



**Fire Protection
Association ®**

BS EN 1634-1

**Fire resistance test for door and shutter assemblies and
openable windows**

TEST REPORT

BS EN 1634-1 – Fire resistance test for door and shutter assemblies and openable windows – TEST REPORT

| | |
|---------------------|---|
| Report number: | FPA 106037 r0 |
| Test date: | 17/04/2024 |
| Test report on: | One single-leaf, double-acting timber based doorset installed with two BQT Solutions YD30D auxiliary locks, one in the leading edge of the door frame and one in the head of the door frame. |
| In accordance with: | BS EN 1634-1:2014+A1:2018 |
| Test sponsor: | <p>BQT Solutions Unit 4, 101 Diana Drive, Wairau Valley, Auckland, 0627, New Zealand</p> <p>This test was conducted by the FPA as service provider to UK Approved Body No. 0843 – UL International (UK) Ltd, 220, Cygnet Court, Centre Park, Warrington, WA1 1PP, United Kingdom, under UL Project No SR 5926726.1486998.</p> |

The Fire Protection Association, London Road, Moreton in Marsh, Gloucestershire, GL56 0RH, UK authorises the above named company to reproduce this report only for the purposes as described in the Conclusion, provided it is reproduced in its entirety.



10536

CONTENTS

| | |
|---|----|
| 1. TEST LOCATION | 4 |
| 2. TEST SPECIMEN DESCRIPTION | 4 |
| 3. SAMPLING OF TEST SPECIMEN | 4 |
| 4. CONSTRUCTION / INSTALLATION | 4 |
| 5. TEST PROCEDURE | 5 |
| 6. SUMMARY AND EVALUATION OF TEST RESULTS: | 6 |
| 6.1 – Doorset | 6 |
| 7. LIMITATIONS | 7 |
| 8. TEST REPORT SIGNATORIES | 8 |
| 9. REVISION HISTORY | 8 |
| Annex A – Construction / Installation Details | 9 |
| A.1 – Supporting Construction | 9 |
| A.2 – General | 10 |
| A.3 – Frame | 10 |
| A.4 – Door Leaf | 10 |
| A.5 – Door Hardware | 11 |
| A.6 – Test sponsor Drawing | 13 |
| A.7 – Closing Forces (N) | 14 |
| A.8 – Latch Forces (N) | 14 |
| A.9 – Door Gaps – Double Action, Single Leaf | 15 |
| Annex B – Test Data | 16 |
| B.1 – Furnace Temperature | 16 |
| B.2 – Furnace Pressure | 16 |
| B.3 – Test Observations | 17 |
| B.4 – Unexposed Surface Thermocouple / Deflection Positions | 18 |
| B.5 – Unexposed Surface Temperature Rise (°C) – Leaf (mean) | 19 |
| B.6 – Unexposed Surface Temperature Rise (°C) – Leaf (max) | 19 |
| B.7 – Unexposed Surface Temperature Rise (°C) – Frame (max) | 20 |
| B.8 – Unexposed Surface Temperature Rise Data (°C) | 21 |
| B.9 – Deflection Data (mm) | 23 |
| Annex C – Photographs | 25 |

1. TEST LOCATION

The Fire Protection Association (FPA), Unit 1-2, Northcot Business Park, Station Road, Blockley, Gloucestershire GL56 9LH. UKAS Accreditation No. 10536.

2. TEST SPECIMEN DESCRIPTION

One single-leaf, double-acting timber based doorset installed with two BQT Solutions YD30D auxiliary locks, one in the leading edge of the door frame and one in the head of the door frame. Tested to evaluate its Fire Resistance performance.

NOTE: The declared test sponsors primary purpose of the test was the evaluation of the BQT Solutions YD30D locks installed in a timber based doorset.

A full description of the tested specimen is given in Annex B.

3. SAMPLING OF TEST SPECIMEN

The pre-prepared doorset, including installed hardware was supplied to the FPA by UL International (UK) Ltd on behalf of BQT Solutions on 10/04/2024.

The FPA was not involved in the selection of the test doors or hardware.

4. CONSTRUCTION / INSTALLATION

The doorset was mounted into a standard EN1363-1, rigid supporting construction. Details of the construction are contained in ANNEX A.

The supporting construction was arranged by the FPA and constructed between 10/04/2024 and 12/04/2024.

The installation of the doorset into the supporting construction was arranged by the FPA and performed on 15/04/2024.

Throughout this period to the date of the test, the laboratory temperature and humidity were measured and recorded as being within the range of 13.7 °C and 19.3 °C and 57.4 % RH and 71.0 % RH respectively.

The maximum size of the primary gaps is shown in Annex A, Illustration A1 – Door Gaps.

5. TEST PROCEDURE

The results of this test, including construction review and testing were in compliance with the applicable requirements in the standards noted below.

| Standard | Title | Edition | Revision Date |
|--------------|---|---------|---------------|
| BS EN 1634-1 | Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware – Part 1: Fire resistance test for door and shutter assemblies and openable windows | 2014+A1 | 2018 |

European Group of Organisations for Fire Testing, Inspection and Certification (EGOLF)

Aspects of some fire test requirements are open to interpretation. EGOLF has identified a number of such areas and have agreed Recommendations and Agreements which define common agreement of interpretations between member fire test laboratories. Such Recommendations and Agreements have been followed for this test, where applicable:

EGOLF Recommendations:

025-2018, 032-2018, 034-2018, 050-2018, 028-2018, 037-2018, 013-2017, 016-2018, 017-2018, 018-2018, 019-2018, 202-2018, 021-2018, 022-2018, 023-2018, 059-2020, 060-2021, 061-2021, 062-2022

EGOLF Agreements:

034-2018, 036-2018

INSTRUMENTATION

Furnace - The test was conducted in a nominal 4m wide x 3m high furnace.

Furnace Temperature - The furnace temperature was measured by twelve EN furnace plate thermometers and controlled to follow the standard heating curve as specified in EN 1363-1.

Furnace Pressure - The furnace was set to control to 0.6 Pa at a height of 400 mm above the door threshold.

Insulation Criteria - Unexposed surface thermocouples - Thermocouples were provided to monitor the unexposed surface of the test specimen. The location of the thermocouples is shown in ANNEX B. A roving thermocouple was available for use during the test.

Integrity Criteria - Gap gauges (6mm and 25mm) and cotton pads were available for use during the test.

Laboratory Temperature - The ambient laboratory temperature at the start of the test was 13.5 °C.

Deflection - A laser array was used to measure the deflection of the specimen at the locations shown in ANNEX B.

Mechanical Conditioning - Prior to the fire test the door was subjected to 25 open and close cycles.

The door was mechanically held in the closed position at the start of the test and released after 5 minutes once the furnace pressure control was stabilised and controlled to the requirement of the test standard.

The test was terminated at 73 minutes at the request of the sponsor.

The test was witnessed remotely by the following representative of the test sponsor:

Michael McGurk.

