FIRE TEST REPORT EUI-23-B-000463

According to BS EN 1363-1:2020 and BS EN 1365-2:2014

Test	EUI-23-B-000463
Performed on	27th February 2024
Regarding	Ecolit Loadbearing 60-Minute Floor. Overall dimension: 2980 x 4280 x 335mm (w x L x th) Loading: 2.5 kN/m^2
Sponsor	ECOLIT LISMULLEN, GARLOW CROSS C15 R273 NAVAN IRELAND

UKAS TESTING

10169

1. DOCUMENT TRACKING

Revision Index.	*Modification*
0	Original document

2. SCOPE OF THIS TEST REPORT

Fire resistance test regarding an asymmetrical loadbearing floor, according to the general requirements of the standard BS EN 1363-1:2020 and to the specific requirements of the standard BS EN 1365-2:2014.

The results reflect the loading, heating and pressure conditions described in Chapter 8, and only to the sample tested with fire on a particular side, as described in sub-section 8.5.

3. TEST LABORATORY

EFECTIS UK & IRELAND
Shore Road
Jordanstown
BT37 0QB County Antrim
Northern Ireland

4. REFERENCE AND MANUFACTURER OF THE TESTED SPECIMEN

Reference:
Ecolit Loadbearing 60-Minute Floor.
Overall dimension: 2980 x 4280 x 335mm (w x L x th)
Loading: 2.5 kN/m^2

Manufacturer:
ECOLIT
LISMULLEN, GARLOW CROSS
C15 R273 NAVAN
IRELAND

5. FURTHER INFORMATIONS FOR UKCA/UKNI MARKING

(Chapter not covered under the UKAS's accreditation)

The tested sample has not been subject to sampling; thus, the results apply to the sample as received.

6. DESCRIPTION OF THE TESTED SPECIMEN

Technical data <u>in this chapter</u> and drawings in Appendix A concerning the sample and its composition have been supplied by the sponsor who attests their accuracy.

6.1. GENERAL

The element was an asymmetrical roof and ceiling, with overall dimensions of 2980mm in width, 4280mm in length, and 335mm in thickness. The structure was comprised of steel frames. On the unexposed side of the specimen, there was a single layer of 20mm Cem-Rock Cement Board, while on the exposed side, there was a single layer of 12mm Cem-Rock eXtreme Cement Board.

See Appendix A.
Overall dimensions:

- Element: 2980 x 4280 x 335mm (w x L x th)
- Clear opening: 3000 x 4000mm (w x L)

6.2. LIST OF THE COMPONENTS

According to the information supplied by the sponsor.

Name	Reference	Characteristics	Material	Supplier
Steel frame	Terrakon Ecolit Steel Framed System	150 x 50 x 1.6mm (D x w x Th)	Galvanised Steel	MERIDIAN STEEL UK
Frame fixing	Evolution Panhead Screw	5.5 x 19mm (Ø x L) Self drilling screw	Galvanised Steel	EVOLUTION
Board (Exposed side)	Cem-Rock eXtreme 12mm	12 x 1200 x 2400mm (th x w x L) Reaction to fire classification (EN 13501-1:2013) A1 (non-combustible) Thermal Conductivity (EN ISO 10456) 0.23 W/Km Density : 935 kg/m^3 (stated)	Cement Board	CEMROCK
Board (Unexposed side)	Cem-Rock 20mm	20 x 1200 x 2400mm (h x w x L) Reaction to fire classification (EN 13501-1:2013) A1 (non-combustible) Thermal Conductivity (EN ISO 10456) 0.2 W/Km Density : 950 kg/m^3 (stated)		
Fixing screws of exposed side	Evolution 40 x 5.5mm screw	5.5 x 40mm (Ø x L) Self drilling screw	Galvanised Steel	EVOLUTION
Fixing screws of unexposed side	Evolution 50 x 5.5mm screw	5.5 x 50mm (Ø x L) Self drilling screw		
Intumescent Sealant	Everbuild Everflex Fire Mate Intumescent Sealant	Fire rated to EN1366-4 (2006) C3 295ml Cartridge	Acrylic Intumescent Fire sealant	EVERBUILD

w = width --- h = height --- th = Thickness --- Ø = diameter --- L = Length

6.3. DETAILED DESCRIPTION OF THE SPECIMEN

The drawings in Appendix A were supplied by the Sponsor, checked by the test laboratory EFECTIS, and are in conformity with the tested specimen.

6.3.1. Frame Structure

The light-gauge steel frames were constructed using nine galvanized steel components for the top and bottom cords, end stubs, and internal lattice web, collectively referenced as the Terrakon Ecolit Steel Framed System (MERIDIAN STEEL UK).

The frame elements were secured together using self-drilling screws, specifically the panhead screw (EVOLUTION) with dimensions of 5.5mm in diameter and 19mm in length (Ø x L). One screw was utilized at each intersection on both flanges.

See Drawing 1, Appendix A for the layout of the specimen frame.

6.3.2. Unexposed side

The unexposed side of the specimen consisted of a single layer of cement board, referred to as Cem-Rock 20mm (CEMROCK), which measured 20mm in thickness, and was secured using self-drilling screws with dimensions of 5.5mm in diameter and 50mm in length (Ø x L), designated as Evolution 50 x 5.5mm screws (EVOLUTION). These screws were placed at 300mm intervals along the joists.

An intumescent sealant, referenced as Everbuild Everflex Fire Mate Intumescent Sealant (EVERBUILD), was applied at every joint.

See Drawing 4, Appendix A for the Cement Board layout on the unexposed side.

6.3.3. Exposed side

The exposed side of the specimen consisted of a single layer of cement board, referred to as Cem-Rock eXtreme 12mm (CEMROCK), which measured 12mm in thickness, and was secured using self-drilling screws with dimensions of 5.5mm in diameter and 40mm in length (Ø x L), designated as Evolution 40 x 5.5mm screws (EVOLUTION). These screws were placed at 300mm intervals along the joists.

An intumescent sealant, referenced as Everbuild Everflex Fire Mate Intumescent Sealant (EVERBUILD), was applied at every joint.

See Drawing 4, Appendix A for the Cement Board layout on the exposed side.

6.3.4. Additional equipment

No additional equipment was installed on the sample.

6.4. VERIFICATION

The tested element was constructed in the Lab as described in Chapter 6 of this report.

7. TEST ASSEMBLY

7.1. DEFINITION OF THE TESTED SPECIMEN

The choice and the definition of this test specimen were carried out by the sponsor.

7.2. ASSEMBLY OF THE TESTED SPECIMEN

7.2.1.1. Supporting construction

The tested specimen was assembled within a refractory concrete frame supplied by EFECTIS.

- Drying duration: more than 28 days.
- Thickness of the frame: 300 mm.
- Opening in the frame: 3000 x 4000 mm (w x L).

7.2.1.2. Staff

The sample was built by the staff of the Sponsor.
The testing frame was supplied and installed on the furnace by the staff of the test laboratory.

8. TEST METHOD

8.1. PRELIMINARY CONDITIONING

The specimen was conditioned inside the test laboratory. Considering its composition and in conformity with the statement in paragraph 8.1 of the BS EN 1363-1:2020, the weight stability was therefore estimated to be reached on the day of the test.

8.2. THERMAL PROGRAM

The temperature rise inside the furnace above the ambient temperature was controlled according to the standard thermal program represented by the following function:

$$T = 345 \log_{10}(8t + 1) + 20$$

where :

t = *Time (min)*
T = *Furnace temperature at time t (°C)*

8.3. PRESSURE

In conformity with the requirements of the standard BS EN 1363-1:2020, the pressure inside the furnace was continuously controlled throughout the whole test, keeping a pressure of 20 ± 2 Pa 100 mm on the underside of the sample, i.e., 100mm below the outermost layer of the ceiling.

Taking into account the dimensions of the specimen and the location of the pressure sensor, the prescribed value was established at 15.6Pa.

8.4. SUPPORTING CONDITIONS AND LOAD APPLIED TO THE SAMPLE

8.4.1.1. Supporting conditions

The specimen was supported on the testing frame by a restrained support.

8.4.1.2. Loading conditions

The load was defined according to the Sponsor specification.
The load was applied in conformity with BS EN 1363-1:2020.
The loadbearing criteria were calculated according to BS EN 1363-1:2020.

The load was applied more than 15 minutes before the start of the test.

- Load applied: 2.5 kN/m^2 uniformly applied load on top of the cement board flooring (see Figure 2, Appendix B).
- Span between supporting lines (including half of the bearing length on each side): 4140mm.
- Distance between the loading: 1000 mm (centre to centre of each loading cage).
- D_{limit} = 136.70mm.
- $(dD/dt)_{limit}$ = 6.08mm/min.
- Limiting loadbearing criterion 1: 205.06mm deflection (D_{limit} x 1.5).
- Limiting loadbearing criterion 2: 136.70mm deflection (D_{limit}) and 6.08mm/min rate of deflection ($(dD/dt)_{limit}$).

See Figure 2, Appendix B for the layout of the loading apparatus.

8.5. FIRE SIDE

The sample was subjected to fire exposure from underneath, with a single layer of 12mm thick Cem-Rock eXtreme board (CEM-ROCK) positioned beneath the steel beam.

9. MEASUREMENTS DURING THE FIRE TEST AND TEST RESULTS

This section provides the details of the sensors used during the fire test. The locations of the sensors are shown in Appendix B.

9.1. TEMPERATURE MEASUREMENTS

9.1.1.1. Ambient temperature in the laboratory

The ambient temperature was measured according to the requirements of the standard BS EN 1363-1:2020, by a dedicated thermocouple. See Chart 1, Appendix C for the measurements recorded during the test.

9.1.1.2. Ambient temperature in the furnace

It was measured in conformity with the standard BS EN 1363-1:2020 by 8 plates thermocouples on the furnace with the metal facing towards the bottom of the furnace. See Chart 2, Appendix C for the measurements recorded during the test.

9.1.1.3. Temperatures of the specimen

The temperatures on the unexposed side of the specimen were measured by 17 thermocouples according to the requirements of the standard BS EN 1363-1:2020 and located according to the standard BS EN 1365-2:2014.

