

Determination of the smoke control based on EN 1634-3:2004 + C1:2007 of electrical outlet wall boxes from Attema at ambient temperature (S_a) and medium temperature 200°C (S_{200})

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1. GENERAL

1.1 REPORT

Currently there is no specific European test standard for the determination of smoke control for electrical outlet wall boxes so no field of direct application can be based on the test results. In the Netherlands the Dutch standard NEN 6075 designates the EN 1634-3 for testing other construction components than doors on smoke control. However in the current standard no maximum flow rate is defined for electrical outlet wall boxes. On a maximum flow rate may be anticipated in the updated version of the standard which is expected to come into effect in 2019.

1.2 SUBJECT

Electrical outlet wall boxes from Attema type UHW50, UHW50-BW, HWD50L and HWD50L-BW.

1.3 INVESTIGATION

Determination of the smoke control according to EN 1634-3: 2004 + C1:2007 of different types of electrical outlet wall boxes from Attema.

1.4 SPONSOR AND MANUFACTURER

Sponsor and manufacturer	
Attema BV	
P.O. Box 58	
4200 AB GORINCHEM	
the Netherlands	

1.5 PLACE AND DATA REGARDING THE EXAMINATION

The research was conducted at the laboratory of Efectis in Bleiswijk the Netherlands.	
Installation of test specimens	16 th October 2017
Smoke resistance tests	16 th October 2017

1.6 NORMATIVE REFERENCES

Standard	Part
NEN 6075_2011_C1_2012	Determination of the resistance to smoke movement between spaces
EN 1363-1:2012	Fire resistance tests – Part 1: General requirements
EN 1634-3:2004 + C1:2007	Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware – Part 3: Smoke control test for door and shutter assemblies and openable windows

1.7 REVISION INFORMATION

This is the third issue of the test report. The test report has been amended in line with the report translated into Dutch. In addition in the third issue Pa is replaced by m^3/h in the result tables.

2. TEST SPECIMEN

2.1 GENERAL

Nine different configurations / types of electrical outlet wall boxes were tested on smoke control in a simulated flexible wall by gypsum board wall panels. For the dimensions and specifications of the materials and components of the examined construction also see the figures in chapter 8. The installation of the construction is given in the paragraphs below.

2.2 TEST SPECIMEN

2.2.1 Test frame

The test frame was constructed of welded steel tubes dimensions 100 x 60 x 5 mm (l x w x t).

Overall dimensions test frame	
Width and height	3600 x 3600 mm
Thickness	100 mm
Aperture	3400 x 3400 mm

2.2.2 Supporting construction

The supporting construction consisted of particle board panels fixed to the tubes of the steel frame with self-drilling / self-tapping galvanised screws $\varnothing 1,5 \times 45$ mm, c.t.c. distance 300 mm maximum. The seams between the wooden panels were backed by wooden beams on which the panels were also fixed with the same screws. After the fixation of the panels all seams between the frame and panels / all steel frame parts were sealed with a fire resistant silicone mastic from Nullifire type FS 703.

2.2.3 Installation frame

On the supporting construction two installation frames were mounted back to back with screws. Between the wall and the frames Compriband sealant was applied. On the frames a heat resistant rubber seal was applied. The frames were fitted with 8 clamps to fix the wall panels during the test.

2.3 WALL PANELS

2.3.1 General

The wall panels were built up of gypsum board. The layers were fixed together with tape on the edges of the board.

Specifications	
Type of gypsum board	Class A
Thickness board	12.5 mm
Number of layers	2

Overall dimensions	600 x 2000 x 25 mm (w x h x t)
--------------------	--------------------------------

2.3.2 Electrical outlet wall boxes

Two types of boxes were installed with varying colours and inlays. The red boxes were fire resistant. (See chapter 8 Figures for details)

Specifications	
Manufacturer boxes	Attema
Manufacturer inlays	Attema
Material boxes	PP
Thickness	2.5 mm
Material inlays	Mix of SEBS and PP
Reference	UHW50, UHW50-BW, HWD50L and HWD50L-BW
Dimensions UHW50	Ø 76 x 53 mm
Dimensions HWD50L	Ø 76 x 54 mm
Box type 1 with inlay	UHW50-BW red, inlay red
Box type 2 with inlay	UHW50 green, inlay dark grey
Box type 3 no inlay	UHW50 green
Box type 4 with inlay	HWD50L-BW red, inlay red
Box type 5 no inlay	HWD50L grey
Box type 5 no inlay	HWD50L grey, capped*
Box type 5 with inlay	HWD50L grey, inlay dark grey
Box type 6 with inlay	UHW50 green, inlay light grey

* One of the two cable outlets was capped (see picture 2)

2.3.3 Electrical outlet wall box configuration

Per test two wall panels were placed back to back in the installation frames. Each panel was fitted with 2 rows of five boxes vertically orientated. In total twenty boxes were installed per test.

2.4 METHOD OF ASSEMBLY

The wall panels were installed in the following order:

- Applying the Compriband on both sides of the supporting construction
- Applying the rubber seal on the installation frames
- Mounting the installation frames.

3. MANUFACTURING OF THE CONSTRUCTION

Efectis the Netherlands	Mounting of the supporting construction in test frame Mounting the installation frames
Attema	Manufacturing/installation wall panels
Attema	Manufacturing/installation electrical outlet wall boxes

4. TEST METHOD

4.1 AMBIENT TEMPERATURE

The ambient temperature in the laboratory during the test was 17 °C.

4.2 SYSTEM LEAKAGE

The system leakage was determined for both the S_a and S_{200} tests.

4.3 VERIFICATION OF THE SPECIMEN

Efectis Nederland BV was not involved in the selection of the test materials. During construction, the materials and parts used were verified based on the information provided by the sponsor.

4.4 SMOKE CONTROL TEST

4.4.1 Conditions

During the test the investigated construction was in the laboratory of Efectis Nederland under the following conditions.

Conditions laboratory	
Ambient temperature:	10 - 40°C
Relative humidity:	50 ± 10 %

4.4.2 Test standard

The test was carried out according to EN 1634-3 and EN 1363-1.

4.4.3 Heating curve

For the medium temperature tests, according to the paragraph 10.2.2.2 of the EN 1634-3, the temperature of 200 (± 20) °C was reached in 30 (± 5) minutes, see figure A.12.

4.4.4 Measurements

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

Test chamber conditions

- The temperatures in the test chamber using wire thermocouples
- Flow rate to establish system leak and total leak
- The pressure in the test chamber.

4.4.5 Environment

The ambient temperature in the laboratory outside the test chamber was measured during the test.

5. RESULTS OF THE SMOKE CONTROL TESTS

5.1 OBSERVATIONS DURING TEST

5.1.1 General

The observations were made from the moment the test of specimen 1 at S_a commenced. For testing to satisfy S_{200} classification, according to the standard the flow rate of the air leakage has to be determined after 2 minutes of stabile pressure.

5.1.2 System leakage

Before the test the system leakage was determined and measured $< 1 \text{ m}^3/\text{h}$.

5.1.3 Electrical outlet wall box colours

The colours of the boxes did not have any effect on the smoke control characteristics. The red boxes were of the fire resistant type.

5.2 OBSERVATIONS S_a

5.2.1 General

Q_t flow rate is in m^3/h .

5.2.2 Test specimen 1

Box type 1 with inlay		UHW50-BW red, inlay red
Time (min)	Pressure (Pa)	Observations S_a Q_t flow rate in m^3/h
0	0	Start of test
2	10	Q_t flow rate: 1.0
4	25	Q_t flow rate: 1.8
6	50	Q_t flow rate (indicative) : 2.8
7	-	End of test

5.2.3 Test specimen 2

Box type 2 with inlay		UHW50 green, inlay dark grey
Time (min)	Pressure (Pa)	Observations S_a Q_t flow rate in m^3/h
0	0	Start of test
2	10	Q_t flow rate: 1.4
4	25	Q_t flow rate: 2.4
7	50	Q_t flow rate (indicative) : 3.8
8	-	End of test

5.2.4 Test specimen 3

Box type 3 no inlay		UHW50 green
Time (min)	Pressure (Pa)	Observations S_a Qt flow rate in m ³ /h
0	0	Start of test
5	10	Qt flow rate: 11.0
6	25	Qt flow rate: 18.8
8	50	Qt flow rate (indicative) : 28.2
9	-	End of test

5.2.5 Test specimen 4

Box type 4 with inlay		HWD50L-BW red, inlay red
Time (min)	Pressure (Pa)	Observations S_a Qt flow rate in m ³ /h
0	0	Start of test
1.5	10	Qt flow rate: 2.0
3	25	Qt flow rate: 3.5
6	50	Qt flow rate (indicative) : 5.6
7	-	End of test

5.2.6 Test specimen 5

Box type 5 no inlay		HWD50L grey
Time (min)	Pressure (Pa)	Observations S_a Qt flow rate in m ³ /h
0	0	Start of test
2	10	Qt flow rate: 17.3
3.5	25	Qt flow rate: 30.1
5.5	50	Qt flow rate (indicative) : 45.2
6	-	End of test

5.2.7 Test specimen 6

Box type 5 no inlay		HWD50L grey, capped
Time (min)	Pressure (Pa)	Observations S_a Qt flow rate in m ³ /h
0	0	Start of test
3	50	Qt flow rate (indicative): 24.6
4.5	25	Qt flow rate: 14.9
5.5	10	Qt flow rate: 8.1
6	-	End of test

* Commence test at 50 Pa based on expected high flow rate regarding test results specimen 5.

