



**CONFIDENTIAL**

**Report: Chilt/RF11067**

**A fire resistance test performed on  
eighteen pipe penetration sealing  
systems within a flexible supporting  
construction**

**Test conducted in accordance with  
BSEN 1366-3: 2009  
Test date: 11<sup>th</sup> May 2011**

**Page 1 of 27**



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## 1 Introduction

Eighteen service pipes and sealing systems were supplied for testing, only fifteen of which are subject to this report.

The pipes and sealing systems were installed into a flexible supporting construction, and tested.

## 2 Specimen verification

The specimens were delivered to Chiltern International Fire Ltd (CIFL) during May 2011. CIFL constructed a 130mm thick steel stud/plasterboard clad partition. The client then subsequently installed the systems into the supporting construction, with assistance from CIFL as required.

## 3 Description of supporting construction

The supporting construction comprised a 3000mm wide x 3000mm high x 132mm thick steel stud/plasterboard clad partition, built in accordance with BSEN 1366-3: 2009 into a refractory lined steel restraint frame.

The partition framing was 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 50mm thick, 100kg/m<sup>3</sup> mineral wool insulation friction fitted between the studs, and clad on both faces with 2 layers of 15mm thick type F plasterboard. The supporting construction was fixed on the horizontal edges only; both 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 pipes measured approximately 1200mm long with a minimum of 500mm protruding from the both faces.

The mineral wool insulation was removed for 100mm surrounding the cut out apertures (see below).



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#### 4.1 Pipes fitted through the partition (see figures 1 to 4)

Specimen Reference	Pipe material	Pipe diameter (nominal)	Pipe wall thickness (nominal)	Opening size diameter
1	HDPE	90	3.5	140
2	HDPE	40	3.0	92
3	PVC-U	43	1.8	92
4	PVC-U	110	3.2	160
5	HDPE	110	4.3	160
6	PVC-U	82	3.2	132
7	PVC-U	160	3.2	210
8	PVC-U	160	3.2	218
9	HDPE	110	4.3	160
12	HDPE	160	6.2	210
13	HDPE	160	6.2	218
14	PVC-U	110	3.2	168
15	PVC-U	125	1.5	183
17	Copper	15	1.0	67
18	Copper	159	2.0	209

#### 4.2 Associated sealing system details

All specimens consisted of the relevant sealing system fitted directly within the aperture cut out in the plasterboard.

Pipes 1 - 7, 12, 17 and 18 were tested capped on the unexposed face only.  
Pipes 8 - 9, and 13 - 15 were test uncapped on both faces.

### 4.3 Sealing system

Specimen Reference	Intumescent	Seal length (mm)	Nominal seal thickness (mm)	Pipe insulation (mm)
1	Firefly 109 Firesleeve	180	25	None fitted
2	Firefly 109 Firesleeve	180	25	None fitted
3	Firefly 109 Firesleeve	180	25	None fitted
4	Firefly 109 Firesleeve	180	25	None fitted
5	Firefly 109 Firesleeve	180	25	None fitted
6	Firefly 109 Firesleeve	180	25	None fitted
7	Firefly 109 Firesleeve	180	25	None fitted
8	Firefly 109 Firesleeve	180	25	None fitted
	Firefly 107	180	4	
9	Firefly 109 Firesleeve	180	25	None fitted
	Firefly 107	180	4	
12	Firefly 109 Firesleeve	180	25	None fitted
13	Firefly 109 Firesleeve	180	25	None fitted
	Firefly 107	180	4	
14	Firefly 109 Firesleeve	180	25	None fitted
	Firefly 107	180	4	
15	Firefly 109 Firesleeve	280	25	None fitted
	Firefly 107	280	4	
17	Firefly 109 Firesleeve	Nominally 150	25	* Rockwool pipe section 40 thick x Ø17 Product Ref. 566 203 13
18	Firefly 109 Firesleeve	Nominally 150	25	* Rockwool pipe section 40 thick x Ø169 Product Ref. 566 200 25

\* Aluminium tape was used to seal the joint between the Rockwool insulation and Firefly 109 firesleeve on both faces.

#### 4.4 Service penetrations supports

(Read in conjunction with Appendix 1, figures 1- 5 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 exposed face, 2No 3000mm Unistrut sections were used as vertical supports, bracketed to 2No. Unistrut sections fixed at the top and bottom of the restraint frame. 8No 500mm long Unistrut cantilever arm sections provided support for Unistrut ‘U’ section channels supporting the pipes at 150mm and 450mm from the wall. All specimens were fixed to the supporting Unistrut ‘U’ section channels using cable ties.

##### Unexposed face supporting construction



On the exposed face, 2No 3000mm Unistrut sections were used as vertical supports, bracketed to 2No. Unistrut sections fixed at the top and bottom of the restraint frame. 8No 500mm long Unistrut cantilever arm sections provided support for 8No horizontal lengths of Unistrut, supporting the pipes at 300mm from the wall.

All pipes were not fixed to the supports.

## Exposed face support system



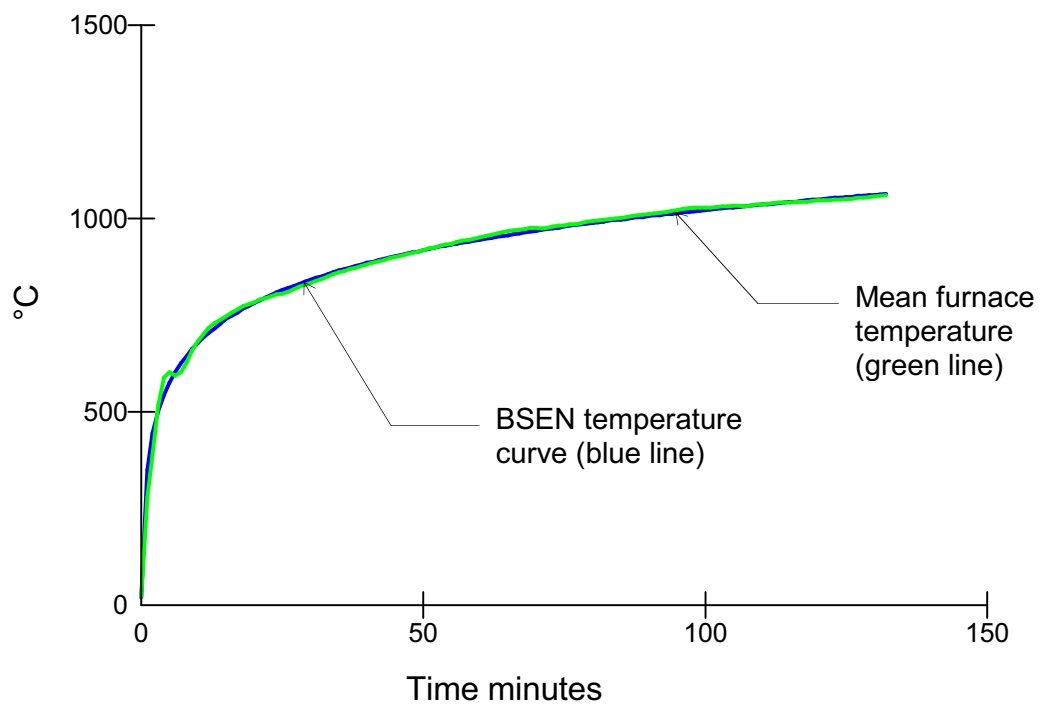
Not subject to this report

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## 5 Test conditions

### 5.1 Furnace temperature

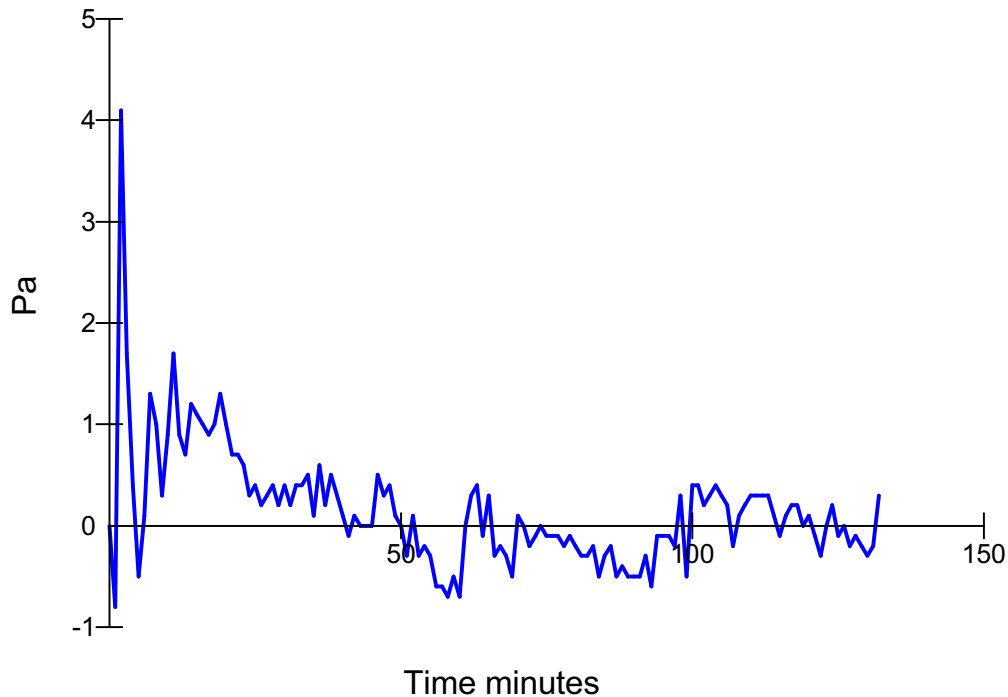
The furnace was controlled to follow the temperature/time relationship specified in BSEN 1363: Part 1: 1999 Section 5.1.1 as closely as possible, using the average of nine plate thermometers suitably distributed within the furnace. The temperatures recorded have been tabulated in Appendix 2 and are shown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



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## 5.2 Pressure readings

After the first 5 minutes of the test, the furnace pressure was maintained at  $0.5 \pm 5$  Pa and after 10 minutes was maintained at  $0.5 \pm 3$  Pa with respect to atmosphere, at a point 0.5m from the notional floor level. Therefore equating to 10 Pa at the base of penetration seals 12, 13, 14, 15 and 16. 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 20° C.