6. SUMMARY AND EVALUATION OF TEST RESULTS:

Based on the test reported herein, the single-leaf, double-acting timber based doorset installed with two BQT Solutions YD30D auxiliary locks, one in the leading edge of the door frame and one in the header of the door frame, was found to satisfy the following criteria of EN 1634-1:

6.1 – Doorset

| Performance Criteria | Performance (Minutes) |
|---|-----------------------|
| INSULATION | |
| Average temperature, increase of $\Delta 140^{\circ}\text{C}$ | 73 ^{*1} |
| Maximum temperature on leaf/leaves, increase of $\Delta 180^{\circ}\text{C}$ | 73 ^{*1} |
| Maximum temperature on the frame adjacent to leaf/leaves, increase of $\Delta 360^{\circ}\text{C}$ | 73 ^{*1} |
| INTEGRITY | |
| Sustained Flaming | 73 |
| Ignition of the cotton pad | 73 |
| Cracks / openings in excess of given dimensions | 73 ^{*2} |
| ^{*1} By virtue of Integrity failure. ^{*2} No failure observed during the test. | |
| The specimen was deemed to be symmetrical. The results apply to fire exposure in either direction. | |

7. LIMITATIONS

The result(s) described in this report are only applicable to the sample(s) as received and tested as described in this test report and Annex(es).

The results only relate to the behaviour of the specimen 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.

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 1363-1. Any significant deviation with respect to size, constructional 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.

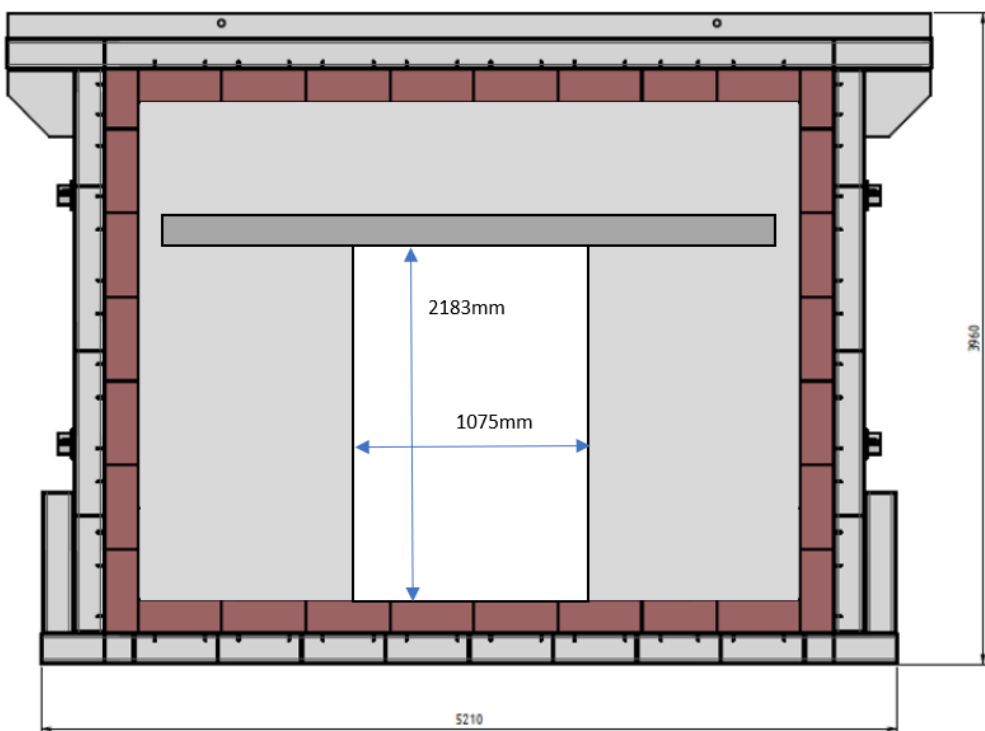
No direct field of application is relevant for the test specimen at the moment. The direct field of application will be handled in the classification report. (EGOLF 013-2017)

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.

| 8. TEST REPORT SIGNATORIES | |
|--|-----------|
| Steve Harms Technical Consultant | |
| Responsible Engineer | Signature |
| Chris Miles Commercial Director | |
| Reviewed by | Signature |
| Richard Glover Head of Fire Testing & Experimental Unit | |
| Authorised by | Signature |

| 9. REVISION HISTORY | | |
|---------------------|---------------|---------------------|
| Revision No. | Date of Issue | Details of Revision |
| 0 | 24/04/2024 | First Issue |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Annex A – Construction / Installation Details

| A.1 – Supporting Construction | | Verified by FPA |
|--|--|----------------------------|
|  <ul style="list-style-type: none"> • AAC blockwork, wall thickness of approx. 140/150mm • Pillars to be of equal width. • Dense concrete lintel to head of opening. <p>Viewed from the unexposed face</p> | | |
| Specification | EN 1363-1 Low density rigid wall construction | ✓ |
| Wall thickness | 140mm | ✓ |
| Aperture dimensions | Nominally 2183mm high x 1075mm wide | ✓ |
| Masonry walls: | | |
| Brick / block dimensions | Nominally 440mm x 210mm x 140mm | ✓ |
| Brick / block density | 600kg/m ³ (nominal) | ✓ |
| Lintels | Pre-stressed concrete lintel 100mm x 40mm x 1500mm R15 | ✓ |

| A.2 – General |
|--|
| Mechanical Conditioning – Prior to the fire test the doors were subjected to 25 open and close cycles. |
| The door was un-latched and was mechanically held in the closed position at the at the start of the test and released after 5 minutes once the furnace pressure control was stabilised and controlled to the requirement of the test standard. |

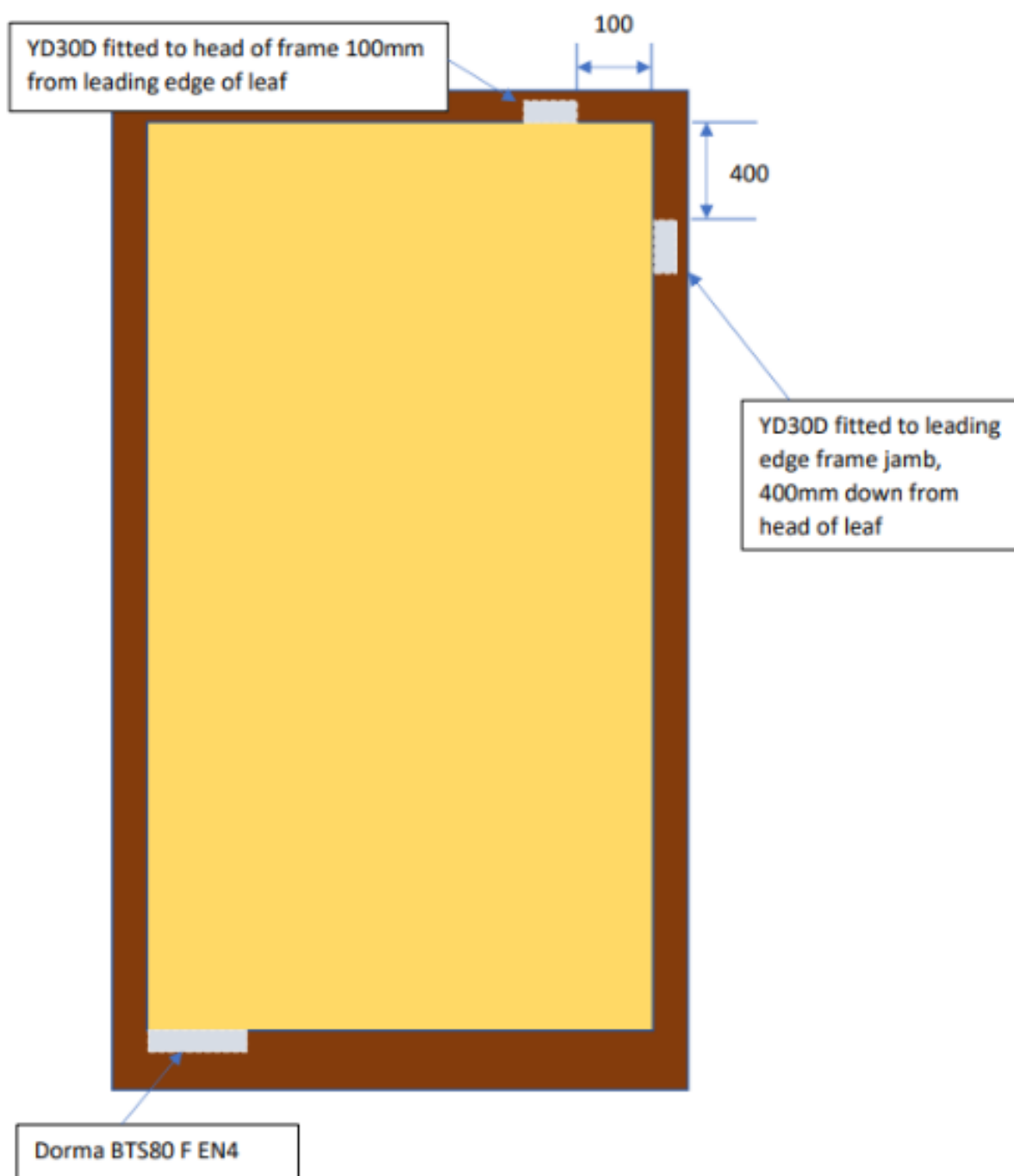
| A.3 – Frame | | Verified by FPA |
|--|---|------------------------|
| Manufacturer / Reference | S.A Joinery Ltd. | |
| Construction Type | Hardwood – Sapele. Density not specified. | |
| Moisture Content | 11.0% | ✓ |
| Profile / rebate | Scalloped back edge and plain leading edge. | ✓ |
| Intumescent type and locations | 2 No. Pyroplex 8700, 15mm x 4mm strips equidistant inside perimeter of frame rebate profile, spaced 10mm apart. | ✓ |
| Smoke seals / gaskets | None | ✓ |
| Fixing to supporting construction type | M5 x 120mm steel screws at 500mm centres. | ✓ |

