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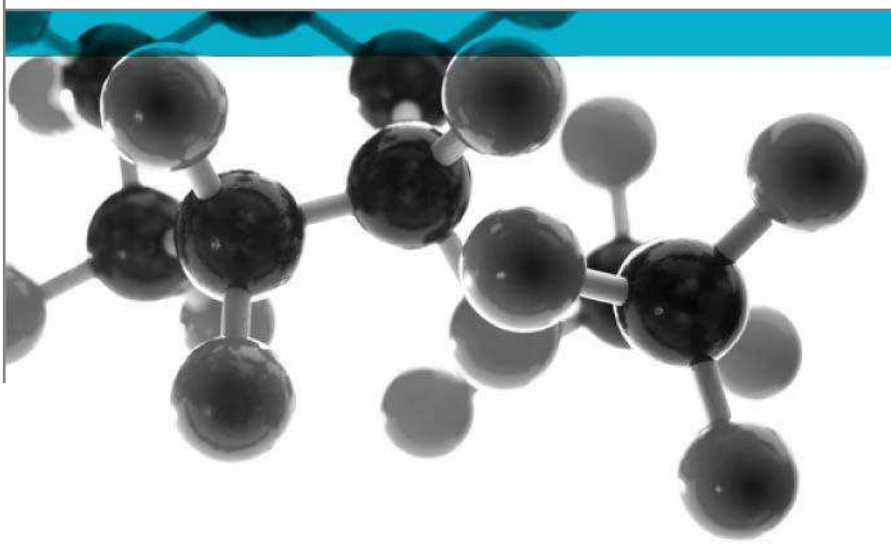
BS 8458:2015: Annex C



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 Ltd.

Document Reference: 514130

Date: 8th March 2022

Issue No.:1

Executive Summary

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

Generic Description	Product reference	Operating pressure / angle / diameter	Flow rate or weight per unit length
Automist multiroom "Smartscan" targeted water mist fire suppression system	"Automist Multiroom Smartscan Hydra System"	90 bar (range: 80 – 100bar)	6.0 l/min
Individual components used to manufacture the system:			
Nozzle	"Smartscan vertical flat 65º spray nozzle (part of SH11 spray head assembly)"	Vertical flat cone 65º	Not applicable
Hose	"Automist High Pressure Hoses"	1/4" hose: Internal: Ø 6.3mm External: Ø 15mm 5/16" hose: Internal: Ø 7.9mm External: Ø 16.6mm	1/4" hose: 0.20kg/m 5/16" hose: 0.23kg/m
Pump	"Automist Pump AP08"	Not applicable	Not applicable
Smoke alarm	"Automist Wired Smoke Detector DT02"	Not applicable	Not applicable
Please see page 6 of this test report for the full description of the system tested			

Test Sponsor Plumis Ltd., Unit 4, Phoenix Trading Estate, Bilton Road, Perivale, UB6 7DZ

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
75mm below the underside of the ceiling	87	154	135	212	165	97	136	115
1.6m above the floor, close to fire (if applicable)	31	74	48	N/A	N/A	N/A	N/A	N/A
1.6m above the floor, centre (if applicable)	41	78	N/A	51	31	24	16	19
1.6m above the floor, furthest from fire	45	80	77	72	51	61	46	36

Key:
Test 1 (a1) – Corner, 6m diagonally on opposite wall.
Test 2 (a2) – Corner, nozzle 4.04m from the corner, same wall.
Test 3 (b1) – Between two nozzles, nozzles opposites on centre of short walls.
Test 4 (b2) – Beneath a nozzle, nozzles opposites on centre of short walls.
Test 5 (c) – Beneath a nozzle, directly below nozzle 2m from the corner.
Test 6 (d) – Beneath a nozzle, nozzles opposites on centre of short walls, ventilation test.
Test 7 (e1) – Beneath a nozzle, nozzle on centre of short wall, open room test.
Test 8 (e2) – Beneath a nozzle, directly below nozzle 2m from the 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 test 1, 2, 3, 4, 5, 6, 7 & 8.

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

Thermocouple location	Maximum temperature °C (as per BS 8458:2015: Annex C.4 paragraph 3)
	Test 1
75mm below the underside of the ceiling	109
1.6m above the floor, close to fire (if applicable)	N/A
1.6m above the floor, centre (if applicable)	32
1.6m above the floor, furthest from fire	58

Key:
Test 9 (a3) (Extra Additional Test) – Beneath a nozzle, 2 nozzles 2m from each corner with plywood cut down to 900mm.

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 8th, 9th,10th & 11th February 2022

Signatories

Responsible Officer
E. Anderson *
Testing Officer

Authorised
T. Kinder *
Senior Technical Officer

* For and on behalf of Warringtonfire.

Report Issued: 8th March 2022

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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: Clause 5 details that the system actuation should be automatic by glass bulb or fusible link, initiated by heat generated from the fire.

The “Automist Multiroom Smartscan Hydra System” utilised smoke alarm detection that automatically initiated the spray heads scanning which subsequently discharged on detection of the fire.

BS 8458:2015: Clause 6.3 (a) (5) details that the watermist systems should meet the following criteria; positioning of nozzles with regard to ceiling (flat, sloping or curved).

The “Automist Multiroom Smartscan Hydra System” is a system that is installed in the walls at 1.45m from the floor.

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.

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” however, an extra nozzle was fitted outside the room but it did not discharge water because it could not see the fire therefore, the external nozzle to the room scanned but did not discharge.

Test 9 (a3) was an extra additional test for exploration purposes only and has been included in this report but not for the purposes of the classification.

Instruction to test

The test was conducted on the 8th, 9th, 10th & 11th February 2022 at the request of Plumis Ltd., the sponsor of the test.

Provision of the system to test

The system was supplied by the sponsor of the test. Warringtonfire was not involved in any selection or sampling procedure. The results stated in this report apply to the system as received.

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.

Test facility The test facility at Warringtonfire is constructed in accordance with the specifications detailed in BS 8458:2015. Warringtonfire operates a quality system in accordance with BS EN ISO/IEC 17025:2017.

Operating pressure at most remote nozzle The systems operating pressure was 80 - 100bar (when one nozzle activated). In the case of all the tests the 2nd nozzle did not activate.

Water flow rate The systems water flow rate at operation was 6.0 l/min

Detection/actuation method The system utilised smoke alarm detection that automatically initiated the spray heads scanning which subsequently discharged 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	26.1	59.6
2	20.2	57.7
3	15.7	66.4
4	15.1	41.7
5	15.3	58.0
6	21.9	53.2
7	24.9	59.1
8	23.7	55.1
9	23.2	37.3

Description of system

The description of the system given below has been prepared from information provided by the sponsor of the test. This information has not been independently verified by 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 Ltd.
Manufacturer's recommended minimum design pressure at the nozzles		90 bar (range: 80 – 100bar)
Water flow rate		6.0 l/min
Nozzle	General description	316 stainless steel flat cone 65º 316SS single nozzle with M10x1 thread, 0.62 K factor
	Product reference	"Smartscan vertical flat 65º spray nozzle (part of SH11 spray head assembly)"
	Name of manufacturer	Plumis Ltd.
	Spray angle	65º
	Spray pattern	Flat cone (vertical)
	k factor	0.62
	Colour reference	"316 stainless steel"
	Colour	"Silver" (observed by Warringtonfire)
	Photograph	
Hose	Generic type	Synthetic rubber inner core with single wire braiding and rubberized exterior. BSPP (G type) 60 degree cone mating surface fittings
	Product reference	"Automist High Pressure Hoses"
	Name of manufacturer	Plumis Ltd.
	Diameter (inner and outer)	1/4" hose: Internal: Ø 6.5mm External: Ø 13.4mm 5/16" hose: Internal: Ø 8.0mm External: Ø 15.0mm
	Wall thickness	3.5mm
	Length (used for test)	20m 1/4" hose and 40m 5/16" hose (60m total length)
	Weight per unit length	1/4" hose: 0.20kg/m 5/16" hose: 0.23kg/m
	Colour	Black & Blue
	Flame retardant details	Fire testing according to ISO 15540 and ISO 15541

Continued on next page

Pump	General description	Automist high pressure pump. 6.0l/min, 120 bar maximum working pressure
	Product reference	“Automist Pump AP08”
	Name of manufacturer	Plumis Ltd.
	Power supply	230VAC 1.7kW
	Electrical connection	Electrical connection via recessed screw terminals behind access panel on pump enclosure
	Filters	External inlet filter (Mesh 80)
	Strainers	Strainer at water inlet (part of the solenoid)
	Photograph	
Smoke alarm	General description	Photoelectrical optical smoke detector, 2 wires, conventional, EN 54-7
	Product reference	“Automist Wired Smoke Detector DT02”
	Name of manufacturer	Plumis Ltd.
	Colour	White with red LED
	Photograph	
Brief description of manufacturing process		**See Note 1 below**

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

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
75mm below the underside of the ceiling	87	154	135	212	165	97	136	115
1.6m above the floor, close to fire (if applicable)	31	74	48	N/A	N/A	N/A	N/A	N/A
1.6m above the floor, centre (if applicable)	41	78	N/A	51	31	24	16	19
1.6m above the floor, furthest from fire	45	80	77	72	51	61	46	36

Key:
Test 1 (a1) – Corner, 6m diagonally on opposite wall.
Test 2 (a2) – Corner, nozzle 4.04m from the corner, same wall.
Test 4 (b1) – Between two nozzles, nozzles opposites on centre of short walls.
Test 5 (b2) – Beneath a nozzle, nozzles opposites on centre of short walls.
Test 3 (c) – Beneath a nozzle, directly below nozzle 2m from the corner.
Test 6 (d) – Beneath a nozzle, nozzles opposites on centre of short walls, ventilation test.
Test 7 (e1) – Beneath a nozzle, nozzle on centre of short wall, open room test.
Test 8 (e2) – Beneath a nozzle, directly below nozzle 2m from the 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 test 1, 2, 3, 4, 5, 6, 7 & 8.

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

Thermocouple location	Maximum temperature °C (as per BS 8458:2015: Annex C.4 paragraph 3)
	Test 1
75mm below the underside of the ceiling	109
1.6m above the floor, close to fire (if applicable)	N/A
1.6m above the floor, centre (if applicable)	32
1.6m above the floor, furthest from fire	58

Key:
Test 9 (a3) (Extra Additional Test) – Beneath a nozzle, 2 nozzles 2m from each corner with plywood cut down to 900mm.

