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ASSESSMENT REPORT

An assessment of the fire performance of I- and H-section steel beams and columns protected with Rockwool FireProTM BeamClad, installed using the stud welded pin method, in accordance with the ASFP Yellow Book, 5th Edition

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1.Introduction

A relationship between protection thickness, section factor and fire resistance for I- and H-section steel beams and columns protected with Rockwool FirePro™ BeamClad has been established using the multiple linear regression method defined in section 2.3.4.7 of the ASFP Yellow Book, *Fire protection for structural steel in buildings, 5th Edition,* using test data generated in accordance with ENV 13381-4:2002.

The results of this analysis are summarised in appendix A for I- and H-section beams and columns at design temperatures of 350°C, 400°C, 450°C, 500°C, 550°C, 600°C, 620°C and 650°C, and for fire resistance periods of 30, 60, 90, 120 and 180 minutes.

2.Scope

To determine the relationship between protection thickness, section factor and fire resistance for I- and H-section steel beams and columns protected with Rockwool FirePro™ BeamClad, installed using the stud welded pin method, using the multiple linear regression method defined in section 2.3.4.7 of the ASFP Yellow Book, *Fire protection for structural steel in buildings, 5th Edition.*

3.Supporting data

This assessment is based on supporting test data which is more than five years old. This supporting data has therefore been reviewed against current test procedures.

Details of the supporting data used in the preparation of this assessment are given in appendix B.

4.Description of the proposed fire protection system

Rockwool FirePro™ BeamClad is a stone wool insulation board supplied in slabs 2000mm long x 1200mm wide with a nominal density of 165kg/m^3. The insulation can also be foil or tissue faced. The measured densities for the various board thicknesses are given in appendix C.

The insulation is applied to the steel sections as a box protection system. The system is installed using 2.7mm-diameter stud-welded pins fitted with 28mm-diameter spring washers. The pins are supplied in various lengths, the length being used dependent on board thickness.

In the case of beams, the pins are welded to the steel section along the flange tips and in two rows along the face of the bottom flange, nominally 50mm in from each edge; all pins are located at maximum 320mm centres. The boards are pushed over the pins and secured in position using the washers so that the boards covering the flange are fitted between those covering the web. Transverse joints in the boards fixed to the webs and offset with respect to those fixed to the flange by a minimum of 100mm.

The fixing system for columns is the same except that only a single row of pins is used down the centre of the web where the web width is less than 120mm and the protection thickness 30mm or greater.

As an alternative, the system may also be installed with the joints glued using Rockwool FireProTM Glue in addition to being fixed with the stud welded pins and spring washers as outlined above.

5.Assessment

5.1 General

This assessment has been carried out using thermal data generated by the testing of short unloaded sections and relates to a range of design temperatures for both beams and columns.

The assessment method used in the multiple linear regression method detailed in section 2.3.4.7 of the ASFP Yellow Book, *Fire protection for structural steel in buildings, 5th Edition.*

5.2 Assessment parameters

The following parameters are used in the assessment protocol:

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a) The average thickness of the board/slab.

b) The calculated section factor using the measured dimensions of each section.

c) The mean temperature calculated as follows:

I-section beams: The average of the temperatures recorded by the thermocouples attached to the lower flange plus the average of the temperatures recorded by the thermocouples attached to the web divided by 2.

I-section columns: The average of the temperatures recorded by the thermocouples attached to the flanges plus the average of the temperatures recorded by the thermocouples attached to the web divided by 2.

d) At least the minimum data set in accordance with section 2.3.2.3 of the ASFP Yellow Book.

e) The maximum fire resistance period.

5.3 Multiple linear regression method

The data from the sections has been analysed using the multiple linear regression method detailed in section 2.3.4.7 of the ASFP Yellow Book, *Fire protection for structural steel in buildings, 5th Edition*, using the following equation:

$$\text{Fire resistance time (minutes) } t = a_0 + a_1 d_p V/A + a_2 d_p$$

Details of the calculated regression coefficients and the linear modification factors applied are detailed in table 1.

