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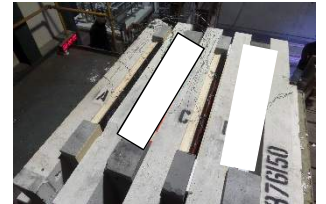
Testing, calibrating, advising.

Title:

The fire resistance performance of two horizontal ventilated cavity barrier fire seals, when tested to the general principles of BSEN 1363-1: 2012, using the test method stated in ASFP TGD 19: 2014 (fire resistance tests for 'Open-State' cavity barriers).

WF Report No:

376150 A



Prepared for:

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Date:

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1 Introduction

Two horizontal ventilated cavity barrier fire seals were tested installed within a reinforced AAC floor slab built on top of a 1.5m x 1.5m furnace.

A further two horizontal and four vertical cavity fire barriers were also tested, but are not subject to this report.

2 Specimen verification

The specimens were delivered to Exova Warringtonfire during November 2016. Exova Warringtonfire fabricated the supporting constructions and subsequently installed the cavity barrier sealing systems into the supporting constructions in line with the sponsor's instructions.

2.1 Conditioning

Exova Warringtonfire stored the specimens in climatic conditions approximate to those in normal service.

2.2 Sampling

Exova Warringtonfire was not involved in factory sampling of the components used for the specimens subject to this report.

3 Description of supporting constructions

Supporting construction

The horizontal supporting construction comprised a 1800mm x 1800mm x 150mm thick reinforced AAC floor slab, built on top of a 1.5m x 1.5m furnace aperture. The supporting construction included 1 No. aperture, 104mm wide x 1000mm long x 600mm high labelled as Seal A and 1 No. aperture 113mm wide x 1000mm long x 600mm high labelled as Seal C to accept the cavity closer specimens. Both apertures were lined to one side with 45mm thick x 95mm high softwood timber, which was faced with 9mm thick OSB. Both apertures had Monarperm 500 breather membrane fitted onto the OSB. Seal C only was lined with 9mm OSB on the second face of the aperture.

4 Description of specimens

Details of the specimens are shown overleaf. All measurements are in mm and the descriptions are written viewing the specimens from the unexposed face unless stated otherwise.

4.1 Horizontal ventilated cavity fire sealing systems

Ventilated cavity seal A

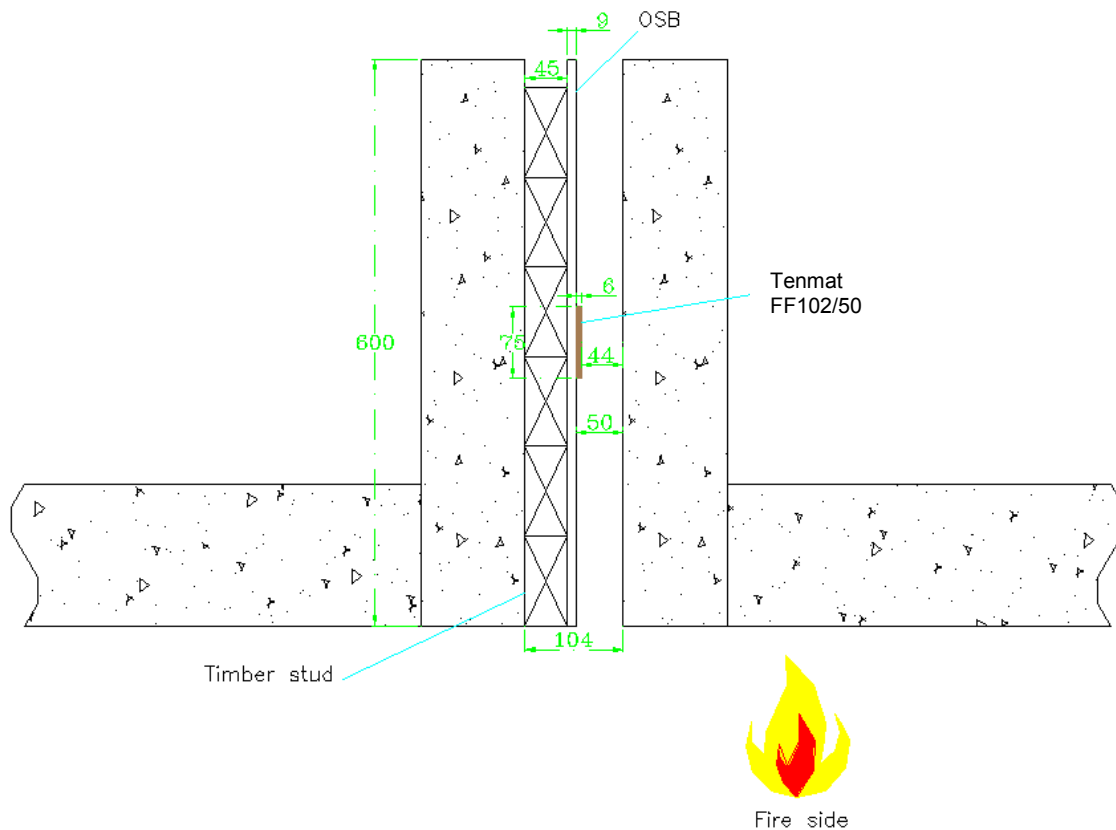
The cavity seal barrier comprised 75mm wide x 6mm thick Tenmat FF102/50 intumescent, aluminium foil wrapped with the join along the front face of the seal along the centre line, fitted at mid height within the cavity, fixed to the timber stud / OSB with 40mm long wood screws fitted at 250mm centres along the centre line of the seal, leaving a 44mm wide free air space. There was a straight splice butt join in the seal 250mm from one end of the seal.

