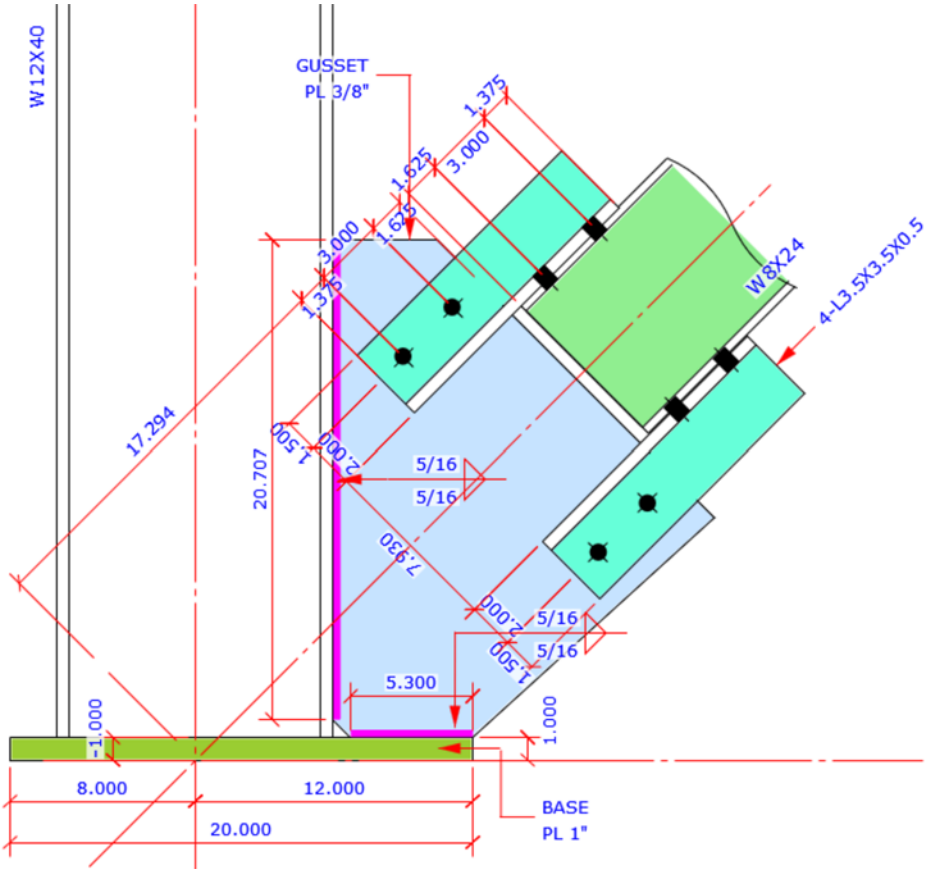
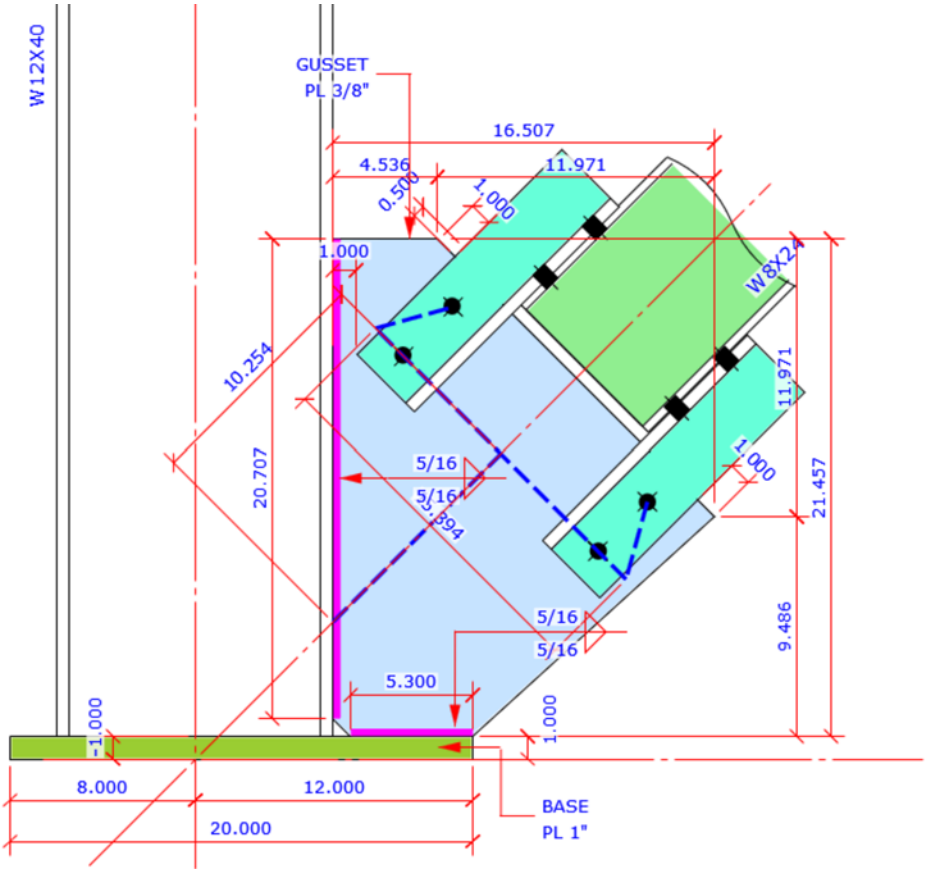
Result Summary - Overall | Vertical Brace Connection | Code=AISC 360-10 LRFD

Result Summary - Overall	geometries & weld limitations = **PASS**	limit states max ratio = **0.84**	**PASS**
Brace to Gusset	geometries & weld limitations = **PASS**	limit states max ratio = **0.72**	**PASS**
Gusset to Column	geometries & weld limitations = **PASS**	limit states max ratio = **0.43**	**PASS**
Gusset to Base Plate	geometries & weld limitations = **PASS**	limit states max ratio = **0.84**	**PASS**

Sketch | Vertical Brace Connection | Code=AISC 360-10 LRFD




W12X40
GUSSET
PL 3/8"
16.507
4.536
11.971
0.500
1.000
1.000
W8X24
10.254
20.707
11.971
5/16
5/16
3.894
1.000
21.457
5/16
5/16
9.486
5.300
1.000
1.000
8.000
12.000
20.000
BASE
PL 1"

Members & Components Summary

Member	Brace Connection				Code=AISC 360-10 LRFD
Column Section					
W12X40	d = 11.900	[in]	b_f = 8.010	[in]	
	t_f = 0.515	[in]	t_w = 0.295	[in]	
	k_{des} = 1.020	[in]	k_{det} = 1.375	[in]	
	k_1 = 0.875	[in]	A = 11.700	[in^2]	
	S_x = 51.50	[in^3]	Z_x = 57.00	[in^3]	
Steel Grade A992	F_y = 50.0	[ksi]	F_u = 65.0	[ksi]	

Gusset Plate Interface Forces Calculation

Brace Axial Force Load Case 1

Refer to AISC DG29 Fig. 4-22 for all charts and definitions of variables and symbols shown in calculation below

Brace axial force	P = from user input	= -100.00	[kips]	in tension	
Brace to ver line angle	θ = from user input	= 45.0	[°]		
Brace force hor component	H = P sin θ	= -70.71	[kips]		
Brace force ver component	V = P cos θ	= -70.71	[kips]		
	L = 21.457 [in]	clip = 0.750	[in]	AISC DG29 Fig. 4-22	
	$\bar{\beta}$ = 0.5 (L - clip) + clip	= 11.104	[in]		
Brace work point eccentricity	e = -1.000 [in]	column e_c = 5.950	[in]	AISC DG29 Fig. 4-22	
Gusset - column shear	V = P cos θ	= **-70.71**	[kips]	AISC DG29 Fig. 4-22	
Gusset - column axial	$H_c = \frac{H\,e + V\,e_c}{\bar{\beta}}$	= **-31.52**	[kips]	in tension	
Gusset - base plate shear	$H_b = \frac{H\,(\bar{\beta} - e) - V\,e_c}{\bar{\beta}}$	= **-39.19**	[kips]		

