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REPORT

Determination of the fire resistance of 2 Envirograf 60-minute fire door of type ES/MP and 4 different types of air transfer grilles (ATG's), manufactured by Intumescent Systems Ltd

Report no.	2019-Efectis-R000072
Sponsor	Intumescent Systems Ltd Envirograf House Barfrestone CT15 7JG DOVER UNITED KINGDOM
Prepared by	Efectis Nederland BV
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1. GENERAL

1.1 REPORT

This report surveys the installation of the test specimen, the investigation on fire resistance of the test specimen, the test conditions, the measuring results of the fire test and the field of direct application of the test results.

1.2 SUBJECTS

The fire-resistance test consisted of 2 Envirograf ES/MP 60-minute fire doors manufactured by Envirograf with Envirograf product 42 applied to the doors and 4 air transfer grilles (ATG's). The doors where coated with HW01 on the exposed side and each fitted with ATG's.

Door 1 was fitted with an ATG of type "MG Metal Grill" and 3 low level vents of type "CVG/2", manufactured by Envirograf. Door 2 was fitted with an ATG of type "BG" Block Grill and Letter box ref L3/B manufactured by Envirograf.

The four additional ATG's installed into the flexible supporting construction where (Top LHS) type "BG", (Top RHS) type "MG", (Middle RHS) type "MG/TL" and (Bottom RHS) type "NBG", all manufactured by Envirograf.

1.3 INVESTIGATION

The investigation consisted of the determination of fire resistance based on:

- EN 1634-1:2012+A1:2018: 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;
- EN 1364-5:2017: Fire resistance tests for non-loadbearing elements- Part 5: Air transfer grilles.

1.4 SPONSOR AND MANUFACTURER

Table 1.1: Sponsor and manufacturer

Sponsor and manufacturer	Intumescent Systems Ltd, Envirograf House, Barfrestone, CT15 7JG DOVER, UNITED KINGDOM
Manufacturer of the doors	Howden Joinery Group Plc 40 Portman Square, London W1H 6LT UNITED KINGDOM

1.5 LOCATION AND DATE REGARDING THE EXAMINATION

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

Table 1.2: Date of the examination

Notified body number	1234
Assembly-of the test specimen	25th to 26th of October 2018
Fire resistance test	31st of July 2018

1.6 NORMATIVE REFERENCES

Table 1.3: Normative references

European standard	**Part**
EN 1363-1: 2012	Fire resistance tests - Part 1: General Requirements
EN 1363-2: 1999	Fire resistance tests - Part 2: Alternative and additional procedures
EN 1634-1:2012+A1:2018	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
EN 16034:2014	Pedestrian doorsets, industrial, commercial, garage doors and openable windows – Product standard, performance characteristics – Fire resisting and/or smoke control characteristics
EN 1364-5: 2017	Fire resistance tests for non-loadbearing elements- Part 5: Air transfer grilles

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.

2.2 TEST SPECIMENS

The test specimens consisted of two doors (opening towards the fire) and four different types of air transfer grilles (ATG's). The doors where coated with Envirograf Product 42 HW01 fire retardant coating and fitted with three types of ATG's.

Door one was coated with two coats of HW01 intumescent coating at a loading of 8m² per litre per coat on the exposed side, followed by one coat of Enviroclear top coat at a loading of 8m² per litre per coat. The unexposed side was painted with one coat of Envirograf white undercoat followed by two coats of Johnson's acrylic white satin topcoat. Door one contained two types of ATG's, a "MG" grill fitted central and towards the top and a set of three low level vents of type "CVG/2", manufactured by Envirograf.

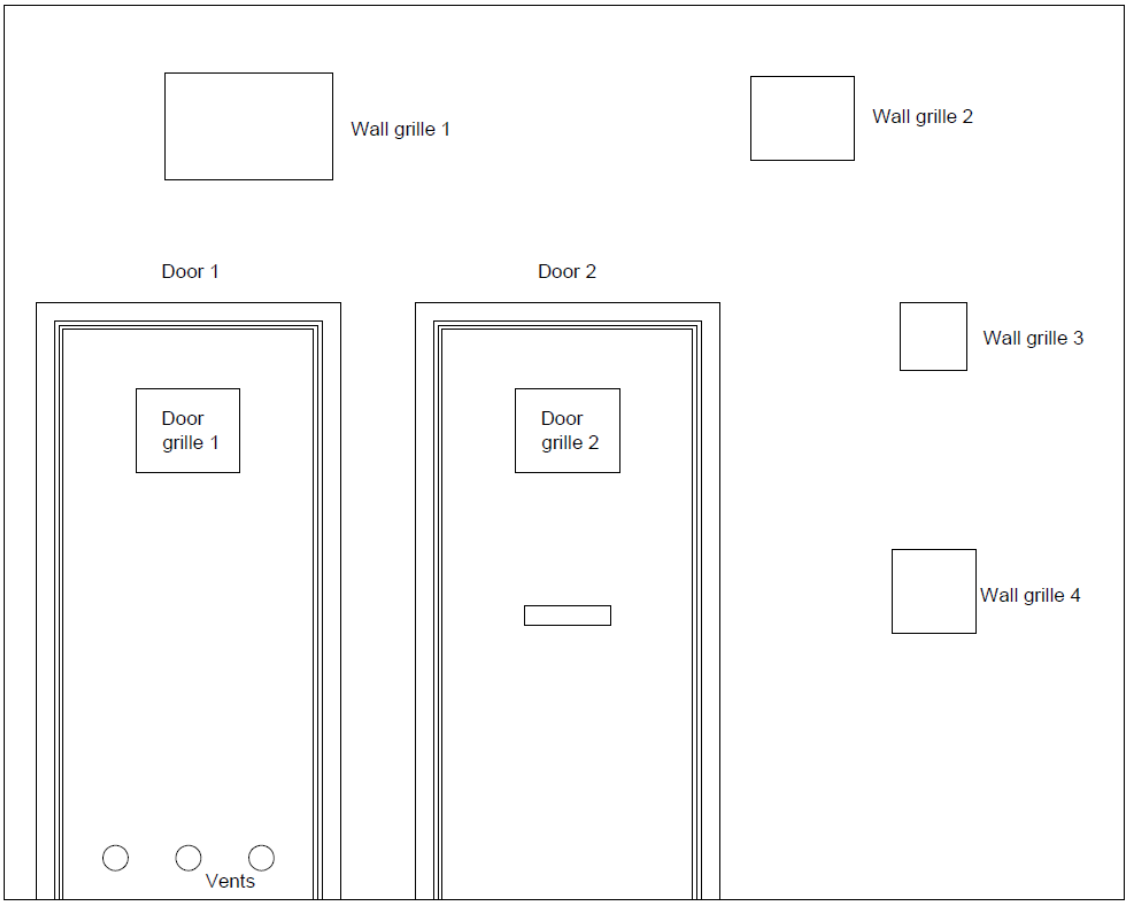
Door two was coated with two coats of HW01 intumescent coating at a loading of 8m ² per litre per coat on the exposed side, followed by one coat of Enviroclear top coat at a loading of 8m ² per litre per coat. The unexposed side was painted with one coat of Envirograf white undercoat followed by two coats of Johnson's acrylic white satin topcoat. Door two contained one ATG's, a "BG" Block grill fitted central and towards the top, manufactured by Envirograf.

Both door sets were also fitted with Envirograf Product 69 ES/SDS surface mounted fire and smoke seals, Envirograf product 71 set of three door closing hinges (ref SCH) and Intumescent Lock paper for Locks and Handles (ref LP).

The four different ATG's installed into the flexible supporting construction where of types "BG" Block Grill, "MG" Metal Grill, "MG (TL)" Metal Grill with Thermal Link and "MG (NBG)"New Block Grill, manufactured by Envirograf.

Table 2.1: Location of ATG's

Location of grilles and vents



Location	*Grille type*
Wall grille 1	Block grille (BG) 600mm wide by 400mm high
Wall grille 2	MG/8 grille 425mm by 425mm
Wall grille 3	MG/TL grille 300mm by 300mm
Wall grille 4	New-style block grille (NBG) 360mm by 360mm
Door grille 1 & vents	MG/4A grille 300mm by 300mm, CVG/2 vents
Door grille 2	Block grille (BG) 300mm wide by 400mm high,

2.2.1 Test Frame

The test frame was constructed of steel beams comprising a fire-resistant concrete lining (density: 1450 kg/m^3 ± 200 kg/m^3), with an aperture of 4 x 3 m (w x h) with an insertion width of 240 mm.

2.2.2 Supporting Construction

The specimens where mounted into a flexible standard supporting construction. The supporting construction was a lightweight plasterboard faced steel stud partition, constructed in accordance with EN 1363-1.

Table 2.2: Specifications supporting construction

Specifications supporting construction	
Overall dimensions	3000 x 4000 x 125 mm (w x h x t)
Frame work	Steel profiles U and C: 45 x 75 x 45 mm
Panel material	Gypsum board, thickness 12.5 mm, two layers at each side of the wall
Insulation	Rockwool: thickness 50 mm, density +/- 50 kg/m^3
Apertures	Door 1: 830 x 2100 mm (w x h) Door 2: 830 x 2100 mm (w x h) Grille 1: 600 x 400 mm (w x h) Grille 2: 370 x 370 mm (w x h) Grille 3: 240 x 240 mm (w x h) Grille 4: 300 x 300 mm (w x h)

2.2.3 Restraint / Free edge

The flexible standard supporting construction was erected so that both vertical edges were unrestrained. The gaps were filled with mineral wool to provide a seal without restricting freedom of movement. The gaps were approx. 50 mm wide.

2.2.4 Non-combustible floor simulation

On the bottom bar of the test frame a calcium silicate board, thickness 20 mm, was placed to simulate a non-combustible floor according to EN 1634-1. The calcium silicate board extended 200 mm on both side of the specimen.

2.2.5 Door 1(left): door leaf

Specifications door 1	
Manufacturer	Envirograf
Type	Flush
Product name	Envirograf ES/MP 60-minute fire door
Material	Door: Ash Timber, Plywood, Product 38 ES/MP Cloth, Plasterboard. Ash door edge lipping. Coating: Risk side 2 coats HW01, 1 coat Enviroclear top coat. Non risk side 1 coat Envirograf undercoat followed by 2 coats Johnson's acrylic topcoat.
Dimensions	2050mm High by 730mm wide by 54mm thick.

Location	Mounted into door frame
Function	Openable partition
Fixing	With Envirograf SCH hinges attached to door frame

2.2.6 Door 1(left): door frame

Specifications frame door 1	
Manufacturer	Envirograf
Type	Internal
Product name	Single Door Hard wood frame with door stops.
Material	Frame: Red Wood Coating: 2 coats HW01 followed by I coat Enviroclear top-coat. Envirograf Product 69 ES/SDS surface mounted fire and smoke seal
Dimensions	Frame overall height 2110mm by overall width 840mm by 125mm deep by 50mm thick. Door stops 32mm by 18mm
Location	Mounted into supporting construction
Function	Bearing structure for door
Fixing	Drywall screws 4.2mm by 100mm long

2.2.7 Door 2 (right): door leaf

Specifications door 2	
Manufacturer	Envirograf
Type	Flush
Product name	Envirograf ES/MP 60-minute fire door
Material	Door: Ash Timber, Plywood, Product 38 ES/MP Cloth, Plasterboard. Ash door edge lipping. Coating: Risk side 2 coats HW01, 1 coat Enviroclear topcoat. Non risk side 1 coat Envirograf undercoat followed by 2 coats Johnsons topcoat.
Dimensions	2050mm High by 730mm wide by 54mm thick.
Location	Mounted into door frame

Function	Openable partition
Fixing	With Envirograf SCH hinges attached to door frame

2.2.8 Door 2 (right): door frame

Specifications frame door 2	
Manufacturer	Envirograf
Type	Internal
Product name	Single Door Hard wood frame with door stops.
Material	Frame: Red Wood Coating: 2 coats HW01, followed by 1 coat Enviroclear top-coat. Envirograf Product 69 ES/SDS surface mounted fire and smoke seal
Dimensions	Frame overall height: 2110mm by overall width 840m by 125mm deep by 50mm thick. Door stops: 32mm by 18mm
Location	Mounted into supporting construction
Function	Bearing structure for door
Fixing	Drywall screws 4.2mm by 100mm long

2.2.9 Locks and hinges

Specifications locks and hinges	
Manufacturer	Envirograf or Smith and Locke
Types	Door handle, hinges and lock/Latch mechanism
Product name	Door handle: 2000 Series Leaver on Back plate Latch Hinges: Envirograf Product 71 SCH Self Closing Hinges and Intumescent hinge and lock Protector Lock/Latch mechanism: Tubular Latch
Material	Door handle: Aluminium Hinges: Mild Steel, Powder coated white Lock/Latch mechanism: Mild steel, Zinc passivated Intumescent hinge and lock paper
Dimensions	Door handle: 100mm by 40 by 15mm Back plate 102mm by 40mm by 9mm Hinges: 100mm x 76mm x 2.5mm

	Lock/Latch mechanism: 65mm long by 20mm square.
Location	Door handle: 900 mm from bottom at right side Hinges: top, middle and bottom on left side Lock/Latch mechanism: 900 mm from bottom at right side inside the door
Function	Enabling opening and closing of door
Fixing	Door handle: Attached to lock/latch system Hinges: screwed into door frame and door Lock/Latch mechanism: fixed with screws

2.2.10 Block grille (BG)

Specifications block grille (BG)	
Manufacturer	Envirograf
Type	Air transfer grille
Product name	Intumescent Block Grilles (BG)
Material	1.2mm Zintec mild steel, Intumescent G-Mix material,12.5mm square galvanised wire mesh and Aluminium foil tape 30 micron
Dimensions	Door grille 2: 300 x 400 x 38 mm (w x h x d) Wall grille 1: 600 x 400 x 38 mm (w x h x d)
Location	Door grille 2: Mounted into aperture in door, flush with both (exposed and unexposed) sides Wall grille 1: Mounted centred into aperture in supporting construction
Function	Normal (non-fire) situation: ventilation Fire situation: fire-resistant seal
Fixing	Product 58 AM White Mastic Sealant

2.2.11 MG grilles

Specifications MG grilles	
Manufacturer	Envirograf
Type	Air transfer grille
Product name	Intumescent MG grilles (slotted / louvered)
Parts and material	Front Plates & Back plate's 1.2mm Zintec mild steel, Powder coated. Black Multigraf intumescent material.
Dimensions	Door grille 1: MG 300mm x 300 mm (w x h)

	Wall grille 2: MG 425 x 425 mm (w x h)
Location	Door grille 1: Mounted onto both exposed side and non-exposed side of door. Wall grille 2: mounted onto both exposed side and non-exposed side of wall.
Functions	Normal (non-fire) situation: ventilation Fire situation: fire-resistant seal
Fixing	With screws of type: No.8 x 50mm Self-tap pan head

2.2.12 MG/TL grille

Specifications MG/TL grille	
Manufacturer	Envirograf
Type	Air transfer grille
Product name	Intumescent MG/TL grille (slotted / Louvered)
Parts and material	Front plates: Zintec mild steel Powder coated Back plate: Zintec mild steel Powder coated Multigraf intumescent material
Closing mechanism inner plate	Thermal break; triggered at 70˚C
Dimensions	300 x 300 mm (w x h)
Location	Wall grille 3: mounted onto both exposed side and non-exposed side of supporting construction
Functions	Normal (non-fire) situation: ventilation Fire situation: smoke and fire-resistant seal
Fixing	With screws of type: No.8 x 50mm Self-tap pan head

2.2.13 New-style Block grille (NBG)

Specifications New-style Block grille (NBG)	
Manufacturer	Envirograf
Type	Air transfer grille
Product name	Intumescent NBG grille
Parts and material	Front Plate & block grill assembly Zintec mild steel, Powder coated Front plate: Zintec mild steel Powder coated Intumescent G-Mix material, aluminium foil tape 30 micron.

Dimensions	Wall grille 4: 360 x 360 x mm (w x h x d)
Location	Wall grille 4: Front plate block grill assembly mounted onto exposed side and front plate non-exposed side of supporting construction.
Function	Normal (non-fire) situation: ventilation Fire situation: fire-resistant seal
Fixing	With screws of type: No.8 x 50mm Self-tap pan head

2.2.14 Cover plates for grilles

Specifications cover plates for grilles	
Manufacturer	Envirograf
Type	Air transfer grille
Product name	NBG plate MG Plate MG/TL Plate
Material	Powder coated Zintec steel plate Black Multigraf intumescent material Multigraf intumescent material Intumescent G-Mix material
Dimensions	Door grille 1: (slotted and Louvered) 300 x 300 mm (w x h) Wall grille 2: (slotted and louvered) 430 x 430 mm (w x h) Wall grille 3: (slotted and louvered) 300 x 300 mm (w x h) Wall grille 4: (slotted) 360 x 360 mm (w x h)
Location	Door grille 1: Slotted mounted onto door on exposed side and louvered non-exposed side. Wall grille 2: Slotted mounted onto wall on exposed side and louvered non-exposed side. Wall grille 3: Slotted mounted onto wall on exposed side and louvered non-exposed side. Wall grille 4: Slotted Mounted onto wall on both exposed and non-exposed side.
Function	Ventilation
Fixing	With screws of type: No.8 x 50 mm self-tap pan head

2.2.15 Vents

Specifications vents	
Manufacturer	Envirograf
Type	Door and cupboard vent grilles

Product name	CVG2
Material	Powder coated Zintec steel plate and Intumescent Multigraf material
Dimensions	Face diameter: 90 mm Cut hole diameter: 76 mm Depth: variable between 38 and 56 mm
Location	Mounted at bottom of the door 1 and penetrating all the way through (see drawings chapter 9)
Functions	Normal (non-fire) situation: ventilation Fire situation: fire-resistant seal
Fixing	Self-clamping

2.2.16 Coating

Specifications coating	
Manufacturer	Envirograf
Type	Intumescent coating
Product name	Door 1 (left): Product 42 HW01 Door 2 (right): Product 42 HW01
Material	Door 1 (left): Intumescent Paint Door 2 (right): Intumescent Paint
Location	Door 1: Risk side coated with 2 coats HW01 followed by 1 coat of Enviroclear. Non-risk side coated with 1 coat Envirograf undercoat followed by 2 coats Johnson's acrylic top coat. Door 2: T Risk side coated with 2 coats HW01 followed by 1 coat of Enviroclear. Non-risk side coated with 1 coat Envirograf undercoat followed by 2 coats Johnson's top coat.
Function	Increasing the fire-resistance of the material it is covering

2.2.17 Mastic

Specifications mastic	
Manufacturer	Envirograf
Type	Envirograf product 58 Intumescent Mastic
Product name	AM white Mastic
Material	Intumescent acrylic mastic
Location	Between Block grille and door

	Between Block grille and supporting construction Between door frames and supporting constructions Around profile of MG front plates, door frames and supporting construction.
Function	Securing block grilles, sealing seams and gap filling

2.2.18 Decorative finishing

Specifications decorative finish	
Manufacturer	Envirograf
Type	Decorative architrave
Product name	Square Chamfered
Material	Hard Red Wood timber
Dimensions	68mm wide by 20mm thick 6.0 mm
Location	Architrave fitted along sides and top of door frame, both to risk and no-risk sides of the supporting structure covering the seam between the door frame and the supporting construction.
Function	Decorative Finish

2.2.19 Letter box

Specifications door letter box	
Manufacturer	Envirograf
Type	Door letter box
Product name	L3/B
Material	Stainless steel flap, Mild steel powder coated frame and Rubberised intumescent liner.
Dimensions	Letter box assembly: 312mm wide by 74mm high by 15mm deep. Line:r 300mm x 40mm x 4mm.
Location	Mounted near centre of door 2, 900mm from bottom and penetrating all the way through. (see drawings chapter 9)
Function	Normal (non-fire) situation: receiving mail Fire situation: fire-resistant seal

2.3 METHOD OF ASSEMBLY

The test specimen was built in the following order:

- Installation of the flexible partition wall
- Mounting of doors
- Mounting of MG and BG grilles into door
- Mounting of MG and BG grilles into flexible partition wall
- Sealing of seams with sealant

3. ASSEMBLY AND MANUFACTURING OF THE CONSTRUCTION

Table 3.1: Assembly and manufacturing of the construction

Efectis Nederland BV	Test frame and support construction
Intumescent Systems Ltd	Assembly and manufacturing of specimen

4. RESEARCH METHOD

4.1 VERIFICATION OF THE SPECIMEN

The materials and components used were inspected during assembly on the basis of the supplied drawings and data. Efectis Nederland BV was not involved in the selection or sampling of the materials.

Efectis Nederland BV received samples of materials used in the construction of the specimen to determine the density and moisture content.

4.2 CONDITIONING OF THE TEST SPECIMEN

4.2.1 Mechanical conditioning

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.

Table 4.1: Laboratory conditions during conditioning

Laboratory conditions during conditioning	
Ambient temperature:	20 ± 5°C
Relative humidity:	50 ± 10 %

4.2.2 Density and moisture content

The density and the moisture content of materials and components used during assembly was not known, no samples were delivered, by Efectis Nederland BV.

4.2.3 Conditioning of supporting construction

The supporting construction being a metal stud wall was conditioned for 6 days before the fire test under the conditions mentioned in 4.2.1.