#### 5.4 Thermocouple positions ( see Appendix 1 figure 5)

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

Thermocouple Number	Pipe reference	Type (location)
1	-	Furnace
2	-	Furnace
3	-	Furnace
4	-	Furnace
5	-	Furnace
6	-	Furnace
7	-	Furnace
8	-	Furnace
9	-	Furnace
10	-	Not used
11	1	Fitted on plasterboard 25mm from firesleeve
12	1	Fitted on pipe 25mm from plasterboard
13	2	Fitted on plasterboard 25mm from firesleeve
14	2	Fitted on pipe 25mm from plasterboard
15	3	Fitted on plasterboard 25mm from firesleeve
16	3	Fitted on pipe 25mm from plasterboard
17	4	Fitted on plasterboard 25mm from firesleeve
18	4	Fitted on pipe 25mm from plasterboard
19	5	Fitted on plasterboard 25mm from firesleeve
20	5	Fitted on pipe 25mm from plasterboard
21	6	Fitted on plasterboard 25mm from firesleeve
22	6	Fitted on pipe 25mm from plasterboard
23	7	Fitted on plasterboard 25mm from firesleeve
24	7	Fitted on pipe 25mm from plasterboard
25	8	Fitted on plasterboard 25mm from firesleeve
26	8	Fitted on pipe 25mm from plasterboard
27	9	Fitted on plasterboard 25mm from firesleeve
28	9	Fitted on pipe 25mm from plasterboard
34	12	Fitted on plasterboard 25mm from firesleeve
35	12	Fitted on pipe 25mm from plasterboard
36	13	Fitted on plasterboard 25mm from firesleeve
37	13	Fitted on pipe 25mm from plasterboard
38	14	Fitted on plasterboard 25mm from firesleeve
39	14	Fitted on pipe 25mm from plasterboard
40	15	Fitted on plasterboard 25mm from Firesleeve
41	15	Fitted on Firesleeve 25mm from plasterboard
42	15	Fitted on pipe 25mm from Firesleeve
45	17	Fitted on plasterboard 25mm from firesleeve
46	17	Fitted on pipe insulation 25mm from plasterboard
47	18	Fitted on plasterboard 25mm from firesleeve
48	18	Fitted on pipe insulation 25mm from plasterboard
49	-	Laboratory ambient

Graphs of each service penetration can be found in Section 10.  
The temperatures recorded have been tabulated in the Appendix 2.

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## 6 Observations

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

Time (minutes)	Pipe reference	Comments
00.00		Test started.
08.00	8 and 13	There is smoke issuing from out of the open ends of the specimens.
12.00	13	The specimen is starting to collapse but there is no glow visible.
13.00	9	The specimen is starting to collapse around the sleeve area.
17.00	13	The pipe has fully collapsed but the sleeve has reacted and sealed the opening.
19.00	9	The specimen has collapsed but the sleeve has reacted to seal the gaps.
20.00	All	The smoke issuing from all the pipes has stopped.
33.00	8	There is smoke issuing from around the sleeve.
34.00	4	There is smoke issuing from around the sleeve.
37.00	13	The inner Firefly 107 sleeve has been expelled out to the non fire side by approximately 20-25mm.
39.00	18	There is discolouration around the top half of the sleeve and around the plasterboard.
50.00	18	There is a glow visible at the capped end of the pipe.
52.00	13	The inner Firefly 107 sleeve is falling out of the outer due to expanding graphite.
56.00	12	The pipe is starting to deform and discolouration can be seen around the inner Firefly 107 sleeve.
58.30	4	The specimen is starting to deform at the top of the pipe and the sleeve has started to discolour.
63.00	18	There is a glow visible where the firesleeve and insulation meet.
89.00	12	There is a glow visible at the top between the firesleeve and the pipe.

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91.50	18	A cotton pad integrity test was performed above the specimen, no failure.
93.50	12	A cotton pad integrity test was performed at the top of the sleeve, no failure.
95.10	12	A cotton pad integrity test was performed at the top of the specimen, between the sleeve and pipe, no failure.
96.30	12	A cotton pad integrity test was performed at the top of the specimen, between the sleeve and pipe which resulted in ignition of the cotton pad thereby constituting <b>integrity failure</b> .
124.30	7	There is a glow visible at the top right of the specimen, between the sleeve and pipe.
125.29	7	A cotton pad integrity test was performed at the top right of the specimen, between the sleeve and pipe, no failure.
126.30	7	A cotton pad integrity test was performed at the top right of the specimen, between the sleeve and pipe, no failure.
128.10	7	A cotton pad integrity test was performed at the top right of the specimen, between the sleeve and pipe, no failure.
129.00	7	A cotton pad integrity test was performed at the top right of the specimen, between the sleeve and pipe, no failure.
130.45	7	A cotton pad integrity test was performed at the top right of the specimen, between the sleeve and pipe, no failure.
132.00	7	A cotton pad integrity test was performed at the top right of the specimen, between the sleeve and pipe which resulted in ignition of the cotton pad thereby constituting <b>integrity failure</b> .
132.00	14	There is continuous flaming thereby constituting <b>integrity failure</b> . Test terminated.

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## 7 Expression of results

Pipe penetration seal	Integrity			Insulation
	Cotton pad	Gap gauge	Continuous flaming	
1	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
2	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
3	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
4	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
5	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
6	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
7	132 (one hundred and thirty two) minutes	**132 (one hundred and thirty two) minutes	**132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
8	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	131 (one hundred and thirty one) minutes
9	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
12	96 (ninety six) minutes	**96 (ninety six) minutes	**96 (ninety six) minutes	**96 (ninety six) minutes

\* Failure criteria was not achieved upon termination of the test at 132 minutes

\*\* Failure criteria was not achieved prior to initial failure

Pipe penetration seal	Integrity			Insulation
	Cotton pad	Gap gauge	Continuous flaming	
13	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	120 (one hundred and twenty) minutes
14	**132 (one hundred and thirty two) minutes	**132 (one hundred and thirty two) minutes	132 (one hundred and thirty two) minutes	**132 (one hundred and thirty two) minutes
15	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
17	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes
18	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	*132 (one hundred and thirty two) minutes	39 (thirty nine) minutes


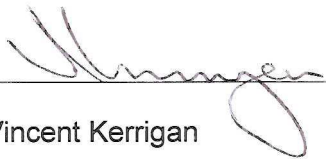
\* Failure criteria was not achieved upon termination of the test at 132 minutes

\*\* Failure criteria was not achieved prior to initial failure

## 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.

<b>Signature:</b>		
<b>Name:</b>	Robert Axe	Vincent Kerrigan
<b>Title:</b>	Deputy Section Leader – Fire Resistance	Technical Manager
<b>Date of issue:</b>	16/6/11	16-06-2011

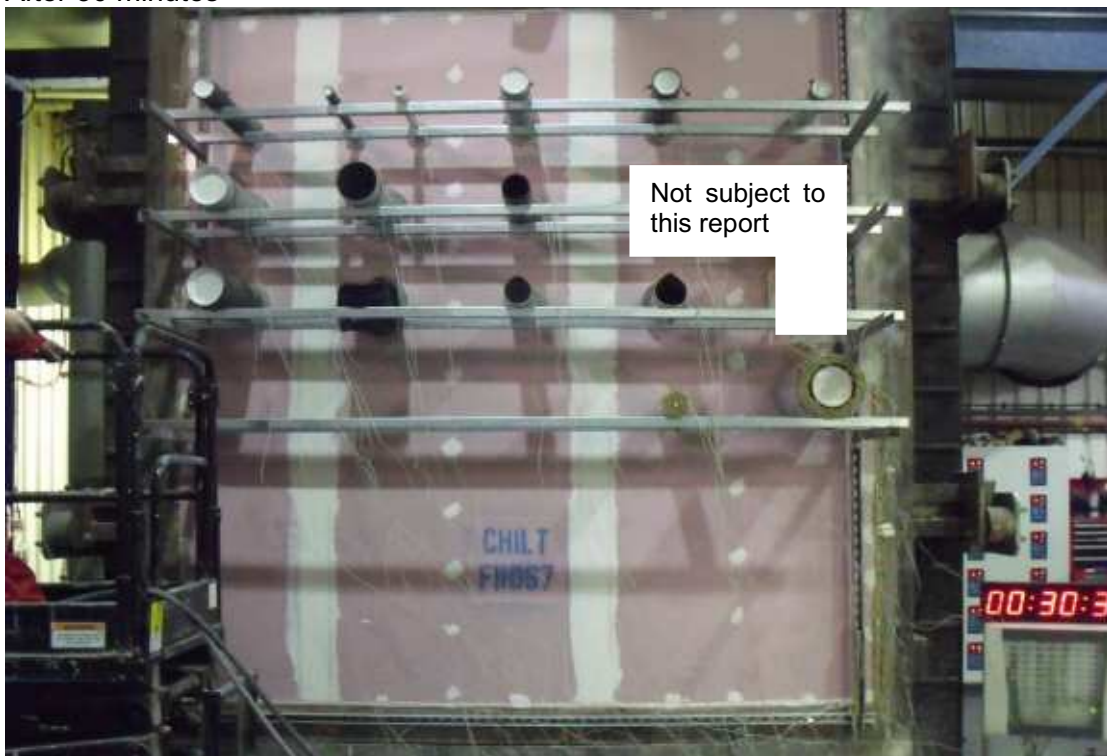
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## 9 Photographs

