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Company Name	Welded to end gusset 2	Project Title	
Group/Team Name		Subtitle	
Designer		Job Number	
Date	28 /12 /2024	Client	

1 Input Parameters

Module	Tension Member Design - Welded to End Gusset
Axial Force (kN)	98.0
Length (mm) *	563.0
Section Profile*	Angles
Section Size*	Ref List of Input Section
Plate Details - Input and Design Preference	
Thickness (mm)	[np.int64(8), np.int64(10), np.int64(12), np.int64(14), np.int64(16), np.int64(18), np.int64(20), np.int64(22), np.int64(25), np.int64(28), np.int64(32), np.int64(36), np.int64(40), np.int64(45), np.int64(50), np.int64(56), np.int64(63), np.int64(75), np.int64(80), np.int64(90), np.int64(100), np.int64(110), np.int64(120)]
Material	E 250 (Fe 410 W)B
Ultimate Strength, F_u (MPa)	410
Yield Strength, F_y (MPa)	250
Weld Details - Input and Design Preference	
Weld Type	Fillet
Type of Weld Fabrication	Shop Weld
Material Grade Overwrite, F_u (MPa)	410.0

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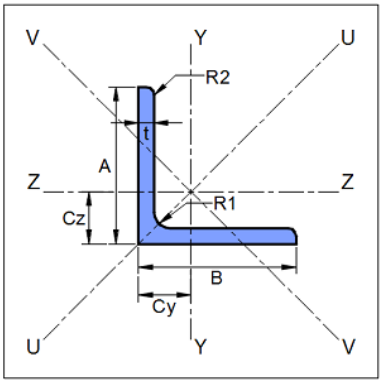
1.1 List of Input Section

Section Size*	'20 x 20 x 3', '20 x 20 x 4', '25 x 25 x 3', '25 x 25 x 4', '25 x 25 x 5', '30 x 30 x 3', '30 x 30 x 4', '30 x 30 x 5', '35 x 35 x 3', '35 x 35 x 4', '35 x 35 x 5', '35 x 35 x 6', '40 x 40 x 3', '40 x 40 x 4', '40 x 40 x 5', '40 x 40 x 6', '45 x 45 x 3', '45 x 45 x 4', '45 x 45 x 5', '45 x 45 x 6', '50 x 50 x 3', '50 x 50 x 4', '50 x 50 x 5', '50 x 50 x 6', '55 x 55 x 4', '55 x 55 x 5', '55 x 55 x 6', '55 x 55 x 8', '60 x 60 x 4', '60 x 60 x 5', '60 x 60 x 6', '60 x 60 x 8', '65 x 65 x 4', '65 x 65 x 5', '65 x 65 x 6', '65 x 65 x 8', '70 x 70 x 5', '70 x 70 x 6', '70 x 70 x 8', '70 x 70 x 10', '75 x 75 x 5', '75 x 75 x 6', '75 x 75 x 8', '75 x 75 x 10', '80 x 80 x 6', '80 x 80 x 8', '80 x 80 x 10', '80 x 80 x 12', '90 x 90 x 6', '90 x 90 x 8', '90 x 90 x 10', '90 x 90 x 12', '100 x 100 x 6', '100 x 100 x 8', '100 x 100 x 10', '100 x 100 x 12', '110 x 110 x 8', '110 x 110 x 10', '110 x 110 x 12', '110 x 110 x 16', '130 x 130 x 8', '130 x130 x 10', '130 x130 x 12', '130 x130 x 16', '150 x 150 x 10', '150 x 150 x 12', '150 