1 Input Parameters

Module	Tension Member Welded
Axial Force (kN)	240.0
Length (mm) *	3200.0
Section Profile*	Channels
Section Size*	Ref List of Input Section
Plate Details - Input and Design Preference	
Thickness (mm)	[14]
Material	E 250 (Fe 410 W)A
Ultimate Strength, Fu (MPa)	410
Yield Strength, Fy (MPa)	250
Weld Details - Input and Design Preference	
Weld Type	Fillet
Type of Weld Fabrication	Field weld
Material Grade Overwrite, f_u (MPa)	410.0

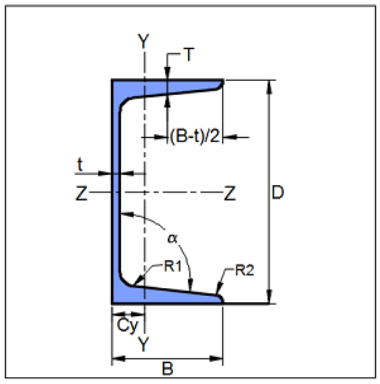
1.1 List of Input Section

Section Size*	'MC 250'

2 Design Checks

Design Status	Pass

2.1 Selected Member Data



Section Size*		('MC 250', 'Channels')	
Material		E 250 (Fe 410 W)A	
Mass, m (kg/m)		30.6	
Area, A (cm^2)		3890.0	
D (mm)	250	I_y(cm^4)	218.0
B (mm)	80	r_z (cm)	9.92
t (mm)	7.2	r_y (cm)	2.37
T (mm)	14.1	Z_z (cm^3)	306.0
Flange Slope	96	Z_y (cm^3)	38.2
R_1 (mm)	12.0	Z_{pz} (cm^3)	358.0
R_2 (mm)	3.2	Z_{py} (cm^3)	38.2
C_y (mm)	23.0	Radius of gyration, r (cm)	23.7
I_z (cm^4)	3820.0		

2.2 Member Check

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{A_g f_y}{\gamma_{mo}}$ $= \frac{3890.0 \times 250}{1.1 \times 10^3}$ $= 884.09$ [$Ref.$ IS 800 : 2007, $Cl.$ 6.2]	

Company Name	IIT Bombay	Project Title	Sample Member Design
Group/Team Name	Osdag	Subtitle	Tension Member Welded
Designer	Engineer #1	Job Number	2.2.4
Date	18 /12 /2020	Client	Somnath Mukherjee, MN Dastur, Kolkata

Check	Required	Provided	Remarks
Tension Rupture Capacity (kN)		$\beta = 1.4 - 0.076 \times \frac{w}{t} \times \frac{f_y}{0.9 f_u} \times \frac{b_s}{L_c}$ $\leq \frac{0.9\ f_u\ \gamma_{m0}}{f_y\ \gamma_{m1}} \geq 0.7$ $= 1.4 - 0.076 \times \frac{80}{7.2} \times \frac{250}{0.9 \times 410} \times \frac{80}{138}$ $\leq \frac{0.9 \times 410 \times 1.1}{250 \times 1.25} \geq 0.7$ $= 1.07$ $T_{dn} = 1 \times (\frac{0.9 A_{nc} f_u}{\gamma_{m1}} + \frac{\beta A_{go} f_y}{\gamma_{m0}})$ $= 1 \times (\frac{0.9 \times 1596.96 \times 410}{1.25} + \frac{1.07 \times 2256.0 \times 250}{1.1})$ $= 1020.04$ [$Ref.\ IS\ 800:2007,\ Cl.\ 6.3.3$]	
Tension Capacity (kN)	240.0	$T_d = min(T_{dg}, T_{dn})$ $= min(884.09, 1020.04)$ $= 884.09$ [$Ref.\ IS\ 800:2007,\ Cl.\ 6.1$]	**Pass**
Slenderness	$\frac{KL}{r} \leq 400$	$\frac{KL}{r} = \frac{1 \times 3200.0}{23.7}$ $= 135.02$ [$Ref.\ IS\ 800:2007,\ Cl.\ 7.1.2$]	**Pass**
Utilization Ratio	≤ 1	$Utilization\ Ratio = \frac{F}{T_d} = \frac{240.0}{884.09}$ $= 0.27$	

Check	Required	Provided	Remarks
Axial Load Considered (kN)	$Ac_{min} = 0.3A_c$ $= 0.3 \times 884.09$ $= 265.23$ $Ac_{max} = 884.09$ [$Ref.\ IS\ 800:2007,\ Cl.\ 10.7$]	$A = 265.23$	**Pass**

2.3 Weld Design

Check	Required	Provided	Remarks
Min. Weld Size (mm)	$t_{w_{min}}$ *based on thinner part* $= 7$ *or* 5 s_{min} *based on thicker part* $= 5$ [$Ref\ IS\ 800:2007, Table\ 21\ (Cl 10.5.2.3)$]	5	**Pass**
Max. Weld Size (mm)	*Thickness of thinner part* $= min(14.0, 7.2) = 7.2$ $s_{max} = 16.0$ [$Ref.\ IS\ 800:2007,\ Cl.\ 10.5.3.1$]	5	**Pass**
Throat Thickness (mm)	$t_t \geq 3$ [$Ref.\ IS\ 800:2007,\ Cl.\ 10.5.3.1$]	$t_t = 0.7t_w$ $= 0.7 \times 5$ $= 3.5$ [$Ref.\ IS\ 800:2007,\ Cl.\ 10.5.3.1$]	**Pass**
Effective Length (mm)		$l_w = 486$	

