

1. Priloga A4: Izpisi statičnih izračunov za stransko fasado

2. Kontrola in dimenzioniranje prečnih prereзов

Linear calculation, Extreme : Member
Selection : B1, B2
Class : All ULS

EN 1993-1-1 Code Check

National annex: Slovenian SIST-EN NA

Member B1	2,500 m	U100	S 235	MSN2/1	0,63 -
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Partial safety factors

Gamma M0 for resistance of cross-sections	1,00
Gamma M1 for resistance to instability	1,00
Gamma M2 for resistance of net sections	1,25

Material

Yield strength f_y	235,0	MPa
Ultimate strength f_u	360,0	MPa
Fabrication	Rolled	

.....SECTION CHECK:.....

The critical check is on position 1.750 m

Internal forces	Calculated	Unit
N _{Ed}	0,00	kN
V _{y,Ed}	0,11	kN
V _{z,Ed}	0,33	kN
T _{Ed}	0,00	kNm
M _{y,Ed}	3,23	kNm
M _{z,Ed}	-0,03	kNm

Classification for cross-section design

According to EN 1993-1-1 article 5.5.2

Classification of Internal Compression parts

According to EN 1993-1-1 Table 5.2 Sheet 1

Maximum width-to-thickness ratio	11,00
Class 1 Limit	72,00
Class 2 Limit	83,00
Class 3 Limit	106,50

=> Internal Compression parts Class 1

Classification of Outstand Flanges

According to EN 1993-1-1 Table 5.2 Sheet 2

Maximum width-to-thickness ratio	4,18
Class 1 Limit	9,00
Class 2 Limit	10,00
Class 3 Limit	14,09

=> Outstand Flanges Class 1

=> Section classified as Class 1 for cross-section design

Bending moment check for M_y

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

W _{pl,y}	4,9838e-05	m ³
M _{pl,y,Rd}	11,71	kNm
Unity check	0,28	-

Bending moment check for M_z

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

W _{pl,z}	1,7531e-05	m ³
M _{pl,z,Rd}	4,12	kNm
Unity check	0,01	-

Shear check for V_y

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

E _t	1,20	
A _v	8,5000e-04	m ²
V _{pl,y,Rd}	115,33	kN
Unity check	0,00	-

Shear check for V_z

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Eta	1,20	
Av	6,2325e-04	m^2
Vpl,z,Rd	84,56	kN
Unity check	0,00	-

Combined bending, axial force and shear force check
According to EN 1993-1-1 article 6.2.1 and formula (6.2)

Npl,Rd	317,25	kN
Mpl,y,Rd	11,71	kNm
Mpl,z,Rd	4,12	kNm

Unity check (6.2) = 0,00 + 0,28 + 0,01 = 0,28 -

Note: No specific interaction formulae according to EN 1993-1-1 article 6.2.9.1 apply.

Therefore the plastic linear summation according to EN 1993-1-1 article 6.2.1(7) is verified.

Note: Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

....:STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 0,250 m

Classification of Internal Compression parts

According to EN 1993-1-1 Table 5.2 Sheet 1

Maximum width-to-thickness ratio	11,00
Class 1 Limit	72,00
Class 2 Limit	83,00
Class 3 Limit	79,05

=> Internal Compression parts Class 1

Classification of Outstand Flanges

According to EN 1993-1-1 Table 5.2 Sheet 2

Maximum width-to-thickness ratio	4,18
Class 1 Limit	9,00
Class 2 Limit	10,00
Class 3 Limit	15,03

=> Outstand Flanges Class 1

=> Section classified as Class 1 for member buckling design

Lateral Torsional Buckling Check

According to article EN 1993-1-1 : 6.3.2.1. and formula (6.54)

LTB Parameters		
Method for LTB curve	Art. 6.3.2.2.	
Wy	4.1200e-05	m^3
Elastic critical moment Mcr	18.00	kNm
Relative slenderness Lambda,LT	0.73	
Relative slenderness Lambda,T	0.27	
Relative slenderness Lambda,EXTRA	1.00	
Limit slenderness Lambda,LT,0	0.40	
LTB curve	a	
Imperfection Alpha,LT	0.21	
Reduction factor Chi,LT	0.67	
Buckling resistance Mb,Rd	6.44	kNm
Unity check	0.50	-

Note: Lambda,EXTRA is determined according to "Design rule for lateral torsional buckling of channel sections, 2007".