See Figure 1, Appendix B for the plot of the instrumentation, and Charts 5 to 6, Appendix C for the measurements recorded during the test.

Location	*Markings*	*Appendix*
On the centre of the quadrant	1, 2 ,4, 5	B
On the geometric centre of the specimen	3	
Adjacent to intersecting joints	7, 8, 9, 10, 11, 15, 16	
At mid-span, adjacent to a joint	12, 13, 14	
At mid-span, 150 mm from the edge of the sample	6, 17	

9.2. PRESSURE MEASUREMENTS

In conformity with the requirements of the standard BS EN 1363-1:2020, the pressure inside the furnace was continuously controlled throughout the whole test, according to the conditions described in section 8.3 of this document. See Chart 4, Appendix C for the measurements recorded during the test.

9.3. DEFLECTION MEASUREMENTS

In conformity with the requirements of the standard BS EN 1363-1:2020, the deflection of the sample was measured using calibrated wire type displacement gauges and recorded via a data acquisition system, near the edge and on the centre of the sample. See Figure 1 Appendix B for the plot of the instrumentation and Charts 10 and 11, Appendix C for the measurements recorded during the test.

Location	*Markings*	*Appendix*
Mid-span – 50 mm from the edge of the sample (“Logger box side”)	1	B
Centre of the sample	2	
Mid-span – 50 mm from the edge of the sample (“Wall side”)	3	

10. OBSERVATIONS

10.1. BEFORE THE TEST

- Ambient temperature inside the laboratory : 15°C.
- Specimen temperature before the test : 14°C.
- More than 15 minutes before the test : Loading of the sample.

During and after the loading, the deflection was monitored. The sample deflected as per the following: ***Channel 1***: 1.3mm, ***Channel 2***: 3.2mm and ***Channel 3***: 3.4mm.

10.2. DURING THE TEST

Time (min)	*Specimen*	*Observations*
00	**NES/ES**	**Start of the test.**
3	NES	A small amount of smoke was released from the long side edges.
9	NES	More smoke was released from the long side edges.
13	ES	NSC.
15	NES	Smoke was released from the perimeters.
30	ES	NSC.
35	ES	The mid portion joints turned black.
42	ES	NSC
45	NES	More smoke was released from the sides of the specimen.
57	ES	Flames on the long board joints.
60	NES	NSC
66	ES/NES	End of test at the request of the sponsor.

ES = Exposed side --- NES = Non-exposed side --- NSC = No Significant Change

10.3. AFTER THE TEST AND COOL DOWN

The centre of the specimen deflected towards to the furnace.

See Photographs 18 and 19, Appendix D.

11. FIRE RESISTANCE CRITERIA

In conformity with the standards mentioned in Chapter 1, the times during which the specimen meets the fire resistance criteria may be regarded as follows:

11.1. FIRE INTEGRITY

11.1.1.1. Cotton wool pad

Duration: **SIXTY-SIX MINUTES (66 Min)**
Cause of limitation: No Failure - End of test at the request of the sponsor.

11.1.2. Gap gauges

Duration: **SIXTY-SIX MINUTES (66 Min)**
Cause of limitation: No Failure - End of test at the request of the sponsor.

11.1.3. Sustained flaming

Duration: **SIXTY-SIX MINUTES (66 Min)**
Cause of limitation: No Failure - End of test at the request of the sponsor.

11.2. THERMAL INSULATION

11.2.1. Thermal insulation

Duration: **SIXTY-SIX MINUTES (66 Min)**
Cause of limitation: No Failure - End of test at the request of the sponsor.

11.3. LOAD-BEARING CAPACITY

11.3.1. Criterion 1 (1.5x D_{Limit})

Duration: **SIXTY-SIX MINUTES (66 Min)**
Cause of limitation: No Failure - End of test at the request of the sponsor.

11.3.2. Criterion 2 (D_{Limit} **and** $(dD/dt)_{Limit}$

Duration: **SIXTY-SIX MINUTES (66 Min)**
Cause of limitation: No Failure - End of test at the request of the sponsor.

12. FIELD OF DIRECT APPLICATION OF THE TEST RESULTS

The direct application field of the test results is limited to the determination of the permissible modifications of the test specimen following a successful fire resistance test. These modifications may be automatically introduced without the sponsor having to apply for any additional assessment, calculation, or agreement.

Note: When extended prescriptions concerning the dimensions of the element are considered, lower dimensions than the actual dimensions may be used for some elements of the test specimen in order to maximize the extrapolation of the test results by modelling the interaction between the elements at the same scale.

As the laboratory was not responsible for the sampling stage, the test results only apply to the tested specimen.

The test results are directly applicable to a similar untested floor or roof construction provided the following is true:

a) With respect to the structural building member:

- The maximum moments and shear forces, which when calculated on the same basis as the test load, shall not be greater than those tested.

b) With respect to the ceiling system:

- The size of panels of the ceiling lining may be increased by a maximum of 5% but limited to a maximum of 50 mm. The length of the grid members can be increased accordingly.
- The total area occupied by fixtures and fittings relative to the area of the ceiling lining is not increased and the maximum tested opening in the lining is not exceeded.

c) With respect to the cavity:

- The height of the cavity h and the minimum distance d between the ceiling and the structural members are equal to or greater than those tested.
- No material is added to the cavity unless the same amount (in terms of both weight and fire load) of material was included in the test specimen.

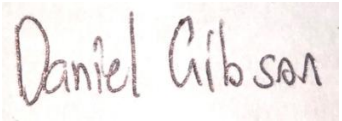
13. STATEMENT

"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, and where appropriate EN 1363-2. 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."

"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".