| A.4 – Door Leaf | | Verified by FPA |
|--|--|------------------------|
| Manufacturer / Reference | Halspan Prima FD60 54mm. | ✓ |
| Construction Type | Tri-layer particle board. | ✓ |
| Moisture Content | <8.0% | ✓ |
| Door opening direction | Double Swing | ✓ |
| Dimensions | W: 937mm H:2040mm T:55mm | ✓ |
| Leaf weight (kg) | 34 kg/m ² | |
| Frame Profile / rebate | N/A | |
| Lipping T | 6mm sapele lippings (leading edge), 20mm maximum sapele lippings (back edge) on vertical edges only glued on with Ureka aro-bond 947 mcpu. | ✓ |
| Facing T | None | ✓ |
| Intumescent type and locations | None | ✓ |
| Smoke seals / gaskets | None | ✓ |
| Evidence of conformity / sampling markings | None | ✓ |
| Meeting edge rebate | None | ✓ |

| A.5 – Door Hardware | | Verified by FPA |
|--|--|-----------------|
| CLOSING DEVICE | | |
| Manufacturer / Reference | Dorma Kaba BTS80 F EN4 | ✓ |
| Evidence of conformity / sampling markings | CERTIFIRE approved for fire doors; Cert. no. CF127 | |
| Surface mount / concealed, Leaf / Frame | Floor mounted with associated bottom strap and top centre. | ✓ |
| Intumescent type, location, thickness | The closer bottom strap, top centre and cover plate were all bedded on 1mm thick mono ammonium phosphate intumescent sheet material. | ✓ |
| Fixing method (number, type and dimensions of screws, type and dimensions of welding) | 4 No.M4 x 6mm grubnut screws. | ✓ |
| LOCKS & LATCHES | | |
| Type | Auxiliary | ✓ |
| Lock Manufacturer / model | BQT Solutions / Cobalt Double YD30D | ✓ |
| Evidence of conformity / sampling markings | None. | ✓ |
| Mounting location | Frame leading edge. 1385mm from bottom of frame to bottom edge of casing. | ✓ |
| Lock Intumescent type, location, thickness | 2mm MAP Intumescent kit around body of the lock, behind the foreend and behind the strike plate. | ✓ |
| Lock fixing method (number, type and dimensions of screws, type and dimensions of welding) | 2 No. M4 32mm steel screw. | ✓ |
| Latch projections mm | Disengaged | ✓ |
| Latch Engagement mm | Disengaged | ✓ |
| Latch locations | 400mm down from top of frame centralized leading edge of frame. | ✓ |
| Strike plate fixing method (number, type and dimensions of screws, type and dimensions of welding) | 2 No. M4 32mm steel screw. | ✓ |
| Status at commencement of test | Auxiliary (un-latched). | ✓ |
| LOCKS & LATCHES | | |
| Type | Auxiliary | ✓ |
| Lock Manufacturer / model | BQT Solutions / Cobalt Double YD30D | ✓ |
| Evidence of conformity / sampling markings | None. | ✓ |
| Mounting location | Head of frame. 102mm from inside edge of frame leading edge to edge of casing. | ✓ |
| Lock Intumescent type, location, thickness | 2mm MAP Intumescent kit around body of the lock, behind the forend and behind the strike plate. | ✓ |
| Lock fixing method (number, type and dimensions of screws, type and dimensions of welding) | 2 No.M4 32mm steel screw. | ✓ |
| Latch projections mm | Disengaged. | ✓ |
| Latch Engagement mm | Disengaged. | ✓ |
| Latch locations | 105mm in from leading edge of frame in header centralized in frame. | ✓ |
| Strike plate fixing method (number, type and dimensions of screws, type and dimensions of welding) | 2 No. M4 32mm steel screw. | ✓ |

| A.5 – Door Hardware | | Verified by FPA |
|--------------------------------|-------------------------|--------------------|
| Status at commencement of test | Auxiliary (un-latched). | ✓ |

A.6 –Test sponsor Drawing



- Pass wires from the YD30D units out through the back edge of the frame
- Both YD30D units to be provided with 2mm Interdens sheet intumescent protection around body of the lock within the frame, behind forend and behind strike plate fitted to the door leaf.
- Structural opening for the doorset is being built as 2183mm high by 1075mm wide – please size doorset to fit.
- As per previous test, for the floor spring the Dorma intumescent requirement is:

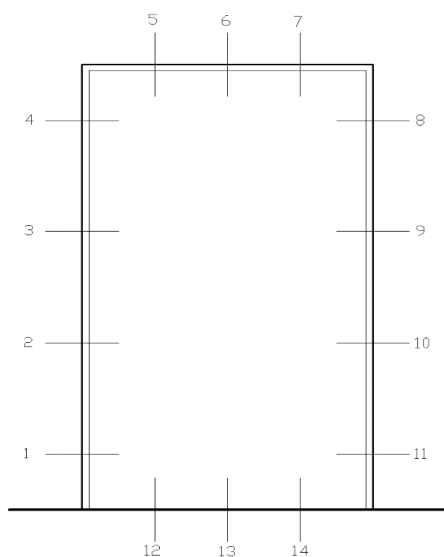
For all 60 minute timber doorset applications for floor spring closers, the closer bottom strap, top centre and cover plate must all be bedded onto 1 mm thick mono ammonium phosphate intumescent sheet material as supplied by DORMA.

| A.7 – Closing Forces (N) | | | | |
|---------------------------------|------|------|------|---------------|
| Measurement No. | 1 | 2 | 3 | Highest Value |
| Single Leaf | 28.5 | 27.0 | 27.4 | 28.5 |

| A.8 – Latch Forces (N) | | | | |
|-------------------------------|-----|-----|-----|---------------|
| Measurement No. | 1 | 2 | 3 | Highest Value |
| Single Leaf | na* | na* | na* | na* |

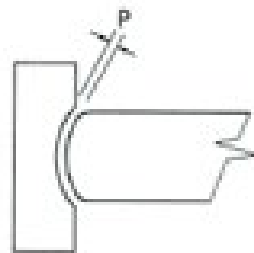
*Latches not engaged during test

A.9 – Door Gaps - Double Action, Single Leaf



Viewed from the unexposed face.

