

FIRE RESISTANCE TEST OF BUILDING ELEMENTS

According to NF EN 1363-1 and NF EN 1365-1

TEST REPORT n° 09 – U – 170

Scope :

A load-bearing steel-reinforced alleviated concrete wall reference "STRUCTURE JK", thickness is 120 mm covered on one side by facing and on the other side by a plasterboard BA 13.

Fire : On the plasterboard side.

Force applied : 25 kN /ml

Applicant :

**JKP
142, Route de la Station
Hall 30
BE – 7070 LE ROEULX**

This test report includes 25 sheets. Copies of this document are allowed only in full.

The approval of the Test department of the COFRAC certifies the competence of the test laboratories only for the tests covered by the approval.

1. SCOPE OF THIS TEST REPORT

Fire resistance test of a load-bearing wall, in conformity with the general requirements of standards NF EN 1363-1 and with the particular requirements of standard NF EN 1365-1 « Fire resistance tests of load-bearing elements - Part 1 : Walls ».

2. TEST LABORATORY

Name : Efectis France
Address : Voie Romaine
F - 57280 MAIZIERES-Lès-METZ

3. FIRE RESISTANCE TEST

No of the test : 09 -U - 170
Date of the test : April 1st 2009

4. REFERENCE AND MANUFACTURER OF THE TEST SPECIMEN

Reference : « STRUCTURE JK »
Manufacturer : JKP
142 route de la Station
BE – 7070 LE ROEULX

5. DESCRIPTION OF THE TEST SPECIMEN

5.1 GENERAL

See plates n° 1 and 2.

The tested specimen was a load-bearing steel-reinforced alleviated concrete wall reference "STRUCTURE JK". This element was covered by an external facing on the non-exposed side, and by a plasterboard BA 13 on the exposed side.

The element was linearly loaded on the top.

Dimensions : 2920 x 3000 x 120 mm (w x h x t).

The exposed height during the test was 2800 mm.

5.2 PARTS LIST

As from the information supplied by the Applicant.

Description	Reference	Material	Specifications	Supplier
Frame	STRUCTURE JK	Galvanized steel	S350GDZ350 MAE Thickness 16/10 mm	JKP
Concrete		Light concrete	150 L of water for 300 kg of cement and 650 L of polystyrene	JKP
Facing	Mortier Chrono			WEBER BROUTIN
Lining	BA 13	Plasterboard	12,5 mm of plasterboard	BPB PLACO
Glue	MAP	Mortar	25 kg of product for 12 L of water	BPB PLACO

Dimensions are in mm.

5.3 DETAIL DESCRIPTION OF THE SPECIMEN

Note : The drawings shown on plates n° 1 and 2 have been provided by the Applicant, checked by the Test Laboratory of Efectis France, and found in conformity with the test specimen.

5.3.1 Structure JK

See plates n° 1 and 2.

The « Structure JK » is a metal panel, made with galvanized steel wires, made without welding, by one piece. It is made with two frames, linked together by jambs, at the knots level. These elements are made with galvanized steel sheet, whose thickness is 16/10 mm. Knots are placed every 125 mm.

The test specimen is composed of 3 panels, whose height is 3000 mm and length is 1200 mm. The last one is cut to adapt the wall to the length of the concrete frame.

JK Panels are linked together by interlocking, and by means of stiffeners, whose reference is POUTRAFILS (JKP), placed every 1000 mm approximately.

A steel wire netting is hooked on each face, at the maximal rate of 20 mm.

5.3.2 Concrete

The metallic frame is filled by light concrete, whose density is 460 kg/m³, injected with a mortar pump, without using framework, formwork or shuttering, then smoothed.

This concrete is made with cement Tecocem 32.5 R (CALCIA) and polystyrene balls PSE POLITERM BLU (EDILTECO), whose diameter is 4 mm.

5.3.3 Covering

The wall is covered on the exposed side by a plasterboard BA13 (BPB PLACO), whose thickness was 12,5 mm. This complex is glued with mortar MAP (BPB PLACO), at a rate of 10 block/m².

On the unexposed side, the wall is covered by an external facing « Mortier chrono » (WEBER), whose thickness is 12 ± 2 mm.

5.4 VERIFICATION

The element used in the conditions described by the Test Laboratory may be regarded as representative of the present standard production.

6. TEST ASSEMBLY

6.1 DEFINITION OF THE TEST SPECIMEN

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

6.2 ASSEMBLY OF THE TEST SPECIMEN

The test specimen was assembled by the Applicant.

6.2.1 Supporting frame

The specimen was assembled within a reinforced concrete supporting frame supplied by the Test Laboratory.

- ◆ Drying time : over 28 days.
- ◆ Thickness of the frame : 350 mm.
- ◆ Dimensions of the opening : 3000 x 3400 mm (w x h).

6.2.2 Subjection of the test specimen

The wall was mounted with two free edges, made with a layer of mineral wool, whose thickness was 40 mm.

See plate n° 3.

7. TEST METHOD

7.1 PREVIOUS CONDITIONING

In conformity with the requirements stated in Section 1, the stability of the test specimen was estimated reached on the day of the test.

7.2 THERMAL PROGRAM

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

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

where : t = Time [min]
 T = Temperature inside the furnace at time t [°C]

7.3 DIRECTION OF FIRE

The fire was on the plasterboard side (inside the construction).

7.4 LOAD

The wall was loaded during the whole test.

The load was applied at the top of the wall with two hydraulic jacks.

- load : uniformly distributed
- intensity of the load : 25 kN/ml

The load was applied 15 minutes before the start of the test.
The intensity of the load has been defined by the Applicant.

Nota : During the 15 minutes before the test and the first 6 minutes of the test, the load was 50 kN/ml.
On request of the Applicant, this value has been decrease to 25 kN/ml.

8. FIRE TEST RESULTS

The locations of the sensors are shown on plates n° 4 and 5.
The readings are recorded on the plates mentioned hereafter.

8.1 TEMPERATURES MEASUREMENTS

8.1.1 Temperature inside the Laboratory

It was measured in conformity with standard NF EN 1363-1 by the thermocouple n° 16.

The readings are recorded on plate n° 6.

8.1.2 Temperature inside the furnace

They were measured in conformity with standard NF EN 1363-1 by 6 plate pyrometers with their metal face towards the back of the furnace.

The respective readings are recorded on plates n° 7 and 8.

8.1.3 Temperature of the element

They were measured in conformity with standard NF EN 1363-1 by 9 thermocouples and placed in conformity with standard NF EN 1365-1.

Location	Mark	Plate
At quarters and intersection of the diagonals	7 to 11	10
At 100 mm of the free edges.	12 and 13	11
At 15 mm of the top of the exposed part.	14 and 15	11

8.2 PRESSURE MEASUREMENTS

The pressure inside the furnace was continuously controlled throughout the whole test.

Taking into account the dimensions of the wall and the location of the sensor, the prescribed value was established at 20 Pa.

Between the 5th and the 12th minute, a 10 Pa difference comparing to the acceptable minimum has been recorded. This difference, limited in time and amplitude is not likely to change the results validity.

The readings are recorded on plate n° 9.

8.3 LOAD MEASUREMENT

The load was applied with two hydraulic jacks.

It was measured and controlled during the whole test.

