Fire resistance test report

Issuing laboratory: Warringtonfire Testing and Certification Limited

Test standard:	BS EN 1365-1:2012 Corr 2013
Test sponsor:	Hevadex
Product:	Asymmetric loadbearing wall comprised of a timber stud OSB panel coated with ‘Flame-Ex’
Report number:	WF543535 AR 1
Test date:	13 June 2024
Version:	1

Warringtonfire, accredited for compliance with ISO/IEC 17025:2017 – Testing

Approved Body Number 1314

The details of the sponsor of test report WF543535 Version 1 are held on file by Warringtonfire. This report is additional to that issued as WF543535 Version 1 on 24/06/2025. The original report shall remain valid and is not replaced by the additional report WF543535 Version 1 AR1.

Quality management

Version	Date	Information about the report		
1	25 June 2025	Description	Initial issue	
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Signed for and on behalf of Warringtonfire Testing and Certification Limited

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1. Introduction

Figure 1 Unexposed face photograph of test construction

This report documents the findings of the fire resistance test of an asymmetric loadbearing wall comprised of a layer of OSB and an intumescent coating on timber studs in accordance with BS EN 1363-1:2020 'Fire resistance tests - Part 1: General requirements' and BS EN 1365-1:2012 Corr 2013 'Fire resistance tests for loadbearing elements Part 1: Walls'

Warringtonfire performed the test on 13 June 2024 at the request of the test sponsor listed in Table 1.

Table 1 Test sponsor details

Test sponsor	Address
Hevadex	Zoomstraat 6A, 9160 Lokeren, Belgium

2. Test measurements and results

Table 2 summarises the results achieved by the test specimen against the performance criteria listed in BS EN 1363-1:2020 and BS EN 1365-1:2012 Corr 2013 for the following parameters:

- Load Bearing Capacity – The specimen must support its test load, without exceeding the limit of vertical contraction (negative elongation) [C_{limit} = *h* / 100 mm], or the limit of rate of vertical contraction (negative elongation) [$(dC / dt)_{limit}$ = 3*h* / 1000 mm/min], where '*h*' is the initial height (in mm) of the test specimen once the load has been applied as specified in BS EN 1363-1:2020.
- Integrity – The specimen must retain its separating function, without causing either ignition of a cotton pad when applied, or permitting the penetration of a gap gauge as specified in BS EN 1363-1:2020, or resulting in sustained flaming on the unexposed surface. Integrity failure also occurs simultaneously with Load bearing as specified in BS EN 1363-1:2020.
- Insulation – The mean temperature rise (ΔTm) of the unexposed surface must not be greater than 140°C and the maximum temperature rise (ΔTM) must not be greater than 180°C. Insulation failure also occurs simultaneously with integrity failure as specified in BS EN 1363-1:2020.

Appendix A includes observations of any significant behaviour of the specimen and details of the occurrence of the relevant performance criteria.

Appendix B details the location of the instrumentation used during the test.

Appendix C includes details of the measurements taken during the test.

Appendix D includes photographs of the test specimen before, during and after the test.

Appendix E includes the load cell calibration certificate

Table 2 Detailed test results

Performance criteria	Results
Test duration	The test was discontinued after a duration of 26 (twenty-six) minutes
Load Bearing Capacity:	
C_{limit} = *h* / 100 mm	25 (twenty-five) minutes*
$(dC / dt)_{limit}$ = 3*h* / 1000 mm/min	25 (twenty-five) minutes*
Integrity:	
Sustained flaming	25 (twenty-five) minutes#
Failure with gap gauge	25 (twenty-five) minutes#
Cotton pad failure	25 (twenty-five) minutes#
Thermal insulation:	
ΔTm = 140°C	22 (twenty-two) minutes
ΔTM = 180°C	19 (nineteen) minutes
Notes:	
The test results for the specimen only apply to the tested orientation. The specimen was not evaluated for insulation or integrity performance within 150mm of the free edge as defined in BS EN 1365-1:2012 Corr 2013. '*' Loadbearing capacity failure was deemed to have occurred by virtue of the loadbearing test criteria evaluation being stopped after 25 minutes of testing. '#' indicates failure due to load bearing capacity failure.	

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3. Test specimen and supporting construction

3.1 Summary of test specimen

Table 3 Summary of tested specimen

Test specimen			
Summary	Asymmetric Loadbearing Wall with an overall dimensions of 2950 mm wide x 2600 mm high x 103 mm thick comprised of an 11 mm thick OSB panel layer coated with a nominally 3 mm thick layer of Flame-Ex (water-borne intumescent coating) on C-16 timber studs with a dimension of 39 mm wide x 89 mm deep.		
Overall size	**Height**	**Width**	**Depth**
	2600 mm	2950 mm	103mm
Restraint conditions	Both vertical edges of the wall system remained unrestrained. The top and bottom edges of the wall system were compression fitted between the top edge of the restraint frame and the timber bedding plate.		

3.2 Drawings of test assembly

The leaders in the drawings (Figures 2 - 4) represent the items listed in Section 3.3. All measurements are in millimetres – unless indicated otherwise.

The drawings were supplied by the test sponsor and verified by Warringtonfire (unless stated otherwise in Section 2.2).

