



Company Name	IIT Bombay	Project Title	Sample Member Design
Group/Team Name	Osdag	Subtitle	Tension Member Welded
Designer	Engineer #1	Job Number	2.2.5
Date	18 /12 /2020	Client	Manas M. Ghosh, INSDAG, Kolkata

1 Input Parameters

Module	Tension Member Welded
Axial Force (kN)	500.0
Length (mm) *	3000.0
Section Profile*	Back to Back Channels
Section Size*	Ref List of Input Section
Plate Details - Input and Design Preference	
Thickness (mm)	[16, 18, 20]
Material	E 250 (Fe 410 W)A
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)	440.0

1.1 List of Input Section

Section Size*	'MC 75', 'MC 125', 'MC 125*', 'MC 150', 'MC 150*', 'MC 175', 'MC 175*', 'MC 200', 'MC 200*', 'MC 225', 'MC 225*', 'MC 250', 'MC 250*', 'MC 250*', 'MC 300', 'MC 300*', 'MC 300*', 'MC 350', 'MC 400', 'JC 100', 'JC 125', 'JC 150', 'JC 175', 'JC 200', 'LC 75', 'LC 100', 'LC 125', 'LC (P) 125', 'LC 150', 'LC (P) 150', 'LC 175', 'LC 200', 'LC (P) 200', 'LC 225', 'LC 250', 'LC 300', 'LC (P) 300', 'LC 350', 'LC 400', 'MPC 75', 'MPC 125', 'MPC 125*', 'MPC 150', 'MPC 150*', 'MPC 175', 'MPC 175*', 'MPC 200', 'MPC 200*', 'MPC 225', 'MPC 225*', 'MPC 250', 'MPC 250*', 'MPC 250*', 'MPC 300', 'MPC 300*', 'MPC 300*', 'MPC 350', 'MPC 400'
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2 Design Checks

Design Status	Pass
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2.1 Selected Member Data

		Section Size*		('JC 125', 'Back to Back Channels')	
		Material		E 300 (Fe 440)	
		Mass, m (kg/m)		15.8	
		Area, A (cm ²)		2000.0	
		D (mm)	125	I_y (cm ⁴)	103.99
		B (mm)	50	r_z (cm)	5.19
		t (mm)	3.0	r_y (cm)	2.28
		T (mm)	6.6	Z_z (cm ³)	86.08
		T_p (mm)	18.0	Z_y (cm ³)	20.8
		Flange Slope	91.5	Z_{pz} (cm ³)	96.89
		R_1 (mm)	6.0	Z_{py} (cm ³)	34.2
		R_2 (mm)	2.4	Radius of gyration, r (cm)	22.8
		I_z (cm ⁴)	538.0		

2.2 Member Check

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{A_g f_y}{\gamma_{mo}}$ $= \frac{1000.0 \times 300}{1.1 \times 10^3}$ $= 545.45$ <p>[Ref. IS 800 : 2007, Cl. 6.2]</p>	



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Check	Required	Provided	Remarks
Tension Rupture Capacity (kN)		$\beta = 1.4 - 0.076 \times \frac{w}{t} \times \frac{f_y}{0.9f_u} \times \frac{b_s}{L_c}$ $\leq \frac{0.9 f_u \gamma_{m0}}{f_y \gamma_{m1}} \geq 0.7$ $= 1.4 - 0.076 \times \frac{50}{3.0} \times \frac{300}{0.9 \times 440} \times \frac{50}{177}$ $\leq \frac{0.9 \times 440 \times 1.1}{300 \times 1.25} \geq 0.7$ $= 1.13$ $T_{dn} = 2 \times \left(\frac{0.9 A_{nc} f_u}{\gamma_{m1}} + \frac{\beta A_{go} f_y}{\gamma_{m0}} \right)$ $= 2 \times \left(\frac{0.9 \times 335.4 \times 440}{1.25} + \frac{1.13 \times 660.0 \times 300}{1.1} \right)$ $= 619.31$ <p>[Ref. IS 800 : 2007, Cl. 6.3.3]</p>	
Tension Capacity (kN)	500.0	$T_d = \min(T_{dg}, T_{dn})$ $= \min(545.45, 619.31)$ $= 545.45$ <p>[Ref. IS 800 : 2007, Cl. 6.1]</p>	Pass
Slenderness	$\frac{KL}{r} \leq 400$	$\frac{KL}{r} = \frac{1 \times 3000.0}{22.8}$ $= 131.58$ <p>[Ref. IS 800 : 2007, Cl. 7.1.2]</p>	Pass
Utilization Ratio	≤ 1	$Utilization Ratio = \frac{F}{T_d} = \frac{500.0}{545.45}$ $= 0.92$	