Location	Mark	Plate
At the top of the wall	For 22 and 23	12

Nota : The date acquisition of the sensor n° 23 was defective. The value of the strength applied to this sensor has been controled on the direct display of the MGC device, and was into the tolerance limits during the whole test.

8.4 DISTORSION MEASUREMENTS

8.4.1 Horizontal bending

In conformity with the requirements of standard NF EN 1365-1, the vertical bending was measured and recorded by means of potentiometric sensors.

Location	Mark	Plate
In the middle of the wall	D 18	13
At 50 mm of the free edge, at middle height	D 17 and D 19	13

8.4.2 Vertical bending

In conformity with the requirements of standard NF EN 1365-1, the vertical bending was measured at the top of the wall, at 100 mm of the free edges.

Location	Mark	Plate
Subsidence at the top of the wall	D 20 and D 21	14
Average subsidence	Average (D 20 and D 21)	14
Subsidence speed (mm/min)	V	15

9. OBSERVATIONS

9.1 BEFORE THE TEST

Temperature inside the Laboratory : 16 °C.

Temperature inside the furnace : 17 °C.

Average temperature of the wall : 16 °C.

9.2 DURING THE TEST

Time [min]	Face*	OBSERVATIONS
-15		Loading of the wall : 50 kN/ml. Nothing to report.
00	US	Start of the test. Vertical cracking at the top.
6	ES and US	Changing of the load's value : 25 kN/ml.
13	US	Smoke release at the cracking.
15	ES and US	Nothing to report.
20	ES	Cracking of the plasterboards.
22	ES	Falling down of parts of plasterboards in the middle of the wall.
30	ES and US	Nothing to report.
45	ES and US	Nothing to report.
60	ES and US	Nothing to report.
90	ES and US	Nothing to report.
110	ES and US	The subsidence speed limit of 9 mm/min is reached.
111	ES and US	The subsidence limit of 30 mm is reached. Falling down of facing and increase of the horizontal bending.
112	ES and US	Breaking of the wall, on the whole width, at 500 mm of the lower part. See Photo B. Termination of the test.

* ES = Exposed side of the wall --- US = Unexposed side of the wall

10. FIRE RESISTANCE CRITERIA

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

10.1 LOAD-BEARING CAPACITY

Duration : **ONE HUNDRED AND TEN MINUTES - (110 min)**
Cause of failure : **Reach of the subsidence speed limit of 9 mm/min**

10.2 ETANCHEITE AU FEU

10.2.1 Tampon de coton

Duration : **ONE HUNDRED AND TEN MINUTES - (110 min)**
Cause of failure : **Lost of the load-bearing capacity criteria.**

10.2.2 Calibres d'ouverture

Duration : **ONE HUNDRED AND TEN MINUTES - (110 min)**
Cause of failure : **Lost of the load-bearing capacity criteria.**

10.2.3 Inflammation soutenue

Duration : **ONE HUNDRED AND TEN MINUTES - (110 min)**
Cause of failure : **Lost of the load-bearing capacity criteria.**

10.3 ISOLATION THERMIQUE

Duration : **ONE HUNDRED AND TEN MINUTES - (110 min)**
Cause of failure : **Lost of the load-bearing capacity criteria.**

11. FIELD OF DIRECT APPLICATION OF THE TEST RESULTS

In conformity with section 13. of the standard NF EN 1365-1, the results of the fire resistance test shall only be valid for any element identical to that submitted to the test and when the following modifications have been applied:

- a) Decrease of the height ;
- b) Increase of the thickness of the wall ;
- c) Increase of the thickness of the materials ;
- d) Decrease of the load ;
- e) Increase of the width if the test specimen was in whole width or with a width of 3 m.

12. CONCLUSION

Nota: This section is not covered by the COFRAC accreditation.

The load of 25 kN/ml correspond to a height of 28 m, that is to say approximately 10 floors.

13. WARNING

'This report gives details about the construction methods, the testing conditions and the results achieved when the specific building element described was tested according to the procedure specified in standard NF EN 1363-1 and, where applicable, in standard NF EN 1363-2.

As concerns the dimensions, details, loading, stresses and boundary or end conditions, any significant deviation other than that which is not excluded within the field of direct application of the appropriate test procedure is not covered by this report.

Because of the nature of the fire tests and of the resulting difficulty in quantifying the uncertainty of the fire resistance assessment, it is impossible to establish any level of accuracy of the results'

Maizières-lès-Metz, May 19th 2009.



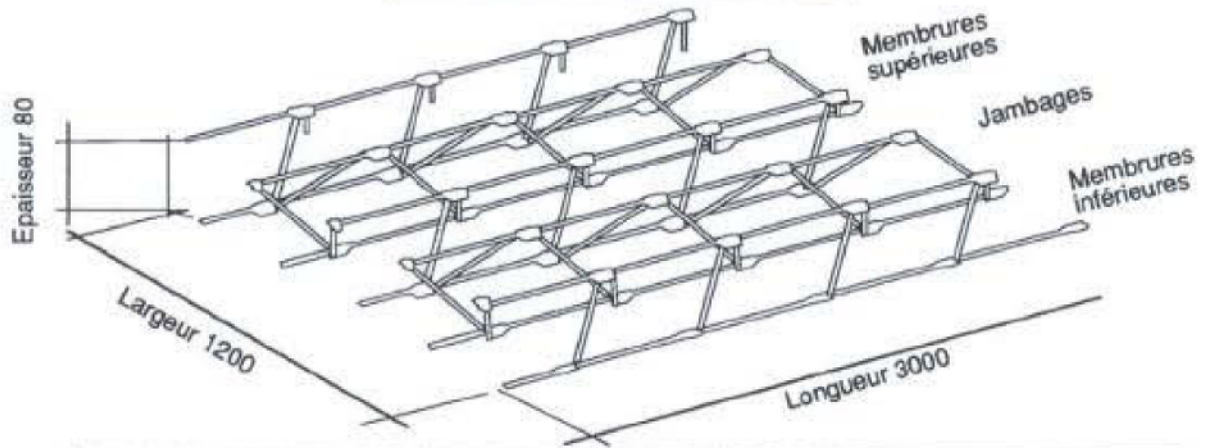
Jérôme VISSE
Fire Safety Technician



Régis KORYLUK
Deputy Director
Head of Section Testing

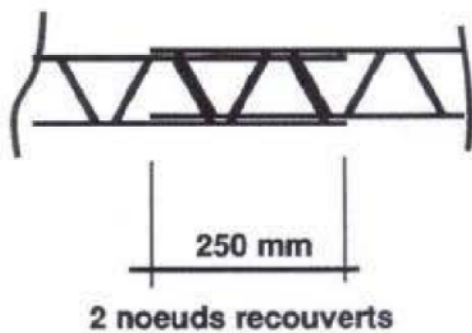
Plate n° 1 – Details of the element.

