

1. STEELWORK PROTECTION

Fire Resistance of Structural Members

Steel structures are a construction system used worldwide.

One of the main advantages is that they have great resistance per weight unit, which provides them with tremendous versatility and the possibility of creating complex yet light structures.

By contrast, one of the drawbacks of steel is its high thermal conductivity. Therefore, in the event of a fire, the progressive increase in temperature plus steel high heat transmission result in a reduction of the structure's bearing capacity and mechanical resistance. The resistance and elastic limit are modified after 250 °C, and after approximately 500 °C the drop in resistance is significant enough so as not to support its design capacity.

To avoid this, **mercor tecresa**® introduces **Tecplaster**® mortar, tested pursuant to standard **UNE EN 13501-2:2016**, to determine the mortar fire protection properties when applied to steel structural elements: beams, pillars or tension members.

Tecplaster® has been designed and tested to cover a great variety of steel profiles characterised by their section factors. Likewise, it is tested for several design temperatures specified in the standard.

TECPLASTER® MORTAR

**CONSTRUCTIVES
SOLUTIONS**

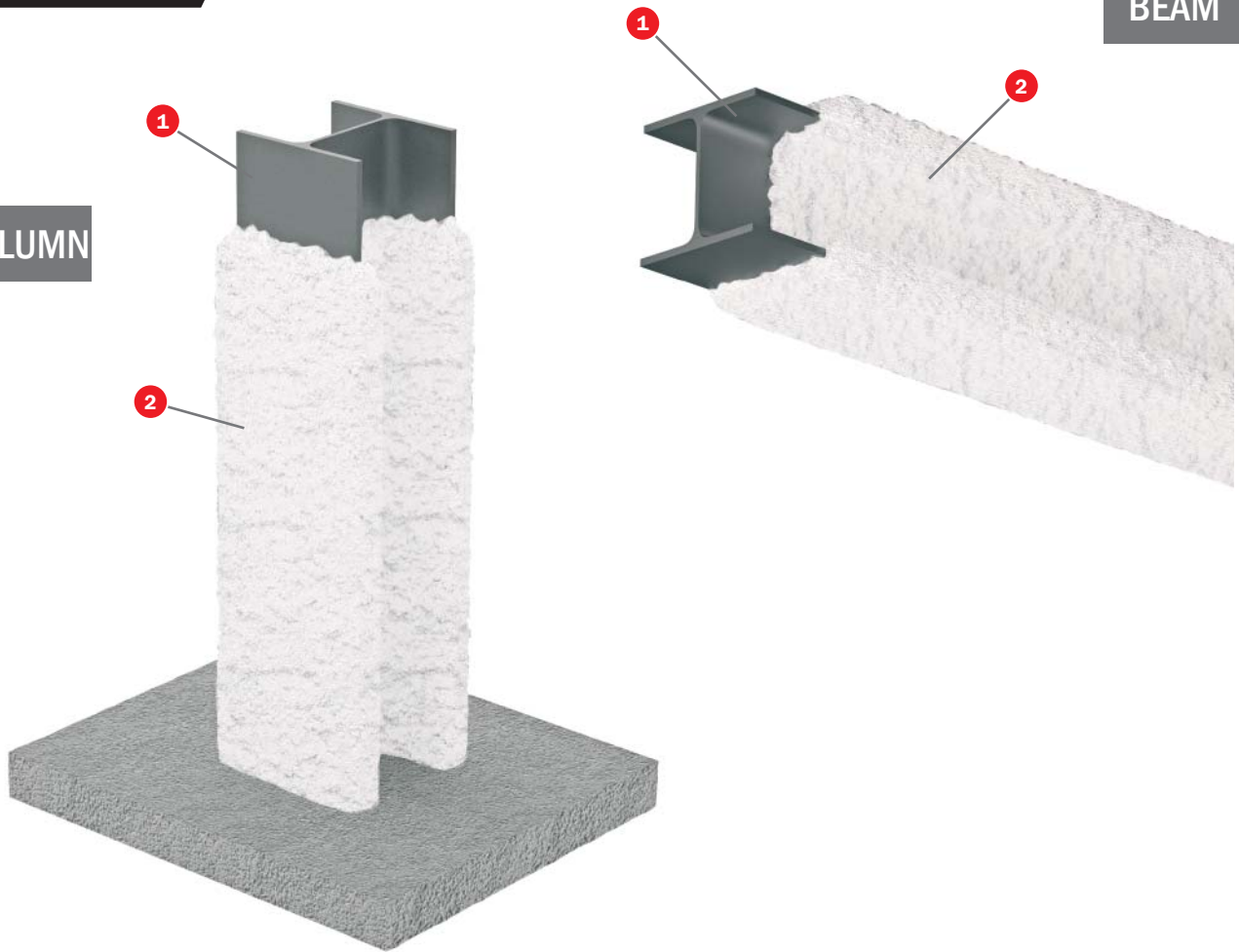
TECPLASTER® MORTAR

STEELWORK PROTECTION

TECPLASTER® MORTAR

BEAM

COLUMN



TESTS

Standard: UNE EN 13501-2

Laboratory: FIRES s.r.o.

Test No : CR-016-17-AUPE

SOLUTION

- 1 Steel profile.
- 2 **Tecplaster®** (thickness according to the profile's section and fire resistance time required).

APPLICATION

Tecplaster® is usually applied by means of a mortar projection machine with a wet screw pump. For manual application, it is advisable to first fit a deployee steel mesh properly attached to the surface to be coated.

Preparing Tecplaster® Mortar: Add water to the mortar at a proportion of 1 kg of dry mortar to 1 litre of water.

