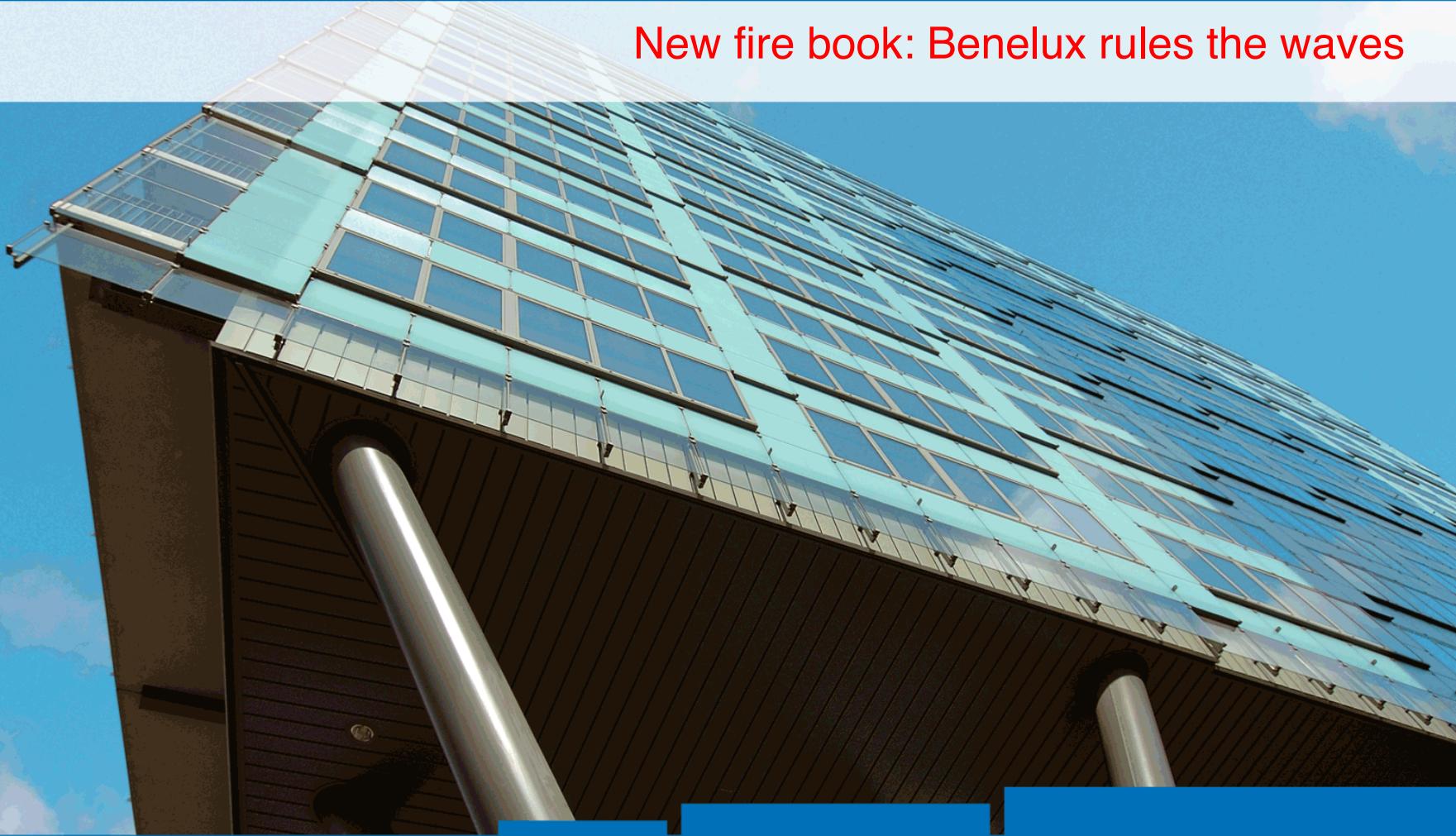


Learning lunch 5 november 2020

New fire book: Benelux rules the waves



Van oud....

Brandveiligheid en berekening van de brandwerendheid van staalconstructies voor gebouwen volgens Eurocode 3

Brand

A.F. Hamerlinck

Handboeken staalconstructies

Brandveiligheid

Brandveiligheid en berekening van de brandwerendheid van staalconstructies voor gebouwen volgens Eurocode 3

Louis Guy Capit, Rik Delhaes, Ivan Marc Franse

Guides de construction métallique

Sécurité incendie

Sécurité incendie et calcul de la résistance au feu des bâtiments en acier selon l'Eurocode 3