Seal length	Seal width	Seal depth
1000mm	6mm	75mm

Cavity size

Length	Block to Block aperture Width	Block to OSB cavity width	Height
1000mm	104mm	50mm	600mm

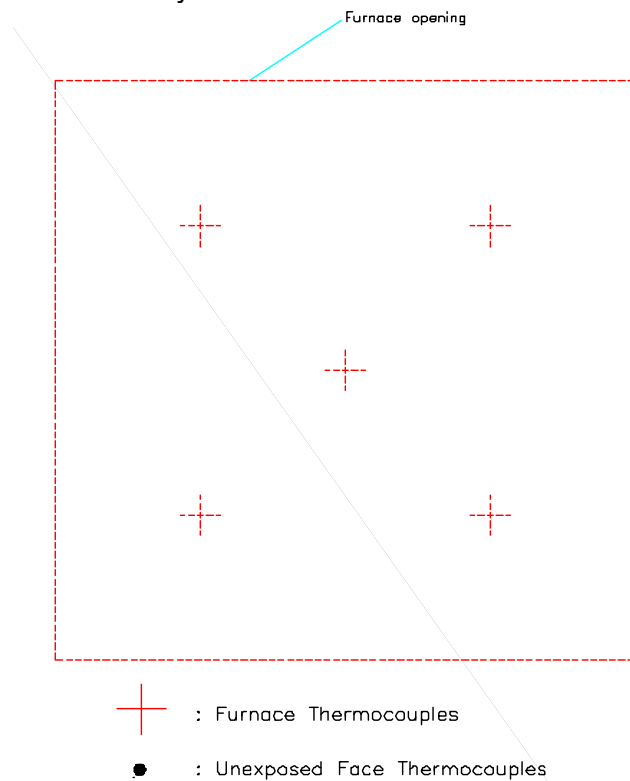
Cross section through ventilated cavity barrier fire seal