Brace Axial Force Load Case 2

Refer to AISC DG29 Fig. 4-22 for all charts and definitions of variables and symbols shown in calculation below

Brace axial force	P = from user input	= 100.00	[kips]	in compression	
Brace to ver line angle	θ = from user input	= 45.0	[°]		
Brace force hor component	H = P sin θ	= 70.71	[kips]		
Brace force ver component	V = P cos θ	= 70.71	[kips]		
	L = 21.457 [in]	clip = 0.750	[in]	AISC DG29 Fig. 4-22	
	$\bar{\beta}$ = 0.5 (L - clip) + clip	= 11.104	[in]		
Brace work point eccentricity	e = -1.000 [in]	column e_c = 5.950	[in]	AISC DG29 Fig. 4-22	
Gusset - column shear	V = P cos θ	= **70.71**	[kips]	AISC DG29 Fig. 4-22	
Gusset - column axial	$H_c = \frac{H\,e + V\,e_c}{\bar{\beta}}$	= **31.52**	[kips]	in compression	
Gusset - base plate shear	$H_b = \frac{H\,(\bar{\beta} - e) - V\,e_c}{\bar{\beta}}$	= **39.19**	[kips]		

Brace to Gusset Sect=W8X24 P_{LC1} =-100.00 kips (T) P_{LC2} =100.00 kips (C) Code=AISC 360-10 LRFD

Result Summary geometries & weld limitations = **PASS** limit states max ratio = **0.72** **PASS**

Geometry Restriction Checks - Flange Angle to Gusset					PASS
Min Bolt Edge Distance - Flange Angle to Gusset					
Bolt diameter	d_b =		= 0.750	[in]	
Min edge distance allowed	$L_{e\text{-}min}$ =		= **1.000**	[in]	AISC 14th Table J3.4
Min edge distance in Flange Angle to Gusset	L_e =		= **1.375**	[in]	
			> $L_{e\text{-}min}$	OK	
Min Bolt Spacing - Flange Angle to Gusset					
Bolt diameter	d_b =		= 0.750	[in]	
Min bolt spacing allowed	$L_{s\text{-}min}$ = 2.667 d_b		= **2.000**	[in]	AISC 14th J3.3
Min Bolt spacing in Flange Angle to Gusset	L_s =		= **3.000**	[in]	
			> $L_{s\text{-}min}$	OK	

Geometry Restriction Checks - Flange Angle to Brace Flange					PASS
Min Bolt Edge Distance - Flange Angle to Brace Flange					
Bolt diameter	d_b =		= 0.750	[in]	
Min edge distance allowed	$L_{e\text{-}min}$ =		= **1.000**	[in]	AISC 14th Table J3.4
Min edge distance in Flange Angle to Brace Flange	L_e =		= **1.063**	[in]	
			> $L_{e\text{-}min}$	OK	
Min Bolt Spacing - Flange Angle to Brace Flange					
Bolt diameter	d_b =		= 0.750	[in]	
Min bolt spacing allowed	$L_{s\text{-}min}$ = 2.667 d_b		= **2.000**	[in]	AISC 14th J3.3
Min Bolt spacing in Flange Angle to Brace Flange	L_s =		= **3.000**	[in]	
			> $L_{s\text{-}min}$	OK	

Brace Force Load Case 1 Sect=W8X24 P =-100.00 kips (T) ratio = **0.72** **PASS**

Brace Axial Force Distribution					
W shape section	b_f = 6.500	[in]	t_f = 0.400	[in]	
	A = 7.080	[in^2]			
Brace axial force	P =		= 100.00	[kips]	in compression
Force carried by w shape flange	P_f = P / 2		= **50.00**	[kips]	

W Shape Brace - Tensile Yield			ratio = 100.00 / 318.60 = **0.31**	PASS
Gross area subject to tension	A_g =	= 7.080	[in^2]	
Steel yield strength	F_y =	= 50.0	[ksi]	
Tensile force required	P_u =	= **100.00**	[kips]	
Tensile yielding strength	$R_n = F_y A_g$	= 354.00	[kips]	AISC 14th Eq D2-1
Resistance factor-LRFD	ϕ = 0.90			AISC 14th D2 (a)
	ϕR_n =	= **318.60**	[kips]	AISC 14th Eq D2-1
	ratio = **0.31**	> P_u	OK	

W Shape Brace - Tensile Rupture			ratio = 100.00 / 212.43	= **0.47**	**PASS**
Section gross area	A_g =		= 7.080	[in^2]	
Tensile net area	A_n =		= 5.680	[in^2]	
No of bolt column	n_h = 2	bolt space s_h =	3.000	[in]	
Length of connection	L = (n_h -1) s_h		= 3.000	[in]	
WT centroid to flange face dist	$\bar{x}$ = half of W8X24 sect centroid to w flange exterior face distance		= 0.699	[in]	
Shear lag factor	U = 1 - $\bar{x}$ / L		= 0.767		AISC 14th Table D3.1
Tensile force required	P_u =		= **100.00**	[kips]	
Tensile effective net area	A_e = A_n U		= 4.357	[in^2]	
Plate tensile strength	F_u =		= 65.0	[ksi]	
Tensile rupture strength	R_n = F_u A_e		= 283.24	[kips]	AISC 14th Eq D2-2
Resistance factor-LRFD	ϕ = 0.75				AISC 14th D2 (b)
	ϕ R_n =		= **212.43**	[kips]	AISC 14th Eq D2-2
	ratio = **0.47**		> P_u	OK	

Flange Angle - Tensile Yield			ratio = 50.00 / 292.50	= **0.17**	**PASS**
Gross area subject to tension	A_g =		= 6.500	[in^2]	
Steel yield strength	F_y =		= 50.0	[ksi]	
Tensile force required	P_u =		= **50.00**	[kips]	
Tensile yielding strength	R_n = F_y A_g		= 325.00	[kips]	AISC 14th Eq D2-1
Resistance factor-LRFD	ϕ = 0.90				AISC 14th D2 (a)
	ϕ R_n =		= **292.50**	[kips]	AISC 14th Eq D2-1
	ratio = **0.17**		> P_u	OK	

Flange Angle - Tensile Rupture			ratio = 50.00 / 178.24	= **0.28**	**PASS**
Section gross area	A_g = 2 L3-1/2X3-1/2X1/2		= 6.500	[in^2]	
Bolt hole diameter	bolt dia d_b = $^3/_4$ [in]	bolt hole dia d_h =	$^7/_8$ [in]		AISC 14th B4.3b
Number of bolt row	n_v = 1	angle leg t =	0.500	[in]	
Tensile net area	A_n = A_g - n_v d_h t x 2		= 5.625	[in^2]	
No of bolt column	n_h = 2	bolt space s_h =	3.000	[in]	
Length of connection	L = (n_h -1) s_h		= 3.000	[in]	
Eccentricity of connection	$\bar{x}$ = from sect L3$^1/_2$ x 3$^1/_2$ x $^1/_2$		= 1.050	[in]	
Shear lag factor	U = 1 - $\bar{x}$ / L		= 0.650		AISC 14th Table D3.1
Tensile force required	P_u =		= **50.00**	[kips]	
Tensile effective net area	A_e = A_n U		= 3.656	[in^2]	
Plate tensile strength	F_u =		= 65.0	[ksi]	
Tensile rupture strength	R_n = F_u A_e		= 237.66	[kips]	AISC 14th Eq D2-2
Resistance factor-LRFD	ϕ = 0.75				AISC 14th D2 (b)
	ϕ R_n =		= **178.24**	[kips]	AISC 14th Eq D2-2
	ratio = **0.28**		> P_u	OK	