Jean-Guy Capit, Rik Delhaes, Ivan-Marc Franse

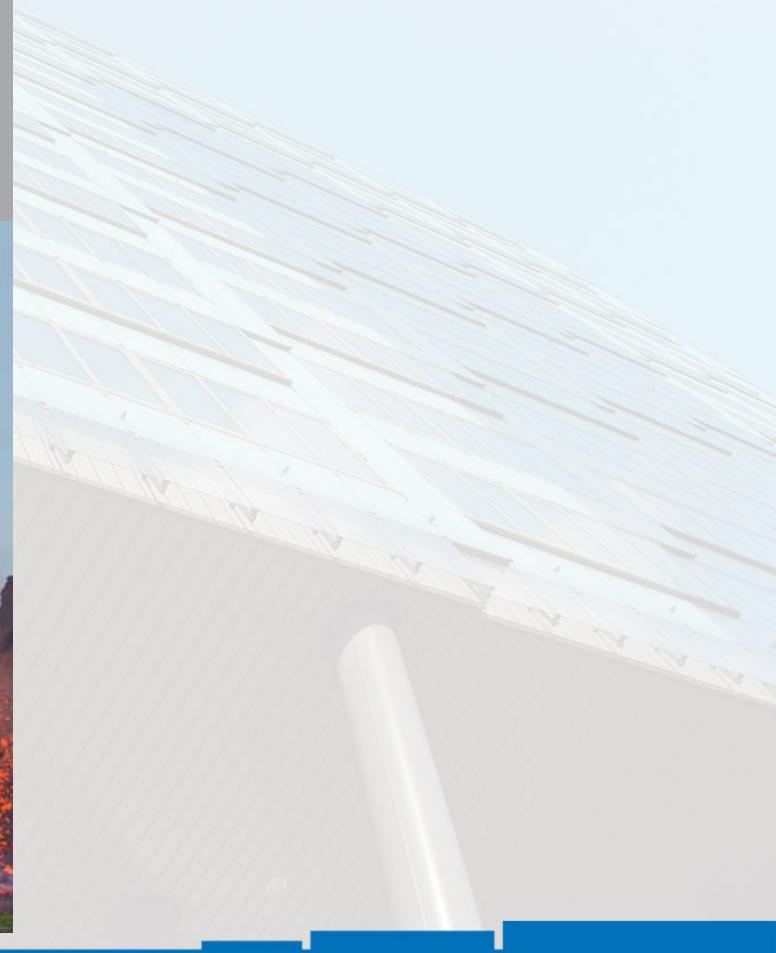
....naar nieuw

Fire safety and fire resistant design of steel structures for buildings
according to Eurocode 3

Steel Design 2

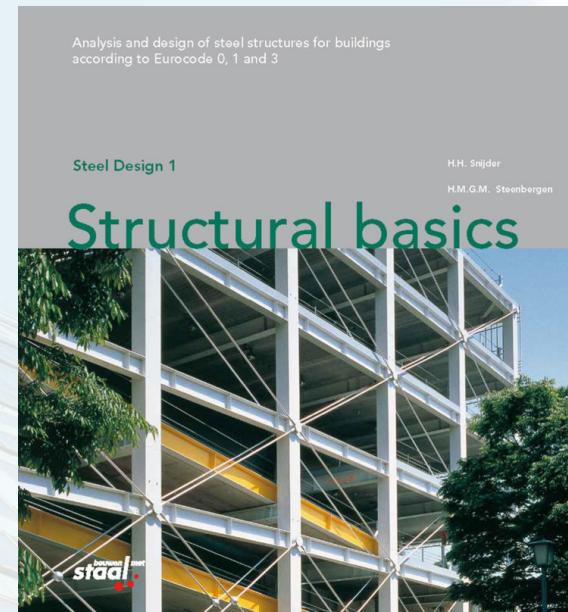
Fire

A.F. Hamerlinck



Onderdeel van een serie

- **Steel Design 1 Structural basics (2019)**
 - Analysis and design of steel structures for buildings according to Eurocode 0, 1 and 3
- **Steel Design 2 Fire (2021)**
 - Fire safety and fire resistant design of steel structures for buildings according to Eurocode 3
- **Steel Design 3 Connections**
 - Behaviour of connections in steel structures and design of mechanical fasteners and welds according to Eurocode 3
- **Steel Design 4 Composite structures**
 - Analysis and design of composite steel and concrete structures for buildings according to Eurocode 4
- **Steel Design 5 Joints**
 - Analysis and design of bolted and welded connections in steel frames and in tubular structures according to Eurocode 3



- universiteiten moeten in Engelse taal lesgeven
- elk land eigen studieboeken ≠ economisch
- Europese boeken om ontwikkelkosten te spreiden
- hoe omgaan met landspecifieke zaken (Nationale Bijlagen in Eurocodes)?

- Engelstalig boek gebaseerd op de EN-versie van de Eurocode, met in kantlijn aangegeven waar de lezer wordt verwezen naar landspecifieke info,

In most European countries the required fire resistance of the main load bearing structure depends on the occupancy and the height of the building (e.g. fig. 1.24 as an example for the Dutch [and Belgian](#) building regulations).

- als pdf te downloaden is bij de landelijke staalinfocenters.
- verspreidingsgebied voornamelijk Europa: actief doen nu mee: België, Luxemburg, Nederland en Zwitserland
- verkoop via de landelijke organisaties, maar ook via Worldsteel en als e-book via Wiley/Ernst & Sohn
- doelgroep: constructeurspraktijk en onderwijs

Ontwikkeling

- concept vergelijkbaar met RFCS-disseminatie met centrale website en info over wettelijke context van regelgeving en toepassing van Eurocodes brand: <https://research.bauforumstahl.de/nl/fire-safety-1/locafi-temperature-assessment-of-a-vertical-member-subjected-to-localised-fire-10/>

The screenshot shows the homepage of the LOCAFI+ online information tool. At the top, there's a navigation bar with the logo 'bauforumstahl' and a dropdown menu set to 'NL'. Below the header is a stylized graphic of a head with gears and a lightbulb, symbolizing research and innovation. A red arrow points from the 'LOCAFI Juridische context_NL' link in the sidebar to the 'Juridische Context' section of the right-hand panel.

ONLINE INFORMATION TOOL NL

I01: LOCAFI+ Temperature assessment of a vertical member subjected to LOCALised Fire

Design Guide_NL

LOCAFI Juridische context_NL

OZone V3 User Manual - OZone is a user-friendly software developed to calculate the thermal actions generated by a fire and the evolution of temperature in a steel structural element, using nominal fire curves or natural fire models based on physical and chemical parameters. This is the belonging user manual.

Software OZone

Seminar Presentations - Presentations on following Topics: Reason for the Projekt, Experimental tests and CFD calibration, Analytical method and validation, OZone Software, Synthesis Fire resistance and Worked examples.

Legal Context_BE

This panel provides detailed information about the LOCAFI+ project. It features the European Union flag and the Research Fund for Coal & Steel logos at the top. The title 'LOCAFI+' is followed by 'Juridische Context'. Below it, a sub-section titled 'Temperatuurbepaling van een verticale stalen staaf blootgesteld aan een lokale brand - Valorisatie' is shown. A red arrow points from the 'LOCAFI Juridische context_NL' link in the left sidebar to this section. Another red arrow points from the 'Legal Context_BE' link in the left sidebar to the bottom right corner of the panel.

