3.0968 in	C _w	6.1876 in ⁶
I ₂	0.5000 in ⁴	r ₂	0.8928 in	J	0.0004253 in ⁴
I _c	6.5155 in ⁴	r _c	3.2229 in		
I _o	8.2660 in ⁴	r _o	3.6301 in		

Net Section Properties

I _x	6.0029 in ⁴	r _x	3.2751 in	Area	0.55963 in ²
S _x (t)	1.5007 in ³	y(t)	4.0000 in	I _{xy}	0.0000 in ⁴
S _x (b)	1.5007 in ³	y(b)	4.0000 in	α	0.000 deg
Z _x	1.7397 in ³				
I _y	0.4697 in ⁴	r _y	0.9161 in	x _o	-1.7491 in
S _y (l)	0.6428 in ³	x(l)	0.7307 in	y _o	0.0000 in
S _y (r)	0.2655 in ³	x(r)	1.7693 in	j _x	3.9701 in
Z _y	0.3966 in ³			j _y	0.0000 in
I _c	6.4726 in ⁴	r _c	3.4009 in	C _w	6.1739 in ⁶
I _o	8.1846 in ⁴	r _o	3.8243 in	J	0.0003794 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F _y =50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	10.750 k	φM _{nxo}	46.704 k-in	φM _{nyo}	11.717 k-in
A _e	0.25293 in ²	I _{xe}	4.8633 in ⁴	I _{ye}	0.4626 in ⁴
φT _n	27.282 k	S _{xe} (t)	1.0379 in ³	S _{ye} (l)	0.6394 in ³
		S _{xe} (b)	1.4675 in ³	S _{ye} (r)	0.2604 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.739 k	φM _{nxo}	46.704 k-in	φM _{nyo}	9.867 k-in
φV _{nx}	5.185 k	I _{xe}	4.8633 in ⁴	I _{ye}	0.2868 in ⁴
Torsion		S _{xe} (t)	1.4675 in ³	S _{ye} (l)	0.2405 in ³
φB _n	35.977 k-in ²	S _{xe} (b)	1.0379 in ³	S _{ye} (r)	0.2193 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=51.046$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=52.838$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in²

$F_{yc}=74.687$ ksi

Eq. A3.3.2-2

$F_{ya}=55.542$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_{ya}=50$ ksi

Max compression stress allowed for negative bending: $F_{ya}=50$ ksi

Axial Tension Strength

$$A_g = 0.62728 \text{ in}^2, F_y = 51.046 \text{ ksi}$$

$$T_n = 32.02 \text{ k}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

Eq. D2-1

$$A_n = 0.55963 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 36.376 \text{ k}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Eq. D3-1

Shear Strength

Stud element 2

$$V_n = 2.8807 \text{ k at } 180 \text{ deg}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Eq. G2.1-2

Stud element 3

$$V_{yh} = 8.2364 \text{ k}$$

$$k_v = 4.3425$$

$$V_{crh} = 0.97752 \text{ k}$$

$$V_n = 1.9321 \text{ k at } 90 \text{ deg}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Eq. G3-2

Eq. G3-8

Eq. G3-6

Eq. G2.1-2

Stud element 4

$$V_n = 2.8807 \text{ k at } 0 \text{ deg}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Eq. G2.1-2

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.5087 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1$$

$$k = 0.43$$

$$\lambda = 0.74488$$

$$\rho = 0.94599$$

$$b = 0.48123 \text{ in (ineffective width} = 0.027474 \text{ in)}$$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 2: Check for lip stiffener reduction

$$S = 31.091$$

$$I_a = 0.00079003 \text{ in}^4$$

$$I_s = 0.00049474 \text{ in}^4$$

$$d_s = 0.30136 \text{ in (lip ineffective width} = 0.17987 \text{ in)}$$

$$k = 3.3746$$

Eq. 1.3-7

Eq. 1.3-8

Eq. 1.3-6

Table 1.3-1

Element 2: Partially stiffened, $w = 2.2674 \text{ in}$

$$f = 50 \text{ ksi}, k = 3.3746$$

$$\lambda = 1.1852$$

$$\rho = 0.68714$$

$$b = 1.558 \text{ in (ineffective width} = 0.70937 \text{ in)}$$

$$b_1 = 0.48785 \text{ in}, b_2 = 1.0702 \text{ in}$$

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1$$

$$k = 0.43$$

$$\lambda = 4.5886$$

$$\rho = 0.20748$$

$$b = 0.65019 \text{ in (ineffective width} = 2.4835 \text{ in)}$$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=4.5886$	Eq. 1.1-3
$\rho=0.20748$	Eq. 1.1-2
$b=0.65019$ in (ineffective width=2.4835 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.74488$	Eq. 1.1-3
$\rho=0.94599$	Eq. 1.1-2
$b=0.48123$ in (ineffective width=0.027474 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.00079003$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.30136$ in (lip ineffective width=0.17987 in)	Eq. 1.3-6
$k=3.3746$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2674$ in	
$f=50$ ksi, $k=3.3746$	
$\lambda=1.1852$	Eq. 1.1-3
$\rho=0.68714$	Eq. 1.1-2
$b=1.558$ in (ineffective width=0.70937 in)	Eq. 1.1-1
$b_1=0.48785$ in, $b_2=1.0702$ in	
$A_e=0.25293$ in ² , $F_n=50$ ksi	
$P_n=12.646$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=7.7674$ in	
$f_1=48.759$ ksi, $f_2=-34.145$ ksi	
$\psi=0.70029$	Eq. 1.1.2-1
$k=17.232$	Eq. 1.1.2-2
$\lambda=1.7742$	Eq. 1.1-3
$\rho=0.49373$	Eq. 1.1-2
$b_e=3.835$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=2.5$ in, $h_o/b_o=3.2$	
$b_1=1.0364$ in	Eq. 1.1.2-3
$b_2=1.9175$ in	Eq. 1.1.2-4
Compression width=4.5683 in	
Ineffective width=1.6144 in	
Element 5: Unstiffened, $w=0.5087$ in	
$f_1=48.759$ ksi, $f_2=43.329$ ksi	
$\psi=0.88865$	Eq. 1.2.2-1
$k=0.47044$	Eq. 1.2.2-2
$\lambda=0.70325$	Eq. 1.1-3

$\rho=0.97713$	Eq. 1.1-2
$b=0.49707$ in (ineffective width=0.011635 in)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.166$	Eq. 1.3-7
$I_a=0.00078817$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.31201$ in (lip ineffective width=0.18505 in)	Eq. 1.3-6
$k=3.3769$	Table 1.3-1
Element 4: Partially stiffened, $w=2.2674$ in	
$f=49.759$ ksi, $k=3.3769$	
$\lambda=1.1819$	Eq. 1.1-3
$\rho=0.6886$	Eq. 1.1-2
$b=1.5613$ in (ineffective width=0.70606 in)	Eq. 1.1-1
$b_1=0.49003$ in, $b_2=1.0713$ in	
Center of gravity shift: $y=-0.68593$ in	
$S_{xe}=1.0379$ in ³ , $F_y=50$ ksi	
$M_{nl}=51.893$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.5087$ in	
$f_1=48.759$ ksi, $f_2=43.329$ ksi	
$\psi=0.88865$	Eq. 1.2.2-1
$k=0.47044$	Eq. 1.2.2-2
$\lambda=0.70325$	Eq. 1.1-3
$\rho=0.97713$	Eq. 1.1-2
$b=0.49707$ in (ineffective width=0.011635 in)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.166$	Eq. 1.3-7
$I_a=0.00078817$ in ⁴	Eq. 1.3-8
$I_s=0.00049474$ in ⁴	
$d_s=0.31201$ in (lip ineffective width=0.18505 in)	Eq. 1.3-6
$k=3.3769$	Table 1.3-1
Element 2: Partially stiffened, $w=2.2674$ in	
$f=49.759$ ksi, $k=3.3769$	
$\lambda=1.1819$	Eq. 1.1-3
$\rho=0.6886$	Eq. 1.1-2
$b=1.5613$ in (ineffective width=0.70606 in)	Eq. 1.1-1
$b_1=0.49003$ in, $b_2=1.0713$ in	
Element 3: Stiffened, $w=7.7674$ in	
$f_1=48.759$ ksi, $f_2=-34.145$ ksi	
$\psi=0.70029$	Eq. 1.1.2-1
$k=17.232$	Eq. 1.1.2-2
$\lambda=1.7742$	Eq. 1.1-3
$\rho=0.49373$	Eq. 1.1-2
$b_e=3.835$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=2.5$ in, $h_o/b_o=3.2$	
$b_1=1.0364$ in	Eq. 1.1.2-3
$b_2=1.9175$ in	Eq. 1.1.2-4

Compression width=4.5683 in
 Ineffective width=1.6144 in
 Element 5: No compressive stress (fully effective)
 Element 4: No compressive stress (fully effective)
 Center of gravity shift: $y=0.68593$ in
 $S_x=1.0379$ in³, $F_y=50$ ksi
 $M_{nl}=51.893$ k-in
 $\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w=0.5087$ in

$f_1=49.365$ ksi, $f_2=49.365$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.74014$

Eq. 1.1-3

$\rho=0.9495$

Eq. 1.1-2

$b=0.48301$ in (ineffective width=0.025691 in)

Eq. 1.1-1

Element 2: Stiffened, $w=2.2674$ in

$f_1=46.727$ ksi, $f_2=-17.087$ ksi

$\psi=0.36567$

Eq. 1.1.2-1

$k=11.825$

Eq. 1.1.2-2

$\lambda=0.61204$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2674$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.67368$ in

Eq. 1.1.2-3

$b_2=1.1337$ in

Eq. 1.1.2-4

Compression width=1.6603 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w=0.5087$ in

$f_1=49.365$ ksi, $f_2=49.365$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=0.74014$

Eq. 1.1-3

$\rho=0.9495$

Eq. 1.1-2

$b=0.48301$ in (ineffective width=0.025691 in)

Eq. 1.1-1

Element 4: Stiffened, $w=2.2674$ in

$f_1=46.727$ ksi, $f_2=-17.087$ ksi

$\psi=0.36567$

Eq. 1.1.2-1

$k=11.825$

Eq. 1.1.2-2

$\lambda=0.61204$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.2674$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=0.625$ in, $h_o/b_o=4$

$b_1=0.67368$ in

Eq. 1.1.2-3

$b_2=1.1337$ in

Eq. 1.1.2-4

Compression width=1.6603 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x = -0.0072632$ in

$S_y = 0.26037$ in³, $F_y = 50$ ksi

$M_{nl} = 13.019$ k-in

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w = 2.2674$ in

$f_1 = 41.107$ ksi, $f_2 = -45.555$ ksi

$\psi = 1.1082$

Eq. 1.1.2-1

$k = 26.956$

Eq. 1.1.2-2

$\lambda = 0.38022$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.2674$ in

Eq. 1.1-1

$h_o = 2.5$ in, $b_o = 8$ in, $h_o/b_o = 0.3125$

$b_1 = 0.55192$ in

Eq. 1.1.2-3

$b_2 = 1.1337$ in

Eq. 1.1.2-4

Compression width = 1.0755 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1 = 44.69$ ksi, $f_2 = 44.69$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 4.3381$

Eq. 1.1-3

$\rho = 0.21882$

Eq. 1.1-2

$b = 0.68573$ in (ineffective width = 2.448 in)

Eq. 1.1-1

$f_1 = 44.69$ ksi, $f_2 = 44.69$ ksi

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 4.3381$

Eq. 1.1-3

$\rho = 0.21882$

Eq. 1.1-2

$b = 0.68573$ in (ineffective width = 2.448 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w = 2.2674$ in

$f_1 = 41.107$ ksi, $f_2 = -45.555$ ksi

$\psi = 1.1082$

Eq. 1.1.2-1

$k = 26.956$

Eq. 1.1.2-2

$\lambda = 0.38022$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.2674$ in

Eq. 1.1-1

$h_o = 2.5$ in, $b_o = 8$ in, $h_o/b_o = 0.3125$

$b_1 = 0.55192$ in

Eq. 1.1.2-3

$b_2 = 1.1337$ in

Eq. 1.1.2-4

Compression width = 1.0755 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0.46148$ in

$S_y = 0.21926$ in³, $F_y = 50$ ksi

$M_{nl} = 10.963$ k-in

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Bimoment Strength, Stud

$C_w=6.1739 \text{ in}^6$, $W_n=7.7224 \text{ in}^2$, $F_y=50 \text{ ksi}$

$B_n=39.974 \text{ k-in}^2$

$\Omega_b=1.67$, $\phi_b=0.9$

G8.1-1

800S250-54

Full Section Properties

Area	0.78274 in ²	Wt.	0.0026613 k/ft	Flat	13.829 in
I _x	7.466 in ⁴	r _x	3.0884 in	I _{xy}	0.000 in ⁴
S _x (t)	1.8665 in ³	y(t)	4.0000 in	α	0.000 deg
S _x (b)	1.8665 in ³	y(b)	4.0000 in		
Z _x	2.1957 in ³	Height	8.0000 in		
I _y	0.615 in ⁴	r _y	0.8861 in	x _o	-1.6560 in
S _y (l)	0.9401 in ³	x(l)	0.6537 in	y _o	0.0000 in
S _y (r)	0.3328 in ³	x(r)	1.8463 in	j _x	4.2988 in
Z _y	0.4921 in ³	Width	2.5000 in	j _y	0.0000 in
I ₁	7.466 in ⁴	r ₁	3.0884 in	C _w	7.5682 in ⁶
I ₂	0.615 in ⁴	r ₂	0.8861 in	J	0.0008358 in ⁴
I _c	8.080 in ⁴	r _c	3.2130 in		
I _o	10.227 in ⁴	r _o	3.6146 in		

Net Section Properties

I _x	7.450 in ⁴	r _x	3.2674 in	Area	0.69784 in ²
S _x (t)	1.8625 in ³	y(t)	4.0000 in	I _{xy}	0.000 in ⁴
S _x (b)	1.8625 in ³	y(b)	4.0000 in	α	0.000 deg
Z _x	2.1638 in ³				
I _y	0.577 in ⁴	r _y	0.9095 in	x _o	-1.7343 in
S _y (l)	0.7910 in ³	x(l)	0.7298 in	y _o	0.0000 in
S _y (r)	0.3261 in ³	x(r)	1.7702 in	j _x	3.9689 in
Z _y	0.4900 in ³			j _y	0.0000 in
I _c	8.027 in ⁴	r _c	3.3916 in	C _w	7.5513 in ⁶
I _o	10.126 in ⁴	r _o	3.8093 in	J	0.0007452 in ⁴

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	14.656 k	φM _n x _o	67.050 k-in	φM _n y _o	16.677 k-in
A _e	0.34484 in ²	I _x e	6.5365 in ⁴	I _y e	0.5772 in ⁴
φT _n	34.020 k	S _x e(t)	1.4900 in ³	S _y e(l)	0.7910 in ³
		S _x e(b)	1.8091 in ³	S _y e(r)	0.3261 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2.859 k	φM _n x _o	67.050 k-in	φM _n y _o	12.576 k-in
φV _{nx}	6.776 k	I _x e	6.5365 in ⁴	I _y e	0.3850 in ⁴
Torsion		S _x e(t)	1.8091 in ³	S _y e(l)	0.3431 in ³
φB _n	44.328 k-in ²	S _x e(b)	1.4900 in ³	S _y e(r)	0.2795 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

$F_y=50$ ksi, $F_u=65$ ksi

$B_c=1.6229$

Eq. A3.3.2-3

$m=0.1816$

Eq. A3.3.2-4

Axial Load

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_y=51.306$ ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_y=50$ ksi

Bending about X-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 3

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 4

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_y=53.509$ ksi

Eq. A3.3.2-1

Max compression stress allowed for positive bending: $F_y=50$ ksi

Max compression stress allowed for negative bending: $F_y=50$ ksi

Bending about Y-axis

Stud corner 2

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

Stud corner 5

$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in²

$F_{yc}=75.384$ ksi

Eq. A3.3.2-2

$F_y=56.825$ ksi

Eq. A3.3.2-1

Max compression stress allowed for negative bending: $F_y=50$ ksi

Axial Tension Strength

$A_g=0.78274$ in², $F_y=51.306$ ksi

$$T_n = 40.159 \text{ k} \quad \text{Eq. D2-1}$$

$$\Omega_t = 1.67, \phi_t = 0.9$$

$$A_n = 0.69784 \text{ in}^2, F_u = 65 \text{ ksi}$$

$$T_n = 45.359 \text{ k} \quad \text{Eq. D3-1}$$

$$\Omega_t = 2, \phi_t = 0.75$$

Shear Strength

Stud element 2

$$V_n = 3.7645 \text{ k at } 180 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 3

$$V_{yh} = 10.234 \text{ k} \quad \text{Eq. G3-2}$$

$$k_v = 4.3391 \quad \text{Eq. G3-8}$$

$$V_{crh} = 1.9386 \text{ k} \quad \text{Eq. G3-6}$$

$$V_n = 3.1762 \text{ k at } 90 \text{ deg} \quad \text{Eq. G2.1-2}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Stud element 4

$$V_n = 3.7645 \text{ k at } 0 \text{ deg} \quad \text{Eq. G2.1-1}$$

$$\Omega_v = 1.67, \phi_v = 0.9$$

Axial Compression Strength

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.4835 \text{ in}$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 0.56413 \quad \text{Eq. 1.1-3}$$

$$\lambda < 0.673 \text{ (fully effective)} \quad \text{Eq. 1.1-1}$$

Element 2: Check for lip stiffener reduction

$$S = 31.091 \quad \text{Eq. 1.3-7}$$

$$I_a = 0.0015382 \text{ in}^4 \quad \text{Eq. 1.3-8}$$

$$I_s = 0.00053312 \text{ in}^4$$

$$d_s = 0.16757 \text{ in (lip ineffective width} = 0.31593 \text{ in)} \quad \text{Eq. 1.3-6}$$

$$k = 2.8256 \quad \text{Table 1.3-1}$$

Element 2: Partially stiffened, $w = 2.217 \text{ in}$

$$f = 50 \text{ ksi}, k = 2.8256$$

$$\lambda = 1.0091 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.77494 \quad \text{Eq. 1.1-2}$$

$$b = 1.718 \text{ in (ineffective width} = 0.49896 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$b_1 = 0.29773 \text{ in}, b_2 = 1.4203 \text{ in}$$

Element 3: Treat as two unstiffened elements

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$$k = 0.43 \quad \text{Eq. 1.2.2-3}$$

$$\lambda = 3.6269 \quad \text{Eq. 1.1-3}$$

$$\rho = 0.25899 \quad \text{Eq. 1.1-2}$$

$$b = 0.80508 \text{ in (ineffective width} = 2.3034 \text{ in)} \quad \text{Eq. 1.1-1}$$

$$f_1 = 50 \text{ ksi}, f_2 = 50 \text{ ksi}$$

$$\psi = 1 \quad \text{Eq. 1.2.2-1}$$

$k=0.43$	Eq. 1.2.2-3
$\lambda=3.6269$	Eq. 1.1-3
$\rho=0.25899$	Eq. 1.1-2
$b=0.80508$ in (ineffective width=2.3034 in)	Eq. 1.1-1
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=0.56413$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.091$	Eq. 1.3-7
$I_a=0.0015382$ in ⁴	Eq. 1.3-8
$I_s=0.00053312$ in ⁴	
$d_s=0.16757$ in (lip ineffective width=0.31593 in)	Eq. 1.3-6
$k=2.8256$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217$ in	
$f=50$ ksi, $k=2.8256$	
$\lambda=1.0091$	Eq. 1.1-3
$\rho=0.77494$	Eq. 1.1-2
$b=1.718$ in (ineffective width=0.49896 in)	Eq. 1.1-1
$b_1=0.29773$ in, $b_2=1.4203$ in	
$A_e=0.34484$ in ² , $F_n=50$ ksi	
$P_n=17.242$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: No compressive stress (fully effective)	
Element 2: No compressive stress (fully effective)	
Element 3: Stiffened, $w=7.717$ in	
$f_1=48.387$ ksi, $f_2=-39.594$ ksi	
$\psi=0.81828$	Eq. 1.1.2-1
$k=19.66$	Eq. 1.1.2-2
$\lambda=1.31$	Eq. 1.1-3
$\rho=0.63517$	Eq. 1.1-2
$b_e=4.9016$ in	Eq. 1.1-1
$h_o=8$ in, $b_o=2.5$ in, $h_o/b_o=3.2$	
$b_1=1.2837$ in	Eq. 1.1.2-3
$b_2=2.4508$ in	Eq. 1.1.2-4
Compression width=4.2441 in	
Ineffective width=0.50957 in	
Element 5: Unstiffened, $w=0.4835$ in	
$f_1=48.387$ ksi, $f_2=42.874$ ksi	
$\psi=0.88608$	Eq. 1.2.2-1
$k=0.47142$	Eq. 1.2.2-2
$\lambda=0.53002$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 4: Check for lip stiffener reduction	
$S=31.192$	Eq. 1.3-7

$I_a=0.0015334 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00053312 \text{ in}^4$	
$ds=0.1681 \text{ in}$ (lip ineffective width=0.3154 in)	Eq. 1.3-6
$k=2.8281$	Table 1.3-1
Element 4: Partially stiffened, $w=2.217 \text{ in}$	
$f=49.677 \text{ ksi}$, $k=2.8281$	
$\lambda=1.0054$	Eq. 1.1-3
$\rho=0.777$	Eq. 1.1-2
$b=1.7226 \text{ in}$ (ineffective width=0.4944 in)	Eq. 1.1-1
$b_1=0.29945 \text{ in}$, $b_2=1.4231 \text{ in}$	
Center of gravity shift: $y=-0.38693 \text{ in}$	
$S_{xe}=1.49 \text{ in}^3$, $F_y=50 \text{ ksi}$	
$M_{nl}=74.5 \text{ k-in}$	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about X-axis	
Effective width calculations for Stud	
Element 1: Unstiffened, $w=0.4835 \text{ in}$	
$f_1=48.387 \text{ ksi}$, $f_2=42.874 \text{ ksi}$	
$\psi=0.88608$	Eq. 1.2.2-1
$k=0.47142$	Eq. 1.2.2-2
$\lambda=0.53002$	Eq. 1.1-3
$\lambda<0.673$ (fully effective)	Eq. 1.1-1
Element 2: Check for lip stiffener reduction	
$S=31.192$	Eq. 1.3-7
$I_a=0.0015334 \text{ in}^4$	Eq. 1.3-8
$I_s=0.00053312 \text{ in}^4$	
$ds=0.1681 \text{ in}$ (lip ineffective width=0.3154 in)	Eq. 1.3-6
$k=2.8281$	Table 1.3-1
Element 2: Partially stiffened, $w=2.217 \text{ in}$	
$f=49.677 \text{ ksi}$, $k=2.8281$	
$\lambda=1.0054$	Eq. 1.1-3
$\rho=0.777$	Eq. 1.1-2
$b=1.7226 \text{ in}$ (ineffective width=0.4944 in)	Eq. 1.1-1
$b_1=0.29945 \text{ in}$, $b_2=1.4231 \text{ in}$	
Element 3: Stiffened, $w=7.717 \text{ in}$	
$f_1=48.387 \text{ ksi}$, $f_2=-39.594 \text{ ksi}$	
$\psi=0.81828$	Eq. 1.1.2-1
$k=19.66$	Eq. 1.1.2-2
$\lambda=1.31$	Eq. 1.1-3
$\rho=0.63517$	Eq. 1.1-2
$b_e=4.9016 \text{ in}$	Eq. 1.1-1
$h_o=8 \text{ in}$, $b_o=2.5 \text{ in}$, $h_o/b_o=3.2$	
$b_1=1.2837 \text{ in}$	Eq. 1.1.2-3
$b_2=2.4508 \text{ in}$	Eq. 1.1.2-4
Compression width=4.2441 in	
Ineffective width=0.50957 in	
Element 5: No compressive stress (fully effective)	
Element 4: No compressive stress (fully effective)	
Center of gravity shift: $y=0.38693 \text{ in}$	

$S_x = 1.49 \text{ in}^3$, $F_y = 50 \text{ ksi}$

$M_n = 74.5 \text{ k-in}$

$\Omega_b = 1.67$, $\phi_b = 0.9$

Eq. F3.1-1

Positive Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: Unstiffened, $w = 0.4835 \text{ in}$

$f_1 = 55.917 \text{ ksi}$, $f_2 = 55.917 \text{ ksi}$

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 0.59658$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w = 2.217 \text{ in}$

$f_1 = 52.283 \text{ ksi}$, $f_2 = -18.884 \text{ ksi}$

$\psi = 0.36119$

Eq. 1.1.2-1

$k = 11.767$

Eq. 1.1.2-2

$\lambda = 0.50566$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.217 \text{ in}$

Eq. 1.1-1

$h_o = 2.5 \text{ in}$, $b_o = 0.625 \text{ in}$, $h_o/b_o = 4$

$b_1 = 0.65959 \text{ in}$

Eq. 1.1.2-3

$b_2 = 1.1085 \text{ in}$

Eq. 1.1.2-4

Compression width = 1.6287 in

$b_1 + b_2 >$ compression width (fully effective)

Element 3: No compressive stress (fully effective)

Element 5: Unstiffened, $w = 0.4835 \text{ in}$

$f_1 = 55.917 \text{ ksi}$, $f_2 = 55.917 \text{ ksi}$

$\psi = 1$

Eq. 1.2.2-1

$k = 0.43$

Eq. 1.2.2-3

$\lambda = 0.59658$

Eq. 1.1-3

$\lambda < 0.673$ (fully effective)

Eq. 1.1-1

Element 4: Stiffened, $w = 2.217 \text{ in}$

$f_1 = 52.283 \text{ ksi}$, $f_2 = -18.884 \text{ ksi}$

$\psi = 0.36119$

Eq. 1.1.2-1

$k = 11.767$

Eq. 1.1.2-2

$\lambda = 0.50566$

Eq. 1.1-3

$\rho = 1$

Eq. 1.1-2

$b_e = 2.217 \text{ in}$

Eq. 1.1-1

$h_o = 2.5 \text{ in}$, $b_o = 0.625 \text{ in}$, $h_o/b_o = 4$

$b_1 = 0.65959 \text{ in}$

Eq. 1.1.2-3

$b_2 = 1.1085 \text{ in}$

Eq. 1.1.2-4

Compression width = 1.6287 in

$b_1 + b_2 >$ compression width (fully effective)

