



FIRE ASSESSMENT REPORT

FAR4853 ISSUE 3

**ASSESSMENT OF MONOKOTE MK-6/HY, MK-6S AND Z-106 FOR
PERFORMANCE IN ACCORDANCE WITH AS 4100:2020 FOR OPEN
STRUCTURAL STEEL SECTIONS**

CLIENT

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ASSESSMENT OBJECTIVE

To assess the fire resistance performance of Monokote MK-6/HY, MK-6s and Z-106 when used to protect open section structural steel beams and columns, in accordance with AS 4100:2020.

CONCLUSION

It is considered that Monokote MK-6/HY, MK-6s and Z-106 would provide a fire resistance for I-section beams and universal columns for various thicknesses and critical temperatures as shown in Tables 1 to 6 in accordance with AS 4100:2020, Steel Structures, Section 12.

The results from the for I and H-section beams (three sided protection) and columns (four sided protection) are also applicable to any re-entrant section, e.g. angles, channels and T-sections etc, depending on the number of sides protected.

LIMITATION

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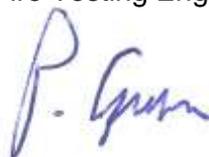
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1. INTRODUCTION

This report gives BRANZ's assessment of open section structural steel members using Monokote MK-6/HY, MK-6s and Z-106 as a three sided and four sided, Cementitious fire protection coating with a fire resistance of 30, 60, 90, 120, 180 and 240 minutes for open section I-beams and H-columns depending on the size of the steel section and thickness of the protection in accordance with AS 4100:2020, Steel Structures, Section 12, Fire. It considers a range of critical steel temperatures between 350°C and 750°C.

The methodology used in the analysis is the numerical regression approach defined in Annex E.5 of EN 13381-4: 2013.

2. BACKGROUND

2.1 Full Scale Testing of Monokote MK-6

In Underwriters Laboratories LLC assessment report No. 4787661077 consideration was given to the contribution to the fire resistance of open steel section structural members protected by a cementitious fire protection coating identified as Monokote MK-6 in a contoured profile. The basis for the assessment was test data from three fire resistance tests, in accordance with BS 476: Part 21: 1987, of steel members protected with Monokote MK-6.

The Monokote MK-6 was spray applied until the desired thickness was achieved as per UL assessment report No. 4787661077. During the application of the test specimens, a number of density plate specimens were prepared in order to monitor the drying of the Monokote MK-6 and subsequently calculate the density of the material. The mean density of the Monokote MK-6 was calculated to be 252 kg/m³.

The specimens included in the tests comprised two, 4.1 m long loaded beams and two, 1 m long unloaded reference beams with nominal thicknesses of 10 mm and 75 mm which was three-sided contoured protection. In addition, a further five, 1 m long unloaded beams and nine, 1 m tall unloaded columns with three-and four sided contoured protection respectively ranging from 10 mm to 76 mm. The specimens included in the tests covered section factors, "exposed surface area to volume ratio" (A/V), from 94 m⁻¹ to 332 m⁻¹. A further data point derived from an unloaded column section with an A/V of 17 m⁻¹ tested in accordance with UL263 was used to allow the reduction of the minimum A/V to 30 m⁻¹.



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Numerical regression analysis was performed as per Annex E.5 of EN 13381-4: 2013:

$$t = a_0 + a_1 d_p + a_2 \frac{d_p}{A_m/V} + a_3 \theta_a + a_4 d_p \theta_a + a_5 d_p \frac{\theta_a}{A_m/V} + a_6 \frac{\theta_a}{A_m/V} + a_7 \frac{1}{A_m/V}$$

Where

t is the fire resistance time (minutes)

a_0 to a_7 are the regression coefficients

d_p is protection thickness (mm)

A_m/V is the section factor (m^{-1})

θ_a is the steel temperature ($^{\circ}C$)

The numerical regression analysis concluded that within the permitted range of section factor, thicknesses of fire protection and design temperature, the minimum thickness of Monokote MK-6 required for each fire resistance duration is as shown in Tables 1 to 6.

2.2 Monokote MK-6/HY and Monokote MK-6s

The assessment applies to both Monokote MK-6/HY and Monokote MK-6s cementitious coatings due to the similarity of the two formulations, Monokote MK-6/HY differs only with the addition of a Monokote MK-6 Accelerator which is not expected to be detrimental to the fire resistance of the coating. As a result, both coatings are referred to simply as Monokote MK-6.

2.3 Thermal Equivalency Testing Monokote MK-6 & Z106

In Underwriters Laboratories LLC letter report No. 4787390697, an evaluation was conducted to determine the effect of higher density cementitious fire protection coatings on thermal transmission when applied to various substrates when tested using the standard time/temperature curve detailed in UL 263.

The MK-6 and Z-106 coatings were spray applied to three types of common substrate already covered by existing UL certification, 3/8 in. expanded metal lath, 26 MSG steel fluted decking and 1/4 in. thick steel plate, the dimensions of each substrate were nominally 900 mm sq.

Following completion of the testing, the times taken for an average 250°F or individual 325°F rise to occur was analysed and a relationship of Density vs Time was generated.



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3. DISCUSSION

3.1 The Standards

Australian Standard AS 4100:2020 requires fire resistance tests, in accordance with AS 1530.4 Section 5 for columns and Section 6 for beams, on at least two loaded beams/columns with the minimum and maximum thickness of protection and a further seven tests on short unloaded specimens to obtain the temperature of the steel sections for a range of protection thicknesses and a range of exposed surface area to mass ratio (S/M) of the steel members. The required thicknesses of protection for alternative steel sections can be determined by regression analysis or by methods in accordance with ENV 13381-4 or EN 13381-8.

Underwriters Laboratories assessment report No. 4787661077 for open steel sections (I and H sections) established the fire protection of the sections protected with Monokote MK-6 by assessing the results of three fire resistance tests on eighteen specimens, including two loaded beams. The tests were in accordance with BS 476: Part 21: 1987 for loaded beams, additional guidance with respect to furnace control and performance criteria comes from BS 476: Part 20: 1987. The method of analysis used followed Annex E5 in EN 13381-4: 2013, numerical regression.

