

# **STEEL BUILDINGS IN EUROPE**

## **Single-Storey Steel Buildings**

### **Part 11: Moment Connections**



















































































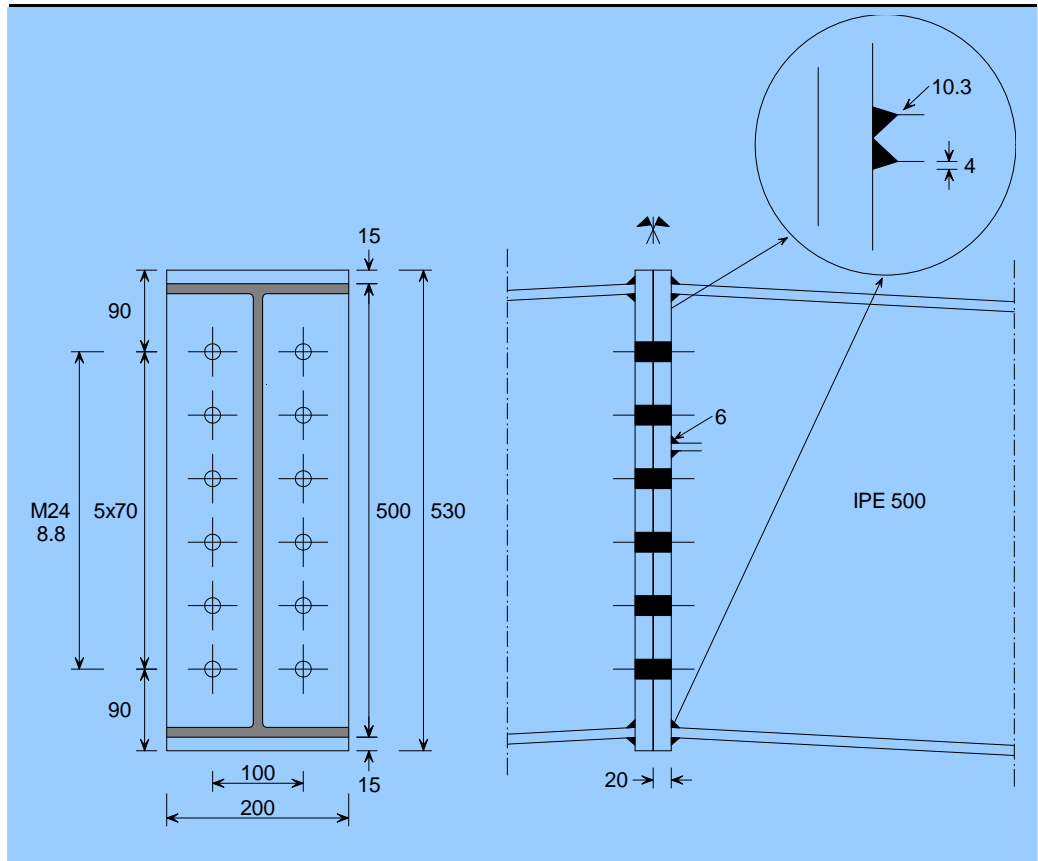








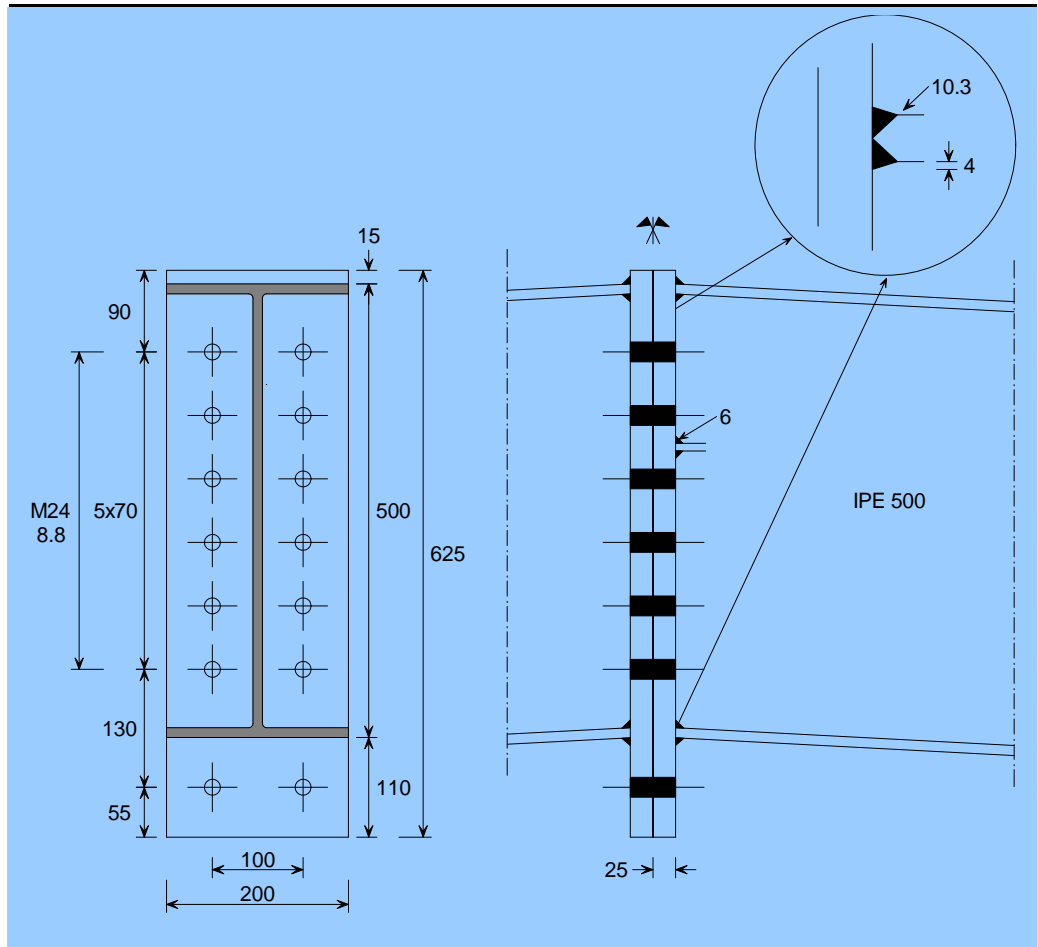
**Table 4.22 Apex connection – IPE 500**



Bolts M24                      8.8  
 Hole diameter                26 mm  
 End plate                         $t_p = 20$  mm

<b>Beam IPE 500</b>	<b>S235</b>	<b>S275</b>	<b>S355</b>
<b>Positive moment</b>			
Design moment resistance $M_{j,Rd}$ (kNm)	339,9	360,0	360,0
Minimum span length for 'rigid' $L_{b,min}$ (m)		7,18	
<b>Negative moment</b>			
Design moment resistance $M_{j,Rd}$ (kNm)	339,9	360,0	360,0
Minimum span length for 'rigid' $L_{b,min}$ (m)		7,18	
<b>Design axial resistance</b>			
Tension $N_{t,j,Rd}$ (kN)	1404	1445	1691
Compression $N_{c,j,Rd}$ (kN)	2726	3190	4044
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>		455	

