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Efectis Nederland report

2012-Efectis-R9284a[Rev.1]

Determination of the fire resistance according to EN 1366-3:2009 of Envirograf penetration seals used on various types of penetrations in a standard flexible supporting construction

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Project name Fire resistance
Project number 2012284

Contents

1 Subject

Determination of the fire resistance according to EN 1366-3: 2009 of Envirograf penetration seals used on PVC, PE, steel and copper pipes, cable trays and electro sockets penetrating a standard flexible supporting construction according to EN 1366-3:2009, being an insulated metal stud gypsum board wall. The test frame was half filled with a flexible wall and half with an aerated concrete wall. The aerated concrete wall is described in a separate report.

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3 Place and data regarding the examination

The examination was performed at the laboratory of Efectis Nederland BV in Rijswijk, The Netherlands.

The specimen was assembled on the 5th – 8th of June 2012.
The fire test was performed on the 18th of June 2012.

4 Test specimen

4.1 General

A fire test was carried out on Envirograf penetration seals used on PVC, PE, steel and copper pipes, cable trays and electro sockets penetrating a standard flexible supporting construction.

For the dimensions and specifications of the materials and components of the examined construction, see the figures in chapter 10. Significant details of the construction are given in the paragraphs below.

4.2 Test frame

The test frame was constructed of steel beams with a fire resistant concrete lining, with internal dimensions of 4000 x 3000 mm (w x h). The depth of the test frame was 250 mm.

4.3 Test specimen

4.3.1 Wall

The standard flexible wall construction according to EN 1366-3:2009, had dimensions of 2000 x 3000 x 100 mm (w x h x t). Between the steel profiles Rockwool insulation was placed with a density of approx. 100 kg/m^3, a thickness of 50 mm and was removed 100 mm around each aperture. The other half of the test frame was filled with aerated concrete and is described in a separate report.

4.3.1.1 Profiles

In the test frame steel C and U profiles type Knauf UW50 were applied and mounted in the concrete lining with Fischer FNA II 6 x 30/5, c.t.c. 500 mm.
Between the top and bottom edge profile, vertical and horizontal profiles type Knauf UW50 were attached with a c.t.c. distance of 600 mm to the edge.

The wall was not fixed at the left and right vertical side, the so called free edges, to make unrestrained deflection possible.

4.3.1.2 Gypsum board

At both sides of the wall, two layers of 15 mm Type F (EN520) gypsum board were applied on the steel profiles. The board was mounted on the steel profiles with drywall screws 3.5 x 25 mm c.t.c. 500 mm and 3.5 x 35 mm for the second (outside) layer, c.t.c 250 mm.

The joints between the boards were filled with Knauf filler.

4.3.2 Penetrations

4.3.2.1 Pipes A, PVC pipes

PVC pipes fitted with Envirograf WPCS fire collars at both sides of the wall, with a depth of 40 mm and a thickness of 6 mm (Ø40 mm pipe) and 18 mm (Ø200 mm pipe).

Table 1:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
A1	PVC	200	7.7	8.3	Envirograf WPCS fire collar (40mm)
A2	PVC	40	3.0	3.1	Envirograf WPCS fire collar (40mm)

4.3.2.2 Pipes B, Copper pipes

Copper pipes insulated with Armaflex with a thickness of 13 mm over a min. length of 480 mm (measured from wall surface), fitted with Envirograf WPCS fire collars at both sides of the wall, with a depth of 40 mm and a thickness of 6 mm (Ø42 mm pipe) and 8 mm (Ø54 mm pipe).

Table 2:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
B1	Copper	54	2.0	1.6	Envirograf WPCS fire collar (40mm)
B2	Copper	42	1.5	1.3	Envirograf WPCS fire collar (40mm)

4.3.2.3 Pipes C, PE-Xa pipes

PE-Xa pipes insulated with Armaflex with a thickness of 13 mm over a min. length of 540 mm (measured from wall surface), fitted with Envirograf WPCS fire collars at both sides of the wall, with a depth of 40 mm and a thickness of 6 mm (Ø16.2 and 40 mm pipe), 8 mm (Ø63 mm pipe).

Table 3:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
C1	PE-Xa	63	8.6	9.0	Envirograf WPCS fire collar (40mm)
C2	PE-Xa	40	6.7	5.7	Envirograf WPCS fire collar (40mm)
C3	PE-Xa	16.2	2.2	2.3	Envirograf WPCS fire collar (40mm)

4.3.2.4 Pipe D, Unicor pipes

Unicor pipe with an annular space of 17.5 mm, filled with Envirograf Acrylic Mastic at both sides of the wall.

Table 4:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
D	Unicor	25	2.7	2.7	Envirograf Acrylic Mastic

4.3.2.5 Pipe E, Plyfolt pipe

Plyfolt pipe with an annular space of 17.5 mm, filled with Envirograf Acrylic Mastic at both sides of the wall.

Table 5:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
E	Plyfolt	20	2.0	1.3	Envirograf Acrylic Mastic

4.3.2.6 Pipes F, PE-Xc HDCE pipes

Impermeable multilayer PE-Xc HDCE pipes containing an overlapped welded aluminium sleeve, fitted with Envirograf WPCS fire collars at both sides of the wall, with a depth of 40 mm and a thickness of 6 mm (Ø40 and 63 mm pipe).

Table 6:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
F1	PE-Xc HDCE	63	6.0	4.7	Envirograf WPCS fire collar (40mm)
F2	PE-Xc HDCE	40	4.0	3.5	Envirograf WPCS fire collar (40mm)

4.3.2.7 Pipes G, steel pipes

Steel pipes insulated with Armaflex with a thickness of 13 mm over a min. length of 550 mm (measured from wall surface), fitted with Envirograf WPCS fire collars at both sides of the wall, with a depth of 40 mm and a thickness of 8 mm (Ø42 mm pipe) and 22 mm (Ø219 mm pipe).

Table 7:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
G1	Steel	219	8.0	8.0	Envirograf WPCS fire collar (40mm)
G2	Steel	42	1.5	1.5	Envirograf WPCS fire collar (40mm)

4.3.2.8 Electro socket I

Both at the fire and non-fire side, a hollow wall junction box, Type Attema UHW40 for plasterboard walls was installed with a front socket facia. Each box contained an Intumescent Systems Ltd DFI Gasket manufactured from 2.0mm Rubberised Intumescent material, 60mm diameter by 50mm across flats with a blue PVE facia.
The Boxes were Placed staggered in the wall by approximately 20 cm.

4.3.2.9 Pipes J, copper pipes

Copper pipes with an annular space of 17.5 mm, filled with Envirograf Acrylic Mastic at both sides of the wall.

Table 8:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
J1	Copper	54	2.0	1.3	Envirograf Acrylic Mastic
J2	Copper	22	1.1	1.0	Envirograf Acrylic Mastic

4.3.2.10 Rectangular opening K

300 x 100 mm (w x h) rectangular opening containing one PVC pipe and two cables type SWA 10 mm^2 4 core armoured cable, opening closed with four Envirograf Intumescent fire and smoke pillows with a dimension of 150 x 100 x 100 mm.

Table 9:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
K	PVC	50	3.3	3.3	Envirograf Intumescent pillows

4.3.2.11 Cable tray L

Steel cable tray with a dimension of 150 x 25 mm (w x h) containing 8 cables type SWA 10 mm sq 4 core armoured cable coated over a min. length of 130 mm with Envirograf EP/C. The aperture was, on top of the cable tray, closed with one Envirograf Intumescent Cable Tray Pillow TE6. Extra weight (4.5 kg) was applied on the fire side of the cable tray to simulate more cables.

4.3.2.12 Ventilation trunking M

PVC Ventilation trunking with a dimension of 110 x 54 mm (w x h) fitted with an Envirograf Firoblock 110V15 wrap, applied around the trunking. The wrap protruded 20 mm from the wall surface at the non fire side and 80 mm from the wall surface at the fire side.

4.3.2.13 Pipe N

PVC pipe with an annular space of 20 mm, filled with Envirograf EN/F Sealant System at both sides of the wall.

Table 10:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
N	PVC	55	2.0	2.2	Envirograf EN/F Sealant System

4.3.2.14 Pipe Q2

Copper pipe with an annular space of 20 mm, filled with Envirograf EN/F Sealant System at both sides of the wall.

Table 11:

No	Material	Pipe diameter (mm)	Pipe wall thickness (mm)	Measured pipe wall thickness (mm)	Penetration seal
Q2	Copper	54	1.0	0.9	Envirograf EN/F Sealant System

4.3.3 Pipe end configuration

During the fire test all plastic pipes were left uncapped (except C1), case U/U. All steel and copper pipes were capped at the fire side, case U/C. Pipe C1 was capped at both sides, case C/C.

4.3.4 Service support construction

In the test a standard service support construction is used according to EN 1366-3: 2009 paragraph 6.3.3 and figure A.6 in the standard (Test arrangement showing service support construction for flexible wall constructions). The steel service support construction was made from steel C-profiles (thickness approx. 2.5 mm).

The pipes were supported on both sides of the wall at a minimum distance of 400 mm from the wall, with steel rods and pipe rings.

4.4 Method of assembly

- Attaching the steel C edge profiles to the concrete lining of the test frame with nail anchors;
- Attaching the vertical and horizontal steel profiles to the edge profiles with screws and rivets;
- Placing the first layer of gypsum on the steel profiles with screws at the non-fire side;
- Placing the second layer of gypsum on the steel profile with screws at the non-fire side;
- Filling up the joints with Knauf filler;
- Drilling of the apertures;
- Placing the insulation between the steel profiles and removing it 100 mm around the apertures;
- Placing the first layer of gypsum on the steel profiles with screws at the fire side;
- Placing the second layer of gypsum on the steel profile with screws at the fire side;
- Drilling of the apertures;
- Filling up the joints with Knauf filler;
- Placing of the service support construction;
- Penetrating the penetrations trough the wall and providing them with the needed penetration seal;
- Connecting the penetrations to the service support construction.

5 Manufacturing of the construction

Table 12:

Efectis Nederland BV, Centre for Fire Safety	– Test frame – Gypsum wall
Intumescent Systems LTD / DFI Trading	– Penetrations – Finish on and around penetrations

6 Research method

6.1 Verification of the specimen

During construction, the materials and parts used were verified on the basis of the data provided.

Efectis Nederland was not involved with the sampling of any of the materials used in the test.

6.2 Conditioning

From the beginning of assembling up to and including testing, the construction under investigation was located in Efectis Nederland's test laboratory.
During this time, the conditions in this area were as follows:

– Ambient temperature: 20±5°C;
– Relative humidity: 50±10%.

6.3 Density and moisture content

Table 13:

Material	Density [kg/m^3]	Moisture content [%]
Gypsum	800	6

6.4 Fire test

6.4.1 Test conditions

The fire test was carried out according to EN 1366-3:2009 and
EN 1363-1:1999. The specimen was heated on one side in accordance with the standard fire curve (cf. figure A.1 in annex A).

The desired overpressure in the furnace was 10 Pa at the bottom of the lowest penetration seal.

6.4.2 Measurements

During the heating the following data was measured and registered:

Furnace conditions

- The temperatures in the furnace using 10 plate thermocouples (TOV1 to TOV10), equally spread over the heated surface;
- The pressure in the furnace.

Specimen

- Surface temperatures of the wall;
- Surface temperatures of the penetrations.

Environment

- The temperature in the laboratory outside the furnace (T Amb).

The positions of the thermocouples were given in figure B.1 in annex B.

7 Test results

7.1 Observations during heating

Table 14: Observations

Time (min)	Observations
0	Start heating
9	Pipe of penetration N has dropped form the wall
22	At penetration L, the underside, the roving thermocouple was used the temperature was 95°C
30	The mineral wool disc at the fire side of penetration G1 has fallen into the furnace. Agreed with customer that when failure of I has occurred the pipe will be closed of on the non fire side.
41	A mineral wool disc at the non fire side of penetration G1 is inserted
45	Penetration C2 falls
50	The pipe of penetration C2 has fallen
62	The pipe of penetration A1 has molten and an opening > Ø 25 mm to the furnace has appeared
73	The thermocouple WCD 2 is broken, a measurement with the roving thermocouple is made 95°C
78	The remains of the pipe of penetration A1 is burning and falling over the pipe of penetration G1
80	The remains of the pipe of penetration A1 are being extinguished
88	The thermocouple WCD 2 is broken, a measurement with the roving thermocouple is made 161°C
90	At penetration L, the underside, the roving thermocouple was used the temperature was 180°
93	The pipe of penetration E has fallen. Its thermocouples are disattached from the wall
99	The remains of the pipe of penetration A1 are being extinguished
108	The remains of the pipe of penetration A1 are being extinguished
118	At penetration L, the underside, the roving thermocouple was used the temperature was 190°
120	End of heating

Photographs of details during assembly and the construction before, during and after the test are shown in annex C.

7.2 Graphs of the fire test

The test results are shown as graphs in Annex A and B. During the heating of the specimen the ambient temperature met the requirements of EN 1363-1:1999.

7.3 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.

8 Summary

Determination of the fire resistance according to EN 1366-3: 2009 of Envirograf and DFI penetration seals used on PVC, PE, steel and copper pipes, cable trays and electro sockets penetrating a standard flexible supporting construction.

Table 15: Summary of test results, A (PVC pipes)

Integrity, (E)	
Flames present longer than 10 sec.:	
A1	78 minutes
A2	120 minutes*
Insulation, (I)	
Max. temperature rise A1	57 minutes
Max. temperature rise A2	111 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 16: Summary of test results, B (Copper pipes)

Integrity, (E)	
Flames present longer than 10 sec.:	
B1	120 minutes*
B2	120 minutes*
Insulation, (I)	
Max. temperature rise B1	49 minutes
Max. temperature rise B2	38 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 17: Summary of test results, C (PE-Xa pipes)

Integrity, (E)	
Flames present longer than 10 sec.:	
C1	120 minutes*
C2	120 minutes*
C3	120 minutes*
Insulation, (I)	
Max. temperature rise C1	88 minutes
Max. temperature rise C2	40 minutes
Max. temperature rise C3	92 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 18: Summary of test results, D (Unicor pipe)

Integrity, (E)	
Flames present longer than 10 sec.:	
D	120 minutes*
Insulation, (I)	
Max. temperature rise D	120 minutes*
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 19: Summary of test results, E (Plyfolt pipe)

Integrity, (E)	
Flames present longer than 10 sec.:	
E	120 minutes*
Insulation, (I)	
Max. temperature rise E	120 minutes*
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 20: Summary of test results, F (PE-Xc HDCE pipes)

Integrity, (E)	
Flames present longer than 10 sec.:	
F1	120 minutes*
F2	120 minutes*
Insulation, (I)	
Max. temperature rise F1	42 minutes
Max. temperature rise F2	79 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 21: Summary of test results, G (Steel pipes)

Integrity, (E)	
Flames present longer than 10 sec.:	
G1	120 minutes*
G2	120 minutes*
Insulation, (I)	
Max. temperature rise G1	38 minutes
Max. temperature rise G2	98 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 22: Summary of test results, I (Electro boxes)

Integrity, (E)	
Flames present longer than 10 sec.:	
I	108 minutes
Insulation, (I)	
Max. temperature rise I	107 minutes
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 23: Summary of test results, J (Copper pipes)

Integrity, (E)	
Flames present longer than 10 sec.:	
J1	120 minutes*
J2	120 minutes*
Insulation, (I)	
Max. temperature rise J1	18 minutes
Max. temperature rise J2	23 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 24: Summary of test results, K (Rectangular opening)

Integrity, (E)	
Flames present longer than 10 sec.:	
K	120 minutes*
Insulation, (I)	
Max. temperature rise K	120 minutes*
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 25: Summary of test results, L (Steel cable tray)

Integrity, (E)	
Flames present longer than 10 sec.:	
L	120 minutes*
Insulation, (I)	
Max. temperature rise L	120 minutes*
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 26: Summary of test results, M (PVC Ventilation trunking)

Integrity, (E)	
Flames present longer than 10 sec.:	
M	120 minutes*
Insulation, (I)	
Max. temperature rise M	96 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 27: Summary of test results, N (PVC pipe)

Integrity, (E) Flames present longer than 10 sec.: N	 120 minutes*
Insulation, (I) Max. temperature rise N	 8 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

Table 28: Summary of test results, Q2 (Copper pipe)

Integrity, (E) Flames present longer than 10 sec.: Q	 120 minutes*
Insulation, (I) Max. temperature rise Q	 21 minutes
*The heating was terminated after 120 minutes after consulting the client.	
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.	

9 Field of direct application of test results

The field of direct application can be found in the classification reports referring to this test report.