Mcr Parameters		
LTB length	2.500	m
k	1.00	
kw	1.00	
C1	1.17	
C2	0.19	
C3	1.00	

Note: C Parameters according to ECCS 119 2006 / Galea 2002
load in center of gravity

Compression and bending check

According to article EN 1993-1-1 : 6.3.3. and formula (6.61), (6.62)

Interaction Method 1

Table of values		
Student version *Student version* *Student version* *Student version*		
kyy	1.000	
kyz	1.000	
kzy	1.000	
kzz	1.000	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.3500e-03	m^2
Wy	4.1200e-05	m^3
Wz	8.4900e-06	m^3
NRk	317.25	kN
My,Rk	9.68	kNm
Mz,Rk	2.00	kNm
My,Ed	-3.73	kNm
Mz,Ed	0.09	kNm
Interaction Method 1		
Mcr0	15.36	kNm
reduced slenderness 0	0.79	
Psi y	0.000	
Psi z	0.000	
Cmy,0	1.000	
Cmz,0	1.000	
Cmy	1.000	
Cmz	1.000	
CmLT	1.000	
muy	1.000	
muz	1.000	
wy	1.210	
wz	1.500	
npl	-0.000	
aLT	0.986	
bLT	0.003	
cLT	0.190	
dLT	0.002	
eLT	0.059	
Cyy	0.999	
Cyz	0.905	
Czy	1.000	
Czz	1.000	

Unity check (6.61) = 0.00 + 0.58 + 0.05 = 0.63
 Unity check (6.62) = 0.00 + 0.58 + 0.05 = 0.63

Shear buckling check

in buckling field 1

According to article EN 1993-1-5 : 5. & 7.1. and formula (5.10) & (7.1)

Table of values	
Student version *Student version* *Student version* *Student version*	
hw/t	13.833

The web slenderness is such that the Shear Buckling Check is not required.
 The member satisfies the stability check.

EN 1993-1-1 Code Check

National annex: Slovenian SIST-EN NA

Member B2	2,500 m	U100	S 235	MSN2/1	0,43 -
Partial safety factors					
Student version *Student version* *Student version* *Student version* *Student version*					
Gamma M0 for resistance of cross-sections					1,00
Gamma M1 for resistance to instability					1,00
Gamma M2 for resistance of net sections					1,25

Material		
Student version *Student version* *Student version* *Student version*		
Yield strength fy	235,0	MPa
Ultimate strength fu	360,0	MPa
Fabrication	Rolled	

.....SECTION CHECK:.....

The critical check is on position 2.500 m

Internal forces	Calculated	Unit
N,Ed	0,00	kN
Vy,Ed	0,17	kN
Vz,Ed	-4,27	kN
T,Ed	0,00	kNm
My,Ed	-3,73	kNm
Mz,Ed	0,07	kNm

Classification for cross-section design

According to EN 1993-1-1 article 5.5.2

Classification of Internal Compression parts

According to EN 1993-1-1 Table 5.2 Sheet 1

Maximum width-to-thickness ratio	11,00
Class 1 Limit	72,00
Class 2 Limit	83,00
Class 3 Limit	126,39

=> Internal Compression parts Class 1

Classification of Outstand Flanges

According to EN 1993-1-1 Table 5.2 Sheet 2

Maximum width-to-thickness ratio	4,18
Class 1 Limit	9,00
Class 2 Limit	10,00
Class 3 Limit	13,93

=> Outstand Flanges Class 1

=> Section classified as Class 1 for cross-section design

Bending moment check for My

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Wpl,y	4,9838e-05	m^3
Mpl,y,Rd	11,71	kNm
Unity check	0,32	-

Bending moment check for Mz

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Wpl,z	1,7531e-05	m^3
Mpl,z,Rd	4,12	kNm
Unity check	0,02	-

