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EN 1991-1-2: Improved rules for design fires

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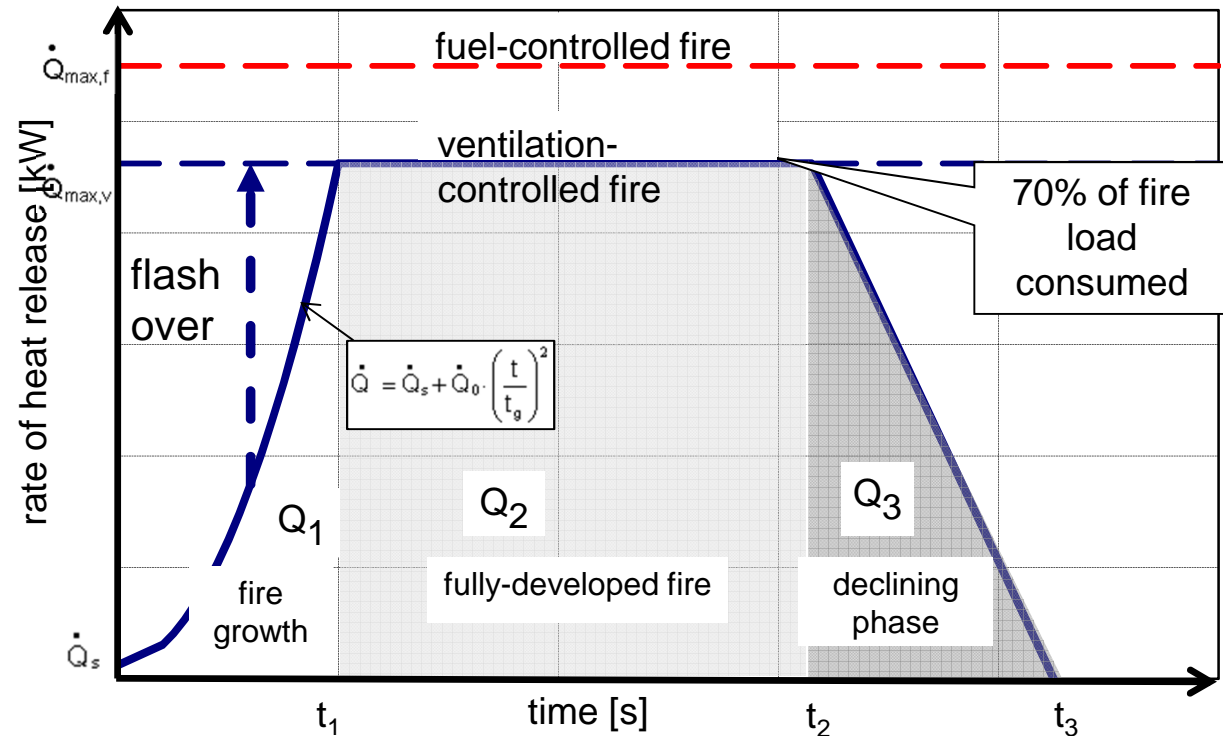
hhpberlin Ingenieure für Brandschutz GmbH, Hamburg