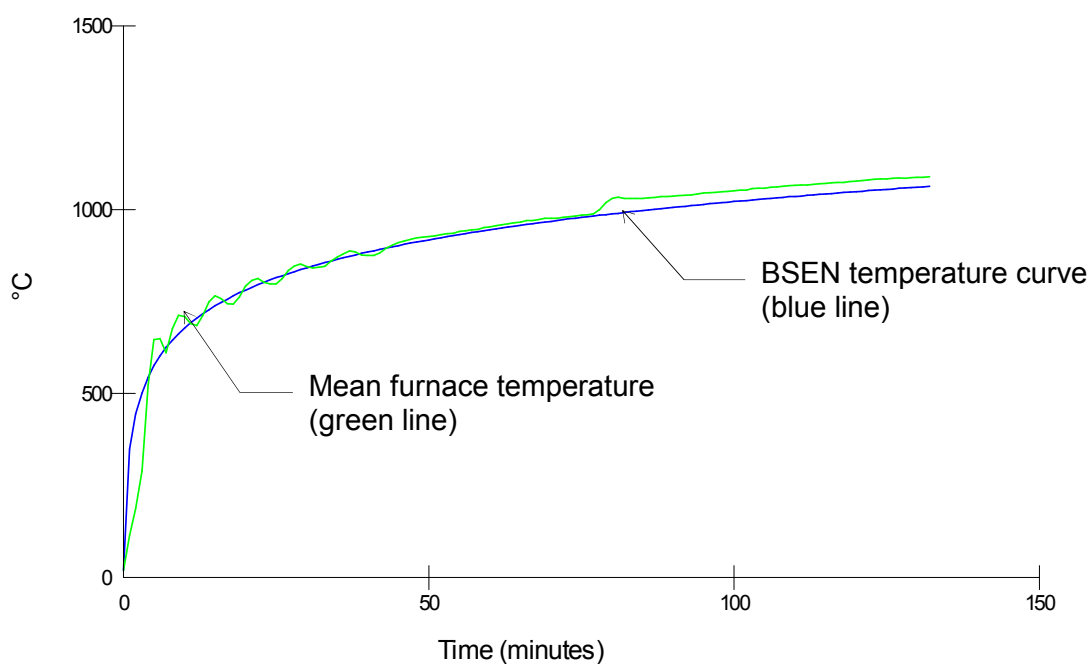
5 Test Conditions

5.1 Furnace temperature

The furnace was controlled to follow the temperature/time relationship specified in BS EN 1363: Part 1: 2012 Section 5.1.1 as closely as possible, using the average of five plate thermometers suitably distributed within the furnace.

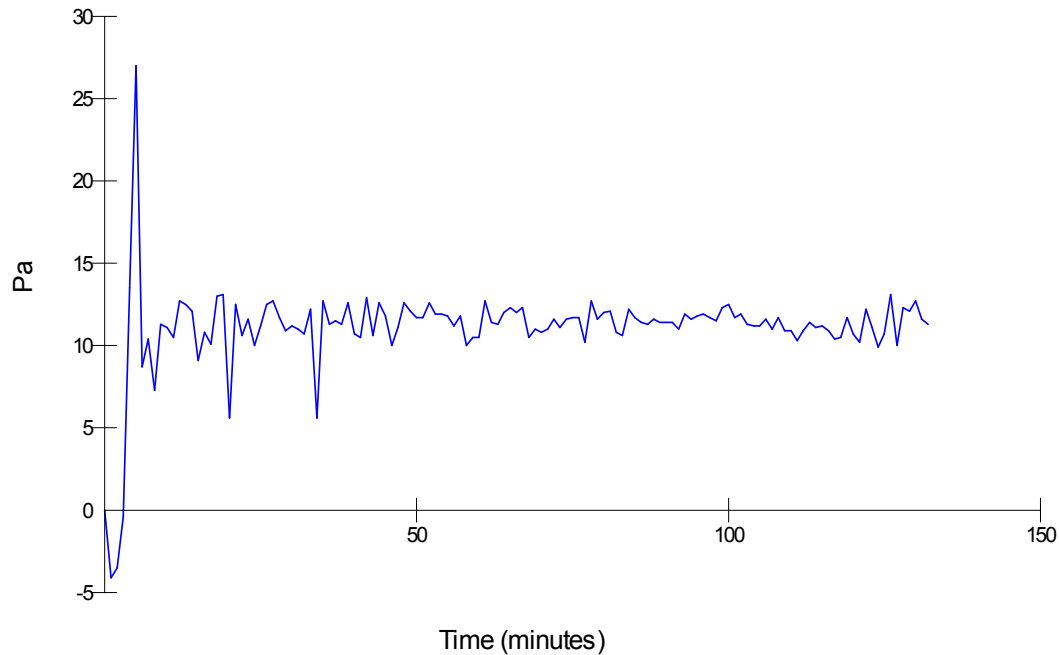


The temperatures were recorded and are shown graphically below:



