Fire Resistance Testing

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CONFIDENTIAL

Report: BMT/FEI/F13139
An indicative fire resistance test performed on six pipe penetration sealing systems within a plasterboard clad steel stud supporting construction.
Test conducted to the temperature and pressure conditions of
BSEN 1363-1: 1999 and the principles of BSEN 1366-3: 2009

Test date: 26th February 2014

BM TRADA – the new name for Chiltern International Fire Ltd

From July 1st 2013, Chiltern International Fire Ltd commenced trading under the name of its parent company BM TRADA and at the same time adopted a brand new visual identity.

Historically, the group has delivered its services through a number of individual companies: BM TRADA Certification Ltd, TRADA Technology Ltd, Chiltern International Fire Ltd (including Chiltern Dynamics) and a network of international offices. Both BM TRADA Group and these individual companies will now trade under the same name - BM TRADA - and adopt the new visual identity.

To coincide with this change, our Technical Reports, Test Reports, Products Assessments, company stationery and marketing collateral have been re-designed to carry the new branding and visual identity.

The validity of all documents previously issued by the individual companies including certificates, test reports and product assessments is unaffected by this change and a letter to this effect will be available to download from our website www.bmtradagroup.com.

About BM TRADA.

With origins dating back to 1934, we have a deep history and services which are highly valued by our customers. We offer independent certification, testing, inspection, training and technical services around the world. In all these areas we continue to use industry-leading experts in their chosen fields to develop and deliver services – an ethos that has been at the heart of our approach since we began.

A recent review of our businesses and customers revealed that the individual identities sometimes make communications confusing, and that in an already complex business area, clarity and simplicity in communications is rare, but valued. It also revealed that a single identity and combined offer would help us strengthen our appeal.

With this in mind, we brought the companies together under the name BM TRADA and took the opportunity to create a fresh new visual identity.

We have modernised our image and combined our strengths. However, our values, our people and the integrity of our services remain the same. I hope you will welcome these changes and the improvements they will bring.

Jon Osborn
Chief Operating Officer

Contents

1 Introduction

Nine pipe penetration sealing systems, of which only six are subject to this report, were installed into a plasterboard clad steel stud supporting system and tested.

2 Specimen verification

The fire stopping specimens were delivered to BM TRADA during February 2014. BM TRADA constructed a nominally 1500mm high x 1500mm wide x 100mm thick plasterboard clad steel stud supporting construction.
The client subsequently installed the systems into the supporting construction, with assistance from BM TRADA as required.

3 Description of supporting construction

The supporting construction comprised 50mm wide steel studs, head and base track, clad on both faces with 2No. layers of 12.5mm thick Type 'F' plasterboard, with 50mm thick, 35kg/m^3 density, rock mineral fibre filling the cavity between the studs, cut back for 100mm around the penetration apertures.

4 Description of specimens

Position 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 pipes had a minimum of 500mm protruding from both faces of the supporting construction.

All pipes were tested uncapped at both ends.

4.1 Service penetration supports

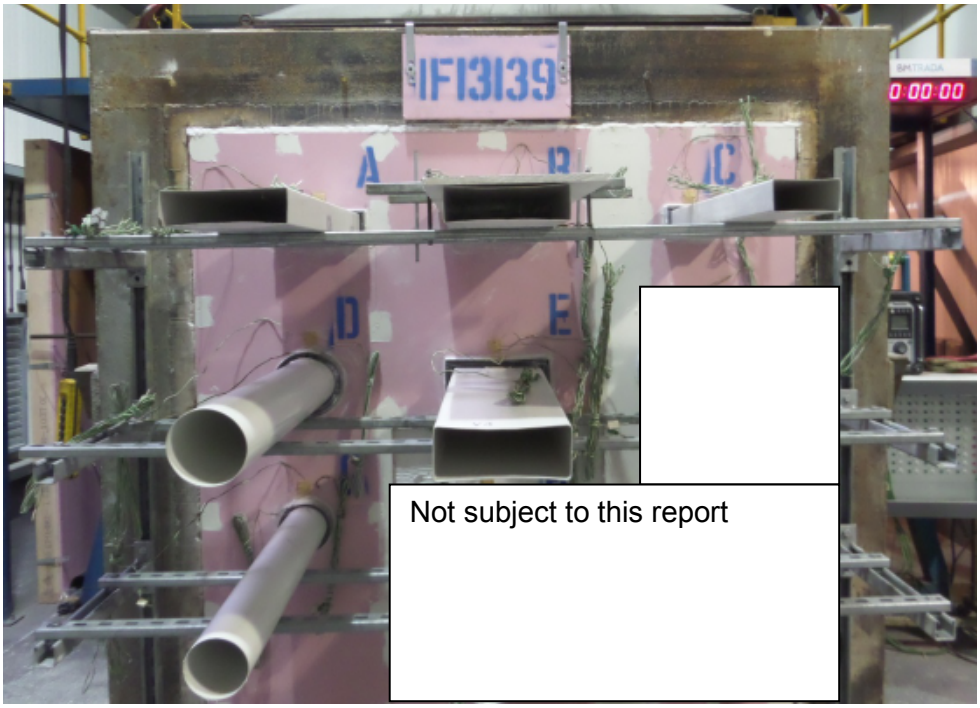
(Read in conjunction with Appendix 1, figure 1 and photographs)

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

The Unistrut frame section was constructed using 3mm thick profiled steel 'u' channel.

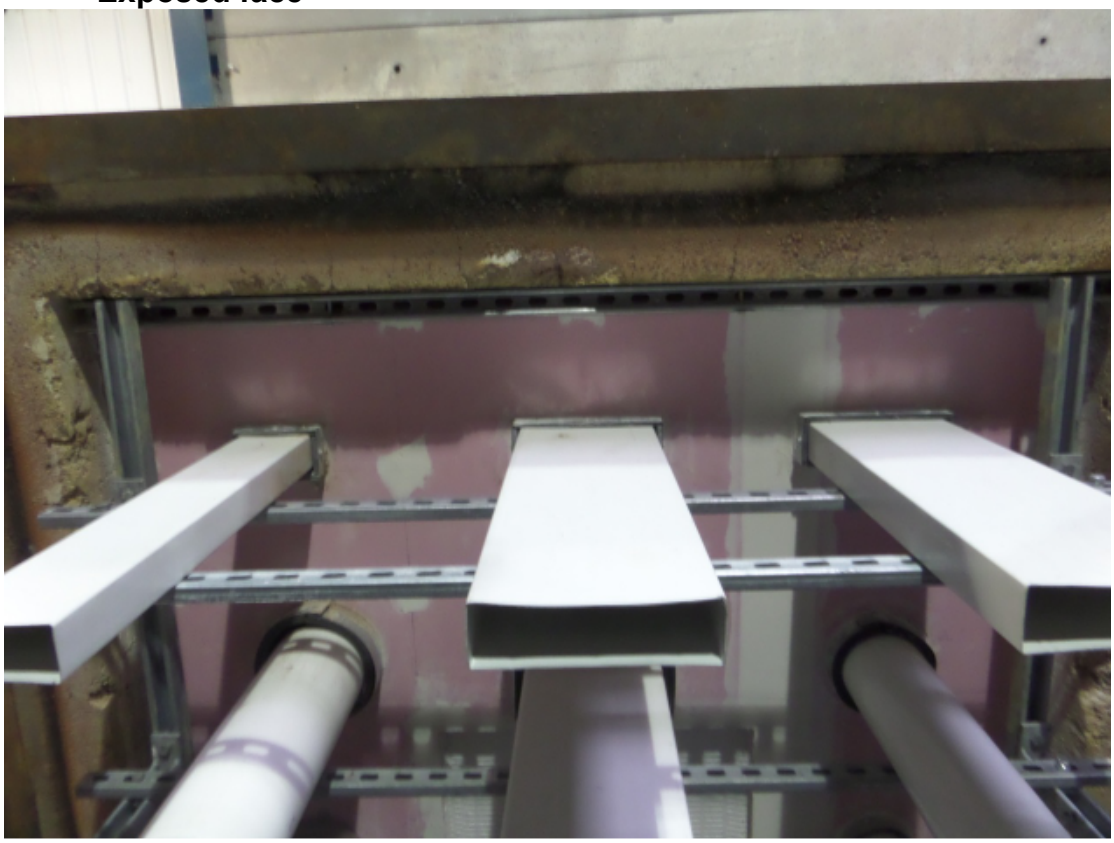
On the unexposed face, 6No 500mm Unistrut cantilever arm sections provided support for 6No. horizontal lengths of Unistrut, providing horizontal support for the pipes 200mm and 450mm from the face of the supporting construction, fixed to 2No. vertical lengths of Unistrut fixed to the restraint frame.

Unexposed face



On the exposed face, 6No 500mm Unistrut cantilever arm sections provided support for 6No. horizontal lengths of Unistrut, providing horizontal support for the pipes 200mm and 450mm from the face of the supporting construction, fixed to 2No. vertical lengths of Unistrut fixed to 2No. horizontal lengths of Unistrut fixed to the supporting construction