Flange Angle - Brace Side - Bolt Shear			ratio = 50.00 / 71.57	= **0.70**	**PASS**
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Number of bolt carried shear	n_s = 4.0		shear plane m = 1		
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$		= 95.43	[kips]	AISC 14th Eq J3-1
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th Eq J3-1
	ϕR_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Brace Side - Bolt Bearing on Angle			ratio = 50.00 / 71.57	= **0.70**	**PASS**
Single Bolt Shear Strength					
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = F_{nv} A_b$		= 23.86	[kips]	AISC 14th Eq J3-1
Bolt Bearing / TearOut Strength on Plate					
Bolt hole diameter	bolt dia d_b = 3/4	[in]	bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing & edge distance	spacing L_s = 3.000	[in]	edge distance L_e = 1.375	[in]	
Plate tensile strength	F_u = 65.0	[ksi]			
Plate thickness	t = 0.500	[in]			
Interior Bolt					
Bolt hole edge clear distance	$L_c = L_s - d_h$		= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5 L_c t F_u \le 3.0 d_b t F_u$				AISC 14th Eq J3-6b
	= 106.64 ≤ 73.13		= 73.13	[kips]	
Bolt strength at interior	$R_{n\text{-}in} = \min(R_{n\text{-}t\&b\text{-}in}, R_{n\text{-}bolt})$		= 23.86	[kips]	
Edge Bolt					
Bolt hole edge clear distance	$L_c = L_e - d_h / 2$		= 0.969	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}ed} = 1.5 L_c t F_u \le 3.0 d_b t F_u$				AISC 14th Eq J3-6b
	= 47.23 ≤ 73.13		= 47.23	[kips]	
Bolt strength at edge	$R_{n\text{-}ed} = \min(R_{n\text{-}t\&b\text{-}ed}, R_{n\text{-}bolt})$		= 23.86	[kips]	
Number of bolt	interior n_{in} = 2		edge n_{ed} = 2		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in} + n_{ed} R_{n\text{-}ed}$		= 95.43	[kips]	
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th J3-10
	ϕR_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Brace Side - Bolt Bearing on Brace Flange	ratio = 50.00 / 71.57	= **0.70**	**PASS**

Single Bolt Shear Strength

Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = F_{nv} A_b$		= 23.86	[kips]	AISC 14th Eq J3-1

Bolt Bearing / TearOut Strength on Plate

Bolt hole diameter	bolt dia d_b = 3/4	[in]	bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing & edge distance	spacing L_s = 3.000	[in]	edge distance L_e = 1.625	[in]	
Plate tensile strength	F_u = 65.0	[ksi]			
Plate thickness	t = 0.400	[in]			

Interior Bolt

Bolt hole edge clear distance	$L_c = L_s - d_h$		= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5\, L_c\, t\, F_u \le 3.0\, d_b\, t\, F_u$				AISC 14th Eq J3-6b
	= 85.31 ≤ 58.50		= 58.50	[kips]	
Bolt strength at interior	$R_{n\text{-}in} = \min(R_{n\text{-}t\&b\text{-}in}, R_{n\text{-}bolt})$		= 23.86	[kips]	

Edge Bolt

Bolt hole edge clear distance	$L_c = L_e - d_h / 2$		= 1.219	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}ed} = 1.5\, L_c\, t\, F_u \le 3.0\, d_b\, t\, F_u$				AISC 14th Eq J3-6b
	= 47.53 ≤ 58.50		= 47.53	[kips]	
Bolt strength at edge	$R_{n\text{-}ed} = \min(R_{n\text{-}t\&b\text{-}ed}, R_{n\text{-}bolt})$		= 23.86	[kips]	

Number of bolt	interior n_{in} = 2		edge n_{ed} = 2		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in} + n_{ed} R_{n\text{-}ed}$		= 95.43	[kips]	
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th J3-10
	ϕ R_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Block Shear - 1-Side Strip ratio = 25.00 / 70.69 = **0.35** **PASS**

Plate Block Shear - Side Strip

Bolt hole diameter	bolt dia d_b = 3/4 [in]	bolt hole dia d_h = 7/8	[in]	AISC 14th	B4.3b
Plate thickness	t_p = 0.500 [in]				
Plate strength	F_y = 50.0 [ksi]	F_u = 65.0	[ksi]		
Bolt no in ver & hor dir	n_v = 1	n_h = 2			
Bolt spacing in hor dir	s_h = 3.000 [in]				
Bolt edge dist in ver & hor dir	e_v = 1.500 [in]	e_h = 1.375	[in]		
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p$	= 2.188	[in^2]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p$	= 1.531	[in^2]		
Net area subject to tension	$A_{nt} = (e_v - 0.5 d_h) t_p$	= 0.531	[in^2]		
Block shear strength required	V_u =	= **25.00**	[kips]		
Uniform tension stress factor	U_{bs} = 1.00			AISC 14th	Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 94.25	[kips]	AISC 14th	Eq J4-5
Resistance factor-LRFD	ϕ = 0.75			AISC 14th	Eq J4-5
	ϕR_n =	= **70.69**	[kips]		
	ratio = **0.35**	> V_u	OK		

Brace Flange - Block Shear - 1-Side Strip ratio = 25.00 / 50.95 = **0.49** **PASS**

Plate Block Shear - Side Strip

Bolt hole diameter	bolt dia d_b = 3/4 [in]	bolt hole dia d_h = 7/8	[in]	AISC 14th	B4.3b
Plate thickness	t_p = 0.400 [in]				
Plate strength	F_y = 50.0 [ksi]	F_u = 65.0	[ksi]		
Bolt no in ver & hor dir	n_v = 1	n_h = 2			
Bolt spacing in hor dir	s_h = 3.000 [in]				
Bolt edge dist in ver & hor dir	e_v = 1.063 [in]	e_h = 1.625	[in]		
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p$	= 1.850	[in^2]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p$	= 1.325	[in^2]		
Net area subject to tension	$A_{nt} = (e_v - 0.5 d_h) t_p$	= 0.250	[in^2]		
Block shear strength required	V_u =	= **25.00**	[kips]		
Uniform tension stress factor	U_{bs} = 1.00			AISC 14th	Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 67.94	[kips]	AISC 14th	Eq J4-5
Resistance factor-LRFD	ϕ = 0.75			AISC 14th	Eq J4-5
	ϕR_n =	= **50.95**	[kips]		
	ratio = **0.49**	> V_u	OK		

Flange Angle - Gusset PL Side - Bolt Shear			ratio = 50.00 / 71.57	= **0.70**	**PASS**
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Number of bolt carried shear	n_s = 2.0		shear plane m = 2		
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$		= 95.43	[kips]	AISC 14th Eq J3-1
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th Eq J3-1
	ϕR_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Gusset PL Side - Bolt Bearing on Angle			ratio = 25.00 / 35.78	= **0.70**	**PASS**
Single Bolt Shear Strength					
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = F_{nv} A_b$		= 23.86	[kips]	AISC 14th Eq J3-1
Bolt Bearing / TearOut Strength on Plate					
Bolt hole diameter	bolt dia d_b = $^3/_4$	[in]	bolt hole dia d_h = $^{13}/_{16}$	[in]	AISC 14th Table J3.3
Bolt spacing & edge distance	spacing L_s = 3.000	[in]	edge distance L_e = 1.375	[in]	
Plate tensile strength	F_u = 65.0	[ksi]			
Plate thickness	t = 0.500	[in]			
Interior Bolt					
Bolt hole edge clear distance	$L_c = L_s - d_h$		= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5 L_c t F_u \le 3.0 d_b t F_u$				AISC 14th Eq J3-6b
	= 106.64 ≤ 73.13		= 73.13	[kips]	
Bolt strength at interior	$R_{n\text{-}in} = \min(R_{n\text{-}t\&b\text{-}in}, R_{n\text{-}bolt})$		= 23.86	[kips]	
Edge Bolt					
Bolt hole edge clear distance	$L_c = L_e - d_h / 2$		= 0.969	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}ed} = 1.5 L_c t F_u \le 3.0 d_b t F_u$				AISC 14th Eq J3-6b
	= 47.23 ≤ 73.13		= 47.23	[kips]	
Bolt strength at edge	$R_{n\text{-}ed} = \min(R_{n\text{-}t\&b\text{-}ed}, R_{n\text{-}bolt})$		= 23.86	[kips]	
Number of bolt	interior n_{in} = 1		edge n_{ed} = 1		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in} + n_{ed} R_{n\text{-}ed}$		= 47.71	[kips]	
Required shear strength	V_u =		= **25.00**	[kips]	
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th J3-10
	ϕR_n =		= **35.78**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Gusset PL Side - Bolt Bearing on Gusset Plate	ratio = 50.00 / 69.21	= **0.72**	**PASS**

