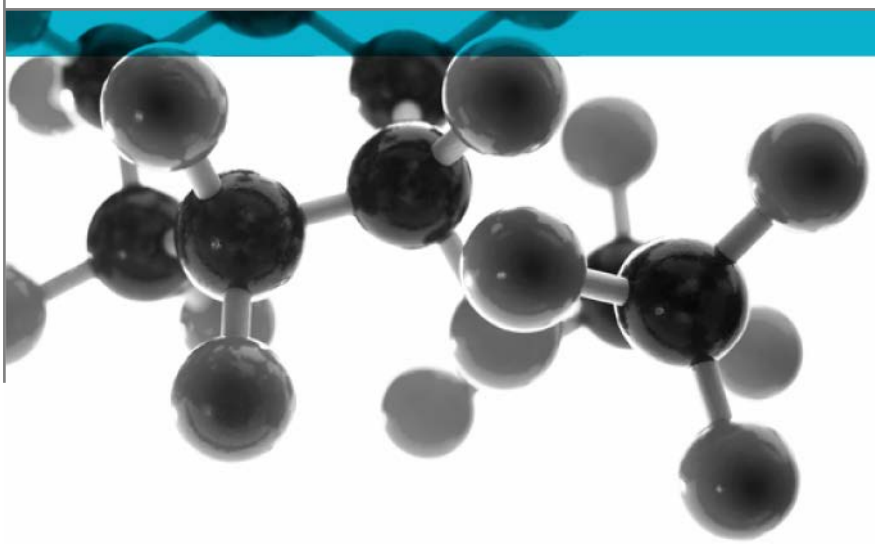
Exova Warringtonfire
Holmesfield Road
Warrington
WA1 2DS
United Kingdom

T : +44 (0 1925 655116
F : +44 (0) 1925 655419
E : warrington@exova.com
W: www.exova.com

BS 8458:2015: Annex C



Method for Measuring the Capability of a Watermist System to Control a Fire – "Room Fire Test for Watermist Systems with Automatic Nozzles"

A Report To: Plumis

Document Reference: 396489

Date: 23rd April 2018

Issue No.: 1

Testing
Advising
Assuring

Executive Summary

Objective To demonstrate the capability of a watermist system to control a fire when tested in accordance with BS 8458:2015: Annex C.

Generic Description	Product reference	Thickness / diameter / angle	Weight per unit area / density / weight per unit length
Automist multiroom "Smartscan" targeted water mist fire suppression system	"Automist Multiroom Smartscan ("Hydra") System"	Not applicable	Not applicable
Individual components used to manufacture the system:			
Nozzle	"Smartscan vertical flat 65º spray nozzle part of SH11 spray head assembly"	65º flat cone	Not applicable
Hose	"Production High Pressure Hose 150bar Working Pressure"	1/4" hose: Internal: Ø 6.3mm External: Ø 15mm 5/16" hose: Internal: Ø 7.9mm External: Ø 16.6mm	0.33 to 0.39kg/m
Pump	"AP08"	Not applicable	Not applicable
Heat alarm	"51000"	Not applicable	Not applicable
Please see pages 7 & 8 of this test report for the full description of the system tested			

Test Sponsor Plumis, Unit 1E, Clapham North Art Centre, 26 Voltaire Road, London, SW4 6DH

Test Results:

Thermocouple location	Maximum temperature °C (as per BS 8458:2015: Annex C.4 paragraph 3)										
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8	Test 9	Test 10	Test 11
75mm below the underside of the ceiling	109	270	139	219	100	92	104	90	131	111	96
1.6m above the floor, close to fire (if applicable)	33	49	N/A	63	62	36	N/A	72	40	N/A	34
1.6m above the floor, centre (if applicable)	52	N/A	39	N/A	47	N/A	39	63	N/A	31	30
1.6m above the floor, furthest from fire	48	38	56	40	51	46	40	45	34	31	30

Key:
Nozzle configuration 1 (as detailed in Figures 12, 13, 14 and 15):
Test 1 – Corner.
Test 2 – Between two nozzles.
Test 3 – Beneath a nozzle.
Test 4 – Between two nozzles ventilation test.
Nozzle configuration 2 (as detailed in Figures 16, 17, 18 and 19):
Test 5 – Corner.
Test 6 – Between two nozzles open room test.
Test 7 – Beneath a nozzle open room test.
Test 8 – Corner ventilation test.
Nozzle configuration 3 (as detailed in Figures 20, 21, 22 and 23):
Test 9 – Between two nozzles open room test.
Test 10 – Beneath a nozzle open room test.
Test 11 – Corner open room test.

Where the thermocouples were positioned at 1.6m above the floor, the temperatures did not exceed 55°C for any 120 s interval, during all the tests.

The fire test maximum temperatures as defined in BS 8458:2015: Table 2, are detailed in Appendix 2.

Conclusion

The system complies with Clause 6.1 (a) & (b) for domestic premises at a maximum room size of 80m² and maximum ceiling height of 3.5m.

The system complies with Clause 6.1 (a) & (b) for residential premises at a maximum room size of 80m² and maximum ceiling height of 3.5m.

Date of Test

5th, 6th and 8th March 2018

Signatories

	
Responsible Officer T. Kinder * Technical Officer	Authorised T. Mort * Senior Technical Officer

* For and on behalf of **Exova Warringtonfire**.

Report Issued: 23rd April 2018

CONTENTS PAGE NO.

Test Details

Purpose of test	To determine the performance of a system when it is subjected to the conditions of test specified in BS 8458:2015 “Code of practice for design and installation” Annex C "Room fire tests for watermist systems with automatic nozzles". The test was performed in accordance with the procedure specified in BS 8458:2015: Annex C and this report should be read in conjunction with that Standard.
Deviation from test standard	BS 8458:2015: Annex C.3 details that a nozzle connected to a water‑filled pipe should be used and in accordance with BS 8458:2015: 6.1 (c) the nozzle, external to the room, should not operate. No thermal sensitive bulb or shared water supply is used with the “Automist Multiroom Smartscan (“Hydra”) System” therefore the third nozzle, external to the room was deemed not to be applicable. BS 8458:2015: Clause 6.3 (b) details that the watermist system should be a wet pipe system (i.e. one that is permanently charged with water). The “Automist Multiroom Smartscan (“Hydra”) System” is a dry pipe system.
Instruction to test	The test was conducted on the 5th, 6th and 8th March 2018 at the request of Plumis, the sponsor of the test.
Provision of the system to test	The system was supplied by the sponsor of the test. **Exova Warringtonfire** was not involved in any selection or sampling procedure.
Conditioning of ignition and fuel packages	The plywood sheets, sacrificial boards, wooden frames, foam sheets and wood crib sticks were conditioned to constant mass at a temperature of 23 ± 2°C and a relative humidity of 50 ± 5% prior to testing. The cribs were conditioned, such that the moisture content was 10 ± 2%, 3 mm below the wood stick surface prior to testing.
Ignition package	Ignition packages, as detailed in Annex C.1.3 were used.
Fuel package	Fuel packages, as detailed in Annex C.1.4 were used.
Test room	The test room was erected, as detailed in Annex C.1.1.
Operating pressure at pump	The systems operating pressure was approximately 105 bar. The operating pressures throughout the tests are presented in Figures 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11.
Water flow rate	The systems water flow rate at operation was 6l/min.
Detection/actuation method	The system utilised heat alarm detection that automatically activated the system on detection of the fire.

Additives, propellants and atomizing media used

No additives, propellants or atomizing media were used in the system.

Test hall geometry

The test room is located inside a dry, naturally ventilated, approximately 14.7m (length) x 8m (width) x 5.1m (high) building.

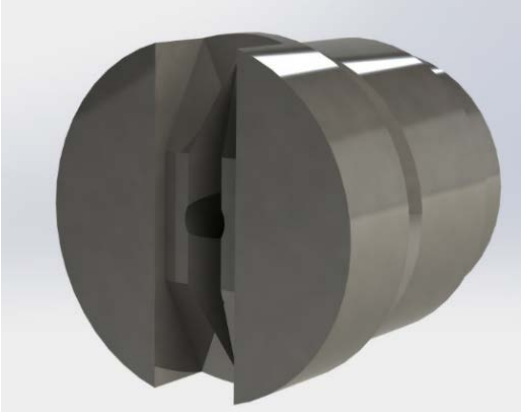
Environmental conditions at the beginning of the test

Test No.	Temperature (ºC)	Humidity (%)
1	18.6	47.2
2	25.8	39.3
3	23.0	39.9
4	22.4	47.4
5	17.9	48.7
6	16.6	53.7
7	20.0	66.5
8	17.8	58.7
9	20.0	50.6
10	20.6	66.4
11	19.7	52.3

Description of system

The description of the specimens given below has been prepared from information provided by the sponsor of the test. This information has not been independently verified by **Exova Warringtonfire.**

All values quoted are nominal, unless tolerances are given.

General description		Automist multiroom “Smartscan” targeted water mist fire suppression system
System reference		“Automist Multiroom Smartscan (“Hydra”) System”
Name of manufacturer		Plumis
Detailed description		Automist pre-engineered active targeted, single nozzle, multiroom, watermist fire suppression system
Nozzle	Product reference	“Smartscan vertical flat 65º spray nozzle part of SH11 spray head assembly”
	General description	Flat cone 65º 316SS single nozzle with M10x1 thread, 0.62 K factor.
	Name of manufacturer	Plumis supply chain
	Angle	65º flat cone
	Nozzle positions	Vertical, pointing to fire location
	Colour reference	“316 stainless steel” “Silver” (observed by **Exova Warringtonfire**)
	Photograph	
Hose	Product reference	“Production High Pressure Hose 150bar Working Pressure”
	General description	Synthetic rubber inner core with double wire braiding and rubberised exterior. BSPP (G type) 60 degree cone mating surface fittings
	Name of manufacturer	Plumis supply chain
	Diameter	1/4” hose: Internal: Ø 6.3mm External: Ø 15mm 5/16” hose: Internal: Ø 7.9mm External: Ø 16.6mm
	Wall thickness	4.35mm
	Length (used for test)	20m 1/4” hose and 40m 5/16” hose (60m total length)
	Weight per unit length	0.33 to 0.39kg/m
	Colour reference	“Black”
	Flame retardant details	**See Note 2 below**

Continued on next page

Pump	Product reference	"AP08"
	General description	Automist Pluvia high pressure pump. 6.0 l/min, 120 bar maximum working pressure
	Name of manufacturer	Plumis supply chain
	Power supply	230VAC 1.7kW
	Electrical connection	Electrical connection via recessed screw terminals behind access panel on pump enclosure
	Photograph	
Heat alarm	Product reference	"51000"
	General description	Multi-criteria optical smoke + heat wireless Apollo alarm
	Name of manufacturer	Apollo
	Colour reference	"White"
	Photograph	
Brief description of manufacturing process		**See Note 1 below**

Note 1. The sponsor was unwilling to provide this information.

Note 2. The sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the component.

Test Results

Applicability of test results

The test results relate only to the behaviour of the system under the particular conditions of test, they are not intended to be the sole criterion for assessing the potential fire hazard of the system in use.

The test results relate only to the system in the form in which it was tested. Small differences in the composition of the system may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any system which is supplied or used is fully represented by the system which was tested.

Test results:

Thermocouple location	Maximum temperature °C (as per BS 8458:2015: Annex C.4 paragraph 3)										
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8	Test 9	Test 10	Test 11
75mm below the underside of the ceiling	109	270	139	219	100	92	104	90	131	111	96
1.6m above the floor, close to fire (if applicable)	33	49	N/A	63	62	36	N/A	72	40	N/A	34
1.6m above the floor, centre (if applicable)	52	N/A	39	N/A	47	N/A	39	63	N/A	31	30
1.6m above the floor, furthest from fire	48	38	56	40	51	46	40	45	34	31	30

Key:
Nozzle configuration 1 (as detailed in Figures 12, 13, 14 and 15):
Test 1 – Corner.
Test 2 – Between two nozzles.
Test 3 – Beneath a nozzle.
Test 4 – Between two nozzles ventilation test.
Nozzle configuration 2 (as detailed in Figures 16, 17, 18 and 19):
Test 5 – Corner.
Test 6 – Between two nozzles open room test.
Test 7 – Beneath a nozzle open room test.
Test 8 – Corner ventilation test.
Nozzle configuration 3 (as detailed in Figures 20, 21, 22 and 23):
Test 9 – Between two nozzles open room test.
Test 10 – Beneath a nozzle open room test.
Test 11 – Corner open room test.

Where the thermocouples were positioned at 1.6m above the floor, the temperatures did not exceed 55°C for any 120 s interval, during all the tests.

The fire test maximum temperatures as defined in BS 8458:2015: Table 2, are detailed in Appendix 2.