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10 Figures

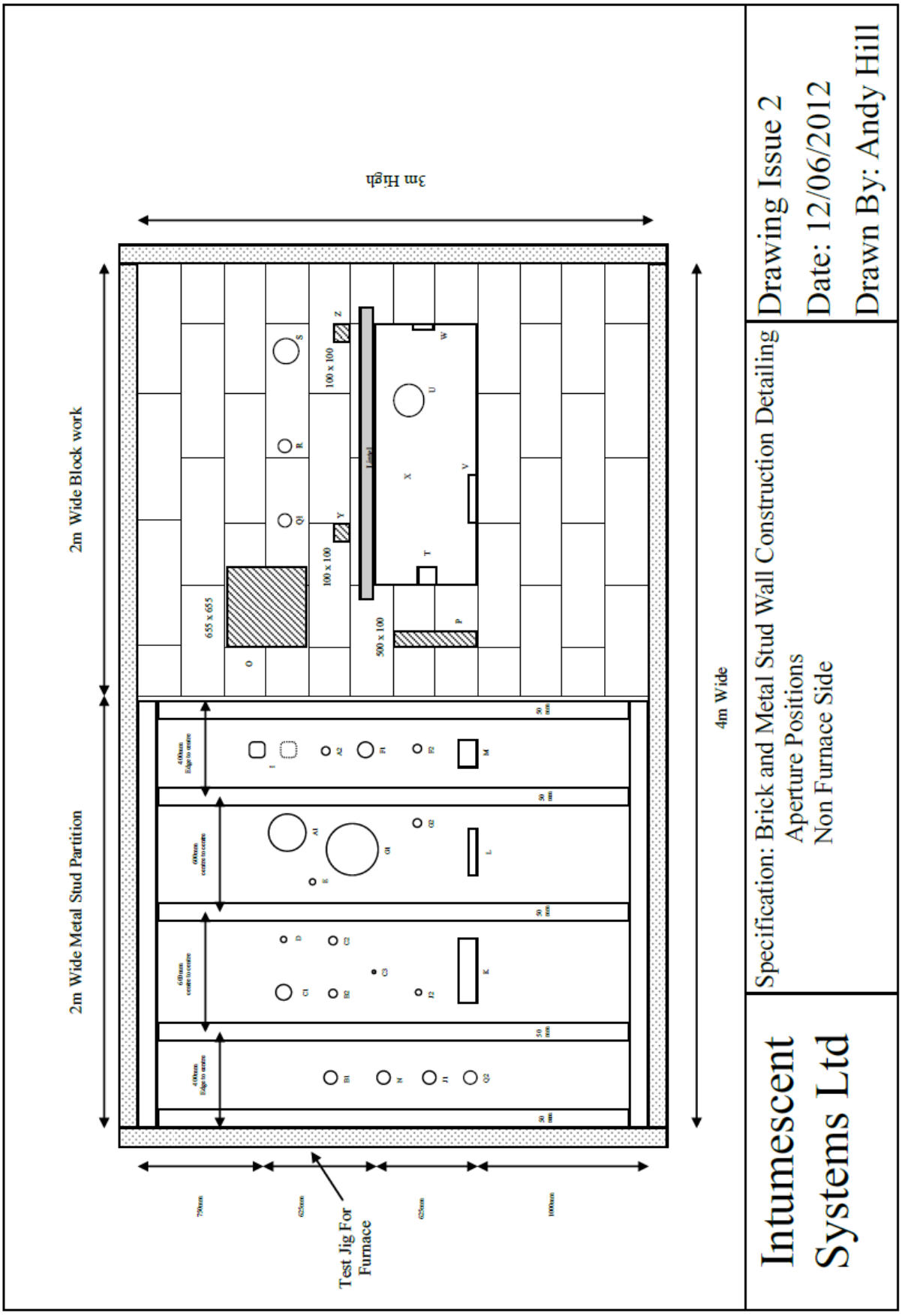


Figure 1: Overview of apertures

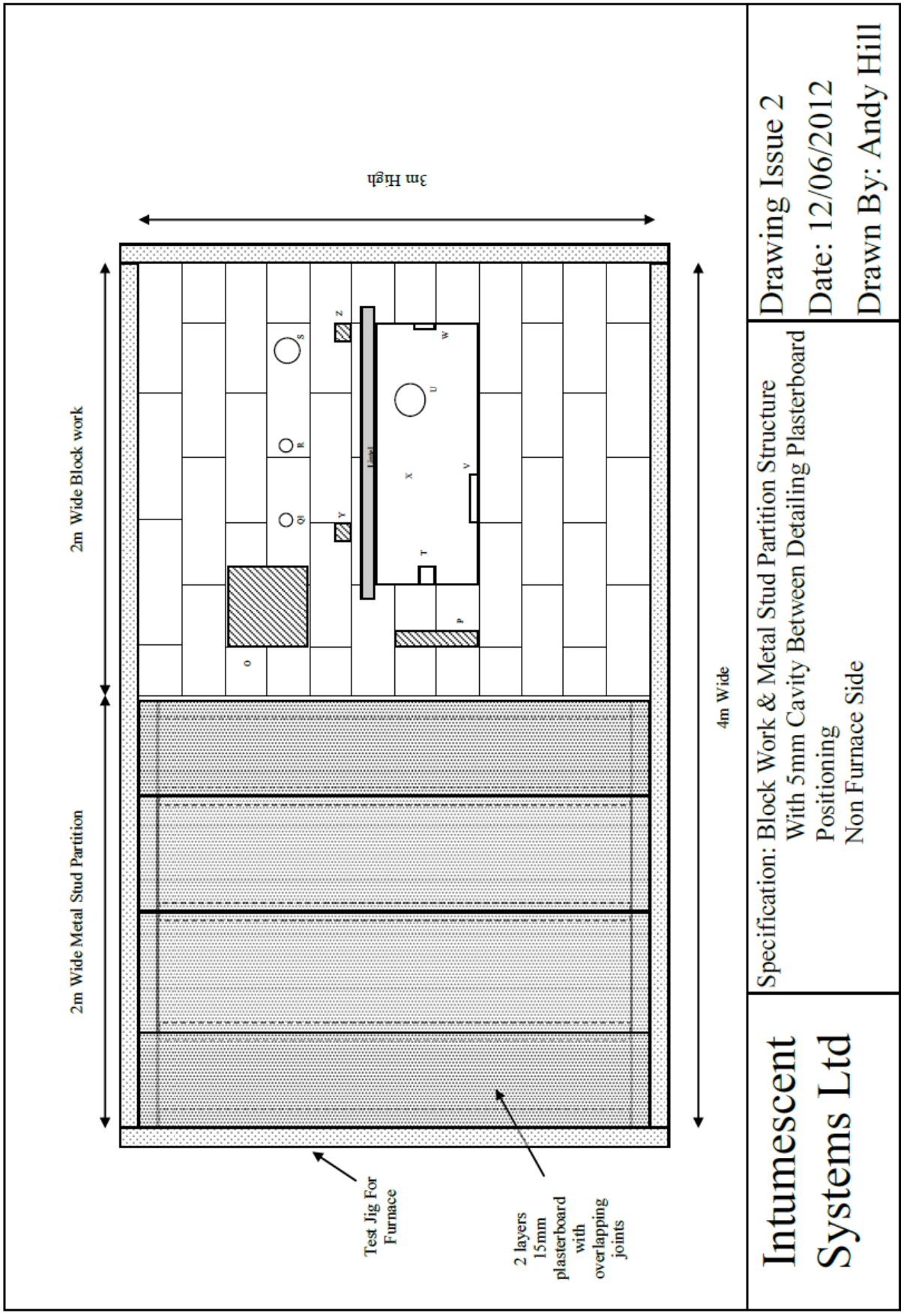


Figure 2: Overview of wall

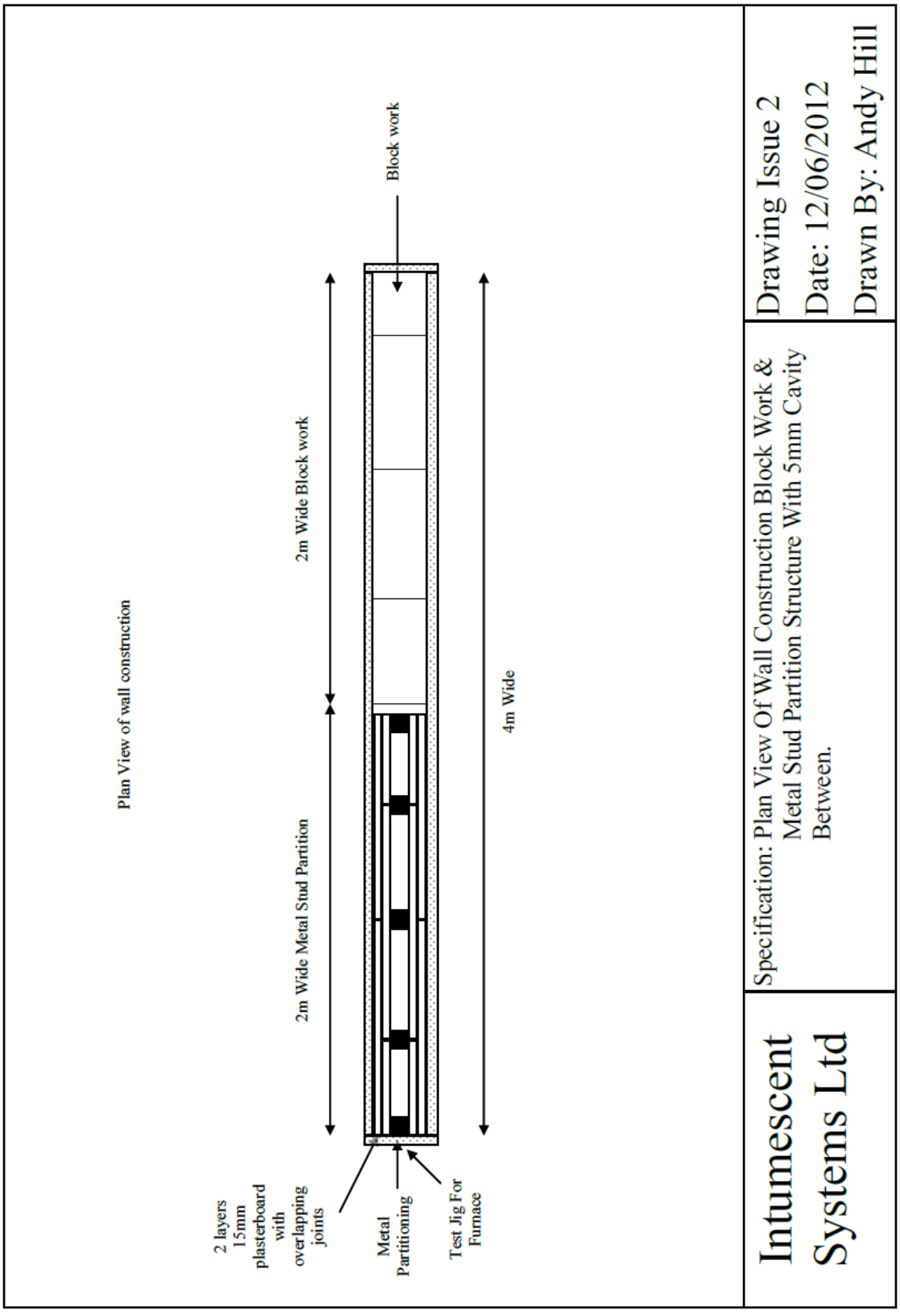


Figure 3: Horizontal section of wall

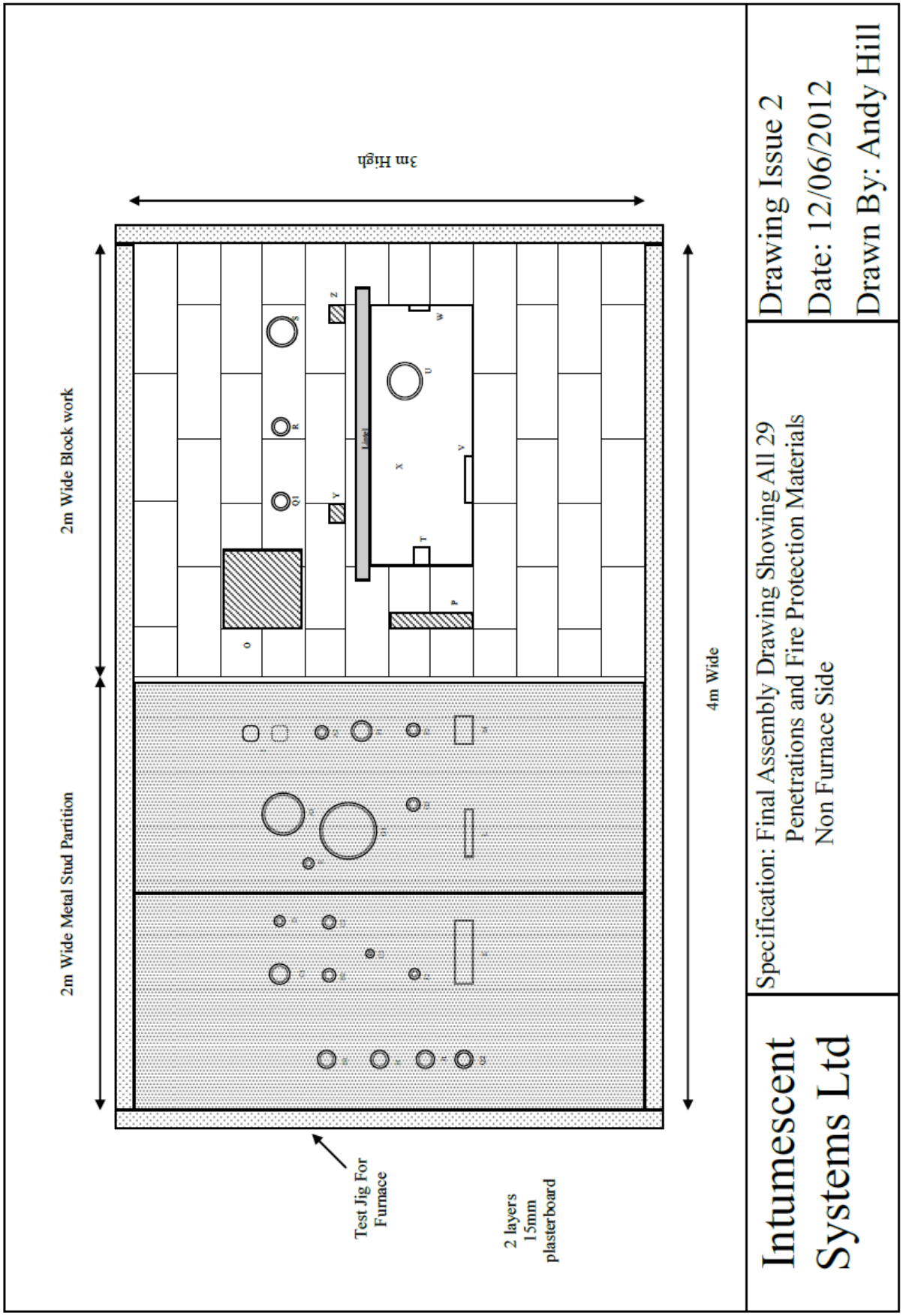
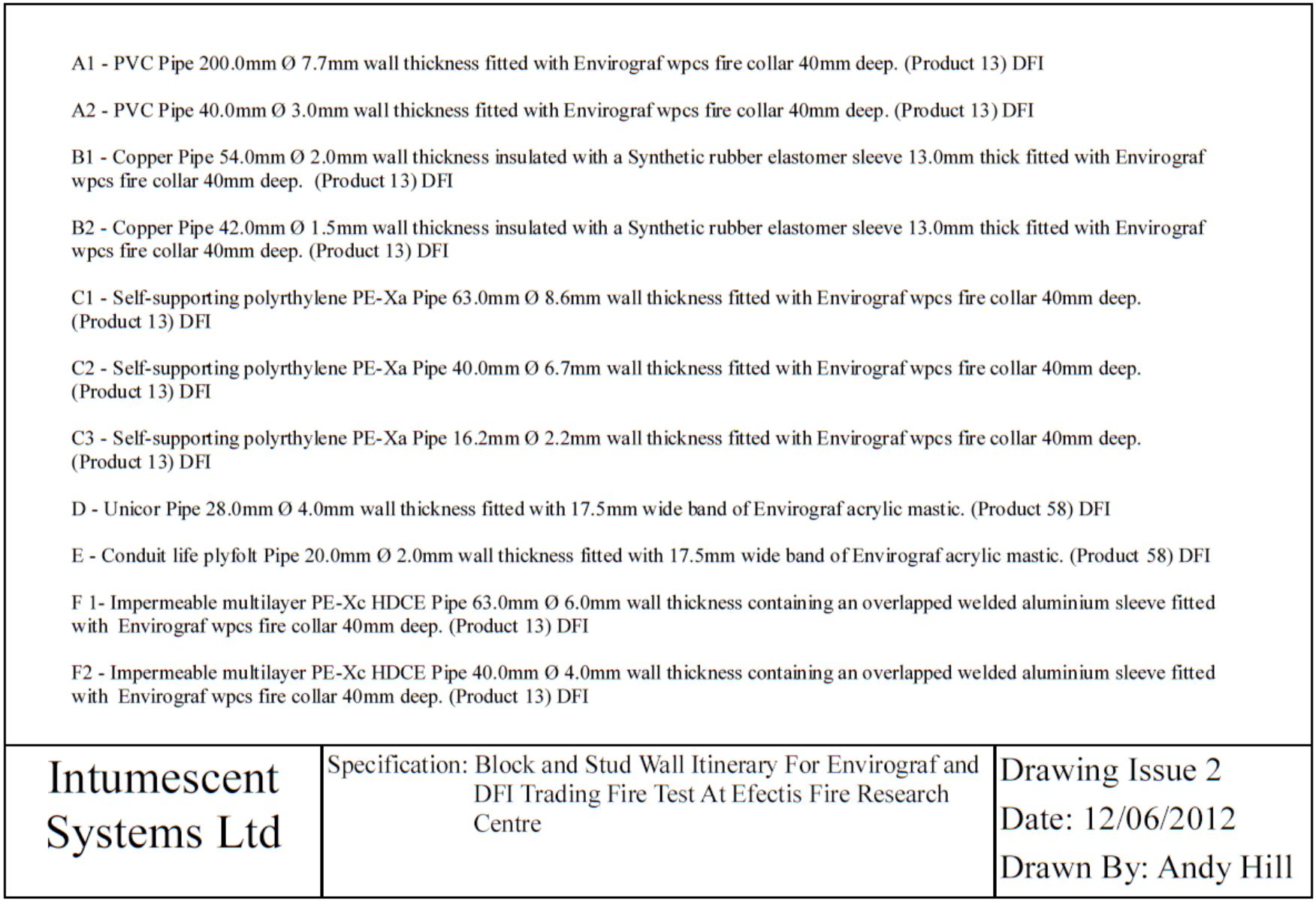


Figure 4: Overview of wall and apertures



A1 - PVC Pipe 200.0mm Ø 7.7mm wall thickness fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

A2 - PVC Pipe 40.0mm Ø 3.0mm wall thickness fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

B1 - Copper Pipe 54.0mm Ø 2.0mm wall thickness insulated with a Synthetic rubber elastomer sleeve 13.0mm thick fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

