Critical temperature

Temperature increases significantly change the mechanical properties of steel.

At 400 °C, steel's yield strength is reduced to 60% its initial value. It has been proven that a steel structure subjected to heat can no longer perform its load-bearing functions after a certain amount of time, and will collapse. The temperature at which this occurs is called the critical temperature.

The critical temperature will change depending on the weight of the initial load and will depend on the admissible level of stress and the nature of this stress.

For the purpose of simplification, the following minimal critical temperature values may be used, based on Eurocode 1993-1-2:
- 500 °C for compressed elements or elements subject to bending and axial compression.
- 540 °C for isostatic beams and tensioned elements.
- 570 °C for hyperstatic beams.

Section factor

Section factor S/V expresses the relationship between the surface exposed to thermal flow S [m2] and the volume of an element by length unit [m3]. Its value considerably influences the behaviour of the structural element when exposed to fire.

An element with an S/V quotient [m-1] with a low value will heat much more slowly than an element with a high section factor. It will therefore be more resistant to fire.

The following table provides the section factors for the commonly-used metal sections for beams exposed on 3 sites and posts exposed on 4 sides.
For other types, contact Projiso's technical department.

Section factors of commonly-used metal sections (in m-1)

Metal beams exposed on 3 sides

	HEA	HEB	IPE	IPN	UAP
80	-	-	371	346	267
100	218	180	336	302	253
120	221	167	311	269	-
130	-	-	-	-	236
140	209	155	291	239	-
150	-	-	-	-	210
160	190	140	269	220	-
175	-	-	-	-	202
180	186	131	254	200	-
200	175	122	235	185	191
220	162	116	221	171	183
240	148	108	205	161	-
250	-	-	-	-	169
260	141	105	-	149	-
270	-	-	198	-	162
280	136	102	-	139	-
300	127	96	188	131	151
320	118	92	-	124	-
330	-	-	175	-	-
340	112	89	-	117	-
360	108	86	163	110	-
380	-	-	-	105	-
400	102	83	153	100	-
425	-	-	-	95	-
450	97	78	144	90	-
475	-	-	-	85	-
500	92	77	133	81	-
550	91	76	125	76	-

Metal beams exposed on 4 sides

	HEA	HEB	IPE	IPN	UAP
80	-	-	431	402	309
100	266	219	390	350	291
120	268	202	360	310	-
130	-	-	-	-	268
140	253	188	336	275	-
150	-	-	-	-	239
160	231	170	310	253	-
175	-	-	-	-	228
180	226	158	293	230	-
200	212	148	269	212	214
220	196	140	254	196	205
240	179	131	236	184	-
250	-	-	-	-	188
260	171	127	-	170	-
270	-	-	227	-	180
280	165	124	-	159	-
300	153	116	216	150	168
320	142	110	-	141	-
330	-	-	200	-	-
340	135	106	-	133	-
360	129	103	186	125	-
380	-	-	-	119	-
400	121	98	174	113	-
425	-	-	-	107	-
450	113	92	163	101	-
475	-	-	-	96	-
500	107	89	150	91	-
550	105	88	141	85	-

Working principle

The fibrous coating around a metal structure slows the heating speed of the steel, thereby improving its behaviour when exposed to fire.

The thickness of the coating to install will vary depending on:
- The type of protective material
- The section factor of the section to protect
- The critical temperature of the section to protect

Coating offered by Projiso

- A dry fibrous coating made from mineral wool, FIBROFEU®

Installation

- The base is untreated or rustproofed steel; while our products do not increase steel corrosion, a base treated with an alkyd or epoxy primer is recommended for long-term resistance to corrosion.
- The base must be clean, dry, free of dust, rolling residue, rust, oil or any other contaminant that may affect adhesion.
- A suitable primer must be applied before the fire protection coating is applied.

On the following pages, you will find examples of installation thicknesses.