LE PANNEAU STANDARD

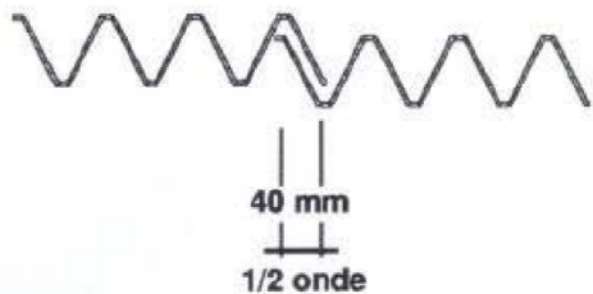


RECOUVREMENTS

Recouvrement longitudinal



Recouvrement latéral



AGRAFAGE

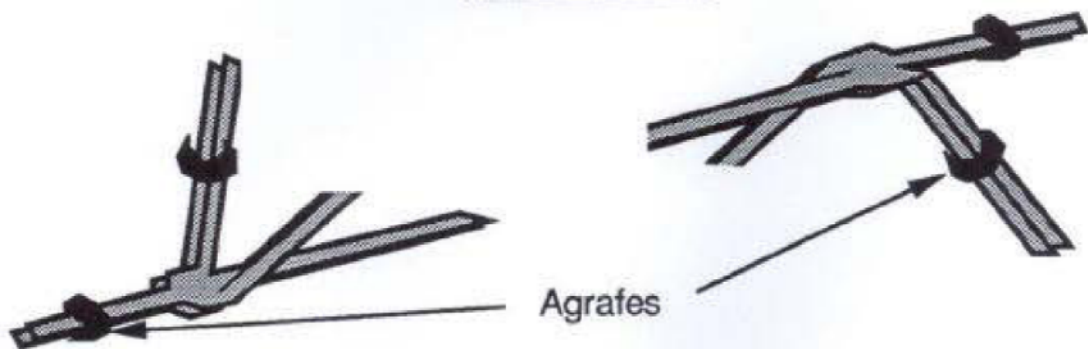


Plate n° 2 – Details of POUTRAFILS.

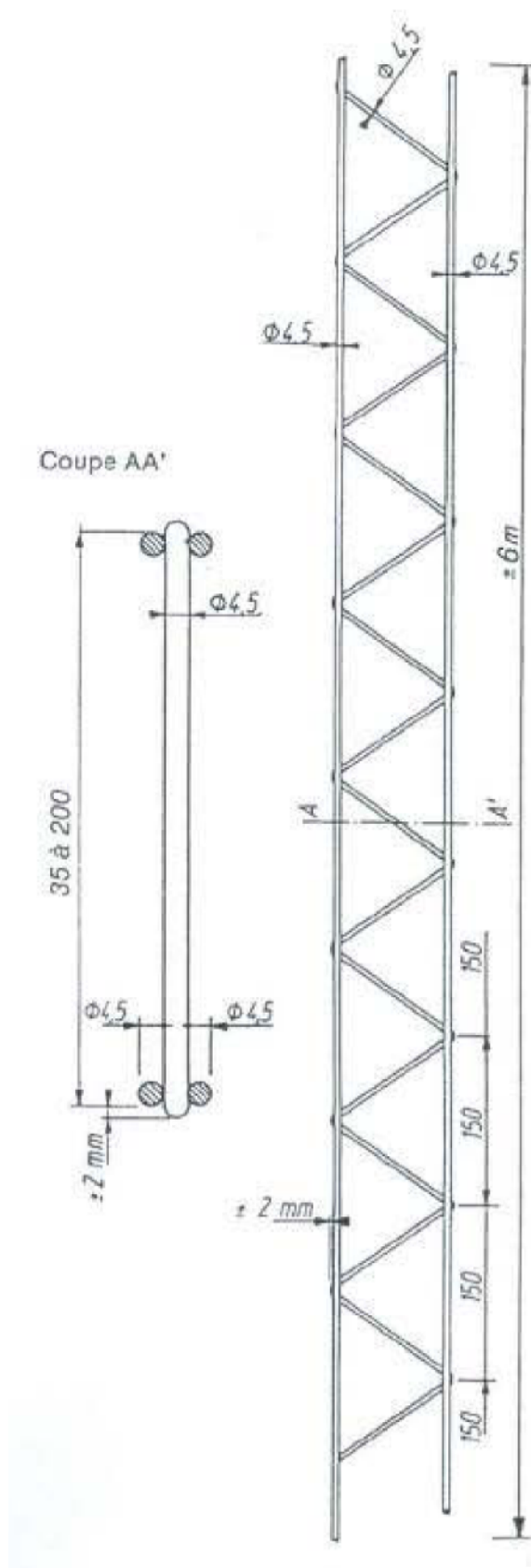


Plate n° 3 – Mounting.

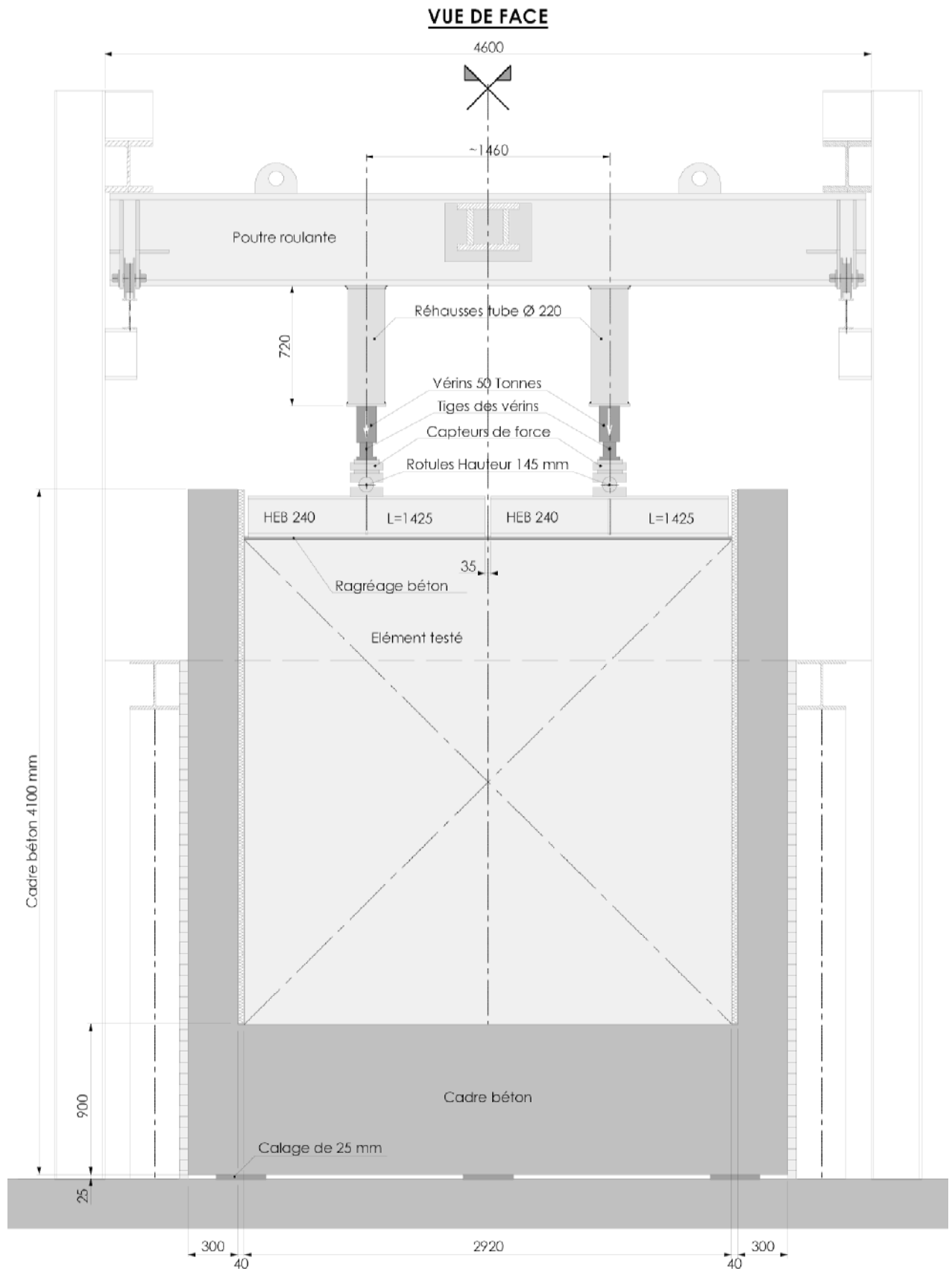


Plate n° 4 – Sensor's location.