Clause 6.1 (a)(1) for domestic premises:

The watermist system suppressed the test fires for a discharge duration of 10 minutes for domestic premises, measured from nozzle operation, during tests 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11 (See Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11)

Clause 6.1 (a)(2) for domestic premises:

Within 2 minutes from the operation of the first nozzle, the mean recorded temperatures 75mm below the underside of the ceiling decreased and remained steady during tests 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11 (See Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11)

Clause 6.1 (b) for domestic premises:

From the start of the test, the recorded temperatures did not exceed the values indicated in BS 8458:2015: Table 2 for domestic premises, during tests 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11 (See Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11)

Clause 6.1 (a)(1) for residential premises:

The watermist system suppressed the test fires for a discharge duration of 30 minutes for residential premises, measured from nozzle operation, during tests 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11 (See Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11)

Clause 6.1 (a)(2) for residential premises:

Within 2 minutes from the operation of the first nozzle, the mean recorded temperatures 75mm below the underside of the ceiling decreased and remained steady during tests 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11 (See Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11)

Clause 6.1 (b) for residential premises:

From the start of the test, the recorded temperatures did not exceed the values indicated in BS 8458:2015: Table 2 for residential premises, during tests 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11 (See Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11)

Conclusion

The system complies with Clause 6.1 (a) & (b) for domestic premises at a maximum room size of 80m² and maximum ceiling height of 3.5m.

The system complies with Clause 6.1 (a) & (b) for residential premises at a maximum room size of 80m² and maximum ceiling height of 3.5m.

Observations

The visual observations taken during the tests are shown in Appendix 1.

Temperatures

The rolling average temperatures logged during the tests are presented in Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11.

Fire test layout

Diagrams detailing the fire test layouts are presented in Figures 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23.

Validity

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 five years old should be considered by the user. The laboratory that issued the report 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.

Appendix 1

Observations during test of Test 1

00:01 Test start, the fire loads were ignited.

00:39 Heat alarm sounded. Nozzle began to scan room.

01:24 Nozzle 2 activated.

31:24 Test terminated.

Observations during test of Test 2

00:01 Test start, the fire loads were ignited.

00:31 Heat alarm sounded. Nozzle began to scan room.

01:08 Nozzle 1 activated.

31:08 Test terminated.

Observations during test of Test 3

00:01 Test start, the fire loads were ignited.

00:29 Heat alarm sounded. Nozzle began to scan room.

00:54 Nozzle 1 activated.

30:54 Test terminated.

Observations during test of Test 4

00:01 Test start, the fire loads were ignited.

00:28 Heat alarm sounded. Nozzle began to scan room.

01:06 Nozzle 1 activated.

31:06 Test terminated.

Observations during test of Test 5

00:01 Test start, the fire loads were ignited.

00:35 Heat alarm sounded. Nozzle began to scan room.

01:14 Nozzle 1 activated.

31:14 Test terminated.

Observations during test of Test 6

00:01 Test start, the fire loads were ignited.

00:27 Heat alarm sounded. Nozzle began to scan room.

00:58 Nozzle 2 activated.

30:58 Test terminated.

Observations during test of Test 7

00:01 Test start, the fire loads were ignited.

00:33 Heat alarm sounded. Nozzle began to scan room.

00:52 Nozzle 2 activated.

30:52 Test terminated.

Observations during test of Test 8

00:01 Test start, the fire loads were ignited.

00:37 Heat alarm sounded. Nozzle began to scan room.

01:06 Nozzle 1 activated.

31:06 Test terminated.

Observations during test of Test 9

00:01 Test start, the fire loads were ignited.

00:29 Heat alarm sounded. Nozzle began to scan room.

02:18 Nozzle 1 activated.

32:18 Test terminated.

Observations during test of Test 10

00:01 Test start, the fire loads were ignited.

00:26 Heat alarm sounded. Nozzle began to scan room.

02:16 Nozzle 1 activated.

32:16 Test terminated.

Observations during test of Test 11

00:01 Test start, the fire loads were ignited.

00:33 Heat alarm sounded. Nozzle began to scan room.

00:53 Nozzle 1 activated.

30:53 Test terminated.

Appendix 2

Table 2 **Fire test maximum temperatures**

Thermocouple location	Maximum allowable temperature °C
75mm below the underside of the ceiling	320
1.6 m above the floor	95
1.6 m above the floor	55 (for not more than any 120 s interval)

Figure 1

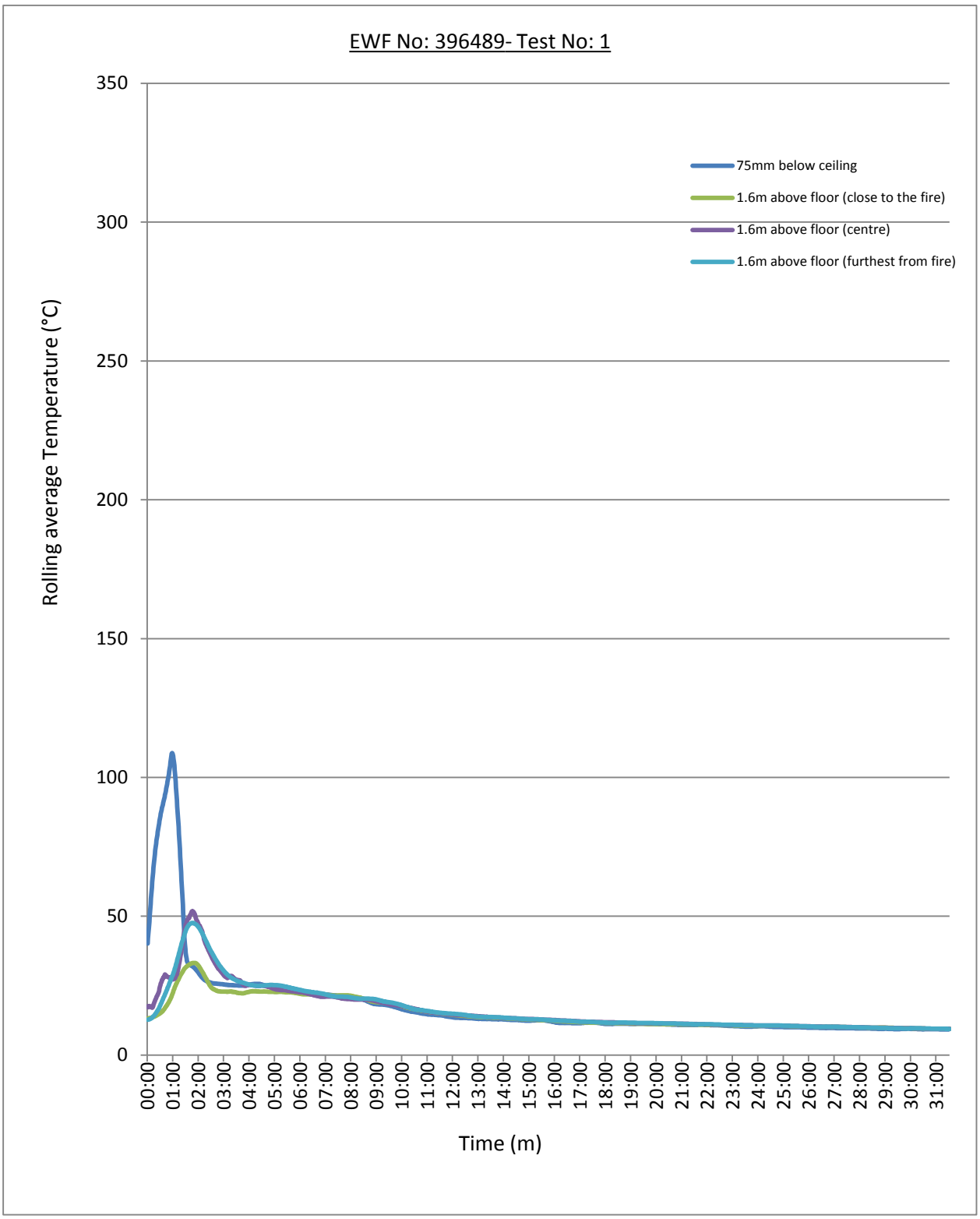

EWF No: 396489- Test No: 1
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (centre)
1.6m above floor (furthest from fire)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 2

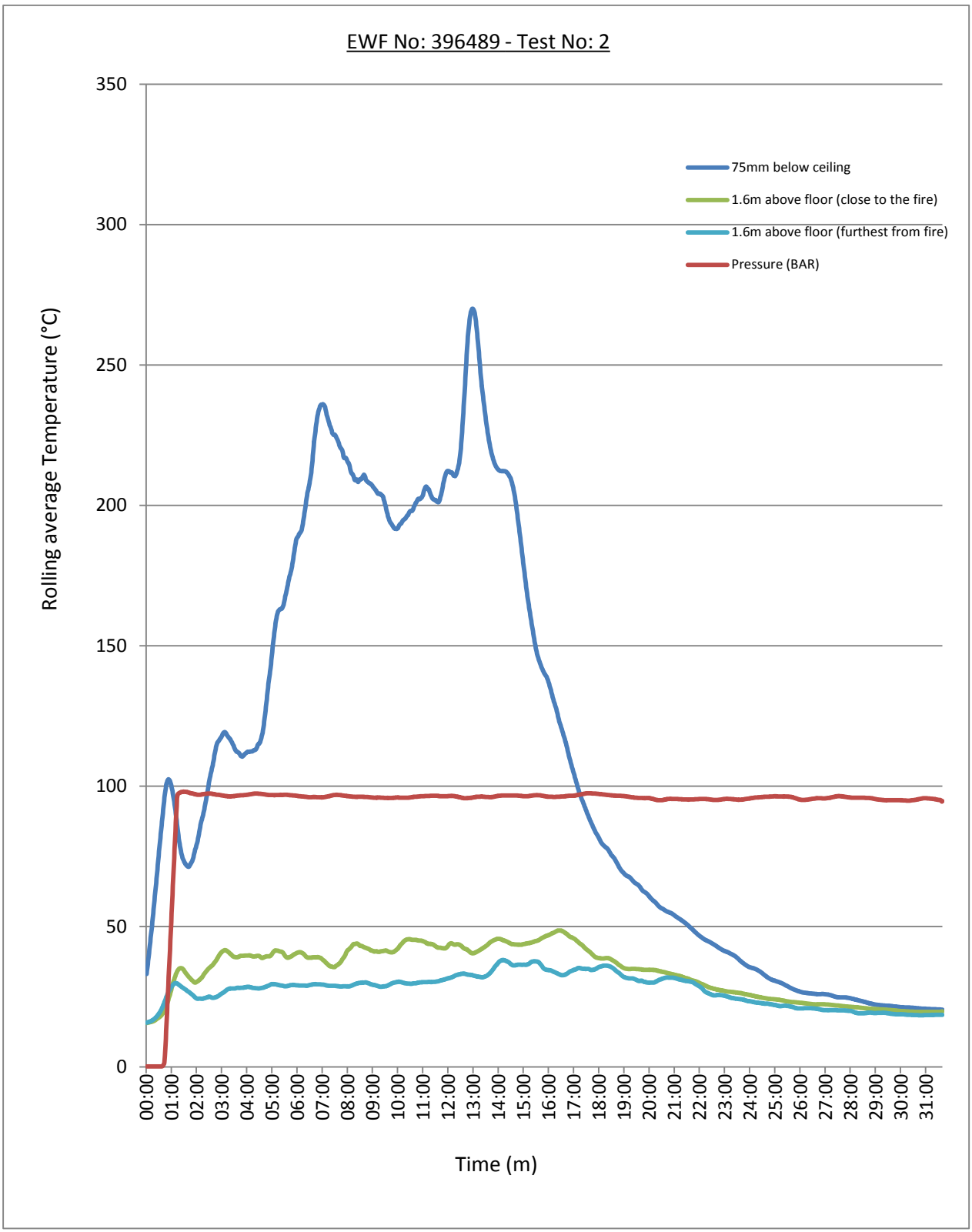

EWF No: 396489 - Test No: 2
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 3

