

Company Name		Project Title	
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Designer		Job Number	
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1 Input Parameters

Module	Tension Members Welded Design
Axial (kN) *	500.0
Length (mm) *	5000.0
Section Size*	Ref List of Input Section
Plate Details	
Plate Thickness (mm)*	[3.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 20.0, 22.0, 24.0, 25.0, 26.0, 28.0, 30.0, 32.0, 36.0, 40.0, 45.0, 50.0, 56.0, 63.0, 80.0]
Material *	E 250 (Fe 410 W)B
Ultimate strength, fu (MPa)	410
Yield Strength , fy (MPa)	250
Weld Details	
Weld Type	Fillet
Type of weld fabrication	Shop Weld
Material grade overwrite (MPa) Fu	410.0
Safety Factors - IS 800:2007 Table 5 (Clause 5.4.1)	
Governed by Yielding	$\gamma_{m0} = 1.1$
Governed by Ultimate Stress	$\gamma_{m1} = 1.25$
Connection Weld	$\gamma_{mw} = 1.25$

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 x 130 x 10', '130 x 130 x 12', '130 x 130 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 10', '200 x 200 x 12', '200 x 200 x 16', '200 x 200 x 20']
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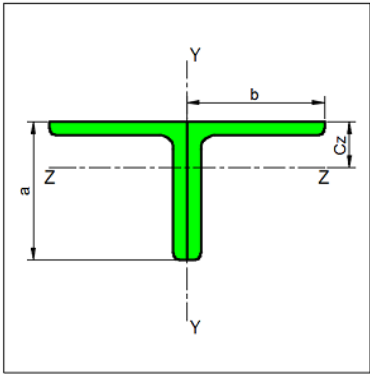
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	12', '200 x 200 x 16', '200 x 200 x 20', '200 x 200 x 25', '50 x 50 x 7', '50 x 50
	x 8', '55 x 55 x 10', '60 x 60 x 10', '65 x 65 x 10', '70 x 70 x 7', '100 x 100 x
	7', '100 x 100 x 15', '120 x 120 x 8', '120 x 120 x 10', '120 x 120 x 12', '120 x 1
	20 x 15', '130 x 130 x 9', '150 x 150 x 15', '150 x 150 x 18', '180 x 180 x 15', '1
	80 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', '5
	0 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', '10
	0 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']

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2 Design Checks

2.1 Selected Member Data

		Section Size*		('60 x 60 x 10', 'Back to Back Angles')	
		Material *		E 250 (Fe 410 W)B	
		Ultimate strength, f_u (MPa)		410	
		Yield Strength, f_y (MPa)		250	
		Mass	8.71	I_z (mm ⁴)	710000.0
		Area(mm ²) - A	1100.0	I_y (mm ⁴)	1471100.0
		a(mm)	60.0	r_z (mm)	18.0
		b(mm)	60.0	r_y (mm)	25.9
		t(mm)	10.0	Z_z (mm ³)	1000000
		R1(mm)	6.5	Z_y (mm ³)	24520.0
		R2(mm)	0.0	Z_{pz} (mm ³)	1000
		C_y (mm)	N/A	Z_{py} (mm ³)	1000
		C_z (mm)	18.6	r (mm)	17.96