LOCAFI+
Juridische Context

Temperatuurbepaling van een verticale stalen staaf blootgesteld aan een lokale brand -
Valorisatie

LOCAFI+: Temperature assessment of a vertical member subjected to LOCALised Fire - Dissemination

Periode: 01/07/2017 – 31/12/2018

Fire safety engineering
Juridisch kader en
referentiedocumenten in België

University of Liège / Infosteel

RFCS 2016 – LOCAFIplus – Grant Agreement 754072

Ontwikkeling

- concept vergelijkbaar met RFCS-disseminatie met centrale website en info over wettelijke context van regelgeving en toepassing van Eurocodes brand: <https://research.bauforumstahl.de/nl/fire-safety-1/locafi-temperature-assessment-of-a-vertical-member-subjected-to-localised-fire-10/>

The screenshot shows the LOCAFI+ online information tool interface. At the top, there's a logo for 'bauforumstahl' and language selection buttons ('ONLINE INFORMATION TOOL', 'FR'). Below the header is a decorative graphic featuring gears and a lightbulb. The main content area displays a research document titled 'I02: LOCAFI+ Temperature assessment of a vertical member subjected to LOCALised Fire'. This document includes a link to the 'OZone V3 User Manual_FR' and a section on 'Seminar Presentations'. A red arrow points from the 'Legal Context_LUX' link in the document to a separate document on the right.

LOCAFI+ Contexte Légal

Temperature assessment of a vertical steel member subjected to localized fire - Valorization

Ingénierie du Feu : Contexte légal et documents de référence au Luxembourg

ArcelorMittal

Organisatie

- uitgever Bouwen met Staal
- samenwerking met Worldsteel en Tata Steel Nederland als deelfinancier
- partners: België, Duitsland, Luxemburg, Nederland en Zwitserland
- aan ‘Fire’ werkten mee: Koen Michielsen, Infosteel (B), Graham Couchman, Steel Construction Institute (UK), Cor van Eldik en Ralph Hamerlinck, Bouwen met Staal (NL)

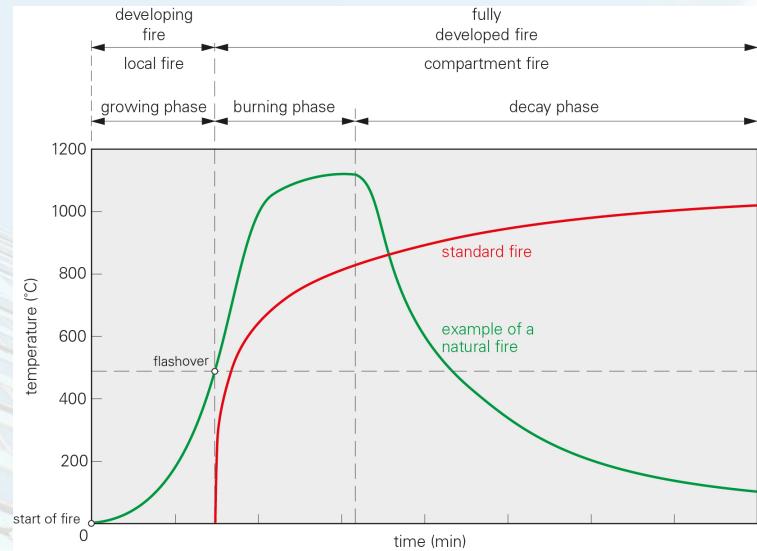


- hoofdstuk 1, 2, 4: klaar
- hoofdstuk 3: inhoudelijk klaar, nog redactie bewerking
- eind 2020 boek gereed voor druk
- verschijnt begin 2021, met daarna de nationale teksten (pdf's te downloaden op websites van de staal instituten)

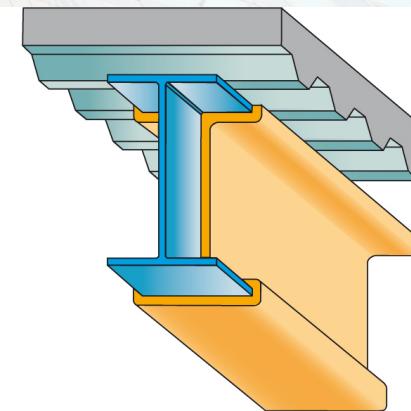
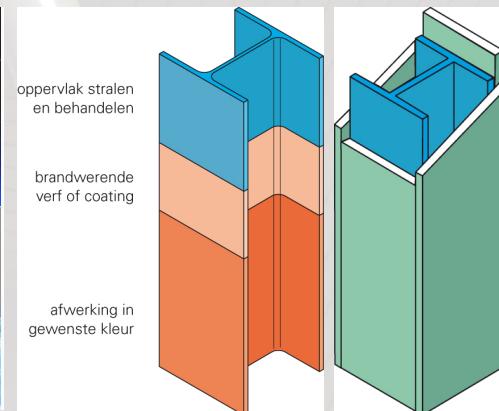
- Chapter 1 Fire Safety
- Chapter 2 Calculation of the fire resistance
- Chapter 3 Fire safety engineering
- Chapter 4 Design tables

Chapter 1 Fire Safety

- Wat is brandveiligheid?
 - doelstellingen
 - maatregelen
- Ontwikkeling van brand
- Ontwerpen van brandveilige gebouwen
- Veiligheidseisen bij brand
- Belastingen bij brand
- Gedrag van staal bij brand