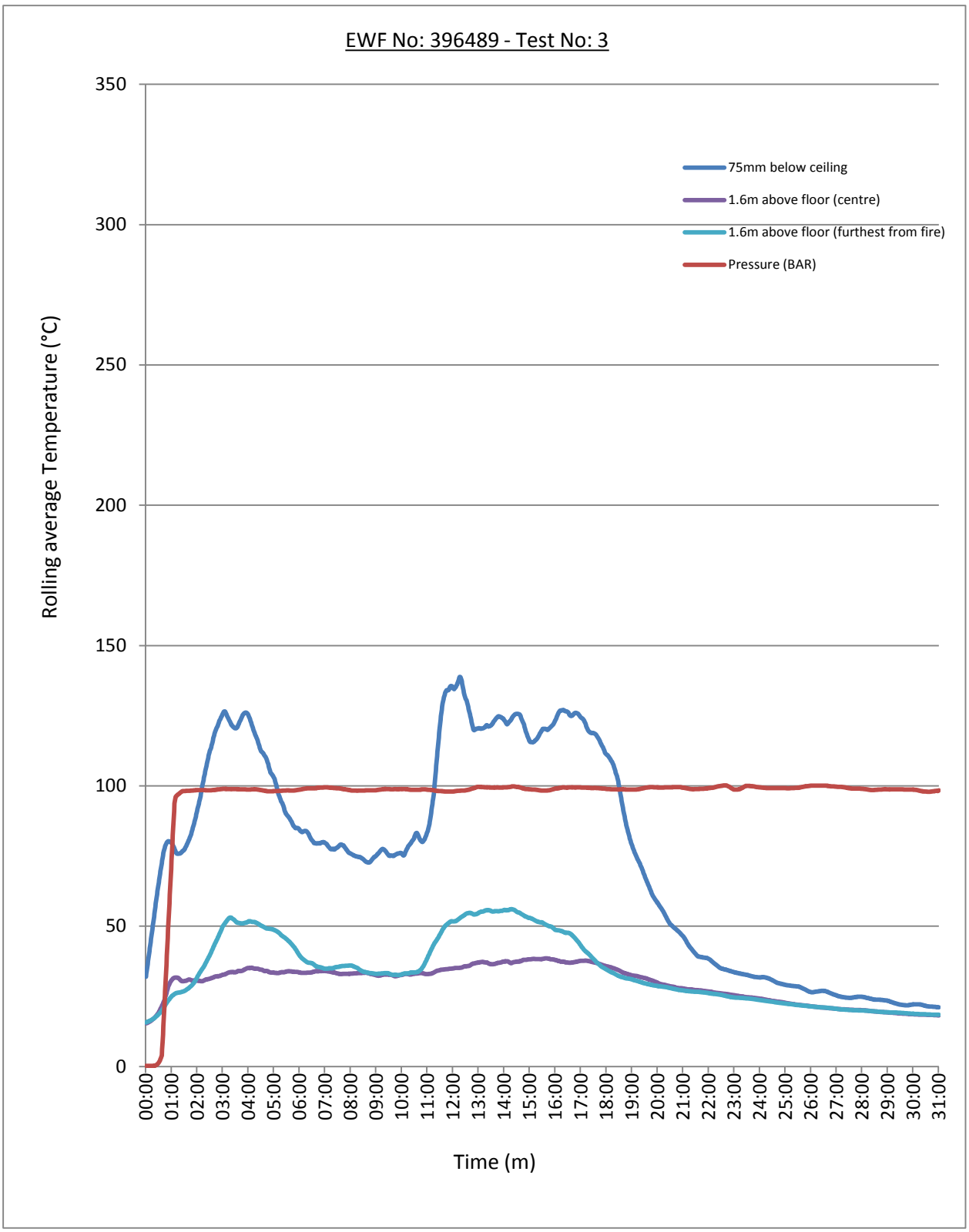

EWF No: 396489 - Test No: 3
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 4

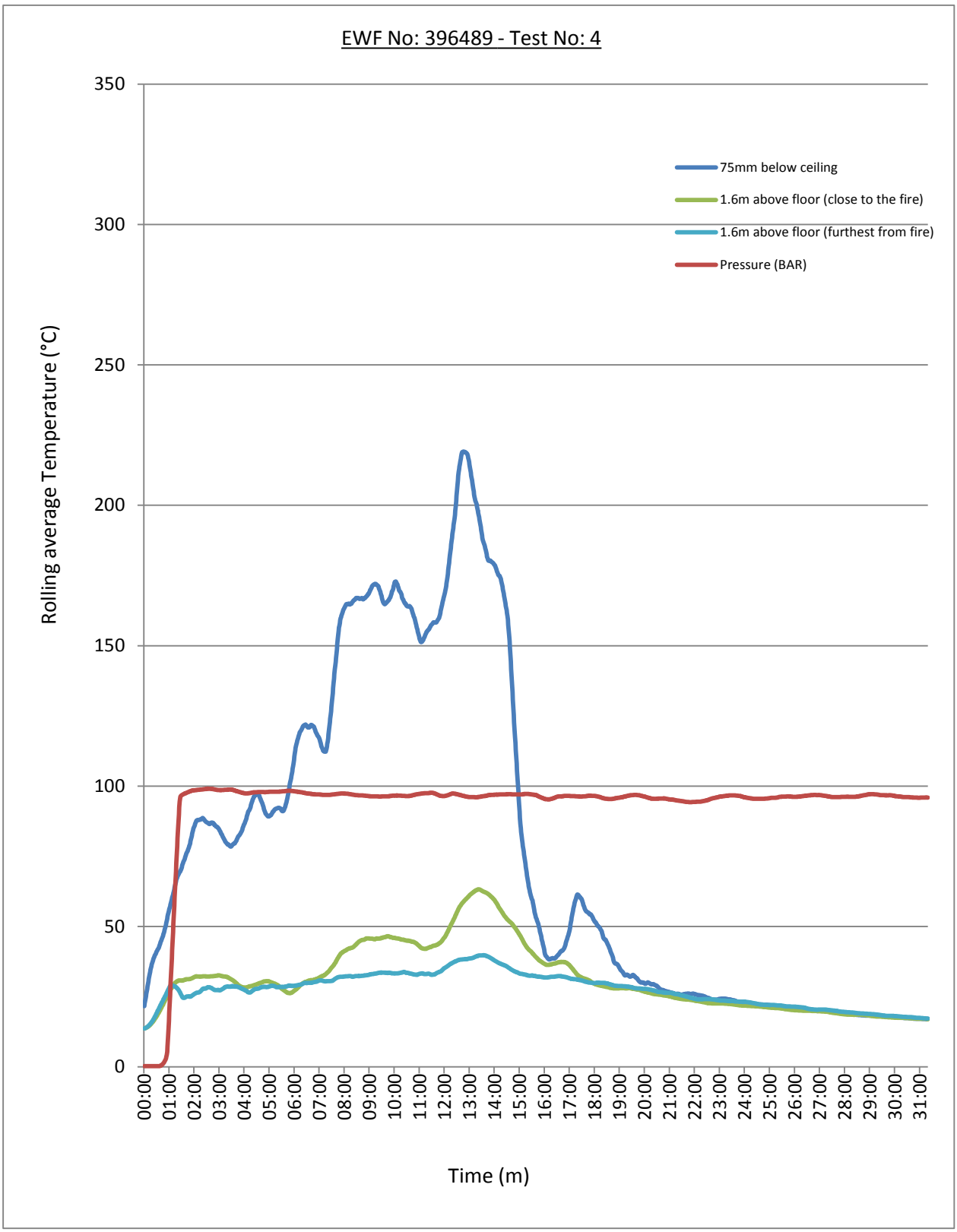

EWF No: 396489 - Test No: 4
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 5

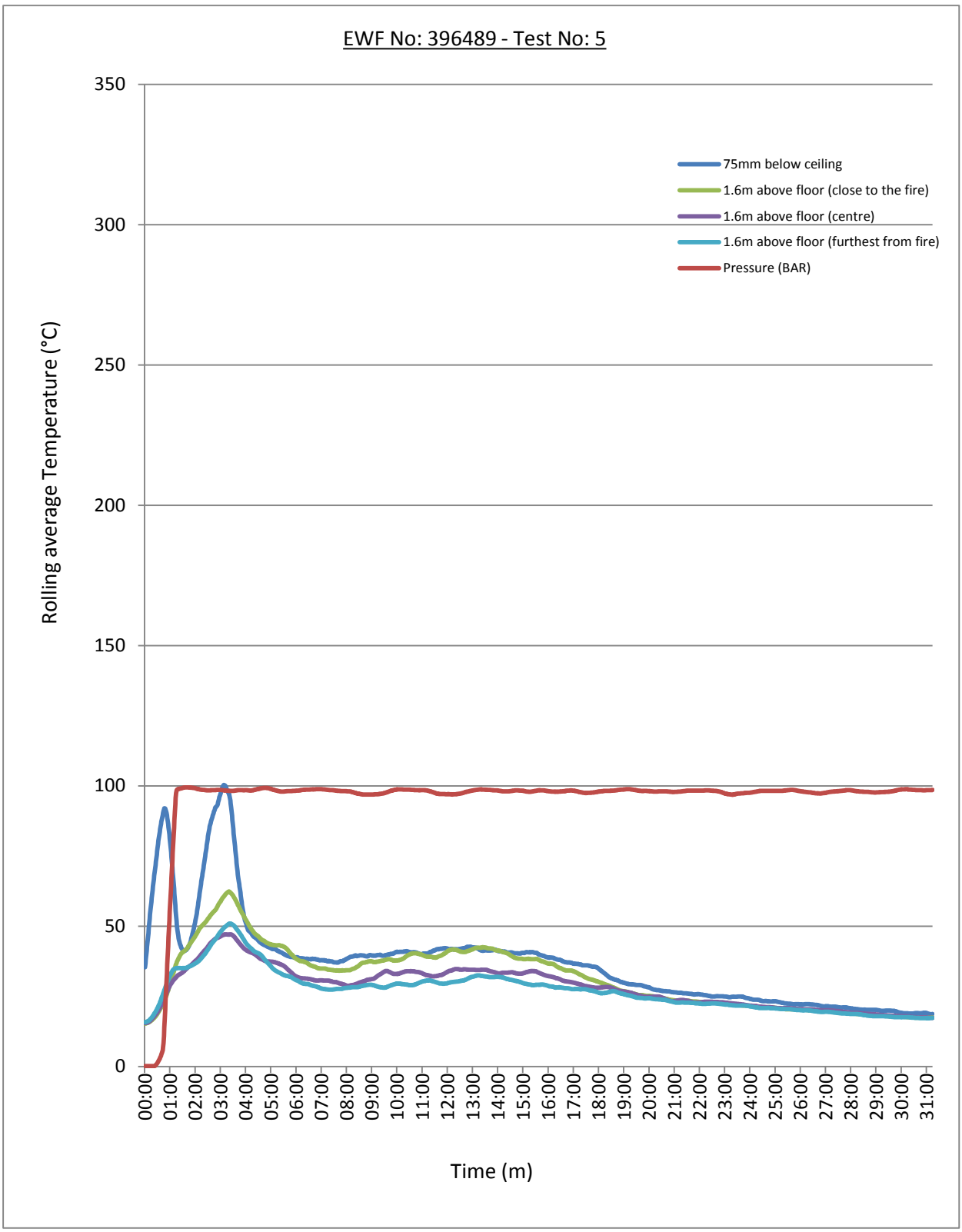

EWF No: 396489 - Test No: 5
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 6

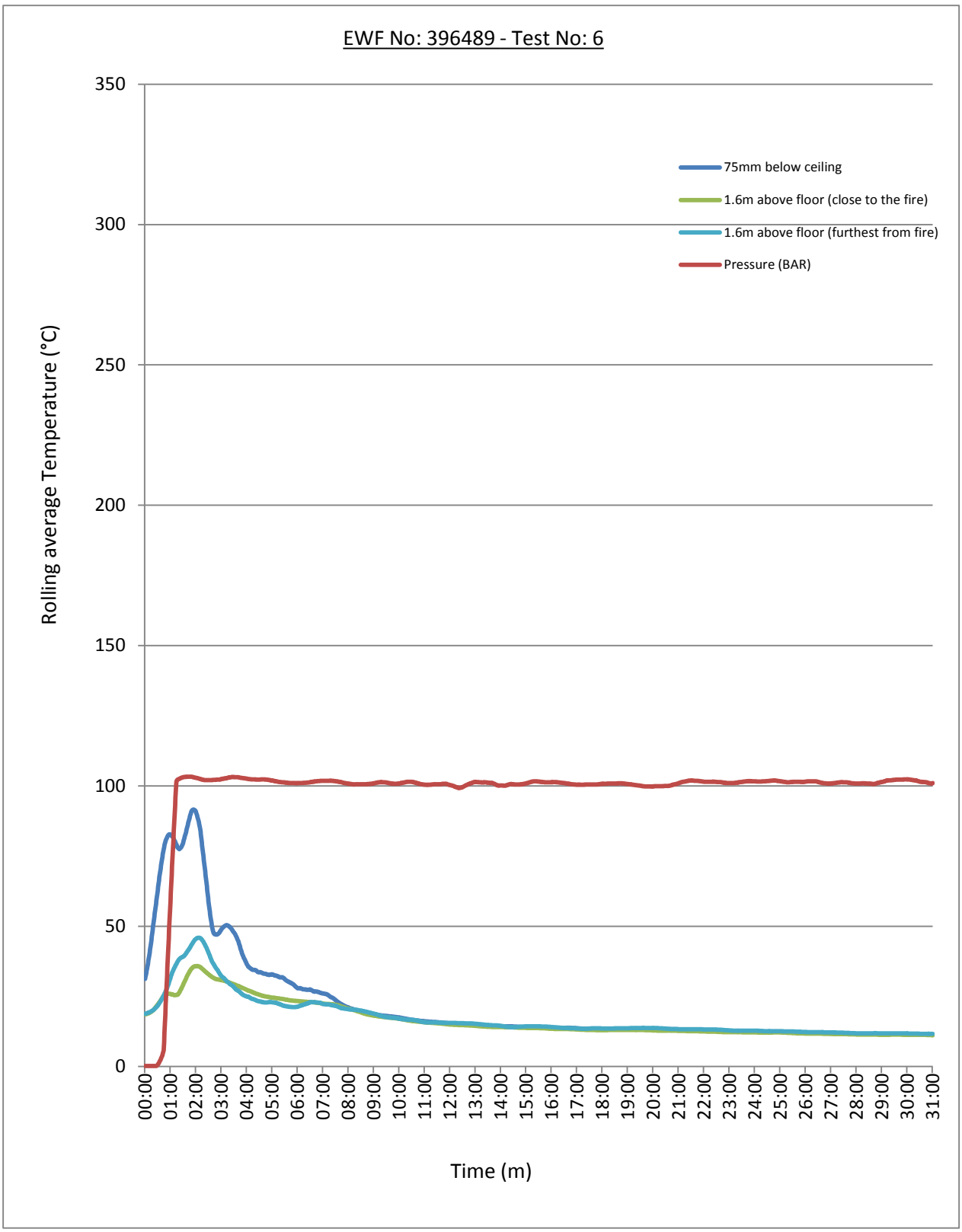

EWF No: 396489 - Test No: 6
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 7