Leading edge on right.



| Hanging Edge | |
|--------------|-----|
| Pos | P |
| 1 | 2.2 |
| 2 | 2.2 |
| 3 | 2.4 |
| 4 | 2.4 |
| Mean | 2.3 |
| Max | 2.4 |
| Min | 2.2 |

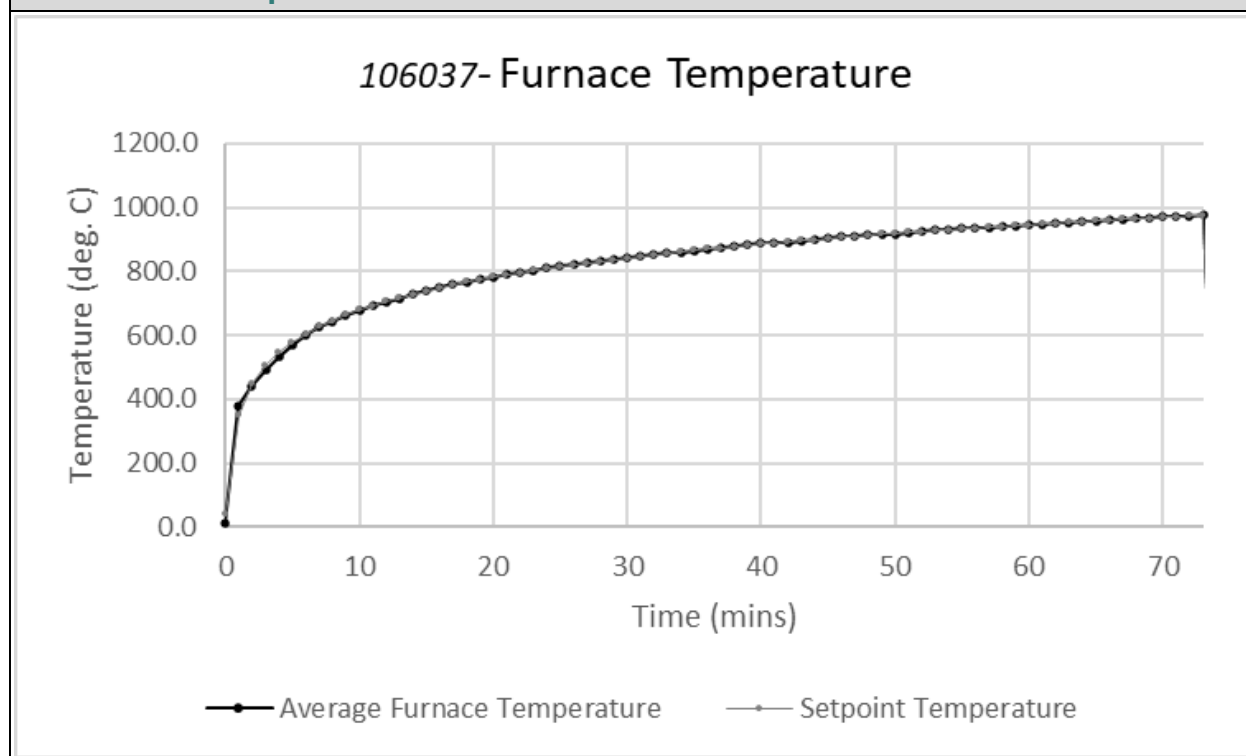
| Closing Edge | |
|--------------|-----|
| Pos | P |
| 8 | 3.1 |
| 9 | 3.1 |
| 10 | 3.4 |
| 11 | 3.5 |
| Mean | 3.3 |
| Max | 3.5 |
| Min | 3.1 |

| Top Edge | |
|----------|-----|
| Pos | P |
| 5 | 2.8 |
| 6 | 2.9 |
| 7 | 4.4 |
| Mean | 3.3 |
| Max | 4.4 |
| Min | 2.8 |

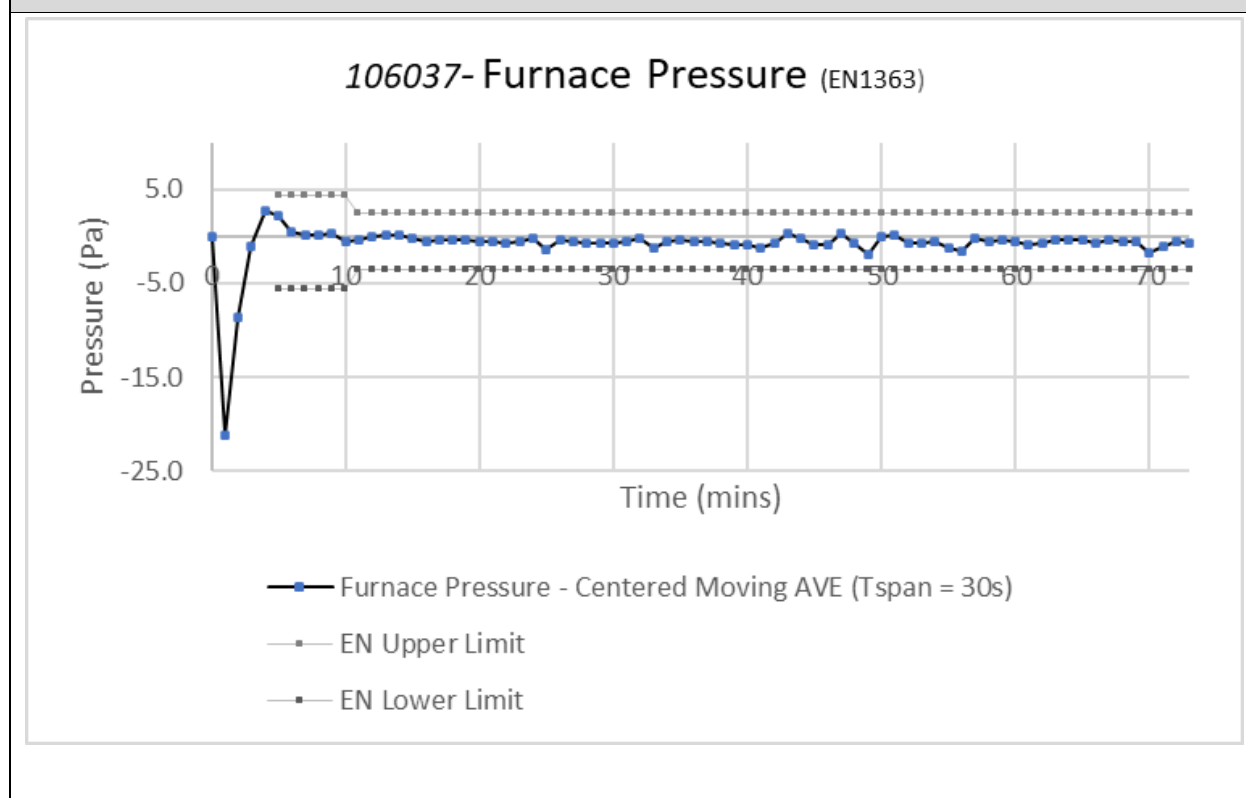
| Threshold | |
|-----------|-----|
| Pos | P |
| 12 | 2.6 |
| 13 | 3.3 |
| 14 | 2.7 |
| Mean | 2.8 |
| Max | 3.3 |
| Min | 2.7 |

