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BRE Global Test Report

Fire resistance test in accordance with EN1634-1:2014 on a single action, single-leaf doorset with one vision panel, mounted in a brick and block-wall supporting construction.

Prepared for: BRE Fire Investigation.

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BRE Global Ltd
Watford, Herts
WD25 9XX

Customer Services 0333 321 8811

From outside the UK:
T + 44 (0) 1923 664000
F + 44 (0) 1923 664010
E enquiries@bre.co.uk
www.bre.co.uk

Prepared for:
BRE Fire Investigation,
Bucknalls Lane,
Garston,
Watford,
Hertfordshire,
WD25 9XX

UKAS TESTING
0578

Prepared by

Name K. D. Fardell

Position Senior Consultant

Date 28th August 2018

Signature

Authorised by

Name T. Baker

Position Laboratory Manager

Date 28th August 2018

Signature

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SUMMARY

A single action, single leaf doorset with one vision panel, was submitted to a fire resistance test carried out in accordance with EN 1634-1:2014, on 13th February 2018 for a duration of 28 minutes.

The doorset was installed within a nominal 215mm-deep brick and block-wall supporting construction and orientated so that the door leaf opened towards the furnace. Prior to the start of the test, the door leaf was latched, but not locked.

In the orientation tested (the door opening towards the fire) the specimen was found to achieve the following fire resistance:

Integrity:	- sustained flaming:	15 minutes
	- gap gauges:	16 minutes
	- cotton pad:	15 minutes
Insulation:		10 minutes.

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1 OBJECTIVE

To determine at the request of BRE Fire Investigation, the fire resistance of a single action, single leaf doorset (including one vision panel) when subjected to a fire resistance test in accordance with EN 1634-1 : 2014.

2 TEST CONSTRUCTION

2.1 General

The single-leaf insulated composite doorset was fitted into an aperture, nominally 900mm-wide x 1990mm-high, constructed within a brick and block work wall supporting construction, built within a concrete lined furnace test frame of aperture size 3050mm x 3050mm.

Prior to the test, a threshold was fitted in accordance with Fire Test Study Group Resolution 513.

The doorset was orientated so that the leaf opened towards the furnace.

In accordance with this standard, the door leaf was latched but not locked.

Drawings of the type of doorset supplied for test were not supplied by the sponsor, and BRE was not involved in the selection of the test specimen.

The specimen is shown before, during and after testing in Photographs.

2.2 Supporting construction

The doorset was installed in a 215mm-deep brick and blockwork wall, with the doorframe anchored into the brickwork surrounding the doorset. For convenience, the outer parts of the wall were constructed from aerated concrete blocks.

The aperture for the doorset (nominally 910mm-wide x 2105mm-high, was set centrally within the wall, with the door sill located at a nominal height of 550mm above the base of the wall.

2.3 Door Frame

Details of the frame construction were not available / not provided.

The frame was of overall size nominally 1990mm-high x 70mm-deep and provided a clear opening of 743mm x 1930mm. The frame was observed to be made from a white, plastic-type material.

The frame was screw fixed through into the brickwork surround using 7.5mm-diameter x 110mm-long screw fixings, with three fixings per jamb and two fixings across the horizontal head section. Fixings to each jamb were located nominally 435mm, 1200mm, and 1560mm above the threshold of the door and 100mm from each corner of the horizontal head section.

Both side frame members and the top frame member incorporated two nylon brush smoke seals (nominally 8mm to 10mm wide) and a nominally 10mm-wide white gasket seal.

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Gaps between brick and blockwork wall supporting construction and door frame were filled from both faces with gun grade fire retardant expanding foam (Flameguard Siroflex), supplied in 700ml cartridges.

Some white plastic trim was fixed over the gap between the door frame and brick wall, being held in place with white coloured general-purpose silicone sealant (supplied in 310ml cartridges).

The threshold incorporated an 8mm-thick aluminium profile, incorporating an approximately 10mm-wide white gasket material, and a 4mm-wide black plastic strip embedded in the aluminium, approximately 8mm from the exposed side of the threshold.

2.4 Door Leaf

Details of the leaf construction were not available / not provided.

The leaf was of nominal measured dimensions 765mm-wide x 1947mm-high x 45mm-deep, with a wood effect decorative finish (black on the external / unexposed face and white on the internal / exposed face).

Incorporated within the leaf was one semi-circular double-glazed vision panel (nominally 520mm-wide x 225mm-tall located at mid-width, near the top of the leaf.

There were no visible markings on the leaf to identify the stated fire rating of the doorset.

The door leaf opened towards the furnace.

For the purposes of this test, the leaf was latched but unlocked for the test.

2.5 Door Fittings

Although no details were provided, a visual examination showed the doorset being fitted with the following furniture:

Three steel hinges, one located nominally 175mm from the bottom, one located nominally 980mm from the bottom and one located nominally 180mm from the top of the door leaf.

The door leaf was fitted with a three-point locking system and a latch, the latch being located nominally 1020mm from the bottom of the leaf.

A door closer was fitted to the exposed face of the doorset but was not used to retain the leaf in the closed position for the test.

Door security spyhole located centrally within the width of the leaf, nominally 500mm below the top edge of the leaf, concealed within a stainless-steel door knocker on the unexposed face.

A steel letterbox was located nominally 820mm above the base of the leaf within the centre of the leaf. The letterbox was fitted with a steel hinged flap on both sides of the leaf.

Stainless-steel rain deflector fitted across the base of the door (unexposed / exterior face only).

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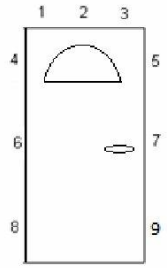
2.6 Door frame / supporting construction gaps

During installation of the door frame, the gaps (subsequently filled with expanding foam and covered with white plastic trim) were observed to be as follows:



Gap location

Gaps measured from exposed face

Location	1	2	3	4	5	6	7	8	9
Gap -mm	13	16	18	15	10	10	15	8	17

Gaps measured from unexposed face

Location	1	2	3	4	5	6	7	8	9
Gap -mm	18	17	14	10	17	15	10	18	9

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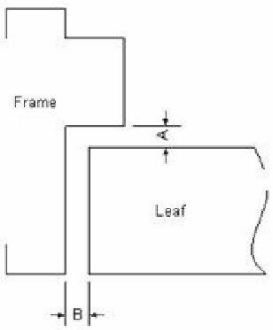
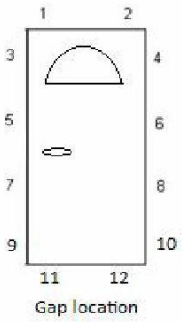
2.7 Door leaf / frame gaps

The gaps between the door leaf and frame were measured (in mm) and found to be as given in the sketch and table below.





