REFERENCES	CALCULATIONS	RESULTS

MEMBER REPORT FOR ZSECTIONLIPPED SECTION

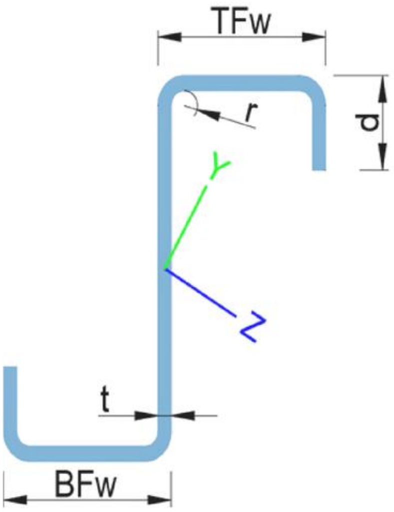
Design checks for AISI S100-12 as per provision ASD

PROJECT DETAILS

Project Name:
Project ID:
Company:
Designer:
Client:
Project Notes:
Project Units: Imperial

General member design information

Section Name: 12ZS2.75x070
Shape: Z-Section w/ Lips



Dimensions:
Height, ***h = 12 in***
Thickness, ***t = 0.07 in***
Top Flange Width, ***TFw = 2.75 in***
Bottom Flange Width, ***BFw = 2.75 in***
Lip Depth, ***d = 0.93 in***
Fillet Radius, ***r = 0.188 in***

Properties:
Area, ***A = 1.33*** in^2
Moment of Inertia about the z-axis, ***Iz = 27.9*** in^4
Moment of Inertia about the Y-Axis, ***Iy = 1.02*** in^4
Plastic Section Modulus about the z-axis, ***Zz = 5.446*** in^3
Plastic Section Modulus about the Y-Axis, ***Zy = 0.959*** in^3
Torsion Constant, ***J = 0.00217*** in^4
Warping Constant, ***Iw = 56*** in^6

Material properties:
Material Name: ***Structural Steel***
Modulus of Elasticity, ***E = 29007.547 ksi***
Yield Strength, ***Fy = 37.71 ksi***
Ultimate Tensile Strength, ***Fu = 59.465 ksi***

Design Parameters:
Design Method: ***ASD***

Flexural Buckling parameters:
Effective length factor for flexural buckling about Z-Axis, ***Kz =1***
Effective length factor for flexural buckling about Y-Axis, ***Ky =1***
Member length for flexural buckling, ***L =137.795 in***
Length between braced points, ***Lb =137.795 in***

Lateral Torsional Buckling parameters:
Coefficient for lateral-torsional buckling, ***Cs =-1***
End moment coefficient in interaction formula, ***CTf =1.0***

Bending coefficient dependent on moment gradient, ***Cb =1.0***
Effective length factor for flexural buckling about Z-Axis, ***Kz =1***
Member length for Lateral Torsional Buckling, ***L =137.795 in***

Design Internal Forces

Load Case:
Name = ***Worst Case Load Combination***
Type = ***User Define***

For check axial strength:
Absolute Maximum Axial Force, ***P*** = 0.004 kip

For check flexural strength about Z-Axis:
Absolute Maximum Major Bending Moment, ***Mz*** = 0.191 kip-in

For check flexural strength about Y-Axis:
Absolute Maximum Major Bending Moment, ***My*** = 0.025 kip-in

For check shear strength Y-Axis:
Absolute Maximum Shear Force, ***Vx*** = 0.006 kip

For check shear strength Z-Axis:
Absolute Maximum Shear Force, ***Vy*** = 0 kip

For check interaction of combined compression and bending strength:
Axial Force, ***P*** = 0.004 kip
Z-Axis Bending Moment, ***Mz*** = 0.191 kip-in
Y-Axis Bending Moment, ***My*** = 0.025 kip-in

For check interaction of combined bending and shear strength:
Z-Axis Bending Moment, ***Mz*** = 0.191 kip-in
Y-Axis Bending Moment, ***My*** = 0.025 kip-in
Shear Force, ***Vy*** = 0.006 kip
Shear Force, ***Vz*** = 0 kip