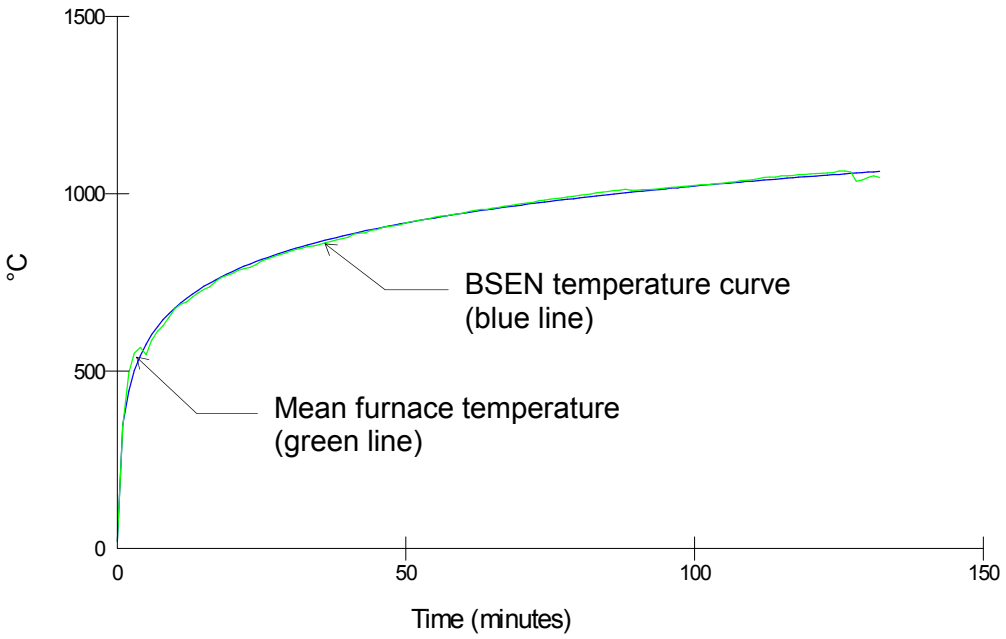
Exposed face



5 Test conditions

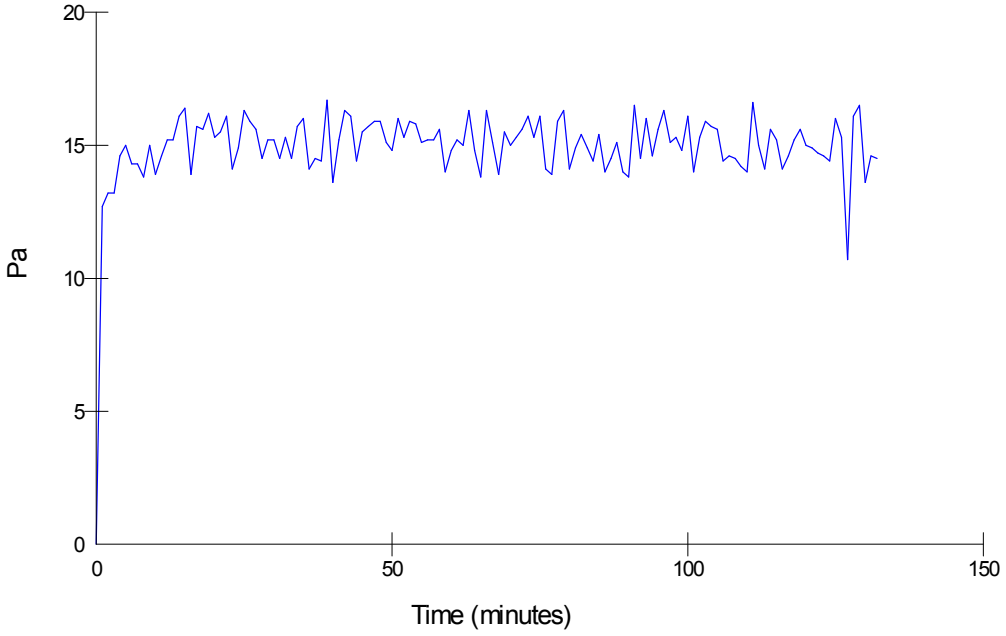
5.1 Furnace temperature

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 five plate thermometers suitably distributed within the furnace. The temperatures recorded have been tabulated in Appendix 2 and are shown graphically below:



5.2 Pressure readings

After the first 5 minutes of the test, the furnace pressure was maintained at 15 ± 5 Pa and after 10 minutes was maintained at 15 ± 3 Pa with respect to atmosphere, to simulate 10 Pa at the underside of the lowest penetration. 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 10°C.

5.4 Thermocouple positions (see figure 2 of appendix 1 for locations)

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

Thermocouple Number	Sealing system	Type (location)
1	-	Furnace
2	-	Furnace
3	-	Furnace
4	-	Furnace
5	-	Furnace
6	-	Laboratory ambient
10	Pipe A	On plasterboard 25mm from seal
11	Pipe A	On seal 25mm from pipe
12	Pipe A	On pipe 25mm from seal
13	Pipe B	On plasterboard 25mm from top of seal
14	Pipe B	On soffit 25mm from pipe at top of seal
39	Pipe B	On plasterboard 25mm from seal at side
15	Pipe B	On seal 25mm from pipe at side of seal
16	Pipe B	On pipe 25mm from seal at side
17	Pipe C	On plasterboard 25mm from seal
18	Pipe C	On seal 25mm from pipe
19	Pipe C	On pipe 25mm from seal
20	Pipe D	On plasterboard 25mm from seal
21	Pipe D	On seal 25mm from pipe
22	Pipe D	On pipe 25mm from seal
23	Pipe E	On plasterboard 25mm from seal
24	Pipe E	On seal 25mm from pipe
25	Pipe E	On pipe 25mm from seal
29	Pipe G	On plasterboard 25mm from seal
30	Pipe G	On seal 25mm from pipe
31	Pipe G	On pipe 25mm from seal

Graphs of each service penetration can be found in Section 7. The temperatures recorded have been tabulated in the Appendix 2.

6 Observations

All comments refer to the exposed face unless stated otherwise.

Time (minutes)	
00.00	Test started.
01.30	Pipe G is collapsing.
01.40	Pipe D is collapsing. Pipe E is collapsing.
02.00	Pipe A is collapsing.
03.00	Pipe C is collapsing.
07.30	There is smoke issuing from all pipes.
20.50	The graphite at the top of pipe E is falling out.
29.30	Pipe B, there is discolouration to the pipe under the soffit.
44.00	Pipe B, the pipe is distorting.
47.10	Pipe E, there is discolouration to the plasterboard above.
53.35	Pipe B, there is discolouration to the plasterboard above the soffit.
60.00	Pipe E, there is an increase in smoke issuing.
74.15	Pipe G, there is an increase in smoke issuing.
80.00	Pipe C, the graphite is exuding from the steel sleeve at the bottom of the pipe.
81.00	Pipe E, there is an increase in smoke issuing.
82.40	Pipe G, the graphite is exuding from the sleeve under the pipe.
90.00	Pipe E, the graphite is exuding from the sleeve around the pipe.
95.00	Pipe E, there is further discolouration to the plasterboard above the pipe.
96.00	Pipe E, the graphite under the pipe is falling out.
97.30	Pipe E, there is an increase in smoke issuing.
100.00	Pipe E, there is a glow visible at the underside of the pipe.
101.20	Pipe E, there is a glow visible at the top of the pipe.
101.40	Pipe E, a cotton pad integrity test was performed at the top of the pipe which resulted in ignition of the cotton pad.

101.45 Pipe E, there is flaming for in excess of 10 seconds at the top of the pipe**.**

102.40 Pipe D, the graphite is falling out.

111.30 Pipe D, there is further increase in smoke issuing

112.20 Pipe D, there is a glow visible at the top.

113.36 Pipe D, a cotton pad integrity test was performed at the top, which failed to ignite the cotton pad. No failure.

114.45 Pipe D, a cotton pad integrity test was performed at the top, which failed to ignite the cotton pad. No failure.

115.00 Pipe D, there is intermittent flaming.

116.00 Pipe D, a cotton pad integrity test was performed at the top, which failed to ignite the cotton pad. No failure.

117.15 Pipe D, a cotton pad integrity test was performed at the top, which failed to ignite the cotton pad. No failure.

117.40 Pipe D, a 25mm gap gauge test was attempted, no failure found.

118.45 Pipe D, a cotton pad integrity test was performed at the top, which failed to ignite the cotton pad. No failure.

119.00 Pipe D, a 25mm gap gauge test was recorded at the top of the pipe, thereby constituting **integrity failure**.

120.25 Pipe D, a cotton pad integrity test was performed at the top which resulted in ignition of the cotton pad**,** thereby constituting **further integrity failure.**

121.00 Pipe G, there is an increase in smoke issuing.

128.05 Pipe G, the graphite is falling out from under the pipe.

128.30 Pipe G, there is a glow visible.

128.48 Pipe G, there is flaming for in excess of 10 seconds.

130.00 Test terminated

Primary Observations

Time (minutes)	Comments
101.40	Pipe E, a cotton pad integrity test was performed at the top of the pipe which resulted in ignition of the cotton pad.
101.45	Pipe E, there is flaming for in excess of 10 seconds at the top of the pipe.
115.00	Pipe D, there is intermittent flaming.
119.00	Pipe D, a successful 25mm gap gauge test was performed at the top.
120.25	Pipe D, a cotton pad integrity test was performed at the top which resulted in ignition of the cotton pad.
128.48	Pipe G, there is flaming for in excess of 10 seconds.
130.00	Test terminated.

