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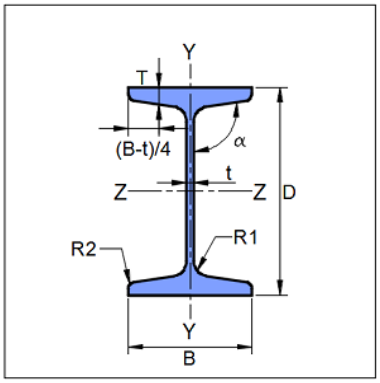
1 Input Parameters

Module			Column-to-Column Cover Plate Bolted Connection	
Main Module			Moment Connection	
Bending Moment (kNm) *			23.0	
Shear Force (kN) *			23.0	
Axial Force (kN)			23.0	
Column Section - Mechanical Properties				
	Beam Section *		HB 225*	
	Material *		E 450 (Fe 590) E	
	Ultimate Strength, F_u (MPa)		590	
	Yield Strength, F_y (MPa)		450	
	Mass, m (kg/m)	46.52	I_z (cm^4)	5430.0
	Area, A (cm^2)	59.2	I_y(cm^4)	1360.0
	D (mm)	225.0	r_z (cm)	9.57
	B (mm)	225.0	r_y (cm)	4.79
	t (mm)	8.6	Z_z (cm^3)	483.0
	T (mm)	9.1	Z_y (cm^3)	121.0
	Flange Slope	94	Z_{pz} (cm^3)	538.0
	R_1 (mm)	10.0	Z_{py} (cm^3)	203.0
	R_2 (mm)	5.0		
Bolt Details - Input and Design Preference				
Diameter (mm) *			[8, 10, 12, 14, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 42, 45, 48, 52, 56, 60, 64]	
Property Class *			[3.6, 4.6, 4.8, 5.6, 5.8, 6.8, 8.8, 9.8, 10.9, 12.9]	
Type *			Bearing Bolt	
Bolt Tension			Non pre-tensioned	
Hole Type			Standard	
Slip Factor, (μ_f)			0.3	
Detailing - Design Preference				
Edge Preparation Method			Sheared or hand flame cut	
Gap Between Columns (mm)			3.0	
Are the Members Exposed to Corrosive Influences?			False	
Plate Details - Input and Design Preference				

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Preference *	Outside
Material *	E 450 (Fe 590) E
Ultimate Strength, F_u (MPa)	590
Yield Strength, F_y (MPa)	450
Thickness (mm) *	[8, 10, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 75, 80, 90, 100, 110, 120]

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2 Design Checks

Design Status	Pass

2.1 Member Capacity

Check	Required	Provided	Remarks
Section Classification		**Semi-Compact** [Ref: Table 2, Cl.3.7.2 and 3.7.4, IS 800:2007]	
Axial Capacity Member (kN)	$P_x = 23.0$	$T_{dg} = \frac{A_g f_y}{\gamma_{m0}}$ $= \frac{5920.0 \times 450}{1.1 \times 10^3}$ $= 2421.82$ [Ref. IS 800:2007, Cl.6.2]	
Shear Capacity Member (kN)		$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{206.8 \times 8.6 \times 450}{\sqrt{3} \times 1.1 \times 1000}$ $= 420.06$ [Ref. IS 800:2007, Cl.10.4.3]	
Allowable Shear Capacity (kN)	$V_y = 23.0$	$V_d = 0.6\ V_{dy}$ $= 0.6 \times 420.06$ $= 252.03$ [Limited to low shear]	Pass
Plastic Moment Capacity (kNm)		$M_{d_z} = \frac{\beta_b Z_p fy}{\gamma_{m0}}$ $= \frac{0.9 \times 538000.0 \times 450}{1.1 \times 10^6}$ $= 197.59$ [Ref. IS 800:2007, Cl.8.2.1.2]	

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Check	Required	Provided	Remarks
Moment Deformation Criteria (kNm)		$M_{dc} = \frac{1.5 Z_e f y}{\gamma_{m0} \times 10^6}$ $= \frac{1.5 \times 483000.0 \times 450}{1.1 \times 10^6}$ $= 296.39$ [Ref. IS 800:2007, Cl.8.2.1.2]	
Moment Capacity Member (kNm)	$M_z = 23.0$	$M_{dz} = \min(M_{dz},\ M_{dc})$ $= \min(197.59, 296.39)$ $= 197.59$ [Ref. IS 800:2007, Cl.8.2]	