Fire resistance tests for loaded beam tests in accordance with BS 476: Part 21: 1987 or AS 1530.4:2014 are essentially the same with respect to furnace conditions and failure criteria. The only significant difference is that the BS 476: Part 21 test uses a 1.5 mm diameter mineral insulated metal sheathed thermocouples (MIMS) in the furnace compared with a 3 mm diameter mineral insulated metal sheathed thermocouples (MIMS) for AS 1530.4 tests. Although it is accepted that the smaller diameter thermocouple will heat up more rapidly, the difference between the two diameters thermocouples after 5 minutes would be minimal and therefore it is expected that the test results would be no less if the specimens had been tested in accordance with AS 1530.4.

The placement of the specimen thermocouples between that tested and AS 1530.4:2014 are slightly different. For loadbearing beams, AS 1530.4-2014 specifies that the thermocouples on the flanges on the I and H sections are at the web and the toe whereas in the BS test the thermocouples are specified to be midway between the web and the toe. Although the thermocouple locations were not positioned as defined in AS 1530.4 they were positioned in representative positions and complied with the minimum number of thermocouples required. Based on this it is considered that the measured temperatures would be sufficiently similar had they been positioned in accordance with AS1530.4 to be used in this analysis.

In the loaded beam tests, there was no significant material detachment observed for either the minimum or maximum thickness loaded beam, which established the ability for the thickest and thinnest protection to remain.



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It is therefore considered that the resulting tables established in the Underwriters Laboratories assessment report No. 4787661077 and repeated in Tables 1 to 6 would be valid if the structural steel specimens protected by Monokote MK-6 had been tested in accordance with AS 1530.4:2014 and would comply with the requirement of AS 4100:2020.

Tables 1 to 6 show the minimum thickness of Monokote MK-6 required to satisfy FRLs ranging from 30 minutes to 240 minutes for open section structural steel beams and columns with design temperatures ranging from 350°C to 750°C.

3.2 Interpretation of Thermal Equivalency Testing

The analysis of the test data generated from the small scale thermal equivalency testing showed that the thickness of coating required to achieve a given fire resistance period decreased as the density of the coating increased.

Monokote MK-6/HY and MK-6s both have a stated density of 240 kg/m³, the mean density recorded from the six density plates prepared during the application of Monokote MK-6 to the loaded beams and short sections tested under UL Test No. 4787661075 was calculated to be 252 kg/m³, the stated density of the Z-106 coating is 350 kg/m³.

It is therefore deemed acceptable to use the thicknesses shown in Tables 1- 6 for the cementitious coatings Monokote MK-6/HY, Monokote MK-6s and Z-106.

3.3 Angles, Channels and T-Sections

Results for I or H sections are directly applicable to angles, channels and T-sections for the same section factor, whether used as individual elements or as bracing.

4. CONCLUSION

It is considered that Monokote MK-6/HY, MK-6s and Z-106 as a three-sided and four-sided fire protection coating would provide a fire resistance for I-section beams and universal columns for various thicknesses and critical temperatures as shown in Tables 1 to 6 in accordance with AS 4100:2020, Steel Structures, Section 12.

The results from the for I and H-section beams (three sided protection) and columns (four sided protection) are also applicable to any re-entrant section, e.g. angles, channels and T-sections etc, depending on the number of sides protected.



Table 1: I-Section Beams and Columns: Fire Protection Period 30 minutes

MONOKOTE MK6										
Section Factor up to m ⁻¹	Table 1: I-Section Beams and Columns: Fire Resistance Period: 30 Minutes									
	Thickness (mm) Required for a Design Temperature of									
	350°C	400°C	450°C	500°C	550°C	600°C	620°C	650°C	700°C	750°C
30	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
35	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
40	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
45	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
50	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
55	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
60	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
65	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
70	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
75	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
80	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
85	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
90	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
95	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
100	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
105	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
110	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
115	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
120	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
125	9.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
130	10.3	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
135	10.8	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
140	11.2	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
145	11.6	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
150	12.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
155	12.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
160	12.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
165	13.0	9.6	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
170	13.3	10.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
175	13.6	10.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
180	13.9	10.8	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
185	14.1	11.1	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
190	14.3	11.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
195	14.6	11.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
200	14.8	12.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
205	15.0	12.3	9.8	9.4	9.4	9.4	9.4	9.4	9.4	9.4
210	15.1	12.5	10.1	9.4	9.4	9.4	9.4	9.4	9.4	9.4
215	15.3	12.8	10.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
220	15.5	13.0	10.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4
225	15.6	13.2	11.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4
230	15.8	13.4	11.3	9.4	9.4	9.4	9.4	9.4	9.4	9.4
235	15.9	13.6	11.5	9.6	9.4	9.4	9.4	9.4	9.4	9.4
240	16.1	13.8	11.7	9.9	9.4	9.4	9.4	9.4	9.4	9.4
245	16.2	14.0	12.0	10.1	9.4	9.4	9.4	9.4	9.4	9.4
250	16.3	14.2	12.2	10.4	9.4	9.4	9.4	9.4	9.4	9.4
255	16.5	14.4	12.4	10.7	9.4	9.4	9.4	9.4	9.4	9.4
260	16.6	14.5	12.6	10.9	9.4	9.4	9.4	9.4	9.4	9.4
265	16.7	14.7	12.8	11.1	9.7	9.4	9.4	9.4	9.4	9.4
270	16.8	14.8	13.0	11.4	9.9	9.4	9.4	9.4	9.4	9.4
275	16.9	15.0	13.2	11.6	10.2	9.4	9.4	9.4	9.4	9.4
280	17.0	15.1	13.3	11.8	10.4	9.4	9.4	9.4	9.4	9.4
285	17.1	15.2	13.5	12.0	10.6	9.5	9.4	9.4	9.4	9.4
290	17.2	15.4	13.7	12.2	10.8	9.7	9.4	9.4	9.4	9.4
295	17.3	15.5	13.8	12.3	11.1	10.0	9.5	9.4	9.4	9.4
300	17.4	15.6	14.0	12.5	11.3	10.2	9.7	9.4	9.4	9.4
305	17.4	15.7	14.1	12.7	11.5	10.4	9.9	9.4	9.4	9.4
310	17.5	15.8	14.2	12.9	11.6	10.6	10.1	9.4	9.4	9.4
315	17.6	15.9	14.4	13.0	11.8	10.8	10.4	9.6	9.4	9.4
320	17.7	16.0	14.5	13.2	12.0	11.0	10.6	9.8	9.4	9.4
325	17.7	16.1	14.6	13.3	12.2	11.2	10.8	10.0	9.4	9.4
330	17.8	16.2	14.7	13.5	12.3	11.4	11.0	10.2	9.4	9.4
335	17.9	16.3	14.9	13.6	12.5	11.6	11.1	10.4	9.4	9.4
340	17.9	16.4	15.0	13.7	12.6	11.8	11.3	10.6	9.6	9.4
345	18.0	16.5	15.1	13.9	12.8	11.9	11.5	10.8	9.8	9.4
350	18.1	16.6	15.2	14.0	12.9	12.1	11.7	11.0	10.0	9.4
355	18.1	16.7	15.3	14.1	13.1	12.2	11.8	11.2	10.2	9.4
360	18.2	16.7	15.4	14.2	13.2	12.4	12.0	11.3	10.4	9.6
365	18.2	16.8	15.5	14.3	13.4	12.5	12.1	11.5	10.5	9.8