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 (See Figures 1, 2, 3, 4, 5, 6, 7, 8 & 9).

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 (See Figures 1, 2, 3, 4, 5, 6, 7, 8 & 9).

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 (See Figures 1, 2, 3, 4, 5, 6, 7, 8 & 9).

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 (See Figures 1, 2, 3, 4, 5, 6, 7, 8 & 9).

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 (See Figures 1, 2, 3, 4, 5, 6, 7, 8 & 9).

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 (See Figures 1, 2, 3, 4, 5, 6, 7, 8 & 9).

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.

Fire test layout

Diagrams detailing the fire test layouts are presented in Figures 10, 11, 12, 13, 14, 15, 16, 17 & 18.

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.

01:46 Nozzle 1 activated.

31:00 Test terminated.

Observations during test of Test 2

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

01:56 Nozzle 1 activated.

31:00 Test terminated.

Observations during test of Test 3

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

01:10 Nozzle 2 activated.

31:00 Test terminated.

Observations during test of Test 4

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

01:47 Nozzle 1 activated.

31:00 Test terminated.

Observations during test of Test 5

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

01:12 Nozzle 1 activated.

31:00 Test terminated.

Observations during test of Test 6

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

01:26 Nozzle 2 activated.

31:00 Test terminated.

Observations during test of Test 7

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

01:17 Nozzle 1 activated.

31:00 Test terminated.

Observations during test of Test 8

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

01:16 Nozzle 1 activated.

31:00 Test terminated.

Observations during test of Test 9

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

01:19 Nozzle 1 activated.

31:00 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

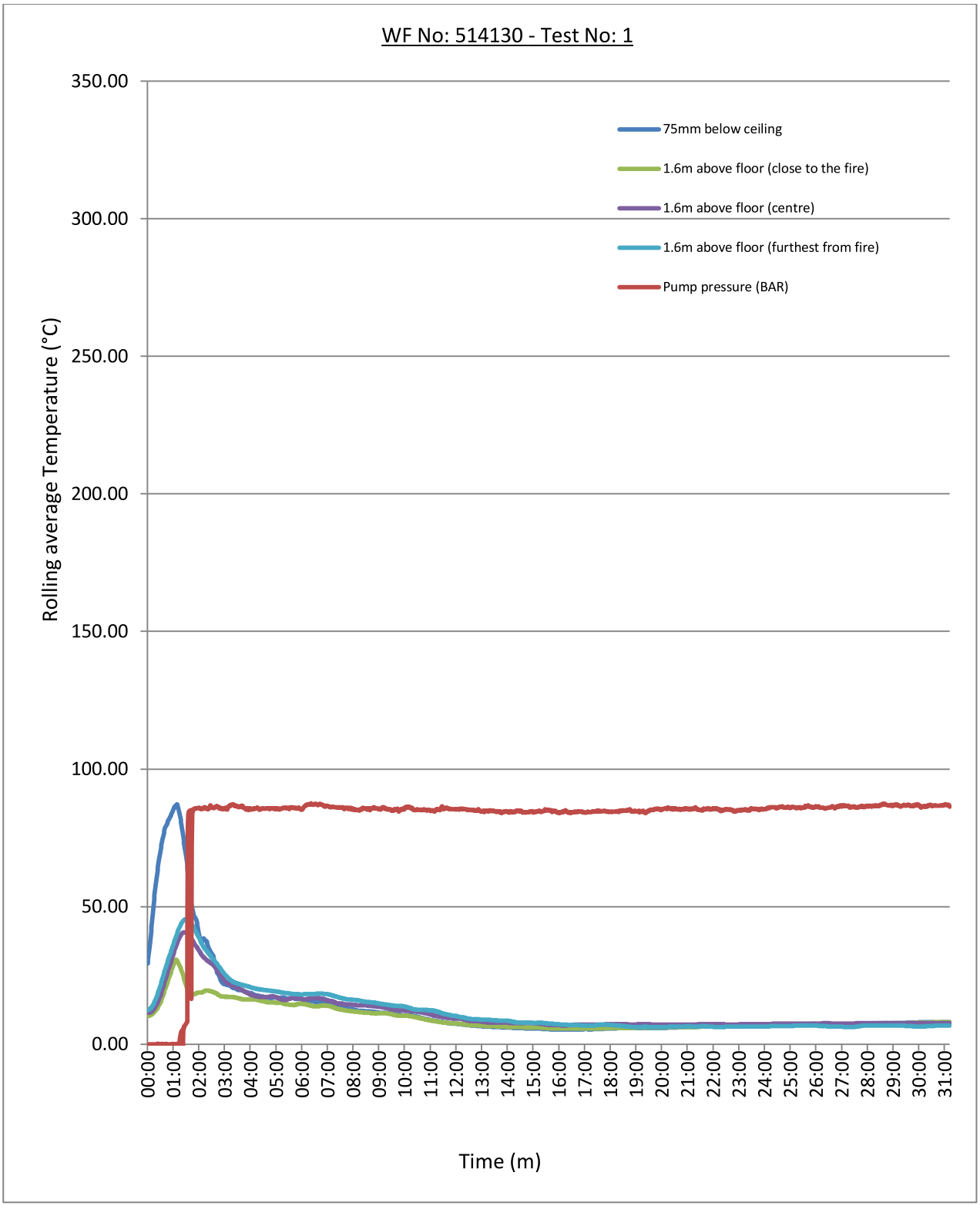

WF No: 514130 - Test No: 1
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pump pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
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 2

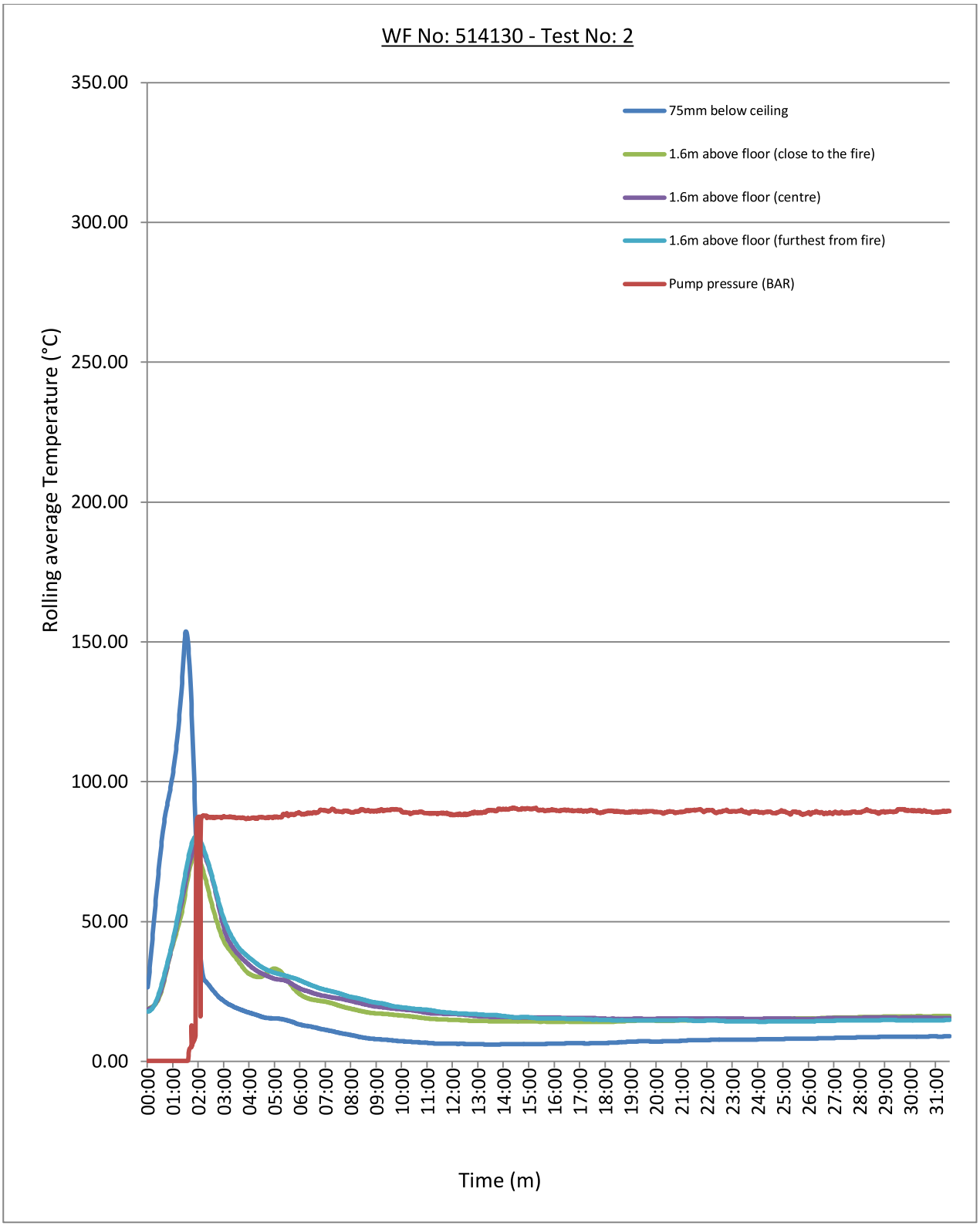

WF No: 514130 - Test No: 2
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pump pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
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

