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REPORT

Determination of the resistance to fire, according to EN 1365-2:2014 of a wooden floor construction protected with Envirograf® Intumescent timber frame fire retardant coating system 42 HW01

Report no.	2018-Efectis-R000437
Sponsor	Intumescent Systems Ltd Envirograf House Barfrestone CT15 7JG DOVER Great-Britain
Product name	Product 42 HW01
Prepared by	Efectis Nederland BV
Notified body no.	1234
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Issue	1
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CONTENTS

1. GENERAL

1.1 REPORT

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.

1.2 SUBJECT

An insulated wooden floor construction protected with Envirograf® Intumescent timber frame fire retardant coating system product 42 HW01.

1.3 INVESTIGATION

Determination of fire resistance according to EN 1365-2; Fire resistance tests of loadbearing elements : part 2 Floors and Roofs.

1.4 SPONSOR AND MANUFACTURER

Sponsor and Manufacturer
Intumescent Systems Ltd Envirograf House Barfrestone CT15 7JG DOVER Great-Britain

1.5 PLACE AND DATA REGARDING THE EXAMINATION

The research was conducted at the laboratory of Efectis Nederland BV in Bleiswijk, the Netherlands.

Assembly-of the test specimen	29, 30, 31 January and 1 February 2018
Fire resistance tests	6 February 2018

1.6 NORMATIVE REFERENCES

European standard	**Part**
EN 1363-1: 2012	Fire resistance tests - Part 1: General Requirements
EN 1365-2:2014	Fire resistance tests for loadbearing elements - Part 2 : floors and roofs
EN 13501-2: 2016	Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests excluding ventilation services

1.7 REVISION INFORMATION

This is the first issue of the test report.

2. TEST SPECIMEN

2.1 GENERAL

For the dimensions and specifications of the materials and components of the examined construction, also see the figures in chapter 8. Details of the assembly of the construction are given in the paragraphs below.
The density and moisture content of the relevant used building materials defined by the sponsor and measured by Efectis are mentioned in the table in paragraph 4.3 if applicable.

2.2 TEST SPECIMEN

The test specimen was a loadbearing wooden floor construction protected with Envirograf® Intumescent timber frame fire retardant coating system product 42 HW01.

2.2.1 Test frame

The test frame was constructed of steel profiles. The inner dimensions of the frame were 4.3 x 3.5 m, the heated area was 4 x 3.2 m.

2.2.2 Supporting construction

In the horizontal steel frame an aerated concrete supporting construction was built to support the wooden floor construction. This supporting construction had the following specifications

Specifications	
Material	Aerated concrete
Internal dimensions	4000 x 3200 mm
Density	650 kg/m^3 ± 200 kg/m^3
Thickness	150 mm

2.2.3 Wooden floor construction

Specifications	
Overall dimensions	4000 x 3200 mm
Wooden beams	Ash
Dimensions	65 x 220 mm
Centre to centre distance beams	455 mm
Wooden floorboards	Ash, tongue and groove
Thickness	33 mm
Width	125 mm
Fixing of floor boards	Screws, dimensions 3.5 x 50 mm

Specifications	
Position of fixings	Fixing of floor board in every joist, 2 nails p/joist
Free edges	The floor had two free edges, the span length was 3.2 m

2.3 COATING

On the wooden floor Envirograf® Intumescent timber frame fire retardant coating system HW-01 was applied.

Specifications	
Primer	
Type	HWAP water based adhesion primer
Number of layers	1
Drying time between layers	Between 2 and 3 hours
Coating	
Type	product 42 HW01 white intumescent coating
Number of layers	2
Drying time between layers	Between 1 and 2 days
Top coat	
Type	HW acrylic white, emulsion coating
Number of layers	1

2.4 SEALING

The perimeter of the floor and joists were sealed with Envirograf, Intumescent acrylic mastic, product 58.

2.5 METHOD OF ASSEMBLY

The test specimen was built in the following order:

- Placing the joists on the aerated concrete supporting construction;
- Fixing of the floorboards on the joists;
- Sealing of the edges with mineral wool;
- Applying of the primer underneath the floor construction;
- Applying of the coating underneath the floor construction;
- Applying of the top coat underneath the floor construction.

3. ASSEMBLY AND MANUFACTURING OF THE CONSTRUCTION

Efectis Nederland BV Centre for Fire Safety	Supplying test frame Supplying supporting construction Mounting wooden floor construction
Intumescent Systems Ltd	Protection of the wooden floor construction with coating

4. RESEARCH METHOD

4.1 VERIFICATION OF THE SPECIMEN

Efectis Nederland BV was not involved in the selection of the materials to be tested.
Based on the information and samples provided by the sponsor the materials and parts used during construction were verified according to EN16034.

4.2 CONDITIONING TEST SPECIMEN

From the moment of assembly until the fire resistance test the specimen was stored in the laboratory of Efectis Nederland BV under the following conditions.

Conditions	
Ambient temperature:	20 ± 5°C
Relative humidity:	50 ± 10 %

4.3 DENSITY AND MOISTURE CONTENT

Material	**Density [kg/m^3]**	**Moisture content [%]**
Beams	624	9.7
Floor boards	799	8.3

4.4 FIRE TEST

4.4.1 Test conditions

The fire test was carried out according to EN 1365-2 and EN 1363-1.
During heating the ambient temperature fulfilled the requirements of EN 1363-1, see annex A.
The aimed pressure in the furnace was maximum 20 Pa at 100 mm below the specimen. Due to the desired furnace pressure, the pressure set at a height of 1.2 m below the specimen was 10.5 Pa.

4.4.2 Measurements

During the heating the following data was measured and registered (see appendix B):

Furnace conditions

- The temperatures in the furnace using plate thermocouples, equally spread over the heated surface
- The pressure in the furnace.

Specimen

- Surface temperatures of the test specimen
- Deflection of the test specimen.

Environment

- The temperature in the laboratory outside the furnace.

The positions of the thermocouples and displacement measurements are given in appendix B.

4.4.3 Load

The test specimen was loaded with a total load of 1.73 kN/m².