Table applies to beams with protection to three sides and a concrete slab. Thickness is protection material only.
Table also applies to beams and columns protected on four sides.



Table 2: I-Section Beams and Columns: Fire Protection Period 60 minutes

MONOKOTE MK6										
Section Factor up to m ⁻¹	Table 2: I-Section Beams and Columns: Fire Resistance Period: 60 Minutes									
	Thickness (mm) Required for a Design Temperature of									
	350°C	400°C	450°C	500°C	550°C	600°C	620°C	650°C	700°C	750°C
30	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
35	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
40	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
45	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
50	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
55	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
60	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
65	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
70	9.8	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
75	11.6	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
80	13.2	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
85	14.6	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
90	15.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
95	16.8	9.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
100	17.7	11.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
105	18.5	12.2	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
110	19.2	13.2	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
115	19.8	14.2	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
120	20.4	15.0	9.9	9.4	9.4	9.4	9.4	9.4	9.4	9.4
125	20.9	15.8	10.9	9.4	9.4	9.4	9.4	9.4	9.4	9.4
130	21.4	16.5	11.8	9.4	9.4	9.4	9.4	9.4	9.4	9.4
135	21.8	17.1	12.6	9.4	9.4	9.4	9.4	9.4	9.4	9.4
140	22.3	17.7	13.4	9.5	9.4	9.4	9.4	9.4	9.4	9.4
145	22.6	18.2	14.1	10.3	9.4	9.4	9.4	9.4	9.4	9.4
150	23.0	18.7	14.7	11.1	9.4	9.4	9.4	9.4	9.4	9.4
155	23.3	19.2	15.3	11.8	9.4	9.4	9.4	9.4	9.4	9.4
160	23.6	19.6	15.9	12.5	9.5	9.4	9.4	9.4	9.4	9.4
165	23.9	20.0	16.4	13.1	10.3	9.4	9.4	9.4	9.4	9.4
170	24.1	20.4	16.9	13.7	10.9	9.4	9.4	9.4	9.4	9.4
175	24.4	20.7	17.3	14.3	11.6	9.4	9.4	9.4	9.4	9.4
180	24.6	21.1	17.8	14.8	12.2	10.0	9.4	9.4	9.4	9.4
185	24.8	21.4	18.2	15.3	12.8	10.6	9.6	9.4	9.4	9.4
190	25.0	21.7	18.5	15.7	13.3	11.2	10.3	9.4	9.4	9.4
195	25.2	21.9	18.9	16.2	13.8	11.8	10.8	9.4	9.4	9.4
200	25.4	22.2	19.2	16.6	14.3	12.3	11.4	9.9	9.4	9.4
205	25.6	22.5	19.5	17.0	14.7	12.8	11.9	10.4	9.4	9.4
210	25.7	22.7	19.8	17.3	15.1	13.3	12.4	11.0	9.4	9.4
215	25.9	22.9	20.1	17.7	15.5	13.8	12.9	11.5	9.4	9.4
220	26.0	23.1	20.4	18.0	15.9	14.2	13.4	12.0	9.9	9.4
225	26.2	23.3	20.6	18.3	16.3	14.6	13.8	12.4	10.4	9.4
230	26.3	23.5	20.9	18.6	16.6	15.0	14.2	12.8	10.9	9.4
235	26.4	23.7	21.1	18.9	16.9	15.4	14.6	13.3	11.4	9.8
240	26.6	23.9	21.3	19.1	17.2	15.7	14.9	13.7	11.8	10.3
245	26.7	24.0	21.5	19.4	17.5	16.0	15.3	14.0	12.2	10.7
250	26.8	24.2	21.7	19.6	17.8	16.4	15.6	14.4	12.6	11.2
255	26.9	24.3	21.9	19.9	18.1	16.7	16.0	14.7	13.0	11.6
260	27.0	24.5	22.1	20.1	18.4	17.0	16.3	15.1	13.3	12.0
265	27.1	24.6	22.3	20.3	18.6	17.3	16.6	15.4	13.7	12.3
270	27.2	24.8	22.5	20.5	18.9	17.5	16.8	15.7	14.0	12.7
275	27.3	24.9	22.6	20.7	19.1	17.8	17.1	16.0	14.3	13.0
280	27.4	25.0	22.8	20.9	19.3	18.0	17.4	16.2	14.6	13.4
285	27.4	25.1	23.0	21.1	19.5	18.3	17.6	16.5	14.9	13.7
290	27.5	25.2	23.1	21.3	19.7	18.5	17.9	16.8	15.2	14.0
295	27.6	25.3	23.2	21.4	19.9	18.7	18.1	17.0	15.5	14.3
300	27.7	25.5	23.4	21.6	20.1	18.9	18.3	17.2	15.7	14.5
305	27.8	25.6	23.5	21.8	20.3	19.1	18.5	17.5	16.0	14.8
310	27.8	25.7	23.6	21.9	20.5	19.3	18.7	17.7	16.2	15.1
315	27.9	25.8	23.8	22.1	20.6	19.5	18.9	17.9	16.5	15.3
320	28.0	25.8	23.9	22.2	20.8	19.7	19.1	18.1	16.7	15.6
325	28.0	25.9	24.0	22.3	21.0	19.9	19.3	18.3	16.9	15.8
330	28.1	26.0	24.1	22.5	21.1	20.1	19.5	18.5	17.1	16.0
335	28.1	26.1	24.2	22.6	21.3	20.2	19.7	18.7	17.3	16.3
340	28.2	26.2	24.3	22.7	21.4	20.4	19.9	18.9	17.5	16.5
345	28.3	26.3	24.4	22.8	21.5	20.6	20.0	19.0	17.7	16.7
350	28.3	26.3	24.5	23.0	21.7	20.7	20.2	19.2	17.9	16.9
355	28.4	26.4	24.6	23.1	21.8	20.9	20.3	19.4	18.1	17.1
360	28.4	26.5	24.7	23.2	21.9	21.0	20.5	19.5	18.3	17.3
365	28.5	26.6	24.8	23.3	22.1	21.1	20.6	19.7	18.4	17.4

