

Report Number BTC 21719FA

A FIRE RESISTANCE APPRAISAL COVERING A SERIES OF TESTS CARRIED OUT ON THE BRITISH GYPSUM GYPLYNER ENCASE STEEL PROTECTION SYSTEM CLAD WITH A MULTIPLE LAYER OF GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4:2013.

Appraisal Date: 23rd March 2021

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Customer: **British Gypsum**

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FOREWORD

This appraisal report reviews and analyses the data from eight separate fire resistance tests covering the GypLynr ENCASE steel protection system in accordance with the procedures given in BS EN 13381-4:2013.

The appraisal sponsor was British Gypsum.

This report provides the constructional details, the test conditions, the results obtained and the interpolated data obtained when the specified fire protection system described herein was tested following the procedures of BS EN 13381-4. Any deviation with respect to thickness and density of fire protection material and constructional details, loads, stresses, edge or end conditions other than those allowed under the field of application could invalidate the test result.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

REPORT AUTHORISATION

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TEST REPORT AMENDMENTS

Page	Amendments	Date

Report Amendments Author

Amendments Authorised by

INTRODUCTION TO BS EN 13381-4:2013

BS EN 13381-4:2013 specifies a test method for determining the contribution made by applied passive fire protection systems to the fire resistance of structural steel members, which can be used as beams or columns. It considers only sections without openings in the web. It is not directly applicable to structural tension members without further evaluation. Results from analysis of 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. BS EN 13381-4:2013 does not apply to solid bar or rod.

BS EN 13381-4:2013 covers fire protection systems that involve only passive materials and not to reactive fire protection materials as defined in BS EN 13381-4:2013.

The evaluation is designed to cover a range of thicknesses of the applied fire protection material, a range of steel sections, characterized by their section factors, a range of design temperatures and a range of valid fire protection classification periods.

BS EN 13381-4:2013 contains the fire test procedures, which specifies the tests which should be carried out to determine the ability of the fire protection system to remain coherent and attached to the steelwork, and to provide data on the thermal characteristics of the fire protection system, when exposed to the standard temperature/time curve specified in EN 1363-1.

The fire test methodology makes provision for the collection and presentation of data, which can be used as direct input to the calculation of fire resistance of steel structural members in accordance with the procedures given in EN 1993-1-2 and EN 1994-1-2.

BS EN 13381-4:2013 also contains the assessment, which prescribes how the analysis of the test data shall be made and gives guidance on the procedures by which interpolation should be undertaken.

The assessment procedure is used to establish:

- a) On the basis of temperature data derived from testing loaded and unloaded sections, a correction factor and any practical constraints on the use of the fire protection system under fire test conditions, (the physical performance).
- b) On the basis of the temperature data derived from testing short steel sections, the thermal properties of the fire protection system, (the thermal performance).

The limits of applicability of the results of the assessment arising from the fire test are defined, together with permitted direct application of the results, to different steel sections and grades and to the fire protection system.

The results of the test and assessment obtained according to BS EN 13381-4:2013 are directly applicable to steel sections of I and H cross sectional shape and hollow sections.

TESTS USED IN THE APPRAISAL

This appraisal report reviews and analyses the data from six separate fire resistance tests conducted in accordance with the procedures given in BS EN 13381-4:2013. The test sponsor for all of the short column data and the loaded test data was British Gypsum. The following tests use Gyplyner Encase System.

The ten tests were as follows:

BTC 21597F

A FIRE RESISTANCE TEST ON A LOADED STEEL BEAM PROTECTED GYPLYNER ENCASE SYSTEM CLAD WITH A DOUBLE LAYER OF 12.5 MM GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4: 2013.

BTC 21471F

A FIRE RESISTANCE TEST ON A LOADED STEEL BEAM PROTECTED GYPLYNER ENCASE SYSTEM CLAD WITH A TRIPPLE LAYER OF 15 MM GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4: 2013.

BTC 21604F

A FIRE RESISTANCE TEST ON 4 SHORT STRUCTURAL STEEL COLUMNS PROTECTED USING THE GYPLYNER ENCASE SYSTEM CLAD WITH EITHER A SINGLE LAYER OF 12.5 MM GYPROC FIRELINE OR A TRIPLE LAYER OF 15 MM GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4: 2013.

BTC 21527F

A FIRE RESISTANCE TEST ON 4 SHORT STRUCTURAL STEEL COLUMNS PROTECTED USING THE GYPLYNER ENCASE SYSTEM CLAD WITH A DOUBLE LAYER OF 15 mm GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4: 2013.

BTC 21472F

A FIRE RESISTANCE TEST ON 4 SHORT STRUCTURAL STEEL COLUMNS PROTECTED USING THE GYPLYNER ENCASE SYSTEM CLAD WITH A DOUBLE LAYER OF 12.5mm GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4: 2013.

BTC 21532F

A FIRE RESISTANCE TEST ON 4 SHORT STRUCTURAL STEEL COLUMNS PROTECTED USING THE GYPLYNER ENCASE SYSTEM CLAD WITH A DOUBLE LAYER OF 12.5mm OR 15mm GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4: 2013.

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BTC 21530F

A FIRE RESISTANCE TEST ON 4 SHORT STRUCTURAL STEEL COLUMNS PROTECTED USING THE GYPLYNER ENCASE SYSTEM CLAD WITH A TRIPLE LAYER OF 15mm GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4: 2013.

BTC 21667F

A FIRE RESISTANCE TEST ON 4 SHORT STRUCTURAL STEEL COLUMNS PROTECTED USING THE GYPLYNER ENCASE SYSTEM CLAD WITH A DOUBLE OR TRIPLE LAYER OF 15mm GYPROC FIRELINE, CONDUCTED IN ACCORDANCE WITH BS EN 13381-4: 2013.

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Individual Test Specimens

Section ID	Test Report No.	Section Serial Size	Section factor (m ⁻¹)	Calculated Section Factor (m ⁻¹)	Gyproc FireLine cladding thickness (mm)
LBS06	BTC 21597F	406mm x 178mm x 67kg	115	118.63	2 x 12.5
RBS06	BTC 21597F	406mm x 178mm x 67kg	115	120.37	2 x 12.5
LB1	BTC 21471F	406mm x 178mm x 67kg	115	121.74	3 x 15
RB1	BTC 21471F	406mm x 178mm x 67kg	115	126.52	3 x 15
SCS13	BTC 21472F	305mm x 305mm x 198kg/m	50	52.93	2 x 12.5
SCS14	BTC 21472F	203mm x 203mm x 52kg/m	125	127.93	2 x 12.5
SCS16	BTC 21472F	203mm x 102mm x 23kg/m	210	218.32	2 x 12.5
SCS18	BTC 21532F	305mm x 102mm x 25kg/m	255	257.07	2 x 12.5
SCS19	BTC 21527F	305mm x 305mm x 198kg/m	50	52.46	2 x 15
SCS20	BTC 21527F	203mm x 203mm x 52kg/m	125	127.71	2 x 15
SCS33	BTC 21667F	203mm x 102mm x 23kg/m	210	217.92	2 x 15
SCS34	BTC 21667F	305mm x 102mm x 25kg/m	255	268.49	2 x 15
SCS32	BTC 21604F	305mm x 305mm x 198kg/m	50	54.61	3 x 15
SCS26	BTC 21530F	203mm x 203mm x 52kg/m	125	124.9	3 x 15
SCS35	BTC 21667F	203mm x 102mm x 23kg/m	210	219.94	3 x 15
SCS36	BTC 21667F	305mm x 102mm x 25kg/m	255	265.86	3 x 15

TEST SPECIMEN CONSTRUCTION

Short Column Sections

Each short section was clad as follows:

Gypframe GL10 GypLyner Steel Framing Clips were fitted to each flange at 100mm from the top and bottom ends of each steel section, e.g. at 800mm centres. 1000mm long lengths of Gypframe GL1 Lining Channels were engaged onto the clips.

Sections were clad with either a double layer of 12.5mm Gyproc FireLine, a double layer of 15mm Gyproc FireLine or a triple layer of 15mm Gyproc FireLine that was fixed to all framing members at 300mm centres using British Gypsum Drywall Screws.

All board joints were left unfinished.

Cladding thickness	Screw lengths
2 x 12.5mm	25mm & 35mm
2 x 15mm	25mm & 40mm
3 x 15mm	25mm, 40mm and 55mm

Short Column Steelwork Preparation – The Building Test Centre

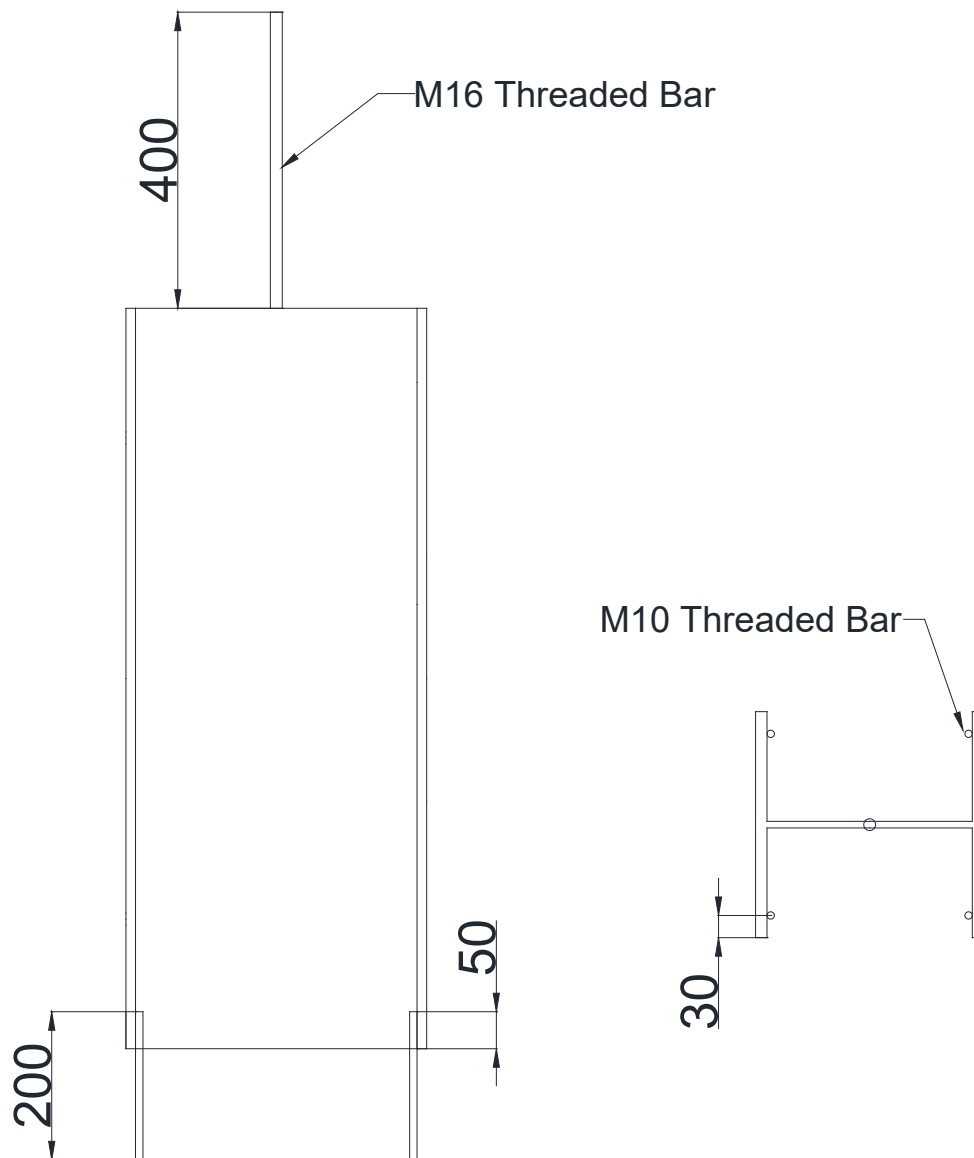


Figure 1. Steel column preparation

Short Column Thermocouple Layout – The Building Test Centre

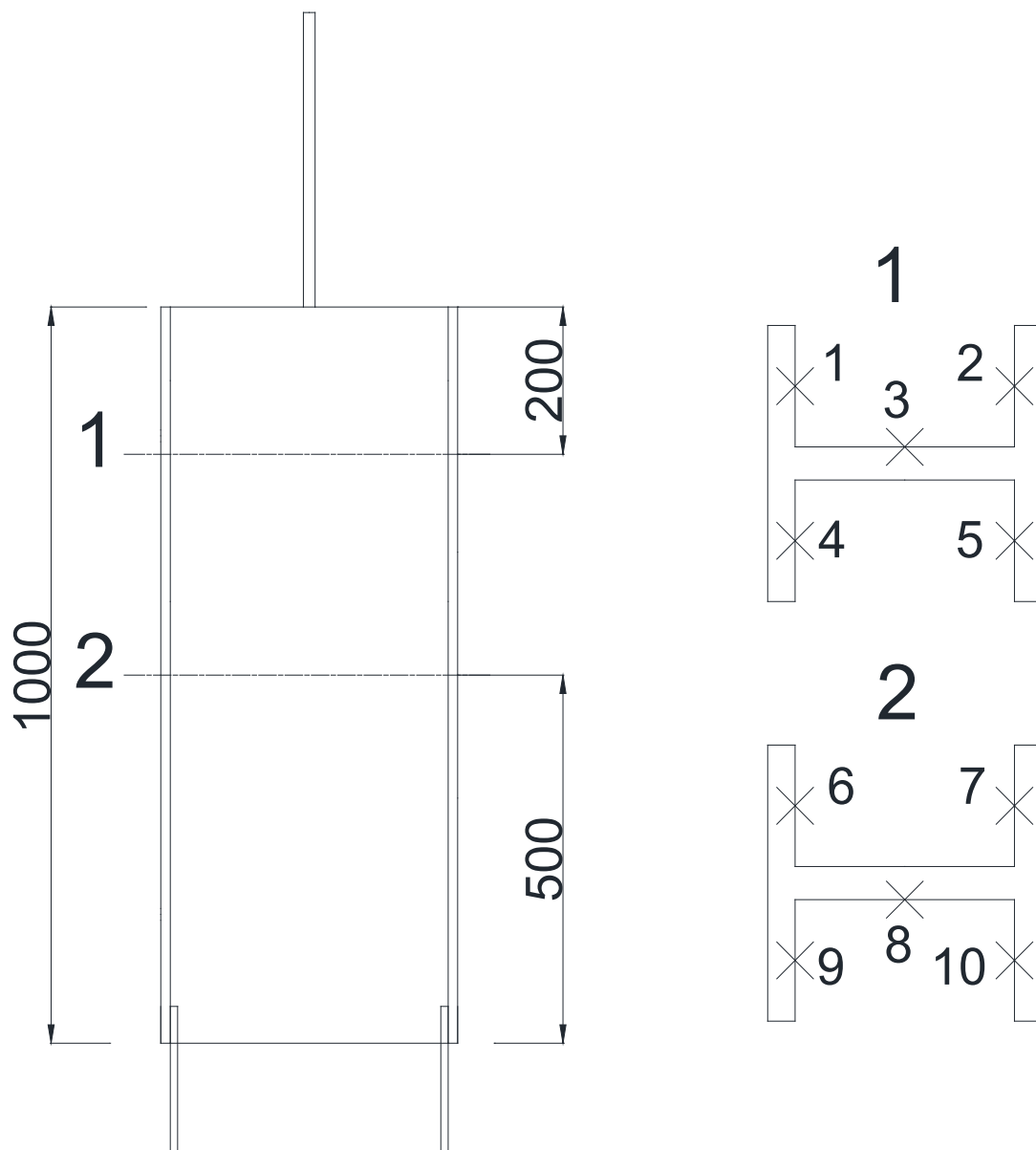


Figure 2. Steel column thermocouple layout.

Short Column Board Layout – The Building Test Centre

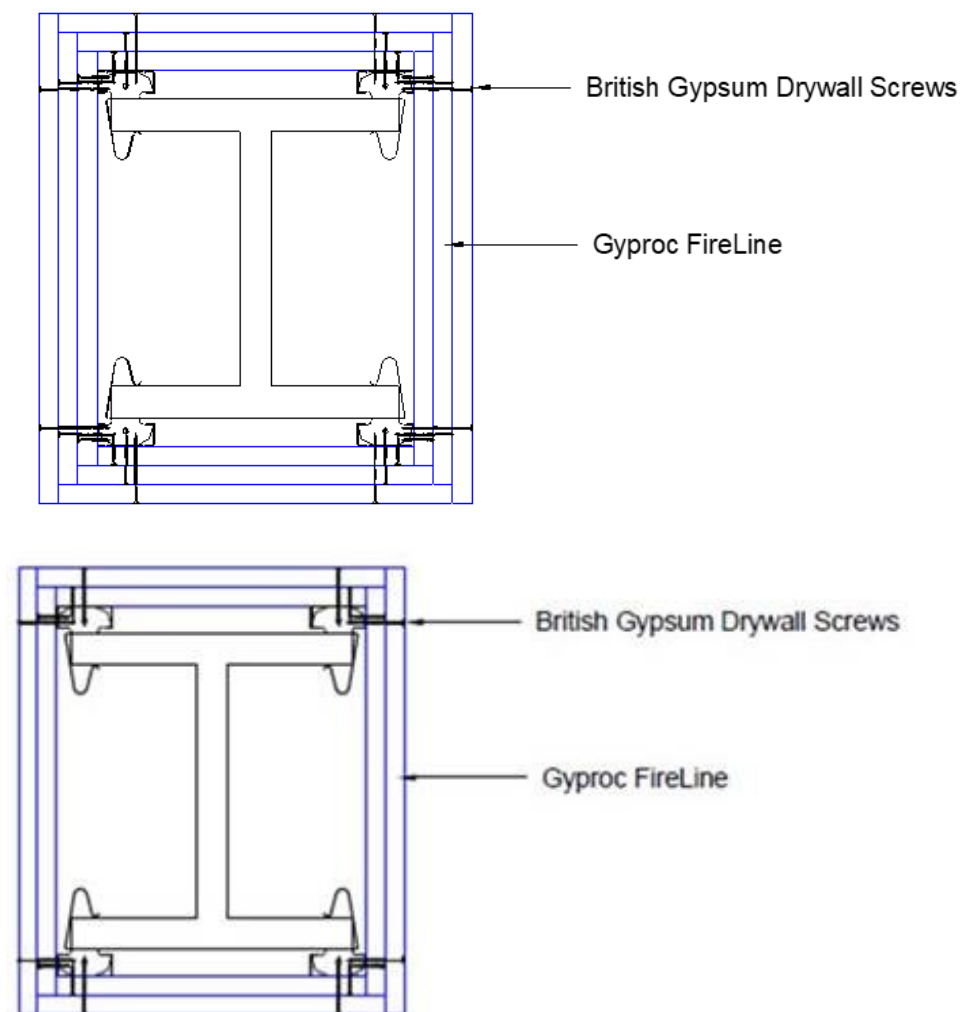


Figure 3. Short column board and staple layout.

Short Column End Detail – The Building Test Centre

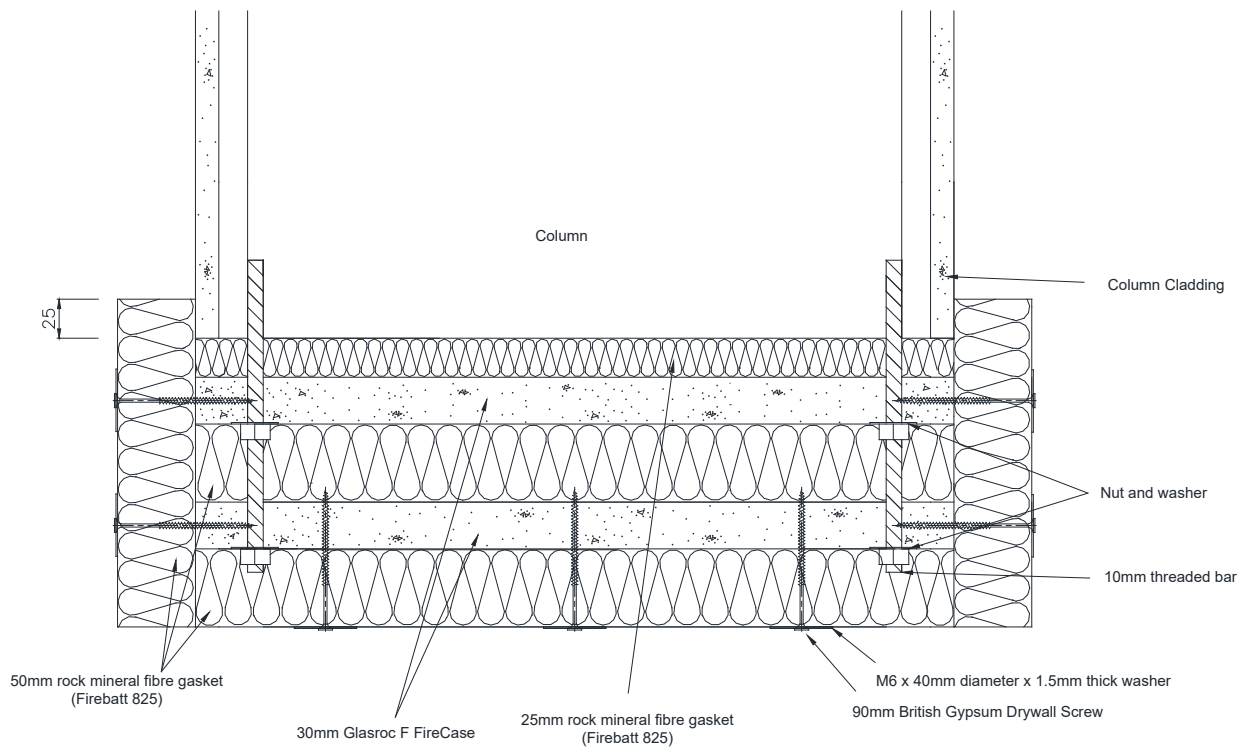


Figure 4. Short column end detail.