2.2 Load Consideration

Check	Required	Provided	Remarks
Interaction Ratio		I.R. axial $= P_x/T_{dg}$ $= 23.0/2421.82$ $= 0.0095$ I.R. moment $= M_z/M_{dz}$ $= 23.0/197.59$ $= 0.1164$ I.R. sum $=$ I.R. axial + I.R. moment $= 0.0095 + 0.1164$ $= 0.1259$	

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Check	Required	Provided	Remarks
Minimum Required Load	if I.R. axial < 0.3 and I.R. moment < 0.5 $P_{\text{xmin}} = 0.3T_{\text{dg}}$ $M_{\text{zmin}} = 0.5M_{d_{\text{z}}}$ elif sum I.R. $<= 1.0$ and I.R. moment < 0.5 if $(0.5 - \text{I.R. moment}) < (1 - \text{sum I.R.})$ $M_{\text{zmin}} = 0.5 \times M_{d_{\text{z}}}$ else $M_{\text{zmin}} = M_{\text{z}} + ((1 - \text{sum I.R.}) \times M_{d_{\text{z}}})$ $P_{\text{xmin}} = P_{\text{x}}$ elif sum I.R. $<= 1.0$ and I.R. axial < 0.3 if $(0.3 - \text{I.R. axial}) < (1 - \text{sum I.R.})$ $P_{\text{xmin}} = 0.3T_{\text{dg}}$ else $P_{\text{xmin}} = P_{\text{x}} + ((1 - \text{sum I.R.}) \times T_{\text{dg}})$ $M_{\text{zmin}} = M_{\text{z}}$ else $P_{\text{xmin}} = P_{\text{x}}$ $M_{\text{zmin}} = M_{\text{z}}$ Note: AL is the user input for load	$M_{\text{zmin}} = 98.8$ $P_{\text{xmin}} = 726.55$ [Ref. IS 800:2007, Cl.10.7]	
Applied Axial Force (kN)	$P_x = 23.0$	$P_u = \max(P_{\text{x}},\ P_{\text{xmin}})$ $= \max(23.0, 726.55)$ $= 726.55$	

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Check	Required	Provided	Remarks
Applied Shear Force (kN)	$V_y = 23.0$	$V_{y_{\min}} = \min(0.15V_{d_y},\ 40.0)$ $= \min(0.15 \times 420.06,\ 40.0)$ $= 40.0$ $V_u = \max(V_y,\ V_{y_{\min}})$ $= \max(23.0, 40.0)$ $= 40.0$ [Ref. IS 800:2007, Cl.10.7]	
Applied Moment (kNm)	$M_z = 23.0$	$M_u = \max(M_z,\ M_{z\min})$ $= \max(23.0,\ 98.8)$ $= 98.8$ [Ref. IS 800:2007, Cl.8.2.1.2]	
Force Carried by Web		$A_w =$ Axial force in web $= \frac{(D-2T)tAu}{A}$ $= \frac{(225.0 - 2 \times 9.1) \times 8.6 \times 726.55}{5920.0}$ $= 218.27$ kN $M_w =$ Moment in web $= \frac{Z_w Mu}{Z}$ $= \frac{61298.28 \times 98.8}{538000.0}$ $= 11.26$ kNm	

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Check	Required	Provided	Remarks
Force Carried by Flange		A_f = Axial force in flange $= \frac{AuBT}{A}$ $= \frac{726.55 \times 225.0 \times 9.1}{5920.0}$ $= 251.28$ kN M_f = Moment in flange $= Mu - M_w$ $= 98.8 - 11.26$ $= 87.54$ kNm F_f = flange force $= \frac{M_f \times 10^3}{D - T} + A_f$ $= \frac{87.54 \times 10^3}{225.0 - 9.1} + 251.28$ $= 656.74$ kN	

