



CONFIDENTIAL

Report: Chilt/RF10169

A fire resistance test performed on nine duct penetration sealing systems within flexible supporting constructions

Test conducted in accordance with EN 1366-3: 2009

Test date: 2nd November 2010

Page 1 of 25



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1 Introduction

Twelve ducts and sealing systems were installed into a 132mm thick flexible supporting construction, of which six only are subject to this report, and nine ducts and sealing systems were installed into a 208mm thick flexible supporting construction, of which five only are subject to this report.

2 Specimen verification

The specimens were delivered to Chiltern International Fire Ltd (CIFL) during November 2010. CIFL constructed a 132mm thick steel stud/plasterboard clad partition and a 208mm thick steel stud/plasterboard partition. CIFL then subsequently installed the systems into the supporting constructions, under instruction from the client.

3 Description of supporting construction

The supporting construction comprised of a 1.5m wide x 3m high x 132mm thick steel stud/plasterboard clad partition, and a 1.5m wide x 3m high x 208mm steel stud/plasterboard clad partition, built in accordance with EN1366-3, into a refractory lined steel restraint frame.

The 132mm thick partition framing comprised of 70mm wide galvanised steel 'C' section studs, at nominally 600mm centres, and 72mm wide galvanised steel 'U' channel head and base track, with 60mm thick, 100kg/m³ mineral wool insulation friction fitted between the studs, and clad on both faces with 2 layers of 15mm thick British Gypsum Fireline plasterboard. The supporting construction was fixed on the horizontal edges only, the vertical edges remained free.

The 208mm thick partition framing consisted of 146mm wide galvanised steel 'C' section studs, at nominally 600mm centres, and 148mm wide galvanised steel 'U' channel head and base track, with 140mm thick, 100kg/m² mineral wool insulation friction fitted between the studs, and clad on both faces with 2 layers of 15mm thick British Gypsum Fireline plasterboard. The supporting construction was fixed on the horizontal edges only, the vertical edges remained free.

4 Description of specimen

Details of the specimens are shown in Appendix 1. All measurements are in mm and the descriptions are written viewing the specimens from the unexposed face unless stated otherwise.

All ducts were manufactured from VEKA Rigid Pvc and measured 1200mm long with 500mm protruding from the exposed face and were fitted with a 90° bend on the unexposed face only.

The mineral wool insulation fitted inside the partition was removed for 100mm surrounding each duct cut out aperture.

Each duct fitted through the 208mm thick partition utilised a Verplas Telescopic Fire Stop Kit, comprising two galvanised metal sleeves (an inner and outer sleeve) to form the telescopic assembly, and a Verplas Firewrap intumescent band fitted centrally in the partition aperture, within the telescopic assembly.

Each duct fitted through the 132mm thick partition utilised a Verplas, galvanised metal sleeve (inner only), and a Verplas Firewrap intumescent band fitted centrally in the partition aperture, within the metal sleeve.

4.1 Ducts fitted through 208mm thick partition (see figures 1 and 3)

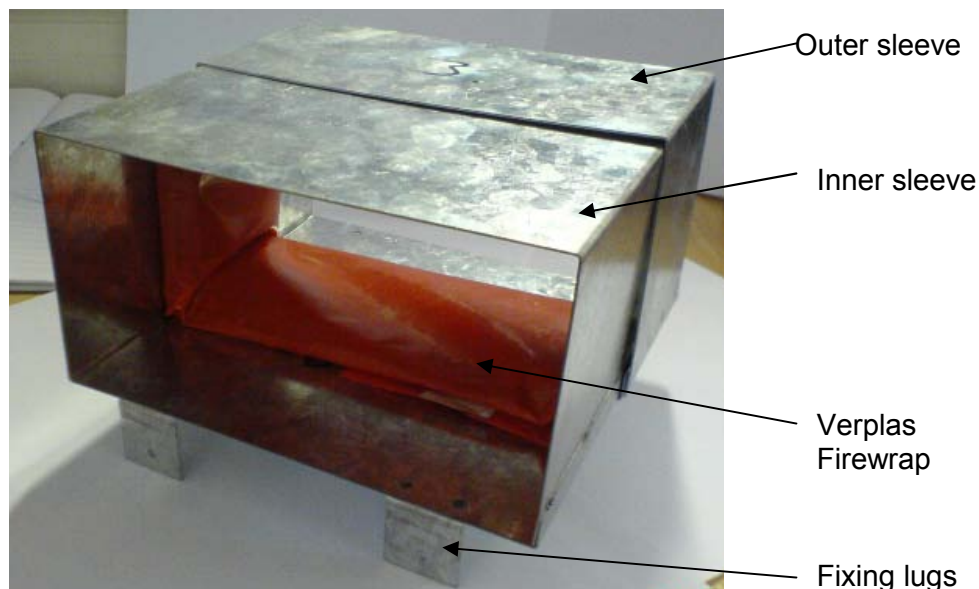
Specimen No	Duct system reference	Duct material / reference	Duct size (nominal)	Duct wall thickness (nominal)	Cut out aperture size
A	System 100 rectangular	PVC	110mm x 54mm	1.5-1.7mm	126mm x 72mm
B	System 125 rectangular	PVC	150mm x 70mm	1.5-1.7mm	174mm x 94mm
C	System 204 rectangular	PVC	204mm x 60mm	1.5-1.7mm	234mm x 84mm
D	System 255 rectangular	PVC	233mm x 29mm	1.8-2mm	248mm x 46mm
E	System 300 rectangular	PVC	310mm x 29mm	1.8-2mm	326mm x 46mm

4.2 Ducts fitted through 132mm thick partition (see figures 1 and 4)

Specimen No	Duct system reference	Duct material / reference	Duct size (nominal)	Duct wall thickness (nominal)	Cut out aperture size
F	System 100 rectangular	PVC	110mm x 54mm	1.5-1.7mm	126mm x 72mm
G	System 125 rectangular	PVC	150mm x 70mm	1.5-1.7mm	174mm x 94mm
H	System 150 rectangular	PVC	180mm x 95mm	1.5-1.7mm	204mm x 116mm
I	System 204 rectangular	PVC	204mm x 60mm	1.5-1.7mm	234mm x 84mm
J	System 255 rectangular	PVC	233mm x 29mm	1.8-2mm	248mm x 46mm
K	System 300 rectangular	PVC	310mm x 29mm	1.8-2mm	326mm x 46mm

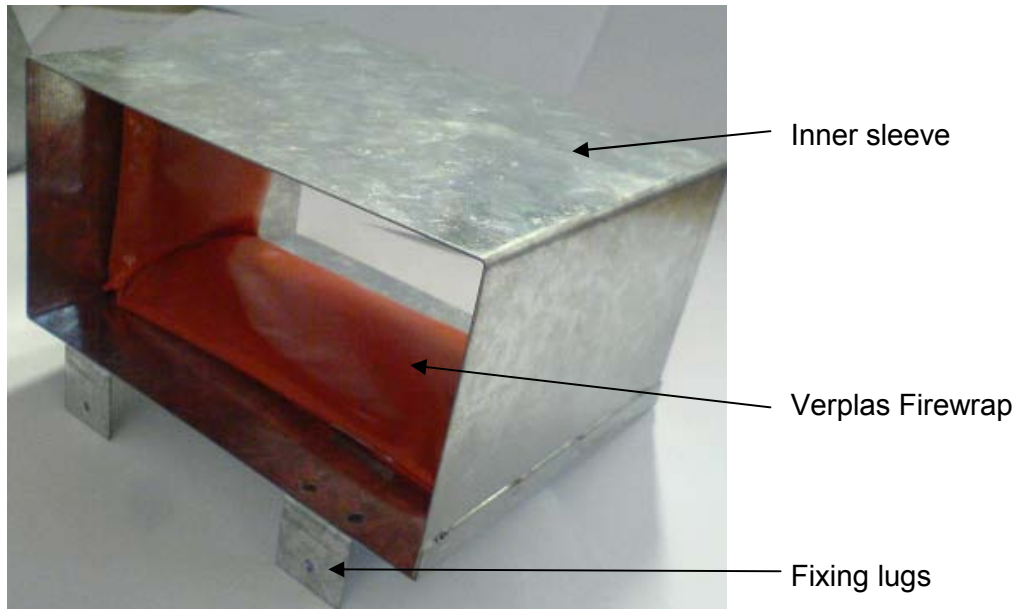
4.3 Duct seal specifications

Each duct fitted through the 208mm thick partition utilised a Verplas Telescopic Fire Stop Kit, comprising two galvanised metal sleeves (an inner and outer sleeve) to form the telescopic assembly, and a Verplas Firewrap intumescent band fitted centrally in the partition thickness, within the telescopic assembly. The metal sleeves were fixed to the plasterboard on both faces through two fixing lugs along the bottom edge of the sleeve, with 42mm long Drywall screws and sealed to the plasterboard on both faces with a 5mm wide fillet of mastic.



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Each duct fitted through the 132mm thick partition utilised a Verplas, galvanised metal sleeve (inner only), and a Verplas Firewrap intumescent band fitted centrally in the partition thickness, within the metal sleeve. The metal sleeve was fixed to the plasterboard through two fixing lugs along the bottom edge of the sleeve to the exposed face plasterboard, with 42mm long Drywall screws and sealed to the plasterboard on both faces with a 5mm wide fillet of mastic.



208mm thick partition

Specimen No	Telescopic Fire Stop Kit Reference	Fire sealing product	Fire wrap dimensions	Inner sleeve reference	Outer sleeve reference
A	FSK110X54	Firewrap FW110X54	70mm wide x 4mm thick	FWS110X54 X141	FWS110X54 X91
B	FSK150X70	Firewrap FW150X70	70mm wide x 8mm thick	FWS150X70 X141	FWS150X70 X91
C	FSK204X60	Firewrap FW204X60	70mm wide x 8mm thick	FWS204X60 X141	FWS204X60 X91
D	FSK225X25	Firewrap FW225X25	70mm wide x 4mm thick	FWS225X25 X141	FWS225X25 X91
E	FSK300X25	Firewrap FW300X25	70mm wide x 4mm thick	FWS300X25 X141	FWS300X25 X91

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132mm thick partition

Specimen No	Fire sealing product	Fire wrap dimensions	Galvanised sleeve reference
F	Firewrap FW110X54	70mm wide x 4mm thick	FWS110X54X141
G	Firewrap FW150X70	70mm wide x 8mm thick	FWS150X70X141
H	Firewrap FW180X90	70mm wide x 8mm thick	FWS180X90X141
I	Firewrap FW204X60	70mm wide x 8mm thick	FWS204X60X141
J	Firewrap FW225X25	70mm wide x 4mm thick	FWS225X25X141
K	Firewrap FW300X25	70mm wide x 4mm thick	FWS300X25X141

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4.4 Service penetrations supports

(Read in conjunction with Figures 1 - 4 and photographs)

The service penetration support system consisted of Unistrut steel frame sections and associated attachments.

Unistrut frame section – Constructed-using 3mm thick profiled steel ‘u’ channel.

On the unexposed face, 3No 3000mm long lengths of double channel Unistrut frame section were used as vertical supports on the wall/partition (see photographs). The vertical supports were bolted to the restraint frame using Unistrut steel brackets and masonry anchors. 12No 500mm long Unistrut cantilever arm sections provided horizontal supports for 12No 3000mm horizontal lengths of Unistrut, supporting the ducts at 150mm and 450mm from the walls. All ducts were cable tied down to the supports at 450mm from the wall.