7 Sealing systems (see figure 1 of Appendix 1)

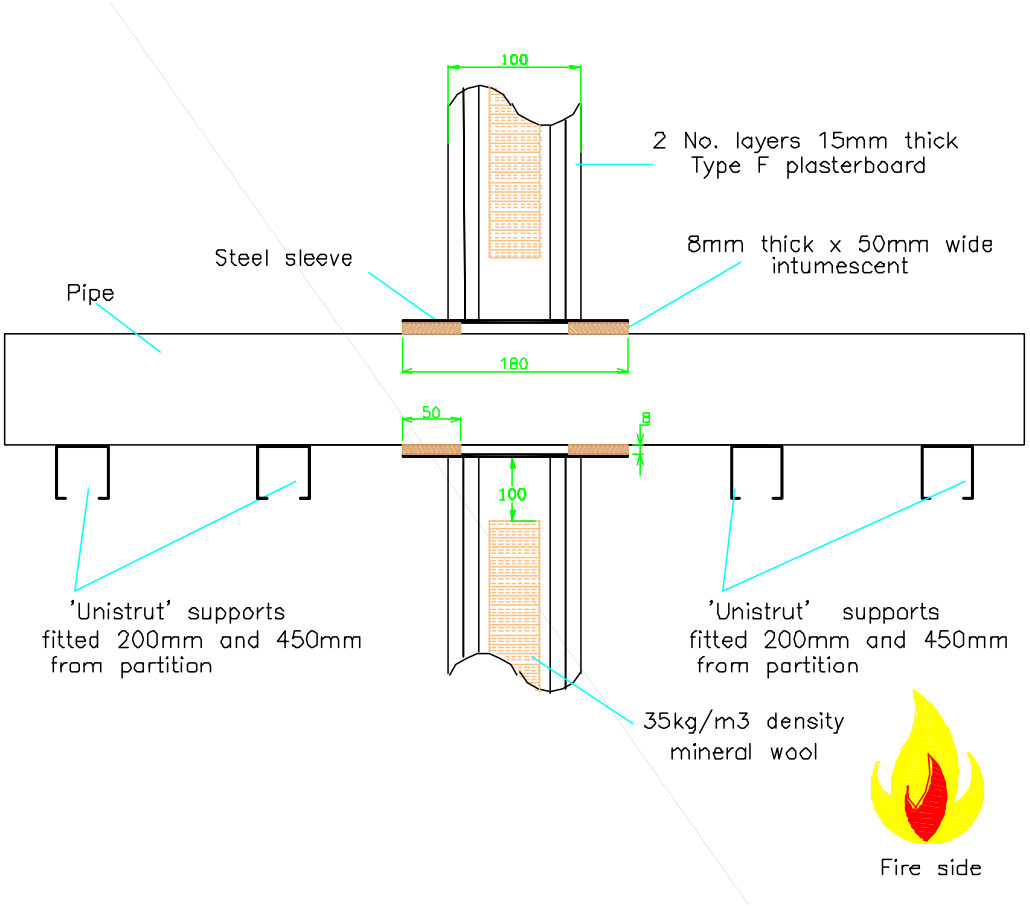
Pipe A

Service detail

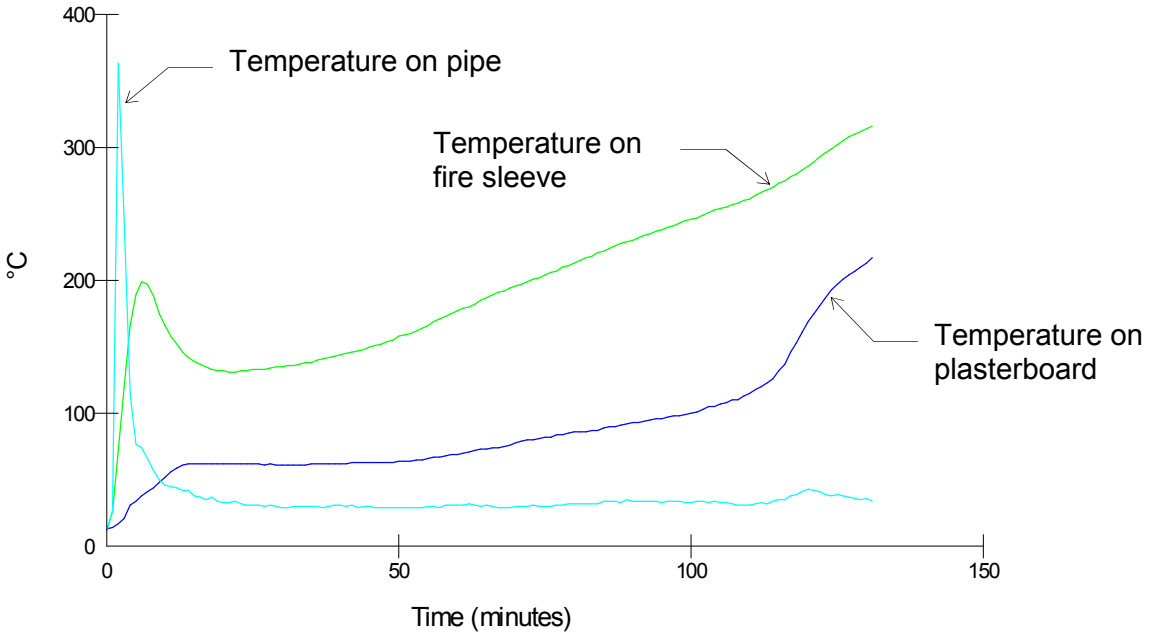
Test Reference	Pipe material	Pipe size (nominal)	Wall thickness (nominal)	Aperture (nominal)
A	PVC	204mm x 60mm	2.0	230mm x 80mm

Penetration seal detail

Test Reference	Product code	Galvanised steel sleeve	Intumescent size
A	QRS205/60	0.5mm thick x 230 wide x 80mm high x 180mm deep	50mm wide x 8mm thick fitted inside sleeve on both faces



Temperatures recorded on pipe penetration



Pipe B

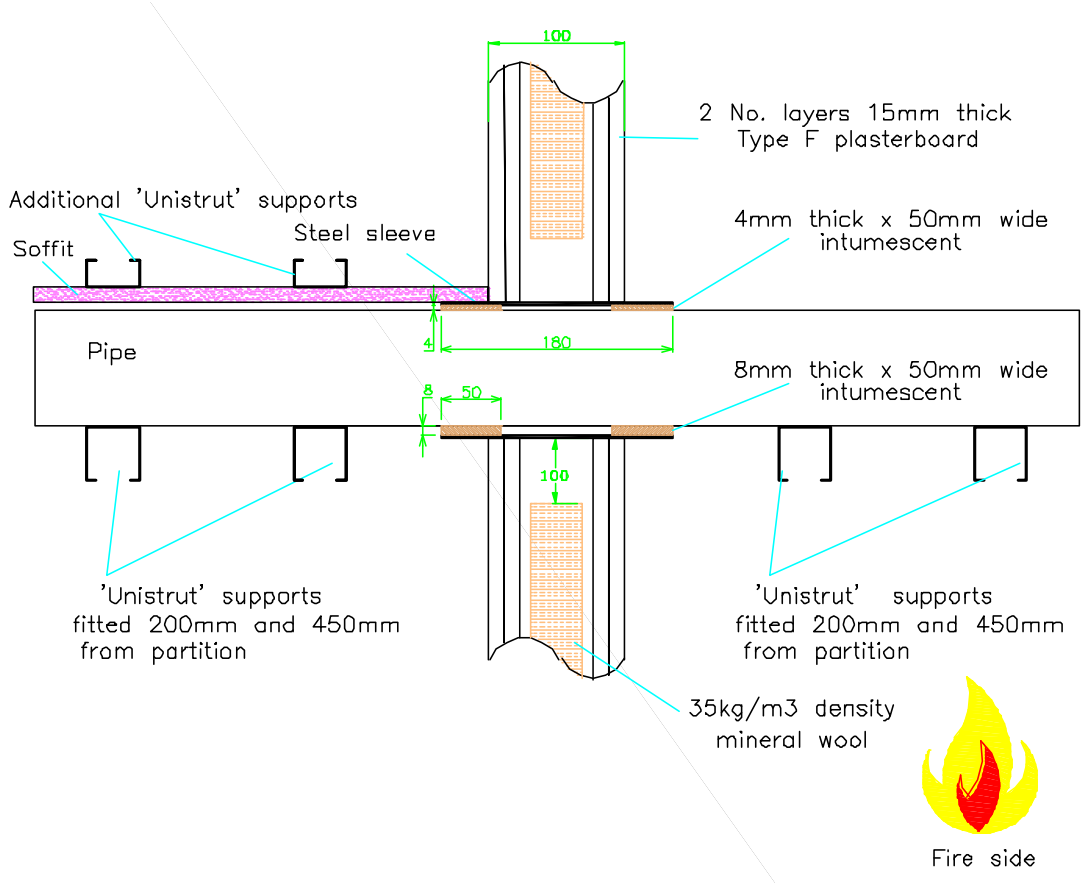
Service detail

Test Reference	Pipe material	Pipe size (nominal)	Wall thickness (nominal)	Aperture (nominal)
B	PVC	204mm x 60mm	2.0	230mm x 80mm

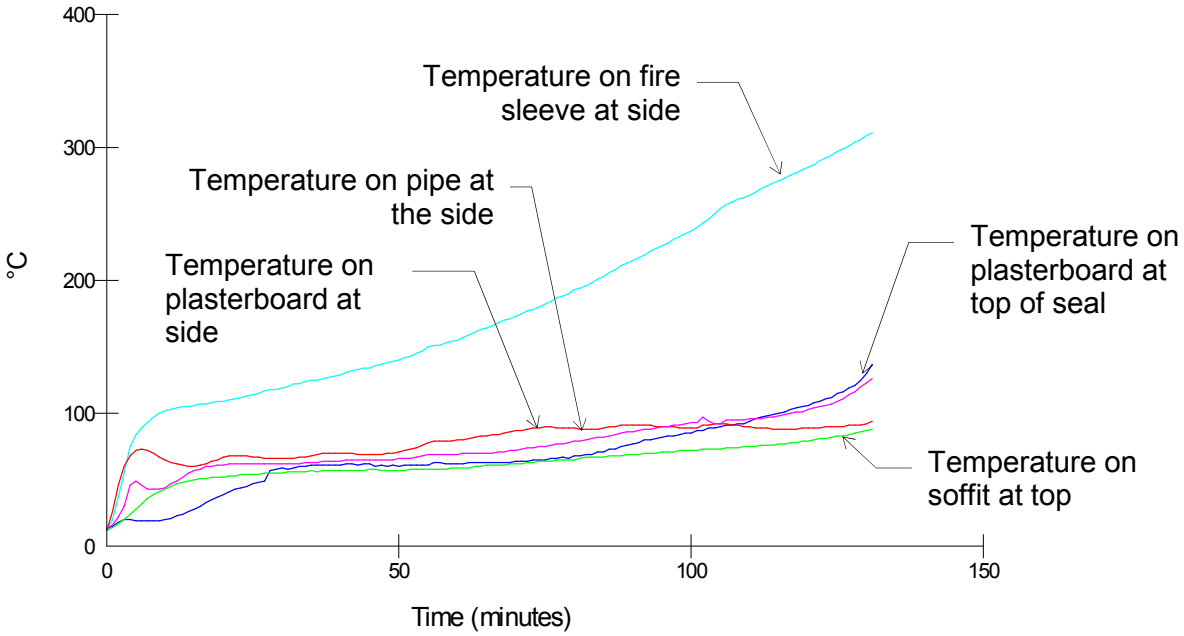
Penetration seal detail

Test Reference	Product code	Galvanised steel sleeve	Intumescent size
B	QRSC205/60	0.5mm thick x 230 wide x 80mm high x 180mm long	50mm wide x 4mm thick at top of sleeve on both faces
			50mm wide x 8mm thick at bottom and sides of seal on both faces

Specimen B had a 15mm thick x 300mm wide x 500mm long British Gypsum Glasroc Multiboard soffit section fitted butted up to the pipe / steel sleeve / plasterboard wall on the top of the non fire side. It was clamped to the support system using appropriate Unistrut support and was sealed to the wall with a bead of Quelfire GM Intumescent Acoustic Sealant.



