The Second Generation Eurocodes

Key changes and benefits through design examples

Online, 3-5 June 2025

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Eurocode 9 – Part 1-2: Structural fire design

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EUROCODES

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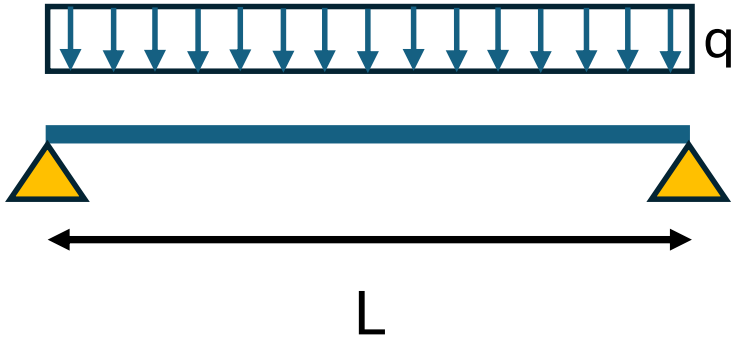
EN 1999

Design of aluminium structures

Eurocode 9 – Part 1-2: Structural fire design

INPUT DATA



M_{max}=43.74 kNm

T_{max}=32.4 kN

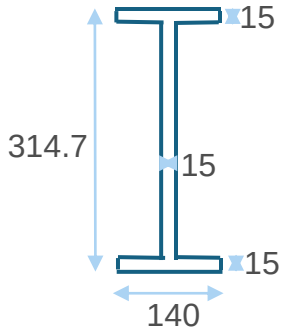
q=12 kN/m

L=5.4 m

The member is fully restrained against lateral movement throughout its length (no lateral torsional buckling)

Extruded Profile Section:

H 140x314.7x15x15



Alluminium Alloy:

- EN AW-6082 T61
- f_0= 260 MPa
- f_u = 310MPa
- A = 10%
- $f_{0,HAZ}$= 125 MPa
- $f_{u,HAZ}$= 185 MPa
- $\rho_{0,HAZ}$= 0.48
- $\rho_{u,HAZ}$= 0.67
- n_p= 25
- BC= A
- E= 70000 MPa

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CROSS SECTION CLASS

Flat Outstand with no stress gradient *

$\beta = 0.40 \cdot b/t = 1.66$

Internal part with a stress gradient that * results in a neutral axis at the centre

$\beta = \eta \cdot b/t = 7.59$

$\varepsilon = (250/f_0)^{0.5} = 0.98$

$\beta \leq 4\varepsilon/\alpha_c = 3.92$

$\beta \leq 16\varepsilon/\alpha_c = 7.84$

CLASS 1 CROSS SECTIONAL PART

CLASS 1 CROSS SECTIONAL PART

CLASS1 CROSS SECTION

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BENDING MOMENT RESISTANCE FOR NORMAL TEMPERATURE (20°) *

$$M_{Rd} = M_{0Rd} = \frac{\alpha \cdot W_{el} \cdot f_0}{\gamma_{M1}} = \frac{1.2 \cdot 29553244 \cdot 260}{\left(\frac{314.7}{2}\right) \cdot 1.1} = 44.39 \cdot 10^6 Nmm$$

$$\frac{M_{Ed}}{M_{RD}} = \frac{43.74}{44.39} = 0.98$$

SHEAR RESISTANCE FOR NORMAL TEMPERATURE (20°) *

$$V_{Rd} = A_v \cdot \frac{f_0}{\sqrt{3} \cdot \gamma_{M1}} = 4270.5 \cdot \frac{260}{\sqrt{3} \cdot 1.1} = 582 \cdot 10^3\ N$$

$$\frac{V_{Ed}}{V_{RD}} = \frac{32.4}{582} = 0.055 \ll 0.5$$

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∗ **Table 5.1 — 0,2 % proof strength reduction factor, $k_{o,\theta}$, for aluminium alloys at elevated temperature for up to 2 h of thermal exposure**