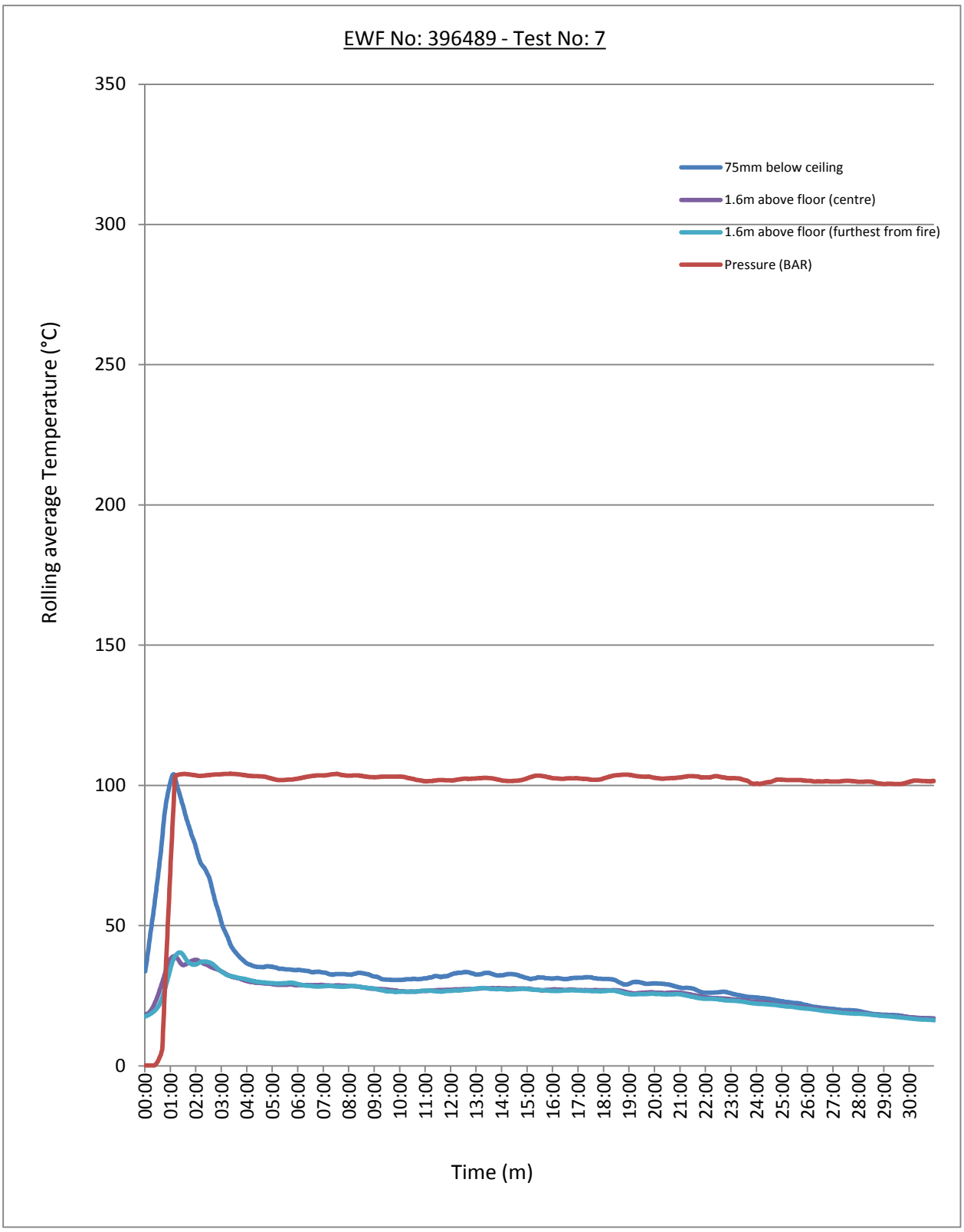

EWF No: 396489 - Test No: 7
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
Time (m)

Figure 8

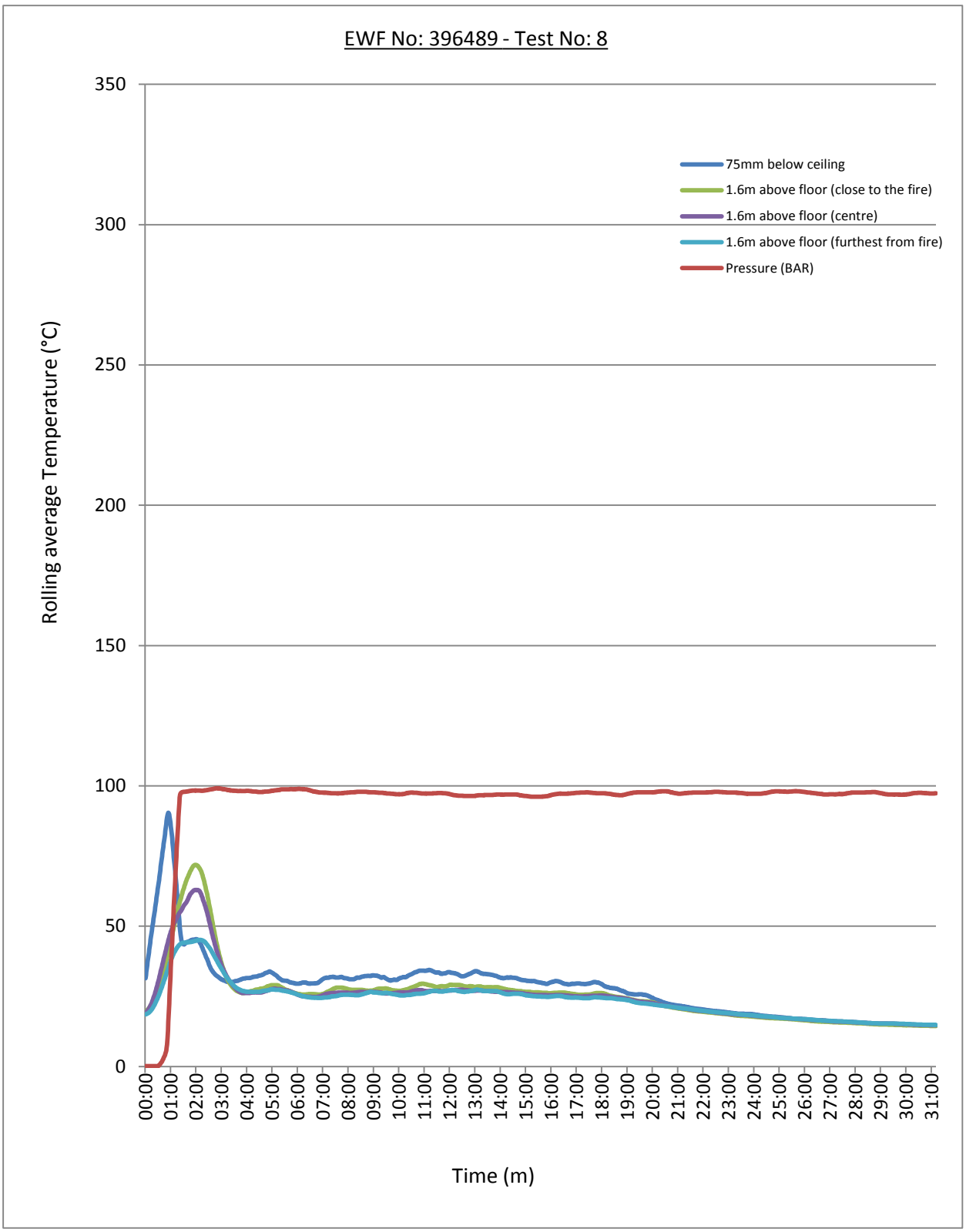

EWF No: 396489 - Test No: 8
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 9

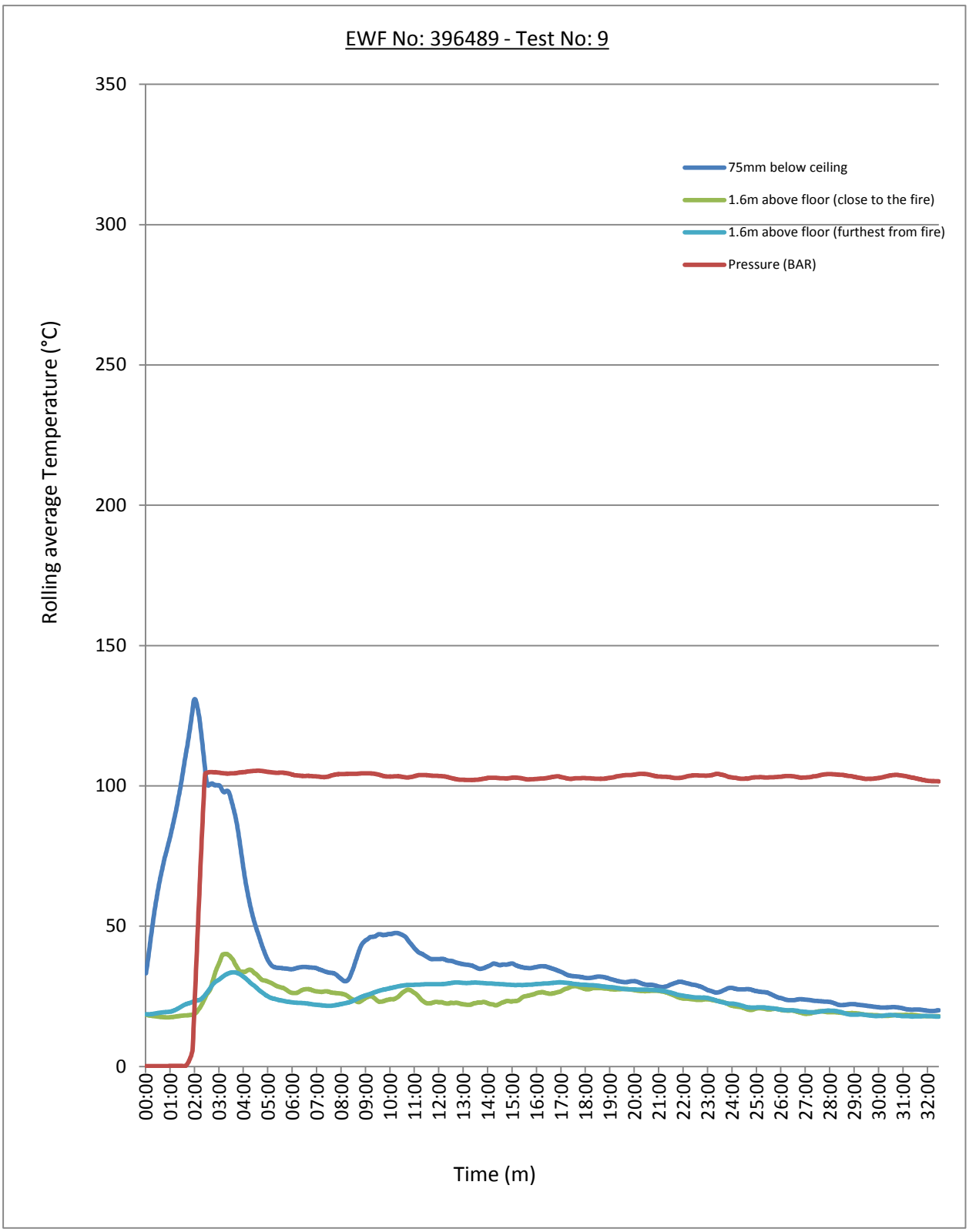

EWF No: 396489 - Test No: 9
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
32:00
Time (m)