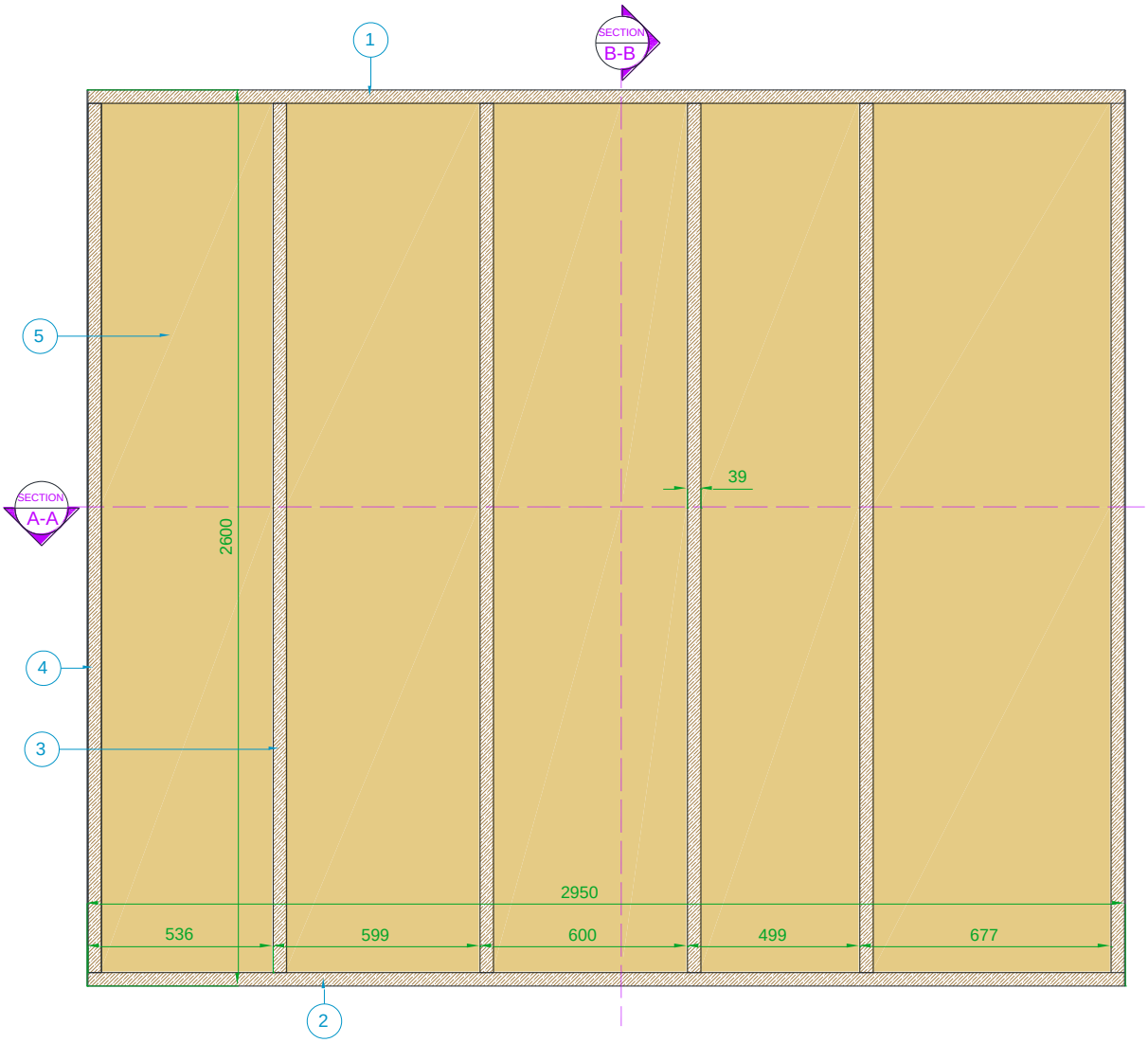

Figure 2 Unexposed Elevation – General elevation of the test construction

Do not scale. All dimensions in mm

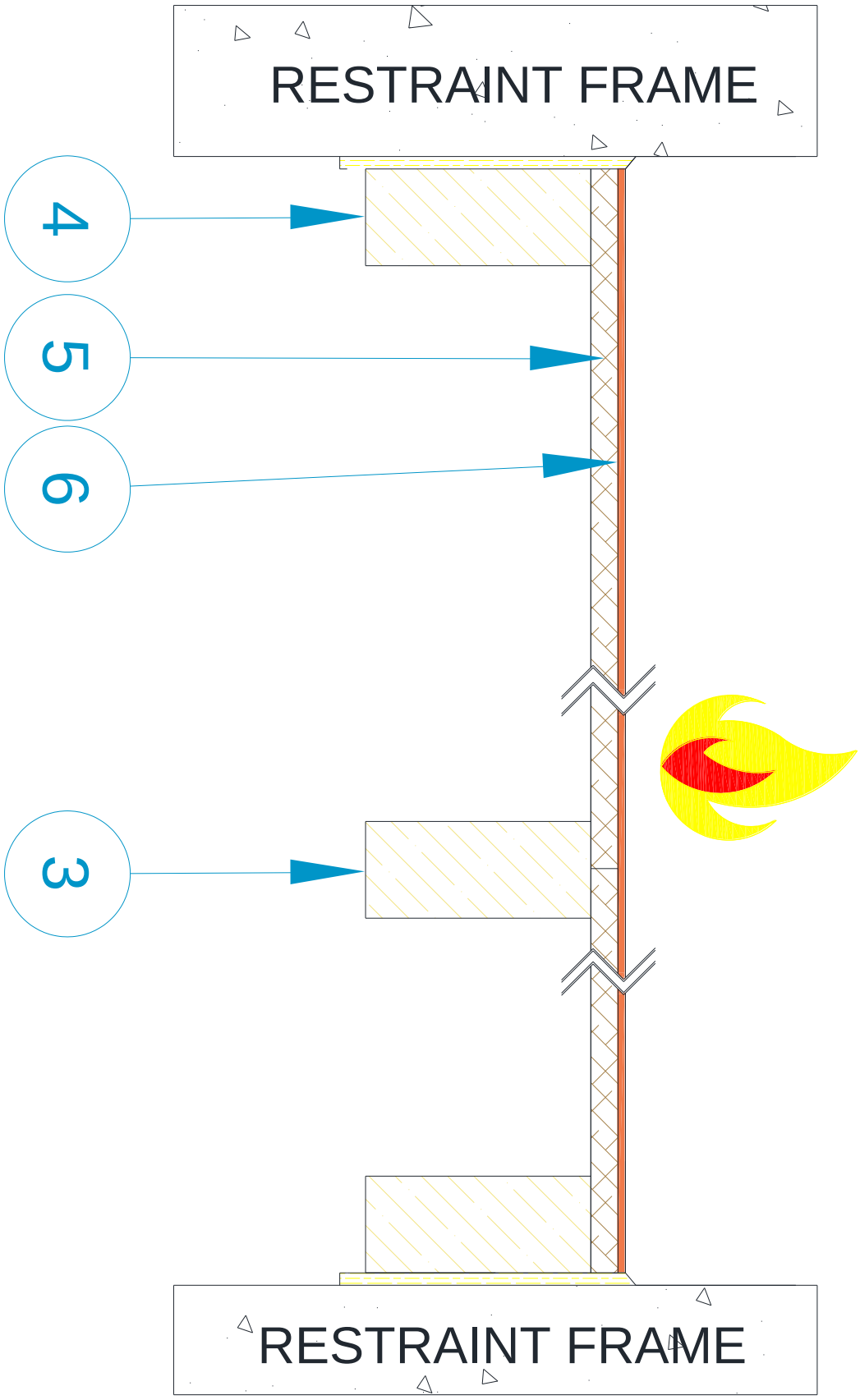

Figure 3 Cross section A – A

Do not scale.

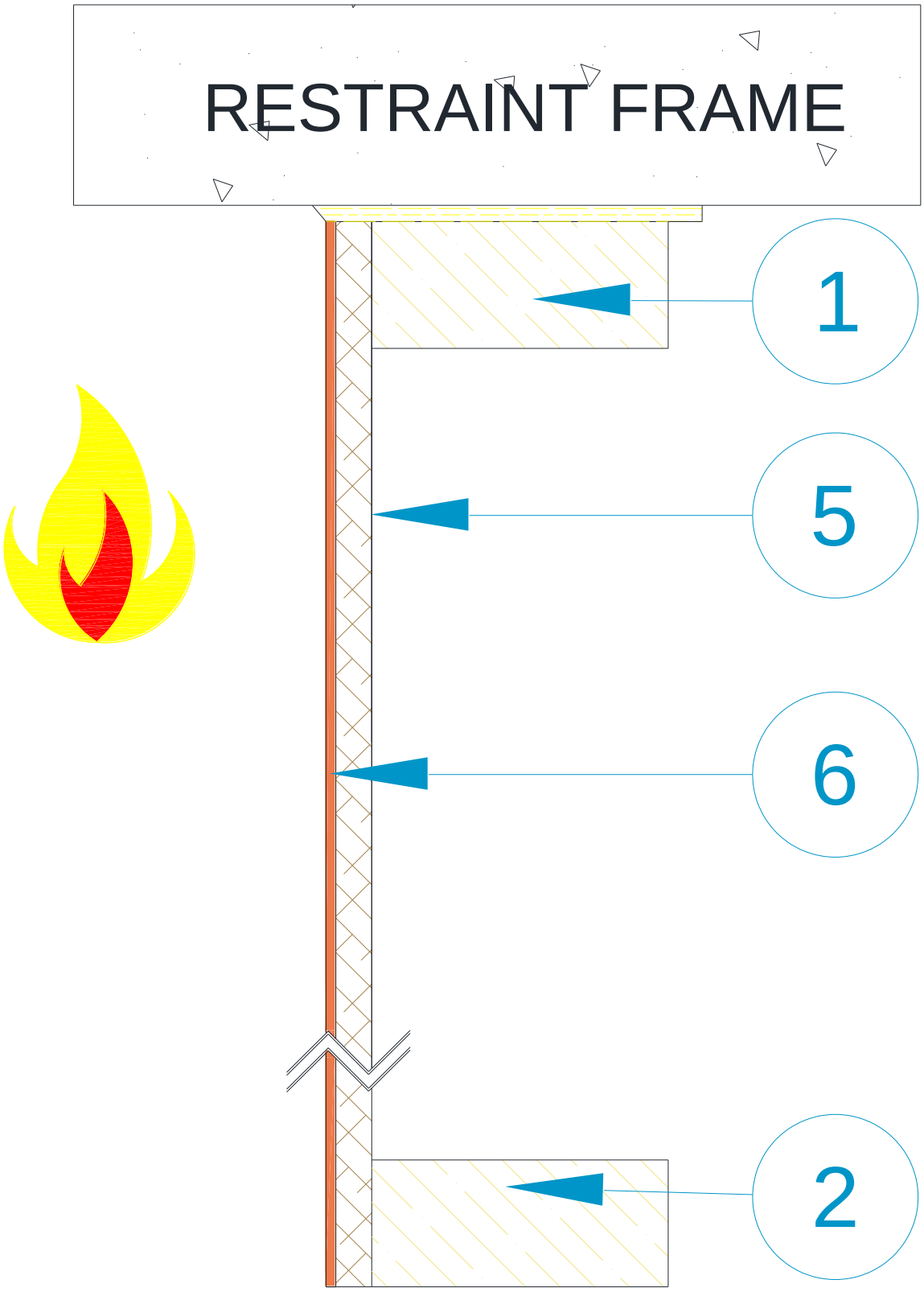

Figure 4 Cross section B – B

Do not scale.

3.3 Schedule of components

Table 4 details the schedule of components which describes the test specimen and lists the components used in the construction of the test specimen. These were provided by the test sponsor and surveyed by Warringtonfire.

All measurements were verified by Warringtonfire unless stated otherwise in the schedule of components. All components marked with an "*" have not been verified by Warringtonfire.