5. RESULTS OF THE FIRE RESISTANCE TEST

5.1 OBSERVATIONS DURING HEATING

Time (min)	F/N	Observations F = Fire side, N = Non-fire side
0	F	Start of heating
3	N	Smoke appears out of the free edge
14	N	Smoke appears out of the seams of the floorboards, near thermocouple 5
20	N	Amount of smoke increases and smoke appears out of more seams
25	N	The floor discolours black at the seam near thermocouple 4
30	N	Applying the roving thermocouple at the discolouring: T= 49°C
35	N	The coating on the joists is foaming at the unexposed side of the joist
44	N	The discoloured place does not change
55	N	More discoloured spots appear at the seams of the floorboards
55	N	Orange glowing in the corner of the floor, near thermocouple 2
57	N	Flaming > 10s near thermocouple 1 & 5
58	F	End of heating after consulting the client

5.2 UNCERTAINTY OF MEASUREMENT

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

5.3 PHOTOGRAPHS

The photographs during assembly, before, during and (when applicable) after the fire test are shown in appendix C.

6. SUMMARY OF TEST RESULTS

Determination of the fire resistance according to EN 1365-2 of a loadbearing wooden floor construction coated with Envirograf® Intumescent timber frame fire retardant coating system product 42 HW01, thickness approx. 250 microns.

Summary of test results

Criterion	**Time (min.)**	**Result**
Loadbearing capacity (R)		
▪ Deflection, limit 116 mm	57	16 mm
▪ Rate of deflection, limit 5.2 mm/min	57	10 mm/min
Integrity (E)		
▪ Cotton pad	57	Not determined
▪ Gap Gauge:		
Ø 6 mm	57	Not determined
Ø 25 mm	57	Not determined
▪ Sustained flaming > 10 seconds	57	Failure
Insulation (I)		
▪ Average temperature	57	No failure
▪ Maximum temperature	57	No failure
The heating was terminated after 58 minutes after consulting the client.		
Classification according to EN 13501-2 could be described in a separate report. The construction could be classified as follows: RE 30, REI 30 and REI 45		

7. FIELD OF DIRECT APPLICATION OF TEST RESULTS

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.