Temperatures recorded on pipe penetration



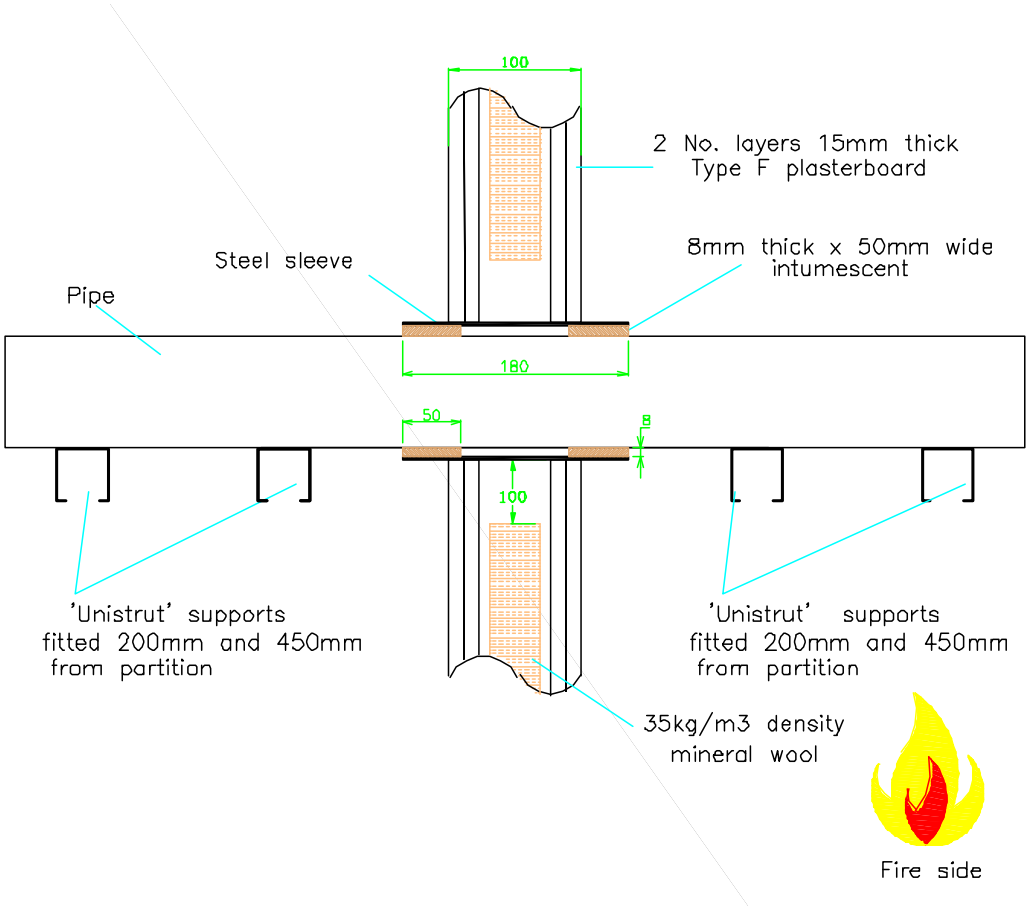
Pipe C

Service detail

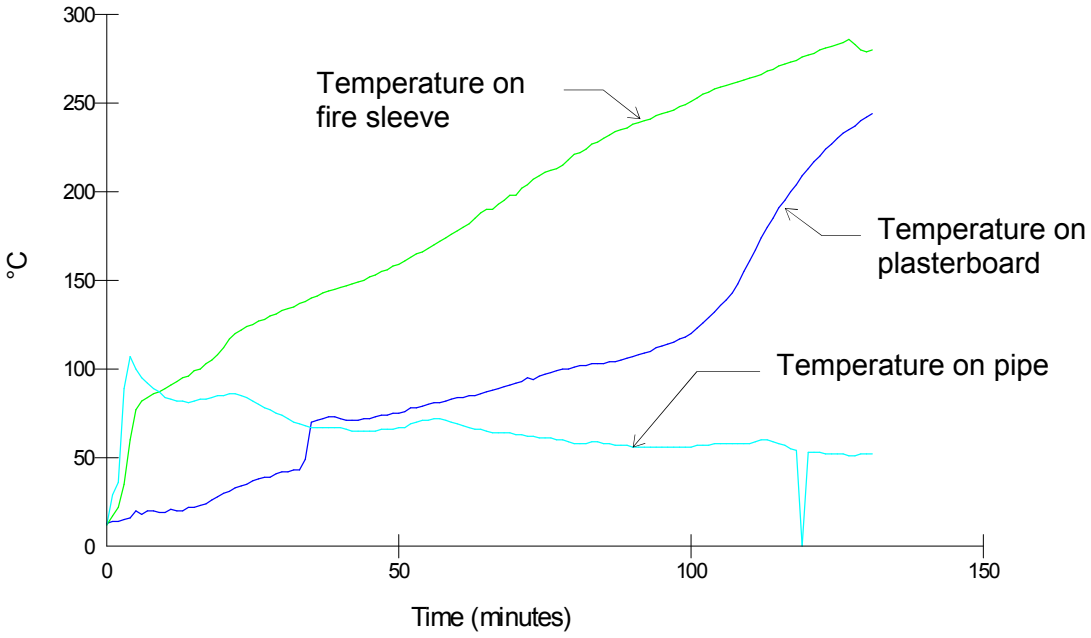
Test Reference	Pipe material	Pipe size (nominal)	Wall thickness (nominal)	Aperture (nominal)
C	PVC	110mm x 50mm	1.5	130mm x 80mm

Penetration seal detail

Test Reference	Product code	Galvanised steel sleeve	Intumescent size
C	QRS110/54	0.5mm thick x 130 wide x 80mm high x 180mm long	50mm wide x 8mm thick fitted inside sleeve on both faces



Temperatures recorded on pipe penetration



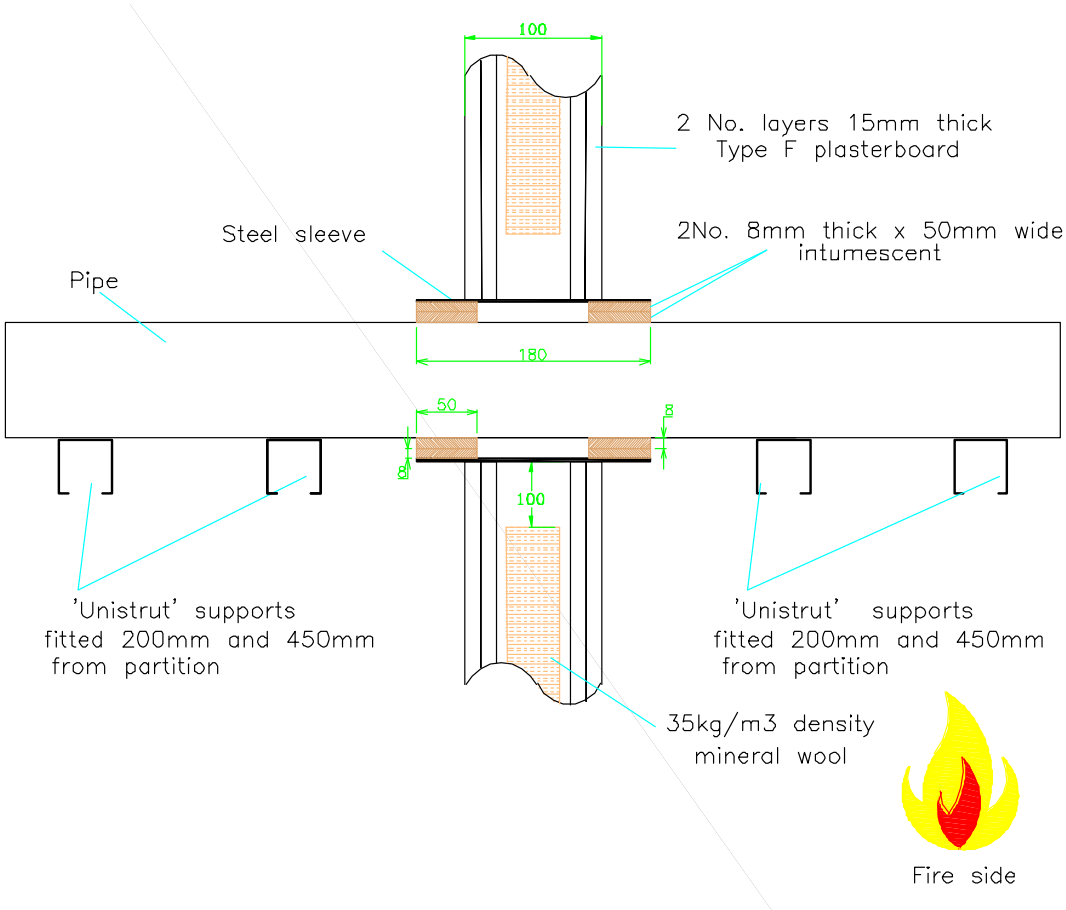
Pipe D

Service detail

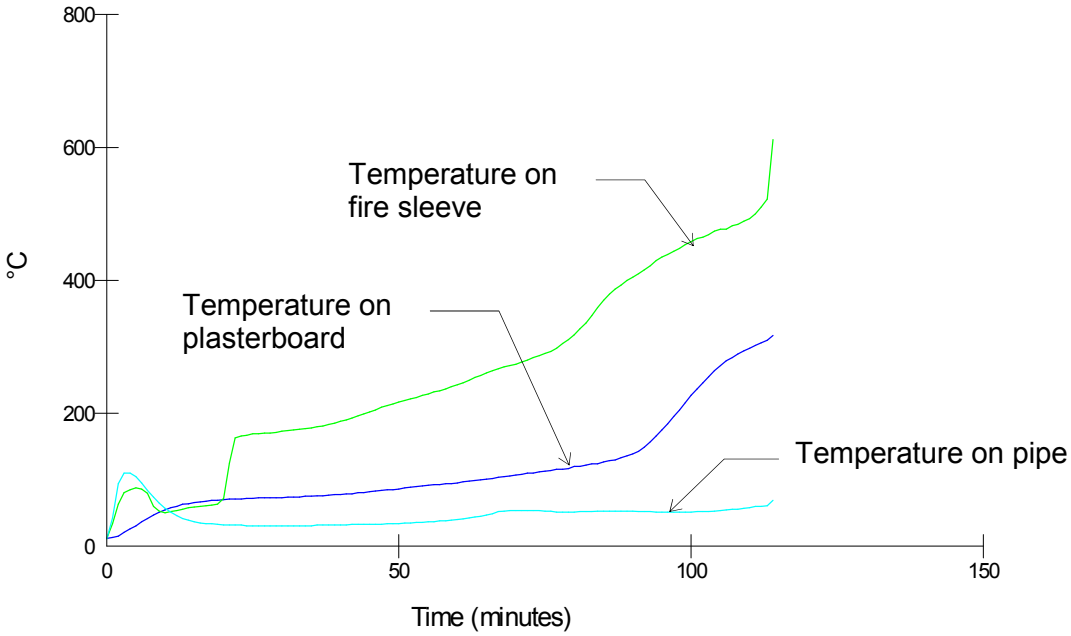
Test Reference	Pipe material	Pipe size (nominal)	Wall thickness (nominal)	Aperture (nominal)
D	PVC	Ø125mm	1.5	Ø157mm