!4th March 2024

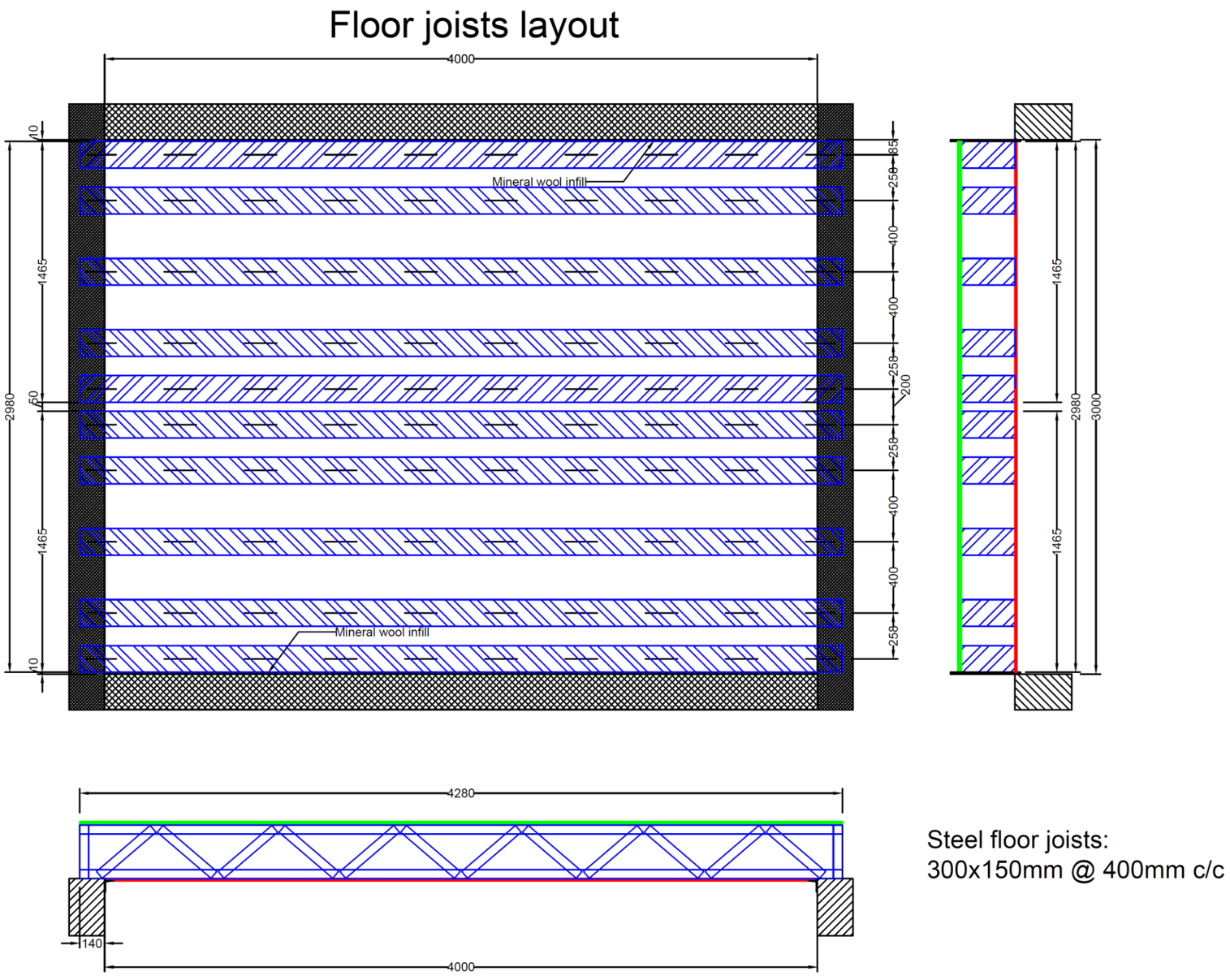
SIGNED **APPROVED**



Daniel Gibson
Project leader

Maurice McKee
Lab Manager

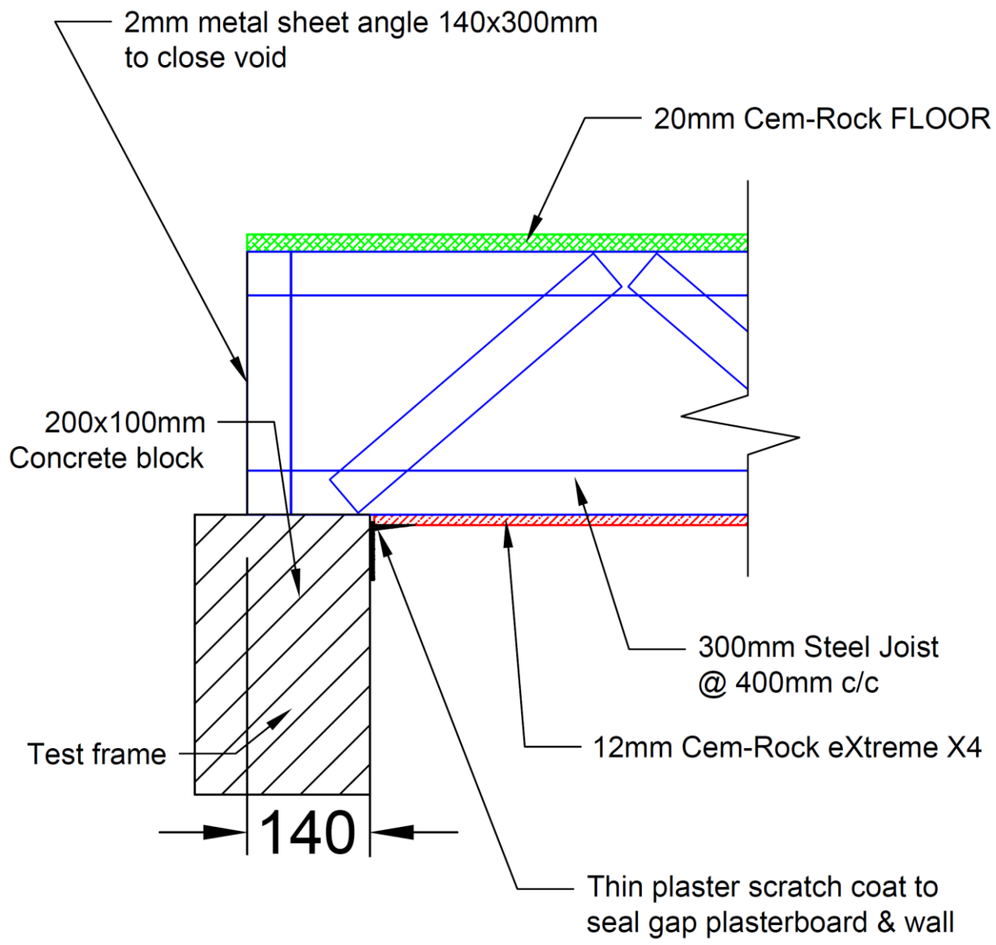
APPENDIX A: DRAWINGS



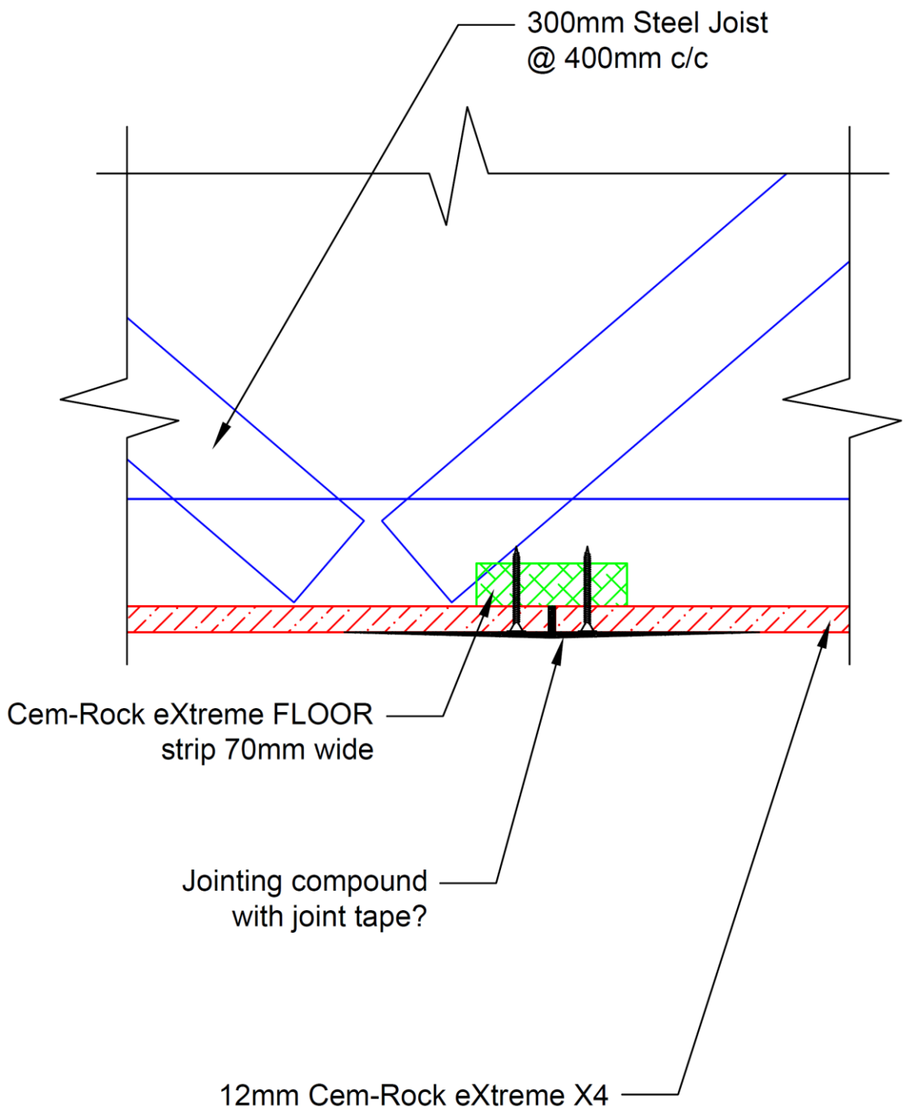
Steel floor joists:
300x150mm @ 400mm c/c

Drawing 1 – Drawing provided by the test Sponsor.