2.3 Flange Bolt Check

Check	Required	Provided	Remarks
Diameter (mm)	Bolt Quantity Optimisation	$d = 22.0$	
Property Class	Bolt Grade Optimisation	8.8	
Bolt Ultimate Strength (N/mm2)		$f_{ub} = 830.0$	
Bolt Yield Strength (N/mm2)		$f_{yb} = 660.0$	
Nominal Stress Area (mm2)		$A_{nb} = 303$ ($Ref\ IS\ 1367 - 3\ (2002)$)	
Hole Diameter (mm)		$d_0 = 24.0$	
Min. Plate Thickness (mm)	$T = 9.1$	$t_{fp} = 10.0$	**Pass**
No. of Bolt Columns		$n_c = 2$	
No. of Bolt Rows		$n_r = 6$	

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Check	Required	Provided	Remarks
Min. Pitch Distance (mm)	$p_{min} = 2.5d$ $= 2.5 \times 22.0$ $= 55.0$ [Ref. IS 800:2007, Cl.10.2.2]	55	**Pass**
Max. Pitch Distance (mm)	$p/g_{max} = \min(32t,\ 300)$ $= \min(32 \times 9.1,\ 300)$ $= \min(291.2,\ 300)$ $= 291.2$ Where, $t = \min(10.0, 9.1)$ [Ref. IS 800:2007, Cl.10.2.3]	55	**Pass**
Min. Gauge Distance (mm)	$p_{min} = 2.5d$ $= 2.5 \times 22.0$ $= 55.0$ [Ref. IS 800:2007, Cl.10.2.2]	0	
Max. Gauge Distance (mm)	$p/g_{max} = \min(32t,\ 300)$ $= \min(32 \times 9.1,\ 300)$ $= \min(291.2,\ 300)$ $= 291.2$ Where, $t = \min(10.0, 9.1)$ [Ref. IS 800:2007, Cl.10.2.3]	0	
Min. End Distance (mm)	$e_{min} = 1.7d_0$ $= 1.7 \times 24.0$ $= 40.8$ [Ref. IS 800:2007, Cl.10.2.4.2]	45	**Pass**

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Check	Required	Provided	Remarks
Max. End Distance (mm)	$e_{max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 10.0 \times \sqrt{\frac{250}{450}} = 89.44$ $e_2 = 12 \times 9.1 \times \sqrt{\frac{250}{450}} = 81.39$ $e_{max} = \min(e_1,\ e_2) = 81.39$ [Ref. IS 800:2007, Cl.10.2.4.3]	45	**Pass**
Min. Edge Distance (mm)	$e_{min} = 1.7d_0$ $= 1.7 \times 24.0$ $= 40.8$ [Ref. IS 800:2007, Cl.10.2.4.2]	49.1	**Pass**
Max. Edge Distance (mm)	$e'_{max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 10.0 \times \sqrt{\frac{250}{450}} = 89.44$ $e_2 = 12 \times 9.1 \times \sqrt{\frac{250}{450}} = 81.39$ $e'_{max} = min(e_1,\ e_2) = 81.39$ [Ref. IS 800:2007, Cl.10.2.4.3]	49.1	**Pass**
Shear Capacity (kN)		$V_{dsb} = \frac{f_{ub} n_n A_{nb}}{\sqrt{3}\gamma_{mb}}$ $= \frac{830.0 \times 1 \times 303}{1000 \times \sqrt{3}\ \times\ 1.25}$ $= 116.16$ [Ref. IS 800:2007, Cl.10.3.3]	