Single Bolt Shear Strength

Bolt shear stress	bolt grade = A325-N	F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750 [in]	bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = 2 \times F_{nv} A_b$	= 47.71	[kips]	AISC 14th Eq J3-1

Bolt Bearing / TearOut Strength on Plate

Bolt hole diameter	bolt dia d_b = 3/4 [in]	bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing & edge distance	spacing L_s = 3.000 [in]	edge distance L_e = 1.625	[in]	
Plate tensile strength	F_u = 65.0 [ksi]			
Plate thickness	t = 0.375 [in]			

Interior Bolt

Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5\, L_c\, t\, F_u \le 3.0\, d_b\, t\, F_u$			AISC 14th Eq J3-6b
	= 79.98 ≤ 54.84	= 54.84	[kips]	
Bolt strength at interior	$R_{n\text{-}in} = \min(R_{n\text{-}t\&b\text{-}in}, R_{n\text{-}bolt})$	= 47.71	[kips]	

Edge Bolt

Bolt hole edge clear distance	$L_c = L_e - d_h / 2$	= 1.219	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}ed} = 1.5\, L_c\, t\, F_u \le 3.0\, d_b\, t\, F_u$			AISC 14th Eq J3-6b
	= 44.56 ≤ 54.84	= 44.56	[kips]	
Bolt strength at edge	$R_{n\text{-}ed} = \min(R_{n\text{-}t\&b\text{-}ed}, R_{n\text{-}bolt})$	= 44.56	[kips]	
Number of bolt	interior n_{in} = 1	edge n_{ed} = 1		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in} + n_{ed} R_{n\text{-}ed}$	= 92.27	[kips]	
Required shear strength	V_u =	= **50.00**	[kips]	
Bolt resistance factor-LRFD	ϕ = 0.75			AISC 14th J3-10
	ϕR_n =	= **69.21**	[kips]	
	ratio = **0.72**	> V_u	OK	

Gusset Plate Overall - Block Shear - Center Strip

ratio = 100.00 / 274.77 = **0.36** **PASS**

Plate Block Shear - Center Strip

Bolt hole diameter	bolt dia d_b = 3/4 [in]	bolt hole dia d_h = 7/8 [in]		AISC 14th	B4.3b
Plate thickness	t_p = 0.375 [in]				
Plate strength	F_y = 50.0 [ksi]	F_u = 65.0 [ksi]			
Bolt no in ver & hor dir	n_v = 2.0	n_h = 2			
Bolt spacing in hor dir	s_h = 3.000 [in]	edge dist e_h = 1.625 [in]			
Width of block shear strip	W_{bs} = 11.930 [in]				
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 3.469	[in^2]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 2.484	[in^2]		
Net area subject to tension when sheared out by center strip	$A_{nt} = [W_{bs} - (n_v - 1) d_h] t_p$	= 4.146	[in^2]		
Block shear strength required	V_u =	= **100.00**	[kips]		
Uniform tension stress factor	U_{bs} = 1.00			AISC 14th	Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 366.36	[kips]	AISC 14th	Eq J4-5
Resistance factor-LRFD	ϕ = 0.75			AISC 14th	Eq J4-5
	ϕR_n =	= **274.77**	[kips]		
	ratio = **0.36**	> V_u	OK		

Gusset Plate - Tensile Yield (Whitmore)

ratio = 100.00 / 259.77 = **0.38** **PASS**

Plate Tensile Yielding Check

Plate size	width b_p = 15.394 [in]	thickness t_p = 0.375 [in]			
Plate yield strength	F_y = 50.0 [ksi]				
Plate gross area in shear	$A_g = b_p t_p$	= 5.773	[in^2]		
Tensile force required	P_u =	= **100.00**	[kips]		
Plate tensile yielding strength	$R_n = F_y A_g$	= 288.64	[kips]	AISC 14th	Eq J4-1
Resistance factor-LRFD	ϕ = 0.90			AISC 14th	Eq J4-1
	ϕR_n =	= **259.77**	[kips]		
	ratio = **0.38**	> P_u	OK		

Gusset Plate - Tensile Rupture (Whitmore)

ratio = 100.00 / 249.43 = **0.40** **PASS**

Plate Tensile Rupture Check

Bolt hole diameter	bolt dia d_b = 3/4 [in]	bolt hole dia d_h = 7/8 [in]		AISC 14th	B4.3b
Number of bolt	n = 2				
Plate size	width b_p = 15.394 [in]	thickness t_p = 0.375 [in]			
Plate tensile strength	F_u = 65.0 [ksi]				
Plate net area in tension	$A_{nt} = (b_p - n d_h) t_p$	= 5.117	[in^2]		
Tensile force required	P_u =	= **100.00**	[kips]		
Plate tensile rupture strength	$R_n = F_u A_{nt}$	= 332.57	[kips]	AISC 14th	Eq J4-2
Resistance factor-LRFD	ϕ = 0.75			AISC 14th	Eq J4-2
	ϕR_n =	= **249.43**	[kips]	AISC 14th	Eq J4-2
	ratio = **0.40**	> P_u	OK		

Brace Force Load Case 2 Sect=W8X24 P =100.00 kips (C) ratio = **0.70** **PASS**

Brace Axial Force Distribution					
W shape section	b_f = 6.500 [in]		t_f = 0.400	[in]	
	A = 7.080 [in^2]				
Brace axial force	P =		= 100.00	[kips]	in compression
Force carried by w shape flange	P_f = P / 2		= **50.00**	[kips]	