Loaded Beam Steelwork Preparation

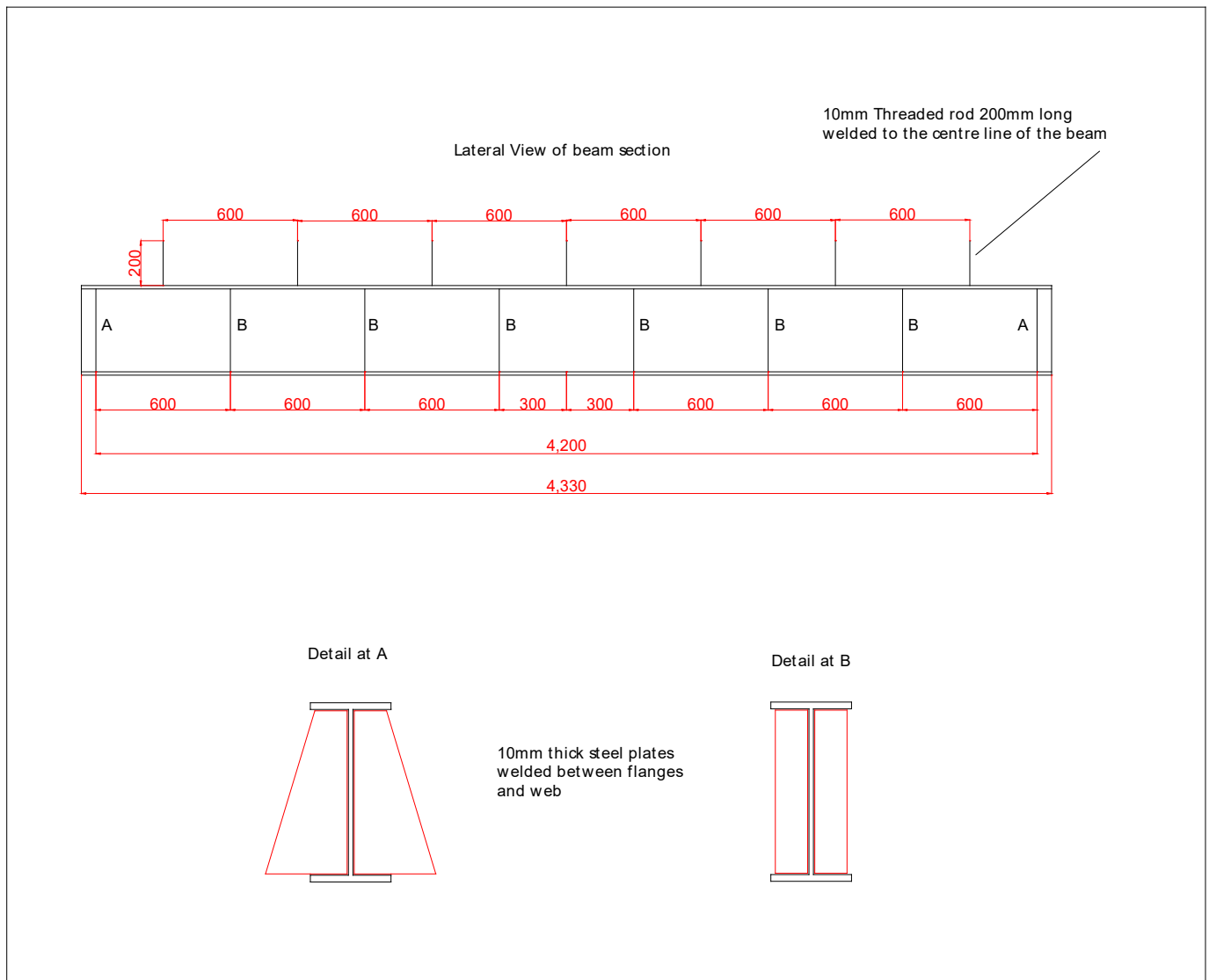


Figure 5. Loaded beam steelwork preparation.

Loaded Beam Thermocouple Layout

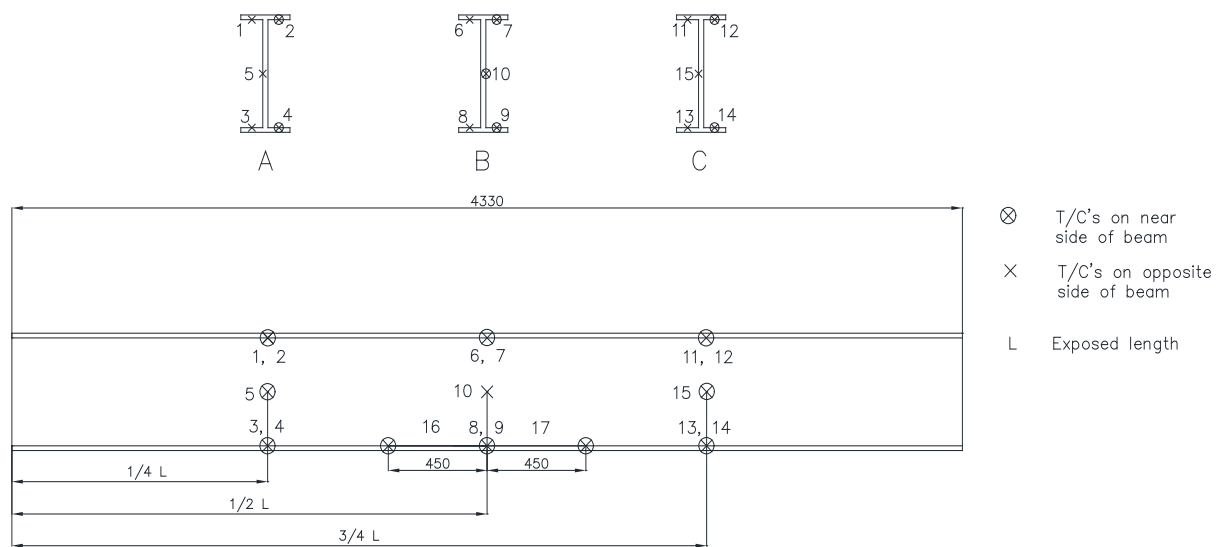


Figure 6. Loaded beam thermocouple layout.

Loaded Beam Test Set-Up

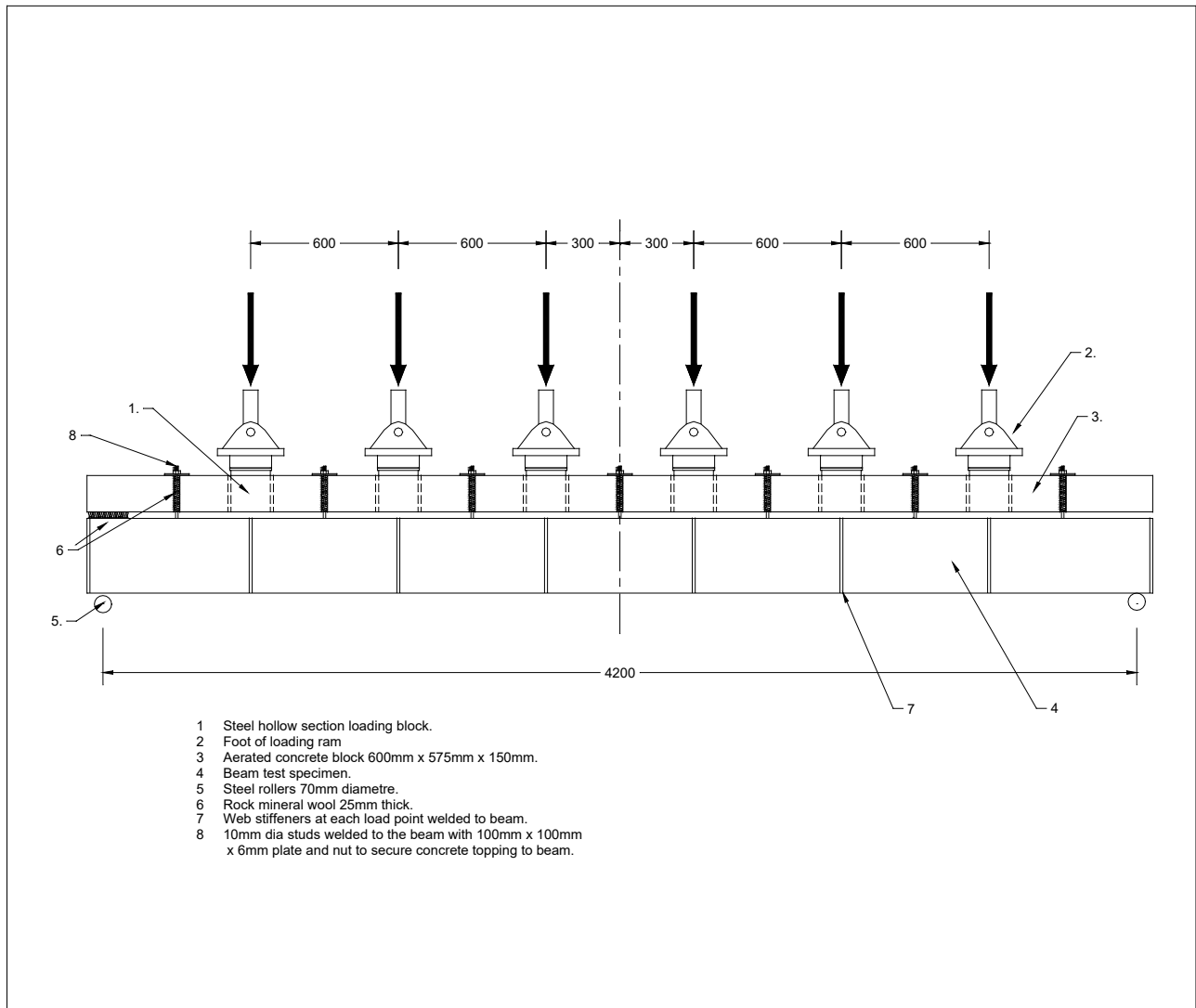


Figure 7. Loaded beam test set-up.

Reference Beam Steelwork Preparation

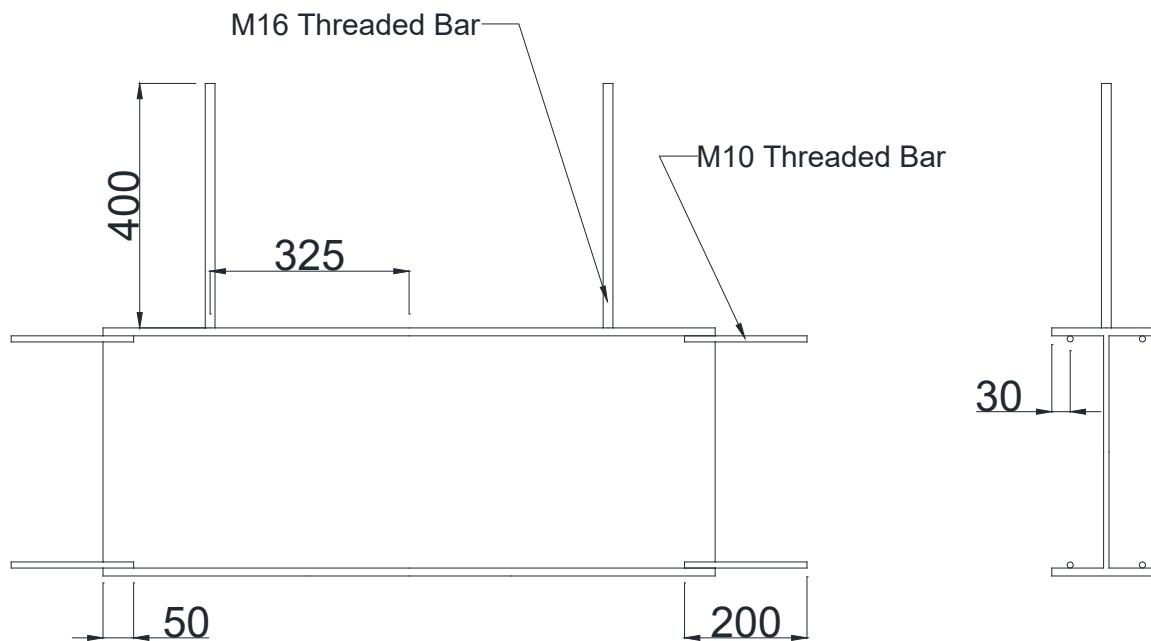


Figure 8. Reference beam steelwork preparation.

Reference Beam Thermocouple Layout

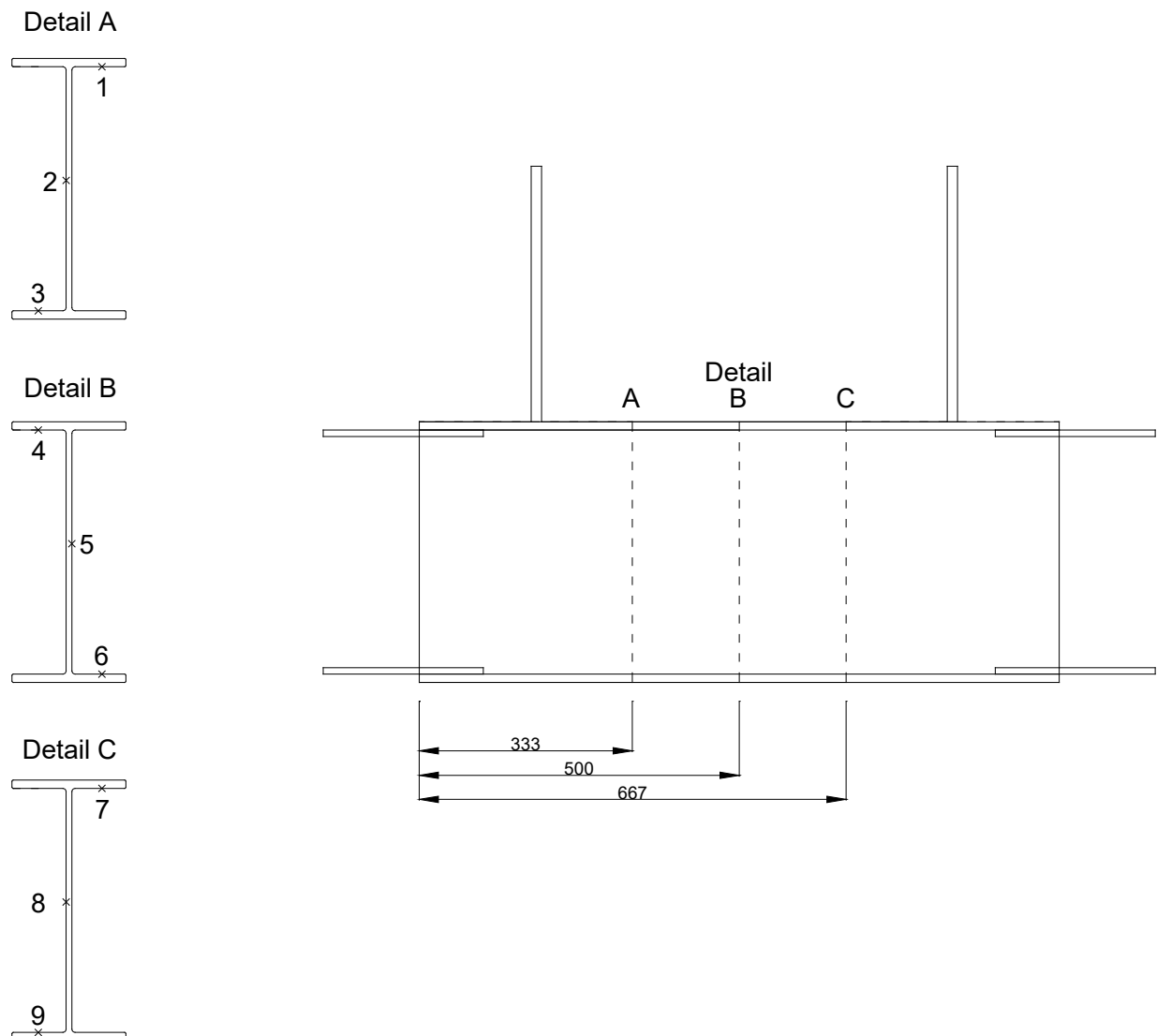


Figure 9. Reference beam thermocouple layout.

Reference Beam End Detail

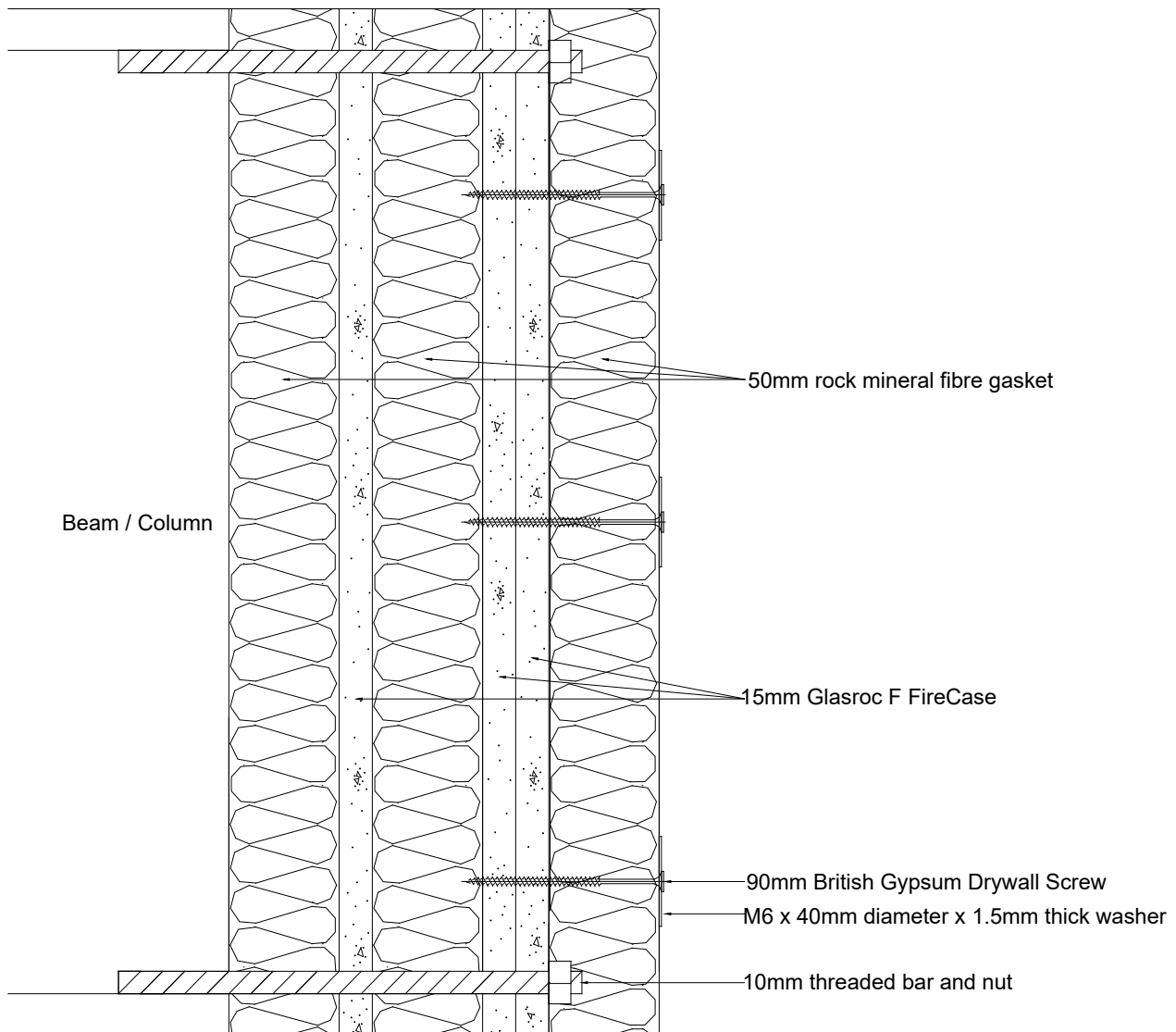


Figure 10. Reference beam end detail.

TEST MATERIALS

See below for the range of materials that were used in the supporting tests of this appraisal report.