Center of gravity shift: $x = 0 \text{ in}$

$S_y = 0.32609 \text{ in}^3$, $F_y = 56.825 \text{ ksi}$

$M_n = 18.53 \text{ k-in}$

Eq. F3.1-1

$\Omega_b = 1.67$, $\phi_b = 0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Stud

Element 1: No compressive stress (fully effective)

Element 2: Stiffened, $w=2.217$ in

$f_1=35.566$ ksi, $f_2=-44.866$ ksi

$\psi=1.2615$

Eq. 1.1.2-1

$k=31.655$

Eq. 1.1.2-2

$\lambda=0.25427$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.217$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=8$ in, $h_o/b_o=0.3125$

$b_1=0.52024$ in

Eq. 1.1.2-3

$b_2=1.1085$ in

Eq. 1.1.2-4

Compression width=0.98033 in

$b_1+b_2 >$ compression width (fully effective)

Element 3: Treat as two unstiffened elements

$f_1=39.673$ ksi, $f_2=39.673$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=3.2307$

Eq. 1.1-3

$\rho=0.28845$

Eq. 1.1-2

$b=0.89665$ in (ineffective width=2.2119 in)

Eq. 1.1-1

$f_1=39.673$ ksi, $f_2=39.673$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=3.2307$

Eq. 1.1-3

$\rho=0.28845$

Eq. 1.1-2

$b=0.89665$ in (ineffective width=2.2119 in)

Eq. 1.1-1

Element 5: No compressive stress (fully effective)

Element 4: Stiffened, $w=2.217$ in

$f_1=35.566$ ksi, $f_2=-44.866$ ksi

$\psi=1.2615$

Eq. 1.1.2-1

$k=31.655$

Eq. 1.1.2-2

$\lambda=0.25427$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=2.217$ in

Eq. 1.1-1

$h_o=2.5$ in, $b_o=8$ in, $h_o/b_o=0.3125$

$b_1=0.52024$ in

Eq. 1.1.2-3

$b_2=1.1085$ in

Eq. 1.1.2-4

Compression width=0.98033 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $x=0.39253$ in

$S_y=0.27947$ in³, $F_y=50$ ksi

$M_n=13.974$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Stud

$C_w=7.5513$ in⁶, $W_n=7.6658$ in², $F_y=50$ ksi

$B_n=49.253$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

SECTION IV TRACK SECTION PROPERTY AND STRENGTH

350T150-27

Full Section Properties

Area	0.18568 in ²	Wt.	0.63130 lb/ft	Flat	6.5610 in
I _x	0.39193 in ⁴	r _x	1.4529 in	I _{xy}	0.00000 in ⁴
S _x (t)	0.21196 in ³	y(t)	1.8491 in	α	0.000 deg
S _x (b)	0.21196 in ³	y(b)	1.8491 in		
Z _x	0.24539 in ³	Height	3.6981 in		
I _y	0.04085 in ⁴	r _y	0.4691 in	x _o	-0.8722 in
S _y (l)	0.11645 in ³	x(l)	0.3508 in	y _o	0.0000 in
S _y (r)	0.03555 in ³	x(r)	1.1492 in	j _x	2.0856 in
Z _y	0.06271 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	0.39193 in ⁴	r ₁	1.4529 in	C _w	0.095098 in ⁶
I ₂	0.04085 in ⁴	r ₂	0.4691 in	J	0.00004957 in ⁴
I _c	0.43278 in ⁴	r _c	1.5267 in		
I _o	0.57404 in ⁴	r _o	1.7583 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	2757.5 lb	φM _{nxo}	422.74 lb-ft	φM _{nyo}	28.01 lb-ft
A _e	0.064882 in ²	I _{xe}	0.25825 in ⁴	I _{ye}	0.00424 in ⁴
φT _n	8484.9 lb	S _{xe} (t)	0.11273 in ³	S _{ye} (l)	0.04157 in ³
		S _{xe} (b)	0.18351 in ³	S _{ye} (r)	0.00747 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1104.5 lb	φM _{nxo}	422.74 lb-ft	φM _{nyo}	120.99 lb-ft
φV _{nx}	2019.4 lb	I _{xe}	0.25825 in ⁴	I _{ye}	0.03305 in ⁴
Torsion		S _{xe} (t)	0.18351 in ³	S _{ye} (l)	0.06950 in ³
φB _n	2459.6 lb-in ²	S _{xe} (b)	0.11273 in ³	S _{ye} (r)	0.03226 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi	
Bc=1.6229	Eq. A3.3.2-3
m=0.1816	Eq. A3.3.2-4
Axial Load	
Track corner 2	
t=0.0283 in, R=0.0796 in, Ac=0.0041675 in ²	
Fyc=67.251 ksi	Eq. A3.3.2-2
Track corner 3	
t=0.0283 in, R=0.0796 in, Ac=0.0041675 in ²	
Fyc=67.251 ksi	Eq. A3.3.2-2
Fya=50.774 ksi	Eq. A3.3.2-1
Max compression stress allowed: Fya=50 ksi	
Bending about X-axis	
Track corner 2	
t=0.0283 in, R=0.0796 in, Ac=0.0041675 in ²	
Fyc=67.251 ksi	Eq. A3.3.2-2
Track corner 3	
t=0.0283 in, R=0.0796 in, Ac=0.0041675 in ²	
Fyc=67.251 ksi	Eq. A3.3.2-2
Fya=51.65 ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: Fya=50 ksi	
Max compression stress allowed for negative bending: Fya=50 ksi	
Bending about Y-axis	
Fya=50 ksi	Eq. A3.3.2-1
Axial Tension Strength	
Ag=0.18568 in ² , Fy=50.774 ksi	
Tn=9427.6 lb	Eq. D2-1
Ωt=1.67, φt=0.9	
An=0.18568 in ² , Fu=65 ksi	
Tn=12069 lb	Eq. D3-1
Ωt=2, φt=0.75	
Shear Strength	
Track element 1	
Vn=1121.9 lb at 180 deg	Eq. G2.1-2
Ωv=1.67, φv=0.9	
Track element 2	
Vn=1227.3 lb at 90 deg	Eq. G2.1-2
Ωv=1.67, φv=0.9	
Track element 3	
Vn=1121.9 lb at 0 deg	Eq. G2.1-2
Ωv=1.67, φv=0.9	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, w=1.3921 in	
f ₁ =50 ksi, f ₂ =50 ksi	
ψ=1	Eq. 1.2.2-1

$k=0.43$	Eq. 1.2.2-3
$\lambda=3.2485$	Eq. 1.1-3
$\rho=0.28699$	Eq. 1.1-2
$b=0.39951$ in (ineffective width=0.99259 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3921$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=3.2485$	Eq. 1.1-3
$\rho=0.28699$	Eq. 1.1-2
$b=0.39951$ in (ineffective width=0.99259 in)	Eq. 1.1-1
Element 2: Stiffened, $w=3.4823$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=2.6643$	Eq. 1.1-3
$\rho=0.34434$	Eq. 1.1-2
$b_e=1.1991$ in	Eq. 1.1-1
$b_1=0.59955$ in	Eq. 1.1.2-9
$b_2=0.59955$ in	Eq. 1.1.2-10
Ineffective width=2.2832 in	
$A_e=0.064882$ in ² , $F_n=50$ ksi	
$P_n=3244.1$ lb	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	
Positive Flexural Strength about X-axis	
Effective width calculations for Track	
Element 1: No compressive stress (fully effective)	
Element 3: Unstiffened, $w=1.3921$ in	
$f_1=49.691$ ksi, $f_2=49.691$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=3.2385$	Eq. 1.1-3
$\rho=0.28781$	Eq. 1.1-2
$b=0.40066$ in (ineffective width=0.99144 in)	Eq. 1.1-1
Element 2: Stiffened, $w=3.4823$ in	
$f_1=47.644$ ksi, $f_2=-28.39$ ksi	
$\psi=0.59588$	Eq. 1.1.2-1
$k=15.321$	Eq. 1.1.2-2
$\lambda=1.3289$	Eq. 1.1-3
$\rho=0.62792$	Eq. 1.1-2
$b_e=2.1866$ in	Eq. 1.1-1
$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$	
$b_1=0.60809$ in	Eq. 1.1.2-3
$b_2=1.0933$ in	Eq. 1.1.2-4
Compression width=2.1821 in	
Ineffective width=0.48067 in	
Center of gravity shift: $y=-0.4418$ in	
$S_{xe}=0.11273$ in ³ , $F_y=50$ ksi	
$M_{nl}=469.71$ lb-ft	Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$$f_1=49.691 \text{ ksi}, f_2=49.691 \text{ ksi}$$

$$\psi=1$$

Eq. 1.2.2-1

$$k=0.43$$

Eq. 1.2.2-2

$$\lambda=3.2385$$

Eq. 1.1-3

$$\rho=0.28781$$

Eq. 1.1-2

$$b=0.40066 \text{ in (ineffective width}=0.99144 \text{ in)}$$

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.4823$ in

$$f_1=47.644 \text{ ksi}, f_2=-28.39 \text{ ksi}$$

$$\psi=0.59588$$

Eq. 1.1.2-1

$$k=15.321$$

Eq. 1.1.2-2

$$\lambda=1.3289$$

Eq. 1.1-3

$$\rho=0.62792$$

Eq. 1.1-2

$$b_e=2.1866 \text{ in}$$

Eq. 1.1-1

$$h_o=3.6981 \text{ in}, b_o=1.5 \text{ in}, h_o/b_o=2.4654$$

$$b_1=0.60809 \text{ in}$$

Eq. 1.1.2-3

$$b_2=1.0933 \text{ in}$$

Eq. 1.1.2-4

$$\text{Compression width}=2.1821 \text{ in}$$

$$\text{Ineffective width}=0.48067 \text{ in}$$

Center of gravity shift: $y=0.4418$ in

$$S_{xe}=0.11273 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=469.71 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$$f_1=50 \text{ ksi}, f_2=-10.569 \text{ ksi}$$

$$\psi=0.21138$$

Eq. 1.2.2-1

$$k=0.61752$$

Eq. 1.2.2-5

$$\lambda=2.7108$$

Eq. 1.1-3

$$\rho=0.40294$$

Eq. 1.2.2-4

$$b=0.56093 \text{ in (ineffective width}=0.83117 \text{ in)}$$

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3921$ in

$$f_1=50 \text{ ksi}, f_2=-10.569 \text{ ksi}$$

$$\psi=0.21138$$

Eq. 1.2.2-1

$$k=0.61752$$

Eq. 1.2.2-5

$$\lambda=2.7108$$

Eq. 1.1-3

$$\rho=0.40294$$

Eq. 1.2.2-4

$$b=0.56093 \text{ in (ineffective width}=0.83117 \text{ in)}$$

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.24894$ in

$$S_{ye}=0.0074697 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=31.124 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$$f_1=17.926 \text{ ksi}, f_2=-50 \text{ ksi}$$

$$\psi=2.7892$$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3921$ in

$$f_1=17.926 \text{ ksi}, f_2=-50 \text{ ksi}$$

$$\psi=2.7892$$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=3.4823$ in

$$f_1=22.501 \text{ ksi}, f_2=22.501 \text{ ksi}$$

$$\psi=1$$

Eq. 1.1.2-1

$$k=4$$

Eq. 1.1.2-8

$$\lambda=1.7873$$

Eq. 1.1-3

$$\rho=0.49063$$

Eq. 1.1-2

$$b_e=1.7085 \text{ in}$$

Eq. 1.1-1

$$b_1=0.85426 \text{ in}$$

Eq. 1.1.2-9

$$b_2=0.85426 \text{ in}$$

Eq. 1.1.2-10

$$\text{Ineffective width}=1.7738 \text{ in}$$

Center of gravity shift: $x=0.12474$ in

$$S_{ye}=0.032263 \text{ in}^3, F_y=50 \text{ ksi}$$

$$M_{nl}=134.43 \text{ lb-ft}$$

Eq. F3.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

Bimoment Strength, Track

$$C_w=0.095098 \text{ in}^6, W_n=1.7399 \text{ in}^2, F_y=50 \text{ ksi}$$

$$B_n=2732.9 \text{ lb-in}^2$$

G8.1-1

$$\Omega_b=1.67, \phi_b=0.9$$

350T150-30

Full Section Properties

Area	0.20452 in ²	Wt.	0.69538 lb/ft	Flat	6.5553 in
Ix	0.43101 in ⁴	rx	1.4517 in	Ixy	0.00000 in ⁴
Sx(t)	0.23310 in ³	y(t)	1.8491 in	α	0.000 deg
Sx(b)	0.23310 in ³	y(b)	1.8491 in		
Zx	0.27007 in ³	Height	3.6981 in		
Iy	0.04491 in ⁴	ry	0.4686 in	x _o	-0.8713 in
Sy(l)	0.12763 in ³	x(l)	0.3519 in	y _o	0.0000 in
Sy(r)	0.03912 in ³	x(r)	1.1481 in	jx	2.0838 in
Zy	0.06903 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	0.43101 in ⁴	r ₁	1.4517 in	Cw	0.10438 in ⁶
I ₂	0.04491 in ⁴	r ₂	0.4686 in	J	0.00006636 in ⁴
Ic	0.47592 in ⁴	rc	1.5254 in		
I _o	0.63120 in ⁴	r _o	1.7568 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	3286.2 lb	φMnxo	511.14 lb-ft	φMnyo	35.63 lb-ft
Ae	0.077323 in ²	Ixe	0.30197 in ⁴	Iye	0.00575 in ⁴
φTn	9358.1 lb	Sxe(t)	0.13630 in ³	Sye(l)	0.04988 in ³
		Sxe(b)	0.20365 in ³	Sye(r)	0.00950 in ³
Shear		Negative Bending		Negative Bending	
φVny	1357.6 lb	φMnxo	511.14 lb-ft	φMnyo	135.32 lb-ft
φVnx	2309.6 lb	Ixe	0.30197 in ⁴	Iye	0.03759 in ⁴
Torsion		Sxe(t)	0.20365 in ³	Sye(l)	0.08203 in ³
φBn	2704.3 lb-in ²	Sxe(b)	0.13630 in ³	Sye(r)	0.03609 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0312 in, R=0.0781 in, Ac=0.0045921 in²

Fyc=68.69 ksi

Eq. A3.3.2-2

Fya=50.839 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
$F_{ya}=51.789$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.20452$ in ² , $F_y=50.839$ ksi	
$T_n=10398$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.20452$ in ² , $F_u=65$ ksi	
$T_n=13294$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1283.1$ lb at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1508.4$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1283.1$ lb at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.4795$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.4147$

$\rho=0.3764$

$b_e=1.3097$ in

$b_1=0.65483$ in

$b_2=0.65483$ in

Ineffective width= 2.1698 in

$A_e=0.077323$ in², $F_n=50$ ksi

$P_n=3866.2$ lb

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3907$ in

$f_1=49.648$ ksi, $f_2=49.648$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.9332$

$\rho=0.31535$

$b=0.43856$ in (ineffective width= 0.95214 in)

Element 2: Stiffened, $w=3.4795$ in

$f_1=47.533$ ksi, $f_2=-31.017$ ksi

$\psi=0.65255$

$k=16.331$

$\lambda=1.1652$

$\rho=0.69618$

$b_e=2.4224$ in

$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$

$b_1=0.6632$ in

$b_2=1.2112$ in

Compression width= 2.1055 in

Ineffective width= 0.23116 in

Center of gravity shift: $y=-0.36632$ in

$S_{xe}=0.1363$ in³, $F_y=50$ ksi

$M_{nl}=567.94$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=49.648$ ksi, $f_2=49.648$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.9332$

$\rho=0.31535$

$b=0.43856$ in (ineffective width= 0.95214 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.4795$ in

$f_1=47.533$ ksi, $f_2=-31.017$ ksi

$\psi=0.65255$

Eq. 1.1.2-1

$k=16.331$

Eq. 1.1.2-2

$\lambda=1.1652$

Eq. 1.1-3

$\rho=0.69618$

Eq. 1.1-2

$b_e=2.4224$ in

Eq. 1.1-1

$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$

$b_1=0.6632$ in

Eq. 1.1.2-3

$b_2=1.2112$ in

Eq. 1.1.2-4

Compression width= 2.1055 in

Ineffective width= 0.23116 in

Center of gravity shift: $y=0.36632$ in

$S_{xe}=0.1363$ in³, $F_y=50$ ksi

$M_{nl}=567.94$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-10.565$ ksi

$\psi=0.2113$

Eq. 1.2.2-1

$k=0.6175$

Eq. 1.2.2-5

$\lambda=2.4564$

Eq. 1.1-3

$\rho=0.43963$

Eq. 1.2.2-4

$b=0.61139$ in (ineffective width= 0.77931 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-10.565$ ksi

$\psi=0.2113$

Eq. 1.2.2-1

$k=0.6175$

Eq. 1.2.2-5

$\lambda=2.4564$

Eq. 1.1-3

$\rho=0.43963$

Eq. 1.2.2-4

$b=0.61139$ in (ineffective width= 0.77931 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.23658$ in

$S_{ye}=0.0095004$ in³, $F_y=50$ ksi

$M_{nl}=39.585$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=16.681$ ksi, $f_2=-50$ ksi

$\psi=2.9975$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=16.681$ ksi, $f_2=-50$ ksi

$\psi=2.9975$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.4795$ in	
$f_1=21.173$ ksi, $f_2=21.173$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.5714$	Eq. 1.1-3
$\rho=0.54729$	Eq. 1.1-2
$b_e=1.9043$ in	Eq. 1.1-1
$b_1=0.95215$ in	Eq. 1.1.2-9
$b_2=0.95215$ in	Eq. 1.1.2-10
Ineffective width= 1.5752 in	
Center of gravity shift: $x=0.10637$ in	
$S_y=0.036085$ in ³ , $F_y=50$ ksi	
$M_n=150.36$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.10438$ in ⁶ , $W_n=1.7369$ in ² , $F_y=50$ ksi	
$B_n=3004.8$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350T150-33

Full Section Properties

Area	0.22658 in ²	Wt.	0.77036 lb/ft	Flat	6.5485 in
I _x	0.47658 in ⁴	r _x	1.4503 in	I _{xy}	0.00000 in ⁴
S _x (t)	0.25774 in ³	y(t)	1.8491 in	α	0.000 deg
S _x (b)	0.25774 in ³	y(b)	1.8491 in		
Z _x	0.29890 in ³	Height	3.6981 in		
I _y	0.04964 in ⁴	r _y	0.4681 in	x _o	-0.8703 in
S _y (l)	0.14056 in ³	x(l)	0.3532 in	y _o	0.0000 in
S _y (r)	0.04329 in ³	x(r)	1.1468 in	j _x	2.0817 in
Z _y	0.07641 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	0.47658 in ⁴	r ₁	1.4503 in	C _w	0.11515 in ⁶
I ₂	0.04964 in ⁴	r ₂	0.4681 in	J	0.00009042 in ⁴
I _c	0.52622 in ⁴	r _c	1.5240 in		
I _o	0.69782 in ⁴	r _o	1.7549 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	3958 lb	φM _n x _o	619.99 lb-ft	φM _n y _o	45.93 lb-ft
A _e	0.093131 in ²	I _x e	0.35438 in ⁴	I _y e	0.00794 in ⁴
φT _n	10382 lb	S _x e(t)	0.16533 in ³	S _y e(l)	0.06048 in ³
		S _x e(b)	0.22795 in ³	S _y e(r)	0.01225 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1684 lb	φM _n x _o	619.99 lb-ft	φM _n y _o	152.18 lb-ft
φV _{nx}	2595 lb	I _x e	0.35438 in ⁴	I _y e	0.04300 in ⁴
Torsion		S _x e(t)	0.22795 in ³	S _y e(l)	0.09766 in ³
φB _n	2989.4 lb-in ²	S _x e(b)	0.16533 in ³	S _y e(r)	0.04058 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0346 in, R=0.0764 in, A_c=0.0050926 in²

F_{yc}=70.273 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0346 in, R=0.0764 in, A_c=0.0050926 in²

F_{yc}=70.273 ksi

Eq. A3.3.2-2

F_{ya}=50.911 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_y=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
$F_y=51.942$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_y=50$ ksi	
Max compression stress allowed for negative bending: $F_y=50$ ksi	
Bending about Y-axis	
$F_y=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.22658$ in ² , $F_y=50.911$ ksi	
$T_n=11535$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.22658$ in ² , $F_u=65$ ksi	
$T_n=14728$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1441.8$ lb at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1871.2$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1441.8$ lb at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.4761$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.1753$

$\rho=0.41321$

$b_e=1.4364$ in

$b_1=0.71818$ in

$b_2=0.71818$ in

Ineffective width= 2.0397 in

$A_e=0.093131$ in², $F_n=50$ ksi

$P_n=4656.5$ lb

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.389$ in

$f_1=49.596$ ksi, $f_2=49.596$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.6404$

$\rho=0.34718$

$b=0.48223$ in (ineffective width= 0.90677 in)

Element 2: Stiffened, $w=3.4761$ in

$f_1=47.411$ ksi, $f_2=-33.68$ ksi

$\psi=0.71038$

$k=17.428$

$\lambda=1.0148$

$\rho=0.77178$

$b_e=2.6828$ in

$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$

$b_1=0.72305$ in

$b_2=1.3414$ in

Compression width= 2.0324 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.29441$ in

$S_{xe}=0.16533$ in³, $F_y=50$ ksi

$M_{nl}=688.88$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=49.596$ ksi, $f_2=49.596$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.6404$

$\rho=0.34718$

$b=0.48223$ in (ineffective width= 0.90677 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.4761$ in

$f_1=47.411$ ksi, $f_2=-33.68$ ksi

$\psi=0.71038$

Eq. 1.1.2-1

$k=17.428$

Eq. 1.1.2-2

$\lambda=1.0148$

Eq. 1.1-3

$\rho=0.77178$

Eq. 1.1-2

$b_e=2.6828$ in

Eq. 1.1-1

$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$

$b_1=0.72305$ in

Eq. 1.1.2-3

$b_2=1.3414$ in

Eq. 1.1.2-4

Compression width= 2.0324 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.29441$ in

$S_{xe}=0.16533$ in³, $F_y=50$ ksi

$M_{nl}=688.88$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-10.558$ ksi

$\psi=0.21117$

Eq. 1.2.2-1

$k=0.61747$

Eq. 1.2.2-5

$\lambda=2.2124$

Eq. 1.1-3

$\rho=0.48152$

Eq. 1.2.2-4

$b=0.66883$ in (ineffective width= 0.72017 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-10.558$ ksi

$\psi=0.21117$

Eq. 1.2.2-1

$k=0.61747$

Eq. 1.2.2-5

$\lambda=2.2124$

Eq. 1.1-3

$\rho=0.48152$

Eq. 1.2.2-4

$b=0.66883$ in (ineffective width= 0.72017 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.22184$ in

$S_{ye}=0.012247$ in³, $F_y=50$ ksi

$M_{nl}=51.031$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=15.484$ ksi, $f_2=-50$ ksi

$\psi=3.2291$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=15.484$ ksi, $f_2=-50$ ksi

$\psi=3.2291$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.4761$ in	
$f_1=19.901$ ksi, $f_2=19.901$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.3724$	Eq. 1.1-3
$\rho=0.61185$	Eq. 1.1-2
$b_e=2.1268$ in	Eq. 1.1-1
$b_1=1.0634$ in	Eq. 1.1.2-9
$b_2=1.0634$ in	Eq. 1.1.2-10
Ineffective width= 1.3493 in	
Center of gravity shift: $x=0.087163$ in	
$S_{ye}=0.040582$ in ³ , $F_y=50$ ksi	
$M_n I=169.09$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.11515$ in ⁶ , $W_n=1.7333$ in ² , $F_y=50$ ksi	
$B_n=3321.6$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350T150-43

Full Section Properties

Area	0.29439 in ²	Wt.	1.0009 lb/ft	Flat	6.5274 in
Ix	0.61556 in ⁴	rx	1.4460 in	Ixy	0.00000 in ⁴
Sx(t)	0.33291 in ³	y(t)	1.8491 in	α	0.000 deg
Sx(b)	0.33291 in ³	y(b)	1.8491 in		
Zx	0.38720 in ³	Height	3.6981 in		
Iy	0.06405 in ⁴	ry	0.4664 in	x _o	-0.8670 in
Sy(l)	0.17935 in ³	x(l)	0.3571 in	y _o	0.0000 in
Sy(r)	0.05604 in ³	x(r)	1.1429 in	jx	2.0753 in
Zy	0.09903 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	0.61556 in ⁴	r ₁	1.4460 in	Cw	0.14767 in ⁶
I ₂	0.06405 in ⁴	r ₂	0.4664 in	J	0.00019960 in ⁴
Ic	0.67961 in ⁴	rc	1.5194 in		
I _o	0.90089 in ⁴	r _o	1.7493 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	6363 lb	φMnxo	866.41 lb-ft	φMnyo	87.26 lb-ft
Ae	0.14971 in ²	Ixe	0.48382 in ⁴	Iye	0.01790 in ⁴
φTn	13543 lb	Sxe(t)	0.23104 in ³	Sye(l)	0.09866 in ³
		Sxe(b)	0.30162 in ³	Sye(r)	0.02327 in ³
Shear		Negative Bending		Negative Bending	
φVny	2867 lb	φMnxo	866.41 lb-ft	φMnyo	204.30 lb-ft
φVnx	3370 lb	Ixe	0.48382 in ⁴	Iye	0.06007 in ⁴
Torsion		Sxe(t)	0.30162 in ³	Sye(l)	0.15115 in ³
φBn	3858.2 lb-in ²	Sxe(b)	0.23104 in ³	Sye(r)	0.05448 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0451 in, R=0.0712 in, Ac=0.0066415 in²

Fyc=74.687 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0451 in, R=0.0712 in, Ac=0.0066415 in²

Fyc=74.687 ksi

Eq. A3.3.2-2

Fya=51.114 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
$F_{ya}=52.375$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.29439$ in ² , $F_y=51.114$ ksi	
$T_n=15047$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.29439$ in ² , $F_u=65$ ksi	
$T_n=19135$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1872.1$ lb at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=3185.8$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1872.1$ lb at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.4655$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=1.6638$

$\rho=0.52157$

$b_e=1.8075$ in

$b_1=0.90375$ in

$b_2=0.90375$ in

Ineffective width= 1.658 in

$A_e=0.14971$ in², $F_n=50$ ksi

$P_n=7485.6$ lb

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3837$ in

$f_1=49.462$ ksi, $f_2=49.462$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.0152$

$\rho=0.44206$

$b=0.61168$ in (ineffective width= 0.77202 in)