Location	Gap A	Gap B
1	0	6.5
2	1.5	5
3	0	6
4	2	4.5
5	0	6
6	2	4

Location	Gap A	Gap B
7	0	5
8	3.5	4
9	0	5
10	4	4
11	0	0
12	1.5	1.5

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3 TEST PROCEDURE

3.1 General

The test was carried out on 13th February 2018 and was witnessed on behalf of BRE Fire Investigation by Dr David Crowder Ms Ciara Holland.

The ambient temperature at the start of the test was 13°C.

3.2 Furnace control

The furnace temperature was measured by means of eight plate thermometers arranged in the furnace in four rows with their measuring junctions nominally 100mm from the fire-side face of the test construction. The furnace was controlled so that the average temperature followed the time/temperature relationship specified in EN 1363-1:2012.

The furnace pressure was monitored at a point 2.4m above the base of the door. The pressure was controlled to provide a neutral pressure height at 500mm above the base of the door.

3.3 Specimen temperature measurements

The unexposed face temperature of the specimen was measured using seventeen chromel / alumel (K-type) thermocouples each soldered to a copper disk and covered with an insulating pad attached to the leaf and frame of the doorset.

The locations of the unexposed face thermocouples are given in the following table and shown in the Photographs.

Thermocouple	Location
1	On the top frame member, near the left-hand side.
2	On the top frame member, near the right-hand side.
3	Near the top left-hand side corner of the door leaf.
4	Near the top right-hand side corner of the door leaf.
5	On the glazed area of the leaf, at the top edge of the glass.
6	On the centre of the glazed area of the leaf.
7*	Near the centre of the top left quarter area of the door leaf
8*	Near the centre of the top right quarter area of the door leaf
9	Near the centre of the moulded panel to the left-hand side of the door leaf, above mid-height of the door.

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Thermocouple	Location
10	Near the centre of the moulded panel to the right-hand side of the door leaf, above mid-height of the door.
11	On the left-hand side frame member, at mid-height.
12*	At the centre of the door leaf.
13	Just below mid-height of the door leaf, near the right hand side edge of the leaf, between the letterbox and latch location.
14	On the right-hand side frame member at mid height.
15*	Near the centre of the bottom left quarter area of the door leaf.
16	At mid-width of the door leaf, 750mm form the bottom of the leaf.
17*	Near the centre of the bottom right quarter area of the door leaf.

* These five thermocouples were used to determine the mean unexposed face temperature of the doorset with all thermocouples (including those on the frame) being used to determine the maximum temperature.

3.4 Deflection

Two linear displacement transducer were connected via taut fine steel wires to the top of the door leaf, at mid-width and to the left hand side corner of the door leaf (which were considered to be the locations of maximum deflection) to continuously monitor the horizontal deflection during the test. Positive and negative values denote the deflection of the leaf toward and away from the furnace respectively.

3.5 Irradiance

The radiation from the specimen during the test was measured using a radiometer located 1m from the centre of the doorset.

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4 RESULTS

4.1 Observations

Observations made during the test are given in the following table and are of the unexposed face.

Time minutes	Observation
0	Start test.
2	A considerable amount of smoke is coming from the doorset, with most smoke from the right-hand side edge of the leaf.
4	Smoke is coming from the letterbox.
9	Approximately half the glazed area has darkened with soot deposits. The unexposed face layer of glass has cracked in several places.
10	Considerable smoke continues to come from the right-hand side edge of the door leaf.
12	Some smoke is now coming from the cracks in the glass.
15	Failure of integrity from sustained flaming at the top edge of the glazing.
16	The glazing fell out from the leaf.
20	Flames coming out from where the glazing has fallen are setting fire to the door frame at the top of the doorset.
21	A red glow and intermittent flaming from adjacent to the handle/latch area.
23	Sustained flaming from the latch area. The front cover of the letterbox has fallen off.
27	The trim around the perimeter of the doorset is flaming and melting.
28	Test stopped.

The first failure of integrity occurred after 15 minutes.

The specimen is shown after 15 minutes and at the end of test in the photographs.

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4.2 Furnace temperature & pressure

The mean furnace temperature, together with the specified curve for comparison is given in the Graphs. Furnace pressure is also given in the Graphs.

4.3 Unexposed face temperatures

The individual, mean and maximum temperatures recorded on the unexposed face of the specimen during the test are plotted against time in Graphs.

The maximum temperature of the door leaf exceeded the 180°C temperature-rise limit after 10 minutes of the test.

The mean unexposed face temperature of the door leaf did not exceed the 140°C temperature-rise limit during the test.

The maximum temperature of the door frame did not exceed the temperature-rise limit of 360°C during the test.

4.4 Deflection

The deflection recorded by the transducers is plotted against time in Graphs, where positive values indicate deflection towards the furnace and negative values indicate deflection away from the furnace.

After approximately 17 minutes from the start of the test, the flaming from the door leaf caused the wire attached to the top of the door leaf at mid-width to detach from the specimen. As such, data from this transducer was not recorded after 17 minutes.

The maximum deflection measured by the transducer attached to the top right-hand side corner of the door leaf was 88mm away from the furnace, recorded at the end of the test.

4.5 Irradiance

The irradiance recorded 1m from the centre of the specimen is given in the attached Graphs. The maximum irradiance was 4.36kW/m^2 recorded at the end of the test.

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5 PERFORMANCE CRITERIA

The standards specify that the result be given as the elapsed times during the test, in completed minutes, for which the test specimen continues to maintain its separating function (integrity) and, separately, also without developing temperatures on the non-fire face exceeding specified limits (insulation, if appropriate).

Integrity is defined in terms of failure by sustained flaming, cotton pad and gap gauges as follows:

Sustained flaming: when sustained flaming for not less than 10s on the non-fire face occurs

Cotton pad: when ignition (flaming or glowing) occurs on a cotton fibre pad applied close to the specimen

Gap gauges: when a 25mm-diameter gap gauge can penetrate through a gap into the furnace; or, apart from the gap between the sill and the leaf, when a 6mm-diameter gap gauge can penetrate through a gap into the furnace and be moved in the gap for a distance of at least 150mm.

Insulation: Failure under the normal procedure is deemed to occur:

a) when the mean non-fire face temperature increases by more than 140°C above its initial value;

b) when the maximum temperature recorded on the non-fire face at the specified locations increases above the initial mean temperature by more than 180ºC with the exception that the limit for the temperature rise on the frame of the door is 360°C;

c) when integrity failure occurs.