Boards

Board	Nominal Thickness	Test Report No.	Nominal Length	Nominal Width	Measured Mass Per Unit Area	Measured Thickness	Measured Moisture Content	Board Identification Numbers
Gyproc FireLine	12.5mm	BTC 21597F	2400mm	1200mm	10.7kg/m ²	12.9mm	0.94%	24 329 20 11:42 24 329 20 11:42 24 329 20 11:42
Gyproc FireLine	15mm	BTC 21471F	2400mm	1200mm	12.9kg/m ²	15.3mm	0.56%	24 070 20 15:42 24 070 20 15:42 24 070 20 15:42
Gyproc FireLine	12.5mm	BTC 21472F	2400mm	1200mm	10.9kg/m ²	12.9mm	0.29%	24 070 20 22:06 24 070 20 22:07 24 070 20 22:07
Gyproc FireLine	12.5mm	BTC 21532F	2400mm	1200mm	10.9kg/m ²	12.9mm	0.17%	24 070 20 22:06 24 070 20 22:07 24 070 20 22:07
Gyproc FireLine	15mm	BTC 21527F	2400mm	1200mm	12.9kg/m ²	15.3mm	0.17%	24 070 20 15:42 24 070 20 15:42 24 070 20 15:42
Gyproc FireLine	15mm	BTC 21667F	2400mm	1200mm	13.1kg/m ²	15.4mm	0.37%	24 017 21 23:12 24 017 21 23:13 24 017 21 23:14
Gyproc FireLine	15mm	BTC 21604F	2400mm	1200mm	10.9kg/m ²	12.9mm	Less than 1%	24 070 20 22:06 24 070 20 22:07 24 070 20 22:07
Gyproc FireLine	15mm	BTC 21530F	2400mm	1200mm	12.9kg/m ²	15.3mm	0.47%	24 070 20 15:42 24 070 20 15:42 24 070 20 15:42

DATA ANALYSIS

Characteristic Steel Beam Temperatures (2 x 12.5mm Loaded Beam)

Time (Minutes)	Loaded Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
0	25.6	26	25.8
0.5	25.4	26	25.7
1	25.3	26	25.7
1.5	25.4	26	25.7
2	25.6	27	26.3
2.5	25.6	27	26.3
3	25.7	28	26.9
3.5	25.8	29	27.4
4	26.1	30	28.1
4.5	26.5	31	28.8
5	26.8	33	29.9
5.5	27.4	34	30.7
6	27.9	36	32
6.5	28.8	38	33.4
7	29.3	39	34.2
7.5	30.4	41	35.7
8	31.1	43	37.1
8.5	32.1	45	38.6
9	33.2	47	40.1
9.5	34.3	50	42.2
10	35.5	52	43.8
10.5	36.7	54	45.4
11	38	56	47
11.5	39.1	58	48.6
12	40.4	60	50.2
12.5	41.5	61	51.3
13	42.7	63	52.9
13.5	44.1	65	54.6
14	45.2	66	55.6
14.5	46.3	68	57.2
15	47.3	69	58.2
15.5	48.4	70	59.2
16	49.6	72	60.8
16.5	50.7	73	61.9
17	51.9	74	63
17.5	52.8	74	63.4

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Time (Minutes)	Loaded Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
18	53.9	75	64.5
18.5	54.9	76	65.5
19	55.7	76	65.9
19.5	56.6	76	66.3
20	57.6	77	67.3
20.5	58.5	77	67.8
21	59.6	77	68.3
21.5	60.6	78	69.3
22	61.8	79	70.4
22.5	62.8	79	70.9
23	63.9	80	72
23.5	65.2	81	73.1
24	66.1	81	73.6
24.5	67.6	82	74.8
25	68.7	82	75.4
25.5	69.8	83	76.4
26	70.9	83	77
26.5	72.1	83	77.6
27	73.4	84	78.7
27.5	74.3	84	79.2
28	75.6	84	79.8
28.5	76.6	85	80.8
29	77.9	86	82
29.5	78.8	86	82.4
30	80.2	87	83.6
30.5	81	87	84
31	81.9	88	85
31.5	83	89	86
32	84.1	89	86.6
32.5	84.9	89	87
33	85.9	90	88
33.5	86.8	90	88.4
34	87.8	91	89.4
34.5	88.7	91	89.9
35	89.4	91	90.2
35.5	90.1	92	91.1
36	90.7	92	91.4
36.5	91.6	93	92.3
37	92.3	94	93.2
37.5	92.6	94	93.3

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Time (Minutes)	Loaded Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
38	93.1	94	93.6
38.5	93.5	95	94.3
39	94.1	95	94.6
39.5	94.3	95	94.7
40	94.4	96	95.2
40.5	94.8	96	95.4
41	94.9	96	95.5
41.5	94.9	96	95.5
42	95.1	97	96.1
42.5	95.5	97	96.3
43	95.6	97	96.3
43.5	95.6	97	96.3
44	95.6	97	96.3
44.5	95.6	97	96.3
45	95.7	97	96.4
45.5	95.8	97	96.4
46	95.8	97	96.4
46.5	95.9	98	97
47	95.9	98	97
47.5	95.9	98	97
48	96	99	97.5
48.5	96.1	99	97.6
49	96.1	99	97.6
49.5	96.1	100	98.1
50	96.2	101	98.6
50.5	96.2	101	98.6
51	96.4	102	99.2
51.5	96.6	103	99.8
52	96.6	104	100.3
52.5	96.9	105	101
53	97	106	101.5
53.5	97.3	107	102.2
54	97.7	109	103.4
54.5	98.3	110	104.2
55	98.7	112	105.4
55.5	99.1	114	106.6
56	99.6	116	107.8
56.5	100.4	118	109.2
57	101	120	110.5
57.5	101.8	122	111.9

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Time (Minutes)	Loaded Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
58	102.5	125	113.8
58.5	103.5	127	115.3
59	104.4	130	117.2
59.5	105.7	132	118.9
60	107.2	135	121.1
60.5	108.9	138	123.5
61	110.8	140	125.4
61.5	112.7	143	127.9
62	115	146	130.5
62.5	117.1	149	133.1
63	119.2	151	135.1
63.5	121.5	154	137.8
64	124	157	140.5
64.5	126.4	160	143.2
65	128.8	162	145.4
65.5	131.4	165	148.2
66	133.7	168	150.9
66.5	136.2	171	153.6
67	138.5	173	155.8
67.5	141.2	176	158.6
68	143.7	179	161.4
68.5	146.4	182	164.2
69	148.8	184	166.4
69.5	151.5	187	169.3
70	154	190	172
70.5	156.8	193	174.9
71	159.4	195	177.2
71.5	162	198	180
72	164.7	201	182.9
72.5	167.5	204	185.8
73	169.9	206	188
73.5	172.6	209	190.8
74	175.4	212	193.7
74.5	177.9	214	196
75	180.7	217	198.9
75.5	183.4	220	201.7
76	186.2	222	204.1
76.5	188.9	225	207
77	191.6	228	209.8
77.5	194.4	230	212.2

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Time (Minutes)	Loaded Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
78	197	233	215
78.5	199.7	236	217.9
79	202.5	238	220.3
79.5	205.1	241	223.1
80	207.9	243	225.5
80.5	211	246	228.5
81	213.8	249	231.4
81.5	216.4	251	233.7
82	219.3	254	236.7
82.5	222	256	239
83	224.9	259	242
83.5	227.6	262	244.8
84	230.4	264	247.2
84.5	233.3	267	250.2
85	236.1	269	252.6
85.5	239.1	272	255.6
86	242	274	258
86.5	244.8	277	260.9
87	247.5	279	263.3
87.5	250.3	282	266.2
88	253.4	285	269.2
88.5	256.3	287	271.7
89	259.3	290	274.7
89.5	262.3	292	277.2
90	265.1	295	280.1
90.5	268.3	298	283.2
91	271.1	300	285.6
91.5	274.5	303	288.8
92	277.5	305	291.3
92.5	280.7	308	294.4
93	283.7	312	297.9
93.5	287.1	316	301.6
94	290.2	320	305.1
94.5	293.4	325	309.2
95	296.7	329	312.9
95.5	300	333	316.5
96	303.5	337	320.3
96.5	306.7	341	323.9
97	310.1	345	327.6
97.5	313.3	349	331.2

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
98	316.8	353	334.9
98.5	320.3	357	338.7
99	323.7	361	342.4
99.5	327	365	346
100	330.3	369	349.7
100.5	333.5	373	353.3
101	337.1	377	357.1
101.5	340.6	381	360.8
102	344.1	385	364.6
102.5	347.7	389	368.4
103	351.2	393	372.1
103.5	354.6	397	375.8
104	358.1	401	379.6
104.5	361.9	406	384
105	365.4	410	387.7
105.5	369	414	391.5
106	372.6	418	395.3
106.5	376	423	399.5
107	379.8	427	403.4
107.5	383.4	431	407.2
108	387	435	411
108.5	390.9	440	415.5
109	394.5	444	419.3
109.5	398.5	448	423.3
110	402.4	452	427.2
110.5	406.5	456	431.3
111	410.6	460	435.3
111.5	414.9	465	440
112	419	469	444
112.5	423.5	473	448.3
113	428.1	477	452.6
113.5	432.9	482	457.5
114	437.4	486	461.7
114.5	442.4	492	467.2
115	447.1	497	472.1
115.5	452.1	502	477.1
116	457	507	482
116.5	461.7	512	486.9
117	466.7	517	491.9
117.5	471.8	522	496.9

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
118	476.7	527	501.9
118.5	481.5	532	506.8
119	487	539	513
119.5	492.2	545	518.6
120	497.7	552	524.9
120.5	504.2	564	534.1
121	514.1	593	553.6
121.5	525.5	627	576.3
122	536.4	656	596.2
122.5	546.8	681	613.9
123	557.4	703	630.2
123.5	567.3	722	644.7
124	576.2	733	654.6
124.5	588.8	745	666.9
125	602.9	761	682
125.5	617.3	777	697.2
126	630.8	791	710.9
126.5	643.3	805	724.2
127	655.2	817	736.1
127.5	665.7	828	746.9
128	675.8	841	758.4
128.5	684.8	853	768.9
129	694.8	865	779.9
129.5	704.5	876	790.3
130	714.1	887	800.6
130.5	723.2	898	810.6
131	731.7	905	818.4
131.5	740	913	826.5
132	748	920	834
132.5	755.6	927	841.3
133	763.6	933	848.3
133.5	777.8	951	864.4
134	789.8	964	876.9
134.5	802	976	889
135	813.7	986	899.9
135.5	825.1	994	909.6
136	841.1	1002	921.6
136.5	857.2	1009	933.1
137	871.6	1017	944.3
137.5	884.3	1024	954.2

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Time (Minutes)	Loaded Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
138	895.6	1032	963.8
138.5	907.1	1042	974.6
139	917.4	1049	983.2
139.5	928.2	1056	992.1
140	938	1062	1000
140.5	947.3	1067	1007.2
141	956.8	1071	1013.9
141.5	965.2	1074	1019.6
142	972.6	1077	1024.8
142.5	979.2	1079	1029.1
143	985.4	1081	1033.2
143.5	991	1083	1037
144	996.4	1084	1040.2
144.5	1001.3	1086	1043.7
145	1005.9	1087	1046.5
145.5	1010	1088	1049
146	1013.5	1089	1051.3
146.5	1017.1	1090	1053.6
147	1020.7	1090	1055.4
147.5	1024.6	1091	1057.8
148	1029.4	1092	1060.7
148.5	1033.7	1092	1062.9
149	1037.4	1093	1065.2

NB: The characteristic temperature is the average of the mean and maximum temperatures.

Customer: **British Gypsum**

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Characteristic Steel Beam Temperatures (2 x 12.5mm Reference Beam)

Time (Minutes)	Reference Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
0	25	25	25
0.5	25	25	25
1	25	25	25
1.5	25	25	25
2	25	25	25
2.5	25	25	25
3	25	25	25
3.5	25	25	25
4	25.2	26	25.6
4.5	25.2	26	25.6
5	25.3	26	25.7
5.5	25.8	26	25.9
6	25.9	26	26
6.5	26.5	27	26.8
7	27	28	27.5
7.5	27.7	29	28.4
8	28.7	30	29.4
8.5	29.3	31	30.2
9	30.3	32	31.2
9.5	31.5	34	32.8
10	32.6	35	33.8
10.5	33.8	37	35.4
11	34.8	38	36.4
11.5	36	39	37.5
12	37.3	41	39.2
12.5	38.8	42	40.4
13	39.7	43	41.4
13.5	40.9	45	43
14	42.1	46	44.1
14.5	43.3	47	45.2
15	44.3	48	46.2
15.5	45.8	49	47.4
16	46.9	51	49
16.5	47.9	52	50
17	49.2	53	51.1
17.5	50.2	54	52.1
18	51	55	53
18.5	52	56	54

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Time (Minutes)	Reference Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
19	53.2	57	55.1
19.5	54.2	58	56.1
20	55	59	57
20.5	56.1	60	58.1
21	57.2	61	59.1
21.5	58.4	62	60.2
22	59.4	63	61.2
22.5	60.6	64	62.3
23	61.6	65	63.3
23.5	62.7	66	64.4
24	63.8	68	65.9
24.5	64.9	69	67
25	66.1	70	68.1
25.5	67.1	71	69.1
26	68.3	72	70.2
26.5	69.3	73	71.2
27	70.4	74	72.2
27.5	71.6	75	73.3
28	72.6	76	74.3
28.5	74	77	75.5
29	74.9	78	76.5
29.5	75.9	78	77
30	77.4	80	78.7
30.5	78.3	81	79.7
31	79.2	81	80.1
31.5	80.2	82	81.1
32	81.3	83	82.2
32.5	82.2	84	83.1
33	83	85	84
33.5	84.2	86	85.1
34	84.9	86	85.5
34.5	86	87	86.5
35	86.9	88	87.5
35.5	87.7	89	88.4
36	88.4	89	88.7
36.5	89.2	90	89.6
37	89.8	91	90.4
37.5	90.4	91	90.7
38	91	92	91.5
38.5	91.7	92	91.9

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Time (Minutes)	Reference Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
39	92.2	93	92.6
39.5	92.9	93	93
40	93	93	93
40.5	93.8	94	93.9
41	93.9	94	94
41.5	94	94	94
42	94.4	95	94.7
42.5	96	96	96
43	95	95	95
43.5	95.2	96	95.6
44	95.3	96	95.7
44.5	95.3	96	95.7
45	95.4	96	95.7
45.5	95.4	96	95.7
46	95.7	96	95.9
46.5	95.8	96	95.9
47	95.8	96	95.9
47.5	95.9	96	96
48	96.1	97	96.6
48.5	96.2	97	96.6
49	96.2	98	97.1
49.5	96.4	98	97.2
50	96.8	99	97.9
50.5	97	100	98.5
51	97.3	101	99.2
51.5	97.6	101	99.3
52	97.9	102	100
52.5	98.5	103	100.8
53	99.1	104	101.6
53.5	99.2	105	102.1
54	100	107	103.5
54.5	100.9	108	104.5
55	101.8	109	105.4
55.5	102.3	111	106.7
56	103.1	112	107.6
56.5	104	114	109
57	105	115	110
57.5	105.9	117	111.5
58	106.7	119	112.9
58.5	107.8	120	113.9

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
59	108.7	122	115.4
59.5	109.6	123	116.3
60	110.7	125	117.9
60.5	112.2	127	119.6
61	113.1	129	121.1
61.5	114.4	131	122.7
62	115.8	133	124.4
62.5	117.2	135	126.1
63	118.9	137	128
63.5	120.5	139	129.8
64	122.4	141	131.7
64.5	124.2	143	133.6
65	126.2	145	135.6
65.5	128.1	147	137.6
66	129.9	150	140
66.5	132.2	152	142.1
67	134.1	155	144.6
67.5	136.4	157	146.7
68	138.8	160	149.4
68.5	141.4	162	151.7
69	143.7	165	154.4
69.5	146.3	168	157.2
70	148.6	170	159.3
70.5	151.3	173	162.2
71	154	176	165
71.5	156.8	179	167.9
72	159.3	182	170.7
72.5	161.9	184	173
73	164.6	187	175.8
73.5	167.2	190	178.6
74	170.1	193	181.6
74.5	172.9	196	184.5
75	175.3	198	186.7
75.5	178	201	189.5
76	181	204	192.5
76.5	183.8	207	195.4
77	186.3	210	198.2
77.5	189.5	213	201.3
78	192	215	203.5
78.5	194.8	218	206.4

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Time (Minutes)	Reference Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
79	197.6	221	209.3
79.5	200.3	224	212.2
80	203.2	227	215.1
80.5	205.7	229	217.4
81	208.7	232	220.4
81.5	211.5	235	223.3
82	214.2	238	226.1
82.5	217.1	240	228.6
83	219.7	243	231.4
83.5	222.6	246	234.3
84	225.4	249	237.2
84.5	228.1	251	239.6
85	230.9	254	242.5
85.5	233.7	257	245.4
86	236.6	260	248.3
86.5	239.2	262	250.6
87	241.8	265	253.4
87.5	244.7	268	256.4
88	247.7	271	259.4
88.5	250.4	274	262.2
89	253.3	276	264.7
89.5	256.1	279	267.6
90	259.1	282	270.6
90.5	261.5	285	273.3
91	264.6	288	276.3
91.5	267.5	291	279.3
92	270.4	293	281.7
92.5	273.4	296	284.7
93	276.3	299	287.7
93.5	279.6	302	290.8
94	282.8	305	293.9
94.5	286.2	308	297.1
95	289.1	311	300.1
95.5	292.4	314	303.2
96	295.8	317	306.4
96.5	299.1	321	310.1
97	302.9	325	314
97.5	306.2	329	317.6
98	309.4	333	321.2
98.5	313.4	338	325.7

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
99	316.7	342	329.4
99.5	320.3	346	333.2
100	323.7	350	336.9
100.5	327.7	354	340.9
101	331.2	359	345.1
101.5	335	363	349
102	338.4	367	352.7
102.5	342.3	371	356.7
103	345.8	375	360.4
103.5	349.5	379	364.3
104	353.3	383	368.2
104.5	357	387	372
105	360.8	391	375.9
105.5	364.6	395	379.8
106	368.3	399	383.7
106.5	372.2	403	387.6
107	376	407	391.5
107.5	379.8	411	395.4
108	383.8	415	399.4
108.5	387.7	419	403.4
109	391.7	423	407.4
109.5	396.2	427	411.6
110	400.4	431	415.7
110.5	404.7	435	419.9
111	409.6	439	424.3
111.5	414.2	443	428.6
112	419	447	433
112.5	424	451	437.5
113	429.2	455	442.1
113.5	433.9	461	447.5
114	439.2	466	452.6
114.5	444.4	472	458.2
115	449.7	478	463.9
115.5	454.8	483	468.9
116	460.2	489	474.6
116.5	465.7	495	480.4
117	470.7	500	485.4
117.5	476.2	506	491.1
118	481.7	512	496.9
118.5	487.3	518	502.7

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
119	492.3	523	507.7
119.5	497.8	529	513.4
120	503.5	535	519.3
120.5	509	541	525
121	514.7	548	531.4
121.5	520.4	554	537.2
122	532	572	552
122.5	561.2	628	594.6
123	592.4	674	633.2
123.5	622.4	712	667.2
124	648.5	736	692.3
124.5	670.9	758	714.5
125	694.2	785	739.6
125.5	715.9	809	762.5
126	734.7	830	782.4
126.5	751.2	853	802.1
127	770.2	877	823.6
127.5	787.7	895	841.4
128	804.3	912	858.2
128.5	820	925	872.5
129	836.3	936	886.2
129.5	853.5	946	899.8
130	869	955	912
130.5	885.8	967	926.4
131	902.2	980	941.1
131.5	917.2	990	953.6
132	929.4	997	963.2
132.5	940.5	1003	971.8
133	950.9	1007	979
133.5	958.8	1009	983.9
134	966.4	1012	989.2
134.5	973.2	1014	993.6
135	979	1015	997
135.5	984.7	1017	1000.9
136	988.2	1014	1001.1
136.5	990.9	1012	1001.5
137	994.1	1013	1003.6
137.5	997.8	1015	1006.4
138	1000.9	1016	1008.5
138.5	1004.7	1018	1011.4

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 2 x 12.5mm		
	Mean	Maximum	Characteristic Mean
139	1008.2	1020	1014.1
139.5	1011.7	1023	1017.4
140	1015.2	1026	1020.6
140.5	1018.4	1029	1023.7
141	1021.5	1032	1026.8
141.5	1024.7	1034	1029.4
142	1027.5	1037	1032.3
142.5	1030.2	1039	1034.6
143	1032.2	1040	1036.1
143.5	1033.8	1041	1037.4
144	1035.8	1043	1039.4
144.5	1037.4	1044	1040.7
145	1038.9	1046	1042.5
145.5	1040	1048	1044
146	1041.1	1049	1045.1
146.5	1042.2	1051	1046.6
147	1043.2	1052	1047.6
147.5	1043.4	1054	1048.7
148	1043.8	1055	1049.4
148.5	1043.9	1055	1049.5
149	1044.4	1056	1050.2

NB: The characteristic temperature is the average of the mean and maximum temperatures.