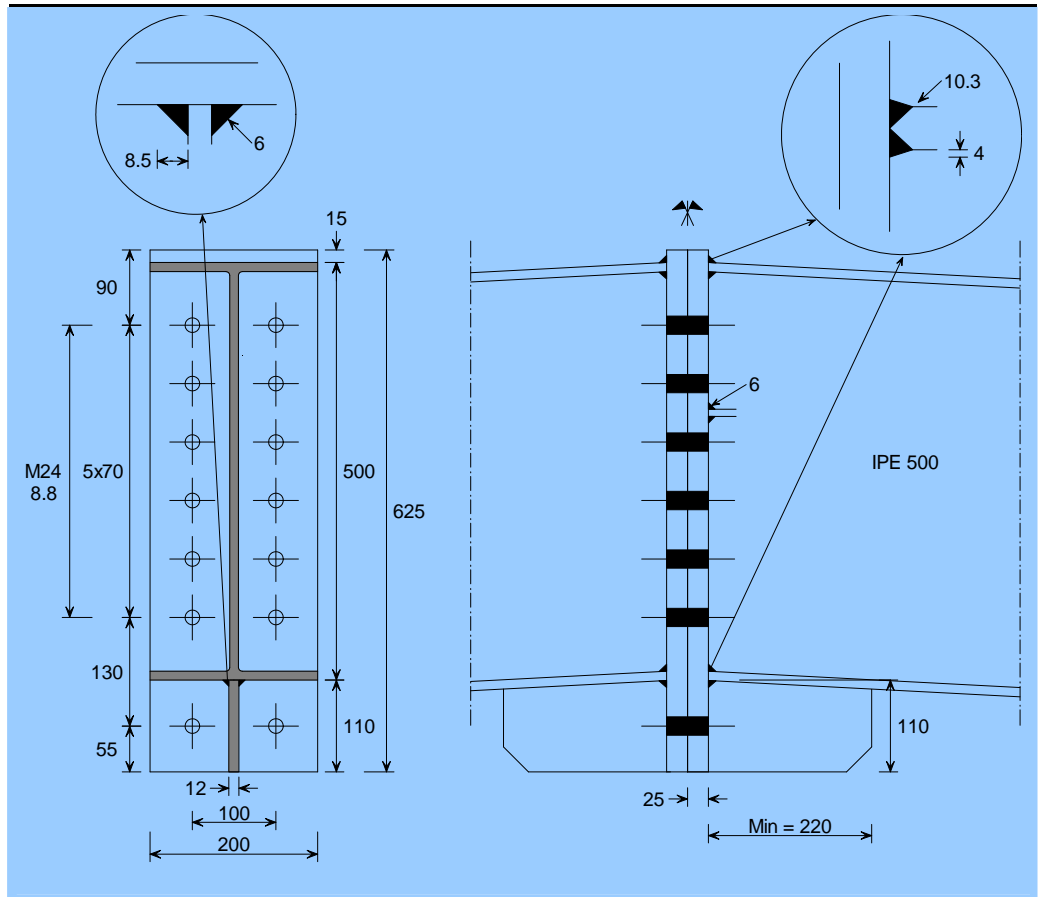
**Table 4.23 Apex connection – IPE 500**



Bolts M24	8.8
Hole diameter	26 mm
End plate	$t_p = 25$ mm

Beam IPE 500	S235	S275	S355
<b>Positive moment</b>			
Design moment resistance $M_{j,Rd}$ (kNm)	448,6	504,8	577,1
Minimum span length for 'rigid' $L_{b,min}$ (m)		3,87	
<b>Negative moment</b>			
Design moment resistance $M_{j,Rd}$ (kNm)	358,1	407,3	426,3
Minimum span length for 'rigid' $L_{b,min}$ (m)		5,62	
<b>Design axial resistance</b>			
Tension $N_{t,j,Rd}$ (kN)	1684	1934	2131
Compression $N_{c,j,Rd}$ (kN)	2726	3190	4044
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			
		531	

**Table 4.24 Apex connection – IPE 500**



Bolts M24	8.8
Hole diameter	26 mm
End plate	$t_p = 25$ mm
Stiffeners	$t_p = 12$ mm

Beam IPE 500	S235	S275	S355
<b>Positive moment</b>			
Design moment resistance $M_{j,Rd}$ (kNm)	472,4	533,6	620,4
Minimum span length for 'rigid' $L_{b,min}$ (m)		3,03	
<b>Negative moment</b>			
Design moment resistance $M_{j,Rd}$ (kNm)	358,1	407,3	426,3
Minimum span length for 'rigid' $L_{b,min}$ (m)		5,62	
<b>Design axial resistance</b>			
Tension $N_{t,j,Rd}$ (kN)	1775	2041	2238
Compression $N_{c,j,Rd}$ (kN)	2726	3190	4044
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			
		531	

## 4.5 Eaves connections

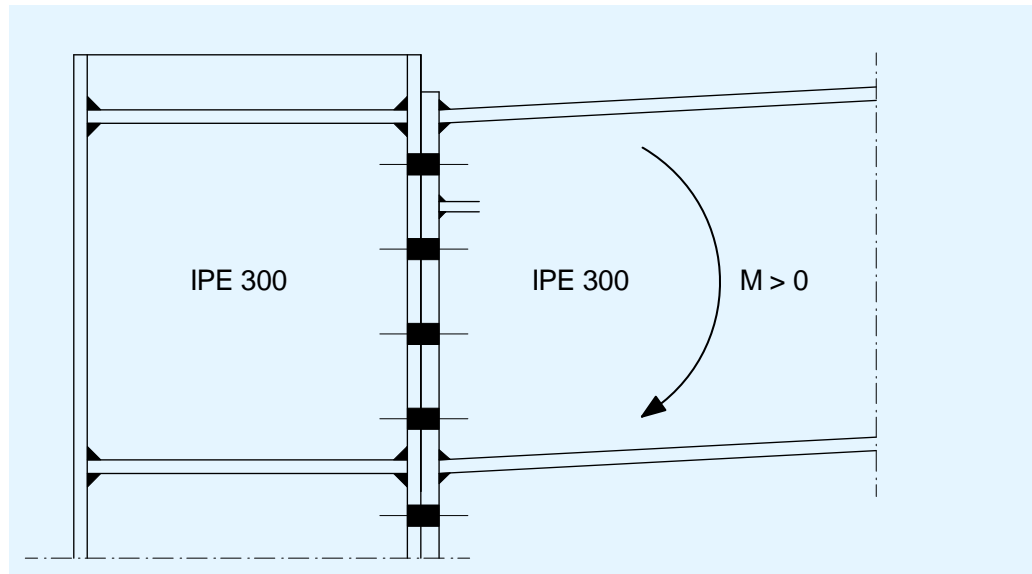
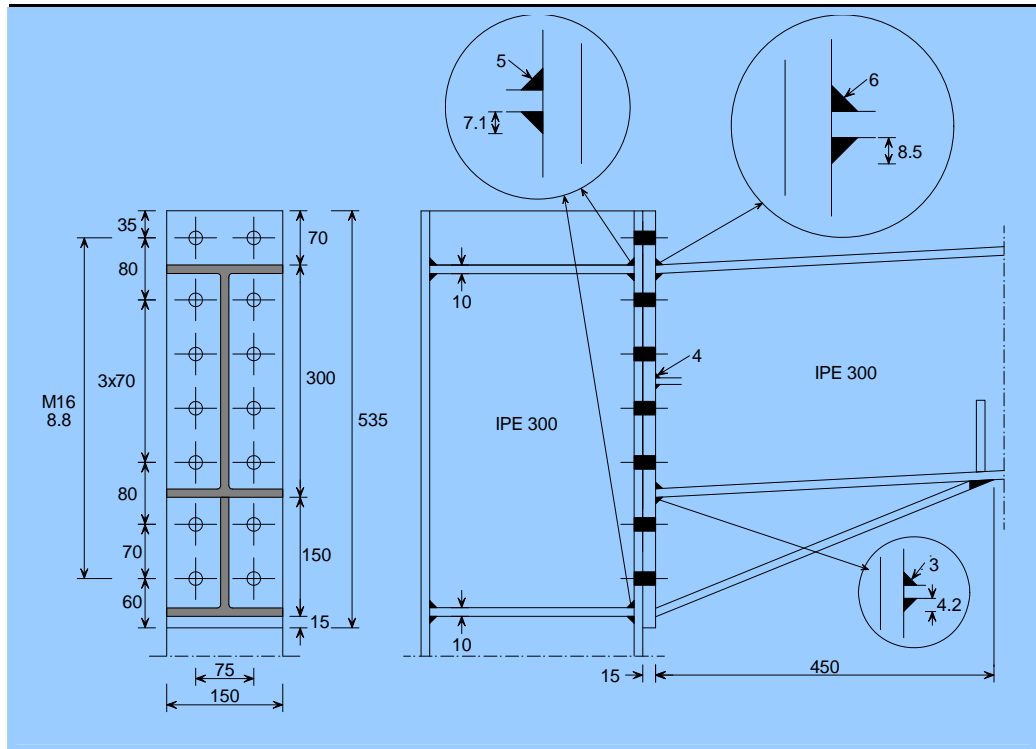