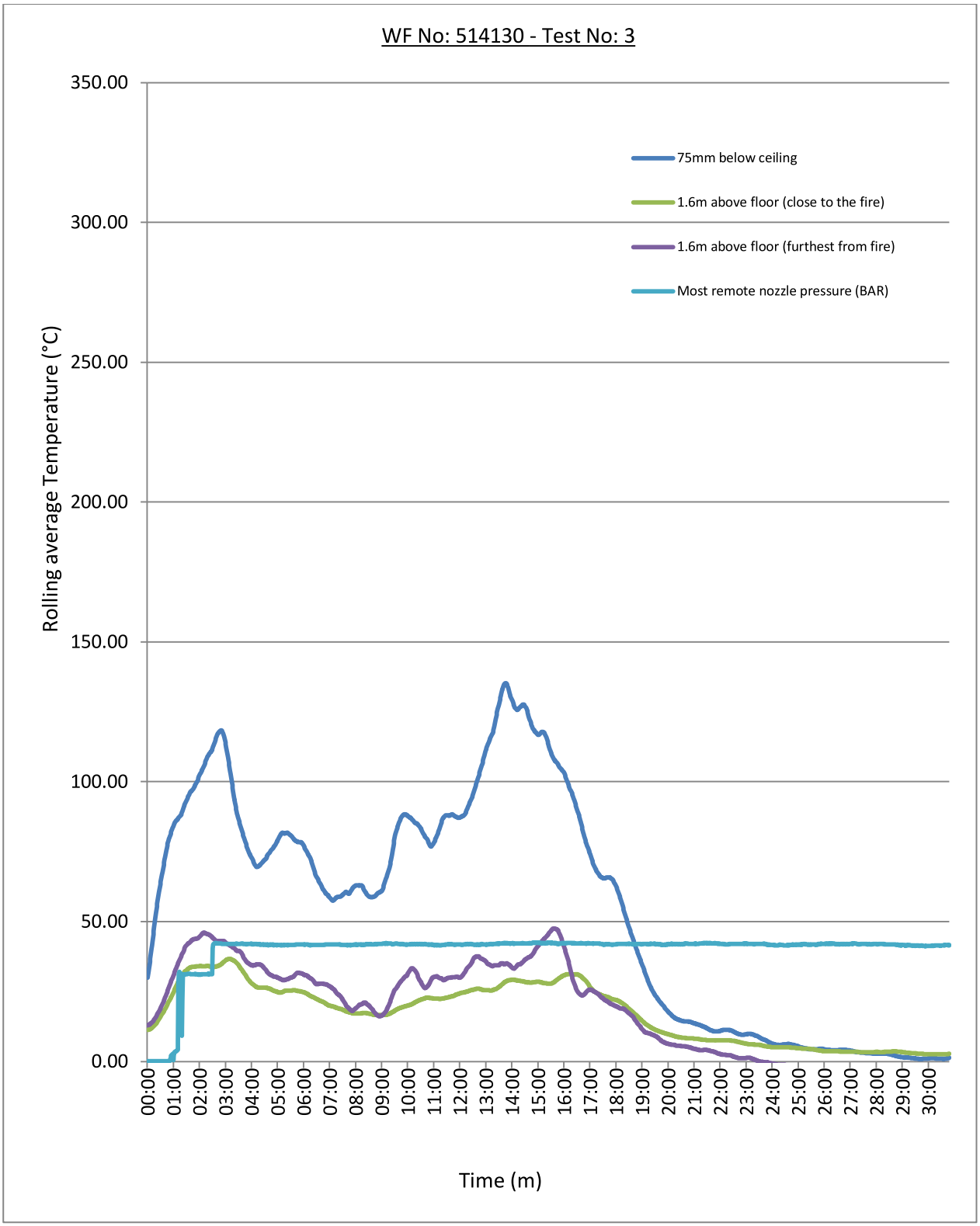
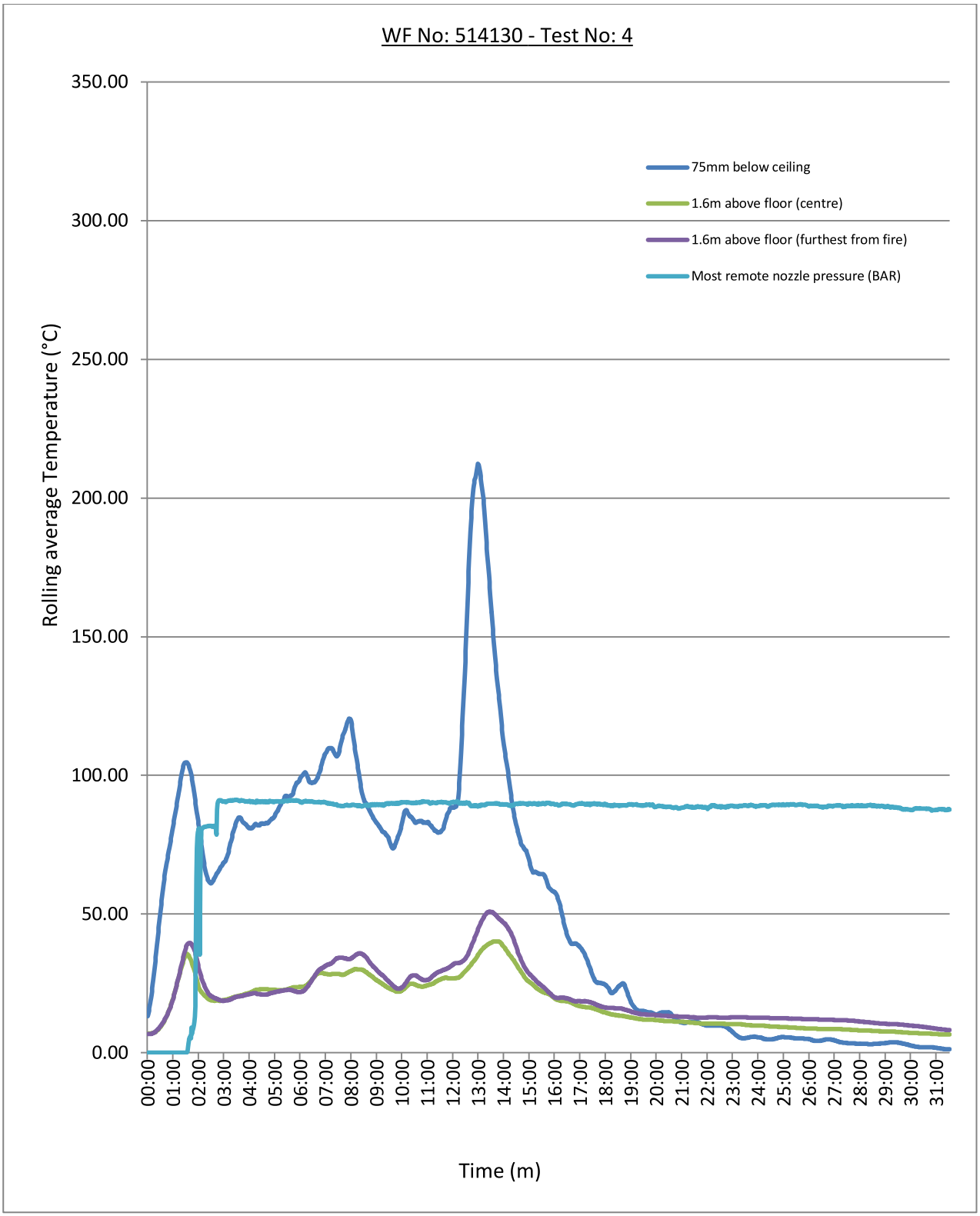

WF No: 514130 - Test No: 3
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (close to the fire)
1.6m above floor (furthest from fire)
Most remote nozzle pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
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 5


WF No: 514130 - Test No: 4
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Most remote nozzle 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
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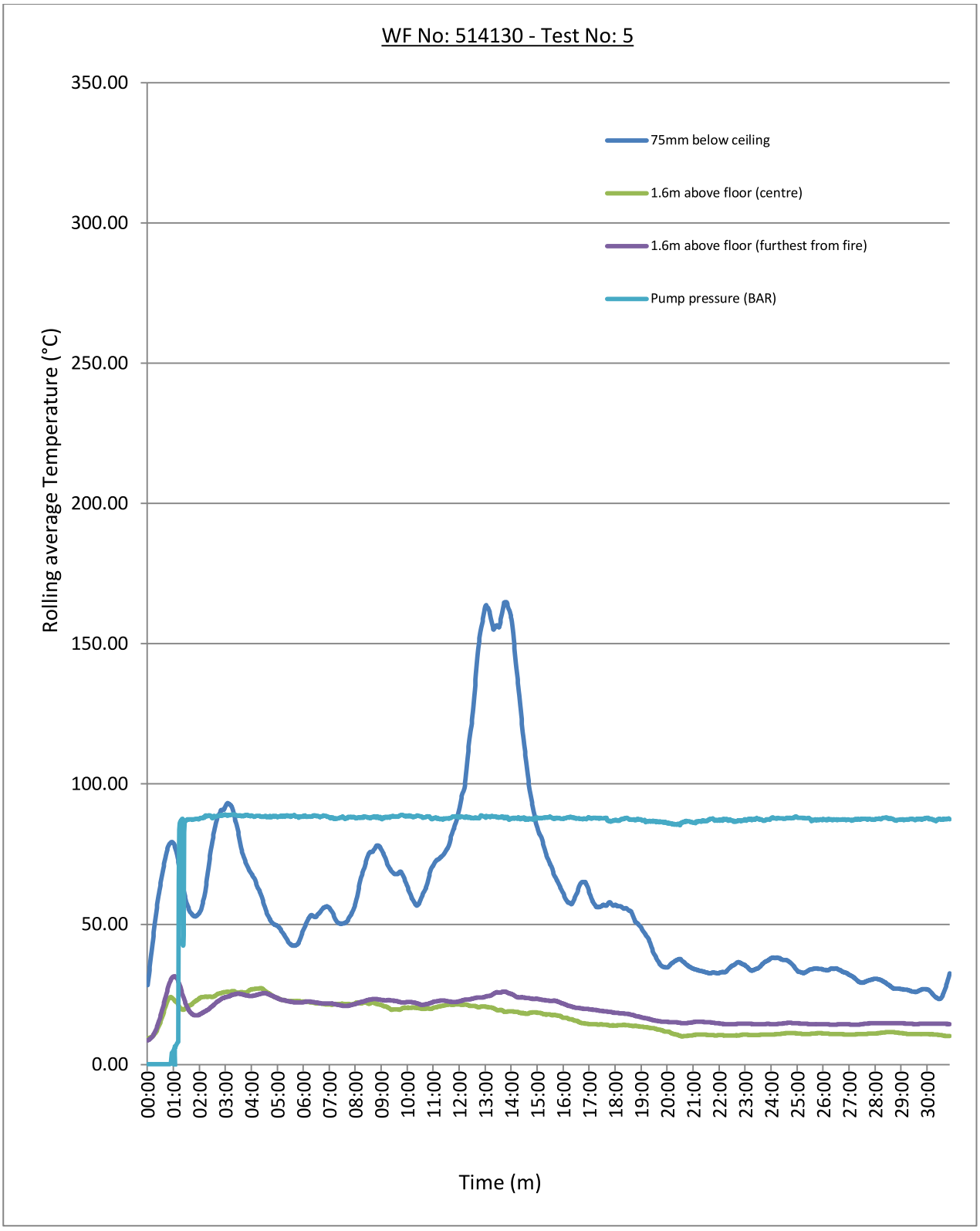
25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 3