Figure 10

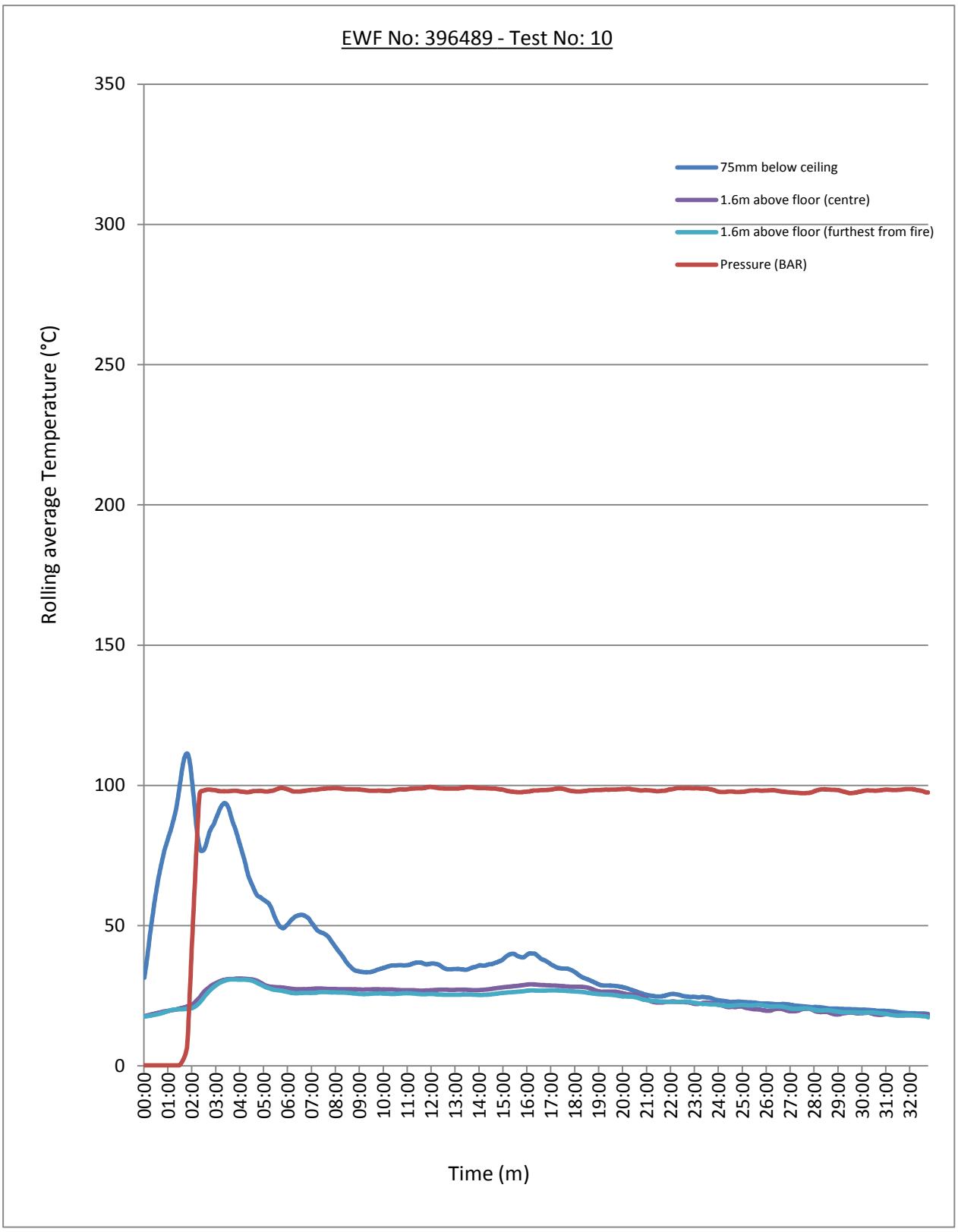

EWF No: 396489 - Test No: 10
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
31:00
32:00
Time (m)

Figure 11

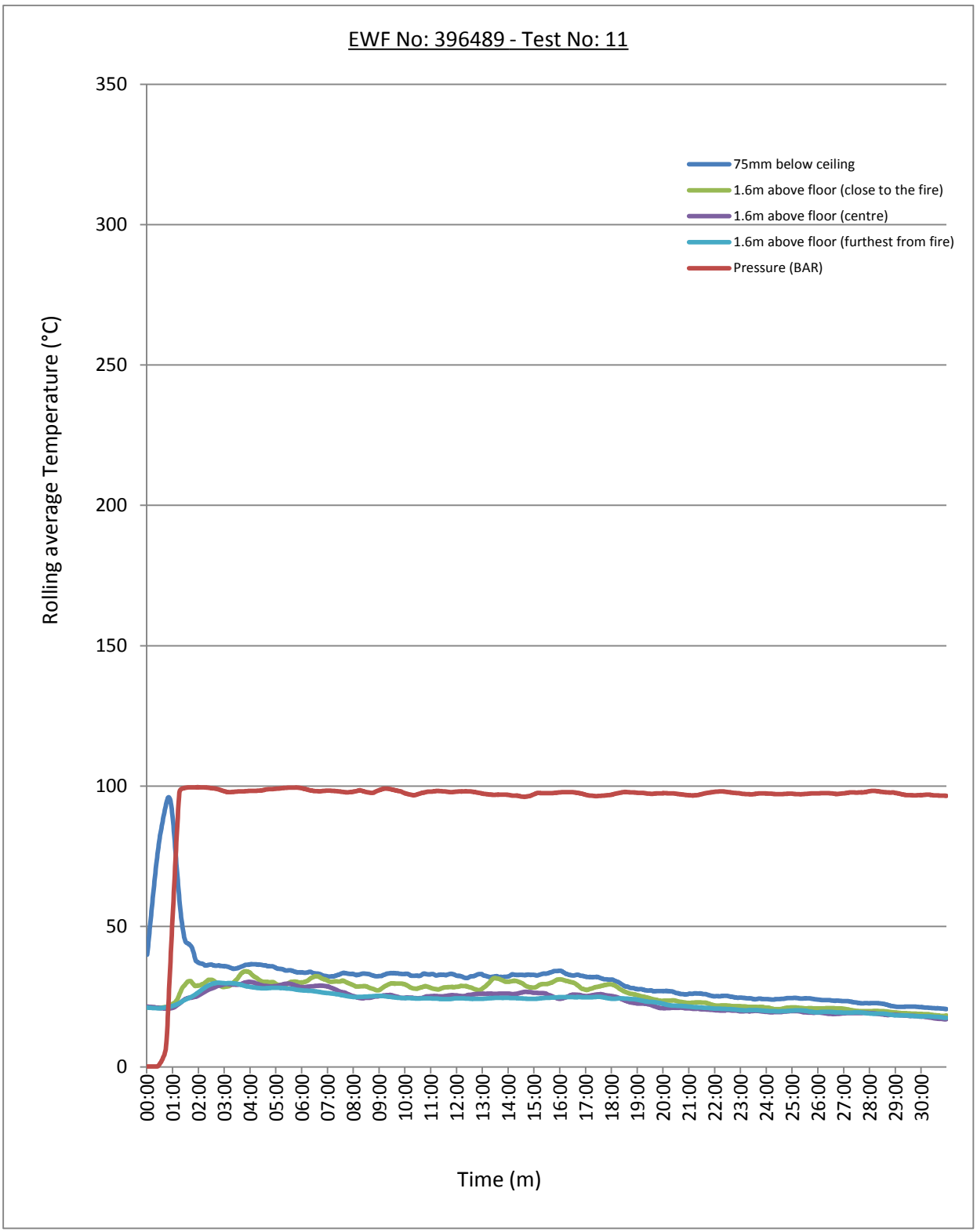
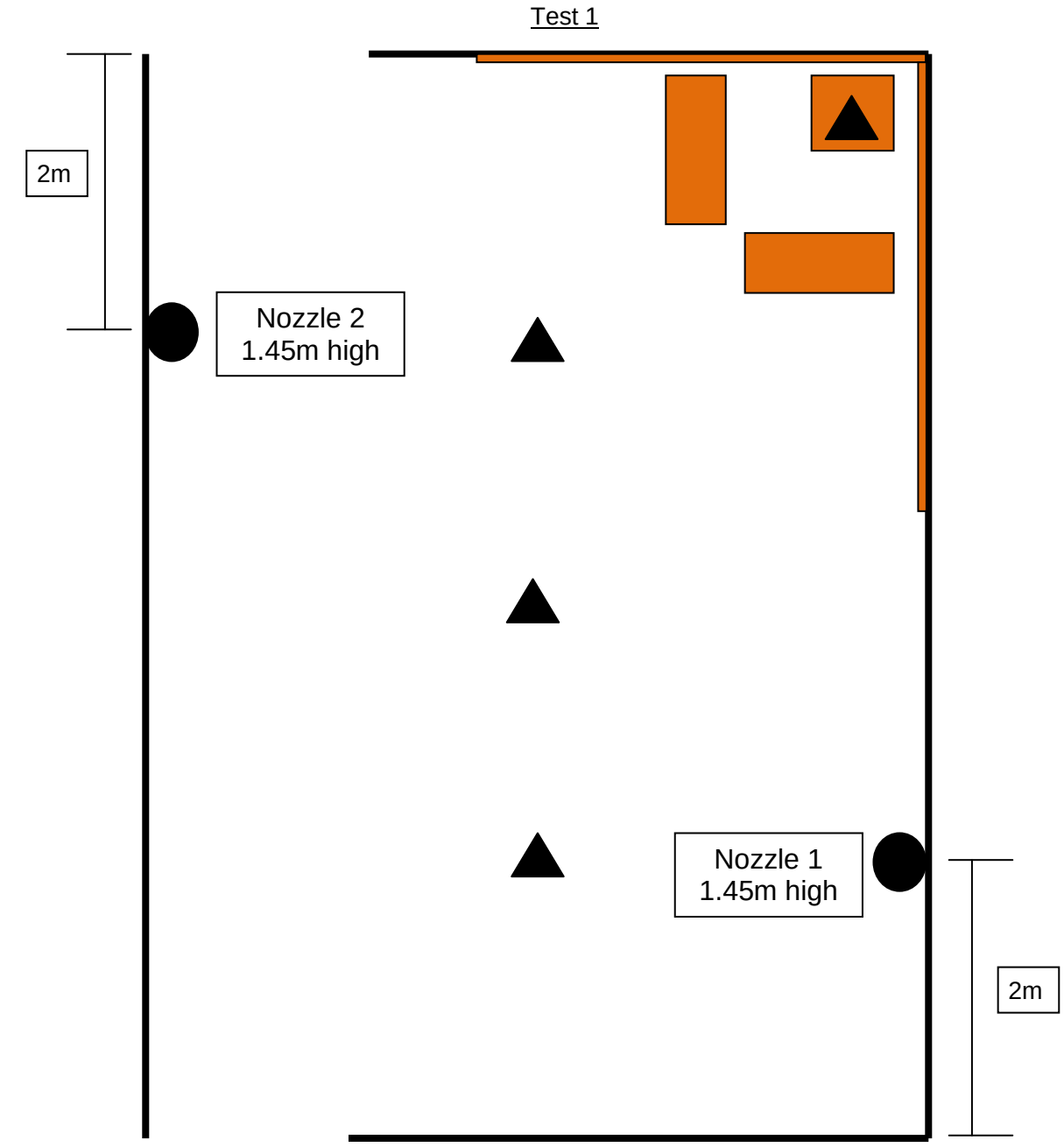

EWF No: 396489 - Test No: 11
Rolling average Temperature (°C)
350
300
250
200
150
100
50
0
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
25:00
26:00
27:00
28:00
29:00
30:00
Time (m)