Figure 4.3 Sign convention for bending moment in eaves connections

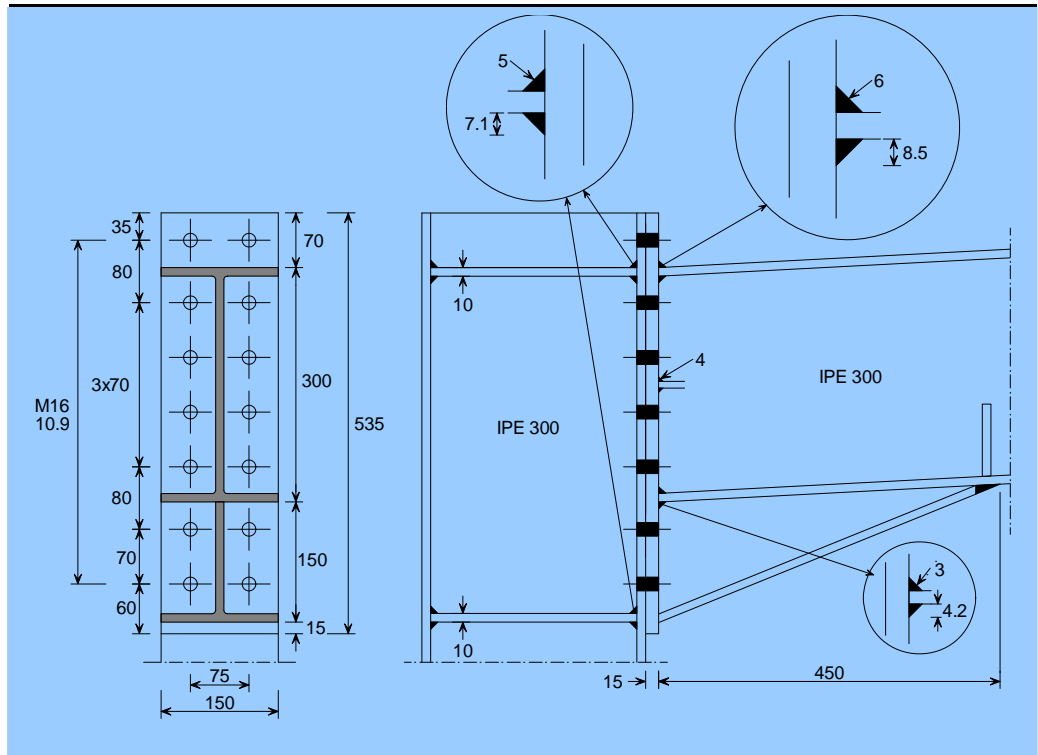
**Table 4.25 Eaves connection – IPE 300**



Bolts M16	8.8
Hole diameter	18 mm
Column stiffeners	$t_p = 10$ mm
End plate	$t_p = 15$ mm

Column IPE 300	Beam IPE 300	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		134,7	154,3	187,4
Minimum span length for 'rigid' $L_{b,min}$ (m)			9,03	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		110,5	124,2	146,6
Minimum span length for 'rigid' $L_{b,min}$ (m)			12,10	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		348	408	526
Compression $N_{c,j,Rd}$ (kN)		348	408	526
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			236	

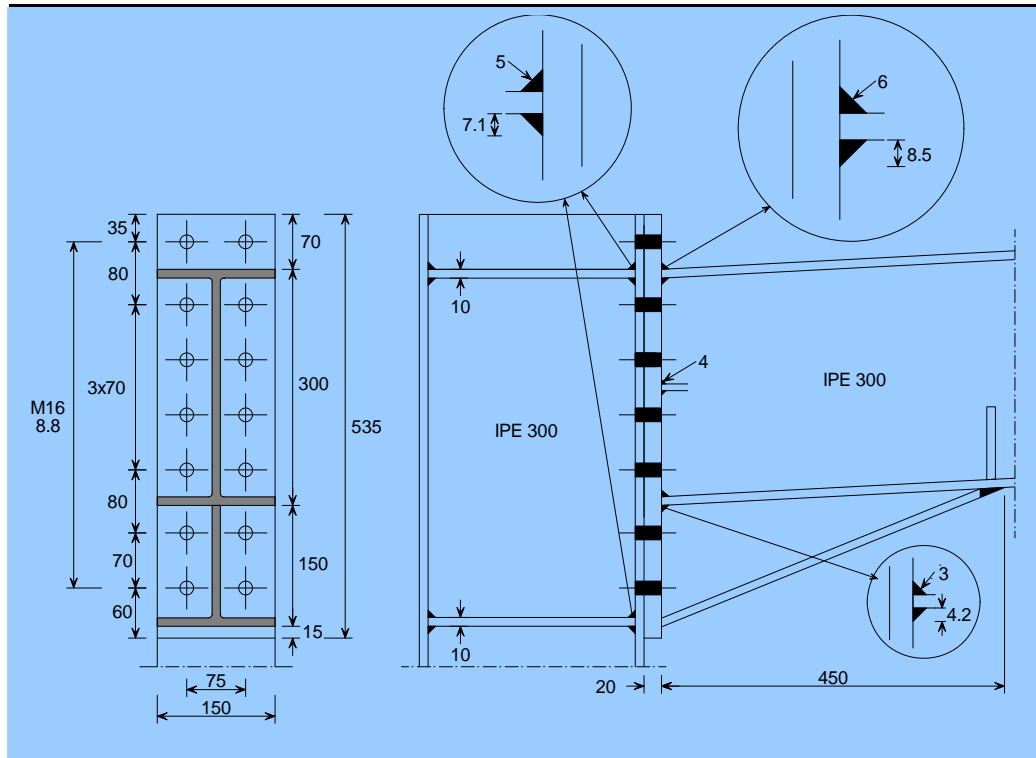
**Table 4.26 Eaves connection – IPE 300**



Bolts M16	10.9
Hole diameter	18 mm
Column stiffeners	$t_p = 10$ mm
End plate	$t_p = 15$ mm

Column IPE 300	Beam IPE 300	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		136,4	158,2	197,2
Minimum span length for 'rigid' $L_{b,min}$ (m)			9,03	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		112,7	130,4	158,8
Minimum span length for 'rigid' $L_{b,min}$ (m)			12,10	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		348	408	526
Compression $N_{c,j,Rd}$ (kN)		348	408	526
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			246	