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Check	Required	Provided	Remarks
Bearing Capacity (kN)		$V_{\text{dpb}} = \frac{2.5 k_b d t f_u}{\gamma_{mb}}$ $= \frac{2.5 \times 0.51 \times 22.0 \times 9.1 \times 590}{1000 \times 1.25}$ $= 120.48$ [Ref. IS 800:2007, Cl.10.3.4]	
Bolt Capacity (kN)		$V_{\text{db}} = \min\ (V_{\text{dsb}},\ V_{\text{dpb}})$ $= \min\ (116.16,\ 120.48)$ $= 116.16$ [Ref. IS 800:2007, Cl.10.3.2]	
Long Joint Reduction Factor	if $l_j \geq 15d$ then $V_{\text{rd}} = \beta_{lj} V_{\text{db}}$ if $l_j < 15d$ then $V_{\text{rd}} = V_{\text{db}}$ where, $l_j = ((nc \text{ or } nr) - 1) \times (p \text{ or } g)$ $\beta_{lj} = 1.075 - l/(200d)$ but $0.75 \leq \beta_{lj} \leq 1.0$ [Ref. IS 800:2007, Cl.10.3.3.1]	$l = ((n_c \text{ or } n_r) - 1) \times (p \text{ or } g)$ $l_c = 2 \times \left(\left(\frac{6}{2} - 1\right) \times 55 + 45\right) + 3.0$ $= 313.0$ $l_r = 2 \times \left(\left(\frac{2}{2} - 1\right) \times 0 + 49.1\right)$ $+ 10.0) + 8.6 = 126.8$ $l = 313.0$ $15d = 15 \times 22.0 = 330.0$ since, $l < 15d$ then $V_{\text{rd}} = V_{\text{db}}$ $V_{\text{rd}} = 116.16$ [Ref. IS 800:2007, Cl. 10.3.3.1]	

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Check	Required	Provided	Remarks
Large Grip Length Reduction Factor	if $l_g \geq 5d$, then $V_{rd} = \beta_{lg} V_{db}$ if $l_g < 5d$ then $V_{rd} = V_{db}$ $l_g \leq 8d$ where, $l_g = \Sigma(t_{ep} + t_{member})$ $\beta_{lg} = 8d/(3d + l_g)$ but $\beta_{lg} \leq \beta_{lj}$ [Ref. IS 800:2007, Cl.10.3.3.2]	$l_g = \Sigma\ (t_p + t_{member})$ $= 19.1$ $5d = 110.0$ $8d = 176.0$ since, $l_g < 5d$; $\beta_{lg} = 1.0$ [Ref. IS 800:2007, Cl.10.3.3.2]	
Capacity (kN)	$V_{res} = \frac{2\sqrt{V_u^2 + A_u^2}}{bolts_{req}}$ $= \frac{2 \times \sqrt{0.0^2 + 656.74^2}}{12}$ $= 109.46$	$V_{rd} = \beta_{lj}\beta_{lg} V_{db}$ $= 1.0 \times 1.0 \times 116.16$ $= 116.16$	**Pass**

2.4 Web Bolt Check

Check	Required	Provided	Remarks
Diameter (mm)	Bolt Quantity Optimisation	$d = 22.0$	
Property Class	Bolt Grade Optimisation	8.8	
Min. Plate Thickness (mm)	$t/2 = 4.3$	$t_{wp} = 8.0$	**Pass**
No. of Bolt Rows		$n_r = 6$	
No. of Bolt Columns		$n_c = 2$	
Min. Pitch Distance (mm)	$p_{min} = 2.5d$ $= 2.5 \times 22.0$ $= 55.0$ [Ref. IS 800:2007, Cl.10.2.2]	55	**Pass**

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Check	Required	Provided	Remarks
Max. Pitch Distance (mm)	$p/g_{max} = \min(32t,\ 300)$ $= \min(32 \times 8.0,\ 300)$ $= \min(256.0,\ 300)$ $= 256.0$ Where, $t = \min(8.0, 8.6)$ [Ref. IS 800:2007, Cl.10.2.3]	55	**Pass**
Min. Gauge Distance (mm)	$p_{min} = 2.5d$ $= 2.5 \times 22.0$ $= 55.0$ [Ref. IS 800:2007, Cl.10.2.2]	55	**Pass**
Max. Gauge Distance (mm)	$p/g_{max} = \min(32t,\ 300)$ $= \min(32 \times 8.0,\ 300)$ $= \min(256.0,\ 300)$ $= 256.0$ Where, $t = \min(8.0, 8.6)$ [Ref. IS 800:2007, Cl.10.2.3]	55	**Pass**
Min. End Distance (mm)	$e_{min} = 1.7d_0$ $= 1.7 \times 24.0$ $= 40.8$ [Ref. IS 800:2007, Cl.10.2.4.2]	45	**Pass**