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6 CONCLUSION

A single action, single leaf doorset incorporating one vision panel, when submitted to a fire resistance test in accordance with EN 1634-1 : 2014 on 13th February 2018 at BRE laboratories, Garston, Watford, for a duration of 28 minutes, achieved the following fire resistance:

Integrity:	- sustained flaming:	15 minutes
	- gap gauges:	16 minutes
	- cotton pad:	15 minutes
Insulation:		10 minutes.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in EN 1634-1. Any significant deviation with respect to size, construction details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.

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. 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.

7 REFERENCES

- Fire resistance tests for doors and shutter assemblies. Part 1 : Fire doors and shutters. EN 1634-1 : 2014. British Standards Institution, London, 2014.
- Fire resistance tests. Part 1 : General requirements. EN 1363-1 : 2012. British Standards Institution, London, 2012.

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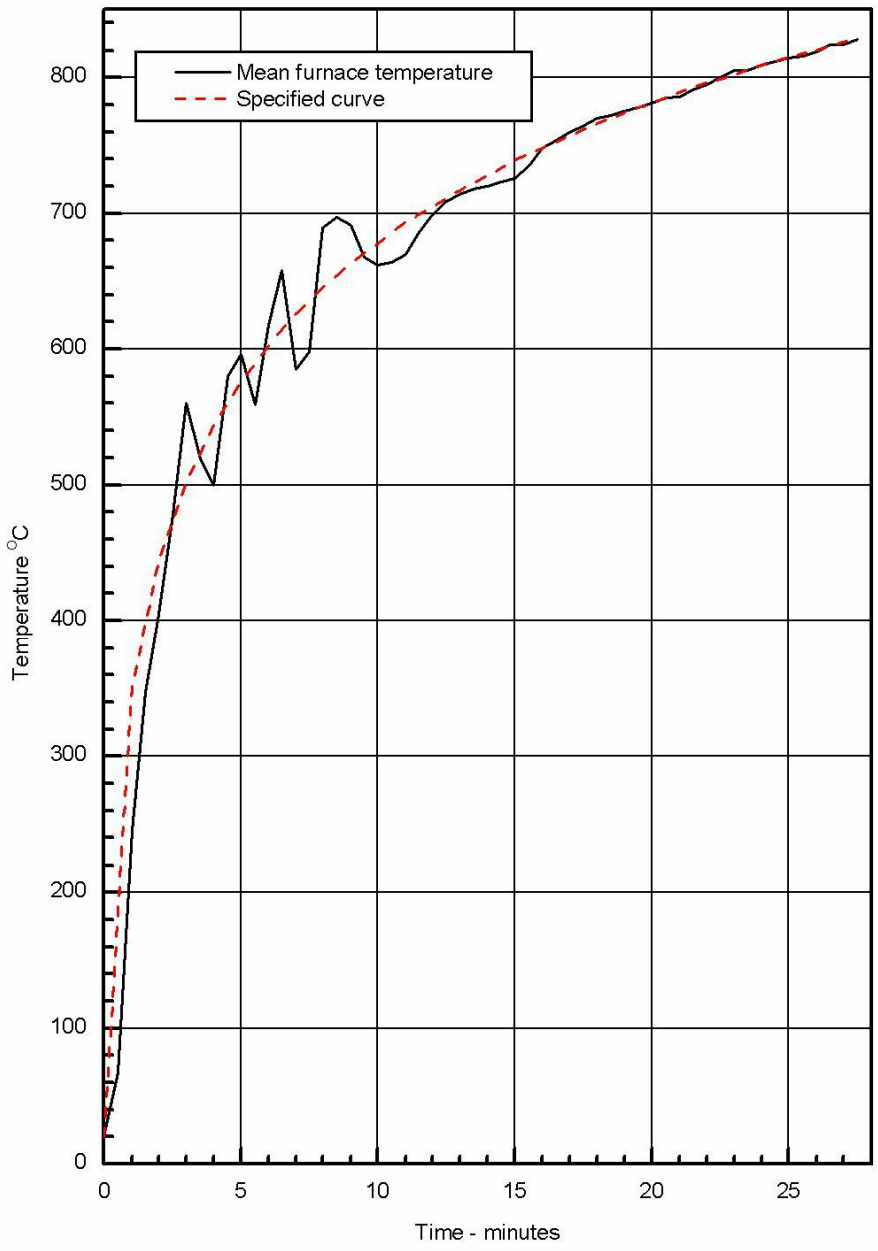
8 GRAPHS



Mean furnace temperature with specified curve for comparison.

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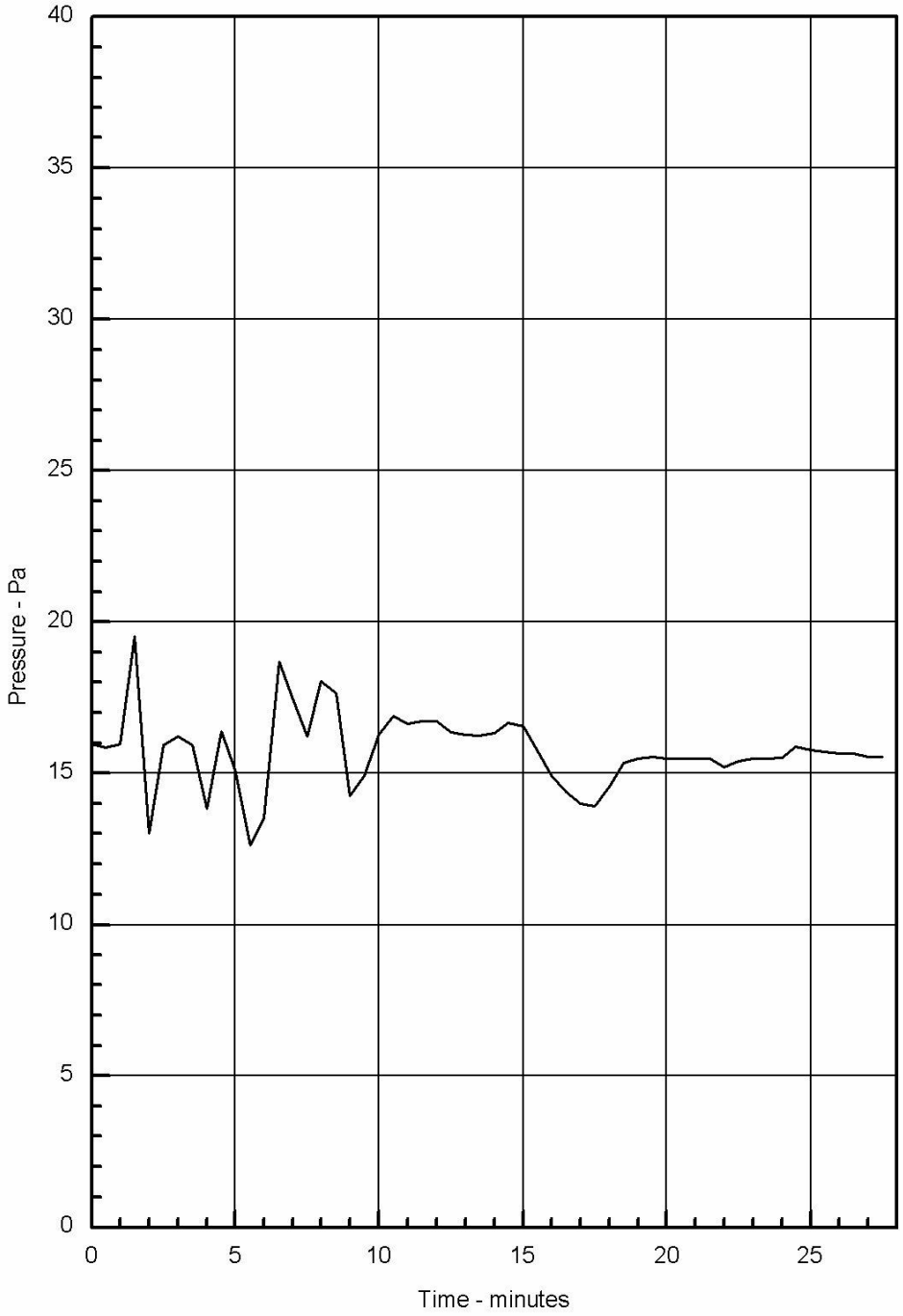