Check	Required	Provided	Remarks
Weld Strength (N/mm)	$R_w = \sqrt{(A_{wh})^2 + (V_{wv})^2}$ $V_{wv} = \frac{V}{l_w} = \frac{0.0}{486}$ $A_{wh} = \frac{A}{l_w} = \frac{265227.273}{486}$ $R_w = \sqrt{(545.74)^2 + (0.0)^2}$ $= 545.74$	$f_w = \frac{t_t \ f_u}{\sqrt{3} \ \gamma_{mw}}$ $= \frac{3.5 \times 410}{\sqrt{3} \times 1.5}$ $= 552.33$ $[Ref.\ IS\ 800 : 2007,\ Cl.\ 10.5.7.1.1]$	**Pass**
Weld Strength (post long joint) (N/mm)	$if\ l \geq 150t_t\ then\ V_{rd} = \beta_{l_w} V_{db}$ $if\ l < 150t_t\ then\ V_{rd} = V_{db}$ $where,$ $l\ = pt.length\ or\ pt.height$ $\beta_{l_w} = 1.2 - \frac{(0.2l)}{(150t_t)}$ $but\ 0.6 \leq \beta_{l_w} \leq 1.0$ $[Ref.\ IS\ 800 : 2007,\ Cl.\ 10.5.7.3]$	$l\ = pt.length\ or\ pt.height$ $l_l = max(280, 153)$ $= 280$ $150t_t = 150 \times 3.5 = 525.0$ $since,\ l < 150t_t$ $then\ f_{wrd} = f_w$ $f_{wrd} = 552.33$ $[Ref.\ IS\ 800 : 2007,\ Cl.\ 10.5.7.3]$	
Weld Strength (N/mm)	545.74	552.33	**Pass**

2.4 Gusset Plate Check

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)	265.23	$T_{dg} = \frac{A_g f_y}{\gamma_{mo}}$ $A_g = l \times t = 250 \times 14.0$ $= \frac{3500.0 \times 250}{1.1 \times 10^3}$ $= 795.45$ $[Ref.\ IS\ 800 : 2007,\ Cl.\ 6.2]$	**Pass**

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Group/Team Name	Osdag	Subtitle	Tension Member Welded
Designer	Engineer #1	Job Number	2.2.4
Date	18 /12 /2020	Client	Somnath Mukherjee, MN Dastur, Kolkata

Check	Required	Provided	Remarks
Min.Height (mm)		$H = 1 \times Depth + clearance$ $= (1 \times 250) + 30$ $= 280$	
Min.Plate Length (mm)		$L = Flangeweld + clearance$ $= 123 + 30$ $= 153$	**Pass**
Min.Member Length (mm)	306	3200.0	**Pass**
Thickness (mm)		$T_p = 14.0$	
Weld Strength (N/mm)	$R_w = \sqrt{(A_{wh})^2 + (V_{wv})^2}$ $V_{wv} = \frac{V}{l_w} = \frac{0.0}{486}$ $A_{wh} = \frac{A}{l_w} = \frac{265227.273}{486}$ $R_w = \sqrt{(545.74)^2 + (0.0)^2}$ $= 545.74$	$f_w = \frac{t_t \ f_u}{\sqrt{3} \ \gamma_{mw}}$ $= \frac{3.5 \times 410}{\sqrt{3} \times 1.5}$ $= 552.33$ $[Ref.\ IS\ 800 : 2007,\ Cl.\ 10.5.7.1.1]$	**Pass**
Block Shear Capacity (kN)		$T_{dbl1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{dbl2} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 1172.46$ $[Ref.\ IS\ 800 : 2007,\ Cl.\ 6.4]$	
Tension Capacity (kN)	$A = 265.23$	$T_d = min(T_{dg}, T_{db})$ $= min(795.45, 1172.46)$ $= 795.45$ $[Ref.\ IS\ 800 : 2007,\ Cl.\ 6.1]$	**Pass**

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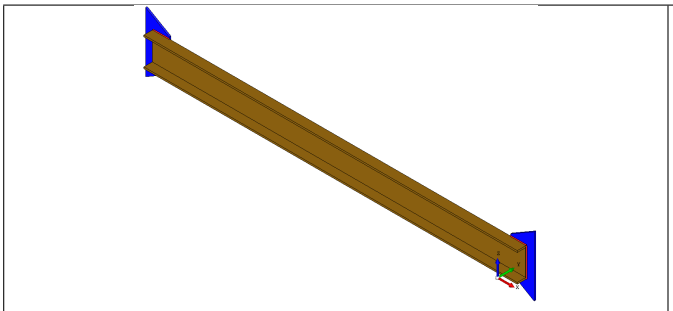
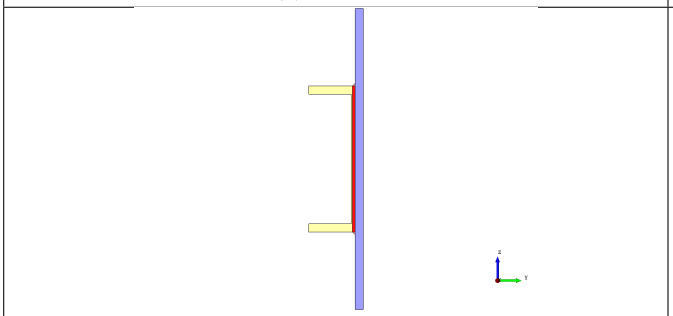
3 3D Views



(a) 3D View

(b) Top View



(c) Side View

(d) Front View

4 Design Log

02:08:59 - osdag - INFO - :In the case of reverse loading, slenderness value shall be less than 180 [Ref. Table 3, IS 800:2007].
02:08:59 - osdag - INFO - :The minimum design force based on the member size is used for performing the connection design, i.e. 265.23 kN [Ref. Cl. 10.7, IS 800:2007].
02:08:59 - 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)).
02:08:59 - osdag - INFO - :Overall welded tension member design is safe.