Table 1 Regression coefficients and linear modification factors for I- and H-section beams

Design temperature (°C)	Regression coefficients			Linear modification factor
	a_0	a_1	a_2	
350	18.842	174.702	-0.022	0.967
400	21.885	201.360	-0.065	0.966
450	25.259	226.831	-0.099	0.964
500	28.650	250.997	-0.101	0.963
550	32.739	275.021	-0.106	0.963
600	37.976	301.080	-0.118	0.968
620	40.121	311.928	-0.119	0.970
650	43.510	327.441	-0.126	0.970

Details of the actual and predicted times for each section are detailed in appendix D.

5.4 Maximum fire resistance period

The maximum fire resistance period is determined by the loaded sections.

The loaded beam protected with the maximum protection thickness satisfied the loadbearing capacity criteria for 164 minutes. The maximum fire resistance period covered by this assessment is therefore 180 minutes as the protection system remained intact during the overrun period.

5.5 Criteria for acceptability

The acceptability of the analysis within the range of steel section temperatures and duration of the test has been judged up to the maximum temperature tested on the following basis:

a) for each short section the predicted time in minutes to reach the design temperature calculated to one decimal place shall not exceed the corrected time by more than 15%;

b) the mean value of all percentage differences as calculated in a) shall be less than zero;

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c) a maximum of 30% of individual values of all percentage differences as calculated in a) shall be more than zero;

d) the results of the analysis which satisfy (a) to (c) above shall also comply with the following rules provided all other parameters remain constant:

   1) the thickness of the fire protection material increases with fire resistance time;

   2) as the section factor increases the fire resistance time decreases;

   3) as the fire resistance time increases the temperature increases;

   4) as thickness increases temperature decreases;

   5) as section factor increases the temperature increases;

   6) as section factor increases thickness increases.

e) Using the regression coefficients derived from the short section data the predicted time to reach the design temperature for each loaded section shall not be greater than the measured time.

Table 2 details the compliance with criteria (a) to (c) at each design temperature.

Table 2 Compliance with criteria for acceptability for I- and H-section beams

Criterion	Design temperature (°C)							
	350	400	450	500	550	600	620	650
a)	6.0	5.6	5.6	5.2	5.1	5.6	5.9	5.8
b)	-2.6	-2.7	-2.8	-3.0	-3.1	-2.6	-2.3	-2.4
c)	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1

5.6 Permitted extensions

5.6.1. Section factor

The assessment is valid for section factors between 46m^{-1} and 306m^{-1}.

5.6.2. Protection thickness

The assessment is valid for thicknesses of Rockwool FirePro™ BeamClad between 20mm and 55mm.

5.6.3. Other sections with re-entrant details

The results of the assessment are directly applicable to angles, channels and T-sections for the same section factor.

5.6.4. Method of fixing and support

The assessment only applies to the method of fixing and support for the protection system used for the tested sections and an alternative system utilising glued joints in addition to the welded pins and washers. We would consider that the latter would perform at least as well as the tested system where the joints were not glued.

5.6.5. Deep web sections

The maximum beam web depth is limited to 603mm.

The maximum depth of a column is limited to 600mm.

5.6.6. Beams with protection on all sides

The results of the analysis can be applied to beams exposed on all four sides.

5.6.7. Cellular beams

Where a limiting temperature of 450°C has been provided or one associated with a particular design of cellular beam provided by a qualified structural engineer in accordance with the principles of section 4 of

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the ASFP Yellow Book, *Fire protection for structural steel in buildings, 5th Edition,* the section factor for that beam shall be determined as the highest value derived from the following:

a) The section factor of the "I" section above the opening.
b) The section factor of the "I" section below the opening.
c) The section factor derived from $1400/t_w$ where t_w is the thickness of the web in mm.

In all cases the thickness of protection obtained based on the section factor and temperature as derived above shall be increased by 20%. The applied thickness shall not exceed the maximum assessed, as detailed in section 5.6.2, for the product for beam protection.

6.Conclusion

The thicknesses of Rockwool FirePro™ BeamClad required for various periods of fire resistance, when applied to I- and H-section steel beams and columns having various section factors has been predicted using the multiple linear regression method detailed in section 2.3.4.7 of the ASFP Yellow Book, *Fire protection for structural steel in buildings, 5th Edition,* using test data generated in accordance with ENV 13381-4:2002.