4.3 PRE-TEST EXAMINATION AND PREPARATION

4.3.1 Closing forces and locking

Both door leaves where equipped with Envirograf self-closing Hinges Ref SCH. The door leaves were latched but not locked during the fire test.

4.3.2 Open and close cycle

Prior to the fire test, the door sets were opened and closed 25 times according to EN 1634-1+A1 and EN16034. The door leaves where opened to a 90-degree position and then released so that the closing device could close the door to a closed position.

4.3.3 Locking

The door leaves were latched but not locked during the fire test. Keys were removed from the lock.

4.3.4 Gap measurements

Prior to the fire test the gap widths were measured. The measured gap widths are given in chapter 8.

4.4 FIRE TEST

4.4.1 Laboratory conditions

During the fire resistance investigation, the test conditions in the laboratory were as given below.

Table 4.2: Laboratory conditions during fire test

Laboratory conditions	
Ambient temperature:	10 - 40°C
Relative humidity:	50 ± 10 %

4.4.2 Test conditions

The fire test was carried out according to EN 1363-1 and EN 1363-2.

4.4.3 Heating curve

The average temperature of the furnace followed the standard heating curve as described in EN 1363-1. The temperatures inside the furnace during the fire test are given in appendix A.

4.4.4 Furnace pressure

In accordance with the requirements given in EN 1363-1 the desired pressure at 0,5 m from the furnace floor was 0 Pa. At the top of the specimen the pressure did not exceed 20 ± 3 Pa. This was achieved by setting the furnace pressure to 17 Pa at a height of 2,5 m above the furnace floor.

4.4.5 Measurements

During the fire test the following data was measured and registered:

Environment (measurements are given in appendix A)

- The temperature in the laboratory outside the furnace.

Furnace conditions (measurements are given in appendix A)

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

Specimen (measurements are given in appendix B)

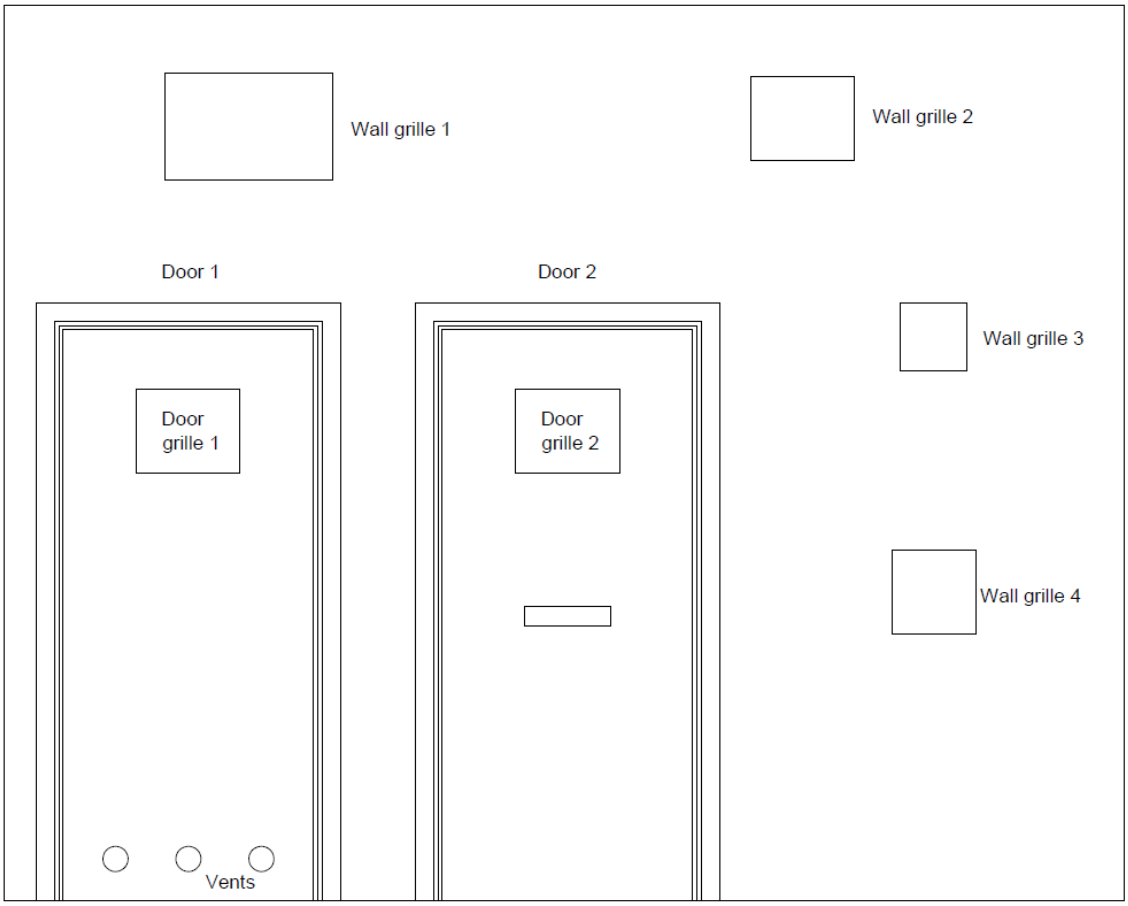
- Surface temperatures of the test specimen;
- Radiation levels at 1.0 m from the centre of the test specimen;
- Deflections of the test specimen.

The positions of thermocouples, deflection and radiation measurements are given in appendix B.

5. RESULTS OF THE FIRE RESISTANCE TEST

5.1 OBSERVATIONS DURING HEATING

Table 5.1: Observations during the fire test



Time (min)	Observations
0	Start of heating
2	TC 87 detaches and falls of

2^{30}	Block grilles are closed (intumescent material is activated)
14	Middle vent at bottom of left door falls out. Client seals hole.
29	Thermocouples 36, 87 and 102 fall off
32	Door letter box is pushed open by activated intumescent inlay
33	Thermocouples 99 and 104 fall off
44	Thermocouple 51 fell off
47	Smoke along top of door frame of both doors
52	Flames < 10 sec at door handle of door 2
58	Regularly short burst of flames < 10 seconds
59	Flames > 10 seconds at door handle and top of door 2
68	Flames > 10 seconds at top of door 1
73	End of heating after consulting client

5.2 GRAPHS OF THE FIRE TEST

The test results are shown as graphs in appendix B. During the heating of the specimen the ambient temperature met the requirements of EN 1363-1.

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.

5.4 PHOTOGRAPHS

The photographs before and during the fire-resistance test are shown in appendix C.

6. SUMMARY OF THE TEST RESULTS

Determination of the fire resistance based on EN 1634-1+A1of 2 Envirograf ES/MP 60-minute fire doors coated with Envirograf product 42 on risk side, fitted with ATG's of types "BG" and "MG" and vents of type CVG2, manufactured by Envirograf.

And the determination of the fire resistance based on EN 1364-5 of 4 ATG's of types "MG", "BG", "MG/TL" and "NBG", manufactured by Envirograf.

Table 6.1: Summary of test results door 1 (left)

Criterion	Time (min.)	Time of reaching a criterion measured from the start of the test in accordance with EN 1634-1
Integrity (E)		
-Cotton pad	73	Not determined
-Gap gauge Ø 6 mm	73	Not determined
-Gap gauge Ø 25 mm	73	Not determined
-Sustained flaming > 10 seconds	68	Failure
Insulation (I)		
-Average temperature	73	No Failure
-Maximum temperature I_1	62	Failure TC 14
-Maximum temperature I_2	67	Failure TC 7
-Maximum temperature vents	12	Failure TC 17 and 21
-Maximum temperature grille	19	Failure TC 35
-Maximum temperature frame	69	Failure TC 55
The heating was terminated after 73 minutes after consulting the client.		
The maximum deflection was 87 mm at 69 minutes		

Table 6.2: Summary of test results door 2 (right)

Criterion	Time (min.)	Time of reaching a criterion measured from the start of the test in accordance with EN 1634-1
Integrity (E)		
-Cotton pad	73	Not determined
-Gap gauge Ø 6 mm	73	Not determined
-Gap gauge Ø 25 mm	73	Not determined
-Sustained flaming > 10 seconds	59	Failure
Insulation (I)		
-Average temperature	73	No Failure
-Maximum temperature I_1	52	Failure TC 52
-Maximum temperature I_2	73	Failure TC 46
-Maximum temperature grille	12	Failure TC 108
-Maximum temperature grille	73	No Failure
-Maximum temperature frame	59	Failure TC 59
The heating was terminated after 73 minutes after consulting the client.		
The maximum deflection was 69 mm at 62 minutes		

Table 6.3: Summary of test results grille type BG (wall grille 1)

Criterion	Time (min.)	Time of reaching a criterion measured from the start of the test in accordance with EN 1364-5:2017
Integrity (E)		
-Cotton pad	73	Not determined
-Gap gauge Ø 6 mm	73	Not determined
-Gap gauge Ø 25 mm	73	Not determined
-Sustained flaming > 10 seconds	73	No Failure
The heating was terminated after 73 minutes after consulting the client.		

Table 6.4: Summary of test results grille type MG (wall grille 2)

Criterion	Time (min.)	Time of reaching a criterion measured from the start of the test in accordance with EN 1364-5:2017
Integrity (E)		
-Cotton pad	73	Not determined
-Gap gauge Ø 6 mm	73	Not determined
-Gap gauge Ø 25 mm	73	Not determined
-Sustained flaming > 10 seconds	73	No Failure
Insulation (I)		
-Average temperature	0	Failure
-Maximum temperature	1	Failure TC 105
The heating was terminated after 73 minutes after consulting the client.		

Table 6.5: Summary of test results grille type MG/TL (wall grille 3)

Criterion	Time (min.)	Time of reaching a criterion measured from the start of the test in accordance with EN 1364-5
Integrity (E)		
-Cotton pad	73	Not determined
-Gap gauge Ø 6 mm	73	Not determined
-Gap gauge Ø 25 mm	73	Not determined
-Sustained flaming > 10 seconds	73	No Failure
Insulation (I)		
-Average temperature	23	Failure
-Maximum temperature	29	Failure TC 76
The heating was terminated after 73 minutes after consulting the client.		

Table 6.4: Summary of test results grille type NBG (wall grille 4)

Criterion	Time (min.)	Time of reaching a criterion measured from the start of the test in accordance with EN 1364-5:2017
Integrity (E)		
-Cotton pad	73	Not determined
-Gap gauge Ø 6 mm	73	Not determined
-Gap gauge Ø 25 mm	73	Not determined
-Sustained flaming > 10 seconds	73	No Failure
Insulation (I)		
-Average temperature	73	Failure
-Maximum temperature	47	Failure TC 88
The heating was terminated after 73 minutes after consulting the client.		

7. FIELD OF DIRECT APPLICATION OF TEST RESULTS FOR DOORS (EN 1634-1)

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

The conclusions in this chapter apply exclusively to al door set types mounted in a wall which are equivalent in detail, including fittings/furniture and materials used, to the structure described in this report and that also comply with the following conditions.

7.1 GENERAL

The field of direct application defines the allowable changes to the test specimen following a successful fire resistance test. These variations can be applied automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

NOTE When extended product size requirements are envisaged, the dimensions of certain components within the test specimen can be less than those intended to be used at full size in order to maximize the extrapolation of the test results by modelling the interaction between components at the same scale.

Where referred to annex B or annex C in this paragraph, the annexes in EN 1634-1 are meant.

7.2 MATERIALS AND CONSTRUCTION

7.2.1 General

Unless otherwise stated in the following text, the materials and construction of the doorset or openable window shall be the same as that tested. The number of leaves and the mode of operation (e.g. sliding, single action or double action) shall not be changed.

7.2.2 Specific restrictions on materials and construction

7.2.2.1 Timber construction

The thickness of the door panel(s) shall not be reduced but may be increased.

The door panel thickness and/or density may be increased provided the total increase in weight is not greater than 25%.

For timber-based board products (e.g. particle board, block board, etc.), the composition (e.g. type of resin) shall not change from that tested. The density shall not be reduced but may be increased.

The cross-sectional dimensions and/or the density of the timber frames (including rebates) shall not be reduced but may be increased.

7.2.3 Decorative finishes

7.2.3.1 Paint

Where the paint finish contributes to the fire resistance of the door (e.g. intumescent paints) then no change shall be permitted.

7.2.3.2 Decorative laminates

Decorative laminates and timber veneers up to 1,5 mm thickness may be added to the faces (but not the edges) of doors that satisfy the insulation criteria (normal or supplementary procedure).

Decorative laminates and timber veneers applied to door leaves that do not satisfy the insulation criteria (normal or supplementary procedure) and/or those in excess of 1,5 mm thickness shall be tested as part of the test specimen. For all door sets tested with decorative laminate faces, the only variations possible shall be within similar types and thicknesses of material (e.g. for colour, pattern, supplier).

7.2.4 Fixings

The number of fixings per unit length used to attach door sets to supporting constructions may be increased, but shall not be decreased and the distance between fixings may be reduced but shall not be increased.

7.2.5 Building hardware

The number of hinges and dog bolts may be increased but shall not be decreased.

NOTE 1 The number of movement restrictors such as locks and latches is not covered by direct application.

NOTE 2 Interchange of building hardware is not covered by the field of direct application.

7.3 PERMISSIBLE SIZE VARIATIONS

7.3.1 General

Door sets of sizes different from those of tested specimens are permitted within certain limitations, but the variations are dependent on product type and the length of time that the performance criteria are fulfilled.

The increase and decrease of dimensions permitted by the field of direct application are applicable to the overall size and to each door leaf, each side panel and each over panel independently.

7.3.2 Test periods

The amount of variation of size permitted is dependent on whether the classification time was just reached (Category 'A') or whether an extended time (Category 'B') in accordance with the values shown in Table 1 were fulfilled before the test was concluded.

7.3.3 Size variation related to product type

7.3.3.1 General

The rules to cover increase or decrease of size without additional considerations are applicable only to six main product groups:

a) hinged and pivoted door sets and openable windows;

Permissible variations for each product group are detailed in Annex B of EN 1634-1 which also contains some examples relating to hinged/pivoted doorsets.

7.3.3.2 Hinged and pivoted door sets and openable windows

7.3.3.2.1 Other changes

For smaller doorset sizes the relative positioning of movement restrictors (e.g. hinges and latches) shall remain the same as tested or any change to the distances between them will be limited to the same percentage reduction as the decrease of test specimen size.

For larger doorset sizes the following shall also apply:

a) the height of the latch above floor level shall be equal to or greater than the tested height, and such increase in height shall be at least proportional to the increase in door height;
b) the distance of the top hinge from the top of door leaf shall be equal to or less than that tested;
c) the distance of the bottom hinge from bottom of door leaf shall be equal to or less than that tested;
d) where three hinges or distortion preventers are used, the distance between the bottom of the door leaf and centre restraint shall be equal to or greater than that tested.

7.3.3.2.2 Timber constructions

The number, size, location and orientation of any joints in the timber framing shall not be changed.

Where decorative veneers of 1.5 mm or greater thickness, or other claddings which themselves provide constructive benefits, are part of the test specimen, they shall not be substituted with alternatives of lesser thickness or strength.

7.3.3.2.3 Gaps

The maximum size of the primary gaps identified in 7.3 of EN 1634-1 is restricted to the following sizes in practice:

$x = (a + b)/2 + 2$ mm

where
x is the maximum permitted gap size;
a is the maximum measured gap size;
b is the mean measured gap size.

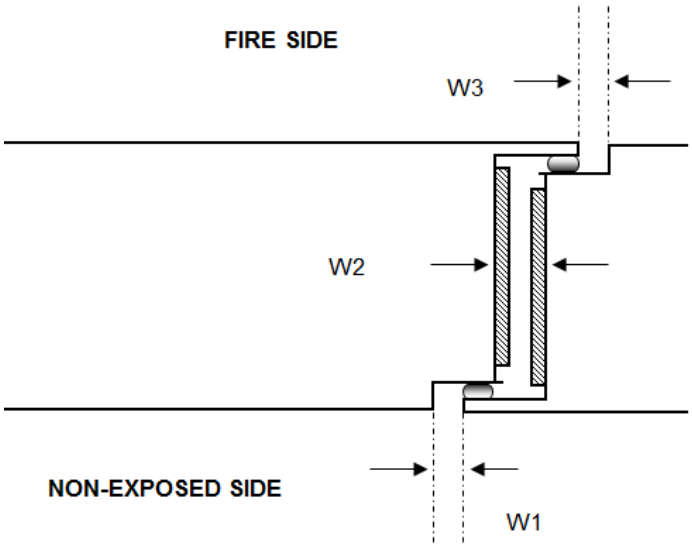


Figure 7.1: Position of maximum gap widths

Door 1 (left) opening towards fire

Table 7.1: Top of door leaf, maximum gap widths in mm (refers to chapter 8 in this report)

W1	W3
3.2	5.5

Table 7.2: Bottom of door leaf, maximum gap widths in mm (refers to chapter 8 in this report)

W1	W3
5.2	6.3

Table 7.3: Hinge side of door leaf, maximum gap widths in mm (refers to chapter 8 in this report)

W1	W3
2.6	4.9

Table 7.4: Latch side of door leaf, maximum gap widths in mm (refers to chapter 8 in this report)

W1	W3
4.6	7.5

Door 2 (right) opening towards fire

Table 7.5: Top of door leaf, maximum gap widths in mm (refers to chapter 8 in this report)

W1	W3
3.9	7.9

Table 7.6: Bottom of door leaf, maximum gap widths in mm (refers to chapter 8 in this report)

W1	W3
5.3	5.8

Table 7.7: Hinge side of door leaf, maximum gap widths in mm (refers to chapter 8 in this report)

W1	W3
3.7	5.4

Table 7.8: Latch side of door leaf, maximum gap widths in mm (refers to chapter 8 in this report)

W1	W3
3.6	8.4

The minimum size of the primary gaps may be reduced.

The permitted gap size may be different for different parts of the door.

7.4 ASYMMETRICAL ASSEMBLIES

7.4.1 General

EN 1363-1 states that for separating elements required to be fire resisting from both sides, two test specimens shall be tested (one from each direction) unless the element is fully symmetrical, i.e. the construction of the doorset is identical on both sides of the centre line when viewed in plan (from above). However, in some cases it is possible to develop rules whereby the fire resistance of an asymmetrical door assembly tested in one direction can apply when the fire exposure is from the other direction. The possibility to develop such rules increases if the consideration is limited to certain types of door assembly and on the criteria being applicable (e.g. integrity only doors). The following rules represent the minimum level of common agreement which shall be followed. The rationale behind the rules is given in Annex C of EN 1634-1.

7.4.2 Specific rules

The rules governing the applicability of tests carried out in one direction to other directions are given in Table 2 and are based on the following premises:

- that each of the door leaves are themselves of symmetrical construction with the exception of the edges (e.g. lock/leading edge and hinge edge or double rebated doors);
- that any restraining/supporting elements of building hardware has been included in a test to EN 1634-1 when exposed in both directions so that they will retain their function when exposed to the heat of the test;
- that there is no change in the number of leaves or the mode of operation (e.g. sliding, swinging, single action or double action);

- that side, over and transom panels are excluded from Table 2 unless they are fully symmetrical.

Table 2 lists the type of door assembly for which rules can be generated and gives the direction in which it should be tested to cover the opposite direction. The separate columns for the integrity and insulation criteria reflect the different ability to make rules for integrity only doors as opposed to those which satisfy both criteria. A 'Yes' means that it is possible to identify the direction of test which covers the opposite direction. A 'No' indicates that it is not possible to identify the direction which will cover the opposite direction.

Table 7.9: Type of doorset and direction to be tested to cover the opposite direction

Type of doorset	Direction to be tested to cover opposite direction	Integrity	Insulation	Radiation
Hinged or pivoted, timber leaf, timber frame	Opening into the furnace	Yes	Yes	Yes

7.5 SUPPORTING CONSTRUCTIONS

7.5.1 General

The fire resistance of a door assembly tested in one form of standard supporting construction may or may not apply when it is mounted in other types of construction. Generally, the rigid and flexible types are not interchangeable and rules governing the direct application within each group are given in 13.5.2 to 13.5.4 of EN 1634-1. However, in some cases it is possible for the result of a test on a particular type of door assembly tested in one form of standard supporting construction to be applicable to that door assembly when mounted in a different type of standard supporting construction. Specific rules governing the situation for hinged and pivoted door assemblies are given in 13.5.4 of EN 1634-1. The rationale behind the rules is given in Annex C of EN 1634-1.

7.5.2 Flexible standard supporting constructions

The fire resistance of a door tested in one of the flexible standard supporting constructions specified in EN 1363-1 can be applied to a door mounted in the same manner in a wall or partition which is of the board covered type with studs made from metal or timber.

The fire resistance of the door is only applicable to a door mounted in a partition with a fire resistance equal to or greater than the partition in which it was tested.

The fire resistance of the partition shall have been established separately in a previous test.

7.5.3 Specific rules for hinged or pivoted doorsets

The rules above assume that the fixing methods used in each type of supporting construction are appropriate to that construction. Thus, for example in a), the test on the timber door leaf in a timber frame will have been carried out with appropriate fixings for timber frames in rigid constructions. The result is applicable to a timber door leaf in a timber frame mounted into a flexible construction with appropriate fixings for timber frames in flexible constructions.

8. FIELD OF DIRECT APPLICATION OF TEST RESULTS FOR AIR TRANSFER GRILLES (EN 1364-5:2017)

8.1 GENERAL

The results of the fire test are directly applicable to constructions of the same design and materials where one or more of the changes listed below are made:

a) decrease in the linear dimensions of the grille;

b) decrease of the pitch of the fixings.