Annex B – Test Data

B.1 – Furnace Temperature

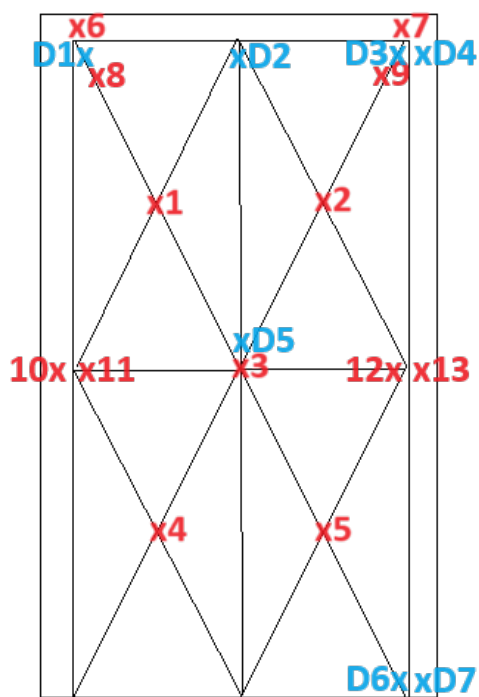


B.2 – Furnace Pressure



| B.3 – Test Observations | |
|--------------------------------|---|
| Time (mins) | Observation |
| 00:00 | Test Start |
| 00:30 | Smoke/steam emitting from door edges. |
| 02:18 | Increase in smoke/steam emitting from door edges. |
| 05:00 | Mechanical restraint holding doors in the closed position removed. |
| 09:30 | 'Yellowing' of closer (floor spring) housing at threshold. |
| 10:06 | Decrease in smoke/steam emitting from door edges. |
| 12:40 | Intermittent 'flickering' of flame at threshold and approx. 300mm up the trailing edge. |
| 14:30 | Visible expansion of intumescent seals. |
| 15:00 | Glow visible through leading edge / frame gap approx. 200mm up from threshold. |
| 18:25 | Intermittent 'flickering' of flame at threshold and approx. 300mm up the trailing edge continues. |
| 19:25 | Visible expansion of intumescent seals along leading edge. |
| 20:45 | Discoloration forming on frame surface at head of door. |
| 21:40 | Glow at leading edge no longer present. |
| 22:14 | Moisture dripping down the surface of the leaf approx. 200mm in from trailing edge. |
| 35:48 | Discoloration forming on top trailing and leading-edge corner surfaces. |
| 41:02 | Intermittent 'flickering' of flame at threshold continues along approx. full length of closer (floor spring) cover plate. |
| 54:00 | Erosion of door leaf at threshold visible. |
| 64:50 | Intumescent material falls from the head of the door onto the threshold. |
| 66:53 | Glow now visible along approx. half of the threshold length from the closer (floor spring) side. |
| 68:35 | Black liquid dripping onto threshold from frame head. |
| 69:55 | Cotton pad applied to the head of the leaf at mid-width. Pad charred, no glow or flaming. |
| 71:20 | Cotton pad applied to the top leading-edge corner of the leaf. Pad charred, no glow or flaming. |
| 73:00 | INTEGRITY FAILURE – Cotton pad applied to the head of the leaf at mid-width. Pad flamed immediately after application. |
| 73:10 | FURTHER INTEGRITY FAILURE – Sustained flaming >10s along top edge of door leaf. |
| 73:48 | Test stopped at the request of the sponsor. |

B.4 – Unexposed Surface Thermocouple / Deflection Positions



Unexposed face

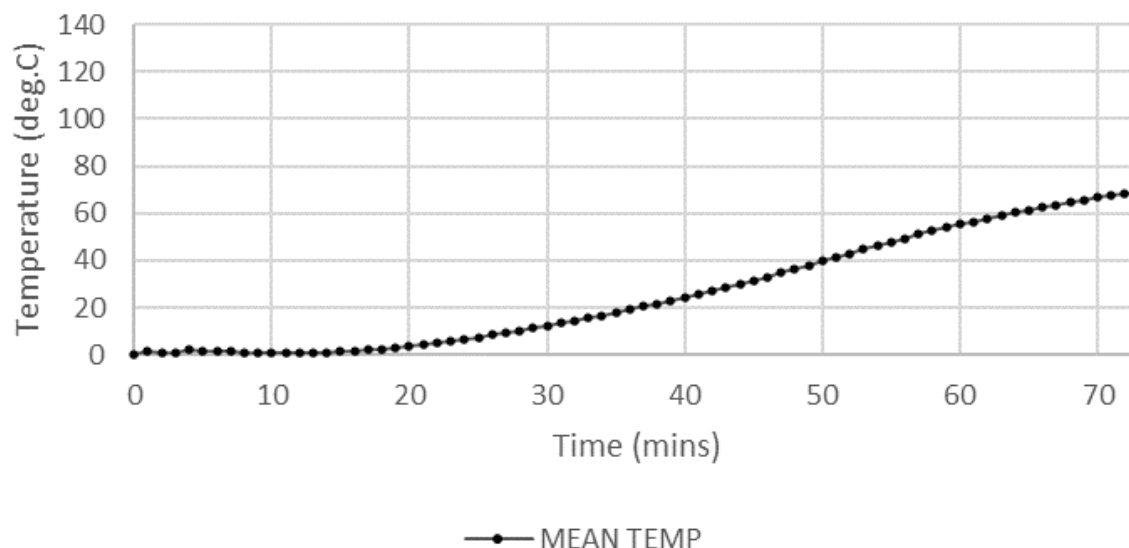
X – Thermocouple location

X – Deflection measurement location

| Thermocouple no. | Evaluation |
|------------------------------|-------------------------------|
| TC1 – TC5 | Mean temperature on the leaf. |
| TC1 – TC5, TC's 8, 9, 11, 12 | Max temperature on the leaf. |
| TC's 6, 7, 10, 13 | Max temperature on the frame. |

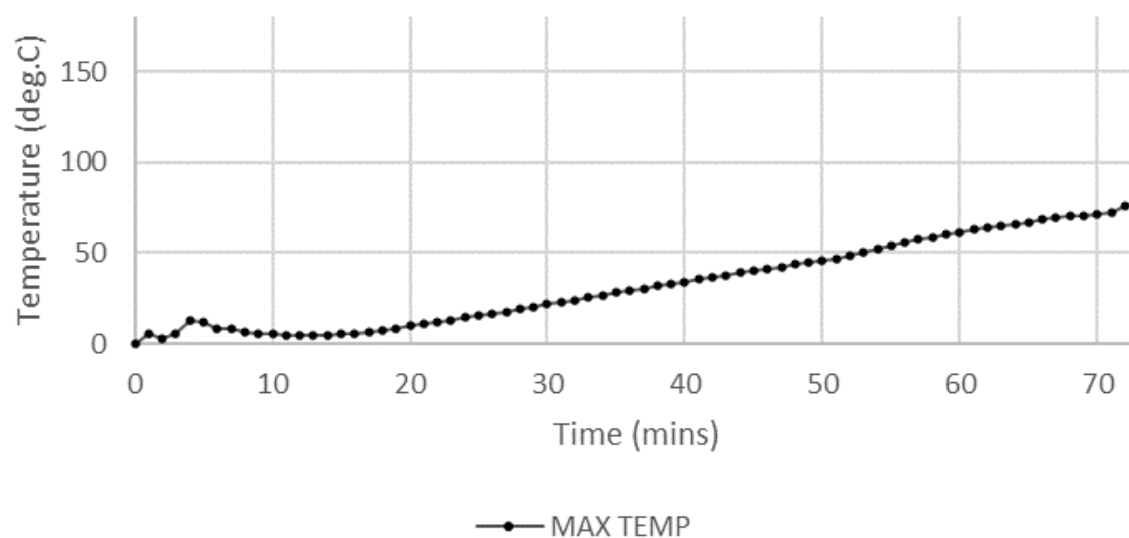
B.5 - Unexposed Surface Temperature Rise (°C) - Leaf (mean)