5.2 Pressure readings

After the first 5 minutes of the test, the furnace pressure was maintained at 11.5 ± 5 Pa and after 10 minutes was maintained at 11.5 ± 3 Pa with respect to atmosphere, equating to 20Pa 100mm below the underside of the cavity seal. The pressure readings were recorded and are shown graphically below:



5.3 Ambient temperature

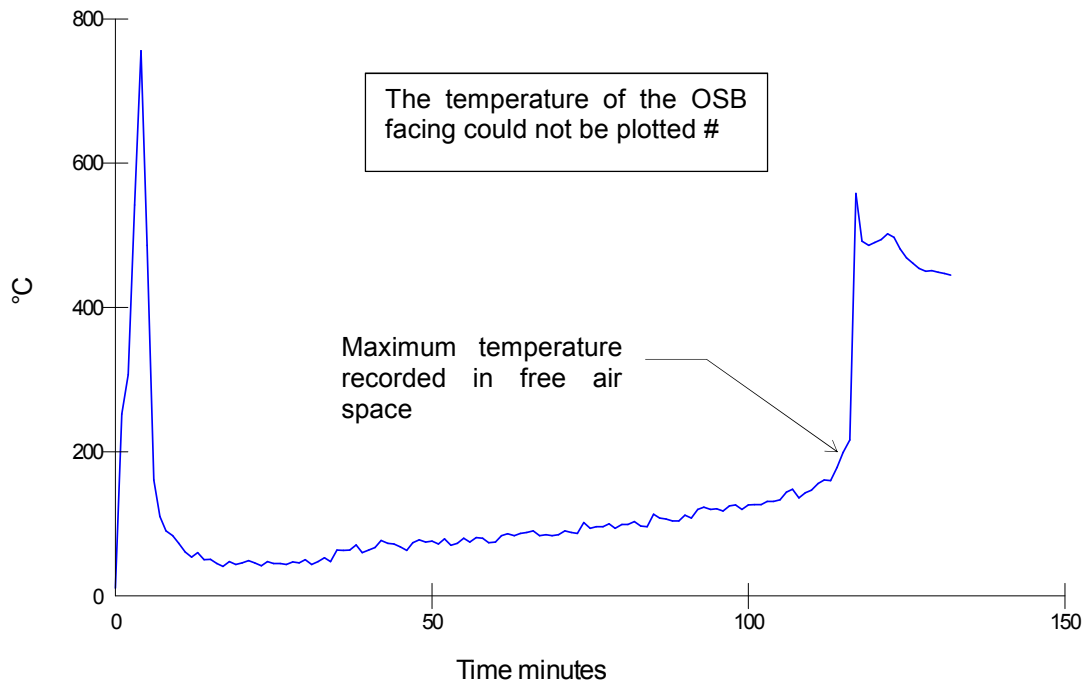
The ambient temperature of the test area at commencement of the test was 10°C.