For ATG fire tested without decorative covers and meeting the requirements of E class, the application with decorative covers is not permitted.

For ATG fire tested with decorative covers, the application without decorative covers is not permitted.

8.2 ORIENTATION

Test results are only applicable to the orientation in which the grille was tested.

8.3 POSITION

The Block Grilles were positioned in the centre of the wall with equal spacing on the exposed and non-exposed sides of the supporting construction.

The MG and MG/TL Grilles were positioned with one front and back plate fitted to the exposed side and one front and back plate fitted to the non- exposed side.
The NBG Grille was positioned with the Plate & block grill assembly fitted on the exposed side and the plate on the non- exposed side.

If the ATG are tested in the wall flush with the wall at the exposed side and flush with the wall at the non-exposed side may be located at all locations inside a wall of the same construction.

The ATG tested in the thinnest wall, flush with the unexposed side may be used in a thicker wall of the same construction at the same location or moved further away from the unexposed side.
The ATG tested in the thinnest wall at the position flush with the non-exposed side may be used in a thicker wall of the same construction at the same location.

If ATG shall be applied where neutral plane may occur between its bottom and top boundaries it shall be tested using one specimen fully above and one specimen fully below neutral pressure plane as described below (see Figure 5). The pressures in tests shall cover the maximum levels for intended applications.

To define in which position an ATG could be placed according to the pressure it was applied during the fire resistance test at its bottom and top locations, the following criteria and formula apply:

According to EN 1363-1 neutral pressure plane could be found at a height of 0,5 m above the notional floor level and the pressure gradient will be approximately 8,5 Pa per metre of furnace's height. This plane could be moved keeping the following formula:

$H(p) = (p + 4.25) / 8.5$

Where

H(p) is the height in function of the pressure, measured in metres;

p I s the pressure, measured in Pascal or N/m2.

Also, the following relation is equivalent:

p (H) = 8,5× H - 4,25

Where

p(H) is the pressure in function of the height, measured in Pascals or N/m2;

H is the height, measured in metres.

Air transfer grilles installed in vertical supporting constructions, tested under negative pressure conditions can be installed in vertical constructions with the grilles top height less than 0,5 m above notional floor level or where maximum pressure at the upper part of the grill correspond to 0 Pa.

Air transfer grilles installed in vertical supporting constructions, tested under positive pressure conditions can be installed in vertical constructions with the grilles bottom equal to or more than 0,5 m above notional floor level or where minimum pressure at the lower part of the grill correspond to 0 Pa.

For example:

a) Example 1

ATG to be placed in the building with its lower part at 2,5 m from the notional floor level shall be tested to a minimum positive pressure of

p (2,5 [m]) = 8,5× 2,5 − 4,25 = 17 [Pa]

or what is the same, ATG tested with pressure of 17 Pa at its lower part could be placed with its lower part 0,5m from the notional floor level to a height of

H (17 [Pa]) = (17 + 4,25) / 8,5 = 2,5 m

b) Example 2

ATG to be placed in the building with its upper p art a t − 1,5 m from the notional floor level shall be tested to a maximum negative pressure of

p (−1,5 [m]) = 8,5× (−1,5) − 4,25 = −17 [Pa]

or what is the same, ATG tested with pressure of −17 Pa at its upper part could be placed with its upper part 0,5 m from the notional floor level to a height of

H(-17 [Pa]) = ((-17) + 4,25) / 8.5 = -1,5 m

For ATG tested in walls or floors the distance from the edge of the grille and the perimeter of the construction shall not be decreased more then to 200 mm or less, unless it has been tested with the reduced distance.

The distance between the ATG and any other opening (e.g. door) in a building element shall be minimum 200 mm or less, unless it has been tested with the reduced distance.

8.4 NUMBER

The number of ATG mounted in multiple arrangements may be decreased but shall not be increased from the tested configuration.

8.5 SUPPORTING CONSTRUCTION

8.5.1 Wall/floor grilles

The results of a test of ATG, tested in one of the supporting constructions given in EN 1363-1 is applicable to any other supporting construction within the same type (rigid, low density of flexible) that has a greater fire resistance (thicker, denser, more layers of boards as appropriate).