Joist support

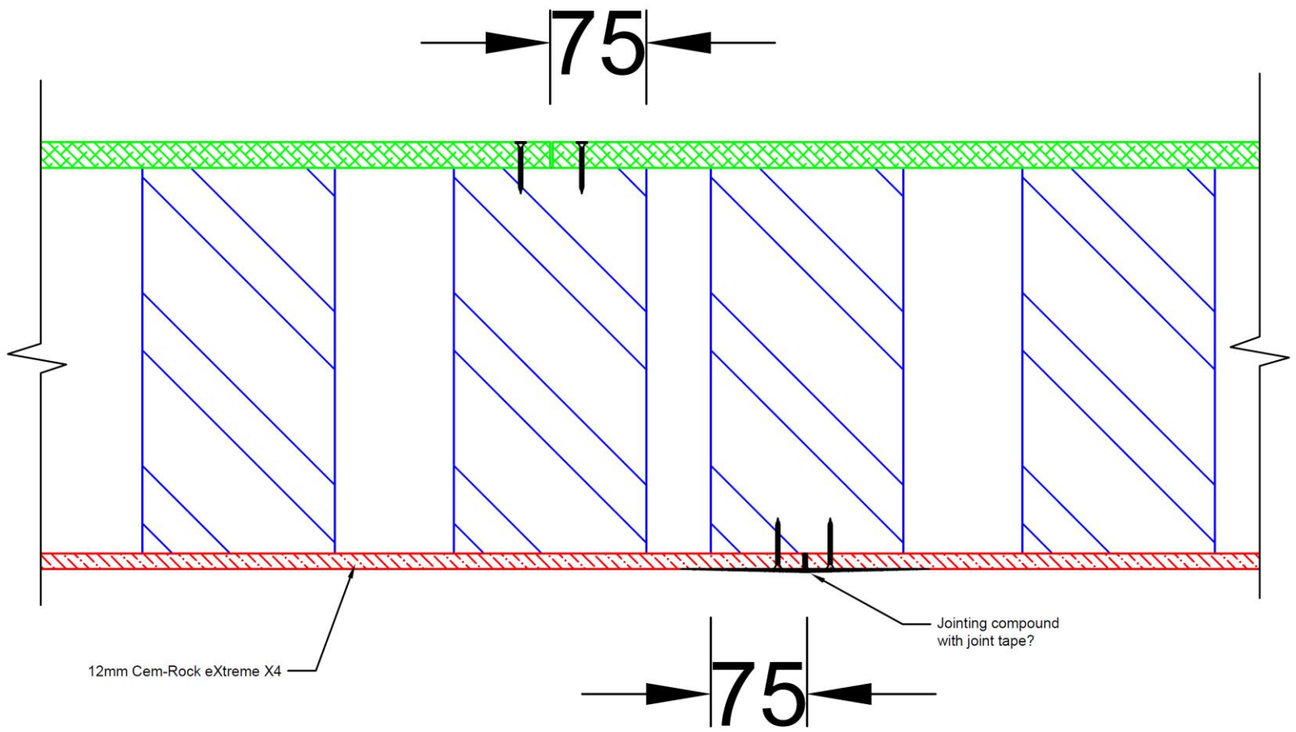


Ceiling board cross joint



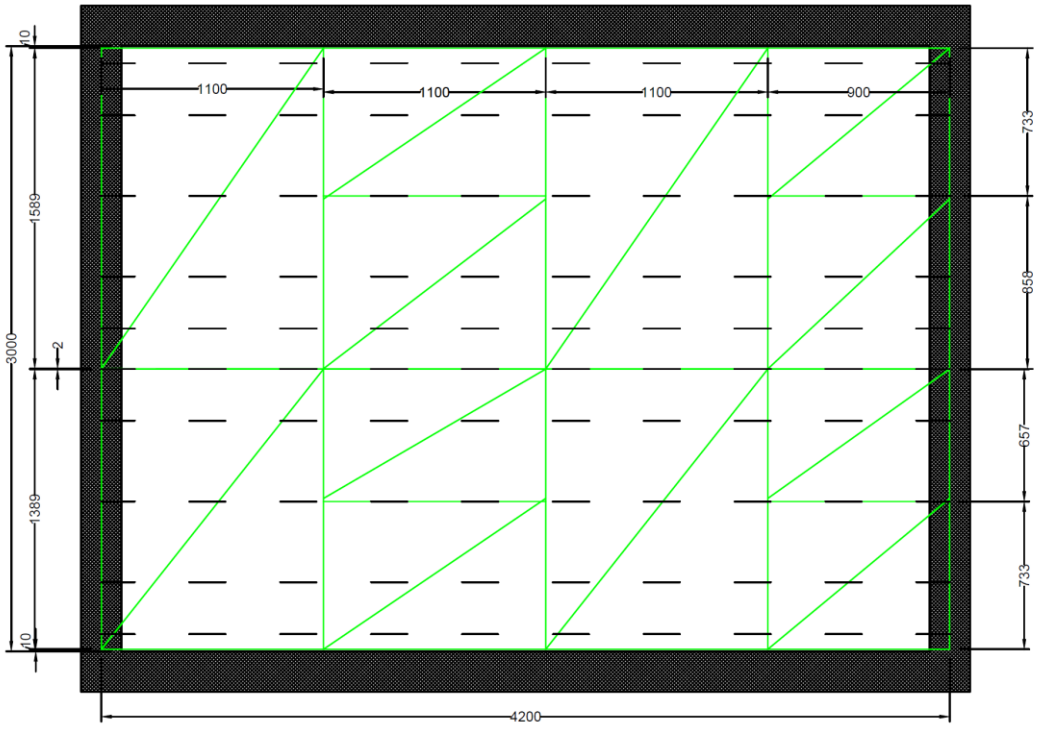
Drawing 2 – Drawing provided by the test Sponsor.

Joint between panels



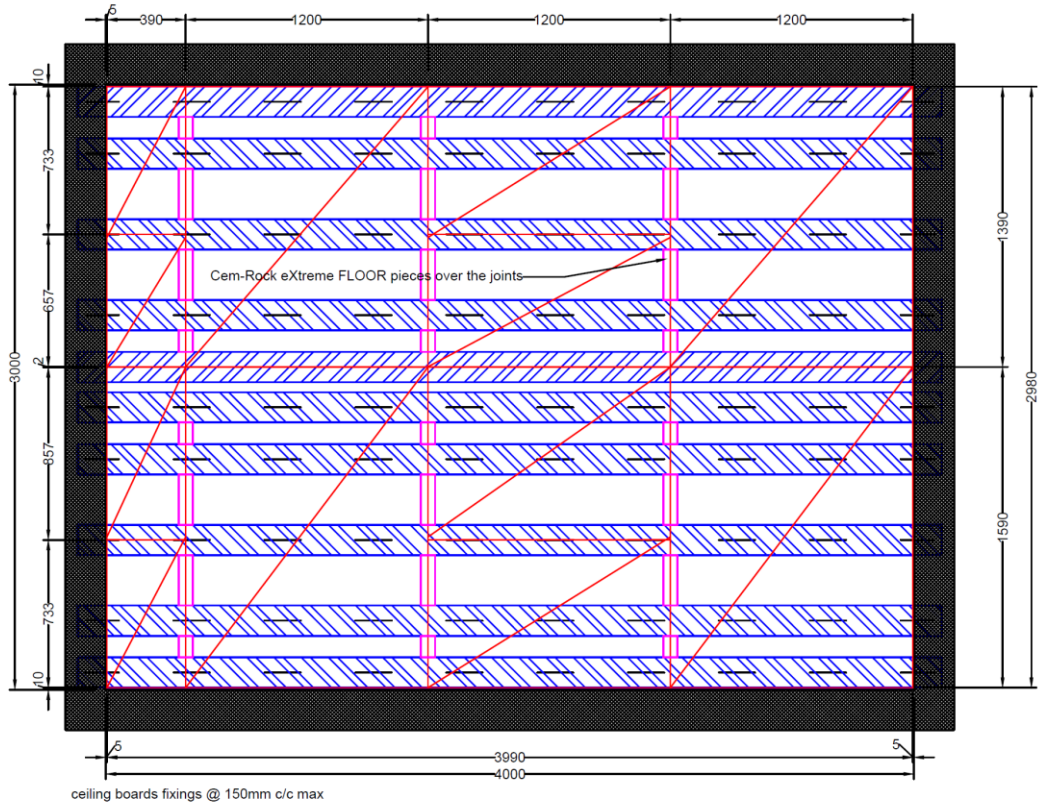
Drawing 3 – Drawing provided by the test Sponsor.

20mm floor board plan



Cem-Rock FLOOR fixings @ 200mm c/c at perimeter edge and 300mm c/c at in the interior supports.

12mm Cem-Rock eXtreme ceiling board plan (view from the top)



ceiling boards fixings @ 150mm c/c max

Drawing 4 – Drawing provided by the test Sponsor.

APPENDIX B: INSTRUMENTATION

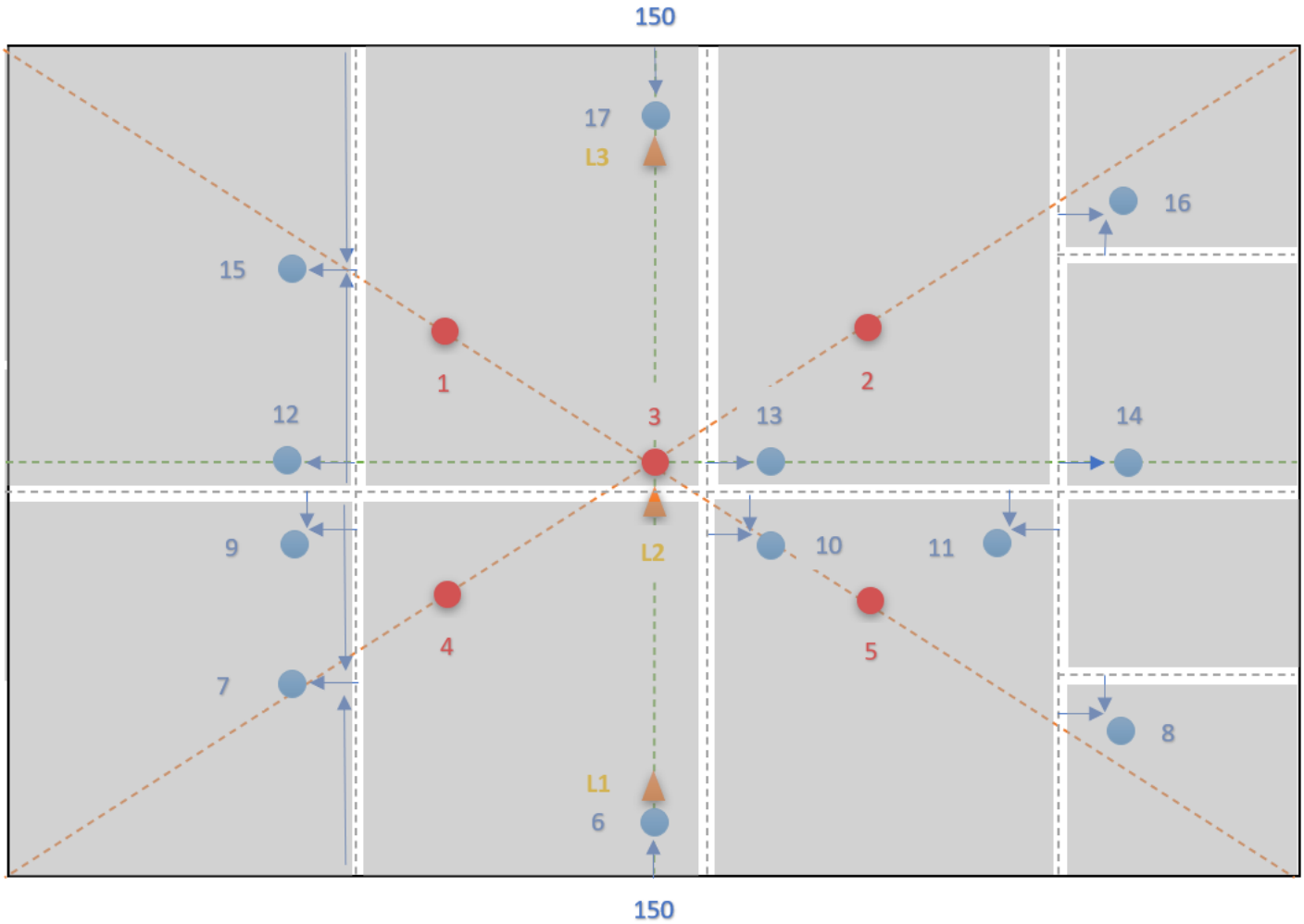


Figure 1 – Plot of the instrumentation installed on the unexposed side of the sample.

All Distance in mm, drawing not to scale.

Thermocouples 1 to 5 to be installed no less than 50mm from hotspots(joints, screws, etc).

Remaining thermocouples to be installed no less than 20mm from hotspots.

- Thermocouples for average Temperature rise (1 – 5).
- Thermocouples for maximum Temperature rise (6 – 17).
- LVDTs (L1 – L3).

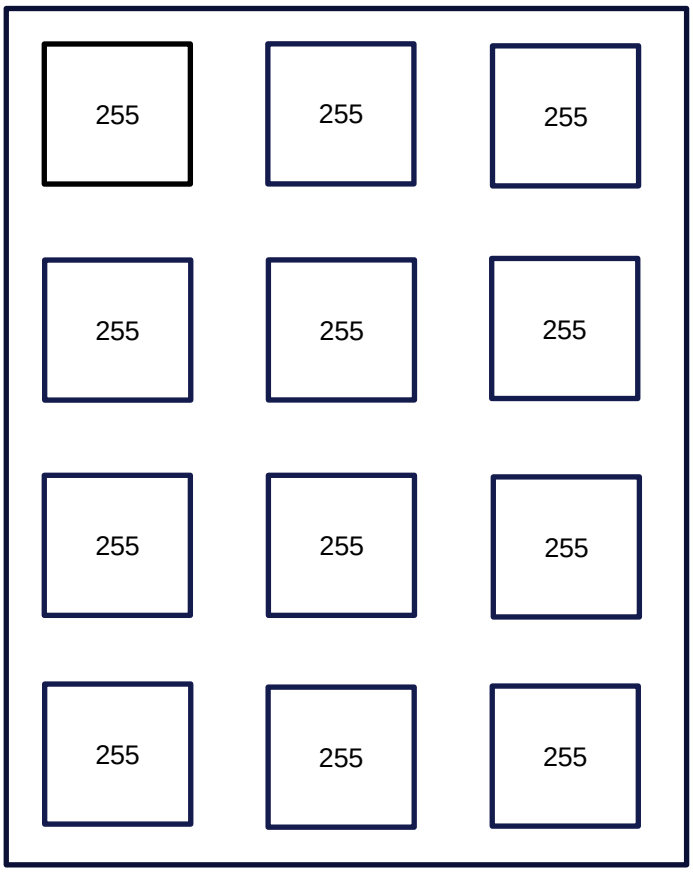


Figure 2 - Layout of the load distribution across the unexposed side of the sample.