Element 2: Stiffened, $w=3.4655$ in

$f_1=47.223$ ksi, $f_2=-35.529$ ksi

$\psi=0.75236$

$k=18.267$

$\lambda=0.75663$

$\rho=0.93736$

$b_e=3.2484$ in

$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$

$b_1=0.8657$ in

$b_2=1.6242$ in

Compression width= 1.9776 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.24501$ in

$S_{xe}=0.23104$ in³, $F_y=50$ ksi

$M_{nl}=962.68$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=49.462$ ksi, $f_2=49.462$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.0152$

$\rho=0.44206$

$b=0.61168$ in (ineffective width= 0.77202 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.4655$ in

$f_1=47.223$ ksi, $f_2=-35.529$ ksi

$\psi=0.75236$

Eq. 1.1.2-1

$k=18.267$

Eq. 1.1.2-2

$\lambda=0.75663$

Eq. 1.1-3

$\rho=0.93736$

Eq. 1.1-2

$b_e=3.2484$ in

Eq. 1.1-1

$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$

$b_1=0.8657$ in

Eq. 1.1.2-3

$b_2=1.6242$ in

Eq. 1.1.2-4

Compression width= 1.9776 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.24501$ in

$S_{xe}=0.23104$ in³, $F_y=50$ ksi

$M_{nl}=962.68$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-10.535$ ksi

$\psi=0.21069$

Eq. 1.2.2-1

$k=0.61735$

Eq. 1.2.2-5

$\lambda=1.691$

Eq. 1.1-3

$\rho=0.6032$

Eq. 1.2.2-4

$b=0.83465$ in (ineffective width= 0.54905 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-10.535$ ksi

$\psi=0.21069$

Eq. 1.2.2-1

$k=0.61735$

Eq. 1.2.2-5

$\lambda=1.691$

Eq. 1.1-3

$\rho=0.6032$

Eq. 1.2.2-4

$b=0.83465$ in (ineffective width= 0.54905 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.17563$ in

$S_{ye}=0.023268$ in³, $F_y=50$ ksi

$M_{nl}=96.95$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=12.728$ ksi, $f_2=-50$ ksi

$\psi=3.9284$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=12.728$ ksi, $f_2=-50$ ksi

$\psi=3.9284$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.4655$ in	
$f_1=16.978$ ksi, $f_2=16.978$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=0.96951$	Eq. 1.1-3
$\rho=0.79739$	Eq. 1.1-2
$b_e=2.7634$ in	Eq. 1.1-1
$b_1=1.3817$ in	Eq. 1.1.2-9
$b_2=1.3817$ in	Eq. 1.1.2-10
Ineffective width= 0.70214 in	
Center of gravity shift: $x=0.040324$ in	
$S_{ye}=0.054481$ in ³ , $F_y=50$ ksi	
$M_n I=227.01$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.14767$ in ⁶ , $W_n=1.7223$ in ² , $F_y=50$ ksi	
$B_n=4286.9$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

350T150-54

Full Section Properties

Area	0.36721 in ²	Wt.	1.2485 lb/ft	Flat	6.4877 in
I _x	0.7616 in ⁴	r _x	1.4402 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.41189 in ³	y(t)	1.8491 in	α	0.000 deg
S _x (b)	0.41189 in ³	y(b)	1.8491 in		
Z _x	0.48088 in ³	Height	3.6981 in		
I _y	0.0794 in ⁴	r _y	0.4649 in	x _o	-0.8660 in
S _y (l)	0.21902 in ³	x(l)	0.3623 in	y _o	0.0000 in
S _y (r)	0.06976 in ³	x(r)	1.1377 in	j _x	2.0743 in
Z _y	0.12349 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	0.7616 in ⁴	r ₁	1.4402 in	C _w	0.18080 in ⁶
I ₂	0.0794 in ⁴	r ₂	0.4649 in	J	0.00039212 in ⁴
I _c	0.8410 in ⁴	r _c	1.5133 in		
I _o	1.1164 in ⁴	r _o	1.7436 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	9636 lb	φM _{nxo}	1165.1 lb-ft	φM _{nyo}	149.4 lb-ft
A _e	0.22672 in ²	I _{xe}	0.63387 in ⁴	I _{ye}	0.03525 in ⁴
φT _n	16984 lb	S _{xe} (t)	0.31071 in ³	S _{ye} (l)	0.14863 in ³
		S _{xe} (b)	0.38230 in ³	S _{ye} (r)	0.03985 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	4359 lb	φM _{nxo}	1165.1 lb-ft	φM _{nyo}	260.6 lb-ft
φV _{nx}	4152 lb	I _{xe}	0.63387 in ⁴	I _{ye}	0.07867 in ⁴
Torsion		S _{xe} (t)	0.38230 in ³	S _{ye} (l)	0.21382 in ³
φB _n	4770.5 lb-in ²	S _{xe} (b)	0.31071 in ³	S _{ye} (r)	0.06949 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0566 in, R=0.0849 in, A_c=0.010064 in²

F_{yc}=75.384 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0566 in, R=0.0849 in, A_c=0.010064 in²

F_{yc}=75.384 ksi

Eq. A3.3.2-2

F_{ya}=51.391 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
$F_{ya}=52.938$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.36721$ in ² , $F_y=51.391$ ksi	
$T_n=18871$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.36721$ in ² , $F_u=65$ ksi	
$T_n=23868$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=2306.7$ lb at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=4843.2$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=2306.7$ lb at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.4151$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=1.3064$

$\rho=0.63654$

$b_e=2.1738$ in

$b_1=1.0869$ in

$b_2=1.0869$ in

Ineffective width= 1.2413 in

$A_e=0.22672$ in², $F_n=50$ ksi

$P_n=11336$ lb

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3585$ in

$f_1=49.306$ ksi, $f_2=49.306$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.574$

$\rho=0.54652$

$b=0.74244$ in (ineffective width= 0.61606 in)

Element 2: Stiffened, $w=3.4151$ in

$f_1=46.532$ ksi, $f_2=-37.175$ ksi

$\psi=0.79891$

$k=19.241$

$\lambda=0.57465$

$\rho=1$

$b_e=3.4151$ in

$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$

$b_1=0.89897$ in

$b_2=1.7076$ in

Compression width= 1.8984 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.19103$ in

$S_{xe}=0.31071$ in³, $F_y=50$ ksi

$M_n=1294.6$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=49.306$ ksi, $f_2=49.306$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.574$

$\rho=0.54652$

$b=0.74244$ in (ineffective width= 0.61606 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.4151$ in

$f_1=46.532$ ksi, $f_2=-37.175$ ksi

$\psi=0.79891$

Eq. 1.1.2-1

$k=19.241$

Eq. 1.1.2-2

$\lambda=0.57465$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=3.4151$ in

Eq. 1.1-1

$h_o=3.6981$ in, $b_o=1.5$ in, $h_o/b_o=2.4654$

$b_1=0.89897$ in

Eq. 1.1.2-3

$b_2=1.7076$ in

Eq. 1.1.2-4

Compression width= 1.8984 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.19103$ in

$S_{xe}=0.31071$ in³, $F_y=50$ ksi

$M_{nl}=1294.6$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-9.7061$ ksi

$\psi=0.19412$

Eq. 1.2.2-1

$k=0.6134$

Eq. 1.2.2-5

$\lambda=1.3271$

Eq. 1.1-3

$\rho=0.72168$

Eq. 1.2.2-4

$b=0.9804$ in (ineffective width= 0.3781 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-9.7061$ ksi

$\psi=0.19412$

Eq. 1.2.2-1

$k=0.6134$

Eq. 1.2.2-5

$\lambda=1.3271$

Eq. 1.1-3

$\rho=0.72168$

Eq. 1.2.2-4

$b=0.9804$ in (ineffective width= 0.3781 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.12516$ in

$S_{ye}=0.039847$ in³, $F_y=50$ ksi

$M_{nl}=166.03$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=9.9542$ ksi, $f_2=-50$ ksi

$\psi=5.023$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=9.9542$ ksi, $f_2=-50$ ksi

$\psi=5.023$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.4151$ in	
$f_1=14.95$ ksi, $f_2=14.95$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=0.71438$	Eq. 1.1-3
$\rho=0.96873$	Eq. 1.1-2
$b_e=3.3083$ in	Eq. 1.1-1
$b_1=1.6542$ in	Eq. 1.1.2-9
$b_2=1.6542$ in	Eq. 1.1.2-10
Ineffective width= 0.10679 in	
Center of gravity shift: $x=0.0055904$ in	
$S_{ye}=0.069494$ in ³ , $F_y=50$ ksi	
$M_n=289.56$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.1808$ in ⁶ , $W_n=1.7055$ in ² , $F_y=50$ ksi	
$B_n=5300.5$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

362T150-27

Full Section Properties

Area	0.18746 in ²	Wt.	0.63737 lb/ft	Flat	6.6241 in
Ix	0.40760 in ⁴	rx	1.4745 in	Ixy	0.00000 in ⁴
Sx(t)	0.21674 in ³	y(t)	1.8806 in	α	0.000 deg
Sx(b)	0.21674 in ³	y(b)	1.8806 in		
Zx	0.25127 in ³	Height	3.7612 in		
Iy	0.04105 in ⁴	ry	0.4680 in	x _o	-0.8663 in
Sy(l)	0.11810 in ³	x(l)	0.3476 in	y _o	0.0000 in
Sy(r)	0.03562 in ³	x(r)	1.1524 in	jx	2.1183 in
Zy	0.06273 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	0.40760 in ⁴	r ₁	1.4745 in	Cw	0.098994 in ⁶
I ₂	0.04105 in ⁴	r ₂	0.4680 in	J	0.00005005 in ⁴
Ic	0.44865 in ⁴	rc	1.5470 in		
I _o	0.58935 in ⁴	r _o	1.7731 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 33H, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
φPno	2151.1 lb	φMnxo	345.62 lb-ft	φMnyo	24.96 lb-ft
Ae	0.076687 in ²	Ixe	0.30397 in ⁴	Iye	0.00657 in ⁴
φTn	5668.3 lb	Sxe(t)	0.13964 in ³	Sye(l)	0.05166 in ³
		Sxe(b)	0.19185 in ³	Sye(r)	0.01009 in ³
Shear		Negative Bending		Negative Bending	
φVny	914.5 lb	φMnxo	345.62 lb-ft	φMnyo	82.60 lb-ft
φVnx	1404.1 lb	Ixe	0.30397 in ⁴	Iye	0.03549 in ⁴
Torsion		Sxe(t)	0.19185 in ³	Sye(l)	0.08131 in ³
φBn	1656.5 lb-in ²	Sxe(b)	0.13964 in ³	Sye(r)	0.03337 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=33 ksi, Fu=45 ksi

Bc=1.7189

Eq. A3.3.2-3

m=0.19382

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0283 in, R=0.0796 in, Ac=0.0041675 in²

Fyc=46.421 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0283 in, R=0.0796 in, Ac=0.0041675 in²

Fyc=46.421 ksi

Eq. A3.3.2-2

Fya=33.597 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=33$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in ²	
$F_{yc}=46.421$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in ²	
$F_{yc}=46.421$ ksi	Eq. A3.3.2-2
$F_{ya}=34.284$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=33$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=33$ ksi	
Bending about Y-axis	
$F_{ya}=33$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.18746$ in ² , $F_y=33.597$ ksi	
$T_n=6298.1$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.18746$ in ² , $F_u=45$ ksi	
$T_n=8435.8$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=780.05$ lb at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1016.1$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=780.05$ lb at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3921$ in	
$f_1=33$ ksi, $f_2=33$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6391$	Eq. 1.1-3
$\rho=0.34733$	Eq. 1.1-2
$b=0.48352$ in (ineffective width=0.90858 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3921$ in	
$f_1=33$ ksi, $f_2=33$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6391$	Eq. 1.1-3
$\rho=0.34733$	Eq. 1.1-2
$b=0.48352$ in (ineffective width=0.90858 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.5454$ in

$f_1=33$ ksi, $f_2=33$ ksi

$\psi=1$

$k=4$

$\lambda=2.2037$

$\rho=0.40848$

$b_e=1.4482$ in

$b_1=0.72411$ in

$b_2=0.72411$ in

Ineffective width= 2.0972 in

$A_e=0.076687$ in², $F_n=33$ ksi

$P_n=2530.7$ lb

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3921$ in

$f_1=32.785$ ksi, $f_2=32.785$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.6305$

$\rho=0.34836$

$b=0.48495$ in (ineffective width= 0.90715 in)

Element 2: Stiffened, $w=3.5454$ in

$f_1=31.364$ ksi, $f_2=-22.387$ ksi

$\psi=0.71377$

$k=17.494$

$\lambda=1.0273$

$\rho=0.76496$

$b_e=2.7121$ in

$h_o=3.7612$ in, $b_o=1.5$ in, $h_o/b_o=2.5075$

$b_1=0.73028$ in

$b_2=1.356$ in

Compression width= 2.0688 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.29616$ in

$S_{xe}=0.13964$ in³, $F_y=33$ ksi

$M_{nl}=384.02$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$f_1=32.785$ ksi, $f_2=32.785$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.6305$

$\rho=0.34836$

$b=0.48495$ in (ineffective width= 0.90715 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.5454$ in

$f_1=31.364$ ksi, $f_2=-22.387$ ksi

$\psi=0.71377$

Eq. 1.1.2-1

$k=17.494$

Eq. 1.1.2-2

$\lambda=1.0273$

Eq. 1.1-3

$\rho=0.76496$

Eq. 1.1-2

$b_e=2.7121$ in

Eq. 1.1-1

$h_o=3.7612$ in, $b_o=1.5$ in, $h_o/b_o=2.5075$

$b_1=0.73028$ in

Eq. 1.1.2-3

$b_2=1.356$ in

Eq. 1.1.2-4

Compression width= 2.0688 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.29616$ in

$S_{xe}=0.13964$ in³, $F_y=33$ ksi

$M_{nl}=384.02$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$f_1=33$ ksi, $f_2=-6.8643$ ksi

$\psi=0.20801$

Eq. 1.2.2-1

$k=0.61671$

Eq. 1.2.2-5

$\lambda=2.2037$

Eq. 1.1-3

$\rho=0.48207$

Eq. 1.2.2-4

$b=0.67108$ in (ineffective width= 0.72102 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3921$ in

$f_1=33$ ksi, $f_2=-6.8643$ ksi

$\psi=0.20801$

Eq. 1.2.2-1

$k=0.61671$

Eq. 1.2.2-5

$\lambda=2.2037$

Eq. 1.1-3

$\rho=0.48207$

Eq. 1.2.2-4

$b=0.67108$ in (ineffective width= 0.72102 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.22036$ in

$S_{ye}=0.010085$ in³, $F_y=33$ ksi

$M_{nl}=27.735$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$f_1=10.158$ ksi, $f_2=-33$ ksi

$\psi=3.2486$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3921$ in

$f_1=10.158$ ksi, $f_2=-33$ ksi

$\psi=3.2486$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w = 3.5454$ in	
$f_1 = 13.065$ ksi, $f_2 = 13.065$ ksi	
$\psi = 1$	Eq. 1.1.2-1
$k = 4$	Eq. 1.1.2-8
$\lambda = 1.3866$	Eq. 1.1-3
$\rho = 0.60676$	Eq. 1.1-2
$b_e = 2.1512$ in	Eq. 1.1-1
$b_1 = 1.0756$ in	Eq. 1.1.2-9
$b_2 = 1.0756$ in	Eq. 1.1.2-10
Ineffective width = 1.3942 in	
Center of gravity shift: $x = 0.088891$ in	
$S_y = 0.033375$ in ³ , $F_y = 33$ ksi	
$M_n I = 91.78$ lb-ft	Eq. F3.1-1
$\Omega_b = 1.67$, $\phi_b = 0.9$	
Bimoment Strength, Track	
$C_w = 0.098994$ in ⁶ , $W_n = 1.7749$ in ² , $F_y = 33$ ksi	
$B_n = 1840.5$ lb-in ²	G8.1-1
$\Omega_b = 1.67$, $\phi_b = 0.9$	

362T150-30

Full Section Properties

Area	0.20842 in ²	Wt.	0.00070864 k/ft	Flat	6.6803 in
I _x	0.46557 in ⁴	r _x	1.4946 in	I _{xy}	0.00000 in ⁴
S _x (t)	0.24356 in ³	y(t)	1.9116 in	α	0.000 deg
S _x (b)	0.24356 in ³	y(b)	1.9116 in		
Z _x	0.28298 in ³	Height	3.8231 in		
I _y	0.04534 in ⁴	r _y	0.4664 in	x _o	-0.8597 in
S _y (l)	0.13120 in ³	x(l)	0.3456 in	y _o	0.0000 in
S _y (r)	0.03928 in ³	x(r)	1.1544 in	j _x	2.1493 in
Z _y	0.06908 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	0.46557 in ⁴	r ₁	1.4946 in	C _w	0.11295 in ⁶
I ₂	0.04534 in ⁴	r ₂	0.4664 in	J	0.00006763 in ⁴
I _c	0.51092 in ⁴	r _c	1.5657 in		
I _o	0.66496 in ⁴	r _o	1.7862 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	3.2923 k	φM _{nxo}	6.3389 k-in	φM _{nyo}	0.4244 k-in
A _e	0.077465 in ²	I _{xe}	0.32398 in ⁴	I _{ye}	0.00571 in ⁴
φT _n	9.5336 k	S _{xe} (t)	0.14086 in ³	S _{ye} (l)	0.05094 in ³
		S _{xe} (b)	0.21270 in ³	S _{ye} (r)	0.00943 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.3526 k	φM _{nxo}	6.3389 k-in	φM _{nyo}	1.6253 k-in
φV _{nx}	2.3096 k	I _{xe}	0.32398 in ⁴	I _{ye}	0.03766 in ⁴
Torsion		S _{xe} (t)	0.21270 in ³	S _{ye} (l)	0.08236 in ³
φB _n	2.8139 k-in ²	S _{xe} (b)	0.14086 in ³	S _{ye} (r)	0.03612 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

F_{ya}=50.824 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_y=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
$F_y=51.789$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_y=50$ ksi	
Max compression stress allowed for negative bending: $F_y=50$ ksi	
Bending about Y-axis	
$F_y=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.20842$ in ² , $F_y=50.824$ ksi	
$T_n=10.593$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.20842$ in ² , $F_u=65$ ksi	
$T_n=13.548$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.2831$ k at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1.5029$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.2831$ k at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.6045$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.5015$

$\rho=0.36461$

$b_e=1.3142$ in

$b_1=0.65711$ in

$b_2=0.65711$ in

Ineffective width= 2.2903 in

$A_e=0.077465$ in², $F_n=50$ ksi

$P_n=3.8733$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3907$ in

$f_1=49.661$ ksi, $f_2=49.661$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.9336$

$\rho=0.31531$

$b=0.43851$ in (ineffective width= 0.95219 in)

Element 2: Stiffened, $w=3.6045$ in

$f_1=47.623$ ksi, $f_2=-30.761$ ksi

$\psi=0.64593$

$k=16.21$

$\lambda=1.2127$

$\rho=0.675$

$b_e=2.433$ in

$h_o=3.8231$ in, $b_o=1.5$ in, $h_o/b_o=2.5487$

$b_1=0.66733$ in

$b_2=1.2165$ in

Compression width= 2.19 in

Ineffective width= 0.3061 in

Center of gravity shift: $y=-0.38839$ in

$S_{xe}=0.14086$ in³, $F_y=50$ ksi

$M_{nl}=7.0432$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=49.661$ ksi, $f_2=49.661$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.9336$

$\rho=0.31531$

$b=0.43851$ in (ineffective width= 0.95219 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.6045$ in

$f_1=47.623$ ksi, $f_2=-30.761$ ksi

$\psi=0.64593$

Eq. 1.1.2-1

$k=16.21$

Eq. 1.1.2-2

$\lambda=1.2127$

Eq. 1.1-3

$\rho=0.675$

Eq. 1.1-2

$b_e=2.433$ in

Eq. 1.1-1

$h_o=3.8231$ in, $b_o=1.5$ in, $h_o/b_o=2.5487$

$b_1=0.66733$ in

Eq. 1.1.2-3

$b_2=1.2165$ in

Eq. 1.1.2-4

Compression width= 2.19 in

Ineffective width= 0.3061 in

Center of gravity shift: $y=0.38839$ in

$S_{xe}=0.14086$ in³, $F_y=50$ ksi

$M_{nl}=7.0432$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-10.235$ ksi

$\psi=0.2047$

Eq. 1.2.2-1

$k=0.61592$

Eq. 1.2.2-5

$\lambda=2.4595$

Eq. 1.1-3

$\rho=0.43703$

Eq. 1.2.2-4

$b=0.60778$ in (ineffective width= 0.78292 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-10.235$ ksi

$\psi=0.2047$

Eq. 1.2.2-1

$k=0.61592$

Eq. 1.2.2-5

$\lambda=2.4595$

Eq. 1.1-3

$\rho=0.43703$

Eq. 1.2.2-4

$b=0.60778$ in (ineffective width= 0.78292 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.23358$ in

$S_{ye}=0.0094316$ in³, $F_y=50$ ksi

$M_{nl}=0.47158$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=16.668$ ksi, $f_2=-50$ ksi

$\psi=2.9997$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=16.668$ ksi, $f_2=-50$ ksi

$\psi=2.9997$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.6045$ in	
$f_1=21.16$ ksi, $f_2=21.16$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.6273$	Eq. 1.1-3
$\rho=0.53143$	Eq. 1.1-2
$b_e=1.9155$ in	Eq. 1.1-1
$b_1=0.95777$ in	Eq. 1.1.2-9
$b_2=0.95777$ in	Eq. 1.1.2-10
Ineffective width=1.689 in	
Center of gravity shift: $x=0.11167$ in	
$S_{ye}=0.036117$ in ³ , $F_y=50$ ksi	
$M_n=1.8058$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.11295$ in ⁶ , $W_n=1.8063$ in ² , $F_y=50$ ksi	
$B_n=3.1266$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

362T150-33

Full Section Properties

Area	0.23090 in ²	Wt.	0.00078507 k/ft	Flat	6.6735 in
Ix	0.51483 in ⁴	rx	1.4932 in	Ixy	0.00000 in ⁴
Sx(t)	0.26933 in ³	y(t)	1.9116 in	α	0.000 deg
Sx(b)	0.26933 in ³	y(b)	1.9116 in		
Zx	0.31320 in ³	Height	3.8231 in		
Iy	0.05012 in ⁴	ry	0.4659 in	x _o	-0.8586 in
Sy(l)	0.14449 in ³	x(l)	0.3469 in	y _o	0.0000 in
Sy(r)	0.04346 in ³	x(r)	1.1531 in	jx	2.1472 in
Zy	0.07647 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	0.51483 in ⁴	r ₁	1.4932 in	Cw	0.12461 in ⁶
I ₂	0.05012 in ⁴	r ₂	0.4659 in	J	0.00009214 in ⁴
Ic	0.56495 in ⁴	rc	1.5642 in		
I _o	0.73519 in ⁴	r _o	1.7844 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	3.966 k	φMnxo	7.7946 k-in	φMnyo	0.5473 k-in
Ae	0.093325 in ²	Ixe	0.38342 in ⁴	Iye	0.00788 in ⁴
φTn	10.576 k	Sxe(t)	0.17321 in ³	Sye(l)	0.06177 in ³
		Sxe(b)	0.23822 in ³	Sye(r)	0.01216 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.680 k	φMnxo	7.7946 k-in	φMnyo	1.8285 k-in
φVnx	2.595 k	Ixe	0.38342 in ⁴	Iye	0.04312 in ⁴
Torsion		Sxe(t)	0.23822 in ³	Sye(l)	0.09826 in ³
φBn	3.1107 k-in ²	Sxe(b)	0.17321 in ³	Sye(r)	0.04063 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Fya=50.894 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
$F_{ya}=51.942$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.2309$ in ² , $F_y=50.894$ ksi	
$T_n=11.752$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.2309$ in ² , $F_u=65$ ksi	
$T_n=15.009$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.4418$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1.8665$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.4418$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.6011$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.2535$

$\rho=0.40043$

$b_e=1.442$ in

$b_1=0.72099$ in

$b_2=0.72099$ in

Ineffective width= 2.1591 in

$A_e=0.093325$ in², $F_n=50$ ksi

$P_n=4.6662$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.389$ in

$f_1=49.609$ ksi, $f_2=49.609$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.6407$

$\rho=0.34714$

$b=0.48217$ in (ineffective width= 0.90683 in)

Element 2: Stiffened, $w=3.6011$ in

$f_1=47.492$ ksi, $f_2=-33.864$ ksi

$\psi=0.71304$

$k=17.48$

$\lambda=1.0506$

$\rho=0.7525$

$b_e=2.7098$ in

$h_o=3.8231$ in, $b_o=1.5$ in, $h_o/b_o=2.5487$

$b_1=0.72981$ in

$b_2=1.3549$ in

Compression width= 2.1022 in

Ineffective width= 0.017446 in

Center of gravity shift: $y=-0.30201$ in

$S_{xe}=0.17321$ in³, $F_y=50$ ksi

$M_{nl}=8.6607$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=49.609$ ksi, $f_2=49.609$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.6407$

$\rho=0.34714$

$b=0.48217$ in (ineffective width= 0.90683 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.6011$ in

$f_1=47.492$ ksi, $f_2=-33.864$ ksi

$\psi=0.71304$

Eq. 1.1.2-1

$k=17.48$

Eq. 1.1.2-2

$\lambda=1.0506$

Eq. 1.1-3

$\rho=0.7525$

Eq. 1.1-2

$b_e=2.7098$ in

Eq. 1.1-1

$h_o=3.8231$ in, $b_o=1.5$ in, $h_o/b_o=2.5487$

$b_1=0.72981$ in

Eq. 1.1.2-3

$b_2=1.3549$ in

Eq. 1.1.2-4

Compression width= 2.1022 in

Ineffective width= 0.017447 in

Center of gravity shift: $y=0.30201$ in

$S_{xe}=0.17321$ in³, $F_y=50$ ksi

$M_{nl}=8.6607$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-10.228$ ksi

$\psi=0.20456$

Eq. 1.2.2-1

$k=0.61589$

Eq. 1.2.2-5

$\lambda=2.2152$

Eq. 1.1-3

$\rho=0.47872$

Eq. 1.2.2-4

$b=0.66494$ in (ineffective width= 0.72406 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-10.228$ ksi

$\psi=0.20456$

Eq. 1.2.2-1

$k=0.61589$

Eq. 1.2.2-5

$\lambda=2.2152$

Eq. 1.1-3

$\rho=0.47872$

Eq. 1.2.2-4

$b=0.66494$ in (ineffective width= 0.72406 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.21924$ in