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Check	Required	Provided	Remarks
Max. End Distance (mm)	$e_{max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 16.0 \times \sqrt{\frac{250}{450}} = 143.11$ $e_2 = 12 \times 8.6 \times \sqrt{\frac{250}{450}} = 76.92$ $e_{max} = \min(e_1,\ e_2) = 76.92$ [Ref. IS 800:2007, Cl.10.2.4.3]	45	**Pass**
Min. Edge Distance (mm)	$e_{min} = 1.7d_0$ $= 1.7 \times 24.0$ $= 40.8$ [Ref. IS 800:2007, Cl.10.2.4.2]	45	**Pass**
Max. Edge Distance (mm)	$e'_{max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 16.0 \times \sqrt{\frac{250}{450}} = 143.11$ $e_2 = 12 \times 8.6 \times \sqrt{\frac{250}{450}} = 76.92$ $e'_{max} = min(e_1,\ e_2) = 76.92$ [Ref. IS 800:2007, Cl.10.2.4.3]	45	**Pass**
Shear Capacity (kN)		$V_{dsb} = \frac{f_{ub} n_n A_{nb}}{\sqrt{3}\gamma_{mb}}$ $= \frac{830.0 \times 2 \times 303}{1000 \times \sqrt{3}\ \times\ 1.25}$ $= 232.32$ [Ref. IS 800:2007, Cl.10.3.3]	

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Check	Required	Provided	Remarks
Bearing Capacity (kN)		$V_{dpb} = \frac{2.5 k_b d t f_u}{\gamma_{mb}}$ $= \frac{2.5 \times 0.51 \times 22.0 \times 8.6 \times 590}{1000 \times 1.25}$ $= 113.86$ [Ref. IS 800:2007, Cl.10.3.4]	
Bolt Capacity (kN)		$V_{db} = \min(V_{dsb},\ V_{dpb})$ $= \min(232.32,\ 113.86)$ $= 113.86$ [Ref. IS 800:2007, Cl.10.3.2]	
Bolt Force Parameter(s) (mm)	l_n = length available $l_n = g\ (n_c - 1)$ $= 55 \times (2 - 1)$ $= 313.0$ $y_{max} = l_n/2$ $= 313.0/2$ $= 27.5$ $x_{max} = p(\frac{n_r}{2} - 1)/2$ $= 55 \times (\frac{6}{2} - 1)/2$ $= 55.0$		
Moment Demand (kNm)	$M_d = (V_u \times \text{ecc} + M_w)$ ecc = eccentricity M_w = external moment acting on web $= \frac{(40.0 \times 10^3 \times 101.5 + 11.26 \times 10^6)}{10^6}$ $= 15.32$		

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Check	Required	Provided	Remarks
Bolt Force (kN)	$vbv = V_u/((n_r/2) \times n_c)$ $= \frac{40.0}{(2 \times (6/2))}$ $= 6.67$ $tmh = \frac{M_d \times y_{\max}}{\Sigma r_i^2}$ $= \frac{15.32 \times 27.5}{16.64}$ $= 25.32$ $tmv = \frac{M_d \times x_{\max}}{\Sigma r_i^2}$ $= \frac{15.32 \times 55.0}{16.64}$ $= 50.63$ $abh = \frac{A_u}{((n_r/2) \times n_c)}$ $= \frac{218.27}{(2 \times (6/2))}$ $= 36.38$ $v_{\text{res}} = \sqrt{(vbv + tmv)^2 + (tmh + abh)^2}$ $= \sqrt{(6.67 + 50.63)^2 + (25.32 + 36.38)^2}$ $= 84.2$		