The results of this analysis are summarised in appendix A for I- and H-section beams and columns. The analysis has been carried out at design temperatures of 350°C, 400°C, 450°C, 500°C, 550°C, 600°C, 620°C and 650°C, for fire resistance periods of 30, 60, 90, 120 and 180 minutes.

7.Validity of the assessment

7.1 Declaration by applicant

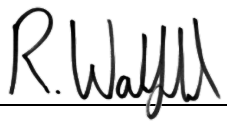
We the undersigned confirm that we have read and complied with the obligations placed on us by the Passive Fire Protection Forum (PFPF) Guide to undertaking technical assessments and engineering evaluations based on fire test evidence 2021 Industry Standard Procedure.

We confirm that any changes which are the subject of this assessment, has not to our knowledge been tested to the standard against which this assessment has been made.

We agree to withdraw this assessment from circulation should the component or element of structure, or any of its component parts be the subject of a failed fire resistance test to the standard against which this assessment is being made.

We understand that this assessment is based on test evidence and will be withdrawn should evidence become available that causes the conclusion to be questioned. In that case, we accept that new test evidence may be required.

We are not aware of any information that could affect the conclusions of this assessment. If we subsequently become aware of any such information, we agree to ask BRE Global to withdraw the assessment.

Signature:	
Name:	Rob Wakefield
Position:	Fire Certification Engineer
Company:	ROCKWOOL UK
Date:	10/06/2025

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7.2 BRE Global declaration

This assessment was reviewed on 14 March 2025. We have received written confirmation from Rockwool Limited that there have been no changes in the specification of their Rockwool FirePro™ BeamClad protection system for structural steelwork since the original date of the assessment. There have been no changes in the fire test procedures or methods of assessment, which would adversely affect the fire performance of the system. We are therefore satisfied that the validity of this assessment may be extended for a further five years.

This assessment is issued on the basis of test data and information to hand at the time of issue. If contradictory evidence becomes available to BRE Global the assessment will be unconditionally withdrawn, and the applicant will be notified in writing. Similarly, the assessment should be re-evaluated if the assessed construction is subsequently tested since actual test data is deemed to take precedence.

The assessment is valid for a period of five years after which it is recommended that it be submitted to BRE Global for re-evaluation.

This assessment has been carried out in accordance with the Passive Fire Protection Forum (PFPF) Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence 2021. It relates to the fire performance of the product and does not cover aspects of quality, durability, maintenance nor service requirements. This assessment relates only to the specimen(s) assessed and does not by itself imply that the product is approved under any Loss Prevention Certification Board approval or certification scheme or any other endorsements, approval or certification scheme.

The assessment report is not valid unless it incorporates the declaration duly signed by the applicant.

Next review date: 07 April 2030

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Appendix A – Results of analysis

Table 3 Required thickness (mm) of Rockwool FirePro™ BeamClad for a design temperature of 350°C

Board thickness (mm)	Limiting section factor (m^{-1}) for a fire resistance of				
	30min	60min	90min	120min	180min
20	301	83	48	-	-
25	306	104	60	-	-
30	306	125	72	51	-
35	306	145	85	59	-
40	306	166	96	68	-
45	306	186	108	76	48
50	306	206	120	85	53
55	306	226	132	93	59

Table 4 Required thickness (mm) of Rockwool FirePro™ BeamClad for a design temperature of 400°C

Board thickness (mm)	Limiting section factor (m^{-1}) for a fire resistance of				
	30min	60min	90min	120min	180min
20	306	102	58	-	-
25	306	126	72	50	-
30	306	150	86	60	-
35	306	174	100	70	-
40	306	197	113	79	50
45	306	220	127	89	56
50	306	243	141	99	62
55	306	264	154	108	68

Table 5 Required thickness (mm) of Rockwool FirePro™ BeamClad for a design temperature of 450°C

Board thickness (mm)	Limiting section factor (m^{-1}) for a fire resistance of				
	30min	60min	90min	120min	180min
20	306	123	67	46	-
25	306	152	84	58	-
30	306	180	100	69	-
35	306	207	116	80	50
40	306	234	132	91	57
45	306	260	147	102	64
50	306	285	162	113	71
55	306	306	177	124	77