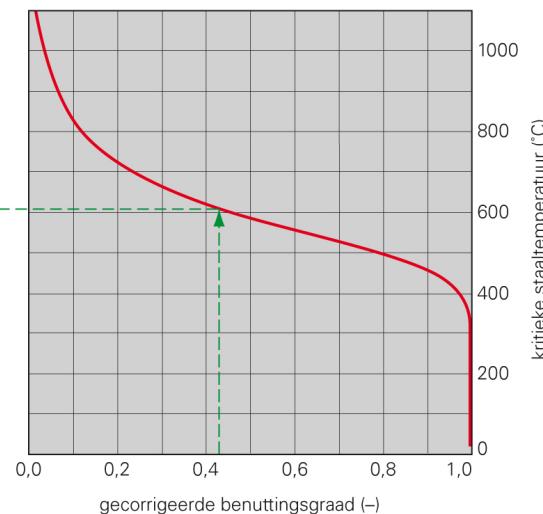
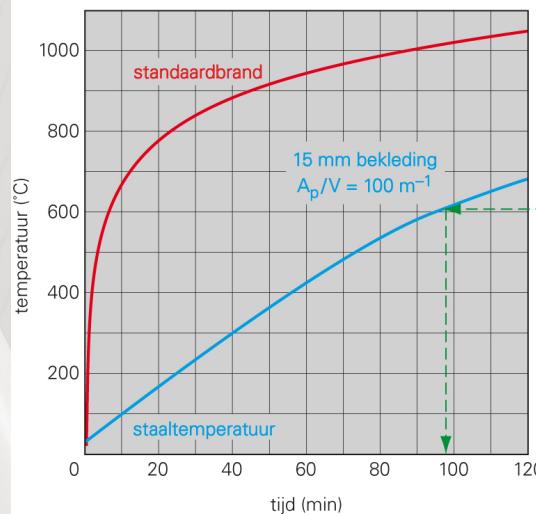
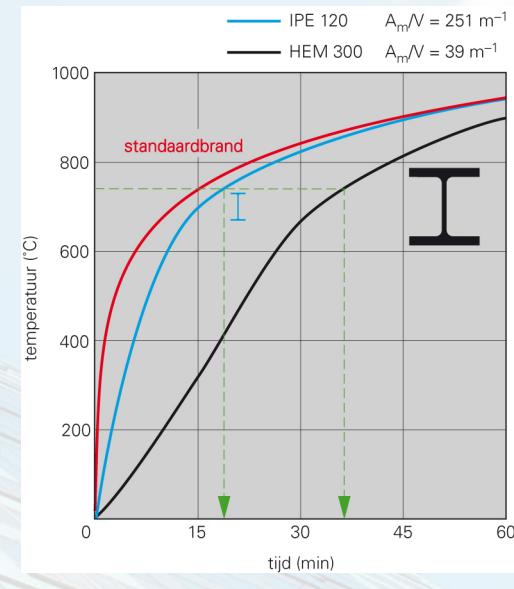


oppervlak stralen en behandelen
brandwerende verf of coating
afwerking in gewenste kleur



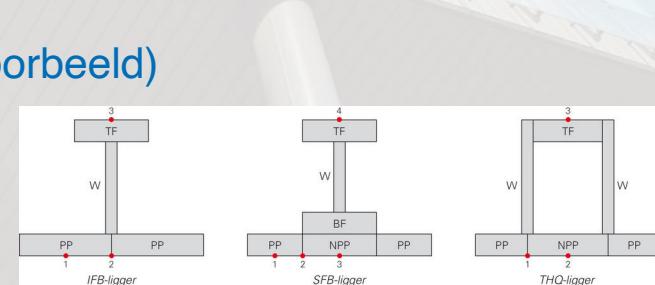
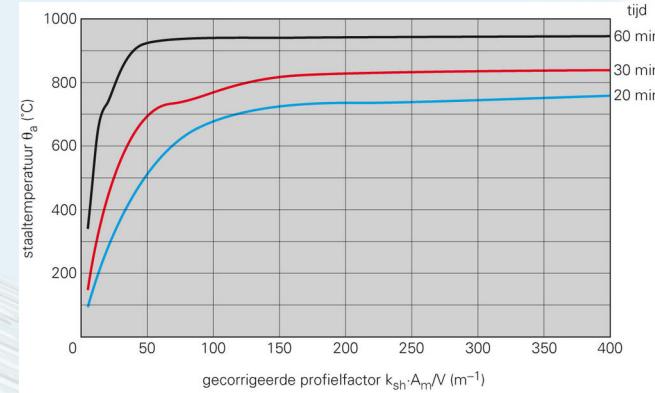
Chapter 1 Fire Safety

- Wat is brandveiligheid?
 - doelstellingen
 - maatregelen
- Ontwikkeling van brand
- Ontwerpen van brandveilige gebouwen
- Veiligheidseisen bij brand
- Belastingen bij brand
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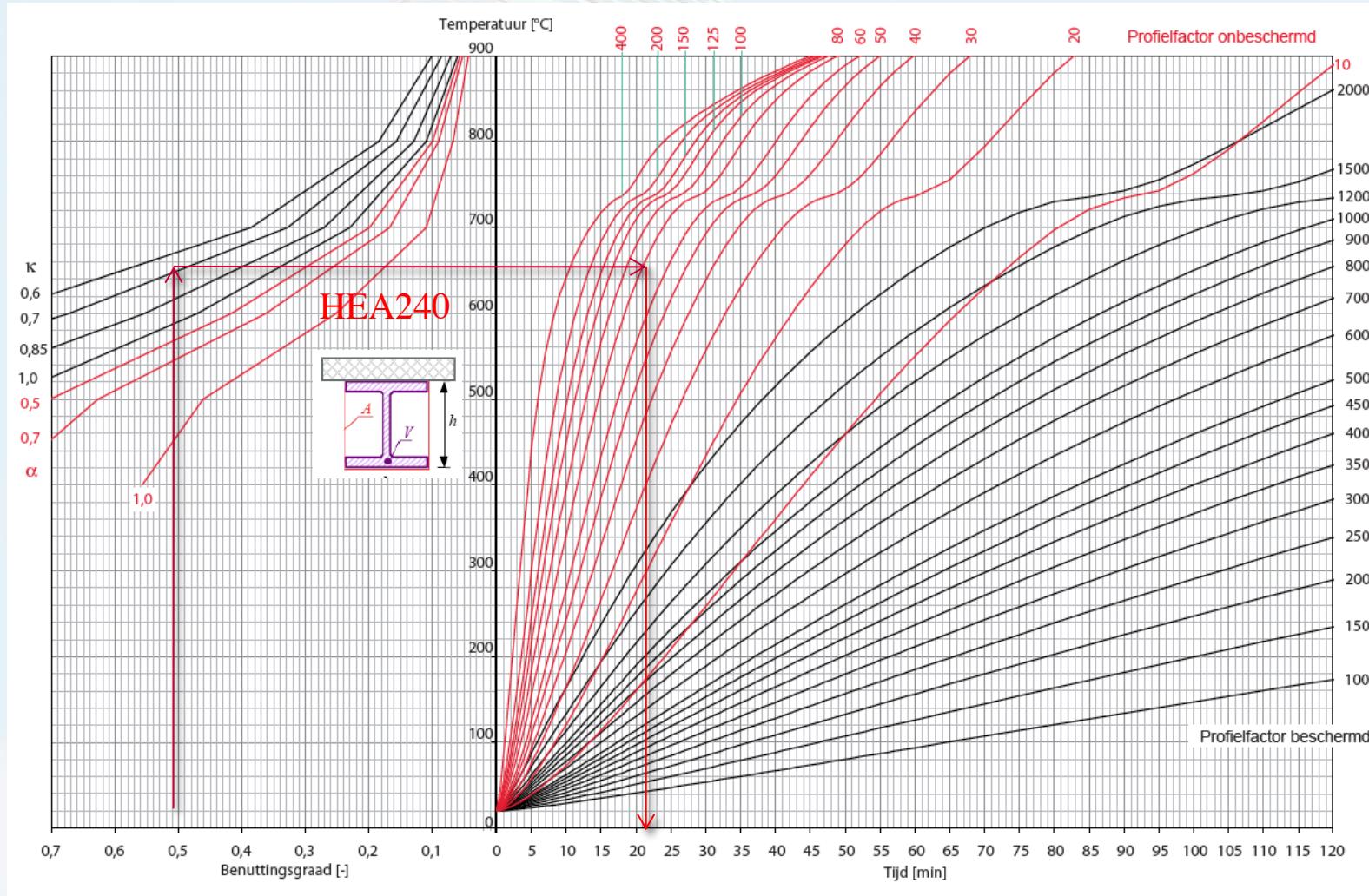
Chapter 2 Calculation of the fire resistance