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Check	Required	Provided	Remarks
Long Joint Reduction Factor	if $l_j \geq 15d$ then $V_{rd} = \beta_{lj} V_{db}$ if $l_j < 15d$ then $V_{rd} = V_{db}$ where, $l_j = ((nc \text{ or } nr) - 1) \times (p \text{ or } g)$ $\beta_{lj} = 1.075 - l/(200d)$ but $0.75 \leq \beta_{lj} \leq 1.0$ [Ref. IS 800:2007, Cl.10.3.3.1]	$l = ((n_c \text{ or } n_r) - 1) \times (p \text{ or } g)$ $l_c = 2 \times \left(\left(\frac{6}{2} - 1\right) \times 55 + 45\right) + 3.0$ $= 313.0$ $l_r = (2 - 1) \times 55 = 55$ $l = 313.0$ $15d = 15 \times 22.0 = 330.0$ since, $l < 15d$ then, $V_{rd} = V_{db}$ $V_{rd} = 113.86$ [Ref. IS 800:2007, Cl.10.3.3.1]	
Large Grip Length Reduction Factor	if $l_g \geq 5d$, then $V_{rd} = \beta_{lg} V_{db}$ if $l_g < 5d$ then $V_{rd} = V_{db}$ $l_g \leq 8d$ where, $l_g = \Sigma(t_{ep} + t_{member})$ $\beta_{lg} = 8d/(3d + l_g)$ but $\beta_{lg} \leq \beta_{lj}$ [Ref. IS 800:2007, Cl.10.3.3.2]	$l_g = \Sigma\ (t_p + t_{member})$ $= 24.6$ $5d = 110.0$ $8d = 176.0$ since, $l_g < 5d$; $\beta_{lg} = 1.0$ [Ref. IS 800:2007, Cl.10.3.3.2]	
Capacity (kN)	84.2	$V_{rd} = \beta_{lj} \beta_{lg} V_{db}$ $= 1.0 \times 1.0 \times 113.86$ $= 113.86$	**Pass**

2.5 Flange Plate Dimensions Check - Outside

Check	Required	Provided	Remarks
Min. Plate Height (mm)	min. flange plate height = beam width = 225.0	225.0	Pass
Min. Plate Length (mm)	$2 \times [2e_{\min} + (\frac{n_r}{2} - 1)p_{\min})]$ $+ \frac{\text{gap}}{2}]$ $= 2 \times [(2 \times 40.8 + (\frac{6}{2} - 1) \times 55.0$ $= + \frac{3.0}{2}]$ = 386.2	403.0	Pass
Min. Plate Thickness (mm)	$T = 9.1$	$t_{fp} = 10.0$	Pass
Plate Area Check (mm2)	plate area >= 1.05 X connected member area = 2149.88 [Ref: Cl.8.6.3.2, IS 800:2007]	plate area = $B_{fp} \times t_{ifp}$ $= 225.0 \times 10.0$ = 2250.0	Pass

2.6 Web Plate Dimensions Check

Check	Required	Provided	Remarks
Min. Plate Height (mm)	$0.6 \times (d_b - 2 \times t_f - 2 \times r_r)$ $= 0.6 \times (225.0 - 2 \times 9.1 - 2 \times 10.0)$ = 135.0 [Ref. INSDAG, Ch.5, sec.5.2.3]	145	Pass

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Check	Required	Provided	Remarks
Min. Plate Length (mm)	$2 \times [2e_{\min} + (\frac{n_r}{2} - 1)p_{\min})] + \frac{\text{gap}}{2}]$ $= 2 \times [(2 \times 40.8 + (\frac{6}{2} - 1) \times 55.0 = +\frac{3.0}{2}]$ $= 386.2$	403.0	**Pass**
Min. Plate Thickness (mm)	$t/2 = 4.3$	$t_{wp} = 8.0$	**Pass**
Plate Area Check (mm2)	plate area >= 1.05 X connected member area $= 1867.4$ [Ref: Cl.8.6.3.2, IS 800:2007]	plate area $= 2 \times W_{wp} \times t_{wp}$ $= 2 \times 145 \times 8.0$ $= 2320.0$	**Pass**

2.7 Member Check

Check	Required	Provided	Remarks
Flange Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 225.0 \times 9.1$ $= \frac{2047.5 \times 450}{1.1 \times 10^3}$ $= 837.61$ [Ref. IS 800:2007, Cl.6.2]	
Flange Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{1 \times \ 0.9 \times (225.0 - 2 \times 24.0) \times 9.1 \times 590}{1.25}$ $= 684.23$ [Ref. IS 800:2007, Cl.6.3.1]	