Flange Angle - Brace Side - Bolt Shear			ratio = 50.00 / 71.57	= **0.70**	**PASS**
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750 [in]		bolt area A_b = 0.442	[in^2]	
Number of bolt carried shear	n_s = 4.0		shear plane m = 1		
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$		= 95.43	[kips]	AISC 14th Eq J3-1
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th Eq J3-1
	ϕ R_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Brace Side - Bolt Bearing on Angle			ratio = 50.00 / 71.57	= **0.70**	**PASS**
Single Bolt Shear Strength					
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750 [in]		bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = F_{nv} A_b$		= 23.86	[kips]	AISC 14th Eq J3-1
Bolt Bearing / TearOut Strength on Plate					
Bolt hole diameter	bolt dia d_b = 3/4	[in]	bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing	spacing L_s = 3.000	[in]			
Plate tensile strength	F_u = 65.0	[ksi]			
Plate thickness	t = 0.500	[in]			
Interior Bolt					
Bolt hole edge clear distance	$L_c = L_s - d_h$		= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5 L_c t F_u \le 3.0 d_b t m F_u$				AISC 14th Eq J3-6b
	= 106.64 ≤ 73.13		= 73.13	[kips]	
Bolt strength at interior	$R_{n\text{-}in}$ = min ($R_{n\text{-}t\&b\text{-}in}$, $R_{n\text{-}bolt}$)		= 23.86	[kips]	
Number of bolt	interior n_{in} = 4				
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in}$		= 95.43	[kips]	
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th J3-10
	ϕ R_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Brace Side - Bolt Bearing on Brace Flange			ratio = 50.00 / 71.57	= **0.70**	**PASS**
Single Bolt Shear Strength					
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = F_{nv} A_b$		= 23.86	[kips]	AISC 14th Eq J3-1
Bolt Bearing / TearOut Strength on Plate					
Bolt hole diameter	bolt dia d_b = 3/4	[in]	bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing	spacing L_s = 3.000	[in]			
Plate tensile strength	F_u = 65.0	[ksi]			
Plate thickness	t = 0.400	[in]			
Interior Bolt					
Bolt hole edge clear distance	$L_c = L_s - d_h$		= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5\ L_c\ t\ F_u \le 3.0\ d_b\ t\ m\ F_u$				AISC 14th Eq J3-6b
	= 85.31 ≤ 58.50		= 58.50	[kips]	
Bolt strength at interior	$R_{n\text{-}in}$ = min ($R_{n\text{-}t\&b\text{-}in}$, $R_{n\text{-}bolt}$)		= 23.86	[kips]	
Number of bolt	interior n_{in} = 4				
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in}$		= 95.43	[kips]	
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th J3-10
	ϕ R_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Gusset PL Side - Bolt Shear			ratio = 50.00 / 71.57	= **0.70**	**PASS**
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Number of bolt carried shear	n_s = 2.0		shear plane m = 2		
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$		= 95.43	[kips]	AISC 14th Eq J3-1
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th Eq J3-1
	ϕ R_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Flange Angle - Gusset PL Side - Bolt Bearing on Angle				ratio = 25.00 / 35.78	= **0.70**	**PASS**
Single Bolt Shear Strength						
Bolt shear stress	bolt grade = A325-N			F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]		bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = F_{nv} A_b$			= 23.86	[kips]	AISC 14th Eq J3-1
Bolt Bearing / TearOut Strength on Plate						
Bolt hole diameter	bolt dia d_b = 3/4	[in]		bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing	spacing L_s = 3.000	[in]				
Plate tensile strength	F_u = 65.0	[ksi]				
Plate thickness	t = 0.500	[in]				
Interior Bolt						
Bolt hole edge clear distance	$L_c = L_s - d_h$			= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5\ L_c\ t\ F_u \le 3.0\ d_b\ t\ m\ F_u$					AISC 14th Eq J3-6b
	= 106.64 ≤ 73.13			= 73.13	[kips]	
Bolt strength at interior	$R_{n\text{-}in}$ = min ($R_{n\text{-}t\&b\text{-}in}$, $R_{n\text{-}bolt}$)			= 23.86	[kips]	
Number of bolt	interior n_{in} = 2					
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in}$			= 47.71	[kips]	
Required shear strength	V_u =			= **25.00**	[kips]	
Bolt resistance factor-LRFD	ϕ = 0.75					AISC 14th J3-10
	ϕ R_n =			= **35.78**	[kips]	
	ratio = **0.70**			> V_u	OK	

Flange Angle - Gusset PL Side - Bolt Bearing on Gusset Plate ratio = 50.00 / 71.57 = **0.70** **PASS**

Single Bolt Shear Strength

Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = 2 \times F_{nv} A_b$		= 47.71	[kips]	AISC 14th Eq J3-1

Bolt Bearing / TearOut Strength on Plate

Bolt hole diameter	bolt dia d_b = 3/4	[in]	bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing	spacing L_s = 3.000	[in]			
Plate tensile strength	F_u = 65.0	[ksi]			
Plate thickness	t = 0.375	[in]			

Interior Bolt

Bolt hole edge clear distance	$L_c = L_s - d_h$		= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5\ L_c\ t\ F_u \le 3.0\ d_b\ t\ m\ F_u$				AISC 14th Eq J3-6b
	= 79.98 ≤ 54.84		= 54.84	[kips]	
Bolt strength at interior	$R_{n\text{-}in}$ = min ($R_{n\text{-}t\&b\text{-}in}$, $R_{n\text{-}bolt}$)		= 47.71	[kips]	
Number of bolt	interior n_{in} = 2				
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in}$		= 95.43	[kips]	
Required shear strength	V_u =		= **50.00**	[kips]	
Bolt resistance factor-LRFD	ϕ = 0.75				AISC 14th J3-10
	ϕ R_n =		= **71.57**	[kips]	
	ratio = **0.70**		> V_u	OK	

Gusset Plate - Compression (Whitmore) ratio = 100.00 / 205.13 = **0.49** **PASS**

Plate Compression Check

Plate size	width b_p = 15.394 [in]	thickness t_p = 0.375	[in]	
	F_y = 50.0 [ksi]	E = 29000	[ksi]	
Plate gross area in compression	$A_g = b_p t_p$	= 5.773	[in^2]	
Plate radius of gyration	$r = t_p / \sqrt{12}$	= 0.108	[in]	
Plate effective length factor	K =	= 0.60		AISC DG29 Page 277
Plate unbraced length	L_u =	= 10.254	[in]	
Plate slenderness	$KL/r = 0.60 \times L_u / r$	= 56.83		
	when $\frac{KL}{r} > 25$, use Chapter E			AISC 14th J4.4 (b)
Elastic buckling stress	$F_e = \frac{\pi^2 E}{(KL/r)^2}$	= 88.61	[ksi]	AISC 14th Eq E3-4
	when $\frac{KL}{r} \le 4.71 \left(\frac{E}{F_y}\right)^{0.5} = 113.43$			AISC 14th E3 (a)
Critical stress	$F_{cr} = 0.658^{(F_y/F_e)} F_y$	= 39.48	[ksi]	AISC 14th Eq E3-2
Plate compression required	P_u =	= **100.00**	[kips]	
Plate compression provided	$R_n = F_{cr} \times A_g$	= 227.92	[kips]	AISC 14th Eq E3-1
Bolt resistance factor-LRFD	ϕ = 0.90			AISC 14th E1
	ϕR_n =	= **205.13**	[kips]	
	ratio = **0.49**	> P_u	OK	

Gusset to Column | Direct Weld Connection | Code=AISC 360-10 LRFD

Result Summary	geometries & weld limitations = **PASS**	limit states max ratio = **0.43**	**PASS**

Weld Limitation Checks - Gusset to Column — PASS

Min Fillet Weld Size

Thinner part joined thickness	t =	= 0.375	[in]	
Min fillet weld size allowed	w_{min} =	= **0.188**	[in]	AISC 14th Table J2.4
Fillet weld size provided	w =	= **0.313**	[in]	
		> w_{min}	OK	

Min Fillet Weld Length

Fillet weld size provided	w =	= 0.313	[in]	
Min fillet weld length allowed	L_{min} = 4 x w	= **1.250**	[in]	AISC 14th J2.2b
Min fillet weld length	L =	= **20.707**	[in]	
		> L_{min}	OK	

Brace Force Load Case 1

Gusset plate t=0.375 | P = -100.00 kips (T) | ratio = **0.43** | **PASS**

Gusset Plate - Shear Yielding — ratio = 70.71 / 232.95 = **0.30** — PASS

Plate Shear Yielding Check

Plate size	width b_p = 20.707 [in]	thickness t_p = 0.375	[in]	
Plate yield strength	F_y = 50.0 [ksi]			
Plate gross area in shear	$A_{gv} = b_p t_p$	= 7.765	[in^2]	
Shear force required	V_u =	= **70.71**	[kips]	
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$	= 232.95	[kips]	AISC 14th Eq J4-3
Resistance factor-LRFD	ϕ = 1.00			AISC 14th Eq J4-3
	ϕR_n =	= **232.95**	[kips]	
	ratio = **0.30**	> V_u	OK	

Gusset Plate - Shear Rupture — ratio = 70.71 / 227.13 = **0.31** — PASS

Plate Shear Rupture Check

Plate size	width b_p = 20.707 [in]	thickness t_p = 0.375	[in]	
Plate tensile strength	F_u = 65.0 [ksi]			
Plate net area in shear	$A_{nv} = b_p t_p$	= 7.765	[in^2]	
Shear force in demand	V_u =	= **70.71**	[kips]	
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$	= 302.84	[kips]	AISC 14th Eq J4-4
Resistance factor-LRFD	ϕ = 0.75			AISC 14th Eq J4-4
	ϕR_n =	= **227.13**	[kips]	
	ratio = **0.31**	> V_u	OK	