Figure 12



Key

Corner, ignition and fuel package

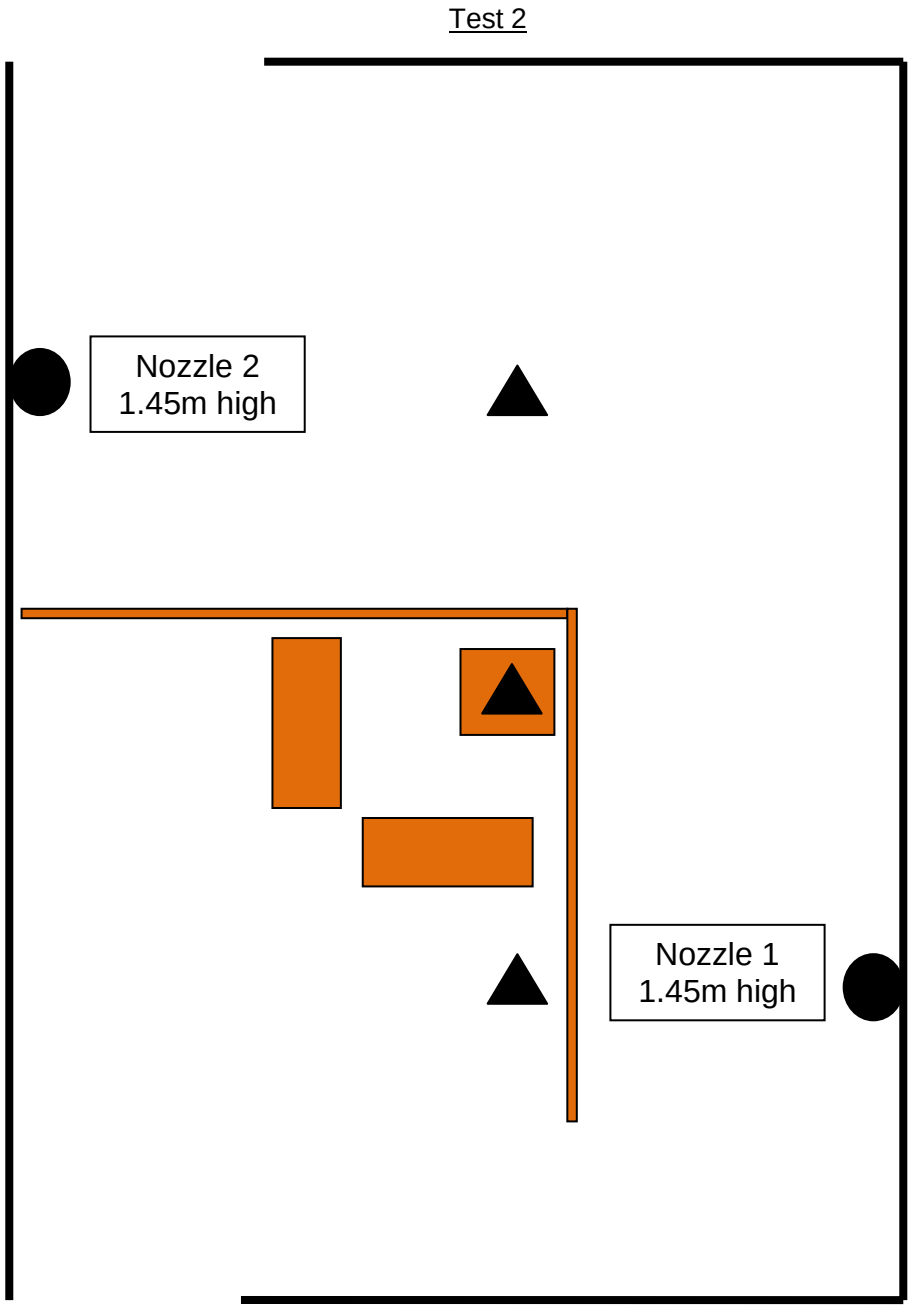
Nozzle

Note 1: Nozzle measurements are the same for Figures 12, 13, 14 & 15

Thermocouple

Drawing not to scale

Figure 13



Key

Between two nozzles ignition and fuel package

Nozzle

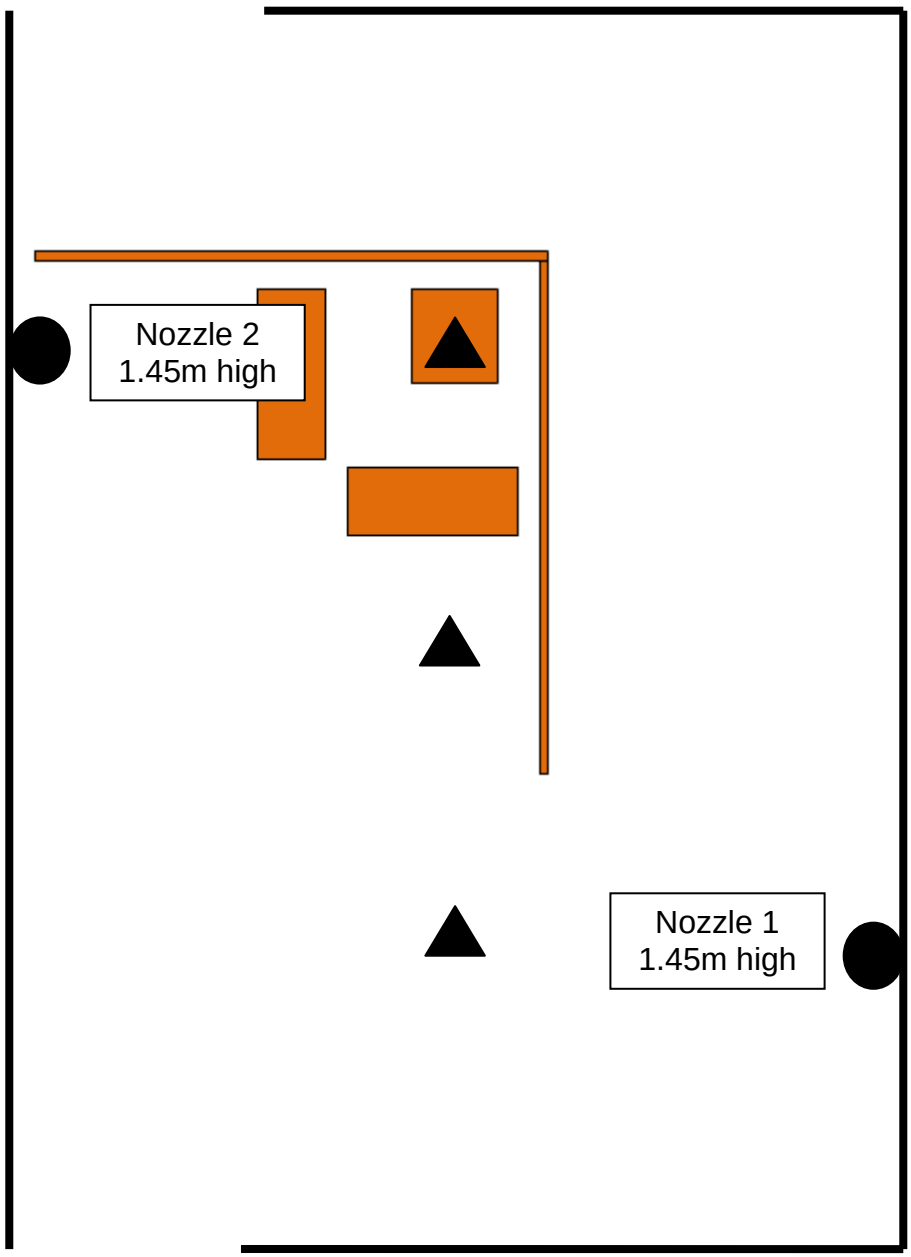
Note 1: Nozzle measurements are the same for Figures 12, 13, 14 & 15