P.G.R. Scholten B.Sc.
Project leader resistance to fire

R.D. Scheepe B.Sc.
Project leader resistance to fire

8. FIGURES

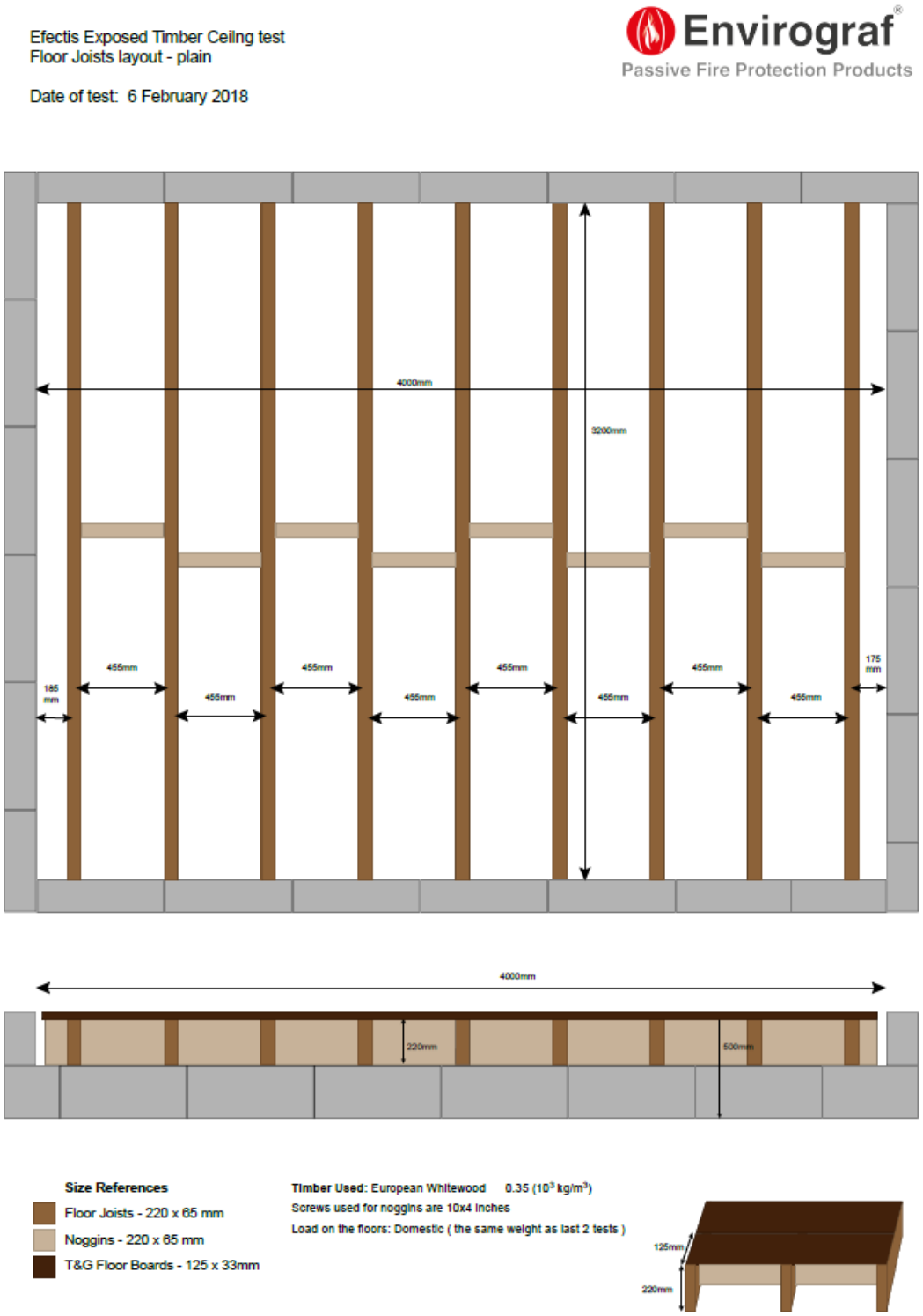

Figure 1 Test specimen lay out

APPENDIX A: FURNACE CONDITIONS AND AMBIENT TEMPERATURE

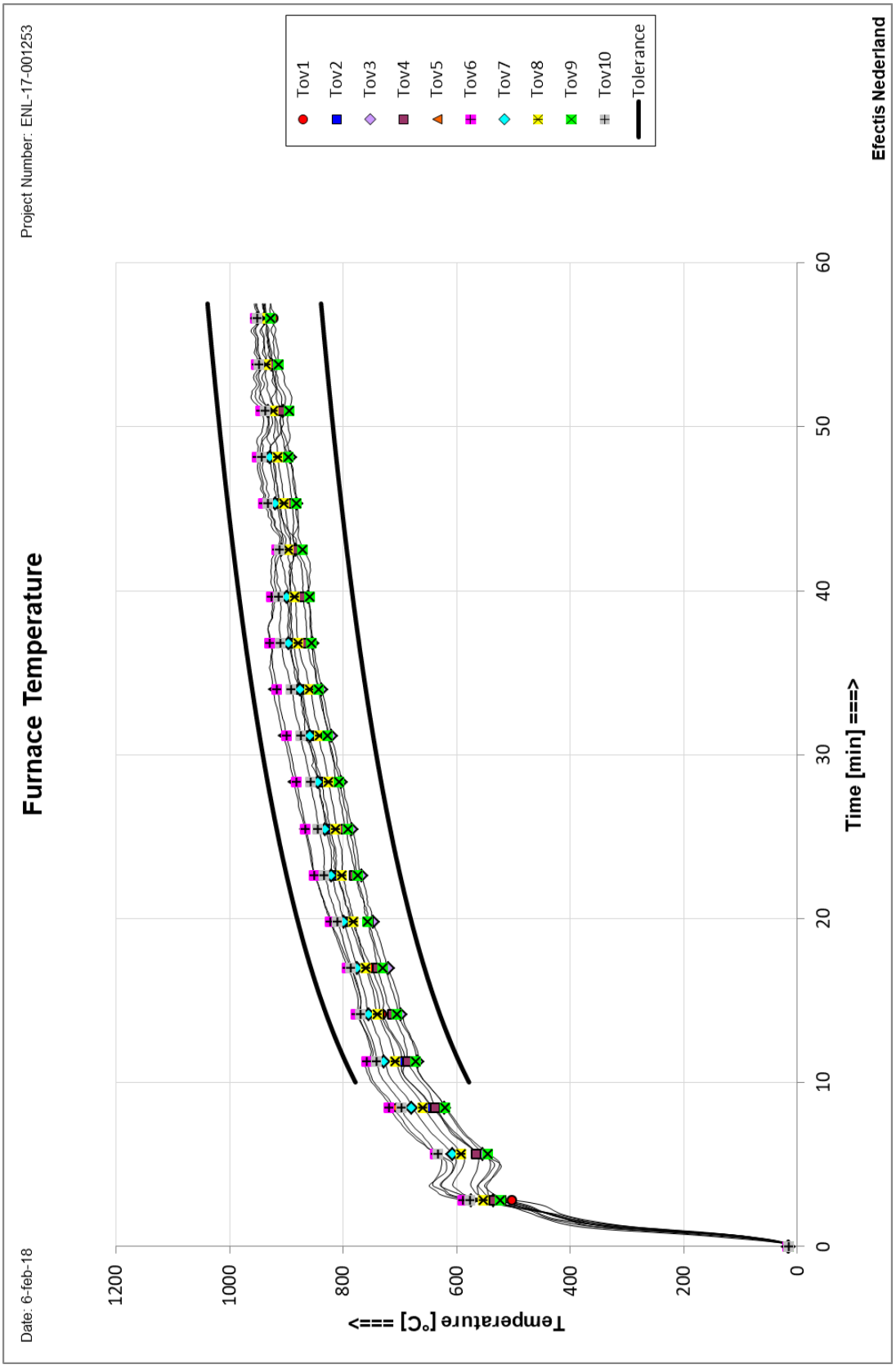
Furnace Temperature
Project Number: ENL-17-001253
Date: 6-feb-18
Efectis Nederland
Tov1
Tov2
Tov3
Tov4
Tov5
Tov6
Tov7
Tov8
Tov9
Tov10
Tolerance
Temperature [°C] ===>
Time [min] ===>
0
200
400
600
800
1000
1200
0
10
20
30
40
50
60

