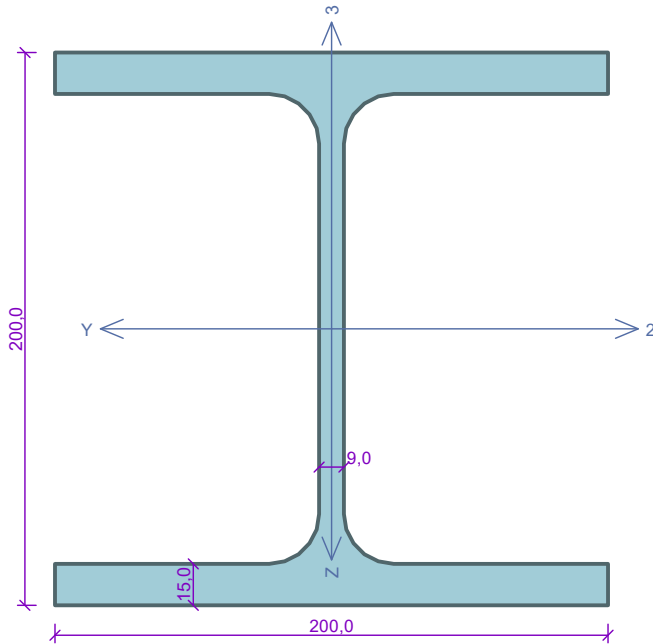


Section 1



Standard EN 1993-1-2/Czech Rep..

Reliability of steel in fire :  $\gamma_{M,fi} = 1,000$

**Section HE 200 B**

Cross-sectional area:  $A = 7,810E03 \text{ mm}^2$

Centre of gravity position:

$y_T = 100,0 \text{ mm}$      $z_T = 100,0 \text{ mm}$

Second moments of area:

$I_y = 5,700E07 \text{ mm}^4$      $I_z = 2,000E07 \text{ mm}^4$

Cross-section moduli:

$W_{y,1} = -5,696E05 \text{ mm}^3$      $W_{z,1} = 2,003E05 \text{ mm}^3$

$W_{y,2} = 5,696E05 \text{ mm}^3$      $W_{z,2} = -2,003E05 \text{ mm}^3$

Torsion constant:

$I_k = 5,960E05 \text{ mm}^4$

Warping constant:

$I_\omega = 1,710E11 \text{ mm}^6$

Plastic cross-section moduli:

$W_{pl,y} = 6,425E05 \text{ mm}^3$      $W_{pl,z} = 3,058E05 \text{ mm}^3$

**Material: EN 10025 : Fe 360**

**Material characteristics:**

Yield strength  $f_y$  : 235,0 MPa

Ultimate strength  $f_u$  : 360,0 MPa

Elastic modulus  $E$  : 210000 MPa

Shear modulus  $G$  : 81000 MPa

**Temperature curve:**

Standard temperature curve

**Fire detail:**

Cross-section protected by spray, exposed to fire on all sides

**Fire protection material:** Spray-coatings - vermiculite

Thickness  $d_p$  : 8,5 mm

Density  $\rho_p$  : 350,0 kg/m<sup>3</sup>

Heat capacity  $c_p$  : 1200,0 J/kg/K

Thermal conduction  $\lambda_p$  : 0,120 W/m/K

**Internal forces in system of cross-section coordinates**

Load with maximal utilization

Load 01: Compression + bending

$N = -82,000 \text{ kN}$

$V_z = 30,000 \text{ kN}$      $M_y = 11,913 \text{ kNm}$

$V_y = 0,000 \text{ kN}$      $M_z = 0,000 \text{ kNm}$

$T_t = 0,000 \text{ kNm}$

$T_\omega = 0,000 \text{ kNm}$      $B = 0,000 \text{ kNm}^2$

**Buckling parameters**

Length: 8,730 m

$L_z = 4,365 \text{ m}$      $k_z = 1,000$      $L_{cr,z} = 4,365 \text{ m}$

$L_y = 4,365 \text{ m}$      $k_y = 1,000$      $L_{cr,y} = 4,365 \text{ m}$

**LTB parameters**

End condition factors:  $k_y = 1.0$      $k_z = 1.0$      $k_w = 1.0$

$l_{z1} = 8,730 \text{ m}$      $M_y$ : Shape no.1

$l_{y1} = 8,730 \text{ m}$      $M_z$ : Shape no.1

**Results - Decisive load:** Load 01: Compression + bending; **Cross-section class:** 1

**Critical temperature:** 659,5°C **Fire resistance period:** 61,5 min  $\geq$  60,0 min **Pass**

**Check at time t = 60,0 min:**

Gas temperature: 945,3°C    Steel temperature: 652,6°C

**Shear check due to shear force  $V_z$ :**

30,000 kN < 115,935 kN **Pass**

Internal forces:  $N = -82,000 \text{ kN}$ ;  $M_y = 11,913 \text{ kNm}$ ;  $M_z = 0,000 \text{ kNm}$