P.G.R. Scholten B.Sc.
Project leader Fire resistance

R.D. Scheepe B.Sc.
Manager Testing

9. FIGURES

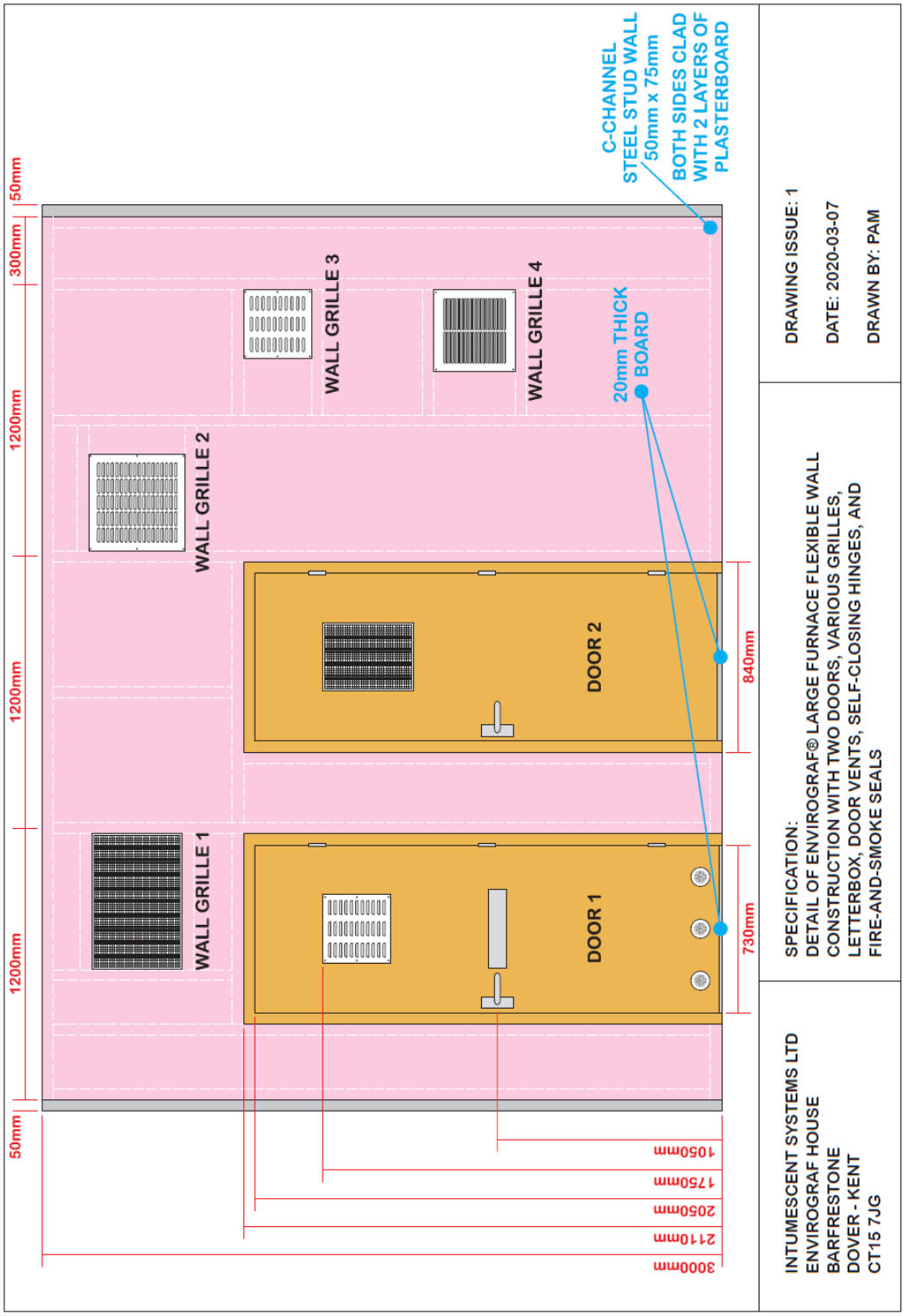


Figure 1: Test specimens overview

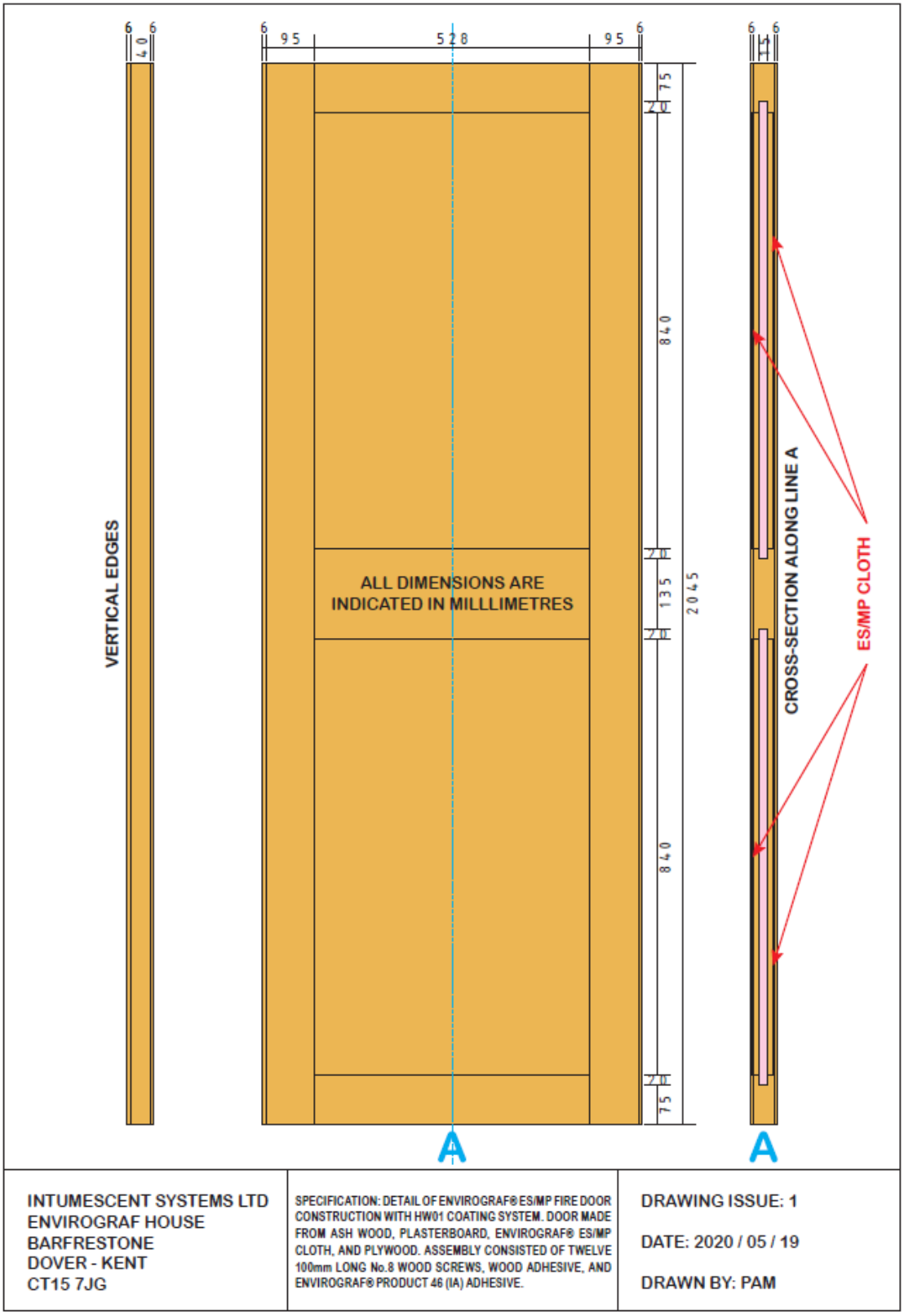


Figure 2: Door details

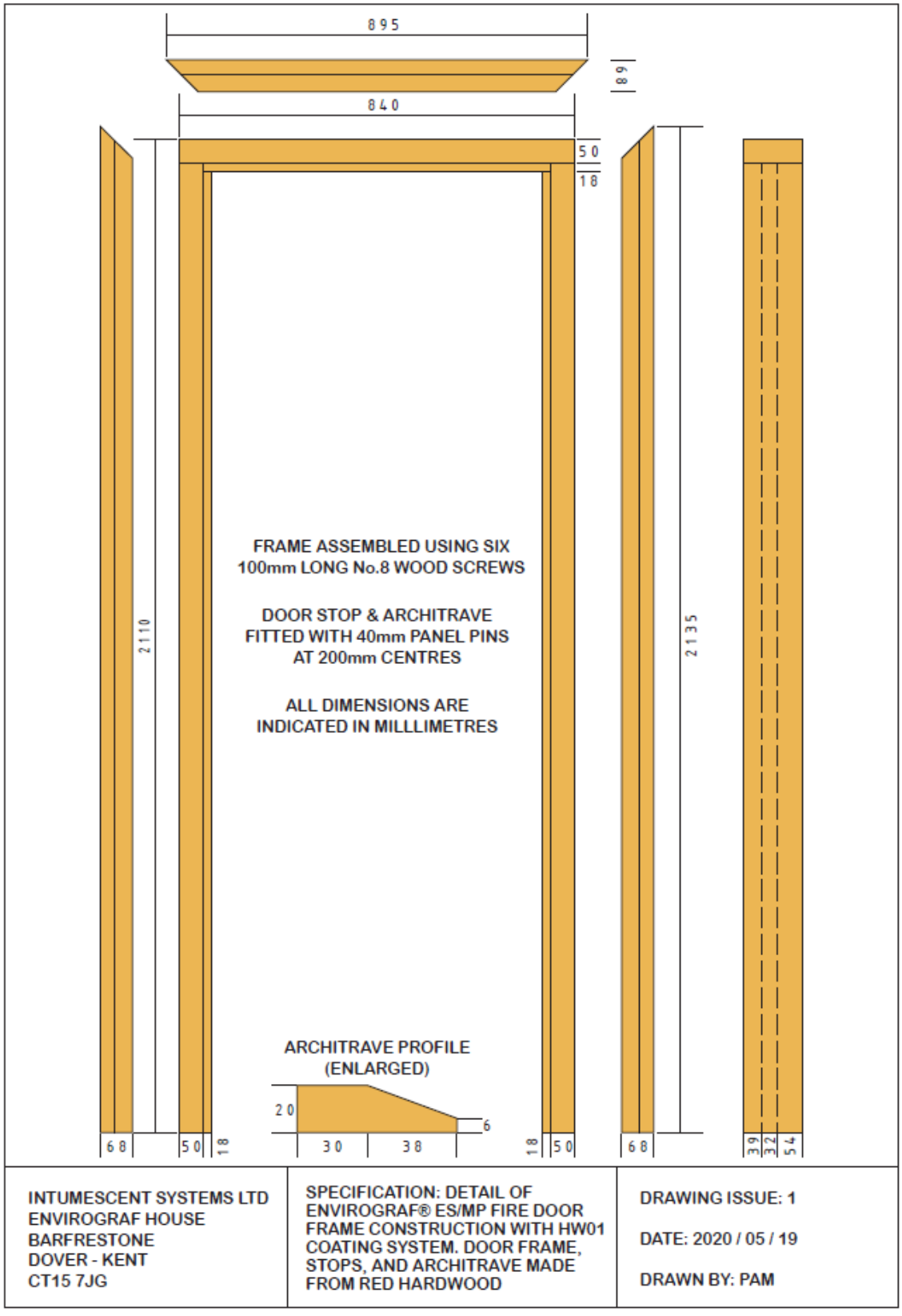


Figure 3: Door frame details

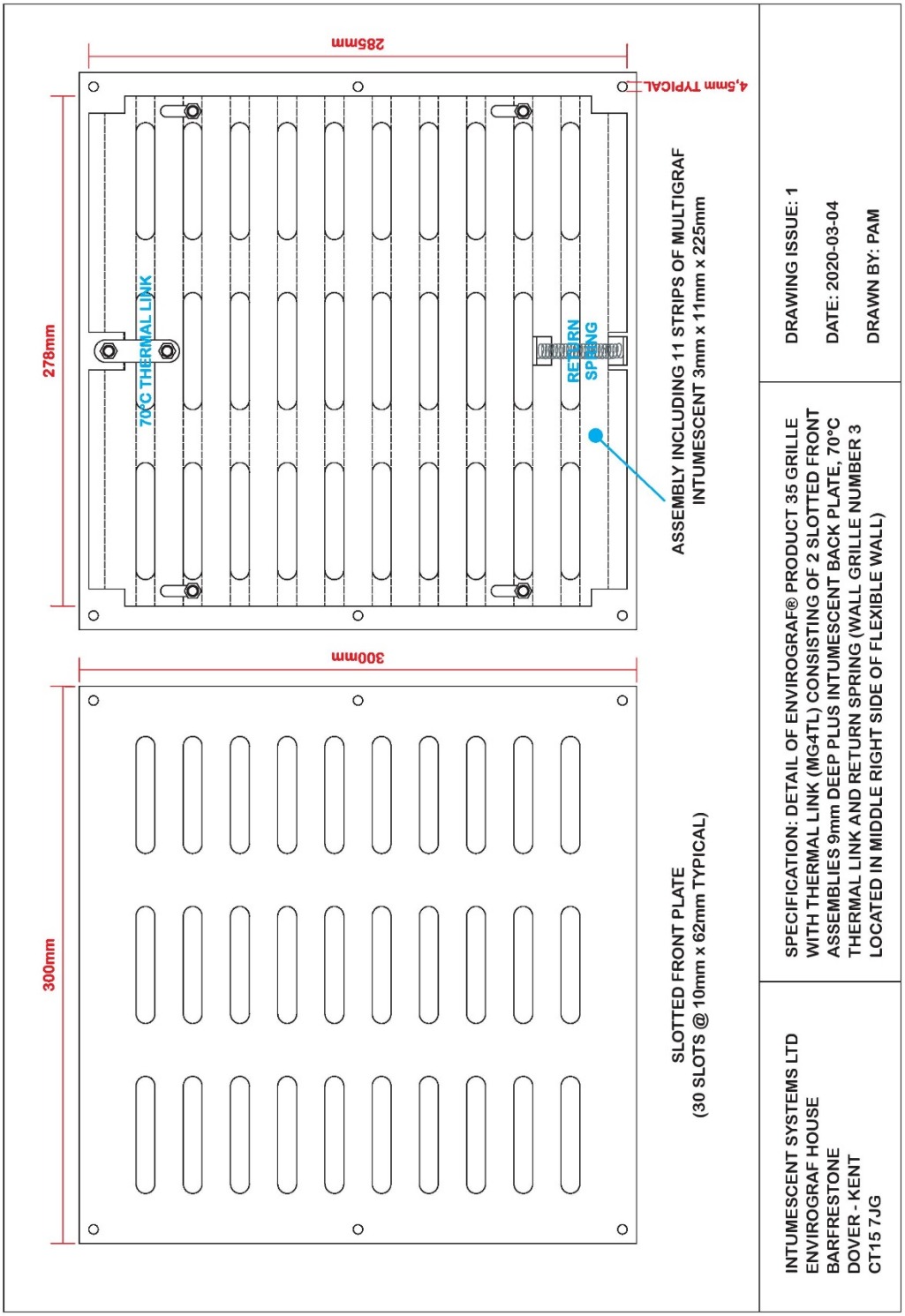


Figure 4: Grille type product 35

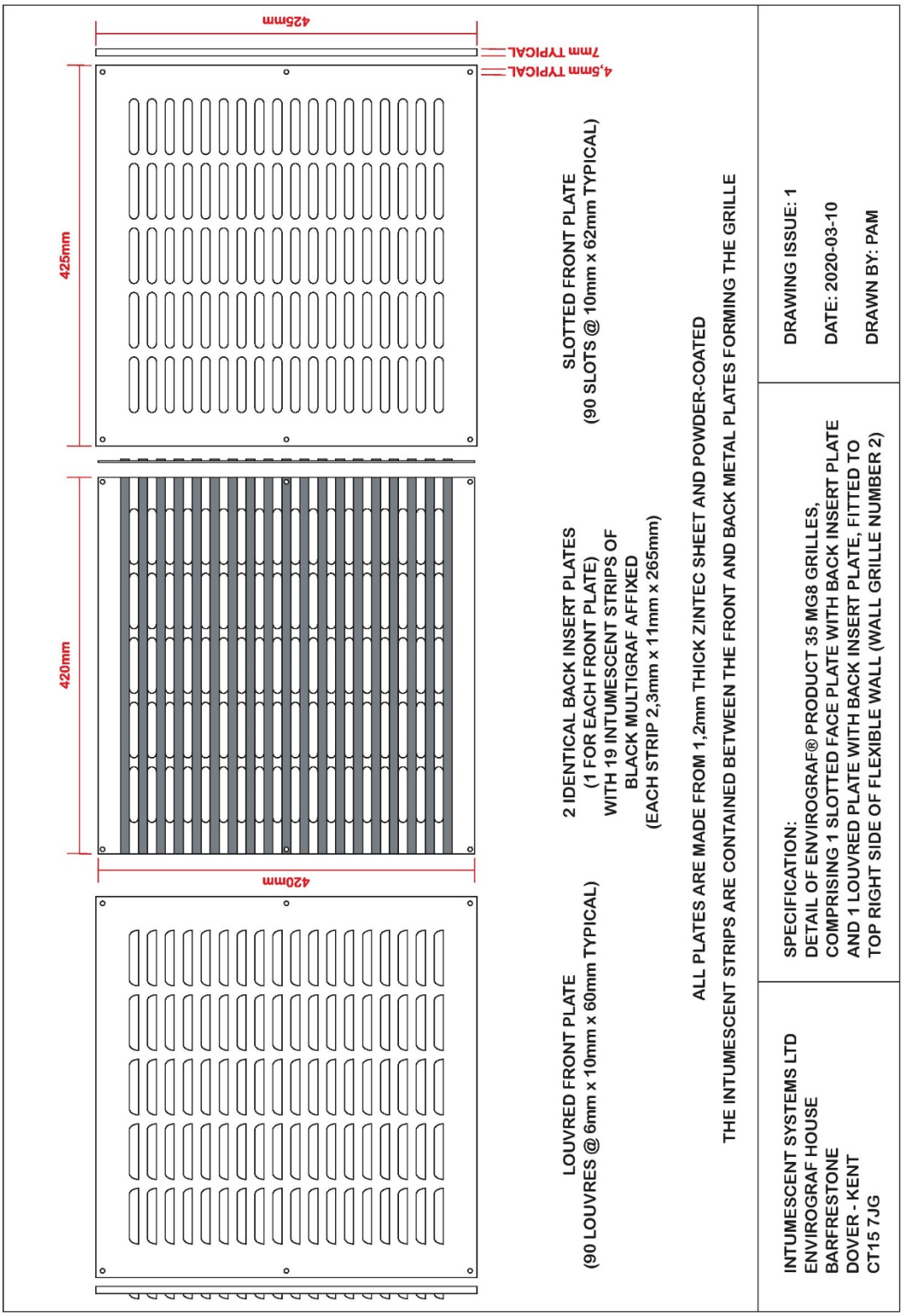


Figure 5: Grille type product 35

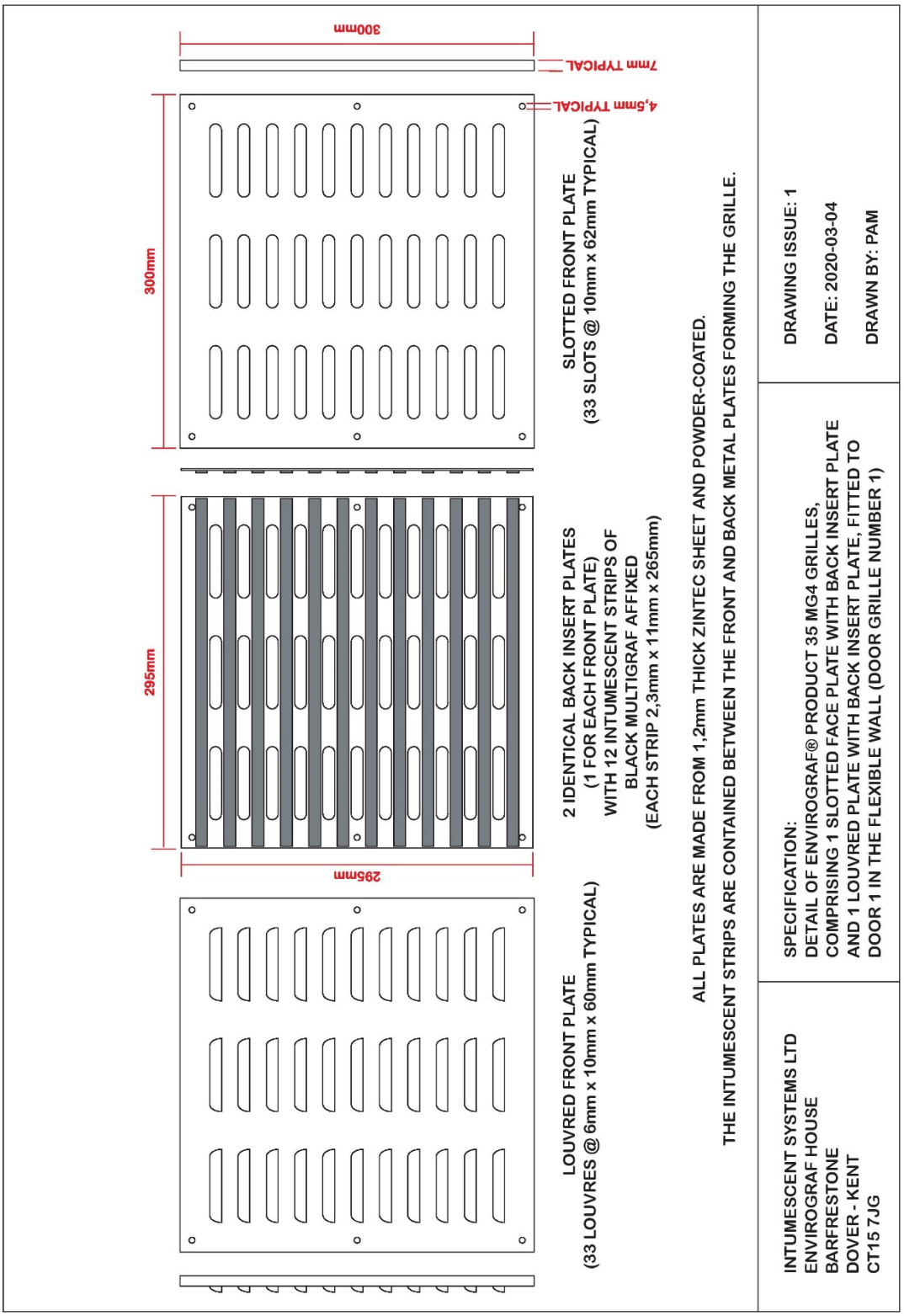


Figure 6: Grille type product 35

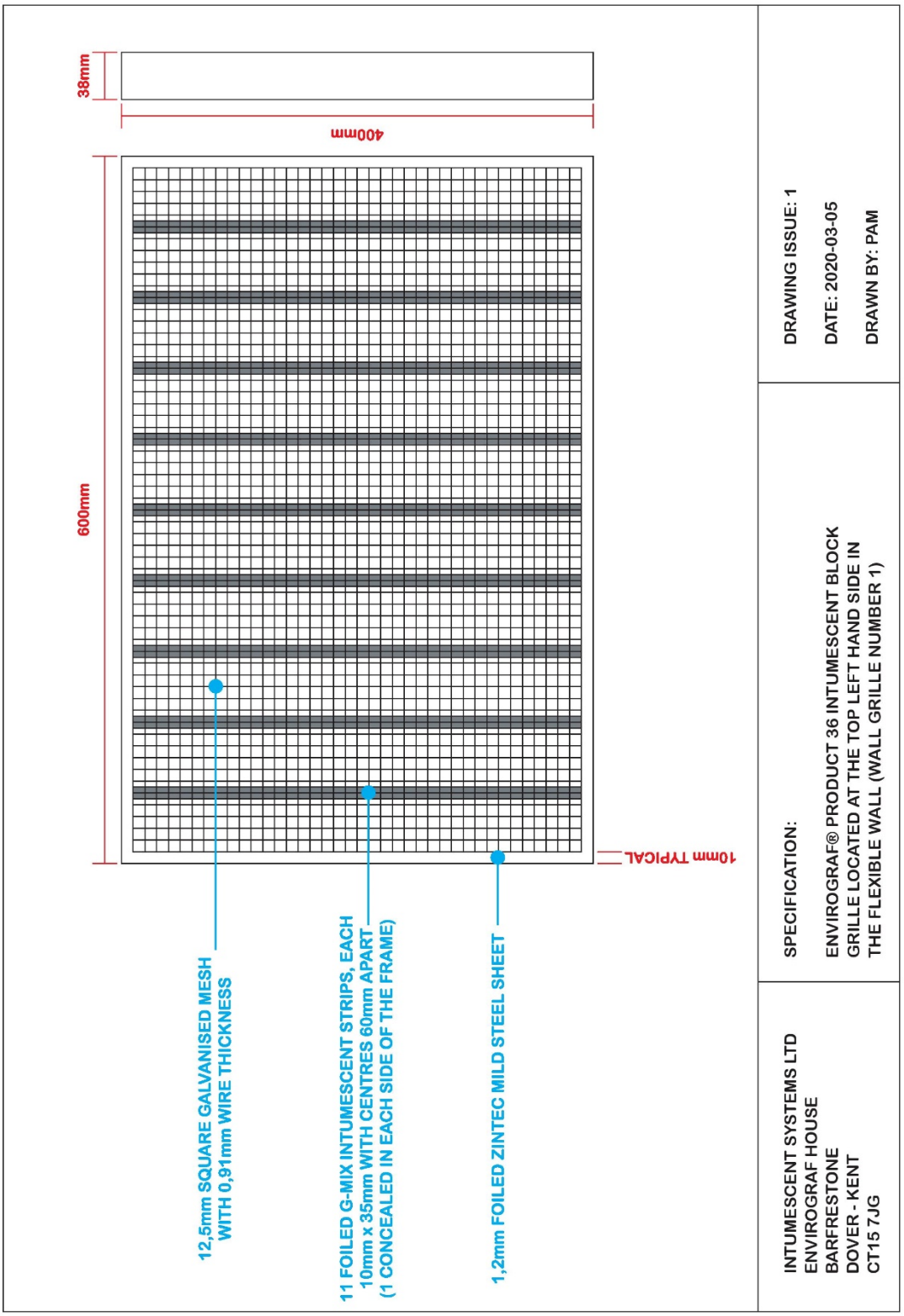


Figure 7: Grille type product 36

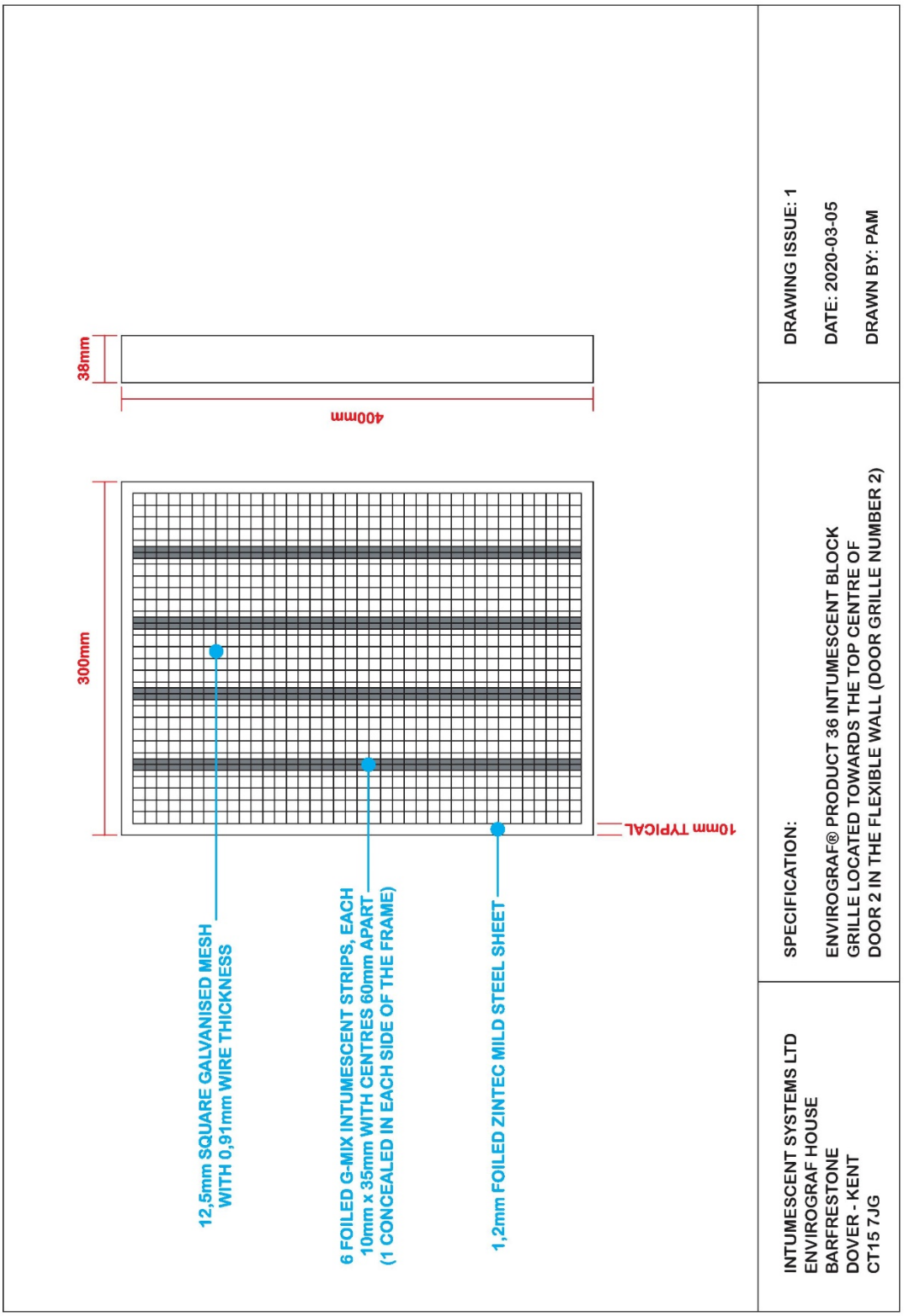