Furnace pressure recorded 2.4m above the base of the doorset.

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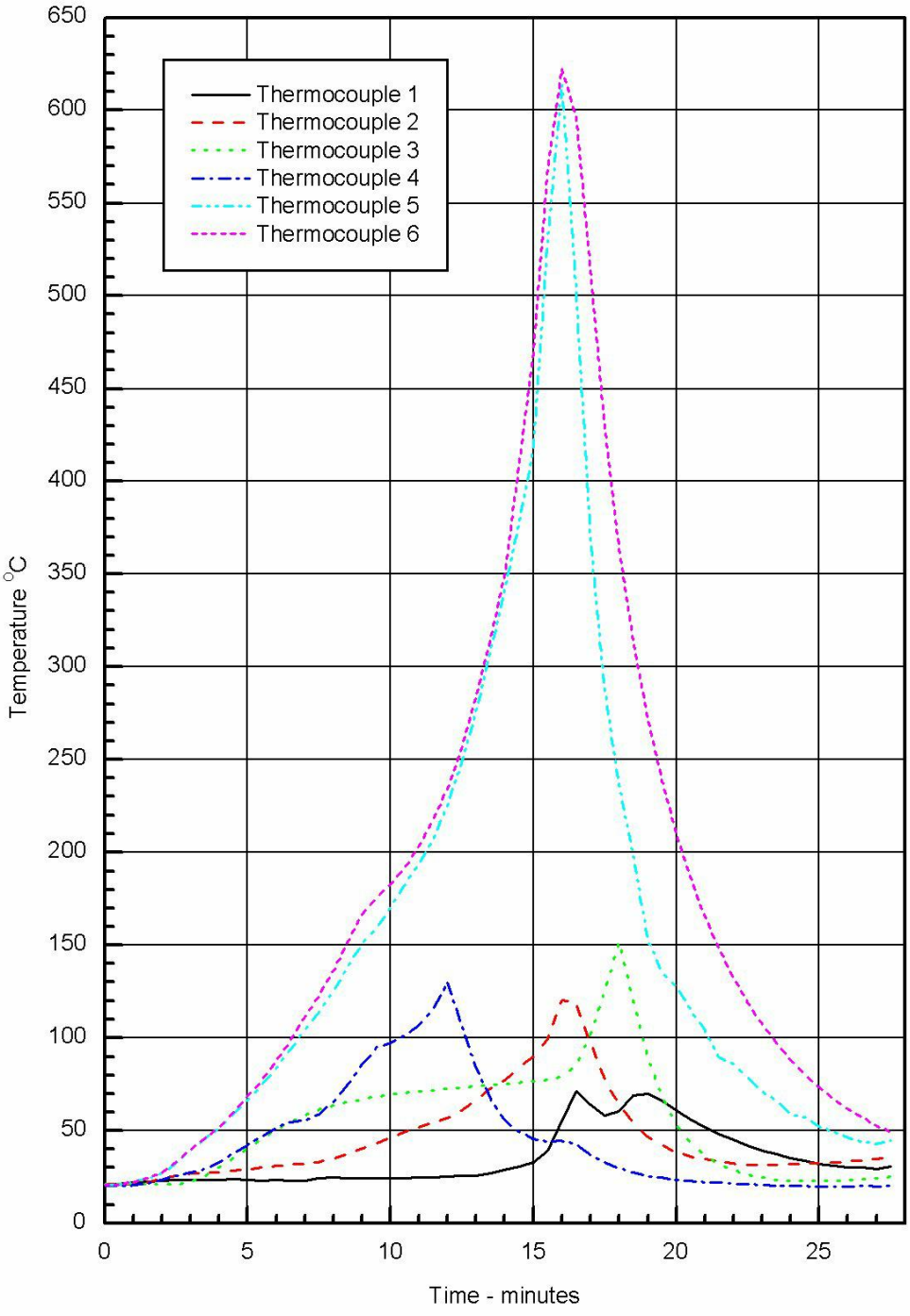

Individual temperatures recorded on the unexposed face by thermocouples 1 to 6.