WF No: 514130 - Test No: 5
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Pump 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
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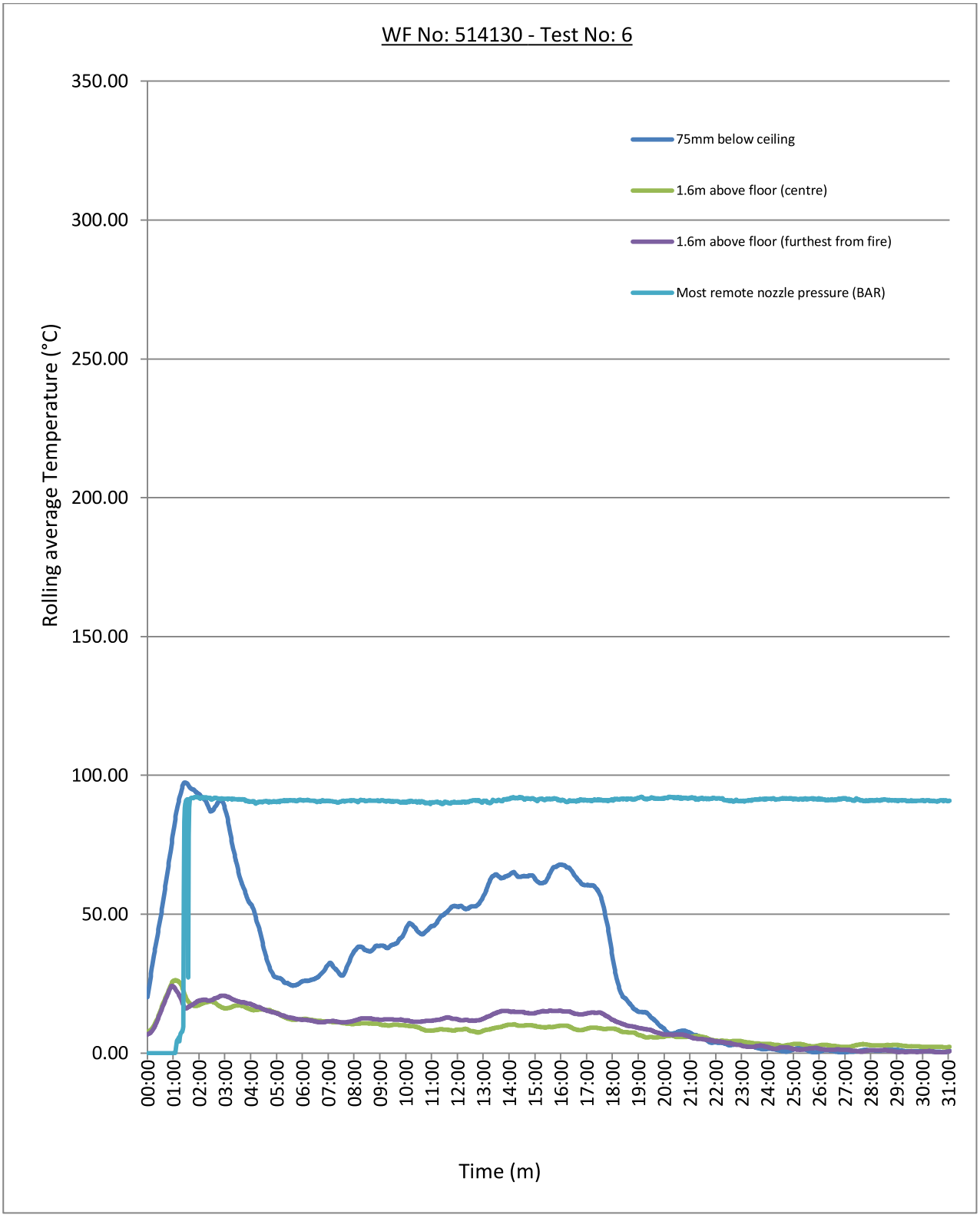
25:00
26:00
27:00
28:00
29:00
30:00
Time (m)

Figure 6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350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Most remote nozzle 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
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25:00
26:00
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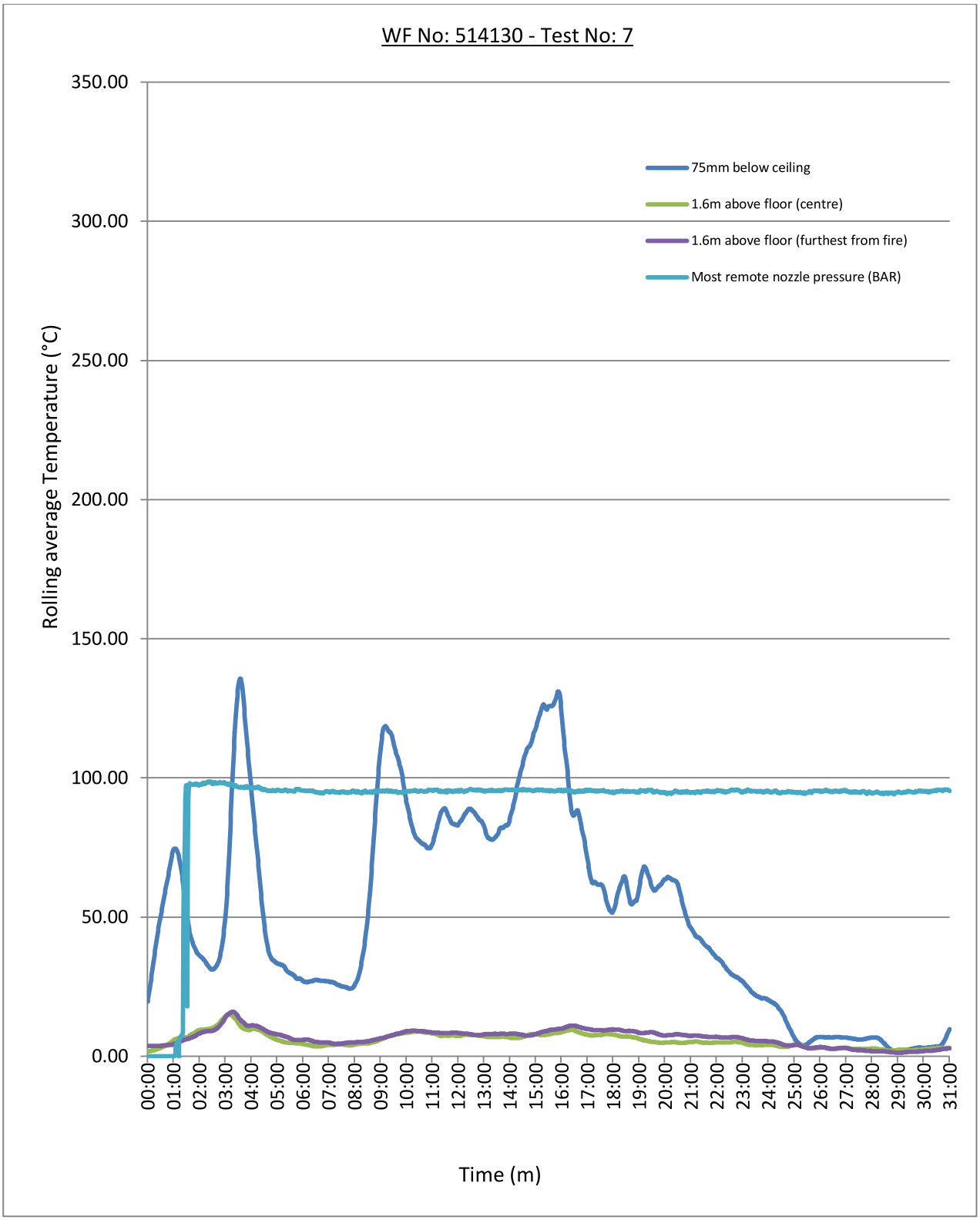
28:00
29:00
30:00
31:00
Time (m)

Figure 7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350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Most remote nozzle 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
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25:00
26:00
27:00
28:00
29:00
30:00
31:00
Time (m)