Figure A.1

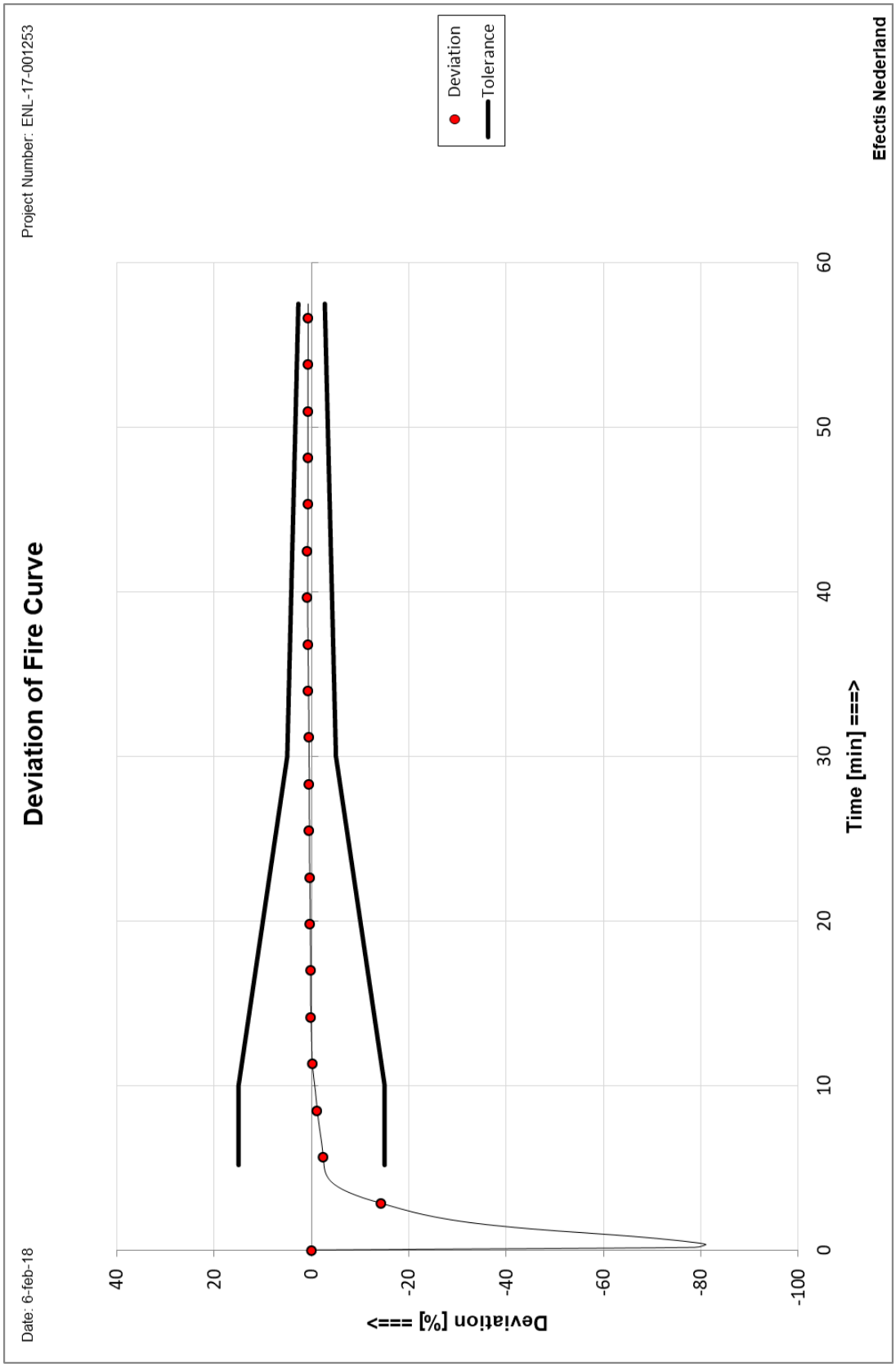
Deviation of Fire Curve
Project Number: ENL-17-001253
Date: 6-feb-18
Efectis Nederland
Deviation
Tolerance
Deviation [%] ===>
Time [min] ===>
40
20
0
-20
-40
-60
-80
-100
0
10
20
30
40
50
60

Figure A.2

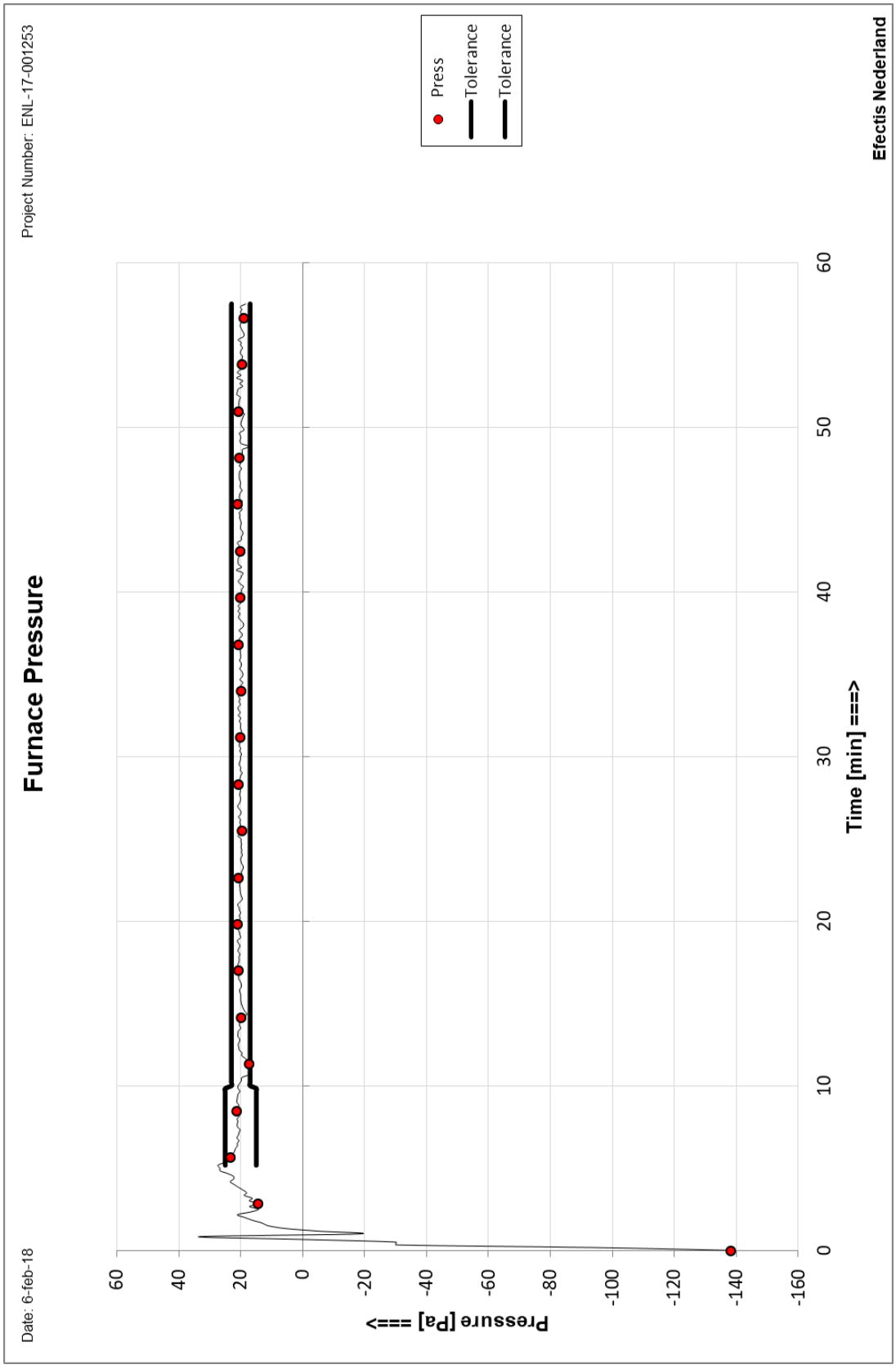
Furnace Pressure
Project Number: ENL-17-001253
Date: 6-feb-18
Efectis Nederland
Press
Tolerance
Tolerance
Pressure [Pa] ===>
Time [min] ===>
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0
10
20
30
40
50
60