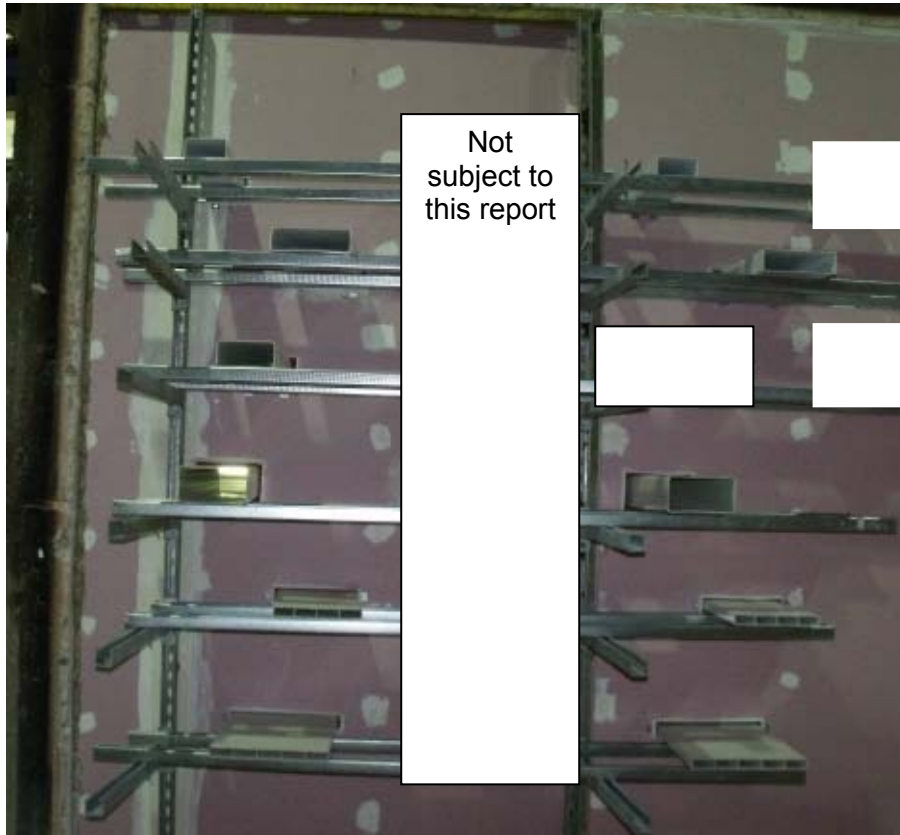
On the exposed face, 2No 3000mm were used as vertical supports on the partition. 12No 500mm long Unistrut cantilever arm sections provided support for 6No 3000mm horizontal lengths and 5No 2000mm lengths of Unistrut, supporting the ducts at 150mm and 450mm from the wall.

Unexposed face support system

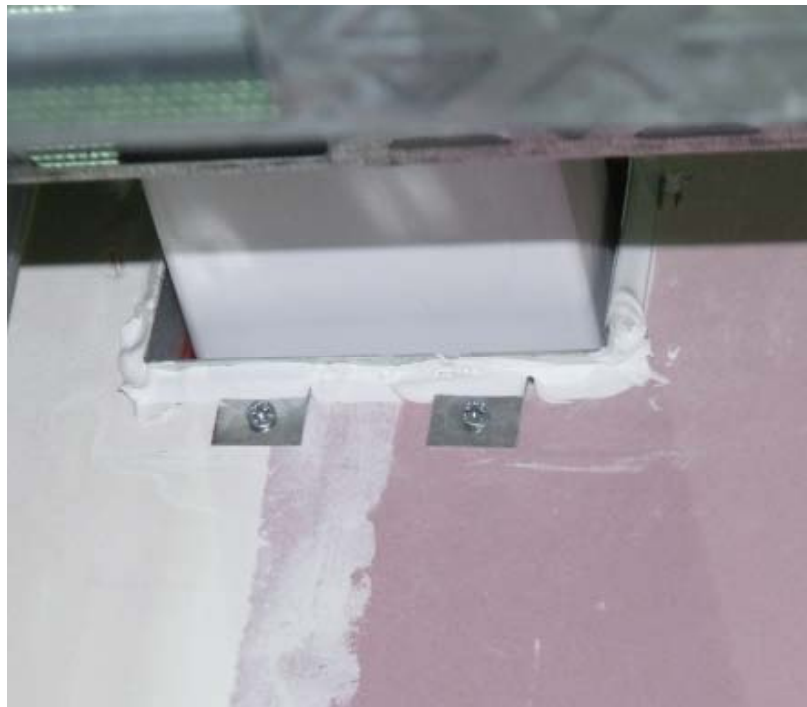


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Exposed face support system



Photograph showing fixing lugs screwed to plasterboard and mastic

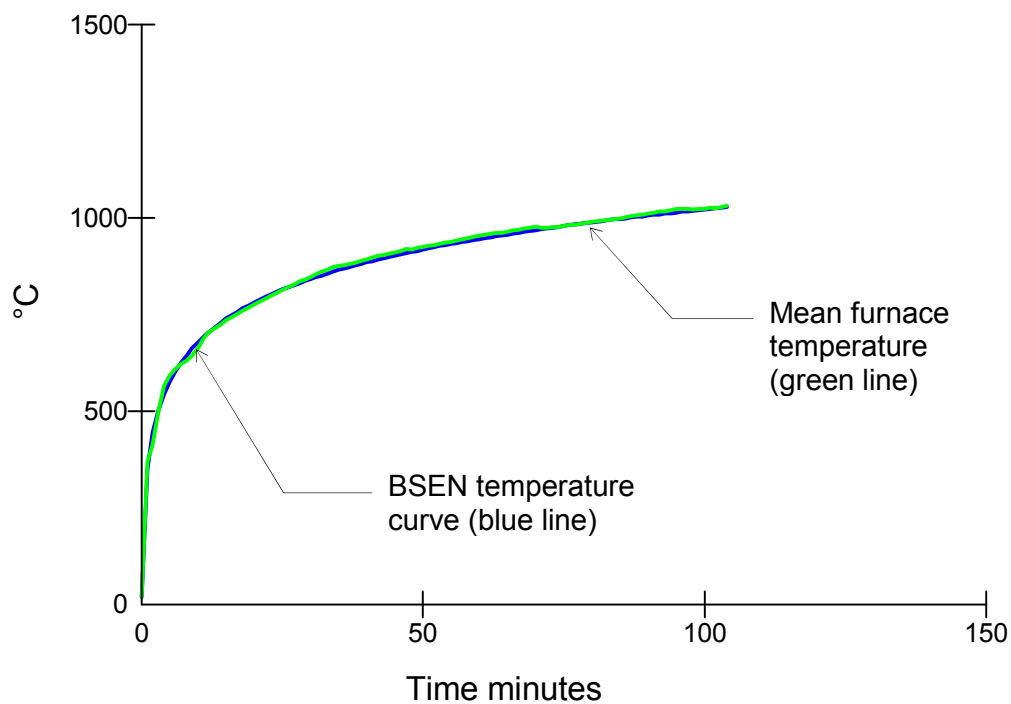


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5 Test conditions

5.1 Furnace temperature

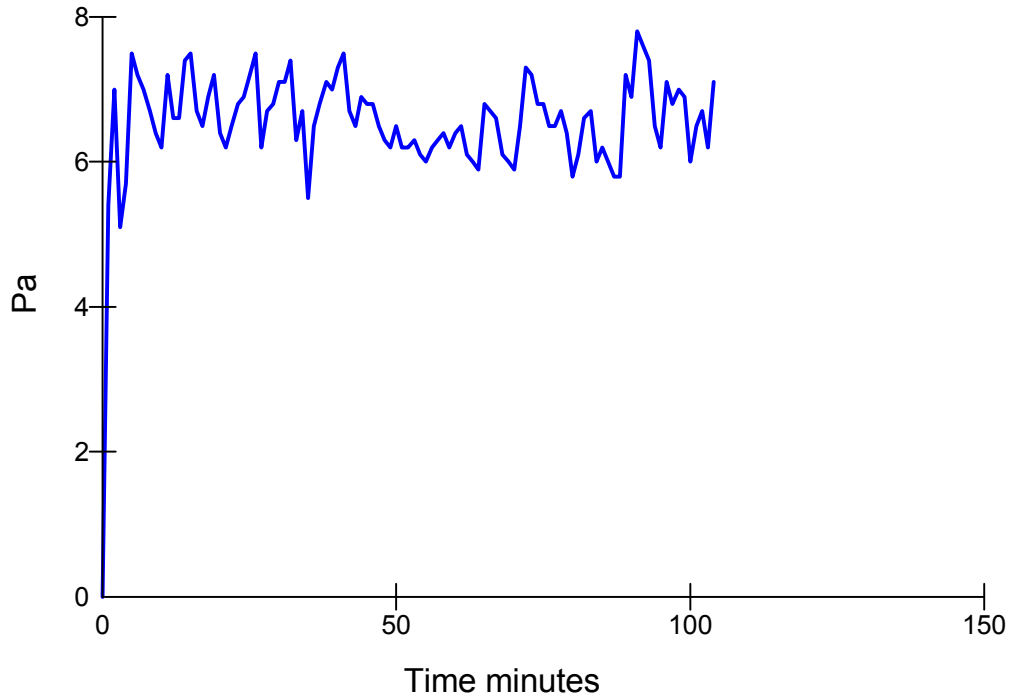
The furnace was controlled to follow the temperature/time relationship specified in BSEN 1363: Part 1: 1999 Section 5.1.1 as closely as possible, using the average of nine plate thermometers suitably distributed within the furnace. The temperatures recorded have been tabulated in Appendix 2 and are shown graphically below:



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5.2 Pressure readings

After the first 5 minutes of the test, the furnace pressure was maintained at 6.5 ± 5 Pa and after 10 minutes was maintained at 6.5 ± 3 Pa with respect to atmosphere, at a point 0.5m from the notional floor level. Therefore equating to 9.5 Pa at the base of ducts E and U. The pressure readings have been tabulated in Appendix 2 and are shown graphically below:



5.3 Ambient temperature

The ambient temperature of the test area at commencement of test was 16° C.

5.4 Thermocouple positions

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

Graphs of each service penetration can be found in Section 9.

The temperatures recorded have been tabulated in Appendix 2.

Duct penetration	Thermocouple number	Type (location)
-	1	Furnace
-	2	Furnace
-	3	Furnace
-	4	Furnace
-	5	Furnace
-	6	Furnace
-	7	Furnace
-	8	Furnace
-	9	Furnace
A	12	On partition 25mm from metal sleeve
A	13	On duct 25mm from metal sleeve
B	16	On partition 25mm from metal sleeve
B	17	On duct 25mm from metal sleeve
C	22	On partition 25mm from metal sleeve
C	23	On duct 25mm from metal sleeve
D	24	On partition 25mm from metal sleeve
D	25	On duct 25mm from metal sleeve
E	26	On partition 25mm from metal sleeve
E	27	On duct 25mm from metal sleeve
F	30	On partition 25mm from metal sleeve
F	31	On duct 25mm from metal sleeve
G	34	On partition 25mm from metal sleeve
G	35	On duct 25mm from metal sleeve
H	38	On partition 25mm from metal sleeve
H	39	On duct 25mm from metal sleeve
I	42	On partition 25mm from metal sleeve
I	43	On duct 25mm from metal sleeve
J	46	On partition 25mm from metal sleeve
J	47	On duct 25mm from metal sleeve
K	50	On partition 25mm from metal sleeve
K	51	On duct 25mm from metal sleeve
-	52	Laboratory ambient

6 Observations

All comments relate to the unexposed face unless otherwise specified, (reference to Appendix 1 - figure 1).