- Begrippen en randvoorwaarden
- Berekening van de thermische respons
 - achtergronden (on)beschermd profielen **NIEUW**
 - thermisch verzinkt staal **NIEUW**
- Berekening van de mechanische respons
 - verbindingen (met rekenvoorbeeld) **NIEUW**
 - trekstaven (met rekenvoorbeeld)
 - liggers met buiging zonder kip (met 2 rekenvoorbeelden)
 - kolom met druk (met rekenvoorbeeld)
 - liggers met kip (met rekenvoorbeeld)
- Geïntegreerde liggers
 - thermisch gedrag
 - rekenmethode onbeschermde liggers (met rekenvoorbeeld)
 - beschermde liggers



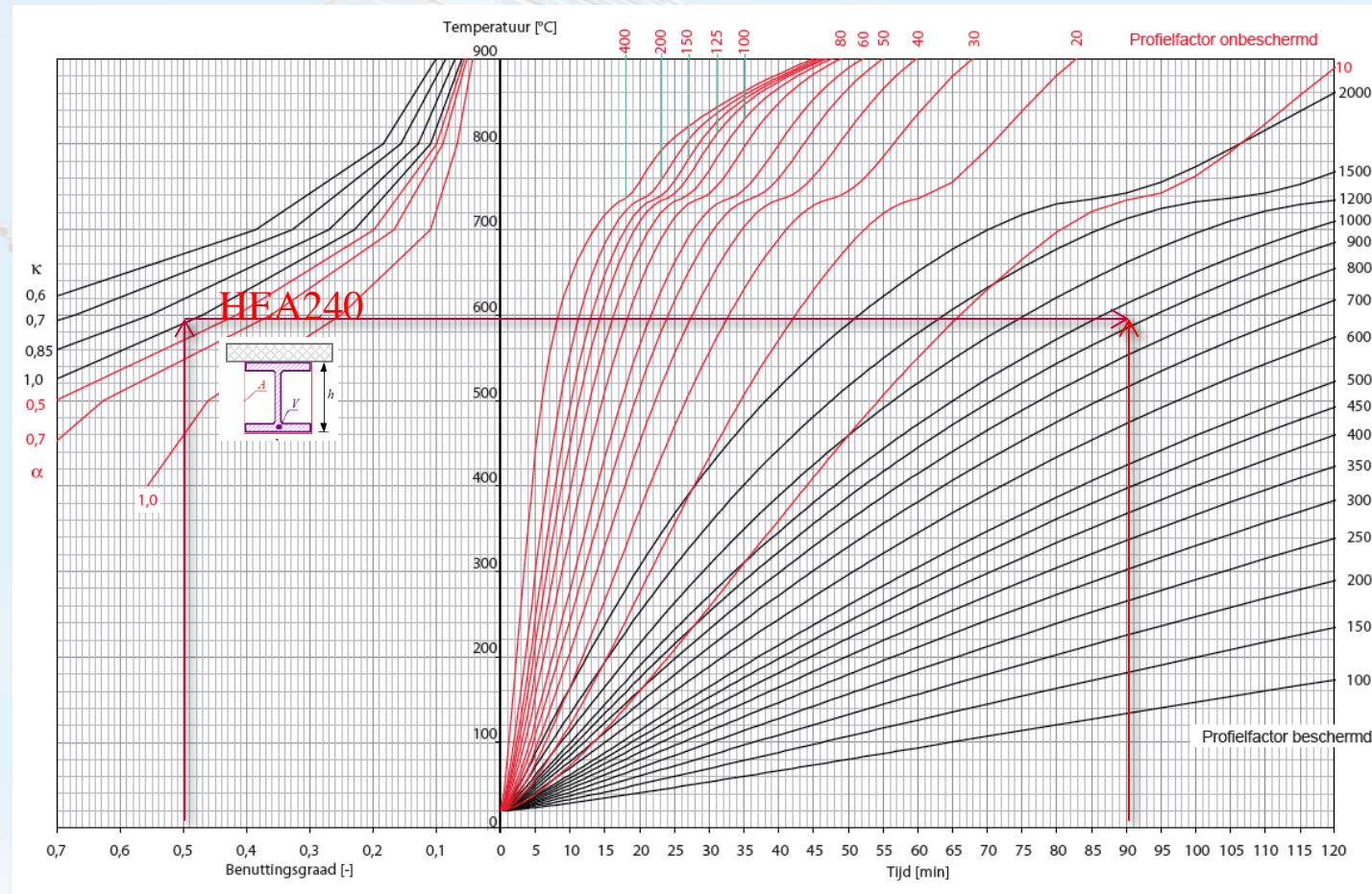
Chapter 2 Calculation of the fire resistance