$S_{ye}=0.012161$ in³, $F_y=50$ ksi

$M_{nl}=0.60807$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=15.385$ ksi, $f_2=-50$ ksi

$\psi=3.25$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=15.385$ ksi, $f_2=-50$ ksi

$\psi=3.25$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w = 3.6011$ in	
$f_1 = 19.795$ ksi, $f_2 = 19.795$ ksi	
$\psi = 1$	Eq. 1.1.2-1
$k = 4$	Eq. 1.1.2-8
$\lambda = 1.418$	Eq. 1.1-3
$\rho = 0.59582$	Eq. 1.1-2
$b_e = 2.1456$ in	Eq. 1.1-1
$b_1 = 1.0728$ in	Eq. 1.1.2-9
$b_2 = 1.0728$ in	Eq. 1.1.2-10
Ineffective width = 1.4555 in	
Center of gravity shift: $x = 0.091932$ in	
$S_y = 0.040633$ in ³ , $F_y = 50$ ksi	
$M_n I = 2.0316$ k-in	Eq. F3.1-1
$\Omega_b = 1.67$, $\phi_b = 0.9$	
Bimoment Strength, Track	
$C_w = 0.12461$ in ⁶ , $W_n = 1.8027$ in ² , $F_y = 50$ ksi	
$B_n = 3.4563$ k-in ²	G8.1-1
$\Omega_b = 1.67$, $\phi_b = 0.9$	

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Full Section Properties

Area	0.30002 in ²	Wt.	0.0010201 k/ft	Flat	6.6524 in
I _x	0.66512 in ⁴	r _x	1.4889 in	I _{xy}	0.00000 in ⁴
S _x (t)	0.34795 in ³	y(t)	1.9116 in	α	0.000 deg
S _x (b)	0.34795 in ³	y(b)	1.9116 in		
Z _x	0.40577 in ³	Height	3.8231 in		
I _y	0.06467 in ⁴	r _y	0.4643 in	x _o	-0.8554 in
S _y (l)	0.18433 in ³	x(l)	0.3508 in	y _o	0.0000 in
S _y (r)	0.05627 in ³	x(r)	1.1492 in	j _x	2.1408 in
Z _y	0.09914 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	0.66512 in ⁴	r ₁	1.4889 in	C _w	0.15984 in ⁶
I ₂	0.06467 in ⁴	r ₂	0.4643 in	J	0.00020342 in ⁴
I _c	0.72979 in ⁴	r _c	1.5596 in		
I _o	0.94930 in ⁴	r _o	1.7788 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	6.381 k	φM _{nxo}	10.930 k-in	φM _{nyo}	1.041 k-in
A _e	0.15014 in ²	I _{xe}	0.52454 in ⁴	I _{ye}	0.01780 in ⁴
φT _n	13.796 k	S _{xe} (t)	0.24289 in ³	S _{ye} (l)	0.10077 in ³
		S _{xe} (b)	0.31532 in ³	S _{ye} (r)	0.02312 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2.872 k	φM _{nxo}	10.930 k-in	φM _{nyo}	2.456 k-in
φV _{nx}	3.370 k	I _{xe}	0.52454 in ⁴	I _{ye}	0.06030 in ⁴
Torsion		S _{xe} (t)	0.31532 in ³	S _{ye} (l)	0.15264 in ³
φB _n	4.0152 k-in ²	S _{xe} (b)	0.24289 in ³	S _{ye} (r)	0.05458 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0451 in, R=0.0712 in, A_c=0.0066415 in²

F_{yc}=74.687 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0451 in, R=0.0712 in, A_c=0.0066415 in²

F_{yc}=74.687 ksi

Eq. A3.3.2-2

F_{ya}=51.093 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_y=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
$F_y=52.375$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_y=50$ ksi	
Max compression stress allowed for negative bending: $F_y=50$ ksi	
Bending about Y-axis	
$F_y=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.30002$ in ² , $F_y=51.093$ ksi	
$T_n=15.329$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.30002$ in ² , $F_u=65$ ksi	
$T_n=19.502$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.8721$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=3.1914$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.8721$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.5905$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=1.7238$

$\rho=0.50608$

$b_e=1.8171$ in

$b_1=0.90854$ in

$b_2=0.90854$ in

Ineffective width= 1.7734 in

$A_e=0.15014$ in², $F_n=50$ ksi

$P_n=7.5072$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3837$ in

$f_1=49.478$ ksi, $f_2=49.478$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.0155$

$\rho=0.44199$

$b=0.61159$ in (ineffective width= 0.77211 in)

Element 2: Stiffened, $w=3.5905$ in

$f_1=47.307$ ksi, $f_2=-35.827$ ksi

$\psi=0.75733$

$k=18.369$

$\lambda=0.78244$

$\rho=0.9187$

$b_e=3.2986$ in

$h_o=3.8231$ in, $b_o=1.5$ in, $h_o/b_o=2.5487$

$b_1=0.87791$ in

$b_2=1.6493$ in

Compression width= 2.0432 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.24803$ in

$S_{xe}=0.24289$ in³, $F_y=50$ ksi

$M_{nl}=12.144$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=49.478$ ksi, $f_2=49.478$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.0155$

$\rho=0.44199$

$b=0.61159$ in (ineffective width= 0.77211 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.5905$ in

$f_1=47.307$ ksi, $f_2=-35.827$ ksi

$\psi=0.75733$

Eq. 1.1.2-1

$k=18.369$

Eq. 1.1.2-2

$\lambda=0.78244$

Eq. 1.1-3

$\rho=0.9187$

Eq. 1.1-2

$b_e=3.2986$ in

Eq. 1.1-1

$h_o=3.8231$ in, $b_o=1.5$ in, $h_o/b_o=2.5487$

$b_1=0.87791$ in

Eq. 1.1.2-3

$b_2=1.6493$ in

Eq. 1.1.2-4

Compression width= 2.0432 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.24803$ in

$S_{xe}=0.24289$ in³, $F_y=50$ ksi

$M_{nl}=12.144$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-10.204$ ksi

$\psi=0.20407$

Eq. 1.2.2-1

$k=0.61577$

Eq. 1.2.2-5

$\lambda=1.6931$

Eq. 1.1-3

$\rho=0.59989$

Eq. 1.2.2-4

$b=0.83006$ in (ineffective width= 0.55364 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-10.204$ ksi

$\psi=0.20407$

Eq. 1.2.2-1

$k=0.61577$

Eq. 1.2.2-5

$\lambda=1.6931$

Eq. 1.1-3

$\rho=0.59989$

Eq. 1.2.2-4

$b=0.83007$ in (ineffective width= 0.55363 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.1742$ in

$S_{ye}=0.023122$ in³, $F_y=50$ ksi

$M_{nl}=1.1561$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=12.59$ ksi, $f_2=-50$ ksi

$\psi=3.9713$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=12.59$ ksi, $f_2=-50$ ksi

$\psi=3.9713$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.5905$ in	
$f_1=16.831$ ksi, $f_2=16.831$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.0001$	Eq. 1.1-3
$\rho=0.77993$	Eq. 1.1-2
$b_e=2.8003$ in	Eq. 1.1-1
$b_1=1.4002$ in	Eq. 1.1.2-9
$b_2=1.4002$ in	Eq. 1.1.2-10
Ineffective width= 0.79016 in	
Center of gravity shift: $x=0.044246$ in	
$S_{ye}=0.054576$ in ³ , $F_y=50$ ksi	
$M_n I=2.7288$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.15984$ in ⁶ , $W_n=1.7914$ in ² , $F_y=50$ ksi	
$B_n=4.4613$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.37428 in ²	Wt.	0.0012726 k/ft	Flat	6.6127 in
Ix	0.8232 in ⁴	rx	1.4830 in	Ixy	0.0000 in ⁴
Sx(t)	0.43062 in ³	y(t)	1.9116 in	α	0.000 deg
Sx(b)	0.43062 in ³	y(b)	1.9116 in		
Zx	0.50405 in ³	Height	3.8231 in		
Iy	0.0801 in ⁴	ry	0.4627 in	x _o	-0.8544 in
Sy(l)	0.22508 in ³	x(l)	0.3560 in	y _o	0.0000 in
Sy(r)	0.07005 in ³	x(r)	1.1440 in	jx	2.1401 in
Zy	0.12366 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	0.8232 in ⁴	r ₁	1.4830 in	Cw	0.19580 in ⁶
I ₂	0.0801 in ⁴	r ₂	0.4627 in	J	0.00039968 in ⁴
Ic	0.9033 in ⁴	rc	1.5535 in		
I _o	1.1765 in ⁴	r _o	1.7730 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	9.673 k	φMnxo	14.680 k-in	φMnyo	1.784 k-in
Ae	0.22760 in ²	Ixe	0.68674 in ⁴	Iye	0.03511 in ⁴
φTn	17.302 k	Sxe(t)	0.32623 in ³	Sye(l)	0.15185 in ³
		Sxe(b)	0.39972 in ³	Sye(r)	0.03964 in ³
Shear		Negative Bending		Negative Bending	
φVny	4.395 k	φMnxo	14.680 k-in	φMnyo	3.135 k-in
φVnx	4.152 k	Ixe	0.68674 in ⁴	Iye	0.07911 in ⁴
Torsion		Sxe(t)	0.39972 in ³	Sye(l)	0.21708 in ³
φBn	4.9659 k-in ²	Sxe(b)	0.32623 in ³	Sye(r)	0.06966 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0566 in, R=0.0849 in, Ac=0.010064 in²

Fyc=75.384 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0566 in, R=0.0849 in, Ac=0.010064 in²

Fyc=75.384 ksi

Eq. A3.3.2-2

Fya=51.365 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
$F_{ya}=52.938$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.37428$ in ² , $F_y=51.365$ ksi	
$T_n=19.225$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.37428$ in ² , $F_u=65$ ksi	
$T_n=24.328$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=2.3067$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=4.8836$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=2.3067$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.5401$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=1.3543$

$\rho=0.61845$

$b_e=2.1894$ in

$b_1=1.0947$ in

$b_2=1.0947$ in

Ineffective width= 1.3507 in

$A_e=0.2276$ in², $F_n=50$ ksi

$P_n=11.38$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3585$ in

$f_1=49.328$ ksi, $f_2=49.328$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.5744$

$\rho=0.54642$

$b=0.74231$ in (ineffective width= 0.61619 in)

Element 2: Stiffened, $w=3.5401$ in

$f_1=46.639$ ksi, $f_2=-37.452$ ksi

$\psi=0.80303$

$k=19.329$

$\lambda=0.595$

$\rho=1$

$b_e=3.5401$ in

$h_o=3.8231$ in, $b_o=1.5$ in, $h_o/b_o=2.5487$

$b_1=0.93086$ in

$b_2=1.7701$ in

Compression width= 1.9634 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.19352$ in

$S_{xe}=0.32623$ in³, $F_y=50$ ksi

$M_{nl}=16.312$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=49.328$ ksi, $f_2=49.328$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.5744$

$\rho=0.54642$

$b=0.74231$ in (ineffective width= 0.61619 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.5401$ in

$f_1=46.639$ ksi, $f_2=-37.452$ ksi

$\psi=0.80303$

Eq. 1.1.2-1

$k=19.329$

Eq. 1.1.2-2

$\lambda=0.595$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=3.5401$ in

Eq. 1.1-1

$h_o=3.8231$ in, $b_o=1.5$ in, $h_o/b_o=2.5487$

$b_1=0.93086$ in

Eq. 1.1.2-3

$b_2=1.7701$ in

Eq. 1.1.2-4

Compression width= 1.9634 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.19352$ in

$S_{xe}=0.32623$ in³, $F_y=50$ ksi

$M_{nl}=16.312$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-9.3765$ ksi

$\psi=0.18753$

Eq. 1.2.2-1

$k=0.61184$

Eq. 1.2.2-5

$\lambda=1.3288$

Eq. 1.1-3

$\rho=0.71798$

Eq. 1.2.2-4

$b=0.97537$ in (ineffective width= 0.38313 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-9.3765$ ksi

$\psi=0.18753$

Eq. 1.2.2-1

$k=0.61184$

Eq. 1.2.2-5

$\lambda=1.3288$

Eq. 1.1-3

$\rho=0.71798$

Eq. 1.2.2-4

$b=0.97537$ in (ineffective width= 0.38313 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.12482$ in

$S_{ye}=0.039641$ in³, $F_y=50$ ksi

$M_{nl}=1.9821$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=9.7427$ ksi, $f_2=-50$ ksi

$\psi=5.132$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=9.7427$ ksi, $f_2=-50$ ksi

$\psi=5.132$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.5401$ in	
$f_1=14.721$ ksi, $f_2=14.721$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=0.73483$	Eq. 1.1-3
$\rho=0.95343$	Eq. 1.1-2
$b_e=3.3752$ in	Eq. 1.1-1
$b_1=1.6876$ in	Eq. 1.1.2-9
$b_2=1.6876$ in	Eq. 1.1.2-10
Ineffective width= 0.16485 in	
Center of gravity shift: $x=0.0083791$ in	
$S_y=0.06966$ in ³ , $F_y=50$ ksi	
$M_n=3.483$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.1958$ in ⁶ , $W_n=1.7743$ in ² , $F_y=50$ ksi	
$B_n=5.5176$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400T150-30

Full Section Properties

Area	0.22012 in ²	Wt.	0.00074842 k/ft	Flat	7.0553 in
I _x	0.57915 in ⁴	r _x	1.6220 in	I _{xy}	0.00000 in ⁴
S _x (t)	0.27591 in ³	y(t)	2.0991 in	α	0.000 deg
S _x (b)	0.27591 in ³	y(b)	2.0991 in		
Z _x	0.32315 in ³	Height	4.1981 in		
I _y	0.04655 in ⁴	r _y	0.4599 in	x _o	-0.8268 in
S _y (l)	0.14190 in ³	x(l)	0.3281 in	y _o	0.0000 in
S _y (r)	0.03972 in ³	x(r)	1.1719 in	j _x	2.3625 in
Z _y	0.06922 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	0.57915 in ⁴	r ₁	1.6220 in	C _w	0.14104 in ⁶
I ₂	0.04655 in ⁴	r ₂	0.4599 in	J	0.00007143 in ⁴
I _c	0.62571 in ⁴	r _c	1.6860 in		
I _o	0.77618 in ⁴	r _o	1.8778 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	3.308 k	φM _{nxo}	6.9504 k-in	φM _{nyo}	0.4159 k-in
A _e	0.077838 in ²	I _{xe}	0.39499 in ⁴	I _{ye}	0.00558 in ⁴
φT _n	10.060 k	S _{xe} (t)	0.15445 in ³	S _{ye} (l)	0.05406 in ³
		S _{xe} (b)	0.24073 in ³	S _{ye} (r)	0.00924 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.336 k	φM _{nxo}	6.9504 k-in	φM _{nyo}	1.6299 k-in
φV _{nx}	2.310 k	I _{xe}	0.39499 in ⁴	I _{ye}	0.03789 in ⁴
Torsion		S _{xe} (t)	0.24073 in ³	S _{ye} (l)	0.08345 in ³
φB _n	3.1462 k-in ²	S _{xe} (b)	0.15445 in ³	S _{ye} (r)	0.03622 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

F_{ya}=50.78 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
$F_{ya}=51.789$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.22012$ in ² , $F_y=50.78$ ksi	
$T_n=11.178$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.22012$ in ² , $F_u=65$ ksi	
$T_n=14.308$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.2831$ k at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1.4847$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.2831$ k at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.9795$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.7617$

$\rho=0.33325$

$b_e=1.3262$ in

$b_1=0.66308$ in

$b_2=0.66308$ in

Ineffective width= 2.6533 in

$A_e=0.077838$ in², $F_n=50$ ksi

$P_n=3.8919$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3907$ in

$f_1=49.695$ ksi, $f_2=49.695$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.9346$

$\rho=0.31521$

$b=0.43837$ in (ineffective width= 0.95233 in)

Element 2: Stiffened, $w=3.9795$ in

$f_1=47.863$ ksi, $f_2=-29.955$ ksi

$\psi=0.62585$

$k=15.847$

$\lambda=1.3575$

$\rho=0.61726$

$b_e=2.4564$ in

$h_o=4.1981$ in, $b_o=1.5$ in, $h_o/b_o=2.7987$

$b_1=0.67746$ in

$b_2=1.2282$ in

Compression width= 2.4476 in

Ineffective width= 0.542 in

Center of gravity shift: $y=-0.45829$ in

$S_{xe}=0.15445$ in³, $F_y=50$ ksi

$M_{nl}=7.7226$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=49.695$ ksi, $f_2=49.695$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.9346$

$\rho=0.31521$

$b=0.43837$ in (ineffective width= 0.95233 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)
 Element 2: Stiffened, $w=3.9795$ in
 $f_1=47.863$ ksi, $f_2=-29.955$ ksi
 $\psi=0.62585$ Eq. 1.1.2-1
 $k=15.847$ Eq. 1.1.2-2
 $\lambda=1.3575$ Eq. 1.1-3
 $\rho=0.61726$ Eq. 1.1-2
 $b_e=2.4564$ in Eq. 1.1-1
 $h_o=4.1981$ in, $b_o=1.5$ in, $h_o/b_o=2.7987$
 $b_1=0.67746$ in Eq. 1.1.2-3
 $b_2=1.2282$ in Eq. 1.1.2-4
 Compression width= 2.4476 in
 Ineffective width= 0.542 in
 Center of gravity shift: $y=0.45829$ in
 $S_{xe}=0.15445$ in³, $F_y=50$ ksi
 $M_{nl}=7.7226$ k-in Eq. F3.1-1
 $\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-9.3335$ ksi

$\psi=0.18667$ Eq. 1.2.2-1

$k=0.61164$ Eq. 1.2.2-5

$\lambda=2.4681$ Eq. 1.1-3

$\rho=0.42994$ Eq. 1.2.2-4

$b=0.59792$ in (ineffective width= 0.79278 in) Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-9.3335$ ksi

$\psi=0.18667$ Eq. 1.2.2-1

$k=0.61164$ Eq. 1.2.2-5

$\lambda=2.4681$ Eq. 1.1-3

$\rho=0.42994$ Eq. 1.2.2-4

$b=0.59792$ in (ineffective width= 0.79278 in) Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.22481$ in

$S_{ye}=0.0092417$ in³, $F_y=50$ ksi

$M_{nl}=0.46209$ k-in Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=16.455$ ksi, $f_2=-50$ ksi

$\psi=3.0386$ Eq. 1.2.2-1

$\psi>1$ (fully effective) Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=16.455$ ksi, $f_2=-50$ ksi

$\psi=3.0386$ Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.9795$ in	
$f_1=20.933$ ksi, $f_2=20.933$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.7869$	Eq. 1.1-3
$\rho=0.49072$	Eq. 1.1-2
$b_e=1.9528$ in	Eq. 1.1-1
$b_1=0.97642$ in	Eq. 1.1.2-9
$b_2=0.97642$ in	Eq. 1.1.2-10
Ineffective width= 2.0267 in	
Center of gravity shift: $x=0.12593$ in	
$S_{ye}=0.036219$ in ³ , $F_y=50$ ksi	
$M_n=1.811$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.14104$ in ⁶ , $W_n=2.0173$ in ² , $F_y=50$ ksi	
$B_n=3.4958$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400T150-33

Full Section Properties

Area	0.24388 in ²	Wt.	0.00082918 k/ft	Flat	7.0485 in
Ix	0.64055 in ⁴	rx	1.6207 in	Ixy	0.00000 in ⁴
Sx(t)	0.30516 in ³	y(t)	2.0991 in	α	0.000 deg
Sx(b)	0.30516 in ³	y(b)	2.0991 in		
Zx	0.35771 in ³	Height	4.1981 in		
Iy	0.05146 in ⁴	ry	0.4593 in	x _o	-0.8257 in
Sy(l)	0.15624 in ³	x(l)	0.3293 in	y _o	0.0000 in
Sy(r)	0.04395 in ³	x(r)	1.1707 in	jx	2.3605 in
Zy	0.07665 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	0.64055 in ⁴	r ₁	1.6207 in	Cw	0.15564 in ⁶
I ₂	0.05146 in ⁴	r ₂	0.4593 in	J	0.00009732 in ⁴
Ic	0.69200 in ⁴	rc	1.6845 in		
I _o	0.85829 in ⁴	r _o	1.8760 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	3.988 k	φMnxo	8.5292 k-in	φMnyo	0.5366 k-in
Ae	0.093834 in ²	Ixe	0.46698 in ⁴	Iye	0.00772 in ⁴
φTn	11.160 k	Sxe(t)	0.18954 in ³	Sye(l)	0.06556 in ³
		Sxe(b)	0.26925 in ³	Sye(r)	0.01192 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.664 k	φMnxo	8.5292 k-in	φMnyo	1.8340 k-in
φVnx	2.595 k	Ixe	0.46698 in ⁴	Iye	0.04340 in ⁴
Torsion		Sxe(t)	0.26925 in ³	Sye(l)	0.09975 in ³
φBn	3.4784 k-in ²	Sxe(b)	0.18954 in ³	Sye(r)	0.04076 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Fya=50.847 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
$F_{ya}=51.942$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.24388$ in ² , $F_y=50.847$ ksi	
$T_n=12.4$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.24388$ in ² , $F_u=65$ ksi	
$T_n=15.852$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.4418$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1.8493$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.4418$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.9761$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.4882$

$\rho=0.36636$

$b_e=1.4567$ in

$b_1=0.72834$ in

$b_2=0.72834$ in

Ineffective width= 2.5194 in

$A_e=0.093834$ in², $F_n=50$ ksi

$P_n=4.6917$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.389$ in

$f_1=49.649$ ksi, $f_2=49.649$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.6418$

$\rho=0.34701$

$b=0.482$ in (ineffective width= 0.907 in)

Element 2: Stiffened, $w=3.9761$ in

$f_1=47.747$ ksi, $f_2=-32.966$ ksi

$\psi=0.69044$

$k=17.042$

$\lambda=1.178$

$\rho=0.69036$

$b_e=2.7449$ in

$h_o=4.1981$ in, $b_o=1.5$ in, $h_o/b_o=2.7987$

$b_1=0.7438$ in

$b_2=1.3725$ in

Compression width= 2.3521 in

Ineffective width= 0.23584 in

Center of gravity shift: $y=-0.3647$ in

$S_{xe}=0.18954$ in³, $F_y=50$ ksi

$M_{nl}=9.4769$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=49.649$ ksi, $f_2=49.649$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.6418$

$\rho=0.34701$

$b=0.482$ in (ineffective width= 0.907 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.9761$ in

$f_1=47.747$ ksi, $f_2=-32.966$ ksi

$\psi=0.69044$

Eq. 1.1.2-1

$k=17.042$

Eq. 1.1.2-2

$\lambda=1.178$

Eq. 1.1-3

$\rho=0.69036$

Eq. 1.1-2

$b_e=2.7449$ in

Eq. 1.1-1

$h_o=4.1981$ in, $b_o=1.5$ in, $h_o/b_o=2.7987$

$b_1=0.7438$ in

Eq. 1.1.2-3

$b_2=1.3725$ in

Eq. 1.1.2-4

Compression width= 2.3521 in

Ineffective width= 0.23584 in

Center of gravity shift: $y=0.3647$ in

$S_{xe}=0.18954$ in³, $F_y=50$ ksi

$M_{nl}=9.4769$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-9.3258$ ksi

$\psi=0.18652$

Eq. 1.2.2-1

$k=0.6116$

Eq. 1.2.2-5

$\lambda=2.2229$

Eq. 1.1-3

$\rho=0.47108$

Eq. 1.2.2-4

$b=0.65433$ in (ineffective width= 0.73467 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-9.3258$ ksi

$\psi=0.18652$

Eq. 1.2.2-1

$k=0.6116$

Eq. 1.2.2-5

$\lambda=2.2229$

Eq. 1.1-3

$\rho=0.47108$

Eq. 1.2.2-4

$b=0.65433$ in (ineffective width= 0.73467 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.21156$ in

$S_{ye}=0.011924$ in³, $F_y=50$ ksi

$M_{nl}=0.59618$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=15.199$ ksi, $f_2=-50$ ksi

$\psi=3.2898$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=15.199$ ksi, $f_2=-50$ ksi

$\psi=3.2898$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.9761$ in	
$f_1=19.597$ ksi, $f_2=19.597$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.5577$	Eq. 1.1-3
$\rho=0.55129$	Eq. 1.1-2
$b_e=2.192$ in	Eq. 1.1-1
$b_1=1.096$ in	Eq. 1.1.2-9
$b_2=1.096$ in	Eq. 1.1.2-10
Ineffective width= 1.7841 in	
Center of gravity shift: $x=0.10575$ in	
$S_y=0.040757$ in ³ , $F_y=50$ ksi	
$M_n=2.0378$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.15564$ in ⁶ , $W_n=2.0135$ in ² , $F_y=50$ ksi	
$B_n=3.8649$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400T150-43

Full Section Properties

Area	0.31694 in ²	Wt.	0.0010776 k/ft	Flat	7.0274 in
I _x	0.8280 in ⁴	r _x	1.6164 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.39448 in ³	y(t)	2.0991 in	α	0.000 deg
S _x (b)	0.39448 in ³	y(b)	2.0991 in		
Z _x	0.46361 in ³	Height	4.1981 in		
I _y	0.0664 in ⁴	r _y	0.4577 in	x _o	-0.8225 in
S _y (l)	0.19920 in ³	x(l)	0.3333 in	y _o	0.0000 in
S _y (r)	0.05691 in ³	x(r)	1.1667 in	j _x	2.3542 in
Z _y	0.09943 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	0.8280 in ⁴	r ₁	1.6164 in	C _w	0.19976 in ⁶
I ₂	0.0664 in ⁴	r ₂	0.4577 in	J	0.00021488 in ⁴
I _c	0.8944 in ⁴	r _c	1.6799 in		
I _o	1.1088 in ⁴	r _o	1.8704 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	6.429 k	φM _{nxo}	12.595 k-in	φM _{nyo}	1.022 k-in
A _e	0.15128 in ²	I _{xe}	0.65929 in ⁴	I _{ye}	0.01750 in ⁴
φT _n	14.557 k	S _{xe} (t)	0.27990 in ³	S _{ye} (l)	0.10698 in ³
		S _{xe} (b)	0.35779 in ³	S _{ye} (r)	0.02272 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2.876 k	φM _{nxo}	12.595 k-in	φM _{nyo}	2.467 k-in
φV _{nx}	3.370 k	I _{xe}	0.65929 in ⁴	I _{ye}	0.06092 in ⁴
Torsion		S _{xe} (t)	0.35779 in ³	S _{ye} (l)	0.15667 in ³
φB _n	4.4911 k-in ²	S _{xe} (b)	0.27990 in ³	S _{ye} (r)	0.05482 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0451 in, R=0.0712 in, A_c=0.0066415 in²