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Check	Required	Provided	Remarks
Flange Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 789.62$ [Ref. IS 800:2007, Cl.6.4]	
Flange Tension Capacity (kN)	$F_f = 656.74$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{dn}},\ T_{\text{db}})$ $= \min(837.61, 684.23, 789.62)$ $= 684.23$ [Ref.IS 800:2007, Cl.6.1]	**Pass**
Web Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 206.8 \times 8.6$ $= \frac{1778.48 \times 450}{1.1 \times 10^3}$ $= 727.56$ [Ref. IS 800:2007, Cl.6.2]	
Web Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{1 \times\ 0.9 \times (206.8 - 2 \times 24.0) \times 8.6 \times 590}{1.25}$ $= 580.14$ [Ref. IS 800:2007, Cl.6.3.1]	

Company Name		Project Title	column to column cover plate bolted connection
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Check	Required	Provided	Remarks
Web Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 752.57$ [Ref. IS 800:2007, Cl.6.4]	
Web Tension Capacity (kN)	$A_w = 218.27$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{dn}},\ T_{\text{db}})$ $= \min(727.56, 580.14, 752.57)$ $= 580.14$ [Ref.IS 800:2007, Cl.6.1]	**Pass**

2.8 Flange Plate Capacity Check for Axial Load - Outside

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 225.0 \times 10.0$ $= \frac{2250.0 \times 450}{1.1 \times 10^3}$ $= 920.45$ [Ref. IS 800:2007, Cl.6.2]	
Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{1 \times\ 0.9 \times (225.0 - 2 \times 24.0) \times 10.0 \times 590}{1.25}$ $= 751.9$ [Ref. IS 800:2007, Cl.6.3.1]	

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Check	Required	Provided	Remarks
Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 867.72$ [Ref. IS 800:2007, Cl.6.4]	
Flange Plate Tension Capacity (kN)	$F_f = 656.74$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{dn}},\ T_{\text{db}})$ $= \min(920.45, 751.9, 867.72)$ $= 751.9$ [Ref.IS 800:2007, Cl.6.1]	**Pass**

2.9 Web Plate Capacity Check for Axial Load

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = 2lt = 2 \times 145 \times 8.0$ $= \frac{1160.0 \times 450}{1.1 \times 10^3}$ $= 949.09$ [Ref. IS 800:2007, Cl.6.2]	
Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{2 \times\ 0.9 \times (145 - 2 \times 24.0) \times 8.0 \times 590}{1.25}$ $= 659.29$ [Ref. IS 800:2007, Cl.6.3.1]	

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Check	Required	Provided	Remarks
Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 1400.13$ [Ref. IS 800:2007, Cl.6.4]	
Web Plate Tension Capacity (kN)	$A_w = 218.27$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{dn}},\ T_{\text{db}})$ $= \min(949.09, 659.29, 1400.13)$ $= 659.29$ [Ref.IS 800:2007, Cl.6.1]	**Pass**

2.10 Web Plate Capacity Check for Shear Load

Check	Required	Provided	Remarks
Shear Yielding Capacity (kN)		$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{2 \times 145 \times 8.0 \times 450}{\sqrt{3} \times 1.1 \times 1000}$ $= 547.96$ [Ref. IS 800:2007, Cl.10.4.3]	
Allowable Shear Capacity (kN)	$V = 23.0$	$V_d = 0.6\ V_{dy}$ $= 0.6 \times 547.96$ $= 328.77$ [Limited to low shear]	**Pass**

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Check	Required	Provided	Remarks
Shear Rupture Capacity (kN)		$V_{d_n} = \frac{0.75 A_{vn} f_u}{\sqrt{3}\gamma_{m1}}$ $= 2 \times \frac{(145 - (2 \times 24.0)) \times 8.0 \times 590}{\sqrt{3} \times 1.25}$ $= 317.2$ [Ref. AISC, sect. J4]	
Block Shear Capacity (kN)		$V_{\mathrm{dbl1}} = \frac{A_{\mathrm{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $V_{\mathrm{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $V_{\mathrm{db}} = \min(V_{db1},\ V_{db2}) = 1023.6$ [Ref. IS 800:2007, Cl.6.4]	
Web Plate Shear Capacity (kN)	$V_u = 40.0$	$V_d = \min(S_c,\ V_{d_n},\ V_{d_b})$ $= \min(328.77,\ 317.2,\ 1023.6)$ $= 317.2$ [Ref. IS 800:2007, Cl.6.1]	**Pass**