Note:
Expressed in kilograms per loading unit.
Drawing not to scale.

APPENDIX C: CHARTS

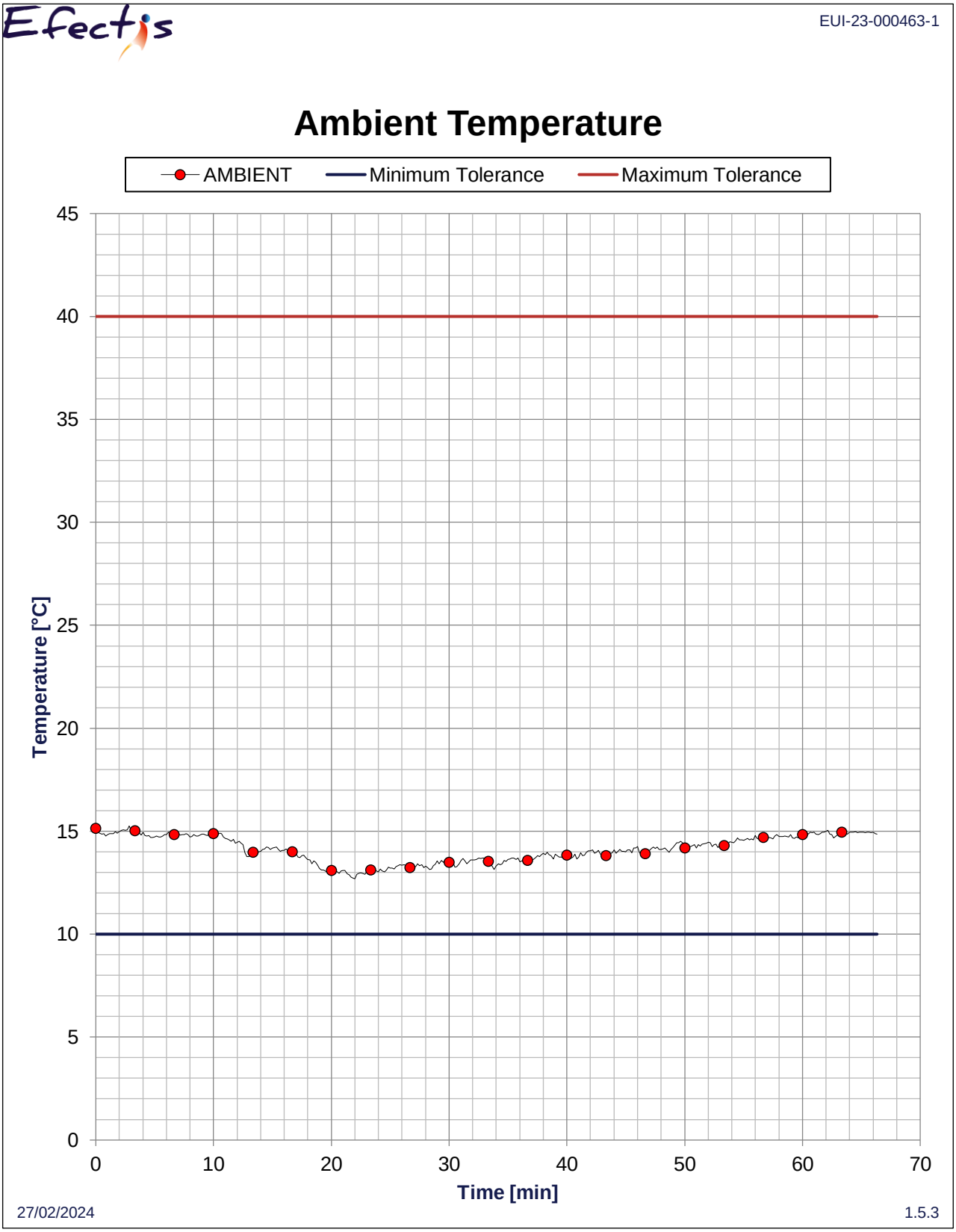


Chart 1 - Ambient temperature inside the laboratory during the test.

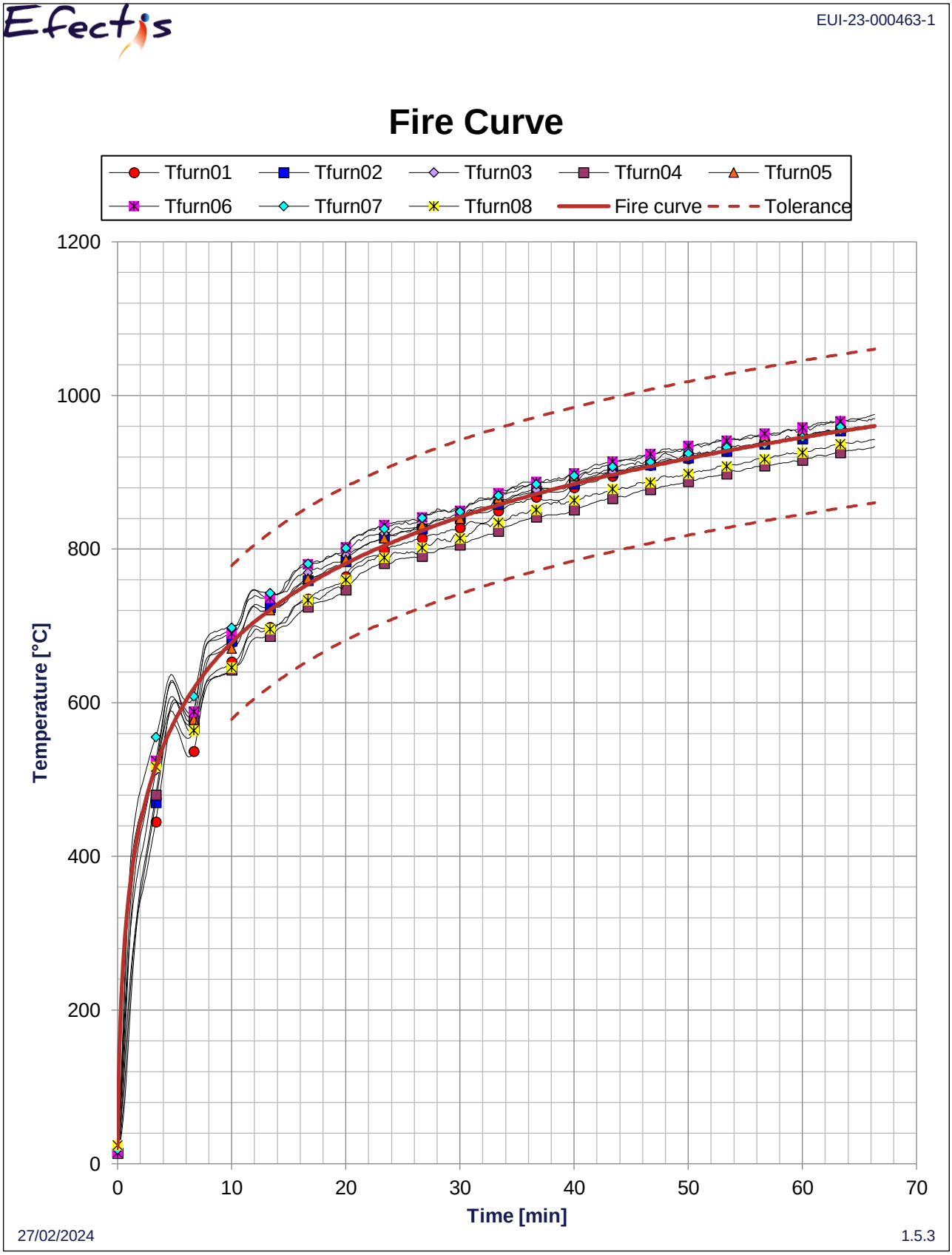


Chart 2 - Temperature inside the furnace, including the standard fire curve as reference.