Figure 8

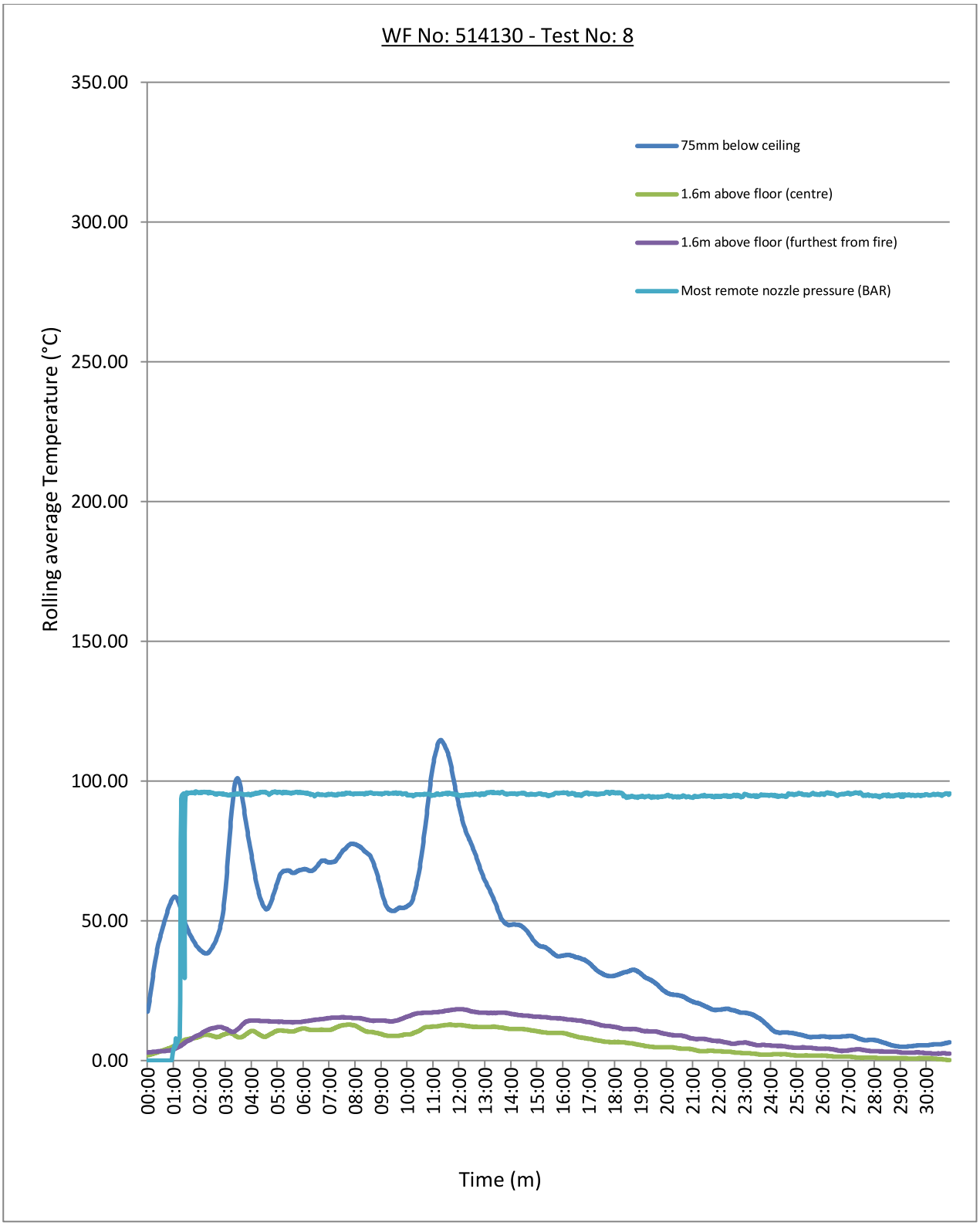

WF No: 514130 - Test No: 8
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Most remote nozzle pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
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 9

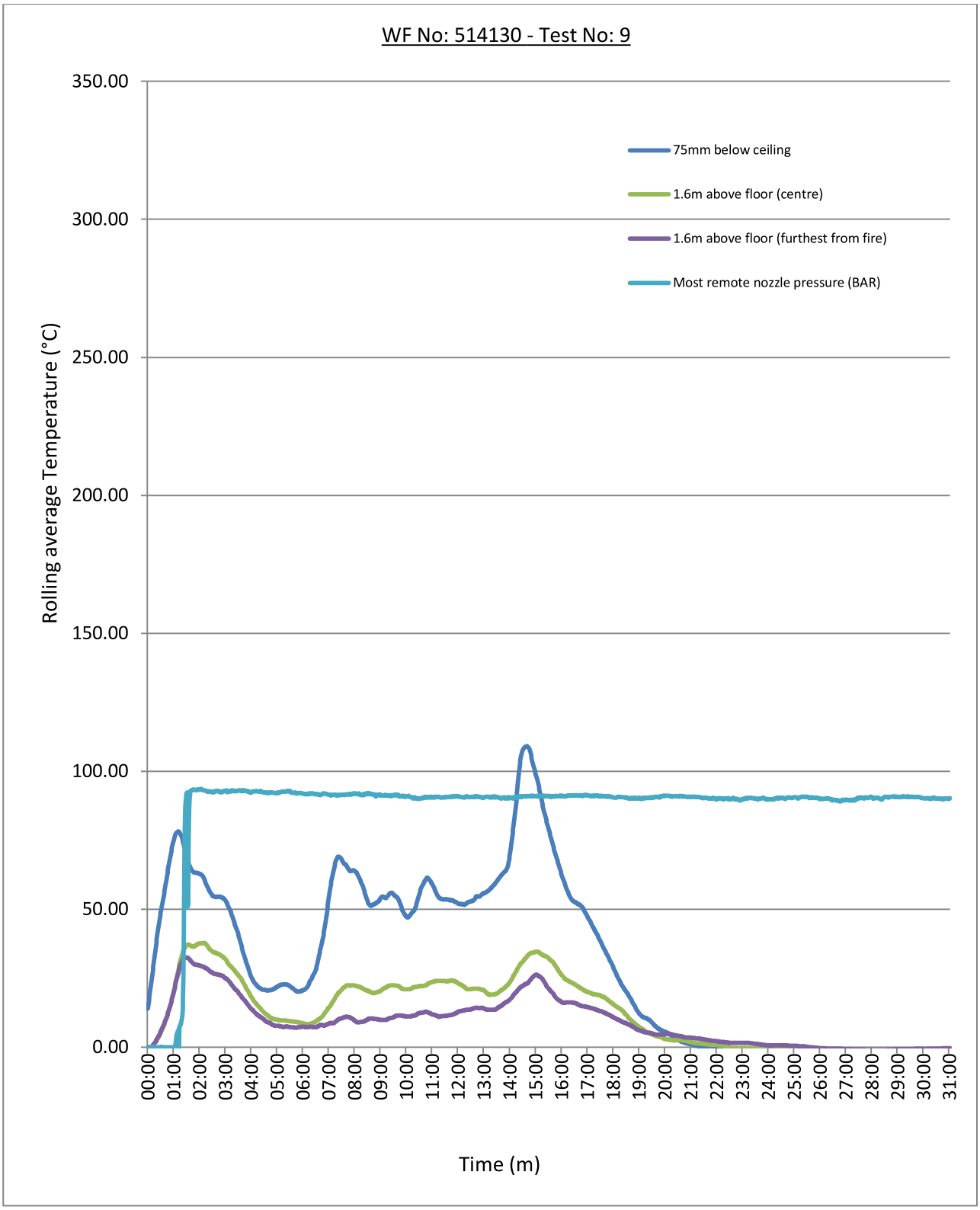
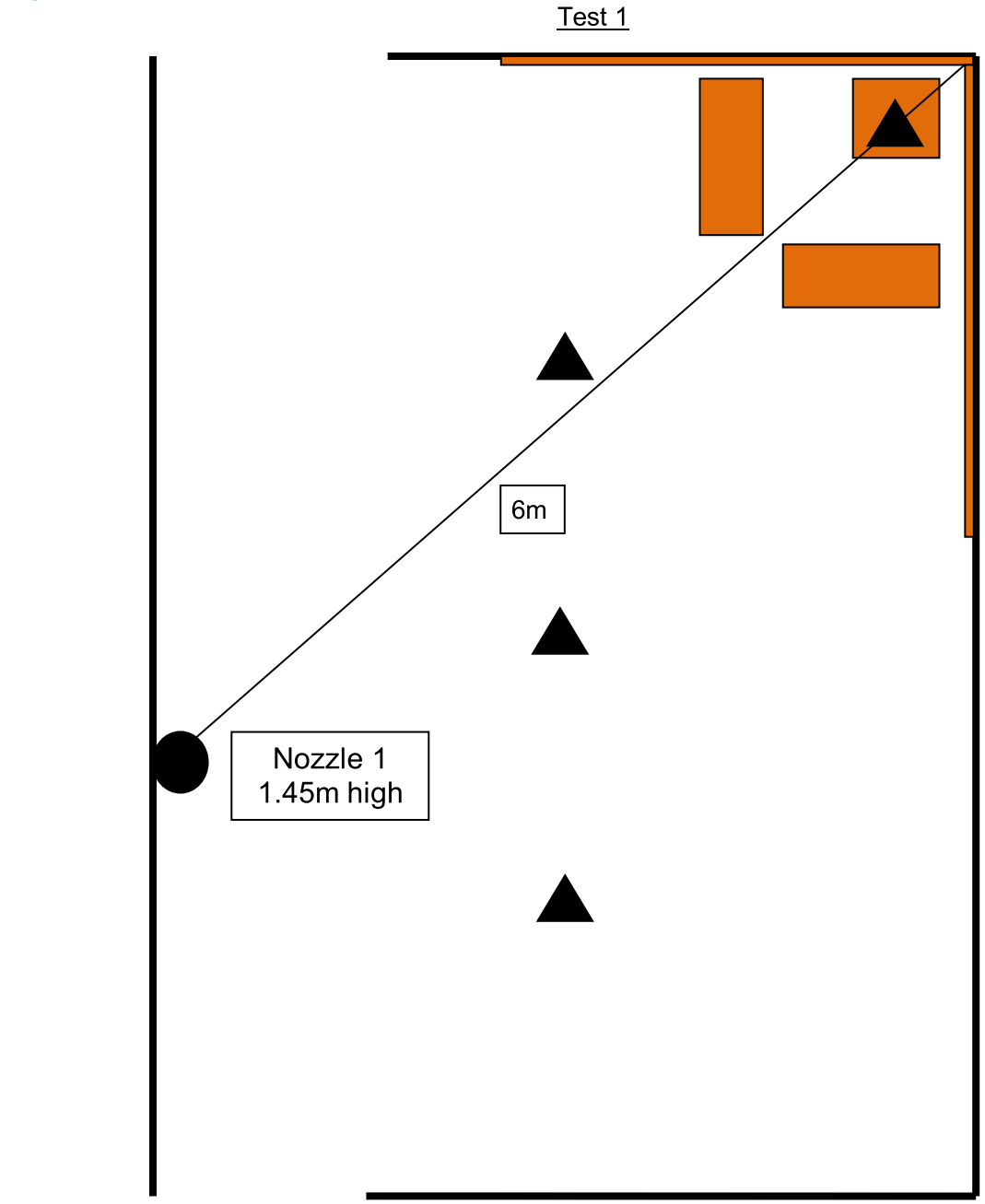

WF No: 514130 - Test No: 9
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rolling average Temperature (°C)
75mm below ceiling
1.6m above floor (centre)
1.6m above floor (furthest from fire)
Most remote nozzle pressure (BAR)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
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 10