Penetration seal detail

Test Reference	Product code	Galvanised steel sleeve	Intumescent size
D	QRS130	0.5mm thick x Ø157mm x 180mm long	2No. layers 50mm wide x 8mm thick each layer, fitted inside sleeve on both faces



Temperatures recorded on pipe penetration



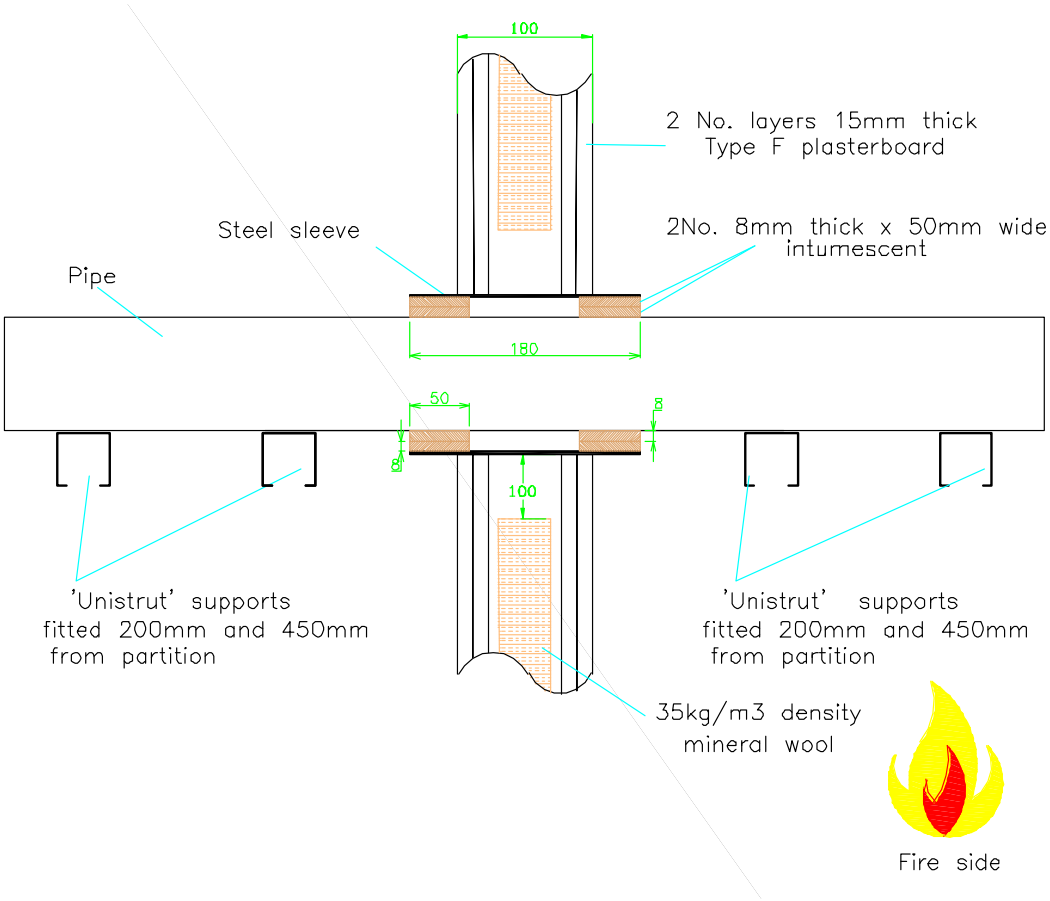
Pipe E

Service detail

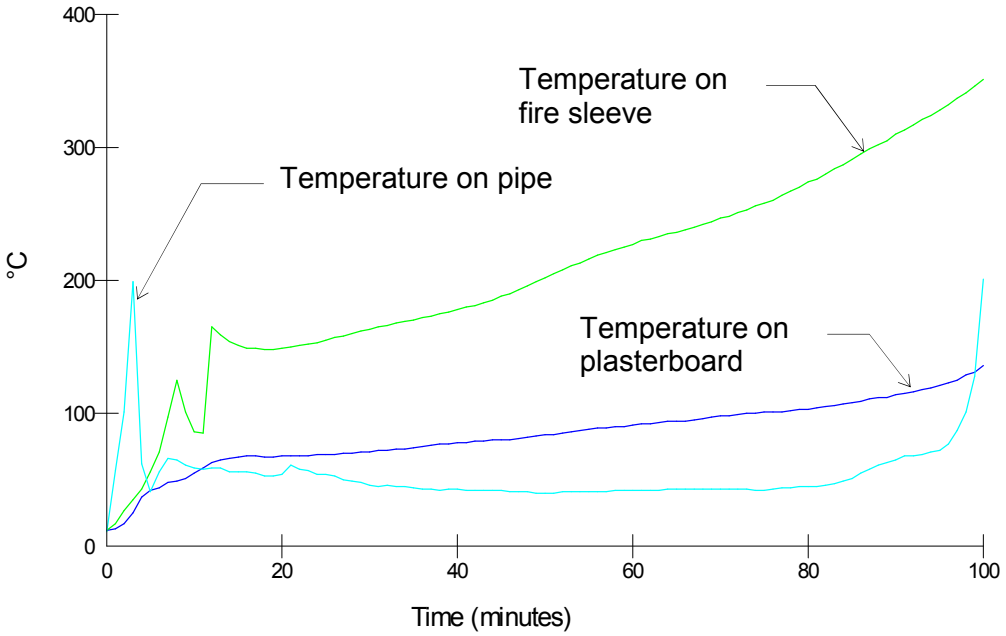
Test Reference	Pipe material	Pipe size (nominal)	Wall thickness (nominal)	Aperture (nominal)
E	PVC	220mm wide x 90mm high	1.5	250mm wide x 130mm high

Penetration seal detail

Test Reference	Product code	Galvanised steel sleeve	Intumescent size
E	QRS220/90	0.5mm thick x 250mm wide x 130mm high x 180mm long	2No. layers 50mm wide x 8mm thick each layer, fitted inside sleeve on both faces



