

Symbol	Values	Unit	Symbol description	Section
MEMBER: 1 Beam_1 ; COORDINATE: x = 0.24 L = 1.60 m				
Cross-section properties: HEA 120				
Ax	25.34	cm ²	Cross-section area	
Ay	21.64	cm ²	Shear area - y-axis	
Az	8.46	cm ²	Shear area - z-axis	
Ix	6.02	cm ⁴	Torsional constant	
Iy	606.20	cm ⁴	Moment of inertia of a section about the y-axis	
Iz	231.00	cm ⁴	Moment of inertia of a section about the z-axis	
Wply	119.00	cm ³	Plastic section modulus about the y (major) axis	
Wplz	58.90	cm ³	Plastic section modulus about the z (minor) axis	
h	11.4	cm	Height of cross-section	
b	12.0	cm	Width of cross-section	
tf	0.8	cm	Flange thickness	
tw	0.5	cm	Web thickness	
ry	4.9	cm	Radius of gyration - y-axis	
rz	3.0	cm	Radius of gyration - z-axis	
Anb	1.00		Net area to gross area ratio	(6.2.2.2)
Eta	1.00		Factor for Av calculation	(6.2.6.(3))
Material:				
Name			S355J2H (S355)	
fy	355.00	MPa	Design yield strength of material	(3.2)
fu	490.00	MPa	limit tensile stress - characteristic value	(3.2)
gM0	1.00		Partial safety factor	(6.1.(1))
gM1	1.00		Partial safety factor	(6.1.(1))
gM2	1.25		Partial safety factor	(6.1.(1))
Designations of additional codes:				
EN112			EN 1991-1-2:2003 - Fire loads on a structure	
EN312			EN 1993-1-2:2005 - Steel structures - fire design	
EN313			EN 1993-1-3:2005 - Steel structures from cold-formed sections	
EN315			EN 1993-1-5:2005 - Steel structures - plated elements	
EC111			ECCS No111:2001 - Guidebook with recommendations for fire calculations	
ENV311			ENV 1993-1-1:1992 - Steel structures - general code	
Class of section				
cf	4.5	cm	flange width	(Table 5.2)
tf	0.8	cm	flange thickness	(Table 5.2)
cf/tf	5.69		Flange slenderness	(Table 5.2)
KLF	1		Flange class	(5.5.2)
cw	7.4	cm	Web height	(Table 5.2)
tw	0.5	cm	Web thickness	(Table 5.2)
cw/tw	14.80		Web slenderness	(Table 5.2)
alfa	0.50		Relative extent of the compressed plastic zone	(Table 5.2)
psi	-1.00		Stress or strain ratio	(Table 5.2)

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KLW	1		Web class	(5.5.2)
(hw/tw)lim	58.58		limit slenderness of a web for shear	EN315(5.1)
hw/tw	19.60		web slenderness for shear	EN315(5.1)
KLSZ	Plastic		Web class (shear)	EN315(5.1)
KL	1		Section type	(5.5.2)
Parameters of buckling analysis:				
About the y axis of cross-section				
Curve,y	b		Buckling curve	(Table 6.2)
Lcr,y	0.21	m	Effective buckling length	(6.3.1.2.(1))
Lamy	4.33		Slenderness ratio	(6.3.1.2.(1))
Lam_y	0.06		Non-dimensional slend. ratio for buckling	(6.3.1.2.(1))
alfa,y	0.34		imperfection factor	(6.3.1.2.(2))
fi,y	0.48		Coefficient for calculation of X	(6.3.1.2.(1))
Xy	1.00		Reduction factor for buckling	(6.3.1.2.(1))
Ny,b,Rd	899.57	kN	Design buckling resistance of comp. member	(6.3.1.1.(3))
About the z axis of cross-section				
Curve,z	c		Buckling curve	(Table 6.2)
Lcr,z	6.80	m	Effective buckling length	(6.3.1.2.(1))