Key

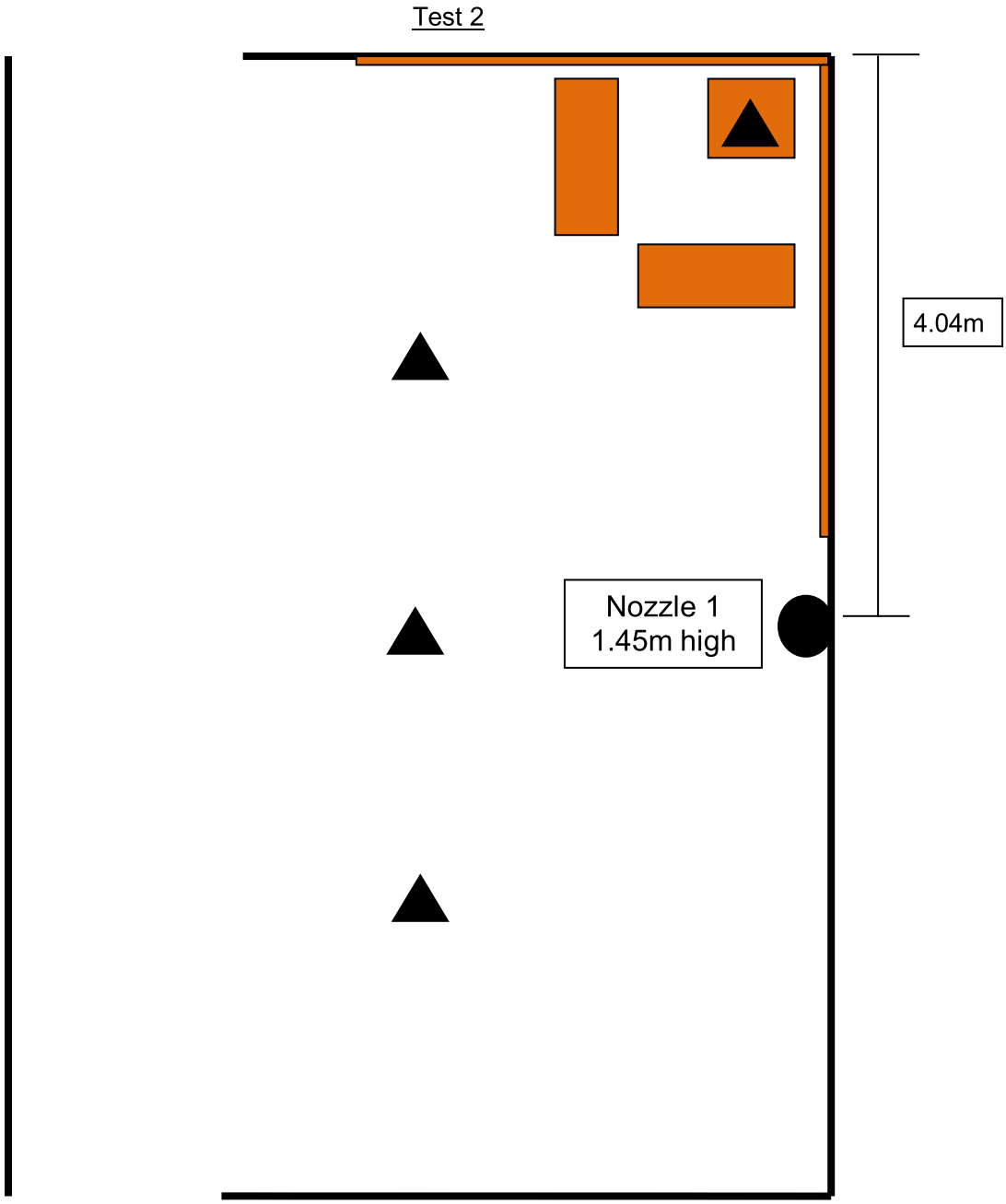
Corner, ignition and fuel package

Nozzle

Thermocouple

Drawing not to scale

Figure 11



Key

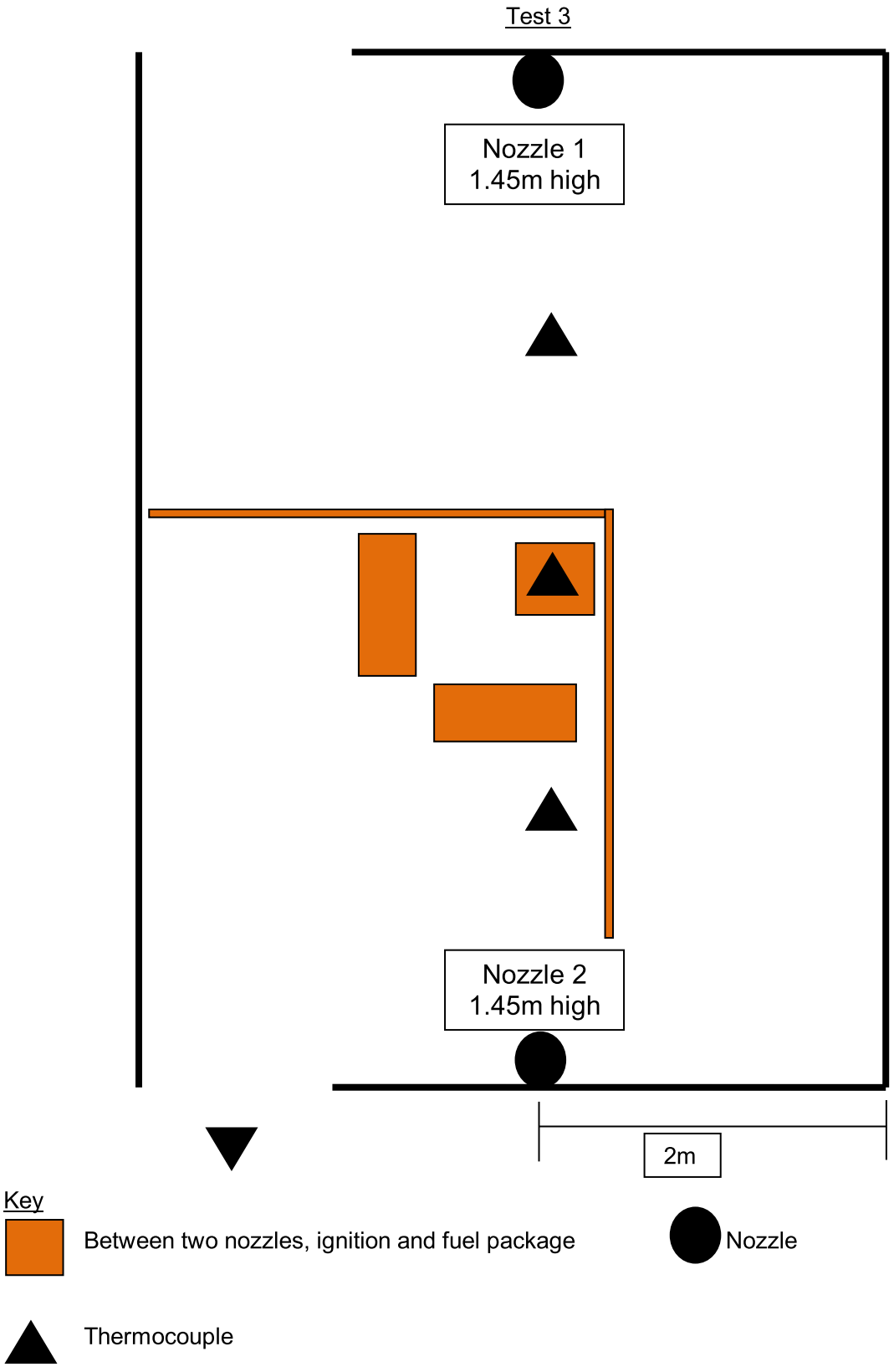
Corner, ignition and fuel package

Nozzle

Thermocouple