Table applies to beams with protection to three sides and a concrete slab. Thickness is protection material only.
Table also applies to beams and columns protected on four sides.



Table 3: I-Section Beams and Columns: Fire Protection Period 90 minutes

MONOKOTE MK6										
Section Factor up to m ⁻¹	Table 3: I-Section Beams and Columns: Fire Resistance Period: 90 Minutes									
	Thickness (mm) Required for a Design Temperature of									
	350°C	400°C	450°C	500°C	550°C	600°C	620°C	650°C	700°C	750°C
30	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
35	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
40	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
45	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
50	11.1	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
55	15.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
60	18.1	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
65	20.5	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
70	22.4	11.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
75	24.1	14.3	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
80	25.4	16.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
85	26.6	18.2	10.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4
90	27.6	19.8	12.2	9.4	9.4	9.4	9.4	9.4	9.4	9.4
95	28.5	21.2	14.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4
100	29.3	22.3	15.6	9.4	9.4	9.4	9.4	9.4	9.4	9.4
105	30.0	23.4	17.0	11.2	9.4	9.4	9.4	9.4	9.4	9.4
110	30.6	24.3	18.3	12.8	9.4	9.4	9.4	9.4	9.4	9.4
115	31.2	25.2	19.4	14.2	9.5	9.4	9.4	9.4	9.4	9.4
120	31.7	25.9	20.4	15.5	11.0	9.4	9.4	9.4	9.4	9.4
125	32.1	26.6	21.4	16.6	12.4	9.4	9.4	9.4	9.4	9.4
130	32.6	27.3	22.2	17.6	13.6	10.1	9.4	9.4	9.4	9.4
135	32.9	27.8	23.0	18.6	14.7	11.4	9.9	9.4	9.4	9.4
140	33.3	28.3	23.7	19.5	15.7	12.6	11.1	9.4	9.4	9.4
145	33.6	28.8	24.3	20.2	16.7	13.7	12.2	9.8	9.4	9.4
150	33.9	29.3	24.9	21.0	17.6	14.7	13.3	11.0	9.4	9.4
155	34.2	29.7	25.4	21.7	18.4	15.6	14.3	12.0	9.4	9.4
160	34.5	30.1	25.9	22.3	19.1	16.5	15.2	13.0	9.8	9.4
165	34.7	30.4	26.4	22.9	19.8	17.2	16.0	13.9	10.8	9.4
170	34.9	30.8	26.9	23.4	20.4	18.0	16.8	14.7	11.7	9.4
175	35.1	31.1	27.3	23.9	21.0	18.7	17.5	15.5	12.6	10.2
180	35.3	31.4	27.7	24.4	21.6	19.3	18.2	16.2	13.4	11.1
185	35.5	31.7	28.0	24.8	22.1	19.9	18.8	16.9	14.1	11.9
190	35.7	31.9	28.4	25.3	22.6	20.5	19.4	17.5	14.8	12.6
195	35.9	32.2	28.7	25.7	23.1	21.0	19.9	18.1	15.5	13.4
200	36.0	32.4	29.0	26.0	23.5	21.5	20.5	18.7	16.1	14.0
205	36.2	32.6	29.3	26.4	23.9	22.0	21.0	19.2	16.7	14.7
210	36.3	32.8	29.5	26.7	24.3	22.4	21.4	19.7	17.3	15.3
215	36.4	33.0	29.8	27.0	24.7	22.8	21.9	20.2	17.8	15.9
220	36.6	33.2	30.1	27.3	25.0	23.2	22.3	20.6	18.3	16.4
225	36.7	33.4	30.3	27.6	25.4	23.6	22.7	21.0	18.8	16.9
230	36.8	33.6	30.5	27.9	25.7	24.0	23.1	21.5	19.2	17.4
235	36.9	33.7	30.7	28.2	26.0	24.3	23.4	21.8	19.6	17.9
240	37.0	33.9	30.9	28.4	26.3	24.7	23.8	22.2	20.0	18.3
245	37.1	34.0	31.1	28.6	26.6	25.0	24.1	22.6	20.4	18.7
250	37.2	34.2	31.3	28.9	26.8	25.3	24.4	22.9	20.8	19.2
255	37.3	34.3	31.5	29.1	27.1	25.6	24.7	23.2	21.2	19.5
260	37.4	34.4	31.7	29.3	27.3	25.8	25.0	23.5	21.5	19.9
265	37.5	34.6	31.8	29.5	27.6	26.1	25.3	23.8	21.8	20.3
270	37.6	34.7	32.0	29.7	27.8	26.4	25.6	24.1	22.1	20.6
275	37.7	34.8	32.1	29.9	28.0	26.6	25.8	24.4	22.4	20.9
280	37.7	34.9	32.3	30.0	28.2	26.8	26.1	24.6	22.7	21.2
285	37.8	35.0	32.4	30.2	28.4	27.1	26.3	24.9	23.0	21.5
290	37.9	35.1	32.5	30.4	28.6	27.3	26.5	25.1	23.3	21.8
295	37.9	35.2	32.7	30.5	28.8	27.5	26.7	25.4	23.5	22.1
300	38.0	35.3	32.8	30.7	29.0	27.7	26.9	25.6	23.8	22.4
305	38.1	35.4	32.9	30.8	29.1	27.9	27.1	25.8	24.0	22.6
310	38.1	35.5	33.0	31.0	29.3	28.1	27.3	26.0	24.2	22.9
315	38.2	35.6	33.1	31.1	29.4	28.2	27.5	26.2	24.4	23.1
320	38.2	35.7	33.2	31.2	29.6	28.4	27.7	26.4	24.7	23.3
325	38.3	35.7	33.4	31.4	29.7	28.6	27.9	26.6	24.9	23.6
330	38.4	35.8	33.5	31.5	29.9	28.7	28.1	26.8	25.1	23.8
335	38.4	35.9	33.6	31.6	30.0	28.9	28.2	27.0	25.3	24.0
340	38.5	36.0	33.6	31.7	30.2	29.1	28.4	27.1	25.4	24.2
345	38.5	36.0	33.7	31.8	30.3	29.2	28.5	27.3	25.6	24.4
350	38.6	36.1	33.8	31.9	30.4	29.3	28.7	27.4	25.8	24.6
355	38.6	36.2	33.9	32.0	30.5	29.5	28.8	27.6	26.0	24.8
360	38.6	36.2	34.0	32.1	30.7	29.6	29.0	27.7	26.1	24.9
365	38.7	36.3	34.1	32.2	30.8	29.7	29.1	27.9	26.3	25.1