5.4 Unexposed face thermocouple positions and test equipment

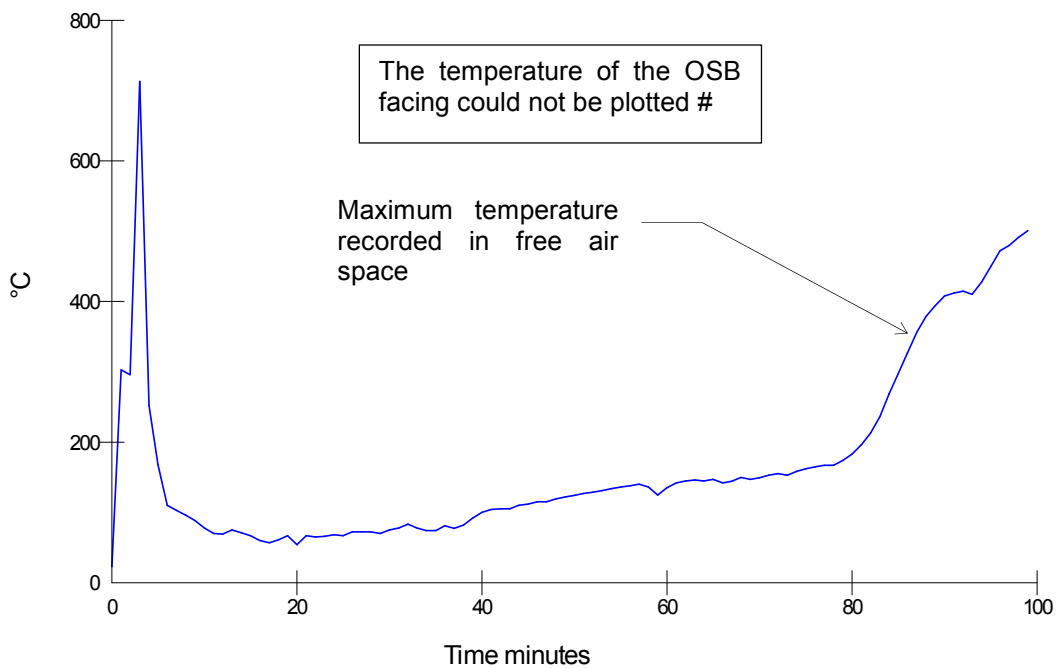
- 5.4.1 The temperature of the unexposed face of each specimen was monitored by means of thermocouples positioned in accordance with the test standard to determine the maximum unexposed face temperature rise.
- 5.4.2 A roving thermocouple was available to monitor any positions suspected of being at a greater temperature than indicated by fixed position thermocouples.
- 5.4.3 The thermocouple positions are shown on each specimen are tabulated in section 5.6.
- 5.4.4 The temperatures recorded have been tabulated in the Appendix
- 5.4.5 Cotton pads were available to assess integrity of the specimens.

5.5 Unexposed face temperatures

Ventilated cavity barrier fire seal A



Ventilated cavity barrier fire seal C



Due to the nature of the specimens under evaluation, the thermocouples could not be adequately fixed to the OSB facing after construction, and a roving thermocouple could not be employed without the danger of possible mechanical damage being caused to the test specimen.

5.6 Thermocouple positions

The temperature of the unexposed face was monitored by means of the following thermocouples.

Thermocouple Number	Type (location)
1	Furnace
2	Furnace
3	Furnace
4	Furnace
5	Furnace
6	Laboratory ambient
Cavity seal A	
10	In free air space, 25mm above the cavity fire seal, $\frac{1}{4}$ from the end of the aperture
11	In free air space, 25mm above the cavity fire seal, $\frac{1}{2}$ from the end of the aperture
12	In free air space, 25mm above the cavity fire seal, $\frac{3}{4}$ from the end of the aperture
13	On OSB 25mm above cavity fire seal, $\frac{1}{4}$ from the end of the seal
14	On OSB 25mm above cavity fire seal, $\frac{1}{2}$ from the end of the seal
15	On OSB 25mm above cavity fire seal, $\frac{3}{4}$ from the end of the seal
Cavity seal C	
25	In free air space, 25mm above the cavity fire seal, $\frac{1}{4}$ from the end of the aperture
26	In free air space, 25mm above the cavity fire seal, $\frac{1}{2}$ from the end of the aperture
27	In free air space, 25mm above the cavity fire seal, $\frac{3}{4}$ from the end of the aperture
28	On OSB 25mm above cavity fire seal, $\frac{1}{4}$ from the end of the seal
29	On OSB 25mm above cavity fire seal, $\frac{1}{2}$ from the end of the seal
30	On OSB 25mm above cavity fire seal, $\frac{3}{4}$ from the end of the seal

The temperatures recorded have been tabulated in the Appendix.

6 Observations

All comments refer to the unexposed face unless stated otherwise.