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2.2 Member Checks

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} \text{ or } A_c = \frac{2 * A_g * f_y}{\gamma_{m0}}$ $= \frac{2 * 1100.0 * 250}{1.1}$ $= 500.0$	
Tension Rupture Capacity (kN)		$\beta = 1.4 - 0.076 * \frac{w}{t} * \frac{f_y}{0.9 * f_u} * \frac{b_s}{L_c}$ $\leq \frac{0.9 * f_u * \gamma_{m0}}{f_y * \gamma_{m1}} \geq 0.7$ $= 1.4 - 0.076 * \frac{60.0}{10.0} * \frac{250}{0.9 * 410} * \frac{60.0}{241}$ $\leq \frac{0.9 * 410 * 1.1}{250 * 1.25} \geq 0.7$ $= 1.32$ $T_{dn} = 2 * \left(\frac{0.9 * A_{nc} * f_u}{\gamma_{m1}} + \frac{\beta * A_{go} * f_y}{\gamma_{m0}} \right)$ $= 2 * \left(\frac{0.9 * 500.0 * 410}{1.25} + \frac{1.32 * 600.0 * 250}{1.1} \right)$ $= 655.2$	
Tension Capacity (kN)	500.0	$T_d = \min(T_{dg}, T_{dn})$ $= \min(500.0, 655.2)$ $= 500.0$	Pass
Slenderness	$\frac{K * L}{r} \leq 400$	$\frac{K * L}{r} = \frac{1 * 5000.0}{17.96}$ $= 278.32$	Pass
Utilization Ratio	$Utilization \ Ratio \leq 1$	$Utilization \ Ratio = \frac{F}{T_d} = \frac{500.0}{500.0}$ $= 1.0$	
Axial Load Considered (kN)	$A_{cmin} = 0.3 * A_c$ $= 0.3 * 500.0$ $= 150.0$ $A_{cmax} = 500.0$	$A = 500.0$	Pass

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2.3 Thickness Checks

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)	500.0	$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{1 * 200.0 * 40.0 * 250}{1.1}$ $= 545.45$	Pass

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2.4 Weld Checks

Check	Required	Provided	Remarks
Min Weld Size (mm)	$t_{w_{min}}$ based on thinner part $= 10 \text{ or } 7$ <i>IS800 : 2007 cl.10.5.2.3 Table21</i> $t_{w_{min}}$ based on thicker part $= 10$	10	Pass
Max Weld Size (mm)	<i>Thickness of Thinner part</i> $= \min(40.0, 10.0) = 10.0$ $t_{w_{max}} = 10$	10	Pass
Throat Thickness (mm)	$t_t \geq 3$	$t_t = 0.7 * t_w$ $= 0.7 * 10$ $t_t = 7.0$	Pass
Effective length (mm)		$l_w = 964.0$	
Weld Strength (kN/mm)	$R_w = \sqrt{(T_{wh} + A_{wh})^2 + (T_{wv} + V_{wv})^2}$ $T_{wh} = \frac{M * y_{max}}{I_{pw}} = \frac{0.0 * 0.0}{1.0}$ $T_{wv} = \frac{M * x_{max}}{I_{pw}} = \frac{0.0 * 0.0}{1.0}$ $V_{wv} = \frac{V}{l_w} = \frac{0.0}{964.0}$ $A_{wh} = \frac{A}{l_w} = \frac{500000.0}{964.0}$ $R_w = \sqrt{(0.0 + 518.67)^2 + (0.0 + 0.0)^2}$ $= 518.67$	$f_w = \frac{t_t * f_u}{\sqrt{3} * \gamma_{mw}}$ $= \frac{7.0 * 410}{\sqrt{3} * 1.25}$ $= 1325.6$	Pass

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2.5 Gusset Plate Checks

Check	Required	Provided	Remarks
Min.Height (mm)		$H = 1 * Depth + clearance$ $= (1 * 200.0) + 40$ $= 100.0$	
Min.Length (mm)	5000.0	$L = Flangeweld + clearance$ $= 221 + 40$ $= 261$	Pass
Thickness (mm)		$t_p = 40.0$	
Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{1 * 200.0 * 40.0 * 250}{1.1}$ $= 545.45$	
Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{1 * 0.9 * 200.0 * 40.0 * 410}{1.25}$ $= 708.48$	
Block Shear Capacity (kN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3} \gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3} \gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = \min(T_{db1}, T_{db2}) = 2209.56$	
Tension Capacity (kN)	$A = 500.0$	$T_d = \min(T_{dg}, T_{dn}, T_{db})$ $= \min(545.45, 708.48, 2209.56)$ $= 545.45$	Pass

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2.6 Intermittent Connection

Check	Required	Provided	Remarks
Connection (nos)		4	
Spacing (mm)	1000	895.6	Pass
Min.Height (mm)		100	
Min.Length (mm)		50	