The ratio between water and **Tecplaster® Mortar** determines the required consistency.

Surface preparation: Surface must be free of grease, dust and loose debris. Metal surfaces must be primed and concrete surfaces should not contain any remains of stripping agent.

Tecplaster® Mortar usually has a rough finish from spray projection. In special cases, it can be smoothed. It can be painted with topcoat.

Tecplaster® Mortar is applicable indoors between 5°C and 40°C, provided relative humidity is not too high in the environment.

Tecplaster® should be stored on flat surfaces, never outdoors, and the material covered from sunlight and moisture.

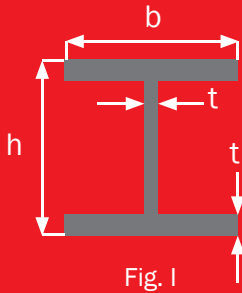


Fig. I



Fig. II - **4 SIDED**
 $P = 4b + 2h - 2t$



Fig. III - **3 SIDED**
 $P = 3b + 2h - 2t$



Fig. IV - **2 SIDED**
 $P = 2b + h - t$



Fig. V - **1 SIDE**
 $P = b$

SECTION FACTOR CALCULATION

Tecplaster® application on a metal structure is performed covering the entire surface of the profile that could be attacked by fire.

We define the profile section factor (profiled) or mass factor as: the relation between the section of the exposed external perimeter of the structural element itself per unit of length and its volumetric section per unit of length.

To simplify the calculation, the following expression is used:

$$Mass = \frac{P}{A} \text{ (m}^{-1}\text{)}$$

where:

P = Profile's protected straight section perimeter (m)

A = Profile's straight section area (m²)

MASS CALCULATION EXAMPLES FOR HEB - 180

HEB - 180 profile measures

$$h = 180 \text{ mm} / b = 180 \text{ mm} / t = 8.5 \text{ mm}$$

4 sided "profiled" protection example (See Fig. II)

1.- Perimeter exposed to fire calculation:

$$P = 4 \times b + 2 \times h - 2 \times t = 4 \times 180 + 2 \times 180 - 2 \times 8,5 = 1063 \text{ mm} = 1,063 \text{ m}$$