Lamz	225.22		Slenderness ratio	(6.3.1.2.(1))
Lam_z	2.95		Non-dimensional slend. ratio for buckling	(6.3.1.2.(1))
alfa,z	0.49		imperfection factor	(6.3.1.2.(2))
fi,z	5.52		Coefficient for calculation of X	(6.3.1.2.(1))
Xz	0.10		Reduction factor for buckling	(6.3.1.2.(1))
Nz,b,Rd	88.36	kN	Design buckling resistance of comp. member	(6.3.1.1.(3))
Parameters of lateral-torsional buckling analysis:				
Detailed method [6.3.2.3]				
Lcr,upp	6.80	m	Lateral buckling length of upper flange	active
Lcr,low	6.80	m	Lateral buckling length of lower flange	inactive
C1	1.13		Factor for M _{cr} calculations	ENV311(F.1.2.(5))
C2	0.46		Factor for M _{cr} calculations	ENV311(F.1.2.(5))
C3	0.53		Factor for M _{cr} calculations	ENV311(F.1.2.(5))
I _w	6488.8	cm ⁶	Warping constant	(6.3.2.2)
z _g	5.7	cm	Distance from the point where the load is applied to the shear center	ENV311(F.1.2.(1))
M _{cr}	23.26	kN*m	Critical moment for lateral-torsional buckling	ENV311(F.1)
kc	0.94		correction factor determined by loading method	(6.3.2.3.(2))
Lam_LT	1.35		Non-dimens. slend. ratio for lat.-tors. buckling	(6.3.2.2.(1))
Lam,LT0	0.40		slenderness ratio	(6.3.2.3.(1))
Curve,LT	b		Lateral buckling curve	(6.3.2.3.(1))
alfa,LT	0.34		Imperfection factor for lateral buckling curves	(Table 6.3)
fi,LT	1.34		Coefficient for calculation of XLT	(6.3.2.3.(1))
Beta	0.75		Coefficient for calculation of XLT	(6.3.2.3.(1))
XLT	0.50		Reduction factor for lateral-torsional buckling	(6.3.2.3.(1))
f	0.99		reduction coefficient for calculation of XLT,mod	(6.3.2.3.(2))
XLT,mod	0.50		modified lateral buckling coefficient	(6.3.2.3.(2))

Symbol	Values	Unit	Symbol description	Section
Parameters of global stability analysis of member				
Method of interaction parameter calculations - Annex A				
Ncr,y	280173.99	kN	Euler buckling load in y direction	(Table A.1)
Ncr,z	103.54	kN	Euler buckling load in z direction	(Table A.1)
Ncr,T	1559.73	kN	Critical force (lateral-torsional buckling)	(Table A.1)
Miy	1.00		Coefficient for calculation of interaction coefficients kij	(Table A.1)
Miz	1.00		Coefficient for calculation of interaction coefficients kij	(Table A.1)
wy	1.12		Coefficient related to ratio of section properties	(Table A.1)
wz	1.50		Coefficient related to ratio of section properties	(Table A.1)
Lam_0	1.35		Relative slenderness for lateral buckling (constant moment)	(Table A.1)
Cmy,0	1.00		Parameter related to bending moment distribution	(Table A.2)
Cmz,0	1.00		Parameter related to bending moment distribution	(Table A.2)
Cmy	1.00		Parameter related to bending moment distribution	(Table A.1)
Cmz	1.00		Parameter related to bending moment distribution	(Table A.1)
Cmy,0LT	1.00		Parameter related to bending moment distribution	(Table A.2)
CmyLT	1.00		Parameter related to bending moment distribution	(Table A.1)