F_{yc}=74.687 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0451 in, R=0.0712 in, A_c=0.0066415 in²

F_{yc}=74.687 ksi

Eq. A3.3.2-2

F_{ya}=51.035 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
$F_{ya}=52.375$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.31694$ in ² , $F_y=51.035$ ksi	
$T_n=16.175$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.31694$ in ² , $F_u=65$ ksi	
$T_n=20.601$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.8721$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=3.1957$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.8721$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.9655$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=1.9038$

$\rho=0.46456$

$b_e=1.8422$ in

$b_1=0.92111$ in

$b_2=0.92111$ in

Ineffective width= 2.1233 in

$A_e=0.15128$ in², $F_n=50$ ksi

$P_n=7.5639$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3837$ in

$f_1=49.521$ ksi, $f_2=49.521$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.0164$

$\rho=0.44182$

$b=0.61135$ in (ineffective width= 0.77235 in)

Element 2: Stiffened, $w=3.9655$ in

$f_1=47.531$ ksi, $f_2=-36.65$ ksi

$\psi=0.77108$

$k=18.653$

$\lambda=0.85958$

$\rho=0.86561$

$b_e=3.4326$ in

$h_o=4.1981$ in, $b_o=1.5$ in, $h_o/b_o=2.7987$

$b_1=0.91024$ in

$b_2=1.7163$ in

Compression width= 2.239 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.2564$ in

$S_{xe}=0.2799$ in³, $F_y=50$ ksi

$M_n=13.995$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=49.521$ ksi, $f_2=49.521$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.0164$

$\rho=0.44182$

$b=0.61135$ in (ineffective width= 0.77235 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.9655$ in

$f_1=47.531$ ksi, $f_2=-36.65$ ksi

$\psi=0.77108$

Eq. 1.1.2-1

$k=18.653$

Eq. 1.1.2-2

$\lambda=0.85958$

Eq. 1.1-3

$\rho=0.86561$

Eq. 1.1-2

$b_e=3.4326$ in

Eq. 1.1-1

$h_o=4.1981$ in, $b_o=1.5$ in, $h_o/b_o=2.7987$

$b_1=0.91024$ in

Eq. 1.1.2-3

$b_2=1.7163$ in

Eq. 1.1.2-4

Compression width= 2.239 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.2564$ in

$S_{xe}=0.2799$ in³, $F_y=50$ ksi

$M_{nl}=13.995$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-9.2997$ ksi

$\psi=0.18599$

Eq. 1.2.2-1

$k=0.61148$

Eq. 1.2.2-5

$\lambda=1.6991$

Eq. 1.1-3

$\rho=0.59083$

Eq. 1.2.2-4

$b=0.81754$ in (ineffective width= 0.56616 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-9.2997$ ksi

$\psi=0.18599$

Eq. 1.2.2-1

$k=0.61148$

Eq. 1.2.2-5

$\lambda=1.6991$

Eq. 1.1-3

$\rho=0.59083$

Eq. 1.2.2-4

$b=0.81754$ in (ineffective width= 0.56616 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.16972$ in

$S_{ye}=0.022718$ in³, $F_y=50$ ksi

$M_{nl}=1.1359$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=12.228$ ksi, $f_2=-50$ ksi

$\psi=4.089$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=12.228$ ksi, $f_2=-50$ ksi

$\psi=4.089$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.9655$ in	
$f_1=16.444$ ksi, $f_2=16.444$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.0918$	Eq. 1.1-3
$\rho=0.73135$	Eq. 1.1-2
$b_e=2.9002$ in	Eq. 1.1-1
$b_1=1.4501$ in	Eq. 1.1.2-9
$b_2=1.4501$ in	Eq. 1.1.2-10
Ineffective width=1.0653 in	
Center of gravity shift: $x=0.055525$ in	
$S_{ye}=0.054823$ in ³ , $F_y=50$ ksi	
$M_n I=2.7411$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.19976$ in ⁶ , $W_n=2.0015$ in ² , $F_y=50$ ksi	
$B_n=4.9901$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

400T150-54

Full Section Properties

Area	0.39551 in ²	Wt.	0.0013447 k/ft	Flat	6.9877 in
I _x	1.0256 in ⁴	r _x	1.6103 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.48859 in ³	y(t)	2.0991 in	α	0.000 deg
S _x (b)	0.48859 in ³	y(b)	2.0991 in		
Z _x	0.57622 in ³	Height	4.1981 in		
I _y	0.0823 in ⁴	r _y	0.4562 in	x _o	-0.8214 in
S _y (l)	0.24317 in ³	x(l)	0.3384 in	y _o	0.0000 in
S _y (r)	0.07085 in ³	x(r)	1.1616 in	j _x	2.3541 in
Z _y	0.12413 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	1.0256 in ⁴	r ₁	1.6103 in	C _w	0.24498 in ⁶
I ₂	0.0823 in ⁴	r ₂	0.4562 in	J	0.00042234 in ⁴
I _c	1.1079 in ⁴	r _c	1.6737 in		
I _o	1.3747 in ⁴	r _o	1.8644 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	9.771 k	φM _{nxo}	16.859 k-in	φM _{nyo}	1.758 k-in
A _e	0.22990 in ²	I _{xe}	0.86145 in ⁴	I _{ye}	0.03469 in ⁴
φT _n	18.258 k	S _{xe} (t)	0.37464 in ³	S _{ye} (l)	0.16136 in ³
		S _{xe} (b)	0.45372 in ³	S _{ye} (r)	0.03907 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	4.471 k	φM _{nxo}	16.859 k-in	φM _{nyo}	3.153 k-in
φV _{nx}	4.152 k	I _{xe}	0.86145 in ⁴	I _{ye}	0.08018 in ⁴
Torsion		S _{xe} (t)	0.45372 in ³	S _{ye} (l)	0.22546 in ³
φB _n	5.5583 k-in ²	S _{xe} (b)	0.37464 in ³	S _{ye} (r)	0.07007 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0566 in, R=0.0849 in, A_c=0.010064 in²

F_{yc}=75.384 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0566 in, R=0.0849 in, A_c=0.010064 in²

F_{yc}=75.384 ksi

Eq. A3.3.2-2

F_{ya}=51.292 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
$F_{ya}=52.938$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.39551$ in ² , $F_y=51.292$ ksi	
$T_n=20.286$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.39551$ in ² , $F_u=65$ ksi	
$T_n=25.708$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=2.3067$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=4.9683$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=2.3067$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1

Element 2: Stiffened, $w=3.9151$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=1.4977$

$\rho=0.5696$

$b_e=2.2301$ in

$b_1=1.115$ in

$b_2=1.115$ in

Ineffective width= 1.685 in

$A_e=0.2299$ in², $F_n=50$ ksi

$P_n=11.495$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3585$ in

$f_1=49.385$ ksi, $f_2=49.385$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.5753$

$\rho=0.54615$

$b=0.74195$ in (ineffective width= 0.61655 in)

Element 2: Stiffened, $w=3.9151$ in

$f_1=46.923$ ksi, $f_2=-38.213$ ksi

$\psi=0.81439$

$k=19.575$

$\lambda=0.65588$

$\rho=1$

$b_e=3.9151$ in

$h_o=4.1981$ in, $b_o=1.5$ in, $h_o/b_o=2.7987$

$b_1=1.0264$ in

$b_2=1.9576$ in

Compression width= 2.1578 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.20039$ in

$S_{xe}=0.37464$ in³, $F_y=50$ ksi

$M_{nl}=18.732$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=49.385$ ksi, $f_2=49.385$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.5753$

$\rho=0.54615$

$b=0.74195$ in (ineffective width= 0.61655 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=3.9151$ in

$f_1=46.923$ ksi, $f_2=-38.214$ ksi

$\psi=0.81439$

Eq. 1.1.2-1

$k=19.575$

Eq. 1.1.2-2

$\lambda=0.65588$

Eq. 1.1-3

$\rho=1$

Eq. 1.1-2

$b_e=3.9151$ in

Eq. 1.1-1

$h_o=4.1981$ in, $b_o=1.5$ in, $h_o/b_o=2.7987$

$b_1=1.0264$ in

Eq. 1.1.2-3

$b_2=1.9576$ in

Eq. 1.1.2-4

Compression width= 2.1578 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.20039$ in

$S_{xe}=0.37464$ in³, $F_y=50$ ksi

$M_{nl}=18.732$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-8.4774$ ksi

$\psi=0.16955$

Eq. 1.2.2-1

$k=0.60762$

Eq. 1.2.2-5

$\lambda=1.3334$

Eq. 1.1-3

$\rho=0.70786$

Eq. 1.2.2-4

$b=0.96163$ in (ineffective width= 0.39687 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-8.4774$ ksi

$\psi=0.16955$

Eq. 1.2.2-1

$k=0.60762$

Eq. 1.2.2-5

$\lambda=1.3334$

Eq. 1.1-3

$\rho=0.70786$

Eq. 1.2.2-4

$b=0.96163$ in (ineffective width= 0.39687 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.12342$ in

$S_{ye}=0.039066$ in³, $F_y=50$ ksi

$M_{nl}=1.9533$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=9.3238$ ksi, $f_2=-50$ ksi

$\psi=5.3626$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=9.3238$ ksi, $f_2=-50$ ksi

$\psi=5.3626$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=3.9151$ in	
$f_1=14.267$ ksi, $f_2=14.267$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=0.80004$	Eq. 1.1-3
$\rho=0.90622$	Eq. 1.1-2
$b_e=3.5479$ in	Eq. 1.1-1
$b_1=1.774$ in	Eq. 1.1.2-9
$b_2=1.774$ in	Eq. 1.1.2-10
Ineffective width= 0.36716 in	
Center of gravity shift: $x=0.0172$ in	
$S_y=0.070068$ in ³ , $F_y=50$ ksi	
$M_n=3.5034$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.24498$ in ⁶ , $W_n=1.9834$ in ² , $F_y=50$ ksi	
$B_n=6.1759$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

550T150-27

Full Section Properties

Area	0.24228 in ²	Wt.	0.82374 lb/ft	Flat	8.5610 in
I _x	1.0872 in ⁴	r _x	2.1184 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.38162 in ³	y(t)	2.8491 in	α	0.000 deg
S _x (b)	0.38162 in ³	y(b)	2.8491 in		
Z _x	0.45936 in ³	Height	5.6981 in		
I _y	0.0458 in ⁴	r _y	0.4347 in	x _o	-0.7193 in
S _y (l)	0.16818 in ³	x(l)	0.2722 in	y _o	0.0000 in
S _y (r)	0.03728 in ³	x(r)	1.2278 in	j _x	3.4635 in
Z _y	0.06329 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	1.0872 in ⁴	r ₁	2.1184 in	C _w	0.26473 in ⁶
I ₂	0.0458 in ⁴	r ₂	0.4347 in	J	0.00006468 in ⁴
I _c	1.1330 in ⁴	r _c	2.1625 in		
I _o	1.2584 in ⁴	r _o	2.2790 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	2805 lb	φM _{nxo}	654.10 lb-ft	φM _{nyo}	25.52 lb-ft
A _e	0.065996 in ²	I _{xe}	0.64977 in ⁴	I _{ye}	0.00381 in ⁴
φT _n	11032 lb	S _{xe} (t)	0.17443 in ³	S _{ye} (l)	0.05455 in ³
		S _{xe} (b)	0.32934 in ³	S _{ye} (r)	0.00681 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1021 lb	φM _{nxo}	654.10 lb-ft	φM _{nyo}	122.20 lb-ft
φV _{nx}	2019 lb	I _{xe}	0.64977 in ⁴	I _{ye}	0.03374 in ⁴
Torsion		S _{xe} (t)	0.32934 in ³	S _{ye} (l)	0.07264 in ³
φB _n	4106.7 lb-in ²	S _{xe} (b)	0.17443 in ³	S _{ye} (r)	0.03259 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0283 in, R=0.0796 in, A_c=0.0041675 in²

F_{yc}=67.251 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0283 in, R=0.0796 in, A_c=0.0041675 in²

F_{yc}=67.251 ksi

Eq. A3.3.2-2

F_{ya}=50.593 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in ²	
$F_{yc}=67.251$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0283$ in, $R=0.0796$ in, $A_c=0.0041675$ in ²	
$F_{yc}=67.251$ ksi	Eq. A3.3.2-2
$F_{ya}=51.65$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.24228$ in ² , $F_y=50.593$ ksi	
$T_n=12258$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.24228$ in ² , $F_u=65$ ksi	
$T_n=15748$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1121.9$ lb at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1134.7$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1121.9$ lb at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3921$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=3.2485$	Eq. 1.1-3
$\rho=0.28699$	Eq. 1.1-2
$b=0.39951$ in (ineffective width=0.99259 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3921$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=3.2485$	Eq. 1.1-3
$\rho=0.28699$	Eq. 1.1-2
$b=0.39951$ in (ineffective width=0.99259 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.4823$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.1.2-1

$k=4$

Eq. 1.1.2-8

$\lambda=4.1945$

Eq. 1.1-3

$\rho=0.2259$

Eq. 1.1-2

$b_e=1.2385$ in

Eq. 1.1-1

$b_1=0.61923$ in

Eq. 1.1.2-9

$b_2=0.61923$ in

Eq. 1.1.2-10

Ineffective width= 4.2438 in

$A_e=0.065996$ in², $F_n=50$ ksi

$P_n=3299.8$ lb

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3921$ in

$f_1=49.81$ ksi, $f_2=49.81$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=3.2423$

Eq. 1.1-3

$\rho=0.28749$

Eq. 1.1-2

$b=0.40022$ in (ineffective width= 0.99188 in)

Eq. 1.1-1

Element 2: Stiffened, $w=5.4823$ in

$f_1=48.551$ ksi, $f_2=-25.064$ ksi

$\psi=0.51624$

Eq. 1.1.2-1

$k=14.004$

Eq. 1.1.2-2

$\lambda=2.209$

Eq. 1.1-3

$\rho=0.40761$

Eq. 1.1-2

$b_e=2.2346$ in

Eq. 1.1-1

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=0.63551$ in

Eq. 1.1.2-3

$b_2=1.1173$ in

Eq. 1.1.2-4

Compression width= 3.6157 in

Ineffective width= 1.8629 in

Center of gravity shift: $y=-0.87611$ in

$S_{xe}=0.17443$ in³, $F_y=50$ ksi

$M_n=726.78$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$f_1=49.81$ ksi, $f_2=49.81$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=3.2423$

Eq. 1.1-3

$\rho=0.28749$

Eq. 1.1-2

$b=0.40022$ in (ineffective width= 0.99188 in)

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.4823$ in

$f_1=48.551$ ksi, $f_2=-25.064$ ksi

$\psi=0.51624$

Eq. 1.1.2-1

$k=14.004$

Eq. 1.1.2-2

$\lambda=2.209$

Eq. 1.1-3

$\rho=0.40761$

Eq. 1.1-2

$b_e=2.2346$ in

Eq. 1.1-1

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=0.63551$ in

Eq. 1.1.2-3

$b_2=1.1173$ in

Eq. 1.1.2-4

Compression width= 3.6157 in

Ineffective width= 1.8629 in

Center of gravity shift: $y=0.87611$ in

$S_{xe}=0.17443$ in³, $F_y=50$ ksi

$M_{nl}=726.78$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$f_1=50$ ksi, $f_2=-6.6891$ ksi

$\psi=0.13378$

Eq. 1.2.2-1

$k=0.59935$

Eq. 1.2.2-5

$\lambda=2.7516$

Eq. 1.1-3

$\rho=0.3747$

Eq. 1.2.2-4

$b=0.52162$ in (ineffective width= 0.87048 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3921$ in

$f_1=50$ ksi, $f_2=-6.6892$ ksi

$\psi=0.13378$

Eq. 1.2.2-1

$k=0.59935$

Eq. 1.2.2-5

$\lambda=2.7516$

Eq. 1.1-3

$\rho=0.3747$

Eq. 1.2.2-4

$b=0.52162$ in (ineffective width= 0.87048 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.20233$ in

$S_{ye}=0.0068064$ in³, $F_y=50$ ksi

$M_{nl}=28.36$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3921$ in

$f_1=17.176$ ksi, $f_2=-50$ ksi

$\psi=2.911$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3921$ in

$f_1=17.176$ ksi, $f_2=-50$ ksi

$\psi=2.911$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.4823$ in	
$f_1=21.7$ ksi, $f_2=21.7$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=2.7633$	Eq. 1.1-3
$\rho=0.33307$	Eq. 1.1-2
$b_e=1.826$ in	Eq. 1.1-1
$b_1=0.913$ in	Eq. 1.1.2-9
$b_2=0.913$ in	Eq. 1.1.2-10
Ineffective width= 3.6563 in	
Center of gravity shift: $x=0.19234$ in	
$S_{ye}=0.032586$ in ³ , $F_y=50$ ksi	
$M_n I=135.77$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.26472$ in ⁶ , $W_n=2.9008$ in ² , $F_y=50$ ksi	
$B_n=4563$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

550T150-30

Full Section Properties

Area	0.26692 in ²	Wt.	0.90754 lb/ft	Flat	8.5553 in
I _x	1.1965 in ⁴	r _x	2.1172 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.41996 in ³	y(t)	2.8491 in	α	0.000 deg
S _x (b)	0.41996 in ³	y(b)	2.8491 in		
Z _x	0.50580 in ³	Height	5.6981 in		
I _y	0.0503 in ⁴	r _y	0.4342 in	x _o	-0.7184 in
S _y (l)	0.18415 in ³	x(l)	0.2733 in	y _o	0.0000 in
S _y (r)	0.04102 in ³	x(r)	1.2267 in	j _x	3.4622 in
Z _y	0.06973 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	1.1965 in ⁴	r ₁	2.1172 in	C _w	0.29075 in ⁶
I ₂	0.0503 in ⁴	r ₂	0.4342 in	J	0.00008661 in ⁴
I _c	1.2468 in ⁴	r _c	2.1612 in		
I _o	1.3846 in ⁴	r _o	2.2775 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	3350 lb	φM _n x _o	784.39 lb-ft	φM _n y _o	32.52 lb-ft
A _e	0.078818 in ²	I _x e	0.75783 in ⁴	I _y e	0.00520 in ⁴
φT _n	12166 lb	S _x e(t)	0.20917 in ³	S _y e(l)	0.06551 in ³
		S _x e(b)	0.36520 in ³	S _y e(r)	0.00867 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1266 lb	φM _n x _o	784.39 lb-ft	φM _n y _o	136.83 lb-ft
φV _{nx}	2310 lb	I _x e	0.75783 in ⁴	I _y e	0.03849 in ⁴
Torsion		S _x e(t)	0.36520 in ³	S _y e(l)	0.08643 in ³
φB _n	4516.7 lb-in ²	S _x e(b)	0.20917 in ³	S _y e(r)	0.03649 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

F_{ya}=50.643 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
$F_{ya}=51.789$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.26692$ in ² , $F_y=50.643$ ksi	
$T_n=13518$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.26692$ in ² , $F_u=65$ ksi	
$T_n=17350$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1283.1$ lb at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1406.8$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1283.1$ lb at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.4795$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=3.8027$

$\rho=0.24776$

$b_e=1.3576$ in

$b_1=0.67879$ in

$b_2=0.67879$ in

Ineffective width= 4.1219 in

$A_e=0.078818$ in², $F_n=50$ ksi

$P_n=3940.9$ lb

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3907$ in

$f_1=49.785$ ksi, $f_2=49.785$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.9373$

$\rho=0.31495$

$b=0.43801$ in (ineffective width= 0.95269 in)

Element 2: Stiffened, $w=5.4795$ in

$f_1=48.491$ ksi, $f_2=-27.141$ ksi

$\psi=0.5597$

$k=14.708$

$\lambda=1.953$

$\rho=0.45436$

$b_e=2.4897$ in

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=0.6994$ in

$b_2=1.2448$ in

Compression width= 3.5132 in

Ineffective width= 1.5689 in

Center of gravity shift: $y=-0.77396$ in

$S_{xe}=0.20917$ in³, $F_y=50$ ksi

$M_{nl}=871.54$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=49.785$ ksi, $f_2=49.785$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.9373$

$\rho=0.31495$

$b=0.43801$ in (ineffective width= 0.95269 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.4795$ in

$f_1=48.491$ ksi, $f_2=-27.141$ ksi

$\psi=0.5597$

Eq. 1.1.2-1

$k=14.708$

Eq. 1.1.2-2

$\lambda=1.953$

Eq. 1.1-3

$\rho=0.45436$

Eq. 1.1-2

$b_e=2.4897$ in

Eq. 1.1-1

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=0.6994$ in

Eq. 1.1.2-3

$b_2=1.2448$ in

Eq. 1.1.2-4

Compression width= 3.5132 in

Ineffective width= 1.5689 in

Center of gravity shift: $y=0.77396$ in

$S_{xe}=0.20917$ in³, $F_y=50$ ksi

$M_{nl}=871.54$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-6.6837$ ksi

$\psi=0.13367$

Eq. 1.2.2-1

$k=0.59932$

Eq. 1.2.2-5

$\lambda=2.4934$

Eq. 1.1-3

$\rho=0.4092$

Eq. 1.2.2-4

$b=0.56907$ in (ineffective width= 0.82163 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-6.6837$ ksi

$\psi=0.13367$

Eq. 1.2.2-1

$k=0.59932$

Eq. 1.2.2-5

$\lambda=2.4934$

Eq. 1.1-3

$\rho=0.4092$

Eq. 1.2.2-4

$b=0.56907$ in (ineffective width= 0.82163 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.19397$ in

$S_{ye}=0.0086728$ in³, $F_y=50$ ksi

$M_{nl}=36.137$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=15.886$ ksi, $f_2=-50$ ksi

$\psi=3.1475$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=15.886$ ksi, $f_2=-50$ ksi

$\psi=3.1475$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.4795$ in	
$f_1=20.325$ ksi, $f_2=20.325$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=2.4245$	Eq. 1.1-3
$\rho=0.37503$	Eq. 1.1-2
$b_e=2.055$ in	Eq. 1.1-1
$b_1=1.0275$ in	Eq. 1.1.2-9
$b_2=1.0275$ in	Eq. 1.1.2-10
Ineffective width= 3.4245 in	
Center of gravity shift: $x=0.17199$ in	
$S_{ye}=0.036489$ in ³ , $F_y=50$ ksi	
$M_n I=152.04$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.29075$ in ⁶ , $W_n=2.8967$ in ² , $F_y=50$ ksi	
$B_n=5018.6$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

550T150-33

Full Section Properties

Area	0.29578 in ²	Wt.	1.0056 lb/ft	Flat	8.5485 in
I _x	1.3240 in ⁴	r _x	2.1158 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.46472 in ³	y(t)	2.8491 in	α	0.000 deg
S _x (b)	0.46472 in ³	y(b)	2.8491 in		
Z _x	0.56008 in ³	Height	5.6981 in		
I _y	0.0556 in ⁴	r _y	0.4337 in	x _o	-0.7174 in
S _y (l)	0.20258 in ³	x(l)	0.2746 in	y _o	0.0000 in
S _y (r)	0.04540 in ³	x(r)	1.2254 in	j _x	3.4607 in
Z _y	0.07727 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	1.3240 in ⁴	r ₁	2.1158 in	C _w	0.32099 in ⁶
I ₂	0.0556 in ⁴	r ₂	0.4337 in	J	0.00011803 in ⁴
I _c	1.3797 in ⁴	r _c	2.1597 in		
I _o	1.5319 in ⁴	r _o	2.2758 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	4045 lb	φM _n x _o	954.83 lb-ft	φM _n y _o	42.03 lb-ft
A _e	0.095173 in ²	I _x e	0.89315 in ⁴	I _y e	0.00721 in ⁴
φT _n	13496 lb	S _x e(t)	0.25462 in ³	S _y e(l)	0.07952 in ³
		S _x e(b)	0.40777 in ³	S _y e(r)	0.01121 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1588 lb	φM _n x _o	954.83 lb-ft	φM _n y _o	154.14 lb-ft
φV _{nx}	2595 lb	I _x e	0.89315 in ⁴	I _y e	0.04420 in ⁴
Torsion		S _x e(t)	0.40777 in ³	S _y e(l)	0.10411 in ³
φB _n	4994.8 lb-in ²	S _x e(b)	0.25462 in ³	S _y e(r)	0.04110 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0346 in, R=0.0764 in, A_c=0.0050926 in²

F_{yc}=70.273 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0346 in, R=0.0764 in, A_c=0.0050926 in²

F_{yc}=70.273 ksi

Eq. A3.3.2-2

F_{ya}=50.698 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_y=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
$F_y=51.942$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_y=50$ ksi	
Max compression stress allowed for negative bending: $F_y=50$ ksi	
Bending about Y-axis	
$F_y=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.29578$ in ² , $F_y=50.698$ ksi	
$T_n=14995$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.29578$ in ² , $F_u=65$ ksi	
$T_n=19226$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1441.8$ lb at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1764.3$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1441.8$ lb at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.4761$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.1.2-1

$k=4$

Eq. 1.1.2-8

$\lambda=3.4269$

Eq. 1.1-3

$\rho=0.27308$

Eq. 1.1-2

$b_e=1.4954$ in

Eq. 1.1-1

$b_1=0.7477$ in

Eq. 1.1.2-9

$b_2=0.7477$ in

Eq. 1.1.2-10

Ineffective width= 3.9807 in

$A_e=0.095173$ in², $F_n=50$ ksi

$P_n=4758.7$ lb

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.389$ in

$f_1=49.753$ ksi, $f_2=49.753$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.6446$

Eq. 1.1-3

$\rho=0.34668$

Eq. 1.1-2

$b=0.48154$ in (ineffective width= 0.90746 in)

Eq. 1.1-1

Element 2: Stiffened, $w=5.4761$ in

$f_1=48.417$ ksi, $f_2=-29.655$ ksi

$\psi=0.61248$

Eq. 1.1.2-1

$k=15.61$

Eq. 1.1.2-2

$\lambda=1.707$

Eq. 1.1-3

$\rho=0.51031$

Eq. 1.1-2

$b_e=2.7945$ in

Eq. 1.1-1

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=0.77357$ in

Eq. 1.1.2-3

$b_2=1.3973$ in

Eq. 1.1.2-4

Compression width= 3.3961 in

Ineffective width= 1.2252 in

Center of gravity shift: $y=-0.6587$ in

$S_{xe}=0.25462$ in³, $F_y=50$ ksi

$M_{nl}=1060.9$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=49.753$ ksi, $f_2=49.753$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=2.6446$