Temperatures recorded on pipe penetration



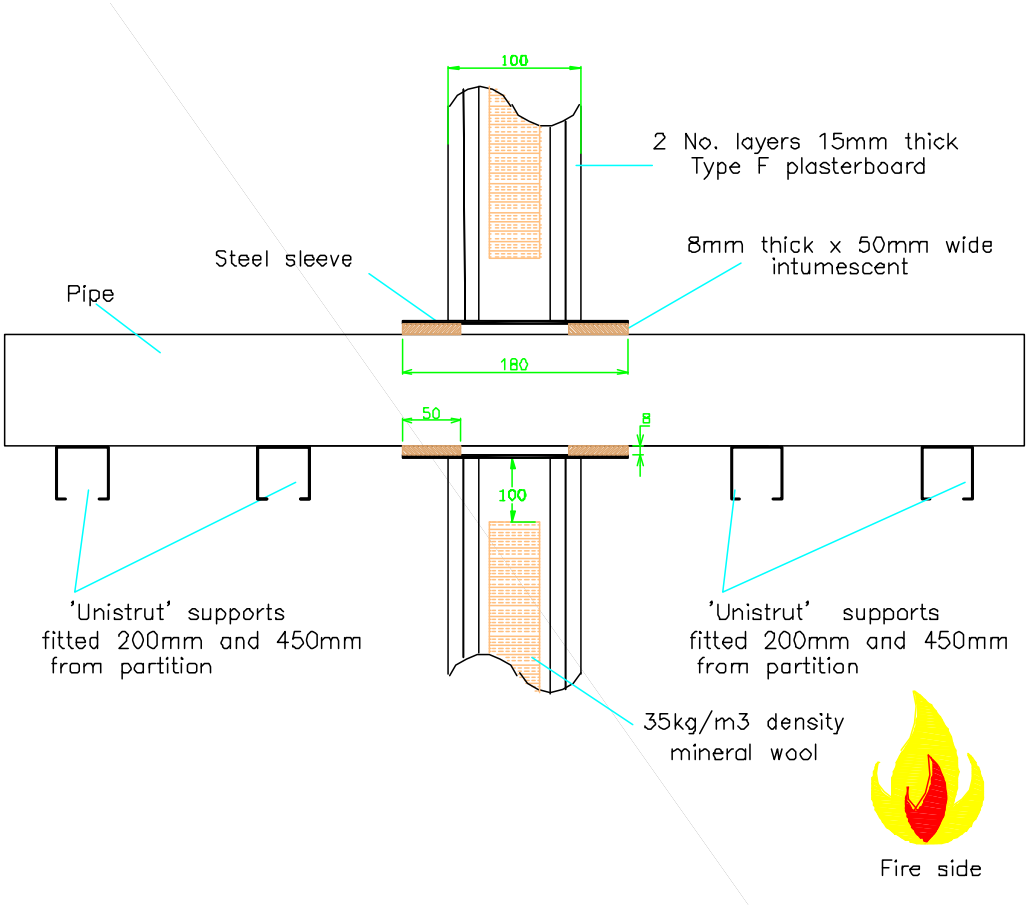
Pipe G

Service detail

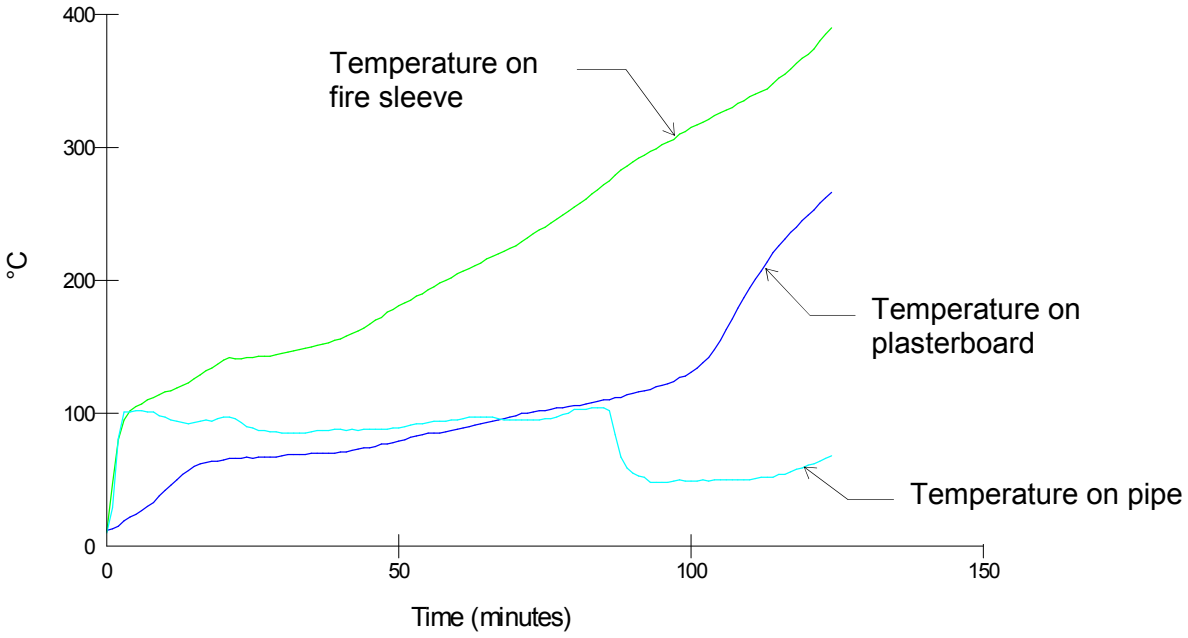
Test Reference	Pipe material	Pipe size (nominal)	Wall thickness (nominal)	Aperture (nominal)
G	PVC	Ø105mm	1.5	Ø127mm wide

Penetration seal detail

Test Reference	Product code	Galvanised steel sleeve	Intumescent size
G	QRS110	0.5mm thick x Ø123mm x 180mm long	2No. layers 50mm wide x 8mm thick each layer, fitted inside sleeve on both faces

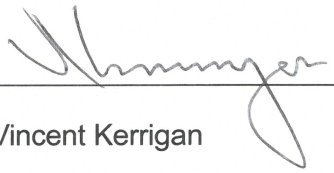


Temperatures recorded on pipe penetration

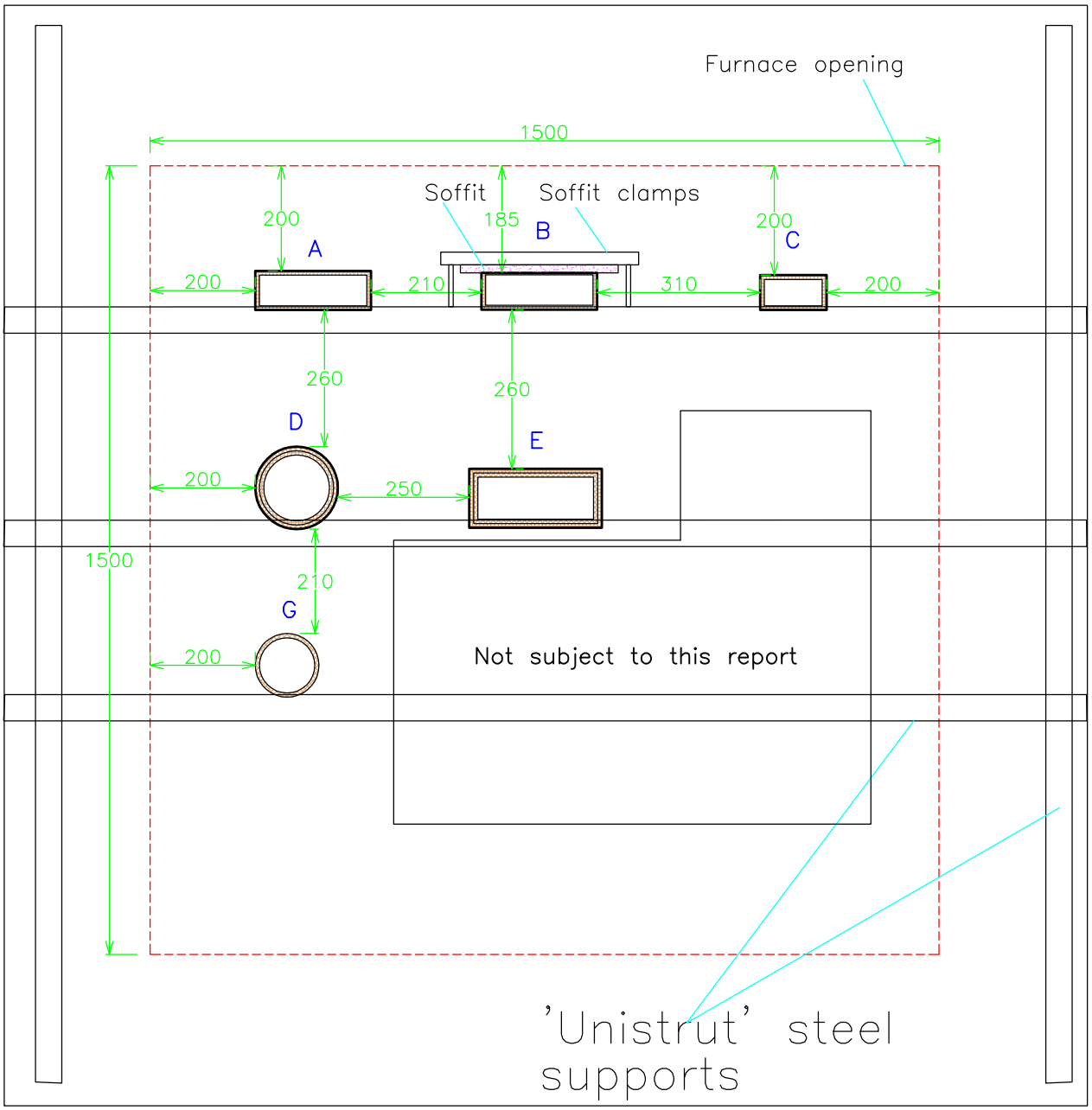


8 Limitations

This test report relates to an investigation which utilised the test methodology given in BSEN 1363-1: 1999 and the principles of BSEN 1366-3 2009 the full requirements of the Standards were not, however, complied with. The information is provided for the test sponsor's information only and should not be used to demonstrate performance against the Standard nor compliance with a regulatory requirement. The test was not conducted under the requirements of UKAS accreditation.

Signature:		
Name:	Robert Axe	Vincent Kerrigan
Title:	Lead Technical Officer - Fire Resistance	Technical Manager
Date of issue:	28-04-2014	28-04-2014

Appendix 1 – figures 1 – 2



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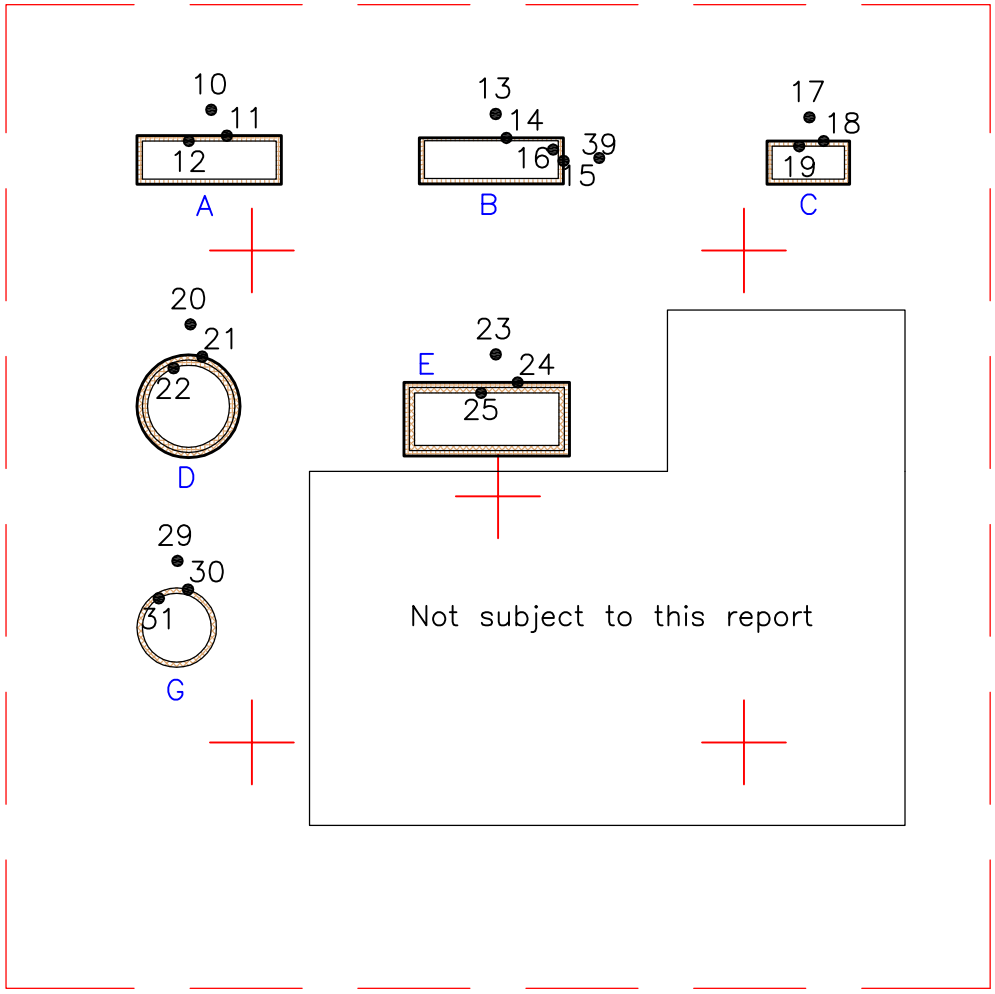
Title: Unexposed face elevation showing support positions (All dimensions in mm)

Date Drawn	Drawn By	Scale
11/03/14	ARD	NTS

Project No.	
BMT/FEI/F13139	Appendix 1



: Furnace Thermocouples

: Unexposed Face Thermocouples

Viewed From Unexposed Face

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Title: Thermocouple positions

