



Created with



<b>Company Name</b>	<b>IIT Bombay</b>	<b>Project Title</b>	<b>Connection Design Examples</b>
<b>Group/Team Name</b>	<b>Osdag</b>	<b>Subtitle</b>	<b>Cleat Angle shear connection</b>
<b>Designer</b>	<b>Engineer #1</b>	<b>Job Number</b>	<b>1.1.3.1.1</b>
<b>Date</b>	<b>18 /06 /2017</b>	<b>Client</b>	<b>Yogesh D Pisal, Aker Powergas Ltd, Pune</b>

<b>Design Conclusion</b>	
<b>Cleat Angle</b>	<b>Pass</b>
<b>Cleat Angle</b>	
<b>Connection Properties</b>	
<b>Connection</b>	
Connection Title	Double Angle Web Cleat
Connection Type	Shear Connection
<b>Connection Category</b>	
Connectivity	Column flange-Beam web
Beam Connection	Bolted
Column Connection	Bolted
<b>Loading (Factored Load)</b>	
Shear Force (kN)	140
<b>Components</b>	
<b>Column Section</b>	SC 250
Material	Fe 410
<b>Beam Section</b>	MB 400
Material	Fe 410
Hole	STD
<b>Cleat Section</b>	90 90 x 12
Thickness (mm)	12
Cleat Leg Size B (mm)	90
Cleat Leg Size A (mm)	90
Hole	STD
<b>Bolts on Beam</b>	
Type	HSFG
Grade	8.8
Diameter (mm)	20
Bolt Numbers	3
Columns (Vertical Lines)	1
Bolts Per Column	3
Gauge (mm)	0
Pitch (mm)	50
End Distance (mm)	37

Edge Distance (mm)	70
<b>Bolts on Column</b>	
Type	HSFG
Grade	8.8
Diameter (mm)	20
Bolt Numbers	6
Columns (Vertical Lines)	1
Bolts Per Column	3
Gauge (mm)	0
Pitch (mm)	50
End Distance (mm)	37
Edge Distance (mm)	70.0
<b>Assembly</b>	
Column-Beam Clearance (mm)	10.0



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### Design Preferences

#### Bolt

Hole Type	Standard
Material Grade (MPa) (overwrite)	800.0
Slip factor	0.48

#### Detailing

Type of Edges	Sheared or hand flame cut
Minimum Edge-End Distance	1.7 times the hole diameter
Gap between beam & support (mm)	10.0
Are members exposed to corrosive influences?	No

#### Design

Design Method	Limit State Design
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Design Check: Beam Connectivity			
Check	Required	Provided	Remark
Bolt shear capacity (kN)		$V_{dsf} = ((0.48 \times 2 \times 1.0 \times 137.2) / (1.25)) = 105.37$ [cl. 10.4.3]	
Bolt bearing capacity (kN)		N/A	
Bearing capacity of beam web (kN)		N/A	
Bearing capacity of cleat (kN)		N/A	
Bearing capacity (kN)		N/A	
Bolt capacity (kN)		105.37	
Critical bolt shear (kN)	$\leq 105.37$	43.828	Pass
No. of bolts		3	
No. of column(s)	$\leq 2$	1	
No. of bolts per column		3	
Bolt pitch (mm)	$\geq 2.5 \times 20 = 50, \leq \text{Min}(32 \times 8.9, 300) = 285$ [cl. 10.2.2]	50	Pass
Bolt gauge (mm)	$\geq 2.5 \times 20 = 50, \leq \text{Min}(32 \times 8.9, 300) = 285$ [cl. 10.2.2]	0	
End distance (mm)	$\geq 1.7 \times 22.0 = 37, \leq 12 \times 8.9 = 106.8$ [cl. 10.2.4]	37	Pass
Edge distance (mm)	$\geq 1.7 \times 22.0 = 37, \leq 12 \times 8.9 = 106.8$ [cl. 10.2.4]	70	Pass
Block shear capacity (kN)	$\geq 140$	$V_{db} = 150.362$ [cl. 6.4.1]	Pass
Cleat height (mm)	$\geq 0.6 \times 400.0 = 240.0, \leq 400.0 - 16.0 - 14.0 - 16.0 - 14.0 - 10 = 330.0$ [cl. 10.2.4, Insdag Detailing Manual, 2002]	240	Pass
		$M_d =$	

Cleat moment capacity (kNm)	$(2 \cdot 105.37 \cdot 50^2) / (50 \cdot 1000) = 3.71$	$(1.2 \cdot 250 \cdot Z) / (1000 \cdot 1.1) = 207.36$ [cl. 8.2.1.2]	Pass
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Design Check: Column Connectivity			
Check	Required	Provided	Remark
Bolt shear capacity (kN)		$V_{dsf} = ((0.48 \times 1 \times 1.0 \times 137.2) / (1.25)) = 52.685$ [cl. 10.4.3]	
Bolt bearing capacity (kN)		N/A	
Bolt bearing capacity (kN)		N/A	
Bolt bearing capacity (kN)		N/A	
Bolt bearing capacity (kN)		N/A	
Bolt capacity (kN)		52.685	
Critical bolt shear (kN)	$\leq 52.685$	46.494	Pass
No. of bolts		6	
No. of column(s) per angle	$\leq 2$	1	
No. of bolts per column per angle		3	
Bolt pitch (mm)	$\geq 2.5 \times 20 = 50, \leq \text{Min}(32 \times 12.0, 300) = 300$ [cl. 10.2.2]	50	Pass
Bolt gauge (mm)	$\geq 2.5 \times 20 = 50, \leq \text{Min}(32 \times 12.0, 300) = 300$ [cl. 10.2.2]	0	
End distance (mm)	$\geq 1.7 \times 22.0 = 37, \leq 12 \times 12.0 = 144.0$ [cl. 10.2.4]	37	Pass
Edge distance (mm)	$\geq 1.7 \times 22.0 = 37, \leq 12 \times 12.0 = 144.0$ [cl. 10.2.4]	70.0	Pass
Block shear capacity (kN)	$\geq 140$	$V_{db} = 150.362$ [cl. 6.4.1]	Pass
Cleat height (mm)	$\geq 0.6 \times 400.0 = 240.0, \leq 400.02 \times (16.0 + 14.0 + 5) = 330.0$ [cl. 10.2.4, Insdag Detailing Manual, 2002]	240	Pass

Cleat moment capacity (kNm)	$(2 \times 52.685 \times 50^2) / (50 \times 1000) = 4.021$	$M_d = (1.2 \times 250 \times Z) / (1000 \times 1.1)$ $= 207.36$ [cl. 8.2.1.2]	<b>Pass</b>
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<b>Additional Comments</b>	
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