Table 4 Schedule of components

1. Head plate		Description
Manufacturer or supplier	:	Vida Wood
Reference	:	CLS C16
Material	:	Pine/Spruce
Density	:	370 kg/m^3*
Moisture content	:	14%*
Overall size		
• Depth	:	89 mm
• Height	:	39 mm
• Width	:	2950 mm
Fixing Method to restraint frame and centres	:	Not fixed to restraint frame
2. Base Plate		**Description**
Manufacturer or supplier	:	Vida Wood
Reference	:	CLS C16
Material	:	Pine/Spruce
Density	:	370 kg/m^3*
Moisture content	:	14%*
Overall size		
• Depth	:	89 mm
• Height	:	39 mm
• Width	:	2950 mm
Fixing Method to restraint frame and centres	:	Not fixed to restraint frame

3. Vertical main studs		Description
Manufacturer or supplier	:	Vida Wood
Reference	:	CLS C16
Material	:	Pine/Spruce
Location and spacing	:	536, 599, 600, 499mm spacing, starting from left hand side as viewed from unexposed face
Density	:	370 kg/m^3*
Moisture content	:	14%*
Overall size		
• Depth	:	89 mm
• Height	:	2522 mm
• Width	:	39 mm
Details of fixings to head and base track		
• Manufacturer	:	Young Black*
• Reference	:	31x88d34gsc*
• Type & material	:	Galvanised screw nail*
• Overall size	:	3.1 mm Ø x 88 mm long*
4. Vertical free edge studs		**Description**
Manufacturer or supplier	:	Vida Wood
Reference	:	CLS C16
Material	:	Pine/Spruce
Location and spacing	:	On either edge of specimen
Density	:	370 kg/m^3*
Moisture content	:	14%*
Overall size		
Depth	:	89 mm
Height	:	2522 mm
Width	:	39 mm
Details of fixings to head and base track		
• Manufacturer	:	Young Black*
• Reference	:	31x88d34gsc*
• Type & material	:	Galvanised screw nail*
• Overall size	:	3.1 mm Ø x 88 mm long*

5. First layer of board applied to the internal framing exposed face		Description
Supplier	:	Norbord (West Fraser)
Reference	:	Sterling OSB Zero
Material	:	OSB 3
Individual board dimension	:	2600 mm high x 1200 mm wide x 11 mm thick
Overall dimension	:	2600 mm high x 1200mm wide x 11 mm thick – joints behind vertical studs 1 & 3 (As viewed from left to right from unexposed face)
Moisture content (%)	:	8%*
Board weight	:	10.6kg per full sheet*
Details of fixings to internal framing		
• Manufacturer	:	Young Black*
• Reference	:	28x50fawgr/sc2*
• Type & material	:	Galvanised Ring Nail*
• Overall size	:	2.8 mm Ø x 50 mm long*
• Spacing	:	Nominally 75 mm*
6. Coating		**Description**
Manufacturer	:	Hevadex
Reference	:	Flame-Ex
Material	:	Water-borne intumescent coating
Location	:	On the exposed face of the specimen
Application method	:	Brush
Nominal application thickness	:	2.75 mm
Post test protrusion	:	22.3 mm

4. Test procedure

Table 5 details the test procedure for this fire resistance test.

Table 5 Test procedure

Item	Detail	
Test standard	The test was performed in accordance with BS EN 1363-1:2020 'Fire resistance tests - Part 1: General requirements and BS EN 1365-1:2012 Corr 2013 'Fire resistance tests for loadbearing elements Part 1: Walls'.	
Product standard and/or EAD	The test sponsor did not provide an instruction to work in accordance with a product standard.	
EGOLF agreements and/or recommendations	Certain aspects of some fire test specifications are open to different interpretations. EGOLF have identified a number of these areas and have agreed on resolutions which define a common agreement of interpretations between fire test laboratories that are members of the group. As a member of EGOLF. Warringtonfire has implemented several of these resolutions into its standard operating procedures. These Resolutions are as follows: EGR 016:2018, EGR 017:2018, EGR 019:2018, EGR 020:2018, EGR 021:2018, EGR 022:2018, EGR 023:2018, EGA 034-2021, EGR 050-2018 and EGR 057rev1:2020	
Deviations from test method	None	
Instrumentation and equipment	The instrumentation was provided in accordance with BS EN 1365-1:2012 Corr. 2013 and BS EN 1363-1:2020.	
Pre-test conditioning	The test specimen was subjected to normal laboratory temperatures and conditions between the completion of construction of the test specimen and the start of the test.	
Installation details	The specimen was received pre-assembled and delivered during May 2024. The specimen was installed directly into a refractory line steel restraint frame, fitted centrally to a steel spreader beam by representatives of Warringtonfire with assistance from representatives of the sponsor. The gaps between the specimen and the restraint frame were filled with mineral wool, nominal density 33kg/m^3, to prevent flames coming around the edge of the specimen and also to allow free movement of the wall specimen.	
Symmetry	Asymmetrical. The direction of exposure was decided by the test sponsor.	
Ambient laboratory temperature	Start of the test	15.2°C
	Minimum temperature	15.2°C
	Maximum temperature	15.5°C
Sampling / specimen selection	Warringtonfire was not involved in factory sampling of the products and materials used for the test specimen described in this report, and as such the results of this test apply to the sample as received.	

5. Application of test results

5.1 Field of direct application

BS EN 1363-1:2020, Fire resistance tests - Part 1: General requirements, states within Section 12.1, Clause v) that “The field of direct application of the results taken from the appropriate standard (or the test method) for the specimen being evaluated, either in the form of the full text from the appropriate standard or only those clauses which are relevant for the specimen tested” shall be included within the test report. The full text of the field of direct application for the results of the specimen being evaluated herein, can be found within the appropriate test standard, which is referenced on the front cover of this report.

5.2 Validity

This document is the original version of this test report and is written in English. In case of doubt, the original version prevails over a translation. This document is issued subject to Warringtonfire’s standard terms and conditions, which are available at: *Terms and Conditions | Element*.

The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criteria for assessing the potential fire hazard of the product in use, nor can the results be extrapolated and applied to other products.

Reports are statements of fact(s) prepared in accordance with the referenced version of the standard(s) stated in Section 4 of this report. Reports are based upon the information provided to Warringtonfire. Warringtonfire takes no responsibility for the accuracy or completeness of such information.

The results stated in this report apply to the test specimen as received.

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 BS EN 1365-1:2012 Corr 2013, BS EN 1363-1:2020.

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.

Any differences in relation to the aforementioned characteristics may significantly affect the performance and will therefore invalidate the application of the test results to the variant product. It is recommended that any proposed variation to the tested configuration or product should be referred to the test sponsor. The test sponsor should then obtain appropriate documentary evidence of compliance from Warringtonfire or another accredited testing authority. The supplier of the product is responsible for ensuring that the product which is supplied for use is identical to the test specimens that were tested.

The specification and the interpretation of fire test methods are both the subject of ongoing development and refinement. Changes in the applicability of the results of tests in relation to associated legislation may also occur. For these reasons the currency and the relevance of test reports should be considered by the user.

The test report also relates only to the sample(s) of the product submitted to the test. The laboratory accepts no responsibility for the representativeness of the test specimens unless so stated in the test report.

Confidence that the product that is supplied to the market will have the performance indicated in the test report can be supported by use of third-party certification schemes.

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5.3 Uncertainty of measurement

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.

Appendix A Test observations

Table 6 shows the observations of any significant behaviour of the specimen during the test.

Figure 5 shows a diagram of the panels as referenced in Table 6

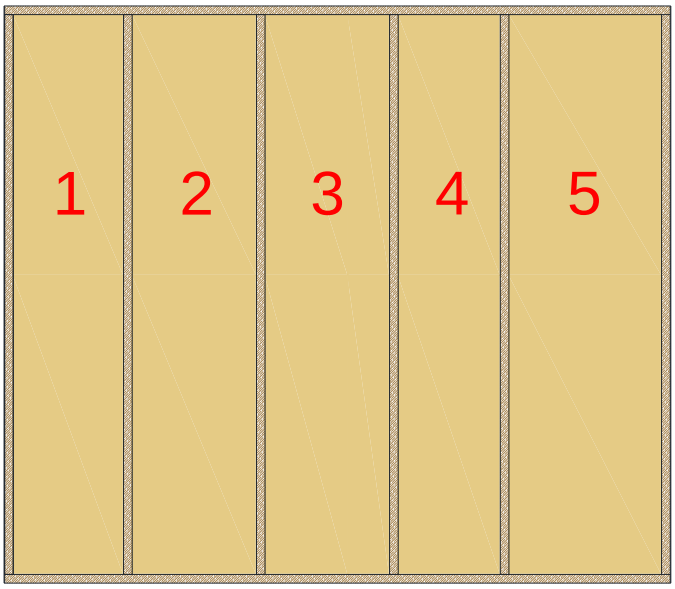

Figure 5 Panel Arrangement for observations

Do not scale.

Table 6 Test observations

Min	Sec	Observation
00	00	Commencement of test.
02	00	Black Bubbling on exposed side of the specimen.
05	00	The exposed side turned completely black.
08	00	The exposed side is cracking.
10	00	There is an increase in the cracking at the exposed side.
11	30	There is steam issuing at all the panels.
14	30	There is an increase in the steam issuing at all the panels.
15	00	The cracking is deepening and widening on the exposed side.
17	10	There is discoloration at the top right of panel 3.
18	40	There is discoloration and increase in the smoke issuing at the top left of panel 2.
19	30	There is smoke issuing along the entire head of the partition.
20	20	There is discoloration going downwards at the right-hand side of panel 3.
21	30	There is an increase in the smoke issuing at the right-hand side of panel 3.
22	40	There is a glow visible at the middle right of panel 3.
23	40	There are multiple visible glows on the right-hand side of panel 3.
25	30	The glows and gaps at panel 3 are largening.
26	**01**	**There is continuous flaming at the right-hand side of the 3rd stud, (left hand side of panel 4) from 800 mm above the base of the specimen to the head of the specimen therefore constituting integrity failure.**
26	40	The test is terminated.