(All dimensions in mm)

Date Drawn	Drawn By	Scale
11/03/14	ARD	NTS

Project No.	
BMT/FEI/F13139	Appendix 1

BMTRADA

Appendix 2 - raw test data (7 pages)

(see figure 2 of appendix 1 for channel locations)

Furnace thermocouples

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 10	Chan 11	Chan 12	Chan 13	Chan 14	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22	Chan 23
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	0	17	17	16	16	16	10	13	12	12	13	12	12	12	13	12	12	12	12	11	12
1	12.7	320	309	373	353	376	10	14	26	27	15	14	20	26	14	17	29	13	34	43	13
2	13.2	525	441	538	512	464	10	17	72	363	18	17	37	46	14	22	36	15	63	94	17
3	13.2	556	504	594	573	530	10	21	119	247	20	20	55	60	15	35	89	21	81	110	25
4	14.6	584	535	596	568	555	10	31	166	115	20	24	75	68	16	60	107	26	85	110	37
5	15	578	511	567	534	542	10	34	189	77	19	28	84	72	20	77	100	31	88	105	42
6	14.3	581	562	617	566	610	10	38	199	74	19	32	89	73	18	82	95	37	86	95	44
7	14.3	582	574	637	605	671	10	41	197	66	19	36	93	72	20	84	92	42	80	84	48
8	13.8	586	589	646	623	700	10	44	188	57	19	39	97	70	20	86	89	47	60	74	49
9	15	607	607	669	656	730	10	48	175	50	19	41	100	67	19	87	87	51	53	65	51
10	13.9	624	623	694	692	748	10	52	166	46	20	43	102	65	19	89	84	55	50	57	55
11	14.6	633	641	704	704	763	10	56	158	45	21	45	103	63	21	91	83	58	52	51	59
12	15.2	639	651	710	709	769	10	59	152	44	23	47	104	62	20	93	82	60	54	46	63
13	15.2	656	664	725	720	781	10	61	146	42	24	48	105	61	20	95	82	63	56	42	65
14	16.1	666	676	738	736	787	10	62	142	42	26	49	105	60	22	96	81	64	58	39	66
15	16.4	673	687	747	748	796	10	62	139	38	28	50	106	60	22	99	82	66	59	37	67
16	13.9	682	693	756	755	804	10	62	137	37	30	51	107	61	23	100	83	67	60	35	68
17	15.7	701	705	770	771	817	10	62	135	35	33	51	107	62	24	103	83	68	61	34	68
18	15.6	712	715	781	785	827	10	62	133	37	35	52	108	64	26	105	84	69	62	34	67
19	16.2	718	721	788	792	831	10	62	132	34	37	52	109	65	28	108	85	69	63	33	67
20	15.3	725	729	795	797	837	10	62	132	33	39	52	109	67	30	112	85	70	72	32	68
21	15.5	734	735	800	809	842	10	62	131	33	41	53	110	68	31	117	86	71	125	32	68
22	16.1	740	740	805	814	846	10	62	131	34	43	53	111	68	33	120	86	71	163	32	68
23	14.1	747	745	809	818	850	10	62	132	32	44	54	112	68	34	122	85	71	166	32	68

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 10	Chan 11	Chan 12	Chan 13	Chan 14	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22	Chan 23
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
24	14.9	753	754	816	822	857	10	62	132	31	45	54	113	68	35	124	84	72	167	31	69
25	16.3	762	760	826	837	866	10	62	133	31	47	54	114	67	37	125	82	72	169	31	69
26	15.9	772	768	832	840	871	10	62	133	31	48	54	115	67	38	127	80	73	169	31	69
27	15.6	776	776	837	846	875	10	61	133	30	49	55	117	66	39	128	78	73	170	31	70
28	14.5	784	782	843	850	882	10	62	134	31	57	55	118	66	39	130	77	73	170	31	70
29	15.2	789	786	846	855	884	10	61	135	30	58	55	118	66	41	131	75	73	171	31	71
30	15.2	797	792	852	866	889	10	61	135	29	59	55	119	66	42	133	74	73	173	31	71
31	14.5	801	799	857	865	893	10	61	136	29	58	56	120	66	42	134	72	74	174	31	72
32	15.3	806	803	862	871	896	10	61	136	30	59	56	122	66	43	135	70	74	175	31	72
33	14.5	811	805	866	878	897	10	61	137	30	60	56	122	67	43	137	69	74	176	31	73
34	15.7	817	808	867	880	895	10	61	138	30	60	56	124	67	49	138	68	75	177	31	73
35	16	821	812	870	883	899	10	62	138	30	61	57	125	68	70	140	67	75	178	31	74
36	14.1	827	817	875	888	903	10	62	140	30	61	56	125	69	71	141	67	76	180	32	75
37	14.5	830	820	878	897	905	10	62	141	29	61	57	126	70	72	143	67	76	181	32	76
38	14.4	833	824	882	902	910	10	62	142	30	61	57	127	70	73	144	67	77	183	32	77
39	16.7	837	831	887	901	915	10	62	143	31	61	57	128	70	73	145	67	78	185	32	77
40	13.6	844	833	889	908	917	10	62	144	31	61	57	129	70	72	146	67	78	188	32	78
41	15.2	850	841	897	921	921	10	62	145	30	62	57	131	70	71	147	66	79	190	32	78
42	16.3	856	843	902	924	923	10	63	146	31	62	57	132	70	71	148	65	79	193	33	79
43	16.1	860	846	902	923	922	10	63	147	29	61	57	133	69	71	149	65	81	196	33	79
44	14.4	867	853	910	929	929	10	63	148	30	62	57	134	69	72	150	65	81	199	33	80
45	15.5	870	855	910	934	929	10	63	150	30	62	58	134	69	72	152	65	82	202	33	80
46	15.7	873	859	916	945	935	10	63	151	29	60	58	136	69	73	153	65	83	205	33	80
47	15.9	879	864	919	941	938	10	63	152	29	61	57	137	69	74	155	66	84	209	33	81
48	15.9	881	866	922	943	941	10	63	154	29	60	57	138	70	74	156	66	85	212	34	82
49	15.1	885	870	925	942	944	10	63	155	29	61	57	139	70	75	158	66	85	214	34	83
50	14.8	892	875	930	948	947	10	64	158	29	60	57	140	71	75	159	67	86	217	34	84
51	16	895	880	931	955	949	10	64	159	29	61	57	142	72	76	161	67	88	219	35	84
52	15.3	899	883	934	957	952	10	64	160	29	61	58	143	73	78	163	69	89	222	35	85
53	15.9	900	888	937	957	956	10	65	162	29	61	58	145	74	78	165	70	90	224	36	86
54	15.8	906	891	940	960	957	10	65	164	29	61	58	147	76	79	166	71	91	227	36	87

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 10	Chan 11	Chan 12	Chan 13	Chan 14	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22	Chan 23
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
55	15.1	908	894	944	964	961	10	66	166	30	61	58	150	78	80	168	71	92	229	37	88
56	15.2	911	895	947	972	961	10	67	169	30	63	58	151	79	81	170	72	93	232	37	89
57	15.2	913	898	948	971	964	10	67	171	29	63	58	151	79	81	172	72	93	234	38	89
58	15.6	917	900	951	975	968	10	68	173	31	62	58	153	79	82	174	71	94	237	38	90
59	14	919	905	952	975	969	10	69	175	31	62	59	154	79	83	176	70	94	240	39	90
60	14.8	924	907	955	975	972	10	69	177	31	62	59	155	80	84	178	69	95	243	40	91
61	15.2	927	910	958	980	976	10	70	179	31	62	59	157	80	84	180	68	97	246	41	92
62	15	930	912	960	986	977	10	71	180	32	63	59	159	81	85	182	67	98	250	43	92
63	16.3	931	916	964	990	981	10	72	182	31	63	60	161	82	85	185	66	99	254	44	93
64	14.8	934	918	966	984	982	10	73	185	30	63	60	163	83	86	188	66	100	257	45	94
65	13.8	937	921	967	987	983	10	73	187	31	63	61	164	83	87	190	65	101	261	47	94
66	16.3	938	925	971	987	988	10	74	189	30	63	61	166	84	88	190	64	102	264	49	94
67	15.1	942	927	974	991	991	9	74	191	29	63	61	168	84	89	193	64	104	267	52	95
68	13.9	945	929	975	997	992	9	75	192	29	63	61	170	85	90	195	64	105	270	53	96
69	15.5	951	932	977	995	992	9	76	194	29	63	62	171	86	91	198	64	106	272	54	97
70	15	952	934	979	1003	995	9	78	196	30	64	62	173	87	92	198	63	107	274	54	98
71	15.3	954	936	983	1002	998	9	79	197	30	64	62	175	87	93	202	63	108	277	54	98
72	15.6	956	939	986	1003	1000	9	80	199	30	64	63	177	88	95	204	62	110	280	54	99
73	16.1	959	942	990	1010	1003	9	80	201	31	65	63	178	89	94	207	62	110	284	54	100
74	15.3	961	945	991	1009	1006	9	81	202	30	65	64	180	89	96	209	61	112	287	54	100
75	16.1	963	948	994	1013	1009	9	82	204	30	65	64	182	90	97	211	61	113	290	53	101
76	14.1	965	950	996	1015	1011	9	82	206	30	66	64	184	90	98	212	61	114	293	53	101
77	13.9	969	951	997	1016	1011	9	84	207	31	66	65	187	89	99	213	60	116	298	51	101
78	15.9	973	954	999	1018	1014	9	84	210	31	67	65	188	89	100	215	60	116	305	51	102
79	16.3	974	957	999	1020	1015	9	85	211	32	66	65	190	89	100	218	59	117	311	51	103
80	14.1	976	960	1003	1023	1018	9	86	213	32	68	65	193	89	101	221	58	120	318	51	103
81	14.9	978	963	1005	1023	1021	9	86	215	32	68	66	194	88	102	222	58	120	327	52	104
82	15.4	981	964	1006	1023	1021	9	86	217	32	69	67	196	88	102	224	58	122	336	52	105
83	14.9	983	966	1009	1035	1024	9	87	218	32	69	67	198	88	103	227	59	124	347	52	106
84	14.4	984	970	1011	1033	1027	9	87	221	32	71	67	201	88	103	228	59	124	359	53	107
85	15.4	985	971	1014	1033	1030	9	89	222	34	71	67	203	89	103	230	58	127	370	53	108