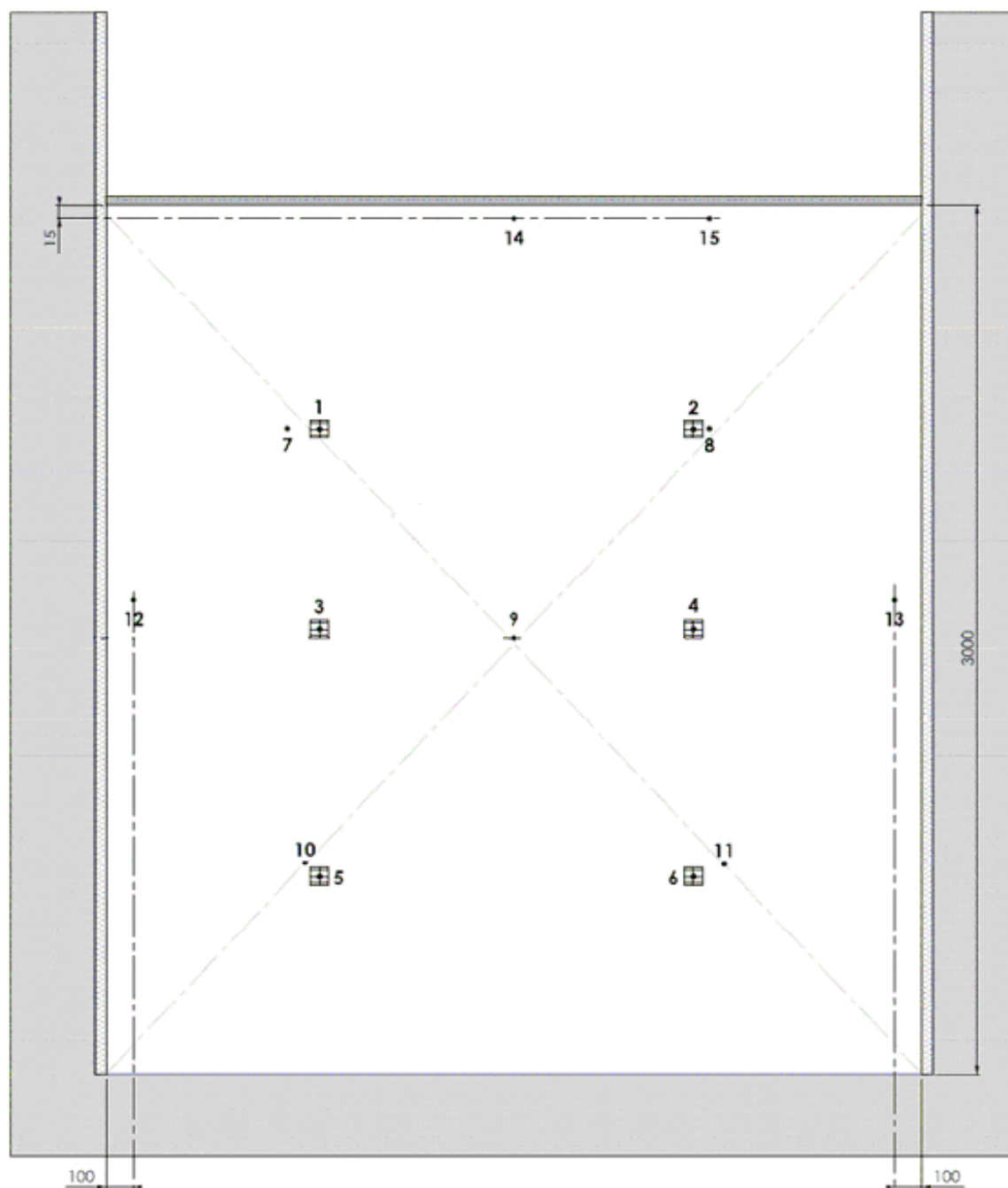
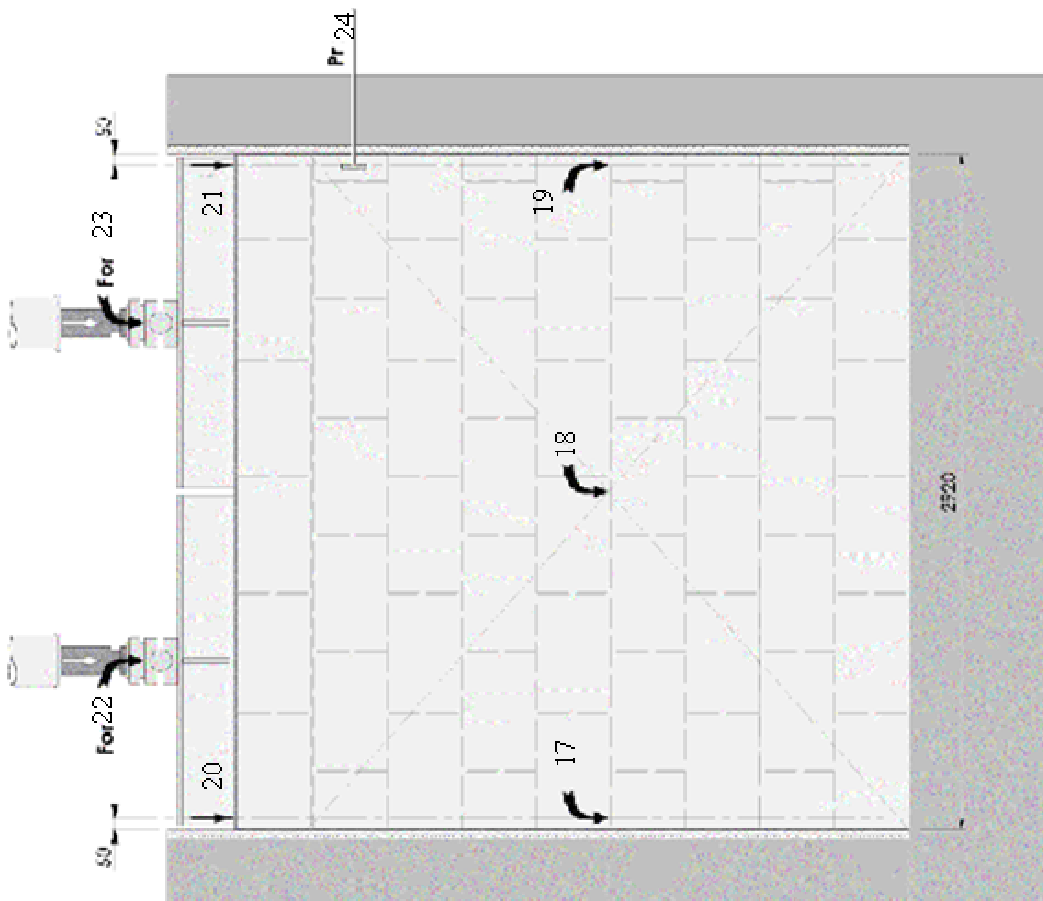