x 150 x 16', '150 x 150 x 20', '200 x 200 x 12', '200 x 200 x 16', '200 x 200 x 20', '200 x 200 x 25', '50 x 50 x 7', '50 x 50 x 8', '55 x 55 x 10', '60 x 60 x 10', '65 x 65 x 10', '70 x 70 x 7', '100 x 100 x 7', '100 x 100 x 15', '120 x 120 x 8', '120 x 120 x 10', '120 x 120 x 12', '120 x 120 x 15', '130 x 130 x 9', '150 x 150 x 15', '150 x 150 x 18', '180 x 180 x 15', '180 x 180 x 18', '180 x 180 x 20', '200 x 200 x 24', '30 x 20 x 3', '30 x 20 x 4', '30 x 20 x 5', '40 x 25 x 3', '40 x 25 x 4', '40 x 25 x 5', '40 x 25 x 6', '45 x 30 x 3', '45 x 30 x 4', '45 x 30 x 5', '45 x 30 x 6', '50 x 30 x 3', '50 x 30 x 4', '50 x 30 x 5', '50 x 30 x 6', '60 x 40 x 5', '60 x 40 x 6', '60 x 40 x 8', '65 x 45 x 5', '65 x 45 x 6', '65 x 45 x 8', '70 x 45 x 5', '70 x 45 x 6', '70 x 45 x 8', '70 x 45 x 10', '75 x 50 x 5', '75 x 50 x 6', '75 x 50 x 8', '75 x 50 x 10', '80 x 50 x 5', '80 x 50 x 6', '80 x 50 x 8', '80 x 50 x 10', '90 x 60 x 6', '90 x 60 x 8', '90 x 60 x 10', '90 x 60 x 12', '100 x 65 x 6', '100 x 65 x 8', '100 x 65 x 10', '100 x 75 x 6', '100 x 75 x 8', '100 x 75 x 10', '100 x 75 x 12', '125 x 75 x 6', '125 x 75 x 8', '125 x 75 x 10', '125 x 95 x 6', '125 x 95 x 8', '125 x 95 x 10', '125 x 95 x 12', '150 x 115 x 8', '150 x 115 x 10', '150 x 115 x 12', '150 x 115 x 16', '200 x 100 x 10', '200 x 100 x 12', '200 x 100 x 16', '200 x 150 x 10', '200 x 150 x 12', '200 x 150 x 16', '200 x 150 x 20', '40 x 20 x 3', '40 x 20 x 4', '40 x 20 x 5', '60 x 30 x 5', '60 x 30 x 6', '60 x 40 x 7', '65 x 50 x 5', '65 x 50 x 6', '65 x 50 x 7', '65 x 50 x 8', '70 x 50 x 5', '70 x 50 x 6', '70 x 50 x 7', '70 x 50 x 8', '75 x 50 x 7', '80 x 40 x 5', '80 x 40 x 6', '80 x 40 x 7', '80 x 40 x 8', '80 x 60 x 6', '80 x 60 x 7', '80 x 60 x 8', '90 x 65 x 6', '90 x 65 x 7', '90 x 65 x 8', '90 x 65 x 10', '100 x 50 x 6', '100 x 50 x 7', '100 x 50 x 8', '100 x 50 x 10', '100 x 65 x 7', '120 x 80 x 8', '120 x 80 x 10', '120 x 80 x 12', '125 x 75 x 12', '135 x 65 x 8', '135 x 65 x 10', '135 x 65 x 12', '150 x 75 x 9', '150 x 75 x 15', '150 x 90 x 10', '150 x 90 x 12', '150 x 90 x 15', '200 x 100 x 15', '200 x 150 x 15', '200 x 150 x 18'