208mm thick partition wall containing duct penetration seals (A, B, C, D and E)

Time (minutes)	Duct	Comments
01.00	-	There is smoke issuing from all ducts.
01.30	A	The duct has collapsed.
15.00	All	All ducts have sealed.
34.00	All	There is discolouration at the top of the sleeves.
62.02	B	There is a glow visible across the top of the intumescent.
66.50	A	A cotton pad integrity test was performed at the top of the duct, no failure.
70.45	A	A cotton pad integrity test was performed at the top of the duct, no failure.
76.30	B	A cotton pad integrity test was performed at the top of the duct which resulted in ignition of the cotton pad thereby constituting integrity failure .
78.00	A	A cotton pad integrity test was performed at the top of the duct, no failure.
81.50	A	A cotton pad integrity test was performed at the top of the duct which resulted in ignition of the cotton pad thereby constituting integrity failure .
85.55	C	A cotton pad integrity test was performed at the top of the duct, no failure.
91.50	C	A cotton pad integrity test was performed at the top of the duct which resulted in ignition of the cotton pad thereby constituting integrity failure .
95.20	E	A cotton pad integrity test was performed at the top of the duct, no failure.
100.30	E	A cotton pad integrity test was performed at the top of the duct which resulted in ignition of the cotton pad thereby constituting integrity failure .
102.29	D	A cotton pad integrity test was performed at the top of the duct which resulted in ignition of the cotton pad thereby constituting integrity failure .
105.00	-	Test terminated

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132mm thick partition wall containing duct penetration seals (F, G, H, I, J and K)

00.43	All	There is smoke issuing from the end of all ducts.
08.55	F/G/H/I	The ducts have sealed off.
38.53		There is discolouration of the partition above the pipes due to smoke issuing.
61.05	G	There is a glow visible at the top of the duct
64.30	G	A cotton pad integrity test was performed at the glow visible at the top of the duct which resulted in ignition of the cotton pad thereby constituting further integrity failure .
67.27	I	There are glows visible around the duct perimeter.
74.08	H	There are glows visible around the duct perimeter.
77.41	F	There is a glow visible at the top of the duct
79.20	H	A cotton pad integrity test was performed at the glow visible which resulted in ignition of the cotton pad thereby constituting further integrity failure .
86.40	F	There is continuous flaming at the top of the duct thereby constituting integrity failure .
88.30	I	A cotton pad integrity test was performed at the glow visible, no failure.
91.00	I	A cotton pad integrity test was performed at the glow visible, no failure.
92.57	J	There is a glow visible at the top of the duct.
93.57	I	A cotton pad integrity test was performed, no failure.
95.00	K	There is a glow visible at the top of the duct.
96.00	K	There is continuous flaming at the left corner thereby constituting integrity failure .
97.30	I	A cotton pad integrity test was performed at the top of the duct, no failure.
98.48	I	A cotton pad integrity test was performed at the top of the duct, no failure.
101.53	J	A cotton pad integrity test was performed on the left side of the duct, no failure.
103.18	J	There is continuous flaming at the right side of the duct thereby constituting integrity failure .



- 103.48 J A cotton pad integrity test was performed at the left side of the duct which resulted in ignition of the cotton pad thereby constituting further **integrity failure.**
- 105.00 - Test terminated

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7 Expression of results

208mm thick partition wall

Duct penetration seal	Integrity			Insulation
	Cotton pad	Gap gauge	Continuous flaming	
A	81 (eighty one) minutes	*81 (eighty one) minutes	*81 (eighty one) minutes	81 (eighty one) minutes
B	76 (seventy six) minutes	*76 (seventy six) minutes	*76 (seventy six) minutes	72 (seventy two) minutes
C	91 (ninety one) minutes	*91 (ninety one) minutes	*91 (ninety one) minutes	3 (three) minutes
D	102 (one hundred and two) minutes	*102 (one hundred and two) minutes	*102 (one hundred and two) minutes	101 (one hundred and one) minutes
E	100 (one hundred) minutes	*100 (one hundred) minutes	*100 (one hundred) minutes	92 (ninety two) minutes

132mm thick partition wall

Duct penetration seal	Integrity			Insulation
	Cotton pad	Gap gauge	Continuous flaming	
F	*86 (eighty six) minutes	*86 (eighty six) minutes	86 (eighty six) minutes	*86 (eighty six) minutes
G	64 (sixty four) minutes	*64 (sixty four) minutes	*64 (sixty four) minutes	54 (fifty four) minutes
H	79 (seventy nine) minutes	*79 (seventy nine) minutes	*79 (seventy nine) minutes	74 (seventy four) minutes
I	**105 (one hundred and five) minutes	**105 (one hundred and five) minutes	**105 (one hundred and five) minutes	77 (seventy seven) minutes
J	103 (one hundred and three) minutes	*103 (one hundred and three) minutes	*103 (one hundred and three) minutes	95 (ninety five) minutes
K	*96 (ninety six) minutes	*96 (ninety six) minutes	96 (ninety six) minutes	*96 (ninety six) minutes

* Failure criteria was not achieved prior to initial failure



** Failure criteria was not achieved upon termination of the test at 105 minutes

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8 Limitations

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.

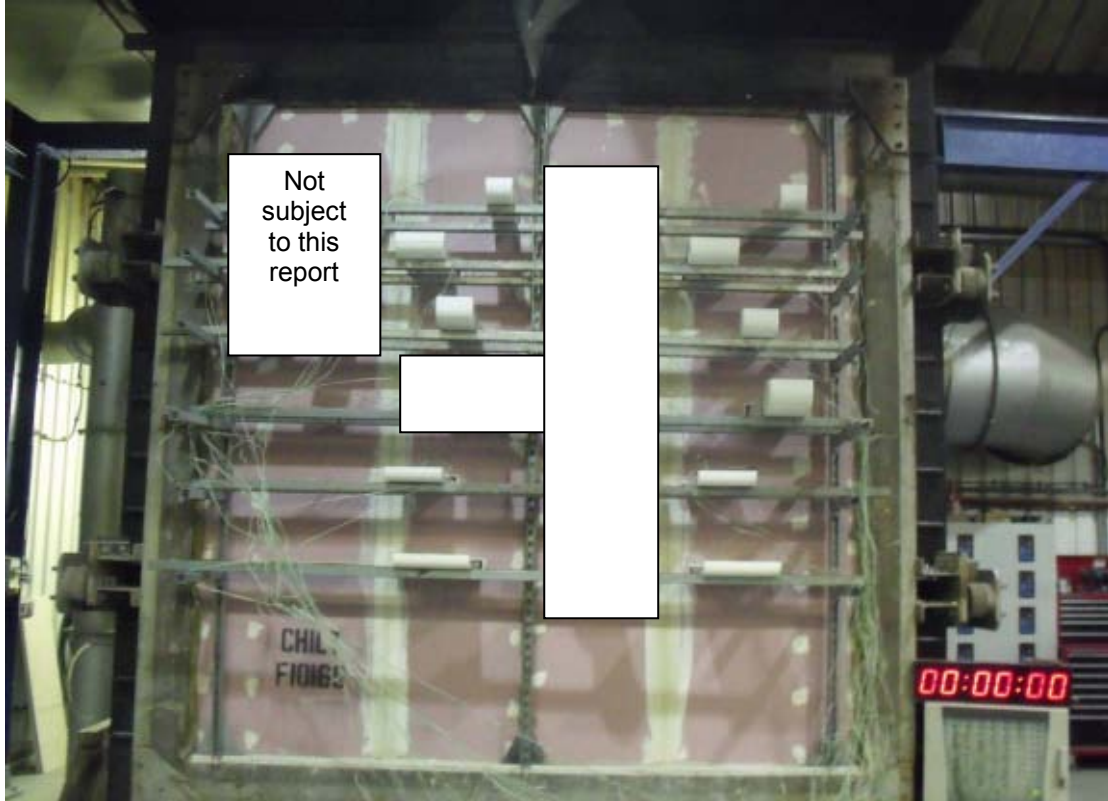
The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. CIFL will be able 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.

Signature:		
Name:	Ross Newman	Vincent Kerrigan
Title:	Principal Test Engineer	Technical Manager
Date of issue:		07-01-2011

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Photograph

Unexposed face at start of test



After 46 minutes

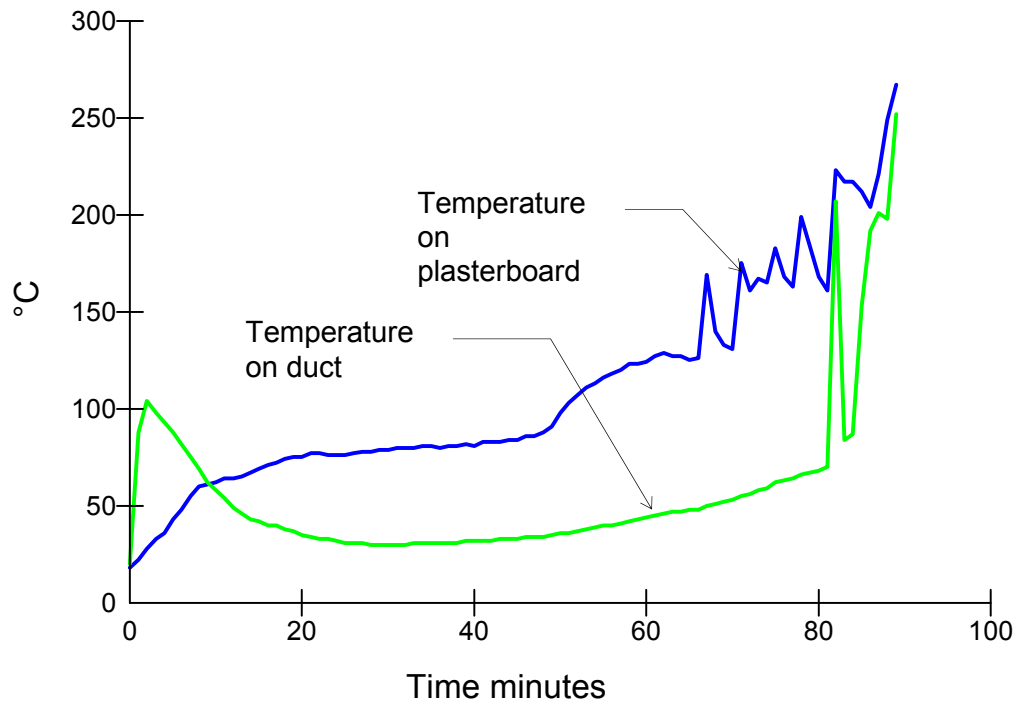


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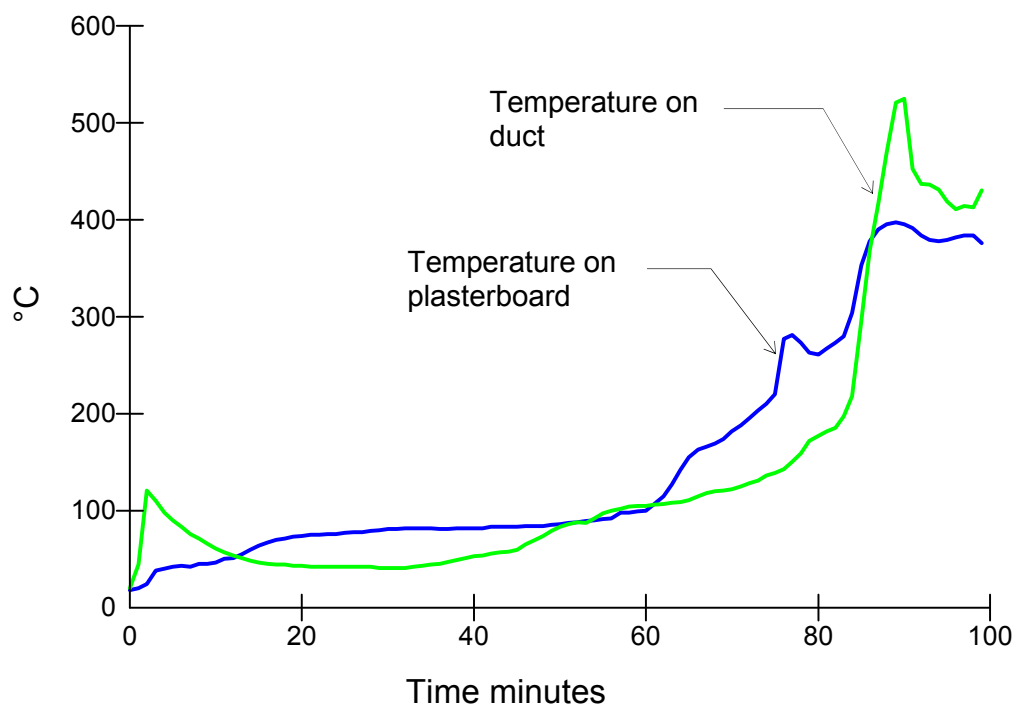
9 Graphs