**Table 4.27 Eaves connection – IPE 300**

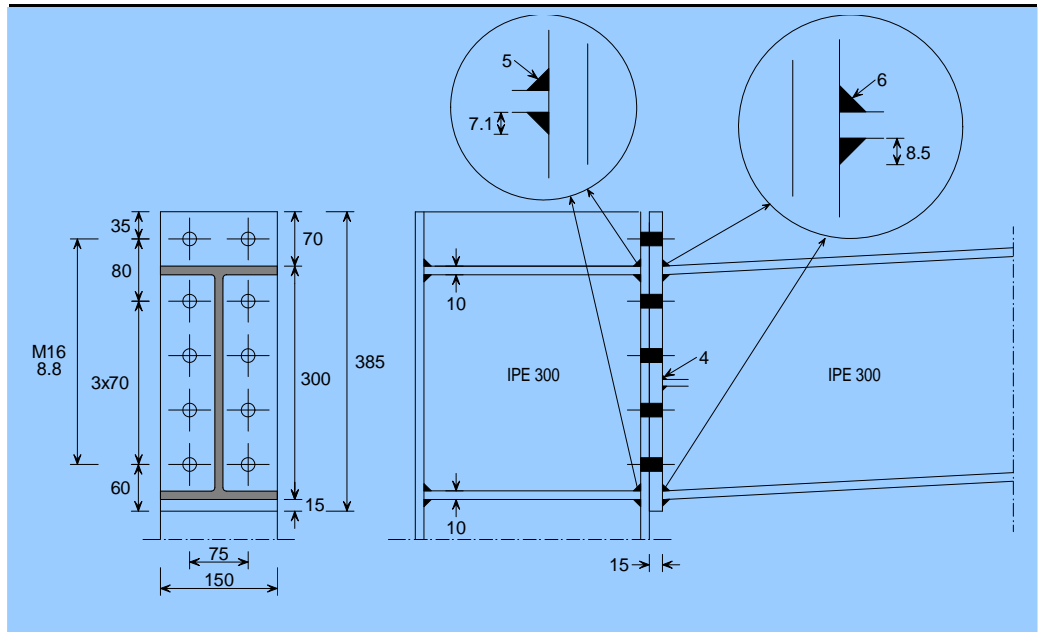


Bolts M16	8.8
Hole diameter	18 mm
Column stiffeners	$t_p = 10$ mm
End plate	$t_p = 20$ mm

Column IPE 300	Beam IPE 300	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		134,7	154,3	189,1
Minimum span length for 'rigid' $L_{b,min}$ (m)			8,91	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		110,5	124,2	146,6
Minimum span length for 'rigid' $L_{b,min}$ (m)			12,02	
<b>Design axial resistance</b>				
Tension $M_{i,j,Rd}$ (kN)		348	408	526
Compression $N_{c,j,Rd}$ (kN)		348	408	526
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			236	



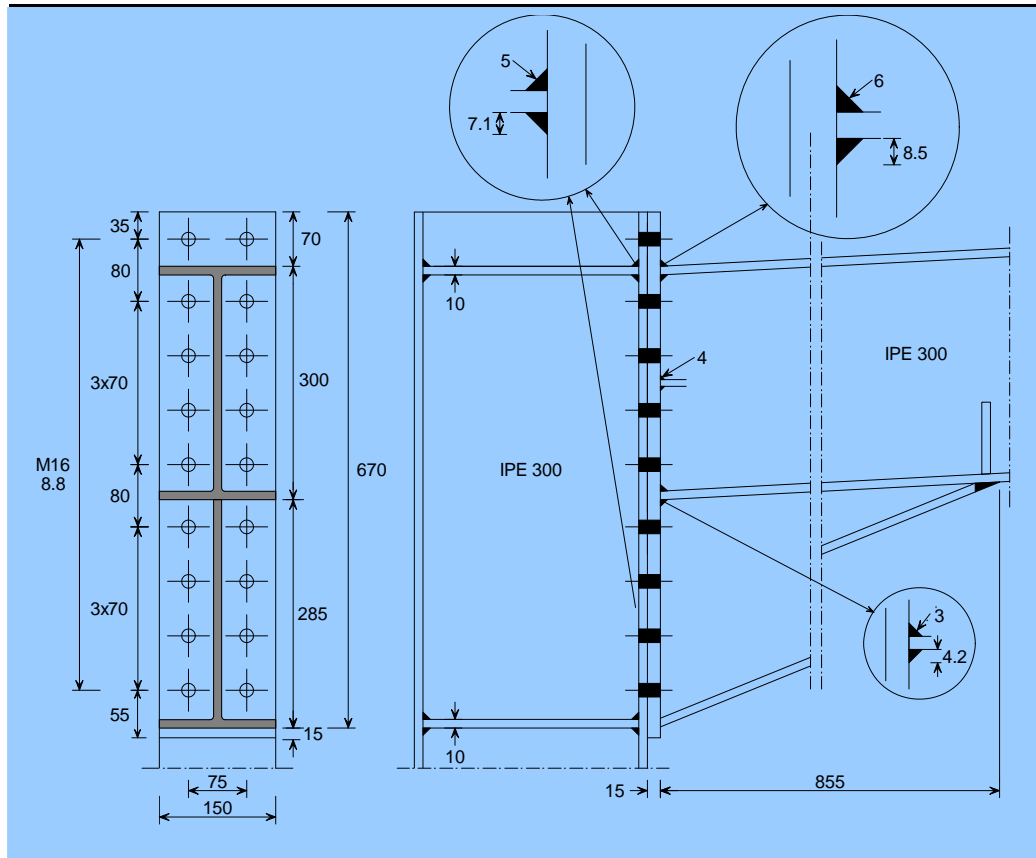
**Table 4.28 Eaves connection – IPE 300**



Bolts M16	8.8
Hole diameter	18 mm
Column stiffeners	$t_p = 10$ mm
End plate	$t_p = 15$ mm

Column IPE 300	Beam IPE 300	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		87,4	98,9	113,6
Minimum span length for 'rigid' $L_{b,min}$ (m)			16,65	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		60,4	63,2	68,9
Minimum span length for 'rigid' $L_{b,min}$ (m)			27,89	
<b>Design axial resistance</b>				
Tension $M_{i,j,Rd}$ (kN)		348	408	526
Compression $N_{c,j,Rd}$ (kN)		348	408	526
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			176	

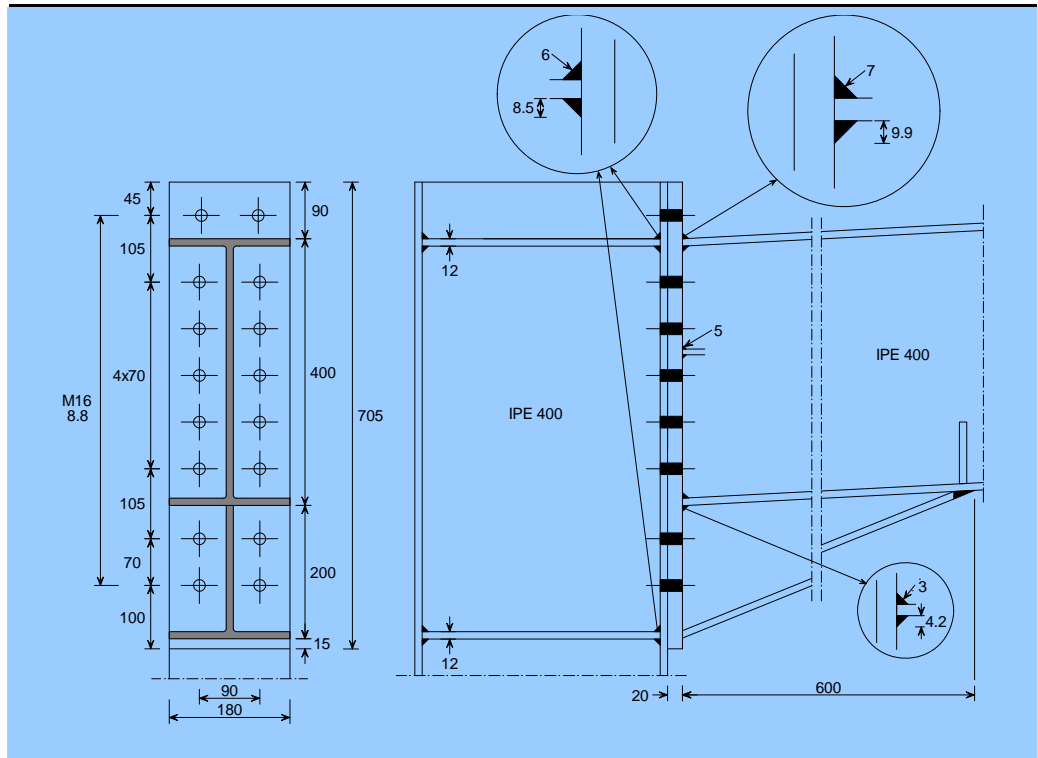
**Table 4.29 Eaves connection – IPE 300**