Table applies to beams with protection to three sides and a concrete slab. Thickness is protection material only.
Table also applies to beams and columns protected on four sides.



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Table 4: I-Section Beams and Columns: Fire Protection Period 120 minutes

MONOKOTE MK6										
Section Factor up to m ⁻¹	Table 4: I-Section Beams and Columns: Fire Resistance Period: 120 Minutes									
	Thickness (mm) Required for a Design Temperature of									
	350°C	400°C	450°C	500°C	550°C	600°C	620°C	650°C	700°C	750°C
30	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
35	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
40	14.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
45	21.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
50	25.5	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
55	28.8	13.8	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
60	31.4	18.1	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
65	33.4	21.5	9.6	9.4	9.4	9.4	9.4	9.4	9.4	9.4
70	35.1	24.3	13.5	9.4	9.4	9.4	9.4	9.4	9.4	9.4
75	36.5	26.5	16.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4
80	37.7	28.4	19.3	10.8	9.4	9.4	9.4	9.4	9.4	9.4
85	38.7	30.0	21.6	13.8	9.4	9.4	9.4	9.4	9.4	9.4
90	39.5	31.4	23.5	16.2	9.6	9.4	9.4	9.4	9.4	9.4
95	40.3	32.6	25.2	18.4	12.2	9.4	9.4	9.4	9.4	9.4
100	40.9	33.7	26.6	20.2	14.5	9.4	9.4	9.4	9.4	9.4
105	41.5	34.6	27.9	21.9	16.5	11.8	9.5	9.4	9.4	9.4
110	42.1	35.4	29.1	23.3	18.2	13.8	11.7	9.4	9.4	9.4
115	42.5	36.2	30.1	24.6	19.8	15.7	13.7	10.3	9.4	9.4
120	43.0	36.9	31.0	25.8	21.2	17.3	15.4	12.2	9.4	9.4
125	43.3	37.5	31.8	26.8	22.4	18.8	16.9	13.9	9.4	9.4
130	43.7	38.0	32.6	27.8	23.6	20.1	18.4	15.4	11.1	9.4
135	44.0	38.5	33.3	28.7	24.6	21.3	19.6	16.8	12.6	9.4
140	44.3	39.0	33.9	29.4	25.6	22.4	20.8	18.0	14.1	10.8
145	44.6	39.4	34.5	30.2	26.4	23.4	21.9	19.2	15.3	12.2
150	44.9	39.8	35.0	30.9	27.2	24.3	22.8	20.2	16.5	13.5
155	45.1	40.2	35.5	31.5	28.0	25.2	23.7	21.2	17.6	14.7
160	45.3	40.5	36.0	32.0	28.7	26.0	24.6	22.1	18.6	15.8
165	45.5	40.8	36.4	32.6	29.3	26.7	25.3	22.9	19.6	16.8
170	45.7	41.1	36.8	33.1	29.9	27.4	26.1	23.7	20.4	17.8
175	45.9	41.4	37.2	33.6	30.5	28.0	26.7	24.4	21.2	18.7
180	46.1	41.7	37.6	34.0	31.0	28.6	27.4	25.1	22.0	19.5
185	46.2	41.9	37.9	34.4	31.5	29.2	28.0	25.8	22.7	20.3
190	46.4	42.2	38.2	34.8	31.9	29.7	28.5	26.4	23.4	21.0
195	46.5	42.4	38.5	35.1	32.4	30.2	29.0	26.9	24.0	21.7
200	46.6	42.6	38.8	35.5	32.8	30.7	29.5	27.4	24.6	22.3
205	46.8	42.8	39.0	35.8	33.2	31.1	30.0	27.9	25.1	22.9
210	46.9	43.0	39.3	36.1	33.5	31.5	30.4	28.4	25.7	23.5
215	47.0	43.1	39.5	36.4	33.9	31.9	30.8	28.9	26.2	24.0
220	47.1	43.3	39.7	36.7	34.2	32.3	31.2	29.3	26.6	24.6
225	47.2	43.5	39.9	37.0	34.5	32.7	31.6	29.7	27.1	25.0
230	47.3	43.6	40.1	37.2	34.8	33.0	32.0	30.1	27.5	25.5
235	47.4	43.8	40.3	37.4	35.1	33.3	32.3	30.4	27.9	25.9
240	47.5	43.9	40.5	37.7	35.3	33.6	32.6	30.8	28.3	26.4
245	47.6	44.0	40.7	37.9	35.6	33.9	32.9	31.1	28.6	26.8
250	47.7	44.2	40.9	38.1	35.8	34.2	33.2	31.4	29.0	27.1
255	47.7	44.3	41.0	38.3	36.1	34.5	33.5	31.7	29.3	27.5
260	47.8	44.4	41.2	38.5	36.3	34.7	33.8	32.0	29.6	27.9
265	47.9	44.5	41.3	38.7	36.5	35.0	34.0	32.3	30.0	28.2
270	48.0	44.6	41.5	38.8	36.7	35.2	34.3	32.6	30.2	28.5
275	48.0	44.7	41.6	39.0	36.9	35.4	34.5	32.8	30.5	28.8
280	48.1	44.8	41.7	39.2	37.1	35.6	34.7	33.0	30.8	29.1
285	48.2	44.9	41.9	39.3	37.3	35.8	35.0	33.3	31.1	29.4
290	48.2	45.0	42.0	39.5	37.5	36.0	35.2	33.5	31.3	29.7
295	48.3	45.1	42.1	39.6	37.6	36.2	35.4	33.7	31.6	29.9
300	48.3	45.2	42.2	39.8	37.8	36.4	35.6	33.9	31.8	30.2
305	48.4	45.3	42.3	39.9	38.0	36.6	35.8	34.1	32.0	30.4
310	48.4	45.3	42.4	40.0	38.1	36.8	35.9	34.3	32.2	30.7
315	48.5	45.4	42.5	40.1	38.3	36.9	36.1	34.5	32.4	30.9
320	48.5	45.5	42.6	40.3	38.4	37.1	36.3	34.7	32.6	31.1
325	48.6	45.6	42.7	40.4	38.5	37.3	36.4	34.9	32.8	31.3
330	48.6	45.6	42.8	40.5	38.7	37.4	36.6	35.0	33.0	31.5
335	48.7	45.7	42.9	40.6	38.8	37.6	36.8	35.2	33.2	31.7
340	48.7	45.8	43.0	40.7	38.9	37.7	36.9	35.4	33.4	31.9
345	48.8	45.8	43.1	40.8	39.0	37.8	37.0	35.5	33.5	32.1
350	48.8	45.9	43.1	40.9	39.2	38.0	37.2	35.7	33.7	32.3
355	48.8	45.9	43.2	41.0	39.3	38.1	37.3	35.8	33.9	32.4
360	48.9	46.0	43.3	41.1	39.4	38.2	37.5	36.0	34.0	32.6
365	48.9	46.0	43.4	41.2	39.5	38.3	37.6	36.1	34.2	32.8