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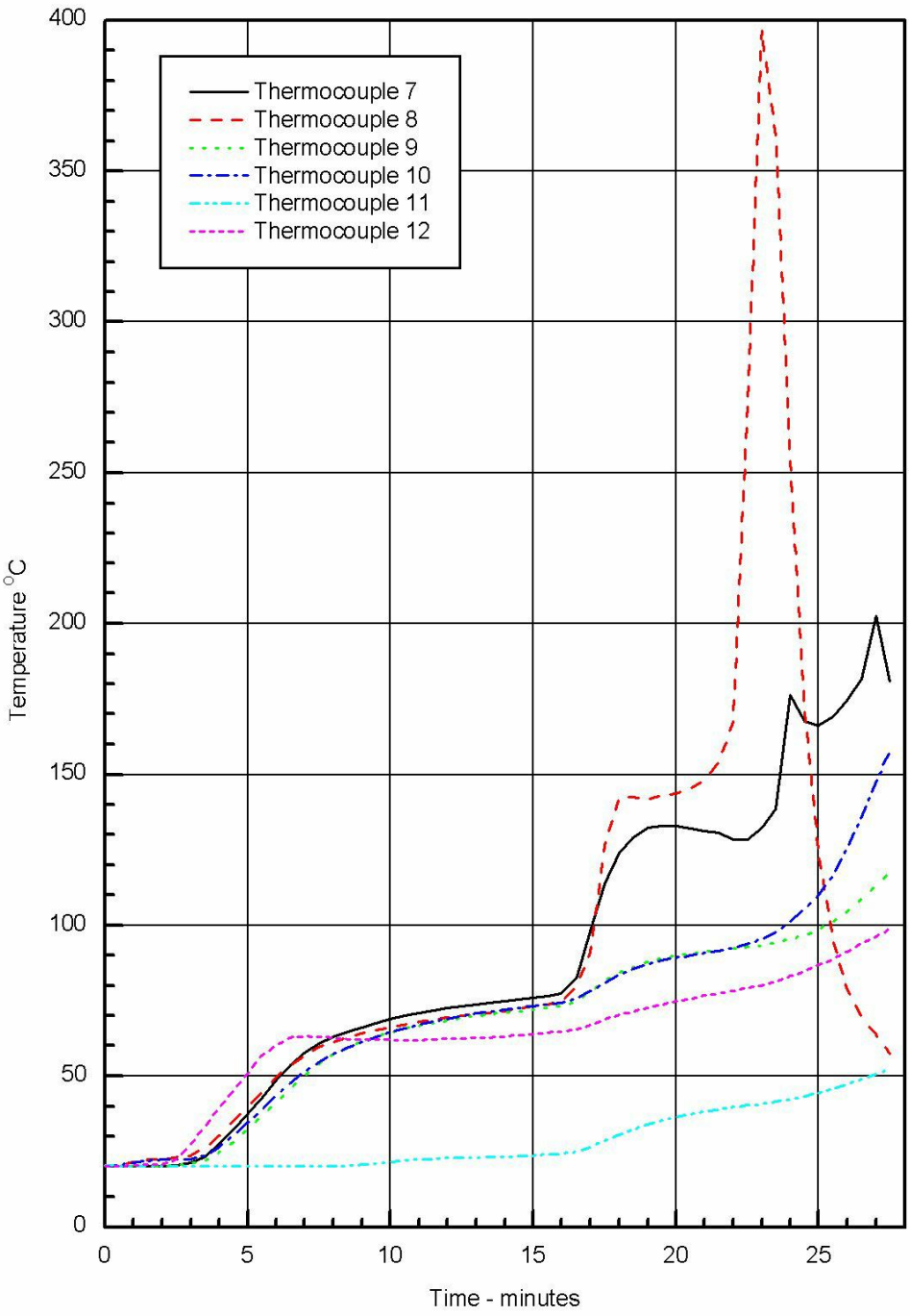

Individual temperatures recorded on the unexposed face by thermocouples 7 to 12.

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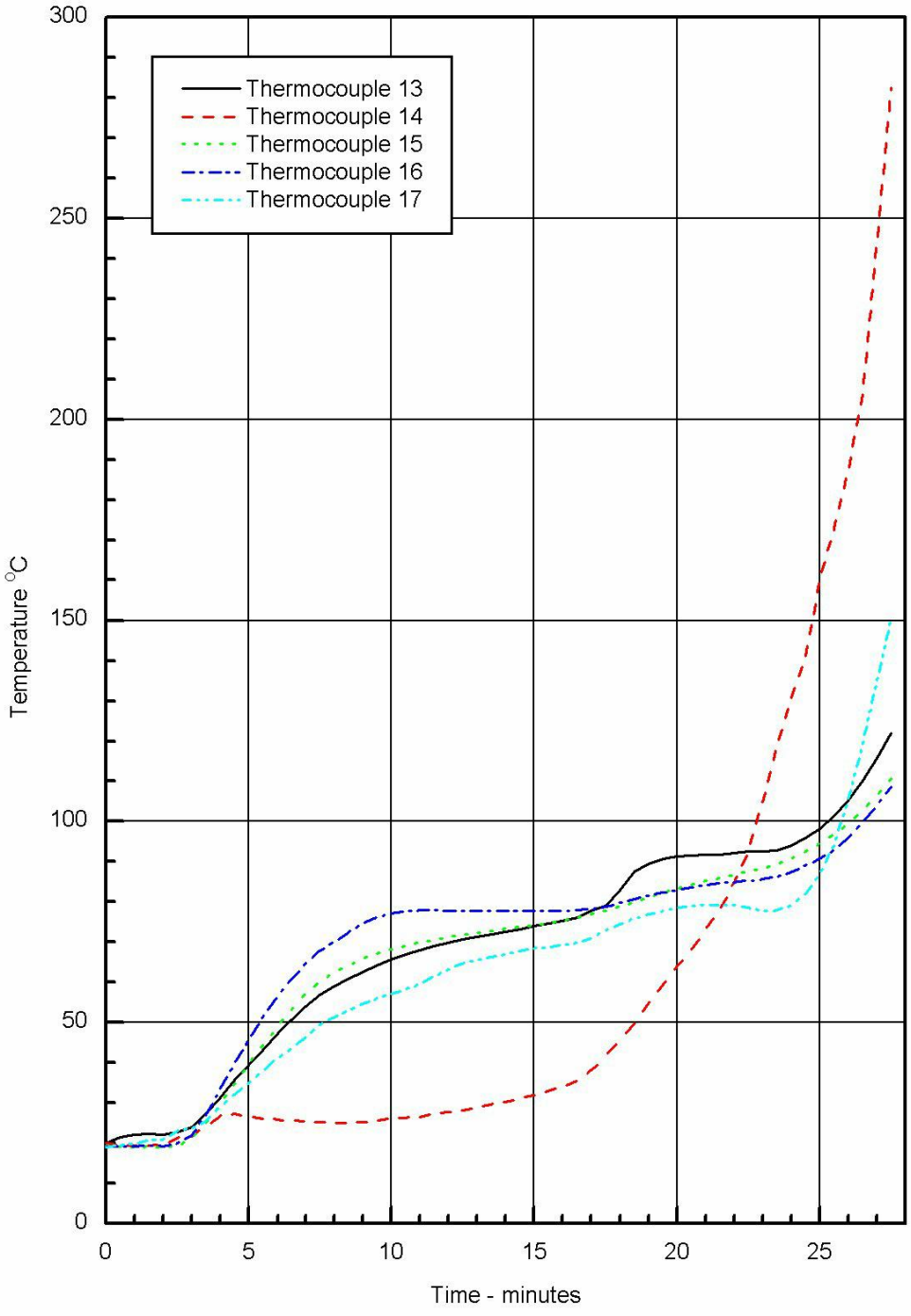

Individual temperatures recorded on the unexposed face by thermocouples 13 to 17.

