REFERENCES	CALCULATIONS	RESULTS
	Web Plate Shear Yielding (HP8x36)	
AISC Sec. J4-2	Allowable Shear Capacity: $\Omega = 1.5$	
AISC Eq. J4-3	$Ra_v = \left(\frac{0.6FyAg_v}{\Omega}\right) = \left(\frac{0.6(38)(0.4)5}{1.5}\right) = 30.4\text{ kips}$	30.4 kips
	Design capacity ratio, DCR: required shear, $R_v = 10.0\text{ kips}$; overall capacity, $Ra_v = 30.4\text{ kips}$; $\text{DCR} = \left(\frac{10.0}{30.4}\right) = 0.329$	Pass
	Web Plate to HP8x36 Flange, Weld Strength	
AISC Table J2.5	Strength of Fillet Welds Weld Size, t = 0.2 in $\Omega = 2.0$ $F_{nw} = 0.6\ F_{EXX}$	
AISC Eq. J2-5	$F_{nw} = 0.6\ F_{EXX}\ (1.0 + 0.5\sin^{1.5}\theta)$ θ = the angle which the load makes with the weld axis = 90, for transversely loaded welds = 0, for longitudinally loaded welds	
	Strength per unit size of weld: Allowable weld stress, $F_{aw} = \left(\frac{0.6(60)}{2.0}\right) = 18\text{ ksi}$ transverse length, $l_t = 5\text{ in}$ longitudinal length, $l_l = 0\text{ in}$ total effective length, $l = l_t\ (1.5) + \ l_l\ (1.0) = 7.5\text{ in}$ $\left(\frac{R_a}{t}\right) = 135.0\text{ kips / in}$	
AISC Sec. J2.2a	Effective size (throat) of fillet weld, a: 0.707 = the cosine or sine of 45deg a = (0.707) t = 0.141 in	
AISC Eq. J2-3	$R_a = \left(\frac{R_a}{t}\right)\ t = 135\ (0.141) = 19.1\text{ kips}$	19.1 kips
	Design capacity ratio, DCR: required load, R = 10.0 kips overall capacity, Ra = 19.1 kips $\text{DCR} = \left(\frac{10.0}{19.1}\right) = 0.524$	Pass

AISC Sec. J4-2 AISC Eq. J4-4	Web Plate Shear Rupture (HP8x36) Allowable Shear Capacity: $\Omega = 2.0$ Calculation of net depth: $\text{total length of bolt hole(s)} = 0.625(2)$ $= 1.3 \text{ in}$ $\text{net depth, } d_{net} = 5 - [0.625(2)]$ $= 3.8 \text{ in}$ $Ra_v = \left(\frac{0.6FyAn_v}{\Omega}\right)$ $= \left(\frac{0.6(59)(0.4)3.75}{2.0}\right)$ $= 26.5 \text{ kips}$ Design capacity ratio, DCR: $\text{required shear, } R_v = 10.0 \text{ kips}$ $\text{overall capacity, } Ra_v = 26.5 \text{ kips}$ $\text{DCR} = \left(\frac{10.0}{26.5}\right)$ $= 0.377$	26.5 kips Pass
AISC Sec. J4-3 AISC Eq. J4-5	Web Plate to HP8x36 Web, Block Shear Rupture Strength Block Shear Strength: $\Omega = 2.0$ $\left(\frac{Ra}{\Omega}\right) = \left(\frac{U_{bs}F_uA_{nt}}{\Omega}\right) + \min\left(\frac{0.6F_yA_{gv}, 0.6F_uA_{nv}}{\Omega}\right)$ Tension Rupture Component: $Ubs = 1.0$ (uniform tension) $\left(\frac{U_{bs}F_uA_{nt}}{\Omega}\right) = \left(\frac{(1.0)(59)(3.0625)(0.4)}{2.0}\right)$ $= 90.35 \text{ kips/in } (0.4)$ $= 36.1 \text{ kips}$ Shear Yielding Component: $0.6F_yA_{gv}$ $\left(\frac{0.6F_yA_{gv}}{\Omega}\right) = \left(\frac{0.6(38)(4)}{2.0}\right)(0.4)$ $= 45.6 \text{ kips/in } (0.4)$ $= 18.2 \text{ kips}$ Shear