Appendix B Instrumentation locations

Figure 6 shows the instrumentation locations for this fire resistance test.

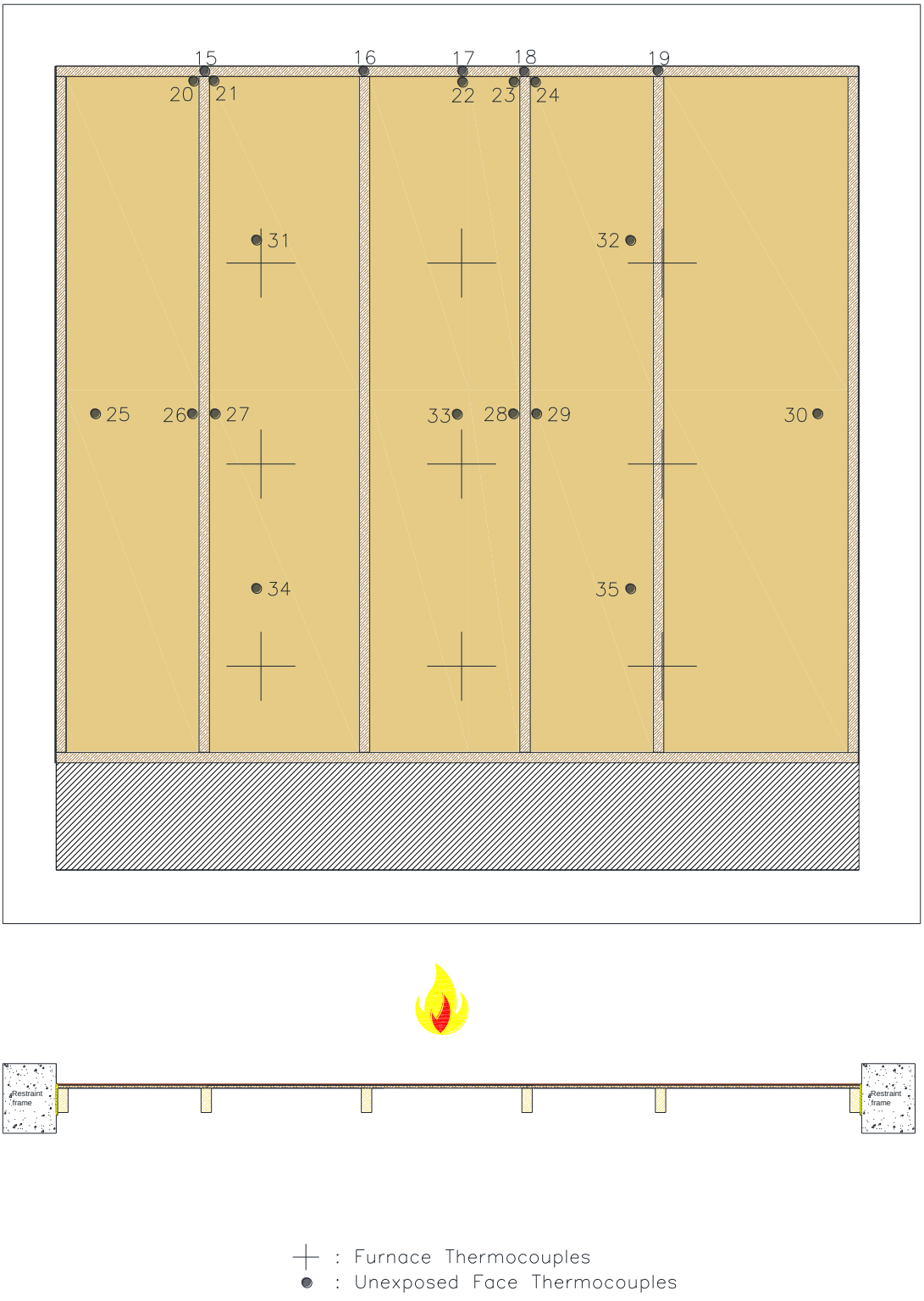

Figure 6 Instrumentation locations

Do not scale.

Appendix C Test data

C.1 Furnace temperature and deviation

The furnace was controlled so that its mean temperature complied with the requirements of BS EN 1363-1: 2020 Clause 5.1 using nine plate thermometers, distributed over a plane 100 ± 50 mm from the surface of the test construction.

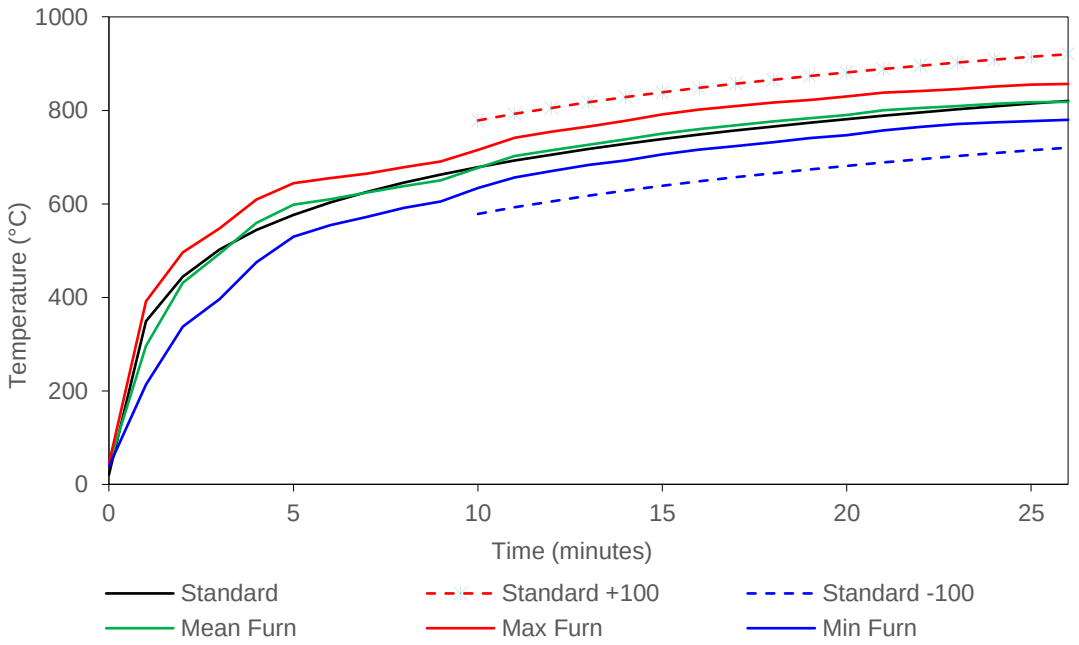

Figure 7 Furnace thermocouple temperature vs time

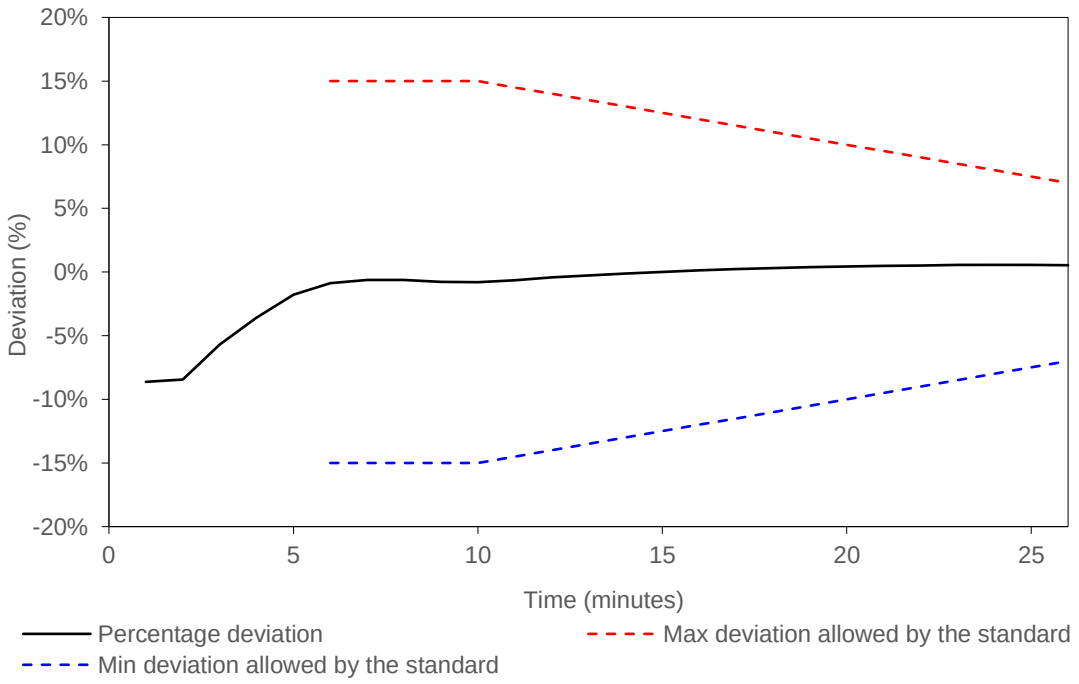

Figure 8 Percentage deviation of exposure severity vs time

C.2 Furnace pressure

The furnace pressure was taken at approximately 500 mm above the base of the specimen.