Company Name		Project Title	column to column cover plate bolted connection
Group/Team Name		Subtitle	
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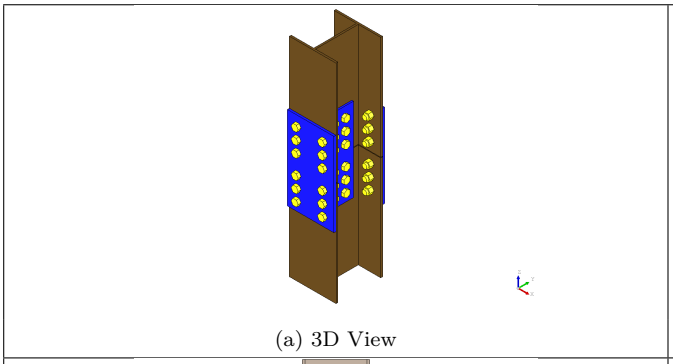
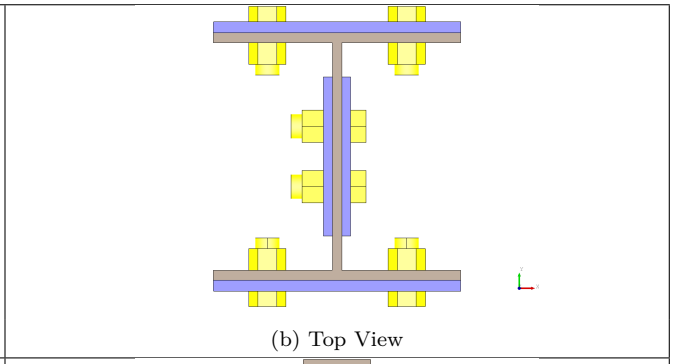
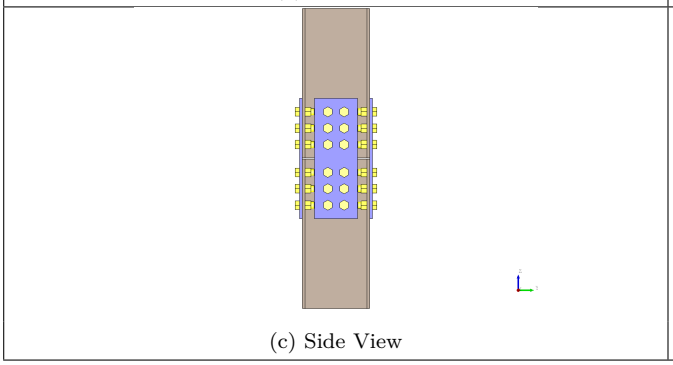
3 3D Views



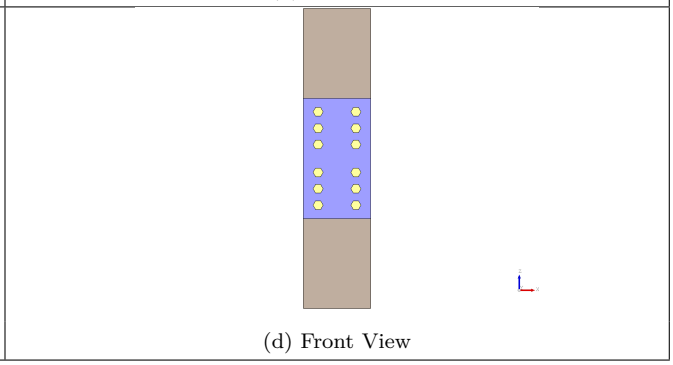
(a) 3D View



(b) Top View



(c) Side View



(d) Front View

4 Design Log

2025-01-21 20:17:06 - Osdag - WARNING - The defined factored load(s) are less than the minimum recommended value [Cl.10.7, IS 800:2007]

2025-01-21 20:17:06 - Osdag - INFO - The load values have been set as per the minimum recommendations of Cl.10.7, IS 800:2007

2025-01-21 20:17:06 - Osdag - INFO - : Overall Bolted Cover Plate Splice Connection design is SAFE

2025-01-21 20:17:06 - Osdag - INFO - : ==========End of Design==========