Bolts M16	8.8
Hole diameter	18 mm
Column stiffeners	$t_p = 10$ mm
End plate	$t_p = 15$ mm

Column IPE 300	Beam IPE 300	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		177,2	204,1	251,9
Minimum span length for 'rigid' $L_{b,min}$ (m)			6,31	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		156,0	178,9	219,0
Minimum span length for 'rigid' $L_{b,min}$ (m)			7,61	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		348	408	526
Compression $N_{c,j,Rd}$ (kN)		348	408	526
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			317	

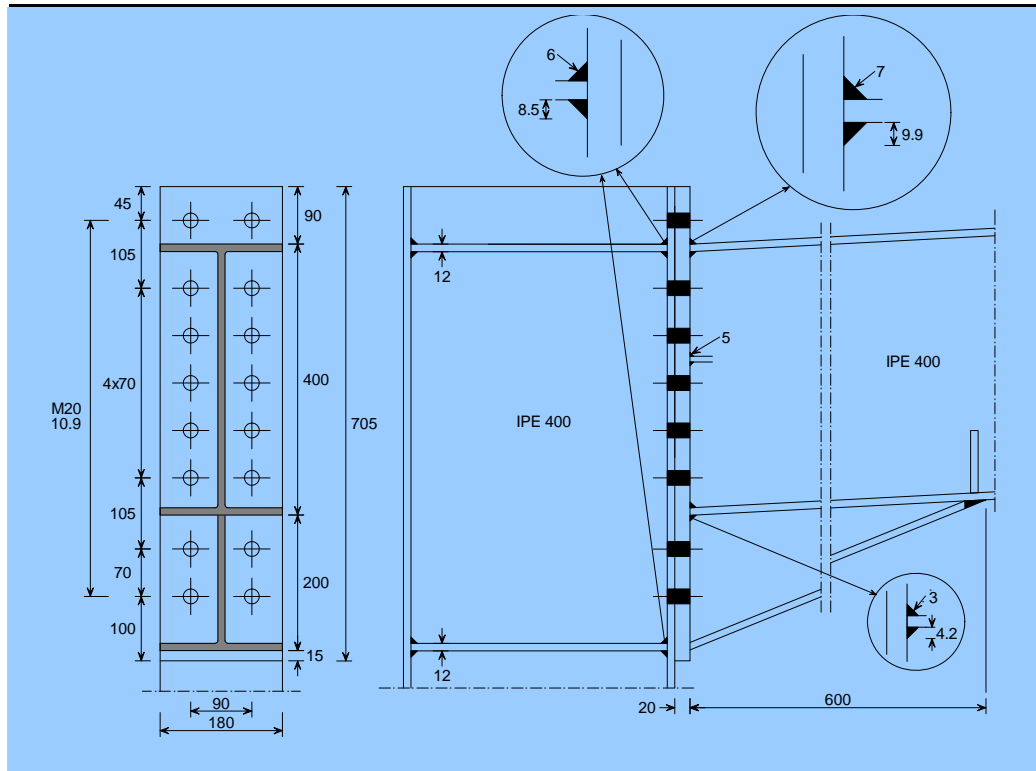
**Table 4.30 Eaves connection – IPE 400**



Bolts M20	8.8
Hole diameter	22 mm
Column stiffeners	$t_p = 12$ mm
End plate	$t_p = 20$ mm

Column IPE 400	Beam IPE 400	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		291,2	338,3	417,5
Minimum span length for 'rigid' $L_{b,min}$ (m)			11,53	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		233,9	263,0	311,8
Minimum span length for 'rigid' $L_{b,min}$ (m)			16,56	
<b>Design axial resistance</b>				
Tension $M_{i,j,Rd}$ (kN)		579	678	875
Compression $N_{c,j,Rd}$ (kN)		579	678	875
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			421	

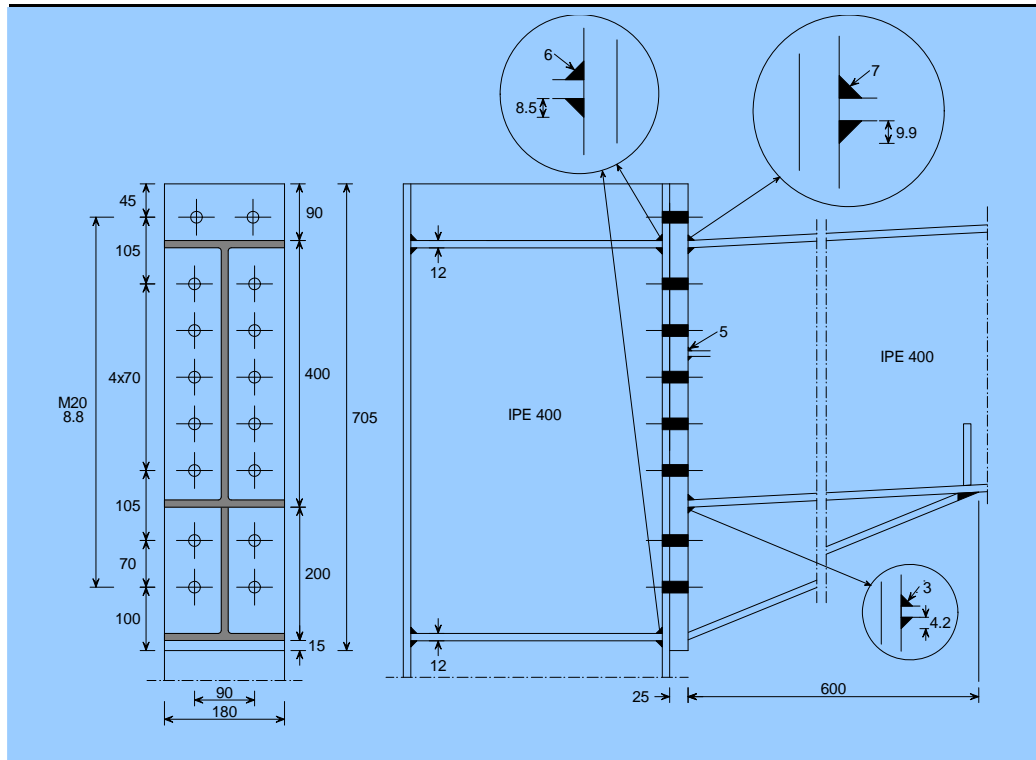
**Table 4.31 Eaves connection – IPE 400**



Bolts M20	10.9
Hole diameter	22 mm
Column stiffeners	$t_p = 12$ mm
End plate	$t_p = 20$ mm

Column IPE 400	Beam IPE 400	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		293,9	341,6	435,2
Minimum span length for 'rigid' $L_{b,min}$ (m)			11,53	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		234,9	274,3	336,5
Minimum span length for 'rigid' $L_{b,min}$ (m)			16,56	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		579	678	875
Compression $N_{c,j,Rd}$ (kN)		579	678	875
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			439	