Unexposed face at start of test

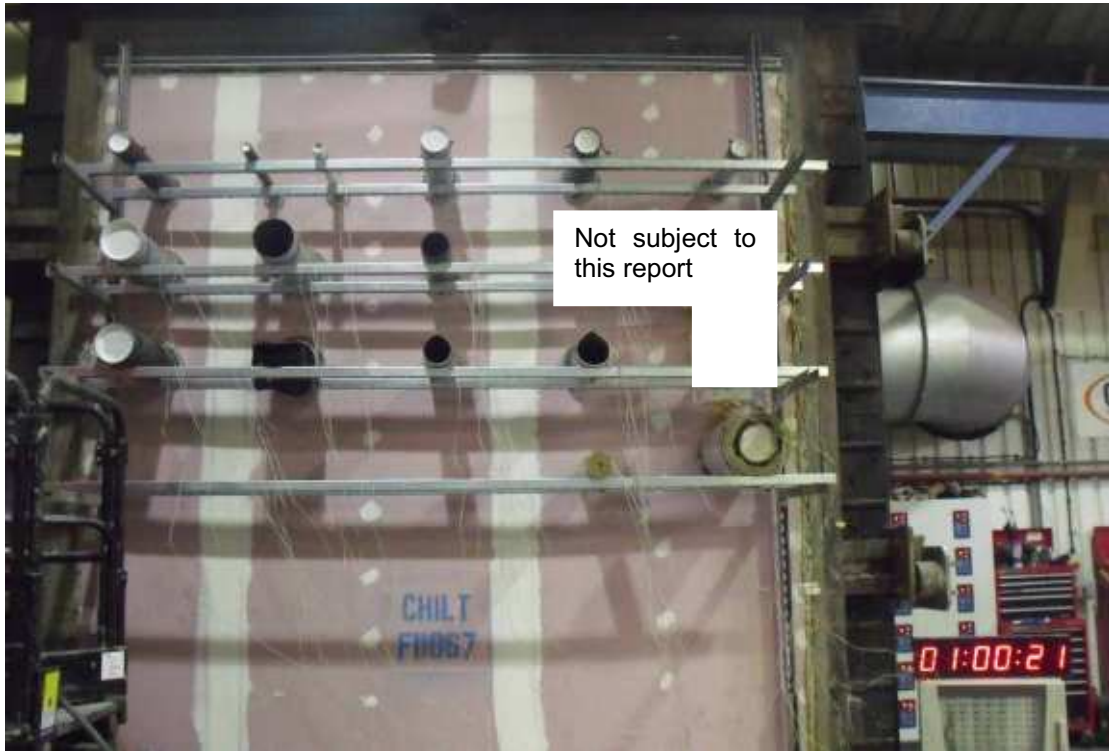


After 30 minutes

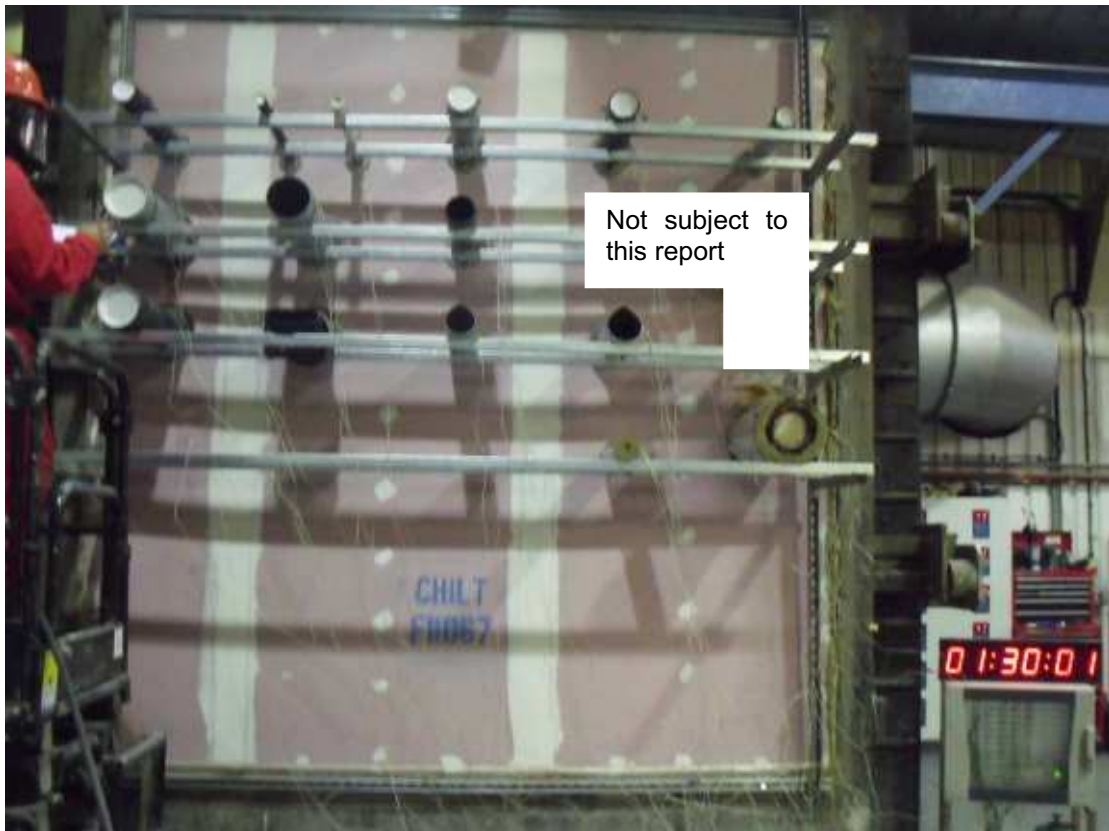


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After 60 minutes

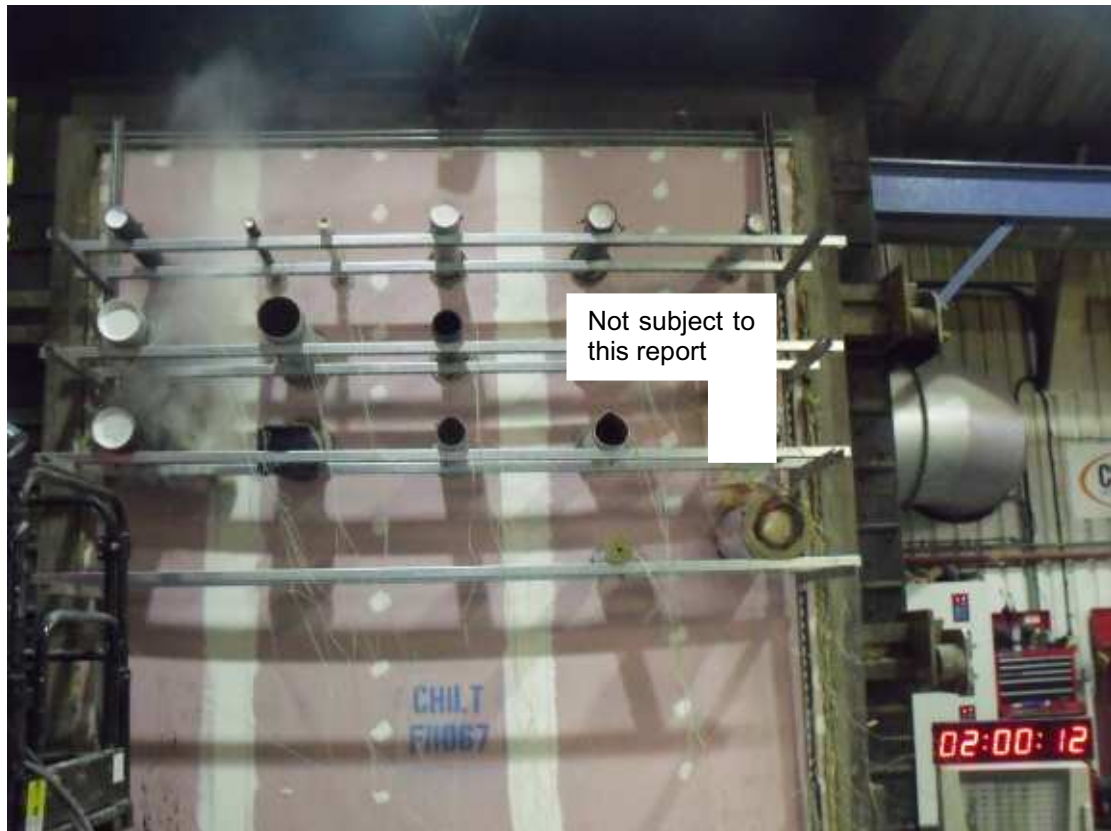


After 90 minutes



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After 120 minutes

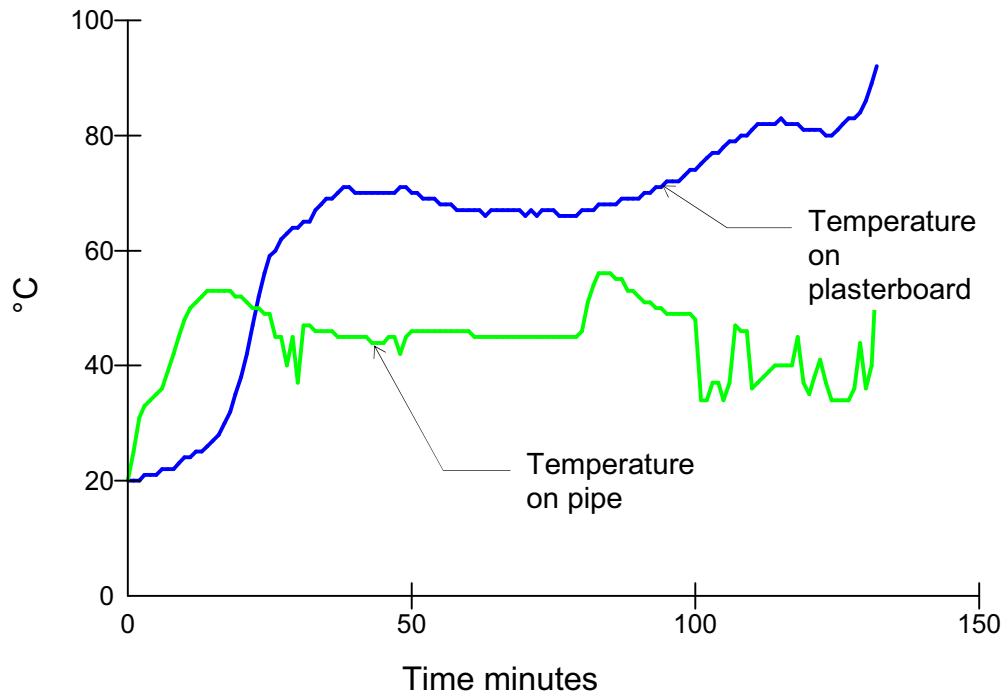