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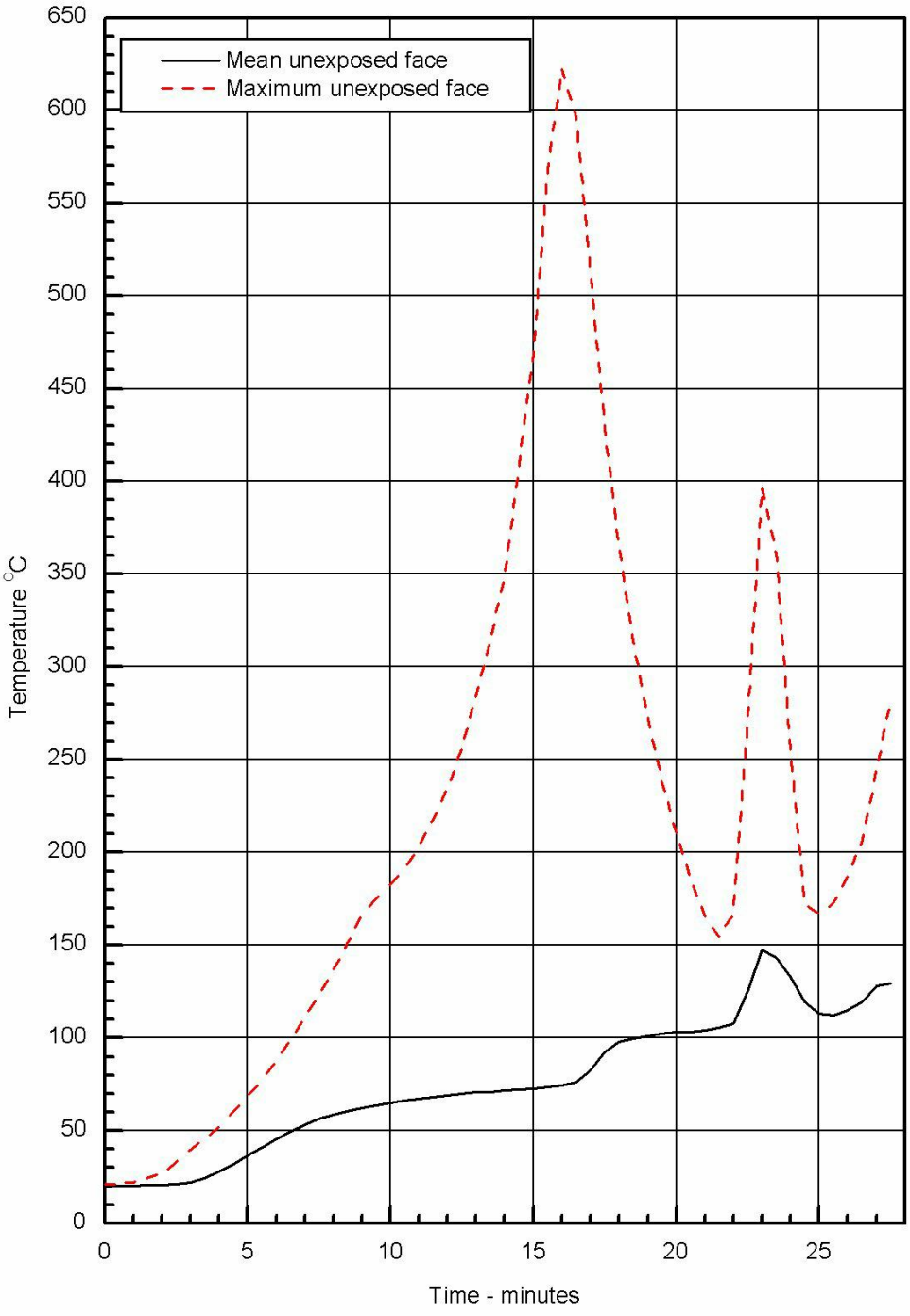

Mean and maximum temperatures recorded on the unexposed face.

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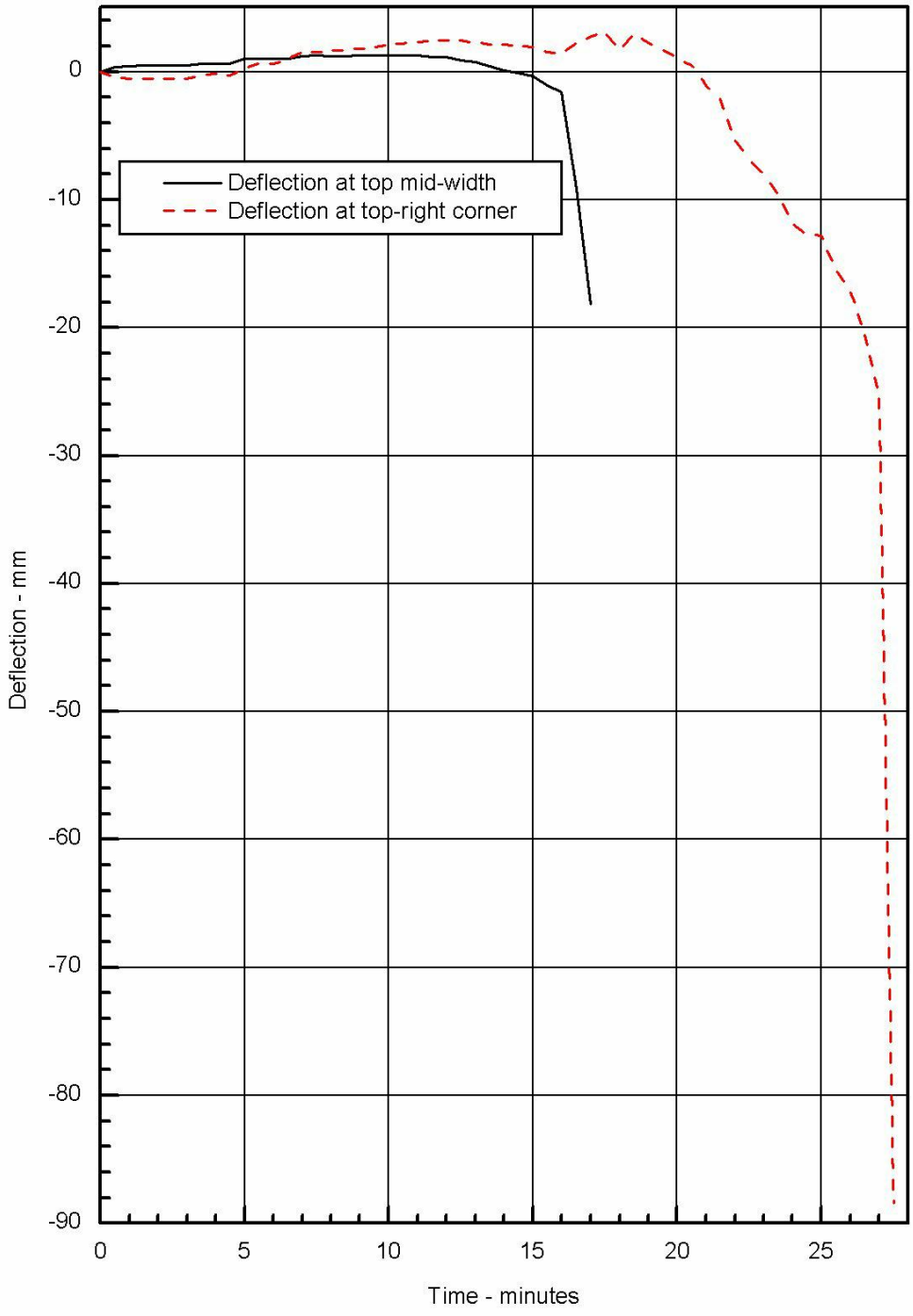