Eq. 1.1-3

$\rho=0.34668$

Eq. 1.1-2

$b=0.48154$ in (ineffective width= 0.90746 in)

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.4761$ in

$f_1=48.417$ ksi, $f_2=-29.655$ ksi

$\psi=0.61248$

Eq. 1.1.2-1

$k=15.61$

Eq. 1.1.2-2

$\lambda=1.707$

Eq. 1.1-3

$\rho=0.51031$

Eq. 1.1-2

$b_e=2.7945$ in

Eq. 1.1-1

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=0.77357$ in

Eq. 1.1.2-3

$b_2=1.3973$ in

Eq. 1.1.2-4

Compression width= 3.3961 in

Ineffective width= 1.2253 in

Center of gravity shift: $y=0.6587$ in

$S_{xe}=0.25462$ in³, $F_y=50$ ksi

$M_{nl}=1060.9$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-6.6749$ ksi

$\psi=0.1335$

Eq. 1.2.2-1

$k=0.59928$

Eq. 1.2.2-5

$\lambda=2.2457$

Eq. 1.1-3

$\rho=0.4487$

Eq. 1.2.2-4

$b=0.62324$ in (ineffective width= 0.76576 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-6.675$ ksi

$\psi=0.1335$

Eq. 1.2.2-1

$k=0.59928$

Eq. 1.2.2-5

$\lambda=2.2457$

Eq. 1.1-3

$\rho=0.4487$

Eq. 1.2.2-4

$b=0.62324$ in (ineffective width= 0.76576 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.18389$ in

$S_{ye}=0.011208$ in³, $F_y=50$ ksi

$M_{nl}=46.7$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=14.541$ ksi, $f_2=-50$ ksi

$\psi=3.4385$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=14.541$ ksi, $f_2=-50$ ksi

$\psi=3.4385$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.4761$ in	
$f_1=18.895$ ksi, $f_2=18.895$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=2.1067$	Eq. 1.1-3
$\rho=0.42511$	Eq. 1.1-2
$b_e=2.328$ in	Eq. 1.1-1
$b_1=1.164$ in	Eq. 1.1.2-9
$b_2=1.164$ in	Eq. 1.1.2-10
Ineffective width= 3.1481 in	
Center of gravity shift: $x=0.14999$ in	
$S_{ye}=0.041103$ in ³ , $F_y=50$ ksi	
$M_n I=171.26$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.32099$ in ⁶ , $W_n=2.8919$ in ² , $F_y=50$ ksi	
$B_n=5549.8$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

550T150-43

Full Section Properties

Area	0.38459 in ²	Wt.	1.3076 lb/ft	Flat	8.5274 in
I _x	1.7144 in ⁴	r _x	2.1114 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.60175 in ³	y(t)	2.8491 in	α	0.000 deg
S _x (b)	0.60175 in ³	y(b)	2.8491 in		
Z _x	0.72669 in ³	Height	5.6981 in		
I _y	0.0718 in ⁴	r _y	0.4320 in	x _o	-0.7143 in
S _y (l)	0.25765 in ³	x(l)	0.2786 in	y _o	0.0000 in
S _y (r)	0.05878 in ³	x(r)	1.2214 in	j _x	3.4558 in
Z _y	0.10048 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	1.7144 in ⁴	r ₁	2.1114 in	C _w	0.41265 in ⁶
I ₂	0.0718 in ⁴	r ₂	0.4320 in	J	0.00026075 in ⁴
I _c	1.7862 in ⁴	r _c	2.1551 in		
I _o	1.9824 in ⁴	r _o	2.2704 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	6556 lb	φM _{nxo}	1622.9 lb-ft	φM _{nyo}	80.5 lb-ft
A _e	0.15426 in ²	I _{xe}	1.3757 in ⁴	I _{ye}	0.0165 in ⁴
φT _n	17602 lb	S _{xe} (t)	0.43278 in ³	S _{ye} (l)	0.13010 in ³
		S _{xe} (b)	0.54609 in ³	S _{ye} (r)	0.02148 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	2811 lb	φM _{nxo}	1622.9 lb-ft	φM _{nyo}	208.0 lb-ft
φV _{nx}	3370 lb	I _{xe}	1.3757 in ⁴	I _{ye}	0.0625 in ⁴
Torsion		S _{xe} (t)	0.54609 in ³	S _{ye} (l)	0.16785 in ³
φB _n	6454.1 lb-in ²	S _{xe} (b)	0.43278 in ³	S _{ye} (r)	0.05546 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0451 in, R=0.0712 in, A_c=0.0066415 in²

F_{yc}=74.687 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0451 in, R=0.0712 in, A_c=0.0066415 in²

F_{yc}=74.687 ksi

Eq. A3.3.2-2

F_{ya}=50.853 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
$F_{ya}=52.375$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.38459$ in ² , $F_y=50.853$ ksi	
$T_n=19557$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.38459$ in ² , $F_u=65$ ksi	
$T_n=24998$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1872.1$ lb at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=3122.8$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1872.1$ lb at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.4655$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.1.2-1

$k=4$

Eq. 1.1.2-8

$\lambda=2.624$

Eq. 1.1-3

$\rho=0.34915$

Eq. 1.1-2

$b_e=1.9083$ in

Eq. 1.1-1

$b_1=0.95414$ in

Eq. 1.1.2-9

$b_2=0.95414$ in

Eq. 1.1.2-10

Ineffective width= 3.5572 in

$A_e=0.15426$ in², $F_n=50$ ksi

$P_n=7712.9$ lb

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3837$ in

$f_1=49.645$ ksi, $f_2=49.645$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.0189$

Eq. 1.1-3

$\rho=0.44134$

Eq. 1.1-2

$b=0.61068$ in (ineffective width= 0.77302 in)

Eq. 1.1-1

Element 2: Stiffened, $w=5.4655$ in

$f_1=48.17$ ksi, $f_2=-37.817$ ksi

$\psi=0.78506$

Eq. 1.1.2-1

$k=18.946$

Eq. 1.1.2-2

$\lambda=1.1834$

Eq. 1.1-3

$\rho=0.68793$

Eq. 1.1-2

$b_e=3.7599$ in

Eq. 1.1-1

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=0.99334$ in

Eq. 1.1.2-3

$b_2=1.8799$ in

Eq. 1.1.2-4

Compression width= 3.0618 in

Ineffective width= 0.18852 in

Center of gravity shift: $y=-0.32978$ in

$S_{xe}=0.43278$ in³, $F_y=50$ ksi

$M_{nl}=1803.3$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=49.645$ ksi, $f_2=49.645$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=2.0189$

Eq. 1.1-3

$\rho=0.44134$

Eq. 1.1-2

$b=0.61068$ in (ineffective width= 0.77302 in)

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.4655$ in

$f_1=48.17$ ksi, $f_2=-37.817$ ksi

$\psi=0.78506$

Eq. 1.1.2-1

$k=18.946$

Eq. 1.1.2-2

$\lambda=1.1834$

Eq. 1.1-3

$\rho=0.68793$

Eq. 1.1-2

$b_e=3.7599$ in

Eq. 1.1-1

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=0.99334$ in

Eq. 1.1.2-3

$b_2=1.8799$ in

Eq. 1.1.2-4

Compression width= 3.0618 in

Ineffective width= 0.18852 in

Center of gravity shift: $y=0.32978$ in

$S_{xe}=0.43278$ in³, $F_y=50$ ksi

$M_{nl}=1803.3$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-6.6457$ ksi

$\psi=0.13291$

Eq. 1.2.2-1

$k=0.59915$

Eq. 1.2.2-5

$\lambda=1.7165$

Eq. 1.1-3

$\rho=0.56419$

Eq. 1.2.2-4

$b=0.78067$ in (ineffective width= 0.60303 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-6.6457$ ksi

$\psi=0.13291$

Eq. 1.2.2-1

$k=0.59915$

Eq. 1.2.2-5

$\lambda=1.7165$

Eq. 1.1-3

$\rho=0.56419$

Eq. 1.2.2-4

$b=0.78067$ in (ineffective width= 0.60303 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.15153$ in

$S_{ye}=0.02148$ in³, $F_y=50$ ksi

$M_{nl}=89.499$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=11.338$ ksi, $f_2=-50$ ksi

$\psi=4.4098$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=11.338$ ksi, $f_2=-50$ ksi

$\psi=4.4098$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.4655$ in	
$f_1=15.494$ ksi, $f_2=15.494$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.4607$	Eq. 1.1-3
$\rho=0.5815$	Eq. 1.1-2
$b_e=3.1782$ in	Eq. 1.1-1
$b_1=1.5891$ in	Eq. 1.1.2-9
$b_2=1.5891$ in	Eq. 1.1.2-10
Ineffective width= 2.2873 in	
Center of gravity shift: $x=0.09387$ in	
$S_{ye}=0.055457$ in ³ , $F_y=50$ ksi	
$M_n I=231.07$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.41265$ in ⁶ , $W_n=2.8771$ in ² , $F_y=50$ ksi	
$B_n=7171.2$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

550T150-54

Full Section Properties

Area	0.48041 in ²	Wt.	1.6334 lb/ft	Flat	8.4877 in
Ix	2.1283 in ⁴	rx	2.1048 in	Ixy	0.0000 in ⁴
Sx(t)	0.74702 in ³	y(t)	2.8491 in	α	0.000 deg
Sx(b)	0.74702 in ³	y(b)	2.8491 in		
Zx	0.90469 in ³	Height	5.6981 in		
Iy	0.0890 in ⁴	ry	0.4305 in	x _o	-0.7129 in
Sy(l)	0.31394 in ³	x(l)	0.2836 in	y _o	0.0000 in
Sy(r)	0.07321 in ³	x(r)	1.2164 in	jx	3.4592 in
Zy	0.12577 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	2.1283 in ⁴	r ₁	2.1048 in	Cw	0.50777 in ⁶
I ₂	0.0890 in ⁴	r ₂	0.4305 in	J	0.00051300 in ⁴
Ic	2.2173 in ⁴	rc	2.1484 in		
I _o	2.4615 in ⁴	r _o	2.2636 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	10027 lb	φMnxo	2233.1 lb-ft	φMnyo	139.7 lb-ft
Ae	0.23592 in ²	Ixe	1.8284 in ⁴	Iye	0.0333 in ⁴
φTn	22078 lb	Sxe(t)	0.59549 in ³	Sye(l)	0.19707 in ³
		Sxe(b)	0.69580 in ³	Sye(r)	0.03727 in ³
Shear		Negative Bending		Negative Bending	
φVny	4519 lb	φMnxo	2233.1 lb-ft	φMnyo	266.8 lb-ft
φVnx	4152 lb	Ixe	1.8284 in ⁴	Iye	0.0831 in ⁴
Torsion		Sxe(t)	0.69580 in ³	Sye(l)	0.25025 in ³
φBn	8002.7 lb-in ²	Sxe(b)	0.59549 in ³	Sye(r)	0.07114 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0566 in, R=0.0849 in, Ac=0.010064 in²

Fyc=75.384 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0566 in, R=0.0849 in, Ac=0.010064 in²

Fyc=75.384 ksi

Eq. A3.3.2-2

Fya=51.064 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
$F_{ya}=52.938$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.48041$ in ² , $F_y=51.064$ ksi	
$T_n=24531$ lb	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.48041$ in ² , $F_u=65$ ksi	
$T_n=31226$ lb	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=2306.7$ lb at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=5020.9$ lb at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=2306.7$ lb at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.4151$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.0716$

$\rho=0.43146$

$b_e=2.3364$ in

$b_1=1.1682$ in

$b_2=1.1682$ in

Ineffective width= 3.0787 in

$A_e=0.23592$ in², $F_n=50$ ksi

$P_n=11796$ lb

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3585$ in

$f_1=49.539$ ksi, $f_2=49.539$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.5777$

$\rho=0.54544$

$b=0.74098$ in (ineffective width= 0.61752 in)

Element 2: Stiffened, $w=5.4151$ in

$f_1=47.696$ ksi, $f_2=-40.49$ ksi

$\psi=0.84892$

$k=20.339$

$\lambda=0.89725$

$\rho=0.84124$

$b_e=4.5554$ in

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=1.1836$ in

$b_2=2.2777$ in

Compression width= 2.9288 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=-0.22132$ in

$S_{xe}=0.59549$ in³, $F_y=50$ ksi

$M_n=2481.2$ lb-ft

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-3

Eq. 1.1.2-4

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=49.539$ ksi, $f_2=49.539$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.5777$

$\rho=0.54544$

$b=0.74098$ in (ineffective width= 0.61752 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.4151$ in

$f_1=47.696$ ksi, $f_2=-40.49$ ksi

$\psi=0.84892$

Eq. 1.1.2-1

$k=20.339$

Eq. 1.1.2-2

$\lambda=0.89725$

Eq. 1.1-3

$\rho=0.84124$

Eq. 1.1-2

$b_e=4.5554$ in

Eq. 1.1-1

$h_o=5.6981$ in, $b_o=1.5$ in, $h_o/b_o=3.7987$

$b_1=1.1836$ in

Eq. 1.1.2-3

$b_2=2.2777$ in

Eq. 1.1.2-4

Compression width= 2.9288 in

$b_1+b_2 >$ compression width (fully effective)

Center of gravity shift: $y=0.22132$ in

$S_{xe}=0.59549$ in³, $F_y=50$ ksi

$M_{nl}=2481.2$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-5.8424$ ksi

$\psi=0.11685$

Eq. 1.2.2-1

$k=0.59549$

Eq. 1.2.2-5

$\lambda=1.3469$

Eq. 1.1-3

$\rho=0.67793$

Eq. 1.2.2-4

$b=0.92097$ in (ineffective width= 0.43753 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-5.8424$ ksi

$\psi=0.11685$

Eq. 1.2.2-1

$k=0.59549$

Eq. 1.2.2-5

$\lambda=1.3469$

Eq. 1.1-3

$\rho=0.67793$

Eq. 1.2.2-4

$b=0.92097$ in (ineffective width= 0.43753 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.11467$ in

$S_{ye}=0.037265$ in³, $F_y=50$ ksi

$M_{nl}=155.27$ lb-ft

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=8.1215$ ksi, $f_2=-50$ ksi

$\psi=6.1565$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=8.1215$ ksi, $f_2=-50$ ksi

$\psi=6.1565$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.4151$ in	
$f_1=12.965$ ksi, $f_2=12.965$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.0548$	Eq. 1.1-3
$\rho=0.75029$	Eq. 1.1-2
$b_e=4.0629$ in	Eq. 1.1-1
$b_1=2.0314$ in	Eq. 1.1.2-9
$b_2=2.0314$ in	Eq. 1.1.2-10
Ineffective width= 1.3522 in	
Center of gravity shift: $x=0.048387$ in	
$S_{ye}=0.071139$ in ³ , $F_y=50$ ksi	
$M_n=296.41$ lb-ft	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.50777$ in ⁶ , $W_n=2.8552$ in ² , $F_y=50$ ksi	
$B_n=8891.8$ lb-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

600T150-30

Full Section Properties

Area	0.28252 in ²	Wt.	0.00096058 k/ft	Flat	9.0553 in
Ix	1.4664 in ⁴	rx	2.2782 in	Ixy	0.0000 in ⁴
Sx(t)	0.47317 in ³	y(t)	3.0991 in	α	0.000 deg
Sx(b)	0.47317 in ³	y(b)	3.0991 in		
Zx	0.57448 in ³	Height	6.1981 in		
Iy	0.0513 in ⁴	ry	0.4261 in	x _o	-0.6887 in
Sy(l)	0.19805 in ³	x(l)	0.2591 in	y _o	0.0000 in
Sy(r)	0.04134 in ³	x(r)	1.2409 in	jx	3.9159 in
Zy	0.06988 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	1.4664 in ⁴	r ₁	2.2782 in	Cw	0.35452 in ⁶
I ₂	0.0513 in ⁴	r ₂	0.4261 in	J	0.00009167 in ⁴
Ic	1.5177 in ⁴	rc	2.3177 in		
I _o	1.6517 in ⁴	r _o	2.4179 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi					
Axial		Positive Bending		Positive Bending	
φP _{no}	3.359 k	φM _{nxo}	9.8746 k-in	φM _{nyo}	0.3839 k-in
A _e	0.079036 in ²	I _{xe}	0.89147 in ⁴	I _{ye}	0.00510 in ⁴
φT _n	12.868 k	S _{xe} (t)	0.21944 in ³	S _{ye} (l)	0.06901 in ³
		S _{xe} (b)	0.41745 in ³	S _{ye} (r)	0.00853 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.244 k	φM _{nxo}	9.8746 k-in	φM _{nyo}	1.6447 k-in
φV _{nx}	2.310 k	I _{xe}	0.89147 in ⁴	I _{ye}	0.03862 in ⁴
Torsion		S _{xe} (t)	0.41745 in ³	S _{ye} (l)	0.08712 in ³
φB _n	4.9849 k-in ²	S _{xe} (b)	0.21944 in ³	S _{ye} (r)	0.03655 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

F_{ya}=50.608 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0312$ in, $R=0.0781$ in, $A_c=0.0045921$ in ²	
$F_{yc}=68.69$ ksi	Eq. A3.3.2-2
$F_{ya}=51.789$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.28252$ in ² , $F_y=50.608$ ksi	
$T_n=14.298$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.28252$ in ² , $F_u=65$ ksi	
$T_n=18.364$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.2831$ k at 180 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1.3822$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.2831$ k at 0 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.9795$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=4.1497$

$\rho=0.22821$

$b_e=1.3646$ in

$b_1=0.68228$ in

$b_2=0.68228$ in

Ineffective width= 4.6149 in

$A_e=0.079036$ in², $F_n=50$ ksi

$P_n=3.9518$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3907$ in

$f_1=49.808$ ksi, $f_2=49.808$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.938$

$\rho=0.31489$

$b=0.43791$ in (ineffective width= 0.95279 in)

Element 2: Stiffened, $w=5.9795$ in

$f_1=48.654$ ksi, $f_2=-24.954$ ksi

$\psi=0.51288$

$k=13.951$

$\lambda=2.1919$

$\rho=0.41044$

$b_e=2.4542$ in

$h_o=6.1981$ in, $b_o=1.5$ in, $h_o/b_o=4.1321$

$b_1=0.69863$ in

$b_2=0.92358$ in

Compression width= 3.9524 in

Ineffective width= 2.3302 in

Center of gravity shift: $y=-0.96352$ in

$S_{xe}=0.21944$ in³, $F_y=50$ ksi

$M_{nl}=10.972$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-6

Eq. 1.1.2-7

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=49.808$ ksi, $f_2=49.808$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.938$

$\rho=0.31489$

$b=0.43791$ in (ineffective width= 0.95279 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.9795$ in

$f_1=48.655$ ksi, $f_2=-24.954$ ksi

$\psi=0.51288$

Eq. 1.1.2-1

$k=13.951$

Eq. 1.1.2-2

$\lambda=2.1919$

Eq. 1.1-3

$\rho=0.41044$

Eq. 1.1-2

$b_e=2.4542$ in

Eq. 1.1-1

$h_o=6.1981$ in, $b_o=1.5$ in, $h_o/b_o=4.1321$

$b_1=0.69863$ in

Eq. 1.1.2-6

$b_2=0.92358$ in

Eq. 1.1.2-7

Compression width= 3.9524 in

Ineffective width= 2.3302 in

Center of gravity shift: $y=0.96352$ in

$S_{xe}=0.21944$ in³, $F_y=50$ ksi

$M_{nl}=10.972$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-6.0338$ ksi

$\psi=0.12068$

Eq. 1.2.2-1

$k=0.59636$

Eq. 1.2.2-5

$\lambda=2.4995$

Eq. 1.1-3

$\rho=0.40413$

Eq. 1.2.2-4

$b=0.56202$ in (ineffective width= 0.82868 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=50$ ksi, $f_2=-6.0338$ ksi

$\psi=0.12068$

Eq. 1.2.2-1

$k=0.59636$

Eq. 1.2.2-5

$\lambda=2.4995$

Eq. 1.1-3

$\rho=0.40413$

Eq. 1.2.2-4

$b=0.56202$ in (ineffective width= 0.82868 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.18519$ in

$S_{ye}=0.0085317$ in³, $F_y=50$ ksi

$M_{nl}=0.42658$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=15.757$ ksi, $f_2=-50$ ksi

$\psi=3.1733$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in

$f_1=15.757$ ksi, $f_2=-50$ ksi

$\psi=3.1733$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.9795$ in	
$f_1=20.187$ ksi, $f_2=20.187$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=2.6367$	Eq. 1.1-3
$\rho=0.34761$	Eq. 1.1-2
$b_e=2.0785$ in	Eq. 1.1-1
$b_1=1.0393$ in	Eq. 1.1.2-9
$b_2=1.0393$ in	Eq. 1.1.2-10
Ineffective width=3.901 in	
Center of gravity shift: $x=0.18425$ in	
$S_{ye}=0.036549$ in ³ , $F_y=50$ ksi	
$M_n I=1.8274$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.35452$ in ⁶ , $W_n=3.2003$ in ² , $F_y=50$ ksi	
$B_n=5.5387$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

600T150-33

Full Section Properties

Area	0.31308 in ²	Wt.	0.0010645 k/ft	Flat	9.0485 in
Ix	1.6229 in ⁴	rx	2.2768 in	Ixy	0.0000 in ⁴
Sx(t)	0.52368 in ³	y(t)	3.0991 in	α	0.000 deg
Sx(b)	0.52368 in ³	y(b)	3.0991 in		
Zx	0.63619 in ³	Height	6.1981 in		
Iy	0.0567 in ⁴	ry	0.4256 in	x _o	-0.6877 in
Sy(l)	0.21781 in ³	x(l)	0.2604 in	y _o	0.0000 in
Sy(r)	0.04575 in ³	x(r)	1.2396 in	jx	3.9146 in
Zy	0.07745 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	1.6229 in ⁴	r ₁	2.2768 in	Cw	0.39144 in ⁶
I ₂	0.0567 in ⁴	r ₂	0.4256 in	J	0.00012493 in ⁴
Ic	1.6796 in ⁴	rc	2.3162 in		
I _o	1.8277 in ⁴	r _o	2.4162 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
φPno	4.057 k	φMnxo	11.825 k-in	φMnyo	0.496 k-in
Ae	0.095470 in ²	Ixe	1.0420 in ⁴	Iye	0.0071 in ⁴
φTn	14.274 k	Sxe(t)	0.26277 in ³	Sye(l)	0.08380 in ³
		Sxe(b)	0.46665 in ³	Sye(r)	0.01103 in ³
Shear		Negative Bending		Negative Bending	
φVny	1.562 k	φMnxo	11.825 k-in	φMnyo	1.853 k-in
φVnx	2.595 k	Ixe	1.0420 in ⁴	Iye	0.0444 in ⁴
Torsion		Sxe(t)	0.46665 in ³	Sye(l)	0.10512 in ³
φBn	5.5129 k-in ²	Sxe(b)	0.26277 in ³	Sye(r)	0.04118 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0346 in, R=0.0764 in, Ac=0.0050926 in²

Fyc=70.273 ksi

Eq. A3.3.2-2

Fya=50.66 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_y=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0346$ in, $R=0.0764$ in, $A_c=0.0050926$ in ²	
$F_{yc}=70.273$ ksi	Eq. A3.3.2-2
$F_y=51.942$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_y=50$ ksi	
Max compression stress allowed for negative bending: $F_y=50$ ksi	
Bending about Y-axis	
$F_y=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.31308$ in ² , $F_y=50.66$ ksi	
$T_n=15.86$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.31308$ in ² , $F_u=65$ ksi	
$T_n=20.35$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.4418$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=1.7358$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.4418$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.9761$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.1.2-1

$k=4$

Eq. 1.1.2-8

$\lambda=3.7398$

Eq. 1.1-3

$\rho=0.25166$

Eq. 1.1-2

$b_e=1.504$ in

Eq. 1.1-1

$b_1=0.75199$ in

Eq. 1.1.2-9

$b_2=0.75199$ in

Eq. 1.1.2-10

Ineffective width= 4.4721 in

$A_e=0.09547$ in², $F_n=50$ ksi

$P_n=4.7735$ k

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.389$ in

$f_1=49.782$ ksi, $f_2=49.782$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=2.6453$

Eq. 1.1-3

$\rho=0.34659$

Eq. 1.1-2

$b=0.48141$ in (ineffective width= 0.90759 in)

Eq. 1.1-1

Element 2: Stiffened, $w=5.9761$ in

$f_1=48.6$ ksi, $f_2=-26.77$ ksi

$\psi=0.55083$

Eq. 1.1.2-1

$k=14.561$

Eq. 1.1.2-2

$\lambda=1.9325$

Eq. 1.1-3

$\rho=0.45856$

Eq. 1.1-2

$b_e=2.7404$ in

Eq. 1.1-1

$h_o=6.1981$ in, $b_o=1.5$ in, $h_o/b_o=4.1321$

$b_1=0.77177$ in

Eq. 1.1.2-6

$b_2=0.9953$ in

Eq. 1.1.2-7

Compression width= 3.8535 in

Ineffective width= 2.0864 in

Center of gravity shift: $y=-0.86622$ in

$S_{xe}=0.26277$ in³, $F_y=50$ ksi

$M_{nl}=13.139$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=49.782$ ksi, $f_2=49.782$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-2

$\lambda=2.6453$

Eq. 1.1-3

$\rho=0.34659$

Eq. 1.1-2

$b=0.48141$ in (ineffective width= 0.90759 in)

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.9761$ in

$f_1=48.6$ ksi, $f_2=-26.77$ ksi

$\psi=0.55083$

Eq. 1.1.2-1

$k=14.561$

Eq. 1.1.2-2

$\lambda=1.9325$

Eq. 1.1-3

$\rho=0.45856$

Eq. 1.1-2

$b_e=2.7404$ in

Eq. 1.1-1

$h_o=6.1981$ in, $b_o=1.5$ in, $h_o/b_o=4.1321$

$b_1=0.77177$ in

Eq. 1.1.2-6

$b_2=0.9953$ in

Eq. 1.1.2-7

Compression width= 3.8535 in

Ineffective width= 2.0864 in

Center of gravity shift: $y=0.86622$ in

$S_{xe}=0.26277$ in³, $F_y=50$ ksi

$M_{nl}=13.139$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-6.0249$ ksi

$\psi=0.1205$

Eq. 1.2.2-1

$k=0.59632$

Eq. 1.2.2-5

$\lambda=2.2512$

Eq. 1.1-3

$\rho=0.44322$

Eq. 1.2.2-4

$b=0.61564$ in (ineffective width= 0.77336 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=50$ ksi, $f_2=-6.0249$ ksi