Figure 8: Grille type product 36

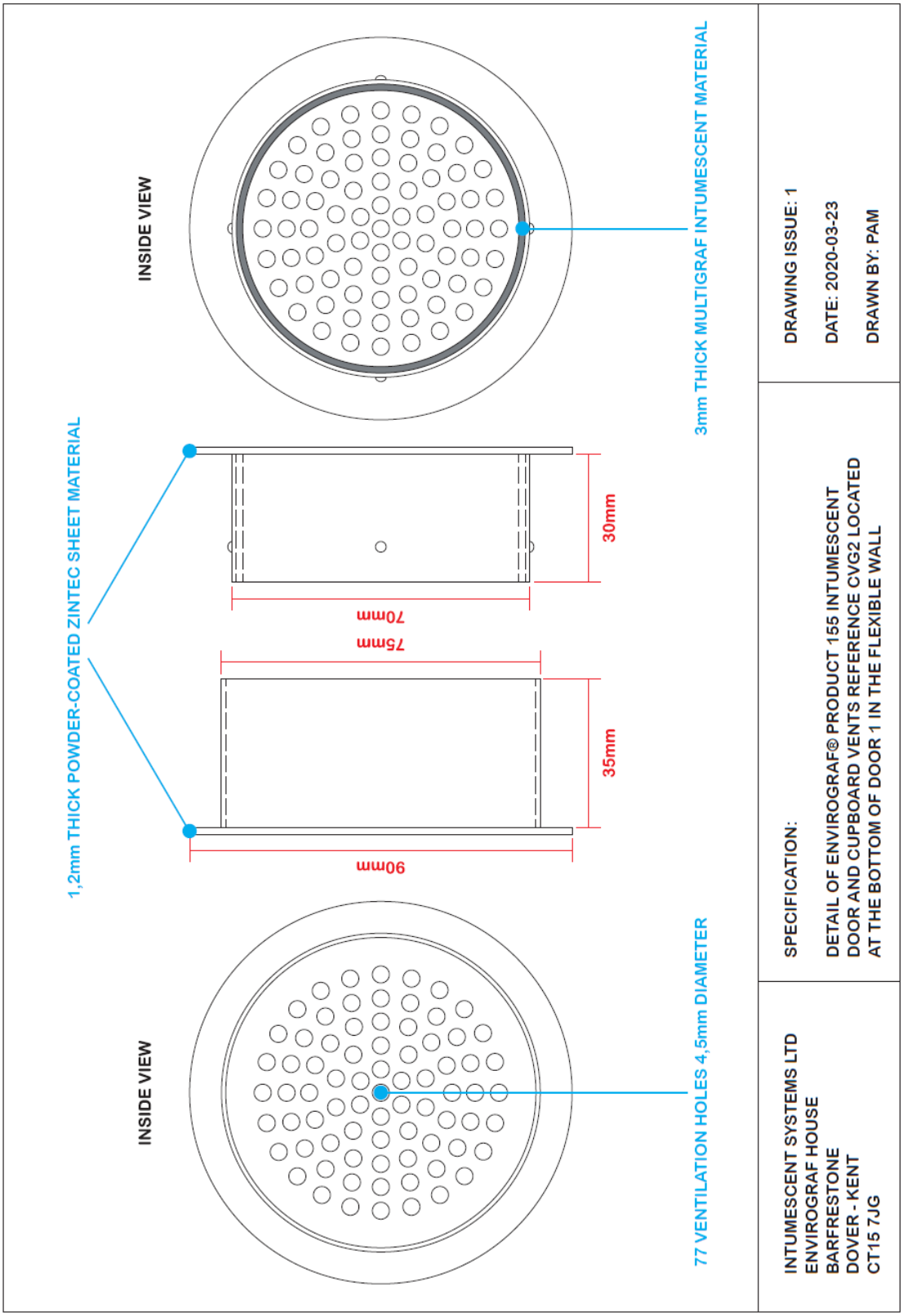


Figure 9: Grille type product 155

APPENDIX A: FURNACE CONDITIONS AND AMBIENT TEMPERATURE

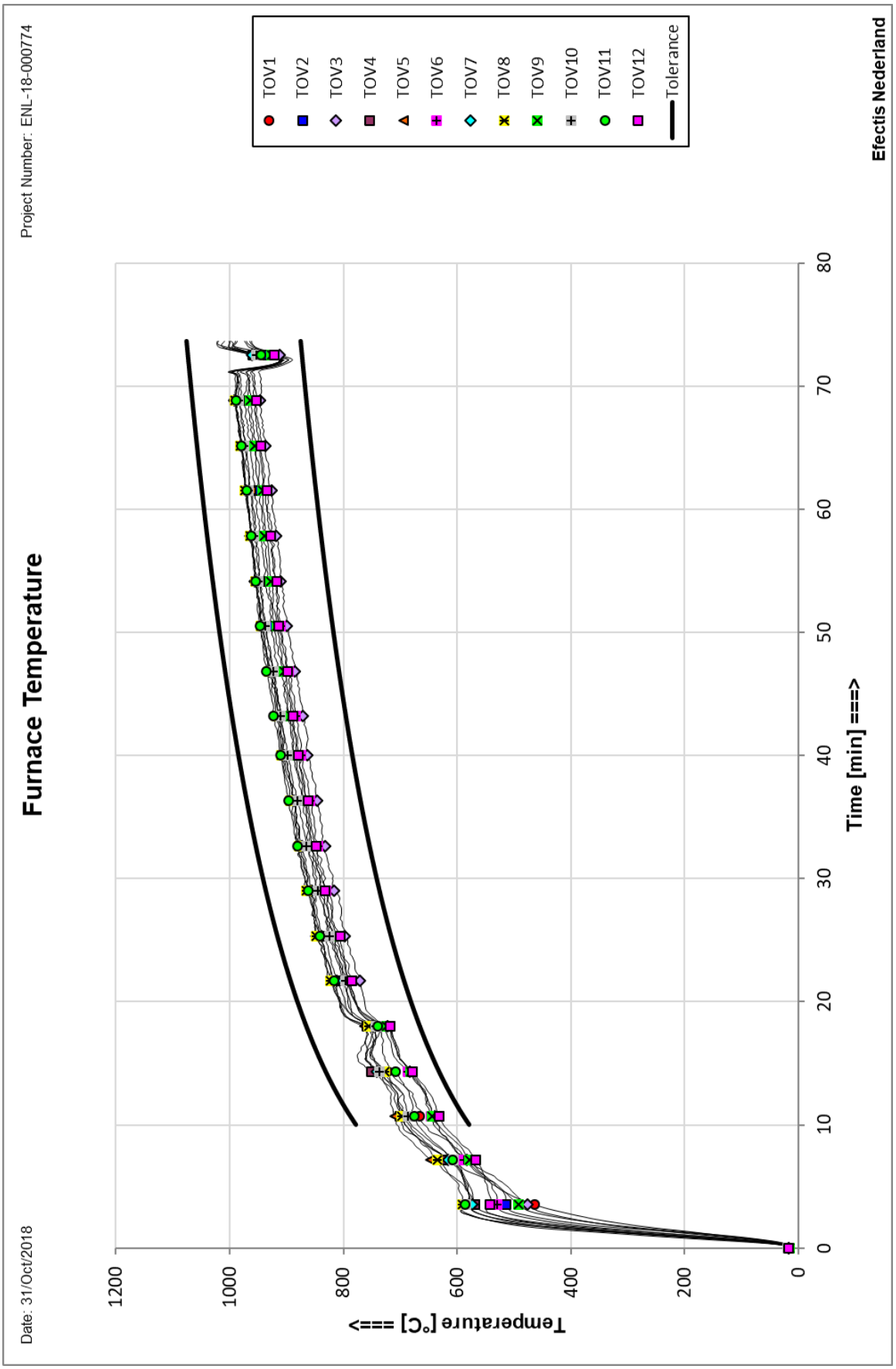


Figure A 1: Furnace temperature

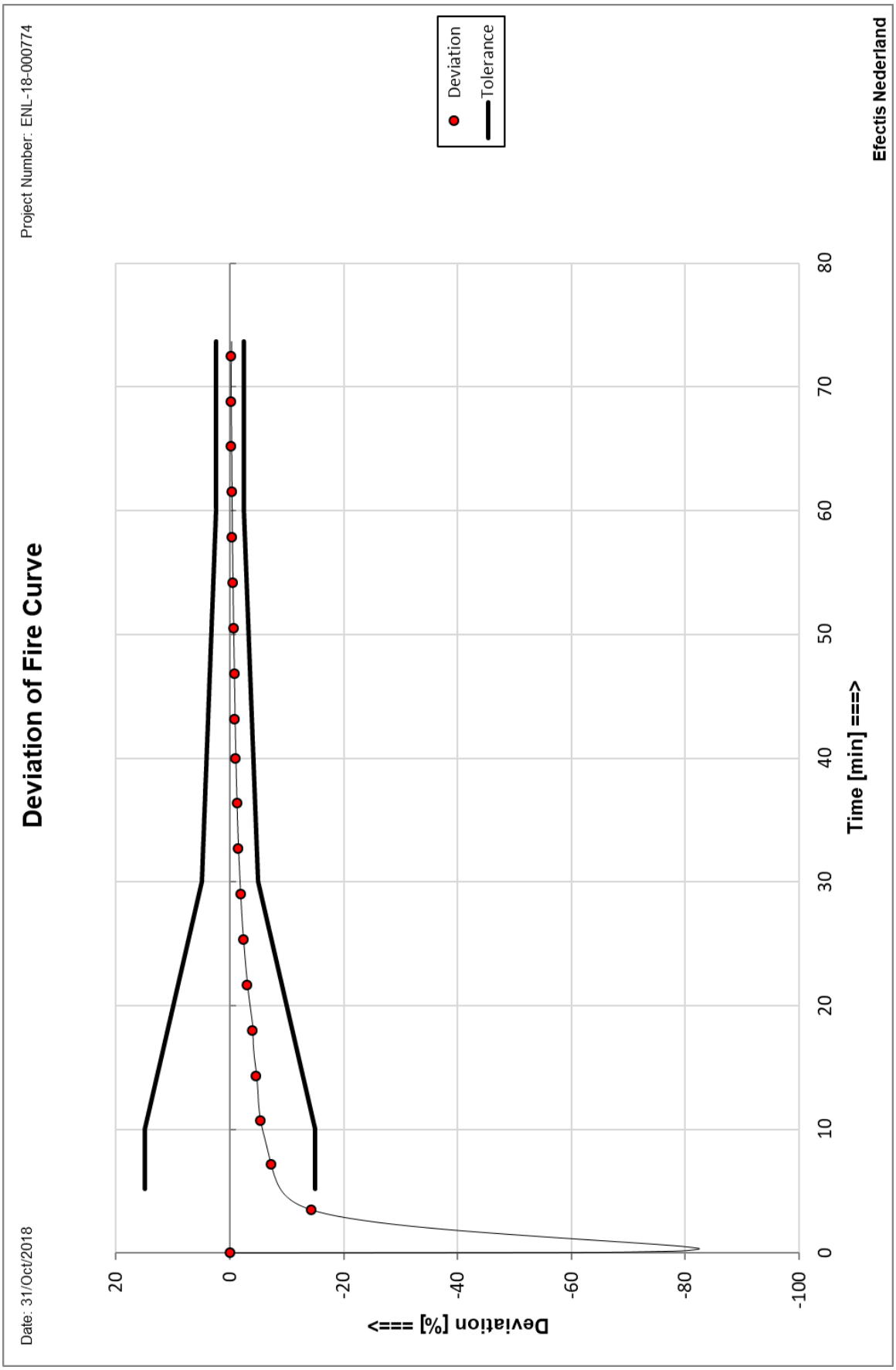


Figure A 2: Deviation of fire curve

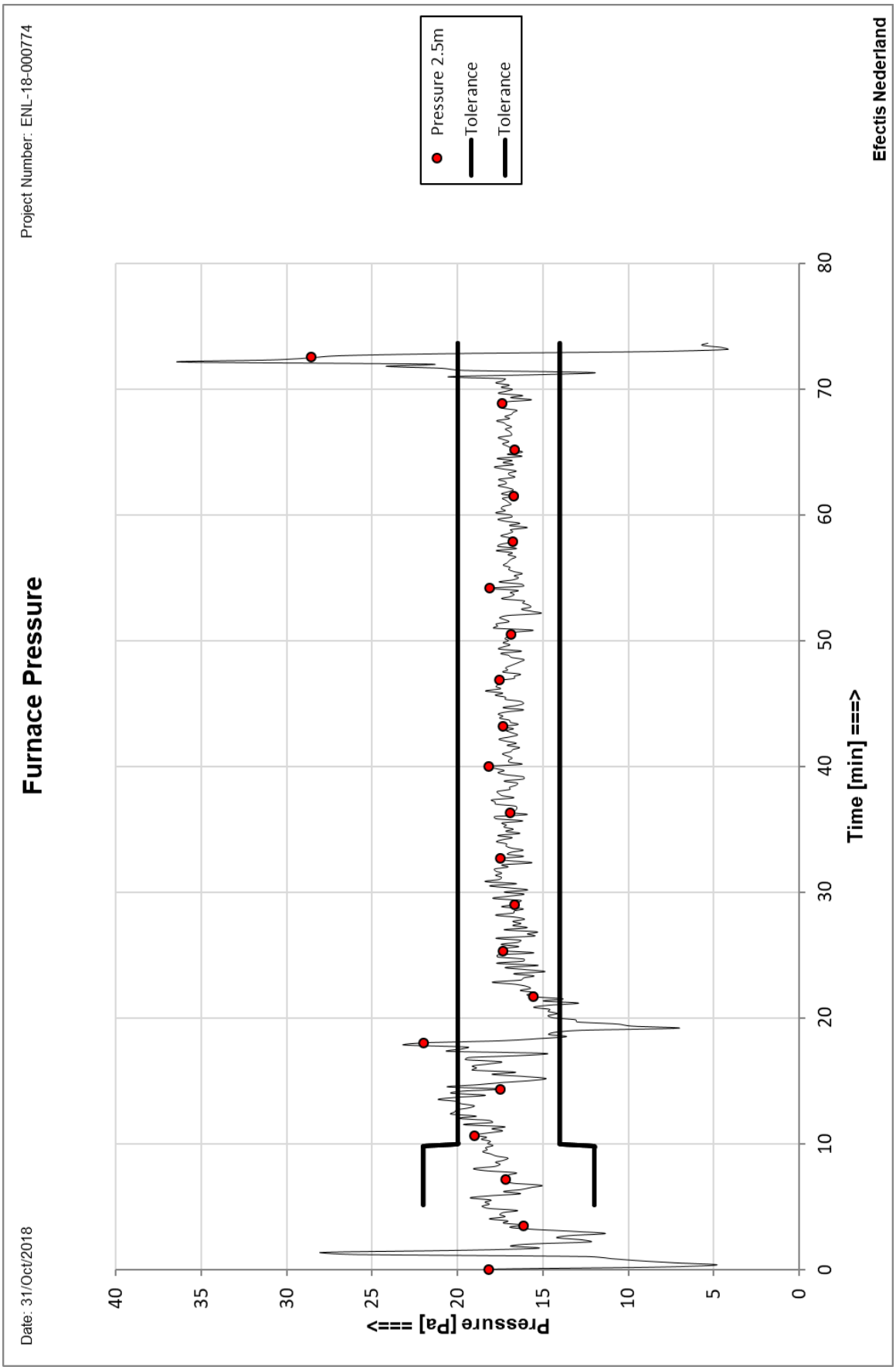


Figure A 3: Furnace pressure

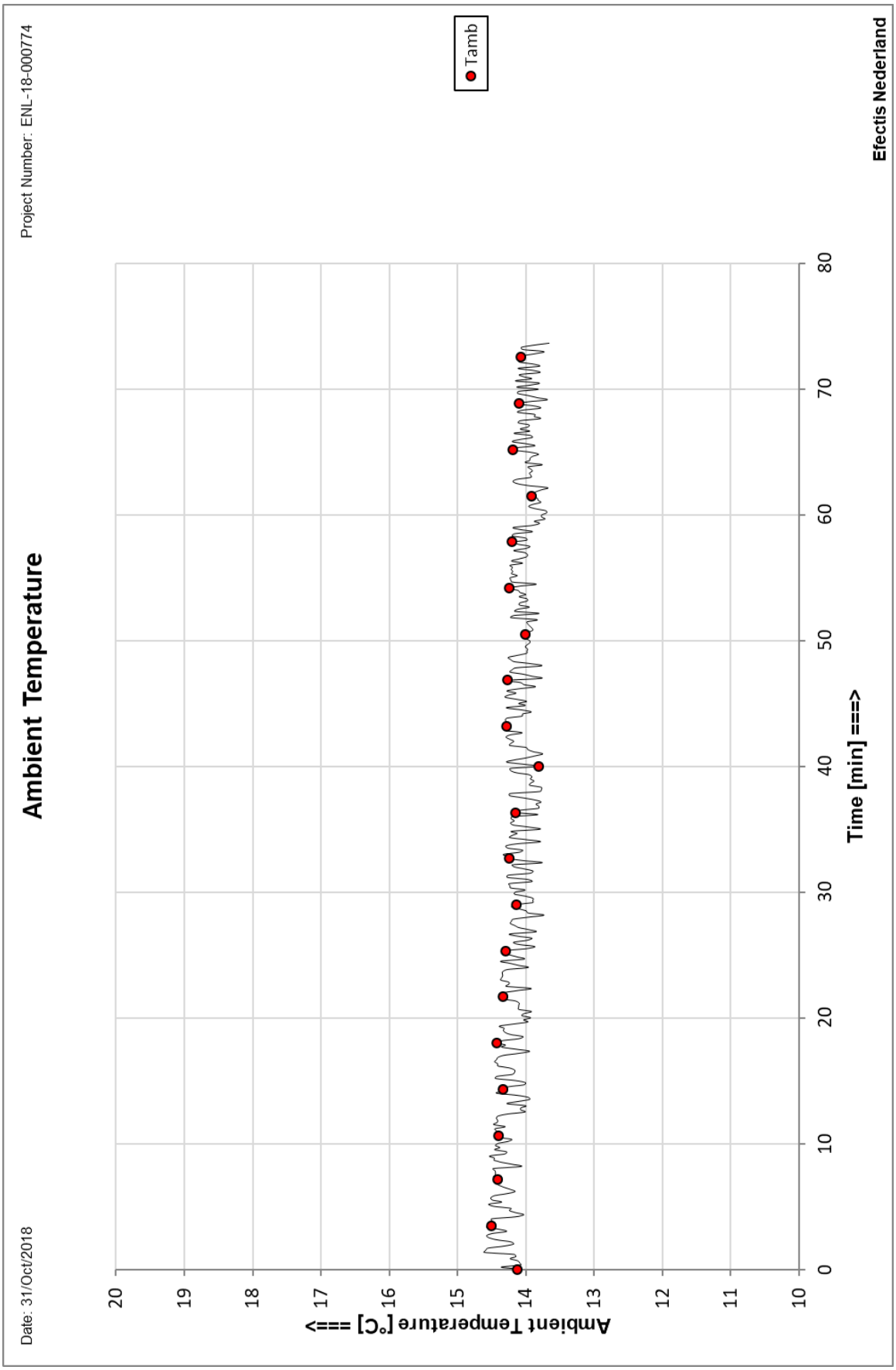


Figure A 4: Ambient temperature

APPENDIX B: POSITION OF THERMOCOUPLES AND TEST RESULTS

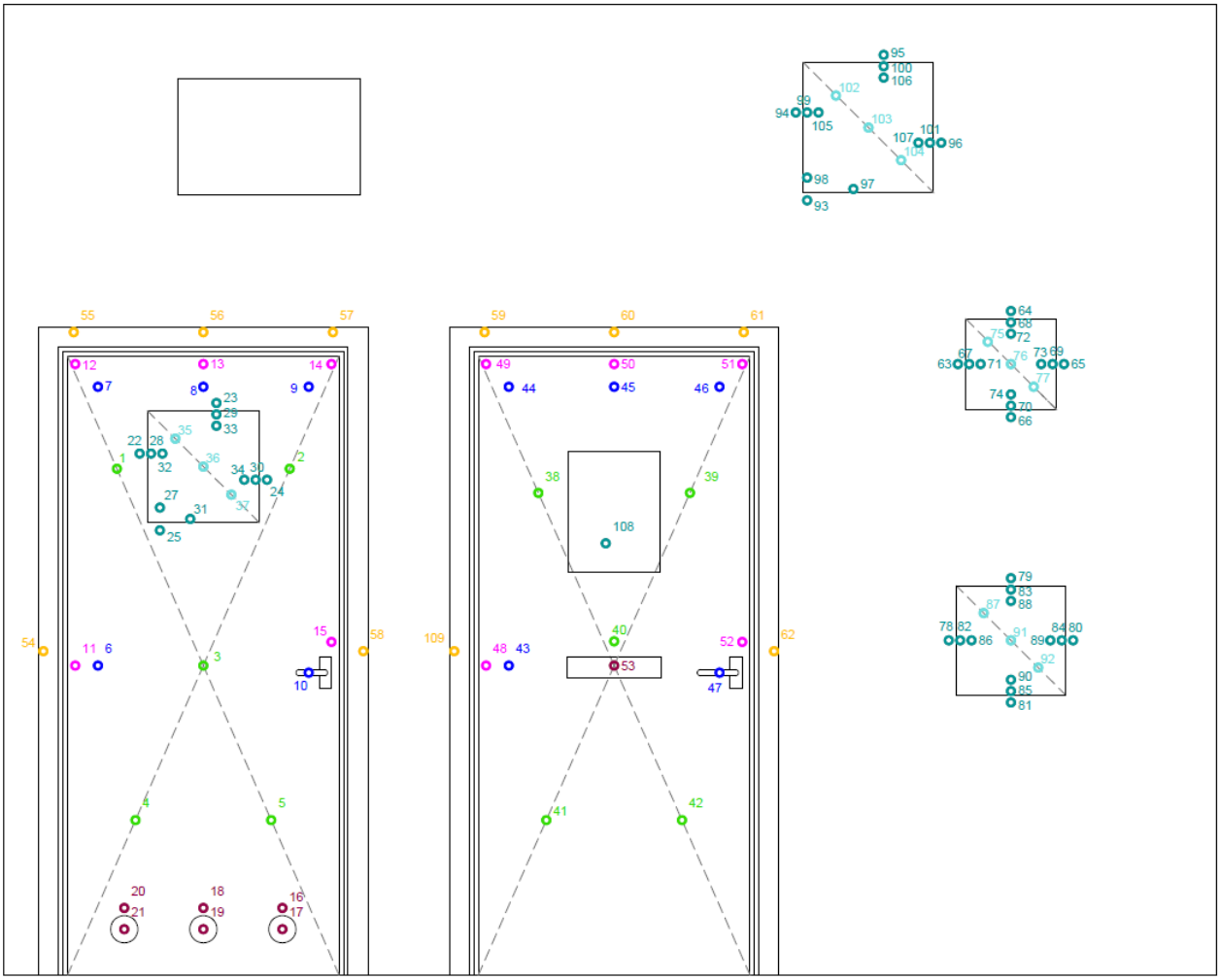


Figure B 1: Position thermocouples

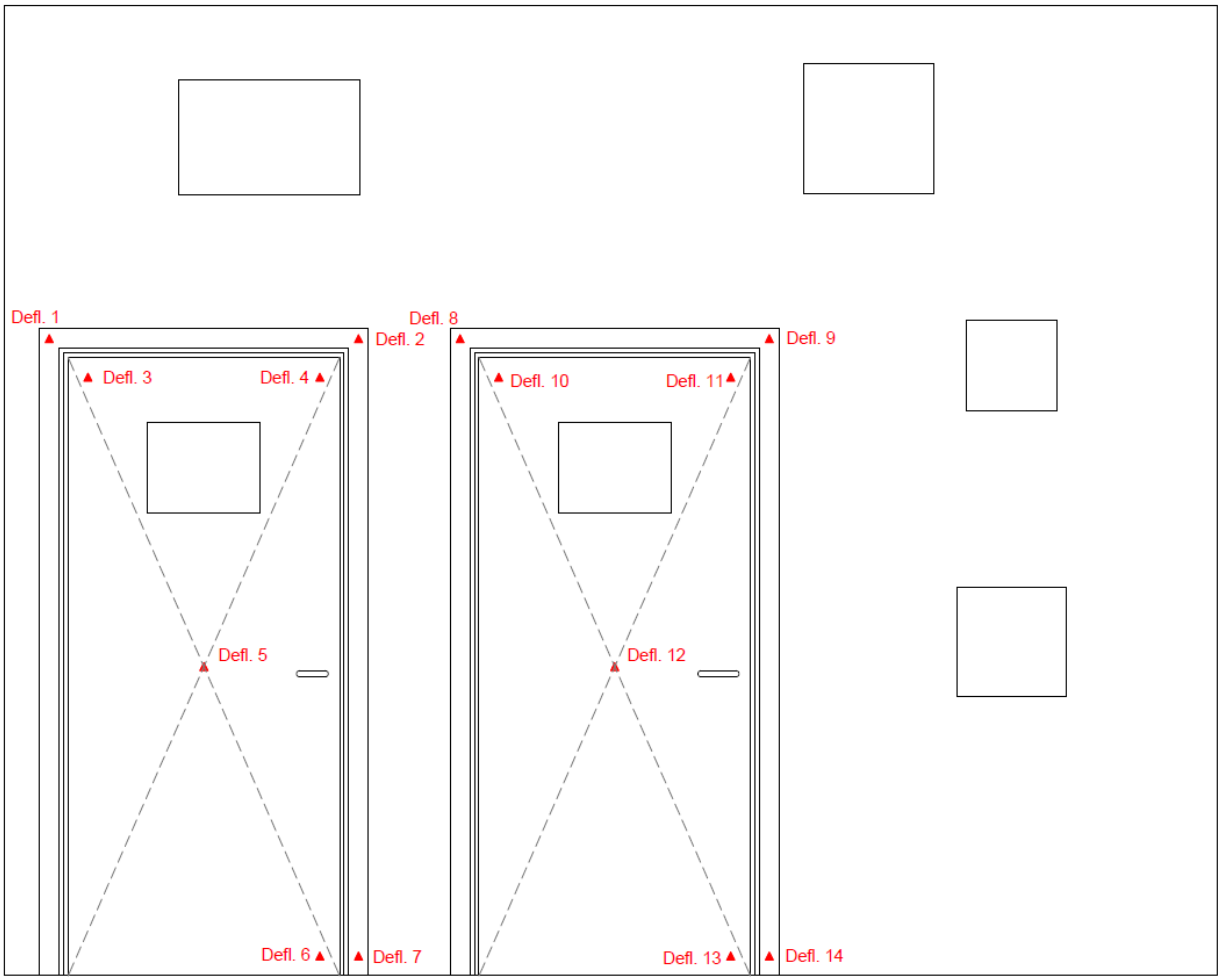


Figure B 2: Position deflection measurements