Duct penetrations through masonry wall

Duct A

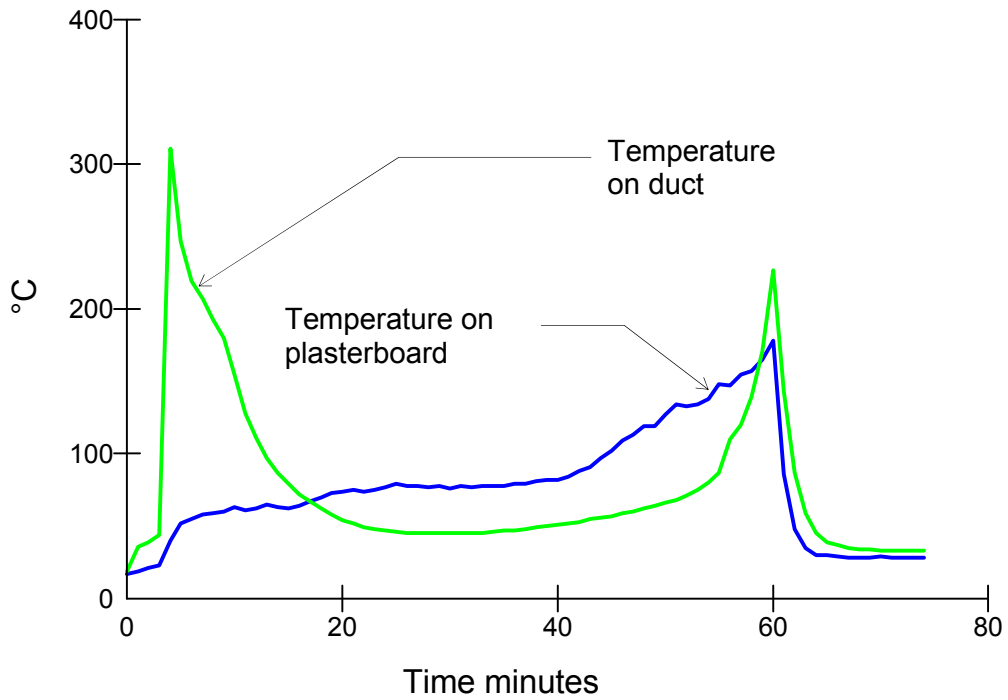


Duct B

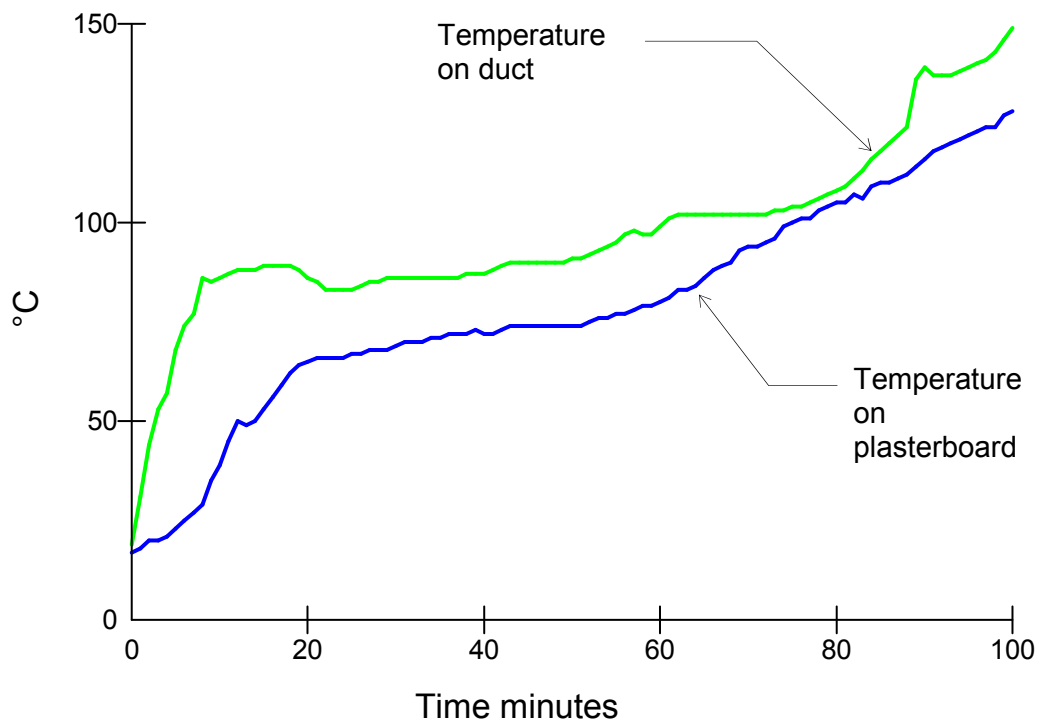


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Duct C

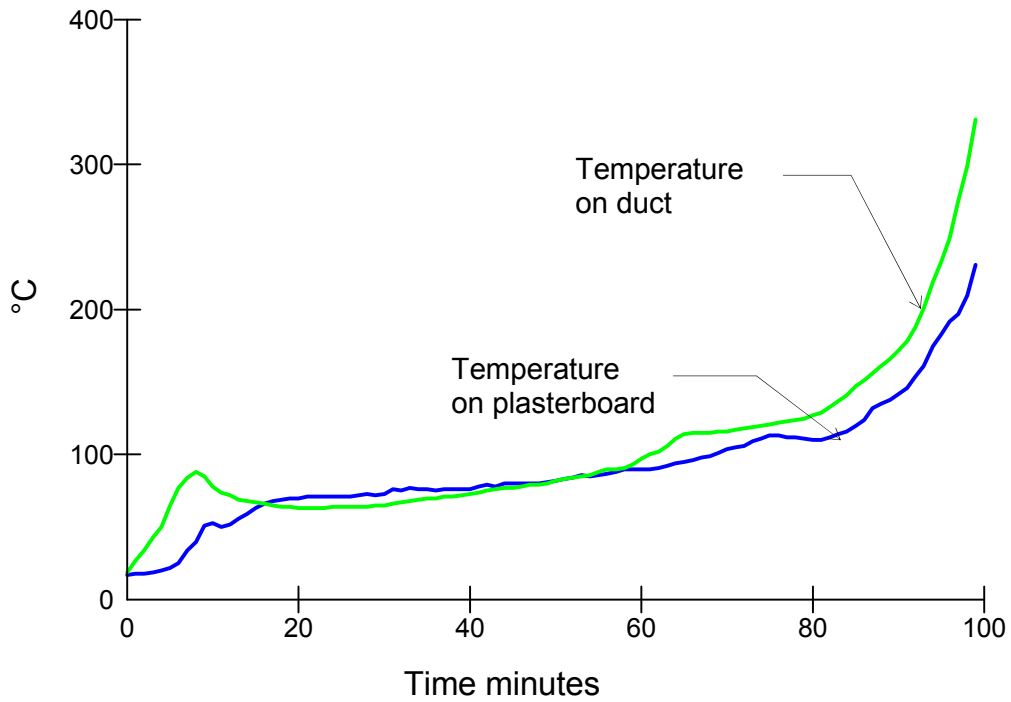


Duct D

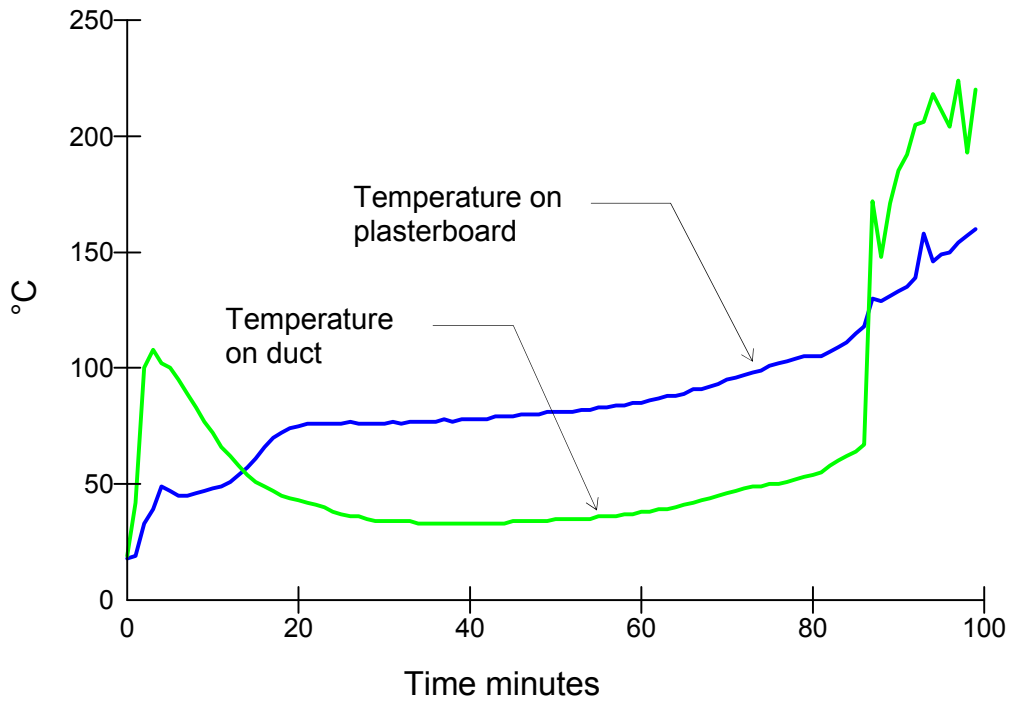


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Duct E

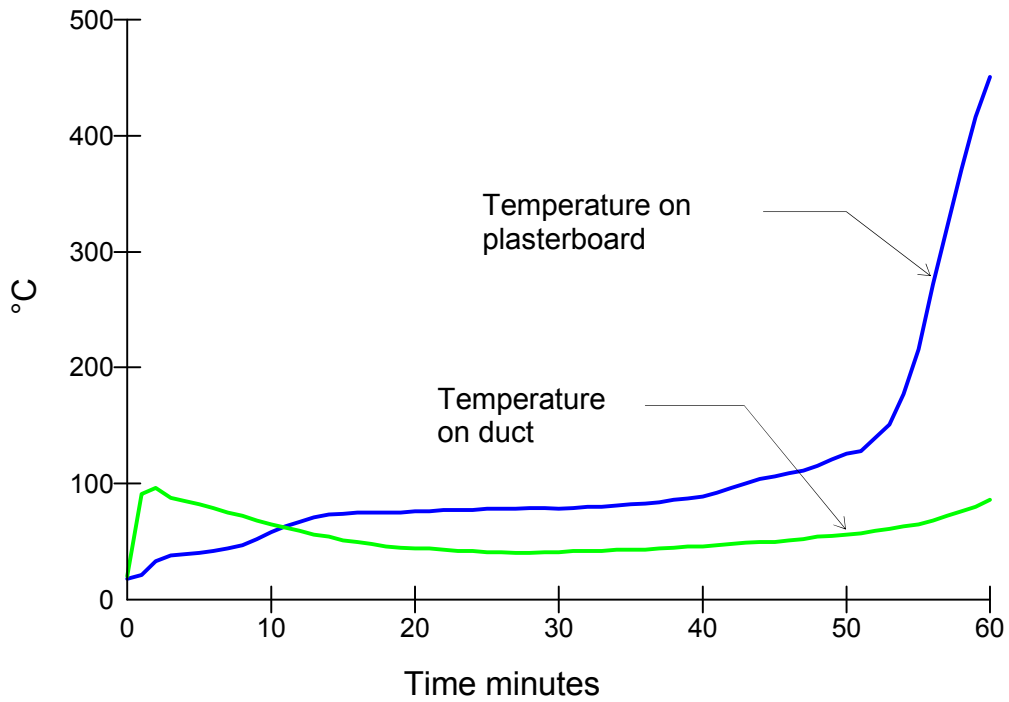


Duct F

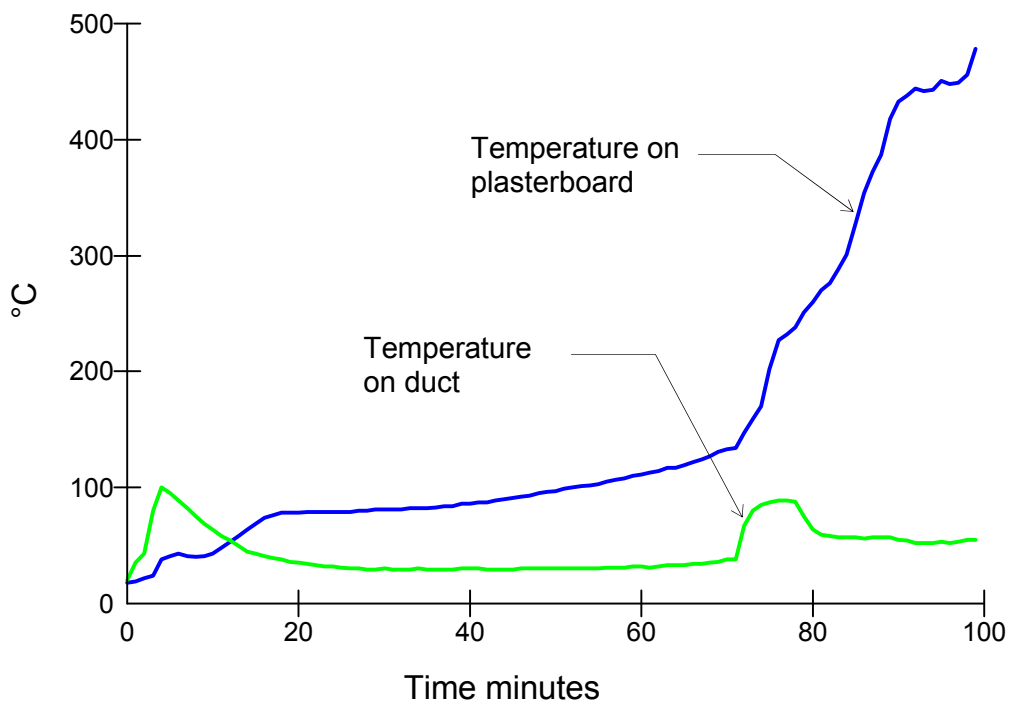


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Duct G

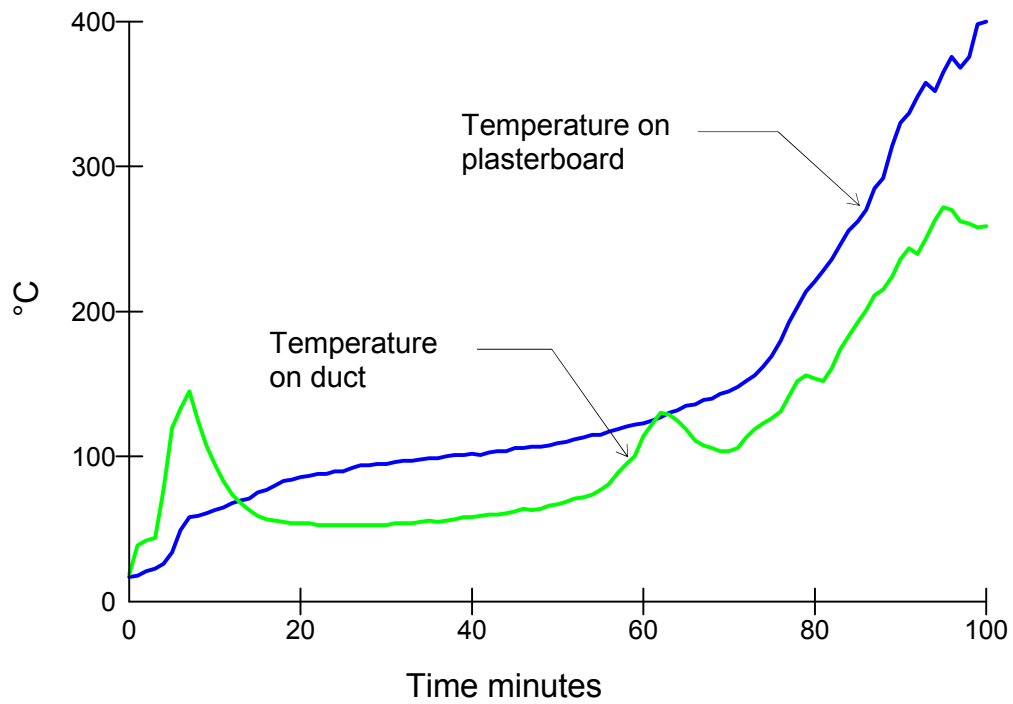


Duct H

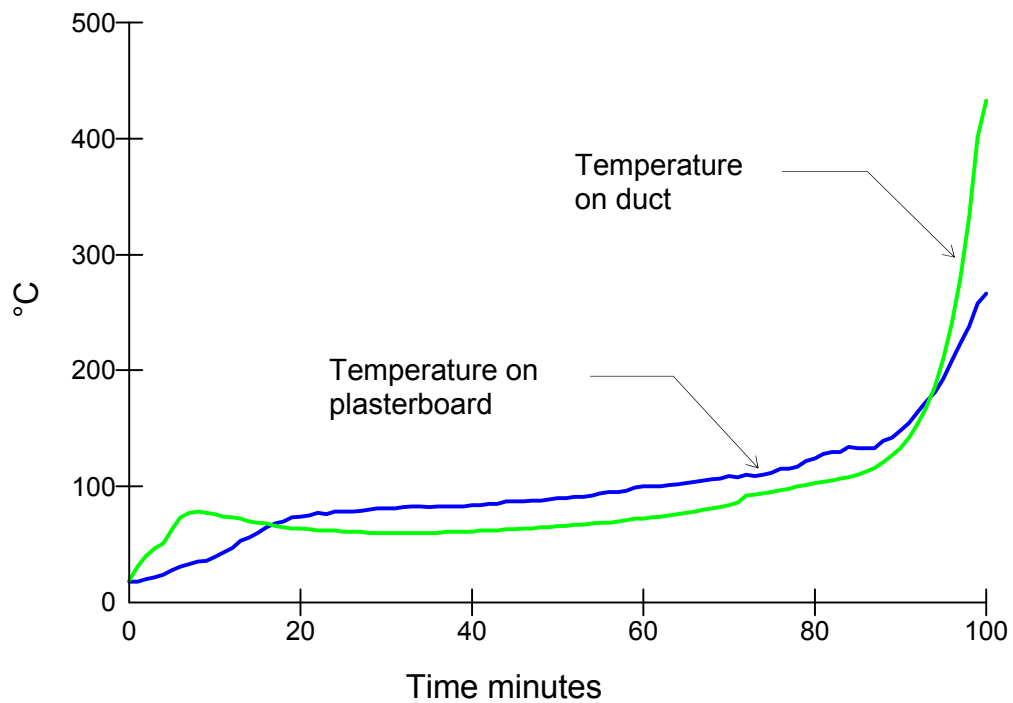


