



316000

```
1 begin
2
3   # Material & Total Geometry
4
5   E=29000 # ksi Elastic Modulus
6   G=11200 # ksi Shear Modulus
7   F_y=50 # ksi Yield Strength
8   L_x=18*12 # in
9   L_y=18*12 # in
10  L_z=18*12 # in
11  L_cx=18*12 # in
12  L_cy=18*12 # in
13  L_cz=18*12 # in
14
15  # Cross Section Geometry
16
17  A=72.5 # in^2 Area
18  d=36.7 # in Total Depth
19
20  t_w=0.8 # in Web Thickness
21
22  b_f=16.5 # in Flange Width
23  t_f=1.35 # in Flange Thickness
24
25  k=2.3 # in Corner, h=d-2*k for web depth
26  h=d-2*k
27
28  γ=247/100 # klf Unit Weight over Length
29
30  λ_f= 6.11 # Flange Ratio
31  λ_w=40.1 # Web Ratio, can also be determined as (d-2*k)/t_w
32
33  I_x=16700
34  I_y=1010
35
36  S_x=913
37  S_y=123
38
39  r_x=15.2
40  r_y=3.74
41
42  Z_x=1030
43  Z_y=190
44
45  r_ts=4.42
46  h_0=35.4
47
48  J=34.7
49  C_w=316000
50 end
```

1 # All current ASTM A6 W, S, M, C and MC shapes except W21x48, W14x99, W14x90, W12x65, W10x12, W8x31, W8x10, W6x15, W6x9, W6x8.5, and M4x6 have compact flanges for  $F_y=50\text{ksi}$ ; all current ASTM A6 W, S, M, HP, C, and MC shapes have compact webs at  $F_y\leq 70\text{ ksi}$ .