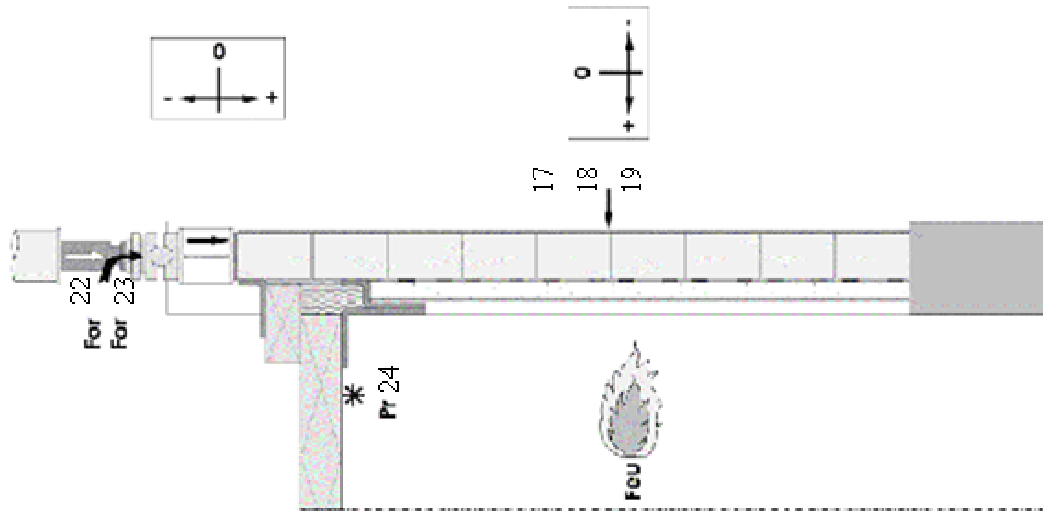
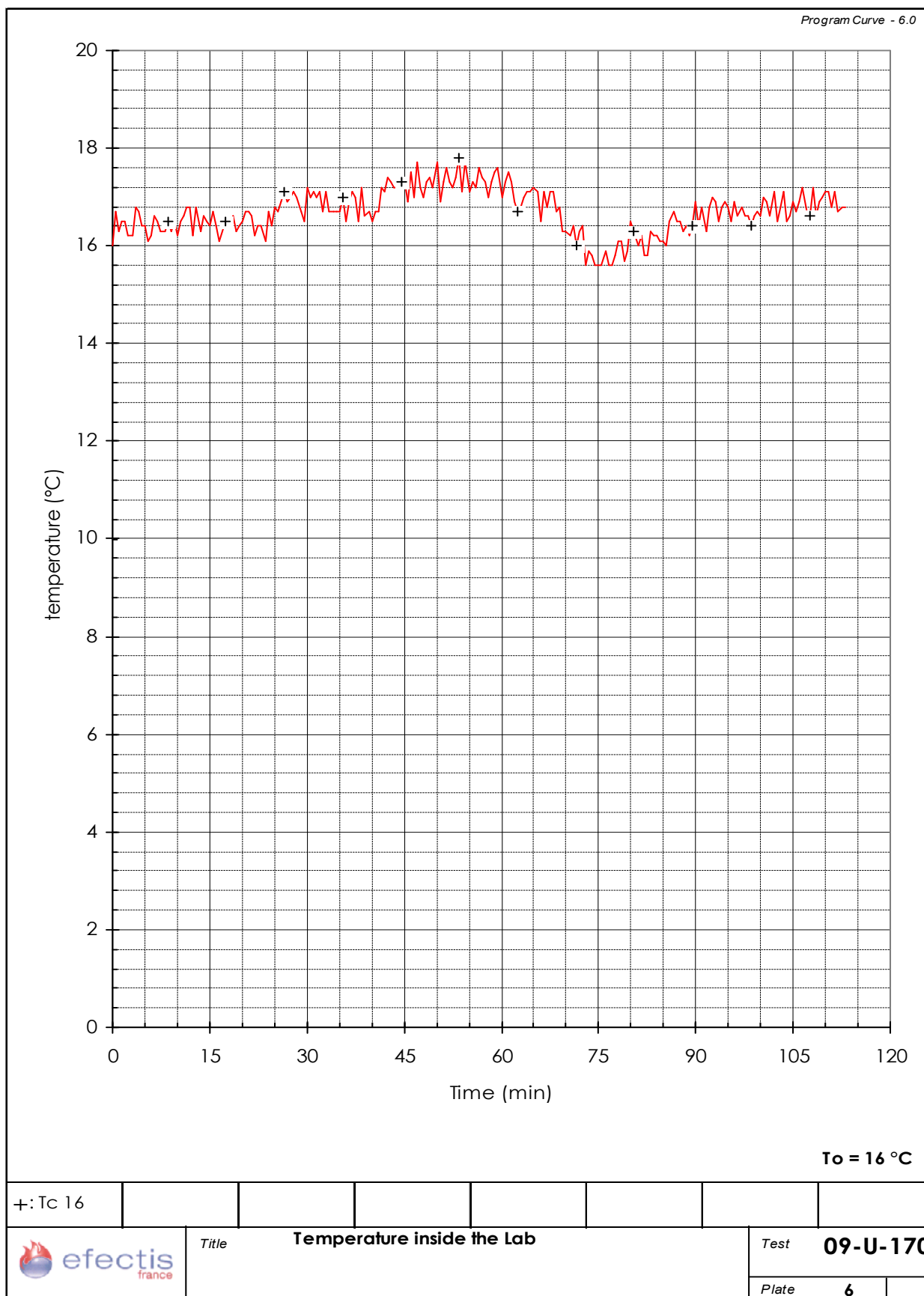