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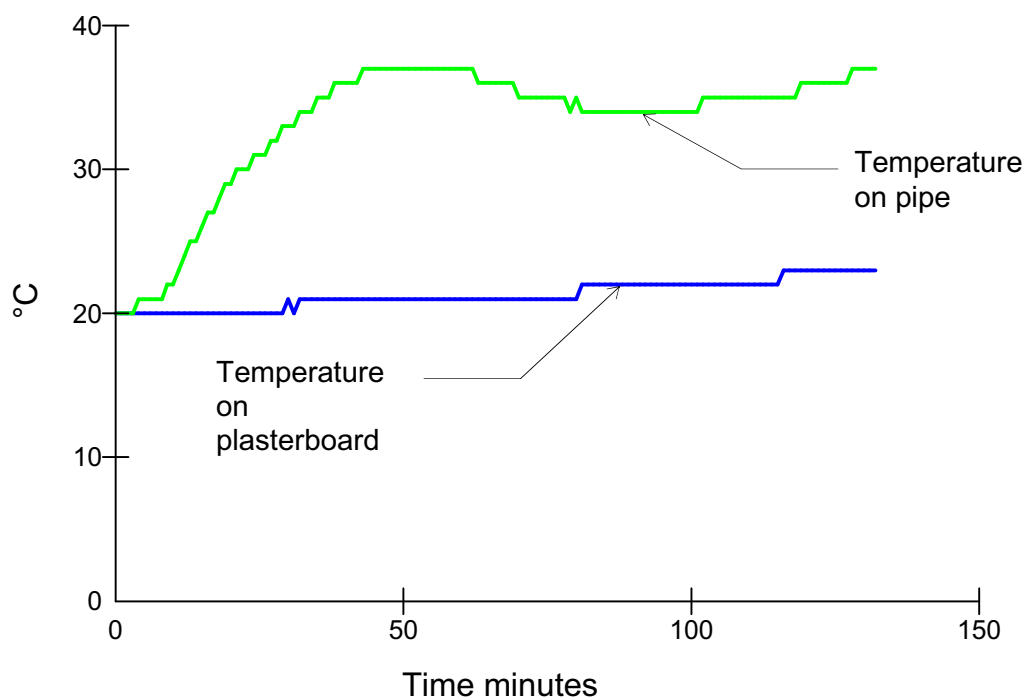
## 10 Graphs

### Unexposed face temperature curves

#### Pipe 1

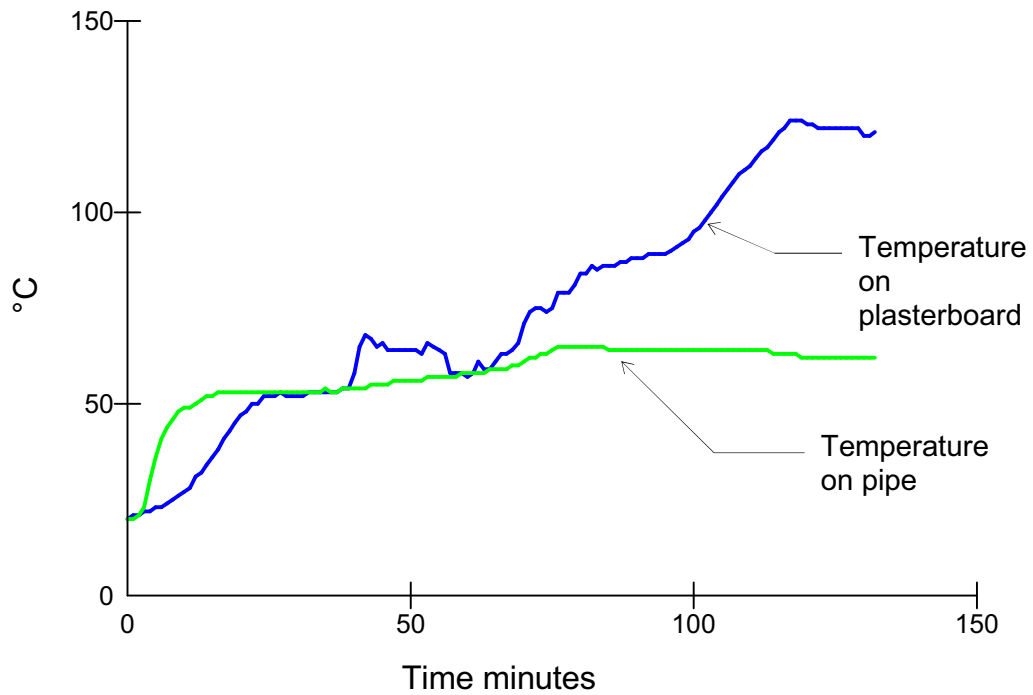


#### Pipe 2

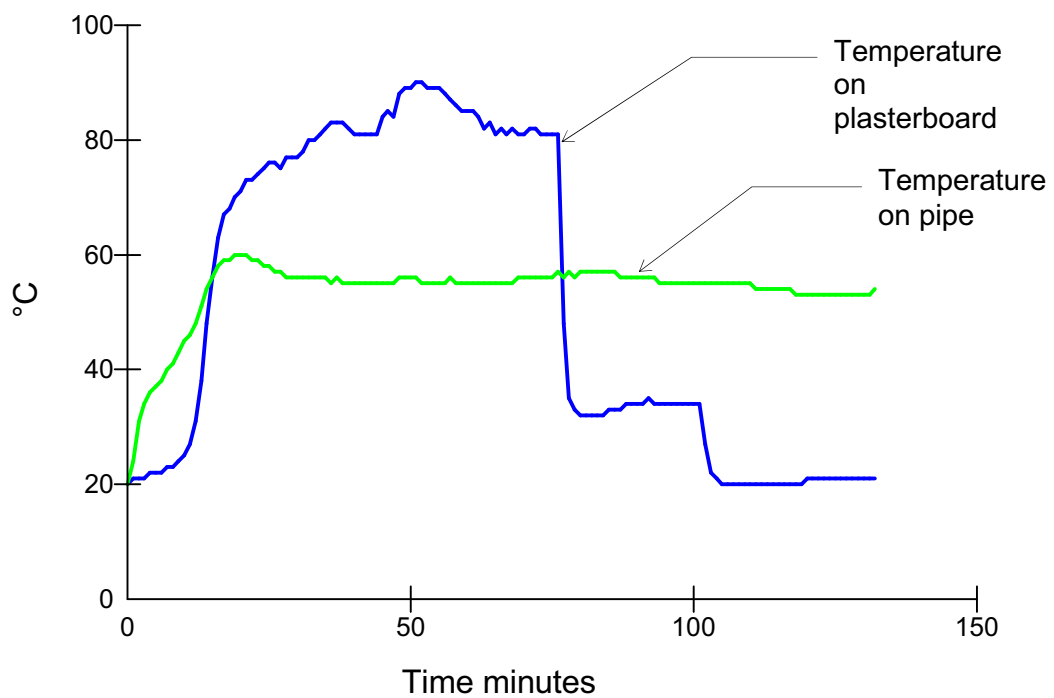


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### Pipe 3

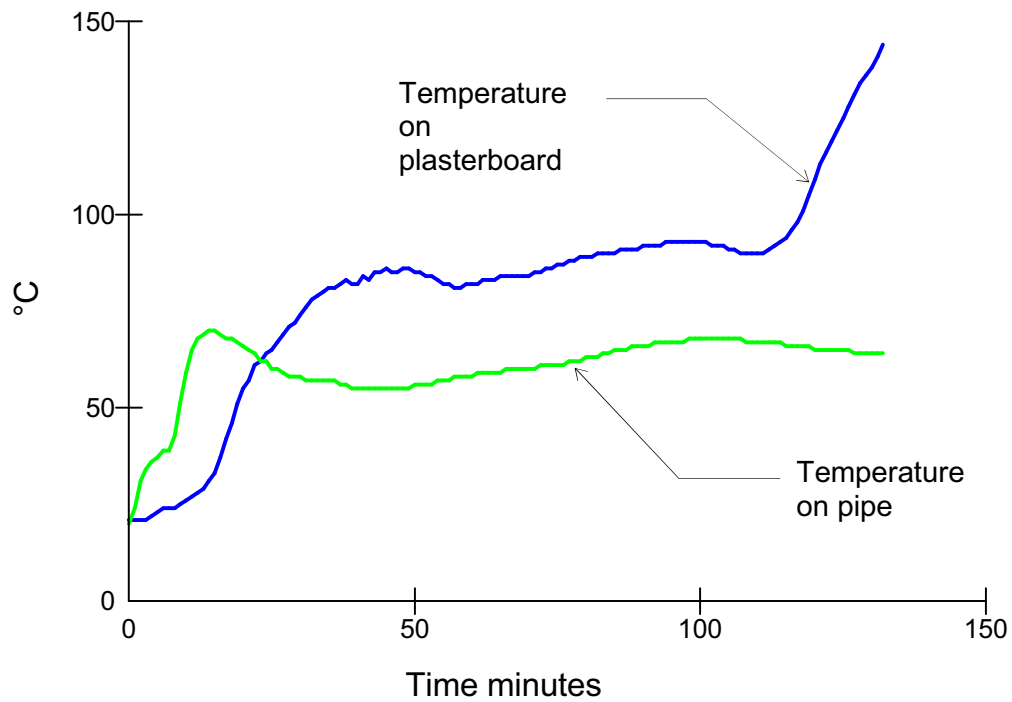


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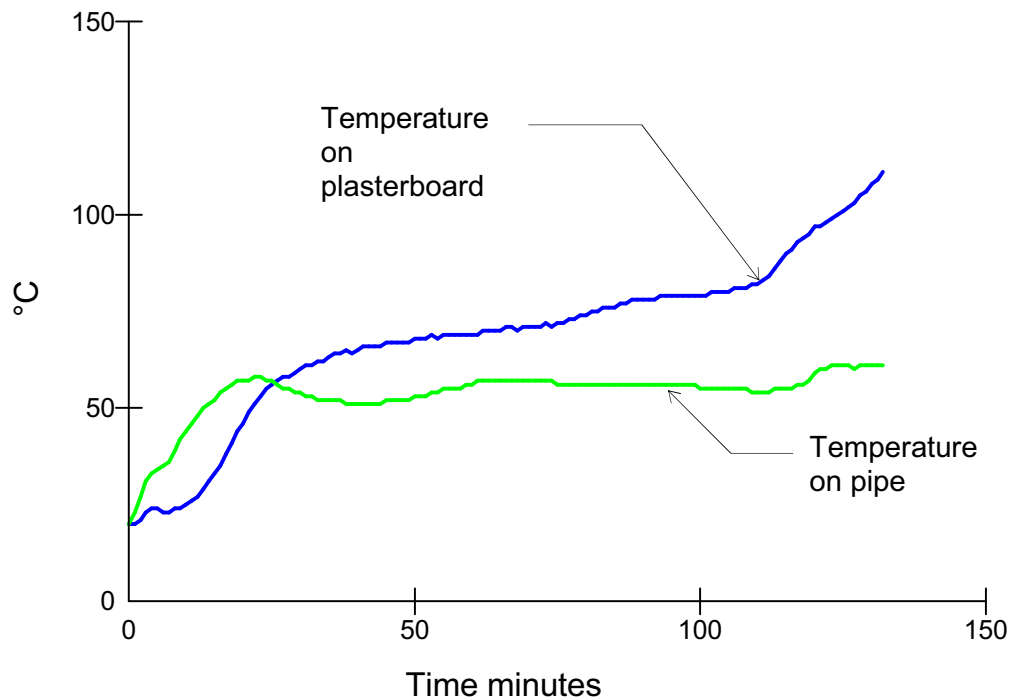