106037- Unexposed Surface Mean Temperature Rise

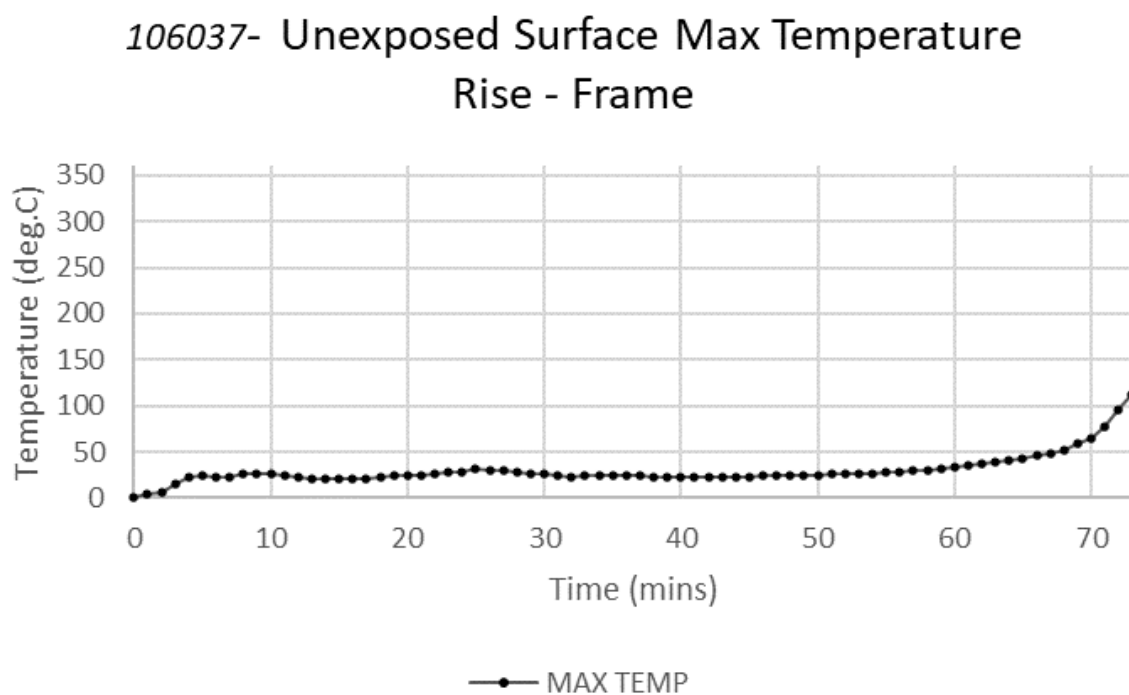


B.6 - Unexposed Surface Temperature Rise (°C) - Leaf (max)

106037- Unexposed Surface Max Temperature Rise - Leaf



B.7 - Unexposed Surface Temperature Rise (°C) - Frame (max)



| B.8 – Unexposed Surface Temperature Rise Data (°C) | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|----------|
| TIME (mins) | TC 1 | TC 2 | TC 3 | TC 4 | TC 5 | TC 6 | TC 7 | TC 8 | TC 9 | TC 10 | TC 11 | TC 12 | TC 13 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 2 | 3 | 1 | 1 | 1 | 3 | 4 | 2 | 4 | 3 | 4 | 6 | 0 |
| 2 | 1 | 1 | 1 | 1 | 1 | 5 | 6 | 2 | 3 | 1 | 2 | 3 | 0 |
| 3 | 1 | 1 | 1 | 1 | 1 | 11 | 16 | 4 | 5 | 1 | 3 | 4 | 0 |
| 4 | 1 | 4 | 1 | 1 | 2 | 15 | 23 | 3 | 7 | 7 | 5 | 13 | 1 |
| 5 | 1 | 4 | 1 | 1 | 2 | 16 | 24 | 3 | 8 | 10 | 4 | 12 | 1 |
| 6 | 1 | 3 | 1 | 1 | 2 | 21 | 23 | 2 | 7 | 7 | 3 | 9 | 1 |
| 7 | 1 | 3 | 1 | 0 | 1 | 23 | 22 | 2 | 7 | 6 | 3 | 8 | 1 |
| 8 | 1 | 2 | 1 | 0 | 1 | 26 | 20 | 2 | 6 | 5 | 3 | 7 | 1 |
| 9 | 1 | 2 | 1 | 0 | 1 | 26 | 18 | 2 | 6 | 5 | 2 | 6 | 1 |
| 10 | 1 | 2 | 1 | 0 | 1 | 26 | 16 | 3 | 5 | 4 | 2 | 5 | 1 |
| 11 | 1 | 1 | 1 | 0 | 1 | 24 | 15 | 2 | 5 | 4 | 2 | 4 | 2 |
| 12 | 1 | 1 | 1 | 0 | 1 | 23 | 13 | 2 | 5 | 4 | 2 | 4 | 2 |
| 13 | 1 | 1 | 1 | 1 | 1 | 22 | 12 | 2 | 5 | 4 | 2 | 4 | 2 |
| 14 | 1 | 2 | 1 | 1 | 1 | 21 | 11 | 2 | 5 | 4 | 2 | 4 | 2 |
| 15 | 1 | 2 | 1 | 1 | 1 | 20 | 11 | 3 | 5 | 4 | 2 | 4 | 2 |
| 16 | 2 | 2 | 1 | 1 | 2 | 21 | 10 | 4 | 6 | 4 | 3 | 4 | 2 |
| 17 | 2 | 3 | 1 | 2 | 2 | 21 | 10 | 4 | 7 | 4 | 3 | 4 | 3 |
| 18 | 3 | 3 | 2 | 2 | 3 | 22 | 10 | 5 | 8 | 4 | 3 | 4 | 3 |
| 19 | 3 | 4 | 2 | 3 | 3 | 24 | 10 | 6 | 9 | 4 | 3 | 5 | 3 |
| 20 | 4 | 4 | 3 | 4 | 4 | 24 | 9 | 7 | 10 | 4 | 4 | 5 | 3 |
| 21 | 5 | 5 | 3 | 4 | 4 | 25 | 9 | 9 | 11 | 5 | 4 | 6 | 3 |
| 22 | 5 | 6 | 4 | 5 | 5 | 27 | 9 | 10 | 12 | 5 | 5 | 6 | 3 |
| 23 | 6 | 7 | 4 | 6 | 6 | 28 | 9 | 11 | 13 | 5 | 6 | 7 | 3 |
| 24 | 7 | 7 | 5 | 7 | 7 | 29 | 9 | 13 | 14 | 5 | 6 | 8 | 3 |
| 25 | 8 | 8 | 6 | 8 | 8 | 31 | 10 | 14 | 16 | 5 | 7 | 9 | 3 |
| 26 | 9 | 9 | 6 | 9 | 9 | 30 | 10 | 16 | 17 | 5 | 8 | 9 | 3 |
| 27 | 10 | 10 | 7 | 9 | 10 | 29 | 10 | 17 | 18 | 6 | 8 | 10 | 3 |
| 28 | 11 | 11 | 8 | 10 | 11 | 28 | 10 | 18 | 19 | 6 | 9 | 11 | 3 |
| 29 | 12 | 12 | 9 | 11 | 11 | 27 | 11 | 20 | 20 | 6 | 10 | 12 | 4 |
| 30 | 13 | 13 | 10 | 12 | 12 | 26 | 11 | 21 | 22 | 7 | 11 | 14 | 4 |
| 31 | 14 | 14 | 11 | 13 | 14 | 24 | 11 | 23 | 23 | 7 | 12 | 15 | 4 |
| 32 | 16 | 15 | 12 | 14 | 15 | 23 | 11 | 24 | 24 | 7 | 13 | 16 | 4 |
| 33 | 17 | 17 | 13 | 16 | 16 | 24 | 12 | 25 | 25 | 7 | 15 | 17 | 4 |
| 34 | 18 | 18 | 15 | 17 | 16 | 24 | 12 | 27 | 26 | 7 | 16 | 18 | 4 |
| 35 | 20 | 19 | 16 | 18 | 18 | 25 | 13 | 28 | 28 | 8 | 17 | 20 | 5 |
| 36 | 21 | 20 | 17 | 19 | 19 | 24 | 14 | 29 | 29 | 8 | 19 | 21 | 5 |
| 37 | 22 | 22 | 18 | 20 | 20 | 24 | 14 | 30 | 30 | 8 | 20 | 22 | 5 |
| 38 | 24 | 23 | 19 | 21 | 21 | 23 | 15 | 32 | 31 | 8 | 21 | 24 | 5 |
| 39 | 26 | 25 | 21 | 22 | 22 | 23 | 15 | 33 | 32 | 8 | 23 | 25 | 6 |
| 40 | 27 | 26 | 22 | 24 | 23 | 23 | 16 | 34 | 33 | 9 | 24 | 26 | 6 |
| 41 | 29 | 27 | 23 | 25 | 25 | 22 | 16 | 35 | 34 | 9 | 26 | 28 | 6 |
| 42 | 30 | 29 | 25 | 26 | 26 | 22 | 17 | 37 | 36 | 10 | 27 | 29 | 7 |
| 43 | 32 | 30 | 26 | 27 | 27 | 22 | 18 | 38 | 37 | 10 | 29 | 30 | 7 |
| 44 | 34 | 32 | 28 | 29 | 28 | 22 | 19 | 39 | 38 | 10 | 30 | 32 | 8 |
| 45 | 35 | 33 | 29 | 30 | 29 | 23 | 20 | 40 | 39 | 11 | 32 | 33 | 8 |