BENDING CAPACITY CHECK

Bending about Y-Axis

Nominal flexural Strength, Mn (Section C3.1) Eq. C3.1.1-1

$$M_{ny} = S_{ye} F_y$$

$$M_{ny} = (0.602)\,(37.71) = 22.701\ kip - in$$

$$\text{Allowable Flexural Strength } = \frac{M_{ny}}{\Omega_b} = \frac{22.701}{1.67} = 13.593\ kip - in$$

Calculate Nominal flexural strength about Y-Axis (M_{ny})

$$\frac{M_{uy}}{\text{Allowable Flexural Strength}} = \frac{0.025}{13.593} = 0.002 < 1.0$$

0.002 **PASS**

Bending about Z-Axis

Nominal flexural Strength, Mn (Section C3.1) Eq. C3.1.1-1

$$M_{nz} = S_{ze} F_y$$

$$M_{nz} = (4.231)\,(37.71) = 154.851\ kip - in$$

Calculate Nominal flexural strength about Z-Axis (M_{nz})

$$\text{Allowable Flexural Strength } = \frac{M_{nz}}{\Omega_b} = \frac{154.851}{1.67} = 92.725\ kip - in$$

$$\frac{M_{uz}}{\text{Allowable Flexural Strength}} = \frac{0.191}{92.725} = 0.002 < 1.0$$

0.002 **PASS**

	$$\lambda_c = \sqrt{\frac{F_y}{F_e}} = \sqrt{\frac{37.71}{30.06}} 1.12$$ *Calculate Slenderness factor (λ_c)* $$F_n = \left(0.658^{\lambda_c^2}\right)(F_y)$$ $$F_n = \left(0.658^{1.12^2}\right)(37.71)$$ *Calculate Nominal Buckling Stress (F_n)* $$P_n = A_e F_n = 0.828\,(22.306) = 18.478\ kip$$ *Calculate Nominal Flexural-Torsional Buckling Strength (P_n)* $$\text{Allowable Strength} = \frac{P_n}{\Omega_c} = \frac{18.478}{1.8} = 10.265\ kip$$ *Calculate the allowable Flexural-Torsional Buckling strength (P_n)* $$\frac{P}{\text{Allowable Strength}} = \frac{0.004}{10.265} = 0 \le 1.0$$	0 **PASS**
Eq. C3.1.4-6	**DISTORTIONAL BUCKLING STRENGTH CHECK (BENDING)** $$F_d = \beta \frac{k_{\phi fe} + k_{\phi we} + k_\phi}{k_{\phi fg} + k_{\phi wg}} = 1.00 \frac{0.2724087 + 0.2601159 + 0.00000}{0.0102690 + 0.0035908} = 38.422\ ksi$$ *Calculate Distortional Buckling Stress (F_d)* $$\lambda_{db} = \sqrt{M_y / M_{crd}} = \sqrt{175.352/178.663} = 0.991$$ *Calculate Slenderness factor (λ_{db})* $$M_n = \left(1 - 0.22\left(\frac{M_{crd}}{M_y}\right)^{0.5}\right)\left(\frac{M_{crd}}{M_y}\right)^{0.5}(M_y) = \left(1 - 0.22\left(\frac{178.663}{175.352}\right)^{0.5}\right)\left(\frac{178.663}{175.352}\right)^{0.5}(175.352) = 137.694\ kip - in$$ $$M_y = S_{fy} F_y = 4.65\,(37.71) = 175.352\ kip - in$$ $$M_{crd} = S_f F_d = 4.65\,(38.422) = 178.663\ kip - in$$ *Calculate Nominal Bending Strength for Distortional Buckling (M_n)* $$\text{Allowable Strength} = \frac{M_n}{\Omega_b} = \frac{137.694}{1.67} = 82.451\ \text{kip-in}$$ *Calculate Allowable Distortional Buckling Strength (M_n)* $$\frac{M}{Capacity} = \frac{0.191}{82.451} = 0.002 < 1.0$$	0.002 **PASS**
Eq. C4.2-6	**DISTORTIONAL BUCKLING STRENGTH CHECK (COMPRESSION)**	

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[illegible]	**LATERAL TORSIONAL BUCKLING CHECK** [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	[illegible]