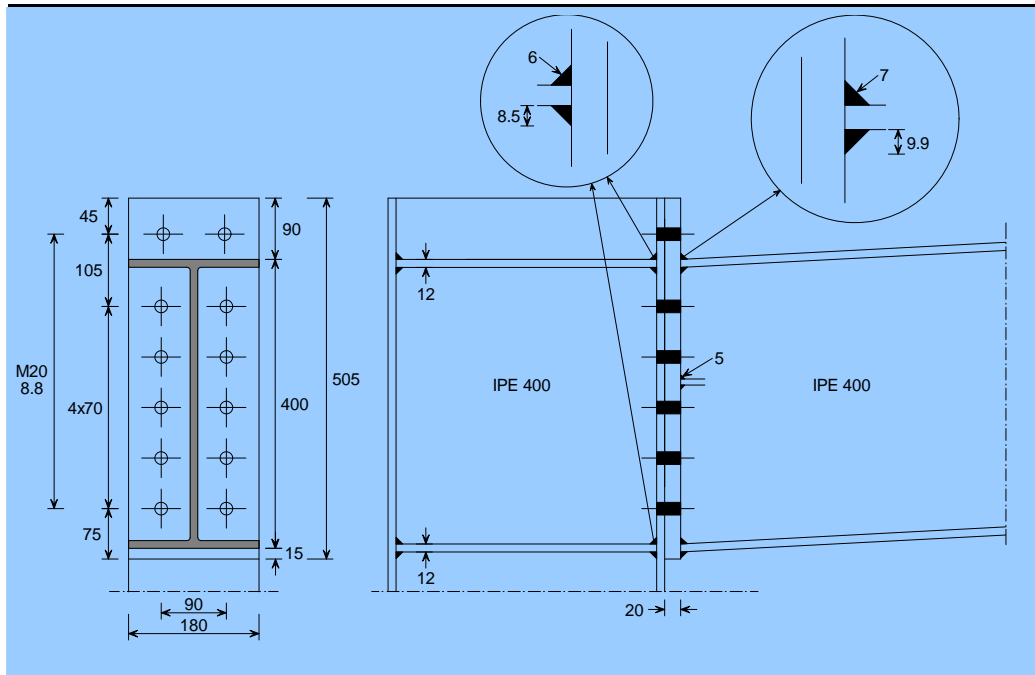
**Table 4.32 Eaves connection – IPE 400**



Bolts M20	8.8
Hole diameter	22 mm
Column stiffeners	$t_p = 12$ mm
End plate	$t_p = 25$ mm

Column IPE 400	Beam IPE 400	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		291,2	338,3	420,8
Minimum span length for 'rigid' $L_{b,min}$ (m)			11,41	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		233,9	263,0	311,8
Minimum span length for 'rigid' $L_{b,min}$ (m)			16,49	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		579	678	875
Compression $N_{c,j,Rd}$ (kN)		579	678	875
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			421	

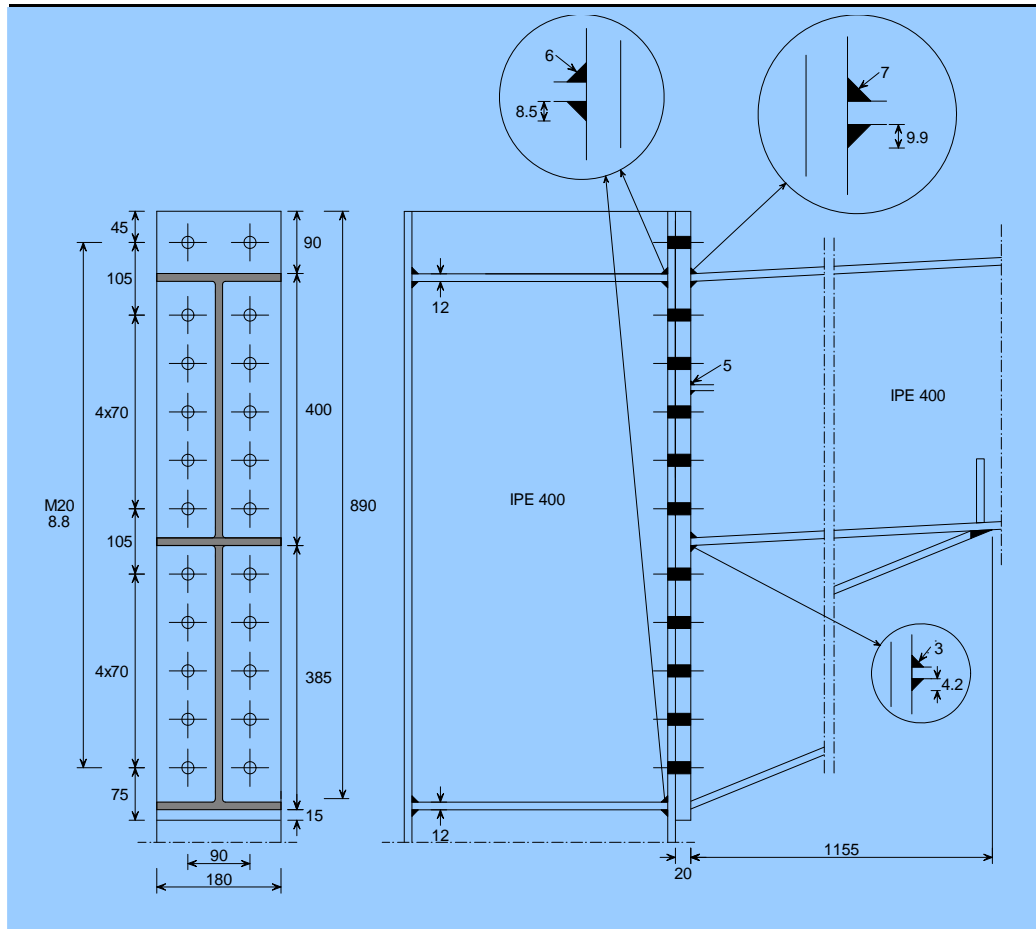
**Table 4.33 Eaves connection – IPE 400**



Bolts M20	8.8
Hole diameter	22 mm
Column stiffeners	$t_p = 12$ mm
End plate	$t_p = 20$ mm

Column IPE 400	Beam IPE 400	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		186,6	214,8	258,2
Minimum span length for 'rigid' $L_{b,min}$ (m)			21,58	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		142,7	160,0	176,5
Minimum span length for 'rigid' $L_{b,min}$ (m)			35,16	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		579	678	875
Compression $N_{c,j,Rd}$ (kN)		579	678	875
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			316	

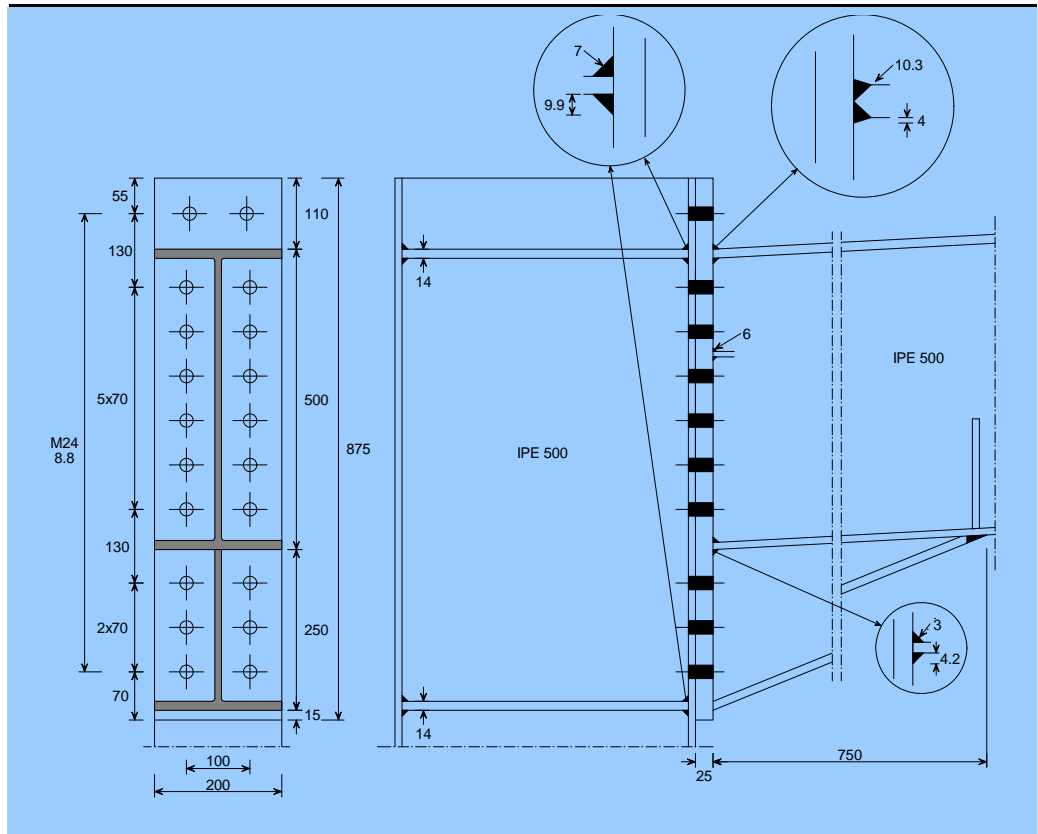
**Table 4.34 Eaves connection – IPE 400**