5.2.8 Test specimen 7

Box type 6 with inlay		UHW50 green, inlay light grey
Time (min)	Pressure (Pa)	Observations S_a Qt flow rate in m ³ /h
0	0	Start of test
3.5	10	Qt flow rate: 1.1
6	25	Qt flow rate: 1.6
8.5	50	Qt flow rate (indicative) : 2.4
9	-	End of test

5.2.9 Test specimen 8

Box type 6 with inlay		UHW50 green, inlay dark grey
Time (min)	Pressure (Pa)	Observations S_a Qt flow rate in m ³ /h
0	0	Start of test
3.5	10	Qt flow rate: 1.0
6	25	Qt flow rate: 1.6
8.5	50	Qt flow rate (indicative) : 2.6
9	-	End of test

5.3 OBSERVATIONS S_{200}

5.3.1 Test specimen 9

Box type 1 with inlay		UHW50-BW red, inlay red
Time (min)	Pressure (Pa)	Observations S_{200} Qt flow rate in m ³ /h
0	0	Start of test
39	14	200° C was reached, not within limit due to a failing thermocouple
44	10	Qt flow rate: < 1
47	25	Qt flow rate: < 1
50	50	Qt flow rate: < 1
50	-	End of test

5.3.2 Test specimen 10

Box type 4 with inlay		HWD50L-BW red, inlay red
Time (min)	Pressure (Pa)	Observations S_{200} Qt flow rate in m ³ /h
0	0	Start of test, T average pressure cabinet 60 °C
24	8	200° C was reached
44	10	Qt flow rate: 1
47	25	Qt flow rate: 1.3
50	50	Qt flow rate: 5.6
50	-	End of test

5.4 TEST RESULTS OF SMOKE CONTROL TESTS

In addition to the observed flow rates during the test, the after the test calculated results are given in the tables in chapter 6.

5.5 GRAPHS OF THE SMOKE CONTROL TEST

The results recorded during the test are shown as graphs in Appendix A.

5.6 PICTURES

The pictures in Appendix C give an impression of the effect of the heating of the test specimens during the smoke control tests.

5.7 UNCERTAINTY OF MEASUREMENTS

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

6. SUMMARY OF TEST RESULTS

6.1 TESTRESULTS

Determination of the smoke control of electrical outlet wall boxes based on EN 1634-3.

6.1.1 Total leakage $Q_t S_a$

For S_a 50 Pa is not required so the test results are indicative.

Test S_a	Type of outlet box	Specifications	Leakage ($Q_t = m^3/h$) at a pressure of:		
			10 Pa	25 Pa	50 Pa
1	System leakage	N/a	< 1	< 1	< 1
2	Box type 1 with inlay	UHW50-BW red, inlay red	1.1	1.8	2.8
3	Box type 2 with inlay	UHW50 green, inlay dark grey	1.4	2.4	4.0
4	Box type 3 no inlay	UHW50 green	10.8	20.7	28.3
5	Box type 4 with inlay	HWD50L-BW red, inlay red	2.0	3.5	5.6
6	Box type 5 no inlay	HWD50L grey	17.3	30.1	45.2
7	Box type 5 no inlay	HWD50L grey, capped	8.1	14.9	24.6
8	Box type 5 with inlay	HWD50L grey, inlay dark grey	1.1	1.8	2.7
9	Box type 6 with inlay	UHW50 green, inlay light grey	1.1	1.5	2.5

6.1.2 Total leakage $Q_t S_{200}$

Test S_{200}	Type of outlet box	Specifications	Leakage ($Q_t = m^3/h$) at a pressure of:		
			10 Pa	25 Pa	50 Pa
1	Box type 1 with inlay	UHW50-BW red, inlay red	< 1	< 1	< 1
2	Box type 4 with inlay	HWD50L-BW red, inlay red	1.3	0.5*	1.8

* Due to temperature lowering in the pressure cabinet the flow rate dropped which made it, due to the recording time limit according to EN 1634-3, not possible to make accurate flow rate readings within the time limit. The leakage rate was between 1.3 and 1.8 m^3/h which is less than the flow rate observed during the test.

7. FIELD OF DIRECT APPLICATION OF TEST RESULTS

Currently there is no specific European test standard for the determination of smoke control for electrical outlet wall boxes so no field of direct application can be based on the test results. See § 1.1. for more details.



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8. FIGURES

Figure 1a UHW50-BW red (fire resistant) with red inlay

Figure 1b UHW50-BW red (fire resistant) with red inlay

Figure 2 UHW50 green

Figure 3 HWD50L-BW red (fire resistant)

Figure 4 HWD50L grey

Figure 5 Inlay light grey

Figure 6 Inlay dark grey



Figure 1a UHW50-BW red (fire resistant) with red inlay



Figure 1b UHW50-BW red (fire resistant) with red inlay



Figure 2 UHW50 Green



Figure 3 HWD50L-BW red (fire resistant)