The furnace was controlled to a pressure of -1.3Pa throughout the test, restricted to ± 5 Pa after the first 5 minutes of testing and ± 3Pa after the first 10 minutes of testing, equating to a pressure of 20Pa at the head of the specimen as defined in BS EN 1363-1:2020.

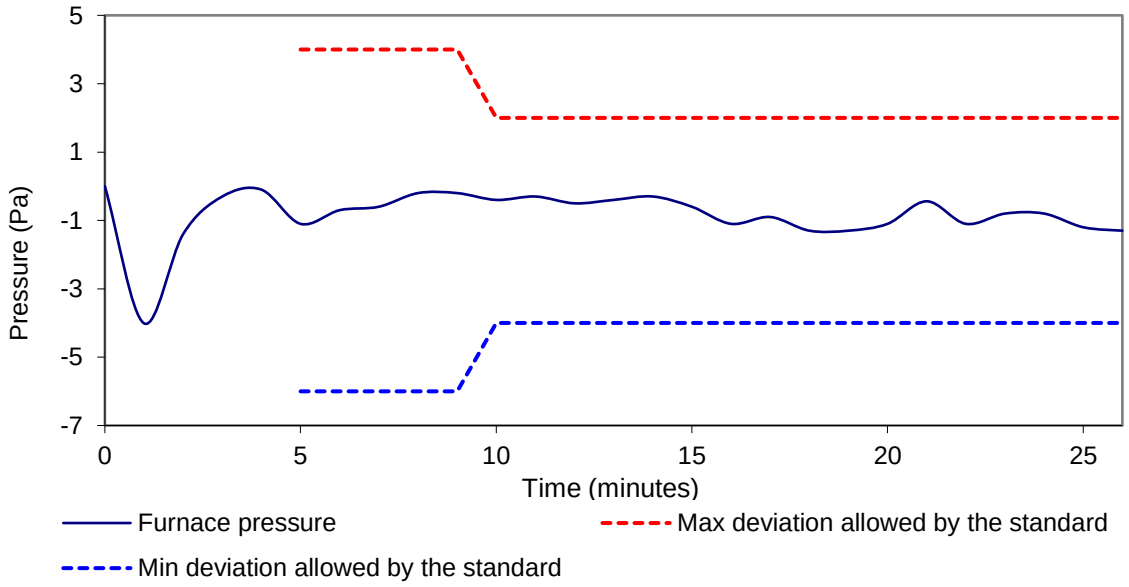

Figure 9 Furnace pressure

C.3 Load application and deflection measurements

The specimen was loaded from below using 3 No. hydraulic jacks. The load was transferred to the specimen using a steel/timber spreader beam. The specimen was loaded along the centre line to 25.08 kN total imposed load. This equates to 8.36 kN per hydraulic ram ±5% as recognised by the standard. Allowing for the self-weight to the wall and the spreader beam, this represents an imposed load of 8 kN per linear metre in accordance with the client's request.

The specimen was loaded for a minimum of 15 minutes before the test commenced.

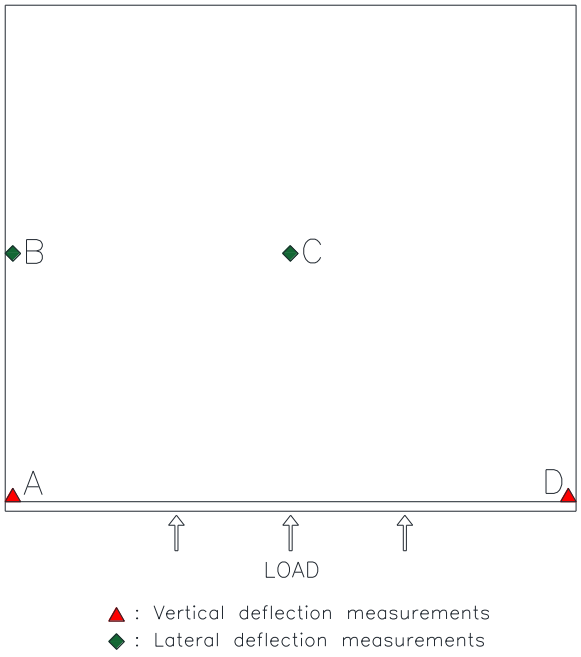

Figure 10 Position of deflection measurements and load

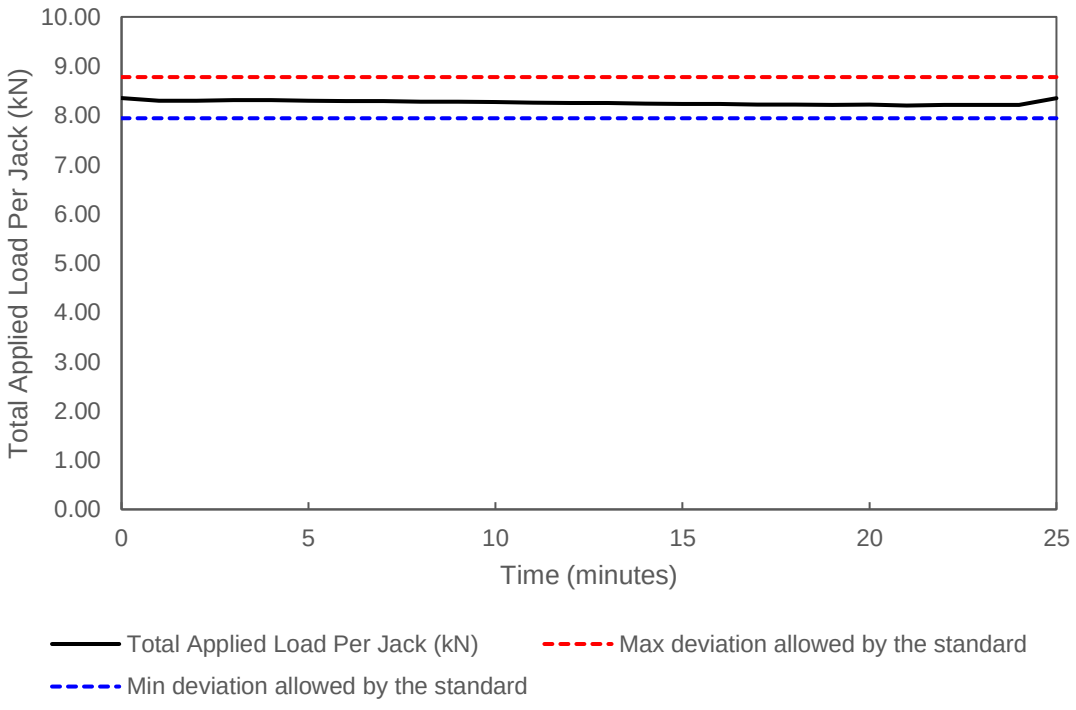

Figure 11 Graph showing the total load applied per loading jack with the associated tolerances as specified in BS EN 1363-1:2020

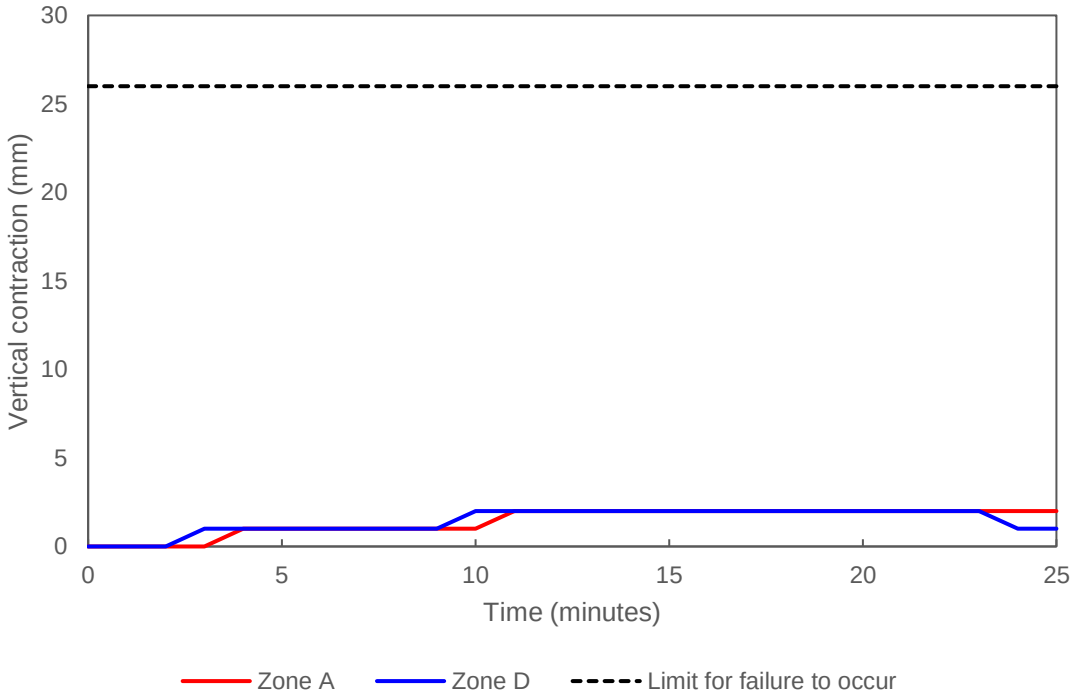

Figure 12 **Graph showing vertical contraction of the specimen at Zones A and D and the limit for failure to have occurred**