Customer: **British Gypsum**

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Characteristic Steel Beam Temperatures (3 x 15mm Loaded Beam)

Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
0	26.6	27	26.8
0.5	26.5	27	26.8
1	26.6	27	26.8
1.5	26.6	27	26.8
2	26.7	27	26.9
2.5	26.7	27	26.9
3	26.7	27	26.9
3.5	26.7	28	27.4
4	26.7	28	27.4
4.5	26.8	29	27.9
5	26.8	29	27.9
5.5	26.8	30	28.4
6	26.9	31	29
6.5	27	31	29
7	27.1	32	29.6
7.5	27.2	33	30.1
8	27.3	33	30.2
8.5	27.4	34	30.7
9	27.5	34	30.8
9.5	27.7	35	31.4
10	27.8	36	31.9
10.5	27.8	36	31.9
11	27.9	37	32.5
11.5	28.1	38	33.1
12	28.2	38	33.1
12.5	28.8	39	33.9
13	29.1	40	34.6
13.5	29.4	41	35.2
14	29.5	41	35.3
14.5	30	42	36
15	30.4	43	36.7
15.5	30.8	44	37.4
16	31.2	45	38.1
16.5	31.7	46	38.9
17	32.3	47	39.7
17.5	32.7	48	40.4
18	33.2	48	40.6
18.5	33.9	49	41.5

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
19	34.4	50	42.2
19.5	35.1	51	43.1
20	35.5	52	43.8
20.5	36.3	53	44.7
21	36.9	53	45
21.5	37.4	54	45.7
22	38.2	55	46.6
22.5	38.8	56	47.4
23	39.5	57	48.3
23.5	39.9	57	48.5
24	40.6	58	49.3
24.5	41.4	59	50.2
25	42	59	50.5
25.5	42.7	60	51.4
26	43.2	60	51.6
26.5	44	61	52.5
27	44.5	61	52.8
27.5	45.2	62	53.6
28	46	63	54.5
28.5	46.7	63	54.9
29	47.4	64	55.7
29.5	48.3	65	56.7
30	48.7	65	56.9
30.5	49.6	66	57.8
31	50.3	66	58.2
31.5	51.2	67	59.1
32	51.9	67	59.5
32.5	52.6	68	60.3
33	53.5	68	60.8
33.5	54.3	69	61.7
34	55.1	69	62.1
34.5	55.8	70	62.9
35	56.7	70	63.4
35.5	57.5	71	64.3
36	58.2	71	64.6
36.5	59.1	72	65.6
37	60	73	66.5
37.5	60.9	74	67.5
38	61.6	75	68.3
38.5	62.3	76	69.2

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
39	63.1	77	70.1
39.5	64	78	71
40	64.8	78	71.4
40.5	65.8	79	72.4
41	66.5	80	73.3
41.5	67.2	81	74.1
42	68.1	81	74.6
42.5	68.9	82	75.5
43	69.8	83	76.4
43.5	70.2	83	76.6
44	71	84	77.5
44.5	71.9	85	78.5
45	72.6	85	78.8
45.5	73.1	86	79.6
46	74	86	80
46.5	74.9	87	81
47	75.3	87	81.2
47.5	76.1	88	82.1
48	76.7	88	82.4
48.5	77.2	88	82.6
49	78.1	89	83.6
49.5	78.5	89	83.8
50	79.1	89	84.1
50.5	79.6	90	84.8
51	80.4	90	85.2
51.5	80.7	90	85.4
52	81.3	90	85.7
52.5	81.9	91	86.5
53	82.4	91	86.7
53.5	82.7	91	86.9
54	83.4	92	87.7
54.5	83.8	92	87.9
55	84.2	92	88.1
55.5	84.8	93	88.9
56	85.1	93	89.1
56.5	85.5	93	89.3
57	85.9	94	90
57.5	86.4	94	90.2
58	86.7	94	90.4
58.5	86.9	94	90.5

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
59	87.4	94	90.7
59.5	87.8	95	91.4
60	88	95	91.5
60.5	88.5	95	91.8
61	88.8	95	91.9
61.5	89	95	92
62	89.6	96	92.8
62.5	89.7	96	92.9
63	89.8	96	92.9
63.5	90.2	96	93.1
64	90.5	96	93.3
64.5	90.7	96	93.4
65	91.2	97	94.1
65.5	91.4	97	94.2
66	91.5	97	94.3
66.5	91.6	97	94.3
67	92.1	98	95.1
67.5	92.4	98	95.2
68	92.5	98	95.3
68.5	92.7	98	95.4
69	92.7	99	95.9
69.5	93.2	99	96.1
70	93.4	99	96.2
70.5	93.6	99	96.3
71	93.7	100	96.9
71.5	93.9	100	97
72	94.3	100	97.2
72.5	94.5	101	97.8
73	94.7	101	97.9
73.5	94.9	101	98
74	94.9	101	98
74.5	95.3	102	98.7
75	95.6	102	98.8
75.5	95.7	102	98.9
76	95.7	102	98.9
76.5	95.9	103	99.5
77	96.2	103	99.6
77.5	96.4	103	99.7
78	96.5	103	99.8
78.5	96.8	104	100.4

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
79	97	104	100.5
79.5	97.2	105	101.1
80	97.3	105	101.2
80.5	97.4	106	101.7
81	97.6	106	101.8
81.5	97.7	106	101.9
82	97.8	107	102.4
82.5	97.9	107	102.5
83	98.1	107	102.6
83.5	98.3	108	103.2
84	98.4	108	103.2
84.5	98.5	108	103.3
85	98.7	109	103.9
85.5	98.9	109	104
86	99.1	110	104.6
86.5	99.2	110	104.6
87	99.3	110	104.7
87.5	99.4	111	105.2
88	99.6	111	105.3
88.5	99.7	111	105.4
89	99.8	112	105.9
89.5	99.8	112	105.9
90	99.8	112	105.9
90.5	100.1	113	106.6
91	100.3	113	106.7
91.5	100.3	113	106.7
92	100.4	114	107.2
92.5	100.5	114	107.3
93	100.7	115	107.9
93.5	100.8	115	107.9
94	100.9	115	108
94.5	100.9	116	108.5
95	101.1	116	108.6
95.5	101.3	116	108.7
96	101.5	117	109.3
96.5	101.5	117	109.3
97	101.5	117	109.3
97.5	101.6	118	109.8
98	101.8	118	109.9
98.5	101.9	118	110

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
99	101.9	119	110.5
99.5	102	119	110.5
100	102.2	119	110.6
100.5	102.2	120	111.1
101	102.3	120	111.2
101.5	102.4	120	111.2
102	102.5	121	111.8
102.5	102.7	121	111.9
103	102.7	121	111.9
103.5	102.8	122	112.4
104	102.8	122	112.4
104.5	103	122	112.5
105	103.2	123	113.1
105.5	103.2	123	113.1
106	103.4	124	113.7
106.5	103.5	124	113.8
107	103.6	124	113.8
107.5	103.8	125	114.4
108	103.8	125	114.4
108.5	103.9	125	114.5
109	104	126	115
109.5	104.3	126	115.2
110	104.5	127	115.8
110.5	104.6	127	115.8
111	104.6	127	115.8
111.5	104.8	128	116.4
112	104.8	128	116.4
112.5	105.1	129	117.1
113	105.2	129	117.1
113.5	105.5	130	117.8
114	105.7	130	117.9
114.5	105.8	131	118.4
115	105.9	131	118.5
115.5	106	132	119
116	106.4	132	119.2
116.5	106.6	133	119.8
117	106.8	133	119.9
117.5	107	134	120.5
118	107.4	134	120.7
118.5	107.6	135	121.3

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
119	108	135	121.5
119.5	108.2	136	122.1
120	108.8	137	122.9
120.5	108.9	137	123
121	109.3	138	123.7
121.5	109.5	139	124.3
122	110.2	139	124.6
122.5	110.5	140	125.3
123	111.3	141	126.2
123.5	111.9	142	127
124	112.9	144	128.5
124.5	112.6	143	127.8
125	113.3	145	129.2
125.5	114.1	146	130.1
126	115.1	147	131.1
126.5	116.1	148	132.1
127	117	149	133
127.5	118.1	151	134.6
128	119.2	152	135.6
128.5	120.4	154	137.2
129	121.9	157	139.5
129.5	123.5	160	141.8
130	125.4	163	144.2
130.5	127.5	167	147.3
131	129.8	171	150.4
131.5	132	175	153.5
132	134.2	178	156.1
132.5	136.9	182	159.5
133	139.5	185	162.3
133.5	142.2	189	165.6
134	144.7	192	168.4
134.5	147.7	195	171.4
135	150.9	199	175
135.5	153.8	202	177.9
136	157	206	181.5
136.5	160.2	209	184.6
137	163.4	213	188.2
137.5	167	216	191.5
138	170.5	220	195.3
138.5	173.9	224	199

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
139	177.6	228	202.8
139.5	181.1	232	206.6
140	184.8	236	210.4
140.5	188.5	240	214.3
141	192.6	245	218.8
141.5	196.4	249	222.7
142	200.2	253	226.6
142.5	204.4	257	230.7
143	208.2	261	234.6
143.5	212.3	267	239.7
144	216.2	272	244.1
144.5	220.3	277	248.7
145	224.4	283	253.7
145.5	228.7	288	258.4
146	233.1	294	263.6
146.5	237.1	299	268.1
147	241.5	305	273.3
147.5	245.8	310	277.9
148	250.1	316	283.1
148.5	254.6	321	287.8
149	259.3	327	293.2
149.5	263.7	332	297.9
150	268.4	338	303.2
150.5	273.2	343	308.1
151	277.9	348	313
151.5	283	354	318.5
152	287.9	361	324.5
152.5	293.3	369	331.2
153	298.5	376	337.3
153.5	306.2	387	346.6
154	314.2	429	371.6
154.5	322.4	468	395.2
155	330	503	416.5
155.5	338	537	437.5
156	345.5	565	455.3
156.5	353	592	472.5
157	360.2	615	487.6
157.5	367.8	638	502.9
158	375.4	661	518.2
158.5	383.8	684	533.9

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
159	393.2	704	548.6
159.5	402.2	722	562.1
160	410.9	736	573.5
160.5	419.2	751	585.1
161	427.7	768	597.9
161.5	436	786	611
162	444.3	802	623.2
162.5	452.4	817	634.7
163	460.3	830	645.2
163.5	467.8	843	655.4
164	475.7	856	665.9
164.5	483.3	869	676.2
165	491.3	881	686.2
165.5	499	891	695
166	506.8	899	702.9
166.5	514.9	907	711
167	523.3	914	718.7
167.5	533.6	922	727.8
168	545.1	929	737.1
168.5	556.5	937	746.8
169	567.3	945	756.2
169.5	578	953	765.5
170	588	960	774
170.5	597.8	968	782.9
171	608.6	976	792.3
171.5	621.9	988	805
172	636.7	1006	821.4
172.5	651	1020	835.5
173	664.7	1032	848.4
173.5	677.3	1042	859.7
174	689.4	1051	870.2
174.5	700.6	1060	880.3
175	711.5	1068	889.8
175.5	722	1074	898
176	732	1080	906
176.5	743.2	1085	914.1
177	758.9	1090	924.5
177.5	776.1	1094	935.1
178	794.7	1098	946.4
178.5	813.4	1102	957.7

Customer: **British Gypsum**

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Time (Minutes)	Loaded Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
179	830.3	1105	967.7
179.5	844.5	1108	976.3
180	857.8	1110	983.9
180.5	870.4	1113	991.7
181	881.8	1116	998.9
181.5	893.8	1120	1006.9
182	905.2	1125	1015.1
182.5	915.7	1128	1021.9
183	924.9	1130	1027.5
183.5	933.5	1133	1033.3
184	941.8	1134	1037.9
184.5	949.9	1136	1043
185	957.6	1138	1047.8
185.5	964.3	1140	1052.2
186	971.1	1142	1056.6
186.5	977.2	1143	1060.1
187	983.4	1145	1064.2
187.5	989.1	1146	1067.6
188	994.5	1147	1070.8
188.5	999.5	1148	1073.8
189	1004.4	1150	1077.2
189.5	1011.5	1171	1091.3
190	1015.1	1168	1091.6
190.5	1019.2	1167	1093.1
191	1023.5	1158	1090.8
191.5	1031.9	1158	1095
192	1040.1	1164	1102.1
192.5	1048.4	1164	1106.2
193	1055.7	1164	1109.9
193.5	1062.4	1165	1113.7
194	1069	1164	1116.5
194.5	1075.5	1162	1118.8
195	1080.5	1161	1120.8
195.5	1084.7	1160	1122.4
196	1087.9	1158	1123

NB: The characteristic temperature is the average of the mean and maximum temperatures.

Customer: **British Gypsum**

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Characteristic Steel Beam Temperatures (3 x 15mm Reference Beam)

Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
0	26.6	29	27.8
0.5	26.7	29	27.9
1	26.7	29	27.9
1.5	26.6	29	27.8
2	26.7	29	27.9
2.5	26.7	29	27.9
3	26.7	29	27.9
3.5	26.6	29	27.8
4	26.7	29	27.9
4.5	26.8	29	27.9
5	26.6	29	27.8
5.5	26.6	29	27.8
6	26.6	29	27.8
6.5	26.6	29	27.8
7	26.6	29	27.8
7.5	26.7	29	27.9
8	26.7	29	27.9
8.5	26.8	29	27.9
9	26.8	29	27.9
9.5	26.9	29	28
10	26.9	29	28
10.5	26.9	29	28
11	27	29	28
11.5	27	29	28
12	27.1	29	28.1
12.5	27.2	30	28.6
13	27.2	30	28.6
13.5	27.3	30	28.7
14	27.3	30	28.7
14.5	28	30	29
15	28.1	30	29.1
15.5	28.2	31	29.6
16	28.3	31	29.7
16.5	28.8	31	29.9
17	29.1	32	30.6
17.5	29.3	32	30.7
18	29.8	32	30.9
18.5	30.1	33	31.6

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
19	30.7	33	31.9
19.5	31	33	32
20	31.4	34	32.7
20.5	32	35	33.5
21	32.4	35	33.7
21.5	33	36	34.5
22	33.5	36	34.8
22.5	34	37	35.5
23	34.8	37	35.9
23.5	35.1	38	36.6
24	35.8	38	36.9
24.5	36.6	39	37.8
25	37.3	40	38.7
25.5	37.8	41	39.4
26	38.4	41	39.7
26.5	39.1	42	40.6
27	39.8	42	40.9
27.5	40.3	43	41.7
28	41.2	44	42.6
28.5	42	45	43.5
29	42.6	45	43.8
29.5	43.6	46	44.8
30	44.1	47	45.6
30.5	44.9	48	46.5
31	45.9	49	47.5
31.5	46.7	50	48.4
32	47.4	51	49.2
32.5	48.2	51	49.6
33	49.2	52	50.6
33.5	50	53	51.5
34	50.7	54	52.4
34.5	51.4	55	53.2
35	52.4	56	54.2
35.5	53.2	57	55.1
36	54.1	58	56.1
36.5	55.1	59	57.1
37	55.6	59	57.3
37.5	56.4	60	58.2
38	57.3	61	59.2
38.5	58.1	62	60.1

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
39	59	63	61
39.5	59.8	63	61.4
40	60.7	64	62.4
40.5	61.2	65	63.1
41	62.2	66	64.1
41.5	63.2	67	65.1
42	64	68	66
42.5	64.8	68	66.4
43	65.4	69	67.2
43.5	66.2	70	68.1
44	67.1	71	69.1
44.5	67.8	71	69.4
45	68.7	73	70.9
45.5	69.5	73	71.3
46	70.1	74	72.1
46.5	70.8	75	72.9
47	71.8	76	73.9
47.5	72.3	76	74.2
48	73	77	75
48.5	73.9	78	76
49	74.7	79	76.9
49.5	75	79	77
50	75.9	80	78
50.5	76.4	81	78.7
51	77.2	82	79.6
51.5	77.8	82	79.9
52	78.3	83	80.7
52.5	79.1	83	81.1
53	79.8	84	81.9
53.5	80.3	85	82.7
54	80.9	85	83
54.5	81.6	86	83.8
55	82	86	84
55.5	82.8	87	84.9
56	83.1	87	85.1
56.5	83.9	88	86
57	84.1	88	86.1
57.5	84.3	88	86.2
58	85.2	89	87.1
58.5	85.5	89	87.3

Customer: **British Gypsum**

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Fire Acoustics Structures

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
59	86.1	90	88.1
59.5	86.5	90	88.3
60	86.6	90	88.3
60.5	87.5	91	89.3
61	87.6	91	89.3
61.5	87.8	91	89.4
62	88.4	91	89.7
62.5	88.7	92	90.4
63	89	92	90.5
63.5	89.7	93	91.4
64	89.9	93	91.5
64.5	89.9	93	91.5
65	90.2	93	91.6
65.5	90.9	94	92.5
66	90.9	94	92.5
66.5	91.1	94	92.6
67	91.7	94	92.9
67.5	91.9	95	93.5
68	92.1	95	93.6
68.5	92.3	95	93.7
69	92.7	96	94.4
69.5	92.9	96	94.5
70	93.1	96	94.6
70.5	93.3	96	94.7
71	93.3	96	94.7
71.5	93.9	96	95
72	94.1	97	95.6
72.5	94.2	97	95.6
73	94.3	97	95.7
73.5	94.4	97	95.7
74	94.4	97	95.7
74.5	94.8	97	95.9
75	94.9	97	96
75.5	95	98	96.5
76	95.3	98	96.7
76.5	95.3	98	96.7
77	95.3	98	96.7
77.5	95.3	98	96.7
78	95.4	98	96.7
78.5	95.4	98	96.7

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
79	95.9	98	97
79.5	96.2	99	97.6
80	96.1	98	97.1
80.5	96.2	98	97.1
81	96.3	99	97.7
81.5	96.3	99	97.7
82	96.3	99	97.7
82.5	96.4	99	97.7
83	96.4	99	97.7
83.5	96.4	99	97.7
84	96.4	99	97.7
84.5	96.4	99	97.7
85	96.8	100	98.4
85.5	96.8	99	97.9
86	96.8	99	97.9
86.5	96.8	99	97.9
87	97	99	98
87.5	97.1	99	98.1
88	97.1	99	98.1
88.5	97.3	100	98.7
89	97.2	99	98.1
89.5	97.3	100	98.7
90	97.2	99	98.1
90.5	97.2	99	98.1
91	97.2	99	98.1
91.5	97.3	100	98.7
92	97.3	100	98.7
92.5	97.2	99	98.1
93	97.1	99	98.1
93.5	97.3	100	98.7
94	97.3	100	98.7
94.5	97.3	100	98.7
95	97.1	99	98.1
95.5	97.3	100	98.7
96	97.2	99	98.1
96.5	97.3	100	98.7
97	97.2	99	98.1
97.5	97.3	99	98.2
98	97.4	100	98.7
98.5	97.3	99	98.2

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
99	97.5	99	98.3
99.5	97.6	99	98.3
100	97.6	99	98.3
100.5	97.5	99	98.3
101	97.7	99	98.4
101.5	97.7	99	98.4
102	97.8	99	98.4
102.5	97.9	99	98.5
103	97.8	99	98.4
103.5	97.8	100	98.9
104	98.1	100	99.1
104.5	98	100	99
105	97.9	100	99
105.5	97.9	100	99
106	98.2	101	99.6
106.5	98.2	101	99.6
107	98.3	101	99.7
107.5	98.5	101	99.8
108	98.4	101	99.7
108.5	98.8	102	100.4
109	98.6	102	100.3
109.5	98.8	102	100.4
110	98.9	102	100.5
110.5	98.9	103	101
111	99	103	101
111.5	99	103	101
112	99.1	103	101.1
112.5	99.2	104	101.6
113	99.3	104	101.7
113.5	99.2	104	101.6
114	99.4	104	101.7
114.5	99.6	105	102.3
115	99.8	105	102.4
115.5	99.8	105	102.4
116	99.9	105	102.5
116.5	100.3	106	103.2
117	100.6	106	103.3
117.5	100.8	106	103.4
118	100.6	107	103.8
118.5	101.2	107	104.1

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
119	101.5	108	104.8
119.5	101.9	108	105
120	102.2	109	105.6
120.5	102.7	109	105.9
121	102.9	110	106.5
121.5	103.4	111	107.2
122	103.8	111	107.4
122.5	104.4	112	108.2
123	104.9	112	108.5
123.5	105.3	113	109.2
124	106	114	110
124.5	106.7	114	110.4
125	107.5	115	111.3
125.5	108.6	116	112.3
126	109.6	117	113.3
126.5	110.7	118	114.4
127	111.8	119	115.4
127.5	112.9	120	116.5
128	114.2	122	118.1
128.5	115.6	123	119.3
129	116.7	124	120.4
129.5	118	125	121.5
130	119.2	126	122.6
130.5	120.6	128	124.3
131	121.9	129	125.5
131.5	123.4	130	126.7
132	124.9	132	128.5
132.5	126.3	133	129.7
133	127.9	135	131.5
133.5	129.5	137	133.3
134	131.1	139	135.1
134.5	132.6	140	136.3
135	134.3	142	138.2
135.5	136.2	144	140.1
136	137.9	146	142
136.5	139.6	149	144.3
137	141.5	151	146.3
137.5	143.3	154	148.7
138	145.6	157	151.3
138.5	147.8	160	153.9

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
139	149.8	163	156.4
139.5	152.2	166	159.1
140	154.5	169	161.8
140.5	156.9	172	164.5
141	159.7	176	167.9
141.5	162.3	179	170.7
142	164.9	182	173.5
142.5	167.7	186	176.9
143	170.7	190	180.4
143.5	173.6	193	183.3
144	176.4	197	186.7
144.5	179.2	200	189.6
145	182.3	204	193.2
145.5	185.4	208	196.7
146	188.7	211	199.9
146.5	191.9	215	203.5
147	195.3	219	207.2
147.5	198.9	223	211
148	202.3	227	214.7
148.5	206	231	218.5
149	210.1	235	222.6
149.5	214.2	240	227.1
150	218.6	245	231.8
150.5	222.8	249	235.9
151	227.6	254	240.8
151.5	232.1	260	246.1
152	237	265	251
152.5	241.9	270	256
153	246.9	276	261.5
153.5	251.9	281	266.5
154	257.4	287	272.2
154.5	262.8	292	277.4
155	268.1	298	283.1
155.5	273.6	304	288.8
156	279	310	294.5
156.5	284.8	316	300.4
157	290.2	322	306.1
157.5	296	329	312.5
158	301.9	335	318.5
158.5	307.5	342	324.8

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
159	313.5	348	330.8
159.5	319.4	355	337.2
160	325.6	362	343.8
160.5	331.8	369	350.4
161	337.9	376	357
161.5	344.1	384	364.1
162	350.3	391	370.7
162.5	356.8	399	377.9
163	363	406	384.5
163.5	369.6	414	391.8
164	376.2	423	399.6
164.5	383	431	407
165	389.4	439	414.2
165.5	396.2	448	422.1
166	403.2	457	430.1
166.5	410.2	466	438.1
167	424.3	500	462.2
167.5	440.8	536	488.4
168	458.2	570	514.1
168.5	475.7	602	538.9
169	491.7	630	560.9
169.5	507	658	582.5
170	522	683	602.5
170.5	535.9	705	620.5
171	549.3	724	636.7
171.5	561.6	736	648.8
172	573.4	751	662.2
172.5	597.8	780	688.9
173	636.8	817	726.9
173.5	670.9	849	760
174	700.5	888	794.3
174.5	730	920	825
175	758.5	946	852.3
175.5	784.8	968	876.4
176	812.4	986	899.2
176.5	837	1001	919
177	857.5	1012	934.8
177.5	875	1022	948.5
178	892	1031	961.5
178.5	908.4	1039	973.7

Customer: **British Gypsum**

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Time (Minutes)	Reference Beam 3 x 15mm		
	Mean	Maximum	Characteristic Mean
179	927.5	1045	986.3
179.5	943.1	1051	997.1
180	956.2	1057	1006.6
180.5	967.8	1062	1014.9
181	978.6	1067	1022.8
181.5	990.1	1073	1031.6
182	1000.1	1077	1038.6
182.5	1009.8	1082	1045.9
183	1018.2	1086	1052.1
183.5	1025.9	1089	1057.5
184	1034.7	1093	1063.9
184.5	1042.1	1096	1069.1
185	1049.5	1099	1074.3
185.5	1055.9	1102	1079
186	1061.3	1104	1082.7
186.5	1066.7	1107	1086.9
187	1071.2	1109	1090.1
187.5	1075.4	1111	1093.2
188	1078.8	1112	1095.4
188.5	1082.4	1114	1098.2
189	1085.1	1115	1100.1
189.5	1087.5	1116	1101.8
190	1090.4	1118	1104.2
190.5	1092.5	1119	1105.8
191	1095	1120	1107.5
191.5	1096.8	1121	1108.9
192	1098.3	1122	1110.2
192.5	1099.6	1122	1110.8
193	1100.9	1123	1112
193.5	1102.1	1124	1113.1
194	1103.1	1125	1114.1
194.5	1104	1125	1114.5
195	1104.3	1125	1114.7
195.5	1104.7	1125	1114.9
196	1104.2	1125	1114.6

NB: The characteristic temperature is the average of the mean and maximum temperatures.