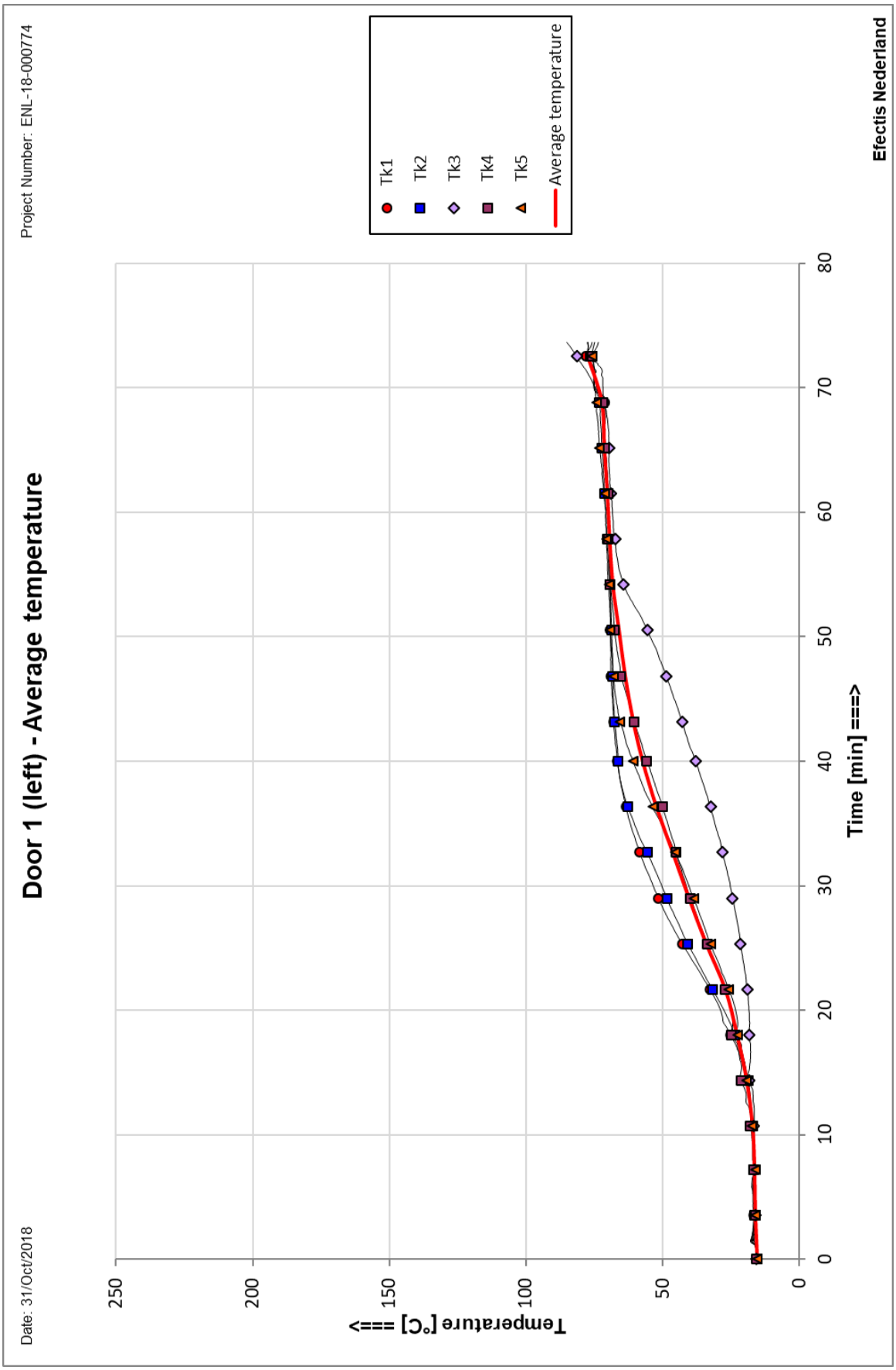


Figure B 3: Door 1 (left)- Average temperature

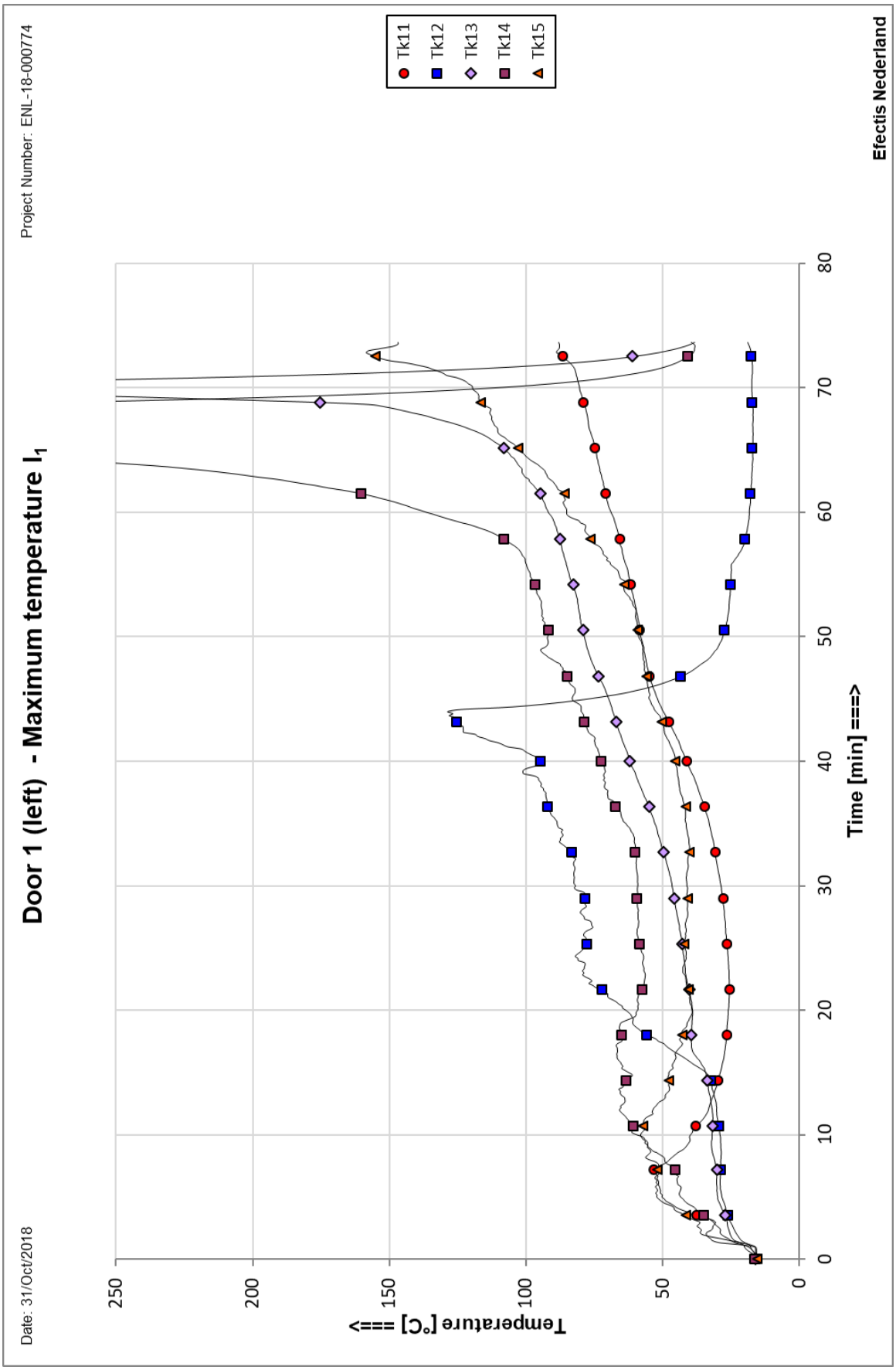


Figure B 4: Door 1 (left) - Maximum temperature I_1

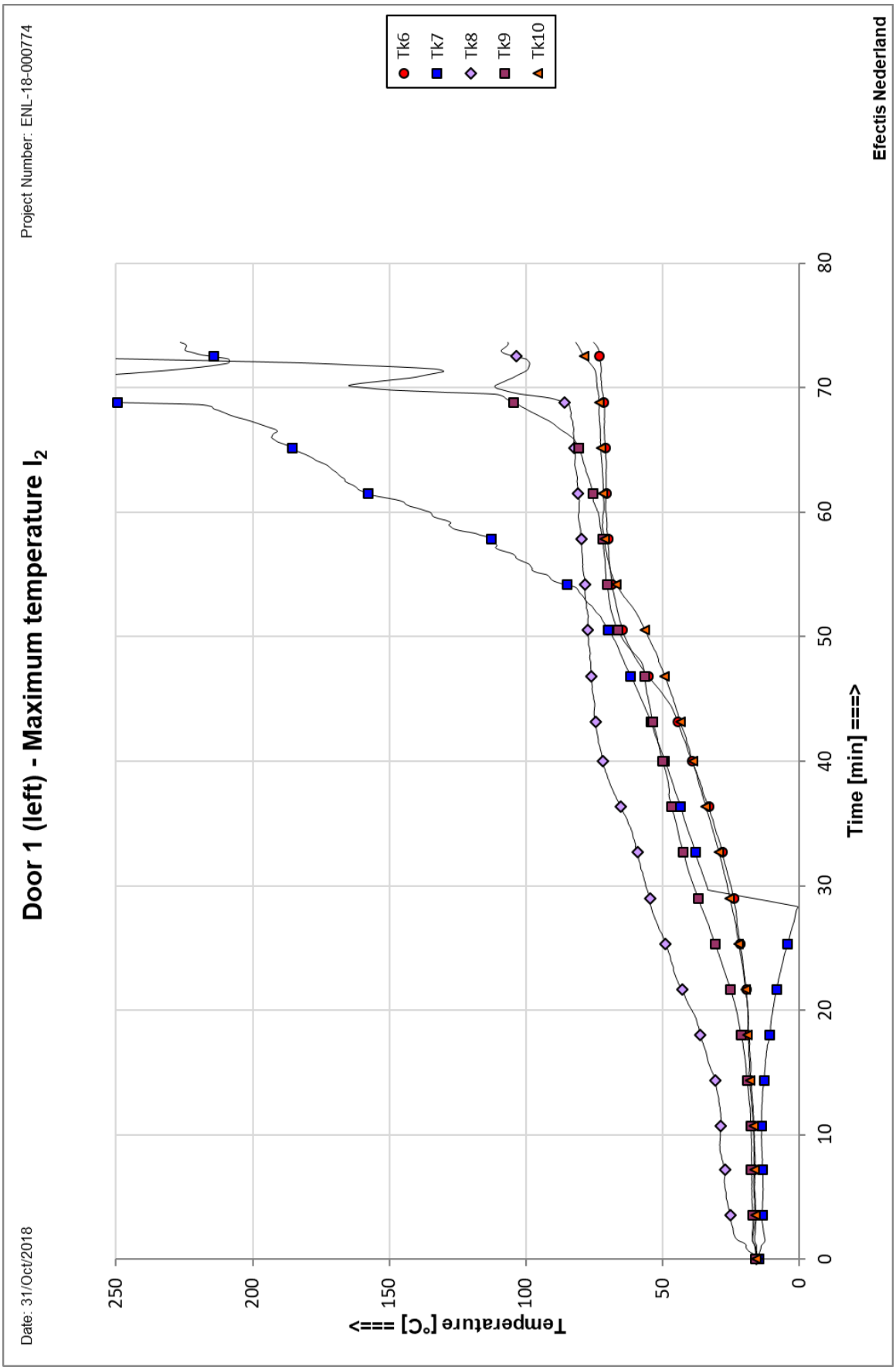


Figure B 5: Door 1 (left) - Maximum temperature I_2

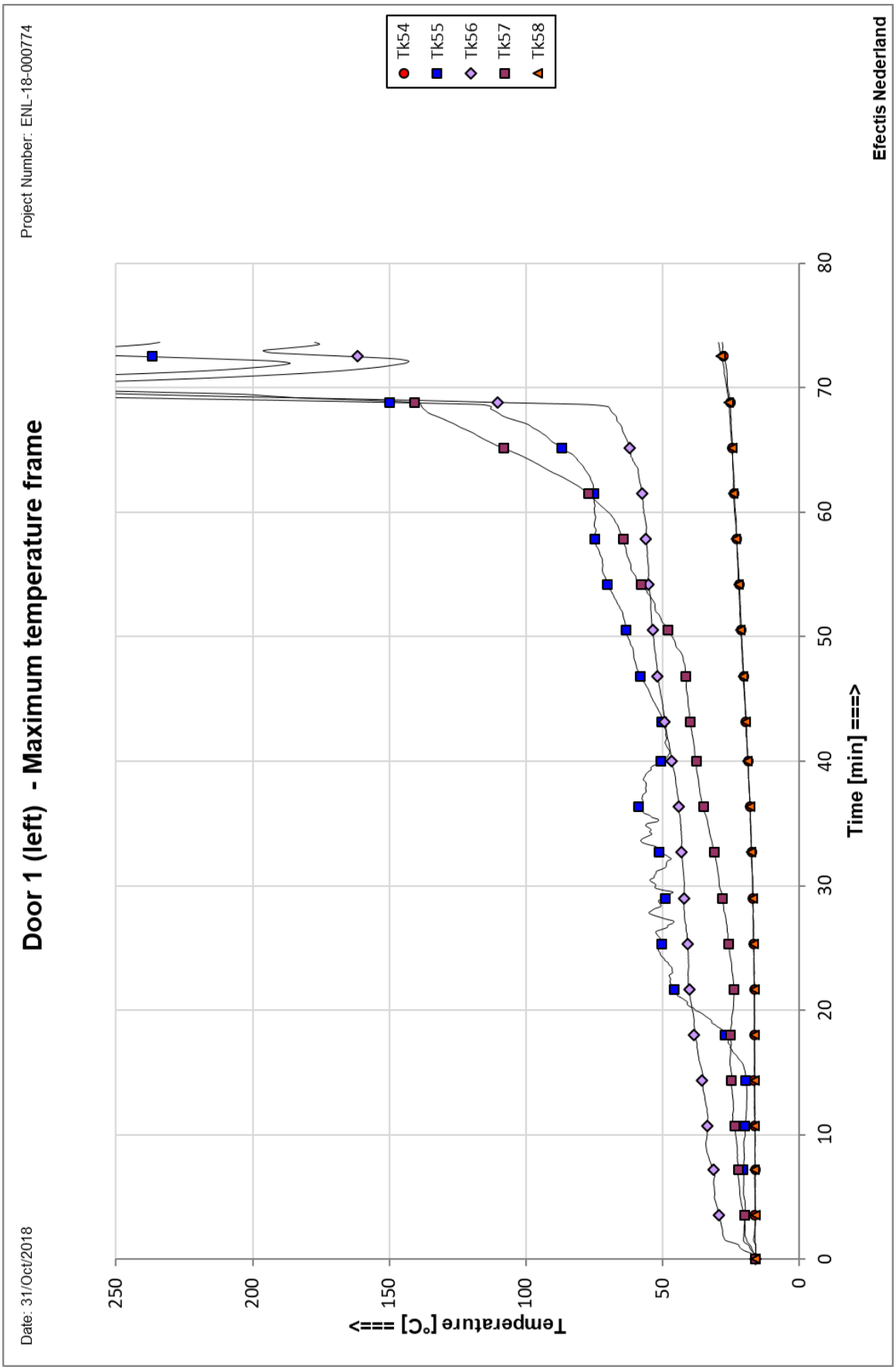


Figure B 6: Door 1 (left) - Maximum temperature frame

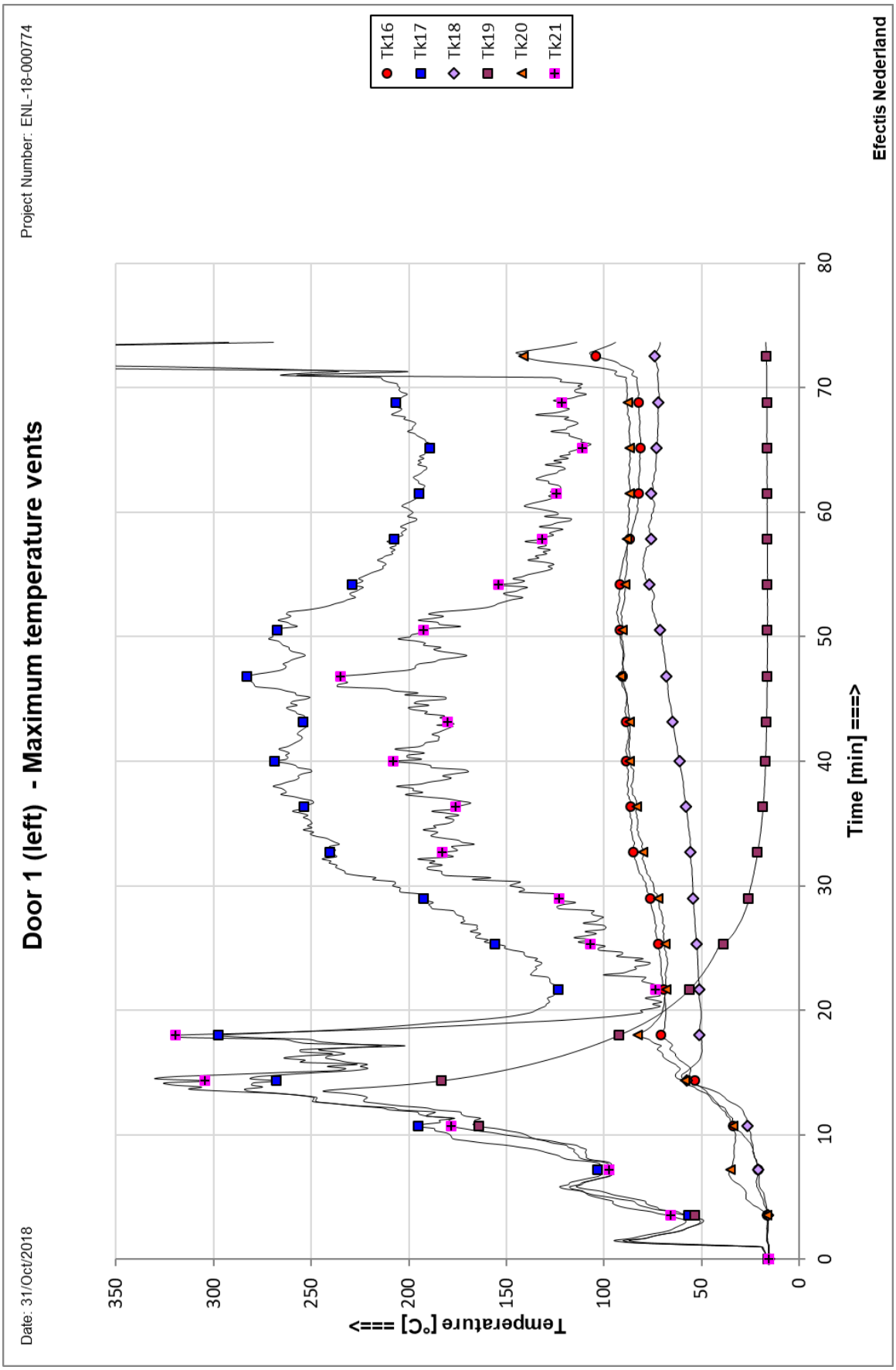


Figure B 7: Door 1 (left) - Maximum temperatures vents

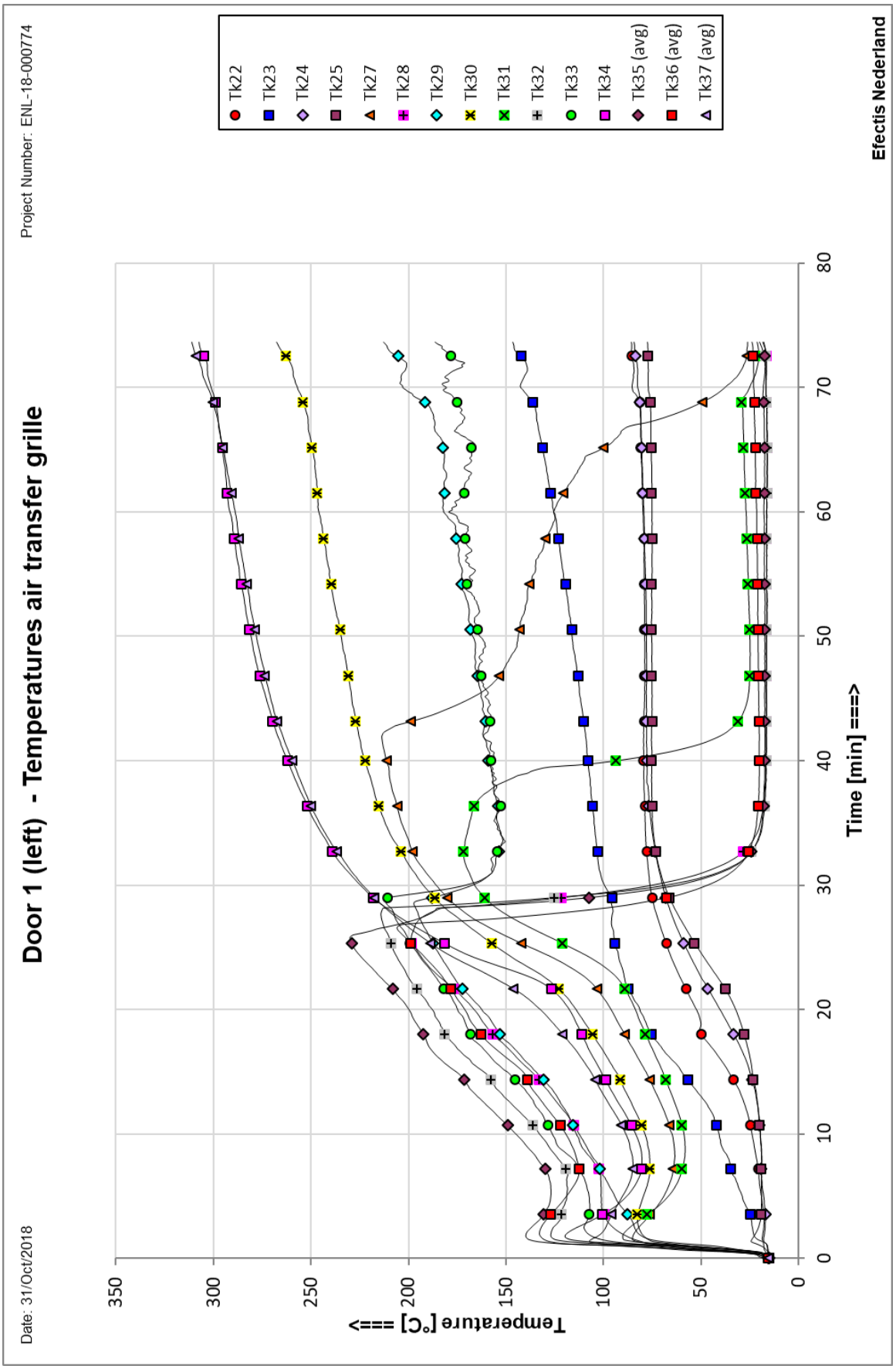


Figure B 8: Door 1 (left) - Temperatures air transfer grille

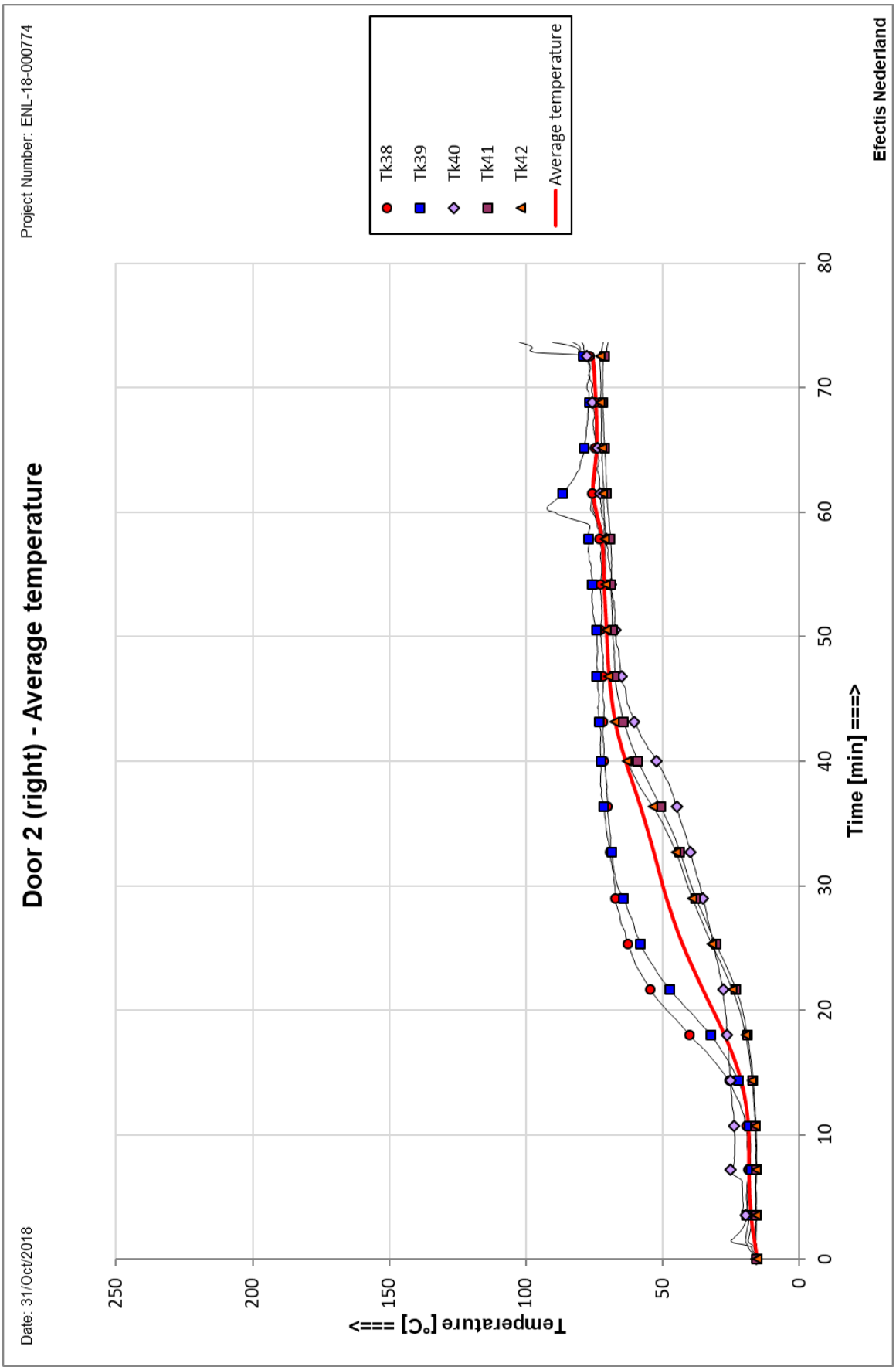


Figure B 9: Door 2 (right) - Average temperatures