Figure 4 HWD50L grey

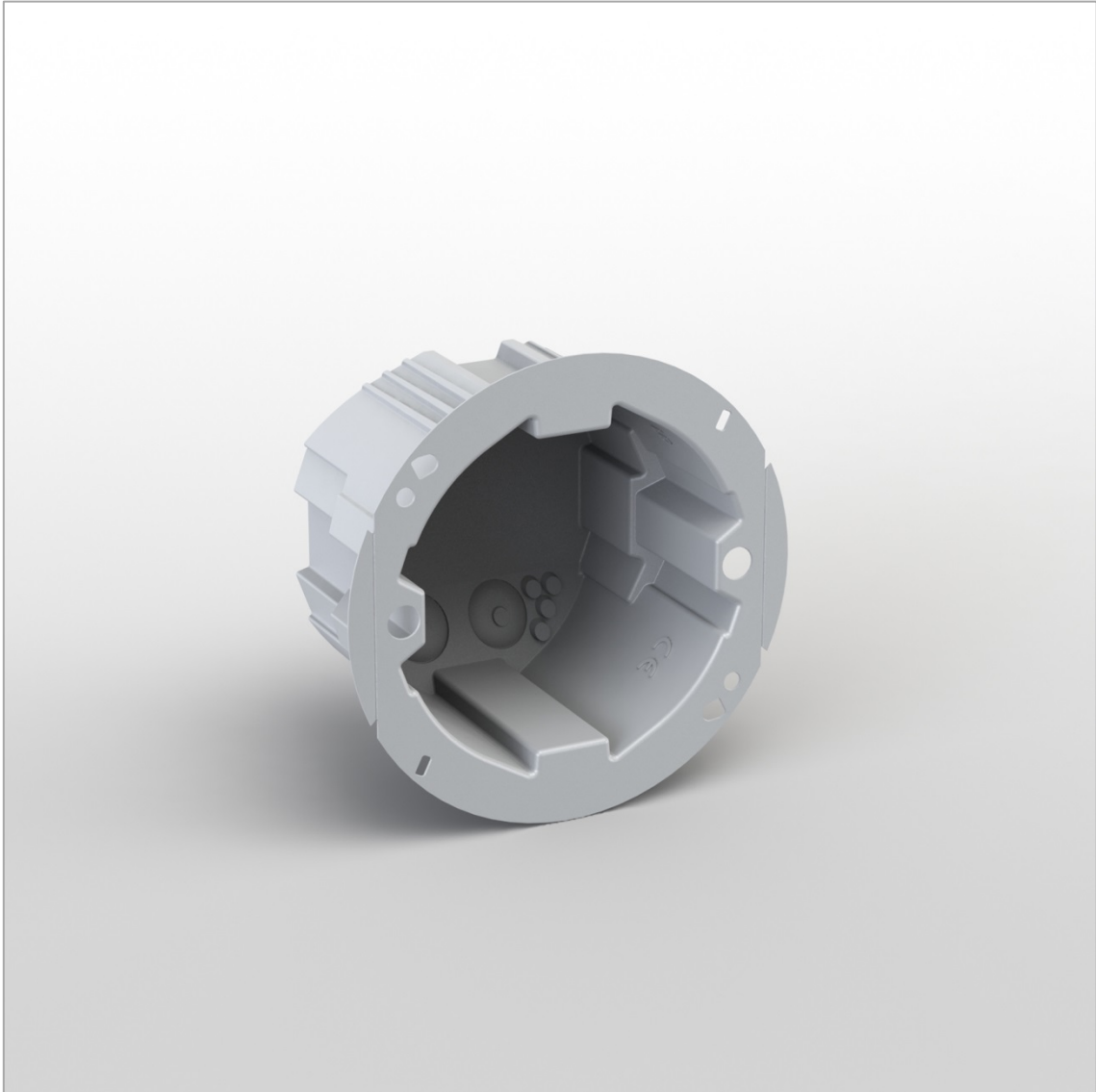


Figure 5 Inlay light grey

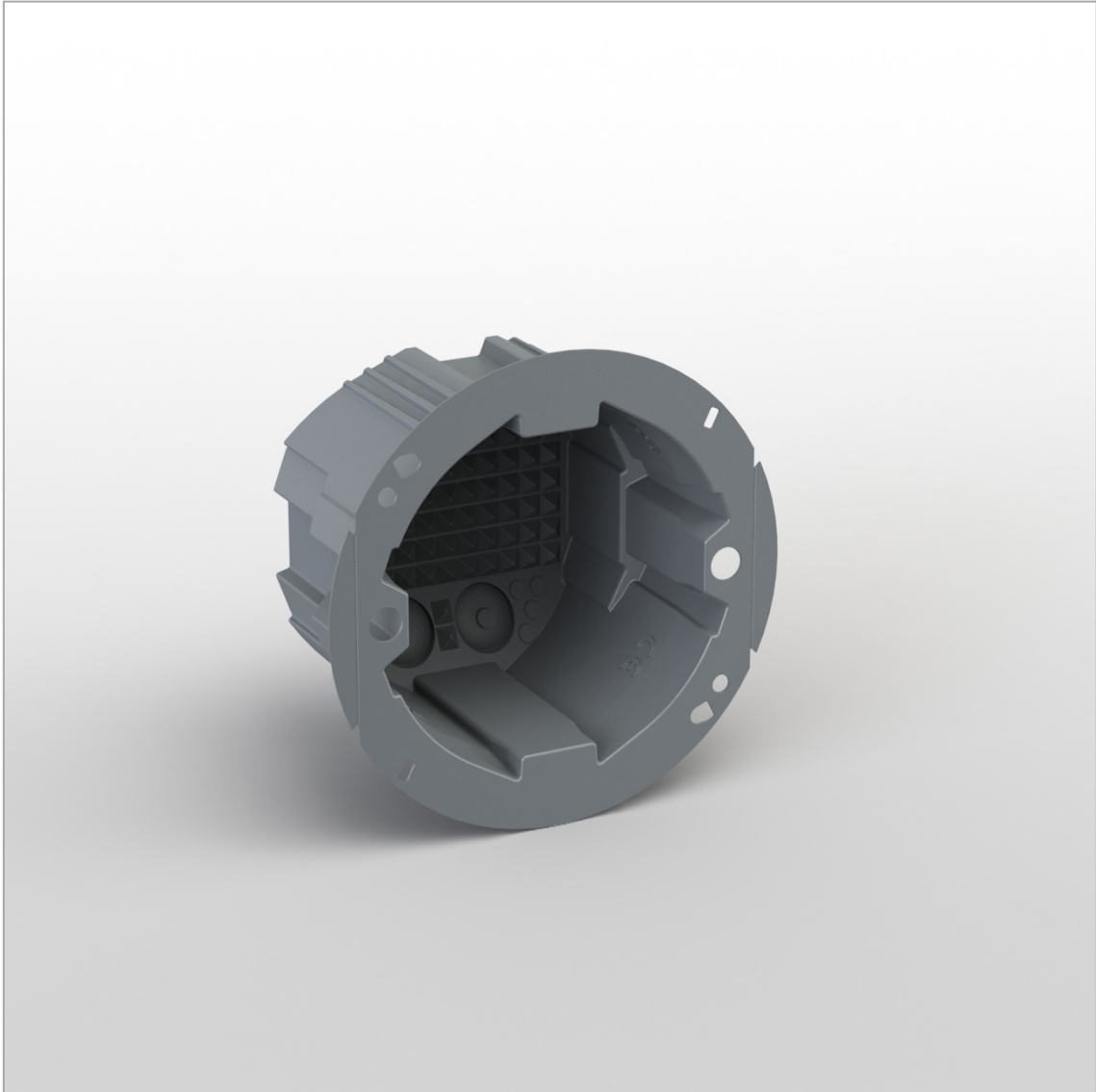


Figure 6 Inlay dark grey

APPENDIX A: TEST RESULTS AND TEST CABINET CONDITIONS

- Figure 1 System leakage
- Figure 2 UHW50-BW red with red inlay
- Figure 3 UHW50 green with dark grey inlay
- Figure 4 UHW50 green without inlay
- Figure 5 HWD50L-BW red with red inlay
- Figure 6 HWD50L grey without inlay
- Figure 7 HWD50L grey without inlay capped
- Figure 8 HWD50L grey with dark grey inlay
- Figure 9 UHW50 green with light grey inlay
- Figure 10 Temperature pressure cabinet, S_{200}
- Figure 11 UHW50-BW red with red inlay, S_{200}
- Figure 12 Temperature pressure cabinet, S_{200}
- Figure 13 HWD50L-BW red with red inlay, S_{200}

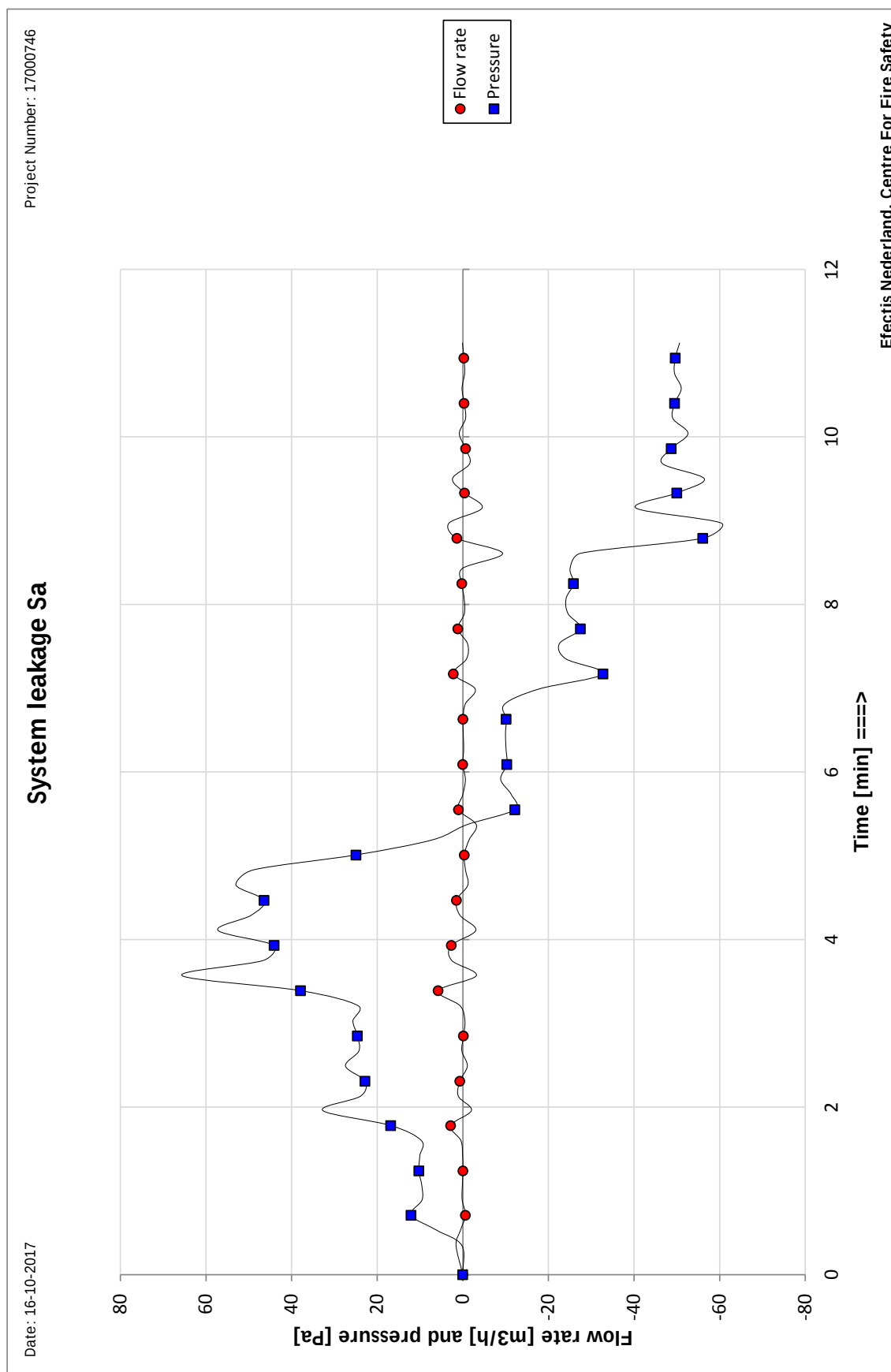


Figure A.1.

