Steel F_y	33	ksi		
Steel Modulus of Elasticity	29500			
Section Height	10	feet	120	inches
Studs X inches O.C.	16	in	1.33	feet
Wind Pressure	5	psf		
Axial Pressure Live Load	0	psf		
Axial Pressure Dead Load	6	psf		
Studs X inches O.C.	16	in	1.33	feet
Width of Hole in Studs	1.5	in		
Member Selection	362S162-33			
Area gross	0.262	in^2		
t	0.0346	in		
I_x	0.551			
S_x	0.304			
r_x	1.450			
V_n	0.834			
F_{ya}	33.0			
M_{nxo}	8.8			
S_e	0.268			
I_e	0.535			
P_n at $f=F_y$	5.8			

Given & Assumptions:

1. Steel Fy = 33 Modulus of Elasticity: 29500
2. Section simply supported at ends

3. Section fully braced against lateral-torsional, flexural-torsional and distortional buckling.

K_x = 1.0; Height (L_x): 10 ft ; Contributory Width: 1.33 ft

Wind Pressure: 5 psf

Contributory Pressure: 6.67 p/lf or 0.0067 k/lf

Required:

Verify combined bending and compression strength of the section using ASD and LRFD methods with ASCE/SEC 7-05 load combinations.

Solution:

Calculate preliminary data for choosing member

Max Wind deflection δ L_x"/240 0.500 in

$I_{minimum} = \frac{(5 \cdot w \cdot L^4 \cdot 1728)}{(384 \cdot E \cdot \delta)}$ 0.1 in^4

ASD Contributory Pressure: 0.0067 k/lf

LRFD Contributory Pressure 1.6W: 0.0107 k/lf

$Max_{moment} = \frac{(w \cdot L^2)}{8} =$ 0.133 ft – k

$S_{required} = \frac{(M_{max})}{(.9 \cdot F_y)}$ 0.054 in^3

Select Member using $I_{minimum}$ and the $S_{required}$ from above.

Member Selection: 362S162-33

$Area_{gross}$	0.26 in^2
I_x	0.55 in^4
S_x	0.3 in^3
r_x	1.45 in

$M_n = S_e * F_y$ 8.84 in – k

Nominal axial strength, P_n (Section C4.1)

$F_e = \frac{\pi^2 * E}{(K * L_x / r_x)^2}$ 42.51 ksi

$\lambda_c = \sqrt{(F_y / F_e)}$ 0.8811 < 1.5

$F_n = 0.658^{\lambda c^2} * F_y$ 23.845 ksi

$A_e = A_g$ – hole 0.210 in² Effective Area

$P_n = A_e * F_n$ 5.01 k

Required Strength $M = \frac{(wL^2)}{4}$

M_{dead} 3.200 in – k

M_{live} 0 in – k

ASD

$M_x = M_{dead} + M_{live}$ 3.200 in – k

$P = P_{dead} + P_{live}$ 0.080 k

LRFD

$M_{ux} = 1.2\ M_{dead} + 1.6\ M_{live}$ 3.84 in – k

$P_u = 1.2\ P_{dead} + 1.6\ P_{live}$ 0.096 k

Combined compression and bending – ASD (Section C5.2.1)

$\frac{(\Omega_c P)}{P_n} =$ 0.0287

$C_{mx} =$ 1

$P_{Ex} = \frac{(\pi^2 \cdot E \cdot I)}{(K_x . L_x)^2} =$ 11.145 k

$\alpha_x = 1 - \frac{(\Omega_c P)}{(P_{Ex})} > 0$ 0.99

$M_y = 0.0$

$\frac{(\Omega_c P)}{P_n} + \frac{(\Omega_b C_{m_x} M_x)}{(M_{nx} \alpha_x)} + \frac{(\Omega_b C_{m_y} M_y)}{(M_{n_y} \alpha_y)} < 1.0$ 0.64 WIthin Limits

$\frac{(\Omega_c P)}{(P_{no})} + \frac{(\Omega_b M_x)}{(M_{nx})} + \frac{(\Omega_b M_y)}{(M_{n_y})} < 1.0$ 0.63 WIthin Limits

Combined compression and bending – LRFD (Section C5.2.2)

$\bar{P} = P_u$ 0.096 k

$\bar{M}_x = M_{ux} =$ 3.84 in – k

$\frac{\bar{P}}{(\phi_c P_n)} =$ 0.02 >0.15 therefore use Equations C5.2.2-1 and C5.2.2-2

C_{mx} = 1.0

P_{Ex} = 11.145 k

$\alpha_x = 1 - \frac{\bar{P}}{(P_{Ex})} > 0$ 0.991

M_y = 0.0

$\frac{\bar{P}}{(\phi_c P_n)} + \frac{(C_{mx}\bar{M}_x)}{(\phi_b M_{nx}\alpha_x)} + \frac{(C_{my}\bar{M}_y)}{(\phi_b M_{ny}\alpha_y)} < 1.0$ 0.508 WIthin Limits

$\frac{\bar{P}}{(\phi_c P_{no})} + \frac{(\bar{M}_x)}{(\phi_b M_{nx})} + \frac{(\bar{M}_y)}{(\phi_b M_{ny})} < 1.0$ 0.501 WIthin Limits