2.- Profile section:

$$A = 65,3 \text{ cm}^2 = 0,00653 \text{ m}^2$$

3.- Section factor:

$$\frac{1,063}{0,00653} = 162,8 \text{ (m}^{-1}\text{)}$$

2 sided "profiled" protection example (See Fig. IV)

1.- Perimeter exposed to fire calculation:

$$P = 2b + h - t = 2 \times 180 + 180 - 8,5 = 531,5 \text{ mm} = 0,5315 \text{ m}$$

2.- Profile section:

$$A = 65.3 \text{ cm}^2 = 0,00653 \text{ m}^2$$

3.- Section factor:

$$\frac{0,5315}{0,00653} = 81,4 \text{ (m}^{-1}\text{)}$$

Once the profile's form factor is known, we should look at the mortar thickness specification chart and find the **Tecplaster®** mortar to be applied for that thick mass so as to comply with the required fire resistance.

The information in this chart appears in the characteristics report under file CR-16-17-AUPE.
Valid chart for 500 °C design temperature on steel pursuant to **UNE EN 13501-2:2016**.

Steelwork protection

Am/V (1/m)	Thickness (mm) of TECPLASTER® mortar for a critical temperature of 500 °C depending on fire resistance time (H and I type open profiles)						
	R 30	R 45	R 60	R 90	R 120	R 180	R 240
68	10,1	10,1	10,1	14,7	20,6	32,4	44,3
80	10,1	10,1	10,4	16,5	22,5	34,6	46,6
100	10,1	10,1	12,5	18,7	24,9	37,2	49,6
120	10,1	10,8	13,9	20,2	26,5	39,1	51,6
140	10,1	11,8	15,0	21,3	27,7	40,4	53,1
160	10,1	12,6	15,8	22,2	28,6	41,4	54,3
180	10,1	13,2	16,4	22,9	29,3	42,2	55,2
200	10,4	13,7	16,9	23,4	29,9	42,9	55,9
220	10,8	14,1	17,4	23,9	30,4	43,4	56,5
240	11,2	14,4	17,7	24,3	30,8	43,9	57,0
260	11,5	14,7	18,0	24,6	31,2	44,3	57,4
280	11,7	15,0	18,3	24,9	31,5	44,6	57,8
300	11,9	15,2	18,5	25,1	31,7	44,9	58,1
320	12,1	15,4	18,7	25,3	31,9	45,2	58,4
323	12,1	15,4	18,7	25,4	32,0	45,2	58,5

Am/V (1/m)	Thickness (mm) of TECPLASTER® mortar for a critical temperature of 500 °C depending on fire resistance time (round or rectangular hollow profiles)						
	R 30	R 45	R 60	R 90	R 120	R 180	R 240
68	10,7	10,7	10,7	15,7	22,0	34,6	47,3
80	10,9	10,9	11,3	17,8	24,3	37,3	50,4
100	11,1	11,1	13,7	20,5	27,3	40,9	54,5
120	11,3	12,1	15,6	22,6	29,7	43,7	57,8
140	11,5	13,4	17,1	24,3	31,6	46,0	60,5
160	11,7	14,6	18,3	25,7	33,2	48,0	--
180	11,9	15,6	19,4	27,0	34,6	49,8	--
200	12,5	16,4	20,3	28,1	35,9	51,5	--
220	13,2	17,2	21,2	29,1	37,1	53,0	--
240	13,8	17,9	22,0	30,1	38,2	54,4	--
260	14,3	18,4	22,5	30,7	38,9	55,4	--
280	14,6	18,7	22,9	31,1	39,3	55,8	--
300	14,9	19,0	23,1	31,4	39,7	56,2	--
320	15,1	19,3	23,4	31,7	39,9	56,5	--
323	15,2	19,3	23,4	31,7	40,0	56,5	--

TECPLASTER® has been tested at different steel temperatures (350 °C - 750 °C).
Consult technical department.