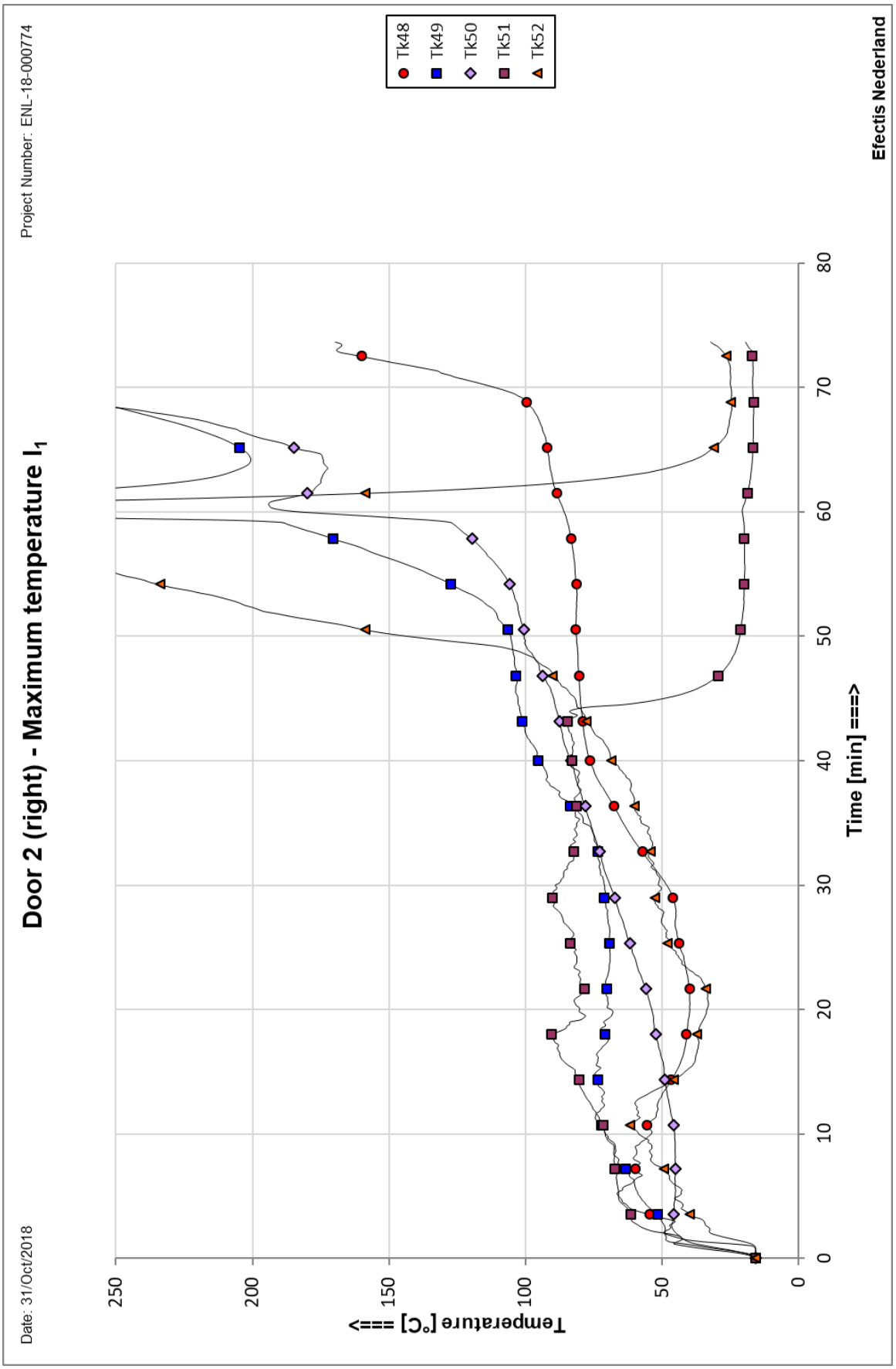


Figure B 10: Door 2 (right)- Maximum temperature I_1

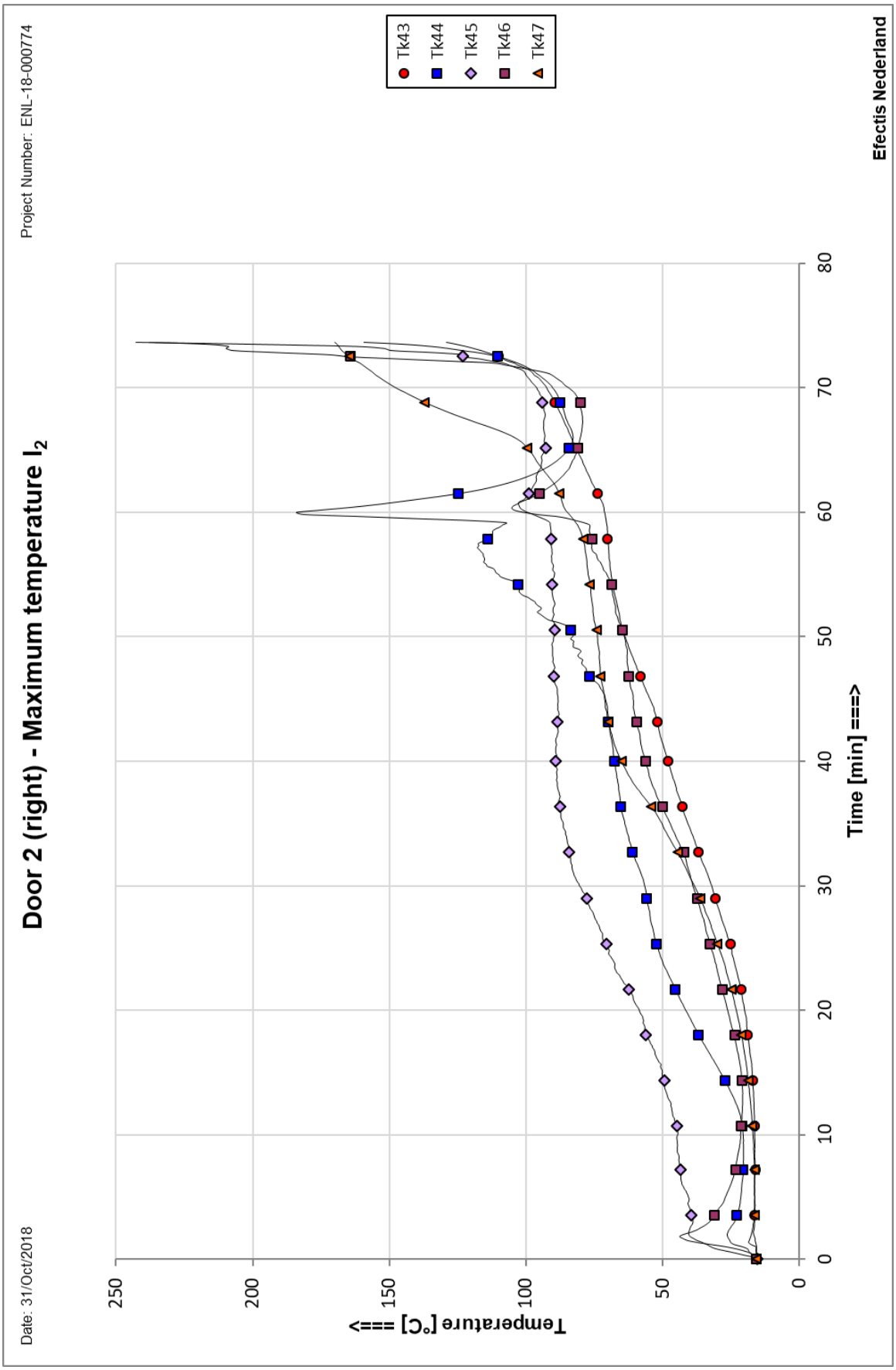


Figure B 11: Door 2 (right) - Maximum temperature I_2

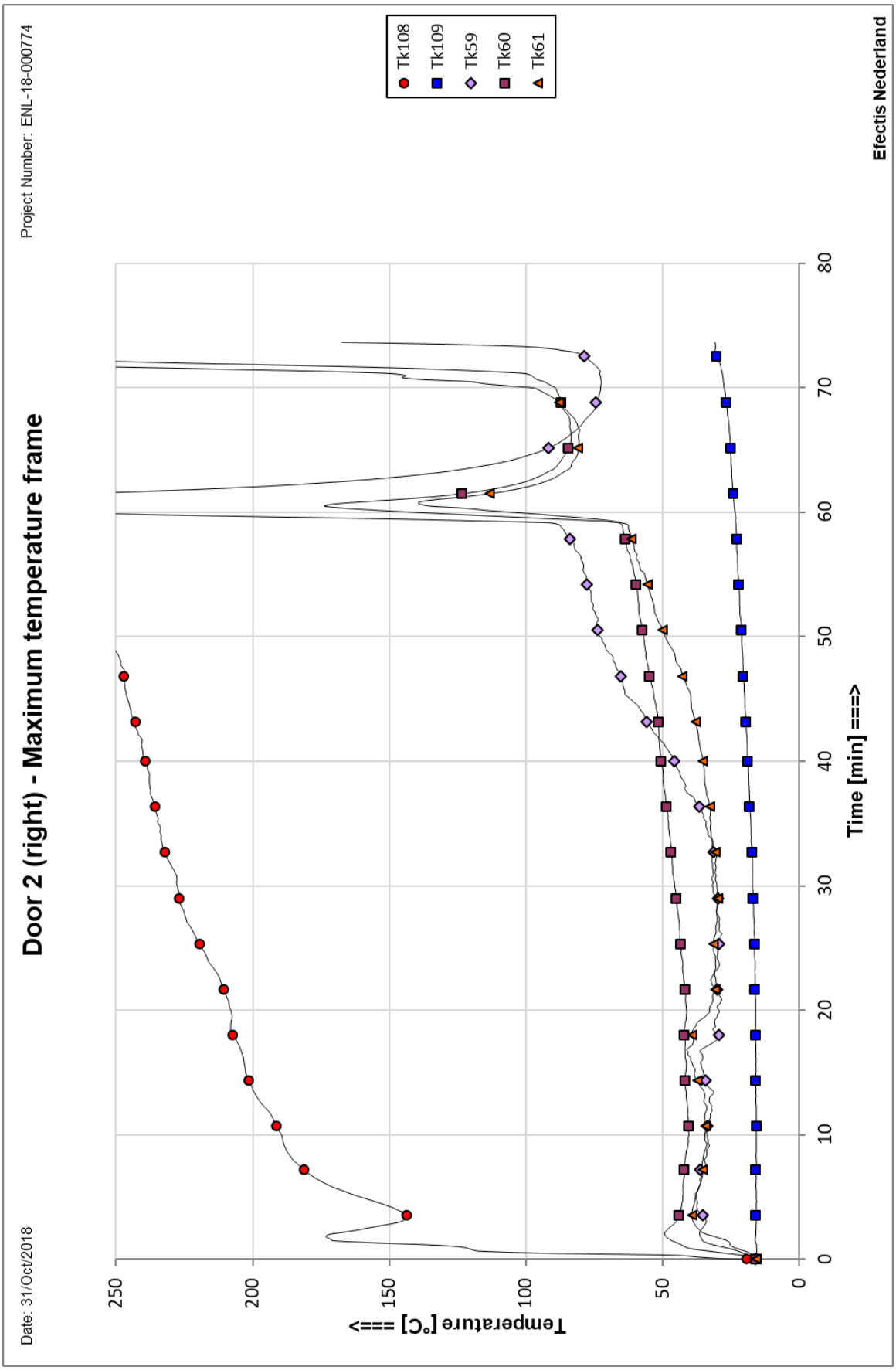


Figure B 12: Door 2 (right) - Maximum temperature frame

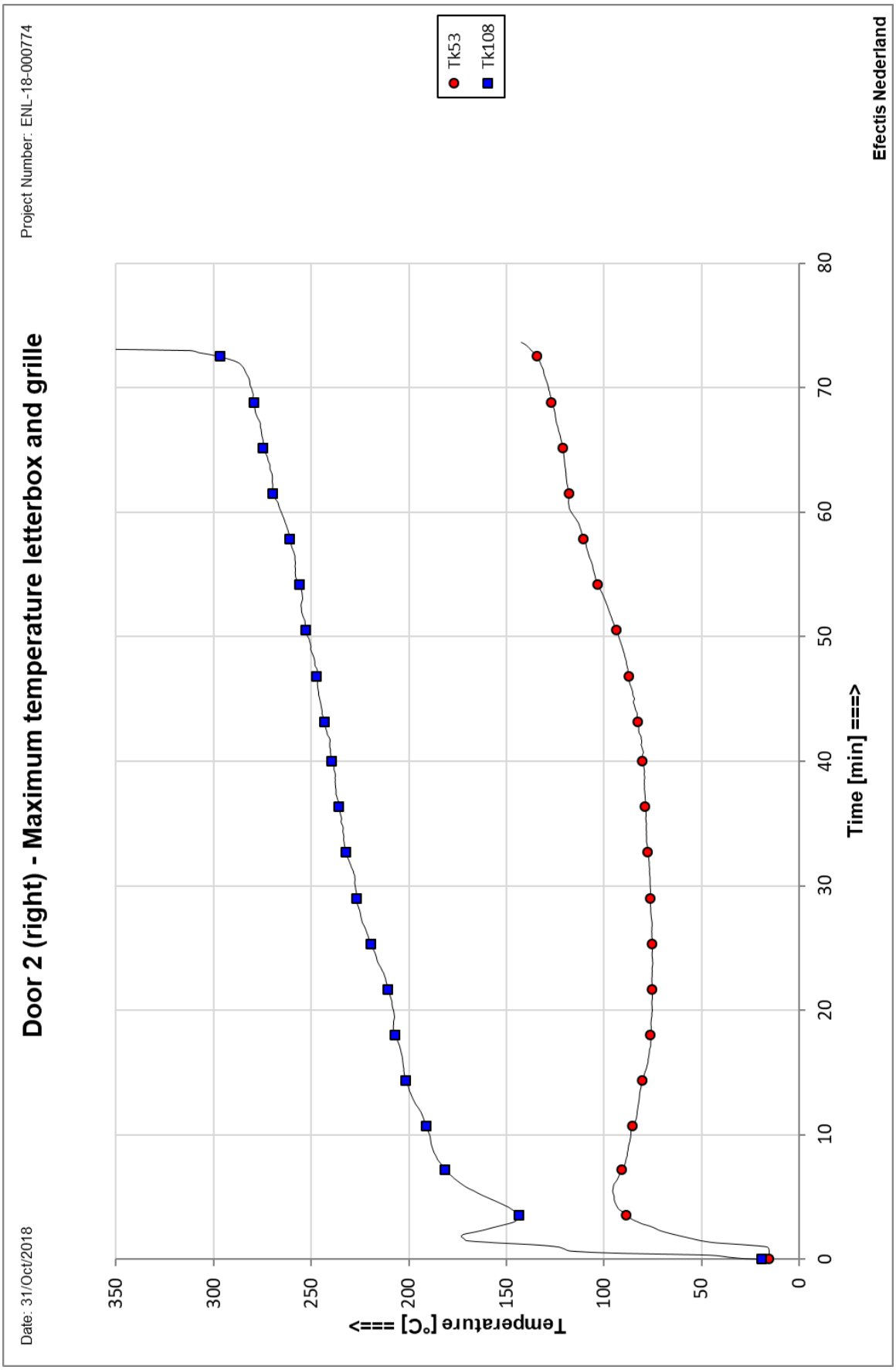


Figure B 13: Door 2 (right) - Maximum temperature letterbox and grille

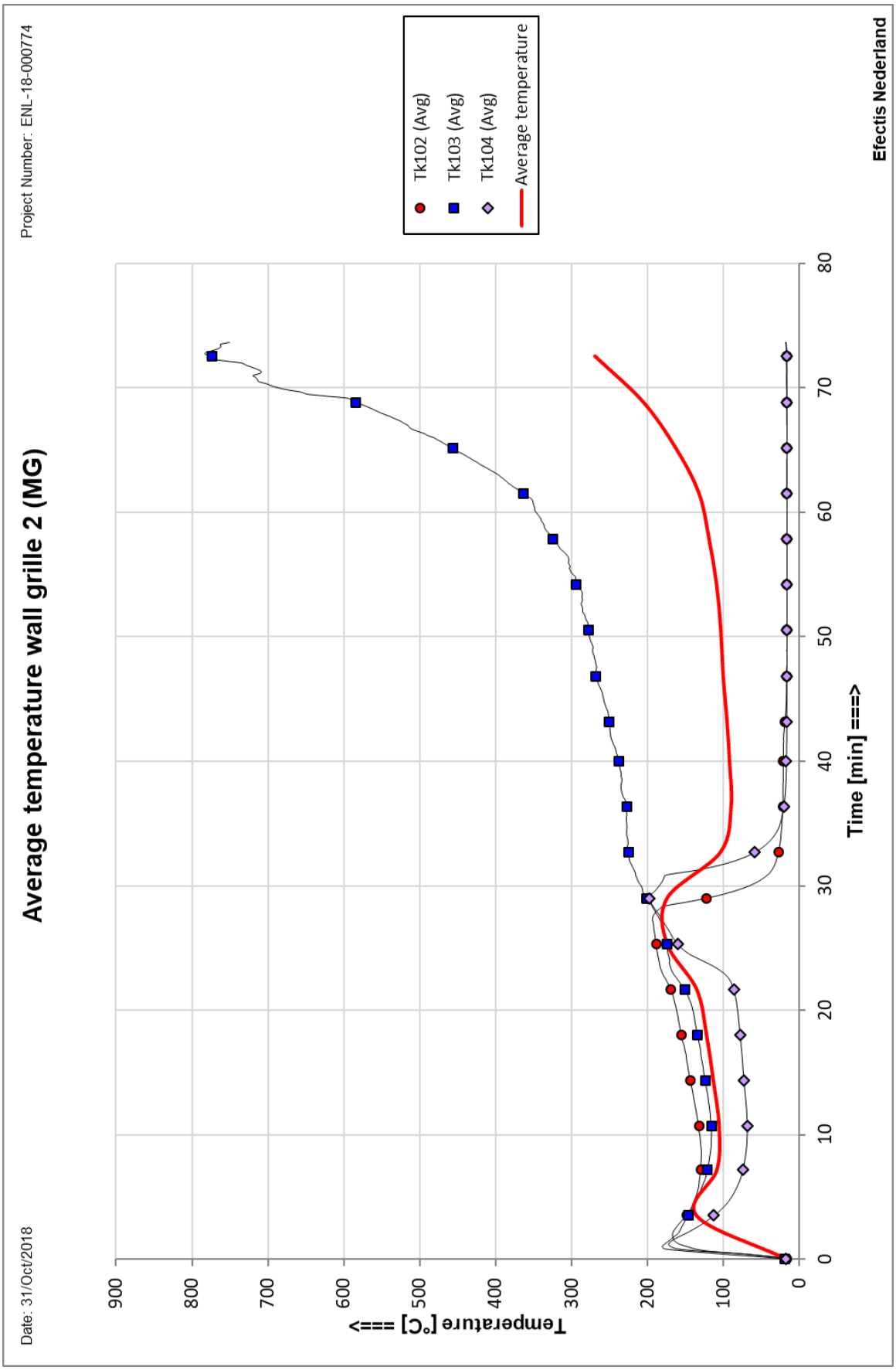


Figure B 14: Wall grille 2 - Average temperature

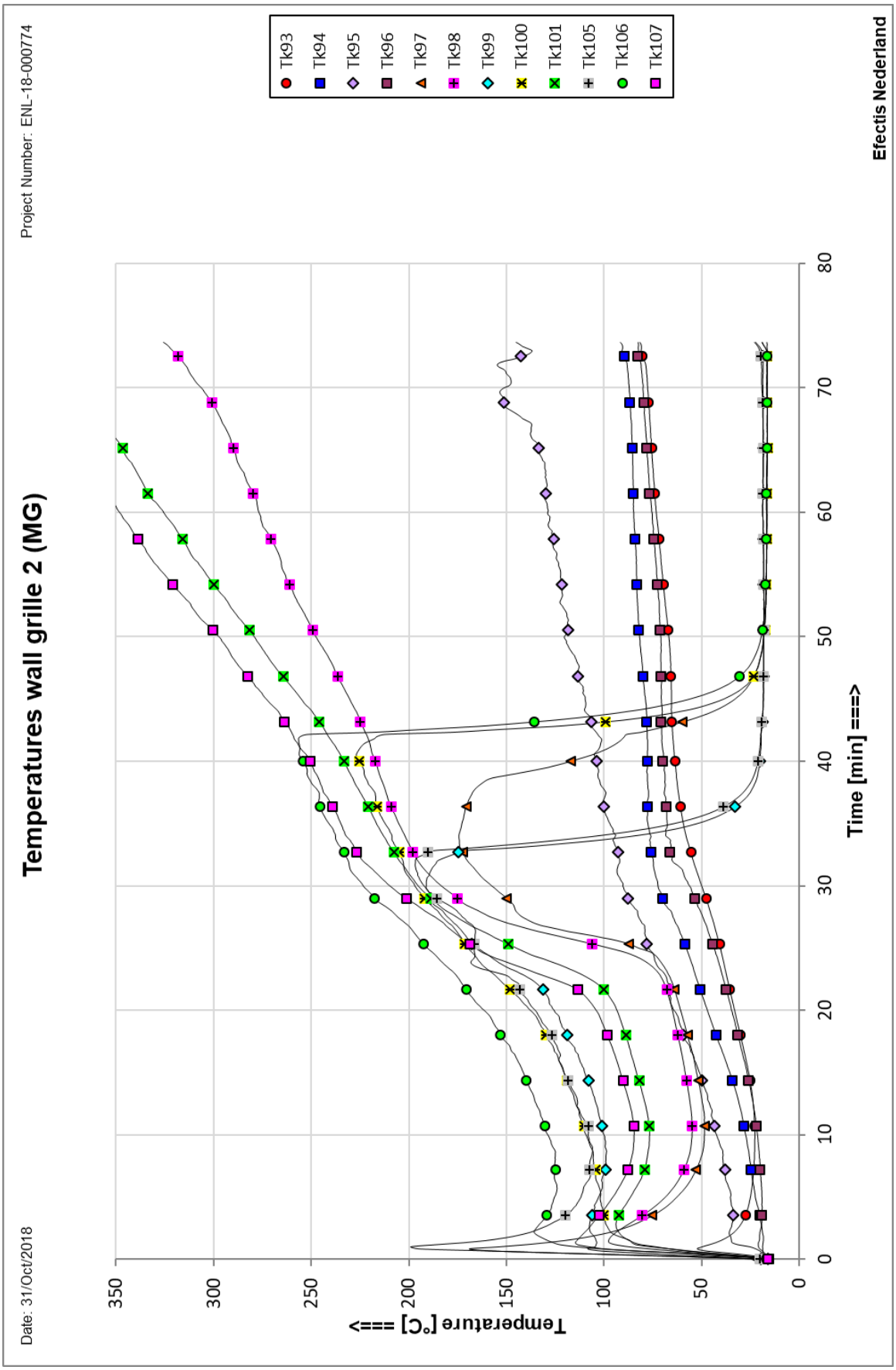


Figure B 15: Wall grille 2 - Maximum temperatures

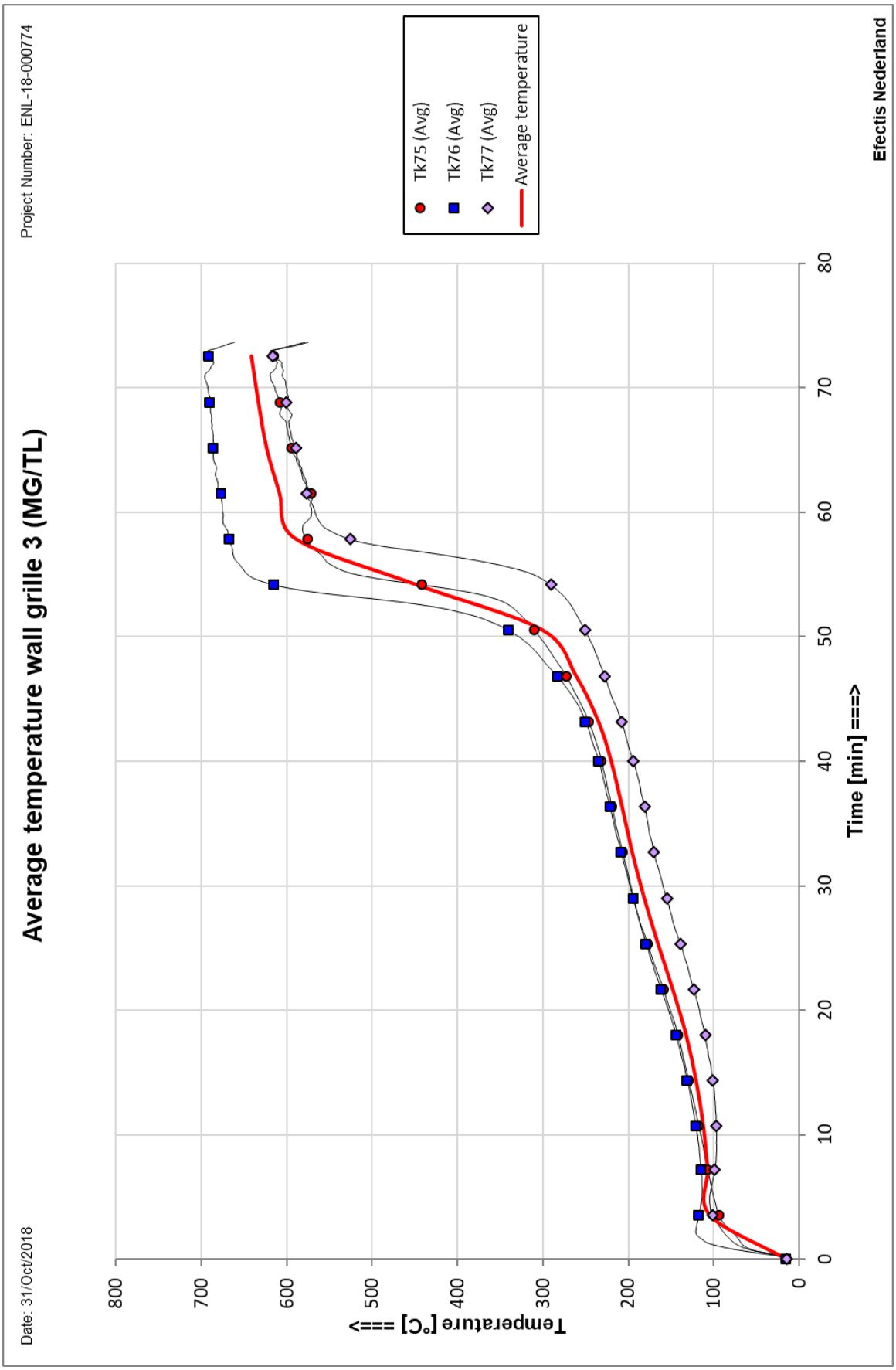


Figure B 16: Wall grille 3 - Average temperatures