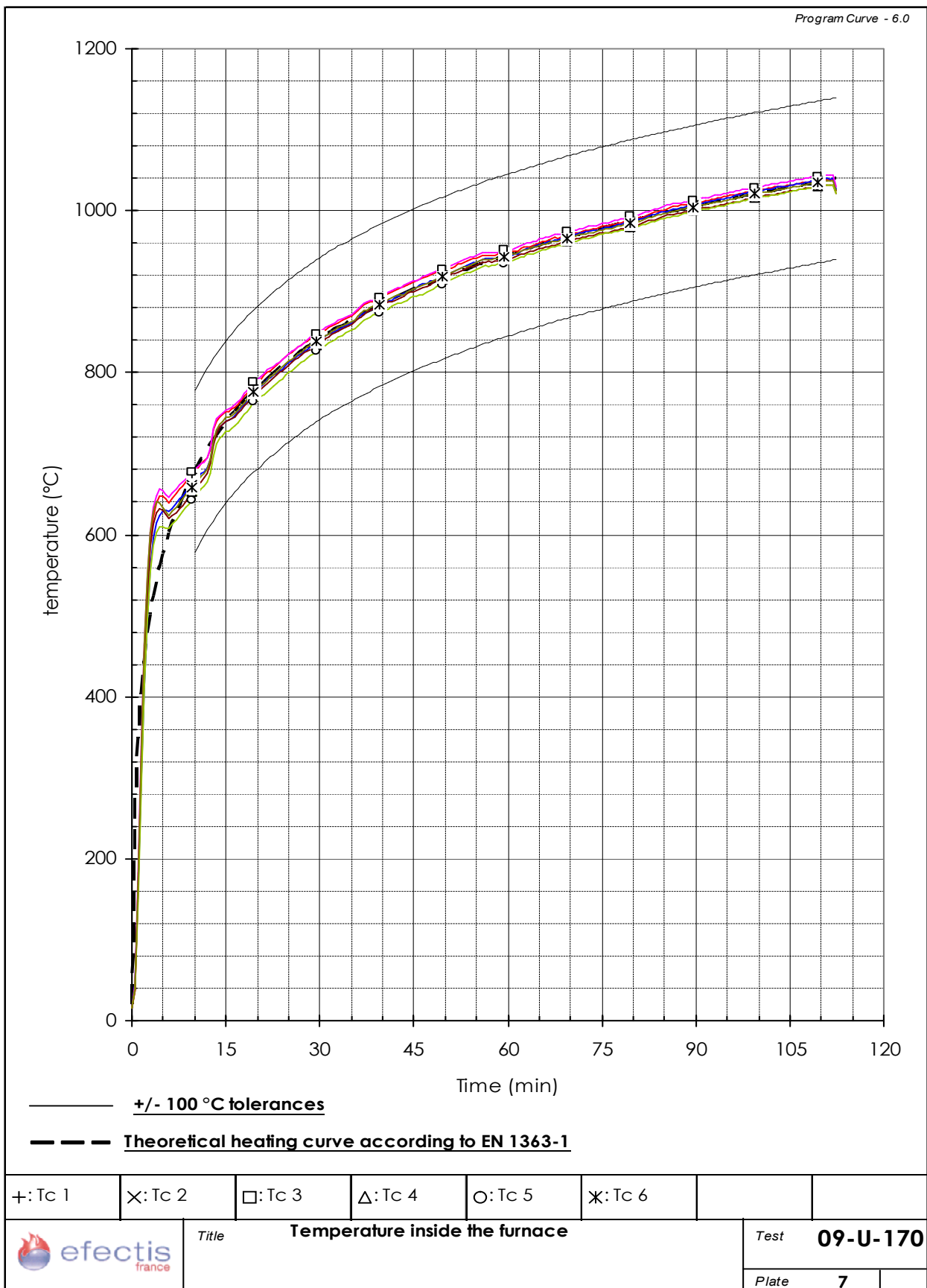
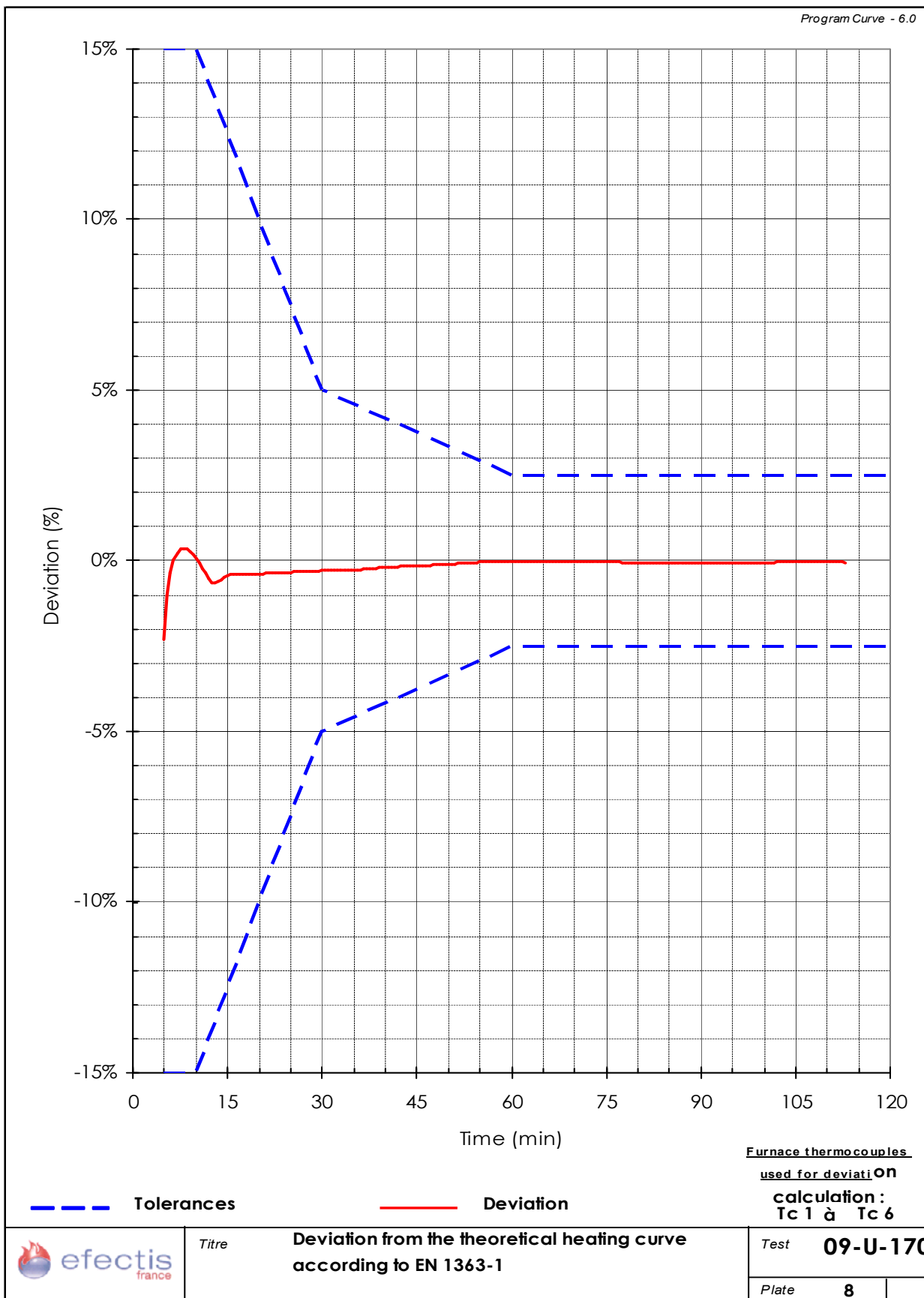