Horizontal deflection recorded at the top of the door leaf.

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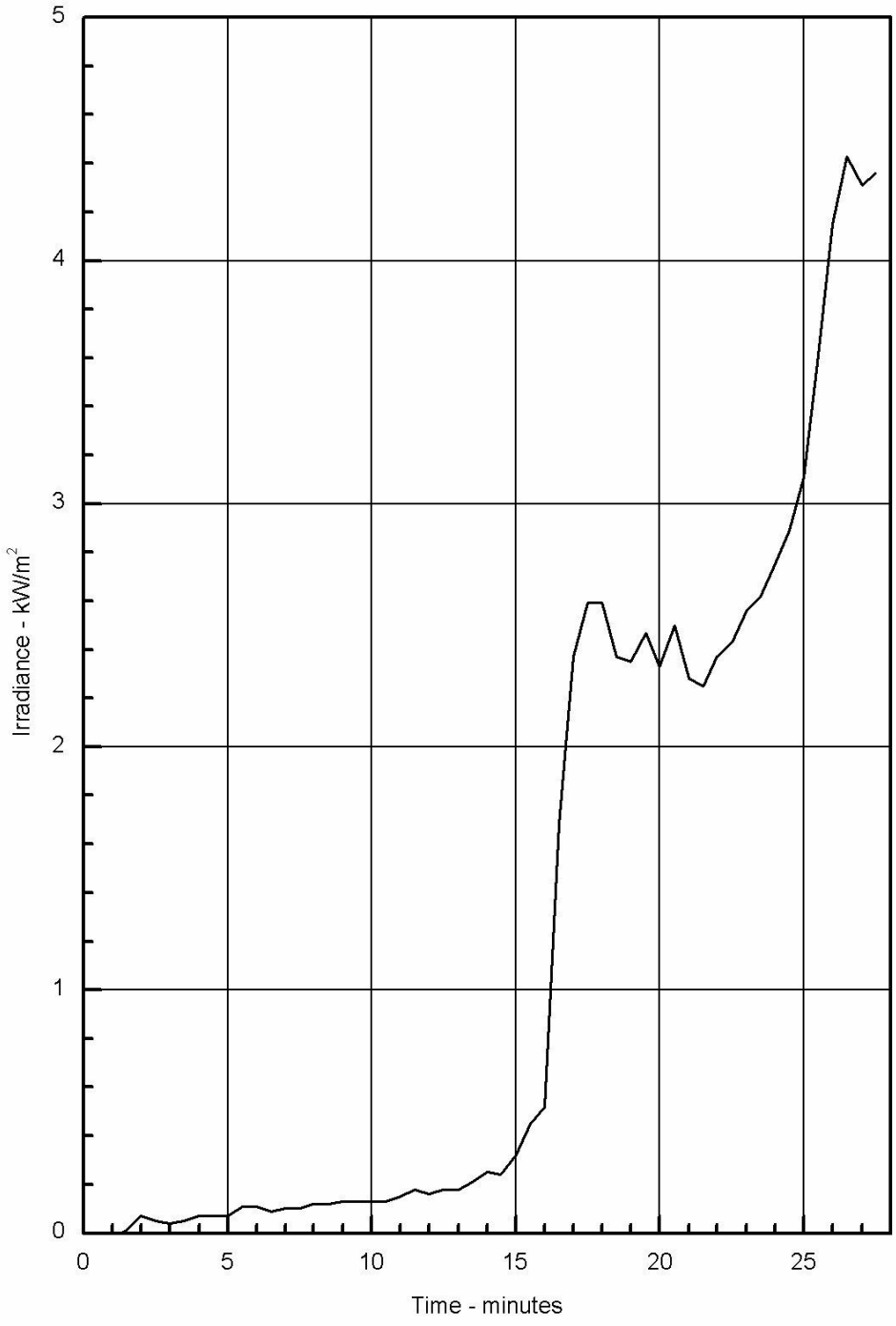

Irradiance recorded 1m from the centre of the doorset.