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Table 6 Required thickness (mm) of Rockwool FirePro™ BeamClad for a design temperature of 500°C

Board thickness (mm)	Limiting section factor (m^{-1}) for a fire resistance of				
	30min	60min	90min	120min	180min
20	306	150	79	53	-
25	306	185	98	66	-
30	306	219	116	79	48
35	306	251	135	92	56
40	306	283	153	105	64
45	306	306	171	117	72
50	306	306	189	130	80
55	306	306	205	142	87

Table 7 Required thickness (mm) of Rockwool FirePro™ BeamClad for a design temperature of 550°C

Board thickness (mm)	Limiting section factor (m^{-1}) for a fire resistance of				
	30min	60min	90min	120min	180min
20	306	187	92	61	-
25	306	229	114	76	-
30	306	271	136	91	54
35	306	306	157	105	63
40	306	306	178	120	72
45	306	306	199	134	81
50	306	306	219	148	90
55	306	306	239	162	98

Table 8 Required thickness (mm) of Rockwool FirePro™ BeamClad for a design temperature of 600°C

Board thickness (mm)	Limiting section factor (m^{-1}) for a fire resistance of				
	30min	60min	90min	120min	180min
20	306	246	110	71	-
25	306	301	136	88	51
30	306	306	162	105	62
35	306	306	187	122	72
40	306	306	212	138	82
45	306	306	236	155	91
50	306	306	259	171	101
55	306	306	282	186	111

Table 9 Required thickness (mm) of Rockwool FirePro™ BeamClad for a design temperature of 620°C

Board thickness (mm)	Limiting section factor (m^{-1}) for a fire resistance of				
	30min	60min	90min	120min	180min
20	306	280	119	75	-
25	306	306	147	94	54
30	306	306	175	112	65
35	306	306	202	129	75
40	306	306	228	147	86
45	306	306	254	164	96
50	306	306	279	181	106
55	306	306	303	198	116

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Appendix B – Supporting data

B.1 DANAK test report no. PG10093

A fire resistance test in accordance with ENV 13381-4:2002 was carried out on two loaded I-section beams and two I-section short beams protected with Rockwool FirePro™ BeamClad on 13 December 2011. The test duration was 200 minutes

Details of the tested specimens relevant to this report are summarised below:

Test specimen	Section type	Measured section factor (m^{-1})	Measured protection thickness (mm)
LB1	IPE400	145	20.4
LB2	IPE400	147	49.9

The specimens satisfied the criteria of the standard as follows:

Loaded beam LB1 Loadbearing capacity: 104 minutes

Loaded beam LB2 Loadbearing capacity: 164 minutes

For full details see DANAK test report no PG10093.

B.2 DANAK test report no. PG10094

A fire resistance test in accordance with ENV 13381-4:2002 was carried out on 13 short I-section columns protected with Rockwool FirePro™ BeamClad on 16 December 2011. The test duration was 240 minutes

Details of the tested specimens are summarised below:

Test specimen	Section type	Measured section factor (m^{-1})	Measured protection thickness (mm)
SC1	HEM280	51	20.4
SC2	HEM280	51	30.4
SC3	HEB450	74	39.8
SC4	HEA290	114	20.4
SC5	HEA290	114	30.4
SC6	HEA290	114	49.9
SC7	IPE240	182	20.4
SC8	IPE240	177	30.4
SC9	IPE240	186	39.8
SC10	IPE240	187	49.9
SC11	IPE140	259	30.4
SC12	IPE140	278	39.8
SC13	IPE140	257	49.9

For full details see DANAK test report no. PG10094.