Bolts M20	8.8
Hole diameter	22 mm
Column stiffeners	$t_p = 12$ mm
End plate	$t_p = 20$ mm

Column IPE 400	Beam IPE 400	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		388,0	451,8	564,0
Minimum span length for 'rigid' $L_{b,min}$ (m)			7,95	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		347,3	400,9	498,3
Minimum span length for 'rigid' $L_{b,min}$ (m)			9,59	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		579	678	875
Compression $N_{c,j,Rd}$ (kN)		579	678	875
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			580	

**Table 4.35 Eaves connection – IPE 500**

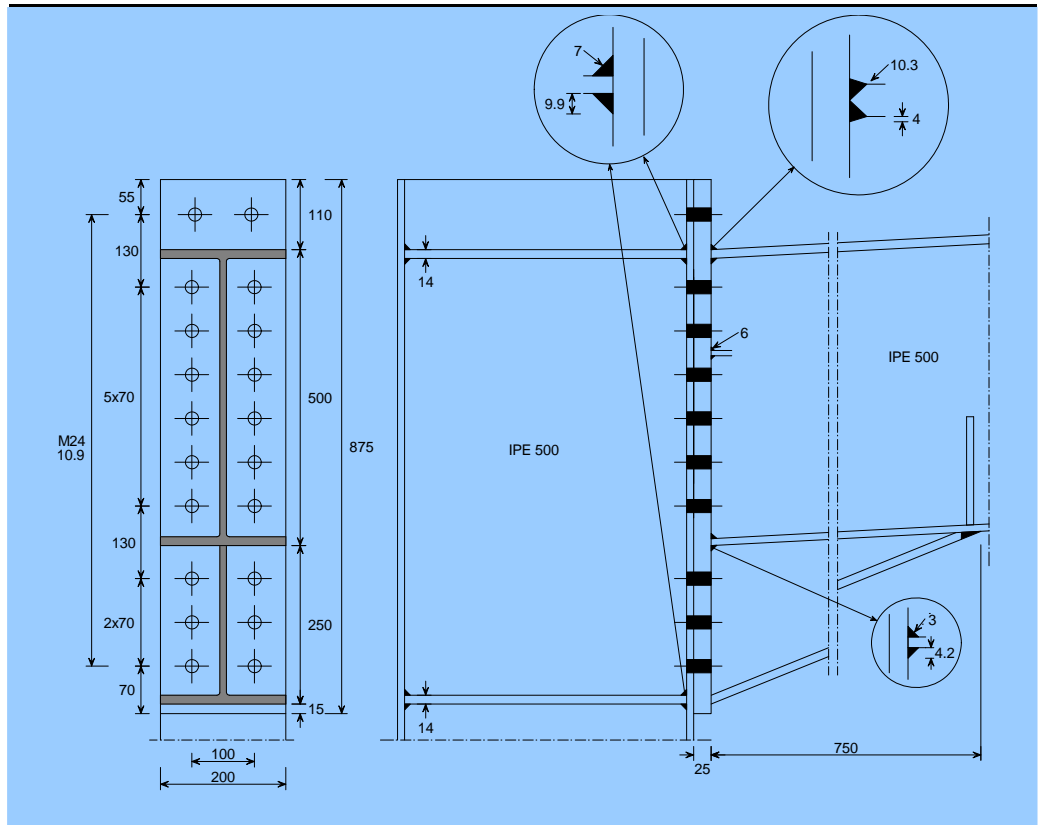


Bolts M24	8.8
Hole diameter	26 mm
Column stiffeners	$t_p = 14$ mm
End plate	$t_p = 25$ mm

Column IPE 500	Beam IPE 500	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		511,0	593,9	739,7
Minimum span length for 'rigid' $L_{b,min}$ (m)			13,80	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		458,4	529,9	650,5
Minimum span length for 'rigid' $L_{b,min}$ (m)			16,62	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		812	951	1227
Compression $N_{c,j,Rd}$ (kN)		812	951	1227
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			759	



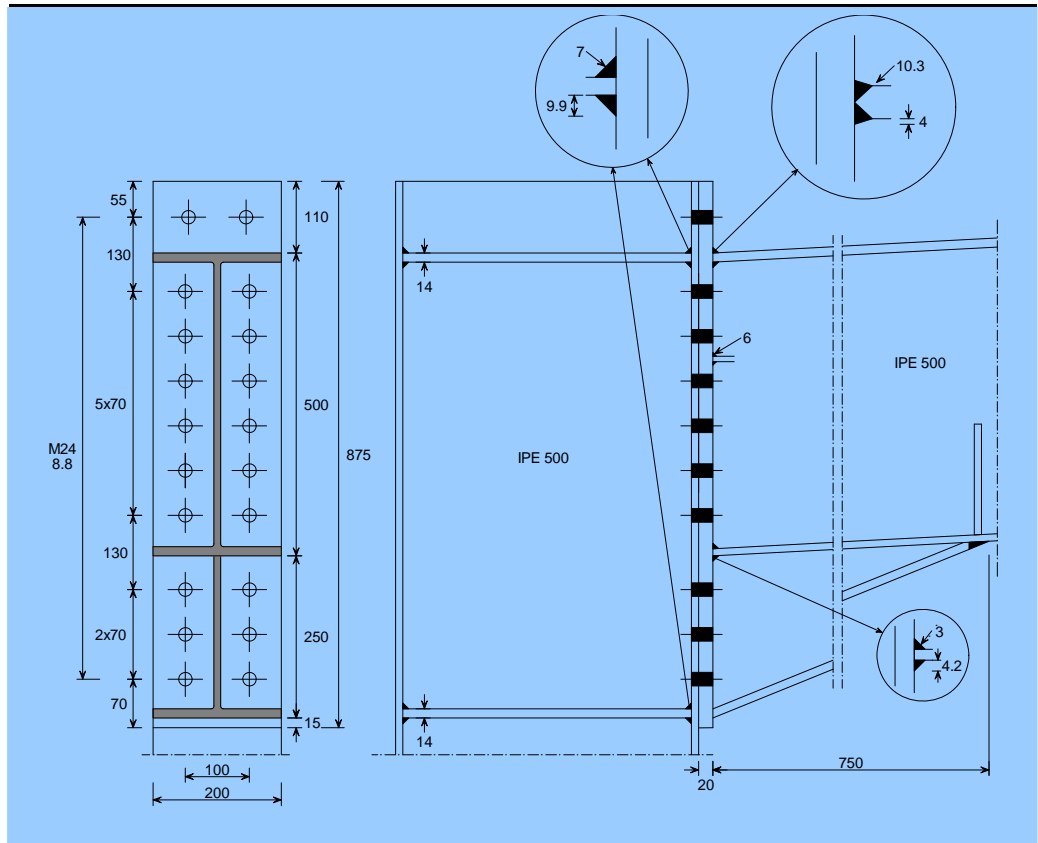
**Table 4.36 Eaves connection – IPE 500**



Bolts M24	10.9
Hole diameter	26 mm
Column stiffeners	$t_p = 14$ mm
End plate	$t_p = 25$ mm