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Check	Required	Provided	Remarks
Axial Load Considered (kN)	$A_{c_{min}} = 0.3A_c$ $= 0.3 \times 545.45$ $= 163.64$ $A_{c_{max}} = 545.45$ [Ref. IS 800 : 2007, Cl. 10.7]	$A = 500.0$	Pass

2.3 Weld Design

Check	Required	Provided	Remarks
Min. Weld Size (mm)	$t_{w_{min}}$ based on thinner part $= 3 \text{ or } 2$ s_{min} based on thicker part = 5 [Ref IS 800 : 2007, Table 21 (Cl. 10.5.2.3)]	3	Pass
Max. Weld Size (mm)	$\text{Thickness of thinner part}$ $= \min(18.0, 3.0) = 3.0$ $s_{max} = 16.0$ [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)		$l_w = 886$	



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Check	Required	Provided	Remarks
Weld Strength (N/mm)	$R_w = \sqrt{(A_{wh})^2 + (V_{wv})^2}$ $V_{wv} = \frac{V}{l_w} = \frac{0.0}{886}$ $A_{wh} = \frac{A}{l_w} = \frac{500000.0}{886}$ $R_w = \sqrt{(564.33)^2 + (0.0)^2}$ $= 564.33$	$f_w = \frac{t_t f_u}{\sqrt{3} \gamma_{mw}}$ $= \frac{3 \times 410}{\sqrt{3} \times 1.25}$ $= 568.11$ <p>[Ref. IS 800 : 2007, Cl. 10.5.7.1.1]</p>	Pass
Weld Strength (post long joint) (N/mm)	<p>if $l \geq 150t_t$ then $V_{rd} = \beta_{lw} V_{db}$</p> <p>if $l < 150t_t$ then $V_{rd} = V_{db}$</p> <p>where,</p> <p>$l = pt.length \text{ or } pt.height$</p> $\beta_{lw} = 1.2 - \frac{(0.2l)}{(150t_t)}$ <p>but $0.6 \leq \beta_{lw} \leq 1.0$</p> <p>[Ref. IS 800 : 2007, Cl. 10.5.7.3]</p>	<p>$l = pt.length \text{ or } pt.height$</p> <p>$l_t = \max(155, 192)$</p> <p>$= 192$</p> <p>$150t_t = 150 \times 3 = 450$</p> <p>since, $l < 150t_t$</p> <p>then $f_{wrd} = f_w$</p> <p>$f_{wrd} = 568.11$</p> <p>[Ref. IS 800 : 2007, Cl. 10.5.7.3]</p>	
Weld Strength (N/mm)	564.33	568.11	Pass

2.4 Gusset Plate Check

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)	500.0	$T_{dg} = \frac{A_g f_y}{\gamma_{mo}}$ $A_g = l \times t = 400 \times 18.0$ $= \frac{7200.0 \times 250}{1.1 \times 10^3}$ $= 511.36$ <p>[Ref. IS 800 : 2007, Cl. 6.2]</p>	Pass



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Check	Required	Provided	Remarks
Min.Height (mm)		$H = 1 \times \text{Depth} + \text{clearance}$ $= (1 \times 400) + 30$ $= 155$	
Min.Plate Length (mm)		$L = \text{Flangeweld} + \text{clearance}$ $= 162 + 30$ $= 192$	Pass
Min.Member Length (mm)	384	3000.0	Pass
Thickness (mm)		$T_p = 18.0$	
Weld Strength (N/mm)	$R_w = \sqrt{(A_{wh})^2 + (V_{wv})^2}$ $V_{wv} = \frac{V}{l_w} = \frac{0.0}{886}$ $A_{wh} = \frac{A}{l_w} = \frac{500000.0}{886}$ $R_w = \sqrt{(564.33)^2 + (0.0)^2}$ $= 564.33$	$f_w = \frac{t_t f_u}{\sqrt{3} \gamma_{mw}}$ $= \frac{3 \times 410}{\sqrt{3} \times 1.25}$ $= 568.11$ [Ref. IS 800 : 2007, Cl. 10.5.7.1.1]	Pass
Block Shear Capacity (kN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3} \gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 A_{vn} f_u}{\sqrt{3} \gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = \min(T_{db1}, T_{db2}) = 1115.73$ [Ref. IS 800 : 2007, Cl. 6.4]	
Tension Capacity (kN)	$A = 500.0$	$T_d = \min(T_{dg}, T_{db})$ $= \min(511.36, 1115.73)$ $= 511.36$ [Ref. IS 800 : 2007, Cl. 6.1]	Pass