B2 - Copper Pipe 42.0mm Ø 1.5mm wall thickness insulated with a Synthetic rubber elastomer sleeve 13.0mm thick fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

C1 - Self-supporting polyrthylene PE-Xa Pipe 63.0mm Ø 8.6mm wall thickness fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

C2 - Self-supporting polyrthylene PE-Xa Pipe 40.0mm Ø 6.7mm wall thickness fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

C3 - Self-supporting polyrthylene PE-Xa Pipe 16.2mm Ø 2.2mm wall thickness fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

D - Unicor Pipe 28.0mm Ø 4.0mm wall thickness fitted with 17.5mm wide band of Envirograf acrylic mastic. (Product 58) DFI

E - Conduit life plyfolt Pipe 20.0mm Ø 2.0mm wall thickness fitted with 17.5mm wide band of Envirograf acrylic mastic. (Product 58) DFI

F 1- Impermeable multilayer PE-Xc HDCE Pipe 63.0mm Ø 6.0mm wall thickness containing an overlapped welded aluminium sleeve fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

F2 - Impermeable multilayer PE-Xc HDCE Pipe 40.0mm Ø 4.0mm wall thickness containing an overlapped welded aluminium sleeve fitted with Envirograf wpcs fire collar 40mm deep. (Product 13) DFI

Intumescent Systems Ltd	Specification: Block and Stud Wall Itinerary For Envirograf and DFI Trading Fire Test At Efectis Fire Research Centre	Drawing Issue 2 Date: 12/06/2012 Drawn By: Andy Hill

Figure 5: List of penetrations 1/3

O - Animal door Flap protector for opening 655mm by 655mm FP01 (Product 118) ISL

P - 500.0mm by 100.0mm rectangle opening fitted with Envirograf Intumescent impregnated fireproof sponge. (Product 40) ISL

Q1 - Copper pipe 54.0mm Ø 1.0mm wall thickness with 15.0mm wide band of Envirograf EN/F Sealant System (Product 146) ISL

Q2 - Copper pipe 54.0mm Ø 1.0mm wall thickness with 20.0mm wide band of Envirograf EN/F Sealant System (Product 146) ISL

R - PVC Pipe 55.0mm Ø 2.0mm wall thickness with 15.0mm Wide Band Envirograf EN/F Sealant System (Product 146) ISL

S - PVC pipe 110.0mm Ø 3.2mm wall thickness1 fitted with Envirograf ISPC100. (Product 13) ISL

T - Steel Trunking 75.0mm by 75.0mm fitted with Envirograf Intumescent Trunking Pillows TP33 (Product 27) ISL

U - PVC Pipe 160.0mm Ø 4.0mm wall thickness fitted with Envirograf Firoblock IWS150. (Product 110) ISL

V - Steel cable tray 150.0mm wide by 25.0mm assembled with cables coated with Envirograf EP/C (Product 80) and Intumescent Cable Tray Pillows TE6 (Product 29) ISL

W - PVC Trunking 100.0mm by 50.0mm fitted with Envirograf Intumescent Pads IP42 (Product 26) ISL

X - 1200.0mm by 600.0mm by 60.0mm thick Envirograf Intumescent Coated Slab IS60 (Product 4) ISL

Y - PVC Trunking 100.0mm by 100.0mm fitted with Envirograf Intumescent Trunking PillowsTP44 (Product 27) ISL

Z - Steel Trunking 100.0mm by 100.0mm fitted with Envirograf Intumescent Pads IP44 (Product 26) ISL

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Figure 6: List of penetrations 2/3

G1 - Steel Pipe 219.0mm Ø 8.0mm wall thickness insulated with a Synthetic rubber elastomer sleeve 13.0mm thick fitted with Envirograf WPCS fire collar 40mm deep. (Product 13) DFI

G2 - Steel Pipe 42.0mm Ø 1.5mm wall thickness insulated with a Synthetic rubber elastomer sleeve 13.0mm thick fitted with Envirograf WPCS fire collar 40mm deep. (Product 13) DFI

H1 - Removed

H2 - Removed

I - 2 x Elektro back boxes for plasterboard wall with front socket facia fitted with Envirograf Intumescent Systems Ltd DFI gasket 2.0mm rubberised intumescent material 60mm diameter x 50mm across flats with blue PVE facia

J1 - Copper Pipe 54.0mm Ø 2.0mm wall thickness fitted with 17.5mm wide band of Envirograf acrylic mastic. (Product 58) DFI

J2 - Copper Pipe 22.0mm Ø 1.1mm wall thickness fitted with 17.5mm wide band of Envirograf acrylic mastic. (Product 58) DFI

K - 300.0mm by 100.0mm rectangle opening containing pipe and cables fitted with Envirograf Intumescent fire and smoke pillows. (Product 1) ISL

L - Steel cable tray 150.0mm wide by 25.0mm assembled with cables coated with Envirograf EP/C (Product 80) and Intumescent Cable Tray Pillows TE6 (Product 29) ISL

M - PVC Ventilation Trunking 110mm x 54mm fitted with Envirograf Firoblock 110V15. (Product 110) ISL

N - PVC Pipe 55.0mm Ø 2.0mm wall thickness fitted with 20mm Wide Band Envirograf EN/F Sealant System. (Product 146) ISL

Intumescent Systems Ltd	Specification: Block and Stud Wall Itinerary For Envirograf and DFI Trading Fire Test At Efectis Fire Research Centre	Drawing Issue 3 Date: 15/04/2016 Drawn By: P Mond

Figure 7: List of penetrations 3/3

A Furnace conditions

Efectis Nederland, Centre for Fire Safety
Date: 18/06/2012

Project : Intumescent Sytems / DFI Trading
Projectnbr : 2012284

Furnace temperatures

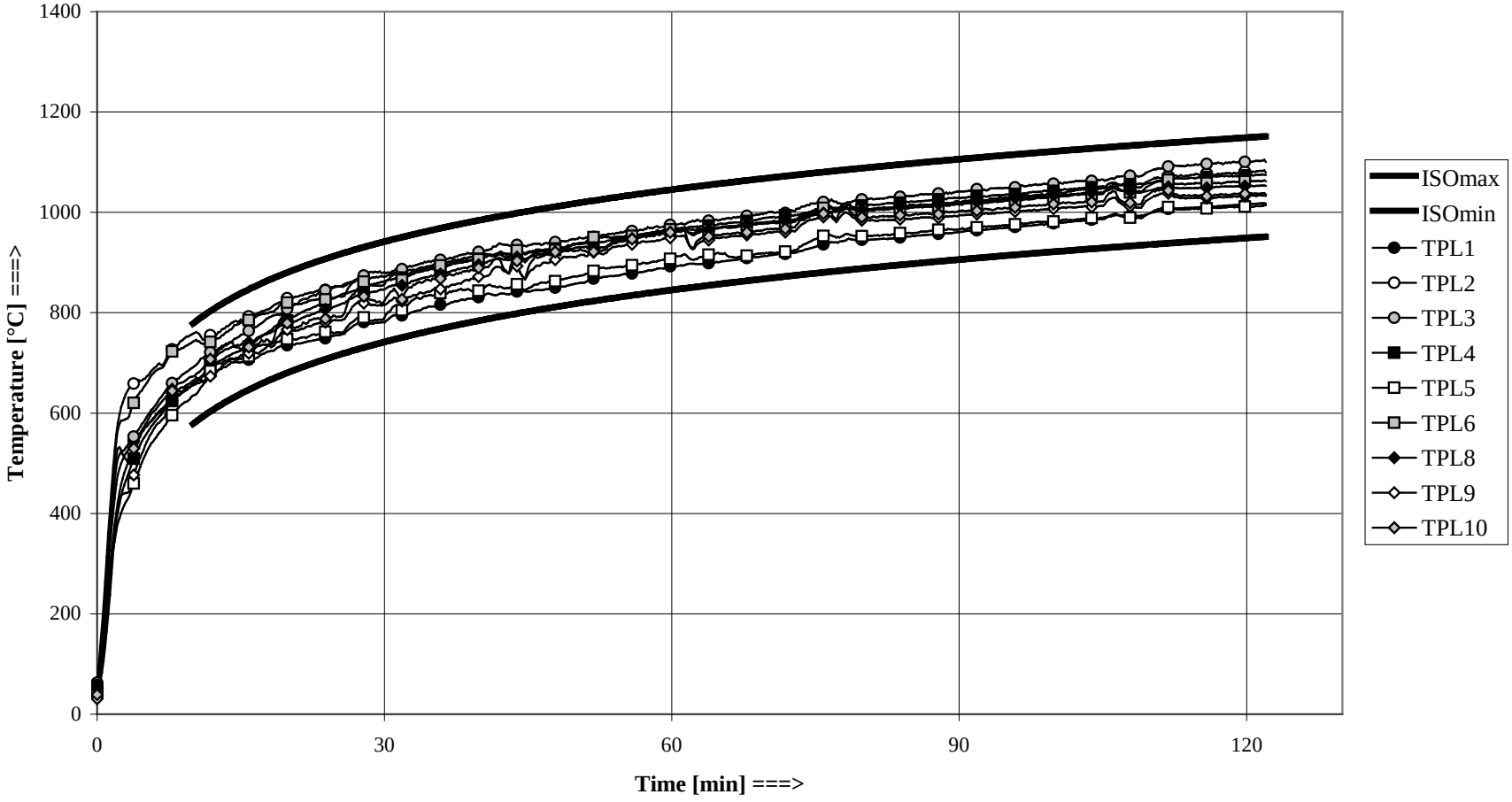

Figure: A.1

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Deviation fire curve according to EN 1363-1

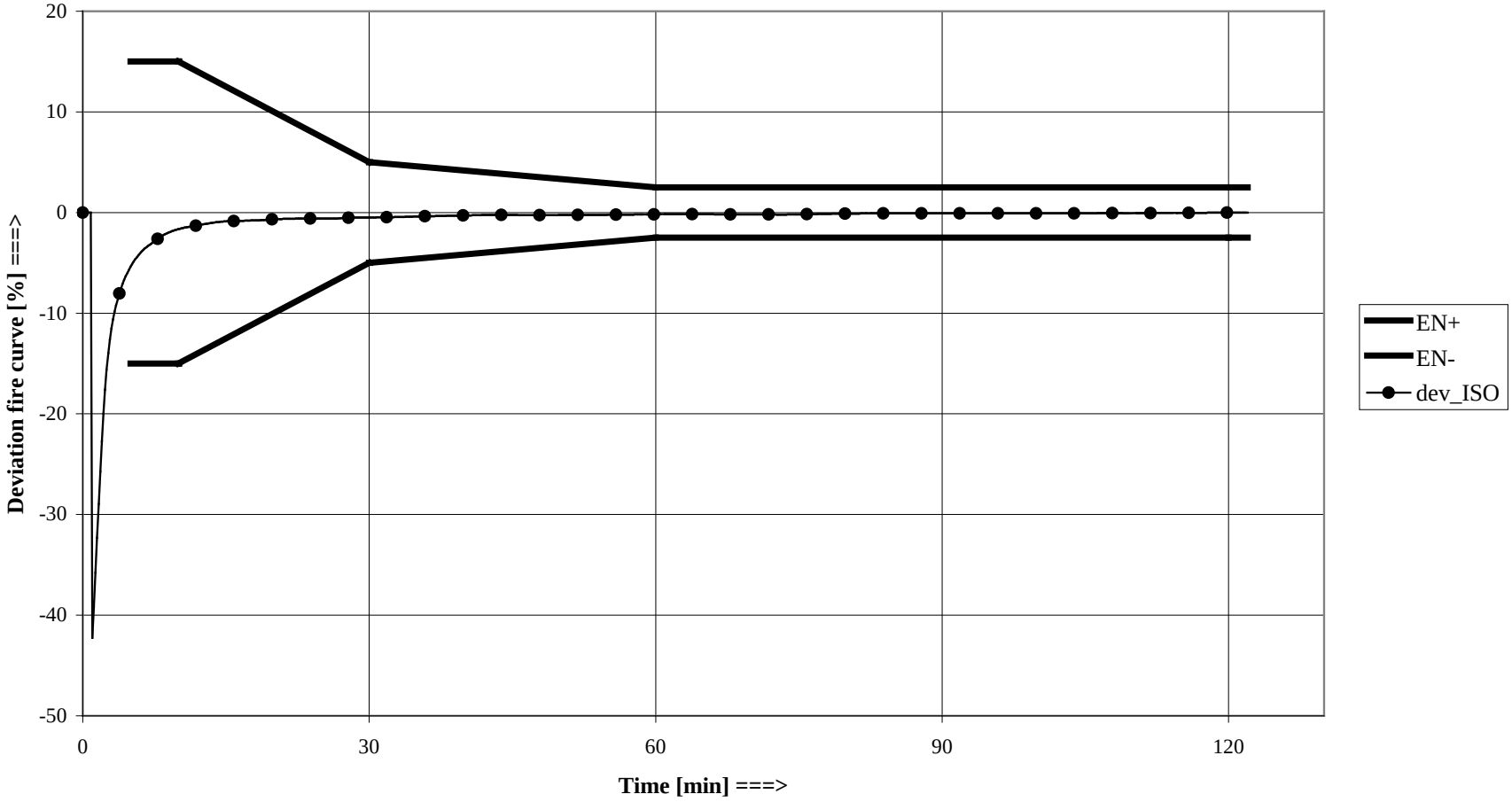

Figure: A.2

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Pressure in the furnace at bottom lowest penetration