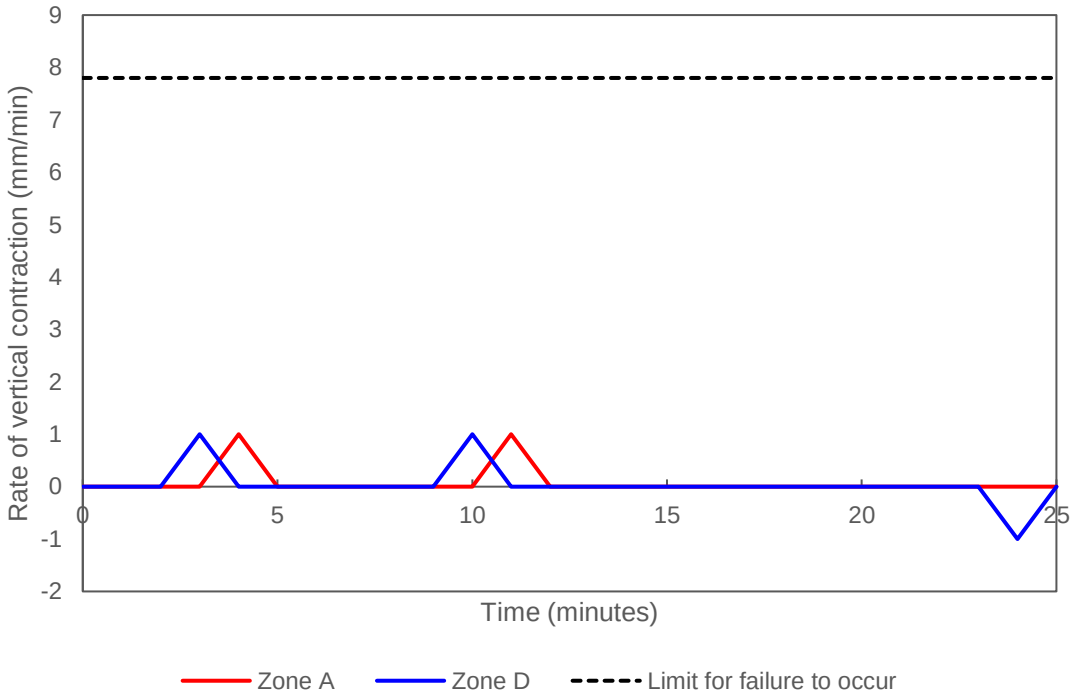

Figure 13 **Graph showing rate of vertical contraction of the specimen at Zones A and D and the limit for failure to have occurred**

Table 7 details the load application and deflection measurements of the test specimen at locations given in Figure 10.

For lateral deflection, positive measurements show movement of the test specimen away from the furnace. Negative measurements show movement of the test specimen towards the furnace.

For vertical contraction, negative measurements show an increase in the test specimens height. Positive measurements show a drop in the test specimens overall height.

Table 7 Load applied and specimen deflections

Time (mins)	Applied Load Per Jack (kN)	Vertical contraction (mm)		Rate of vertical contraction (mm/min)		Lateral deflection (mm)	
		Zone A	Zone D	Zone A	Zone D	Zone B	Zone C
0	8.35	0	0	0	0	0	0
1	8.30	0	0	0	0	0	0
2	8.30	0	0	0	0	0	-3
3	8.31	0	1	0	1	0	-5
4	8.31	1	1	1	0	1	-5
5	8.30	1	1	0	0	2	-5
6	8.29	1	1	0	0	1	-5
7	8.29	1	1	0	0	2	-5
8	8.28	1	1	0	0	2	-5
9	8.28	1	1	0	0	2	-5
10	8.27	1	2	0	1	2	-5
11	8.26	2	2	1	0	2	-5
12	8.25	2	2	0	0	2	-5
13	8.25	2	2	0	0	2	-5
14	8.24	2	2	0	0	2	-5
15	8.23	2	2	0	0	2	-5
16	8.23	2	2	0	0	2	-5
17	8.22	2	2	0	0	2	-5
18	8.22	2	2	0	0	2	-5
19	8.21	2	2	0	0	2	-4
20	8.22	2	2	0	0	2	-4
21	8.20	2	2	0	0	2	-4
22	8.21	2	2	0	0	2	-4
23	8.21	2	2	0	0	2	-4
24	8.21	2	1	0	-1	2	-4
25	8.35	2	1	0	0	2	-4
26	*	*	*	*	*	*	*

Note: '*' Data could not be safely recorded due to the integrity failure of the specimen.

C.4 Specimen temperatures

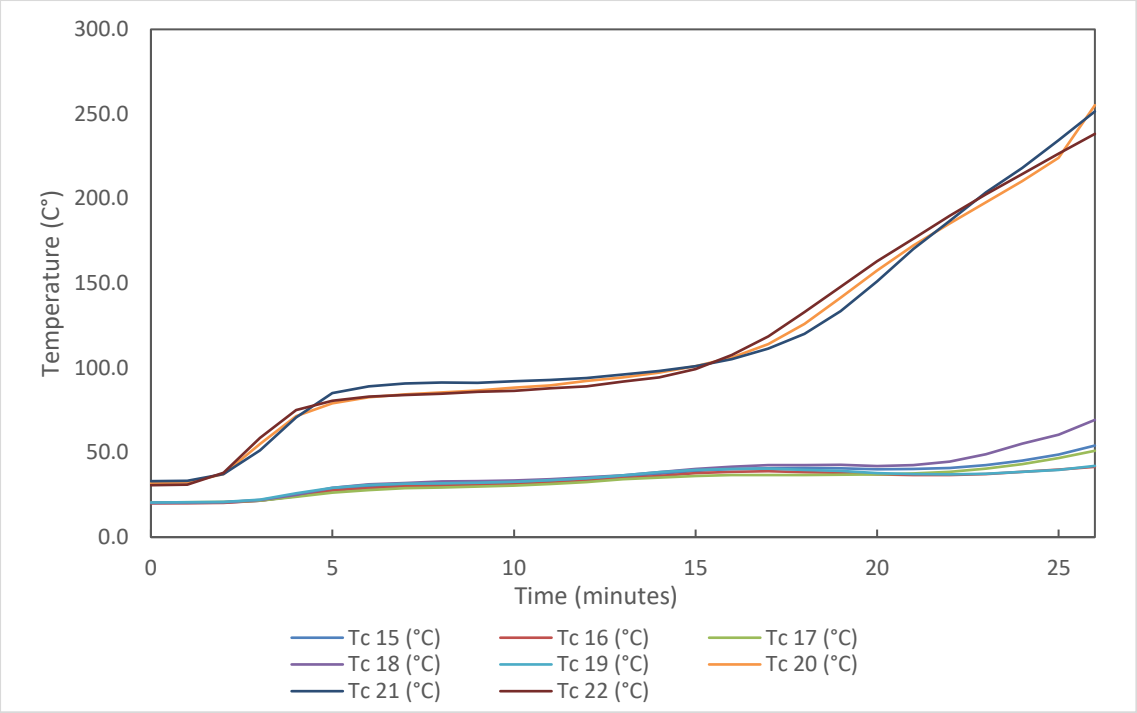

Figure 14 Individual unexposed face temperatures recorded at the maximum locations.

Table 8 Individual unexposed face temperatures recorded at the maximum locations.