2 Design Checks

Design Status	Pass

2.1 Selected Member Data



Section Size*		('55 x 55 x 4', 'Angles')	
Material		E 250 (Fe 410 W)B	
Mass, m (kg/m)		3.4	
Area, A (cm^2)		433.0	
A (mm)	55.0	I_v(cm^4)	5.2
B (mm)	55.0	r_z (cm)	1.7
t (mm)	4.0	r_y (cm)	1.7
R_1 (mm)	6.5	r_u (cm)	2.14
R_2 (mm)	0.0	r_v (cm)	1.1
C_y (mm)	15.0	Z_z (cm^3)	3.14
C_z (mm)	15.0	Z_y (cm^3)	3.14
I_z (cm^4)	12.5	Z_{pz} (cm^3)	5.63
I_y(cm^4)	12.5	Z_{py} (cm^3)	5.66
I_u (cm^4)	19.9	Radius of gyration, r (cm)	11.0

2.2 Member Check

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{A_g f_y}{\gamma_{m0}}$ $= \frac{433.0 \times 250}{1.1 \times 10^3}$ $= 98.41$ [Ref. IS 800:2007, Cl.6.2]	

Check	Required	Provided	Remarks
Tension Rupture Capacity (kN)		$\beta = 1.4 - 0.076 \times \frac{w}{t} \times \frac{f_y}{0.9 f_u} \times \frac{b_s}{L_c}$ $\leq \frac{0.9 f_u \gamma_{m0}}{f_y \gamma_{m1}} \geq 0.7$ $= 1.4 - 0.076 \times \frac{55.0}{4.0} \times \frac{250}{0.9 \times 410} \times \frac{55.0}{116}$ $\leq \frac{0.9 \times 410 \times 1.1}{250 \times 1.25} \geq 0.7$ $= 1.06$ $T_{\mathrm{dn}} = 1 \times \left(\frac{0.9 A_{nc} f_u}{\gamma_{m1}} + \frac{\beta A_{go} f_y}{\gamma_{m0}} \right)$ $= 1 \times \left(\frac{0.9 \times 204.0 \times 410}{1.25} + \frac{1.06 \times 220.0 \times 250}{1.1} \right)$ $= 113.22$ [Ref. IS 800:2007, Cl.6.3.3]	
Tension Capacity (kN)	98.0	$T_{\mathrm{d}} = \min(T_{\mathrm{dg}},\ T_{\mathrm{dn}})$ $= \min(98.41, 113.22)$ $= 98.41$ [Ref.IS 800:2007, Cl.6.1]	**Pass**
Slenderness ratio	$\frac{KL}{r} \leq 400$	$\frac{KL}{r} = \frac{1 \times 563.0}{11.0}$ $= 51.18$ [Ref. IS 800:2007, Cl.7.1.2]	**Pass**
Utilization Ratio	≤ 1	Utilization Ratio $= \frac{F}{T_d} = \frac{98.0}{98.41}$ $= 1.0$	

Check	Required	Provided	Remarks
Axial Load Considered (kN)	$A_{c\min} = 0.3A_c$ $= 0.3 \times 98.41$ $= 29.52$ $A_{c\max} = 98.41$ [Ref. IS 800:2007, Cl.10.7]	$A = 98.0$	**Pass**

2.3 Weld Design

Check	Required	Provided	Remarks
Min. Weld Size (mm)	$t_{w_{\min}}$ based on thinner part $= \max(4,\ 3)$ $s_{\min}$ based on thicker part $= 3$ [Ref. IS 800:2007, Table 21, Cl.10.5.2.3]	3	**Pass**
Max. Weld Size (mm)	Thickness of thinner part $= \min(8.0,\ 4.0) = 4.0$ $s_{\max} = 16.0$ [Ref. IS 800:2007, Cl.10.5.3.1]	3	**Pass**
Throat Thickness (mm)	$t_t \geq 3$ [Ref. IS 800:2007, Cl.10.5.3.1]	$t_t = 0.7t_w$ $= 0.7 \times 3$ $= 3$ [Ref. IS 800:2007, Cl.10.5.3.1]	**Pass**
Effective Length (mm)		$l_w = 251.0$	

Check	Required	Provided	Remarks
Weld Strength (N/mm)	$R_{\mathrm{w}} = \sqrt{(A_{\mathrm{wh}})^2 + (V_{\mathrm{wv}})^2}$ $V_{\mathrm{wv}} = \frac{V}{l_w} = \frac{0.0}{251.0}$ $A_{\mathrm{wh}} = \frac{A}{l_w} = \frac{98000.0}{251.0}$ $R_{\mathrm{w}} = \sqrt{(390.44)^2 + (0.0)^2}$ $= 390.44$	$f_w = \frac{t_t f_u}{\sqrt{3}\gamma_{mw}}$ $= \frac{3 \times 410}{\sqrt{3} \times 1.25}$ $= 568.11$ [Ref. IS 800:2007, Cl.10.5.7.1.1]	Pass
Weld Strength (post long joint) (N/mm)	if $l \geq 150t_t$, then $V_{\mathrm{rd}} = \beta_{l_w} V_{\mathrm{db}}$ if $l < 150t_t$, *then* $V_{\mathrm{rd}} = V_{\mathrm{db}}$ where, l = plate length or height $\beta_{l_w} = 1.2 - \frac{(0.2l)}{(150t_t)}$ but, $0.6 \leq \beta_{l_w} \leq 1.0$ [Ref. IS 800:2007, Cl.10.5.7.3]	l = plate length or height $l_l = \max(85.0, 131)$ $= 131$ $150t_t = 150 \times 3 = 450$ since, $l < 150t_t$ *then* $f_{\mathrm{wrd}} = f_{\mathrm{w}}$ $f_{\mathrm{wrd}} = 568.11$ [Ref. IS 800:2007, Cl.10.5.7.3.]	
Weld Strength (N/mm)	390.44	568.11	Pass

2.4 Gusset Plate Check

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)	98.0	$T_{\mathrm{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 150.0 \times 8.0$ $= \frac{1200.0 \times 250}{1.1 \times 10^3}$ $= 100.0$ [Ref. IS 800:2007, Cl.6.2]	Pass