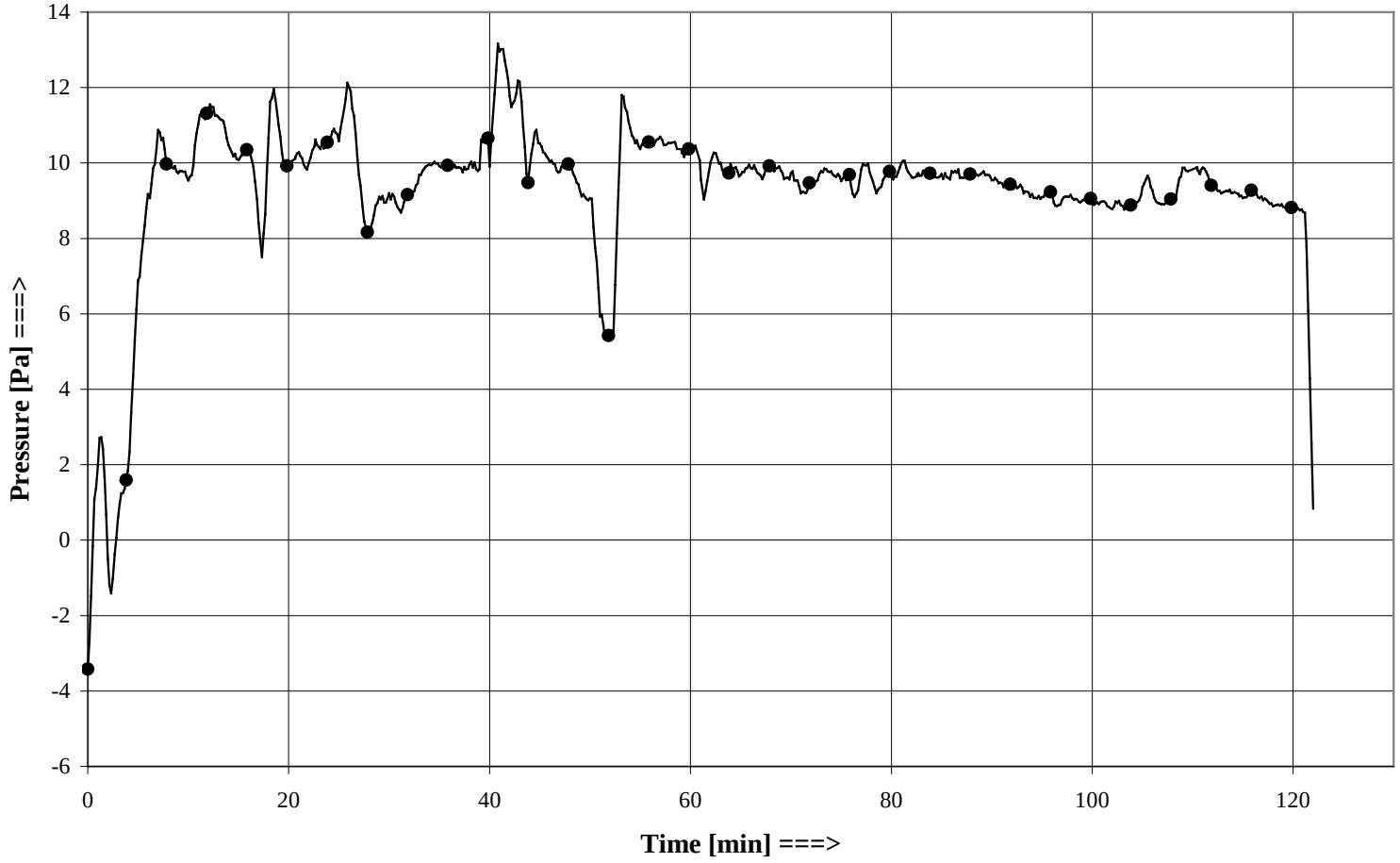

Figure: A.3

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Ambient temperature

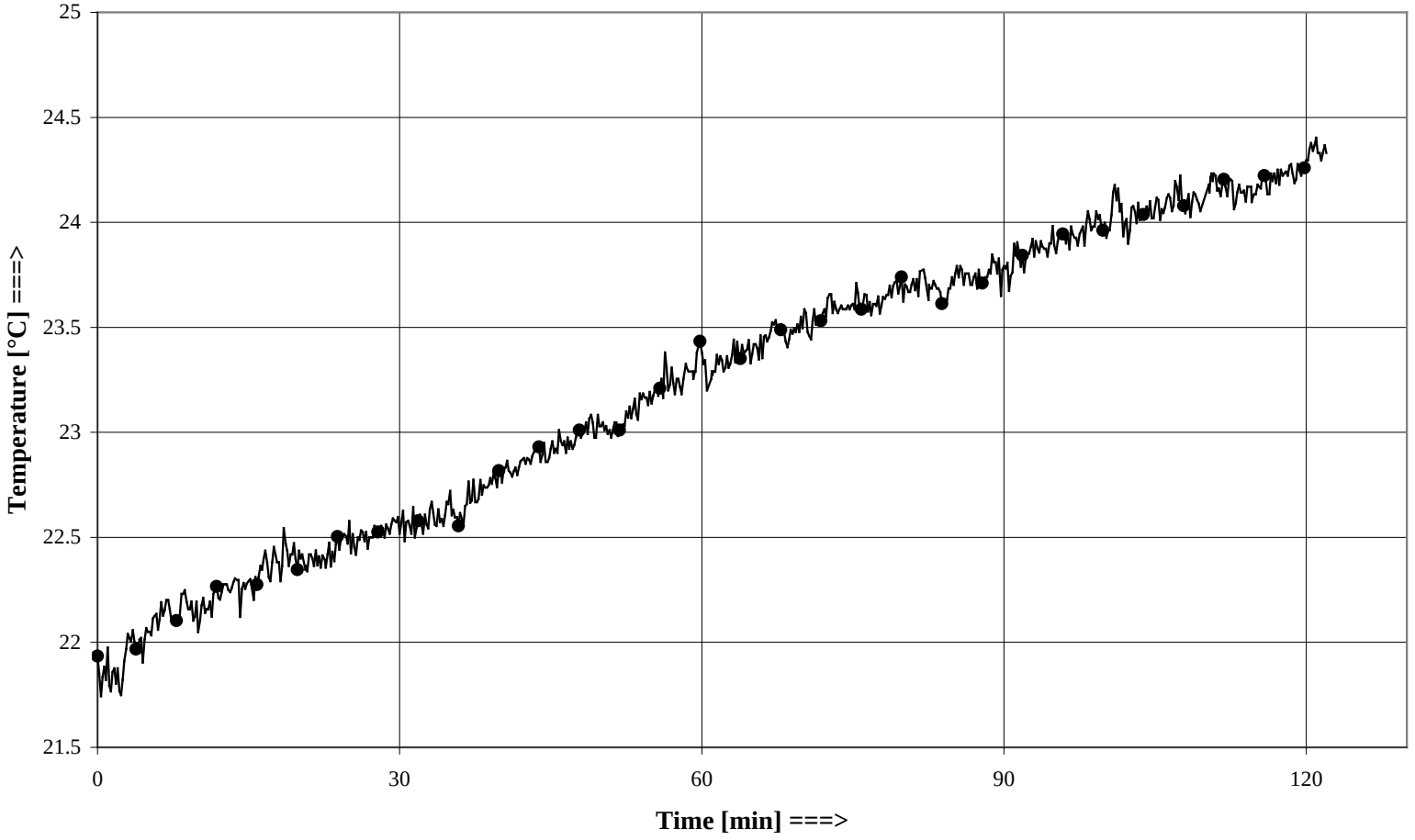

Figure: A.4

B Test results

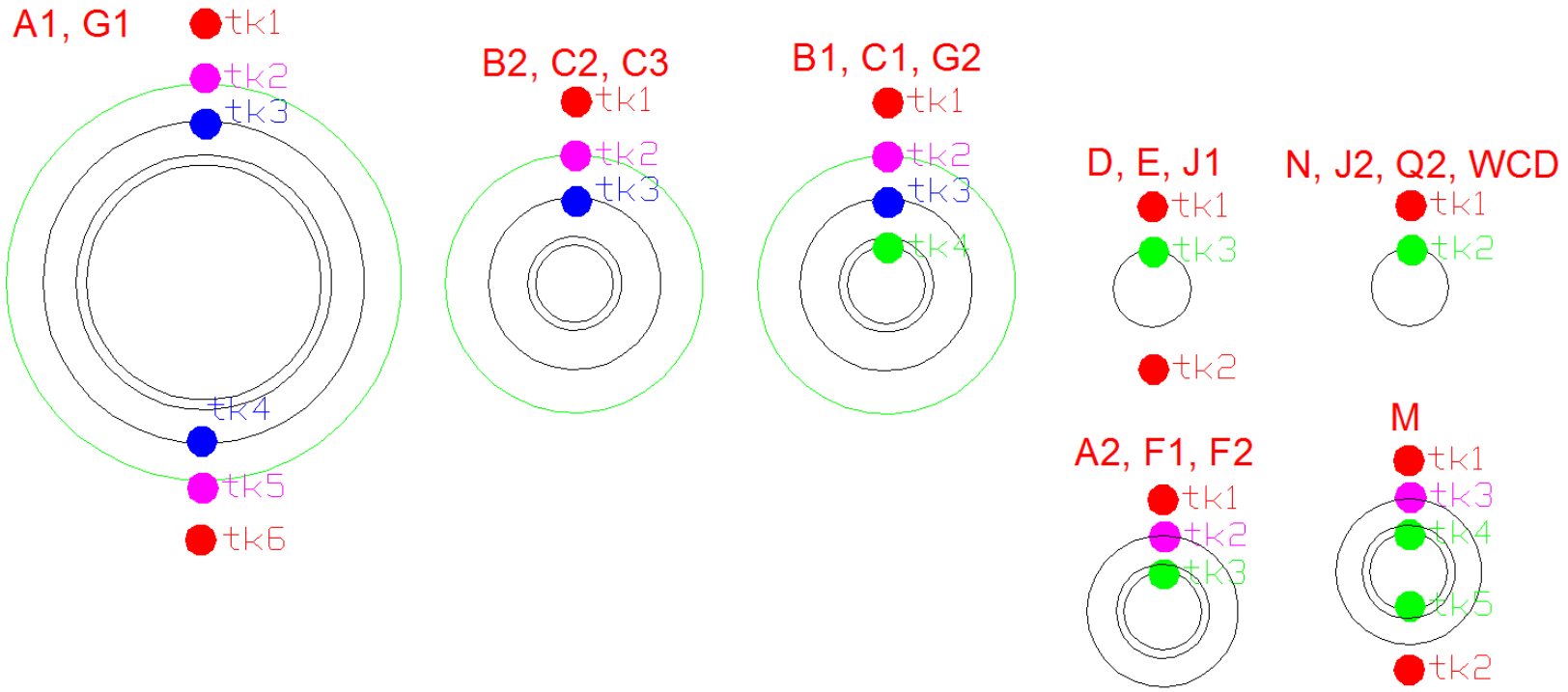

Figure B.1: Positions of thermocouples (tk's)

- **Red thermocouples:** Position E according to § 9.1.2.6 in EN 1366-3:2009 (on wall surface)
- **Pink thermocouples:** Position A according to § 9.1.2.2 in EN 1366-3:2009 on collar, 25 mm from the wall surface
- **Blue thermocouples:** Position A according to § 9.1.2.2 in EN 1366-3:2009 on the insulation material, 25 mm away from the collar or wall surface
- **Green thermocouples**: Position A according to § 9.1.2.2 in EN 1366-3:2009 on the pipe material, 25 mm away from the wall surface, collar or wall surface

Penetration K:
Tk 1, 2 and 3 on the wall surface (position E), tk 4 on the pillow (position A), tk 5, 6 and 7 on the pipe (position A).

Penetration L:
Tk 1 and 2 on the wall surface (position E), tk 3 on the pillow (position A), tk 4 on the coated underside of the cable tray (position D), tk 5 on the coated cables (position A), tk 6 on the non-coated cables (position A), tk 7 on the non-coated underside of the cable tray (position D).