Time (minutes)	Comments
00.00	Test started.
00.43	Seal C, damp proofing liner beginning to melt.
04.19	Seal C, has reacted and sealed off the void.
05.00	Seal A was noted to have already sealed off the void.
07.04	Seal C, there is smoke issuing from the perimeter of the sealed void.
07.30	Both seals, there is discoloration on the supporting construction above the sealed void.
12.58	Seal A, there is smoke issuing from the perimeter of the sealed void.
23.12	Seal A, there is further discoloration along the supporting construction above the sealed void.
33.58	Seal C, there is an increase of smoke issuing at the perimeter of the sealed void.
67.32	Seal C, there is an increase of smoke issuing at the perimeter of the sealed void.
79.51	Seal C, there is an increase of smoke issuing at the perimeter of the sealed void.
80.00	Seal A, there is an increase of smoke issuing at the perimeter of the sealed void.
92.32	Seal C, there is glow at the perimeter of the sealed void.
100.10	Seal C there is a further glow at the perimeter of the sealed void.
105.27	No visual change recorded.
115.19	Seal A, there is glow at the perimeter of the sealed void.
117.32	Seal A there is continuous flaming at the perimeter of the sealed void, thereby constituting to integrity failure .
120.26	Seal C, there is continuous flaming at the perimeter of the sealed void, thereby constituting to integrity failure .
132.00	Test terminated.

7 Expression of results

Horizontal ventilated cavity barrier fire seals overall performance

Specimen	Integrity (minutes)		Insulation (mins)	'Air gap' Insulation (mins)
	Cotton pad	Continuous flaming	Fixed thermocouples	Suspended thermocouples
Seal A	*	117 (one hundred and seventeen) minutes	**	108 (one hundred and eight) minutes #
Seal C	*	120 (one hundred and twenty) minutes	**	80 (eighty) minutes #

* No failure of test criteria at termination of the test at 132 minutes

** Due to the nature of the specimens under evaluation, the thermocouples could not be adequately fixed to the OSB facing after construction, and a roving thermocouple could not be employed without the danger of possible mechanical damage being caused to the test specimen

The initial spike in temperature rise in the free air space exceeding 180°C above ambient is discounted until the effective closure of the cavity barrier and the furnace and temperature and pressure conditions are achieved



This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedures outlined in EN 1363-1, using the test method stated in ASFP TGD 19: 2014 (fire resistance tests for 'Open-State' cavity barriers).

Any significant deviation with respect to size, construction details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.

The results only relate to the behaviour of the element of construction under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behaviour in fires.

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. Exova Warringtonfire will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

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. This test was not conducted under the requirements of UKAS accreditation.

	Written and checked by:	Authorised by:
Signature:		
Name:	Ashley Babb	Callum Sempill
Title:	Lead Technical Officer	Lead Technical Officer
Date of issue:	27 January 2017	27 January 2017