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3 3D View

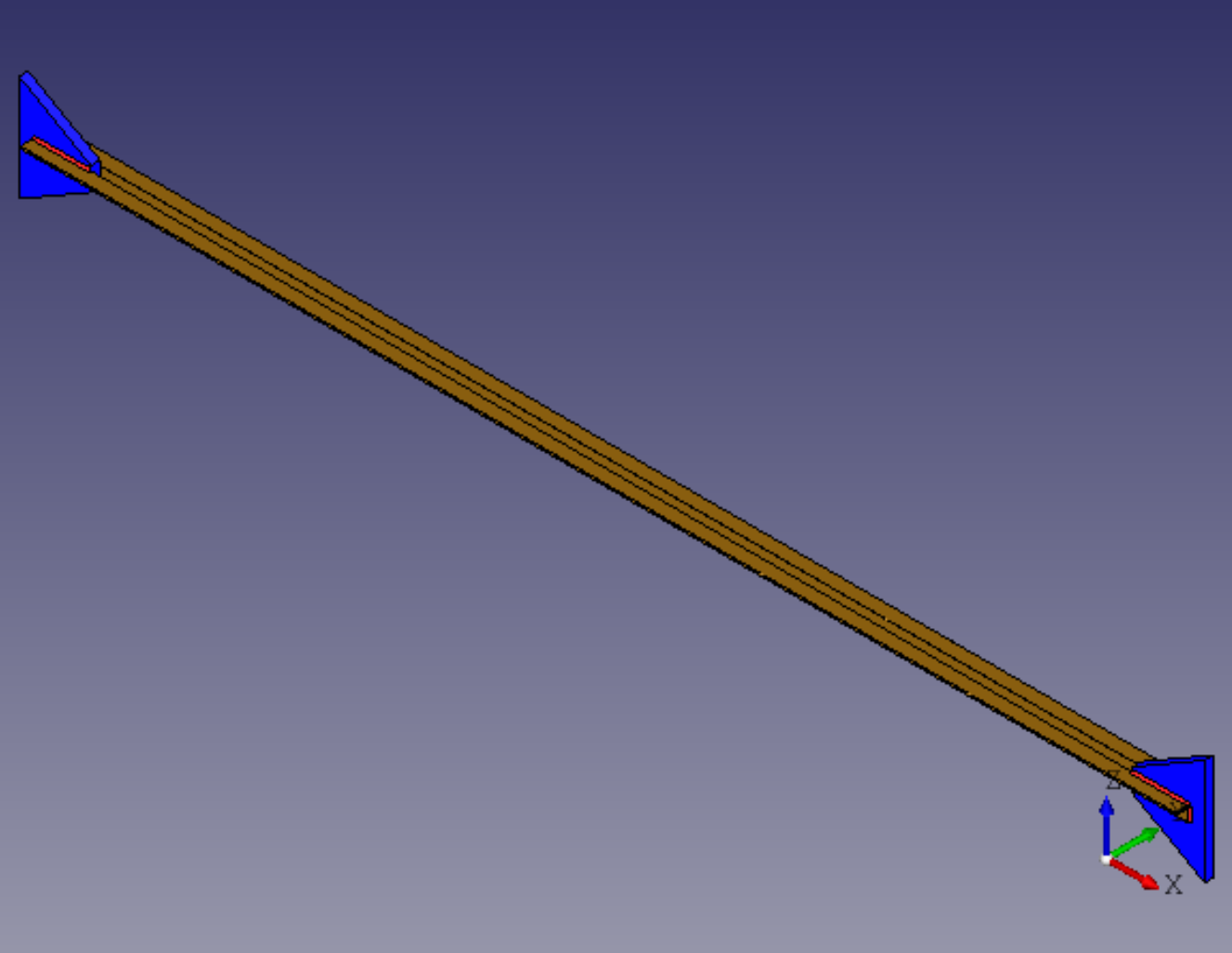


Figure 1: 3D View