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A1 penetration PVC pipe

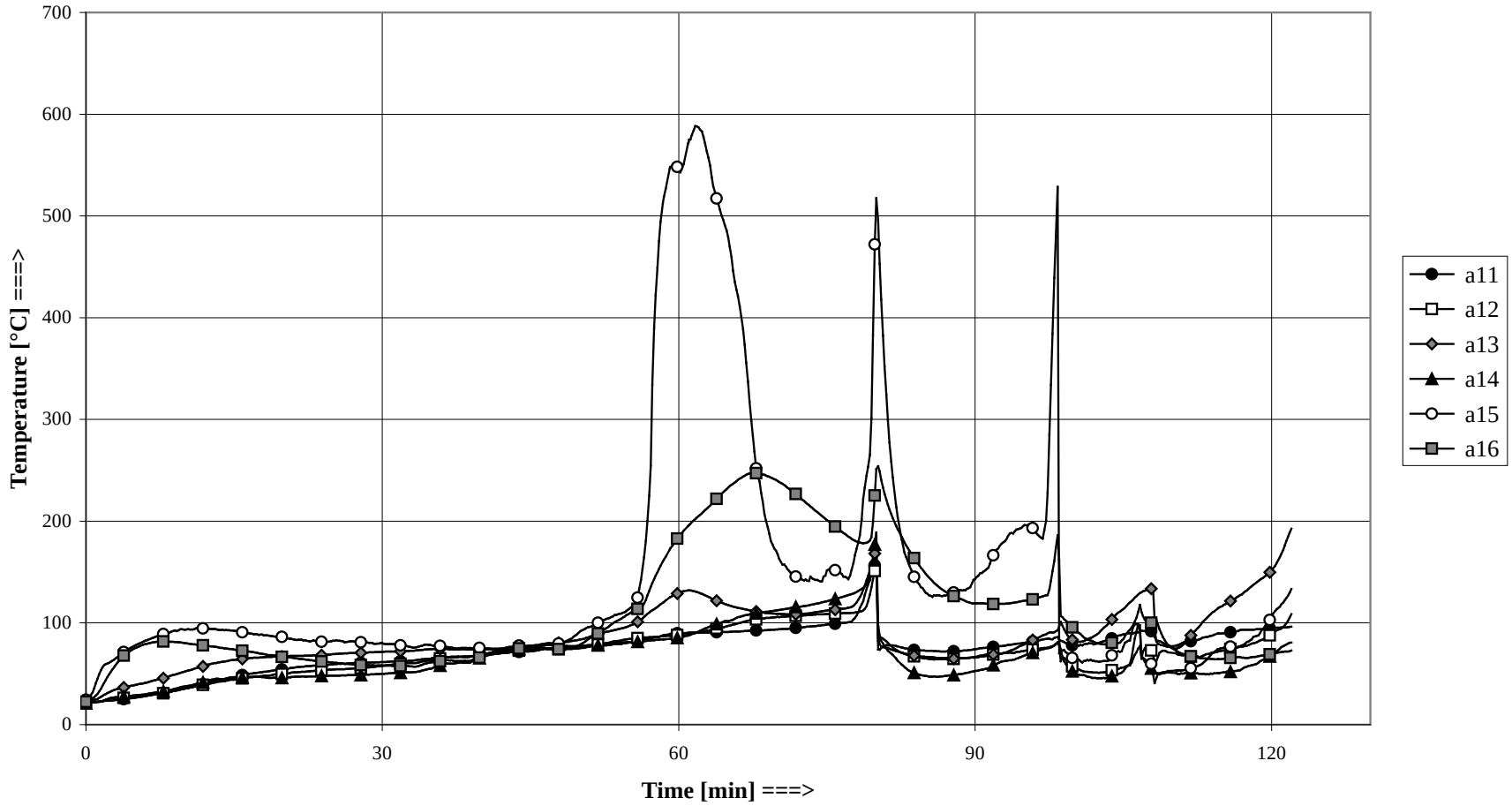

Figure: B.2

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A2 penetration PVC pipe

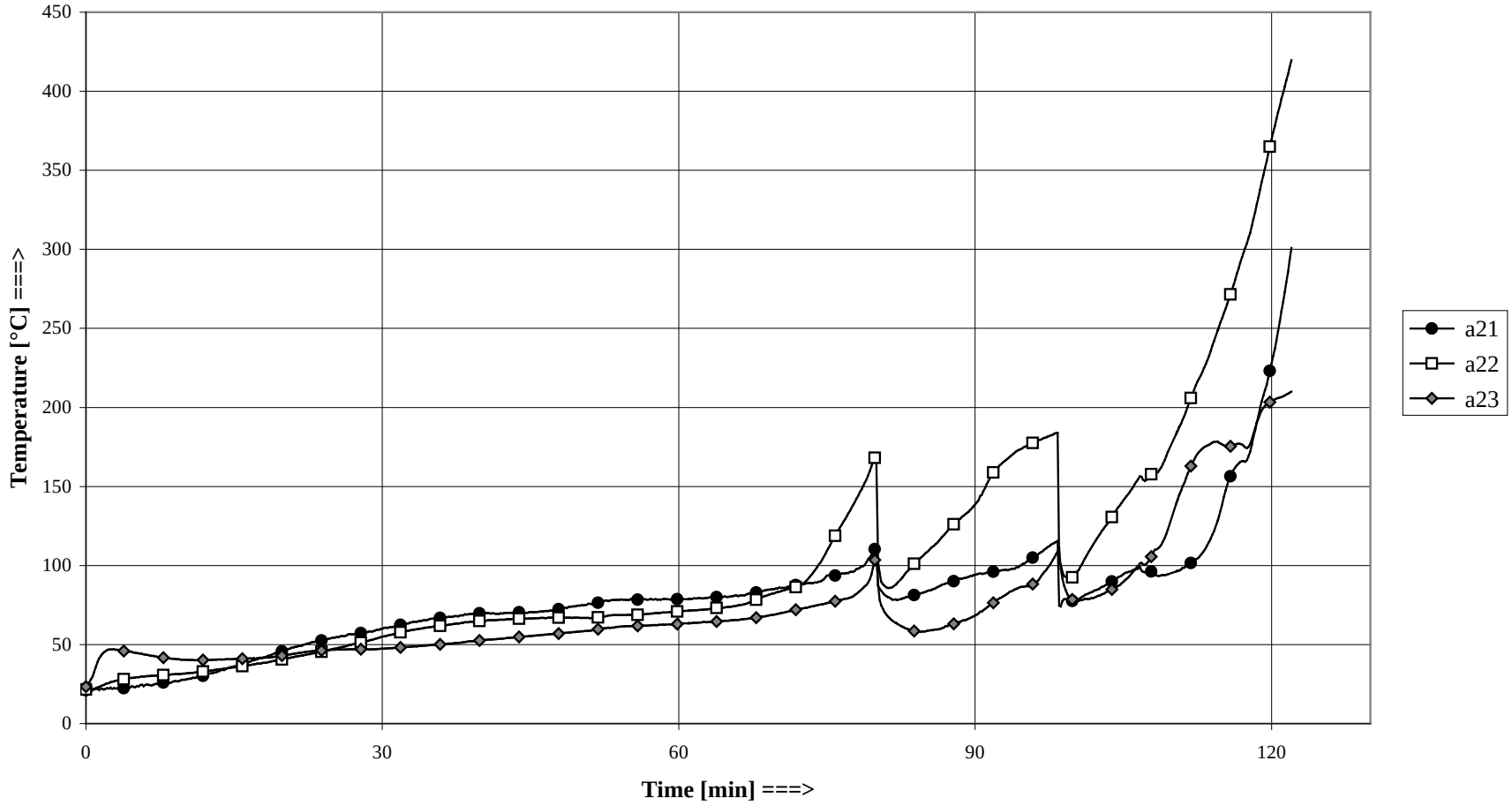

Figure: B.3

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B1 penetration Copper pipe

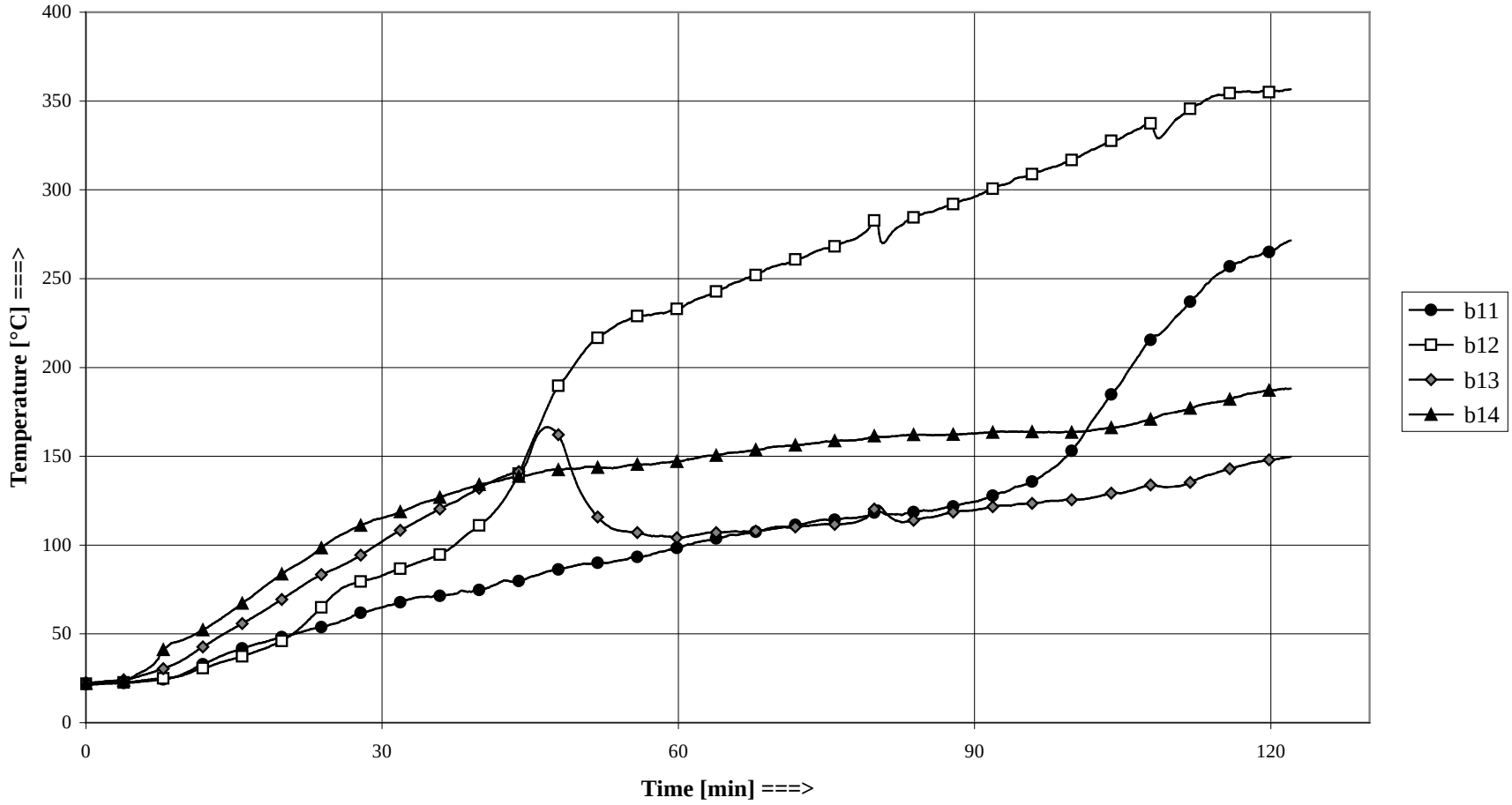

Figure: B.4

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B2 penetration Copper pipe

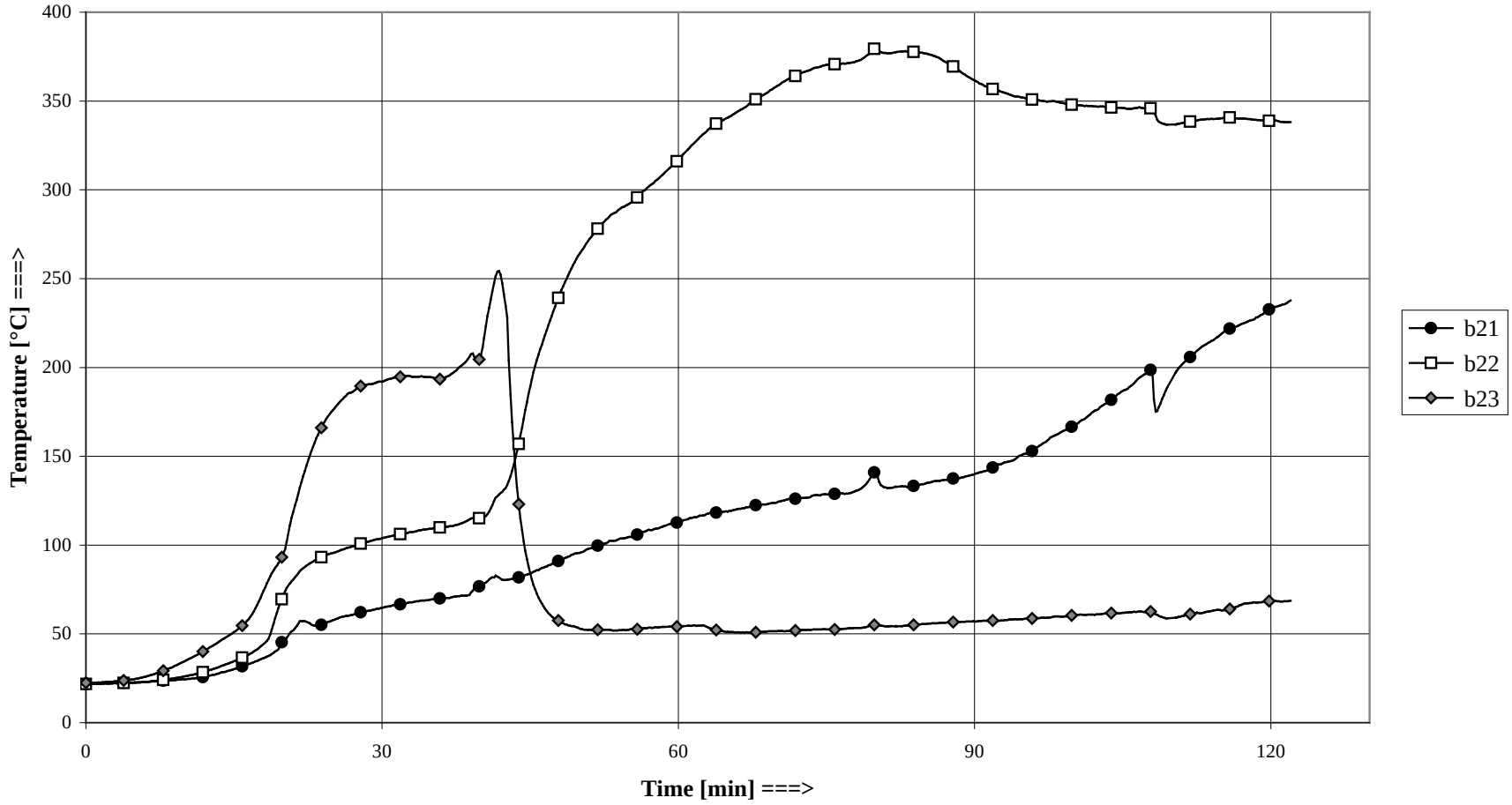

Figure: B.5

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Projectnbr : 2012284

C1 penetration PE-Xa pipe

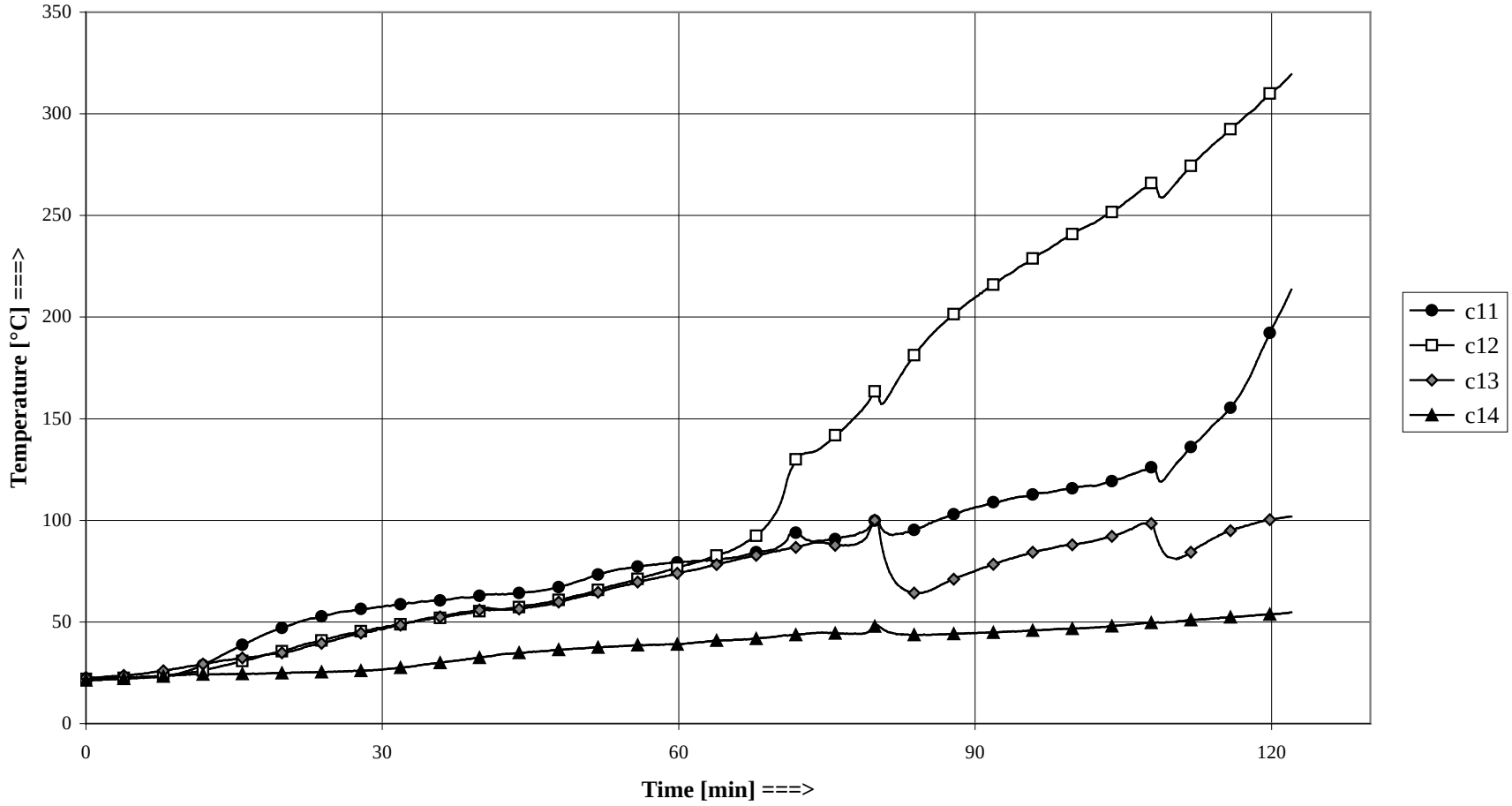

Figure: B.6

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Project : Intumescent Sytems / DFI Trading
Projectnbr : 2012284