$\psi=0.1205$

Eq. 1.2.2-1

$k=0.59632$

Eq. 1.2.2-5

$\lambda=2.2512$

Eq. 1.1-3

$\rho=0.44322$

Eq. 1.2.2-4

$b=0.61564$ in (ineffective width= 0.77336 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.17586$ in

$S_{ye}=0.01103$ in³, $F_y=50$ ksi

$M_{nl}=0.55148$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=14.393$ ksi, $f_2=-50$ ksi

$\psi=3.4739$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=14.393$ ksi, $f_2=-50$ ksi

$\psi=3.4739$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.9761$ in	
$f_1=18.737$ ksi, $f_2=18.737$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=2.2893$	Eq. 1.1-3
$\rho=0.39483$	Eq. 1.1-2
$b_e=2.3595$ in	Eq. 1.1-1
$b_1=1.1798$ in	Eq. 1.1.2-9
$b_2=1.1798$ in	Eq. 1.1.2-10
Ineffective width= 3.6166 in	
Center of gravity shift: $x=0.16184$ in	
$S_{ye}=0.04118$ in ³ , $F_y=50$ ksi	
$M_n=2.059$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.39144$ in ⁶ , $W_n=3.1952$ in ² , $F_y=50$ ksi	
$B_n=6.1254$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

600T150-43

Full Section Properties

Area	0.40714 in ²	Wt.	0.0013843 k/ft	Flat	9.0274 in
Ix	2.1023 in ⁴	rx	2.2723 in	Ixy	0.0000 in ⁴
Sx(t)	0.67836 in ³	y(t)	3.0991 in	α	0.000 deg
Sx(b)	0.67836 in ³	y(b)	3.0991 in		
Zx	0.82565 in ³	Height	6.1981 in		
Iy	0.0732 in ⁴	ry	0.4240 in	x _o	-0.6847 in
Sy(l)	0.27676 in ³	x(l)	0.2645 in	y _o	0.0000 in
Sy(r)	0.05924 in ³	x(r)	1.2355 in	jx	3.9104 in
Zy	0.10080 in ³	Width	1.5000 in	jy	0.0000 in
I ₁	2.1023 in ⁴	r ₁	2.2723 in	Cw	0.50339 in ⁶
I ₂	0.0732 in ⁴	r ₂	0.4240 in	J	0.00027604 in ⁴
Ic	2.1755 in ⁴	rc	2.3116 in		
I _o	2.3663 in ⁴	r _o	2.4108 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, Fy=50 ksi					
Axial		Positive Bending		Positive Bending	
φPno	6.584 k	φMnxo	18.645 k-in	φMnyo	0.953 k-in
Ae	0.15492 in ²	Ixe	1.5389 in ⁴	Iye	0.0163 in ⁴
φTn	18.616 k	Sxe(t)	0.41433 in ³	Sye(l)	0.13726 in ³
		Sxe(b)	0.61956 in ³	Sye(r)	0.02117 in ³
Shear		Negative Bending		Negative Bending	
φVny	2.778 k	φMnxo	18.645 k-in	φMnyo	2.502 k-in
φVnx	3.370 k	Ixe	1.5389 in ⁴	Iye	0.0629 in ⁴
Torsion		Sxe(t)	0.61956 in ³	Sye(l)	0.17053 in ³
φBn	7.1247 k-in ²	Sxe(b)	0.41433 in ³	Sye(r)	0.05560 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

Fy=50 ksi, Fu=65 ksi

Bc=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0451 in, R=0.0712 in, Ac=0.0066415 in²

Fyc=74.687 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0451 in, R=0.0712 in, Ac=0.0066415 in²

Fyc=74.687 ksi

Eq. A3.3.2-2

Fya=50.805 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0451$ in, $R=0.0712$ in, $A_c=0.0066415$ in ²	
$F_{yc}=74.687$ ksi	Eq. A3.3.2-2
$F_{ya}=52.375$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.40714$ in ² , $F_y=50.805$ ksi	
$T_n=20.685$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.40714$ in ² , $F_u=65$ ksi	
$T_n=26.464$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=1.8721$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=3.0865$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=1.8721$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3837$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.0261$	Eq. 1.1-3
$\rho=0.43996$	Eq. 1.1-2
$b=0.60878$ in (ineffective width=0.77492 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.9655$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.864$

$\rho=0.32234$

$b_e=1.9229$ in

$b_1=0.96146$ in

$b_2=0.96146$ in

Ineffective width= 4.0426 in

$A_e=0.15492$ in², $F_n=50$ ksi

$P_n=7.7459$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3837$ in

$f_1=49.696$ ksi, $f_2=49.696$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.02$

$\rho=0.44114$

$b=0.61041$ in (ineffective width= 0.77329 in)

Element 2: Stiffened, $w=5.9655$ in

$f_1=48.434$ ksi, $f_2=-31.882$ ksi

$\psi=0.65825$

$k=16.436$

$\lambda=1.3906$

$\rho=0.60535$

$b_e=3.6112$ in

$h_o=6.1981$ in, $b_o=1.5$ in, $h_o/b_o=4.1321$

$b_1=0.98715$ in

$b_2=1.1906$ in

Compression width= 3.5975 in

Ineffective width= 1.4197 in

Center of gravity shift: $y=-0.61519$ in

$S_{xe}=0.41433$ in³, $F_y=50$ ksi

$M_{nl}=20.716$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-6

Eq. 1.1.2-7

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=49.696$ ksi, $f_2=49.696$ ksi

$\psi=1$

$k=0.43$

$\lambda=2.02$

$\rho=0.44114$

$b=0.61041$ in (ineffective width= 0.77329 in)

Eq. 1.2.2-1

Eq. 1.2.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.9655$ in

$f_1=48.434$ ksi, $f_2=-31.882$ ksi

$\psi=0.65825$

Eq. 1.1.2-1

$k=16.436$

Eq. 1.1.2-2

$\lambda=1.3906$

Eq. 1.1-3

$\rho=0.60535$

Eq. 1.1-2

$b_e=3.6112$ in

Eq. 1.1-1

$h_o=6.1981$ in, $b_o=1.5$ in, $h_o/b_o=4.1321$

$b_1=0.98715$ in

Eq. 1.1.2-6

$b_2=1.1906$ in

Eq. 1.1.2-7

Compression width= 3.5975 in

Ineffective width= 1.4197 in

Center of gravity shift: $y=0.61519$ in

$S_{xe}=0.41433$ in³, $F_y=50$ ksi

$M_{nl}=20.716$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-5.9955$ ksi

$\psi=0.11991$

Eq. 1.2.2-1

$k=0.59619$

Eq. 1.2.2-5

$\lambda=1.7207$

Eq. 1.1-3

$\rho=0.55765$

Eq. 1.2.2-4

$b=0.77162$ in (ineffective width= 0.61208 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=50$ ksi, $f_2=-5.9955$ ksi

$\psi=0.11991$

Eq. 1.2.2-1

$k=0.59619$

Eq. 1.2.2-5

$\lambda=1.7207$

Eq. 1.1-3

$\rho=0.55765$

Eq. 1.2.2-4

$b=0.77162$ in (ineffective width= 0.61208 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.14582$ in

$S_{ye}=0.021167$ in³, $F_y=50$ ksi

$M_{nl}=1.0583$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3837$ in

$f_1=11.132$ ksi, $f_2=-50$ ksi

$\psi=4.4916$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3837$ in

$f_1=11.132$ ksi, $f_2=-50$ ksi

$\psi=4.4915$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.9655$ in	
$f_1=15.274$ ksi, $f_2=15.274$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.5829$	Eq. 1.1-3
$\rho=0.54393$	Eq. 1.1-2
$b_e=3.2448$ in	Eq. 1.1-1
$b_1=1.6224$ in	Eq. 1.1.2-9
$b_2=1.6224$ in	Eq. 1.1.2-10
Ineffective width= 2.7207 in	
Center of gravity shift: $x=0.10435$ in	
$S_{ye}=0.055598$ in ³ , $F_y=50$ ksi	
$M_n I=2.7799$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.50339$ in ⁶ , $W_n=3.1794$ in ² , $F_y=50$ ksi	
$B_n=7.9164$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

600T150-54

Full Section Properties

Area	0.50871 in ²	Wt.	0.0017296 k/ft	Flat	8.9877 in
I _x	2.6113 in ⁴	r _x	2.2656 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.8426 in ³	y(t)	3.0991 in	α	0.000 deg
S _x (b)	0.8426 in ³	y(b)	3.0991 in		
Z _x	1.0283 in ³	Height	6.1981 in		
I _y	0.0908 in ⁴	r _y	0.4225 in	x _o	-0.6831 in
S _y (l)	0.3370 in ³	x(l)	0.2694 in	y _o	0.0000 in
S _y (r)	0.0738 in ³	x(r)	1.2306 in	j _x	3.9153 in
Z _y	0.1263 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	2.6113 in ⁴	r ₁	2.2656 in	C _w	0.61991 in ⁶
I ₂	0.0908 in ⁴	r ₂	0.4225 in	J	0.0005432 in ⁴
I _c	2.7020 in ⁴	r _c	2.3047 in		
I _o	2.9395 in ⁴	r _o	2.4038 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	10.083 k	φM _{nxo}	27.454 k-in	φM _{nyo}	1.656 k-in
A _e	0.23725 in ²	I _{xe}	2.1301 in ⁴	I _{ye}	0.0329 in ⁴
φT _n	23.352 k	S _{xe} (t)	0.61008 in ³	S _{ye} (l)	0.20823 in ³
		S _{xe} (b)	0.78697 in ³	S _{ye} (r)	0.03680 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	4.494 k	φM _{nxo}	27.454 k-in	φM _{nyo}	3.212 k-in
φV _{nx}	4.152 k	I _{xe}	2.1301 in ⁴	I _{ye}	0.0837 in ⁴
Torsion		S _{xe} (t)	0.78697 in ³	S _{ye} (l)	0.25635 in ³
φB _n	8.8379 k-in ²	S _{xe} (b)	0.61008 in ³	S _{ye} (r)	0.07137 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksiB_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0566 in, R=0.0849 in, A_c=0.010064 in²F_{yc}=75.384 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0566 in, R=0.0849 in, A_c=0.010064 in²F_{yc}=75.384 ksi

Eq. A3.3.2-2

F_{ya}=51.004 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
$F_{ya}=52.938$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.50871$ in ² , $F_y=51.004$ ksi	
$T_n=25.946$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.50871$ in ² , $F_u=65$ ksi	
$T_n=33.066$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=2.3067$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=4.993$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=2.3067$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1

Element 2: Stiffened, $w=5.9151$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

$k=4$

$\lambda=2.2628$

$\rho=0.39896$

$b_e=2.3599$ in

$b_1=1.1799$ in

$b_2=1.1799$ in

Ineffective width= 3.5552 in

$A_e=0.23725$ in², $F_n=50$ ksi

$P_n=11.863$ k

$\Omega_c=1.8$, $\phi_c=0.85$

Eq. 1.1.2-1

Eq. 1.1.2-8

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-9

Eq. 1.1.2-10

Eq. E3.1-1

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3585$ in

$f_1=49.595$ ksi, $f_2=49.595$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.5786$

$\rho=0.54518$

$b=0.74063$ in (ineffective width= 0.61787 in)

Element 2: Stiffened, $w=5.9151$ in

$f_1=47.973$ ksi, $f_2=-36.766$ ksi

$\psi=0.76639$

$k=18.556$

$\lambda=1.0291$

$\rho=0.76399$

$b_e=4.5191$ in

$h_o=6.1981$ in, $b_o=1.5$ in, $h_o/b_o=4.1321$

$b_1=1.1998$ in

$b_2=1.3585$ in

Compression width= 3.3487 in

Ineffective width= 0.79033 in

Center of gravity shift: $y=-0.3924$ in

$S_{xe}=0.61008$ in³, $F_y=50$ ksi

$M_{nl}=30.504$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-1

Eq. 1.1.2-2

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Eq. 1.1.2-6

Eq. 1.1.2-7

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=49.595$ ksi, $f_2=49.595$ ksi

$\psi=1$

$k=0.43$

$\lambda=1.5786$

$\rho=0.54518$

$b=0.74063$ in (ineffective width= 0.61787 in)

Eq. 1.2.2-1

Eq. 1.2.2-3

Eq. 1.1-3

Eq. 1.1-2

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=5.9151$ in

$f_1=47.973$ ksi, $f_2=-36.766$ ksi

$\psi=0.76639$

Eq. 1.1.2-1

$k=18.556$

Eq. 1.1.2-2

$\lambda=1.0291$

Eq. 1.1-3

$\rho=0.76399$

Eq. 1.1-2

$b_e=4.5191$ in

Eq. 1.1-1

$h_o=6.1981$ in, $b_o=1.5$ in, $h_o/b_o=4.1321$

$b_1=1.1998$ in

Eq. 1.1.2-6

$b_2=1.3585$ in

Eq. 1.1.2-7

Compression width= 3.3487 in

Ineffective width= 0.79033 in

Center of gravity shift: $y=0.3924$ in

$S_{xe}=0.61008$ in³, $F_y=50$ ksi

$M_{nl}=30.504$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-5.1979$ ksi

$\psi=0.10396$

Eq. 1.2.2-1

$k=0.59259$

Eq. 1.2.2-5

$\lambda=1.3502$

Eq. 1.1-3

$\rho=0.67055$

Eq. 1.2.2-4

$b=0.91094$ in (ineffective width= 0.44756 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-5.1979$ ksi

$\psi=0.10396$

Eq. 1.2.2-1

$k=0.59259$

Eq. 1.2.2-5

$\lambda=1.3502$

Eq. 1.1-3

$\rho=0.67055$

Eq. 1.2.2-4

$b=0.91094$ in (ineffective width= 0.44756 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.11136$ in

$S_{ye}=0.036801$ in³, $F_y=50$ ksi

$M_{nl}=1.84$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=7.8459$ ksi, $f_2=-50$ ksi

$\psi=6.3728$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=7.8459$ ksi, $f_2=-50$ ksi

$\psi=6.3728$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=5.9151$ in	
$f_1=12.666$ ksi, $f_2=12.666$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.1389$	Eq. 1.1-3
$\rho=0.70843$	Eq. 1.1-2
$b_e=4.1904$ in	Eq. 1.1-1
$b_1=2.0952$ in	Eq. 1.1.2-9
$b_2=2.0952$ in	Eq. 1.1.2-10
Ineffective width= 1.7247 in	
Center of gravity shift: $x=0.057257$ in	
$S_{ye}=0.071375$ in ³ , $F_y=50$ ksi	
$M_n I=3.5687$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.61991$ in ⁶ , $W_n=3.1564$ in ² , $F_y=50$ ksi	
$B_n=9.8198$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

800T150-30

Full Section Properties

Area	0.34492 in ²	Wt.	0.0011727 k/ft	Flat	11.055 in
I _x	2.9187 in ⁴	r _x	2.9089 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.71203 in ³	y(t)	4.0991 in	α	0.000 deg
S _x (b)	0.71203 in ³	y(b)	4.0991 in		
Z _x	0.88820 in ³	Height	8.1981 in		
I _y	0.0543 in ⁴	r _y	0.3969 in	x _o	-0.5919 in
S _y (l)	0.25273 in ³	x(l)	0.2150 in	y _o	0.0000 in
S _y (r)	0.04229 in ³	x(r)	1.2850 in	j _x	6.1622 in
Z _y	0.07045 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	2.9187 in ⁴	r ₁	2.9089 in	C _w	0.68268 in ⁶
I ₂	0.0543 in ⁴	r ₂	0.3969 in	J	0.00011192 in ⁴
I _c	2.9730 in ⁴	r _c	2.9359 in		
I _o	3.0938 in ⁴	r _o	2.9949 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	3.384 k	φM _{nxo}	13.326 k-in	φM _{nyo}	0.365 k-in
A _e	0.079633 in ²	I _{xe}	1.6415 in ⁴	I _{ye}	0.0048 in ⁴
φT _n	15.676 k	S _{xe} (t)	0.29613 in ³	S _{ye} (l)	0.08165 in ³
		S _{xe} (b)	0.61832 in ³	S _{ye} (r)	0.00811 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.037 k	φM _{nxo}	13.326 k-in	φM _{nyo}	1.652 k-in
φV _{nx}	2.310 k	I _{xe}	1.6415 in ⁴	I _{ye}	0.0390 in ⁴
Torsion		S _{xe} (t)	0.61832 in ³	S _{ye} (l)	0.08907 in ³
φB _n	6.8959 k-in ²	S _{xe} (b)	0.29613 in ³	S _{ye} (r)	0.03671 in ³

Track element 2 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F_{yc}=68.69 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0312 in, R=0.0781 in, A_c=0.0045921 in²

F _{yc} =68.69 ksi	Eq. A3.3.2-2
F _{ya} =50.498 ksi	Eq. A3.3.2-1
Max compression stress allowed: F _{ya} =50 ksi	
Bending about X-axis	
Track corner 2	
t=0.0312 in, R=0.0781 in, A _c =0.0045921 in ²	
F _{yc} =68.69 ksi	Eq. A3.3.2-2
Track corner 3	
t=0.0312 in, R=0.0781 in, A _c =0.0045921 in ²	
F _{yc} =68.69 ksi	Eq. A3.3.2-2
F _{ya} =51.789 ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: F _{ya} =50 ksi	
Max compression stress allowed for negative bending: F _{ya} =50 ksi	
Bending about Y-axis	
F _{ya} =50 ksi	Eq. A3.3.2-1
Axial Tension Strength	
A _g =0.34492 in ² , F _y =50.498 ksi	
T _n =17.418 k	Eq. D2-1
Ω _t =1.67, φ _t =0.9	
A _n =0.34492 in ² , F _u =65 ksi	
T _n =22.42 k	Eq. D3-1
Ω _t =2, φ _t =0.75	
Shear Strength	
Track element 1	
V _n =1.2831 k at 180 deg	Eq. G2.1-2
Ω _v =1.67, φ _v =0.9	
Track element 2	
h/t exceeds 200 (rational analysis)	
V _n =1.2957 k at 90 deg	Eq. G2.1-2
Ω _v =2, φ _v =0.8 (rational analysis)	
Track element 3	
V _n =1.2831 k at 0 deg	Eq. G2.1-2
Ω _v =1.67, φ _v =0.9	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, w=1.3907 in	
f ₁ =50 ksi, f ₂ =50 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.9436	Eq. 1.1-3
ρ=0.31433	Eq. 1.1-2
b=0.43714 in (ineffective width=0.95356 in)	Eq. 1.1-1
Element 3: Unstiffened, w=1.3907 in	
f ₁ =50 ksi, f ₂ =50 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3

$\lambda=2.9436$	Eq. 1.1-3
$\rho=0.31433$	Eq. 1.1-2
$b=0.43714$ in (ineffective width=0.95356 in)	Eq. 1.1-1
Element 2: Stiffened, $w=7.9795$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=5.5377$	Eq. 1.1-3
$\rho=0.17341$	Eq. 1.1-2
$b_e=1.3837$ in	Eq. 1.1-1
$b_1=0.69185$ in	Eq. 1.1.2-9
$b_2=0.69185$ in	Eq. 1.1.2-10
Ineffective width=6.5958 in	
$A_e=0.079633$ in ² , $F_n=50$ ksi	
$P_n=3.9817$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3907$ in

$f_1=49.859$ ksi, $f_2=49.859$ ksi

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.9395$	Eq. 1.1-3
$\rho=0.31474$	Eq. 1.1-2
$b=0.4377$ in (ineffective width=0.953 in)	Eq. 1.1-1

Element 2: Stiffened, $w=7.9795$ in

$f_1=49.014$ ksi, $f_2=-22.979$ ksi

$\psi=0.46883$	Eq. 1.1.2-1
$k=13.276$	Eq. 1.1.2-2
$\lambda=3.0096$	Eq. 1.1-3
$\rho=0.30798$	Eq. 1.1-2
$b_e=2.4576$ in	Eq. 1.1-1
$h_o=8.1981$ in, $b_o=1.5$ in, $h_o/b_o=5.4654$	
$b_1=0.70847$ in	Eq. 1.1.2-6
$b_2=0.96467$ in	Eq. 1.1.2-7

Compression width=5.4326 in

Ineffective width=3.7594 in

Center of gravity shift: $y=-1.4442$ in

$S_{xe}=0.29613$ in³, $F_y=50$ ksi

$M_{nl}=14.806$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Eq. F3.1-1

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3907$ in

$f_1=49.859$ ksi, $f_2=49.859$ ksi

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3

$\lambda=2.9395$	Eq. 1.1-3
$\rho=0.31474$	Eq. 1.1-2
$b=0.4377$ in (ineffective width=0.953 in)	Eq. 1.1-1
Element 3: No compressive stress (fully effective)	
Element 2: Stiffened, $w=7.9795$ in	
$f_1=49.014$ ksi, $f_2=-22.979$ ksi	
$\psi=0.46883$	Eq. 1.1.2-1
$k=13.276$	Eq. 1.1.2-2
$\lambda=3.0096$	Eq. 1.1-3
$\rho=0.30798$	Eq. 1.1-2
$b_e=2.4576$ in	Eq. 1.1-1
$h_o=8.1981$ in, $b_o=1.5$ in, $h_o/b_o=5.4654$	
$b_1=0.70847$ in	Eq. 1.1.2-6
$b_2=0.96467$ in	Eq. 1.1.2-7
Compression width=5.4326 in	
Ineffective width=3.7594 in	
Center of gravity shift: $y=1.4442$ in	
$S_{xe}=0.29613$ in ³ , $F_y=50$ ksi	
$M_{nl}=14.806$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Positive Flexural Strength about Y-axis	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=-4.1132$ ksi	
$\psi=0.082264$	Eq. 1.2.2-1
$k=0.58775$	Eq. 1.2.2-5
$\lambda=2.5178$	Eq. 1.1-3
$\rho=0.3892$	Eq. 1.2.2-4
$b=0.54126$ in (ineffective width=0.84944 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3907$ in	
$f_1=50$ ksi, $f_2=-4.1132$ ksi	
$\psi=0.082265$	Eq. 1.2.2-1
$k=0.58775$	Eq. 1.2.2-5
$\lambda=2.5178$	Eq. 1.1-3
$\rho=0.3892$	Eq. 1.2.2-4
$b=0.54126$ in (ineffective width=0.84944 in)	Eq. 1.1-1
Element 2: No compressive stress (fully effective)	
Iteration is not required	
Center of gravity shift: $x=-0.1562$ in	
$S_{ye}=0.0081138$ in ³ , $F_y=50$ ksi	
$M_{nl}=0.40569$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about Y-axis	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3907$ in	
$f_1=15.393$ ksi, $f_2=-50$ ksi	
$\psi=3.2481$	Eq. 1.2.2-1
$\psi>1$ (fully effective)	Eq. 1.1-1

Element 3: Unstiffened, $w=1.3907$ in	
$f_1=15.394$ ksi, $f_2=-50$ ksi	
$\psi=3.2481$	Eq. 1.2.2-1
$\psi>1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=7.9795$ in	
$f_1=19.799$ ksi, $f_2=19.799$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=3.4847$	Eq. 1.1-3
$\rho=0.26885$	Eq. 1.1-2
$b_e=2.1453$ in	Eq. 1.1-1
$b_1=1.0726$ in	Eq. 1.1.2-9
$b_2=1.0726$ in	Eq. 1.1.2-10
Ineffective width= 5.8342 in	
Center of gravity shift: $x=0.22283$ in	
$S_{ye}=0.036715$ in ³ , $F_y=50$ ksi	
$M_{nl}=1.8357$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=0.68268$ in ⁶ , $W_n=4.4549$ in ² , $F_y=50$ ksi	
$B_n=7.6621$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	

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Full Section Properties

Area	0.38228 in ²	Wt.	0.0012997 k/ft	Flat	11.048 in
I _x	3.2314 in ⁴	r _x	2.9074 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.78834 in ³	y(t)	4.0991 in	α	0.000 deg
S _x (b)	0.78834 in ³	y(b)	4.0991 in		
Z _x	0.98386 in ³	Height	8.1981 in		
I _y	0.0601 in ⁴	r _y	0.3964 in	x _o	-0.5910 in
S _y (l)	0.27761 in ³	x(l)	0.2164 in	y _o	0.0000 in
S _y (r)	0.04679 in ³	x(r)	1.2836 in	j _x	6.1623 in
Z _y	0.07816 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	3.2314 in ⁴	r ₁	2.9074 in	C _w	0.75402 in ⁶
I ₂	0.0601 in ⁴	r ₂	0.3964 in	J	0.00015255 in ⁴
I _c	3.2915 in ⁴	r _c	2.9343 in		
I _o	3.4250 in ⁴	r _o	2.9932 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	4.092 k	φM _{nxo}	16.002 k-in	φM _{nyo}	0.473 k-in
A _e	0.096286 in ²	I _{xe}	1.9271 in ⁴	I _{ye}	0.0067 in ⁴
φT _n	17.388 k	S _{xe} (t)	0.35561 in ³	S _{ye} (l)	0.09936 in ³
		S _{xe} (b)	0.69347 in ³	S _{ye} (r)	0.01050 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.306 k	φM _{nxo}	16.002 k-in	φM _{nyo}	1.863 k-in
φV _{nx}	2.595 k	I _{xe}	1.9271 in ⁴	I _{ye}	0.0449 in ⁴
Torsion		S _{xe} (t)	0.69347 in ³	S _{ye} (l)	0.10800 in ³
φB _n	7.6274 k-in ²	S _{xe} (b)	0.35561 in ³	S _{ye} (r)	0.04139 in ³

Track element 2 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0346 in, R=0.0764 in, A_c=0.0050926 in²

F_{yc}=70.273 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0346 in, R=0.0764 in, A_c=0.0050926 in²