COST Action TU0904 WP 6 Eurocode upgrades Cracow University of Technology

Design fire – rate of heat release

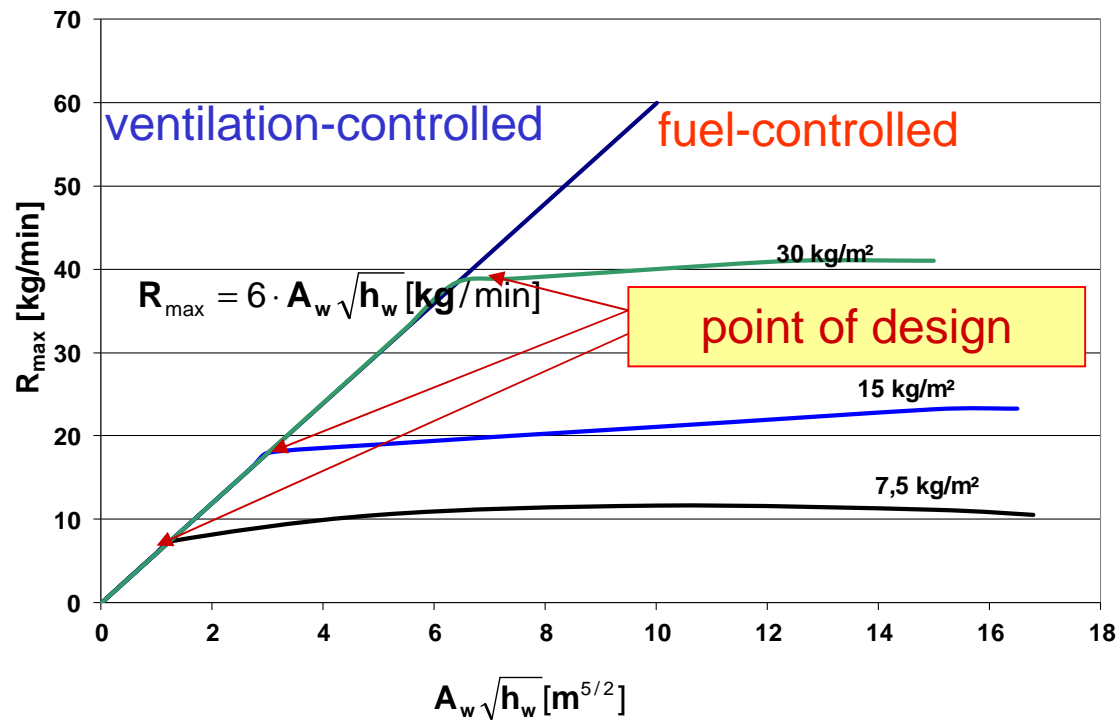
□ Precision required

- Geometry of fire compartment
- Definition of ventilation openings
- Considering flash over
- Temperature-time curves of compartment fires (annex A)
- Safety concept (annex E)



Ventilation openings

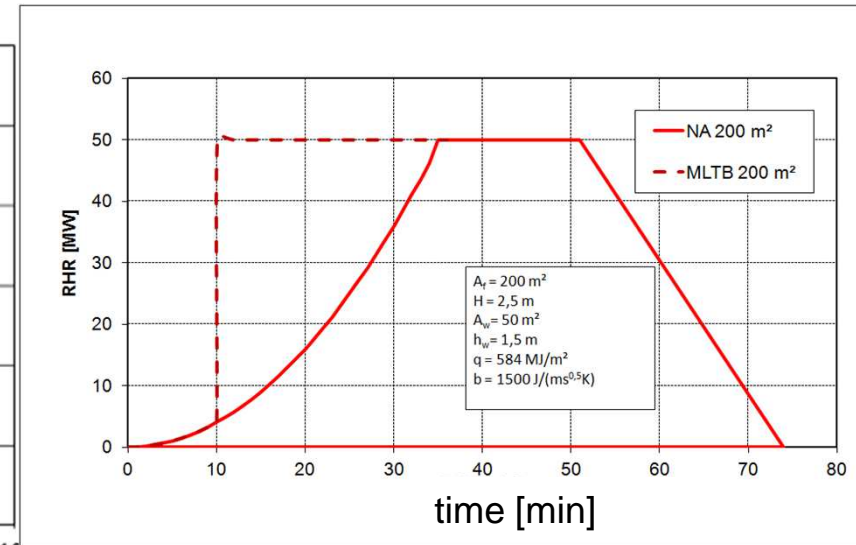
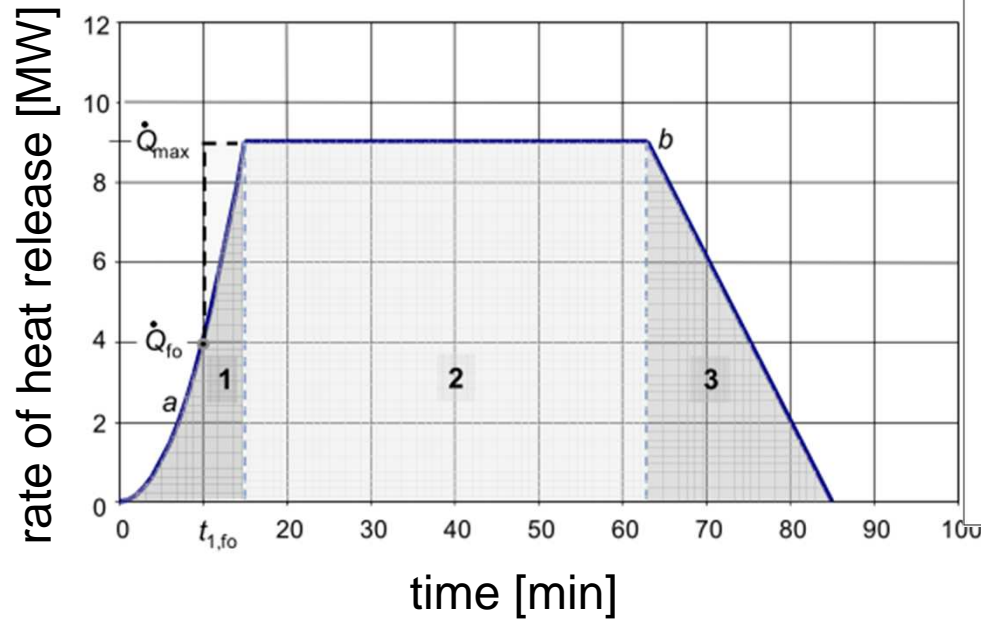
Parameter: fire load vs area of fire compartment