C2 penetration PE-Xa pipe

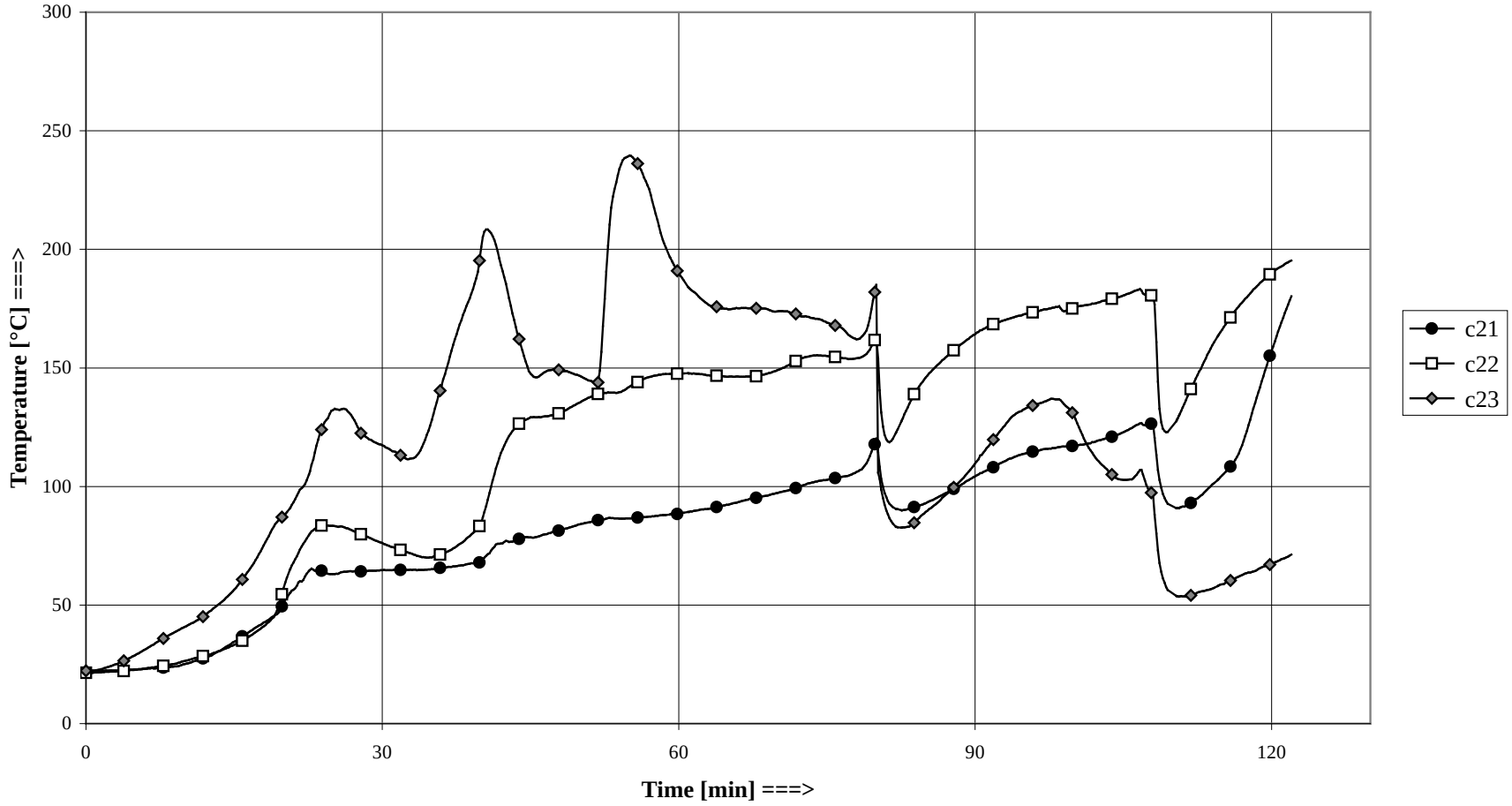

Figure: B.7

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C3 penetration PE-Xa pipe

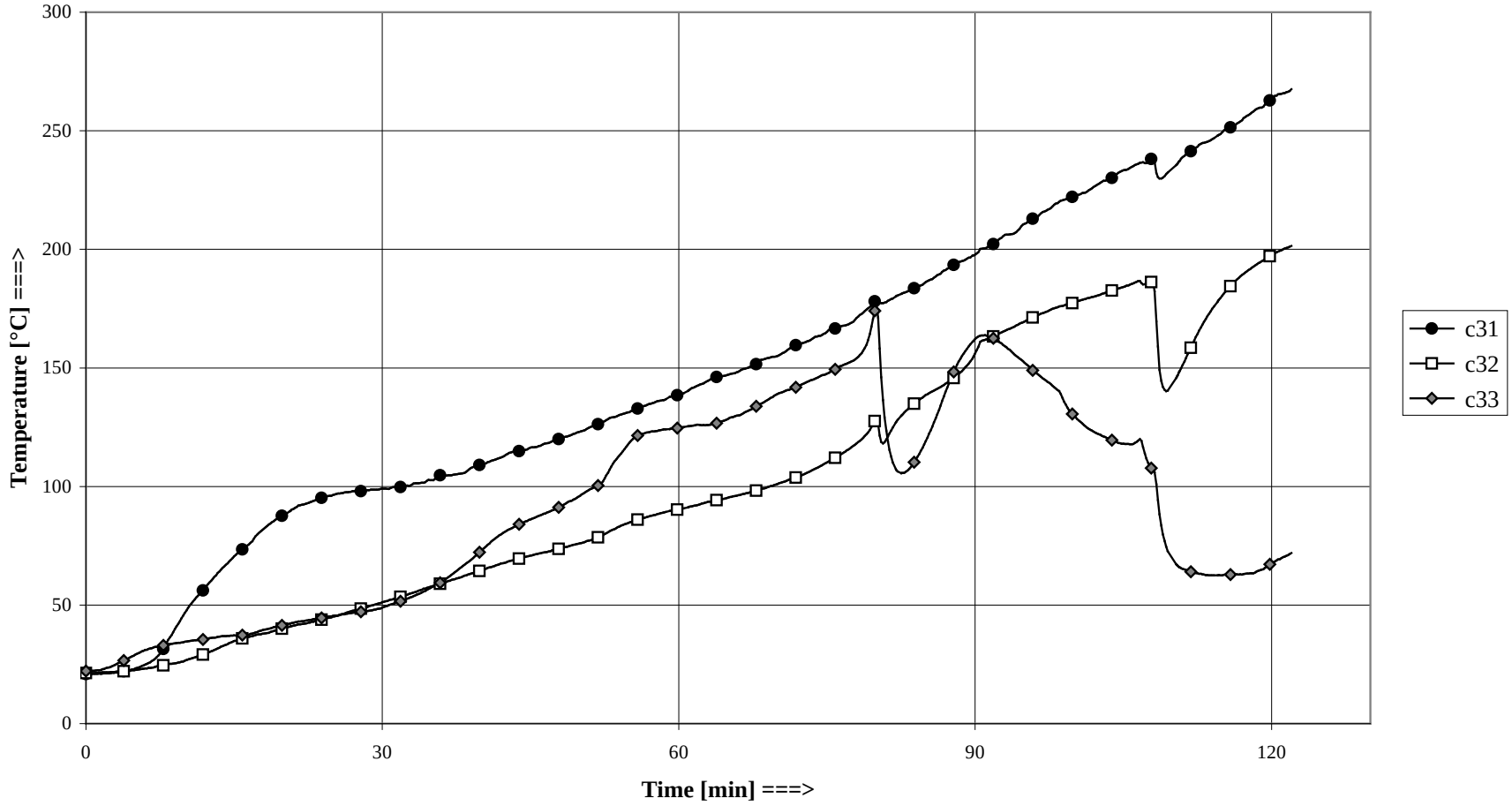

Figure: B.8

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D penetration Unicor pipe

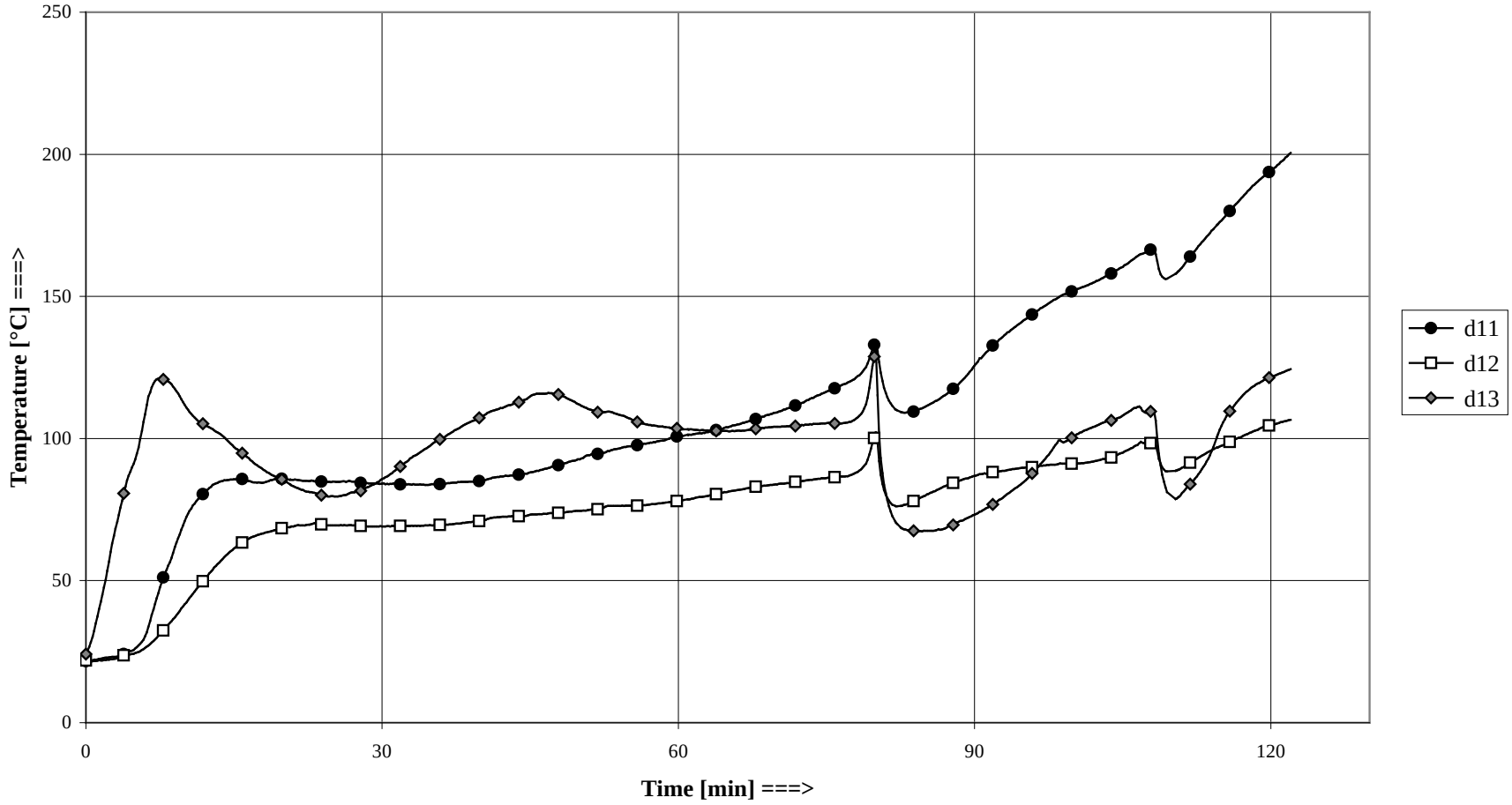

Figure: B.9

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E penetration Conduit

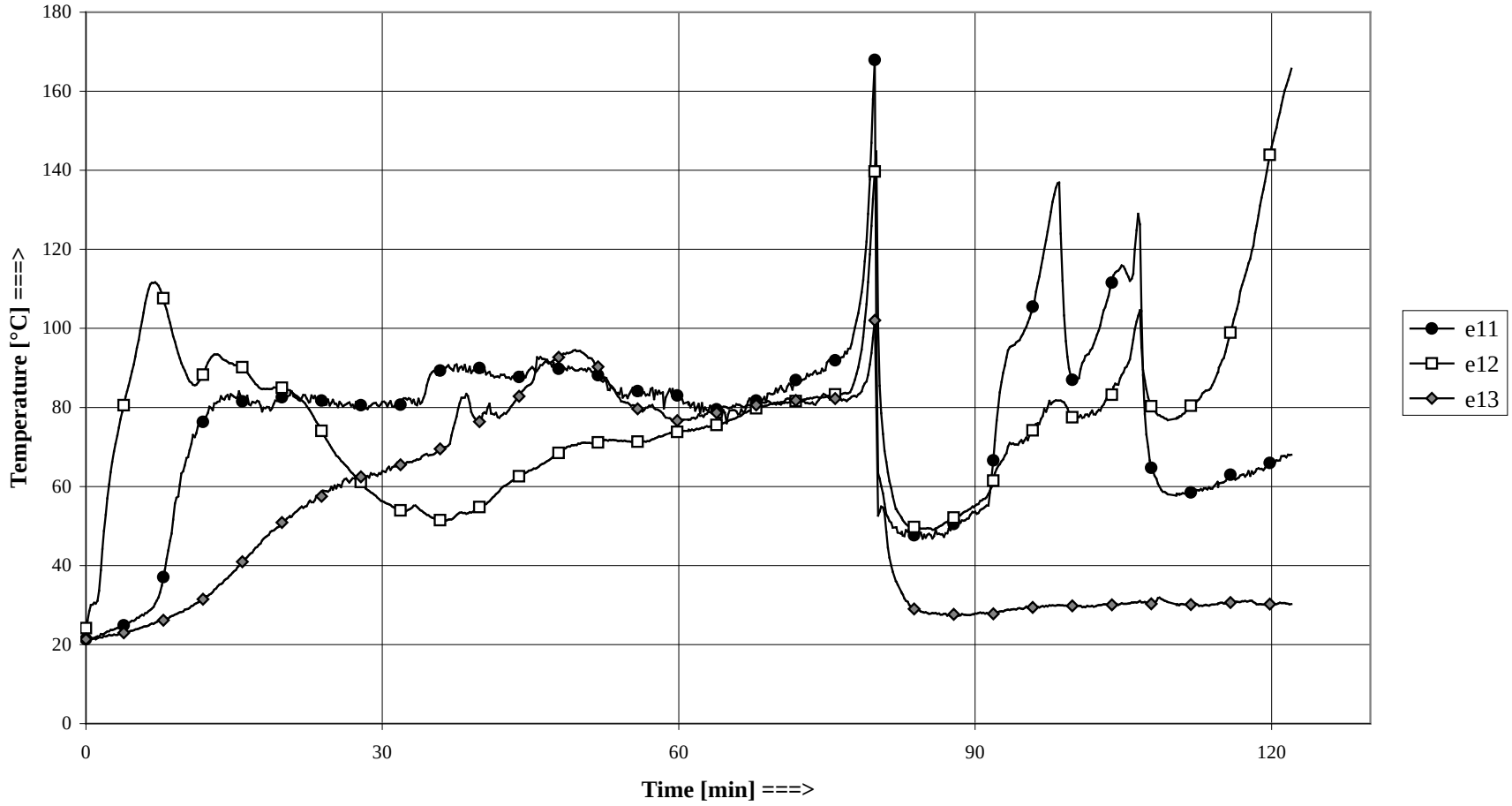

Figure: B.10

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F1 penetration PE-Xc pipe

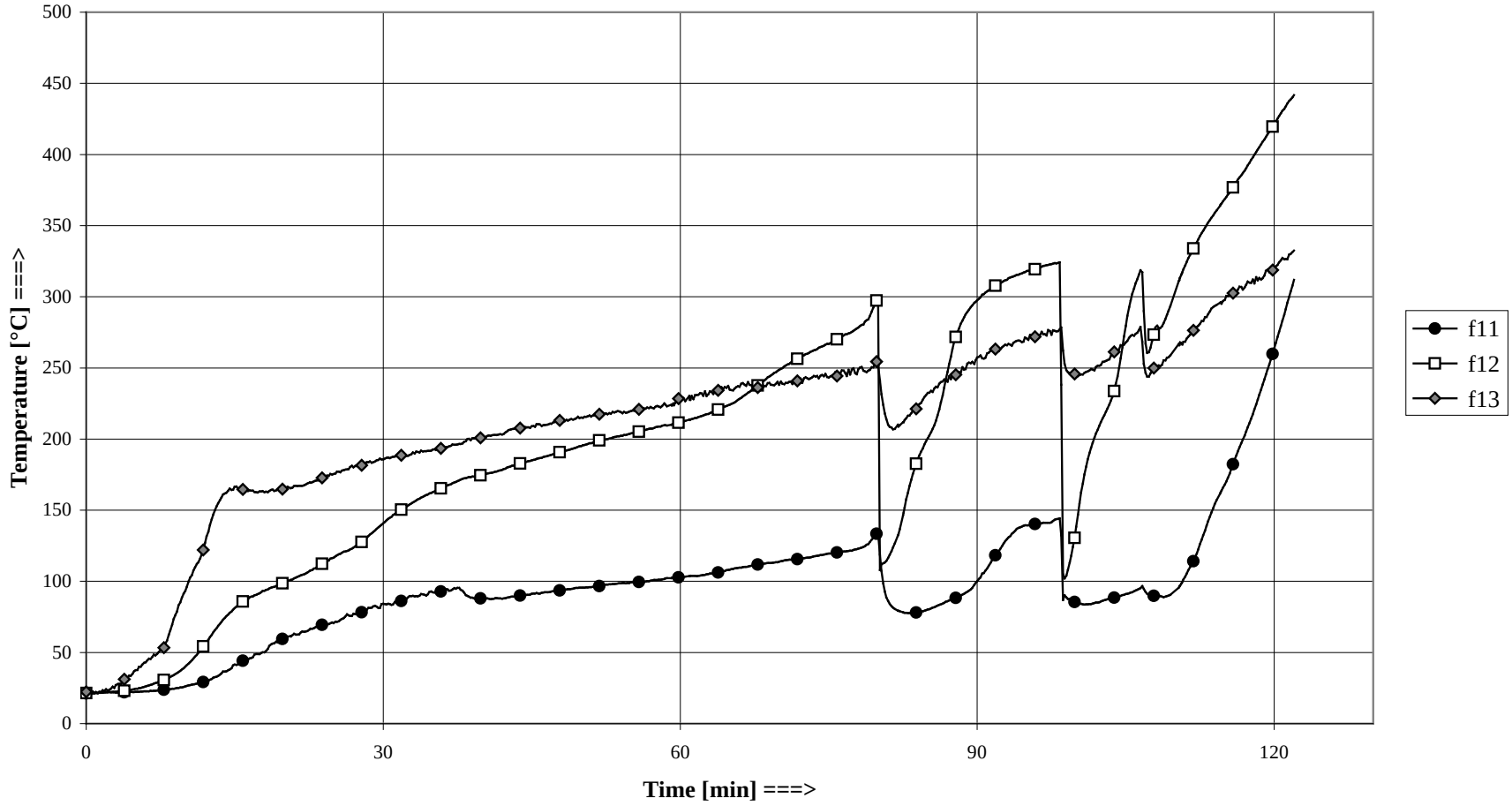

Figure: B.11

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Project : Intumescent Sytems / DFI Trading
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F2 penetration PE-Xc pipe

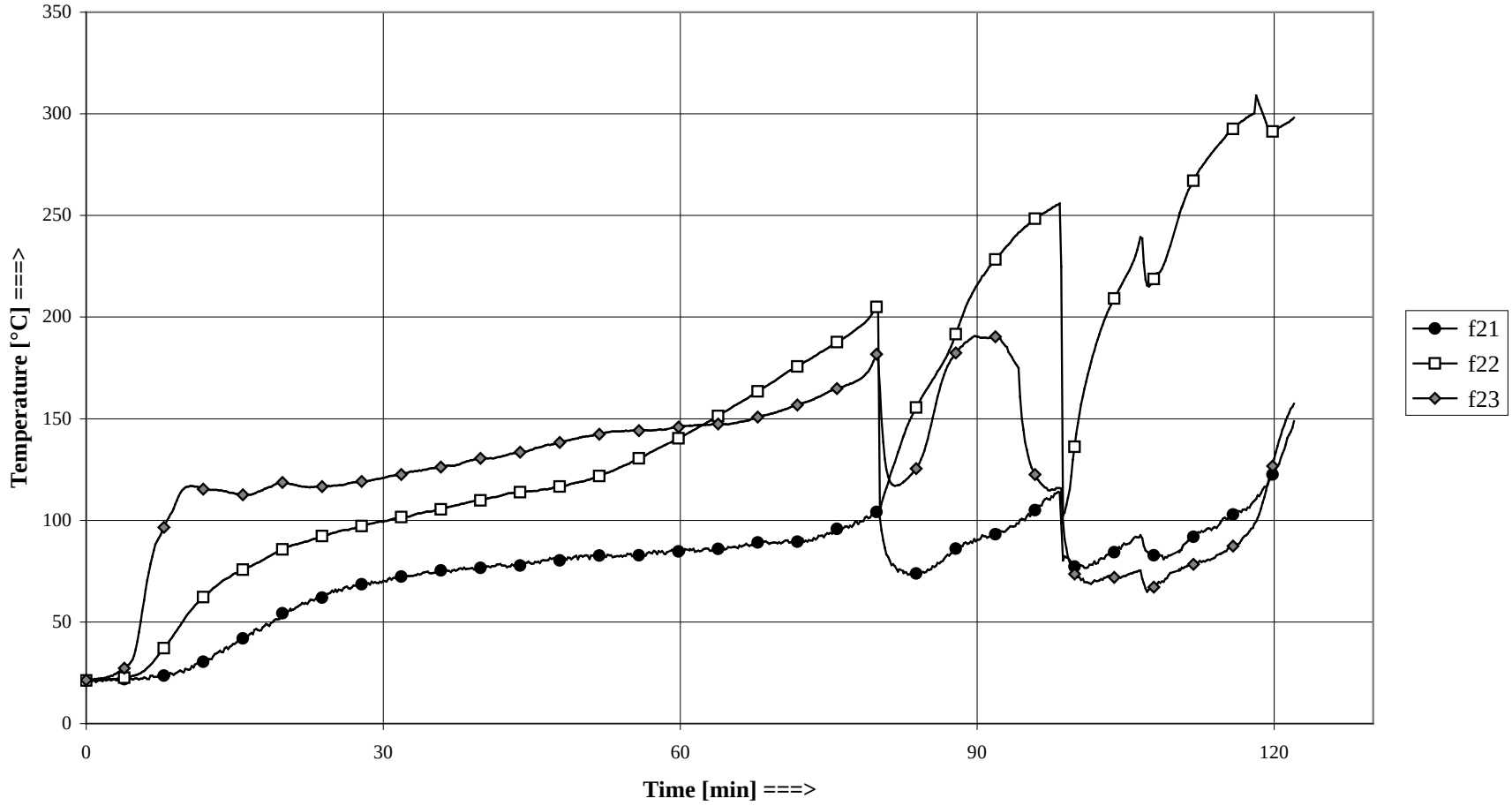

Figure: B.12

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G1 penetration Steel pipe

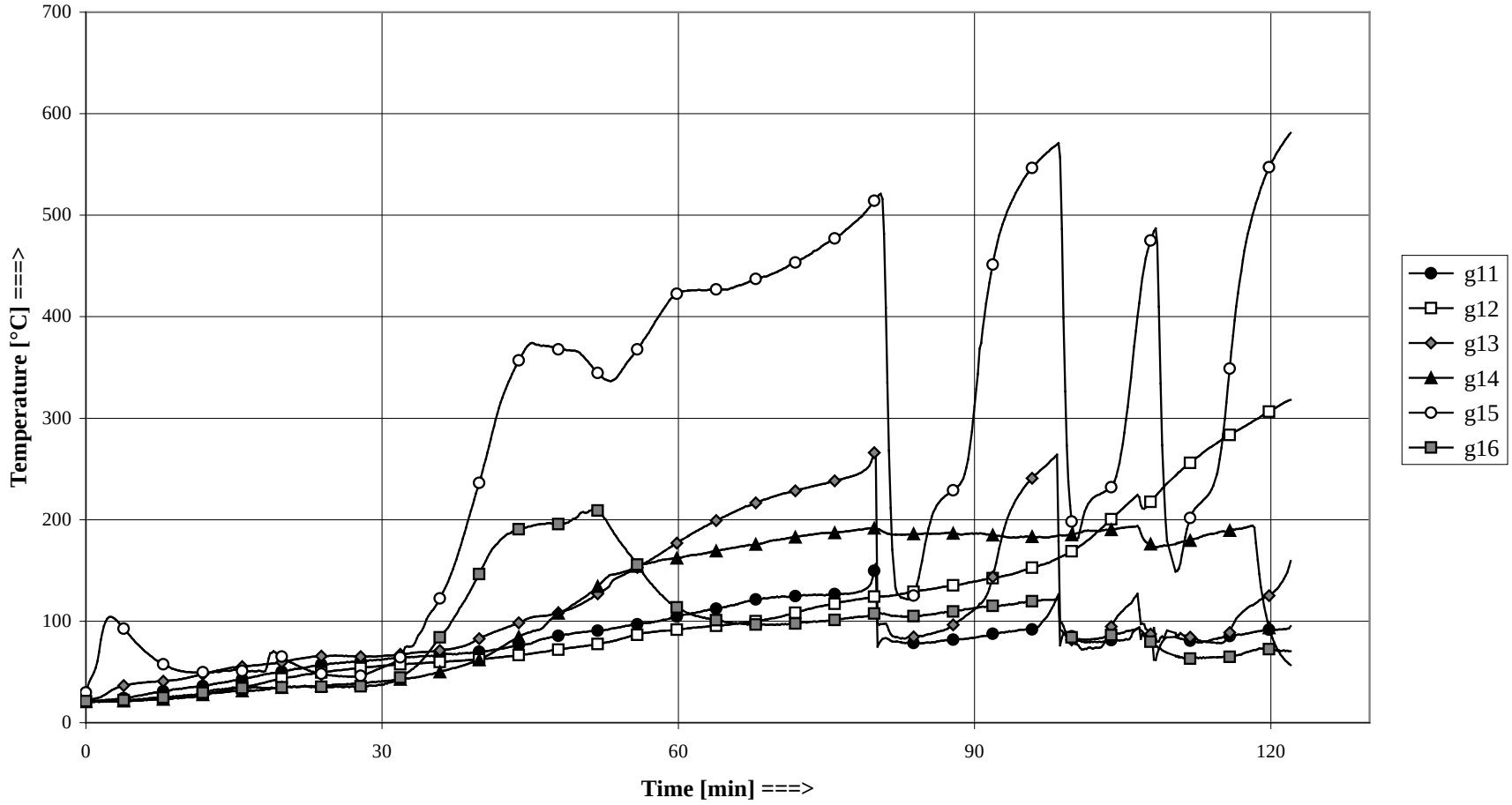

Figure: B.13

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Project : Intumescent Sytems / DFI Trading
Projectnbr : 2012284