Gusset Plate - Axial Tensile Yield			ratio = 31.52 / 349.43	= **0.09**	**PASS**
Plate Tensile Yielding Check					
Plate size	width b_p = 20.707	[in]	thickness t_p = 0.375	[in]	
Plate yield strength	F_y = 50.0	[ksi]			
Plate gross area in shear	$A_g = b_p t_p$		= 7.765	[in^2]	
Tensile force required	P_u =		= **31.52**	[kips]	
Plate tensile yielding strength	$R_n = F_y A_g$		= 388.26	[kips]	AISC 14th Eq J4-1
Resistance factor-LRFD	ϕ = 0.90				AISC 14th Eq J4-1
	ϕR_n =		= **349.43**	[kips]	
	ratio = **0.09**		> P_u	OK	

Gusset Plate - Axial Tensile Rupture			ratio = 31.52 / 378.55	= **0.08**	**PASS**
Plate Tensile Rupture Check					
Plate size	width b_p = 20.707	[in]	thickness t_p = 0.375	[in]	
Plate tensile strength	F_u = 65.0	[ksi]			
Plate net area in tension	$A_{nt} = b_p t_p$		= 7.765	[in^2]	
Tensile force required	P_u =		= **31.52**	[kips]	
Plate tensile rupture strength	$R_n = F_u A_{nt}$		= 504.73	[kips]	AISC 14th Eq J4-2
Resistance factor-LRFD	ϕ = 0.75				AISC 14th Eq J4-2
	ϕR_n =		= **378.55**	[kips]	AISC 14th Eq J4-2
	ratio = **0.08**		> P_u	OK	

Gusset Plate - Flexural Yield Interact			ratio =	= **0.10**	**PASS**
Gusset plate	width b_p = 20.707	[in]	thick t_p = 0.375	[in]	
	yield F_y = 50.0	[ksi]			
Shear plate - gross area	$A_g = b_p \times t_p$		= 7.765	[in^2]	
Shear plate - plastic modulus	$Z_p = (b_p \times t_p^2) / 4$		= 40.198	[in^3]	
Flexural strength available	$M_c = \phi F_y Z_p$ ϕ=0.90		= 150.74	[kip-ft]	
Flexural strength required	M_r = from gusset interface forces calc		= 0.00	[kip-ft]	
Axial strength available	P_c = from axial tensile yield check		= 349.43	[kips]	
Axial strength required	P_r = from gusset interface forces calc		= 31.52	[kips]	
Shear strength available	V_c = from shear yielding check		= 232.95	[kips]	
Shear strength required	V_r = from gusset interface forces calc		= 70.71	[kips]	
Flexural yield interaction	ratio = $(\frac{V_r}{V_c})^2 + (\frac{P_r}{P_c} + \frac{M_r}{M_c})^2$		= **0.10**		AISC 14th Eq 10-5
			< 1.0	OK	

Gusset Plate - Flexural Rupture Interact				
	ratio =	= **0.10**	**PASS**	
Gusset plate	width b_p = 20.707 [in]	thick t_p = 0.375	[in]	
	tensile F_u = 65.0 [ksi]			
Net area of plate	$A_n = b_p \times t_p$	= 7.765	[in^2]	
Plastic modulus of net section	$Z_{net} = (b_p \times t_p^2) / 4$	= 40.198	[in^3]	
Flexural strength available	$M_c = \phi F_u Z_{net}$ ϕ=0.75	= 163.30	[kip-ft]	
Flexural strength required	M_r = from gusset interface forces calc	= 0.00	[kip-ft]	
Axial strength available	P_c = from axial tensile rupture check	= 378.55	[kips]	
Axial strength required	P_r = from gusset interface forces calc	= 31.52	[kips]	
Shear strength available	V_c = from shear rupture check	= 227.13	[kips]	
Shear strength required	V_r = from gusset interface forces calc	= 70.71	[kips]	
Flexural rupture interaction	$\text{ratio} = (\frac{V_r}{V_c})^2 + (\frac{P_r}{P_c} + \frac{M_r}{M_c})^2$	= **0.10**		AISC 14th Eq 10-5
		< 1.0	OK	

Gusset to Column Weld Strength							ratio = 3.74 / 8.78	= **0.43**	**PASS**
Gusset to Column Interface - Forces									
	shear V_c = 70.71	[kips]		axial H_c = -31.52	[kips]	in tension			
	moment M_c = 0.00	[kip-ft]							
Gusset-column fillet weld length	L_{wc} =						= **20.707**	[in]	
Gusset to Column Interface - Combined Weld Stress									
Weld stress from axial force	$f_a = H_c / L_{wc}$						= -1.522	[kip/in]	in tension
Weld stress from shear force	$f_v = V_c / L_{wc}$						= 3.415	[kip/in]	
Weld stress from moment force	$f_b = \frac{M}{L^2 / 6}$						= 0.000	[kip/in]	
Weld stress combined - max	$f_{max} = [(f_a - f_b)^2 + f_v^2]^{0.5}$						= **3.739**	[kip/in]	AISC 14th Eq 8-11
Weld resultant load angle	$\theta = \tan^{-1} [(f_b - f_a) / f_v]$						= 24.0	[°]	
Fillet Weld Strength Calc									
Fillet weld leg size	w = 5/16	[in]		load angle θ = 24.0	[°]				
Electrode strength	F_{EXX} = 70.0	[ksi]		strength coeff C_1 = 1.00					AISC 14th Table 8-3
Number of weld line	n = 2 for double fillet								
Load angle coefficient	$C_2 = (1 + 0.5 \sin^{1.5} \theta)$						= 1.13		AISC 14th Page 8-9
Fillet weld shear strength	$R_{n-w} = 0.6 (C_1 \times 70 \text{ ksi}) 0.707 w n C_2$						= 20.969	[kip/in]	AISC 14th Eq 8-1
Base metal - gusset plate	thickness t = 0.375	[in]		tensile F_u = 65.0	[ksi]				
Base metal - gusset plate is in shear, shear rupture as per AISC 14th Eq J4-4 is checked									AISC 14th J2.4
Base metal shear rupture	$R_{n-b} = 0.6 F_u t$						= 14.625	[kip/in]	AISC 14th Eq J4-4
Double fillet linear shear strength	$R_n = \min (R_{n-w}, R_{n-b})$						= **14.625**	[kip/in]	AISC 14th Eq 9-2
Resistance factor-LRFD	$\phi = 0.75$								AISC 14th Eq 8-1
	ϕR_n =						= 10.969	[kip/in]	
When gusset plate is directly welded to beam or column, apply 1.25 ductility factor to allow adequate force redistribution in the weld group									AISC 14th Page 13-11
Weld strength used for design after applying ductility factor	$\phi R_n = \phi R_n \times (1/1.25)$						= **8.775**	[kip/in]	
	ratio = **0.43**						> f_{max}	OK	

Column Web Local Yielding			ratio = 31.52 / 343.04	= **0.09**	**PASS**
Concentrated force from gusset	P_u =		= **31.52**	[kips]	
Column section	d = 11.900	[in]	t_f = 0.515	[in]	
	t_w = 0.295	[in]	k = 1.020	[in]	
	yield F_y = 50.0	[ksi]			
Length of bearing	l_b = Gusset/Column interface length		= 20.707	[in]	
Gusset plate corner clip	clip = from user input		= 0.750	[in]	
Distance from normal force applied point to member end	$l_N = 0.5\ l_b$ + clip		= 11.104	[in]	
	when $l_N \le d$, use AISC 14th Eq J10-3				AISC 14th Eq J10-3
Column web local yielding strength	$R_n = F_y t_w (2.5\ k + l_b)$		= 343.04	[kips]	AISC 14th Eq J10-3
Resistance factor-LRFD	ϕ = 1.00				
	ϕR_n =		= **343.04**	[kips]	
	ratio = **0.09**		> P_u	OK	

Brace Force Load Case 2 Gusset plate t=0.375 P = 100.00 kips (C) ratio = **0.39** **PASS**