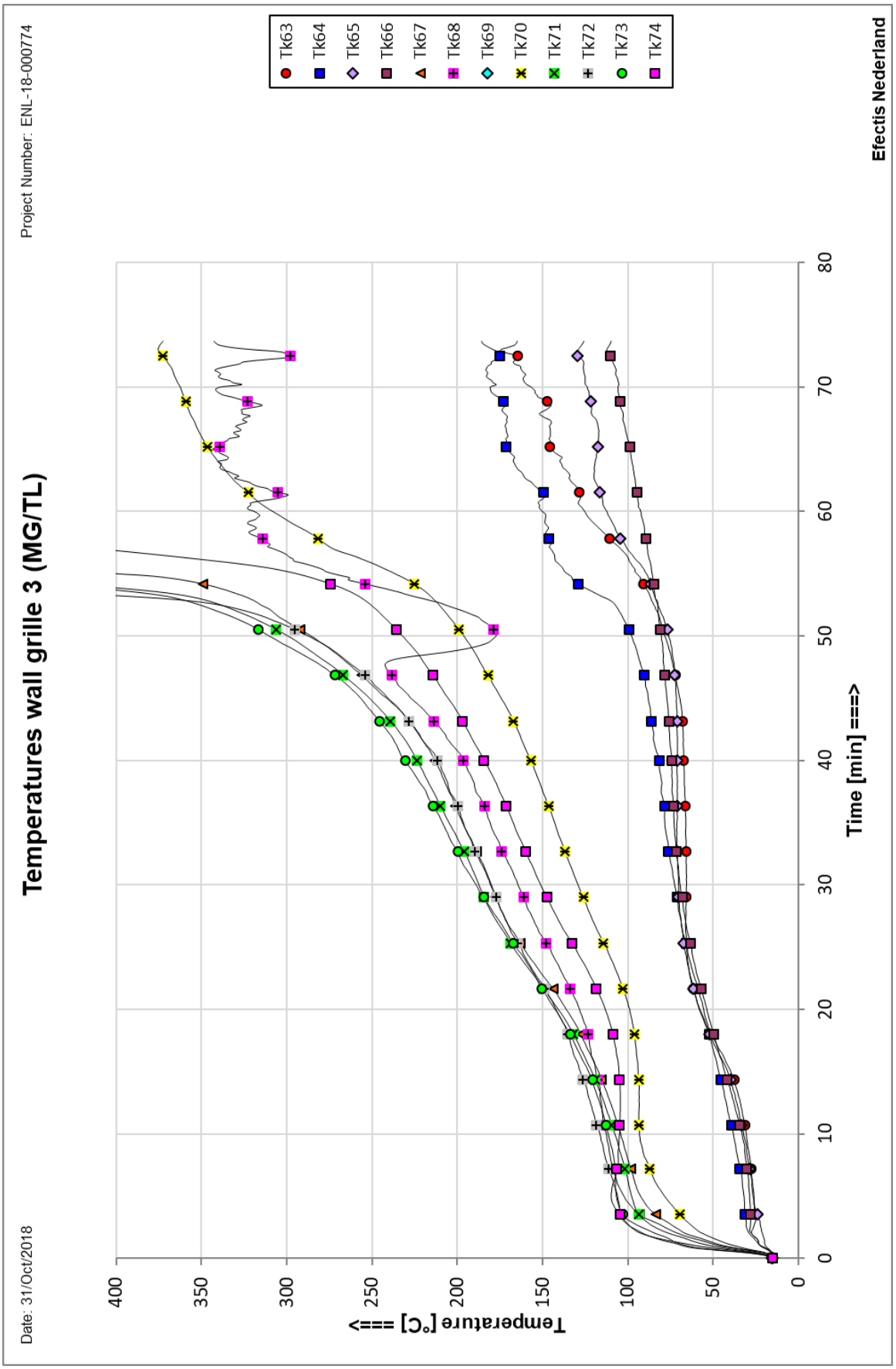


Figure B 17: Wall grille 3 - Maximum temperatures

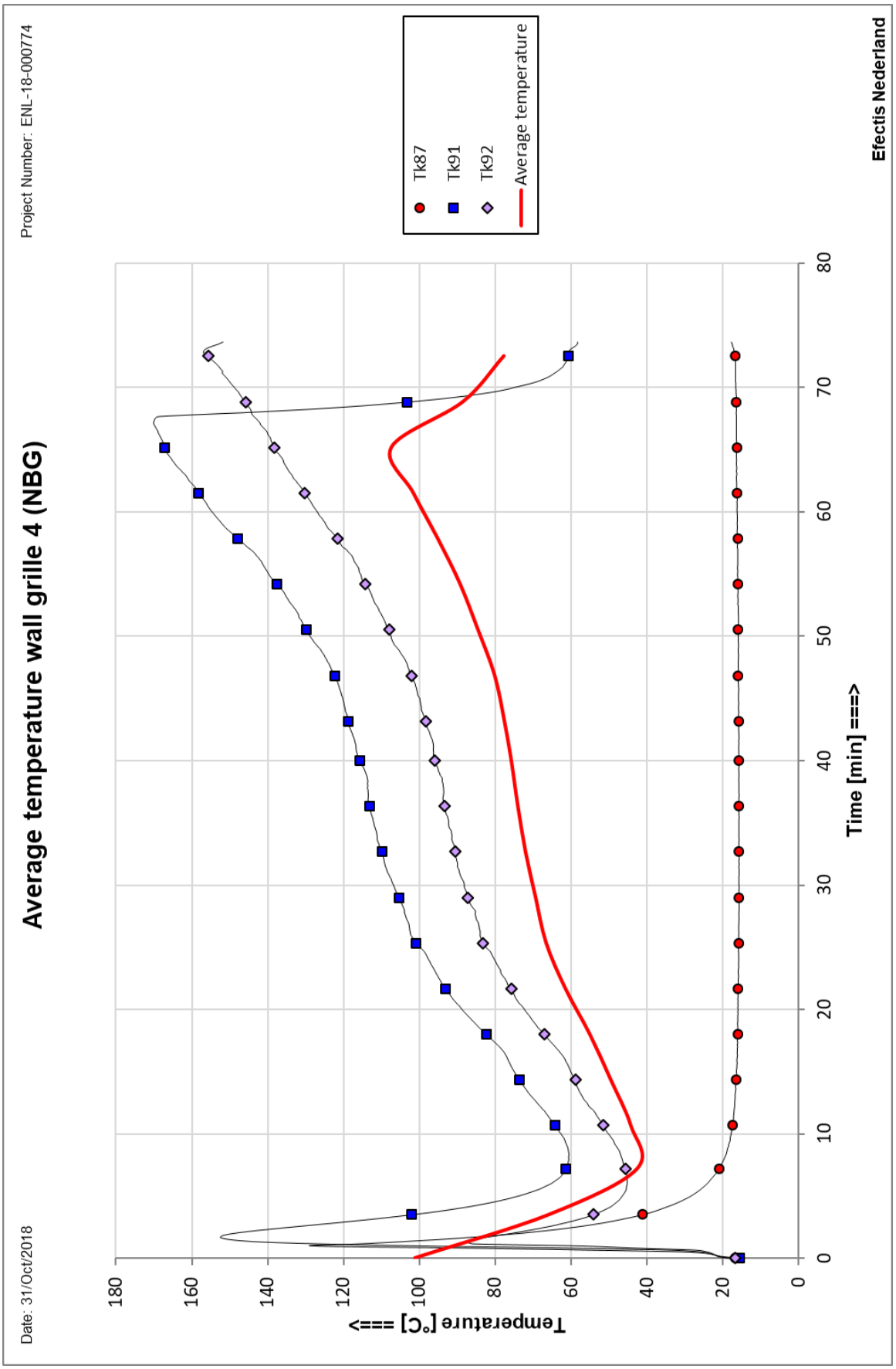


Figure B 18: Wall grille 4 - Average temperature

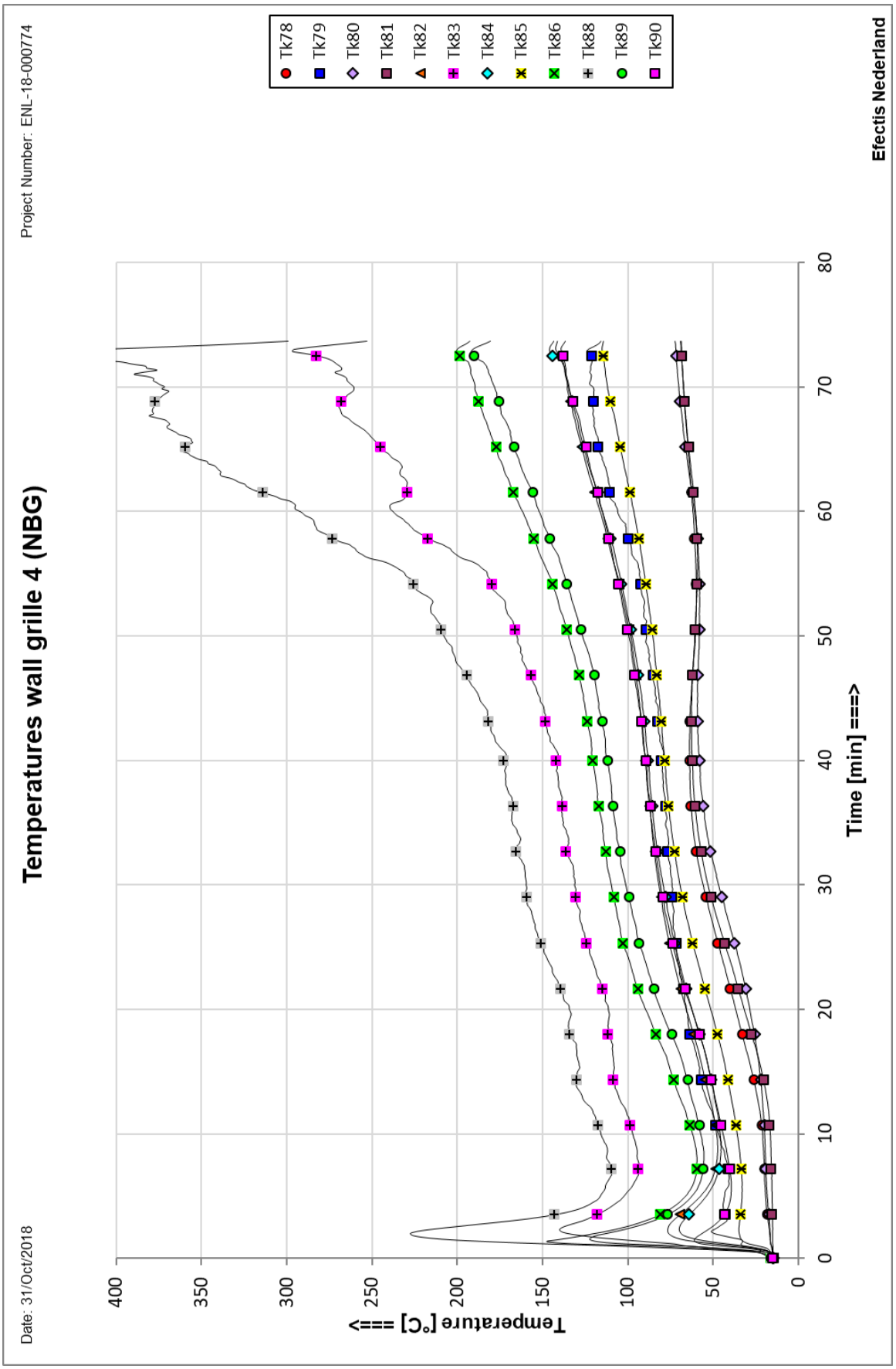


Figure B 19: Wall grille 4 - Maximum temperatures

APPENDIX C: PHOTOS

Photo C 1: Specimen at the beginning of the heating

Photo C 2: Sealing of hole by client after 15 minutes of heating

Photo C 3: Specimen after 23 minutes of heating

Photo C 4: Specimen after 30 minutes of heating

Photo C 5: Specimen after 45 minutes of heating

Photo C 6: Specimen after 59 minutes of heating (heating was stopped after 73 minutes after consulting the client)