Customer: **British Gypsum**

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Stickability Correction Factor

θ	Stickability Correction Factors		
	25mm	30mm	45mm
350°C	0.9709798728	0.9590172167	0.9231292483
400°C	0.9718564519	0.9555126120	0.9064810924
450°C	0.9768613588	0.9573083593	0.8986493607
500°C	0.9813685346	0.9615016960	0.9019011802
550°C	0.9774330930	0.9577371599	0.8986493607
600°C	0.9768994431	0.9573369225	0.8986493607
620°C	0.9768994431	0.9573369225	0.8986493607
650°C	0.9768994431	0.9573369225	0.8986493607
700°C	0.9768994431	0.9573369225	0.8986493607
750°C	0.9768994431	0.9573369225	0.8986493607

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Modified Steel Column Times

SCS13 Modified Steel Column Time

SCS13		
Design Temp	Time (mins)	Modified Time (mins)
350°C	119	115.5
400°C	126	122.5
450°C	132.5	129.4
500°C	139	136.4
550°C	145	141.7
600°C	150	146.5
620°C	150.5	147.0
650°C	152	148.5
700°C	154	150.4
750°C	155.5	151.9

Customer: **British Gypsum**

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SCS14 Modified Steel Column Time

SCS14		
Design Temp	Time (mins)	Modified Time (mins)
350°C	92	89.3
400°C	100.5	97.7
450°C	108.5	106.0
500°C	116	113.8
550°C	122.5	119.7
600°C	128.5	125.5
620°C	130.5	127.5
650°C	133.5	130.4
700°C	138	134.8
750°C	139.5	136.3

Customer: **British Gypsum**

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SCS16 Modified Steel Column Time

SCS16		
Design Temp	Time (mins)	Modified Time (mins)
350°C	74	71.9
400°C	79.5	77.3
450°C	85	83.0
500°C	90.5	88.8
550°C	95.5	93.3
600°C	99.5	97.2
620°C	101	98.7
650°C	103.5	101.1
700°C	106.5	104.0
750°C	109	106.5

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SCS18 Modified Steel Column Time

SCS18		
Design Temp	Time (mins)	Modified Time (mins)
350°C	70	68.0
400°C	74.5	72.4
450°C	79.5	77.7
500°C	84	82.4
550°C	88.5	86.5
600°C	91.5	89.4
620°C	93	90.9
650°C	95	92.8
700°C	98	95.7
750°C	100	97.7

Customer: **British Gypsum**

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SCS19 Modified Steel Column Time

SCS19		
Design Temp	Time (mins)	Modified Time (mins)
350°C	124.5	119.4
400°C	130.5	124.7
450°C	136.0	130.2
500°C	141.5	136.1
550°C	144.0	137.9
600°C	145.5	139.3
620°C	146.0	139.8
650°C	147.0	140.7
700°C	149.0	142.6
750°C	151.0	144.6

SCS20 Modified Steel Column Time

SCS20		
Design Temp	Time (mins)	Modified Time (mins)
350°C	100	95.9
400°C	105	100.3
450°C	109	104.3
500°C	113.5	109.1
550°C	117.5	112.5
600°C	121.5	116.3
620°C	123	117.8
650°C	125.5	120.1
700°C	129	123.5
750°C	131.5	125.9

SCS33 Modified Steel Column Time

SCS33		
Design Temp	Time (mins)	Modified Time (mins)
350°C	88.5	84.9
400°C	94.5	90.3
450°C	100.5	96.2
500°C	106.5	102.4
550°C	111.5	106.8
600°C	116	111.1
620°C	117	112.0
650°C	119	113.9
700°C	122.5	117.3
750°C	125.5	120.1

SCS34 Modified Steel Column Time

SCS34		
Design Temp	Time (mins)	Modified Time (mins)
350°C	86.5	83.0
400°C	91.5	87.4
450°C	97.5	93.3
500°C	104	100.0
550°C	110.5	105.8
600°C	116	111.1
620°C	118	113.0
650°C	121.5	116.3
700°C	124.5	119.2
750°C	127	121.6

SCS32 Modified Steel Column Time

SCS32		
Design Temp	Time (mins)	Modified Time (mins)
350°C	168.0	155.1
400°C	173.0	156.8
450°C	176.0	158.2
500°C	179.0	161.4
550°C	180.0	161.8
600°C	181.0	162.7
620°C	181.0	162.7
650°C	182.0	163.6
700°C	182.0	163.6
750°C	183.0	164.5

SCS26 Modified Steel Column Time

SCS26		
Design Temp	Time (mins)	Modified Time (mins)
350°C	154.5	142.6
400°C	159.0	144.1
450°C	163.5	146.9
500°C	168.0	151.5
550°C	172.5	155.0
600°C	174.5	156.8
620°C	175.0	157.3
650°C	176.0	158.2
700°C	177.0	159.1
750°C	178.0	160.0

SCS35 Modified Steel Column Time

SCS35		
Design Temp	Time (mins)	Modified Time (mins)
350°C	151.5	139.9
400°C	156.0	141.4
450°C	160.0	143.8
500°C	164.0	147.9
550°C	167.5	150.5
600°C	170.0	152.8
620°C	171.0	153.7
650°C	172.5	155.0
700°C	174.5	156.8
750°C	175.5	157.7

SCS36 Modified Steel Column Time

SCS36		
Design Temp	Time (mins)	Modified Time (mins)
350°C	147.5	136.2
400°C	151.5	137.3
450°C	155.5	139.7
500°C	158.5	143.0
550°C	161.0	144.7
600°C	163.5	146.9
620°C	164.5	147.8
650°C	166.0	149.2
700°C	168.5	151.4
750°C	170.0	152.8

CORRECTED AND PREDICTED TIMES

350°C Corrected Vs. Predicted Times

350 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	68.0	69.7
	218.32	0.004580432	71.9	71.9
	127.93	0.007816775	89.3	82.1
	52.93	0.018892877	115.5	117.4
2 x 15	258.08	0.003874768	83.0	82.8
	236.53	0.004227794	84.9	84.9
	203.39	0.004916663	95.9	92.6
	145.69	0.006863889	119.4	119.3
3 x 15	258.08	0.003874768	136.2	136.1
	236.53	0.004227794	139.9	137.0
	203.39	0.004916663	142.6	141.3
	145.69	0.006863889	155.1	154.1

400°C Corrected Vs. Predicted Times

400 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	72.4	71.1
	218.32	0.004580432	77.3	73.4
	127.93	0.007816775	97.7	84.4
	52.93	0.018892877	122.5	121.9
2 x 15	258.08	0.003874768	87.4	87.4
	236.53	0.004227794	90.3	89.5
	203.39	0.004916663	100.3	97.3
	145.69	0.006863889	124.7	124.3
3 x 15	258.08	0.003874768	137.3	138.3
	236.53	0.004227794	141.4	139.3
	203.39	0.004916663	144.1	143.7
	145.69	0.006863889	156.8	156.8

450°C Corrected Vs. Predicted Times

450 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	77.7	72.0
	218.32	0.004580432	83.0	74.4
	127.93	0.007816775	106.0	86.0
	52.93	0.018892877	129.4	125.5
2 x 15	258.08	0.003874768	93.3	93.3
	236.53	0.004227794	96.2	95.3
	203.39	0.004916663	104.3	103.0
	145.69	0.006863889	130.2	129.7
3 x 15	258.08	0.003874768	139.7	139.7
	236.53	0.004227794	143.8	140.6
	203.39	0.004916663	146.9	144.8
	145.69	0.006863889	158.2	157.1

500°C Corrected Vs. Predicted Times

500 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	82.4	72.0
	218.32	0.004580432	88.8	74.6
	127.93	0.007816775	113.8	86.7
	52.93	0.018892877	136.4	128.4
2 x 15	258.08	0.003874768	100.0	99.5
	236.53	0.004227794	102.4	101.5
	203.39	0.004916663	109.1	109.1
	145.69	0.006863889	136.1	135.5
3 x 15	258.08	0.003874768	143.0	143.9
	236.53	0.004227794	147.9	144.8
	203.39	0.004916663	151.5	149.0
	145.69	0.006863889	161.4	161.4

550°C Corrected Vs. Predicted Times

550 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	86.5	72.0
	218.32	0.004580432	93.3	74.6
	127.93	0.007816775	119.7	87.2
	52.93	0.018892877	141.7	130.3
2 x 15	258.08	0.003874768	105.8	103.7
	236.53	0.004227794	106.8	105.6
	203.39	0.004916663	112.5	112.5
	145.69	0.006863889	137.9	136.5
3 x 15	258.08	0.003874768	144.7	144.8
	236.53	0.004227794	150.5	145.7
	203.39	0.004916663	155.0	149.7
	145.69	0.006863889	161.8	161.7

600°C Corrected Vs. Predicted Times

600 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	89.4	72.0
	218.32	0.004580432	97.2	74.8
	127.93	0.007816775	125.5	88.0
	52.93	0.018892877	146.5	133.2
2 x 15	258.08	0.003874768	111.1	108.4
	236.53	0.004227794	111.1	110.1
	203.39	0.004916663	116.3	116.3
	145.69	0.006863889	139.3	137.8
3 x 15	258.08	0.003874768	146.9	146.9
	236.53	0.004227794	152.8	147.7
	203.39	0.004916663	156.8	151.5
	145.69	0.006863889	162.7	162.7

620°C Corrected Vs. Predicted Times

620 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	90.9	72.9
	218.32	0.004580432	98.7	75.7
	127.93	0.007816775	127.5	88.8
	52.93	0.018892877	147.0	133.9
2 x 15	258.08	0.003874768	113.0	110.1
	236.53	0.004227794	112.0	111.7
	203.39	0.004916663	117.8	117.7
	145.69	0.006863889	139.8	138.5
3 x 15	258.08	0.003874768	147.8	147.8
	236.53	0.004227794	153.7	148.6
	203.39	0.004916663	157.3	152.2
	145.69	0.006863889	162.7	162.8

650°C Corrected Vs. Predicted Times

650 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	92.8	73.1
	218.32	0.004580432	101.1	75.9
	127.93	0.007816775	130.4	89.2
	52.93	0.018892877	148.5	134.4
2 x 15	258.08	0.003874768	116.3	112.4
	236.53	0.004227794	113.9	113.9
	203.39	0.004916663	120.1	119.6
	145.69	0.006863889	140.7	139.2
3 x 15	258.08	0.003874768	149.2	148.9
	236.53	0.004227794	155.0	149.6
	203.39	0.004916663	158.2	153.1
	145.69	0.006863889	163.6	163.3

700°C Corrected Vs. Predicted Times

700 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	95.7	74.1
	218.32	0.004580432	104.0	76.9
	127.93	0.007816775	134.8	90.3
	52.93	0.018892877	150.4	136.2
2 x 15	258.08	0.003874768	119.2	115.8
	236.53	0.004227794	117.3	117.3
	203.39	0.004916663	123.5	122.6
	145.69	0.006863889	142.6	141.3
3 x 15	258.08	0.003874768	151.4	151.4
	236.53	0.004227794	156.8	152.0
	203.39	0.004916663	159.1	155.0
	145.69	0.006863889	163.6	163.7

The Building Test Centre

Fire Acoustics Structures

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 email btc.testing@saint-gobain.com

750°C Corrected Vs. Predicted Times

750 °C				
Thickness (mm)	Section Factor (A/V)	Inverse Section Factor (V/A)	Corrected Time (minutes)	Predicted Time (minutes)
2 x 12.5	257.07	0.003889991	97.7	77.1
	218.32	0.004580432	106.5	80.0
	127.93	0.007816775	136.3	93.1
	52.93	0.018892877	151.9	138.3
2 x 15	258.08	0.003874768	121.6	118.7
	236.53	0.004227794	120.1	120.1
	203.39	0.004916663	125.9	125.3
	145.69	0.006863889	144.6	143.3
3 x 15	258.08	0.003874768	152.8	152.7
	236.53	0.004227794	157.7	153.3
	203.39	0.004916663	160.0	156.1
	145.69	0.006863889	164.5	164.4

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SELECTION OF APPRAISAL METHOD

The appraisal method used was the graphical approach, details given in Annex E E.2. This method showed compliance with the requirements in 13.5.

GRAPHICAL METHOD

Line Graphs

350°C GRAPHICAL METHOD

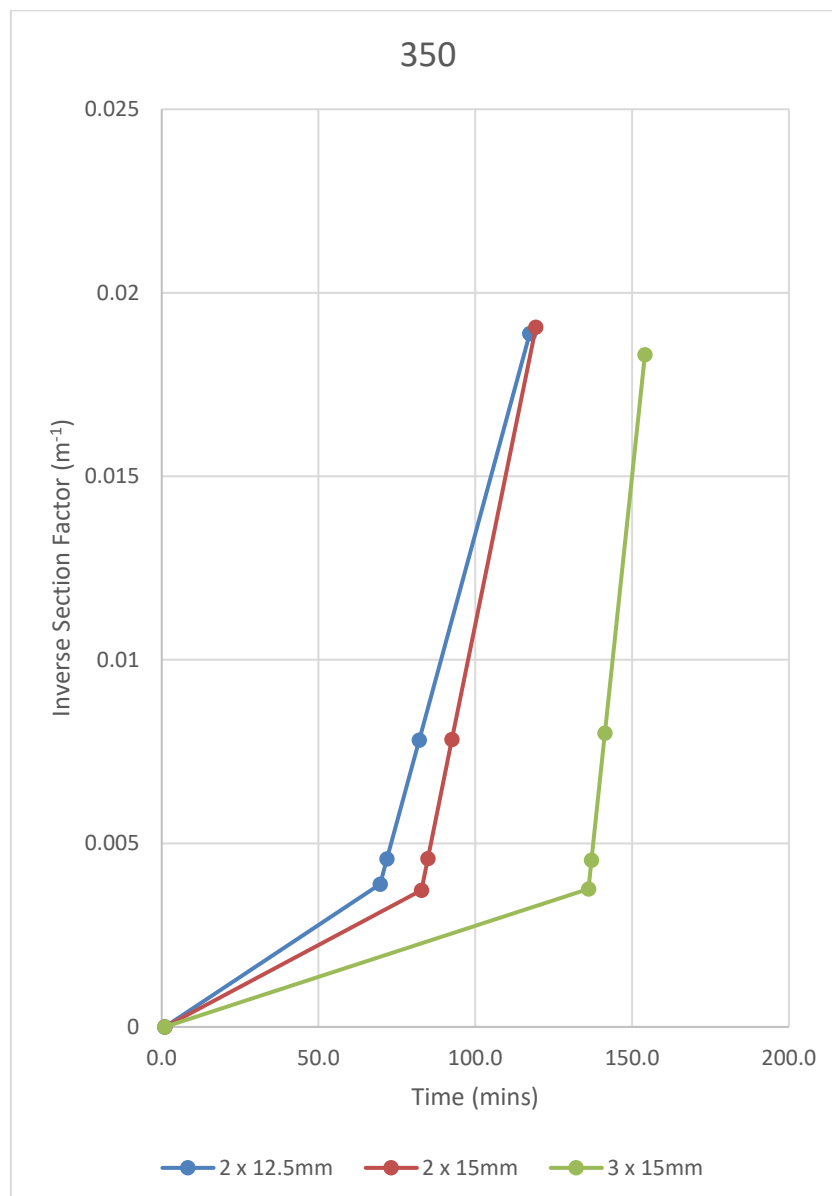


Figure 11. 350°C graphical chart.

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400°C GRAPHICAL METHOD

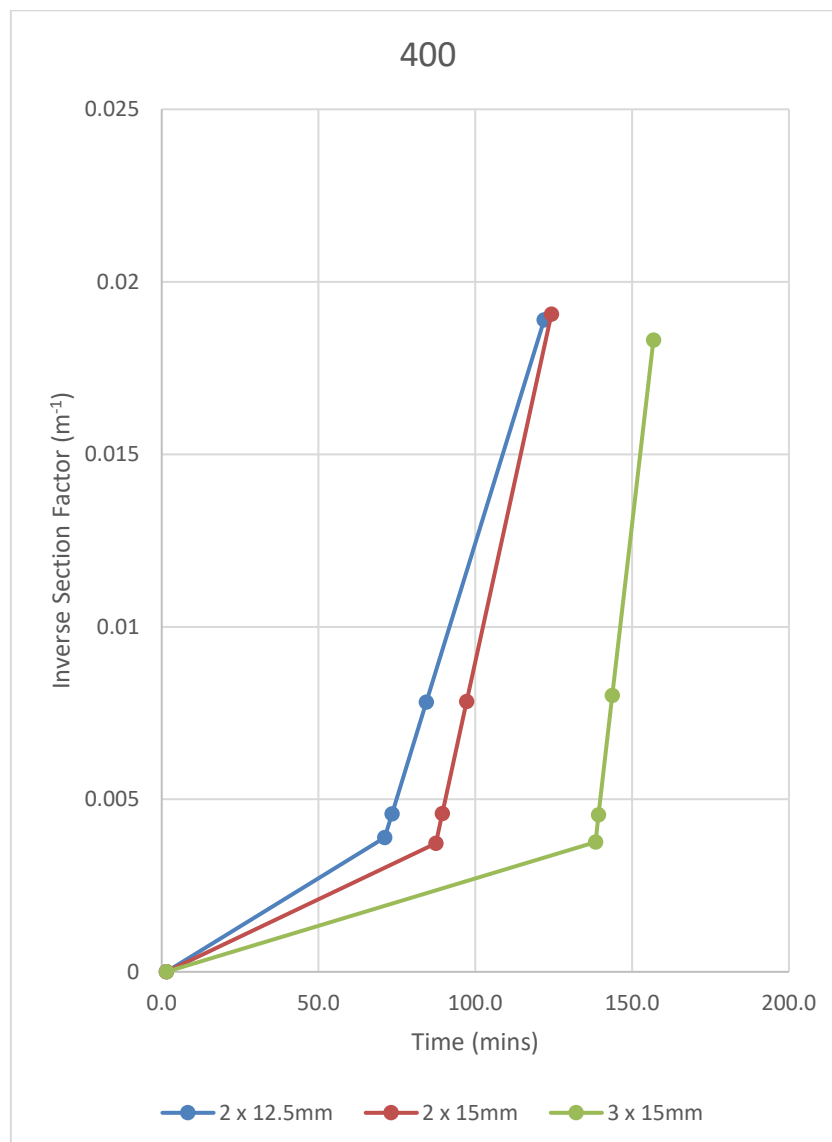


Figure 12. 400°C graphical chart.

450°C GRAPHICAL METHOD

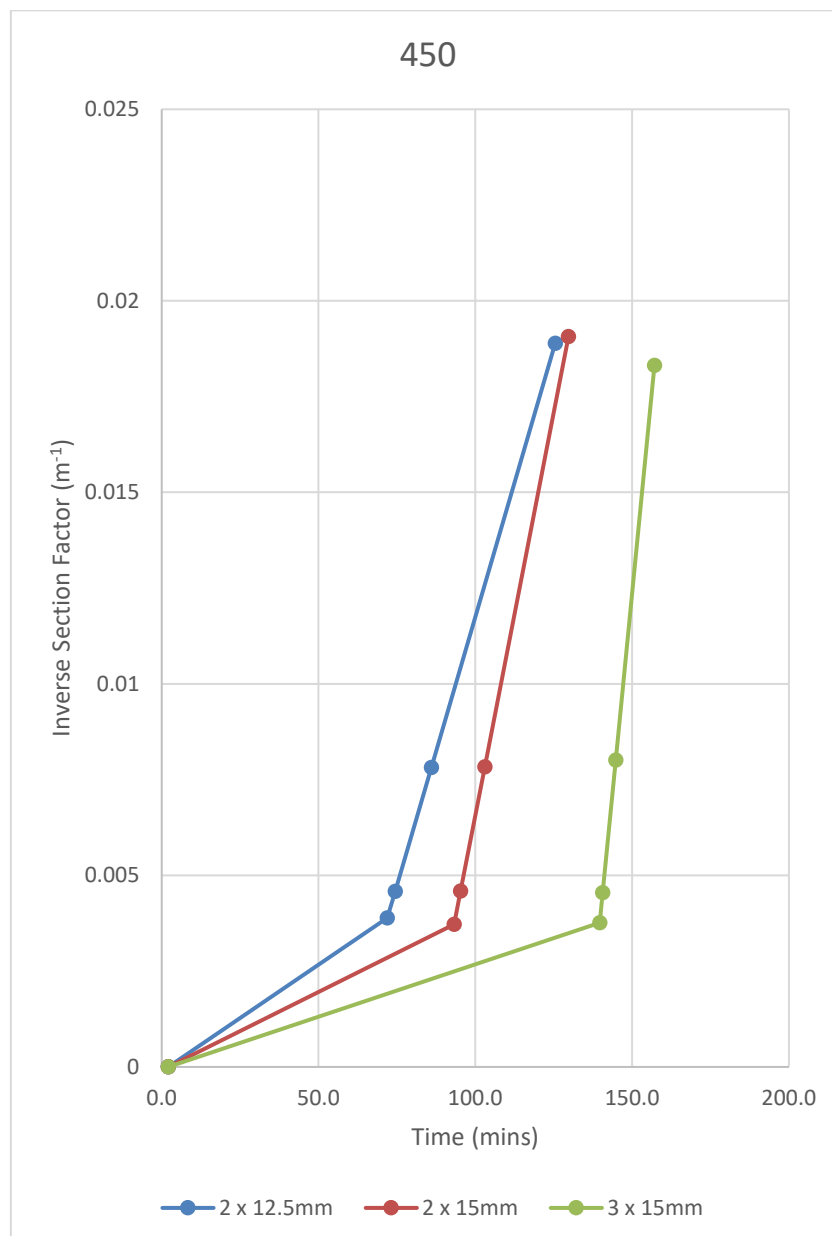


Figure 13. 450°C graphical chart.