2391.7122982860765

1 47929.91445765297/1.67/12

791.6666666666666

```
1  # Remember to convert unit (in to ft)
2
3  begin
4
5  # Major Axis
6
7  # Check Compactness
8   $\lambda_{pf} = 0.38 \sqrt{E/F_y}$  # B4.1b
9   $\lambda_{rf} = \sqrt{E/F_y}$  # B4.1b
10  $\lambda_{pw} = 3.76 \sqrt{E/F_y}$  # B4.1b
11  $\lambda_{rw} = 5.7 \sqrt{E/F_y}$  # B4.1b
12
13 c = 1 # F2-8a
14
15 L_b = max(L_x, L_y) # F2 L_b is the length between points that are either braced
    against lateral displacement of the compression flange or braced against twist of
    the cross section
16
17 M_p = F_y * Z_x # M_n_Y Yield Resistance F2-1
18 C_b = 1 # Lateral Torsional Modification Factor F1.
19
20 if  $\lambda_w \leq \lambda_{pw}$  # Compact Web B4.1b
21
22
23     L_p =  $1.76 r_y \sqrt{E/F_y}$  # F2-5
24     L_r =  $1.95 r_{ts} \sqrt{E / (0.7 F_y) \sqrt{J c / S_x / h_0} + \sqrt{(J c / S_x / h_0)^2 + 6.76 (0.7 F_y / E)^2}}$  # F2-6
25
26     # Lateral Torsional Buckling
27     if L_b <= L_p
28         M_n_LTB = M_p
29     elseif L_b <= L_r
30         M_n_LTB = C_b * (M_p - (M_p - 0.7 * F_y * S_x) * (L_b - L_p) / (L_r - L_p)) # F2-2
31     else
32         F_cr = C_b *  $\pi^2 E / (L_b / r_{ts})^2 \sqrt{1 + 0.078 J c / S_x / h_0 (L_b / r_{ts})^2}$  #
            F2-4
33         M_n_LTB = F_cr * S_x # F2-3
34     end
35
36     if  $\lambda_f \leq \lambda_{pf}$  # Compact Flange B4.1b
37         M_n = min(M_p, M_n_LTB) #F2
38
39     # Flange Local Buckling
40     elseif  $\lambda_f \leq \lambda_{rf}$  # Non-Compact Flange
41         M_n = min(M_p - (M_p - 0.7 * F_y * S_x) * ( $\lambda_f - \lambda_{pf}$ ) / ( $\lambda_{rf} - \lambda_{pf}$ ), M_n_LTB, M_p)
            #F3-1
42
43     else # Slender Flange
44         k_c = 4 / sqrt(h / t_w)
45         M_n = min(0.9 * E * k_c * S_x /  $\lambda_f^2$ , M_n_LTB, M_p) #F3-2
46     end
47
48 elseif  $\lambda_w \leq \lambda_{rw}$  # Non-Compact Web B4.1b
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49
50 I_yc = 1/12*t_f*b_f^3 # F4.2(c)(2) I_yc is the moment of inertial of the
    compression flange about the y-axis
51 S_xc = (1/12*b_f*t_f^3+b_f*t_f*(0.5*d-0.5*t_f)^2)/(d/2) # F4.1 S_xc is the
    elastic section modulus referred to compression flange
52 h_c = h # F4.2(c)(6) h_c is twicee the distance from the centroid to the
    following: the inside face of the compression flange less the fillet or
    corner radius, for rolled shapes; the nearest line of fasteners at the
    compression flange or the inside faces of the compression flange when welds
    are used, for built-up sections
53 M_yc = F_y*S_xc
54
55 # F4.2(c)(6)
56 if I_yc/I_y <= 0.23
57     R_pc = 1 # F4-10
58 else
59     if h_c/t_w <= λ_pw # h_c/t_w
60         R_pc = M_p/M_yc # F4-9a
61     else
62         R_pc = min(M_p/M_yc - (M_p/M_yc-1)*(h_c/t_w-λ_pw)/(λ_rw-λ_pw),
            M_p/M_yc) # F4-9b
63     end
64 end
65
66 #####
67
68 M_n_CFY = R_pc*M_yc # F4-1
69
70 a_w = h_c*t_w/b_f/t_f
71 r_t = b_f/sqrt(12*(1+1/6*a_w))
72
73 F_L=0.7*F_y # F4-6a
74
75 L_p = 1.1*r_t*sqrt(E/F_y)
76 L_r = 1.95*r_t*E/F_L*sqrt(J/S_xc/h_0 + sqrt((J/S_xc/h_0)^2+6.76*(F_L/E)^2))
77
78 if L_b <= L_P
79     M_n_LTB = M_p
80 elseif L_b <= L_r
81     M_n_LTB = C_b*(R_pc*M_yc - (R_pc*M_yc-F_L*S_xc)*(L_b-L_p)/(L_r-L_p))
82 else
83     F_cr = C_b*pi^2*E/(L_b/r_t)^2*sqrt(1+0.078*J/S_xc/h_0*(L_b/r_t)^2)
84     M_n_LTB = F_cr*S_xc
85 end
86
87 if λ_f <= λ_pf # Compact Flange B4.1b
88     M_n = min(M_n_LTB, M_n_CFY, M_p) # F4
89
90 # Flange Local Buckling
91 elseif λ_f <= λ_rf # Non-Compact Flange
92     M_n = min(R_pc*M_yc-(R_pc*M_yc-F_L*S_xc)*(λ_f-λ_pf)/(λ_rf-λ_pf),
        M_n_LTB, M_n_CFY, M_p) # F4-13
93
94 else # Slender Flange
95

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96         # F4.3(c)
97         if 4/sqrt(h/t_w)<=0.35
98             k_c = 0.35
99         else
100             k_c = min(0.76, 4/sqrt(h/t_w))
101         end
102         M_n = min(0.9*E*k_c*S_x/(b_f/2/t_f)^2, M_n_LTB, M_n_CFY, M_p) # F4-14
103     end
104
105     # Doubly Symmetric Shape, no tension flange yielding
106
107     #####
108
109     else # Slender Web B4.1b
110
111         I_yc = 1/12*t_f*b_f^3 # F4.2(c)(2) I_yc is the moment of inertial of the
112         compression flange about the y-axis
113         S_xc = (1/12*b_f*t_f^3+b_f*t_f*(0.5*d-0.5*t_f)^2)/(d/2) # F4.1 S_xc is the
114         elastic section modulus referred to compression flange
115         h_c = h # F4.2(c)(6) h_c is twice the distance from the centroid to the
116         following: the inside face of the compression flange less the fillet or
117         corner radius, for rolled shapes; the nearest line of fasteners at the
118         compression flange or the inside faces of the compression flange when welds
119         are used, for built-up sections
120
121         a_w = min(h_c*t_w/b_f/t_f, 10) # F5.2(c) a_w is defined by Eq F4-12, but
122         shall not exceed 10
123         r_t = b_f/sqrt(12*(1+1/6*a_w))
124
125         L_p = 1.1*r_t*sqrt(E/F_y)
126         L_r = pi*r_t*sqrt(E/0.7/F_y)
127
128         R_pg = min(1-a_w/(1200+300*a_w)*(h_c/t_w-5.7*sqrt(E/F_y)), 1)
129
130         M_n_CFY = R_pg*F_y*S_xc # F5-1
131
132         if L_b <= L_p
133             F_cr = F_y
134         elseif L_b <= L_r
135             F_cr = min(C_b*(F_y - (0.3*F_y)*(L_b-L_p)/(L_r-L_p)), F_y)
136         else
137             F_cr = min(C_b*pi^2*E/(L_b/r_t)^2, F_y)
138         end
139
140         M_n_LTB = R_pg*F_cr*S_xc # F5-2
141
142         if lambda_f <= lambda_pf # Compact Flange B4.1b
143             M_n = min(M_n_LTB, M_n_CFY, M_p) # F5
144
145         # Flange Local Buckling
146         elseif lambda_f <= lambda_rf # Non-Compact Flange
147             M_n = min(R_pg*(F_y-0.3*F_y*(lambda_f-lambda_pf)/(lambda_rf-lambda_pf))*S_xc, M_n_LTB,
148             M_n_CFY, M_p) # F5-8

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143     else # Slender Flange
144         if 4/sqrt(h/t_w)<=0.35
145             k_c = 0.35
146         else
147             k_c = min(0.76, 4/sqrt(h/t_w))
148         end
149         M_n = min(R_pg*0.9*E*k_c*S_x/(b_f/2/t_f)^2, M_n_LTB, M_n_CFY, M_p) # F5-
150     end
151
152     # Doubly Symmetric Shape, no tension flange yielding
153 end
154
155
156 print("remember to convert unit")
157 M_n # Unit in
158 M_n/12 # Unit ft
159
160 # Minor Axis
161
162 m_p = min(F_y*Z_y, 1.6*F_y*S_y)
163
164 if λ_f <= λ_pf # Compact Flange B4.1b
165     m_n = m_p #F2
166
167     # Flange Local Buckling
168 elseif λ_f <= λ_rf # Non-Compact Flange
169     m_n = min(m_p-(m_p-0.7*F_y*S_y)*(λ_f-λ_pf)/(λ_rf-λ_pf), m_p) #F3-1
170
171 else # Slender Flange
172     m_n = min(0.69*E*S_y/λ_f^2, m_p) #F3-2
173 end
174
175 m_n # Unit in
176 m_n/12 # Unit ft
177

```

remember to convert unit



syntax: invalid syntax (incomplete #<julia: "incomplete: premature end of input">)

1. top-level scope @ none:1
2. top-level scope @ none:1

```

1 # Minor Axis!!!
2
3 begin
4

```