9 Photographs

Unexposed face at start of test



After 15 minutes



After 30 minutes



After 45 minutes



Appendix – raw test data

Time	Chan 10	Chan 11	Chan 12	Chan 13	Chan 14	Chan 15	Chan 25	Chan 26	Chan 27	Chan 28	Chan 29	Chan 30
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	11	-	11	10	10	9	10	23	11	10	10	9
1	247	-	252	70	78	59	258	23	303	240	89	157
2	280	-	307	99	118	84	275	23	296	301	115	230
3	609	-	542	475	303	208	171	546	713	283	289	402
4	744	-	756	781	757	687	126	16	252	202	301	408
5	447	-	486	565	578	597	118	19	168	155	308	282
6	167	-	161	260	309	305	84	20	110	144	251	204
7	96	-	110	160	190	187	69	20	103	136	220	162
8	74	-	90	123	138	147	52	25	96	156	212	148
9	72	-	84	101	108	129	47	26	88	150	195	134
10	63	-	73	87	92	114	45	29	78	150	181	123
11	57	-	61	79	80	102	46	27	70	151	180	115
12	52	-	54	73	73	95	50	29	69	149	174	112
13	54	-	60	71	69	91	42	26	75	148	174	109
14	52	-	50	66	65	87	59	25	71	150	171	110
15	47	-	51	62	61	82	67	30	50	148	165	103
16	51	-	45	62	59	77	60	34	60	149	160	100
17	46	-	41	61	58	74	57	30	55	147	155	99
18	41	-	48	57	56	82	54	13	61	142	152	100
19	46	-	44	58	56	81	67	13	52	147	151	98
20	43	-	46	55	54	75	49	13	54	149	148	96
21	44	-	49	54	53	79	67	12	51	153	146	96
22	43	-	46	55	52	71	65	11	54	156	145	94
23	45	-	42	54	51	67	66	11	44	159	141	92
24	44	-	48	54	52	68	68	10	51	165	141	94
25	47	-	45	54	51	65	67	10	51	167	140	93
26	42	-	45	56	52	63	72	15	50	170	138	95
27	40	-	44	58	51	60	72	13	48	172	139	94
28	43	-	47	55	53	61	72	17	52	157	139	95
29	45	-	46	55	53	60	70	20	54	157	142	98
30	46	-	50	54	52	56	75	22	56	175	141	100
31	51	-	44	56	52	54	78	26	49	178	142	100
32	47	-	48	56	54	55	83	27	55	170	145	98
33	50	-	53	56	53	57	78	27	50	164	145	100
34	51	-	48	57	54	50	74	27	48	130	144	100
35	55	-	64	59	53	50	74	28	55	131	146	102
36	53	-	63	58	52	50	81	29	52	142	146	105
37	59	-	64	61	52	50	77	29	53	159	145	109
38	58	-	71	60	53	51	82	29	54	159	150	111
39	60	-	60	61	55	50	92	30	68	159	154	114

Time	Chan 10	-	Chan 12	Chan 13	Chan 14	Chan 15	Chan 25	Chan 26	Chan 27	Chan 28	Chan 29	Chan 30
min	°C	-	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
40	56	-	64	61	55	49	100	31	57	186	155	116
41	61	-	67	59	55	51	104	30	65	182	160	117
42	59	-	77	61	54	52	105	32	70	192	166	119
43	55	-	73	59	56	52	105	32	68	184	173	121
44	62	-	72	59	57	51	110	32	61	184	179	121
45	61	-	68	61	58	53	112	32	69	197	186	122
46	63	-	63	63	59	51	115	33	67	192	191	122
47	61	-	74	61	58	54	115	34	62	194	195	124
48	55	-	78	61	59	56	119	33	59	194	199	126
49	61	-	75	61	61	53	122	36	58	203	203	125
50	62	-	76	63	61	53	124	35	61	197	207	125
51	67	-	72	64	62	50	127	37	67	196	209	127
52	68	-	79	65	61	52	129	36	62	199	214	126
53	67	-	70	67	62	52	131	35	56	200	217	127
54	70	-	73	67	62	52	134	35	61	204	219	127
55	67	-	80	68	63	53	136	35	73	214	222	125
56	68	-	75	67	65	53	138	36	73	217	226	126
57	65	-	81	67	64	54	140	35	60	221	228	127
58	66	-	80	67	65	54	136	35	57	224	230	131
59	71	-	74	66	66	56	125	34	64	224	232	130
60	66	-	75	67	66	54	135	35	68	227	234	131
61	70	-	84	66	67	56	142	34	64	232	237	129
62	67	-	86	63	68	57	145	36	70	236	241	132
63	71	-	84	64	68	58	146	33	77	238	244	131
64	74	-	87	69	69	58	145	34	80	242	247	131
65	71	-	88	66	67	58	147	16	65	245	249	130
66	68	-	90	68	69	59	142	17	72	244	251	133
67	72	-	84	68	70	58	144	17	89	248	253	105
68	74	-	85	70	70	58	150	17	72	249	255	105
69	74	-	84	70	71	56	147	18	78	255	257	151
70	70	-	85	72	73	58	149	18	83	252	260	155
71	76	-	90	70	72	59	153	18	95	260	263	156
72	75	-	88	73	73	58	155	18	96	267	266	160
73	75	-	87	73	75	59	153	19	118	271	269	164
74	73	-	102	72	74	61	158	20	122	277	274	165
75	80	-	94	73	75	60	162	19	126	282	279	166
76	77	-	96	72	76	61	165	20	138	293	284	170
77	76	-	96	72	76	60	167	21	146	300	290	171
78	76	-	100	72	76	61	167	21	152	307	292	174
79	72	-	94	71	79	61	174	22	160	316	298	175
80	80	-	99	70	80	61	183	23	181	333	307	185