Rupture Component: $0.6F_uA_{nv}$ $\left(\frac{0.6F_uA_{nv}}{\Omega}\right) = \left(\frac{0.6(59)(3.0625)}{2.0}\right)(0.4)$ $= 54.2 \text{ kips/in } (0.4)$ $= 21.7 \text{ kips}$ Total Block Shear Capacity: $\left(\frac{Ra}{\Omega}\right) = \left(\frac{U_{bs}F_uA_{nt}}{\Omega}\right) + \min\left(\frac{0.6F_yA_{gv}, 0.6F_uA_{nv}}{\Omega}\right)$ $= 36.1 + \min[18.2, 21.7]$ $= 54.4 \text{ kips}$ Design capacity ratio, DCR:	54.4 kips

	required shear, $R_v = 10.0$ kips overall capacity, $Ra_v = 54.4$ kips $\text{DCR} = \left(\frac{10.0}{54.4}\right)$ $= 0.184$	Pass
AISC Sec. J3.1 AISC Sec. J3.10 AISC Eq. J3.6a	Web Plate to HP8x36 Web, Bolt Group Shear and Bearing Check 1. Shear Strength of Bolts $\Omega = 2.0$ Bolt Diameter $= 0.515$ in Nominal Shear Strength, $Fn_v = 27$ ksi (AISC Table J3.2) Nominal Shear Strength (per bolt), $Rn_v = 0.6\ Fn_v\ A_b$ $= 0.6\ (27)\ 0.208$ in^2 $= 5.6$ kips $\left(\frac{Rn_v}{\Omega}\right) = 2.8$ kips 2. Bearing Strength of Standard Bolt Holes (Ignoring bolt hole deformation at service load level) $\Omega = 2.0$ edge distance, $l_e = 0.72$ in (clear)distance to adjacent hole, $l_c = 2.44$ in Since edge distance is less than the adjacent distance to the next bolt hole, edge distance will control. $\left(\frac{Rn_b}{\Omega}\right) = \left(\frac{1.2 l_c t Fu}{\Omega}\right) \leq \left(\frac{2.4 d t Fu}{\Omega}\right)$ For the outer bolt (tearout), lc = 0.72 in: $Rn_b = 1.2\ l_c$ t F_u $= 1.2(0.72)\ 0.4\ (59)$ $= 25.4$ kips $\left(\frac{Rn_b}{\Omega}\right) = 12.7$ kips For the inner bolt (tearout), lc = 2.44 in: $Rn_b = 1.2\ l_c$ t F_u $= 1.2(2.44)\ 0.4\ (59)$ $= 86.3$ kips $\left(\frac{Rn_b}{\Omega}\right) = 43.1$ kips For overall bearing (bolt hole elongation): $Rn_b = 2.4$ d t F_u $= 2.4(0.5625)\ 0.4\ (59)$ $= 36.5$ kips $\left(\frac{Rn_b}{\Omega}\right) = 18.2$ kips Bolt shear will control over bearing since 2.8 kips < 12.7 kips 3. Capacity of Bolt Group Considering the minimum among: bolt shear capacity, bearing and tearing in inner and outer bolt holes. a). Capacity of outer bolt (as established above): (outer bolt) , $Ra_b = 2.8$ kips / bolt b). Capacity of inner bolt (as established above): (inner bolt) , $Ra_b = 2.8$ kips / bolt c). Capacity of the bolts as a group: sum of the capacities a). and b).	2.8 kips / bolt 12.7 kips / bolt

	$$Ra_b = 2.8 + 1(2.8) = 11.2 \text{ kips}$$ Design capacity ratio, DCR: $$\text{required shear, R} = 10.0 \text{ kips}$$ $$\text{overall capacity, } Ra_b = 11.2 \text{ kips}$$ $$\text{DCR} = \left(\frac{10.0}{11.2}\right) = 0.889$$	11.2 kips Pass