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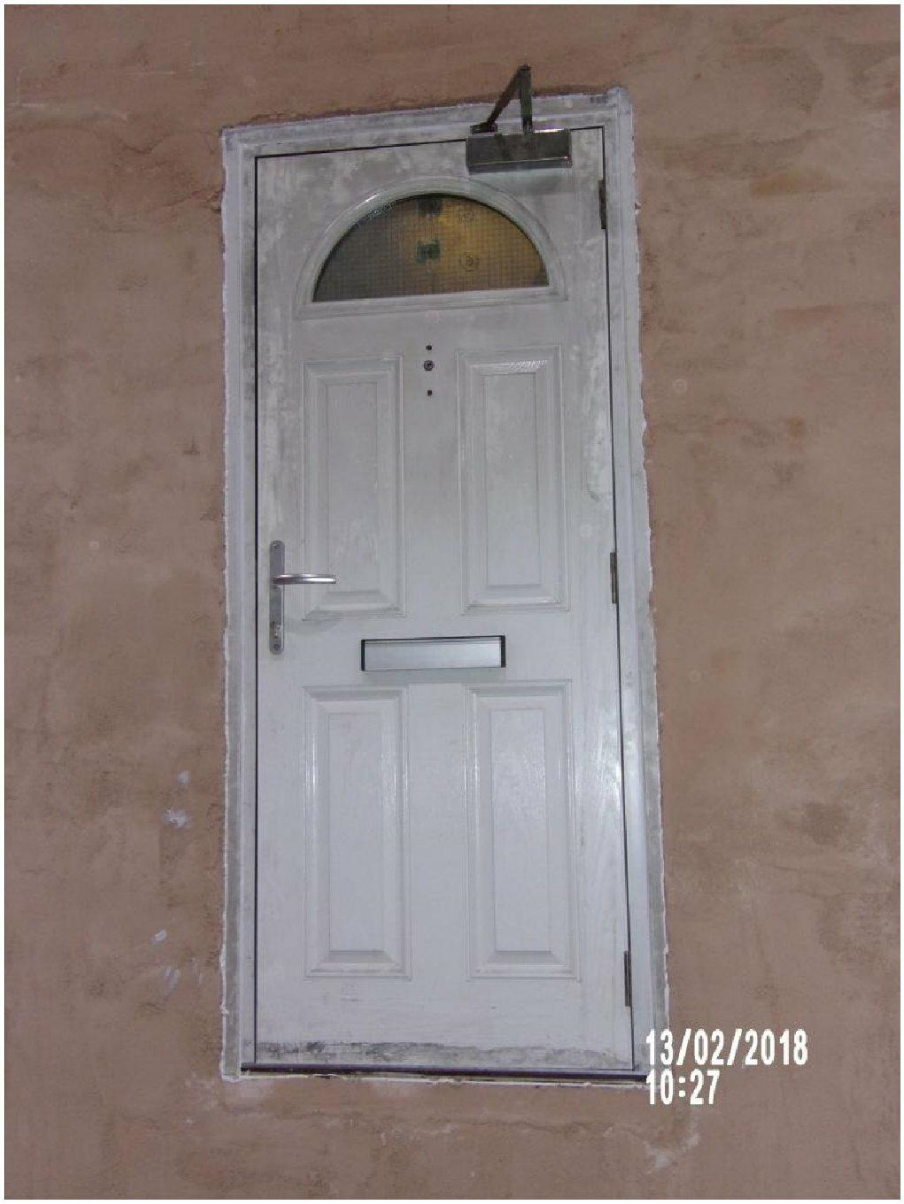
9 PHOTOGRAPHS



Exposed face of specimen before test.

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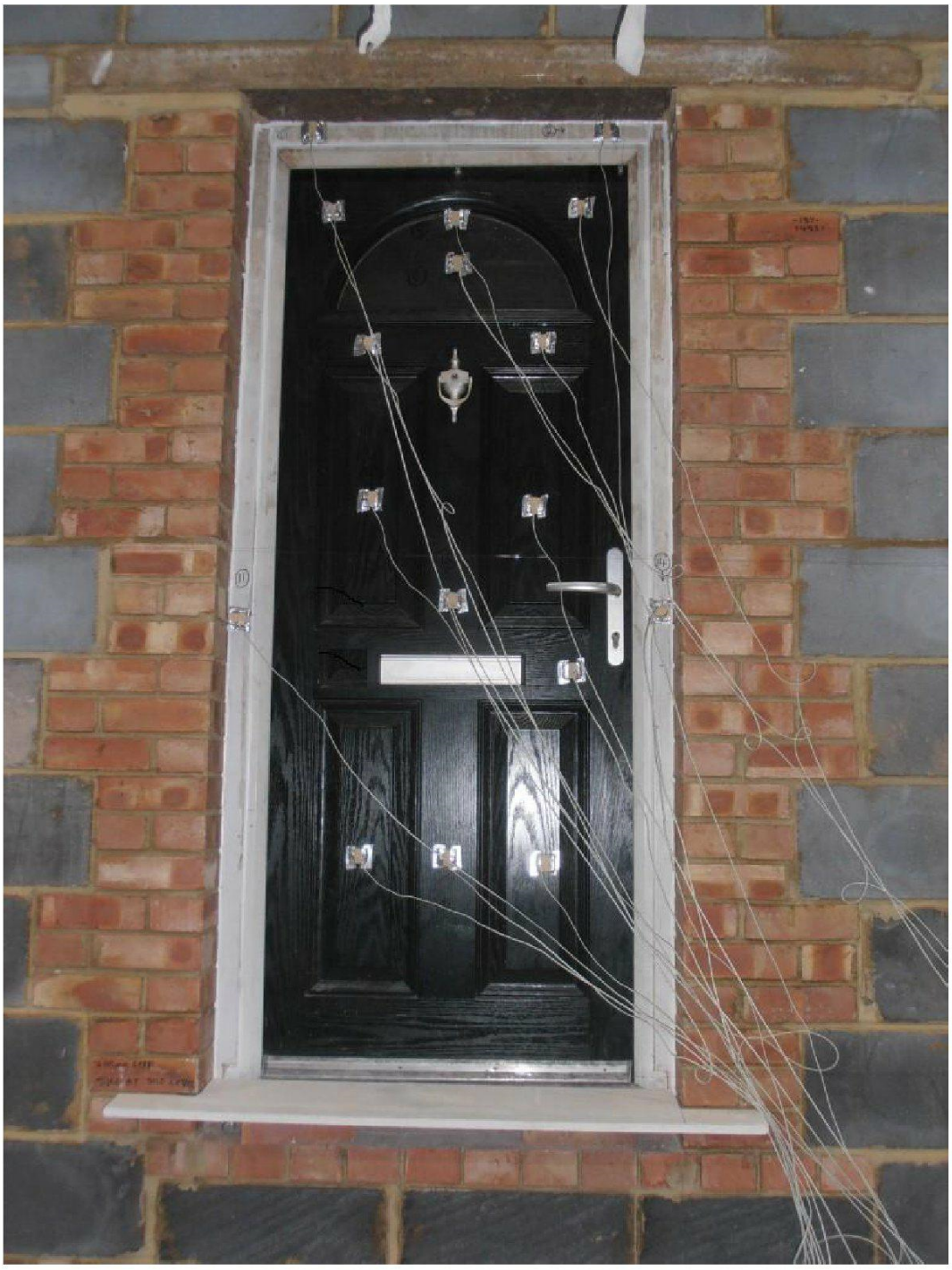

Unexposed face of specimen before test.

Note: The above photograph has been digitally altered to remove a house number from the door leaf.

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Exposed face of specimen at time of first integrity failure (15 minutes).

Note: The above photograph has been digitally altered to remove a house number from the door leaf.

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Unexposed face of specimen at end of test (28 minutes).

REPORT ENDS

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