Figure A.3

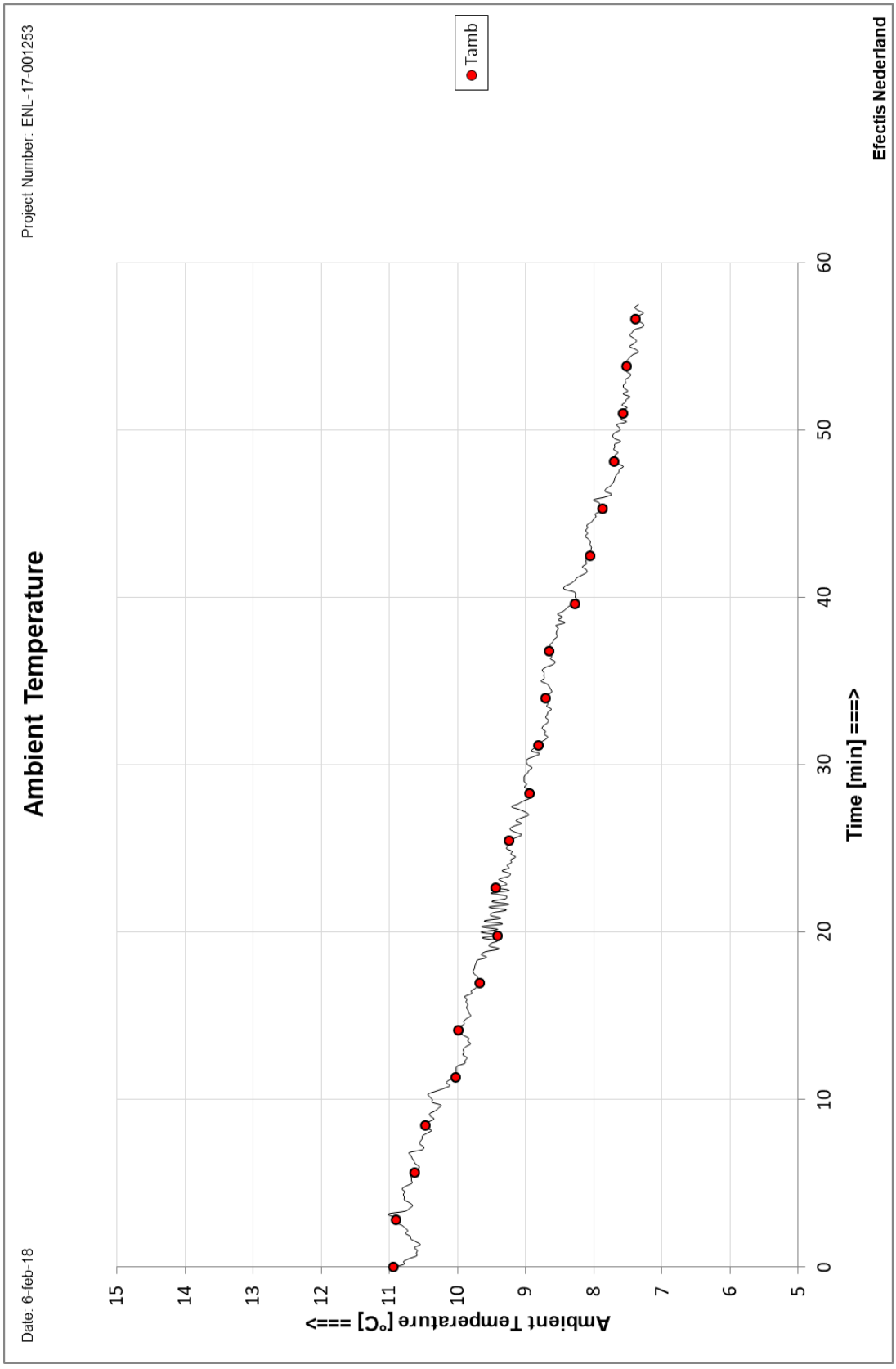
Ambient Temperature
Project Number: ENL-17-001253
Date: 6-feb-18
Efectis Nederland
Tamb
Ambient Temperature [°C] ===>
Time [min] ===>
15
14
13
12
11
10
9
8
7
6
5
0
10
20
30
40
50
60