F _{yc} =70.273 ksi	Eq. A3.3.2-2
F _{ya} =50.54 ksi	Eq. A3.3.2-1
Max compression stress allowed: F _{ya} =50 ksi	
Bending about X-axis	
Track corner 2	
t=0.0346 in, R=0.0764 in, A _c =0.0050926 in ²	
F _{yc} =70.273 ksi	Eq. A3.3.2-2
Track corner 3	
t=0.0346 in, R=0.0764 in, A _c =0.0050926 in ²	
F _{yc} =70.273 ksi	Eq. A3.3.2-2
F _{ya} =51.942 ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: F _{ya} =50 ksi	
Max compression stress allowed for negative bending: F _{ya} =50 ksi	
Bending about Y-axis	
F _{ya} =50 ksi	Eq. A3.3.2-1
Axial Tension Strength	
A _g =0.38228 in ² , F _y =50.54 ksi	
T _n =19.32 k	Eq. D2-1
Ω _t =1.67, φ _t =0.9	
A _n =0.38228 in ² , F _u =65 ksi	
T _n =24.848 k	Eq. D3-1
Ω _t =2, φ _t =0.75	
Shear Strength	
Track element 1	
V _n =1.4418 k at 180 deg	Eq. G2.1-1
Ω _v =1.67, φ _v =0.9	
Track element 2	
h/t exceeds 200 (rational analysis)	
V _n =1.6326 k at 90 deg	Eq. G2.1-2
Ω _v =2, φ _v =0.8 (rational analysis)	
Track element 3	
V _n =1.4418 k at 0 deg	Eq. G2.1-1
Ω _v =1.67, φ _v =0.9	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, w=1.389 in	
f ₁ =50 ksi, f ₂ =50 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.6511	Eq. 1.1-3
ρ=0.3459	Eq. 1.1-2
b=0.48045 in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 3: Unstiffened, w=1.389 in	
f ₁ =50 ksi, f ₂ =50 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3

$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 2: Stiffened, $w=7.9761$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=4.9914$	Eq. 1.1-3
$\rho=0.19152$	Eq. 1.1-2
$b_e=1.5275$ in	Eq. 1.1-1
$b_1=0.76377$ in	Eq. 1.1.2-9
$b_2=0.76377$ in	Eq. 1.1.2-10
Ineffective width=6.4486 in	
$A_e=0.096286$ in ² , $F_n=50$ ksi	
$P_n=4.8143$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.389$ in $f_1=49.84$ ksi, $f_2=49.84$ ksi $\psi=1$

Eq. 1.2.2-1

 $k=0.43$

Eq. 1.2.2-3

 $\lambda=2.6469$

Eq. 1.1-3

 $\rho=0.3464$

Eq. 1.1-2

 $b=0.48115$ in (ineffective width=0.90785 in)

Eq. 1.1-1

Element 2: Stiffened, $w=7.9761$ in $f_1=48.976$ ksi, $f_2=-24.634$ ksi $\psi=0.50299$

Eq. 1.1.2-1

 $k=13.796$

Eq. 1.1.2-2

 $\lambda=2.6599$

Eq. 1.1-3

 $\rho=0.34485$

Eq. 1.1-2

 $b_e=2.7506$ in

Eq. 1.1-1

 $h_o=8.1981$ in, $b_o=1.5$ in, $h_o/b_o=5.4654$ $b_1=0.78521$ in

Eq. 1.1.2-6

 $b_2=1.0449$ in

Eq. 1.1.2-7

Compression width=5.3068 in

Ineffective width=3.4768 in

Center of gravity shift: $y=-1.3201$ in $S_{xe}=0.35561$ in³, $F_y=50$ ksi $M_n=17.78$ k-in

Eq. F3.1-1

 $\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in $f_1=49.84$ ksi, $f_2=49.84$ ksi $\psi=1$

Eq. 1.2.2-1

 $k=0.43$

Eq. 1.2.2-3

$\lambda=2.6469$	Eq. 1.1-3
$\rho=0.3464$	Eq. 1.1-2
$b=0.48115$ in (ineffective width=0.90785 in)	Eq. 1.1-1
Element 3: No compressive stress (fully effective)	
Element 2: Stiffened, $w=7.9761$ in	
$f_1=48.976$ ksi, $f_2=-24.634$ ksi	
$\psi=0.50299$	Eq. 1.1.2-1
$k=13.796$	Eq. 1.1.2-2
$\lambda=2.6599$	Eq. 1.1-3
$\rho=0.34485$	Eq. 1.1-2
$b_e=2.7506$ in	Eq. 1.1-1
$h_o=8.1981$ in, $b_o=1.5$ in, $h_o/b_o=5.4654$	
$b_1=0.78521$ in	Eq. 1.1.2-6
$b_2=1.0449$ in	Eq. 1.1.2-7
Compression width=5.3068 in	
Ineffective width=3.4767 in	
Center of gravity shift: $y=1.3201$ in	
$S_{xe}=0.35561$ in ³ , $F_y=50$ ksi	
$M_{nl}=17.78$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Positive Flexural Strength about Y-axis	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=-4.1045$ ksi	
$\psi=0.082089$	Eq. 1.2.2-1
$k=0.58771$	Eq. 1.2.2-5
$\lambda=2.2677$	Eq. 1.1-3
$\rho=0.42709$	Eq. 1.2.2-4
$b=0.59322$ in (ineffective width=0.79578 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=-4.1045$ ksi	
$\psi=0.08209$	Eq. 1.2.2-1
$k=0.58771$	Eq. 1.2.2-5
$\lambda=2.2677$	Eq. 1.1-3
$\rho=0.42709$	Eq. 1.2.2-4
$b=0.59322$ in (ineffective width=0.79578 in)	Eq. 1.1-1
Element 2: No compressive stress (fully effective)	
Iteration is not required	
Center of gravity shift: $x=-0.14907$ in	
$S_{ye}=0.0105$ in ³ , $F_y=50$ ksi	
$M_{nl}=0.525$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about Y-axis	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=13.976$ ksi, $f_2=-50$ ksi	
$\psi=3.5775$	Eq. 1.2.2-1
$\psi>1$ (fully effective)	Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=13.976$ ksi, $f_2=-50$ ksi

$\psi=3.5775$

$\psi>1$ (fully effective)

Eq. 1.2.2-1

Eq. 1.1-1

Element 2: Stiffened, $w=7.9761$ in

$f_1=18.292$ ksi, $f_2=18.292$ ksi

$\psi=1$

Eq. 1.1.2-1

$k=4$

Eq. 1.1.2-8

$\lambda=3.019$

Eq. 1.1-3

$\rho=0.3071$

Eq. 1.1-2

$b_e=2.4494$ in

Eq. 1.1-1

$b_1=1.2247$ in

Eq. 1.1.2-9

$b_2=1.2247$ in

Eq. 1.1.2-10

Ineffective width= 5.5267 in

Center of gravity shift: $x=0.19925$ in

$S_{ye}=0.041392$ in³, $F_y=50$ ksi

$M_{nl}=2.0696$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Track

$C_w=0.75402$ in⁶, $W_n=4.4485$ in², $F_y=50$ ksi

$B_n=8.4749$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

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Full Section Properties

Area	0.38228 in ²	Wt.	0.0012997 k/ft	Flat	11.048 in
I _x	3.2314 in ⁴	r _x	2.9074 in	I _{xy}	0.0000 in ⁴
S _x (t)	0.78834 in ³	y(t)	4.0991 in	α	0.000 deg
S _x (b)	0.78834 in ³	y(b)	4.0991 in		
Z _x	0.98386 in ³	Height	8.1981 in		
I _y	0.0601 in ⁴	r _y	0.3964 in	x _o	-0.5910 in
S _y (l)	0.27761 in ³	x(l)	0.2164 in	y _o	0.0000 in
S _y (r)	0.04679 in ³	x(r)	1.2836 in	j _x	6.1623 in
Z _y	0.07816 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	3.2314 in ⁴	r ₁	2.9074 in	C _w	0.75402 in ⁶
I ₂	0.0601 in ⁴	r ₂	0.3964 in	J	0.00015255 in ⁴
I _c	3.2915 in ⁴	r _c	2.9343 in		
I _o	3.4250 in ⁴	r _o	2.9932 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	4.092 k	φM _{nxo}	16.002 k-in	φM _{nyo}	0.473 k-in
A _e	0.096286 in ²	I _{xe}	1.9271 in ⁴	I _{ye}	0.0067 in ⁴
φT _n	17.388 k	S _{xe} (t)	0.35561 in ³	S _{ye} (l)	0.09936 in ³
		S _{xe} (b)	0.69347 in ³	S _{ye} (r)	0.01050 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	1.306 k	φM _{nxo}	16.002 k-in	φM _{nyo}	1.863 k-in
φV _{nx}	2.595 k	I _{xe}	1.9271 in ⁴	I _{ye}	0.0449 in ⁴
Torsion		S _{xe} (t)	0.69347 in ³	S _{ye} (l)	0.10800 in ³
φB _n	7.6274 k-in ²	S _{xe} (b)	0.35561 in ³	S _{ye} (r)	0.04139 in ³

Track element 2 h/t exceeds 200.

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0346 in, R=0.0764 in, A_c=0.0050926 in²

F_{yc}=70.273 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0346 in, R=0.0764 in, A_c=0.0050926 in²

F _{yc} =70.273 ksi	Eq. A3.3.2-2
F _{ya} =50.54 ksi	Eq. A3.3.2-1
Max compression stress allowed: F _{ya} =50 ksi	
Bending about X-axis	
Track corner 2	
t=0.0346 in, R=0.0764 in, A _c =0.0050926 in ²	
F _{yc} =70.273 ksi	Eq. A3.3.2-2
Track corner 3	
t=0.0346 in, R=0.0764 in, A _c =0.0050926 in ²	
F _{yc} =70.273 ksi	Eq. A3.3.2-2
F _{ya} =51.942 ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: F _{ya} =50 ksi	
Max compression stress allowed for negative bending: F _{ya} =50 ksi	
Bending about Y-axis	
F _{ya} =50 ksi	Eq. A3.3.2-1
Axial Tension Strength	
A _g =0.38228 in ² , F _y =50.54 ksi	
T _n =19.32 k	Eq. D2-1
Ω _t =1.67, φ _t =0.9	
A _n =0.38228 in ² , F _u =65 ksi	
T _n =24.848 k	Eq. D3-1
Ω _t =2, φ _t =0.75	
Shear Strength	
Track element 1	
V _n =1.4418 k at 180 deg	Eq. G2.1-1
Ω _v =1.67, φ _v =0.9	
Track element 2	
h/t exceeds 200 (rational analysis)	
V _n =1.6326 k at 90 deg	Eq. G2.1-2
Ω _v =2, φ _v =0.8 (rational analysis)	
Track element 3	
V _n =1.4418 k at 0 deg	Eq. G2.1-1
Ω _v =1.67, φ _v =0.9	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, w=1.389 in	
f ₁ =50 ksi, f ₂ =50 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3
λ=2.6511	Eq. 1.1-3
ρ=0.3459	Eq. 1.1-2
b=0.48045 in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 3: Unstiffened, w=1.389 in	
f ₁ =50 ksi, f ₂ =50 ksi	
ψ=1	Eq. 1.2.2-1
k=0.43	Eq. 1.2.2-3

$\lambda=2.6511$	Eq. 1.1-3
$\rho=0.3459$	Eq. 1.1-2
$b=0.48045$ in (ineffective width=0.90855 in)	Eq. 1.1-1
Element 2: Stiffened, $w=7.9761$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=4.9914$	Eq. 1.1-3
$\rho=0.19152$	Eq. 1.1-2
$b_e=1.5275$ in	Eq. 1.1-1
$b_1=0.76377$ in	Eq. 1.1.2-9
$b_2=0.76377$ in	Eq. 1.1.2-10
Ineffective width=6.4486 in	
$A_e=0.096286$ in ² , $F_n=50$ ksi	
$P_n=4.8143$ k	Eq. E3.1-1
$\Omega_c=1.8$, $\phi_c=0.85$	

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.389$ in

$f_1=49.84$ ksi, $f_2=49.84$ ksi

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=2.6469$	Eq. 1.1-3
$\rho=0.3464$	Eq. 1.1-2
$b=0.48115$ in (ineffective width=0.90785 in)	Eq. 1.1-1

Element 2: Stiffened, $w=7.9761$ in

$f_1=48.976$ ksi, $f_2=-24.634$ ksi

$\psi=0.50299$	Eq. 1.1.2-1
$k=13.796$	Eq. 1.1.2-2
$\lambda=2.6599$	Eq. 1.1-3
$\rho=0.34485$	Eq. 1.1-2
$b_e=2.7506$ in	Eq. 1.1-1
$h_o=8.1981$ in, $b_o=1.5$ in, $h_o/b_o=5.4654$	
$b_1=0.78521$ in	Eq. 1.1.2-6
$b_2=1.0449$ in	Eq. 1.1.2-7

Compression width=5.3068 in

Ineffective width=3.4768 in

Center of gravity shift: $y=-1.3201$ in

$S_{xe}=0.35561$ in³, $F_y=50$ ksi

$M_n=17.78$ k-in

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.389$ in

$f_1=49.84$ ksi, $f_2=49.84$ ksi

$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3

$\lambda=2.6469$	Eq. 1.1-3
$\rho=0.3464$	Eq. 1.1-2
$b=0.48115$ in (ineffective width=0.90785 in)	Eq. 1.1-1
Element 3: No compressive stress (fully effective)	
Element 2: Stiffened, $w=7.9761$ in	
$f_1=48.976$ ksi, $f_2=-24.634$ ksi	
$\psi=0.50299$	Eq. 1.1.2-1
$k=13.796$	Eq. 1.1.2-2
$\lambda=2.6599$	Eq. 1.1-3
$\rho=0.34485$	Eq. 1.1-2
$b_e=2.7506$ in	Eq. 1.1-1
$h_o=8.1981$ in, $b_o=1.5$ in, $h_o/b_o=5.4654$	
$b_1=0.78521$ in	Eq. 1.1.2-6
$b_2=1.0449$ in	Eq. 1.1.2-7
Compression width=5.3068 in	
Ineffective width=3.4767 in	
Center of gravity shift: $y=1.3201$ in	
$S_{xe}=0.35561$ in ³ , $F_y=50$ ksi	
$M_{nl}=17.78$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Positive Flexural Strength about Y-axis	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=-4.1045$ ksi	
$\psi=0.082089$	Eq. 1.2.2-1
$k=0.58771$	Eq. 1.2.2-5
$\lambda=2.2677$	Eq. 1.1-3
$\rho=0.42709$	Eq. 1.2.2-4
$b=0.59322$ in (ineffective width=0.79578 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.389$ in	
$f_1=50$ ksi, $f_2=-4.1045$ ksi	
$\psi=0.08209$	Eq. 1.2.2-1
$k=0.58771$	Eq. 1.2.2-5
$\lambda=2.2677$	Eq. 1.1-3
$\rho=0.42709$	Eq. 1.2.2-4
$b=0.59322$ in (ineffective width=0.79578 in)	Eq. 1.1-1
Element 2: No compressive stress (fully effective)	
Iteration is not required	
Center of gravity shift: $x=-0.14907$ in	
$S_{ye}=0.0105$ in ³ , $F_y=50$ ksi	
$M_{nl}=0.525$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Negative Flexural Strength about Y-axis	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.389$ in	
$f_1=13.976$ ksi, $f_2=-50$ ksi	
$\psi=3.5775$	Eq. 1.2.2-1
$\psi>1$ (fully effective)	Eq. 1.1-1

Element 3: Unstiffened, $w=1.389$ in

$f_1=13.976$ ksi, $f_2=-50$ ksi

$\psi=3.5775$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 2: Stiffened, $w=7.9761$ in

$f_1=18.292$ ksi, $f_2=18.292$ ksi

$\psi=1$

Eq. 1.1.2-1

$k=4$

Eq. 1.1.2-8

$\lambda=3.019$

Eq. 1.1-3

$\rho=0.3071$

Eq. 1.1-2

$b_e=2.4494$ in

Eq. 1.1-1

$b_1=1.2247$ in

Eq. 1.1.2-9

$b_2=1.2247$ in

Eq. 1.1.2-10

Ineffective width= 5.5267 in

Center of gravity shift: $x=0.19925$ in

$S_{ye}=0.041392$ in³, $F_y=50$ ksi

$M_{nl}=2.0696$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Bimoment Strength, Track

$C_w=0.75402$ in⁶, $W_n=4.4485$ in², $F_y=50$ ksi

$B_n=8.4749$ k-in²

G8.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

800T150-54

Full Section Properties

Area	0.62191 in ²	Wt.	0.0021145 k/ft	Flat	10.988 in
I _x	5.2143 in ⁴	r _x	2.8956 in	I _{xy}	0.0000 in ⁴
S _x (t)	1.2721 in ³	y(t)	4.0991 in	α	0.000 deg
S _x (b)	1.2721 in ³	y(b)	4.0991 in		
Z _x	1.5936 in ³	Height	8.1981 in		
I _y	0.0962 in ⁴	r _y	0.3933 in	x _o	-0.5865 in
S _y (l)	0.4266 in ³	x(l)	0.2255 in	y _o	0.0000 in
S _y (r)	0.0755 in ³	x(r)	1.2745 in	j _x	6.1743 in
Z _y	0.1282 in ³	Width	1.5000 in	j _y	0.0000 in
I ₁	5.2143 in ⁴	r ₁	2.8956 in	C _w	1.1978 in ⁶
I ₂	0.0962 in ⁴	r ₂	0.3933 in	J	0.0006641 in ⁴
I _c	5.3106 in ⁴	r _c	2.9222 in		
I _o	5.5244 in ⁴	r _o	2.9805 in		

Fully Braced Strength - AISI S100-16/S3-22, US, LRFD

Material Type: A1003 ST Grade 50H, F_y=50 ksi

Axial		Positive Bending		Positive Bending	
φP _{no}	10.238 k	φM _{nxo}	38.016 k-in	φM _{nyo}	1.592 k-in
A _e	0.24089 in ²	I _{xe}	4.0457 in ⁴	I _{ye}	0.0317 in ⁴
φT _n	28.446 k	S _{xe} (t)	0.8448 in ³	S _{ye} (l)	0.2496 in ³
		S _{xe} (b)	1.1867 in ³	S _{ye} (r)	0.0354 in ³
Shear		Negative Bending		Negative Bending	
φV _{ny}	4.339 k	φM _{nxo}	38.016 k-in	φM _{nyo}	3.240 k-in
φV _{nx}	4.152 k	I _{xe}	4.0457 in ⁴	I _{ye}	0.0855 in ⁴
Torsion		S _{xe} (t)	1.1867 in ³	S _{ye} (l)	0.2737 in ³
φB _n	12.247 k-in ²	S _{xe} (b)	0.8448 in ³	S _{ye} (r)	0.0720 in ³

Calculation Details - AISI S100-16/S3-22, US, LRFD

Cold-work of forming stresses

F_y=50 ksi, F_u=65 ksi

B_c=1.6229

Eq. A3.3.2-3

m=0.1816

Eq. A3.3.2-4

Axial Load

Track corner 2

t=0.0566 in, R=0.0849 in, A_c=0.010064 in²

F_{yc}=75.384 ksi

Eq. A3.3.2-2

Track corner 3

t=0.0566 in, R=0.0849 in, A_c=0.010064 in²

F_{yc}=75.384 ksi

Eq. A3.3.2-2

F_{ya}=50.822 ksi

Eq. A3.3.2-1

Max compression stress allowed: $F_{ya}=50$ ksi	
Bending about X-axis	
Track corner 2	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
Track corner 3	
$t=0.0566$ in, $R=0.0849$ in, $A_c=0.010064$ in ²	
$F_{yc}=75.384$ ksi	Eq. A3.3.2-2
$F_{ya}=52.938$ ksi	Eq. A3.3.2-1
Max compression stress allowed for positive bending: $F_{ya}=50$ ksi	
Max compression stress allowed for negative bending: $F_{ya}=50$ ksi	
Bending about Y-axis	
$F_{ya}=50$ ksi	Eq. A3.3.2-1
Axial Tension Strength	
$A_g=0.62191$ in ² , $F_y=50.822$ ksi	
$T_n=31.606$ k	Eq. D2-1
$\Omega_t=1.67$, $\phi_t=0.9$	
$A_n=0.62191$ in ² , $F_u=65$ ksi	
$T_n=40.424$ k	Eq. D3-1
$\Omega_t=2$, $\phi_t=0.75$	
Shear Strength	
Track element 1	
$V_n=2.3067$ k at 180 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 2	
$V_n=4.8207$ k at 90 deg	Eq. G2.1-2
$\Omega_v=1.67$, $\phi_v=0.9$	
Track element 3	
$V_n=2.3067$ k at 0 deg	Eq. G2.1-1
$\Omega_v=1.67$, $\phi_v=0.9$	
Axial Compression Strength	
Effective width calculations for Track	
Element 1: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1
Element 3: Unstiffened, $w=1.3585$ in	
$f_1=50$ ksi, $f_2=50$ ksi	
$\psi=1$	Eq. 1.2.2-1
$k=0.43$	Eq. 1.2.2-3
$\lambda=1.5851$	Eq. 1.1-3
$\rho=0.54333$	Eq. 1.1-2
$b=0.73811$ in (ineffective width=0.62039 in)	Eq. 1.1-1

Element 2: Stiffened, $w=7.9151$ in

$f_1=50$ ksi, $f_2=50$ ksi

$\psi=1$

Eq. 1.1.2-1

$k=4$

Eq. 1.1.2-8

$\lambda=3.0279$

Eq. 1.1-3

$\rho=0.30626$

Eq. 1.1-2

$b_e=2.4241$ in

Eq. 1.1-1

$b_1=1.2121$ in

Eq. 1.1.2-9

$b_2=1.2121$ in

Eq. 1.1.2-10

Ineffective width= 5.491 in

$A_e=0.24089$ in², $F_n=50$ ksi

$P_n=12.044$ k

Eq. E3.1-1

$\Omega_c=1.8$, $\phi_c=0.85$

Positive Flexural Strength about X-axis

Effective width calculations for Track

Element 1: No compressive stress (fully effective)

Element 3: Unstiffened, $w=1.3585$ in

$f_1=49.704$ ksi, $f_2=49.704$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.5804$

Eq. 1.1-3

$\rho=0.54468$

Eq. 1.1-2

$b=0.73995$ in (ineffective width= 0.61855 in)

Eq. 1.1-1

Element 2: Stiffened, $w=7.9151$ in

$f_1=48.522$ ksi, $f_2=-34.127$ ksi

$\psi=0.70333$

Eq. 1.1.2-1

$k=17.291$

Eq. 1.1.2-2

$\lambda=1.4347$

Eq. 1.1-3

$\rho=0.59013$

Eq. 1.1-2

$b_e=4.671$ in

Eq. 1.1-1

$h_o=8.1981$ in, $b_o=1.5$ in, $h_o/b_o=5.4654$

$b_1=1.2613$ in

Eq. 1.1.2-6

$b_2=1.481$ in

Eq. 1.1.2-7

Compression width= 4.6468 in

Ineffective width= 1.9046 in

Center of gravity shift: $y=-0.68988$ in

$S_{xe}=0.84481$ in³, $F_y=50$ ksi

$M_{nl}=42.24$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about X-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=49.704$ ksi, $f_2=49.704$ ksi

$\psi=1$

Eq. 1.2.2-1

$k=0.43$

Eq. 1.2.2-3

$\lambda=1.5804$

Eq. 1.1-3

$\rho=0.54468$

Eq. 1.1-2

$b=0.73995$ in (ineffective width= 0.61855 in)

Eq. 1.1-1

Element 3: No compressive stress (fully effective)

Element 2: Stiffened, $w=7.9151$ in

$f_1=48.522$ ksi, $f_2=-34.127$ ksi

$\psi=0.70333$

Eq. 1.1.2-1

$k=17.291$

Eq. 1.1.2-2

$\lambda=1.4347$

Eq. 1.1-3

$\rho=0.59013$

Eq. 1.1-2

$b_e=4.671$ in

Eq. 1.1-1

$h_o=8.1981$ in, $b_o=1.5$ in, $h_o/b_o=5.4654$

$b_1=1.2613$ in

Eq. 1.1.2-6

$b_2=1.481$ in

Eq. 1.1.2-7

Compression width= 4.6468 in

Ineffective width= 1.9046 in

Center of gravity shift: $y=0.68988$ in

$S_{xe}=0.84481$ in³, $F_y=50$ ksi

$M_{nl}=42.24$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Positive Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-3.2969$ ksi

$\psi=0.065939$

Eq. 1.2.2-1

$k=0.58415$

Eq. 1.2.2-5

$\lambda=1.3599$

Eq. 1.1-3

$\rho=0.64866$

Eq. 1.2.2-4

$b=0.8812$ in (ineffective width= 0.4773 in)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=50$ ksi, $f_2=-3.2969$ ksi

$\psi=0.065939$

Eq. 1.2.2-1

$k=0.58415$

Eq. 1.2.2-5

$\lambda=1.3599$

Eq. 1.1-3

$\rho=0.64866$

Eq. 1.2.2-4

$b=0.8812$ in (ineffective width= 0.4773 in)

Eq. 1.1-1

Element 2: No compressive stress (fully effective)

Iteration is not required

Center of gravity shift: $x=-0.098552$ in

$S_{ye}=0.035388$ in³, $F_y=50$ ksi

$M_{nl}=1.7694$ k-in

Eq. F3.1-1

$\Omega_b=1.67$, $\phi_b=0.9$

Negative Flexural Strength about Y-axis

Effective width calculations for Track

Element 1: Unstiffened, $w=1.3585$ in

$f_1=7.1666$ ksi, $f_2=-50$ ksi

$\psi=6.9768$

Eq. 1.2.2-1

$\psi>1$ (fully effective)

Eq. 1.1-1

Element 3: Unstiffened, $w=1.3585$ in

$f_1=7.1667$ ksi, $f_2=-50$ ksi

$\psi=6.9767$

Eq. 1.2.2-1

$\psi > 1$ (fully effective)	Eq. 1.1-1
Element 2: Stiffened, $w=7.9151$ in	
$f_1=11.93$ ksi, $f_2=11.93$ ksi	
$\psi=1$	Eq. 1.1.2-1
$k=4$	Eq. 1.1.2-8
$\lambda=1.4791$	Eq. 1.1-3
$\rho=0.57554$	Eq. 1.1-2
$b_e=4.5555$ in	Eq. 1.1-1
$b_1=2.2777$ in	Eq. 1.1.2-9
$b_2=2.2777$ in	Eq. 1.1.2-10
Ineffective width= 3.3596 in	
Center of gravity shift: $x=0.086869$ in	
$S_{ye}=0.071996$ in ³ , $F_y=50$ ksi	
$M_n I=3.5998$ k-in	Eq. F3.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	
Bimoment Strength, Track	
$C_w=1.1978$ in ⁶ , $W_n=4.401$ in ² , $F_y=50$ ksi	
$B_n=13.608$ k-in ²	G8.1-1
$\Omega_b=1.67$, $\phi_b=0.9$	