Questions

- Failure time / temperature of glazings
- Grade of opening

Flash over



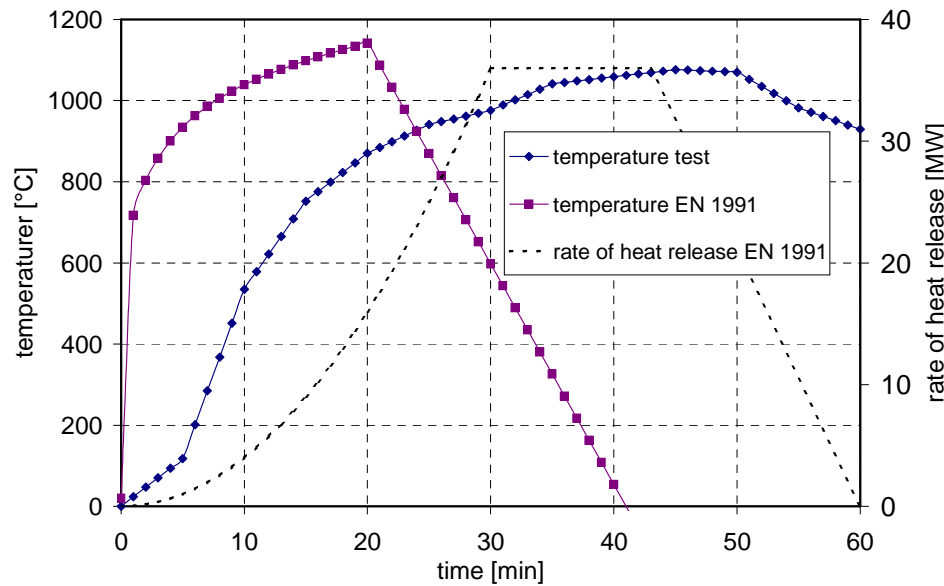
$$t_{1,fo} = \sqrt{t_{\alpha}^2 \cdot \dot{Q}_{fo}}$$

□ Approach of Walton and Thomas

$$\dot{Q}_{fo} = 0,0078 \cdot A_t + 0,378 \cdot A_w \cdot \sqrt{h_w} \quad \text{in MW}$$