Figure A.4

APPENDIX B: POSITIONS OF THE THERMOCOUPLES AND TEST RESULTS

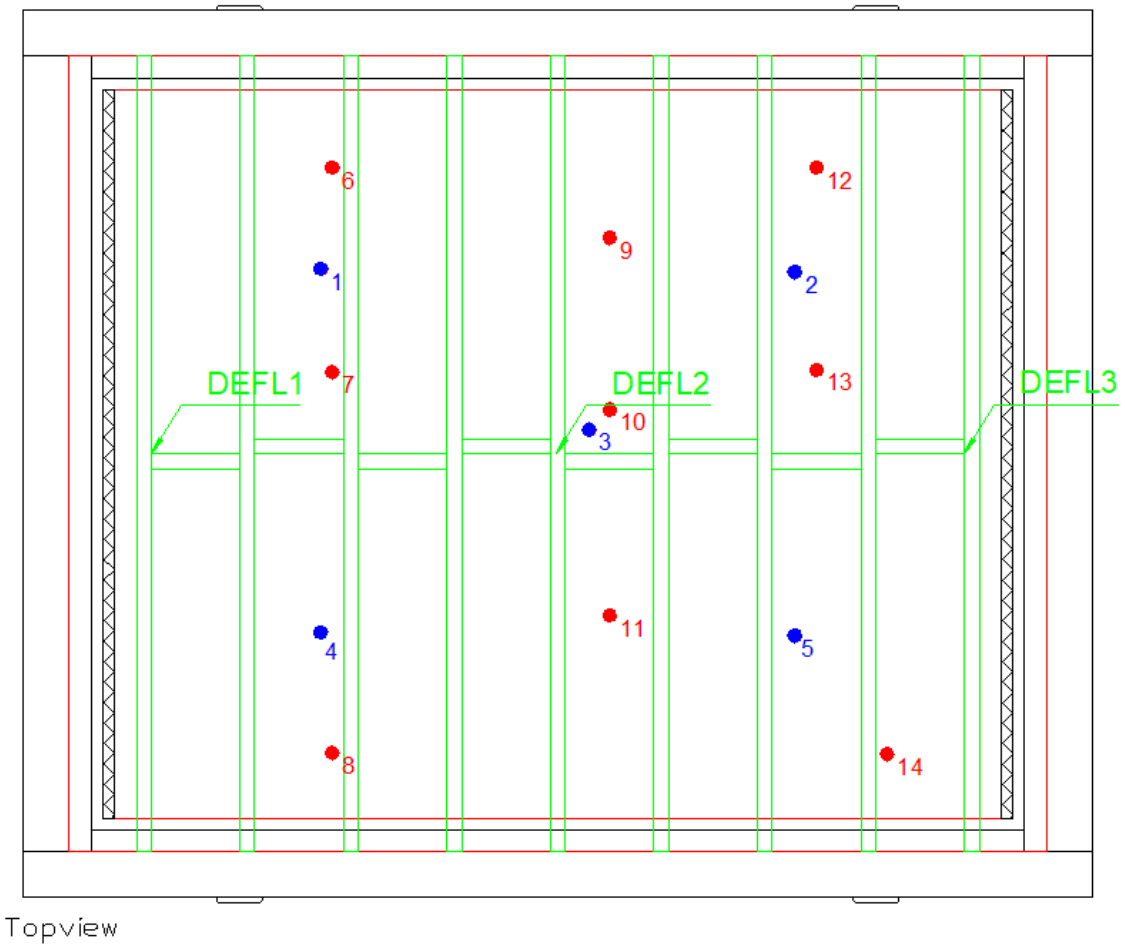

Figure B.1 Positions of thermocouples, deflection and radiation

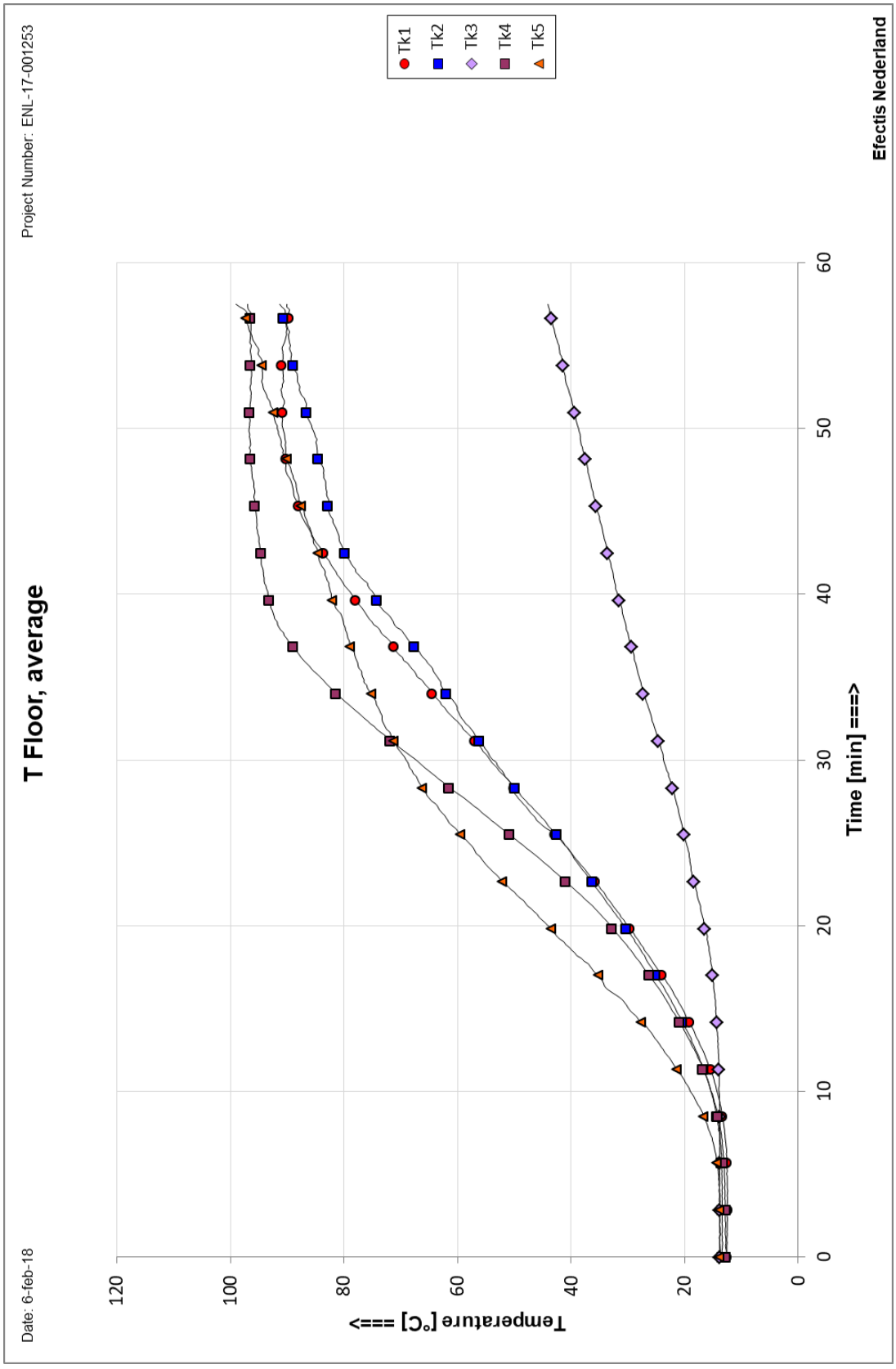

Figure B.2 Surface temperatures on top of the floor (average)