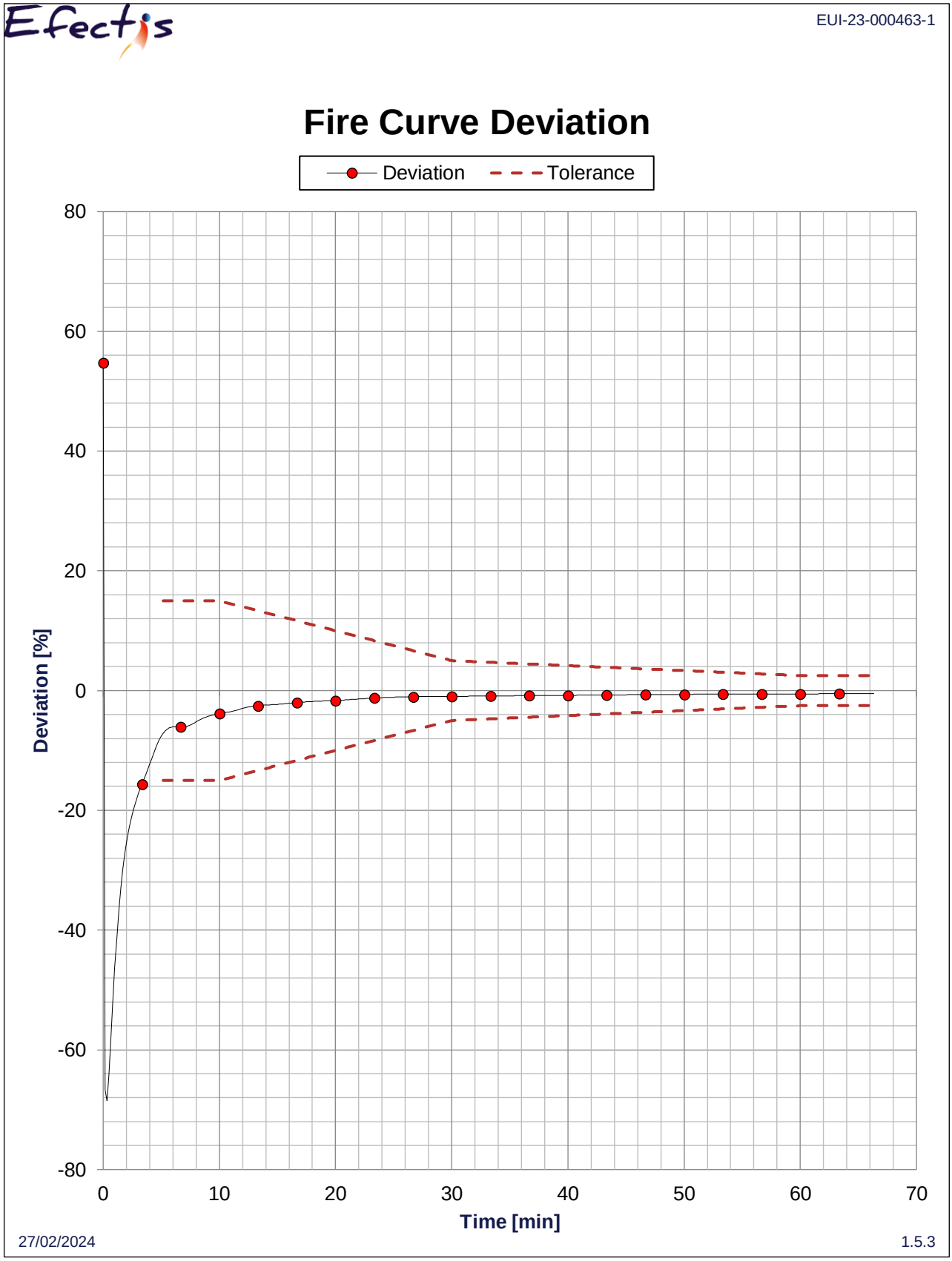


Chart 3 - Deviation from the theoretical fire curve.

EUI-23-000463-1

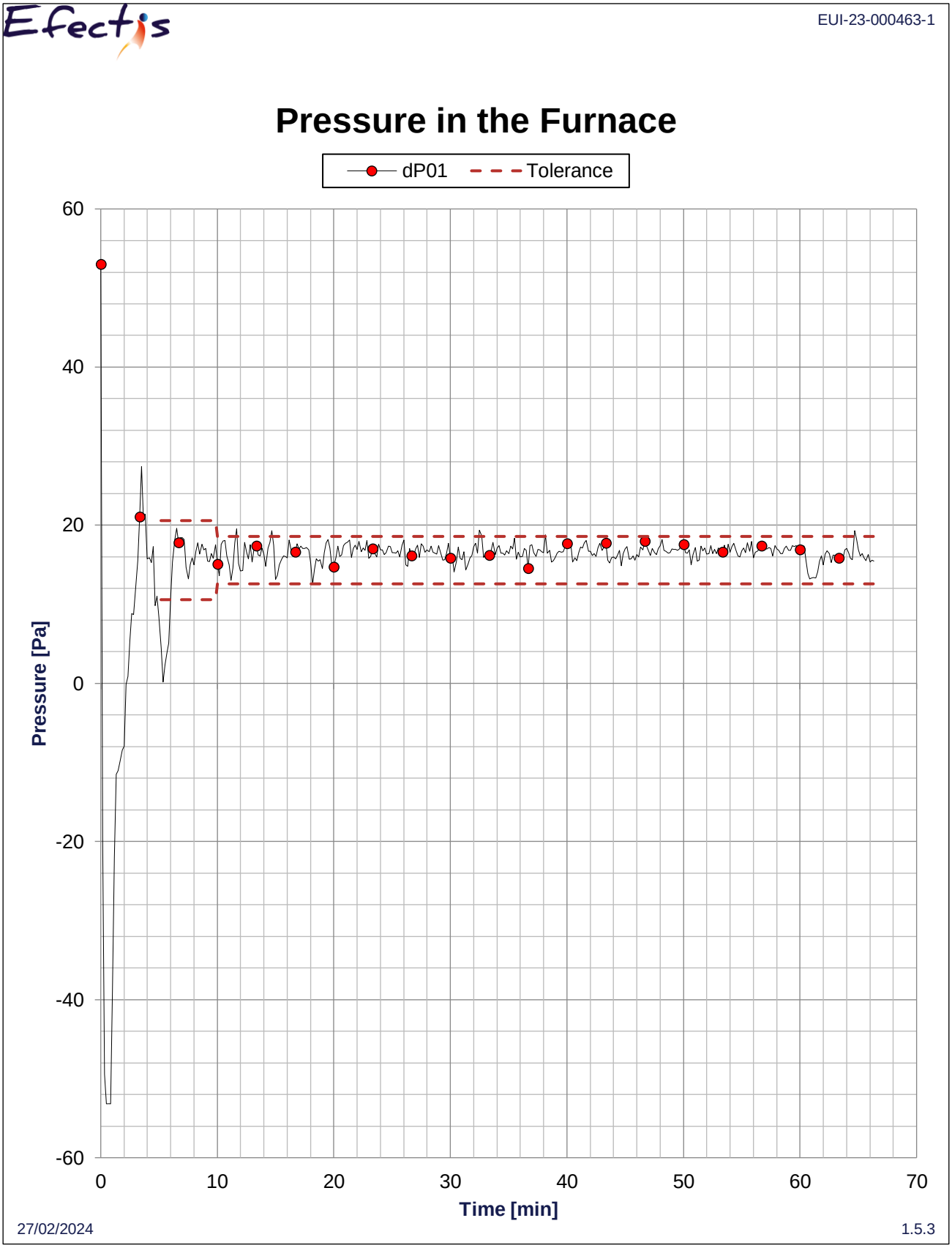


Chart 4 - Pressure conditions inside the furnace.

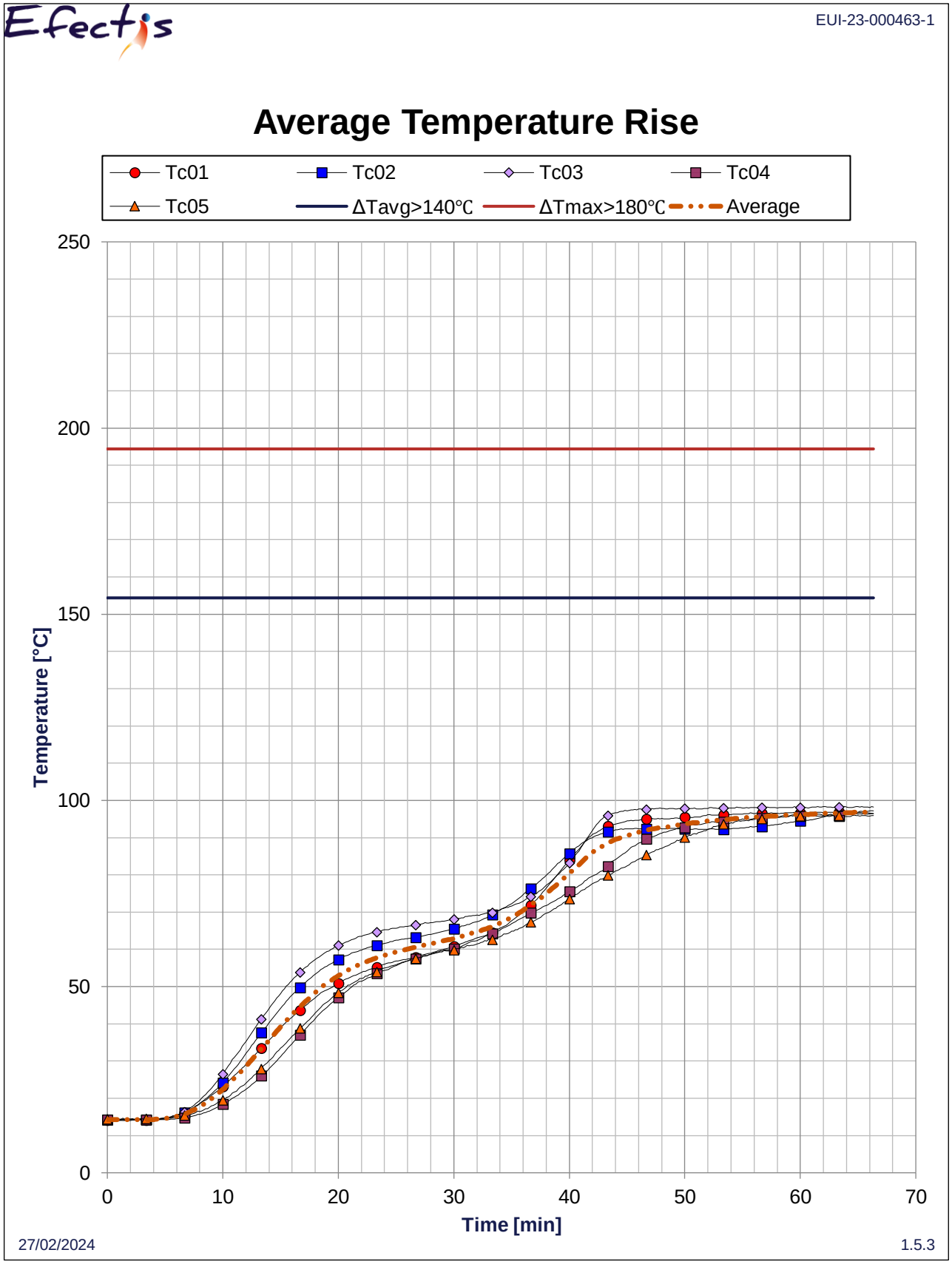


Chart 5 - Average temperature rise on the unexposed surface of the sample.