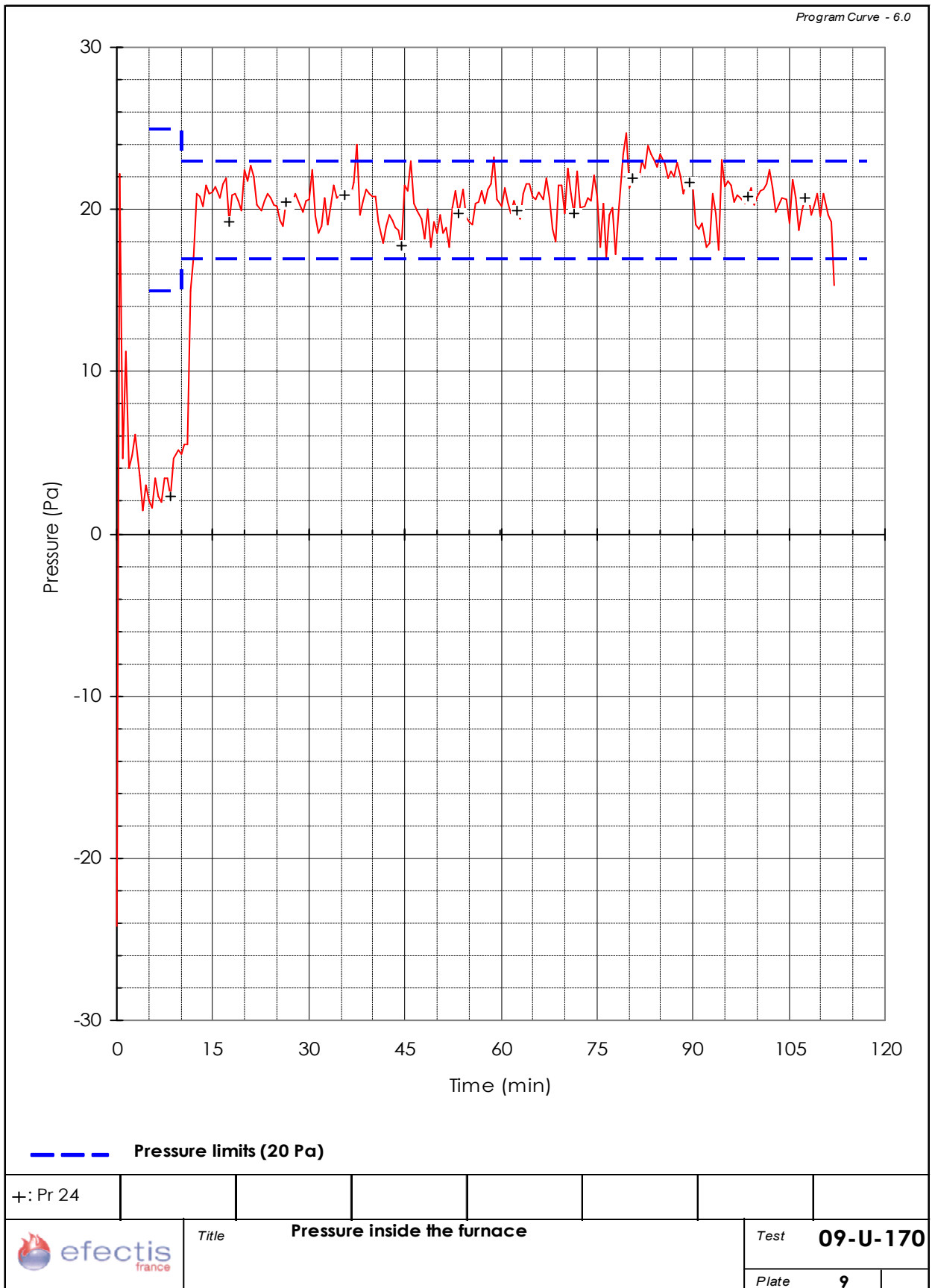
Plate n° 5 – Sensor's location.