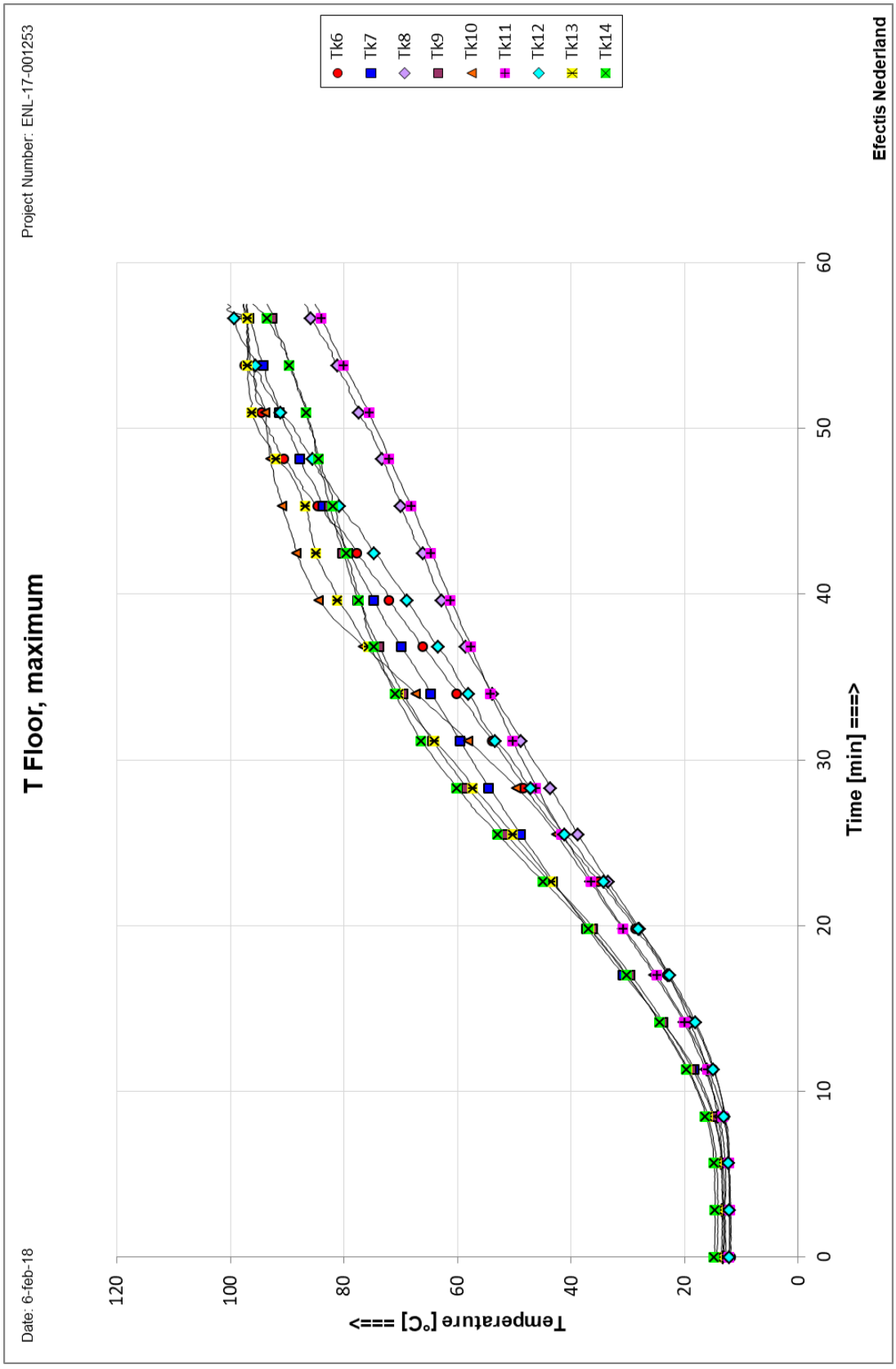

Figure B.3 Surface temperatures on top of the floor (maximum)