Time (mins)	Tc 15 (°C)	Tc 16 (°C)	Tc 17 (°C)	Tc 18 (°C)	Tc 19 (°C)	Tc 20 (°C)	Tc 21 (°C)	Tc 22 (°C)
0	20.2	20.0	20.4	20.3	20.5	32.1	33.1	30.7
1	20.3	20.1	20.6	20.5	20.6	32.3	33.3	31.0
2	20.4	20.3	20.8	20.7	20.7	37.3	37.2	38.1
3	21.6	21.5	21.6	22.0	22.1	55.0	51.2	58.6
4	24.3	24.4	23.8	25.0	25.8	71.5	70.7	75.1
5	27.8	27.6	26.3	29.1	29.2	79.2	85.1	80.5
6	29.8	29.0	27.8	31.2	30.7	82.6	89.1	82.9
7	31.1	30.1	28.9	32.1	31.6	84.3	90.9	84.0
8	31.5	30.4	29.3	32.9	31.8	85.4	91.3	84.7
9	32.1	30.8	29.9	33.1	32.2	86.7	91.1	85.8
10	32.4	31.3	30.4	33.5	32.6	88.3	92.1	86.4
11	33.3	32.1	31.4	34.3	33.7	89.7	92.8	87.9
12	34.3	33.3	32.6	35.4	34.9	92.2	94.1	89.1
13	36.0	34.7	34.2	36.6	36.5	94.3	96.0	91.8
14	37.5	36.1	35.2	38.4	38.4	97.2	98.2	94.4
15	39.1	37.8	36.2	40.2	39.8	101.0	101.0	99.4
16	40.3	38.6	36.7	41.6	40.4	106.1	105.1	107.6
17	40.7	38.9	36.7	42.5	40.5	114.0	111.4	118.6
18	40.9	38.5	36.8	42.6	39.7	126.0	120.1	133.0
19	40.6	38.0	36.9	42.8	39.1	141.4	133.5	147.9
20	40.0	37.1	37.1	42.1	37.9	157.5	151.2	163.0
21	40.3	36.6	37.6	42.6	37.3	172.4	170.2	176.4
22	40.8	36.8	38.5	44.6	37.0	185.4	186.8	190.0
23	42.5	37.3	40.5	49.1	37.5	197.8	203.6	202.5
24	45.2	38.5	43.2	55.2	38.6	210.3	218.1	214.5
25	48.8	39.9	46.7	60.5	39.6	224.1	234.5	226.5
26	54.1	41.6	51.0	69.3	42.1	255.2	251.5	238.3

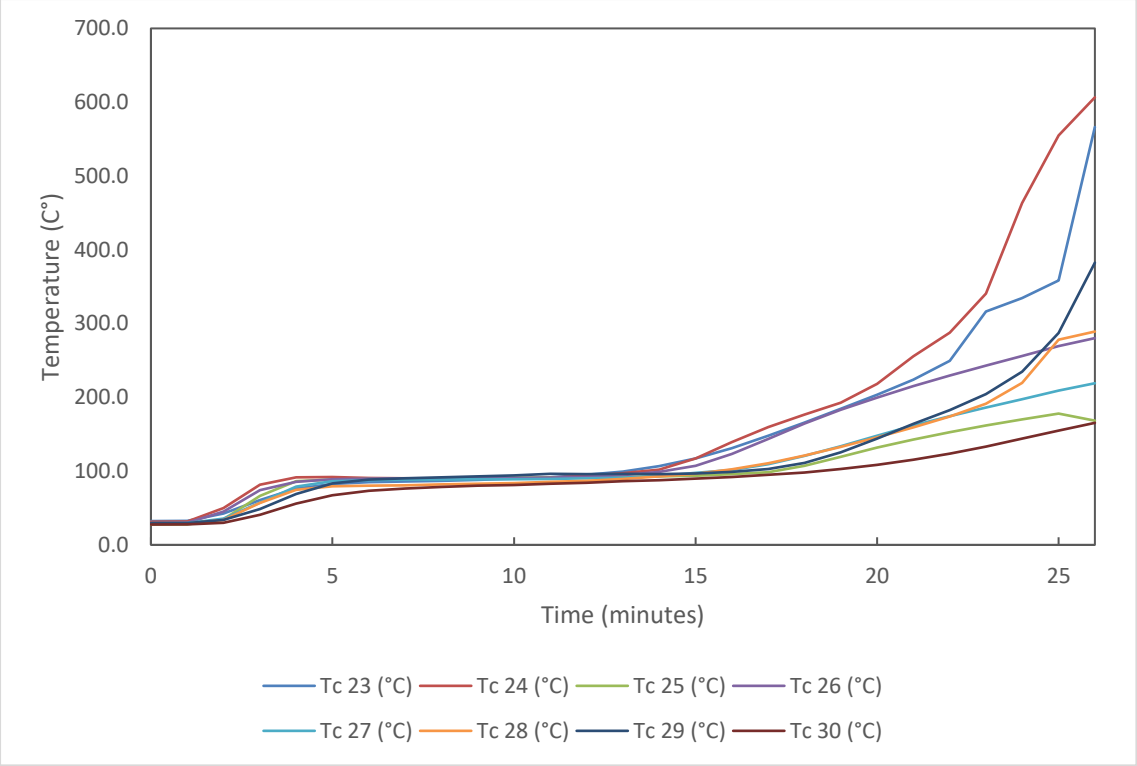

Figure 15 **Individual unexposed face temperatures recorded at the maximum locations.**

Table 9 **Individual unexposed face temperatures recorded at the maximum locations.**

Time (mins)	Tc 23 (°C)	Tc 24 (°C)	Tc 25 (°C)	Tc 26 (°C)	Tc 27 (°C)	Tc 28 (°C)	Tc 29 (°C)	Tc 30 (°C)
0	32.2	31.3	27.6	29.3	29.4	28.6	29.5	27.6
1	32.6	31.7	27.7	29.7	29.6	28.8	29.7	27.8
2	42.4	49.9	34.7	45.3	35.4	33.8	34.0	30.0
3	60.7	81.5	66.6	74.1	57.3	56.9	48.5	40.6
4	76.2	91.7	86.5	85.6	78.9	74.6	69.2	55.8
5	82.6	91.8	88.4	88.9	86.2	79.5	83.4	67.2
6	85.0	90.6	89.6	89.7	87.6	80.2	88.5	73.3
7	86.0	90.1	89.5	90.1	88.3	80.7	90.3	76.5
8	87.0	90.0	89.2	90.2	88.3	82.1	91.5	78.5
9	88.3	89.7	90.5	90.5	88.8	82.9	92.7	80.1
10	89.6	90.3	91.1	90.9	88.7	83.9	94.2	81.3
11	91.3	91.2	91.1	91.2	89.4	85.3	96.1	82.8
12	95.1	93.8	91.7	92.6	90.2	86.8	95.9	84.3
13	99.3	97.0	91.8	94.8	91.0	89.3	96.2	86.1
14	106.7	102.1	92.6	98.9	93.1	92.9	96.0	87.8
15	117.2	117.1	93.7	107.3	97.5	96.4	96.8	89.8
16	130.9	139.2	95.7	123.1	101.7	102.4	98.8	91.8
17	147.8	159.6	98.3	143.6	109.3	110.7	103.0	94.8
18	165.9	176.4	107.1	164.5	120.6	121.1	111.2	98.0
19	184.4	192.6	119.5	183.2	133.8	132.9	125.4	102.7
20	203.4	218.1	131.8	199.7	148.0	145.7	143.9	108.3
21	223.8	255.6	142.8	215.3	162.0	159.0	163.8	115.4
22	249.6	287.8	152.8	229.6	174.5	174.1	182.7	123.5
23	316.3	340.4	161.8	243.0	186.3	191.2	204.5	133.3
24	334.4	463.5	170.0	255.9	197.5	219.4	234.6	143.9
25	358.5	554.9	178.0	269.5	209.0	277.9	287.1	154.8
26	566.3	606.6	168.2	280.2	219.1	289.1	382.4	165.4