CmLT	1.00		Parameter related to bending moment distribution	(Table A.1)
aLT	0.99		Coefficient for calculation of interaction coefficients kij	(Table A.1)
bLT	0.00		Coefficient for calculation of Cyy	(Table A.1)
Cyy	1.00		Coefficient for calculation of interaction coefficients kij	(Table A.1)
cLT	0.02		Coefficient for calculation of Cyz	(Table A.1)
Cyz	0.99		Coefficient for calculation of interaction coefficients kij	(Table A.1)
dLT	0.00		Coefficient for calculation of Czy	(Table A.1)
Czy	1.00		Coefficient for calculation of interaction coefficients kij	(Table A.1)
eLT	0.00		Coefficient for calculation of Czz	(Table A.1)
Czz	1.00		Coefficient for calculation of interaction coefficients kij	(Table A.1)
kyy	1.00		Interaction parameter	(Table B.2)
kyz	0.71		Interaction parameter	(Table B.2)
kzy	0.52		Interaction parameter	(Table B.2)
kzz	1.00		Interaction parameter	(Table B.2)
Internal forces at characteristic points of cross section				
N,Ed	0.48	kN	axial force N.Ed	
My,Ed	1.98	kN*m	bending moment My.Ed	
Mz,Ed	0.00	kN*m	bending moment Mz.Ed	
Vy,Ed	0.00	kN	shear force Vy.Ed	
Vz,Ed	-4.36	kN	shear force Vz.Ed	
Design forces:				
Nc,Rd	899.57	kN	Design compression resistance	(6.2.4)
Nb,Rd	88.36	kN	Design buckling resistance of comp. member	(6.3.1.1)
Mb,Rd	21.33	kN*m	Design buckling resistance moment	(6.3.2.1)
About the y axis of cross-section				
My,pl,Rd	42.24	kN*m	Design plastic resistance moment	(6.2.5.(2))
My,el,Rd	37.75	kN*m	Design elastic resistance moment	(6.2.5.(2))
My,c,Rd	42.24	kN*m	Design moment resistance	(6.2.5.(2))
MN,y,Rd	42.24	kN*m	Reduced design plastic resistance moment	(6.2.9.1)

Symbol	Values	Unit	Symbol description	Section
Vy,c,Rd	443.53	kN	Design plastic shear resistance	(6.2.6.(2))
About the z axis of cross-section				
Mz,pl,Rd	20.91	kN*m	Design plastic resistance moment	(6.2.5.(2))
Mz,el,Rd	13.67	kN*m	Design elastic resistance moment	(6.2.5.(2))
Mz,c,Rd	20.91	kN*m	Design moment resistance of a compressed section part	(6.2.5.(2))
MN,z,Rd	20.91	kN*m	Reduced design plastic resistance moment	(6.2.9.1)
Vz,c,Rd	173.40	kN	Design plastic shear resistance	(6.2.6.(2))
Verification formulas:				
Section strength check:				
UFS[Nc]	0.00		N,Ed/Nc,Rd	(6.2.4.(1))
UFS[NcMyMz]	0.00		$(My,Ed/MN,y,Rd)^{2.00} + (Mz,Ed/MN,z,Rd)^{1.00}$	(6.2.9.1.(6))
UFS[Vy]	0.00		Vy,Ed/Vy,c,Rd	(6.2.6.(1))
UFS[Vz]	0.03		Vz,Ed/Vz,c,Rd	(6.2.6.(1))
Global stability check of member:				
UFB[Lambda]	1.07		Max(Lambda,y/Lambda,max ; Lambda,z/Lambda,max)	instable
UFB[My]	0.09		My,Ed/Mb,Rd	(6.3.2.1.(1))
UFB[NyMyMz]	0.09		$N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed/(XLT*My,Rk/gM1) +$ $kzz*Mz,Ed/(Mz,Rk/gM1)$	(6.3.3.(4))
UFB[NzMyMz]	0.05		$N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed/(XLT*My,Rk/gM1) +$ $kzz*Mz,Ed/(Mz,Rk/gM1)$	(6.3.3.(4))
Ratio:				
RAT	0.09		Efficiency ratio	Instability