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### Pipe 5

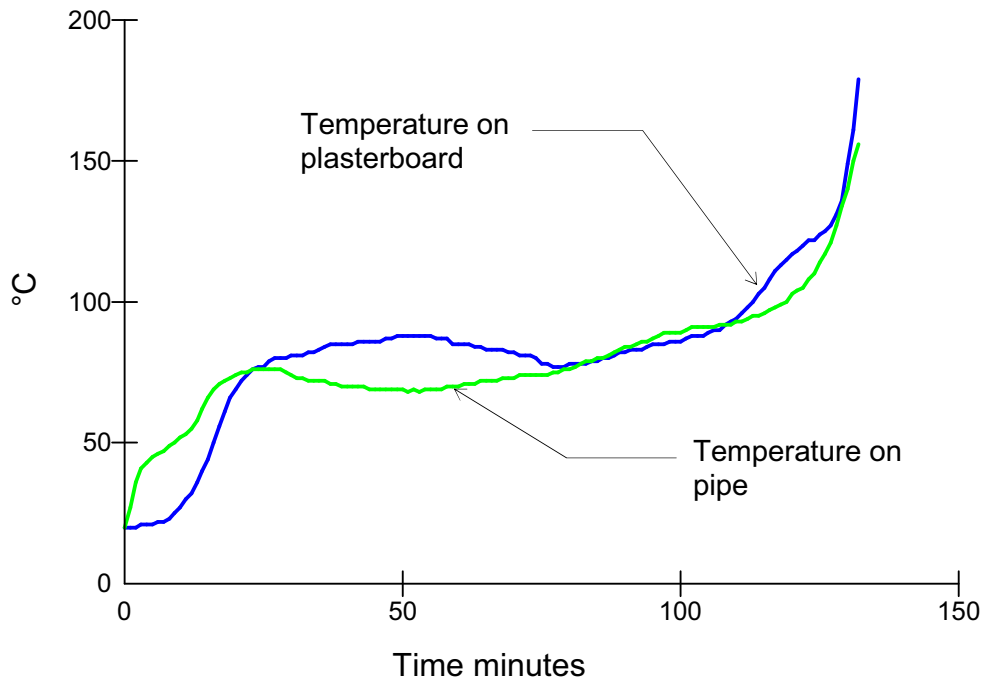


### Pipe 6

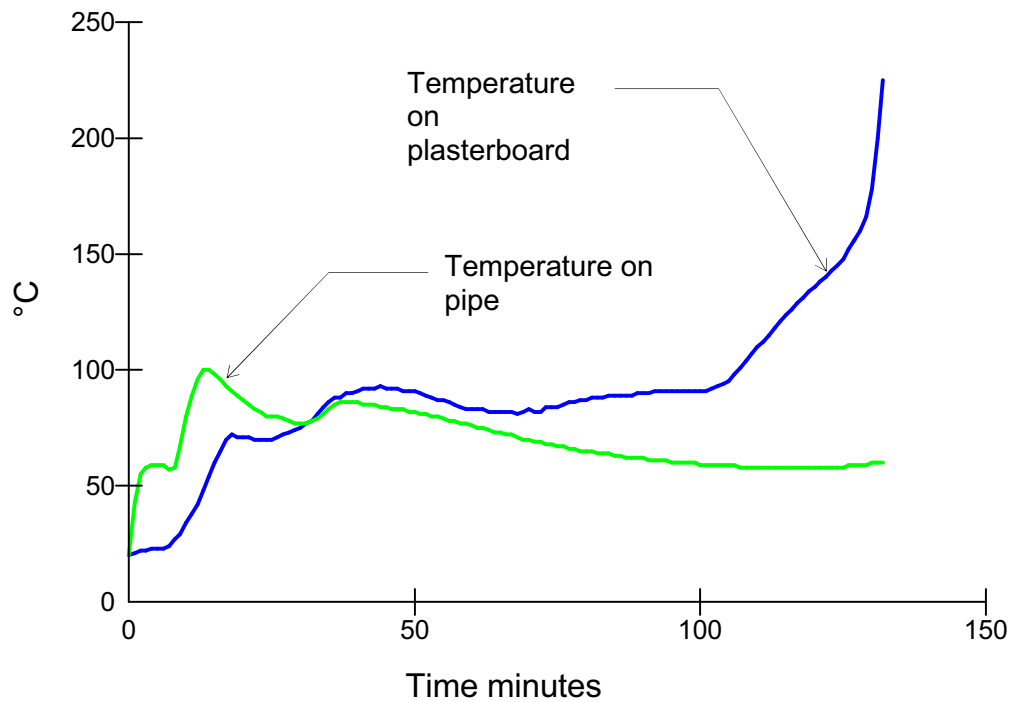


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### Pipe 7

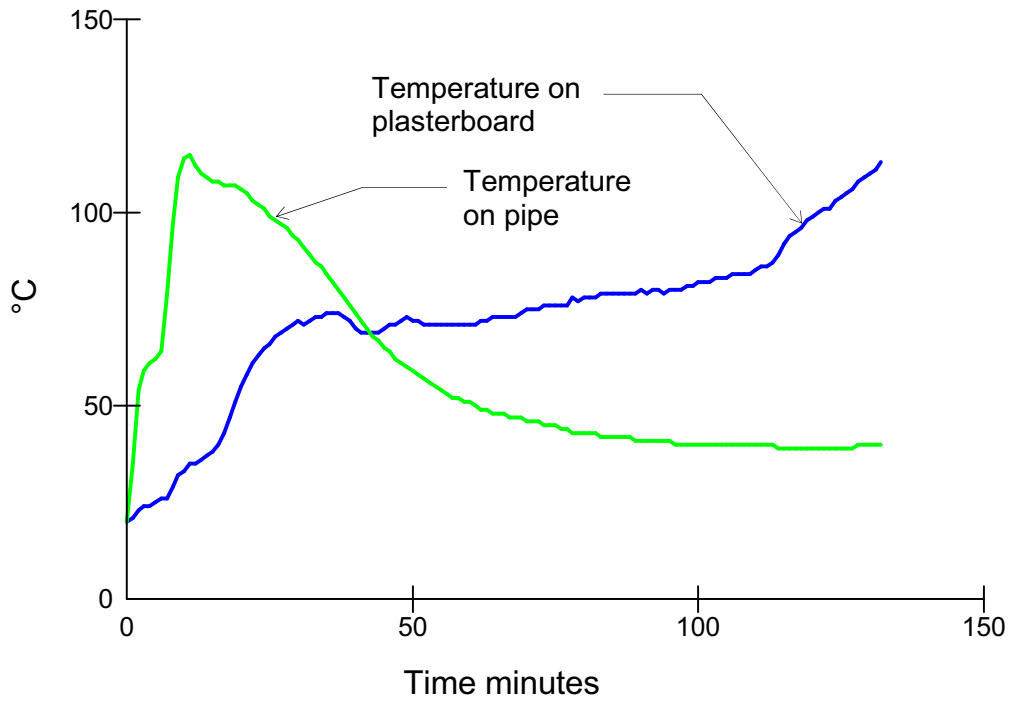


### Pipe 8

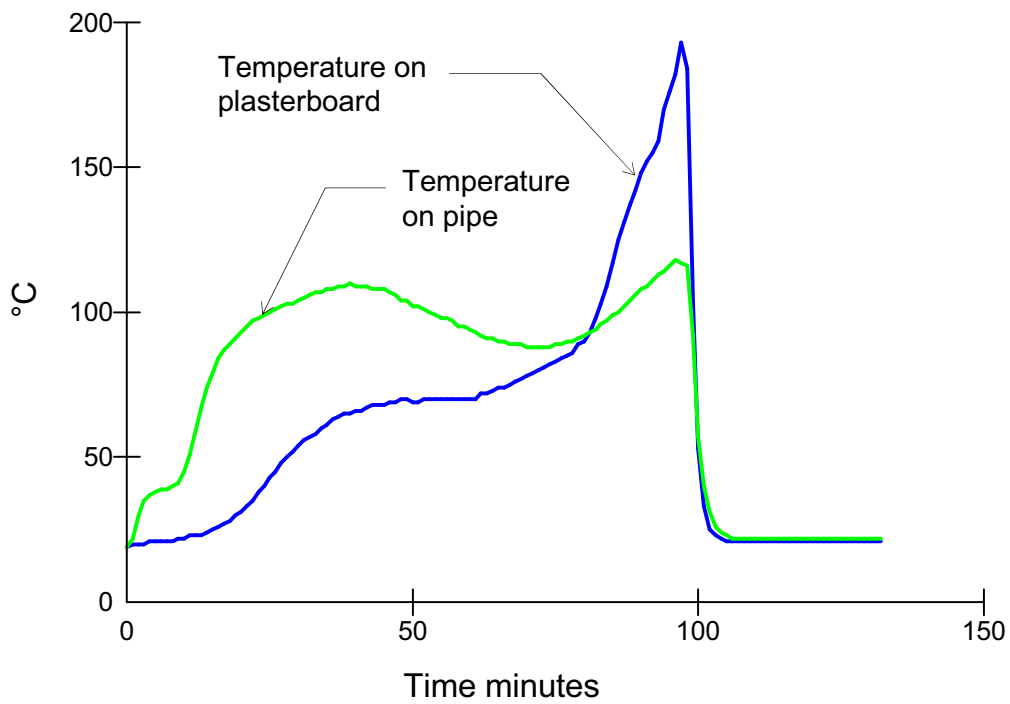