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Duct I

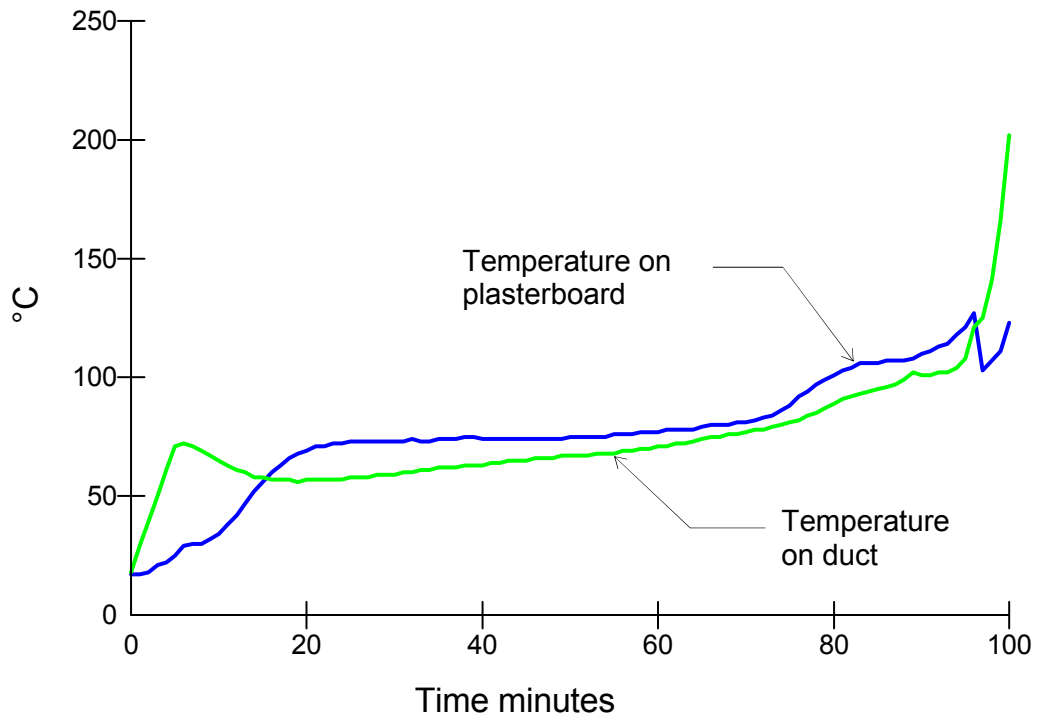


Duct J



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Duct K

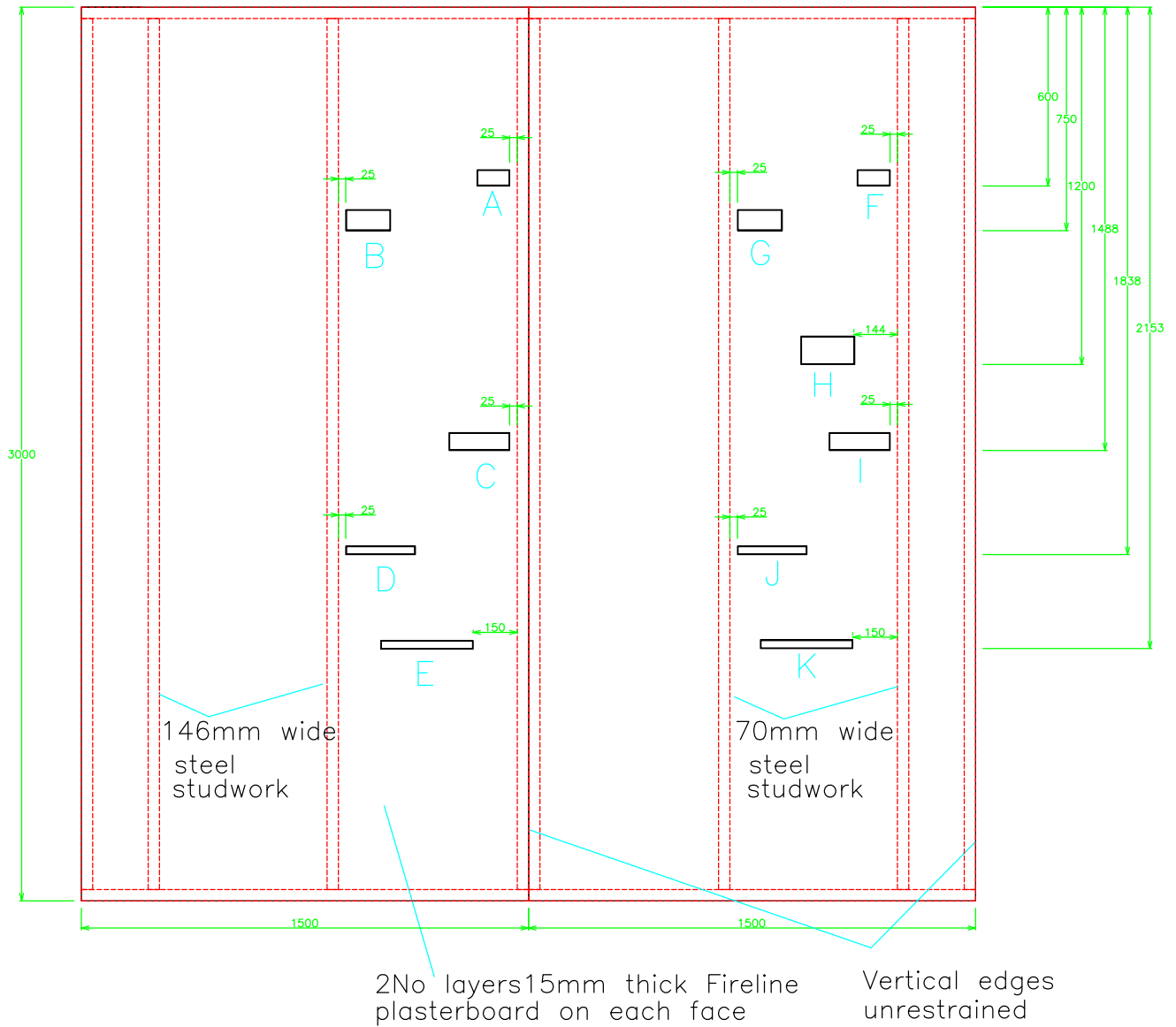


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Appendix 1 – figures 1 – 5

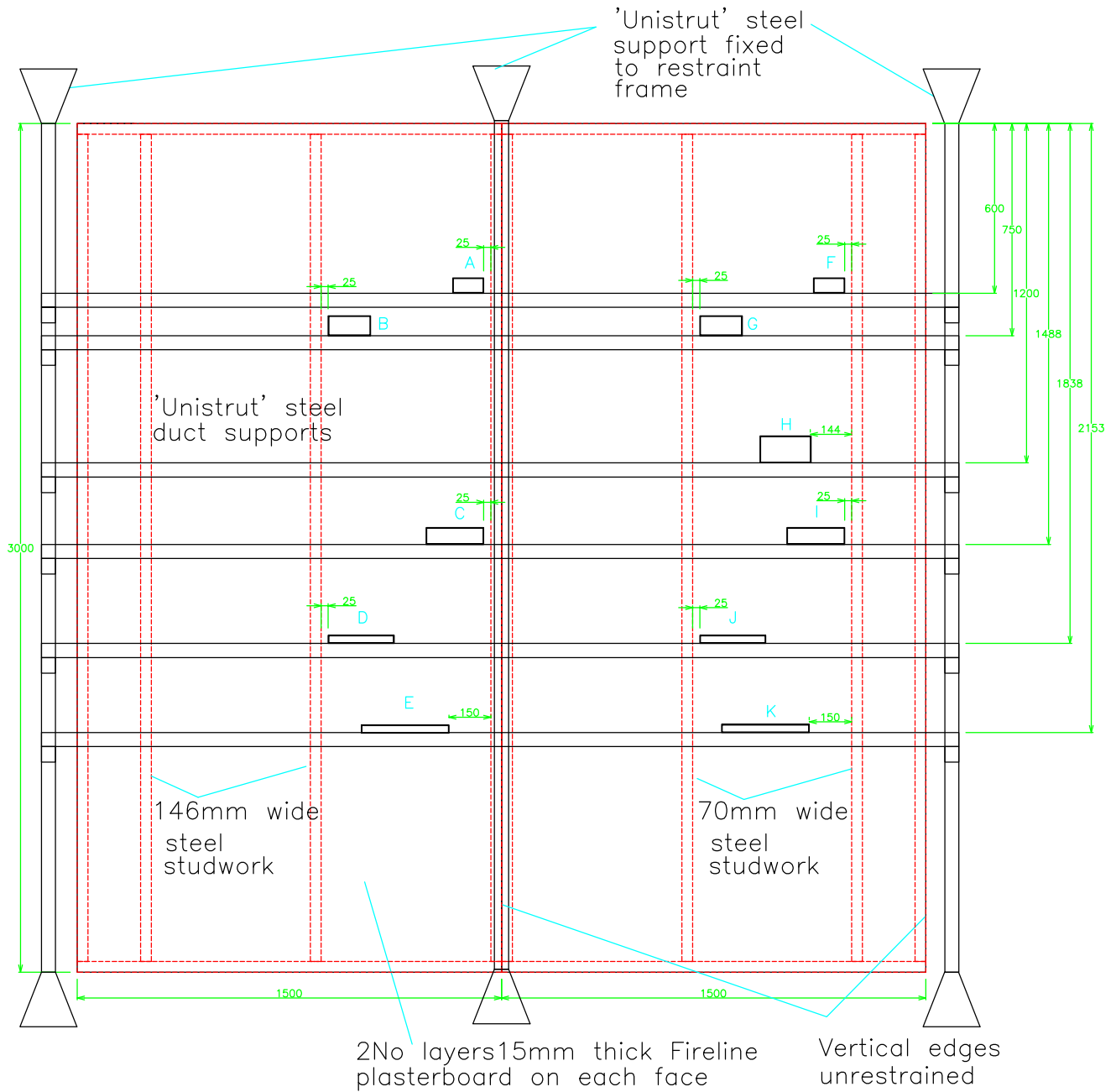
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Title
 Unexposed face front elevation
 showing studwork and duct positions
 (All dimensions in mm)

Date Drawn 24/11/10	Drawn By ARD	Scale NTS
Project No. Chilt/RF10169		Appendix 1