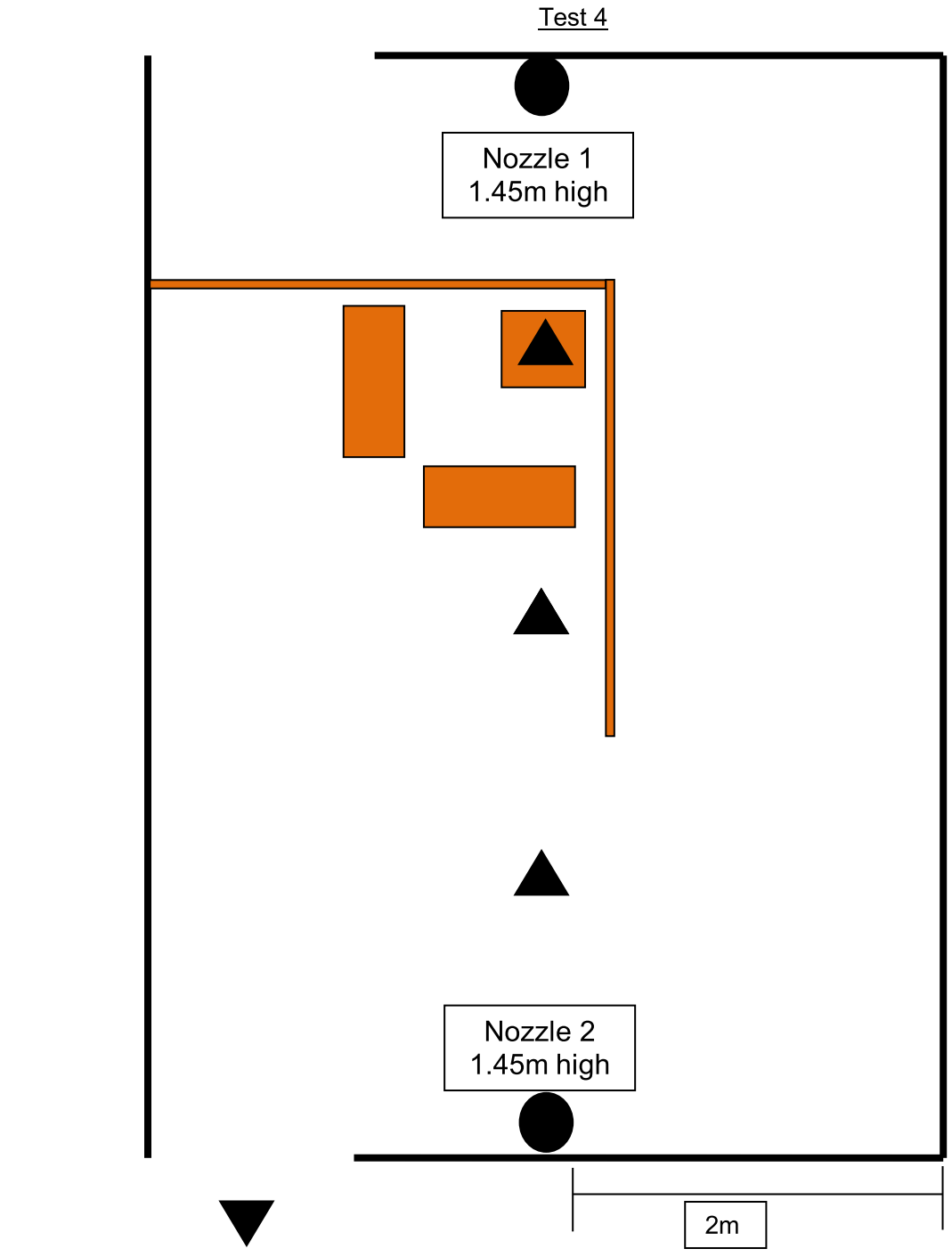
Drawing not to scale

Figure 12



Drawing not to scale

Figure 13



Drawing not to scale

Figure 14

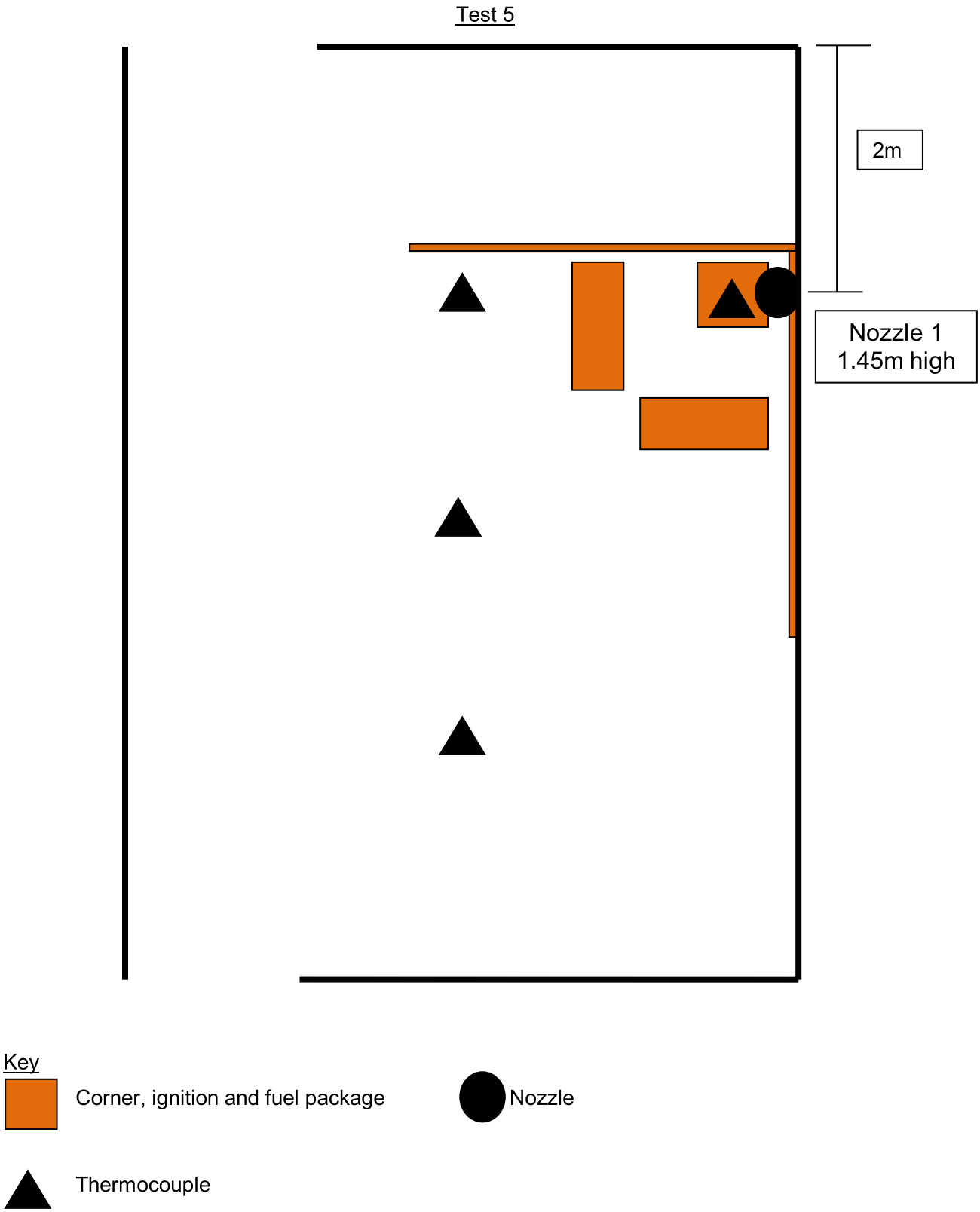
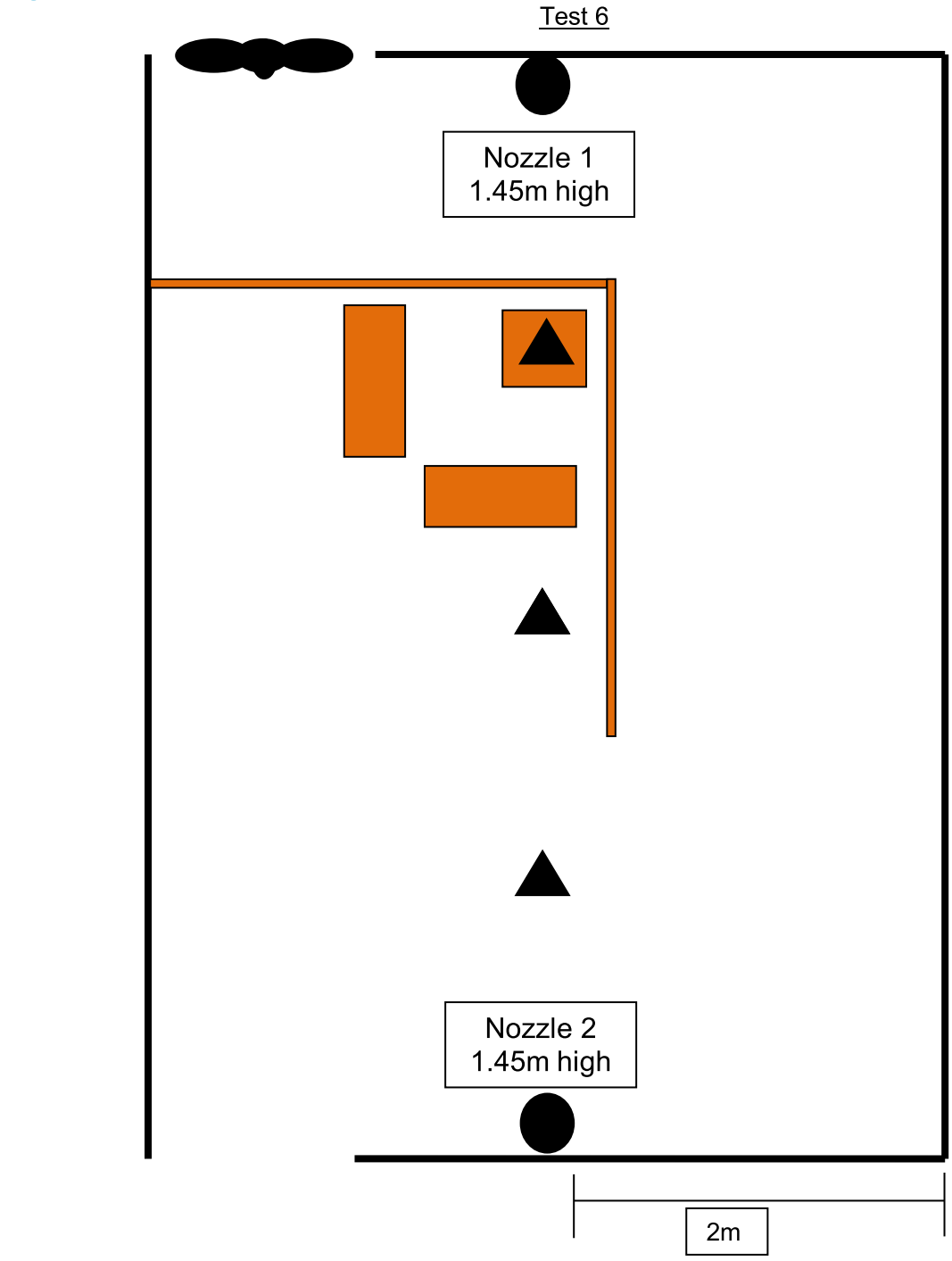
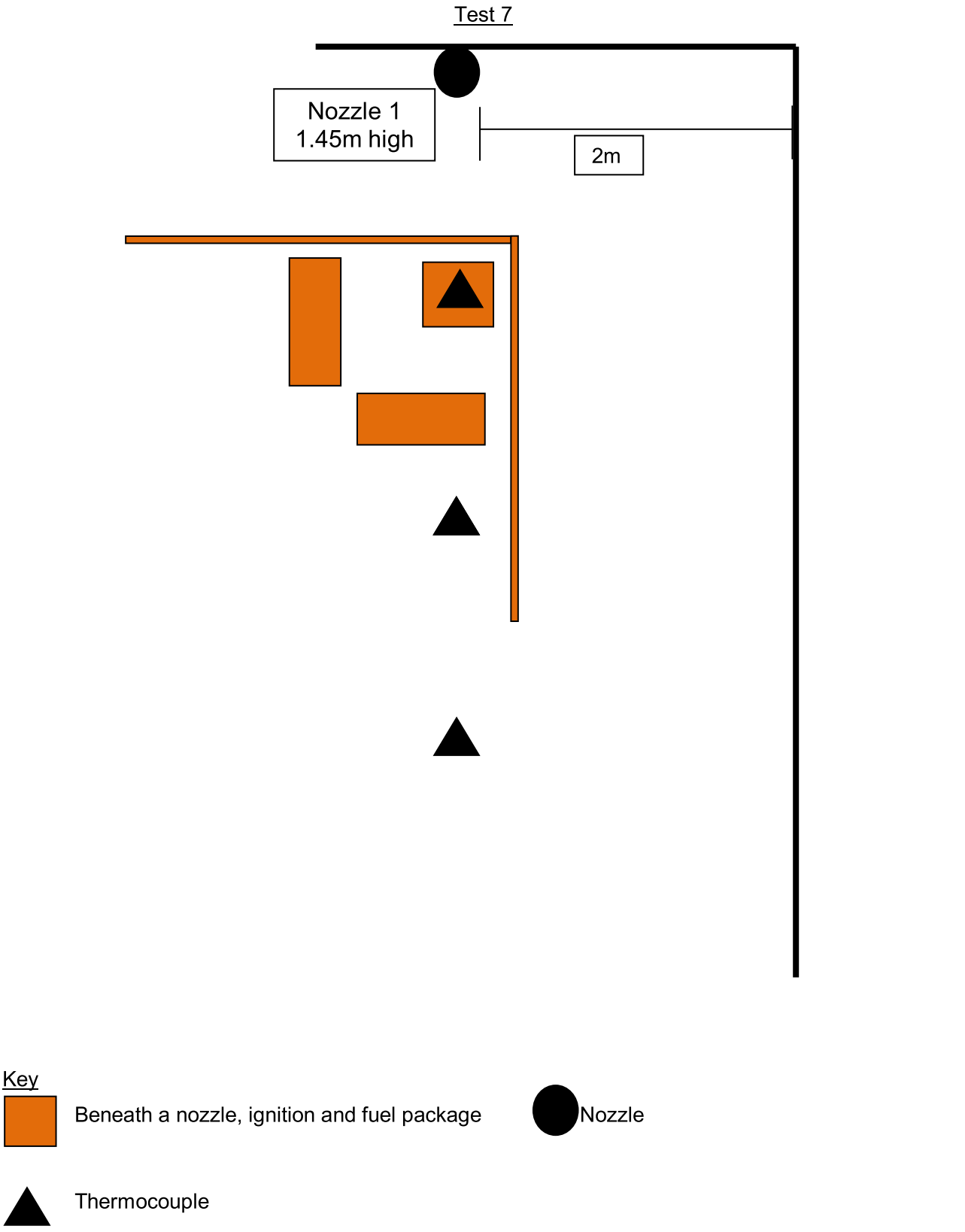