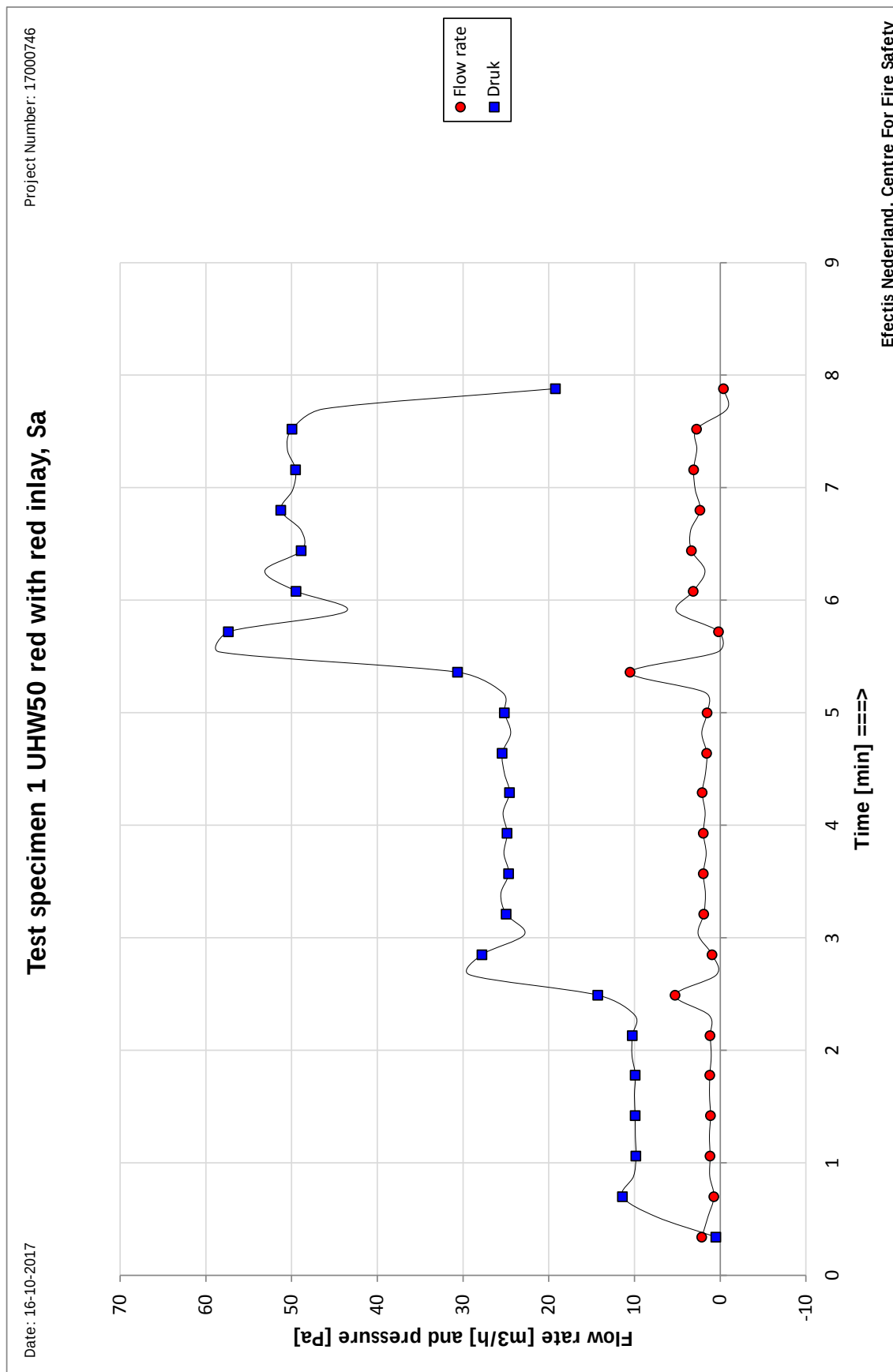


Figure A.2.

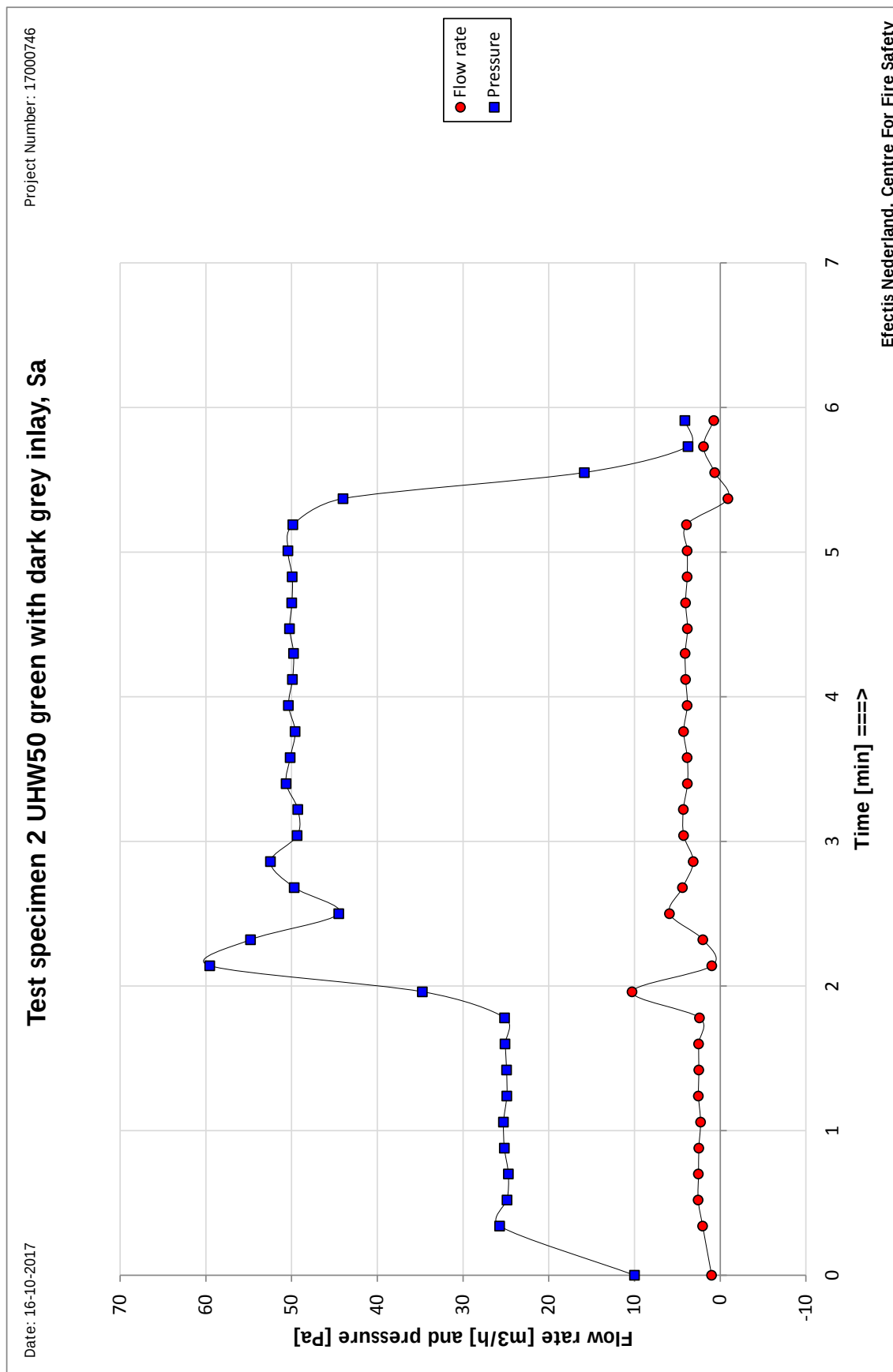


Figure A.3.

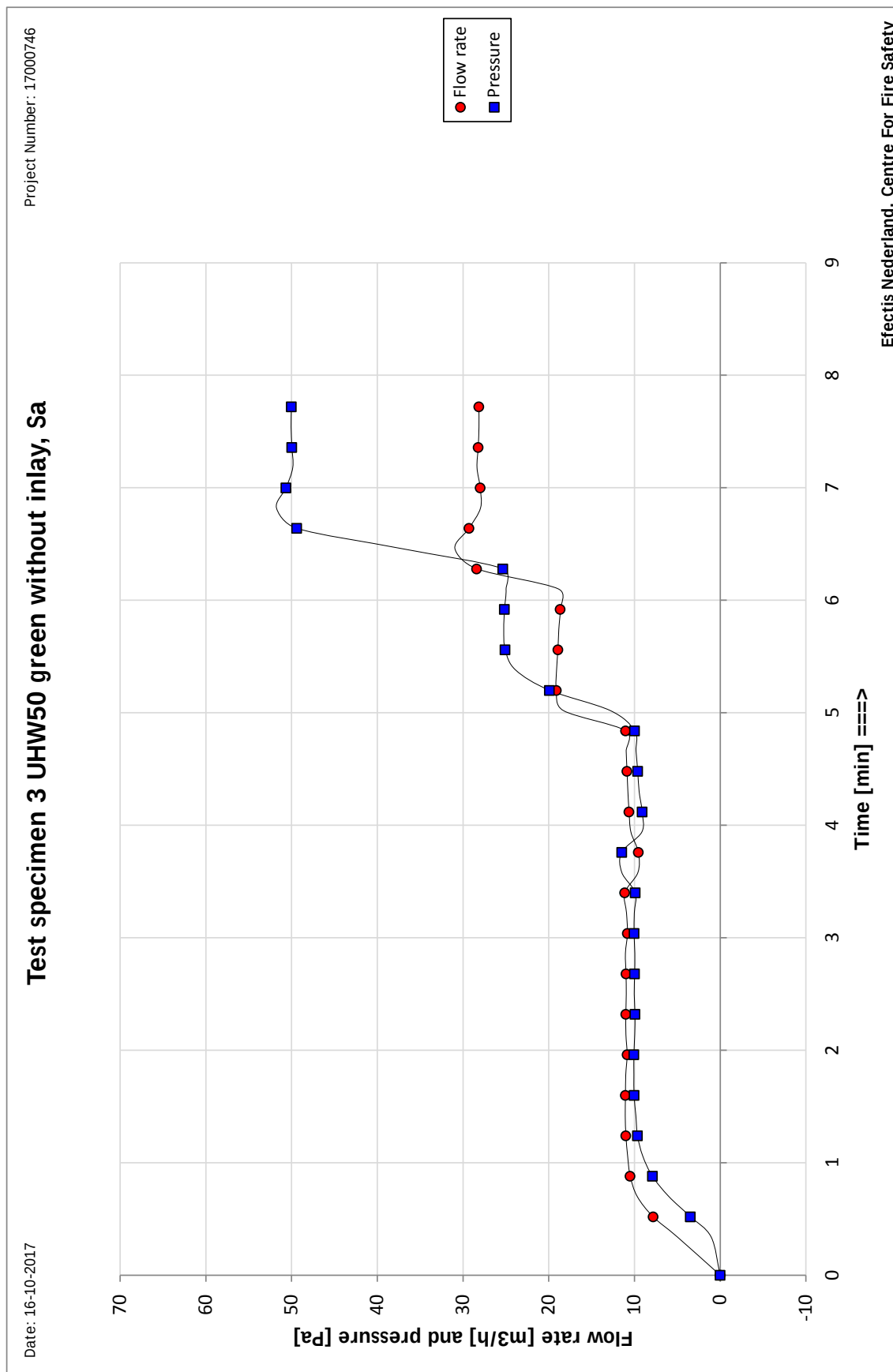


Figure A.4.