Column IPE 500	Beam IPE 500	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		514,9	599,2	763,7
Minimum span length for 'rigid' $L_{b,min}$ (m)			13,80	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		492,3	537,6	682,1
Minimum span length for 'rigid' $L_{b,min}$ (m)			16,62	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		812	951	1227
Compression $N_{c,j,Rd}$ (kN)		812	951	1227
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			791	

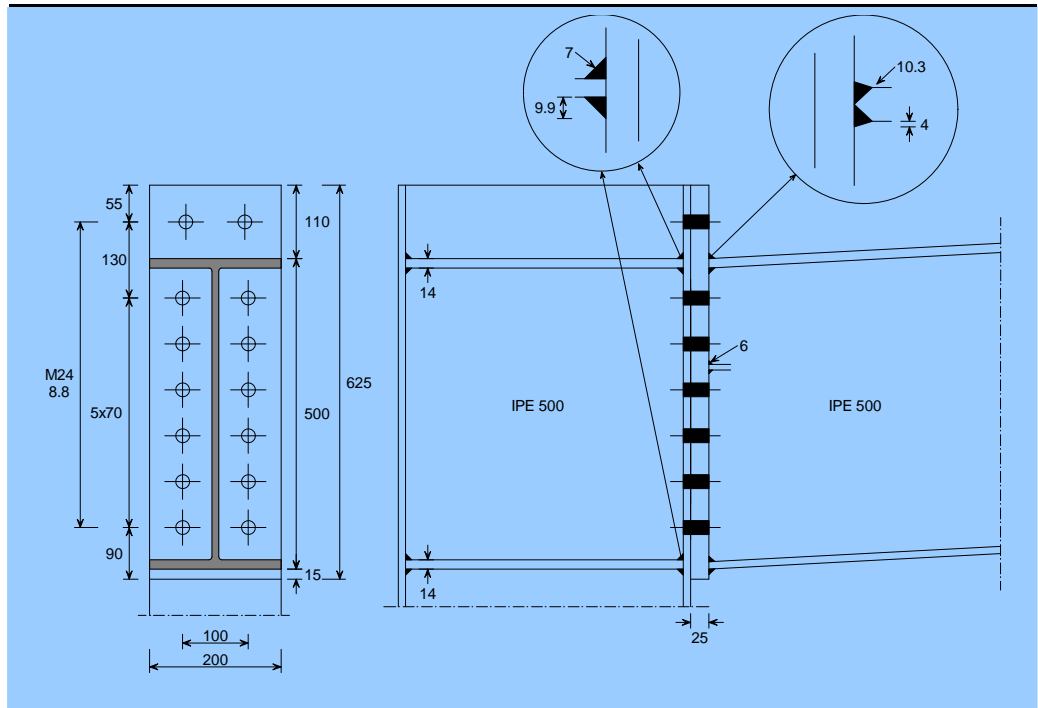
**Table 4.37 Eaves connection – IPE 500**



Bolts M24	8.8
Hole diameter	26 mm
Column stiffeners	$t_p = 14$ mm
End plate	$t_p = 20$ mm

Column IPE 500	Beam IPE 500	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		500,2	580,9	716,4
Minimum span length for 'rigid' $L_{b,min}$ (m)			14,17	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		458,4	529,9	650,5
Minimum span length for 'rigid' $L_{b,min}$ (m)			16,77	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		812	951	1227
Compression $N_{c,j,Rd}$ (kN)		812	951	1227
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			759	

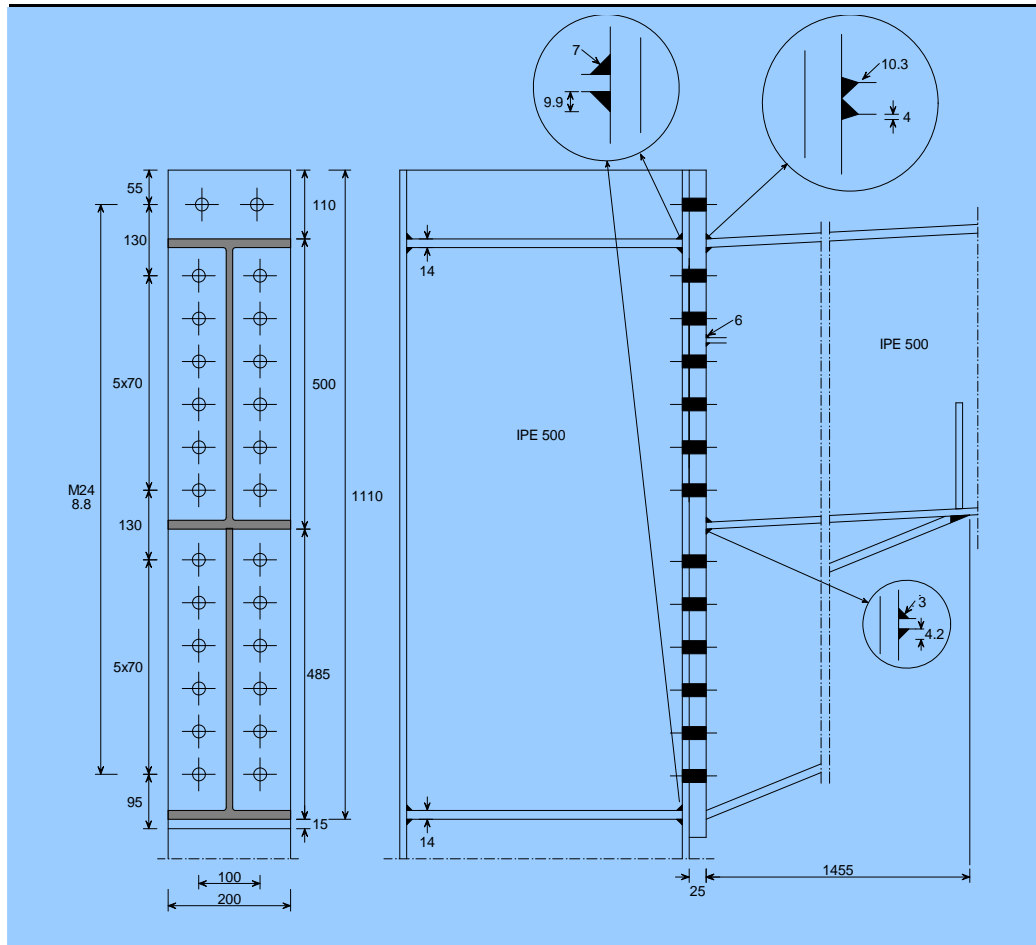
**Table 4.38 Eaves connection – IPE 500**



Bolts M24	8.8
Hole diameter	26 mm
Column stiffeners	$t_p = 14$ mm
End plate	$t_p = 25$ mm

Column IPE 500	Beam IPE 500	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		327,8	379,0	462,3
Minimum span length for 'rigid' $L_{b,min}$ (m)			25,97	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		258,4	297,9	353,7
Minimum span length for 'rigid' $L_{b,min}$ (m)			40,84	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		812	951	1227
Compression $N_{c,j,Rd}$ (kN)		812	951	1227
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			531	

**Table 4.39 Eaves connection – IPE 500**



Bolts M24	8.8
Hole diameter	26 mm
Column stiffeners	$t_p = 14$ mm
End plate	$t_p = 25$ mm

Column IPE 500	Beam IPE 500	S235	S275	S355
<b>Positive moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		683,3	795,8	1000
Minimum span length for 'rigid' $L_{b,min}$ (m)			9,45	
<b>Negative moment</b>				
Design moment resistance $M_{j,Rd}$ (kNm)		612,8	712,6	899,3
Minimum span length for 'rigid' $L_{b,min}$ (m)			11,28	
<b>Design axial resistance</b>				
Tension $N_{t,j,Rd}$ (kN)		812	951	1227
Compression $N_{c,j,Rd}$ (kN)		812	951	1227
<b>Design shear resistance <math>V_{j,Rd}</math> (kN)</b>			987	

## **REFERENCES**

- 1 EN 1993-1-8: Eurocode 3 Design of steel structures. Joint design