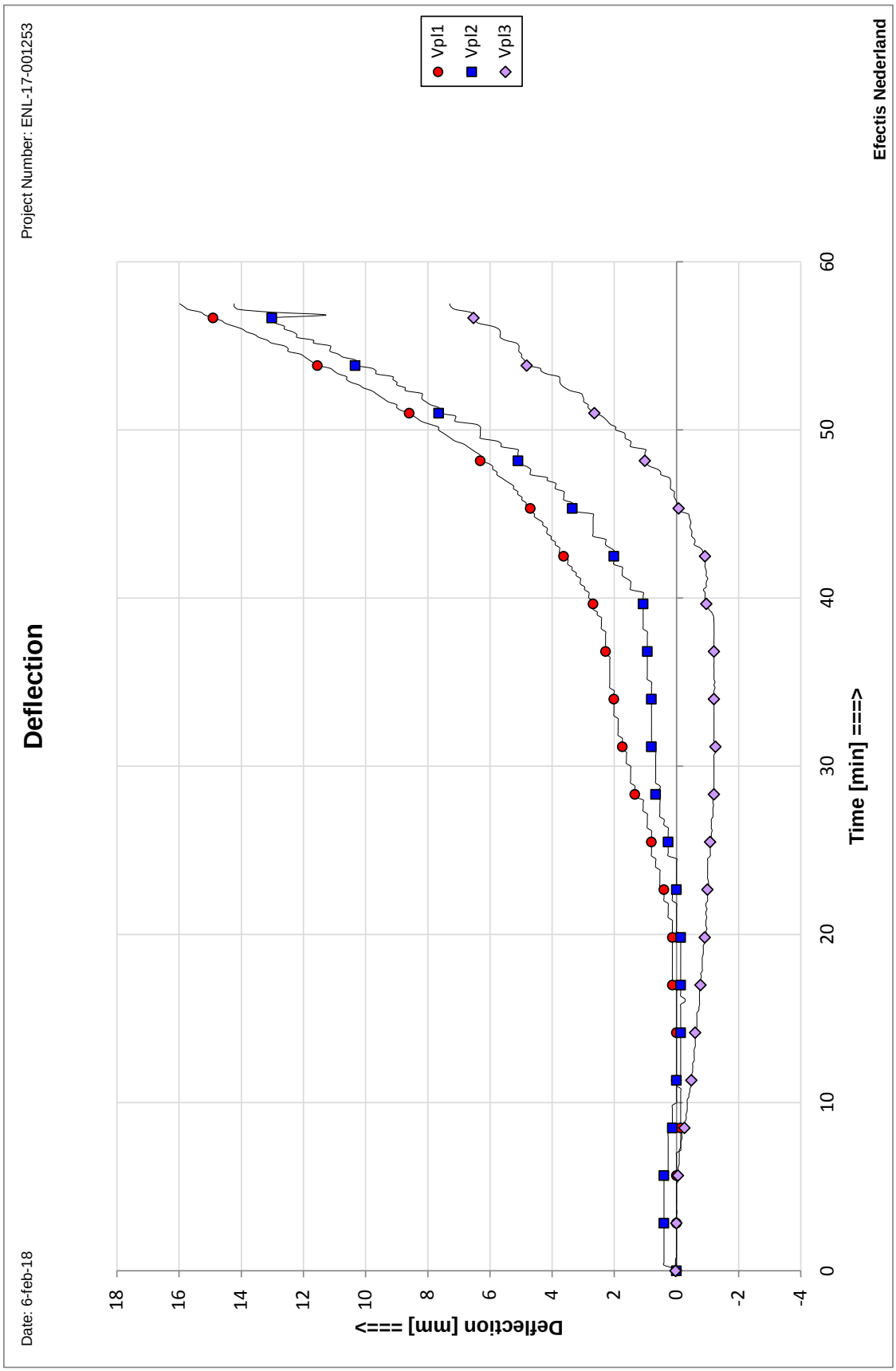

Figure B.4 Deflection

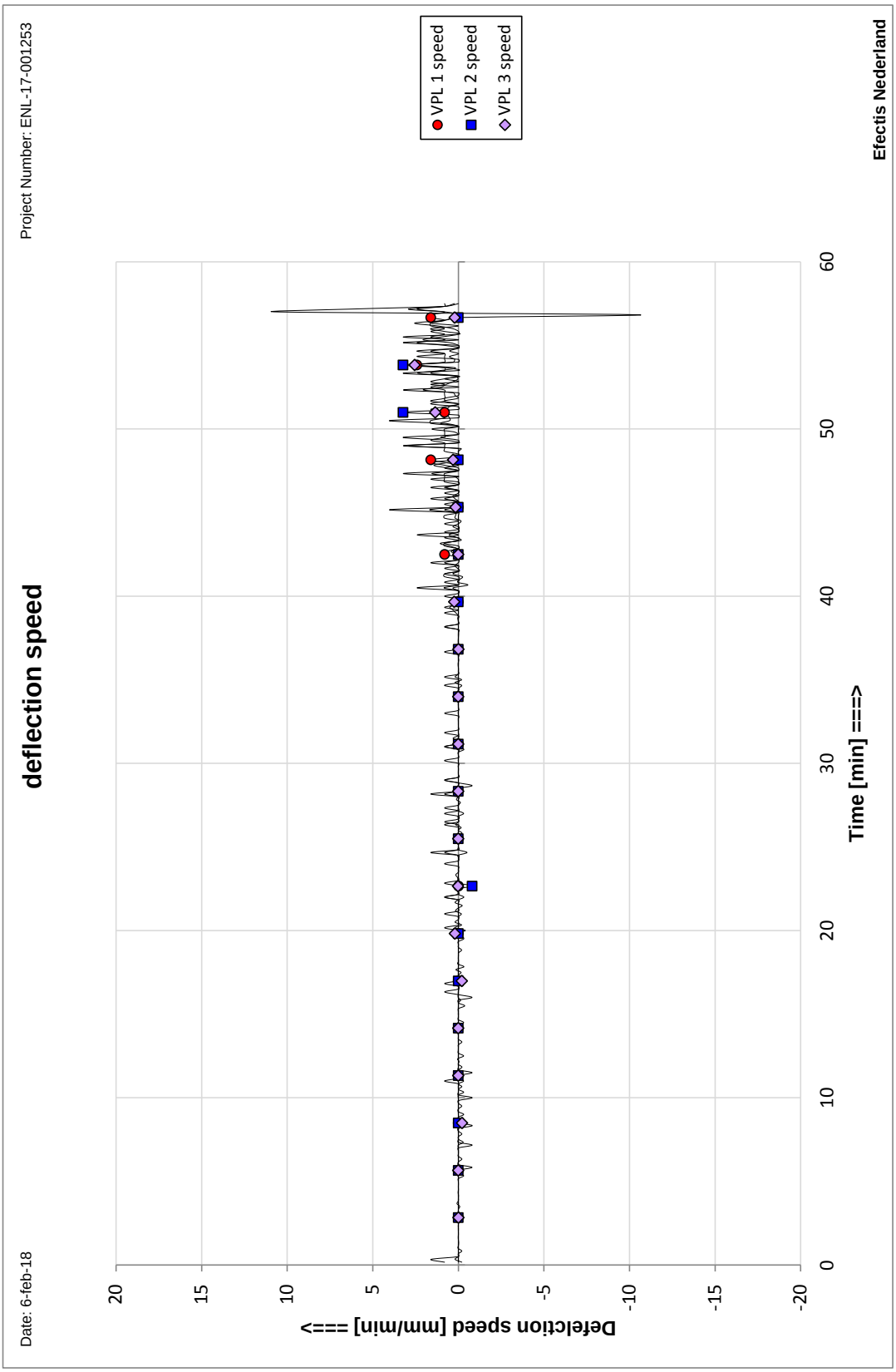

Figure B.5 Deflection speed

APPENDIX C: PHOTOS

INSTALLATION

Photo 1. Fixing of floor boards

Photo 2. Top coating applied to the bottom of the floor construction

TEST

Photo 3. Top of the construction with the load applied, specimen after 2 minutes of heating

Photo 4. Specimen after 10 minutes of heating

Photo 5. Specimen after 19 minutes of heating

Photo 6. Specimen after 30 minutes of heating

Photo 7. Specimen after 45 minutes of heating

Photo 8. Specimen after 57 minutes of heating (end of heating after consulting the client)