| B.8 – Unexposed Surface Temperature Rise Data (°C) | | | | | | | | | | | | | |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|
| TIME (mins) | TC 1 | TC 2 | TC 3 | TC 4 | TC 5 | TC 6 | TC 7 | TC 8 | TC 9 | TC 10 | TC 11 | TC 12 | TC 13 |
| 46 | 37 | 35 | 31 | 31 | 31 | 24 | 21 | 41 | 40 | 11 | 33 | 34 | 8 |
| 47 | 39 | 37 | 32 | 32 | 32 | 24 | 22 | 42 | 42 | 12 | 35 | 35 | 9 |
| 48 | 41 | 38 | 34 | 34 | 34 | 24 | 23 | 44 | 43 | 12 | 37 | 37 | 9 |
| 49 | 43 | 40 | 36 | 35 | 35 | 24 | 24 | 45 | 44 | 13 | 39 | 38 | 10 |
| 50 | 45 | 42 | 38 | 37 | 37 | 25 | 24 | 46 | 45 | 13 | 40 | 40 | 10 |
| 51 | 47 | 44 | 39 | 38 | 38 | 25 | 25 | 47 | 46 | 13 | 42 | 41 | 11 |
| 52 | 48 | 45 | 41 | 40 | 40 | 26 | 26 | 48 | 48 | 13 | 44 | 42 | 12 |
| 53 | 50 | 47 | 43 | 41 | 41 | 26 | 26 | 49 | 49 | 14 | 45 | 43 | 12 |
| 54 | 52 | 49 | 44 | 42 | 43 | 27 | 27 | 50 | 50 | 14 | 47 | 45 | 12 |
| 55 | 54 | 50 | 46 | 44 | 45 | 27 | 28 | 51 | 51 | 15 | 49 | 46 | 13 |
| 56 | 55 | 52 | 48 | 45 | 46 | 28 | 28 | 53 | 52 | 15 | 50 | 47 | 13 |
| 57 | 57 | 53 | 49 | 47 | 48 | 28 | 29 | 54 | 54 | 16 | 52 | 48 | 13 |
| 58 | 59 | 55 | 51 | 48 | 49 | 29 | 31 | 55 | 55 | 17 | 53 | 49 | 14 |
| 59 | 60 | 56 | 53 | 49 | 51 | 30 | 31 | 56 | 56 | 18 | 55 | 50 | 14 |
| 60 | 61 | 57 | 54 | 51 | 52 | 30 | 33 | 57 | 57 | 18 | 56 | 51 | 15 |
| 61 | 63 | 58 | 56 | 52 | 54 | 31 | 35 | 58 | 58 | 19 | 58 | 52 | 15 |
| 62 | 64 | 60 | 57 | 54 | 55 | 32 | 37 | 59 | 59 | 20 | 59 | 53 | 16 |
| 63 | 65 | 61 | 58 | 55 | 57 | 32 | 39 | 60 | 60 | 21 | 60 | 54 | 16 |
| 64 | 66 | 62 | 60 | 56 | 58 | 33 | 41 | 61 | 61 | 22 | 61 | 55 | 17 |
| 65 | 67 | 63 | 61 | 57 | 59 | 34 | 43 | 62 | 62 | 23 | 62 | 56 | 17 |
| 66 | 68 | 63 | 62 | 58 | 60 | 34 | 46 | 63 | 63 | 24 | 62 | 57 | 17 |
| 67 | 69 | 64 | 63 | 59 | 61 | 35 | 49 | 64 | 64 | 25 | 63 | 58 | 18 |
| 68 | 70 | 65 | 64 | 60 | 63 | 36 | 52 | 64 | 65 | 25 | 64 | 58 | 18 |
| 69 | 71 | 66 | 65 | 62 | 64 | 37 | 58 | 65 | 67 | 25 | 65 | 59 | 19 |
| 70 | 71 | 67 | 66 | 63 | 65 | 38 | 65 | 66 | 68 | 26 | 66 | 60 | 20 |
| 71 | 72 | 68 | 67 | 64 | 66 | 39 | 78 | 67 | 71 | 26 | 66 | 61 | 20 |
| 72 | 73 | 69 | 68 | 64 | 66 | 41 | 95 | 68 | 76 | 27 | 67 | 61 | 21 |
| 73 | 74 | 70 | 69 | 65 | 67 | 42 | 111 | 69 | 78 | 28 | 68 | 62 | 21 |

B.9 -Deflection Data (mm)

Specimen Deflection (mm). Positive values indicate movement in towards the furnace.