Gusset Plate - Shear Yielding			ratio = 70.71 / 232.95	= **0.30**	**PASS**
Plate Shear Yielding Check					
Plate size	width b_p = 20.707	[in]	thickness t_p = 0.375	[in]	
Plate yield strength	F_y = 50.0	[ksi]			
Plate gross area in shear	$A_{gv} = b_p t_p$		= 7.765	[in^2]	
Shear force required	V_u =		= **70.71**	[kips]	
Plate shear yielding strength	$R_n = 0.6\ F_y A_{gv}$		= 232.95	[kips]	AISC 14th Eq J4-3
Resistance factor-LRFD	ϕ = 1.00				AISC 14th Eq J4-3
	ϕR_n =		= **232.95**	[kips]	
	ratio = **0.30**		> V_u	OK	

Gusset Plate - Shear Rupture			ratio = 70.71 / 227.13	= **0.31**	**PASS**
Plate Shear Rupture Check					
Plate size	width b_p = 20.707	[in]	thickness t_p = 0.375	[in]	
Plate tensile strength	F_u = 65.0	[ksi]			
Plate net area in shear	$A_{nv} = b_p t_p$		= 7.765	[in^2]	
Shear force in demand	V_u =		= **70.71**	[kips]	
Plate shear rupture strength	$R_n = 0.6\ F_u A_{nv}$		= 302.84	[kips]	AISC 14th Eq J4-4
Resistance factor-LRFD	ϕ = 0.75				AISC 14th Eq J4-4
	ϕR_n =		= **227.13**	[kips]	
	ratio = **0.31**		> V_u	OK	

Gusset Plate - Axial Tensile Yield

ratio = 31.52 / 349.43 = **0.09** **PASS**

Plate Tensile Yielding Check

Plate size	width b_p = 20.707 [in]	thickness t_p = 0.375 [in]			
Plate yield strength	F_y = 50.0 [ksi]				
Plate gross area in shear	$A_g = b_p t_p$	= 7.765	[in^2]		
Tensile force required	P_u =	= **31.52**	[kips]		
Plate tensile yielding strength	$R_n = F_y A_g$	= 388.26	[kips]	AISC 14th Eq J4-1	
Resistance factor-LRFD	ϕ = 0.90			AISC 14th Eq J4-1	
	ϕR_n =	= **349.43**	[kips]		
	ratio = **0.09**	> P_u	OK		

Gusset to Column Weld Strength

ratio = 3.41 / 8.78 = **0.39** **PASS**

Gusset to Column Interface - Forces

	shear V_c = 70.71 [kips]	axial H_c = 31.52	[kips]	in compression	
	moment M_c = 0.00 [kip-ft]				
Gusset-column fillet weld length	L_{wc} =	= **20.707**	[in]		

Gusset to Column Interface - Combined Weld Stress

Weld stress from axial force	$f_a = H_c / L_{wc}$	= 0.000	[kip/in]	in compression
Weld stress from shear force	$f_v = V_c / L_{wc}$	= 3.415	[kip/in]	
Weld stress from moment force	$f_b = \frac{M}{L^2 / 6}$	= 0.000	[kip/in]	
Weld stress combined - max	$f_{max} = f_v$	= **3.415**	[kip/in]	AISC 14th Eq 8-11
Weld resultant load angle	θ = weld only has shear component	= 0.0	[°]	

Fillet Weld Strength Calc

Fillet weld leg size	w = 5/16 [in]	load angle θ = 0.0	[°]		
Electrode strength	F_{EXX} = 70.0 [ksi]	strength coeff C_1 = 1.00		AISC 14th Table 8-3	
Number of weld line	n = 2 for double fillet				
Load angle coefficient	$C_2 = (1 + 0.5 \sin^{1.5} \theta)$	= 1.00		AISC 14th Page 8-9	
Fillet weld shear strength	R_{n-w} = 0.6 (C_1 x 70 ksi) 0.707 w n C_2	= 18.559	[kip/in]	AISC 14th Eq 8-1	
Base metal - gusset plate	thickness t = 0.375 [in]	tensile F_u = 65.0	[ksi]		
Base metal - gusset plate is in shear, shear rupture as per AISC 14th Eq J4-4 is checked				AISC 14th J2.4	
Base metal shear rupture	$R_{n-b} = 0.6 F_u t$	= 14.625	[kip/in]	AISC 14th Eq J4-4	
Double fillet linear shear strength	$R_n = \min (R_{n-w}, R_{n-b})$	= **14.625**	[kip/in]	AISC 14th Eq 9-2	
Resistance factor-LRFD	ϕ = 0.75			AISC 14th Eq 8-1	
	ϕR_n =	= 10.969	[kip/in]		
When gusset plate is directly welded to beam or column, apply 1.25 ductility factor to allow adequate force redistribution in the weld group				AISC 14th Page 13-11	
Weld strength used for design after applying ductility factor	$\phi R_n = \phi R_n$ x (1/1.25)	= **8.775**	[kip/in]		
	ratio = **0.39**	> f_{max}	OK		

Column Web Local Yielding				ratio = 31.52 / 343.04	= **0.09**	**PASS**
Concentrated force from gusset	P_u =			= **31.52**	[kips]	
Column section	d = 11.900	[in]	t_f = 0.515		[in]	
	t_w = 0.295	[in]	k = 1.020		[in]	
	yield F_y = 50.0	[ksi]				
Length of bearing	l_b = Gusset/Column interface length			= 20.707	[in]	
Gusset plate corner clip	clip = from user input			= 0.750	[in]	
Distance from normal force applied point to member end	$l_N = 0.5\ l_b$ + clip			= 11.104	[in]	
	when $l_N \le d$, use AISC 14th Eq J10-3					AISC 14th Eq J10-3
Column web local yielding strength	$R_n = F_y t_w (2.5\ k + l_b)$			= 343.04	[kips]	AISC 14th Eq J10-3
Resistance factor-LRFD	ϕ = 1.00					
	ϕR_n =			= **343.04**	[kips]	
	ratio = **0.09**			> P_u	OK	

Column Web Local Crippling				ratio = 31.52 / 271.09	= **0.12**	**PASS**
Concentrated force from gusset	P_u =			= **31.52**	[kips]	
Column section	d = 11.900	[in]	t_f = 0.515		[in]	
	t_w = 0.295	[in]	k = 1.020		[in]	
	yield F_y = 50.0	[ksi]	E = 29000		[ksi]	
Length of bearing	l_b = Gusset/Column interface length			= 20.707	[in]	
Gusset plate corner clip	clip = from user input			= 0.750	[in]	
Distance from normal force applied point to member end	$l_N = 0.5\ l_b$ + clip			= 11.104	[in]	
	when $l_N \ge d/2$, use Eq J10-4					AISC 14th Eq J10-4
Column web local crippling strength	$R_n = 0.8\ t_w^2\ [1+3\frac{l_b}{d}(\frac{t_w}{t_f})^{1.5}]\ x$ $(\frac{E F_y t_f}{t_w})^{0.5}$			= 361.45	[kips]	AISC 14th Eq J10-4
Resistance factor-LRFD	ϕ = 0.75					AISC 14th J10.3
	ϕR_n =			= **271.09**	[kips]	
	ratio = **0.12**			> P_u	OK	

Gusset to Base Plate | Direct Weld Connection | Code=AISC 360-10 LRFD

Result Summary	geometries & weld limitations = **PASS**	limit states max ratio = **0.84**	**PASS**

Weld Limitation Checks - Gusset to Base Plate — PASS

Min Fillet Weld Size

Thinner part joined thickness	t =	= 0.375	[in]	
Min fillet weld size allowed	w_{min} =	= **0.188**	[in]	AISC 14th Table J2.4
Fillet weld size provided	w =	= **0.313**	[in]	
		> w_{min}	OK	

Min Fillet Weld Length

Fillet weld size provided	w =	= 0.313	[in]	
Min fillet weld length allowed	L_{min} = 4 x w	= **1.250**	[in]	AISC 14th J2.2b
Min fillet weld length	L =	= **5.300**	[in]	
		> L_{min}	OK	