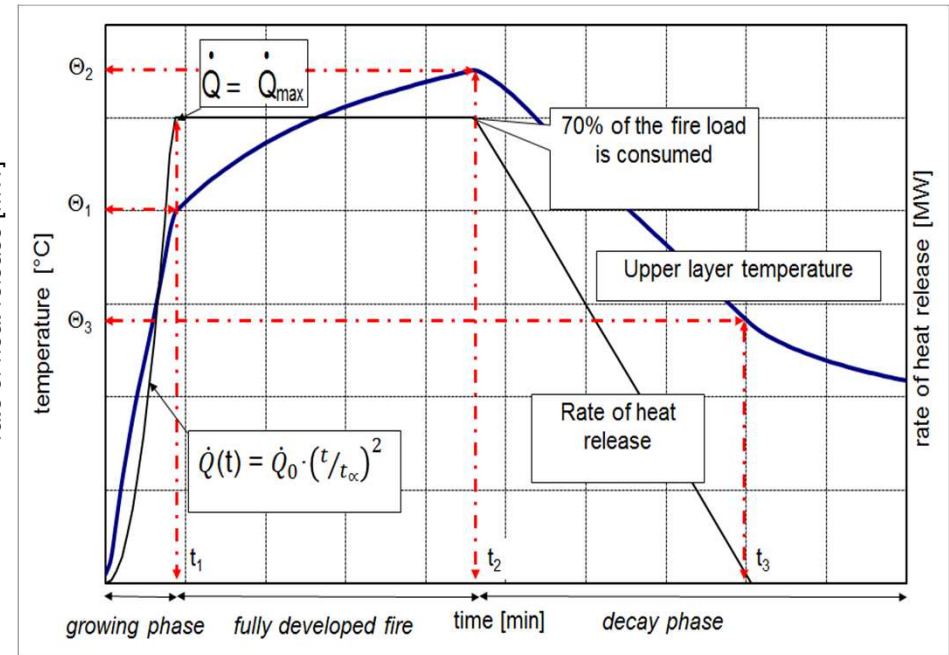
Parametric temperature-time curves

❑ EC 1-1-2 annex A



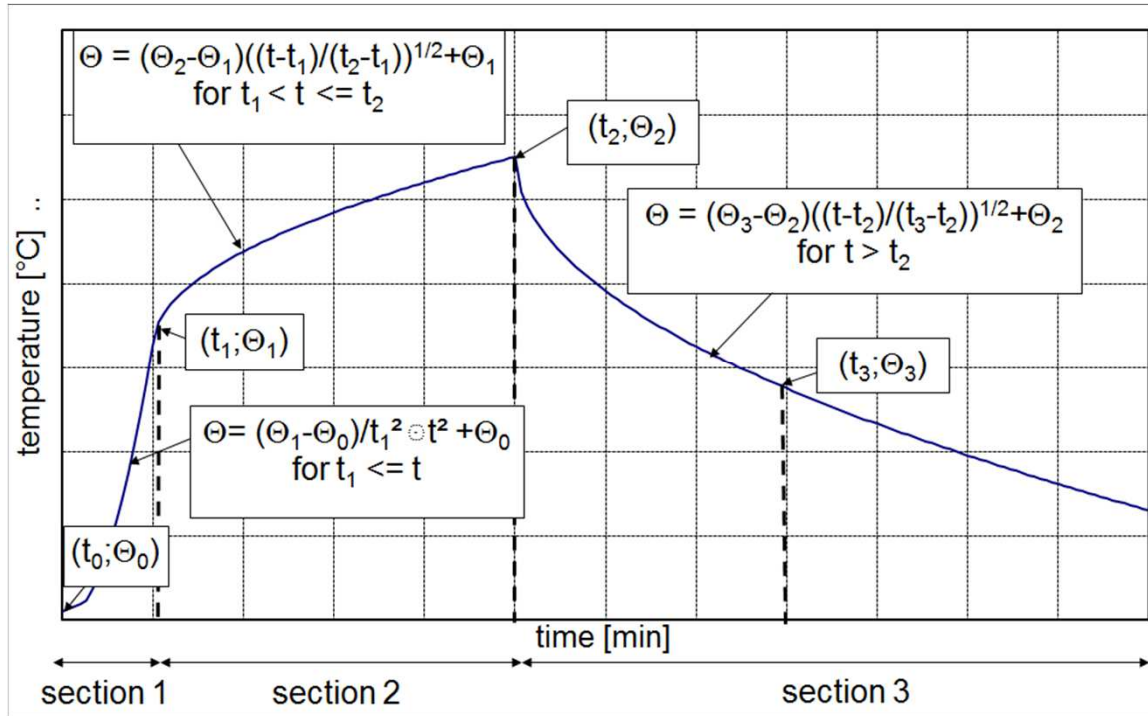
no temporal correlation between RHR and parametric curves

❑ German national annex AA



rate of heat release and temperature-time curve fit together

Definition of parametric temp.-time curves (German annex AA)



ventilation-controlled:

$$\Theta_1 = -8.75 \cdot 1/O - 0.1 b + 1175 \text{ [}^\circ\text{C]}$$

$$\Theta_2 = (0.004 b - 17) \cdot 1/O - 0.4 b + 2175 \text{ [}^\circ\text{C]}$$

$$\Theta_3 = -5.0 \cdot 1/O - 0.16 b + 1060 \text{ [}^\circ\text{C]}$$

fuel-controlled:

$$\Theta_1 = 24000 k + 20 \text{ [}^\circ\text{C]}$$

$$\Theta_2 = 33000 k + 20 \text{ [}^\circ\text{C]}$$

$$\Theta_3 = 16000 k + 20 \text{ [}^\circ\text{C]}$$

$$k = \left(\frac{\dot{Q}_{\max,f}^2}{A_w \sqrt{h_w} \cdot A_T \cdot b} \right)^{1/3}$$



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