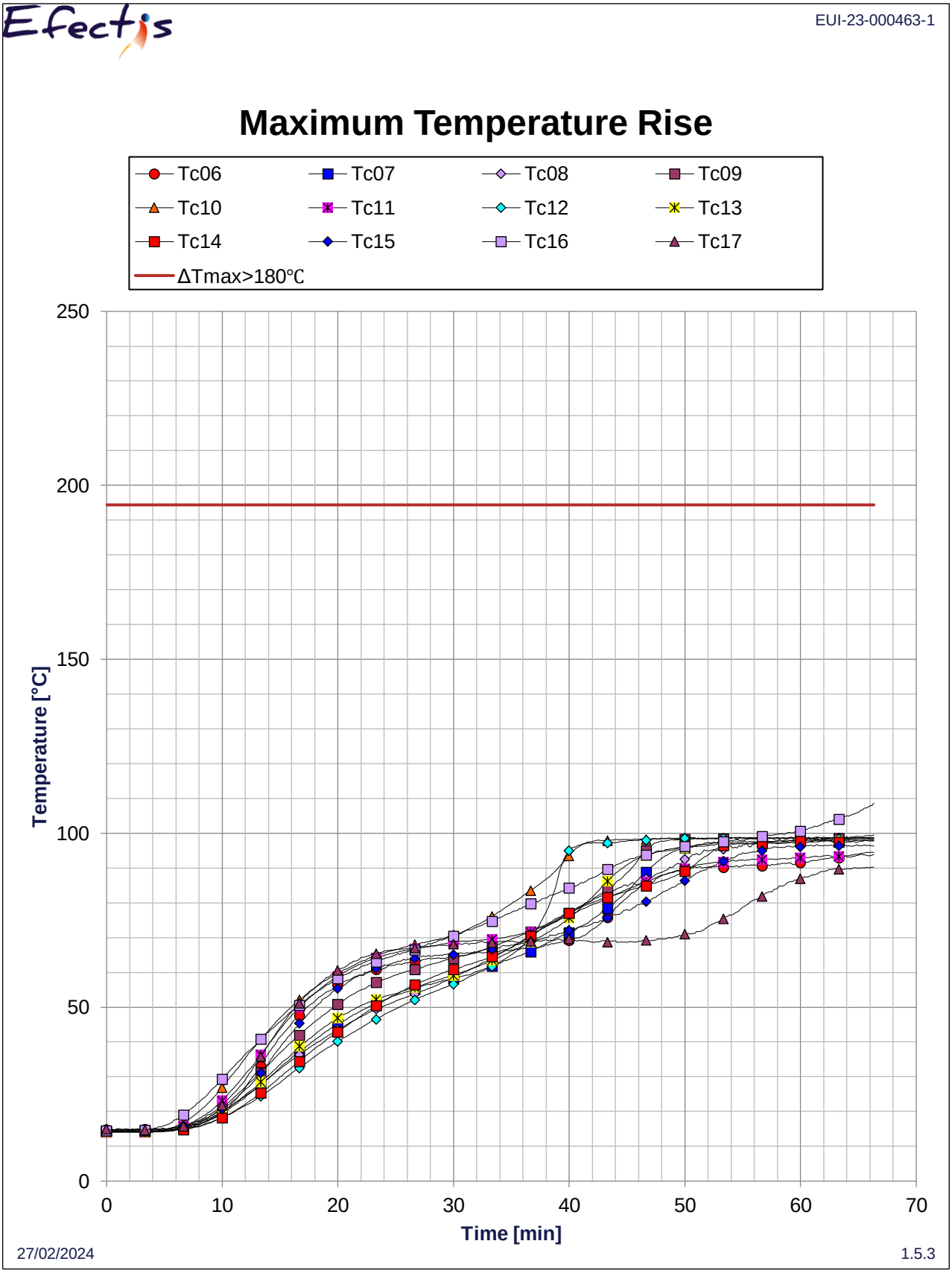


Chart 6 - Maximum temperature rise on the unexposed surface of the sample.

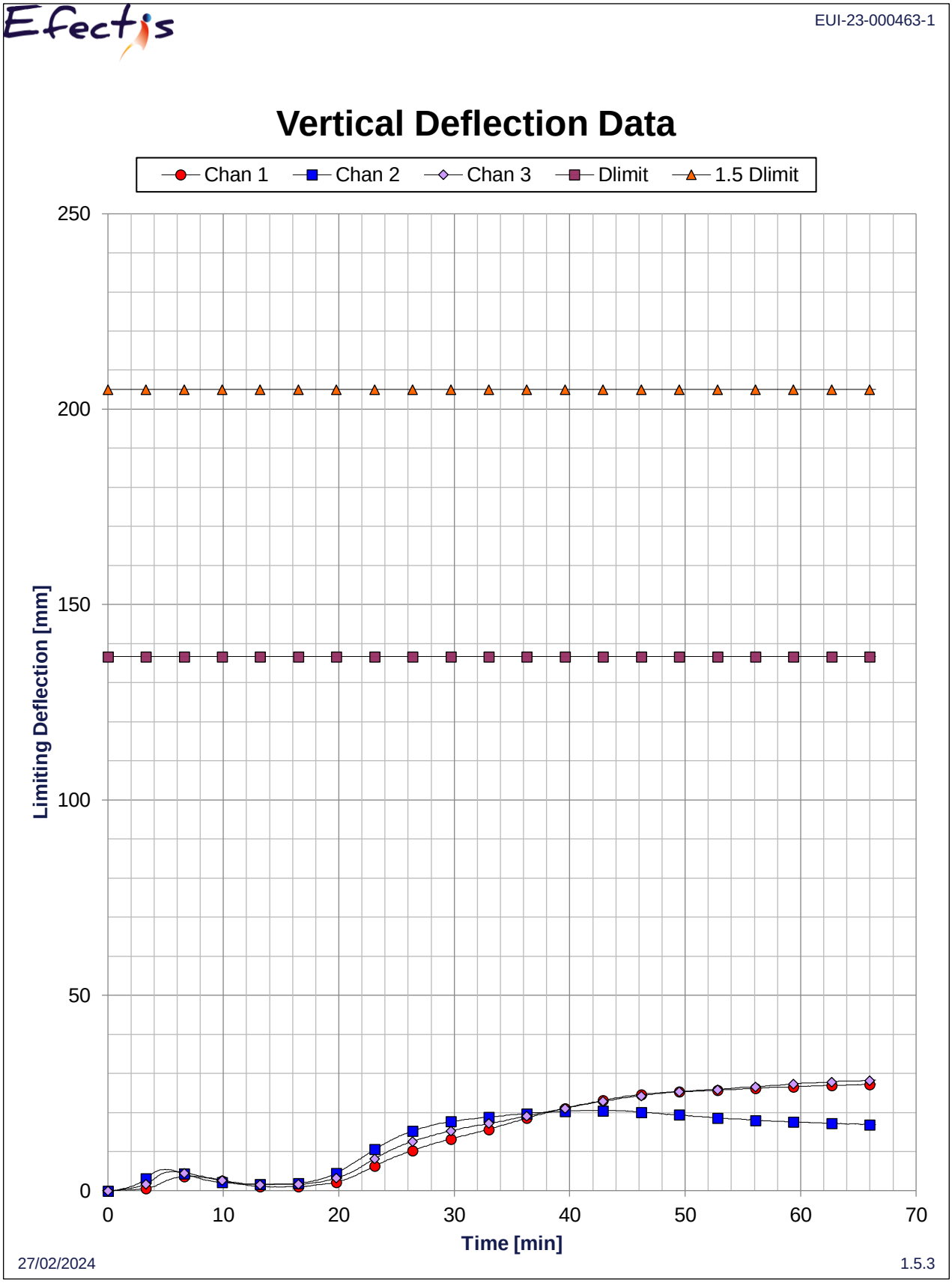


Chart 7 – Vertical deflection recorded during the test.