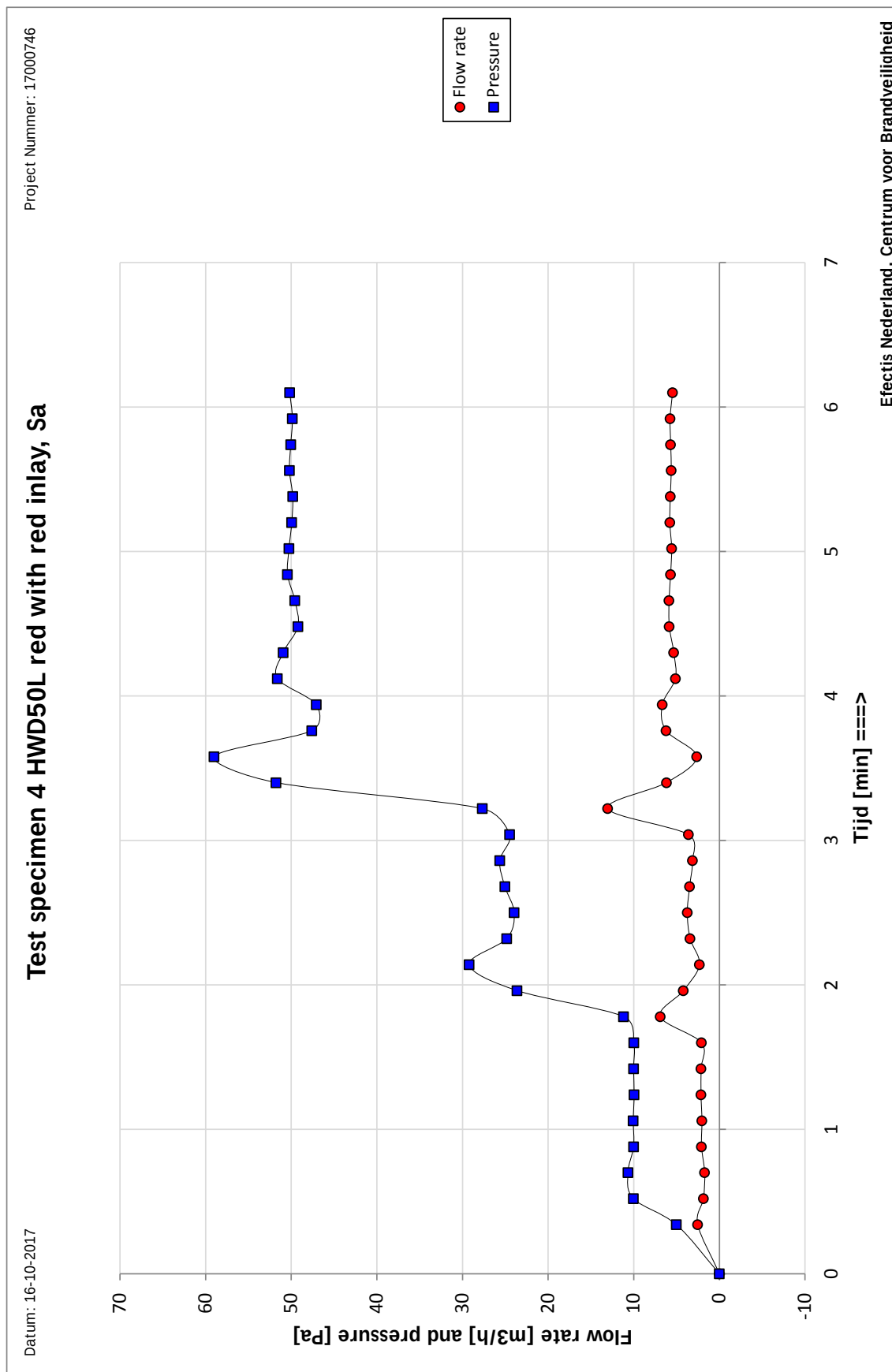


Figure A.5.

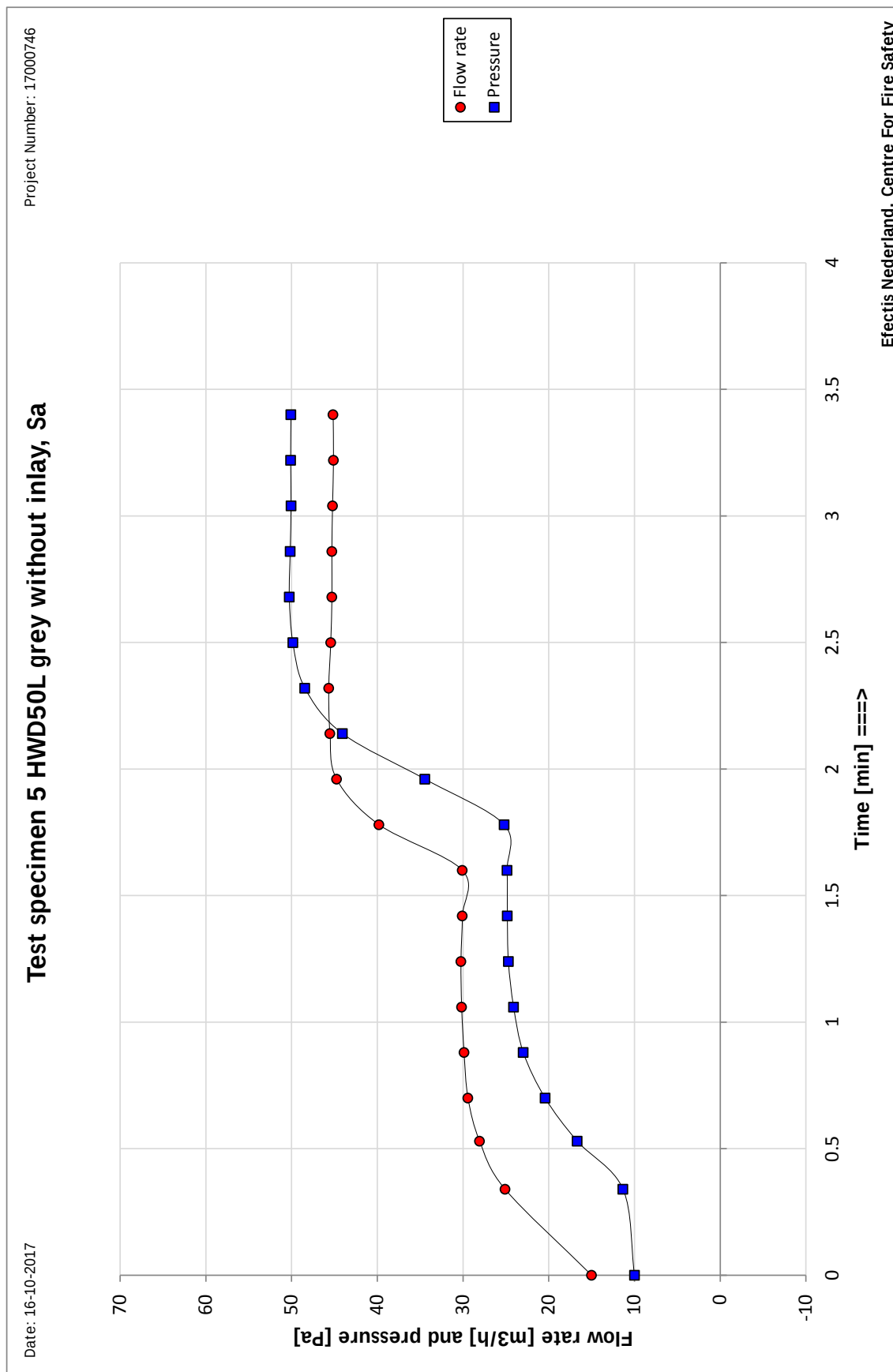


Figure A.6.