Thermocouple

Drawing not to scale

Figure 14

Test 3



Key

Beneath a nozzle ignition and fuel package

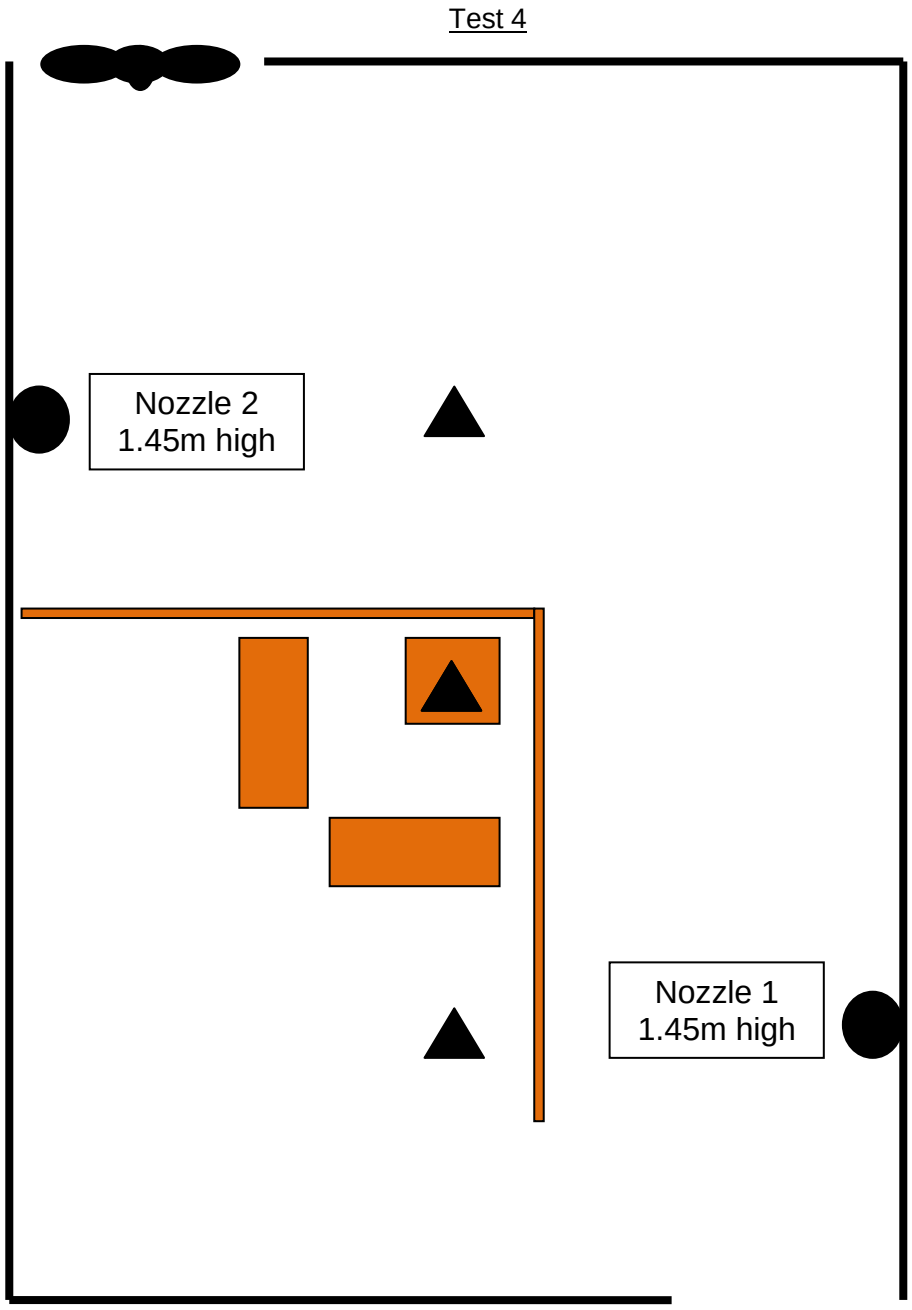
Nozzle

Note 1: Nozzle measurements are the same for Figures 12, 13, 14 & 15

Thermocouple

Drawing not to scale

Figure 15



Key

Between two nozzles ignition and fuel package

Nozzle

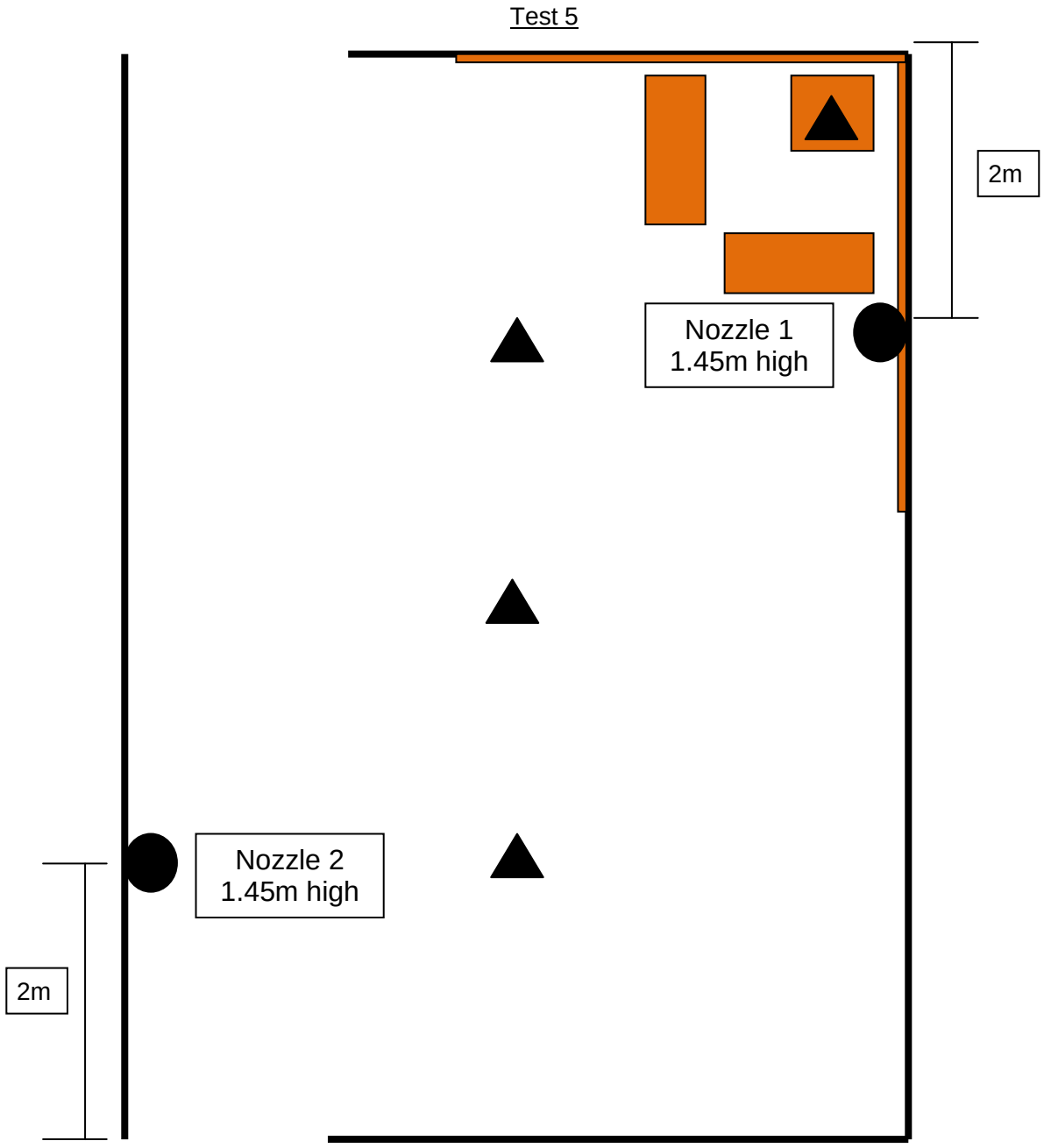
Note 1: Nozzle measurements are the same for Figures 12, 13, 14 & 15