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### Pipe 9

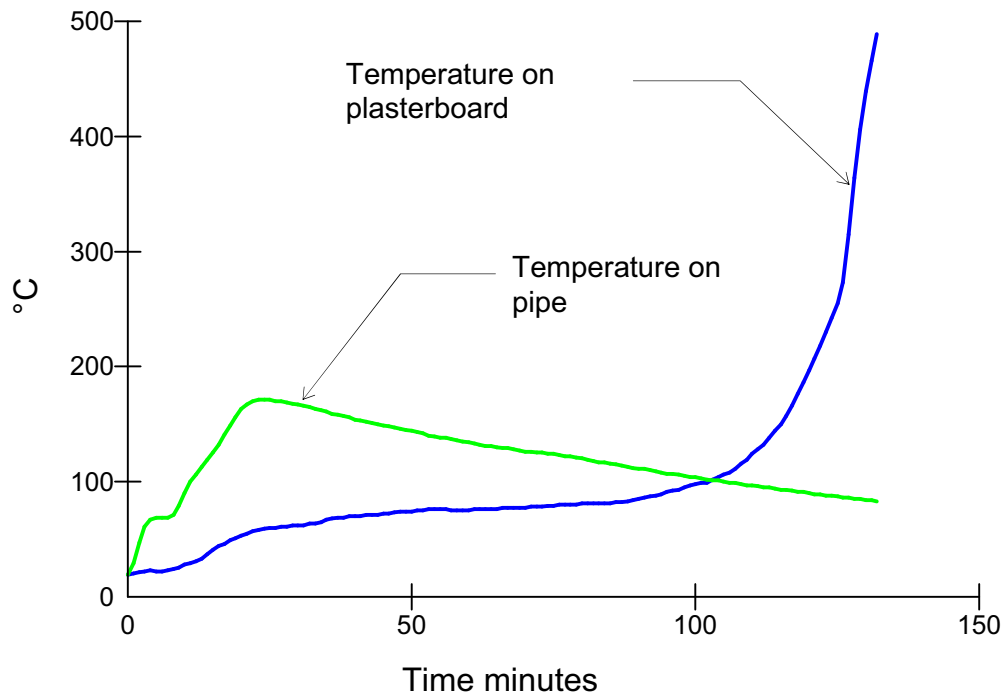


### Pipe 12

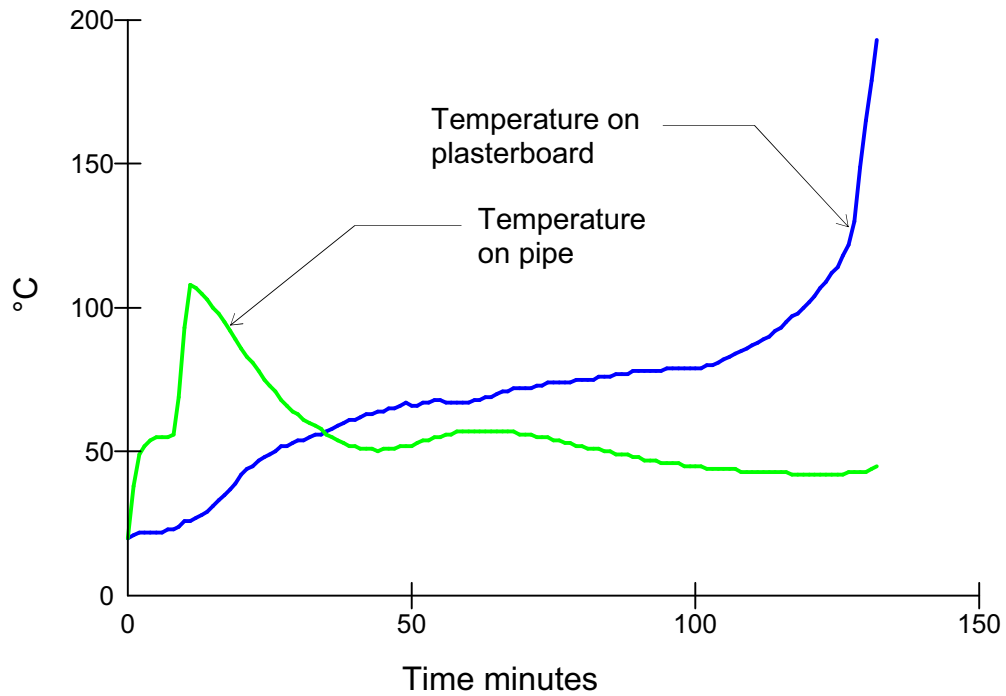


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### Pipe 13

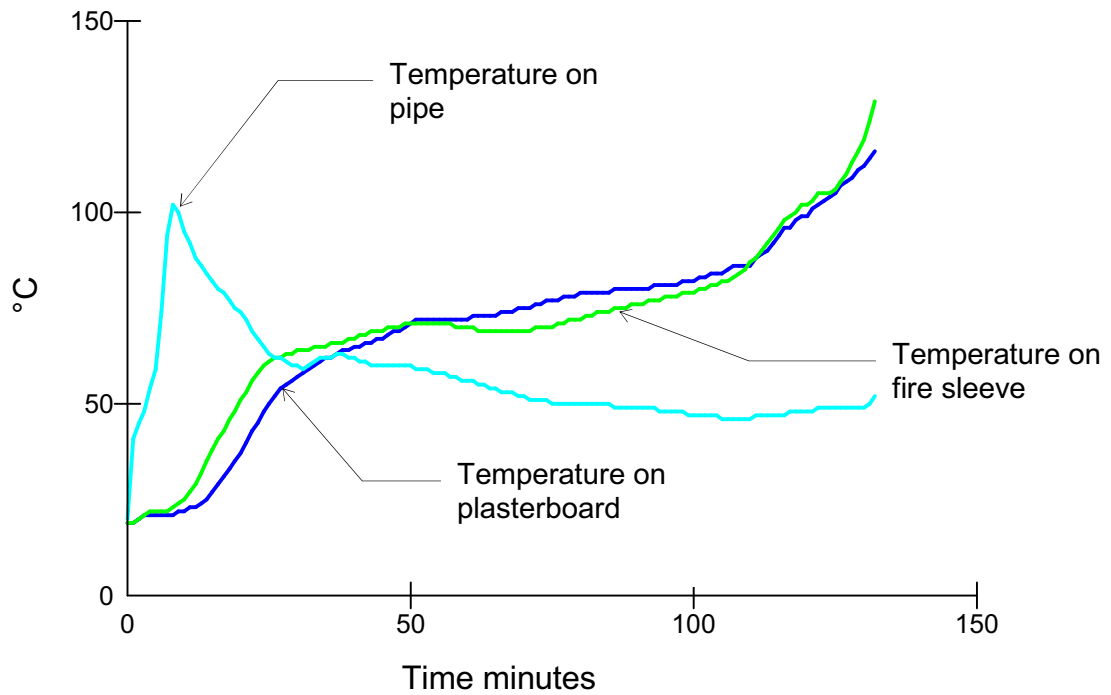


### Pipe 14

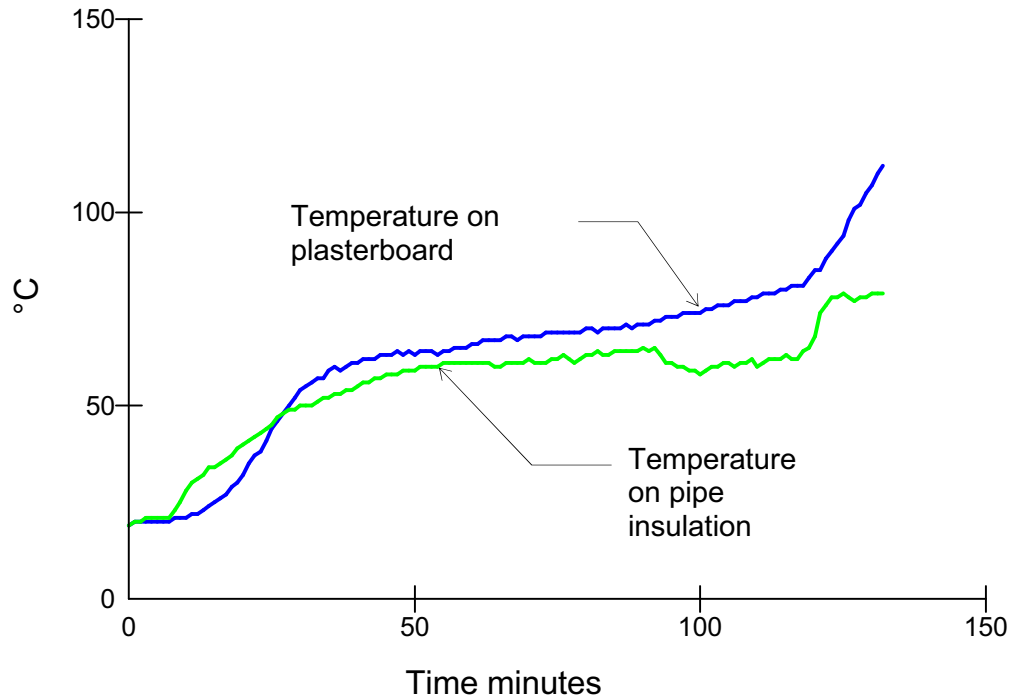


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### Pipe 15