Shear check for Vy

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Eta	1,20	
Av	8,5000e-04	m^2
Vpl,y,Rd	115,33	kN
Unity check	0,00	-

Shear check for Vz

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Eta	1,20	
Av	6,2325e-04	m^2
Vpl,z,Rd	84,56	kN
Unity check	0,05	-

Combined bending, axial force and shear force check

According to EN 1993-1-1 article 6.2.1 and formula (6.2)

Npl,Rd	317,25	kN
Mpl,y,Rd	11,71	kNm
Mpl,z,Rd	4,12	kNm

Unity check (6.2) = 0,00 + 0,32 + 0,02 = 0,34 -

Note: No specific interaction formulae according to EN 1993-1-1 article 6.2.9.1 apply.

Therefore the plastic linear summation according to EN 1993-1-1 article 6.2.1(7) is verified.

Note: Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

.....STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 0,000 m

Classification of Internal Compression parts

According to EN 1993-1-1 Table 5.2 Sheet 1

Maximum width-to-thickness ratio	11,00
Class 1 Limit	72,00
Class 2 Limit	83,00
Class 3 Limit	131,37

=> Internal Compression parts Class 1

Classification of Outstand Flanges

According to EN 1993-1-1 Table 5.2 Sheet 2

Maximum width-to-thickness ratio	4,18
Class 1 Limit	9,00
Class 2 Limit	10,00
Class 3 Limit	14,06

=> Outstand Flanges Class 1

=> Section classified as Class 1 for member buckling design

Lateral Torsional Buckling Check

According to article EN 1993-1-1 : 6.3.2.1. and formula (6.54)

LTB Parameters		
Student version *Student version* *Student version* *Student version* *Student version*		
Method for LTB curve	Art. 6.3.2.2.	
Wy	4.1200e-05	m^3
Elastic critical moment M _{cr}	39.79	kNm
Relative slenderness Lambda _{LT}	0.49	
Limit slenderness Lambda _{LT,0}	0.40	

M _{cr} Parameters		
Student version *Student version* *Student version*		
LTB length	2.500	m
k	1.00	
k _w	1.00	
C ₁	2.59	
C ₂	0.24	
C ₃	1.00	

The slenderness or bending moment is such that Lateral Torsional Buckling effects may be ignored according to EN 1993-1-1 article 6.3.2.2(4)

Compression and bending check

According to article EN 1993-1-1 : 6.3.3. and formula (6.61), (6.62)

Interaction Method 1

Table of values		
Student version *Student version* *Student version* *Student version*		
k _{yy}	1.000	
k _{yz}	1.000	
k _{zy}	1.000	
k _{zz}	1.000	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.3500e-03	m^2
Wy	4.1200e-05	m^3
Wz	8.4900e-06	m^3
NR _k	317.25	kN
My,R _k	9.68	kNm
Mz,R _k	2.00	kNm
My,Ed	-3.73	kNm
Mz,Ed	0.09	kNm
Interaction Method 1		
M _{cr0}	15.36	kNm
reduced slenderness 0	0.79	
Psi y	0.000	
Psi z	0.732	
C _{my,0}	1.000	
C _{mz,0}	1.000	
C _{my}	1.000	
C _{mz}	1.000	
C _{mLT}	1.000	
muy	1.000	
muz	1.000	
wy	1.210	
wz	1.500	
npl	-0.000	
a _{LT}	0.986	
b _{LT}	0.002	
c _{LT}	0.127	
d _{LT}	0.001	
e _{LT}	0.039	
C _{yy}	1.000	

Student version *Student version* *Student version* *Student version*

Table of values

Student version *Student version* *Student version* *Student version*

Cyz	0.937	
Czy	1.000	
Czz	1.000	

Unity check (6.61) = 0.00 + 0.39 + 0.05 = 0.43

Unity check (6.62) = 0.00 + 0.39 + 0.05 = 0.43

Shear buckling check

in buckling field 1

According to article EN 1993-1-5 : 5. & 7.1. and formula (5.10) & (7.1)

Table of values

Student version *Student version* *Student version*

hw/t	13.833
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The web slenderness is such that the Shear Buckling Check is not required.

The member satisfies the stability check.