Test 5
2m
Nozzle 1
1.45m high
Key
Corner, ignition and fuel package
Nozzle
Thermocouple
Drawing not to scale

Figure 15



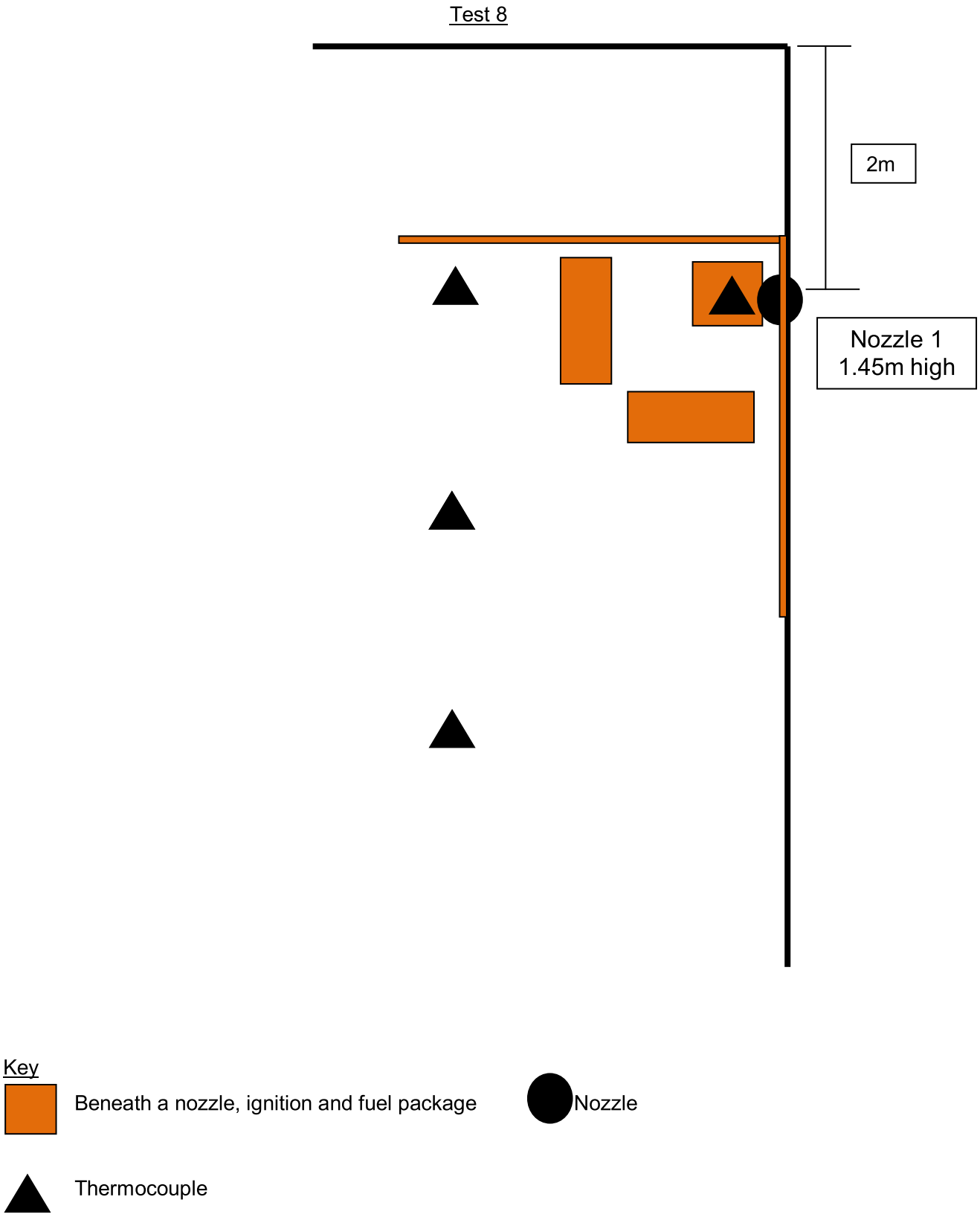
Drawing not to scale

Figure 16



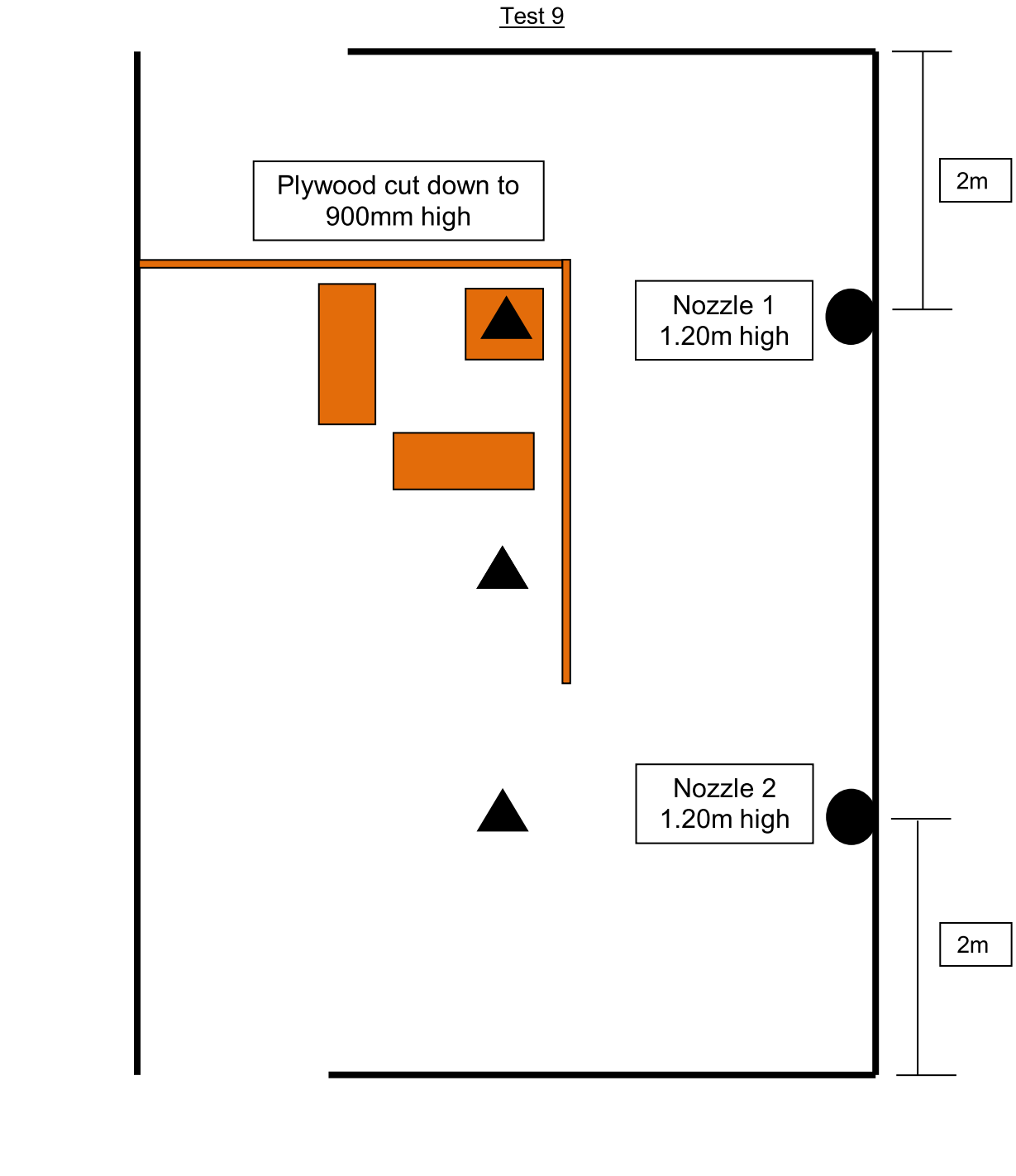
Drawing not to scale

Figure 17



Drawing not to scale

Figure 18



Drawing not to scale

Photographs

Photographs of ignition and fuel package before test 1

Photograph of nozzle

Photograph of system during test 1

Photograph near the end of test 1

Revision History

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

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