Brace Force Load Case 1

Gusset plate t=0.375 | P = -100.00 kips (T) | ratio = **0.84** | **PASS**

Gusset Plate - Shear Yielding — ratio = 39.19 / 59.63 = **0.66** — PASS

Plate Shear Yielding Check

Plate size	width b_p = 5.300 [in]	thickness t_p = 0.375	[in]	
Plate yield strength	F_y = 50.0 [ksi]			
Plate gross area in shear	$A_{gv} = b_p t_p$	= 1.988	[in^2]	
Shear force required	V_u =	= **39.19**	[kips]	
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$	= 59.63	[kips]	AISC 14th Eq J4-3
Resistance factor-LRFD	ϕ = 1.00			AISC 14th Eq J4-3
	ϕR_n =	= **59.63**	[kips]	
	ratio = **0.66**	> V_u	OK	

Gusset Plate - Shear Rupture — ratio = 39.19 / 58.13 = **0.67** — PASS

Plate Shear Rupture Check

Plate size	width b_p = 5.300 [in]	thickness t_p = 0.375	[in]	
Plate tensile strength	F_u = 65.0 [ksi]			
Plate net area in shear	$A_{nv} = b_p t_p$	= 1.988	[in^2]	
Shear force in demand	V_u =	= **39.19**	[kips]	
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$	= 77.51	[kips]	AISC 14th Eq J4-4
Resistance factor-LRFD	ϕ = 0.75			AISC 14th Eq J4-4
	ϕR_n =	= **58.13**	[kips]	
	ratio = **0.67**	> V_u	OK	

Gusset to Base Plate Weld Strength							ratio = 7.39 / 8.78	= **0.84**	**PASS**
Gusset to Beam Interface - Forces									
	shear H_b = 39.19	[kips]		axial V_b = 0.00	[kips]				
	moment M_b = 0.00	[kip-ft]							
Gusset-beam fillet weld length	L_w =						= 5.300	[in]	
Gusset to Beam Interface - Combined Weld Stress									
Weld stress from axial force	$f_a = V_b / L_{wb}$						= 0.000	[kip/in]	
Weld stress from shear force	$f_v = H_b / L_{wb}$						= 7.394	[kip/in]	
Weld stress from moment force	$f_b = \frac{M}{L^2 / 6}$						= 0.000	[kip/in]	
Weld stress combined - max	$f_{max} = f_v$						= **7.394**	[kip/in]	AISC 14th Eq 8-11
Weld resultant load angle	θ = weld only has shear component						= 0.0	[°]	
Fillet Weld Strength Calc									
Fillet weld leg size	w = 5/16	[in]		load angle θ = 0.0	[°]				
Electrode strength	F_{EXX} = 70.0	[ksi]		strength coeff C_1 = 1.00					AISC 14th Table 8-3
Number of weld line	n = 2 for double fillet								
Load angle coefficient	$C_2 = (1 + 0.5 \sin^{1.5} \theta)$						= 1.00		AISC 14th Page 8-9
Fillet weld shear strength	R_{n-w} = 0.6 (C_1 x 70 ksi) 0.707 w n C_2						= 18.559	[kip/in]	AISC 14th Eq 8-1
Base metal - gusset plate	thickness t = 0.375	[in]		tensile F_u = 65.0	[ksi]				
Base metal - gusset plate is in shear, shear rupture as per AISC 14th Eq J4-4 is checked									AISC 14th J2.4
Base metal shear rupture	$R_{n-b} = 0.6 F_u t$						= 14.625	[kip/in]	AISC 14th Eq J4-4
Double fillet linear shear strength	$R_n = \min (R_{n-w}, R_{n-b})$						= **14.625**	[kip/in]	AISC 14th Eq 9-2
Resistance factor-LRFD	ϕ = 0.75								AISC 14th Eq 8-1
	ϕR_n =						= 10.969	[kip/in]	
When gusset plate is directly welded to beam or column, apply 1.25 ductility factor to allow adequate force redistribution in the weld group									AISC 14th Page 13-11
Weld strength used for design after applying ductility factor	$\phi R_n = \phi R_n$ x (1/1.25)						= **8.775**	[kip/in]	
	ratio = **0.84**						> f_{max}	OK	

Brace Force Load Case 2 Gusset plate t=0.375 P = 100.00 kips (C) ratio = **0.84** **PASS**

Gusset Plate - Shear Yielding							ratio = 39.19 / 59.63	= **0.66**	**PASS**
Plate Shear Yielding Check									
Plate size	width b_p = 5.300	[in]		thickness t_p = 0.375	[in]				
Plate yield strength	F_y = 50.0	[ksi]							
Plate gross area in shear	$A_{gv} = b_p t_p$						= 1.988	[in^2]	
Shear force required	V_u =						= **39.19**	[kips]	
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$						= 59.63	[kips]	AISC 14th Eq J4-3
Resistance factor-LRFD	ϕ = 1.00								AISC 14th Eq J4-3
	ϕR_n =						= **59.63**	[kips]	
	ratio = **0.66**						> V_u	OK	

Gusset Plate - Shear Rupture			ratio = 39.19 / 58.13	= **0.67**	**PASS**
Plate Shear Rupture Check					
Plate size	width b_p = 5.300 [in]		thickness t_p = 0.375	[in]	
Plate tensile strength	F_u = 65.0 [ksi]				
Plate net area in shear	$A_{nv} = b_p t_p$		= 1.988	[in^2]	
Shear force in demand	V_u =		= **39.19**	[kips]	
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$		= 77.51	[kips]	AISC 14th Eq J4-4
Resistance factor-LRFD	ϕ = 0.75				AISC 14th Eq J4-4
	ϕR_n =		= **58.13**	[kips]	
	ratio = **0.67**		> V_u	OK	

Gusset to Base Plate Weld Strength			ratio = 7.39 / 8.78	= **0.84**	**PASS**
Gusset to Beam Interface - Forces					
	shear H_b = 39.19 [kips]		axial V_b = 0.00	[kips]	
	moment M_b = 0.00 [kip-ft]				
Gusset-beam fillet weld length	L_w =		= 5.300	[in]	
Gusset to Beam Interface - Combined Weld Stress					
Weld stress from axial force	$f_a = V_b / L_{wb}$		= 0.000	[kip/in]	
Weld stress from shear force	$f_v = H_b / L_{wb}$		= 7.394	[kip/in]	
Weld stress from moment force	$f_b = \frac{M}{L^2 / 6}$		= 0.000	[kip/in]	
Weld stress combined - max	$f_{max} = f_v$		= **7.394**	[kip/in]	AISC 14th Eq 8-11
Weld resultant load angle	θ = weld only has shear component		= 0.0	[°]	
Fillet Weld Strength Calc					
Fillet weld leg size	w = 5/16 [in]		load angle θ = 0.0	[°]	
Electrode strength	F_{EXX} = 70.0 [ksi]		strength coeff C_1 = 1.00		AISC 14th Table 8-3
Number of weld line	n = 2 for double fillet				
Load angle coefficient	$C_2 = (1 + 0.5 \sin^{1.5} \theta)$		= 1.00		AISC 14th Page 8-9
Fillet weld shear strength	$R_{n-w} = 0.6 (C_1 \times 70 \text{ ksi}) 0.707 w n C_2$		= 18.559	[kip/in]	AISC 14th Eq 8-1
Base metal - gusset plate	thickness t = 0.375 [in]		tensile F_u = 65.0	[ksi]	
Base metal - gusset plate is in shear, shear rupture as per AISC 14th Eq J4-4 is checked					AISC 14th J2.4
Base metal shear rupture	$R_{n-b} = 0.6 F_u t$		= 14.625	[kip/in]	AISC 14th Eq J4-4
Double fillet linear shear strength	$R_n = \min (R_{n-w}, R_{n-b})$		= **14.625**	[kip/in]	AISC 14th Eq 9-2
Resistance factor-LRFD	ϕ = 0.75				AISC 14th Eq 8-1
	ϕR_n =		= 10.969	[kip/in]	
When gusset plate is directly welded to beam or column, apply 1.25 ductility factor to allow adequate force redistribution in the weld group					AISC 14th Page 13-11
Weld strength used for design after applying ductility factor	$\phi R_n = \phi R_n \times (1/1.25)$		= **8.775**	[kip/in]	
	ratio = **0.84**		> f_{max}	OK	