500°C GRAPHICAL METHOD

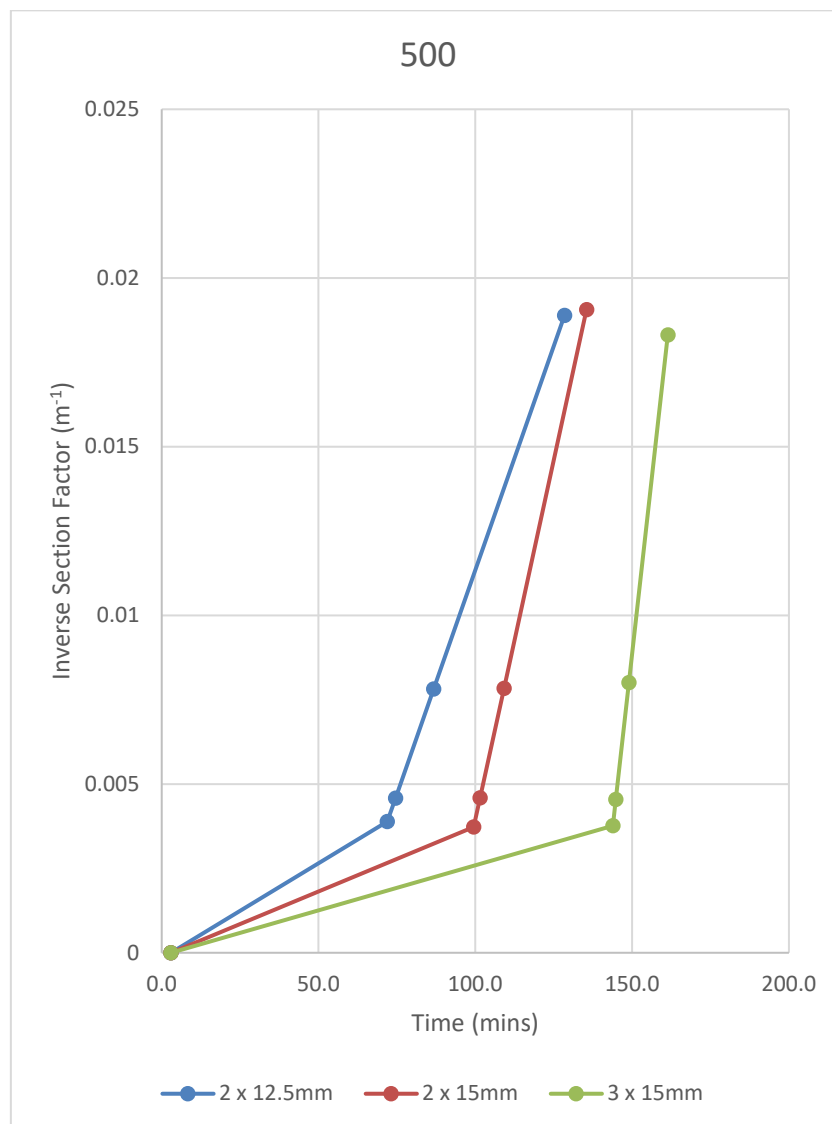


Figure 14. 500°C graphical chart.

550°C GRAPHICAL METHOD

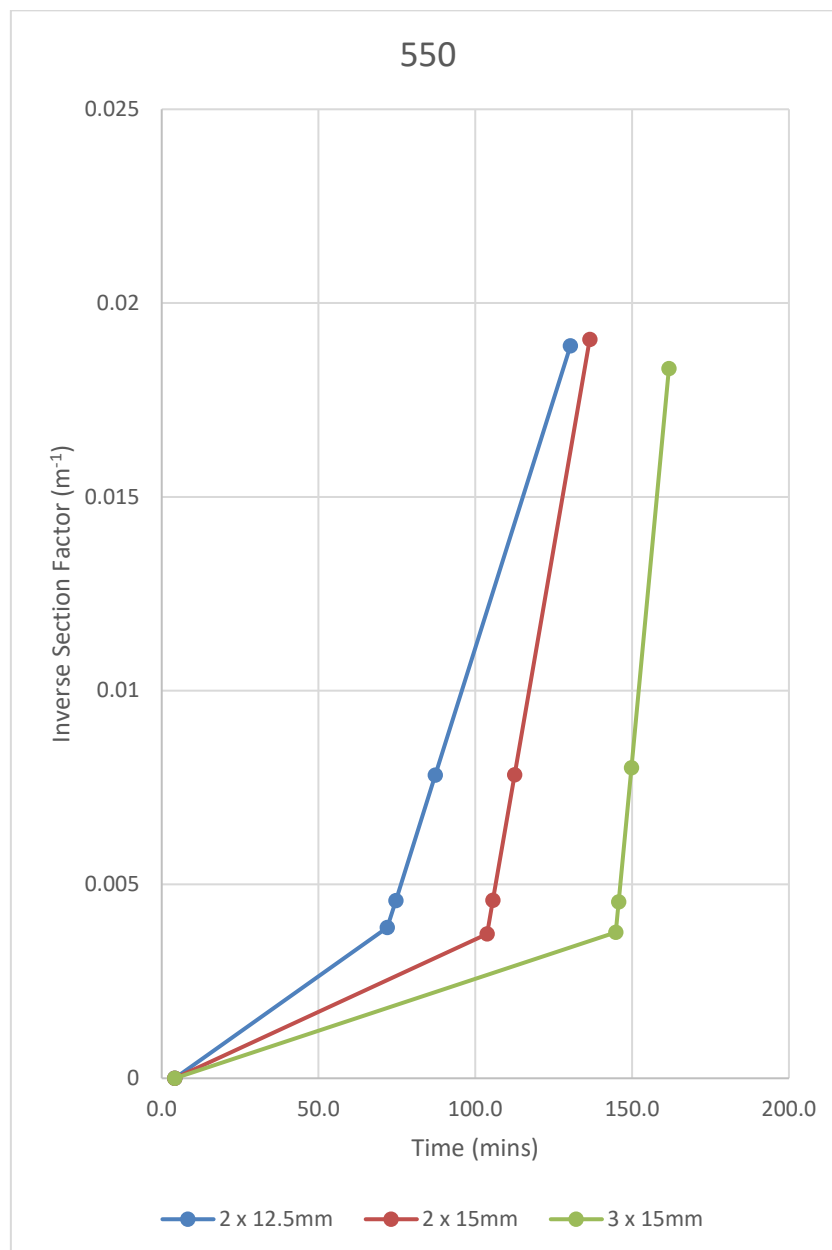


Figure 15. 550°C graphical chart.

600°C GRAPHICAL METHOD

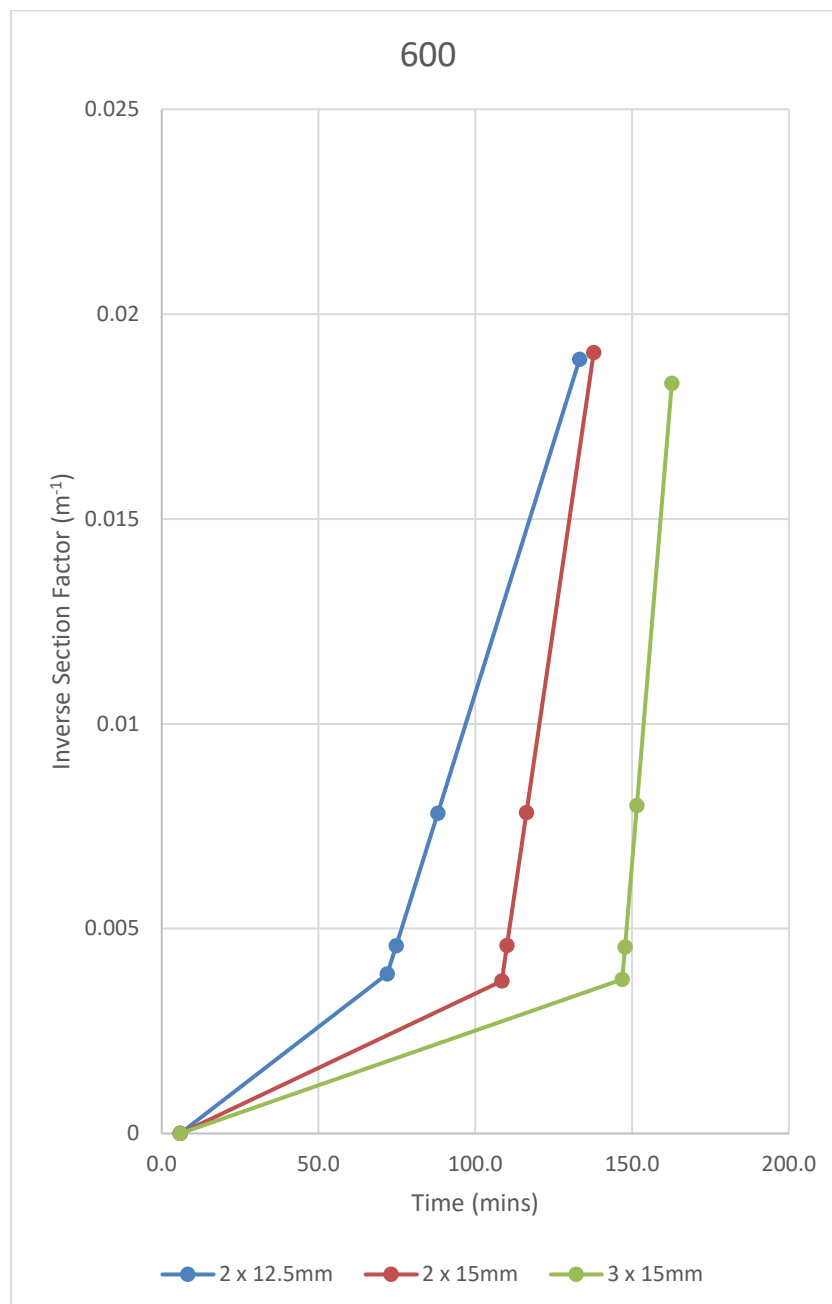


Figure 16. 600°C graphical chart.

620°C GRAPHICAL METHOD

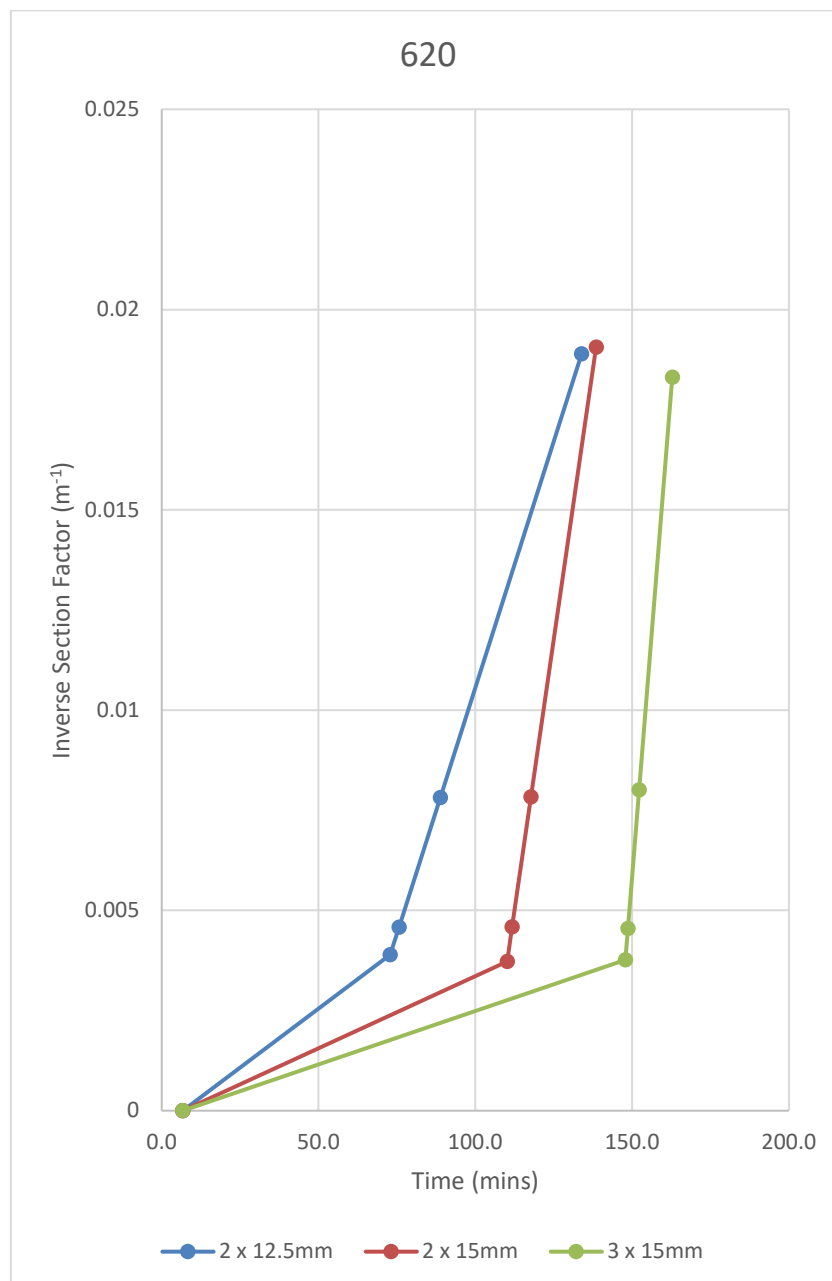


Figure 17. 620°C graphical chart.

650°C GRAPHICAL METHOD

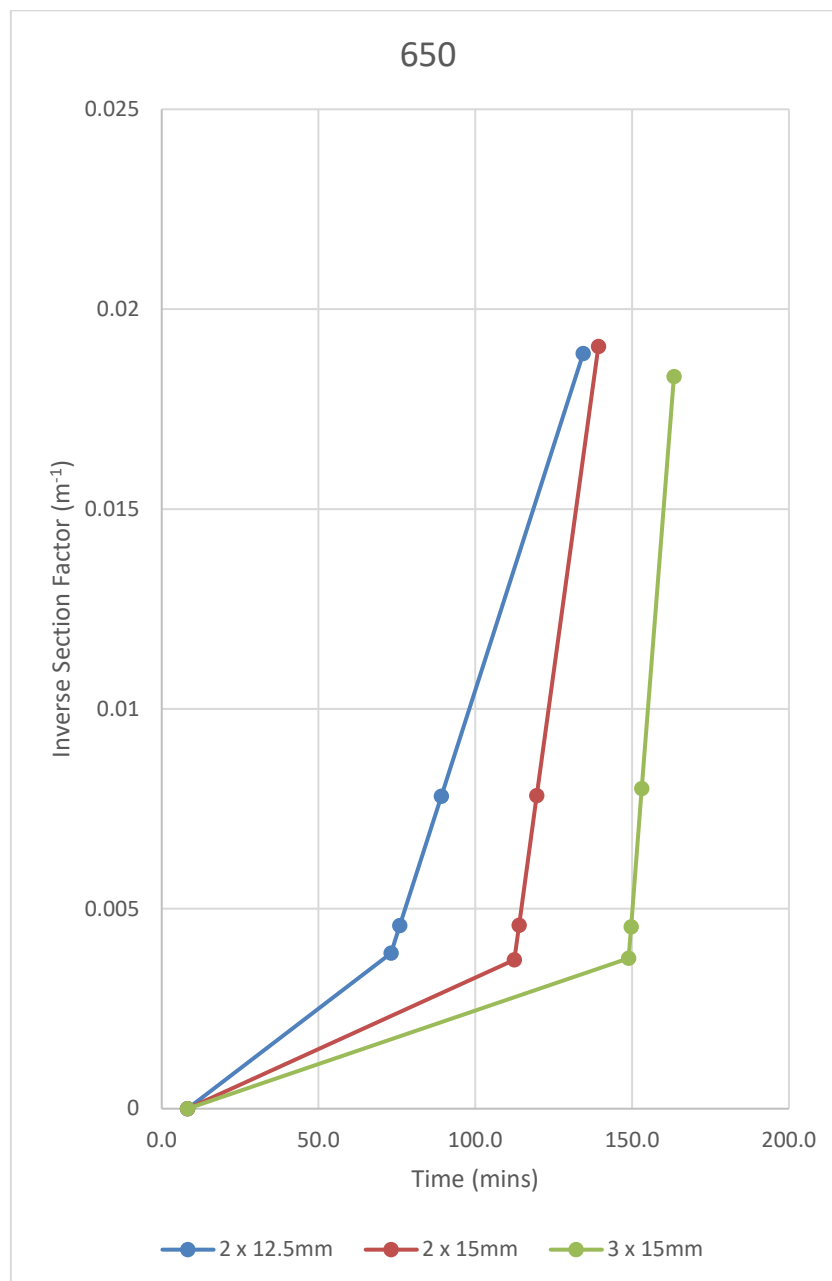


Figure 18. 650°C graphical chart.

700°C GRAPHICAL METHOD

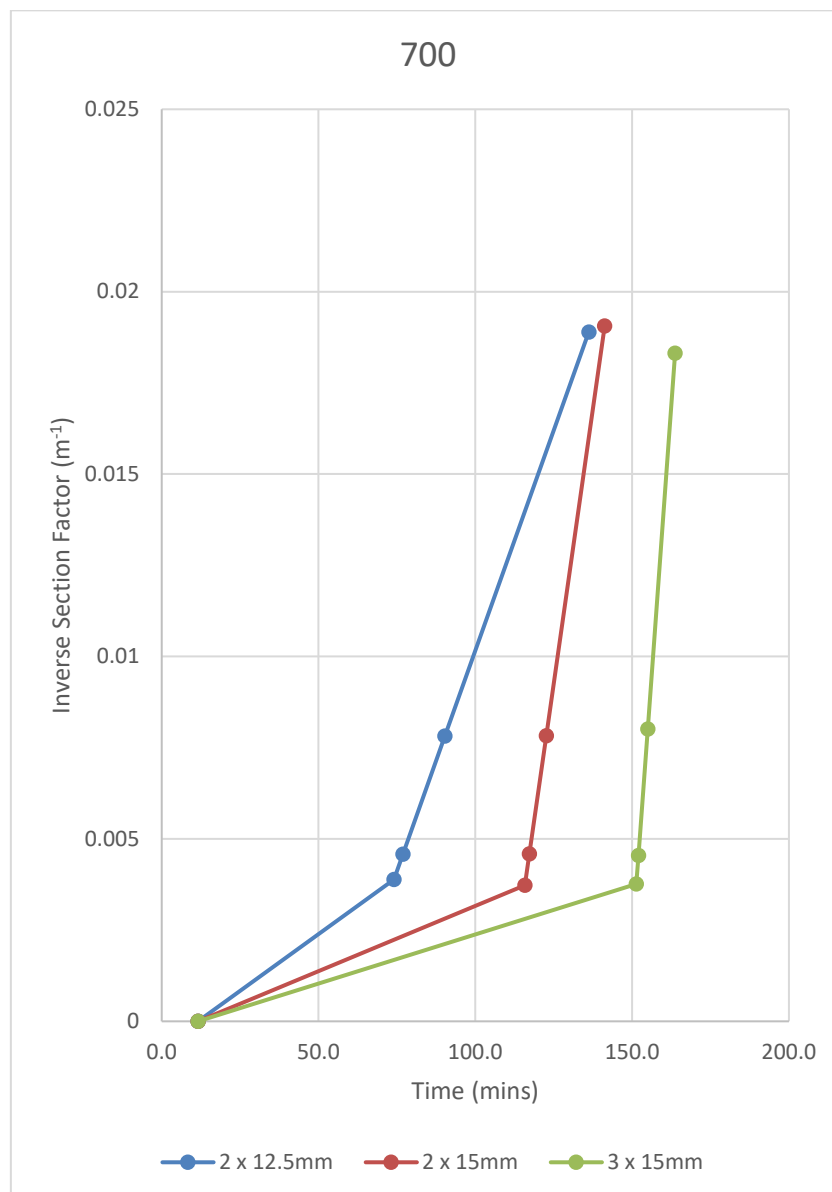


Figure 19. 700°C graphical chart.