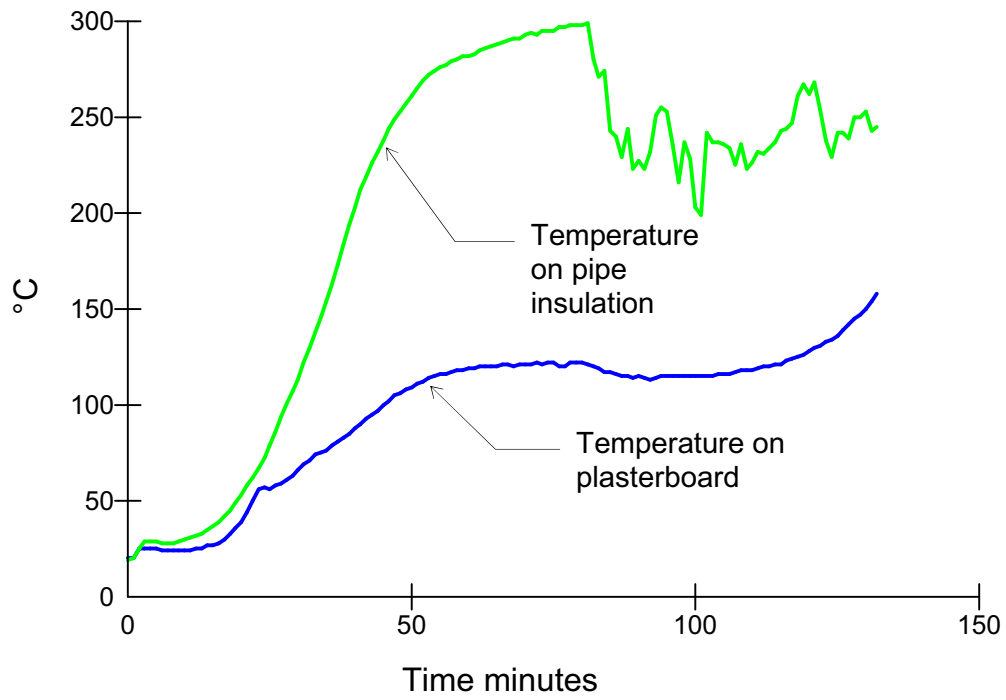


### Pipe 17



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### Pipe 18



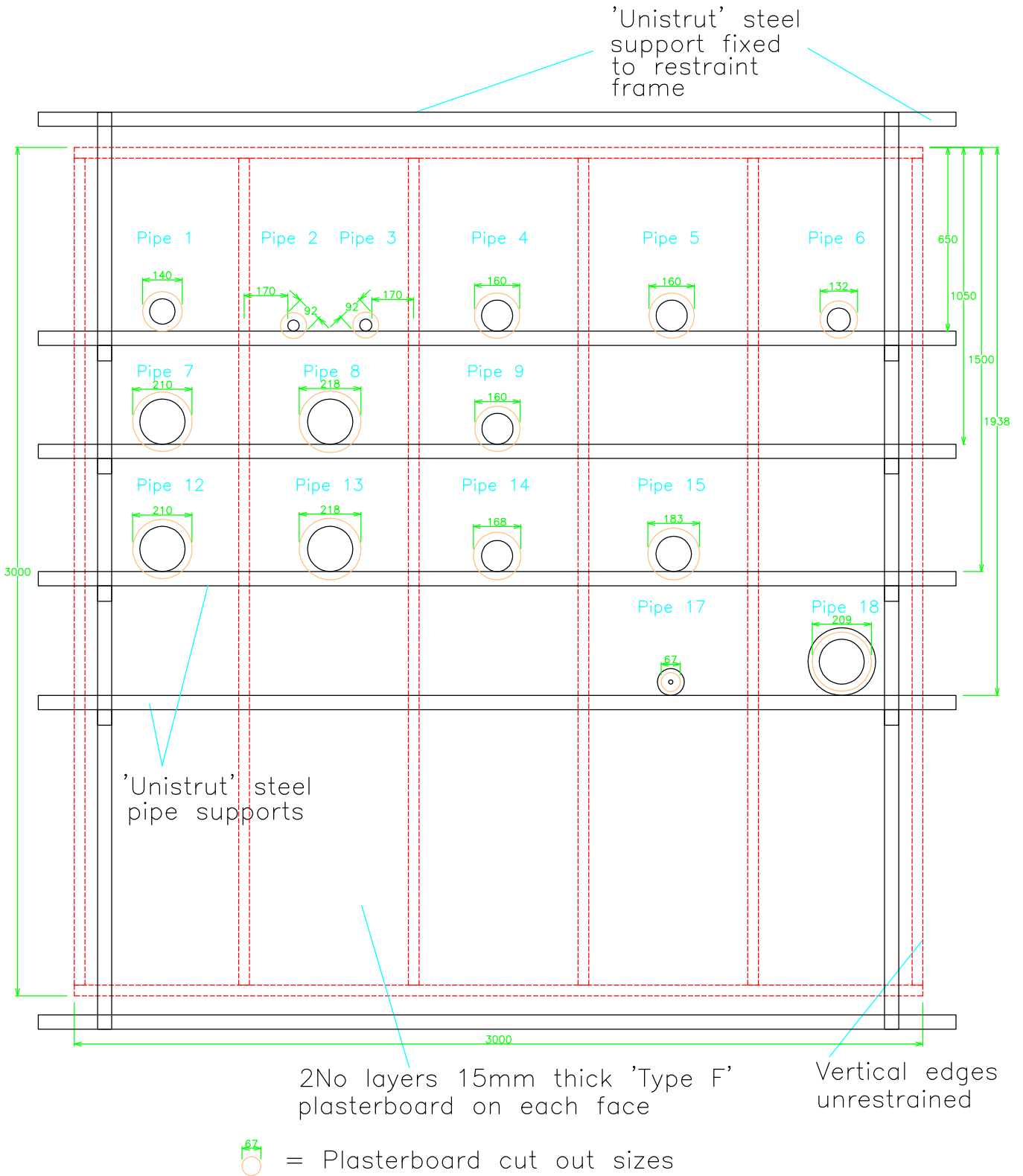
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## Appendix 1 – figures 1 – 5

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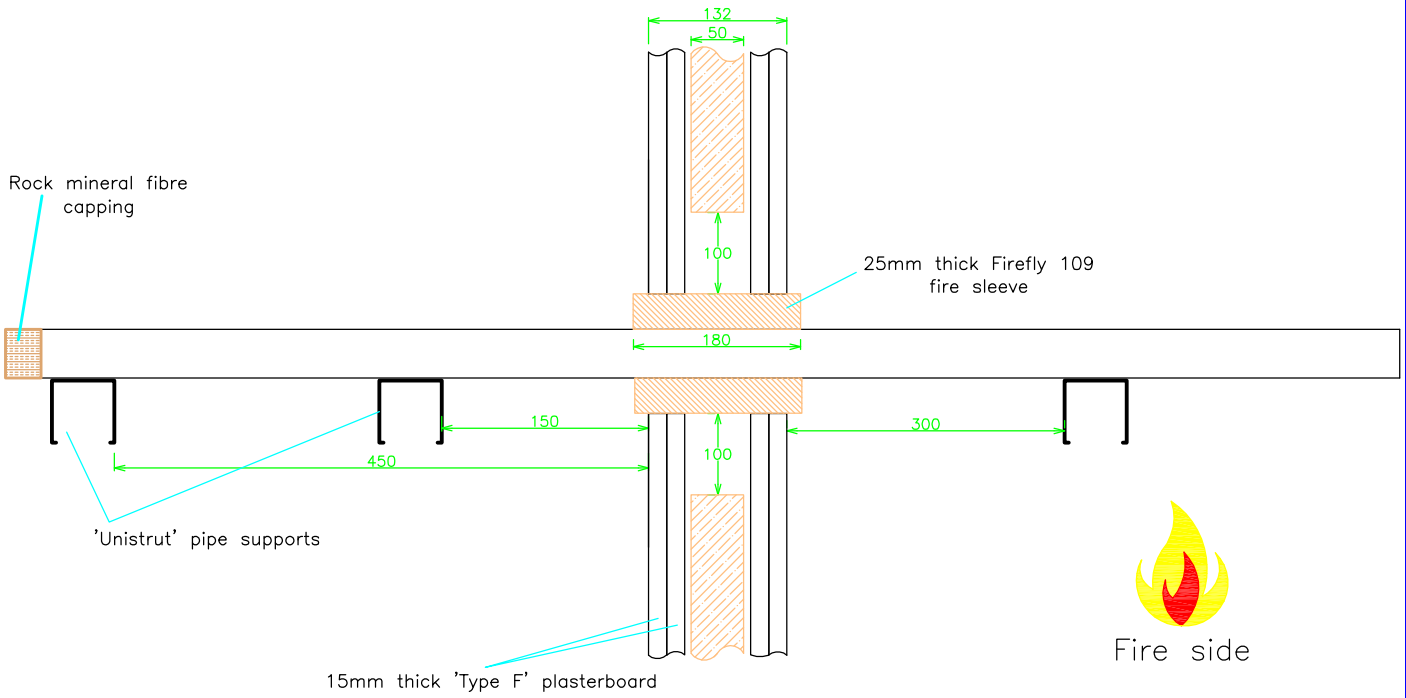


