316000

```
begin

    # Material & Total Geometry

    E=29000 # ksi Elastic Modulus
    G=11200 # ksi Shear Modulus
    F_y=50 # ksi Yield Strength
    L_x=18*12 # in
    L_y=18*12 # in
    L_z=18*12 # in
    L_cx=18*12 # in
    L_cy=18*12 # in
    L_cz=18*12 # in

    # Cross Section Geometry

    A=72.5 # in^2 Area
    d=36.7 # in Total Depth

    t_w=0.8 # in Web Thickness

    b_f=16.5 # in Flange Width
    t_f=1.35 # in Flange Thickness

    k=2.3 # in Corner, h=d-2*k for web depth
    h=d-2*k

    γ=247/100 # klf Unit Weight over Length

    λ_f= 6.11 # Flange Ratio
    λ_w=40.1 # Web Ratio, can also be determined as (d-2*k)/t_w

    I_x=16700
    I_y=1010

    S_x=913
    S_y=123

    r_x=15.2
    r_y=3.74

    Z_x=1030
    Z_y=190

    r_ts=4.42
    h_0=35.4

    J=34.7
    C_w=316000
end
```

```
# 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=50ksi; all current ASTM A6 W, S, M, HP, C, and MC shapes have compact webs at F_y<=70 ksi.
```

```
2391.7122982860765
```

```
47929.91445765297/1.67/12
```

791.6666666666666

```
# Remember to convert unit (in to ft)

begin

# Major Axis

    # Check Compactness
    λ_pf = 0.38*sqrt(E/F_y) # B4.1b
    λ_rf = sqrt(E/F_y) # B4.1b
    λ_pw = 3.76*sqrt(E/F_y) # B4.1b
    λ_rw = 5.7*sqrt(E/F_y) # B4.1b

    c = 1 # F2-8a

    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

    M_p = F_y*Z_x # M_n_Y Yield Resistance F2-1
    C_b = 1 # Lateral Torsional Modification Factor F1.

    if λ_w <= λ_pw # Compact Web B4.1b


        L_p = 1.76*r_y*sqrt(E/F_y) # F2-5
        L_r = 1.95*r_ts*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

        # Lateral Tortional Buckling
        if  L_b <= L_p
            M_n_LTB = M_p
        elseif L_b <= L_r
            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
        else
            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
            M_n_LTB = F_cr*S_x # F2-3
        end

        if λ_f <= λ_pf # Compact Flange B4.1b
            M_n = min(M_p, M_n_LTB) #F2

        # Flange Local Buckling
        elseif λ_f <= λ_rf # Non-Compact Flange
            M_n = min(M_p-(M_p-0.7*F_y*S_x)*(λ_f-λ_pf)/(λ_rf-λ_pf), M_n_LTB, M_p) #F3-1

        else # Slender Flange
            k_c = 4/sqrt(h/t_w)
            M_n =  min(0.9*E*k_c*S_x/λ_f^2, M_n_LTB, M_p) #F3-2
        end

    elseif λ_w <= λ_rw # Non-Compact Web B4.1b
```

```
        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
        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
        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
        M_yc = F_y*S_xc

        # F4.2(c)(6)
        if I_yc/I_y <= 0.23
            R_pc = 1 # F4-10
        else
            if h_c/t_w <= λ_pw # h_c/t_w
                R_pc = M_p/M_yc # F4-9a
            else
                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
            end
        end

##################

        M_n_CFY = R_pc*M_yc # F4-1

        a_w = h_c*t_w/b_f/t_f
        r_t = b_f/sqrt(12*(1+1/6*a_w))

        F_L=0.7*F_y # F4-6a

        L_p = 1.1*r_t*sqrt(E/F_y)
        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))

        if L_b <= L_P
            M_n_LTB = M_p
        elseif L_b <= L_r
            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))
        else
            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)
            M_n_LTB = F_cr*S_xc
        end

        if λ_f <= λ_pf # Compact Flange B4.1b
            M_n = min(M_n_LTB, M_n_CFY, M_p) # F4

        # Flange Local Buckling
        elseif λ_f <= λ_rf # Non-Compact Flange
            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

        else # Slender Flange

```

```
            # F4.3(c)
            if 4/sqrt(h/t_w)<=0.35
                k_c = 0.35
            else
                k_c = min(0.76, 4/sqrt(h/t_w))
            end
            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
        end

        # Doubly Symmetric Shape, no tension flange yielding

####################

    else # Slender Web B4.1b

        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
        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
        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

        a_w = min(h_c*t_w/b_f/t_f, 10) # F5.2(c) a_w is defined by Eq F4-12, but shall not exceed 10
        r_t = b_f/sqrt(12*(1+1/6*a_w))

        L_p = 1.1*r_t*sqrt(E/F_y)
        L_r = pi*r_t*sqrt(E/0.7/F_y)

        R_pg = min(1-a_w/(1200+300*a_w)*(h_c/t_w-5.7*sqrt(E/F_y)), 1)

        M_n_CFY = R_pg*F_y*S_xc # F5-1

        if L_b <= L_p
            F_cr = F_y
        elseif L_b <= L_r
            F_cr = min(C_b*(F_y - (0.3*F_y)*(L_b-L_p)/(L_r-L_p)), F_y)
        else
            F_cr = min(C_b*pi^2*E/(L_b/r_t)^2, F_y)
        end

        M_n_LTB = R_pg*F_cr*S_xc # F5-2

        if λ_f <= λ_pf # Compact Flange B4.1b
            M_n = min(M_n_LTB, M_n_CFY, M_p) # F5

        # Flange Local Buckling
        elseif λ_f <= λ_rf # Non-Compact Flange
            M_n = min(R_pg*(F_y-0.3*F_y*(λ_f-λ_pf)/(λ_rf-λ_pf))*S_xc, M_n_LTB, M_n_CFY, M_p) # F5-8


```

```julia
        else # Slender Flange
            if 4/sqrt(h/t_w)<=0.35
                k_c = 0.35
            else
                k_c = min(0.76, 4/sqrt(h/t_w))
            end
            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-
            9
        end

        # Doubly Symmetric Shape, no tension flange yielding
    end


    print("remember to convert unit")
    M_n # Unit in
    M_n/12 # Unit ft

# Minor Axis

    m_p = min(F_y*Z_y, 1.6*F_y*S_y)

    if λ_f <= λ_pf # Compact Flange B4.1b
        m_n = m_p #F2

    # Flange Local Buckling
    elseif λ_f <= λ_rf # Non-Compact Flange
        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

    else # Slender Flange
        m_n =  min(0.69*E*S_y/λ_f^2, m_p) #F3-2
    end

    m_n # Unit in
    m_n/12 # Unit ft
```

```
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*

```julia
# Minor Axis!!!

begin

```