G2 penetration Steel pipe

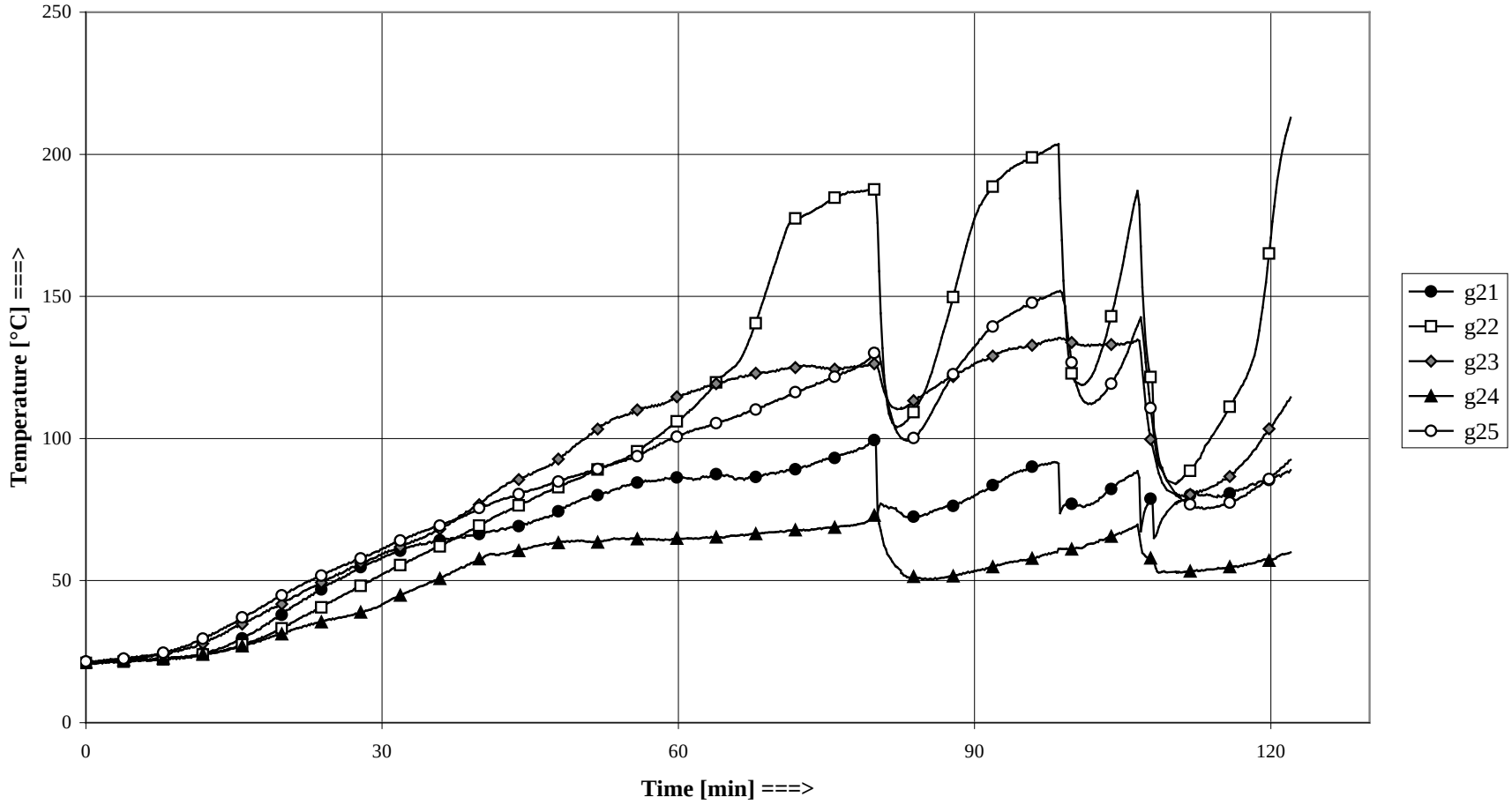

Figure: B.14

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I Elektro socket

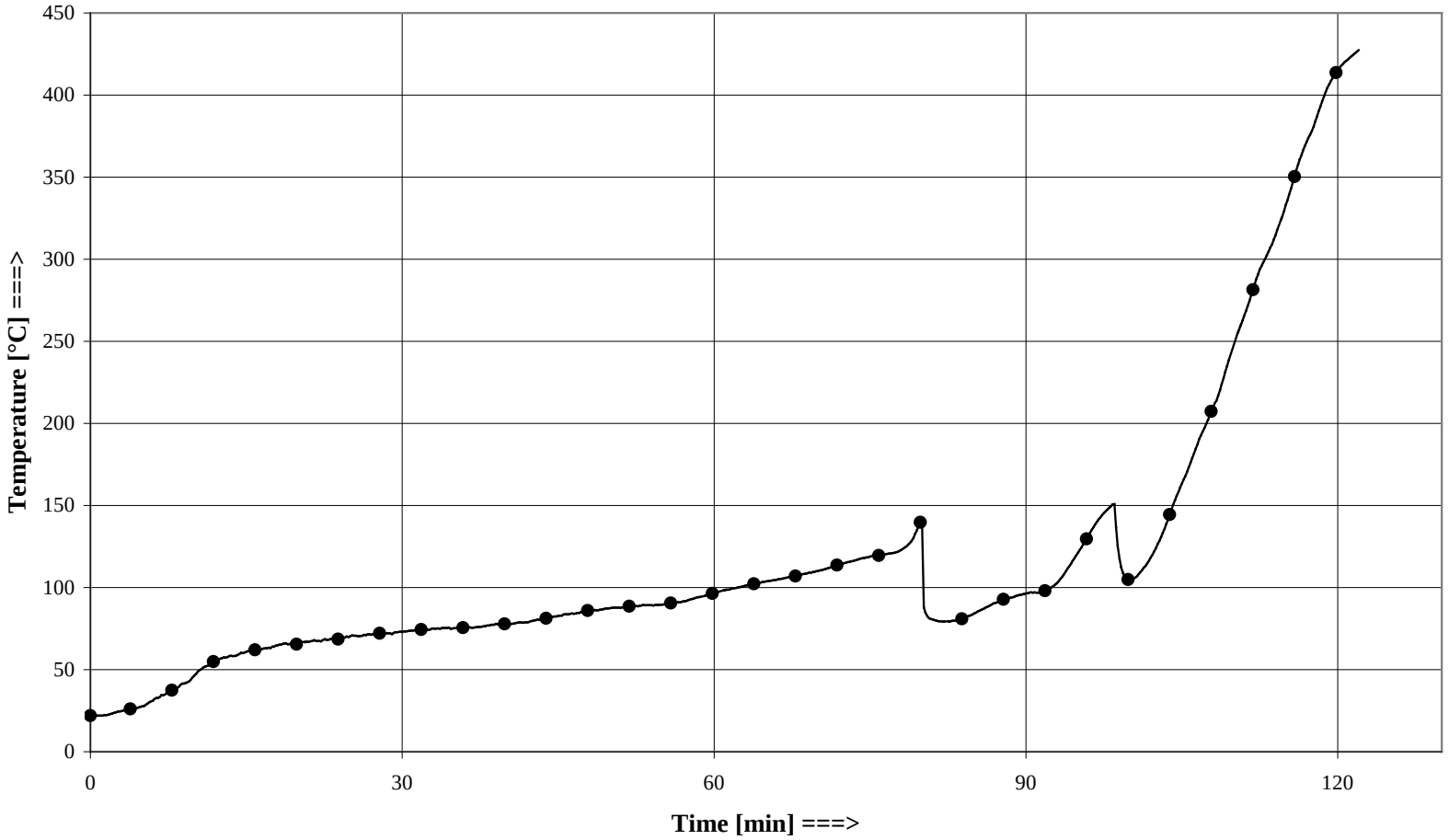

Figure: B.15

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J1 penetration Copper pipe

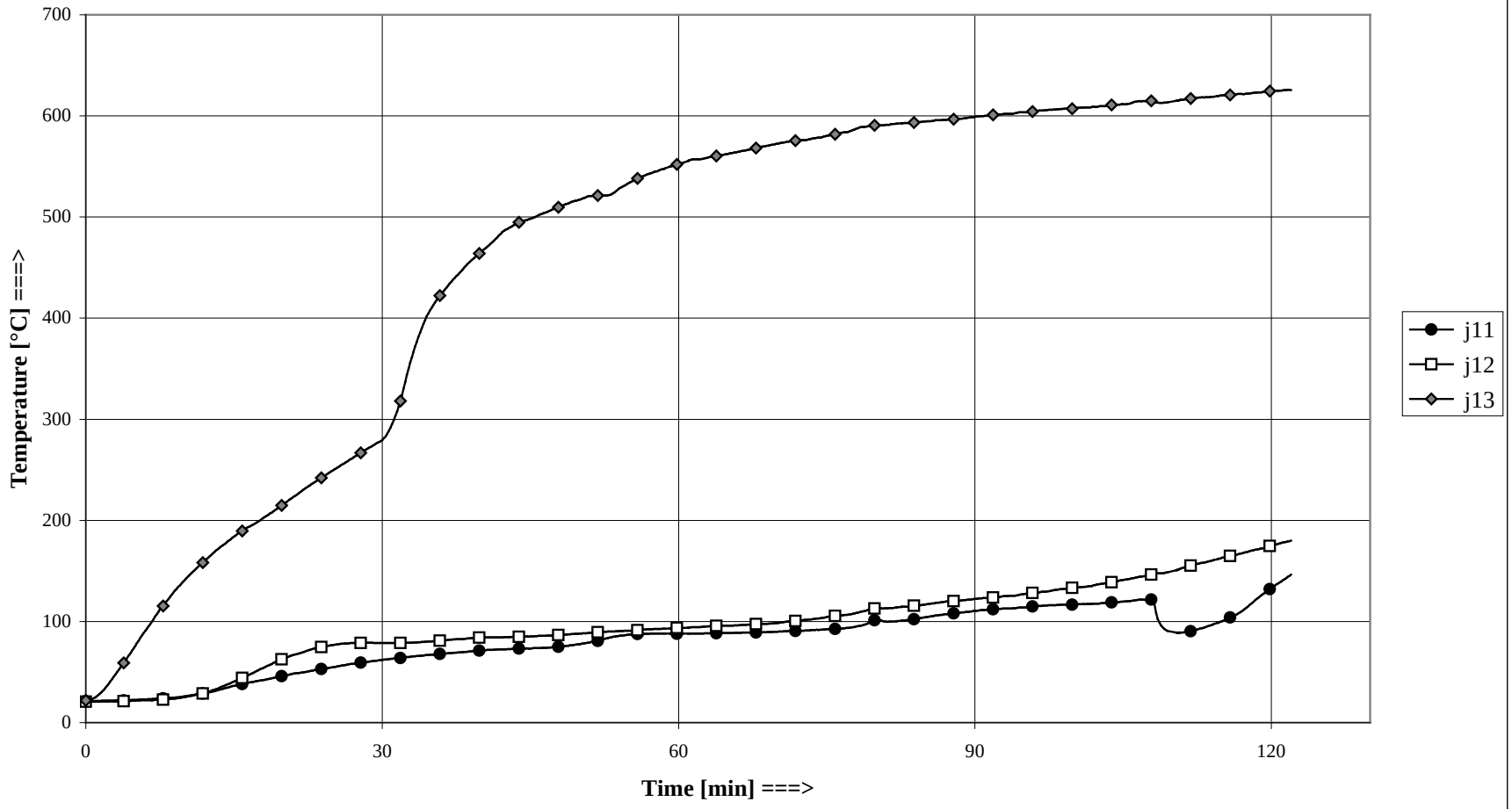

Figure: B.16

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J2 penetration Copper pipe

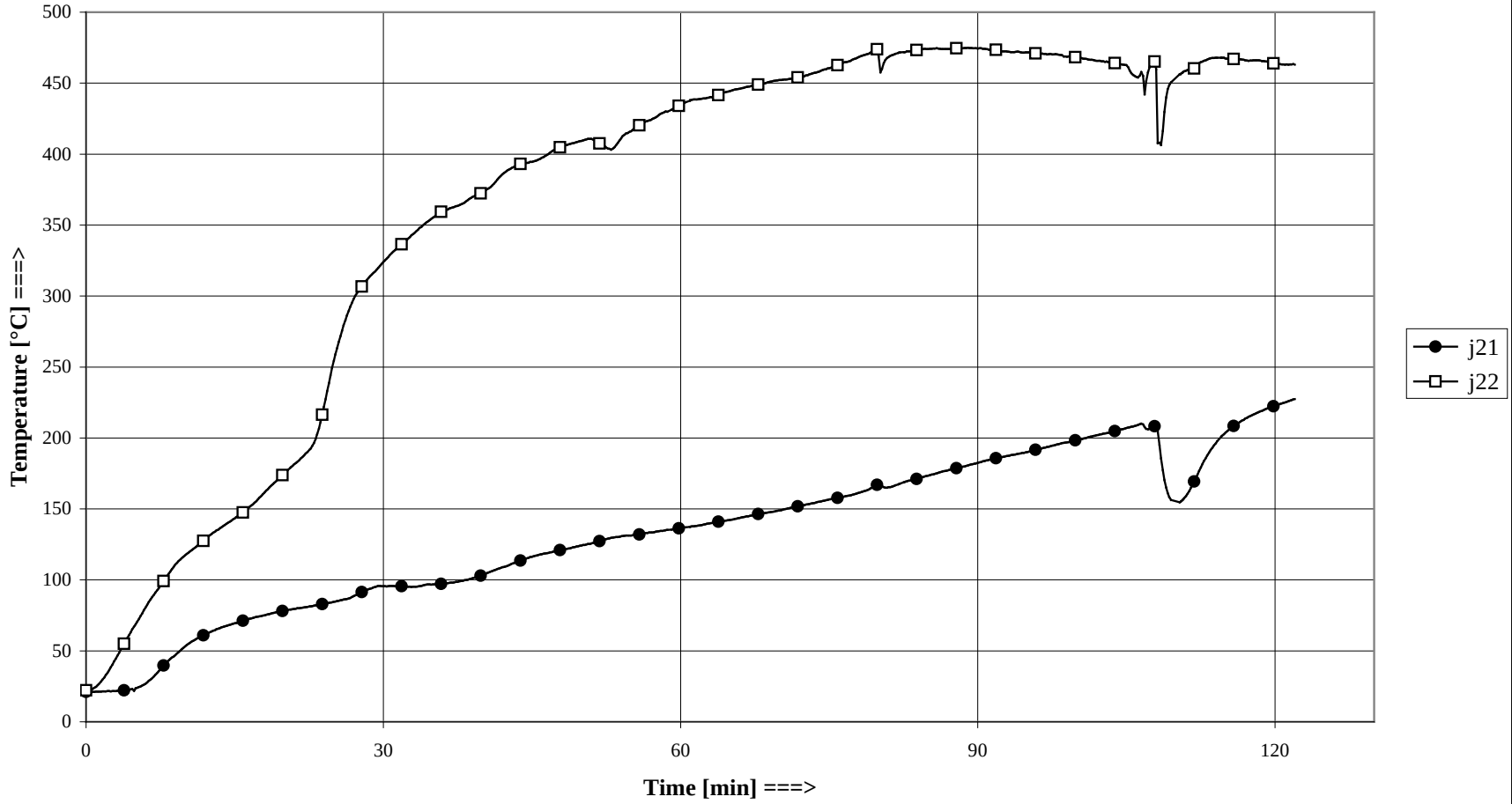

Figure: B.17

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K penetration seal with pipe and cables

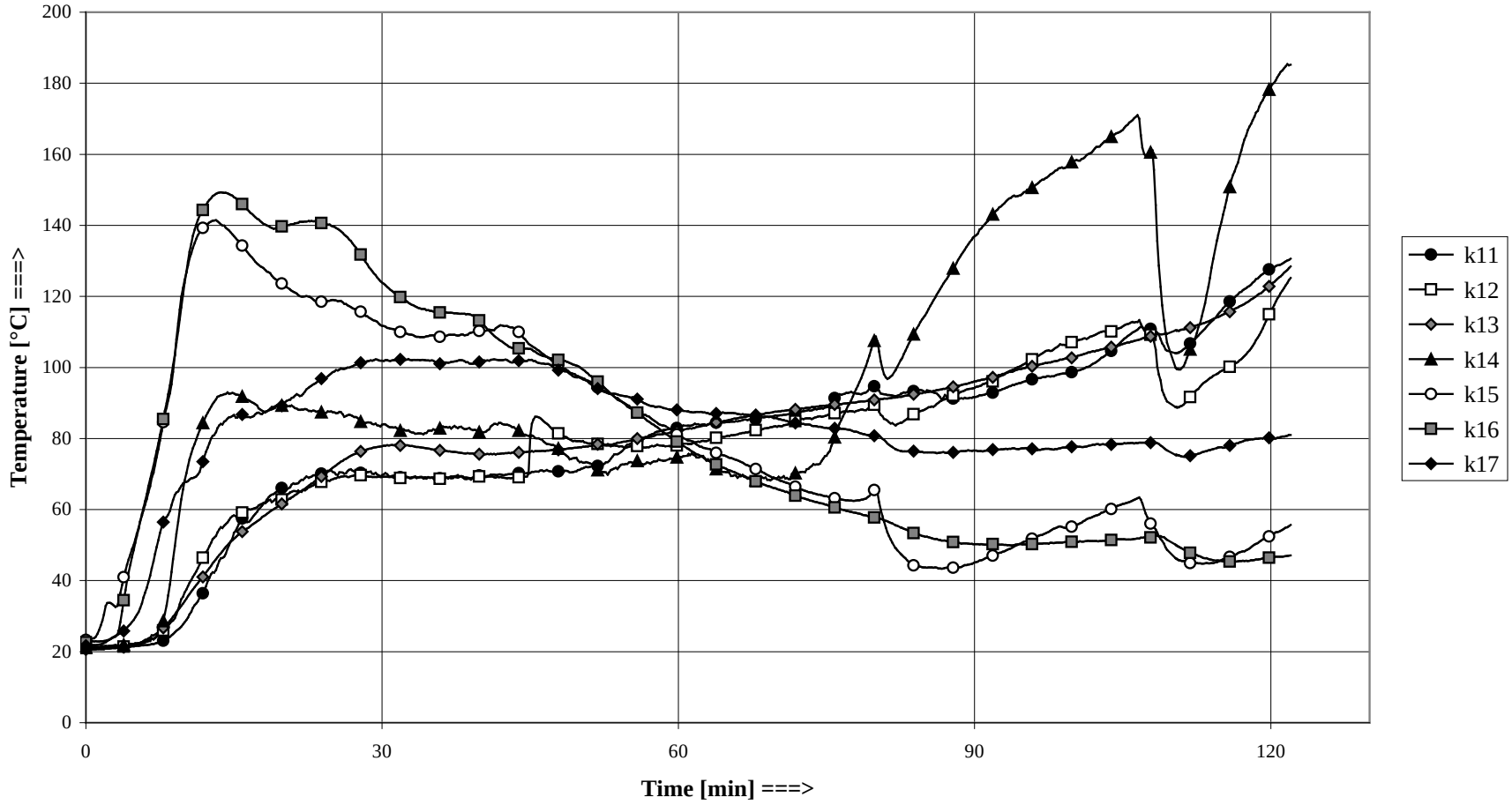

Figure: B.18

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L Steel cable tray with cables