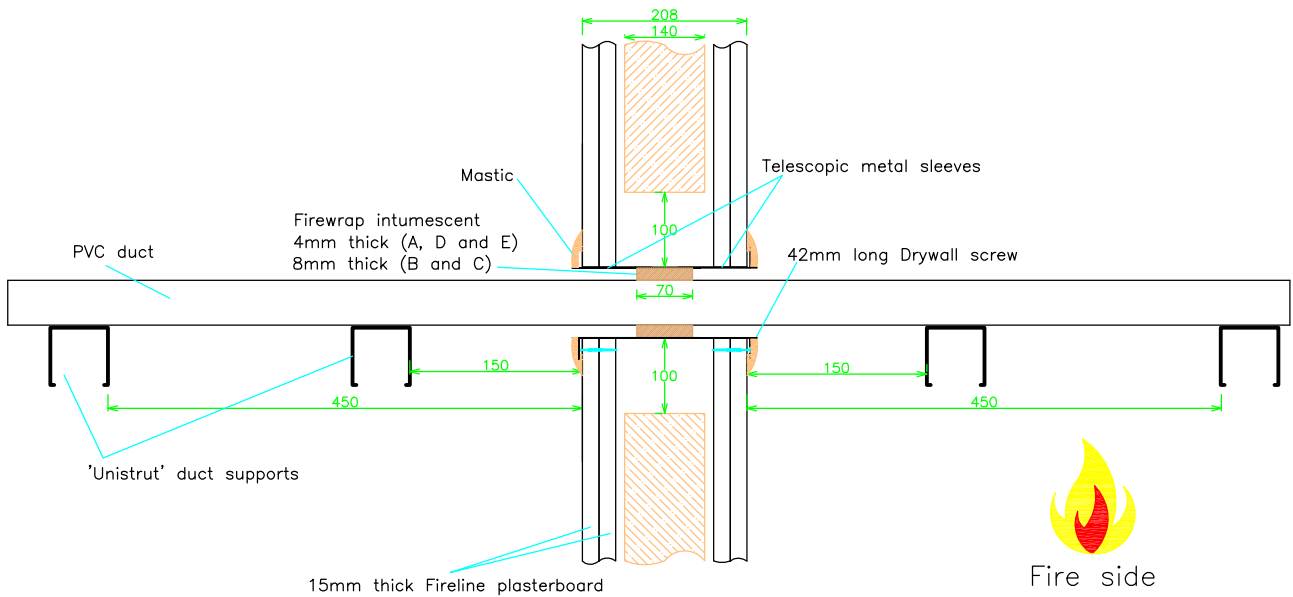


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Title
 Unexposed face front elevation
 showing studwork and pipe supports
 (All dimensions in mm)

Date Drawn 24/11/10	Drawn By ARD	Scale NTS
Project No. Chilt/RF10169		Appendix 1

Duct sealing systems A, B, C, D and E fitted through 208mm thick partition



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Title

Cross section of duct seals through 208mm thick partition

Date Drawn

25/11/10

Drawn By

ARD

Scale

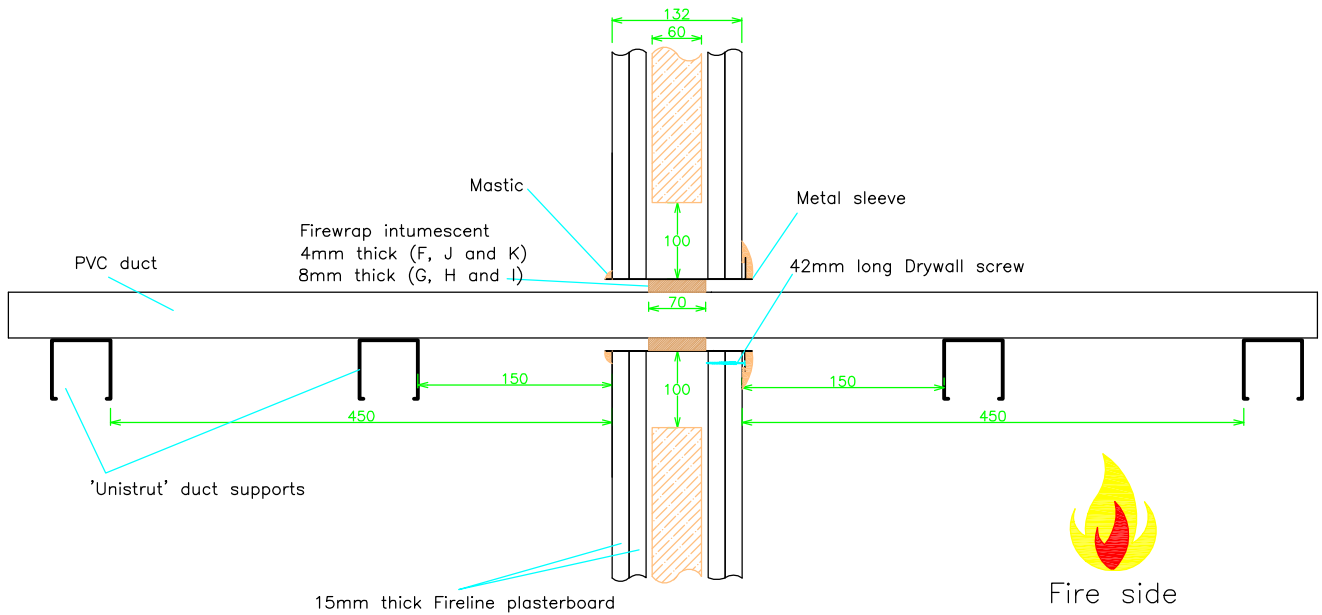
NTS

Project No.