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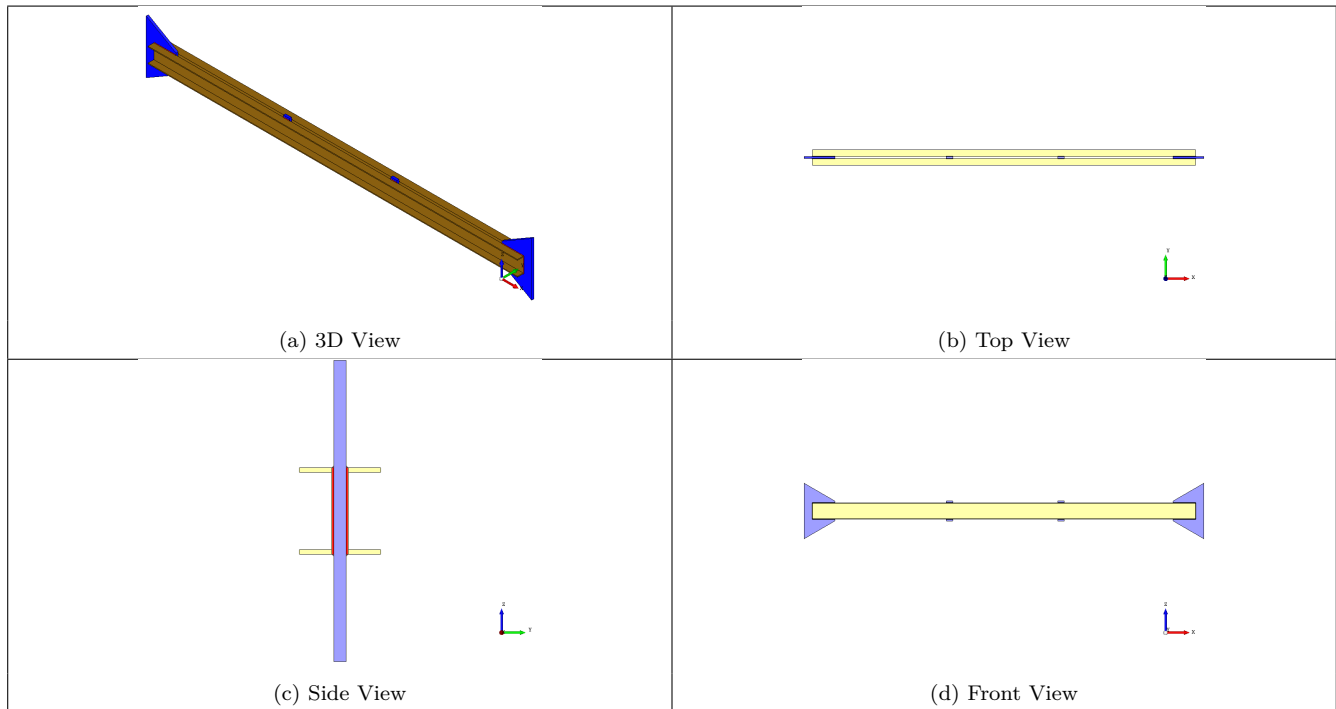
2.5 Intermittent Connection

Check	Required	Provided	Remarks
Connection (nos)		2	
Spacing (mm)	1000	872.0	Pass
Min.Height (mm)		155	
Min.Plate Length (mm)		50	



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3 3D Views



4 Design Log

02:10:22 - osdag - INFO - :In the case of reverse loading, slenderness value shall be less than 180 [Ref. Table 3, IS 800:2007].

02:10:22 - osdag - INFO - :In the case of reverse loading for double sections, spacing of the intermittent connection shall be less than 600 [Ref. Cl. 10.2.5.5, IS 800:2007].

02:10:22 - osdag - INFO - Preheating of thicker plate is required (IS 800:2007 Table 21).

02:10:22 - osdag - INFO - :Overall welded tension member design is safe.