Alloy	Temper	Aluminium alloy temperature °C							
		20	100	150	200	250	300	350	550
EN AW-3004	H34	1,00	1,00	0,98	0,57	0,31	0,19	0,13	0
EN AW-5005	O	1,00	1,00	1,00	1,00	0,82	0,58	0,39	0
EN AW-5005	H14[a]	1,00	0,93	0,87	0,66	0,37	0,19	0,10	0
EN AW-5052	H34[b]	1,00	1,00	0,92	0,52	0,29	0,20	0,12	0
EN AW-5083	O	1,00	1,00	0,98	0,90	0,75	0,40	0,22	0
EN AW-5083	H12[c]	1,00	1,00	0,80	0,60	0,31	0,16	0,10	0
EN AW-5454	O	1,00	1,00	0,96	0,88	0,50	0,32	0,21	0
EN AW-5454	H34	1,00	1,00	0,85	0,58	0,34	0,24	0,15	0
EN AW-6061	T6	1,00	0,95	0,91	0,79	0,55	0,31	0,10	0
EN AW-6063	T5	1,00	0,92	0,87	0,76	0,49	0,29	0,14	0
EN AW-6063	T6[d]	1,00	0,91	0,84	0,71	0,38	0,19	0,09	0
EN AW-6082	T4[e]	1,00	1,00	0,84	0,77	0,77	0,34	0,19	0
EN AW-6082	T6	1,00	0,90	0,79	0,65	0,38	0,20	0,11	0

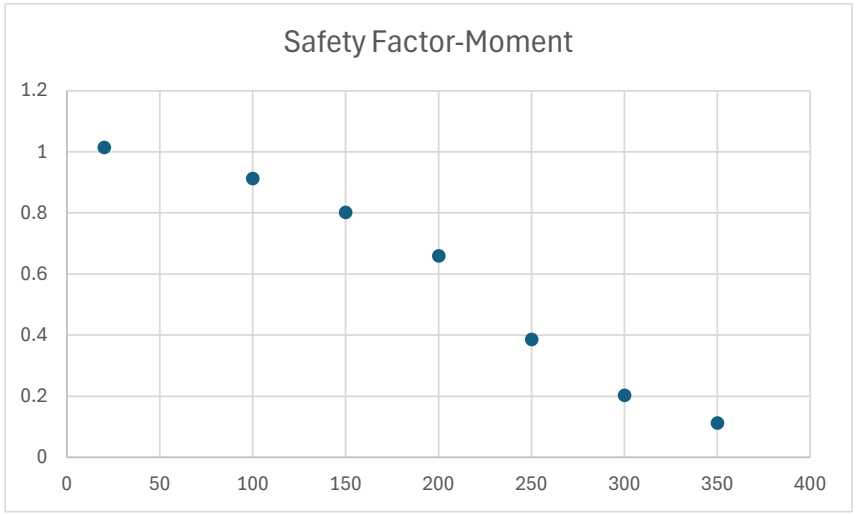
[a] The values may be applied also for temper H24/H34/H12/H32.

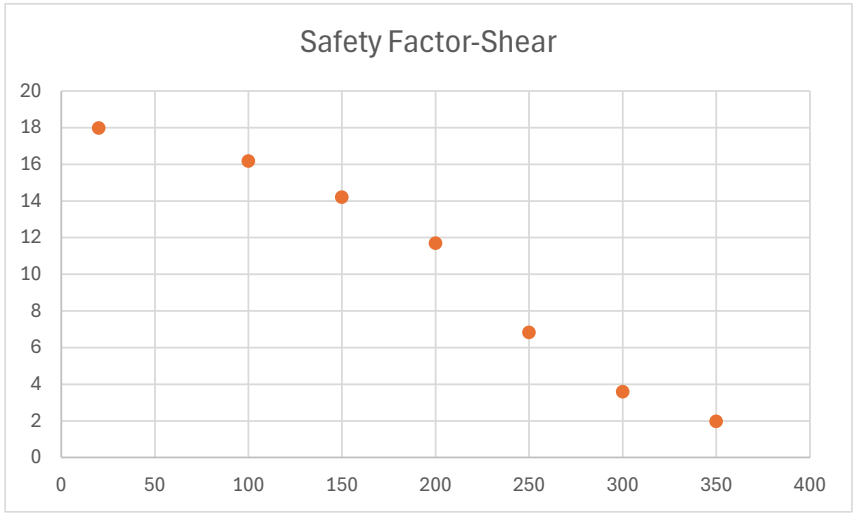
[b] The values may be applied also for temper H12/H22/H32.

[c] The values may be applied also for temper H22/H32.

[d] The values may be applied also for EN AW-6060 T6 and T66.

[e] The values do not include an increase in strength due to aging effects. It is recommended to ignore such effects.





Thank you!