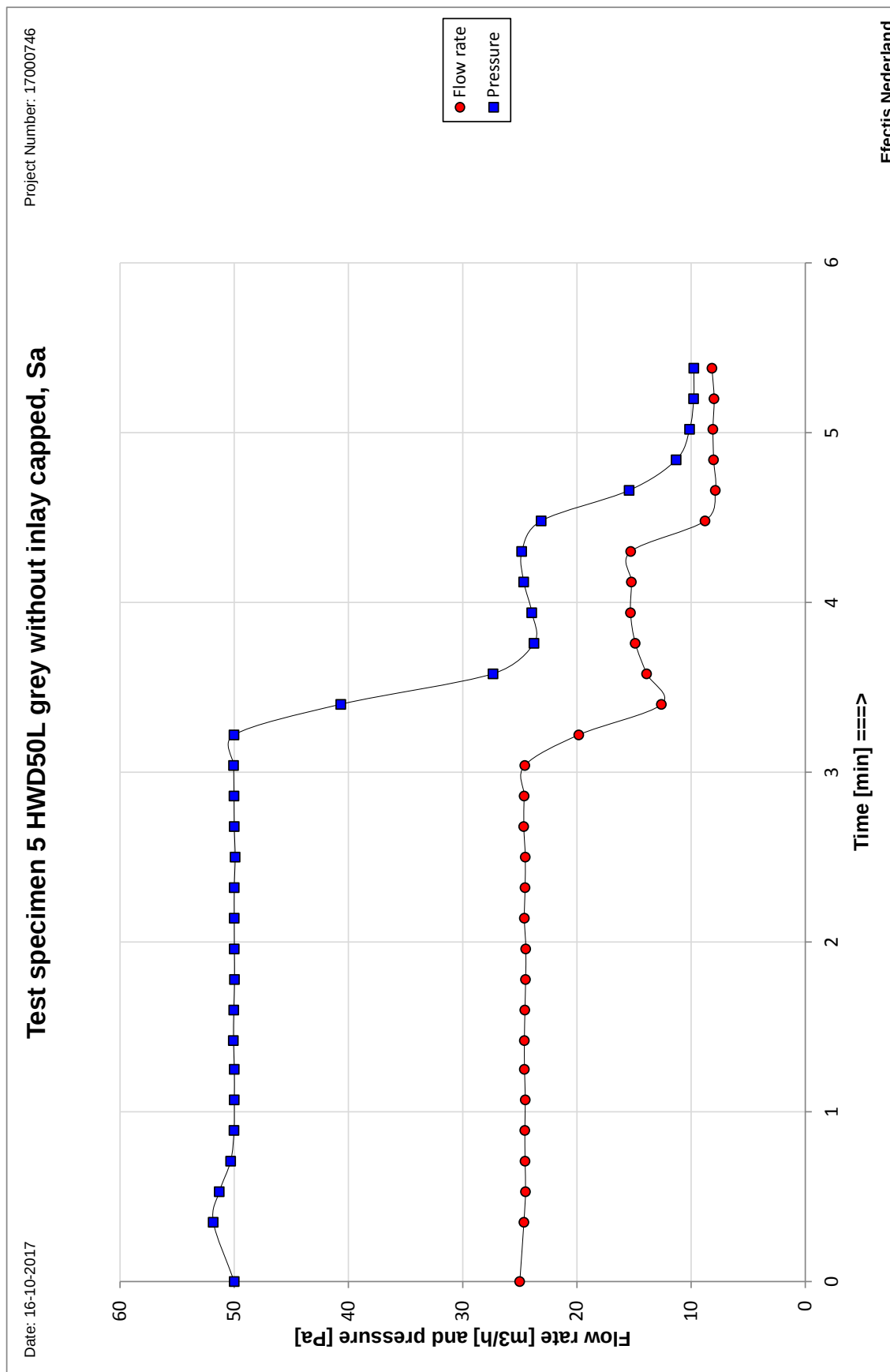


Figure A.7.

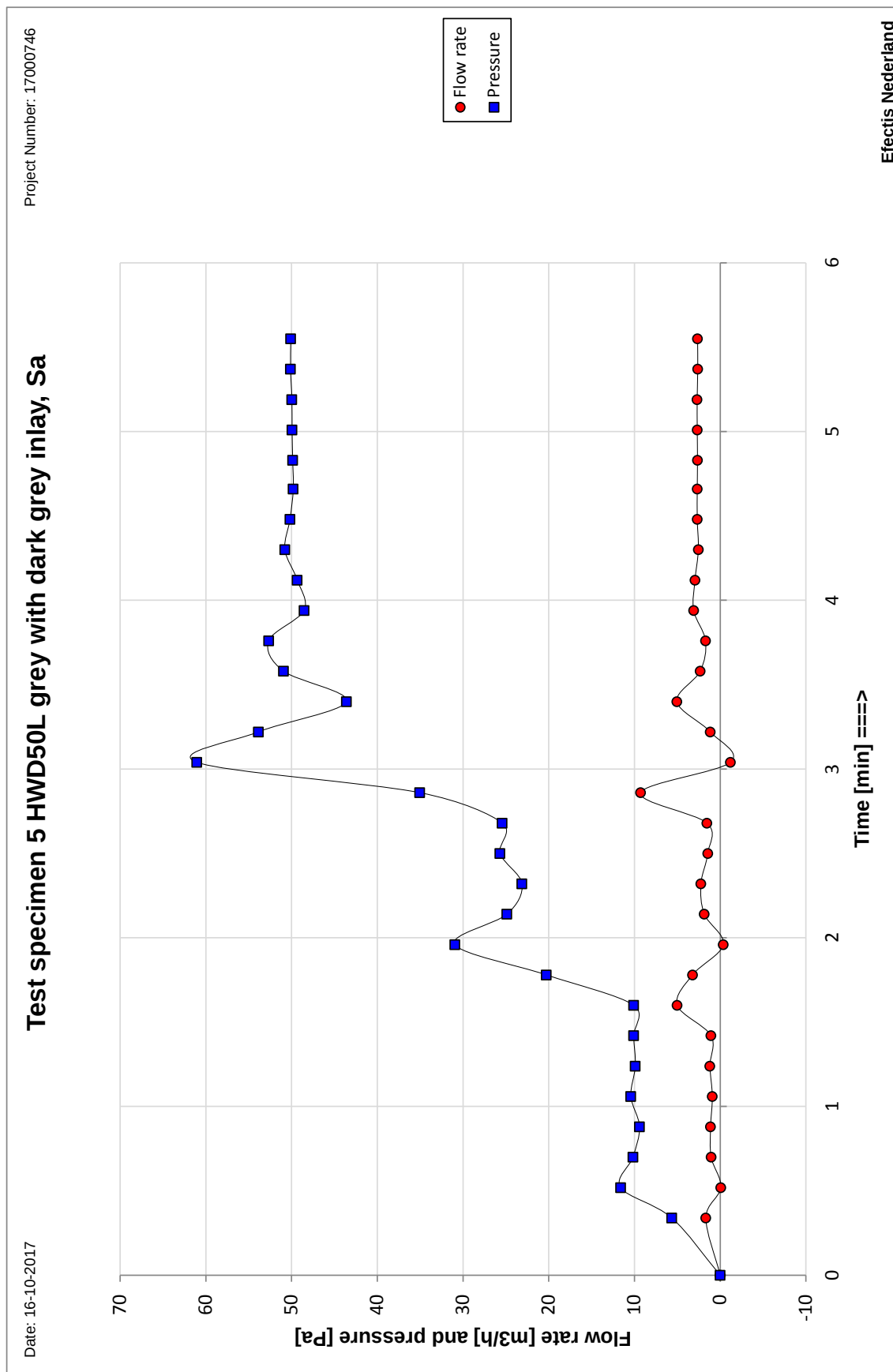


Figure A.8.

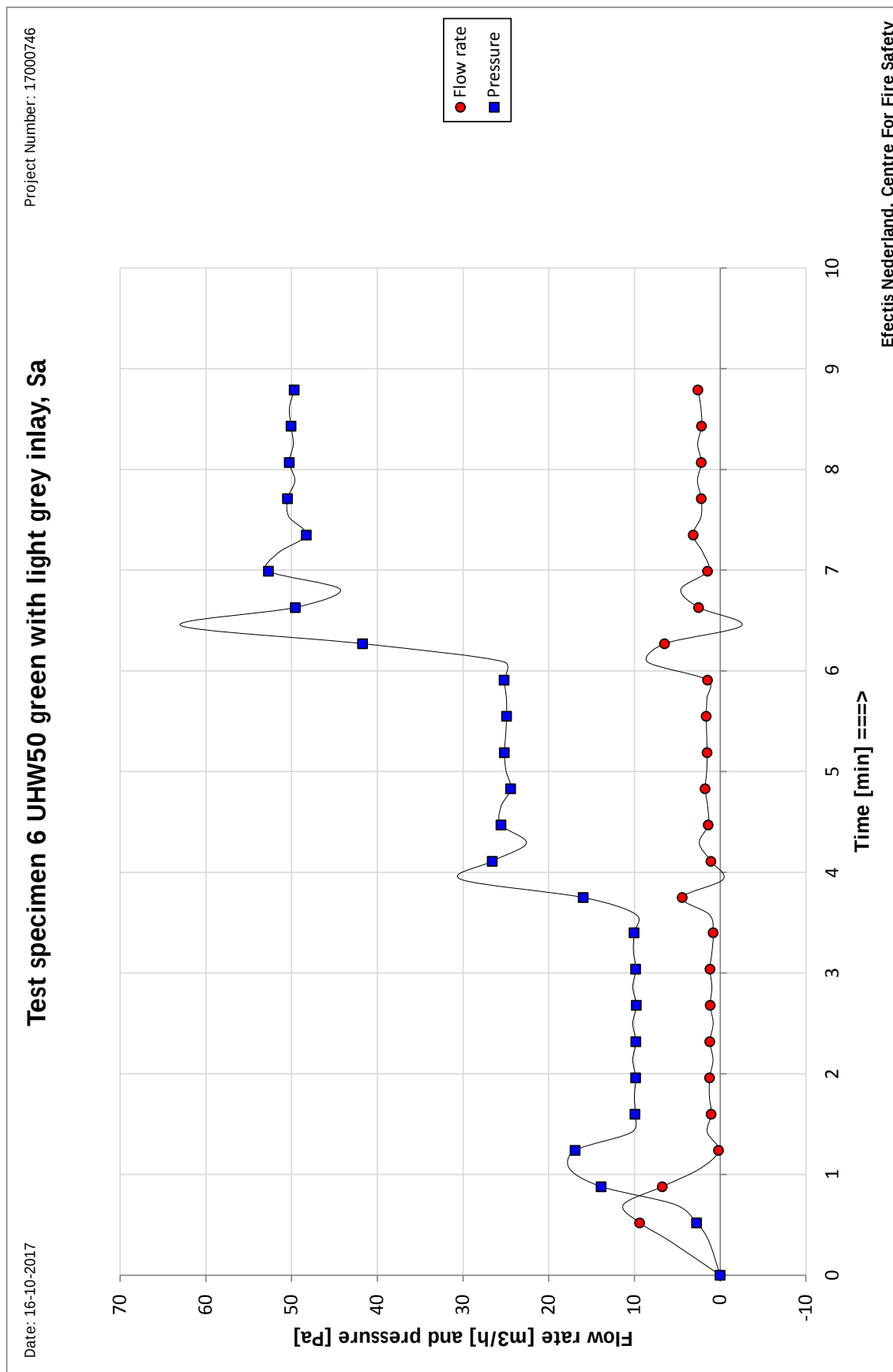


Figure A.9.