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Appendix C – Measured densities of tested Rockwool FirePro™ BeamClad

The nominal density of Rockwool FirePro™ BeamClad is stated by Rockwool Limited to be 165kg/m^3. The mean measured densities of samples taken for the different thicknesses of board used in the tests are as follows:

Sample Material thickness	Density (kg/m^3)
20mm	167.2
30mm	166.4
40mm	165.8
50mm	166.7

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Appendix D – Actual and predicted times for sections to reach each design temperature

Table 10 Actual times for each section to reach each design temperature

Section type	Section reference	Section factor (m^{-1})	Protection thickness (mm)	Time to design temperature (min)							
				350	400	450	500	550	600	620	650
Loaded	LB1	145	20.4	50.7	58.8	67.5	76.6	86.3	96.8	101.2	108.1
Loaded	LB2	147	49.9	92.8	105.6	119.4	134.4	150.3	167.3	174.4	185.1
Unloaded	SC1	51	20.4	96.8	111.0	125.4	140.2	155.4	171.5	178.2	188.5
Unloaded	SC2	51	30.4	116.2	133.2	150.3	167.7	185.7	204.6	212.4	224.8
Unloaded	SC3	74	39.8	119.6	136.1	152.8	169.8	187.3	205.7	213.3	225.2
Unloaded	SC4	114	20.4	51.8	59.0	66.7	74.7	83.7	93.7	97.7	104.2
Unloaded	SC5	114	30.4	70.1	79.3	89.2	99.6	110.5	122.1	127.0	134.5
Unloaded	SC6	114	49.9	101.6	115.6	130.3	145.6	161.2	177.5	184.3	194.6
Unloaded	SC7	182	20.4	38.7	43.9	49.6	55.8	62.4	69.7	72.7	77.6
Unloaded	SC8	177	30.4	49.9	56.7	64.1	72.0	80.5	90.3	94.5	100.7
Unloaded	SC9	186	39.8	61.3	69.6	78.3	87.9	98.2	109.1	113.7	121.1
Unloaded	SC10	187	49.9	64.3	72.3	80.8	91.1	102.0	113.3	118.0	125.3
Unloaded	SC11	259	30.4	36.5	41.2	46.3	52.3	58.8	66.0	69.0	73.8
Unloaded	SC12	278	39.8	40.9	45.8	51.3	57.9	65.0	72.5	75.7	80.7
Unloaded	SC13	257	49.9	52.1	57.8	64.3	72.3	80.8	90.5	94.7	101.2

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Table 11 Predicted times for each section to reach each design temperature

Section type	Section reference	Section factor (m^{-1})	Protection thickness (mm)	Time to design temperature (min)							
				350	400	450	500	550	600	620	650
Loaded	LB1	145	20.4	43.0	48.9	55.1	61.9	69.3	77.9	81.6	87.0
Loaded	LB2	147	49.9	77.0	87.0	97.3	108.8	120.8	134.3	140.1	148.4
Unloaded	SC1	51	20.4	88.3	101.1	114.0	127.0	140.6	156.0	162.5	171.9
Unloaded	SC2	51	30.4	122.3	139.9	157.5	175.2	193.5	213.9	222.4	234.9
Unloaded	SC3	74	39.8	111.9	127.6	143.3	159.6	176.4	195.2	203.2	214.6
Unloaded	SC4	114	20.4	49.7	56.6	63.8	71.5	79.8	89.4	93.5	99.5
Unloaded	SC5	114	30.4	64.8	73.6	82.7	92.5	102.9	114.7	119.7	127.0
Unloaded	SC6	114	49.9	94.2	106.8	119.6	133.5	147.8	163.9	170.7	180.6
Unloaded	SC7	182	20.4	38.0	43.1	48.7	54.7	61.4	69.3	72.7	77.6
Unloaded	SC8	177	30.4	48.2	54.5	61.2	68.7	76.8	86.1	90.1	95.9
Unloaded	SC9	186	39.8	55.3	62.4	69.8	78.3	87.4	97.7	102.1	108.6
Unloaded	SC10	187	49.9	64.3	72.3	80.8	90.6	100.8	112.4	117.4	124.6
Unloaded	SC11	259	30.4	38.7	43.5	48.9	55.0	61.8	69.7	73.1	78.1
Unloaded	SC12	278	39.8	43.0	48.1	53.8	60.6	67.9	76.4	80.0	85.4
Unloaded	SC13	257	49.9	51.7	57.7	64.3	72.3	80.8	90.5	94.7	100.8

Report Ends

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