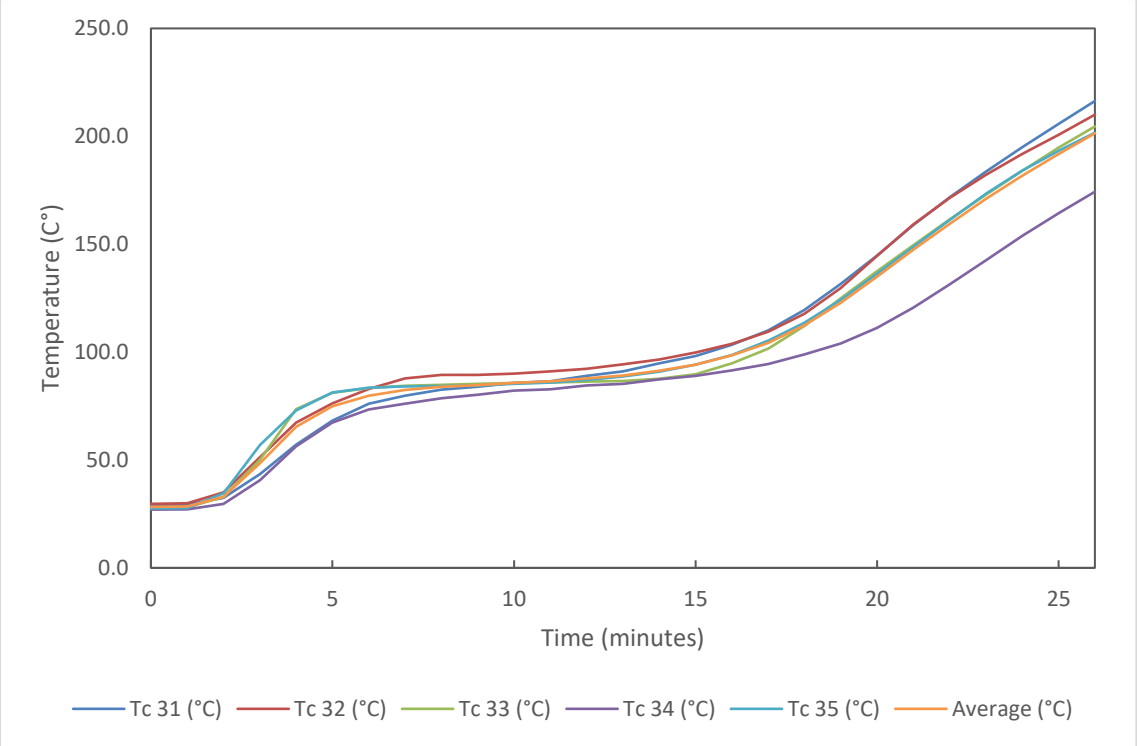

Figure 16 **Individual and mean unexposed face temperatures recorded at the average locations.**

Table 10 **Individual and mean unexposed face temperatures recorded at the average locations.**

Time (mins)	Tc 31 (°C)	Tc 32 (°C)	Tc 33 (°C)	Tc 34 (°C)	Tc 35 (°C)	Average (°C)
0	29.3	29.7	27.9	27.0	27.5	28.3
1	29.4	30.0	28.0	27.2	27.7	28.4
2	32.5	35.0	32.9	29.6	34.6	32.9
3	43.5	51.3	50.1	40.6	57.0	48.5
4	57.1	67.3	73.6	56.3	73.0	65.4
5	68.2	76.2	81.2	67.3	81.3	74.8
6	76.1	82.8	83.4	73.4	83.5	79.8
7	79.7	87.8	84.4	76.1	84.1	82.4
8	82.6	89.4	84.8	78.6	84.2	83.9
9	83.9	89.5	85.2	80.3	84.5	84.7
10	85.7	90.1	85.7	82.1	85.2	85.8
11	86.5	91.0	85.9	82.8	85.9	86.4
12	89.0	92.2	86.3	84.6	87.1	87.8
13	91.1	94.3	86.6	85.3	88.7	89.2
14	94.7	96.5	87.7	87.3	90.8	91.4
15	98.2	99.8	89.8	89.1	94.2	94.2
16	103.4	103.8	94.8	91.5	98.7	98.5
17	110.0	109.5	101.6	94.5	105.3	104.2
18	119.6	117.8	112.1	99.0	113.6	112.4
19	131.5	129.7	124.9	103.9	124.1	122.8
20	144.8	144.6	137.6	111.2	136.3	134.9
21	158.8	159.2	149.5	120.6	148.7	147.4
22	171.8	171.5	161.5	131.4	161.2	159.5
23	183.7	182.2	173.0	142.6	173.4	171.0
24	194.9	191.8	184.0	153.8	184.0	181.7
25	205.8	200.7	194.8	164.3	193.3	191.8
26	216.4	210.0	204.6	174.3	201.6	201.4

Appendix D Photographs

Figure 17 Unexposed face of the specimen before the start of the test

Figure 18 Exposed face of the specimen before the start of the test (support bar and clamp removed prior to fitting onto furnace)

Figure 19 Unexposed face of the specimen after 05:00 minutes of testing

Figure 20 Unexposed face of the specimen after 10:00 minutes of testing

Figure 21 Unexposed face of the specimen after 15:00 minutes of testing

Figure 22 Unexposed face of the specimen after 20:19 minutes of testing

Figure 23 Unexposed face of the specimen after 23:19 minutes of testing

Figure 24 Unexposed face of the specimen after 25:00 minutes of testing

Figure 25 Unexposed face of the specimen after the test

Figure 26 Exposed face of the specimen after the test

Appendix E Load cell calibration certificate

CERTIFICATE OF CALIBRATION

UKAS CALIBRATION 10628

ISSUED BY: PROCTER & CHESTER (MEASUREMENTS) LTD
DATE OF RECEIPT: N/A
DATE OF CALIBRATION: 31/05/2024
DATE OF ISSUE: 03/06/2024
CERTIFICATE NO.: PCM-010632

Page 1 of 2
Approved Signatory APPROVED

☐ J. Chester
☑ M. Dadson

ISSUED TO: Warringtonfire
Chiltern House, Stocking Lane
Hughenden Valley
High Wycombe
Buckinghamshire
HP14 4ND

DESCRIPTION: C2S Load cell SN. 809729
PSDS Display SN. 17681492

CONDITION OF INSTRUMENT	YES / NO
Reported results lie within the stated limits on receipt	N/A
The instrument was adjusted	Y
The instrument was repaired	N
Reported results lie within the stated limits on despatch	Y

DECISION RULE
The decision rule employed: non-linearity and UoM combined not to exceed ±0.7%.

METHOD
The above load cell and display have been calibrated to PCM working standard WI.06-1 BS 8422:2003, using reference load cell verification equipment calibrated to BS EN ISO 376:2011, WI.21 and WI.24. Procedures contribute to ensure validity of results according to QP.01 Technical Records. Calibration carried out at PCM's location as shown below.

TEST EQUIPMENT USED

Asset No.	Description	Cert. No.	Expiry Date
TE041	10kN Tension & Compression Load Cell	093 198722F	30/08/2024
TE100	ML38 Amplifier	TE100-24-1	31/07/2024

Loading Frame AR016 combined Uncertainty of Measurement (UoM) 0.3%FS.

PCM
PROCTER & CHESTER (MEASUREMENTS) LTD
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KENILWORTH
WARWICKSHIRE
CV8 2UE (UK)
TEL: +44 (0)1926 864444
EMAIL sales@pcm-uk.com
WEBSITE www.pcm-uk.com

The results contained within this certificate relate only to the items listed above.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

QF.02 Iss. 9

CALIBRATION CERTIFICATE

CERTIFICATE NO. PCM-010632

UKAS ACCREDITED CALIBRATION LABORATORY No. 10628

LOADING MODE	COMPRESSION	CALIBRATION TYPE	BS 8422:2003 STANDARD	JOB REF No.	22057
LAB TEMP (°C)	19.7	NON-LINEARITY % FS	-0.026	RESPONSE UNITS	kN
TEMP - (°C) START	20.0	REPRODUCIBILITY % FS	0.100		
TEMP - (°C) END	20.0	UNCERTAINTY OF MEASUREMENT %FS	±0.3% + 1 digit @ 2 dp	CALIBRATION DATE	31/05/2024

APPLIED FORCE	RUN 1 - 0°		RUN 2 - 120°		RUN 3 - 240°		MEAN		STANDARD DEVIATION	REPRODUCIBILITY %FS
kN	INCREASING	DECREASING	INCREASING	DECREASING	INCREASING	DECREASING	INCREASING	DECREASING		
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000
2.0	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	0.000	0.000
4.0	4.00	4.00	4.01	3.99	4.00	4.00	4.00	4.00	0.005	0.100
6.0	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	0.000	0.000
8.0	8.00	7.98	8.00	8.00	8.00	8.00	8.00	7.99	0.000	0.000
10.0	10.00		10.00		10.01		10.00		0.005	0.100
0.0	0.00		0.00		0.00		0.00		0.000	0.000

APPLIED FORCE kN	SPAN RESPONSE (A)	POLYNOMIAL RESPONSE * (B)	Δ RESPONSE (B - A)	NON-LINEARITY % FS
2.0	2.00	2.00	0.00	0.004
4.0	4.00	4.00	0.00	-0.026
6.0	6.00	6.00	0.00	0.012
8.0	8.00	8.00	0.00	0.017
10.0	10.00	10.00	0.00	-0.011

2ND ORDER REGRESSION BEST FIT * $y = m_1x^2 + m_2x + c$	m_1 =	5.176E-06
	m_2 =	1.000E+00
	c =	0.000E+00

FORCE AS A FUNCTION OF MEASURED VALUES $F = m_1x^2 + m_2x + c$	m_1 =	-5.2162E-06
	m_2 =	9.9983E-01
	c =	0.0000E+00

(POLYNOMIAL CALIBRATION COEFFICIENTS)

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a coverage probability of approximately 95%.
The uncertainty evaluation has been carried out in accordance with UKAS requirements.
Non-linearity calculated in accordance with BS 8422:2003 ANNEX A - Response in terms of force

AUTHORISED BY: APPROVED

CALIBRATION CARRIED OUT BY
PROCTER & CHESTER (MEASUREMENTS) LTD
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QF.03-1 ISS.6

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL, EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF THE ISSUING LABORATORY.

END OF REPORT

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