750°C GRAPHICAL METHOD

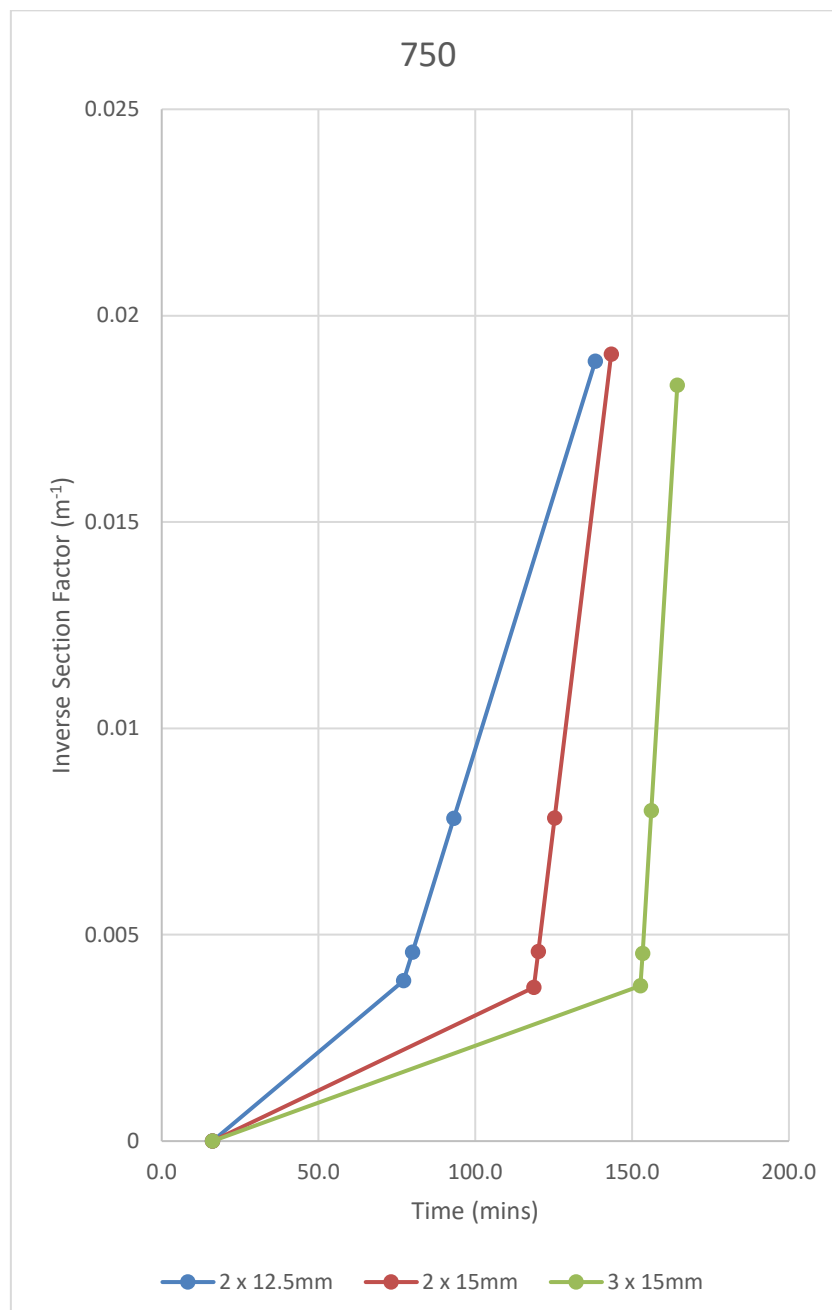


Figure 20. 750°C graphical chart.

Box Graphs 350°C A/V TABLE

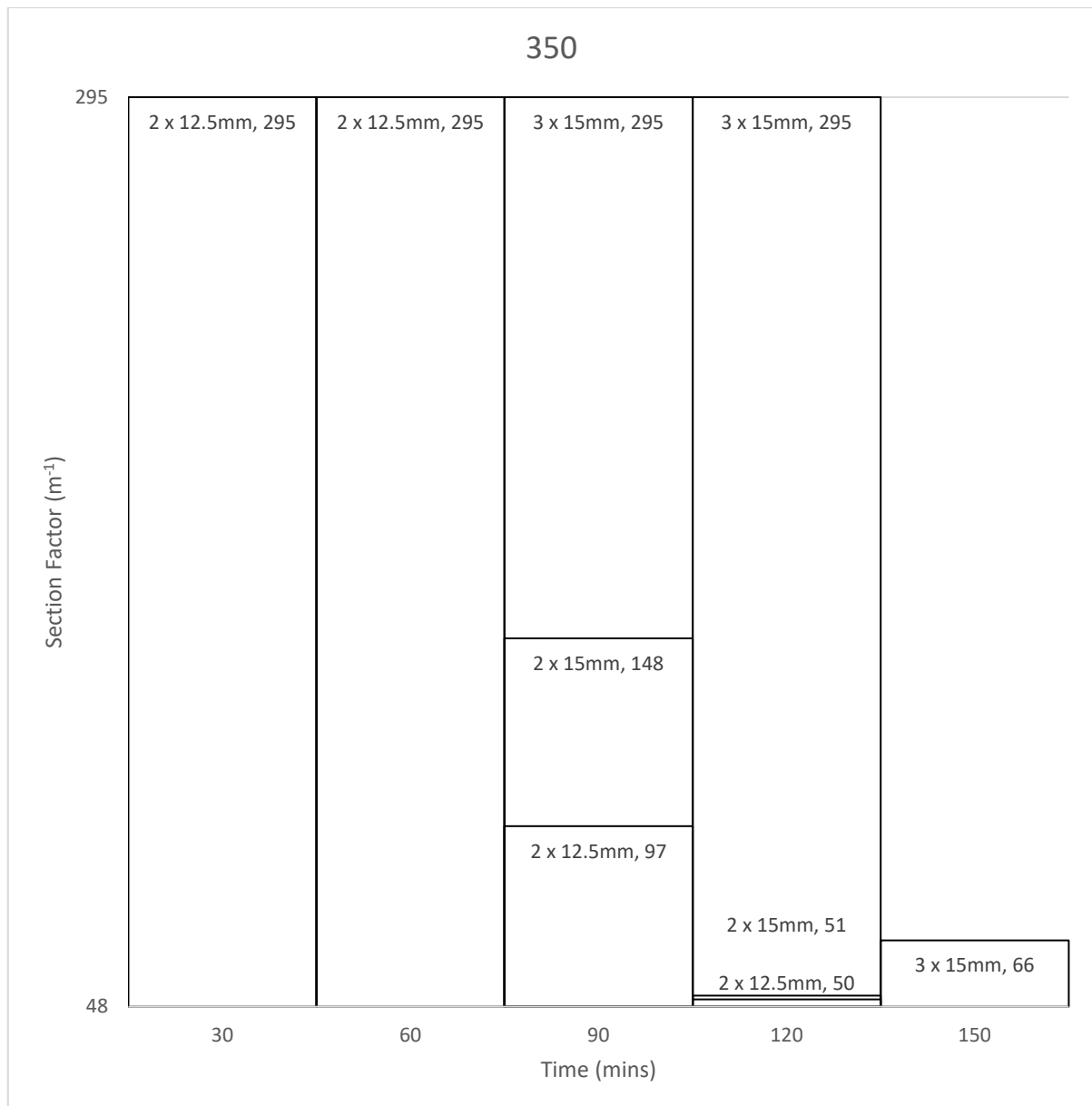


Figure 21. 350°C A/V table.

400°C A/V TABLE

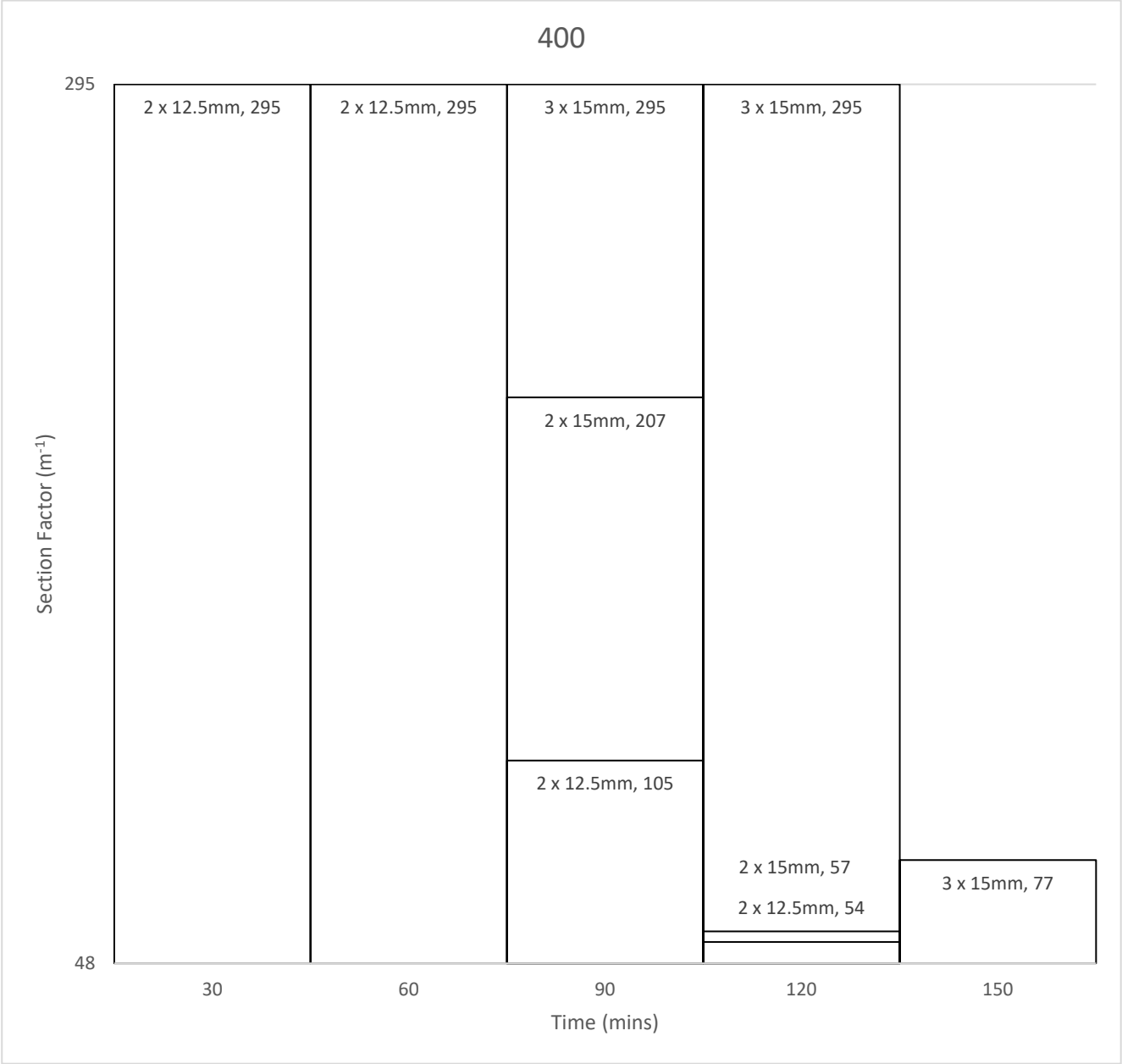


Figure 22. 400°C A/V table.

450°C A/V TABLE

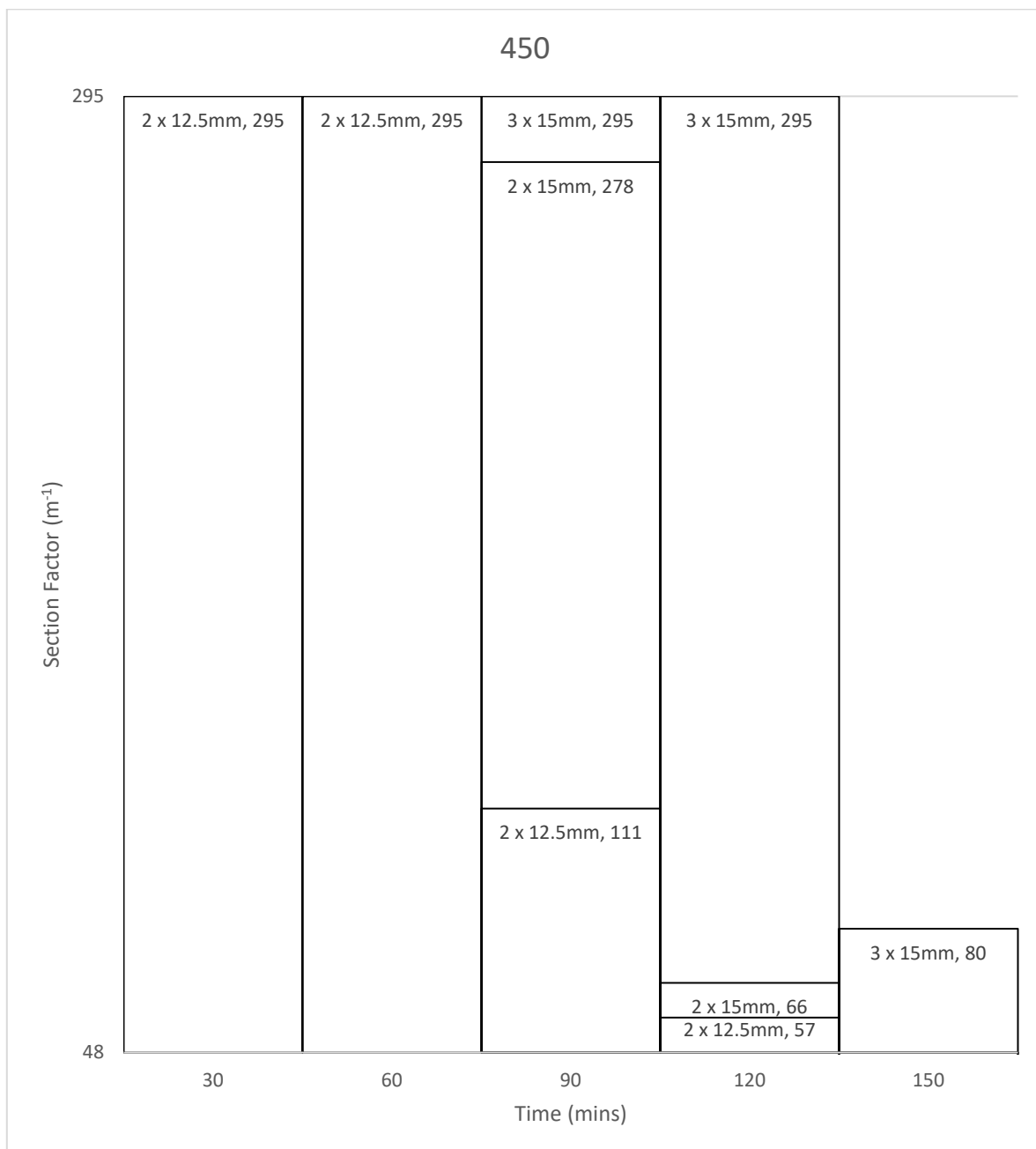


Figure 23. 450°C A/V table.

500°C A/V TABLE

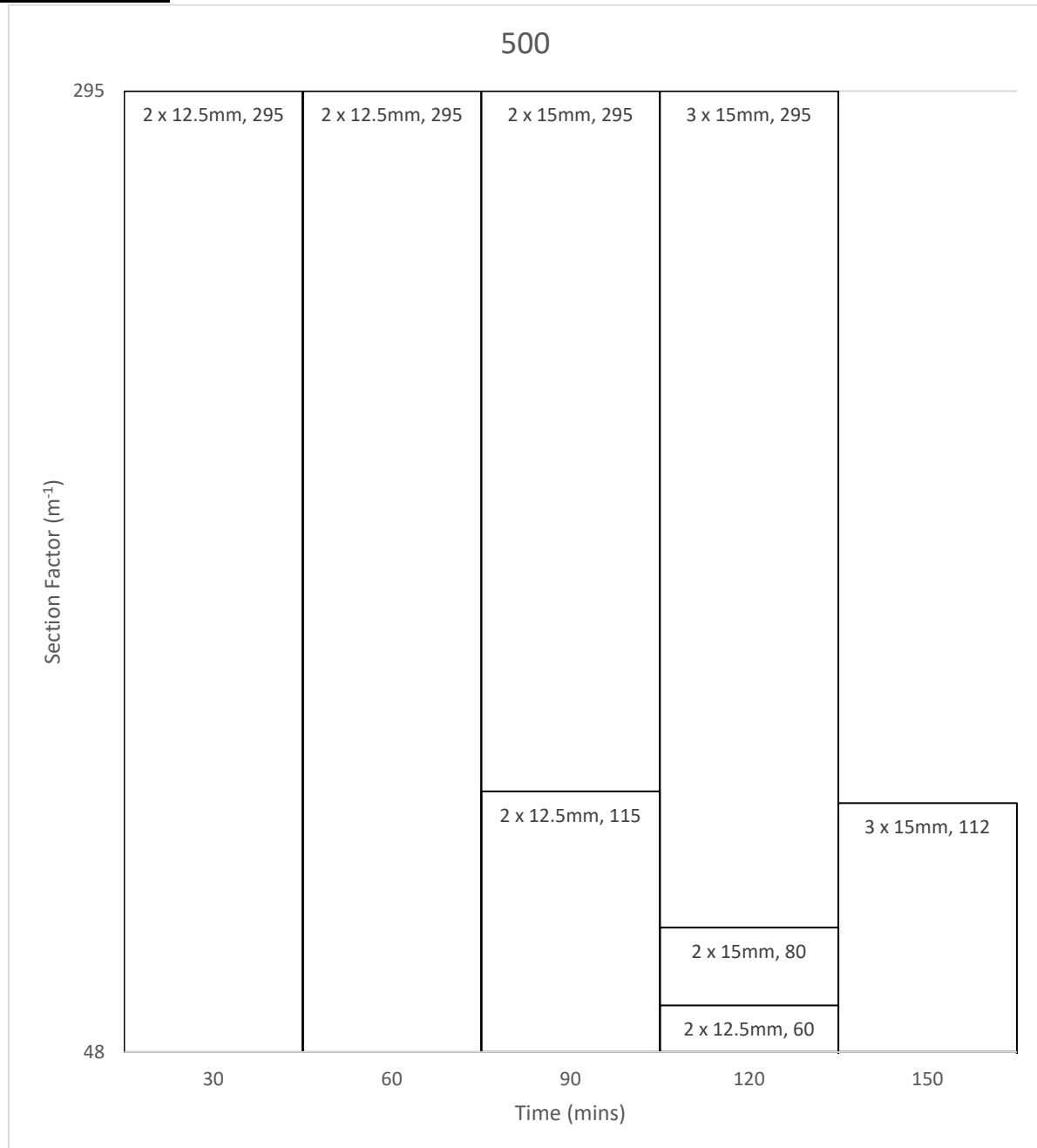


Figure 24. 500°C A/V table.

550°C A/V TABLE

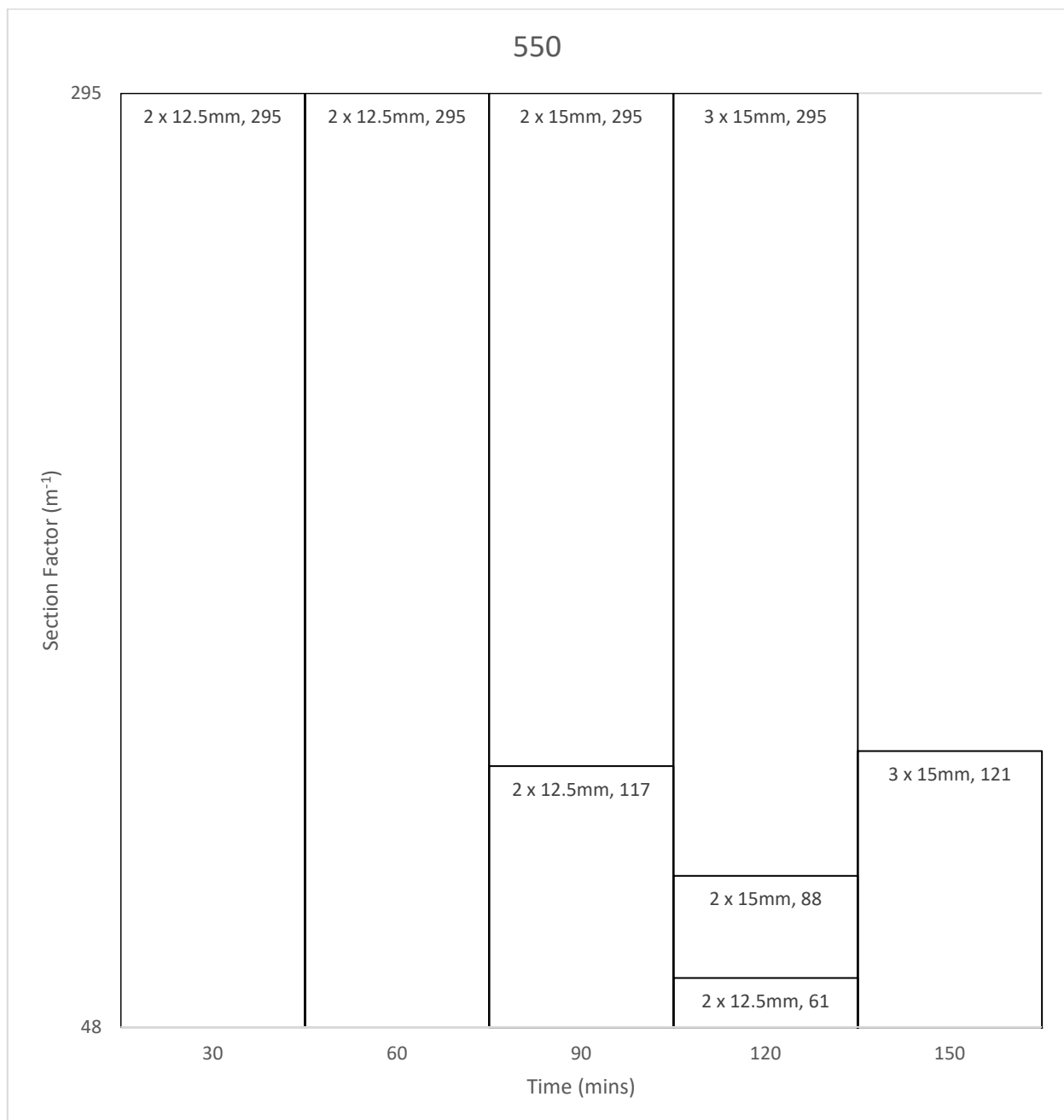


Figure 25. 550°C A/V table.