Table applies to beams with protection to three sides and a concrete slab. Thickness is protection material only.
Table also applies to beams and columns protected on four sides.



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EXTRACTS OR ABRIDGMENTS OF THIS REPORT SHALL NOT BE PUBLISHED WITHOUT PERMISSION FROM BRANZ LTD.

Table 5: I-Section Beams and Columns: Fire Protection Period 180 minutes

MONOKOTE MK6										
Section Factor up to m ⁻¹	Table 5: I-Section Beams and Columns: Fire Resistance Period: 180 Minutes									
	Thickness (mm) Required for a Design Temperature of									
	350°C	400°C	450°C	500°C	550°C	600°C	620°C	650°C	700°C	750°C
30	30.3	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
35	41.1	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
40	47.3	23.0	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
45	51.4	31.5	10.1	9.4	9.4	9.4	9.4	9.4	9.4	9.4
50	54.3	37.3	19.5	9.4	9.4	9.4	9.4	9.4	9.4	9.4
55	56.4	41.6	26.3	11.2	9.4	9.4	9.4	9.4	9.4	9.4
60	58.1	44.8	31.3	18.2	9.4	9.4	9.4	9.4	9.4	9.4
65	59.4	47.3	35.2	23.6	12.8	9.4	9.4	9.4	9.4	9.4
70	60.5	49.4	38.3	27.9	18.2	9.7	9.4	9.4	9.4	9.4
75	61.4	51.0	40.8	31.3	22.6	15.0	11.3	9.4	9.4	9.4
80	62.1	52.4	42.9	34.2	26.2	19.4	16.0	10.2	9.4	9.4
85	62.7	53.6	44.7	36.5	29.2	23.0	19.9	14.5	9.4	9.4
90	63.3	54.7	46.2	38.6	31.8	26.1	23.2	18.2	10.8	9.4
95	63.8	55.6	47.5	40.3	34.0	28.7	26.0	21.3	14.4	9.4
100	64.2	56.3	48.7	41.9	35.9	31.0	28.4	24.0	17.5	12.1
105	64.6	57.0	49.7	43.2	37.6	33.0	30.5	26.3	20.2	15.2
110	64.9	57.6	50.6	44.4	39.0	34.7	32.4	28.4	22.6	17.8
115	65.2	58.2	51.4	45.5	40.4	36.3	34.1	30.2	24.7	20.2
120	65.5	58.7	52.2	46.4	41.5	37.6	35.5	31.8	26.5	22.2
125	65.8	59.2	52.8	47.3	42.6	38.9	36.9	33.3	28.2	24.1
130	66.0	59.6	53.4	48.1	43.6	40.0	38.1	34.6	29.7	25.8
135	66.2	59.9	54.0	48.8	44.4	41.0	39.2	35.8	31.1	27.3
140	66.4	60.3	54.5	49.4	45.2	42.0	40.2	36.9	32.3	28.7
145	66.6	60.6	54.9	50.0	46.0	42.8	41.1	37.9	33.4	29.9
150	66.7	60.9	55.4	50.6	46.6	43.6	41.9	38.8	34.5	31.1
155	66.9	61.2	55.7	51.1	47.3	44.4	42.7	39.6	35.4	32.1
160	67.0	61.4	56.1	51.6	47.8	45.0	43.4	40.4	36.3	33.1
165	67.2	61.7	56.4	52.0	48.4	45.7	44.1	41.1	37.1	34.0
170	67.3	61.9	56.8	52.4	48.9	46.2	44.7	41.8	37.9	34.9
175	67.4	62.1	57.1	52.8	49.3	46.8	45.3	42.4	38.6	35.6