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 High Wycombe, Buckinghamshire, HP14 4ND, UK.  
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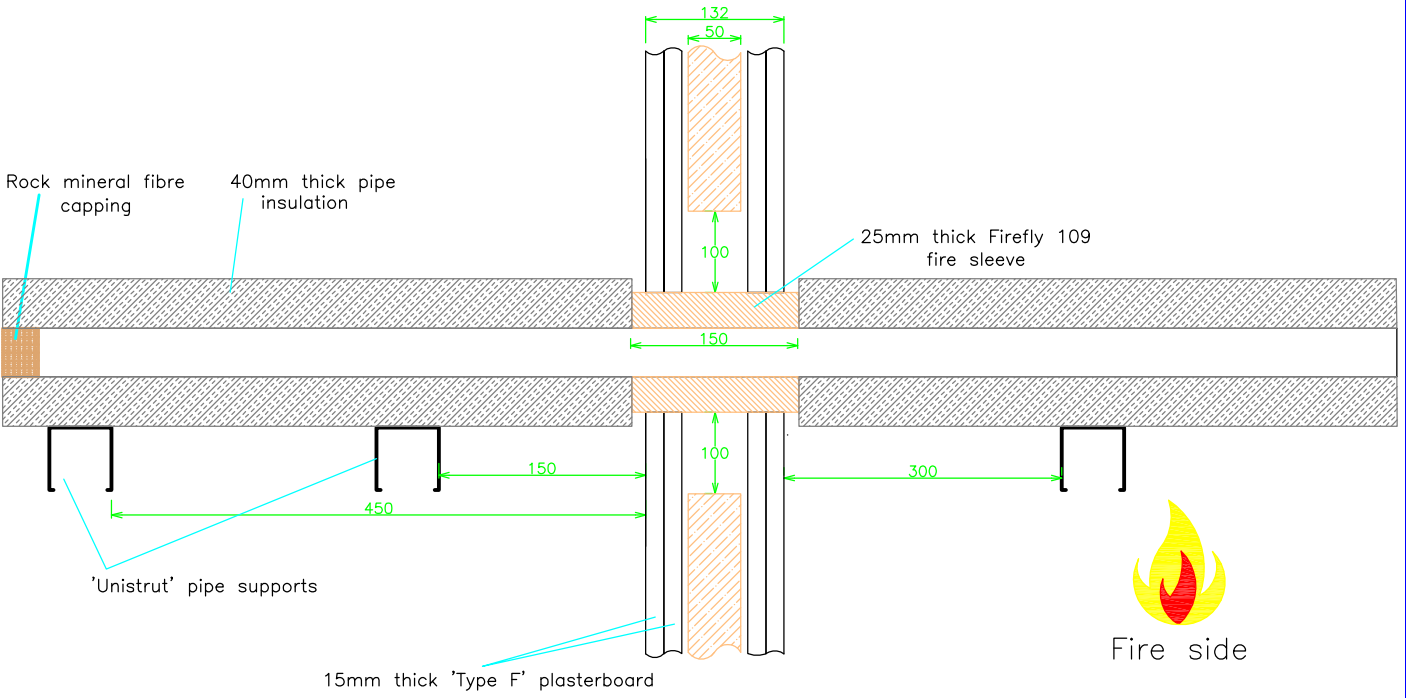
Title  
 Unexposed face front elevation showing studwork and pipe supports  
 (All dimensions in mm)

Date Drawn 19/05/11	Drawn By ARD	Scale NTS
Project No. Chilt/RF11067		Appendix 1

Pipe sealing system  
pipes 1 to 7 and 12



Pipe sealing system  
pipes 17 and 18



Chiltern House, Stocking Lane, Hughenden Valley  
High Wycombe, Buckinghamshire, HP14 4ND, UK.  
Tel: +44 (0)1494 569800 Fax: +44 (0)1494 564895

Title Cross section of pipe seals  
1 to 7, 12, 17 and 18

Date Drawn  
19/05/11

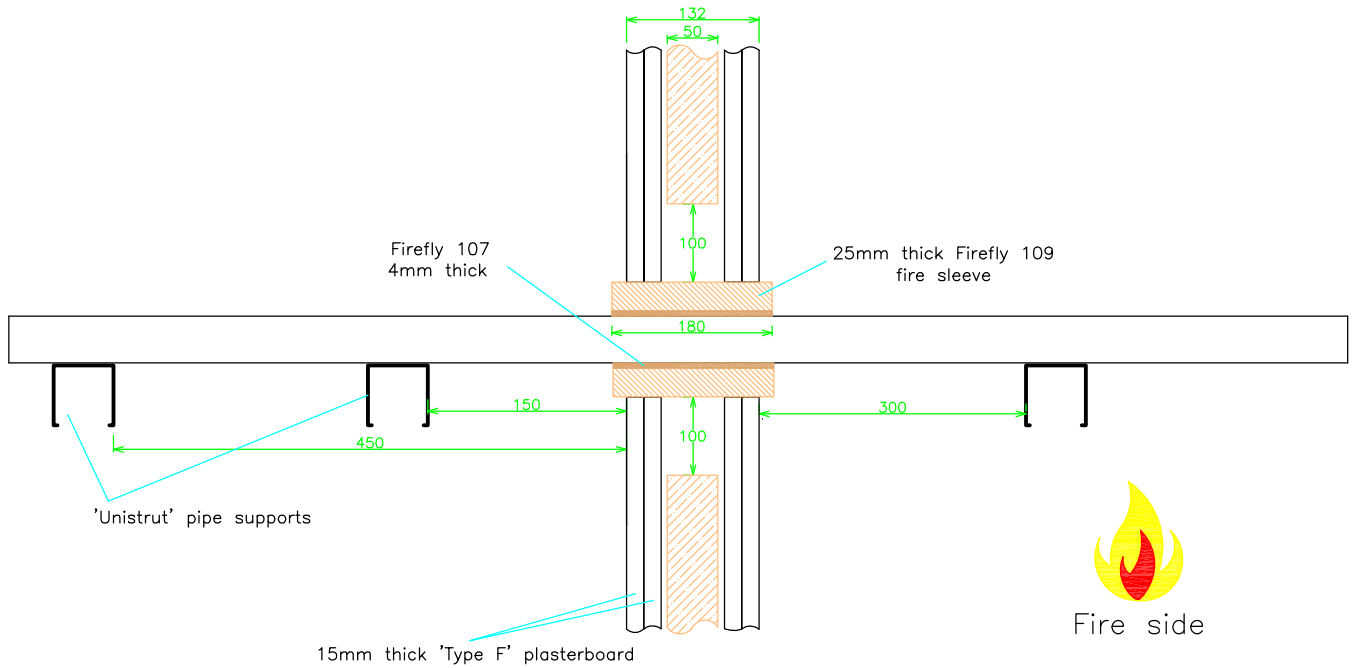
Drawn By  
ARD

Scale  
NTS

Project No.  
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Appendix 1

Pipe sealing systems  
8, 9, 13 and 14



Chiltern House, Stocking Lane, Hughenden Valley  
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Title

Cross section of pipe seals  
8, 9 ,13 and 14

Date Drawn

19/01/11

Drawn By

ARD

Scale

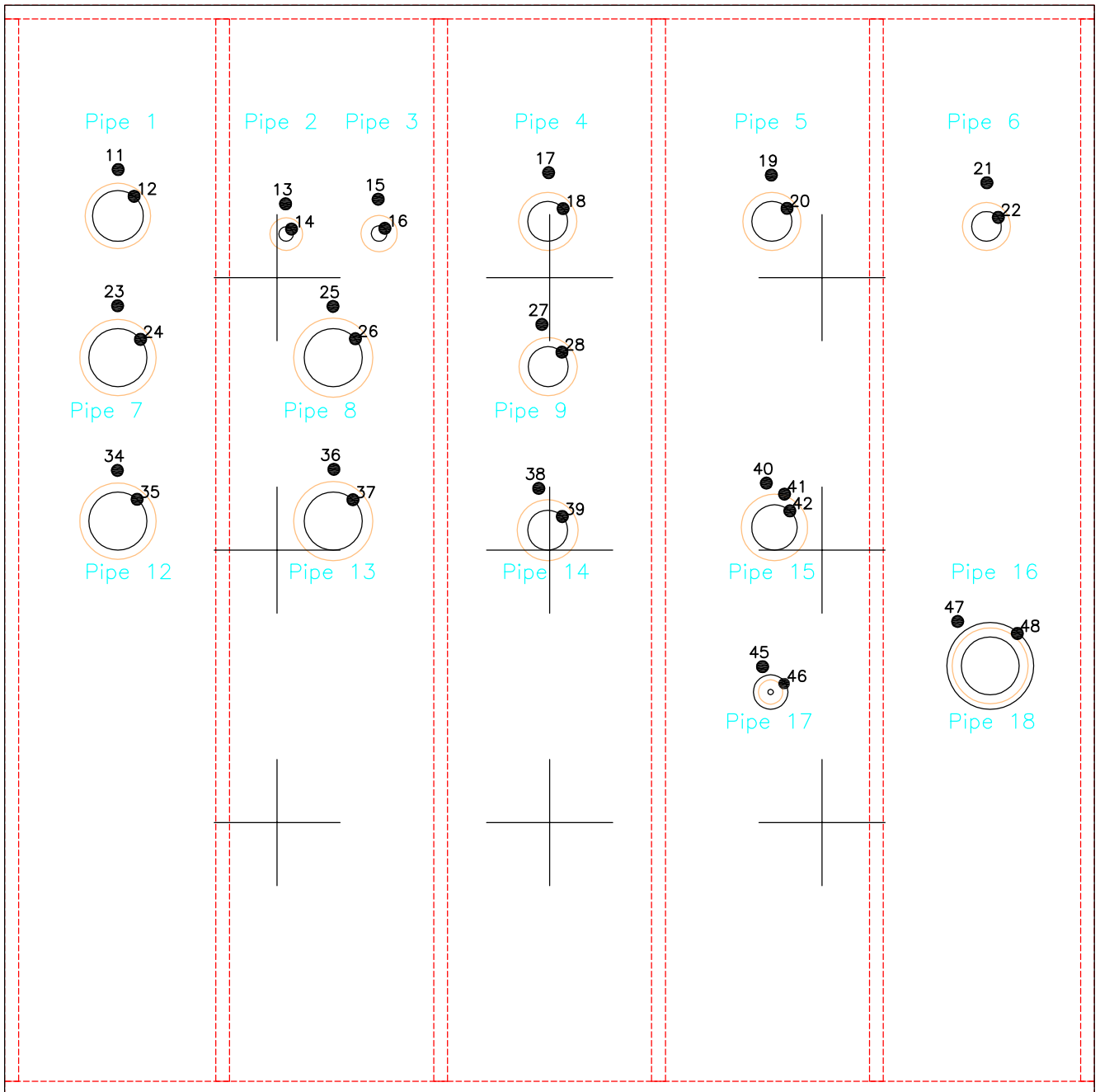
NTS

Project No.

Chilt/RF11067

Appendix 1





 : Furnace Thermocouples  
 : Unexposed Face Thermocouples

Viewed From Unexposed Face



Chiltern House, Stocking Lane, Hughenden Valley  
 High Wycombe, Buckinghamshire, HP14 4ND, UK.  
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Title  
 Thermocouple positions  
 (All dimensions in mm)

Date Drawn 19/05/11	Drawn By ARD	Scale NTS
Project No. Chilt/RF11067		Appendix 1