**Critical combination check: buckling compression and bending moment:**

**Buckling Y:** Resistances:  $N_R = -387,335 \text{ kN}$ ;  $M_{y,R} = 17,682 \text{ kNm}$

$|0,212 + 0,674 + 0,000| = |0,885| < 1$  **Pass**

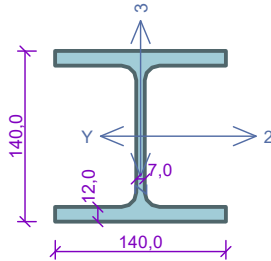
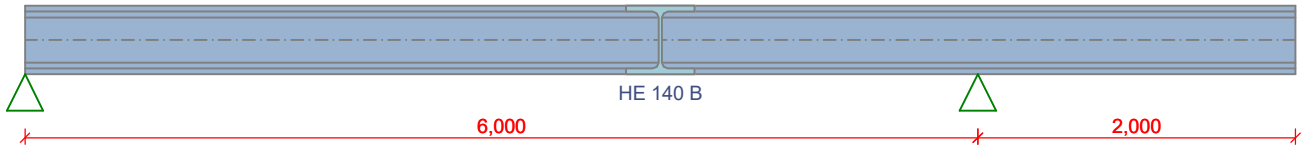
**Buckling Z:** Resistances:  $N_R = -244,724 \text{ kN}$ ;  $M_{y,R} = 19,507 \text{ kNm}$

$|0,335 + 0,611 + 0,000| = |0,946| < 1$  **Pass**

**Section ok**

**PASS**

Beam 1



Standard EN 1993-1-2/Czech Rep..

Section HE 140 B

Material: EN 10210-1 : S 235

Load

- $f_{g,1} = 0,337 \text{ kN/m}$   $\gamma_f = 1,35$
- $f_{g,2} = 1,000 \text{ kN/m}$   $\gamma_f = 1,35$
- $f_{q,3} = 2,000 \text{ kN/m}$   $\gamma_f = 1,5$
- $f_{q,4} = 2,000 \text{ kN/m}$  (0,000 - 6,000m)  $\gamma_f = 1,5$
- $f_{q,5} = 2,000 \text{ kN/m}$  (6,000 - 8,000m)  $\gamma_f = 1,5$

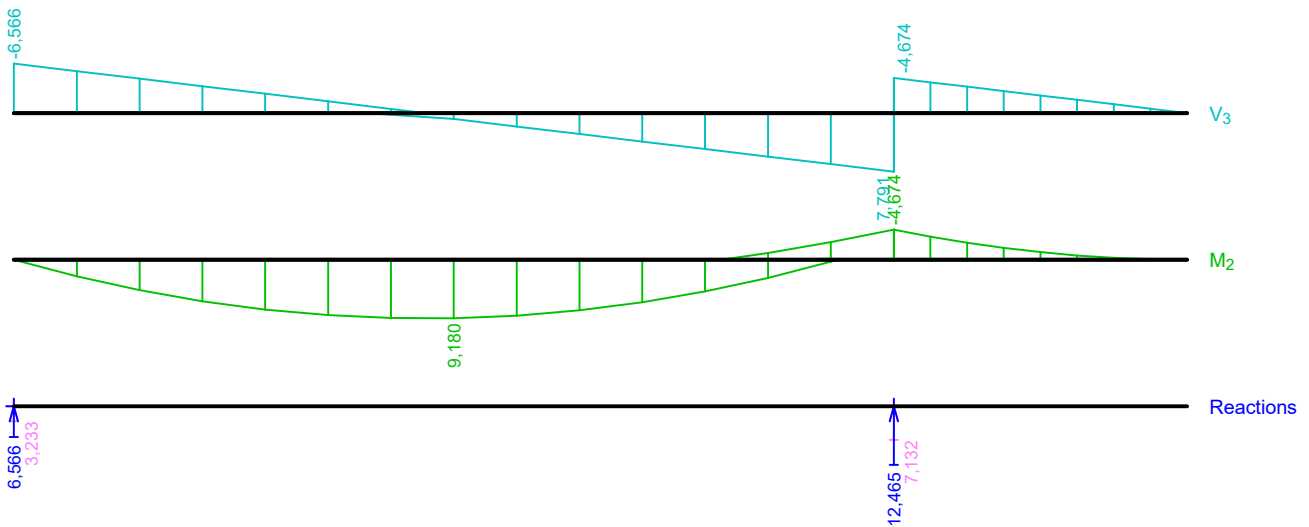
Temperature curve:  
Standard temperature curve

LTB parameters

End condition factors:  $k_y = -$   $k_z = 1,0$   $k_w = 1,0$   
 $l_{z1} = 8,000 \text{ m}$   $M_y$ : Shape no.4  $z_p = 1,000$

Fire detail:

Unprotected cross-section, exposed to fire on three sides



Results - Decisive load: Q4:G1+G2; Cross-section class: 1

Critical temperature: 659,7°C Fire resistance

period: 15,4 min  $\geq$  15,0 min **Pass**

Check at time  $t = 15,0 \text{ min}$ :

Gas temperature: 738,6°C Steel temperature: 651,2°C

Shear check due to shear force  $V_z$ :

0,446 kN < 61,605 kN **Pass**

Bending moment:  $M_y = 9,180 \text{ kNm}$

Bending moment check:

Resistance:  $M_{y,R} = 9,827 \text{ kNm}$

$|0,934| < 1$  **Pass**

Section ok

PASS