Thermocouple

Fan

Drawing not to scale

Figure 16



Key

Corner, ignition and fuel package

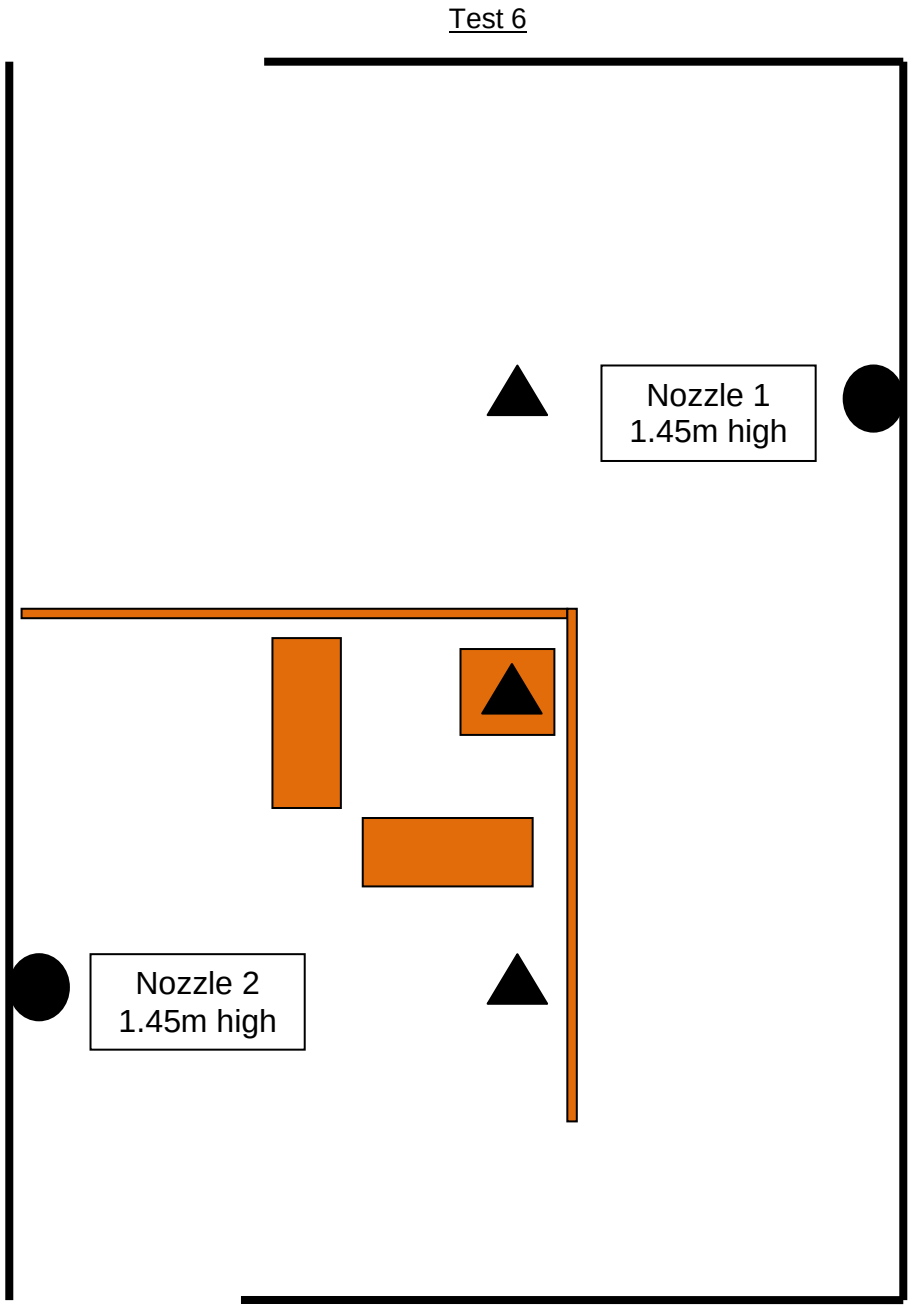
Nozzle

Note 1: Nozzle measurements are the same for Figures 16, 17, 18 & 19

Thermocouple

Drawing not to scale

Figure 17



Key

Between two nozzles ignition and fuel package

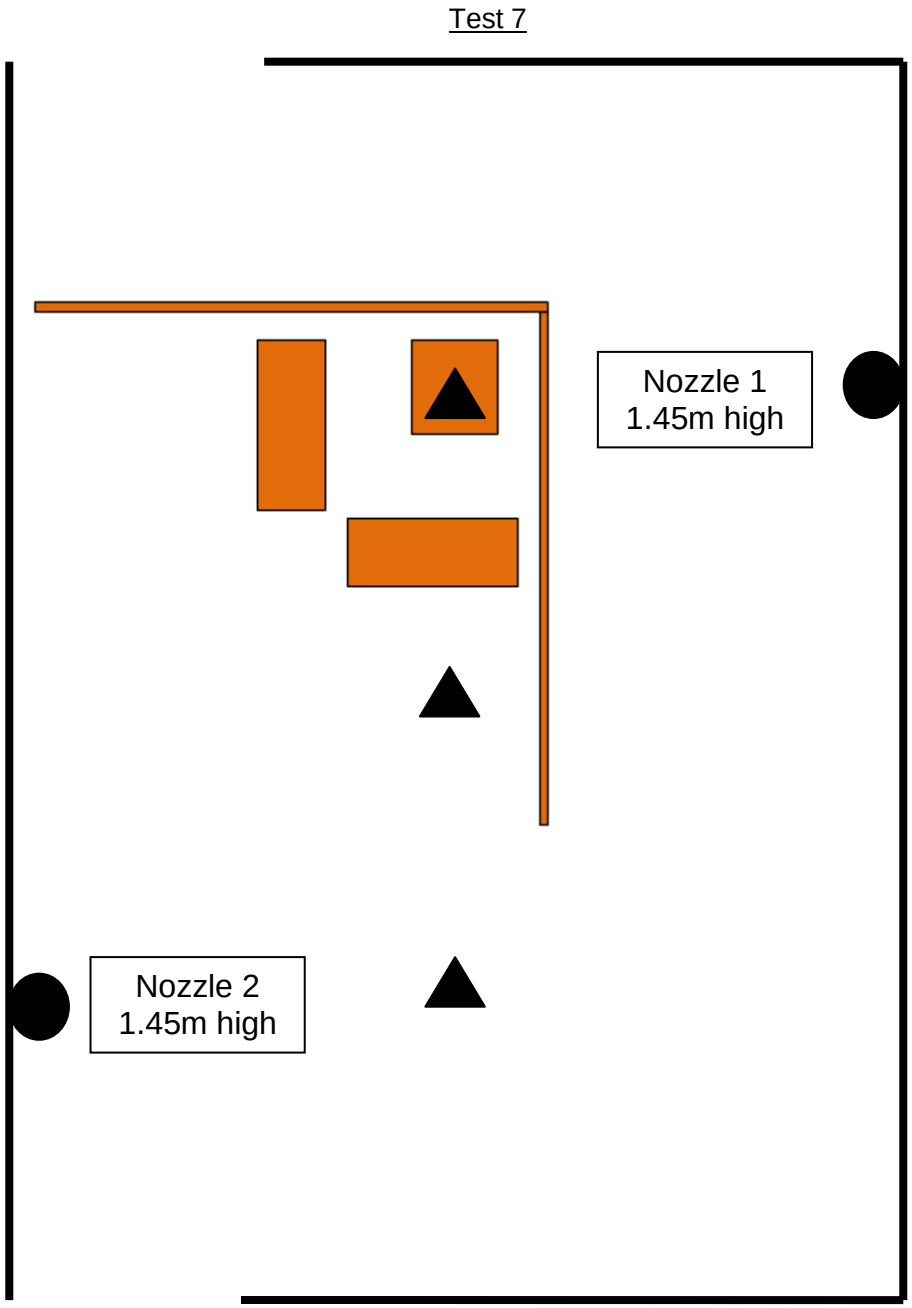
Nozzle

Note 1: Nozzle measurements are the same for Figures 16, 17, 18 & 19

Thermocouple

Drawing not to scale

Figure 18



Key

Beneath a nozzle ignition and fuel package

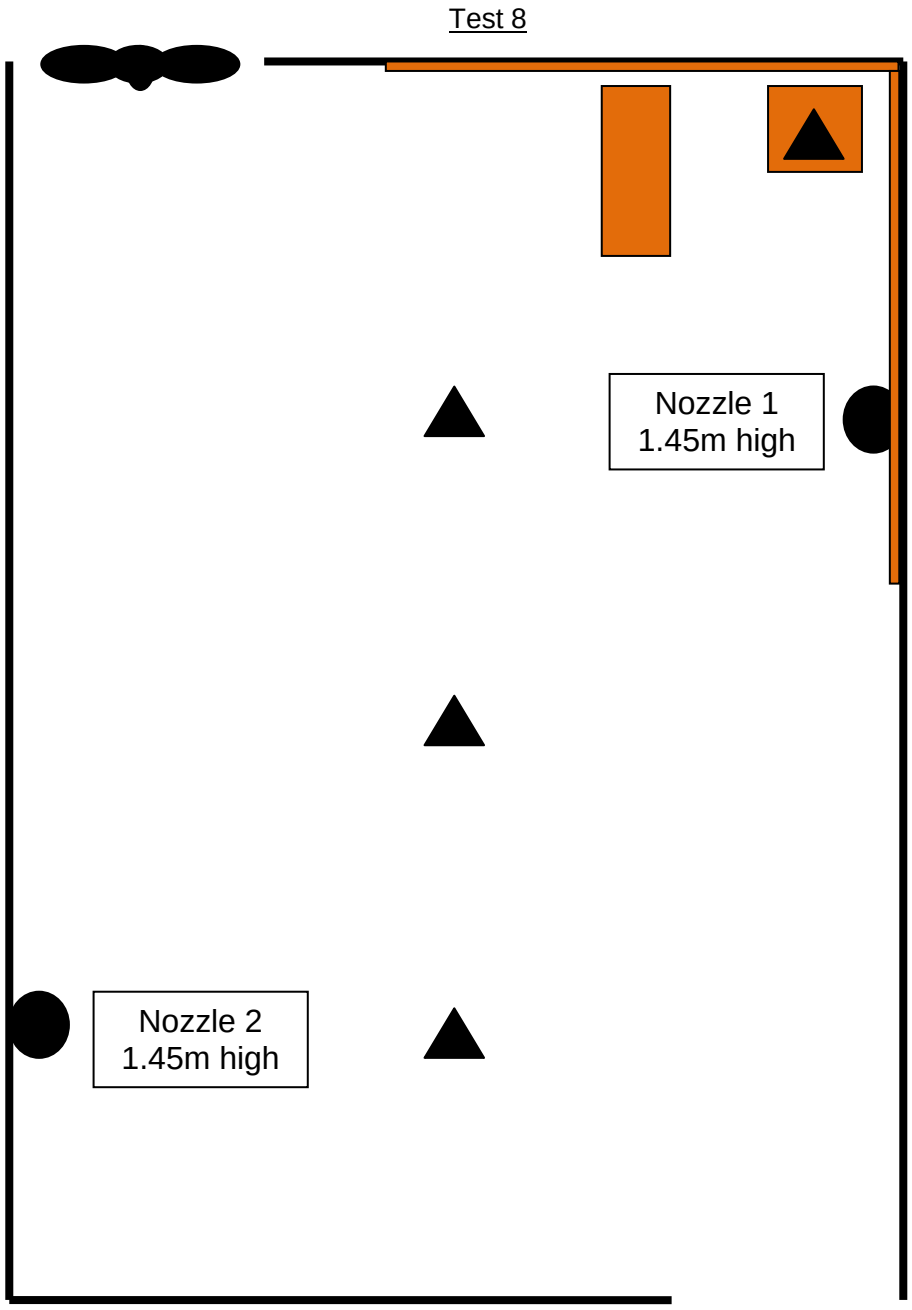
Nozzle

Note 1: Nozzle measurements are the same for Figures 16, 17, 18 & 19

Thermocouple

Drawing not to scale

Figure 19



Key

Corner ignition and fuel package

Nozzle

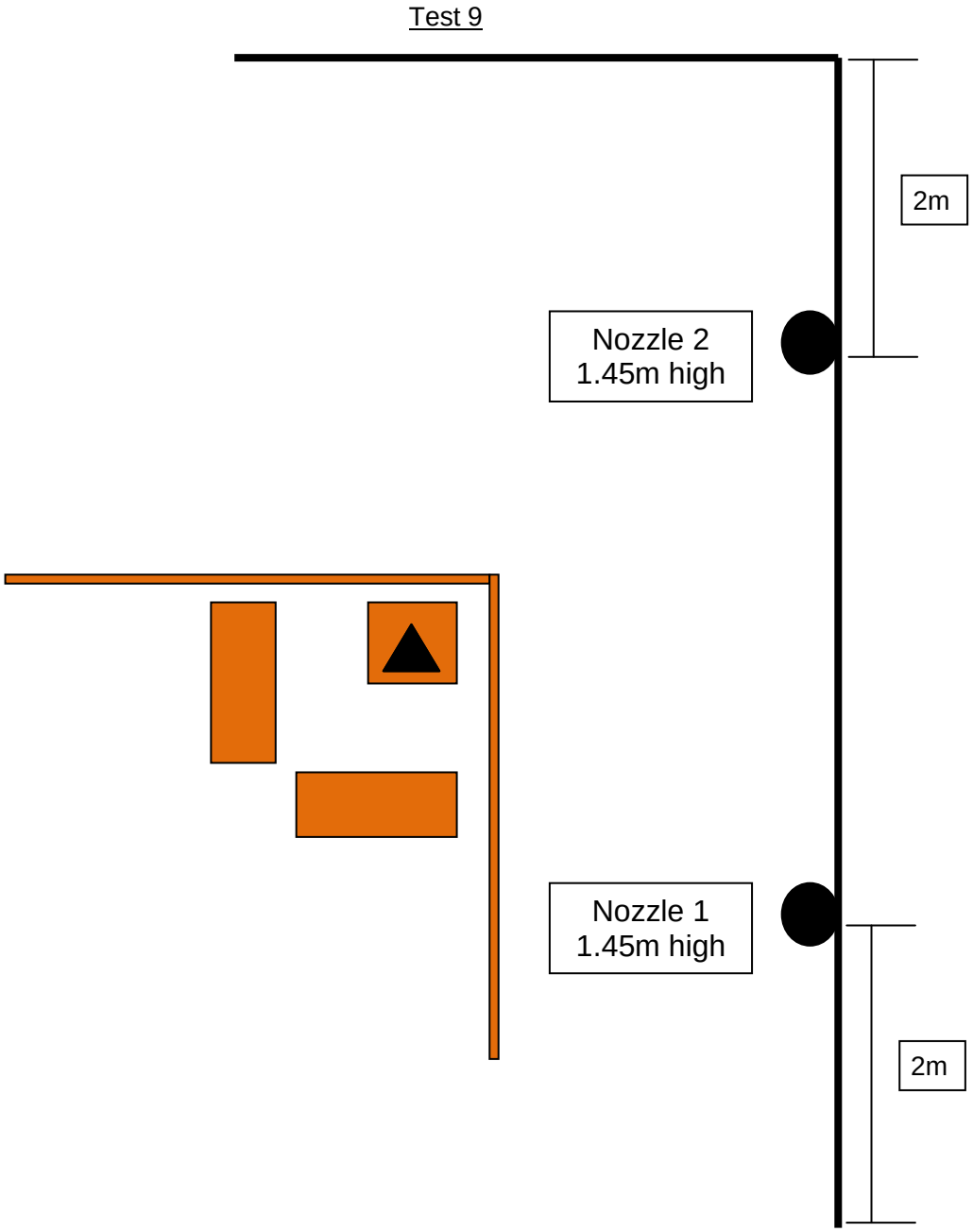
Note 1: Nozzle measurements are the same for Figures 16, 17, 18 & 19

Thermocouple

Fan

Drawing not to scale

Figure 20



Key

Between two nozzles ignition and fuel package

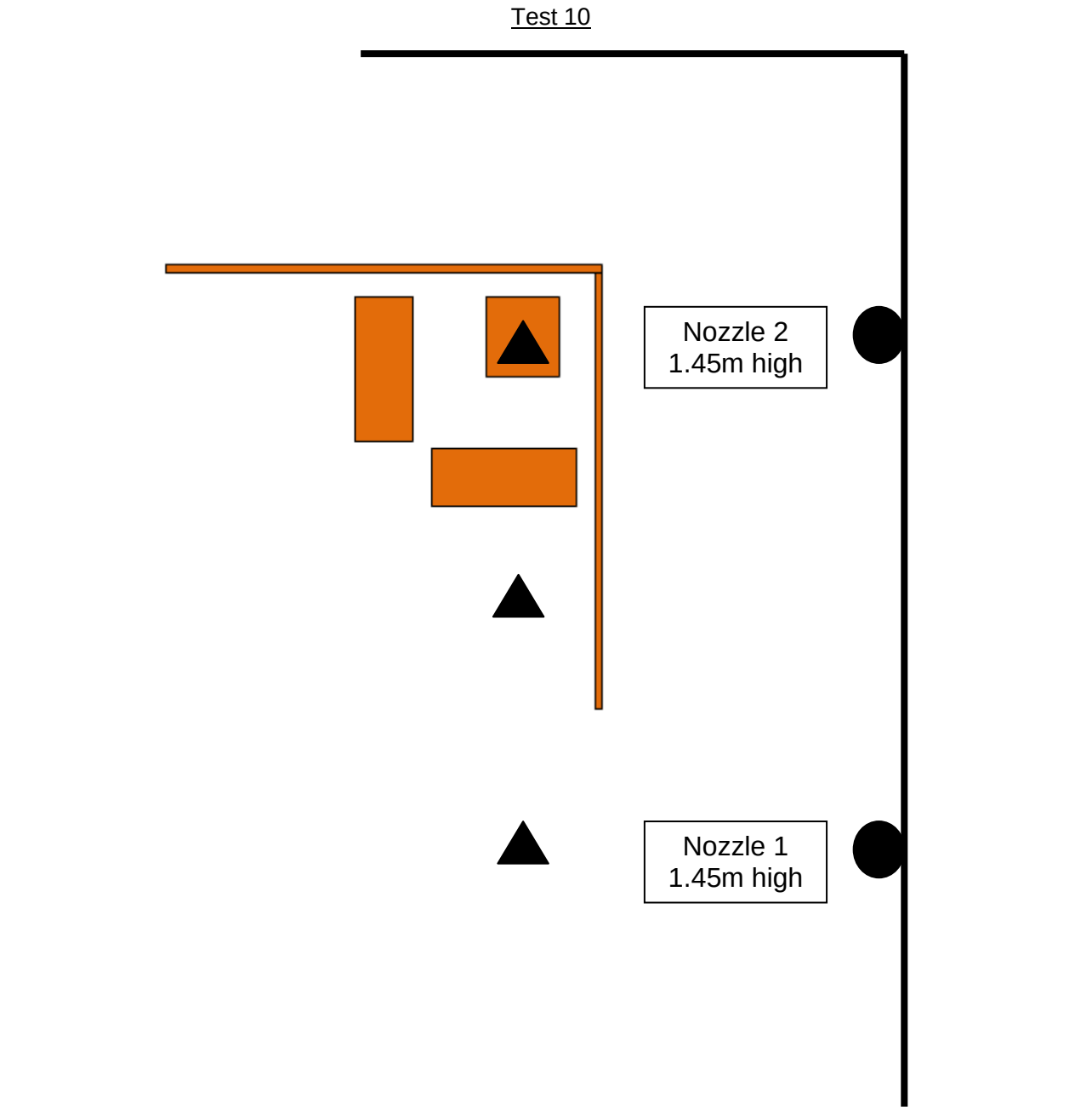
Nozzle

Note 1: Nozzle measurements are the same for Figures 20, 21 & 22

Thermocouple

Drawing not to scale

Figure 21



Key

Beneath a nozzle ignition and fuel package

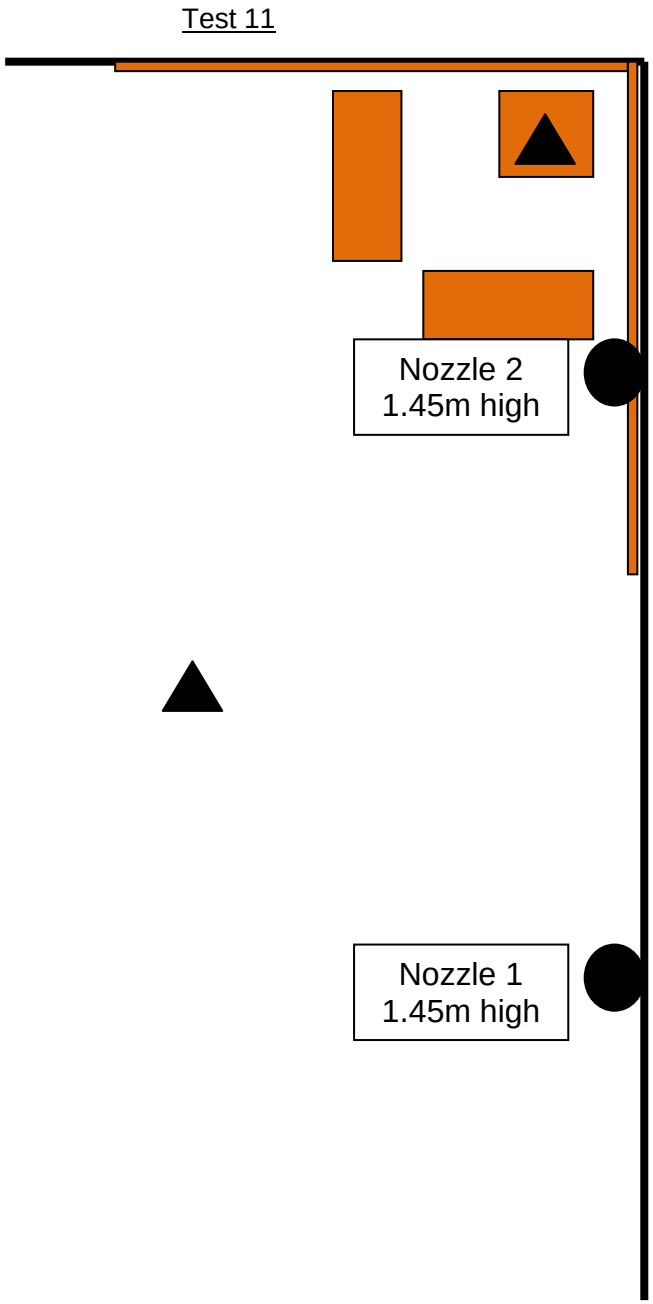
Nozzle

Note 1: Nozzle measurements are the same for Figures 20, 21 & 22

Thermocouple

Drawing not to scale

Figure 22



Key

Corner, ignition and fuel package

Nozzle

Note 1: Nozzle measurements are the same for Figures 20, 21 & 22

Thermocouple

Drawing not to scale

Photographs

Photographs of ignition and fuel package before a test

Photograph of nozzle system before a test

Photograph during a test

Photograph after a test

Revision History

Issue No :	Issue Date:
Revised By:	Approved By:
Reason for Revision:	

Issue No :	Issue Date:
Revised By:	Approved By:
Reason for Revision:	