(-) Missing values due to interference from smoke / steam.

| TIME (mins) | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|----------------|----|----|-----|----|-----|----|----|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | -1 | 4 | 1 | 3 | -2 | 0 | -1 |
| 2 | -2 | 5 | -13 | -2 | 0 | 0 | 1 |
| 3 | - | 4 | - | - | 1 | 0 | 2 |
| 4 | - | 0 | - | 3 | -4 | -2 | 2 |
| 5 | - | -7 | - | 6 | -5 | - | 3 |
| 6 | -2 | 2 | -11 | 4 | -4 | 0 | 3 |
| 7 | 1 | 3 | -17 | 1 | -5 | 1 | 3 |
| 8 | 1 | -6 | - | - | -4 | 3 | 4 |
| 9 | -1 | - | - | - | -4 | 2 | 4 |
| 10 | 0 | - | - | - | -6 | 2 | 4 |
| 11 | - | - | 5 | 5 | -5 | 0 | 3 |
| 12 | -1 | 3 | - | - | -5 | 0 | 3 |
| 13 | -4 | 3 | - | - | -8 | 2 | 4 |
| 14 | 0 | - | 4 | 6 | - | 2 | 4 |
| 15 | 0 | - | - | - | -9 | 1 | 3 |
| 16 | -1 | 5 | 5 | 4 | -9 | 1 | 3 |
| 17 | -2 | 4 | 6 | 5 | -8 | 2 | 3 |
| 18 | -1 | 4 | 4 | 6 | -8 | 3 | 3 |
| 19 | 0 | 4 | 5 | 5 | -8 | 3 | 5 |
| 20 | -1 | 4 | 5 | 7 | -8 | 4 | 4 |
| 21 | -1 | 3 | 4 | 5 | -11 | 2 | 7 |
| 22 | 1 | 2 | 6 | 5 | -12 | 4 | 5 |
| 23 | 6 | 3 | 7 | 6 | -12 | 3 | 6 |
| 24 | 3 | 3 | 9 | 7 | -12 | 2 | 4 |
| 25 | 5 | 2 | 9 | 8 | -12 | 4 | 5 |
| 26 | 1 | 2 | 7 | 8 | -14 | 2 | 4 |
| 27 | 1 | 2 | 8 | 7 | -15 | 4 | 4 |
| 28 | 1 | 3 | 9 | 7 | -15 | 4 | 4 |
| 29 | 2 | 4 | 7 | 8 | -14 | 4 | 5 |
| 30 | 2 | 3 | 9 | 7 | -15 | 5 | 4 |
| 31 | 1 | 2 | 8 | 5 | -16 | 6 | 5 |
| 32 | 3 | 2 | 7 | 5 | -16 | 4 | 4 |
| 33 | 1 | 2 | 8 | 8 | -17 | 5 | 3 |
| 34 | 1 | 2 | 6 | 6 | -17 | 7 | 3 |
| 35 | -1 | 1 | 4 | 6 | -17 | 3 | 3 |
| 36 | 1 | 2 | 7 | 6 | -17 | 7 | 2 |
| 37 | 2 | 0 | 8 | 8 | -16 | 7 | 1 |
| 38 | 3 | 0 | 6 | 7 | -16 | 6 | 2 |
| 39 | -1 | -1 | 8 | 8 | -16 | 3 | 1 |

B.9 -Deflection Data (mm)

Specimen Deflection (mm). Positive values indicate movement in towards the furnace.

(-) Missing values due to interference from smoke / steam.

| TIME (mins) | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|----------------|----|-----|-----|----|-----|----|----|
| 40 | 2 | 0 | 10 | 8 | -17 | 4 | 0 |
| 41 | 0 | 1 | 8 | 5 | -18 | 6 | 1 |
| 42 | 4 | -1 | 9 | 5 | -21 | 7 | -1 |
| 43 | 1 | -1 | 9 | 7 | -22 | 6 | 1 |
| 44 | 5 | 0 | 8 | 7 | -25 | 6 | 0 |
| 45 | 1 | 0 | 9 | 8 | -26 | 7 | 1 |
| 46 | 1 | -1 | 9 | 10 | -27 | 8 | 0 |
| 47 | 1 | -1 | 10 | 7 | -28 | 7 | 1 |
| 48 | 2 | -2 | 8 | 7 | -29 | 6 | 3 |
| 49 | 5 | -1 | 11 | 9 | -31 | 7 | 1 |
| 50 | 2 | -3 | 9 | 9 | -33 | 6 | 1 |
| 51 | 3 | -7 | 10 | 6 | -34 | 6 | 3 |
| 52 | 3 | -3 | 9 | 10 | -34 | 8 | 3 |
| 53 | 7 | -2 | 7 | 9 | -33 | 8 | 3 |
| 54 | 5 | -3 | 9 | 9 | -34 | 7 | 2 |
| 55 | 5 | -3 | 7 | 7 | -36 | 5 | 2 |
| 56 | 3 | -3 | 9 | 6 | -38 | 6 | 2 |
| 57 | 6 | -5 | 8 | 10 | -40 | 6 | 2 |
| 58 | 5 | -4 | 7 | 9 | -42 | 7 | 1 |
| 59 | 5 | -4 | 11 | 11 | -44 | 5 | 0 |
| 60 | 4 | -5 | 11 | 11 | -45 | 6 | 0 |
| 61 | 2 | -7 | 8 | 9 | -46 | 8 | 2 |
| 62 | 2 | -8 | 11 | 8 | -48 | 6 | 1 |
| 63 | 3 | -8 | 9 | 6 | -51 | 8 | 1 |
| 64 | 4 | -9 | 10 | 10 | -52 | 8 | 0 |
| 65 | 1 | -11 | 4 | 9 | -51 | 8 | -1 |
| 66 | 2 | -12 | 1 | 7 | -51 | 9 | -1 |
| 67 | 5 | -13 | -12 | 8 | -51 | 11 | -1 |
| 68 | -2 | -14 | -2 | 8 | -53 | 9 | -1 |
| 69 | -5 | -15 | -12 | 11 | -54 | 10 | -2 |
| 70 | 4 | -16 | -12 | 7 | -55 | 11 | -1 |
| 71 | -2 | -23 | -25 | 9 | -56 | 10 | 0 |
| 72 | 4 | -32 | -45 | - | -55 | 9 | 1 |
| 73 | - | - | - | - | -56 | 11 | 1 |

Annex C- Photographs



Photo C.1 – Unexposed face prior to test.



Photo C.2 – Exposed face prior to test



Photo C.3 – Closer (floor spring), showing cover removed during installation for surveying purposes..



Photo C.4 – Strike plate (leaf)



Photo C.5 –Lock assembly (frame)



Photo C.6 – Unexposed face at 33:57 test duration.



Photo C.7 – Unexposed face at 45 minutes test duration.



Photo C.8 – Unexposed face at 60 minutes test duration.



Photo C.9 – Unexposed face after test termination.



Photo C.10 – Exposed face after test termination.



**Fire Protection
Association[®]**

Our services:

The Fire Protection Association provides a range of fire safety and prevention services. Our aim is to make the built environment a safer place to live and work so we offer:

- Bespoke fire research and testing
- BS 8414 cladding testing
- BS 8458 watermist system testing
- IMO MSC/CIRC.848
- Sprinkler inspection surveys
- Sprinkler head testing
- Fire risk assessments
- DSEAR risk assessments
- Compartmentation surveys
- Fire strategies
- Training
- Membership

FIRE PROTECTION ASSOCIATION

London Road
Moreton-in-Marsh
Gloucestershire
GL56 0RH

T: 01608 812 500

E: firetesting@thefpa.co.uk