Chilt/RF10169

Appendix 1

Duct sealing systems F, G, H, I
J and K fitted through 132mm
thick partition



Chiltern House, Stocking Lane, Hughenden Valley
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Title

Cross section of duct seals
through 132mm thick partition

Date Drawn

24/11/10

Drawn By

ARD

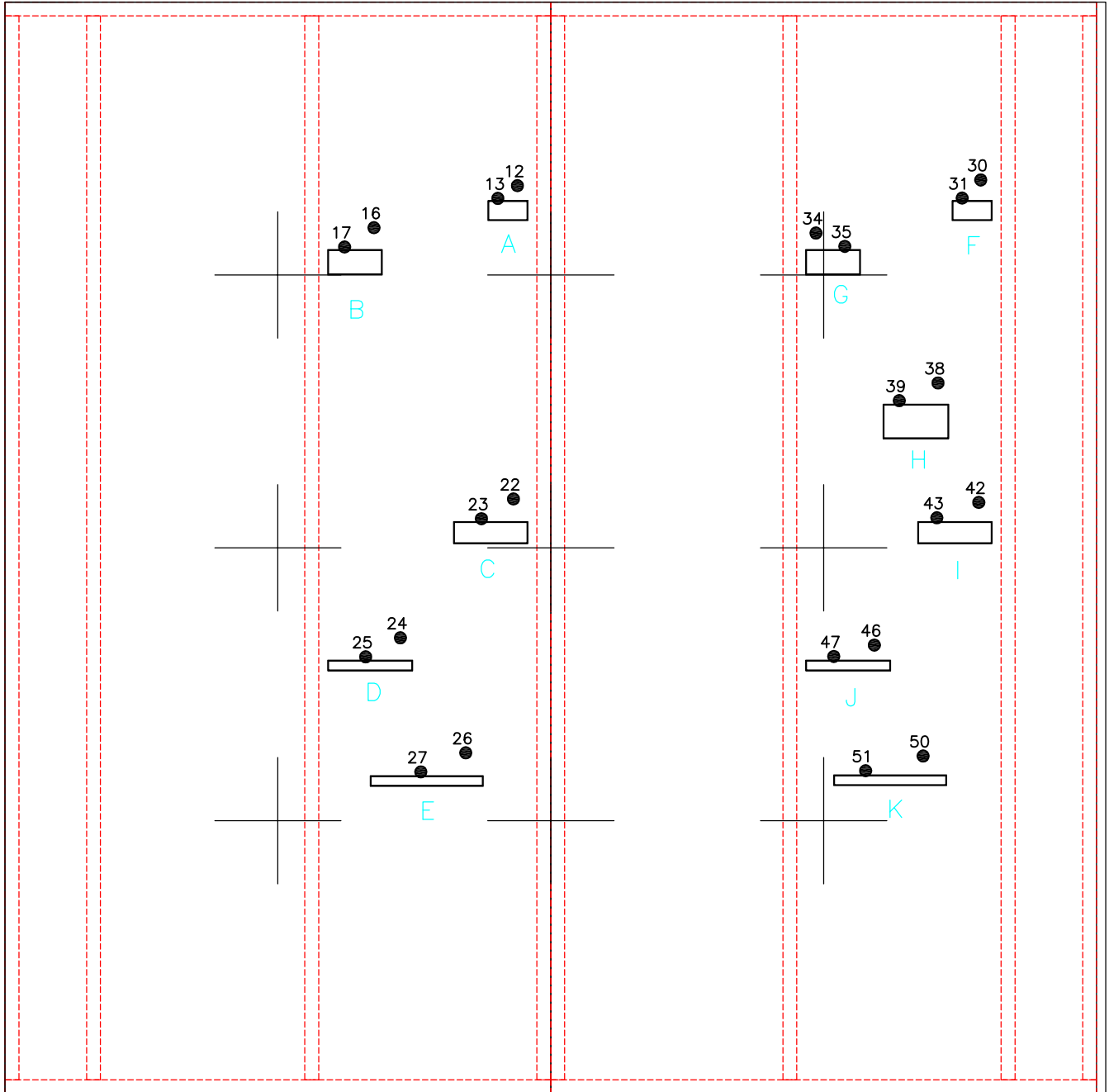
Scale

NTS

Project No.

Chilt/RF10169

Appendix 1



+ : Furnace Thermocouples
 • : Unexposed Face Thermocouples

Viewed From Unexposed Face



Chiltern House, Stocking Lane, Hughenden Valley
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 Tel: +44 (0)1494 569800 Fax: +44 (0)1494 564895

Title Thermocouple positions

(All dimensions in mm)

Date Drawn 24/11/10	Drawn By ARD	Scale NTS
Project No. Chilt/RF10169		Appendix 1



Appendix 2 - raw test data (9 pages)

(see figure 4 of appendix 1 for channel locations)

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8	Chan 9	Chan 12	Chan 13	Chan 16	Chan 17	Chan 22	Chan 23	Chan 24	Chan 25
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	0	21	22	22	22	22	22	23	23	23	18	20	18	20	17	19	17	19
1	5.4	331	282	270	377	273	440	467	464	417	22	88	20	44	19	36	18	31
2	7	382	324	315	459	369	427	505	462	476	28	104	24	121	21	39	20	44
3	5.1	458	410	393	541	479	485	592	570	567	33	98	38	110	23	44	20	53
4	5.7	518	498	462	613	556	545	639	623	635	36	93	40	98	40	311	21	57
5	7.5	544	533	497	643	592	572	663	641	651	43	88	42	90	52	247	23	68
6	7.2	562	557	519	662	612	588	670	657	661	48	82	43	83	55	219	25	74
7	7	578	572	540	673	630	603	678	666	664	55	75	42	76	58	207	27	77
8	6.7	595	589	553	679	643	613	679	674	662	60	69	45	71	59	193	29	86
9	6.4	611	607	574	684	654	630	684	685	668	61	62	45	66	60	180	35	85
10	6.2	633	640	603	702	670	650	694	702	677	62	58	46	61	63	155	39	86
11	7.2	665	677	630	721	697	680	717	725	693	64	54	50	57	61	128	45	87
12	6.6	681	694	647	733	712	696	732	737	705	64	49	51	54	62	111	50	88
13	6.6	691	707	664	741	722	708	741	750	713	65	46	55	51	65	97	49	88
14	7.4	706	719	674	750	732	717	750	757	720	67	43	60	48	63	87	50	88
15	7.5	715	730	689	760	740	729	763	765	727	69	42	64	46	62	79	53	89
16	6.7	725	739	701	767	748	737	771	773	735	71	40	67	45	64	72	56	89
17	6.5	734	748	713	774	757	746	780	780	744	72	40	70	44	67	67	59	89
18	6.9	744	757	720	781	767	755	785	788	751	74	38	71	44	70	62	62	89
19	7.2	753	765	729	788	775	764	790	796	758	75	37	73	43	73	58	64	88



Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8	Chan 9	Chan 12	Chan 13	Chan 16	Chan 17	Chan 22	Chan 23	Chan 24	Chan 25
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
20	6.4	764	773	738	796	783	772	796	802	765	75	35	74	43	74	54	65	86
21	6.2	771	782	746	803	791	783	803	810	773	77	34	75	42	75	52	66	85
22	6.5	777	789	756	808	797	787	808	815	780	77	33	75	42	74	49	66	83
23	6.8	787	796	763	816	805	793	816	821	785	76	33	76	42	75	48	66	83
24	6.9	793	806	773	822	810	805	822	828	792	76	32	76	42	77	47	66	83
25	7.2	802	813	780	831	819	810	835	838	800	76	31	77	42	79	46	67	83
26	7.5	809	821	792	836	825	814	842	845	807	77	31	78	42	78	45	67	84
27	6.2	816	827	797	844	831	820	847	852	815	78	31	78	42	78	45	68	85
28	6.7	824	835	810	849	838	831	854	856	818	78	30	79	42	77	45	68	85
29	6.8	830	841	813	856	847	836	858	863	827	79	30	80	41	78	45	68	86
30	7.1	835	848	825	861	853	844	864	870	833	79	30	81	41	76	45	69	86
31	7.1	839	855	832	868	859	853	869	877	841	80	30	81	41	78	45	70	86
32	7.4	849	860	838	874	865	858	875	883	844	80	30	82	41	77	45	70	86
33	6.3	853	867	848	880	868	862	880	888	850	80	31	82	42	78	45	70	86
34	6.7	859	872	854	885	875	868	886	893	857	81	31	82	43	78	46	71	86
35	5.5	863	876	859	889	881	875	886	895	859	81	31	82	44	78	47	71	86
36	6.5	866	878	864	892	882	877	890	895	860	80	31	81	45	79	47	72	86
37	6.8	868	880	865	896	886	881	891	897	864	81	31	81	47	79	48	72	86
38	7.1	871	885	870	899	890	883	896	901	866	81	31	82	49	81	49	72	87
39	7	877	891	876	904	895	889	901	906	870	82	32	82	51	82	50	73	87
40	7.3	881	895	881	908	898	894	905	910	873	81	32	82	53	82	51	72	87
41	7.5	886	901	887	913	901	898	907	914	878	83	32	82	54	84	52	72	88
42	6.7	892	905	891	917	906	901	913	917	883	83	32	83	56	88	53	73	89
43	6.5	892	906	894	919	910	904	913	919	884	83	33	83	57	91	55	74	90
44	6.9	895	910	895	922	912	906	916	923	888	84	33	83	58	97	56	74	90



Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8	Chan 9	Chan 12	Chan 13	Chan 16	Chan 17	Chan 22	Chan 23	Chan 24	Chan 25
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
45	6.8	899	914	900	926	916	910	919	925	891	84	33	83	60	102	57	74	90
46	6.8	905	919	909	929	919	913	924	929	895	86	34	84	65	109	59	74	90
47	6.5	909	921	911	931	924	916	930	931	898	86	34	84	69	113	60	74	90
48	6.3	909	921	913	932	922	917	924	932	900	88	34	84	74	119	62	74	90
49	6.2	914	925	916	935	925	917	931	935	902	91	35	85	79	119	64	74	90
50	6.5	914	927	920	938	927	923	932	935	903	98	36	86	83	127	66	74	91
51	6.2	918	930	923	939	930	926	937	939	906	103	36	87	86	134	68	74	91
52	6.2	922	933	926	945	933	927	939	941	910	107	37	88	88	133	71	75	92
53	6.3	924	937	929	946	935	931	941	943	912	111	38	89	87	134	75	76	93
54	6.1	926	940	932	950	938	931	943	948	916	113	39	90	92	138	80	76	94
55	6	932	944	933	951	940	934	947	949	919	116	40	91	97	148	87	77	95
56	6.2	935	946	936	953	944	938	949	953	922	118	40	92	100	147	110	77	97
57	6.3	938	949	940	957	948	940	955	956	925	120	41	98	102	155	120	78	98
58	6.4	940	952	943	959	950	946	956	958	928	123	42	98	104	157	139	79	97
59	6.2	944	955	947	963	952	949	958	962	931	123	43	99	105	165	171	79	97
60	6.4	948	958	951	966	955	952	962	963	934	124	44	100	105	178	227	80	99
61	6.5	951	961	953	969	959	954	964	967	937	127	45	107	106	86	143	81	101
62	6.1	954	964	955	974	964	956	967	970	941	129	46	115	107	48	87	83	102
63	6	955	966	957	974	963	956	969	970	941	127	47	127	108	35	59	83	102
64	5.9	957	968	958	975	964	959	970	971	944	127	47	142	109	30	45	84	102
65	6.8	959	971	961	977	966	963	972	974	945	125	48	155	111	30	39	86	102
66	6.7	960	974	967	979	968	964	977	976	947	126	48	163	115	29	37	88	102
67	6.6	967	978	970	981	970	967	978	977	950	169	50	166	118	28	35	89	102
68	6.1	970	979	970	984	974	967	981	981	954	140	51	169	120	28	34	90	102
69	6	971	982	975	984	975	972	985	982	956	133	52	174	121	28	34	93	102



Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8	Chan 9	Chan 12	Chan 13	Chan 16	Chan 17	Chan 22	Chan 23	Chan 24	Chan 25
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
70	5.9	987	983	976	987	977	973	985	983	957	131	53	182	122	29	33	94	102
71	6.5	974	979	973	984	976	972	983	982	955	175	55	188	125	28	33	94	102
72	7.3	973	981	974	985	976	971	983	981	956	161	56	195	128	28	33	95	102
73	7.2	973	982	974	986	977	971	985	983	958	167	58	203	131	28	33	96	103
74	6.8	974	983	975	988	978	972	986	984	960	165	59	210	136	28	33	99	103
75	6.8	975	985	977	989	981	973	987	986	961	183	62	220	139	28	33	100	104
76	6.5	979	987	979	991	982	976	989	988	963	168	63	277	143	28	34	101	104
77	6.5	979	988	981	993	984	978	990	989	964	163	64	281	150	28	34	101	105
78	6.7	983	991	983	996	986	982	993	991	966	199	66	273	159	28	34	103	106
79	6.4	984	992	985	997	988	983	995	993	969	184	67	263	172	29	34	104	107
80	5.8	985	995	987	1000	990	984	998	994	971	168	68	261	177	28	34	105	108
81	6.1	989	996	988	1001	992	987	1000	996	972	161	70	267	182	29	35	105	109
82	6.6	992	1000	992	1003	994	989	1002	998	974	223	207	273	185	29	36	107	111
83	6.7	992	1001	993	1003	996	990	1002	999	975	217	84	280	197	29	36	106	113
84	6	994	1002	992	1007	997	994	1005	1001	978	217	87	304	218	30	37	109	116
85	6.2	998	1006	995	1009	995	994	1006	1002	979	212	153	353	296	29	38	110	118
86	6	1001	1011	1001	1012	1002	998	1009	1005	982	204	192	378	368	30	39	110	120
87	5.8	1003	1014	1005	1014	1006	1000	1011	1008	985	221	201	390	417	31	39	111	122
88	5.8	1006	1016	1008	1016	1008	1004	1015	1009	987	249	198	395	469	31	40	112	124
89	7.2	1007	1016	1007	1018	1010	1002	1015	1013	990	267	252	397	521	32	41	114	136
90	6.9	1008	1020	1010	1018	1013	1006	1018	1016	992	268	125	395	525	31	39	116	139
91	7.8	1011	1024	1014	1021	1015	1007	1019	1020	994	271	128	391	452	30	37	118	137
92	7.6	1018	1030	1017	1024	1018	1006	1023	1022	996	275	124	384	437	30	35	119	137
93	7.4	1018	1030	1011	1026	1018	1009	1023	1024	998	277	136	379	436	30	34	120	137
94	6.5	1025	1035	1016	1029	1020	1016	1023	1024	999	284	321	378	431	30	34	121	138



Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8	Chan 9	Chan 12	Chan 13	Chan 16	Chan 17	Chan 22	Chan 23	Chan 24	Chan 25
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
95	6.2	1030	1037	1020	1031	1024	1017	1025	1026	1001	296	471	379	419	29	34	122	139
96	7.1	1032	1033	1021	1032	1026	1016	1024	1024	1000	309	639	382	411	29	34	123	140
97	6.8	1032	1039	1021	1032	1027	1016	1022	1024	1000	365	234	384	414	30	34	124	141
98	7	1048	1025	1020	1030	1019	1015	1023	1019	1000	357	186	384	413	30	35	124	143
99	6.9	1056	1029	1020	1034	1024	1014	1025	1021	1001	348	186	376	430	31	36	127	146
100	6	1056	1022	1018	1034	1020	1019	1022	1020	1001	352	206	362	491	44	47	128	149
101	6.5	1058	1031	1021	1038	1025	1013	1024	1022	1002	353	222	369	472	57	62	142	192
102	6.7	1047	1037	1020	1035	1026	1014	1023	1021	1003	253	266	383	560	67	77	162	310
103	6.2	1058	1042	1023	1039	1029	1017	1027	1024	1005	219	264	393	613	74	91	185	390
104	7.1	1059	1043	1026	1042	1034	1017	1028	1026	1007	211	266	392	1251	87	108	216	453

Time	Chan 26	Chan 27	Chan 30	Chan 31	Chan 34	Chan 35	Chan 38	Chan 39	Chan 42	Chan 43	Chan 46	Chan 47	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	17	19	18	19	18	20	18	20	17	19	18	19	17	18	16
1	18	27	19	42	21	91	19	35	18	39	18	31	17	29	16
2	18	34	33	100	33	96	22	43	21	42	20	40	18	39	16
3	19	43	39	108	38	88	24	80	23	44	22	47	21	50	16
4	20	50	49	102	39	85	38	100	26	77	24	51	22	61	16
5	22	65	47	100	40	82	41	95	34	120	28	63	25	71	16
6	25	77	45	95	42	79	43	89	49	133	31	73	29	72	16
7	34	84	45	89	44	75	41	82	58	145	33	77	30	71	16
8	40	88	46	83	47	72	40	75	59	125	35	78	30	69	16
9	51	85	47	77	52	68	41	69	61	108	36	77	32	67	16
10	53	78	48	72	58	65	43	64	63	95	39	76	34	65	16



Time	Chan 26	Chan 27	Chan 30	Chan 31	Chan 34	Chan 35	Chan 38	Chan 39	Chan 42	Chan 43	Chan 46	Chan 47	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
11	50	74	49	66	63	62	48	58	65	83	43	74	38	63	16
12	52	72	51	62	67	59	53	54	68	74	47	73	42	61	16
13	56	69	54	58	71	56	58	50	70	68	53	72	47	60	16
14	59	68	57	54	73	54	64	45	71	63	56	70	52	58	16
15	63	67	61	51	74	51	69	43	75	59	60	69	56	58	16
16	66	66	66	49	75	50	74	41	77	57	65	68	60	57	16
17	68	65	70	47	75	48	76	39	80	56	68	66	63	57	16
18	69	64	72	45	75	46	78	38	83	55	70	65	66	57	16
19	70	64	74	44	75	45	78	36	84	54	73	64	68	56	16
20	70	63	75	43	76	44	78	35	86	54	74	64	69	57	16
21	71	63	76	42	76	44	79	34	87	54	75	63	71	57	16
22	71	63	76	41	77	43	79	33	88	53	77	62	71	57	16
23	71	63	76	40	77	42	79	32	88	53	76	62	72	57	16
24	71	64	76	38	77	42	79	32	90	53	78	62	72	57	16
25	71	64	76	37	78	41	79	31	90	53	78	61	73	58	16
26	71	64	77	36	78	41	79	30	92	53	78	61	73	58	16
27	72	64	76	36	78	40	80	30	94	53	79	61	73	58	16
28	73	64	76	35	79	40	80	29	94	53	80	60	73	59	16
29	72	65	76	34	79	41	81	29	95	53	81	60	73	59	16
30	73	65	76	34	78	41	81	30	95	53	81	60	73	59	16
31	76	66	77	34	79	42	81	29	96	54	81	60	73	60	16
32	75	67	76	34	80	42	81	29	97	54	82	60	74	60	16
33	77	68	77	34	80	42	82	29	97	54	83	60	73	61	16
34	76	69	77	33	81	43	82	30	98	55	83	60	73	61	16
35	76	70	77	33	82	43	82	29	99	56	82	60	74	62	16



Time	Chan 26	Chan 27	Chan 30	Chan 31	Chan 34	Chan 35	Chan 38	Chan 39	Chan 42	Chan 43	Chan 46	Chan 47	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
36	75	70	77	33	83	43	83	29	99	55	83	60	74	62	16
37	76	71	78	33	84	44	84	29	100	56	83	61	74	62	16
38	76	71	77	33	86	45	84	29	101	57	83	61	75	63	16
39	76	72	78	33	87	46	86	30	101	58	83	61	75	63	16
40	76	73	78	33	89	46	86	30	102	58	84	61	74	63	16
41	78	74	78	33	92	47	87	30	101	59	84	62	74	64	16
42	79	75	78	33	96	48	87	29	103	60	85	62	74	64	16
43	78	76	79	33	100	49	89	29	104	60	85	62	74	65	16
44	80	77	79	33	104	50	90	29	104	61	87	63	74	65	16
45	80	77	79	34	106	50	91	29	106	62	87	63	74	65	16
46	80	78	80	34	109	51	92	30	106	64	87	64	74	66	16
47	80	79	80	34	111	52	93	30	107	63	88	64	74	66	16
48	80	79	80	34	115	54	95	30	107	64	88	65	74	66	16
49	81	80	81	34	121	55	96	30	108	66	89	65	74	67	16
50	82	82	81	35	126	56	97	30	109	67	90	66	75	67	16
51	83	83	81	35	128	57	99	30	110	69	90	66	75	67	17
52	84	84	81	35	139	59	100	30	112	71	91	67	75	67	17
53	86	85	82	35	151	61	101	30	113	72	91	67	75	68	17
54	85	86	82	35	177	63	102	30	115	74	92	68	75	68	16
55	86	88	83	36	216	65	103	30	115	77	94	69	76	68	17
56	87	90	83	36	272	68	105	31	117	81	95	69	76	69	17
57	88	90	84	36	321	72	107	31	119	89	95	70	76	69	17
58	90	91	84	37	371	76	108	31	121	95	96	71	77	70	17
59	90	93	85	37	416	80	110	32	122	100	99	72	77	70	17
60	90	97	85	38	451	86	111	32	123	114	100	72	77	71	17



Time	Chan 26	Chan 27	Chan 30	Chan 31	Chan 34	Chan 35	Chan 38	Chan 39	Chan 42	Chan 43	Chan 46	Chan 47	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
61	90	100	86	38	489	94	113	31	125	122	100	73	78	71	17
62	91	102	87	39	514	102	114	32	127	130	100	74	78	72	17
63	92	106	88	39	-1213	108	117	33	130	129	101	75	78	72	17
64	94	111	88	40	-1212	112	117	33	132	125	102	76	78	73	17
65	95	114	89	41	-1212	114	119	33	135	119	103	77	79	74	17
66	96	115	91	42	-1212	118	122	34	136	111	104	78	80	75	17
67	98	115	91	43	-1212	120	124	34	139	108	105	80	80	75	17
68	99	115	92	44	-1212	125	127	35	140	106	106	81	80	76	17
69	101	116	93	45	251	141	131	36	143	104	107	82	81	76	17
70	104	116	95	46	246	157	133	38	145	104	109	84	81	77	17
71	105	117	96	47	227	167	134	38	148	106	108	86	82	78	17
72	106	118	97	48	167	138	147	67	152	113	110	92	83	78	17
73	109	119	98	49	161	114	159	80	156	119	109	93	84	79	17
74	111	120	99	49	161	105	170	85	162	123	110	94	86	80	17
75	113	121	101	50	160	103	202	87	169	126	112	95	88	81	17
76	113	122	102	50	164	104	227	89	180	131	115	97	92	82	17
77	112	123	103	51	188	117	232	89	193	142	115	98	94	84	17
78	112	124	104	52	202	119	238	88	203	152	117	100	97	85	17
79	111	125	105	53	217	117	251	75	214	156	122	101	99	87	17
80	110	127	105	54	211	113	260	64	221	154	124	103	101	89	17
81	110	129	105	55	219	106	270	59	228	152	128	104	103	91	17
82	112	133	107	58	227	104	276	58	236	161	130	105	104	92	17
83	114	137	109	60	232	106	288	57	246	174	130	107	106	93	17
84	116	141	111	62	238	109	301	57	256	183	134	108	106	94	17
85	120	147	115	64	1250	121	328	57	262	193	133	110	106	95	17



Time	Chan 26	Chan 27	Chan 30	Chan 31	Chan 34	Chan 35	Chan 38	Chan 39	Chan 42	Chan 43	Chan 46	Chan 47	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
86	124	151	118	67	284	133	354	56	270	201	133	113	107	96	17
87	132	156	130	172	268	141	372	57	285	211	133	116	107	97	17
88	135	161	129	148	237	196	387	57	292	215	139	121	107	99	17
89	138	166	131	171	226	165	418	57	314	224	142	127	108	102	17
90	142	172	133	185	208	198	433	55	330	236	148	133	110	101	17
91	146	178	135	192	190	226	438	54	337	244	155	142	111	101	17
92	154	188	139	205	206	254	444	52	348	240	164	154	113	102	17
93	161	201	158	206	207	288	442	52	358	250	173	167	114	102	17
94	175	219	146	218	226	310	443	52	352	263	181	186	118	104	17
95	183	233	149	211	272	316	451	53	365	272	193	210	121	108	17
96	192	249	150	204	263	309	448	52	376	270	208	240	127	121	17
97	197	275	154	224	263	309	449	53	368	262	223	279	103	125	17
98	210	299	157	193	228	313	456	55	376	261	238	333	107	141	17
99	231	331	160	220	223	311	478	55	398	258	258	401	111	166	17
100	266	459	165	236	230	282	500	56	400	259	266	433	123	202	17
101	621	769	170	236	211	289	509	57	407	257	271	449	137	241	17
102	393	788	173	191	253	358	522	56	416	254	278	465	148	281	17
103	440	785	171	182	276	417	535	56	424	254	286	490	150	323	18
104	467	797	172	186	271	373	555	56	434	253	299	516	160	365	18