- Tool: onbeklede statisch bepaalde ligger



Chapter 2 Calculation of the fire resistance

- Tool: beklede ligger

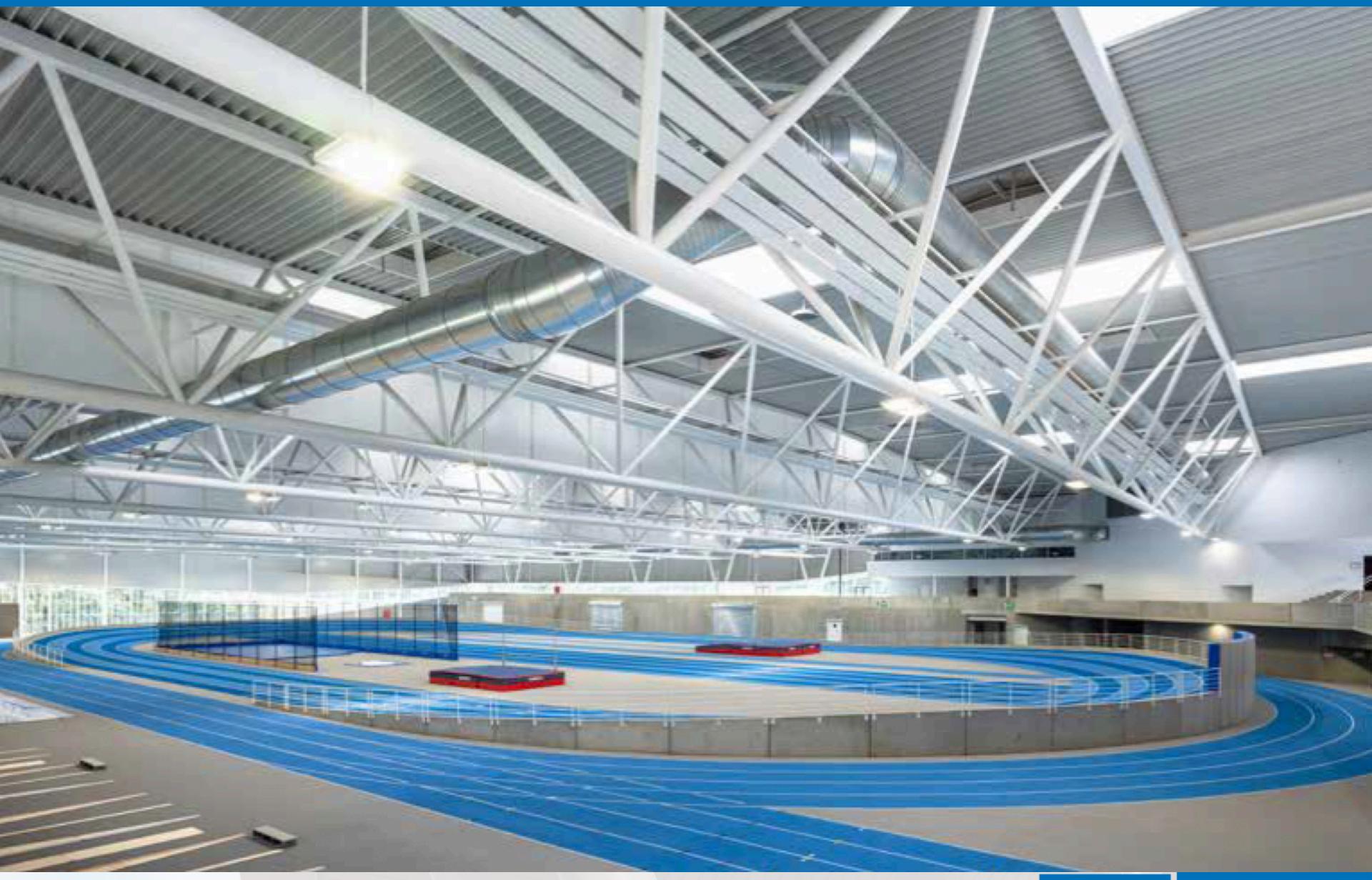


schatting bekledingsdikte

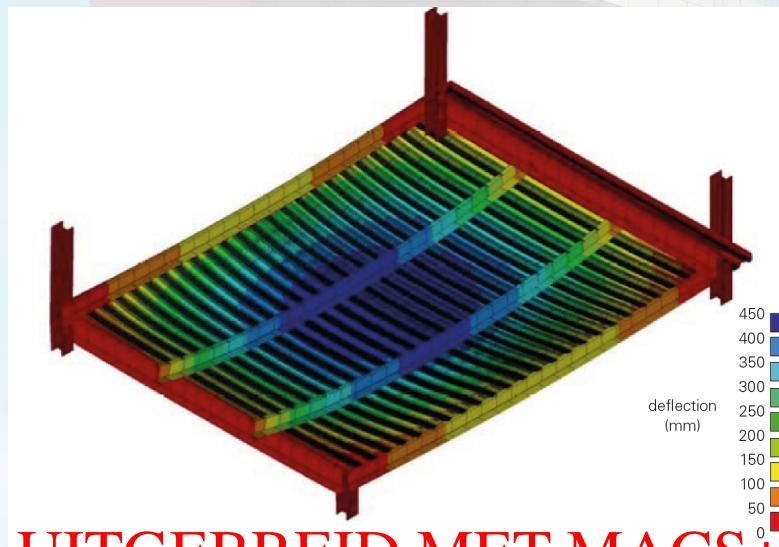
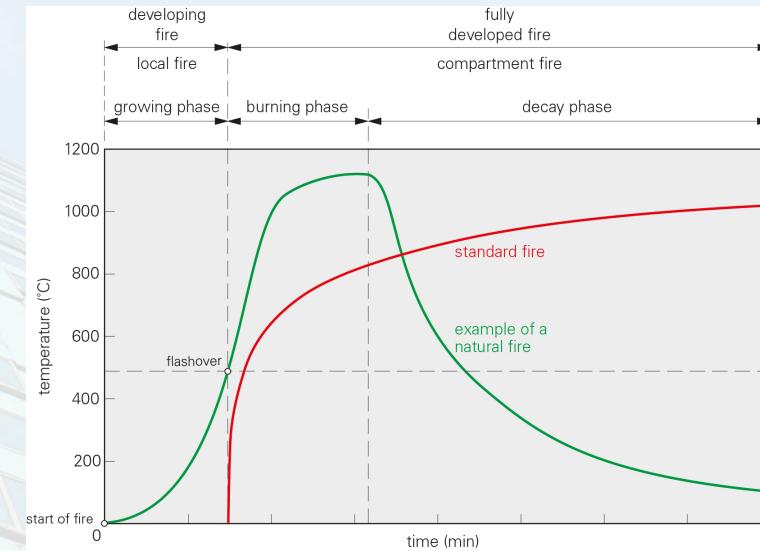
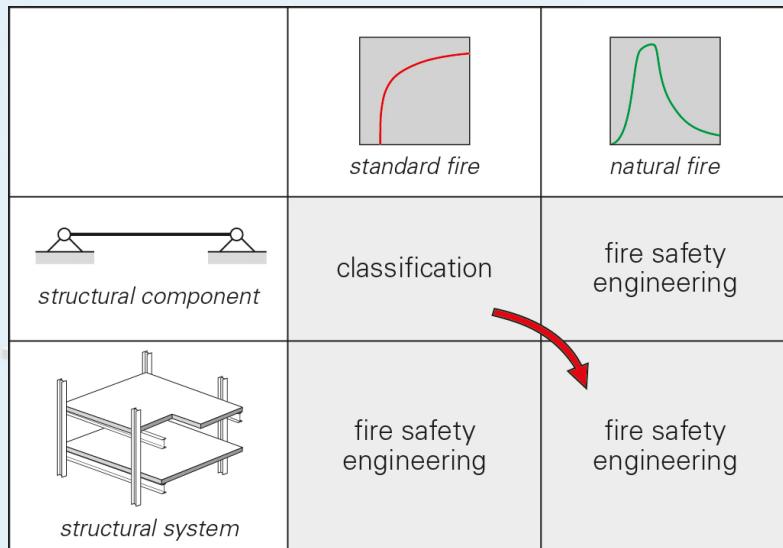


Afb.
2.12

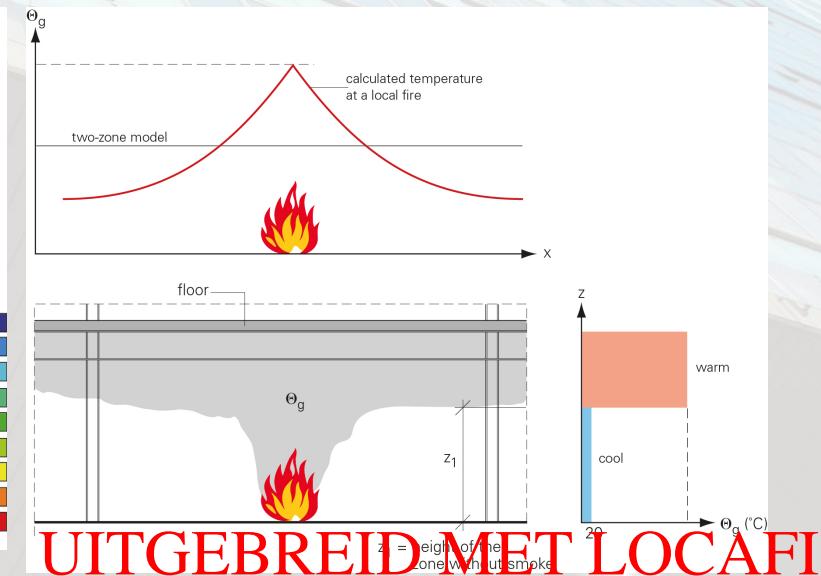
Chapter 3 Fire safety engineering



Chapter 3 Fire safety engineering



UITGEBREID MET MACS+



UITGEBREID MET LOCAFI

Chapter 4 Design tables



4 Design tables

dr.ir. A.F. Hamerlinck

Bouwen met Staal and Adviesbureau Hamerlinck



4.1

Reduction factor $k_{y,\theta}$ defined as the ratio between the (effective) yield strength $f_{y,\theta}$ at a steel temperature θ_a and the yield strength f_y at 20 °C, according to equation (2.2) in Fire 2 (Calculation of the fire resistance).

θ_a	$k_{y,\theta}$								
350	1,000	384	0,988	418	0,963	452	0,913	486	0,830
351	1,000	385	0,988	419	0,962	453	0,911	487	0,827
352	0,999	386	0,987	420	0,961	454	0,909	488	0,825
353	0,999	387	0,987	421	0,960	455	0,907	489	0,822
354	0,999	388	0,986	422	0,958	456	0,905	490	0,819
355	0,999	389	0,986	423	0,957	457	0,903	491	0,816

4.3 (continued)

Reduction factor for the design load level in the fire situation h_f as a function of the ratio between the permanent load G_k and the variable load O_k for different occupancies and load factors $\gamma_G = 1,2$ and $\gamma_Q = 1,5$, according to equation (2.3) of Fire 2 (Calculation of the fire resistance). Every member state specifies in its National Annex whether Ψ_1 or Ψ_2 has to be applied.