AISC Sec. J4-2 AISC Eq. J4-4	Web Element Shear Rupture (HP8x36) Allowable Shear Capacity: $$\Omega = 2.0$$ Calculation of net depth: $$\text{total length of bolt hole(s)} = 0.625(2) = 1.3 \text{ in}$$ $$\text{net depth, } d_{net} = 8.02 - [0.625(2)] = 6.8 \text{ in}$$ $$Ra_v = \left(\frac{0.6FyAn_v}{\Omega}\right) = \left(\frac{0.6(59)(0.445)6.77}{2.0}\right) = 53.3 \text{ kips}$$ Design capacity ratio, DCR: $$\text{required shear, } R_v = 10.0 \text{ kips}$$ $$\text{overall capacity, } Ra_v = 53.3 \text{ kips}$$ $$\text{DCR} = \left(\frac{10.0}{53.3}\right) = 0.188$$	53.3 kips Pass
AISC Sec. J3.1 AISC Sec. J3.10 AISC Eq. J3.6a	Web Element, Bolt Group Shear and Bearing Check 1. Shear Strength of Bolts $$\Omega = 2.0$$ $$\text{Bolt Diameter} = 0.515 \text{ in}$$ $$\text{Nominal Shear Strength, } Fn_v = 27 \text{ ksi (AISC Table J3.2)}$$ $$\text{Nominal Shear Strength (per bolt), } Rn_v = 0.6\ Fn_v\ A_b = 0.6\ (27)\ 0.208 \text{ in}\hat{\ }2 = 5.6 \text{ kips}$$ $$\left(\frac{Rn_v}{\Omega}\right) = 2.8 \text{ kips}$$ 2. Bearing Strength of Standard Bolt Holes (Ignoring bolt hole deformation at service load level) $$\Omega = 2.0$$ $$\text{edge distance, } l_e = 0.72 \text{ in}$$ $$\text{(clear)distance to adjacent hole, } l_c = 2.44 \text{ in}$$ Since edge distance is less than the adjacent distance to the next bolt hole, edge distance will control. $$\left(\frac{Rn_b}{\Omega}\right) = \left(\frac{1.2l_ctFu}{\Omega}\right) \leq \left(\frac{2.4dtFu}{\Omega}\right)$$	2.8 kips / bolt

	For the outer bolt (tearout), lc = 0.72 in: $$Rn_b = 1.2\ l_c\ \text{t}\ F_u$$ $$= 1.2(0.72)\ 0.445\ (59)$$ $$= 28.3 \text{ kips}$$ $$\left(\frac{Rn_b}{\Omega}\right) = 14.2 \text{ kips}$$ For the inner bolt (tearout), lc = 2.44 in: $$Rn_b = 1.2\ l_c\ \text{t}\ F_u$$ $$= 1.2(2.44)\ 0.445\ (59)$$ $$= 96.0 \text{ kips}$$ $$\left(\frac{Rn_b}{\Omega}\right) = 48.0 \text{ kips}$$ For overall bearing (bolt hole elongation): $$Rn_b = 2.4\ \text{d t}\ F_u$$ $$= 2.4(0.5625)\ 0.445\ (59)$$ $$= 40.6 \text{ kips}$$ $$\left(\frac{Rn_b}{\Omega}\right) = 20.3 \text{ kips}$$ Bolt shear will control over bearing since 2.8 kips $<$ 14.2 kips	14.2 kips / bolt
	3. Capacity of Bolt Group Considering the minimum among: bolt shear capacity, bearing and tearing in inner and outer bolt holes. a). Capacity of outer bolt (as established above): $$\text{(outer bolt)}\ ,\ Ra_b = 2.8 \text{ kips / bolt}$$ b). Capacity of inner bolt (as established above): $$\text{(inner bolt)}\ ,\ Ra_b = 2.8 \text{ kips / bolt}$$ c). Capacity of the bolts as a group: sum of the capacities a). and b). $$Ra_b = 2.8 + 1(2.8)$$ $$= 11.2 \text{ kips}$$	11.2 kips
	Design capacity ratio, DCR: $$\text{required shear, R} = 10.0 \text{ kips}$$ $$\text{overall capacity, } Ra_b = 11.2 \text{ kips}$$ $$\text{DCR} = \left(\frac{10.0}{11.2}\right)$$ $$= 0.889$$	Pass