Time	Chan 10	-	Chan 12	Chan 13	Chan 14	Chan 15	Chan 25	Chan 26	Chan 27	Chan 28	Chan 29	Chan 30
min	°C	-	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
81	81	-	99	74	78	62	196	26	194	353	318	184
82	83	-	103	76	82	60	213	31	201	378	331	185
83	84	-	97	78	83	60	236	33	214	407	347	186
84	84	-	96	79	84	61	269	36	225	434	368	195
85	91	-	113	77	84	64	297	38	255	459	389	200
86	94	-	108	80	86	64	327	38	279	482	409	203
87	98	-	107	82	87	61	357	40	302	508	432	210
88	98	-	104	83	91	60	379	43	324	525	451	220
89	97	-	104	88	92	61	394	45	344	538	465	230
90	102	-	112	88	94	65	408	47	361	551	477	245
91	111	-	108	95	95	68	412	67	371	563	486	252
92	103	-	120	92	98	71	415	93	384	575	494	267
93	102	-	123	94	101	73	410	119	405	581	500	284
94	107	-	120	96	101	74	410	126	428	589	507	308
95	109	-	121	95	104	72	408	152	450	597	511	334
96	111	-	118	94	104	71	406	164	472	603	515	366
97	117	-	125	98	106	68	401	182	480	610	521	391
98	119	-	126	101	109	74	398	148	491	617	527	413
99	116	-	120	100	114	73	410	164	501	625	535	434
100	118	-	126	100	117	71	418	194	511	630	542	458
101	123	-	127	104	122	75	426	202	521	274	549	474
102	121	-	127	104	128	75	439	224	529	411	564	480
103	131	-	131	111	131	75	455	231	542	559	582	489
104	137	-	131	118	139	75	468	231	556	560	600	497
105	145	-	133	130	151	77	484	255	570	678	611	513
106	156	-	144	136	155	77	502	262	578	688	619	517
107	155	-	148	142	164	77	513	266	584	693	624	517
108	171	-	136	149	183	77	522	267	595	701	628	517
109	198	-	143	163	211	78	524	266	603	708	635	520
110	223	-	147	172	251	80	532	281	611	697	648	520
111	262	-	156	189	301	83	547	338	616	713	654	528
112	321	-	161	210	414	88	566	553	625	729	671	535
113	355	-	160	222	477	89	579	787	634	736	681	543
114	367	-	178	247	490	95	635	-	641	744	686	548
115	413	-	199	313	509	104	677	-	651	768	694	559
116	425	-	216	403	515	109	722	-	659	779	696	557
117	590	-	558	534	548	269	772	-	673	791	709	565
118	475	-	492	444	497	366	785	-	693	814	746	575
119	457	-	486	425	462	395	827	-	724	832	790	596
120	477	-	490	421	452	406	767	-	701	771	760	560
121	472	-	494	421	447	413	704	-	641	698	690	512

Time	Chan 10	-	Chan 12	Chan 13	Chan 14	Chan 15	Chan 25	-	Chan 27	Chan 28	Chan 29	Chan 30
min	°C	-	°C	°C	°C	°C	°C	-	°C	°C	°C	°C
122	484	-	502	425	444	416	653	-	598	637	632	484
123	479	-	497	437	438	418	621	-	565	593	593	467
124	467	-	481	436	420	413	600	-	544	563	567	454
125	456	-	469	430	406	405	587	-	528	541	549	442
126	447	-	461	425	397	399	581	-	517	526	536	435
127	438	-	454	419	389	393	561	-	510	510	527	426
128	438	-	450	424	384	392	546	-	505	515	522	354
129	440	-	451	430	384	398	538	-	499	510	517	345
130	439	-	449	431	382	400	533	-	493	505	513	337
131	437	-	447	431	383	399	527	-	488	501	509	330
132	437	-	445	430	382	399	524	-	485	448	508	325