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 10	Chan 11	Chan 12	Chan 13	Chan 14	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22	Chan 23
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
86	14	990	974	1015	1039	1030	9	90	224	34	73	68	206	90	104	232	58	129	379	53	109
87	14.5	991	977	1017	1037	1031	9	90	226	34	73	68	208	90	104	234	57	130	387	53	111
88	15.1	993	979	1019	1044	1033	9	91	228	33	75	68	211	91	105	235	57	133	393	53	112
89	14	992	978	1017	1035	1031	9	92	229	35	76	69	213	91	106	236	57	136	400	53	112
90	13.8	993	976	1017	1037	1030	9	93	230	34	77	69	215	91	107	238	56	139	405	53	114
91	16.5	995	977	1017	1040	1031	9	93	232	34	78	69	217	91	108	239	56	143	410	52	115
92	14.5	997	978	1018	1036	1032	9	94	234	34	80	70	219	91	109	240	56	149	416	52	116
93	16	995	980	1020	1040	1034	9	95	235	34	80	70	222	91	110	241	56	157	422	52	118
94	14.6	999	981	1021	1042	1035	9	96	237	34	81	70	224	90	112	243	56	166	430	51	119
95	15.6	998	982	1023	1044	1035	9	96	238	33	82	71	226	90	113	244	56	175	435	51	121
96	16.3	1002	984	1024	1046	1037	9	97	240	34	83	71	228	90	114	245	56	184	439	51	123
97	15.1	1002	985	1025	1048	1039	9	98	241	34	83	71	231	90	115	246	56	195	444	51	125
98	15.3	1005	988	1026	1046	1040	9	98	243	34	84	72	233	89	117	248	56	205	448	51	129
99	14.8	1007	989	1028	1047	1041	9	99	245	33	85	72	235	89	118	249	56	216	454	51	131
100	16.1	1008	990	1029	1048	1043	9	100	246	33	85	72	237	89	120	251	56	227	458	51	136
101	14	1009	992	1031	1050	1043	9	101	247	34	87	72	240	89	123	253	57	237	463	52	141
102	15.3	1010	994	1031	1049	1045	9	103	249	34	87	73	243	91	126	255	57	246	465	52	151
103	15.9	1014	995	1033	1051	1046	9	105	251	33	89	73	246	91	129	256	57	255	469	52	163
104	15.7	1014	996	1035	1052	1048	9	105	253	34	89	73	250	92	132	258	58	264	474	53	239
105	15.6	1014	998	1035	1055	1050	9	107	254	33	90	73	254	92	136	259	58	272	477	54	237
106	14.4	1017	1002	1038	1057	1052	9	108	255	33	91	74	257	92	139	260	58	279	477	55	195
107	14.6	1018	1006	1039	1057	1054	9	110	257	32	91	74	259	91	143	261	58	284	482	56	38
108	14.5	1020	1008	1041	1060	1057	9	110	258	31	92	74	261	91	148	262	58	289	484	56	21
109	14.2	1021	1009	1043	1061	1058	9	113	260	31	92	75	262	90	155	263	58	294	489	57	14
110	14	1024	1012	1046	1062	1060	9	115	261	31	94	75	264	90	161	264	58	298	493	58	11
111	16.6	1025	1012	1046	1067	1061	9	118	264	32	96	75	266	89	167	265	59	302	500	60	10
112	15	1028	1016	1049	1069	1068	9	120	266	33	97	76	269	89	174	266	60	306	510	60	9
113	14.1	1030	1019	1051	1069	1068	9	123	268	32	98	76	271	89	180	268	60	310	522	61	10
114	15.6	1032	1018	1051	1069	1068	9	126	270	34	99	76	273	88	185	269	59	317	612	69	10
115	15.2	1035	1021	1055	1074	1072	9	132	273	35	100	77	275	88	191	271	58	346	259	82	10
116	14.1	1036	1022	1055	1074	1071	9	137	275	35	101	77	277	88	195	272	57	371	259	91	11

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 10	Chan 11	Chan 12	Chan 13	Chan 14	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22	Chan 23
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
117	14.6	1038	1023	1057	1073	1073	9	146	278	38	103	78	279	88	200	273	55	398	285	102	11
118	14.7	1039	1024	1058	1075	1074	9	153	281	39	104	79	281	88	204	274	55	377	275	135	11
119	14.8	1041	1026	1059	1077	1075	9	161	284	40	106	79	283	89	209	276	54	356	264	168	11
120	14.8	1042	1027	1060	1078	1076	9	168	286	41	107	80	285	89	213	277	54	334	254	200	11
121	14.9	1043	1028	1061	1080	1077	9	175	289	42	108	80	287	89	217	278	53	313	243	233	11
122	14.7	1045	1029	1062	1080	1078	9	181	293	41	109	81	290	89	220	280	53	211	166	169	11
123	14.6	1047	1030	1063	1081	1078	9	187	296	39	111	81	292	90	224	281	52	110	89	104	11
124	14.4	1049	1031	1064	1081	1079	9	193	299	38	112	82	294	90	227	282	52	8	12	39	11
125	16	1049	1035	1067	1087	1083	10	197	302	39	115	83	297	90	230	283	52	10	11	23	11
126	15.3	1051	1035	1067	1087	1083	10	201	305	38	116	83	299	90	233	284	52	9	11	18	11
127	10.7	1051	1033	1065	1080	1079	10	204	308	37	119	84	301	91	235	286	51	9	11	16	11
128	16.1	1033	1014	1036	1048	1050	9	207	310	36	121	85	304	91	237	283	51	9	11	15	10
129	16.5	1030	1012	1041	1061	1055	10	210	312	35	125	86	306	91	240	280	52	9	11	15	10
130	13.6	1036	1019	1049	1067	1063	10	213	314	36	130	87	309	92	242	279	52	9	11	16	10

Time	Chan 24	Chan 25	Chan 29	Chan 30	Chan 31
min	°C	°C	°C	°C	°C
0	12	11	12	11	10
1	17	57	13	47	29
2	27	101	15	80	81
3	35	199	19	95	101
4	43	62	22	102	101
5	56	41	24	105	102
6	71	56	27	107	102
7	97	66	30	110	101
8	125	65	33	112	101
9	101	61	38	114	98
10	86	59	42	116	97
11	85	58	46	117	95
12	165	59	50	119	94

Time	Chan 24	Chan 25	Chan 29	Chan 30	Chan 31
min	°C	°C	°C	°C	°C
13	159	59	54	121	93
14	154	56	57	123	92
15	151	56	60	126	93
16	149	56	62	129	94
17	149	55	63	132	95
18	148	53	64	134	94
19	148	53	64	137	96
20	149	54	65	140	97
21	150	61	66	142	97
22	151	58	66	141	96
23	152	57	66	141	93
24	153	54	67	142	90
25	155	54	66	142	89

Time	Chan 24	Chan 25	Chan 29	Chan 30	Chan 31
min	°C	°C	°C	°C	°C
26	157	53	67	143	87
27	158	50	67	143	87
28	160	49	67	143	86
29	162	48	67	144	86
30	163	46	68	145	85
31	165	45	69	146	85
32	166	46	69	147	85
33	168	45	69	148	85
34	169	45	69	149	85
35	170	44	70	150	86
36	172	43	70	151	87
37	173	43	70	152	87
38	175	42	70	153	87
39	176	43	70	155	88
40	178	43	71	156	88
41	180	42	71	158	87
42	181	42	72	160	88
43	183	42	73	162	87
44	185	42	74	164	88
45	188	42	74	167	88
46	190	41	75	170	88
47	193	41	77	172	88
48	196	41	77	176	88
49	199	40	78	178	89
50	202	40	79	181	89
51	205	40	80	183	90
52	208	41	82	185	91
53	211	41	83	188	92
54	213	41	84	190	92
55	216	41	85	193	93
56	219	41	85	195	94

Time	Chan 24	Chan 25	Chan 29	Chan 30	Chan 31
min	°C	°C	°C	°C	°C
57	221	41	85	198	94
58	223	42	86	200	94
59	225	42	87	202	95
60	227	42	88	205	95
61	230	42	89	207	96
62	231	42	90	209	97
63	233	42	91	211	97
64	235	43	92	213	97
65	236	43	93	216	97
66	238	43	94	218	97
67	240	43	95	220	96
68	242	43	96	222	95
69	244	43	97	224	95
70	247	43	98	226	95
71	248	43	100	229	95
72	251	43	100	232	95
73	253	43	101	235	95
74	256	42	102	238	95
75	258	42	102	240	96
76	260	43	103	243	96
77	264	44	104	246	97
78	267	44	104	249	99
79	270	45	105	252	100
80	274	45	106	255	103
81	276	45	106	258	103
82	280	46	107	261	103
83	284	47	108	265	104
84	287	49	109	268	104
85	291	51	110	272	104
86	295	55	110	275	102
87	299	58	112	279	84

Time	Chan 24	Chan 25	Chan 29	Chan 30	Chan 31
min	°C	°C	°C	°C	°C
88	302	61	112	283	67
89	305	63	114	286	59
90	310	65	115	289	55
91	313	68	116	292	53
92	317	68	117	294	52
93	321	69	118	297	48
94	324	71	120	299	48
95	328	72	121	302	48
96	332	77	122	304	48
97	337	87	124	306	49
98	341	101	127	310	50
99	346	128	128	312	49
100	351	201	131	315	49
101	358	238	134	317	49
102	241	228	138	319	50
103	312	99	142	321	49
104	403	45	148	324	50
105	480	24	155	326	50
106	429	17	163	328	50
107	186	15	171	330	50
108	87	14	179	333	50
109	44	13	187	335	50

Time	Chan 24	Chan 25	Chan 29	Chan 30	Chan 31
min	°C	°C	°C	°C	°C
110	27	13	194	338	50
111	19	13	201	340	51
112	16	13	207	342	52
113	13	12	214	344	52
114	12	12	221	348	52
115	12	12	226	352	54
116	12	12	231	355	54
117	11	12	236	359	56
118	11	12	240	363	58
119	11	12	245	367	59
120	11	12	249	370	61
121	11	12	253	374	62
122	11	12	258	380	64
123	11	12	262	385	66
124	11	12	266	390	68
125	11	12	113	242	82
126	11	12	145	274	68
127	11	14	172	338	67
128	11	13	197	386	70
129	11	14	138	236	52
130	11	14	21	29	25

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