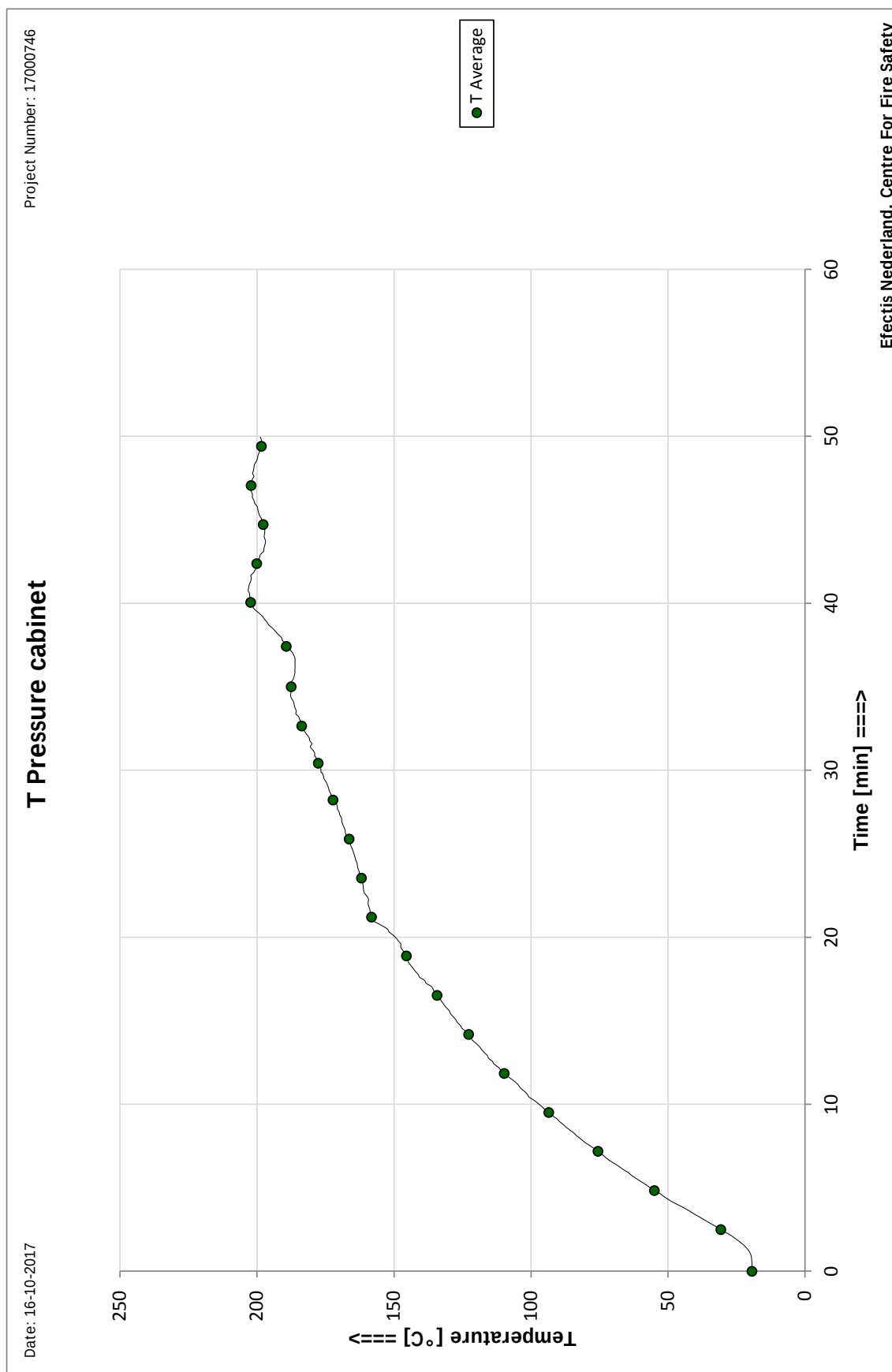


Figure A.10.

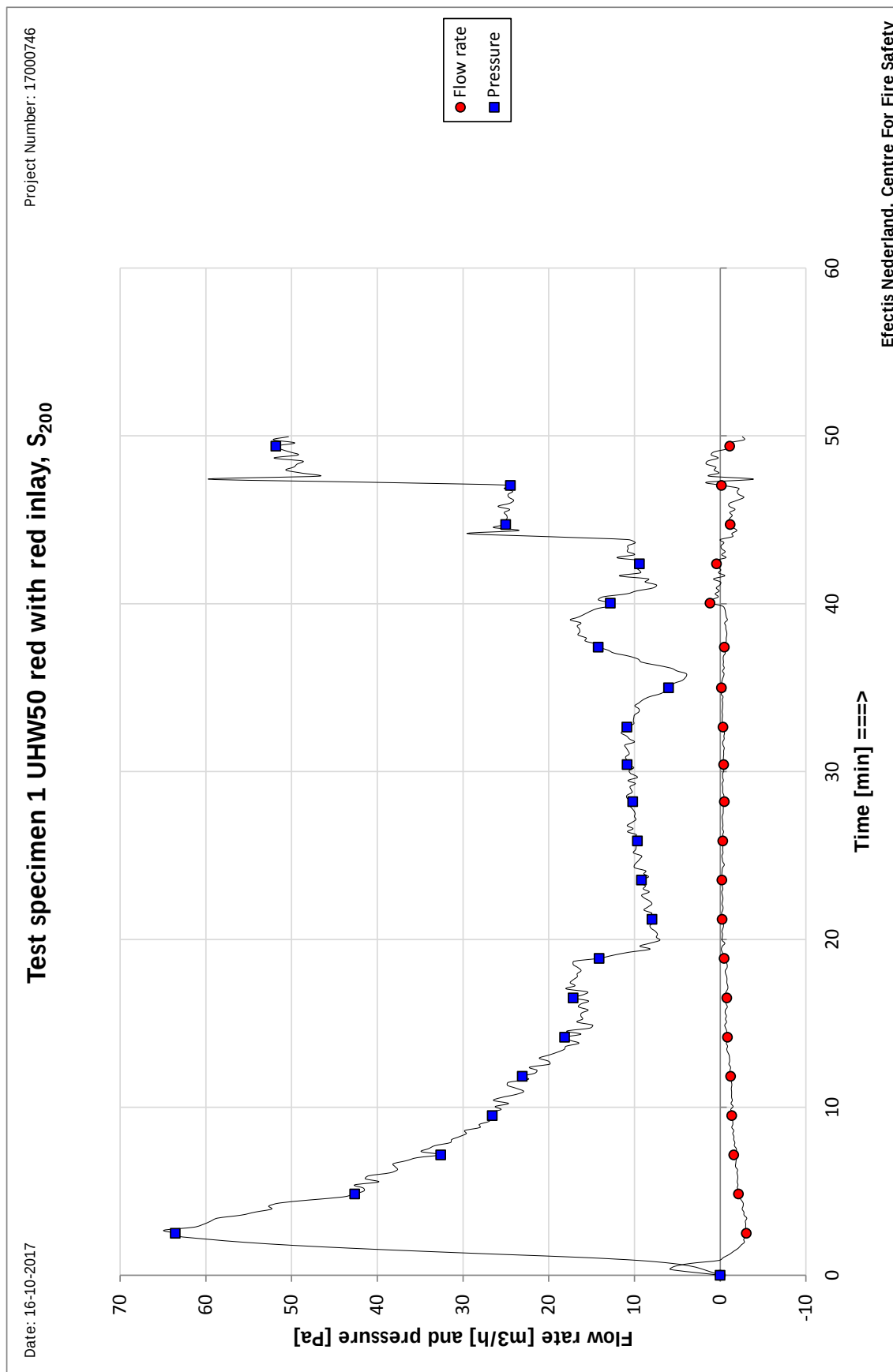


Figure A.11.