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Check	Required	Provided	Remarks
Min.Height (mm)		$H = 1 \times \text{Depth} + \text{Clearance}$ $= (1 \times 150.0) + 30$ $= 85.0$	
Min.Plate Length (mm)		$L = \text{Flange weld} + \text{Clearance}$ $= 101 + 30$ $= 131$	**Pass**
Min.Member Length (mm)	262	563.0	**Pass**
Thickness (mm)		$T = 8.0$	
Weld Strength (N/mm)	$R_{\text{w}} = \sqrt{(A_{\text{wh}})^2 + (V_{\text{wv}})^2}$ $V_{\text{wv}} = \frac{V}{l_w} = \frac{0.0}{251.0}$ $A_{\text{wh}} = \frac{A}{l_w} = \frac{98000.0}{251.0}$ $R_{\text{w}} = \sqrt{(390.44)^2 + (0.0)^2}$ $= 390.44$	$f_w = \frac{t_t f_u}{\sqrt{3}\gamma_{mw}}$ $= \frac{3 \times 410}{\sqrt{3} \times 1.25}$ $= 568.11$ [Ref. IS 800:2007, Cl.10.5.7.1.1]	**Pass**
Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 285.44$ [Ref. IS 800:2007, Cl.6.4]	
Tension Capacity (kN)	$A = 98.0$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{db}})$ $= \min(100.0, 285.44)$ $= 100.0$ [Ref.IS 800:2007, Cl.6.1]	**Pass**

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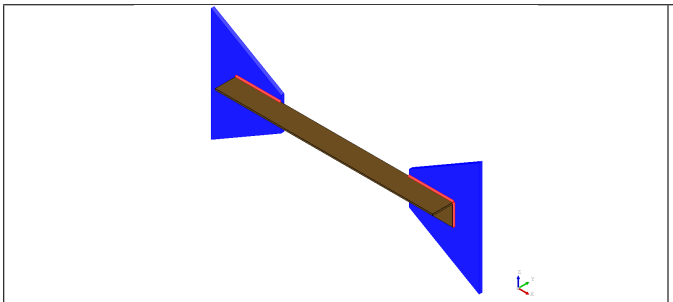
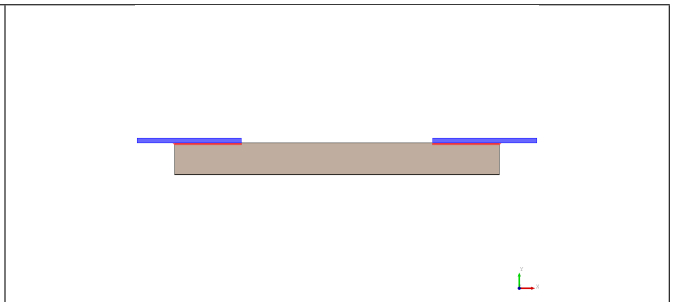
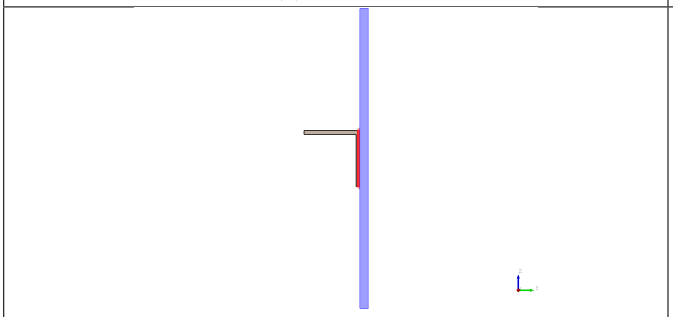
3 3D Views



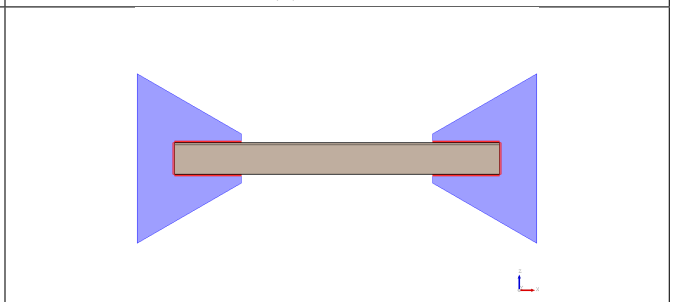
(a) 3D View



(b) Top View



(c) Side View



(d) Front View

4 Design Log

16:56:00 - Osdag - INFO - :In the case of reverse loading, slenderness value shall be less than 180 [Ref. Table 3, IS 800:2007].
16:56:00 - Osdag - INFO - Size of weld is calculated based on the edge type i.e. square edge or round edge (IS 800:2007 Clause 10.5)).
16:56:00 - Osdag - INFO - :Overall welded tension member design is safe.
16:56:00 - Osdag - INFO - :==========End Of design==========