180	67.5	62.3	57.3	53.2	49.8	47.3	45.8	43.0	39.3	36.4
185	67.6	62.5	57.6	53.5	50.2	47.8	46.3	43.6	39.9	37.1
190	67.7	62.6	57.8	53.8	50.6	48.2	46.8	44.1	40.5	37.7
195	67.8	62.8	58.1	54.1	50.9	48.6	47.2	44.6	41.0	38.3
200	67.9	63.0	58.3	54.4	51.3	49.0	47.6	45.0	41.5	38.9
205	68.0	63.1	58.5	54.7	51.6	49.4	48.0	45.4	42.0	39.4
210	68.1	63.2	58.7	54.9	51.9	49.8	48.4	45.9	42.5	39.9
215	68.1	63.4	58.9	55.2	52.2	50.1	48.8	46.2	42.9	40.4
220	68.2	63.5	59.1	55.4	52.5	50.4	49.1	46.6	43.3	40.8
225	68.3	63.6	59.2	55.6	52.7	50.7	49.4	47.0	43.7	41.3
230	68.3	63.7	59.4	55.8	53.0	51.0	49.7	47.3	44.1	41.7
235	68.4	63.8	59.5	56.0	53.2	51.3	50.0	47.6	44.4	42.1
240	68.4	63.9	59.7	56.2	53.4	51.5	50.3	47.9	44.8	42.4
245	68.5	64.0	59.8	56.4	53.6	51.8	50.5	48.2	45.1	42.8
250	68.6	64.1	60.0	56.5	53.9	52.0	50.8	48.5	45.4	43.1
255	68.6	64.2	60.1	56.7	54.1	52.2	51.0	48.7	45.7	43.5
260	68.7	64.3	60.2	56.9	54.2	52.5	51.3	49.0	46.0	43.8
265	68.7	64.4	60.3	57.0	54.4	52.7	51.5	49.2	46.2	44.1
270	68.7	64.5	60.4	57.2	54.6	52.9	51.7	49.4	46.5	44.3
275	68.8	64.5	60.6	57.3	54.8	53.1	51.9	49.7	46.7	44.6
280	68.8	64.6	60.7	57.4	54.9	53.2	52.1	49.9	47.0	44.9
285	68.9	64.7	60.8	57.6	55.1	53.4	52.3	50.1	47.2	45.1
290	68.9	64.8	60.9	57.7	55.2	53.6	52.5	50.3	47.4	45.4
295	68.9	64.8	60.9	57.8	55.4	53.8	52.6	50.5	47.6	45.6
300	69.0	64.9	61.0	57.9	55.5	53.9	52.8	50.6	47.8	45.8
305	69.0	64.9	61.1	58.0	55.6	54.1	53.0	50.8	48.0	46.0
310	69.0	65.0	61.2	58.1	55.8	54.2	53.1	51.0	48.2	46.2
315	69.1	65.1	61.3	58.2	55.9	54.4	53.3	51.1	48.4	46.4
320	69.1	65.1	61.4	58.3	56.0	54.5	53.4	51.3	48.6	46.6
325	69.1	65.2	61.4	58.4	56.1	54.6	53.6	51.4	48.7	46.8
330	69.2	65.2	61.5	58.5	56.2	54.8	53.7	51.6	48.9	47.0
335	69.2	65.3	61.6	58.6	56.3	54.9	53.8	51.7	49.1	47.2
340	69.2	65.3	61.6	58.7	56.4	55.0	54.0	51.9	49.2	47.3
345	69.3	65.4	61.7	58.8	56.5	55.1	54.1	52.0	49.4	47.5
350	69.3	65.4	61.8	58.9	56.6	55.2	54.2	52.1	49.5	47.7
355	69.3	65.5	61.8	58.9	56.7	55.3	54.3	52.3	49.6	47.8
360	69.3	65.5	61.9	59.0	56.8	55.4	54.4	52.4	49.8	48.0
365	69.4	65.5	62.0	59.1	56.9	55.5	54.5	52.5	49.9	48.1

Table applies to beams with protection to three sides and a concrete slab. Thickness is protection material only.
Table also applies to beams and columns protected on four sides.