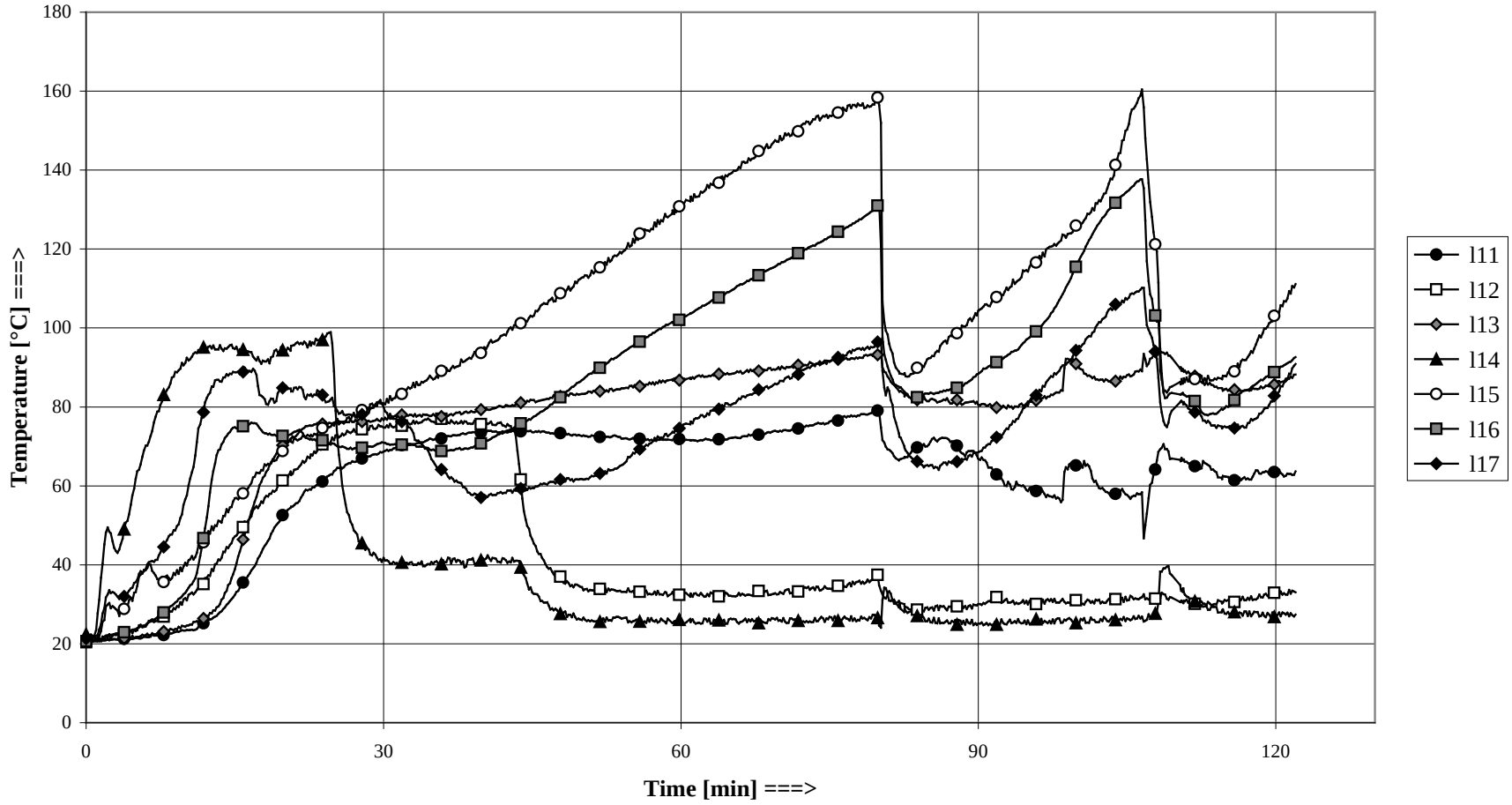

Figure: B.19

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Project : Intumescent Sytems / DFI Trading
Projectnbr : 2012284

M penetration PVC trunking

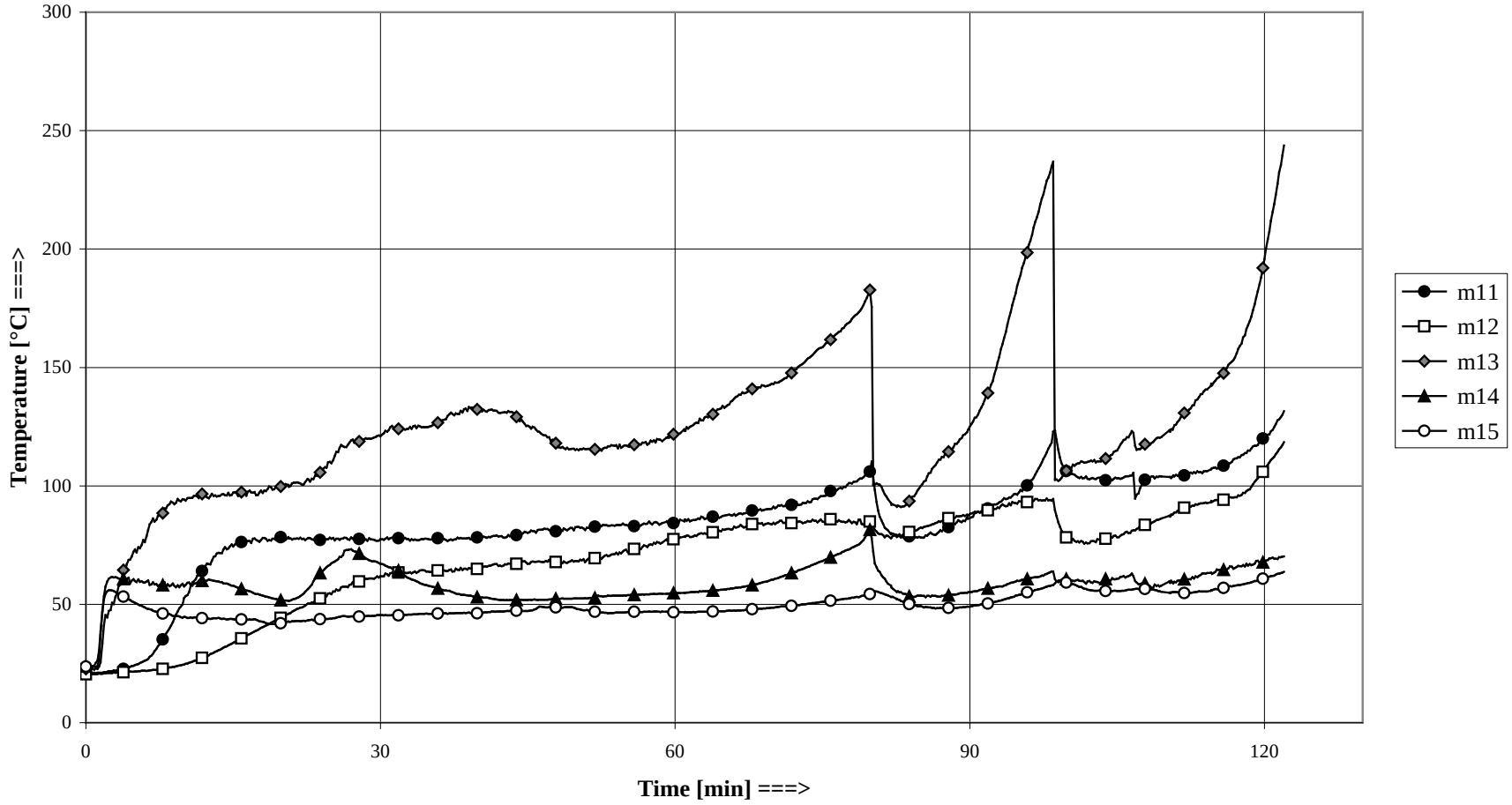

Figure: B.20

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N penetration PVC pipe

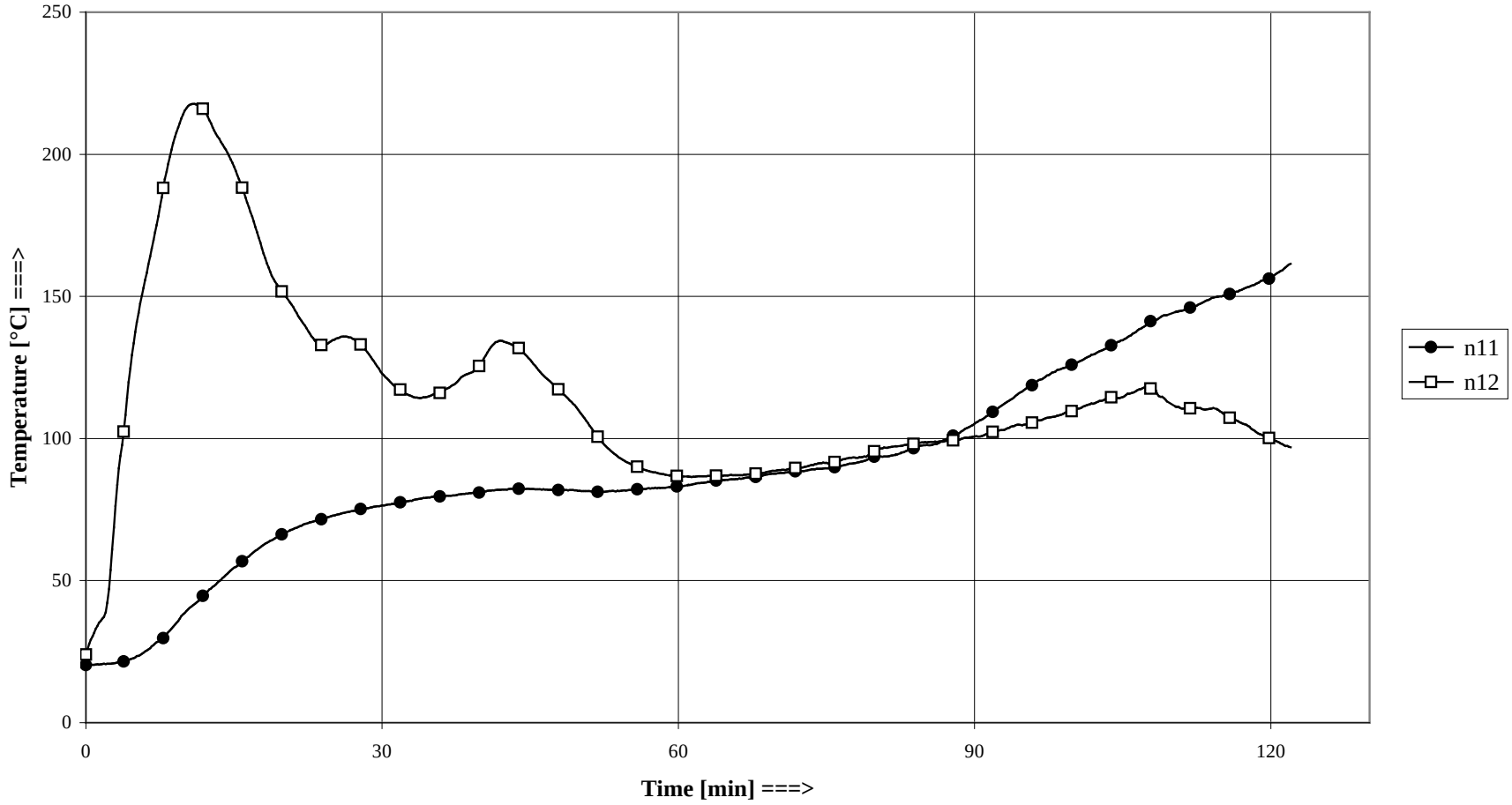

Figure: B.21

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Q2 penetration Copper pipe

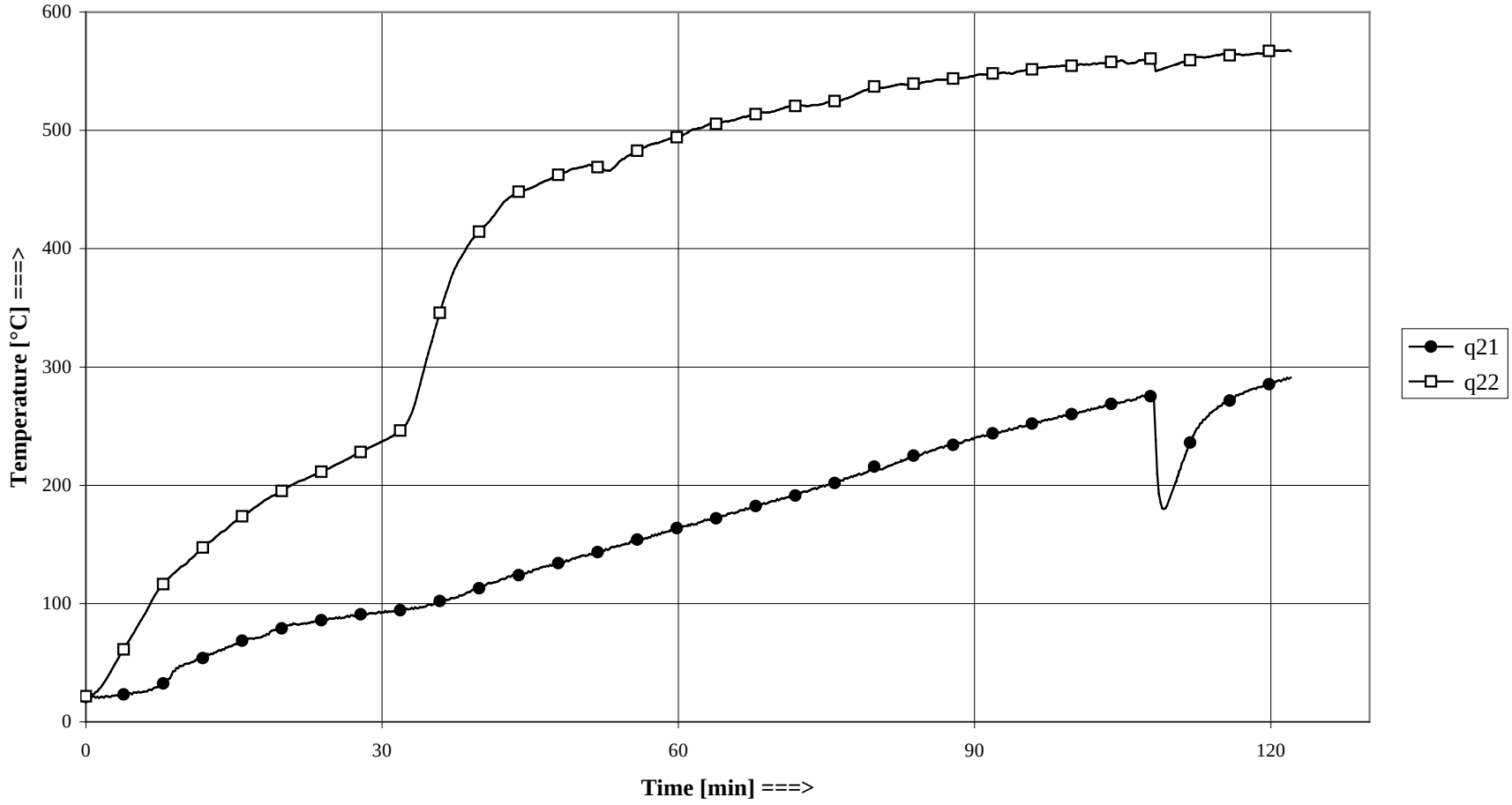

Figure: B.22

C Photographs

Photo 1: The Attema UHW40 hollow wall junction box

Photo 2: The Attema UHW40 hollow wall junction box with the Intumescent Systems Ltd DFI Gasket

Photo 3: Intumescent Systems Ltd DFI Gasket

Photo 4: Wall during construction (before placing insulation)

Photo 5: Fire side of the wall during installation


Photo 6 and 7: Penetrations L and M during installation

Photo 8: Fire side of the wall after installation

Photo 9: Wall before the fire test

Photo 10: Wall after 60 minutes of heating

Photo 11: Wall after 90 minutes of heating

Photo 12: Wall after 120 minutes of heating, end of heating