600°C A/V TABLE

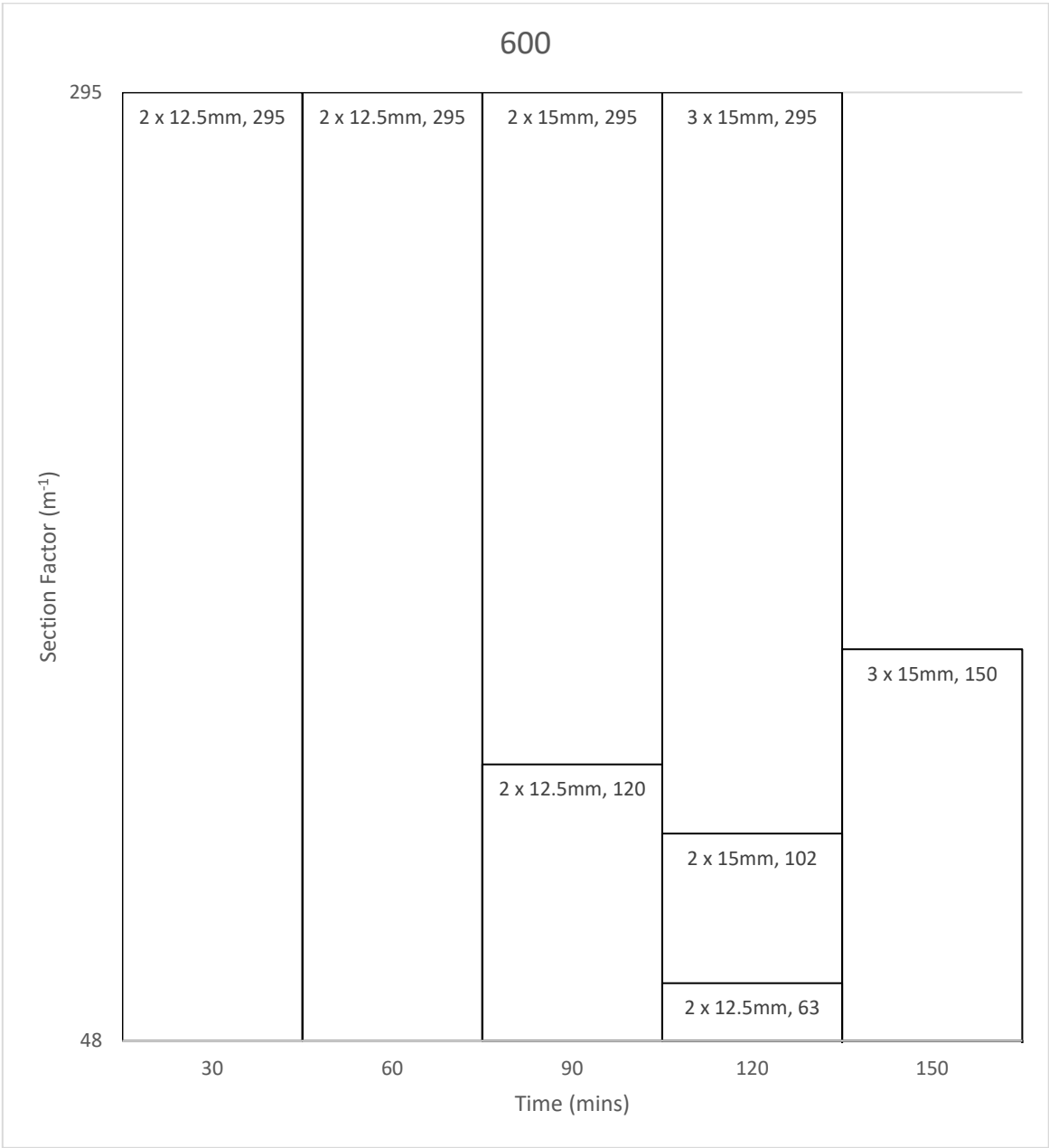


Figure 26. 600°C A/V table.



620°C A/V TABLE

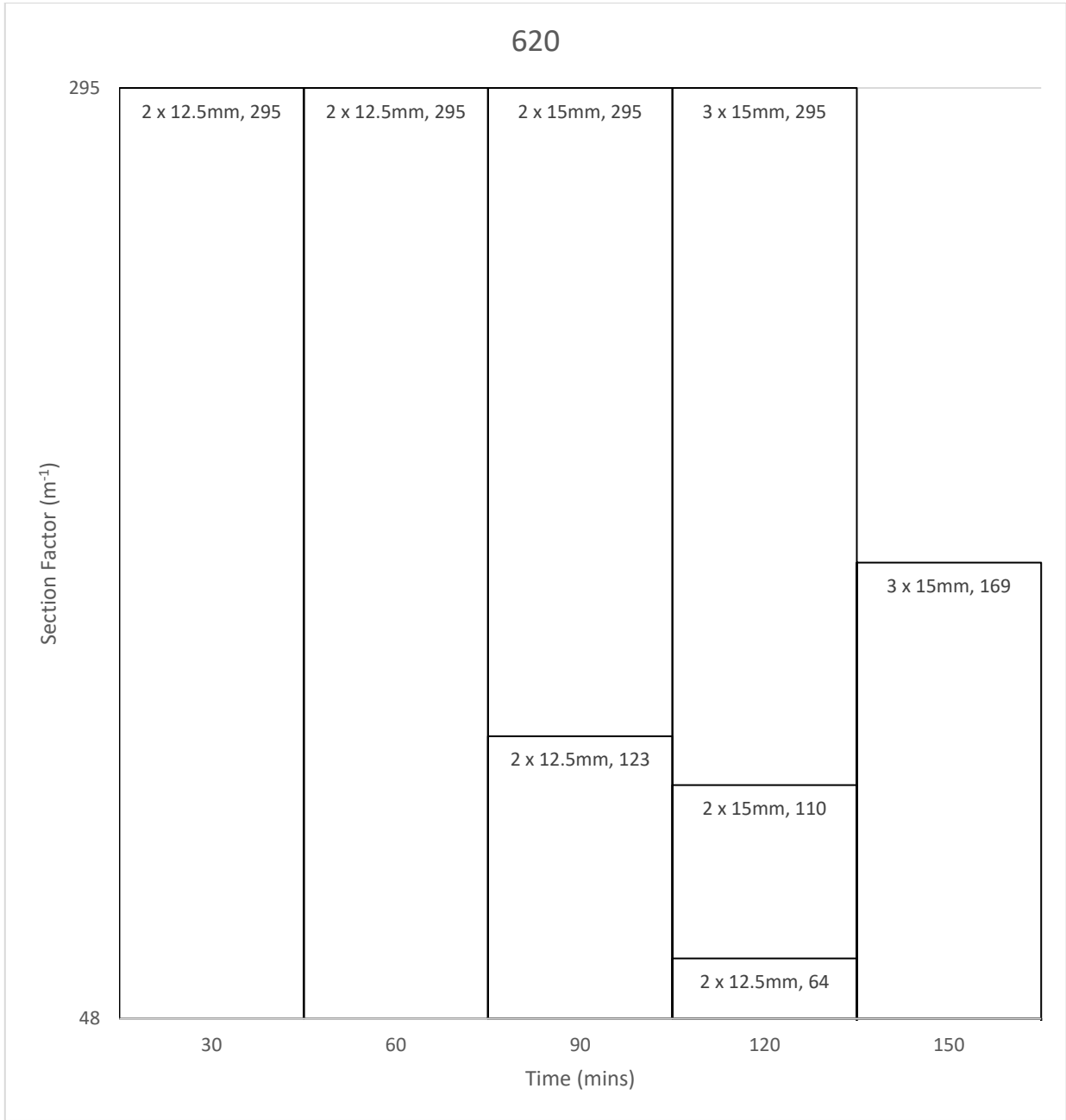


Figure 27. 620°C A/V table.

650°C A/V TABLE

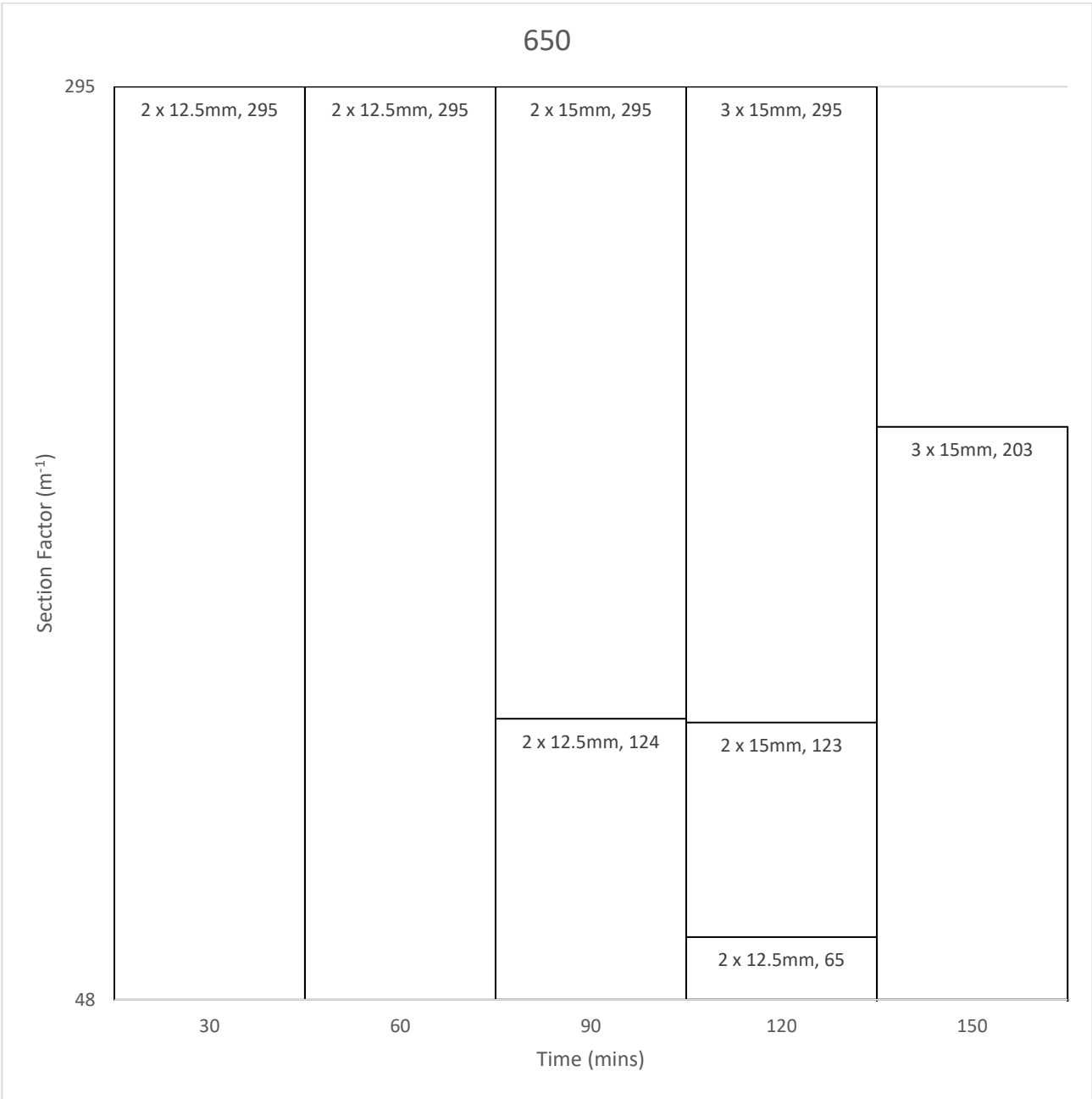


Figure 28. 650°C A/V table.



700°C A/V TABLE

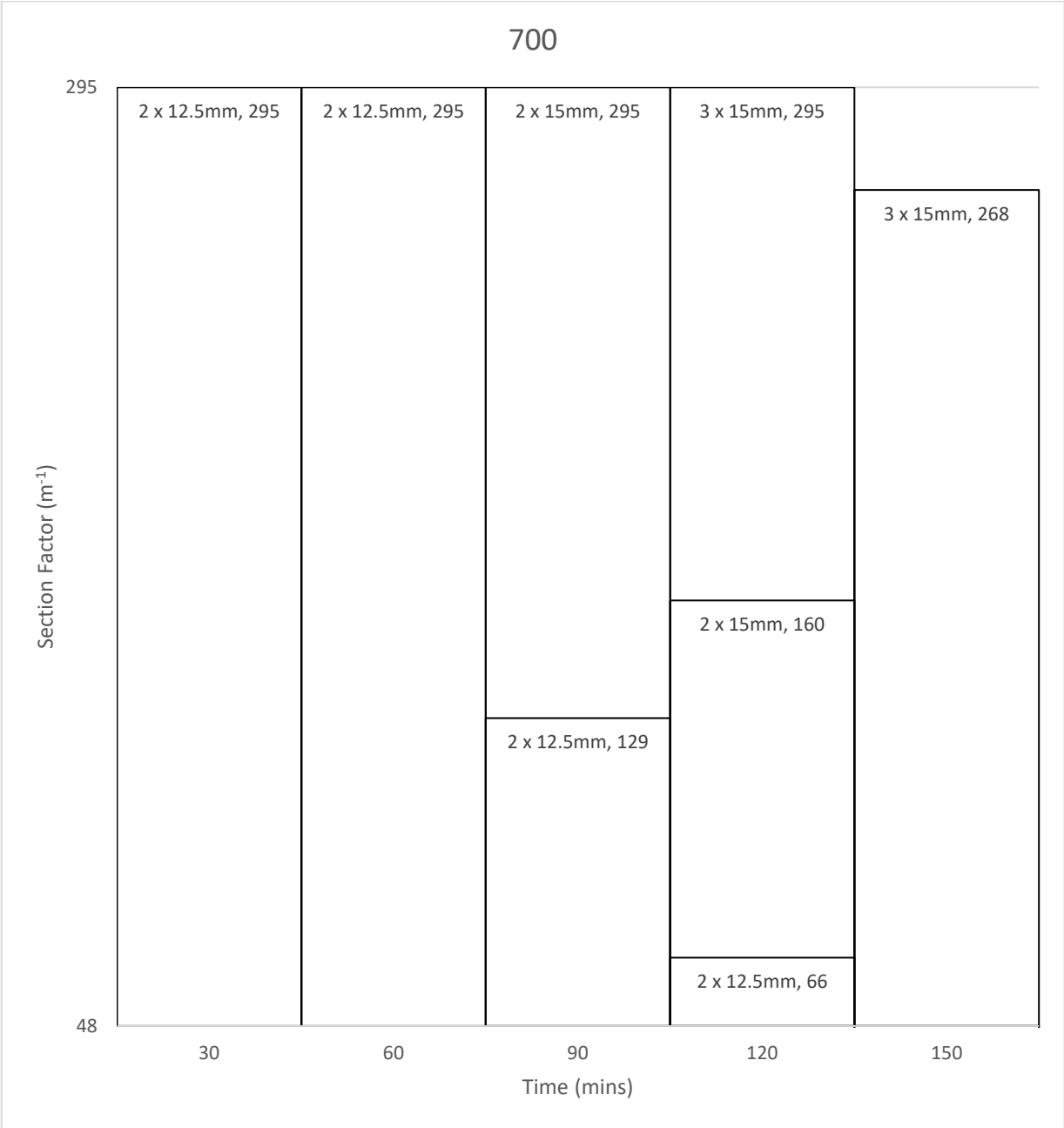


Figure 29. 700°C A/V table.



750°C A/V TABLE

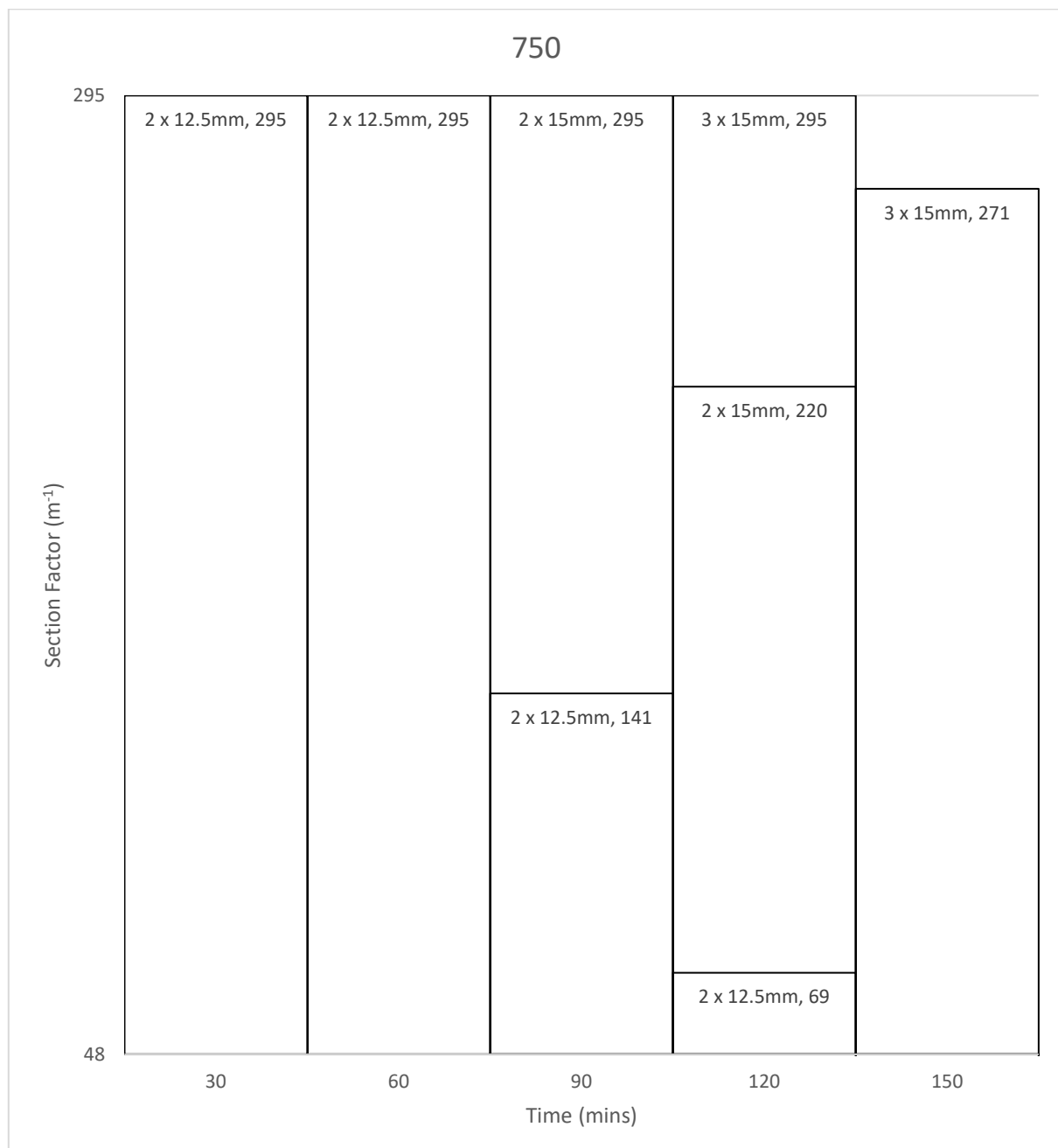


Figure 30. 750°C A/V table.

LIMITS OF APPLICABILITY OF THE APPRAISAL

The results from this test method and the assessment procedure are applicable to fire protection systems over the range of fire protection material thicknesses tested, the values of steel section factor A/V tested and the maximum temperatures established during the test.

For an assessment to be valid for any fire resistance period, the loaded sections protected with the maximum protection thickness shall achieve a load bearing capacity performance as defined in 10.3.1 and 10.3.2 within 85% of this period.

The results of the appraisal are applicable to all other grades of steel to that tested and as given in EN 10025-1 as specified in 6.1 and with the limitations given therein. The results of the assessment may also be applicable to fabricated sections.

The maximum beam web depth shall be limited to the web depth of the loaded beam plus 50%.

The maximum depth of a column, (h) shall be limited to the depth of the loaded beam plus 100%. This is subject to a maximum permitted depth of 600mm for boxed fire protection systems. The assessment is applicable to the method of application used in the test specimen preparation.

The distance of boards of the fire protection system from the steel members shall be as follows;

Tested distance -5mm to +50mm with no change of fixing.

The method of fixing boards is confined to the method used for the test specimens since it may not be suitable for other situations. The suitability of the tested fixing system for different situations shall be demonstrated by appropriate testing.

The appraisal results from single layer fire protection systems and are only applicable to single layer fire protection systems. Double layer systems must be tested and assessed separately (6.6.1).

APPLICABILITY OF THE RESULTS TO SECTION OTHER THAN I OR H

Test data exists on structural hollow section (SHS) as compression and flexural members which together with recent research have indicated comparability between SHS sections and 'I' or 'H' sections in terms of the fire protection thickness related to the section factor. The test information has been analysed for rectangular, square and circular sections to establish comparability with respect to the fire protection thickness, section factor and fire resistance performance and the approaches below for boxed and profiled systems are recommended for both three and four sided protection to both beams and columns.

Boxed systems

No change in thickness is required, i.e. the thickness for a structural hollow section of a given A/V value is equal to that for the 'I' or 'H' section of the same 'box' A/V value.

Profiled systems

For profiled systems, a correction to the thickness is required; see BS EN 13381-4:2013 Annex A.3.

The rules outlined above may be used providing that the different section shape does not require new fixing techniques and does not affect the physical performance of the fire protection system.