Table 6: I-Section Beams and Columns: Fire Protection Period 240 minutes

MONOKOTE MK6										
Section Factor up to m ⁻¹	Table 6: I-Section Beams and Columns: Fire Resistance Period: 240 Minutes									
	Thickness (mm) Required for a Design Temperature of									
	350°C	400°C	450°C	500°C	550°C	600°C	620°C	650°C	700°C	750°C
30	72.3	31.8	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
35	77.1	48.3	13.9	9.4	9.4	9.4	9.4	9.4	9.4	9.4
40	79.9	57.2	31.7	9.4	9.4	9.4	9.4	9.4	9.4	9.4
45	81.7	62.7	42.2	21.2	9.4	9.4	9.4	9.4	9.4	9.4
50	-	66.6	49.2	32.0	15.1	9.4	9.4	9.4	9.4	9.4
55	-	69.3	54.2	39.5	25.5	12.7	9.4	9.4	9.4	9.4
60	-	71.4	57.9	45.0	33.0	22.2	16.8	9.4	9.4	9.4
65	-	73.1	60.7	49.2	38.6	29.4	24.7	16.4	9.4	9.4
70	-	74.4	63.0	52.5	43.1	34.9	30.7	23.3	12.3	9.4
75	-	75.5	64.9	55.2	46.6	39.3	35.5	28.8	18.8	10.3
80	-	76.4	66.5	57.5	49.5	42.9	39.4	33.2	24.1	16.5
85	-	77.2	67.8	59.3	52.0	45.9	42.7	36.8	28.5	21.5
90	-	77.9	68.9	60.9	54.0	48.5	45.4	39.9	32.1	25.7
95	-	78.5	69.9	62.3	55.8	50.6	47.7	42.5	35.2	29.2
100	-	79.0	70.7	63.5	57.3	52.5	49.8	44.8	37.9	32.2
105	-	79.5	71.5	64.6	58.7	54.1	51.5	46.8	40.2	34.8
110	-	79.9	72.2	65.5	59.9	55.6	53.1	48.5	42.2	37.1
115	-	80.2	72.8	66.3	60.9	56.8	54.5	50.1	44.0	39.2
120	-	80.5	73.3	67.1	61.9	58.0	55.7	51.4	45.6	41.0
125	-	80.8	73.8	67.8	62.8	59.0	56.8	52.7	47.0	42.6
130	-	81.1	74.2	68.4	63.5	60.0	57.8	53.8	48.3	44.1
135	-	81.4	74.6	68.9	64.2	60.8	58.7	54.8	49.5	45.4
140	-	81.6	75.0	69.4	64.9	61.6	59.5	55.7	50.5	46.6
145	-	81.8	75.3	69.9	65.5	62.3	60.3	56.5	51.5	47.7
150	-	82.0	75.7	70.3	66.0	62.9	61.0	57.3	52.4	48.7
155	-	82.2	76.0	70.7	66.5	63.5	61.6	58.0	53.2	49.6
160	-	82.3	76.2	71.1	67.0	64.1	62.2	58.7	54.0	50.4
165	-	82.5	76.5	71.5	67.4	64.6	62.8	59.3	54.7	51.2
170	-	82.6	76.7	71.8	67.8	65.1	63.3	59.9	55.3	51.9
175	-	82.8	76.9	72.1	68.2	65.5	63.8	60.4	55.9	52.6
180	-	82.9	77.1	72.4	68.6	65.9	64.2	60.9	56.5	53.3
185	-	-	77.3	72.6	68.9	66.3	64.6	61.4	57.0	53.9
190	-	-	77.5	72.9	69.2	66.7	65.0	61.8	57.5	54.4
195	-	-	77.7	73.1	69.5	67.0	65.4	62.2	58.0	54.9
200	-	-	77.8	73.3	69.8	67.4	65.7	62.6	58.4	55.4
205	-	-	78.0	73.5	70.0	67.7	66.1	63.0	58.9	55.9
210	-	-	78.1	73.7	70.3	68.0	66.4	63.3	59.3	56.3
215	-	-	78.3	73.9	70.5	68.3	66.7	63.6	59.6	56.7
220	-	-	78.4	74.1	70.7	68.5	67.0	63.9	60.0	57.1
225	-	-	78.5	74.3	71.0	68.8	67.2	64.2	60.3	57.5
230	-	-	78.7	74.4	71.2	69.0	67.5	64.5	60.6	57.9
235	-	-	78.8	74.6	71.3	69.2	67.7	64.8	60.9	58.2
240	-	-	78.9	74.7	71.5	69.4	67.9	65.0	61.2	58.5
245	-	-	79.0	74.9	71.7	69.6	68.2	65.3	61.5	58.8
250	-	-	79.1	75.0	71.9	69.8	68.4	65.5	61.8	59.1
255	-	-	79.2	75.1	72.0	70.0	68.6	65.7	62.0	59.4
260	-	-	79.3	75.3	72.2	70.2	68.8	65.9	62.3	59.7
265	-	-	79.3	75.4	72.3	70.4	69.0	66.1	62.5	59.9
270	-	-	79.4	75.5	72.5	70.5	69.1	66.3	62.7	60.2
275	-	-	79.5	75.6	72.6	70.7	69.3	66.5	62.9	60.4
280	-	-	79.6	75.7	72.7	70.9	69.5	66.7	63.1	60.6
285	-	-	79.7	75.8	72.9	71.0	69.6	66.9	63.3	60.9
290	-	-	79.7	75.9	73.0	71.1	69.8	67.0	63.5	61.1
295	-	-	79.8	76.0	73.1	71.3	69.9	67.2	63.7	61.3
300	-	-	79.9	76.1	73.2	71.4	70.0	67.3	63.9	61.5
305	-	-	79.9	76.2	73.3	71.5	70.2	67.5	64.0	61.6
310	-	-	80.0	76.2	73.4	71.7	70.3	67.6	64.2	61.8
315	-	-	80.0	76.3	73.5	71.8	70.4	67.8	64.4	62.0
320	-	-	80.1	76.4	73.6	71.9	70.6	67.9	64.5	62.2
325	-	-	80.2	76.5	73.7	72.0	70.7	68.0	64.6	62.3
330	-	-	80.2	76.5	73.8	72.1	70.8	68.1	64.8	62.5
335	-	-	80.3	76.6	73.9	72.2	70.9	68.3	64.9	62.6
340	-	-	80.3	76.7	74.0	72.3	71.0	68.4	65.1	62.8
345	-	-	80.4	76.8	74.0	72.4	71.1	68.5	65.2	62.9
350	-	-	80.4	76.8	74.1	72.5	71.2	68.6	65.3	63.1
355	-	-	80.5	76.9	74.2	72.6	71.3	68.7	65.4	63.2
360	-	-	80.5	76.9	74.3	72.7	71.4	68.8	65.5	63.3
365	-	-	80.5	77.0	74.3	72.8	71.5	68.9	65.7	63.4

Table applies to beams with protection to three sides and a concrete slab. Thickness is protection material only.
Table also applies to beams and columns protected on four sides.