EUI-23-000463-1

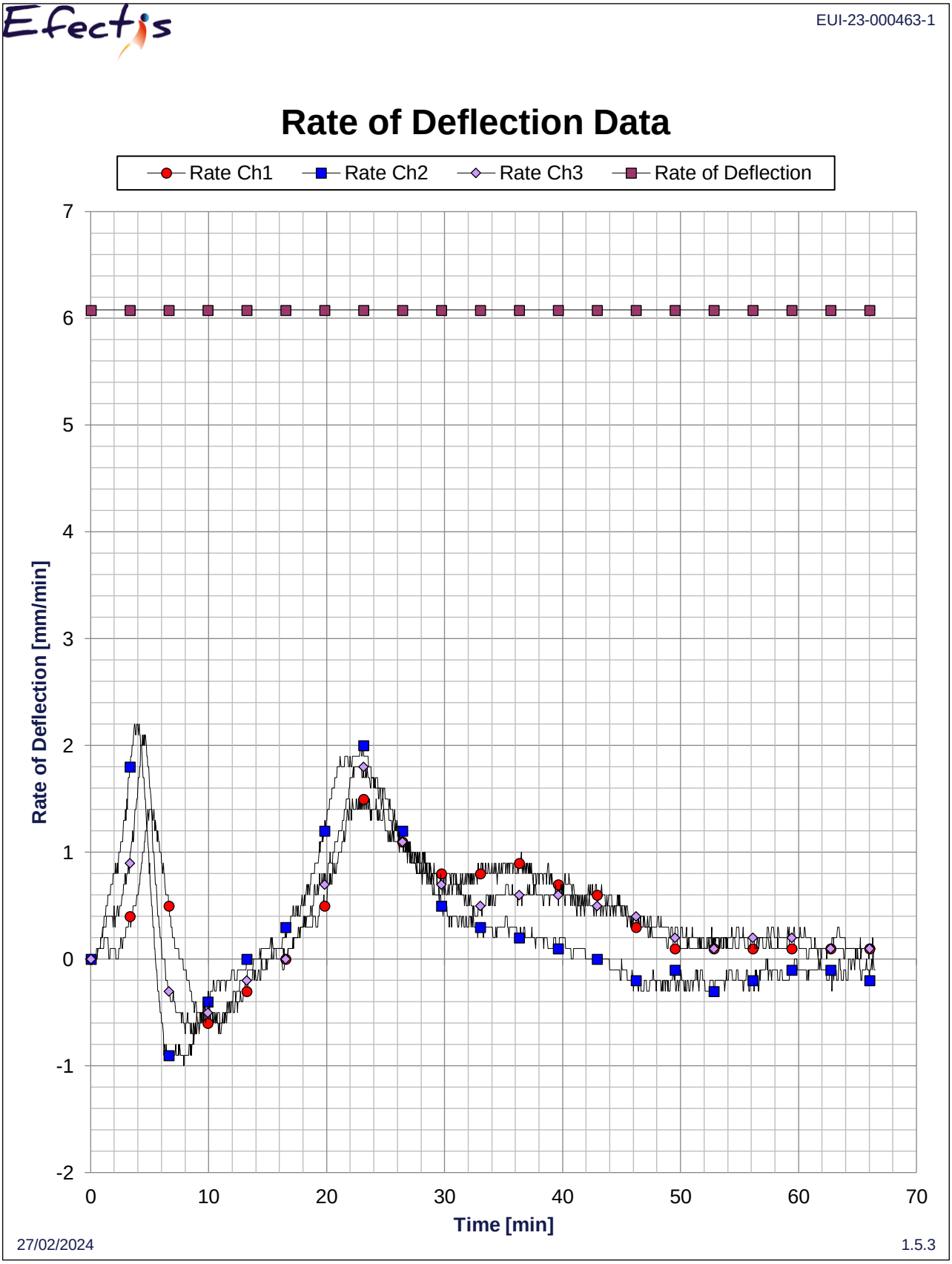
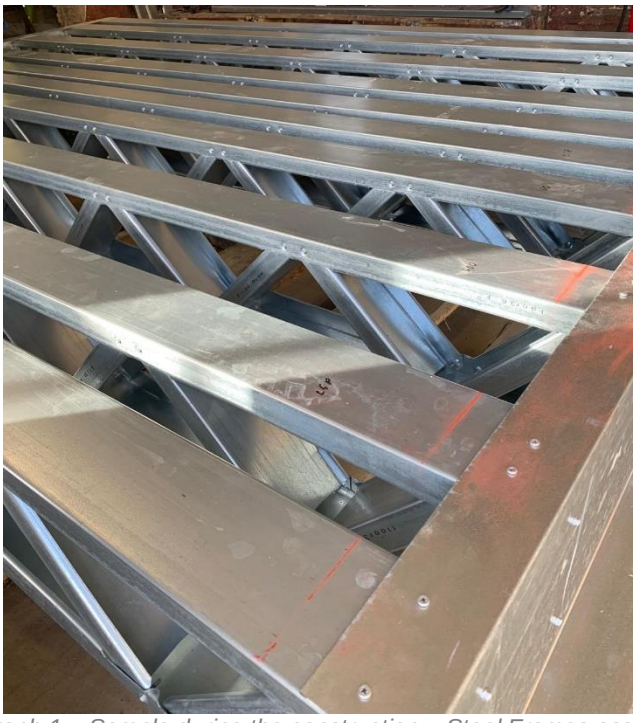


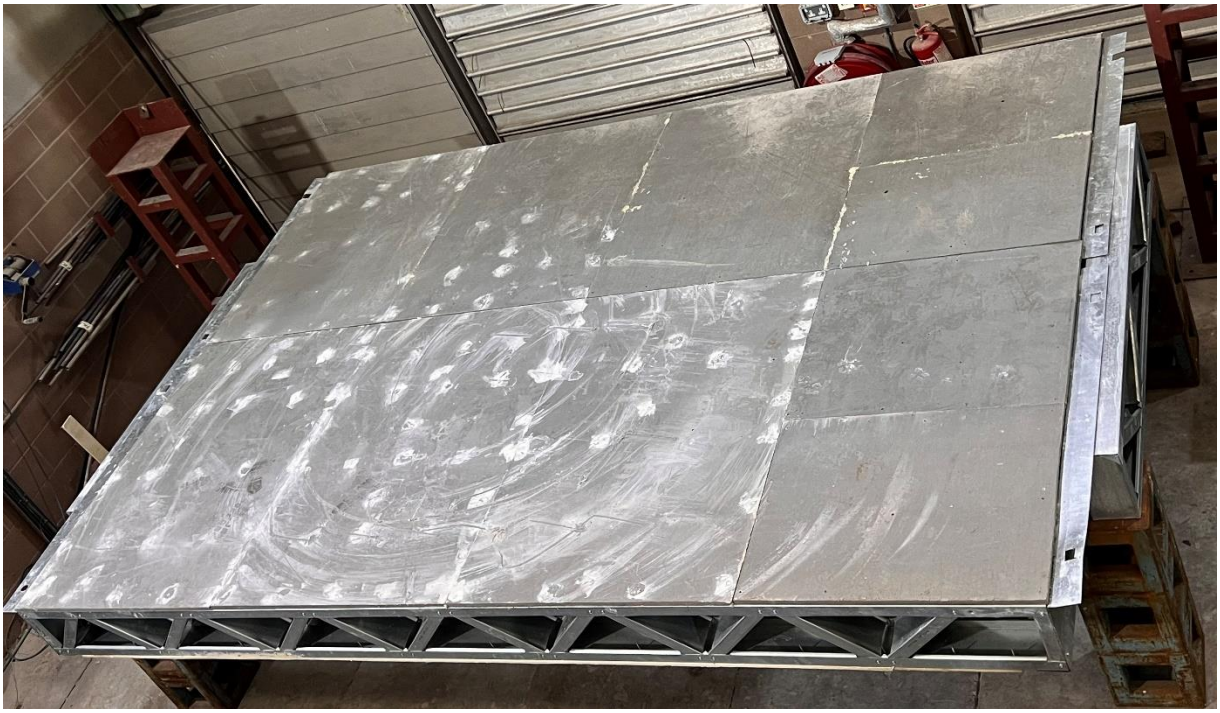
Chart 8 – Rate of vertical deflection recorded during the test.

APPENDIX D: PHOTOGRAPHS



Photograph 1 – Sample during the construction – Steel Frames assembled.

Photograph 2 – Sample during the construction – Ceiling Panels fitting in steel frame.



Photograph 3 – Sample during the construction – Unexposed side of the specimen.

Photograph 4 - Detail of the unexposed side of the sample with side infill.

Photograph 5 - Detail of the exposed side of the sample before the test.

Photograph 6 - Detail of the unexposed side of the sample before the test.

Photograph 7 - Detail of the unexposed side of the sample during the test. Photograph taken during minute 9.

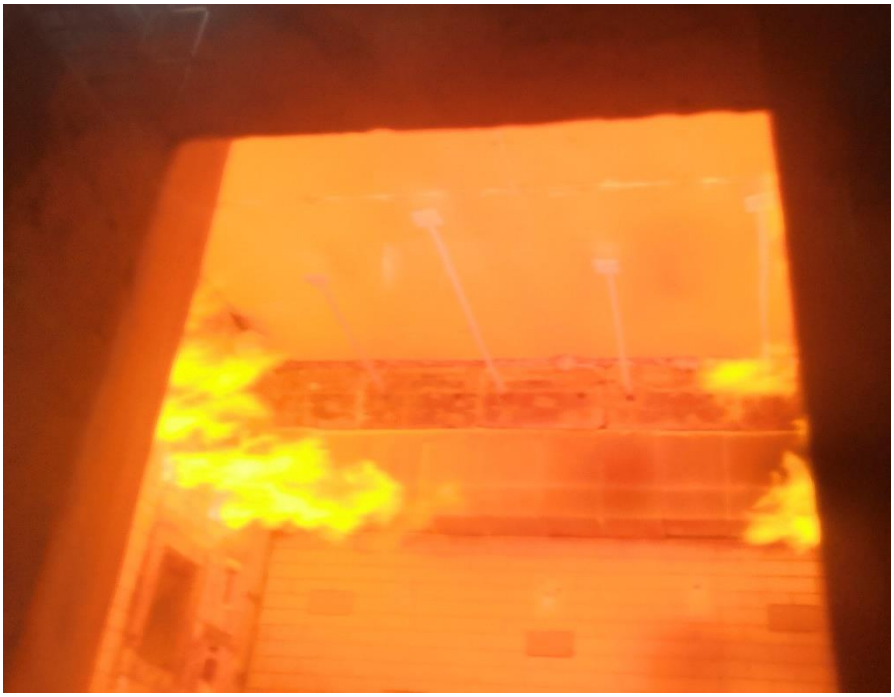
Photograph 8 - Detail of the exposed side of the sample during the test. Photograph taken during minute 13.

Photograph 9 - Detail of the unexposed side of the sample during the test. Photograph taken during minute 15.

Photograph 10 - Detail of the exposed side of the sample during the test. Photograph taken during minute 25.

Photograph 11 - Detail of the unexposed side of the sample during the test. Photograph taken during minute 30.

Photograph 12 - Detail of the exposed side of the sample during the test. Photograph taken during minute 35.



Photograph 13 - Detail of the exposed side of the sample during the test. Photograph taken during minute 42.

Photograph 14 - Detail of the unexposed side of the sample during the test. Photograph taken during minute 45.

Photograph 15 - Detail of the exposed side of the sample during the test. Photograph taken during minute 57.

Photograph 16 - Detail of the unexposed side of the sample during the test. Photograph taken during minute 60.

Photograph 17 - Overall view of the unexposed side of the sample at the end of the test.

Photograph 18 - Detail of the exposed side of the sample after the test.

Photograph 19 - Overall view of the unexposed side of the sample during dismantling.

END OF THE TEST REPORT