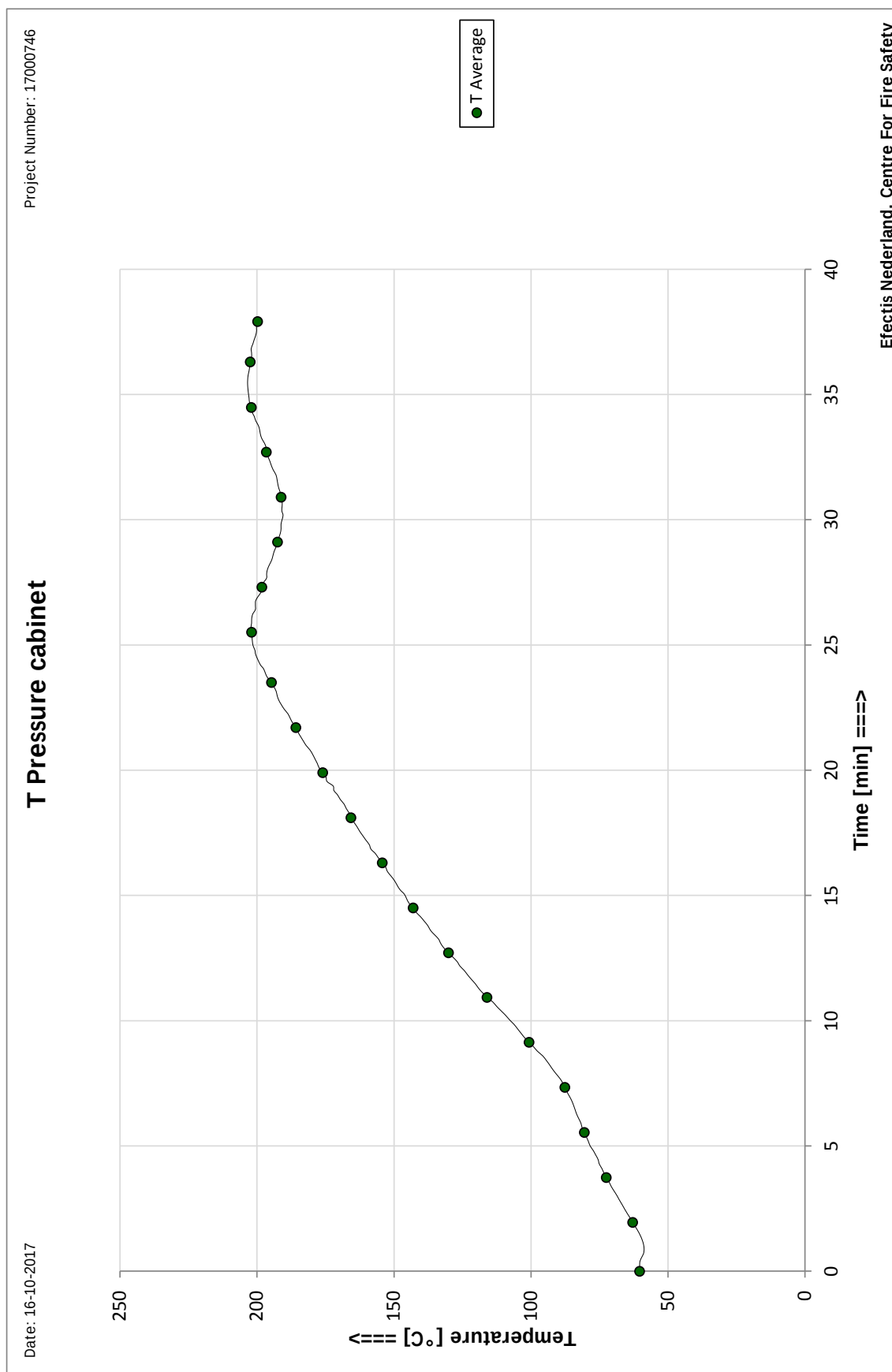


Figure A.12.

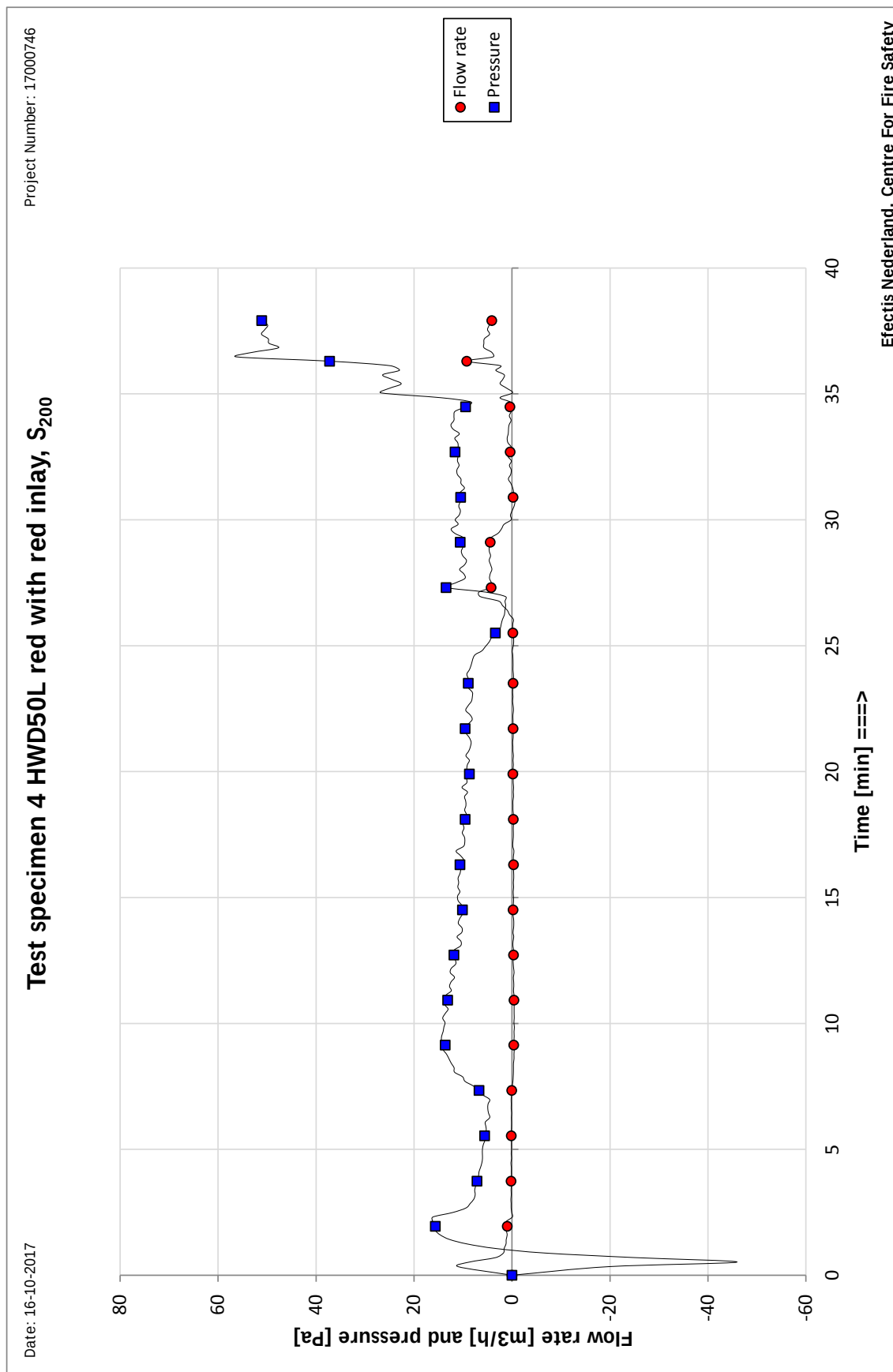


Figure A.13.

APPENDIX B: PICTURES



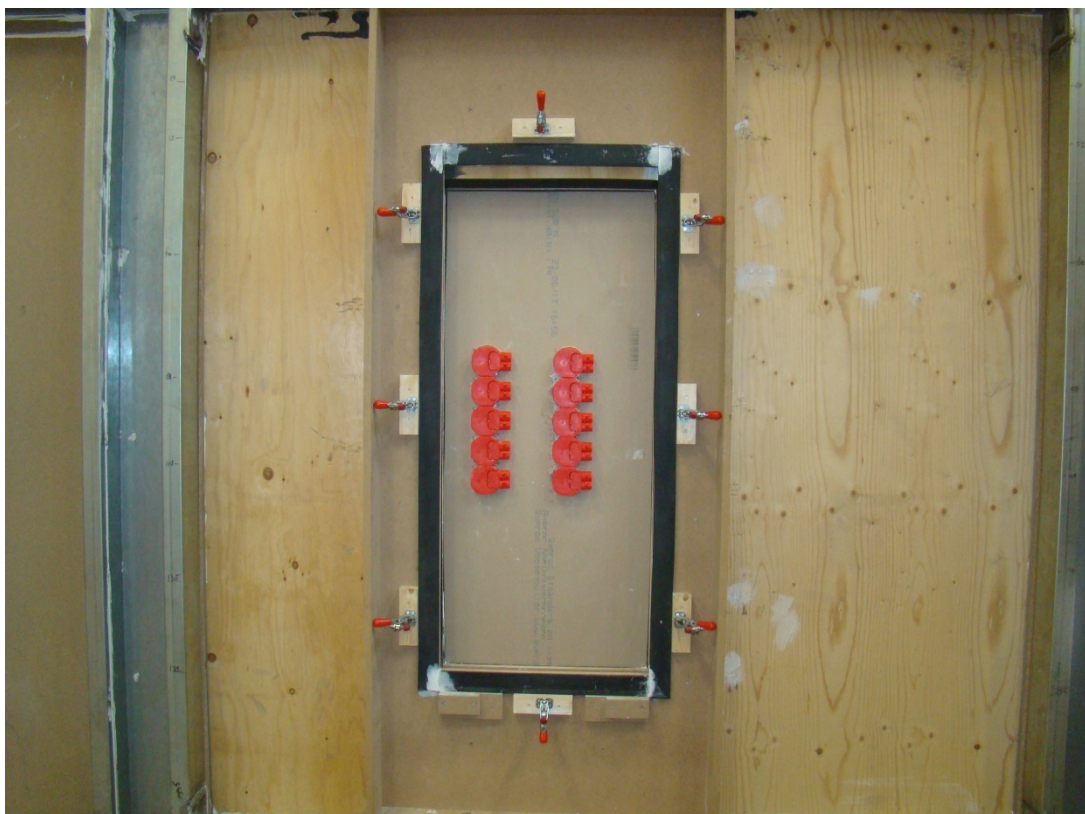
Picture B.1 Determination of system leakage



Picture B.1 General overview electrical outlets



Picture B.2 S_a test, back side panel fixed at pressure cabinet side, capped boxes



Picture B.3 S_a test, back side panel fixed at pressure cabinet side, fire resistant boxes



Picture B.4 S_{200} test, determination of leakages



Picture B.5 S_{200} test, heated panel, deformation socket outlets