G_k/O_k	$\Psi_1 = 0,0$ (roofs)	$\Psi_1 = 0,2$ (wind actions)	$\Psi_1 = 0,5$ (office, residential)	$\Psi_1 = 0,6$ (shopping, congregations)	$\Psi_1 = 0,9$ (storage)			
	$\Psi_2 = 0,0$ (roofs, wind actions)	$\Psi_2 = 0,3$ (office, residential)	$\Psi_2 = 0,6$ (shopping, congregations)	$\Psi_2 = 0,8$ (storage)				
1,35	0,433	0,497	0,529	0,593	0,625	0,657	0,689	0,721
1,40	0,440	0,503	0,535	0,597	0,629	0,660	0,692	0,723
1,45	0,448	0,509	0,540	0,602	0,633	0,664	0,694	0,725

NIEUW

Chapter 4 Design tables

4.4 (continued)

Steel temperature θ_a (°C) of an unprotected I-section exposed to the standard fire curve as a function of the section factor corrected to allow for the shadow factor $k_{sh} \cdot A_m/V$ (m^{-1}), for both non-galvanized and galvanized steel.

With $k_{sh} = 1$ the table can also be used for other types of unprotected sections, such as hollow sections and angles.

$k_{sh} \cdot A_m/V$ (m^{-1})	fire exposure time (minutes)											
	non-galvanized steel					galvanized steel						
	15	20	30	60	90	120	15	20	30	60	90	120
76	497	622	738	935	1001	1046	382	500	726	935	1001	1046
77	501	625	739	936	1001	1046	385	504	728	936	1001	1046
78	504	628	740	936	1001	1046	388	510	729	936	1001	1046
79	508	631	741	936	1001	1046	391	516	731	936	1001	1046
80	511	634	742	936	1001	1046	395	522	732	936	1001	1046



dr.ir. A.F. Hemelink
Bouwen met Staal en Admiraalsteus Haarlemmermeer

NIEUW

Chapter 4 Design tables



Design tables

4.5 (continued)

Section factor A/V (m^{-1}) for IPE, HEA, HEB and HEM sections, exposed to the standard fire curve. Values given for unprotected sections include the correction factor to allow for the shadow effect k_{sh} .

section	unprotected		contour encasement		hollow encasement	
	four-sided heating	three-sided heating	four-sided heating	three-sided heating	four-sided heating	three-sided heating
HEB 600	60	50	86	75	67	56
HEB 650	60	50	85	74	66	56
HEB 700	59	50	82	72	65	55

dr.ir. A.F. Hemelink
Raad van State en Adviesraad Provincie Flevoland

4.6 (continued)

Steel temperature θ_3 ($^{\circ}C$) of unprotected IPE and HE sections after 30 minutes exposure to the standard fire curve (based on values from table 4.5 and table 4.4), for both non-galvanized and galvanized steel.

profiel	non-galvanized steel		galvanized steel	
	four-sided heating	three-sided heating	four-sided heating	three-sided heating
HEB 160	777	741	760	731
HEB 180	767	737	750	723
HEB 200	757	734	741	709

profiel	non-galvanized steel		galvanized steel	
	four-sided heating	three-sided heating	four-sided heating	three-sided heating
HEM 100	739	719	727	680
HEM 120	736	710	718	637
HEM 140	733	700	707	616

NIEUW

NIEUW

Chapter 4 Design tables

4.7

Steel temperature $\theta_{a,\text{ext}}$ ($^{\circ}\text{C}$) of an unprotected I-section exposed to the external fire curve as a function of the section factor $k_{sh}A_m/V$ (m^{-1}) corrected to allow for the shadow factor.

With $k_{sh} = 1$ the table can also be used for other types of unprotected sections, such as hollow sections and angles.

$k_{sh} \cdot A_m / V$ (m^{-1})	fire exposure time (minutes)				$k_{sh} \cdot A_m / V$ (m^{-1})	fire exposure time (minutes)			
	30	60	90	120		30	60	90	120
5	122	219	301	372	105	667	679	679	679
10	208	364	474	547	110	669	679	679	679
15	284	469	571	623	115	671	679	679	679
20	349	541	622	655	120	672	679	679	679

NIEUW

4.12

Critical steel temperature $\theta_{a,\text{cr}}$ ($^{\circ}\text{C}$) for centrally loaded compression members in grade S460 steel.

NIEUW

relative slenderness $\bar{\lambda}$	plastic degree of utilization μ_{pl}															
	0,05	0,06	0,07	0,08	0,09	0,10	0,11	0,12	0,13	0,14	0,15	0,16	0,17	0,18	0,19	0,20
0,00	950	900	880	860	840	820	800	792	783	775	767	758	750	742	733	725
0,04	946	898	877	857	836	816	798	790	781	772	764	755	747	738	730	721
0,08	941	896	875	854	833	812	796	787	779	770	761	752	743	734	726	717
0,12	937	893	872	851	829	808	794	785	776	767	758	749	740	731	722	712
0,16	932	891	869	847	825	803	792	783	773	764	755	745	736	727	717	708
0,20	927	889	866	844	821	799	790	780	770	761	751	742	732	722	713	703



Chapter 4 Design tables

4.13 (continued)

Cross-section class of IPE, HEA, HEB and HEM sections in bending and compression at room temperature and in the fire situation for grades S235, S355, S420 and S460 steel.

section	room temperature								fire							
	bending				compression				bending				compression			
	S235	S355	S420	S460	S235	S355	S420	S460	S235	S355	S420	S460	S235	S355	S420	S460
HEB 600	1	1	1	1	1	3	3	4	1	1	1	1	2	4	4	4
HEB 650	1	1	1	1	2	3	4	4	1	1	1	1	3	4	4	4
HEB 700	1	1	1	1	2	4	4	4	1	1	1	1	3	4	4	4



dr.ir. A.F. Hemelink
Bouwen met Staal en Admiraalsteus Pionierstuk

Bedankt voor jullie aandacht!



- dat het nieuwe boek moge bijdragen aan betere communicatie over staal en brand en aan een hoger kennisniveau