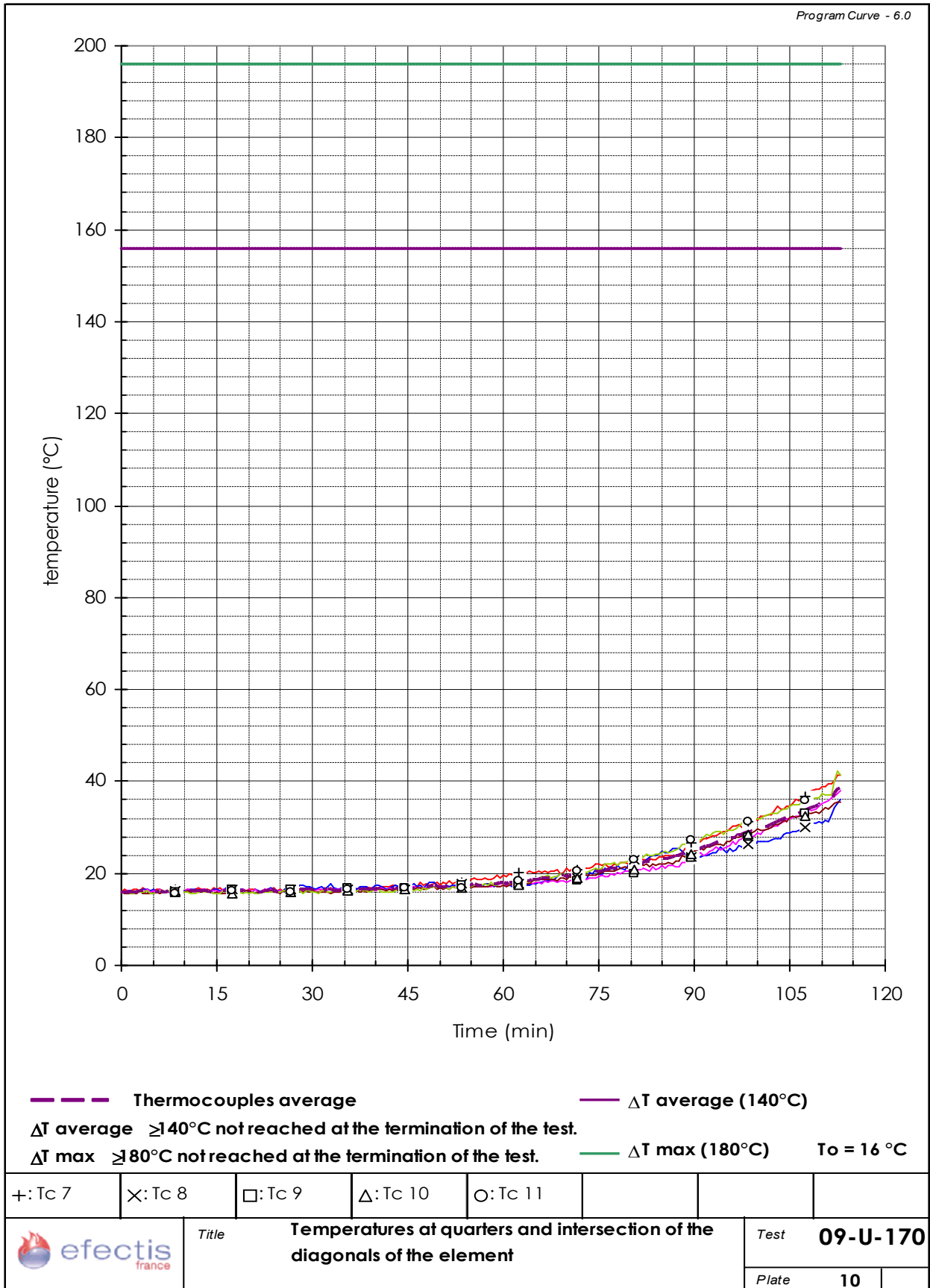


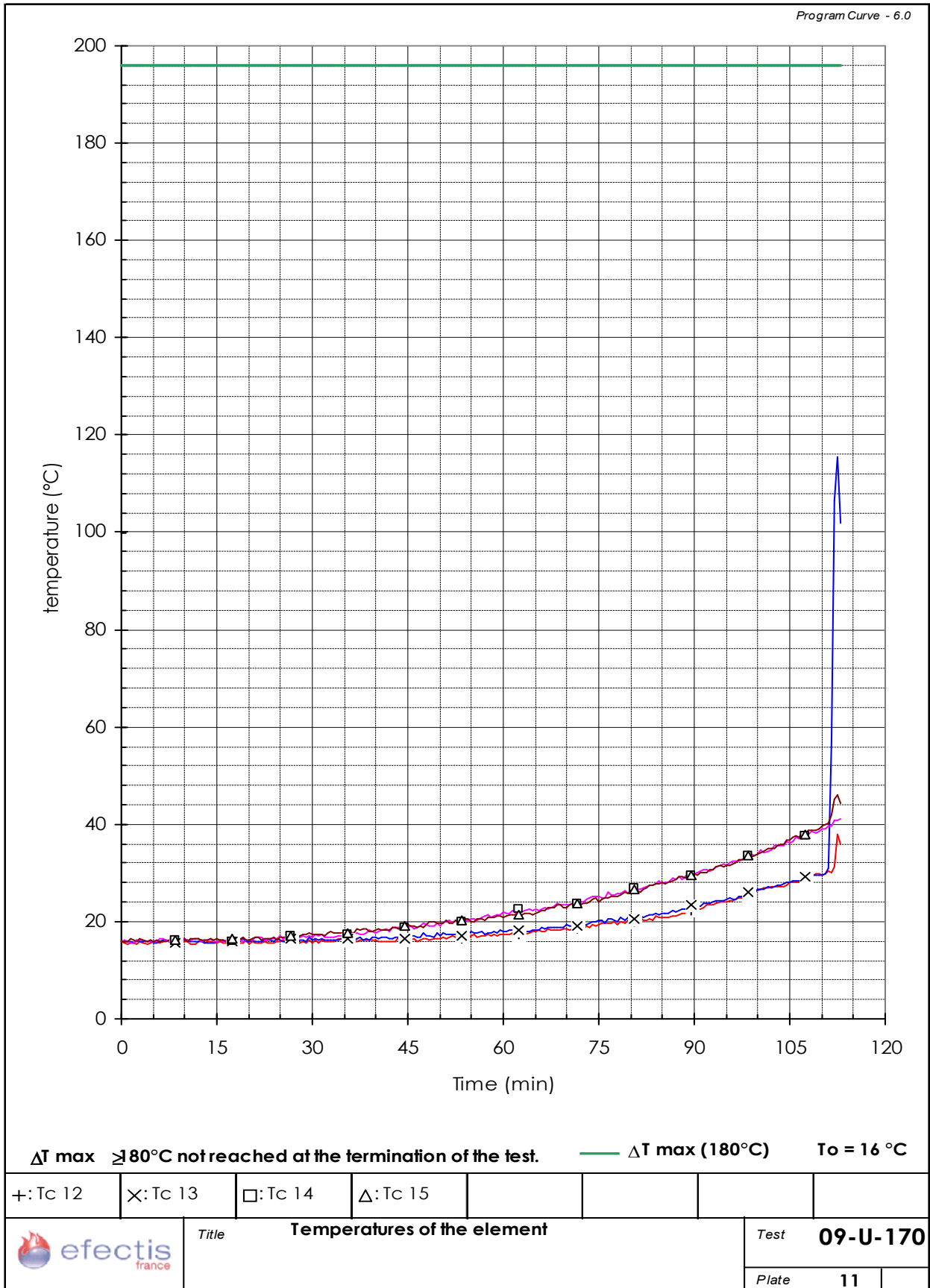


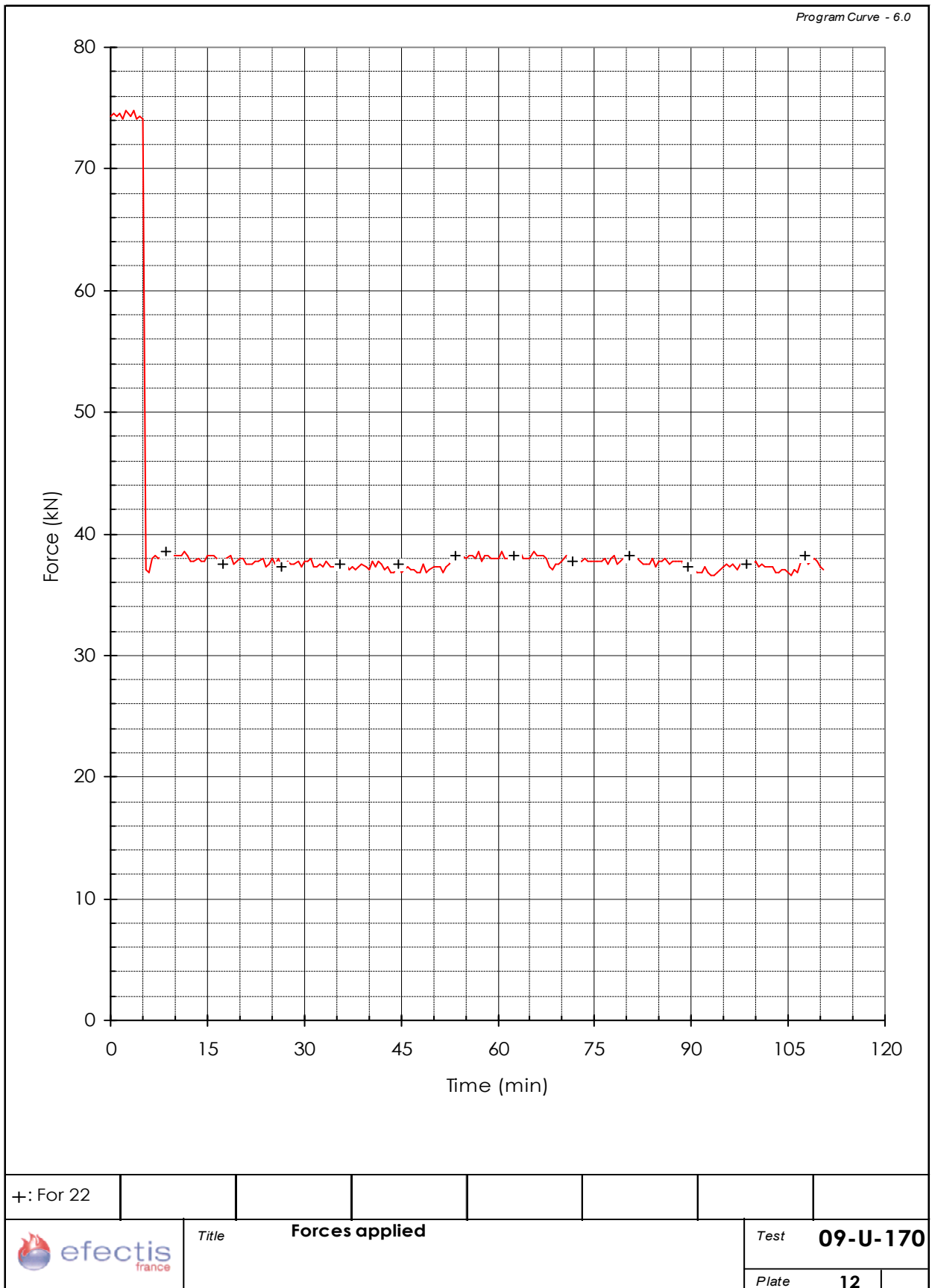


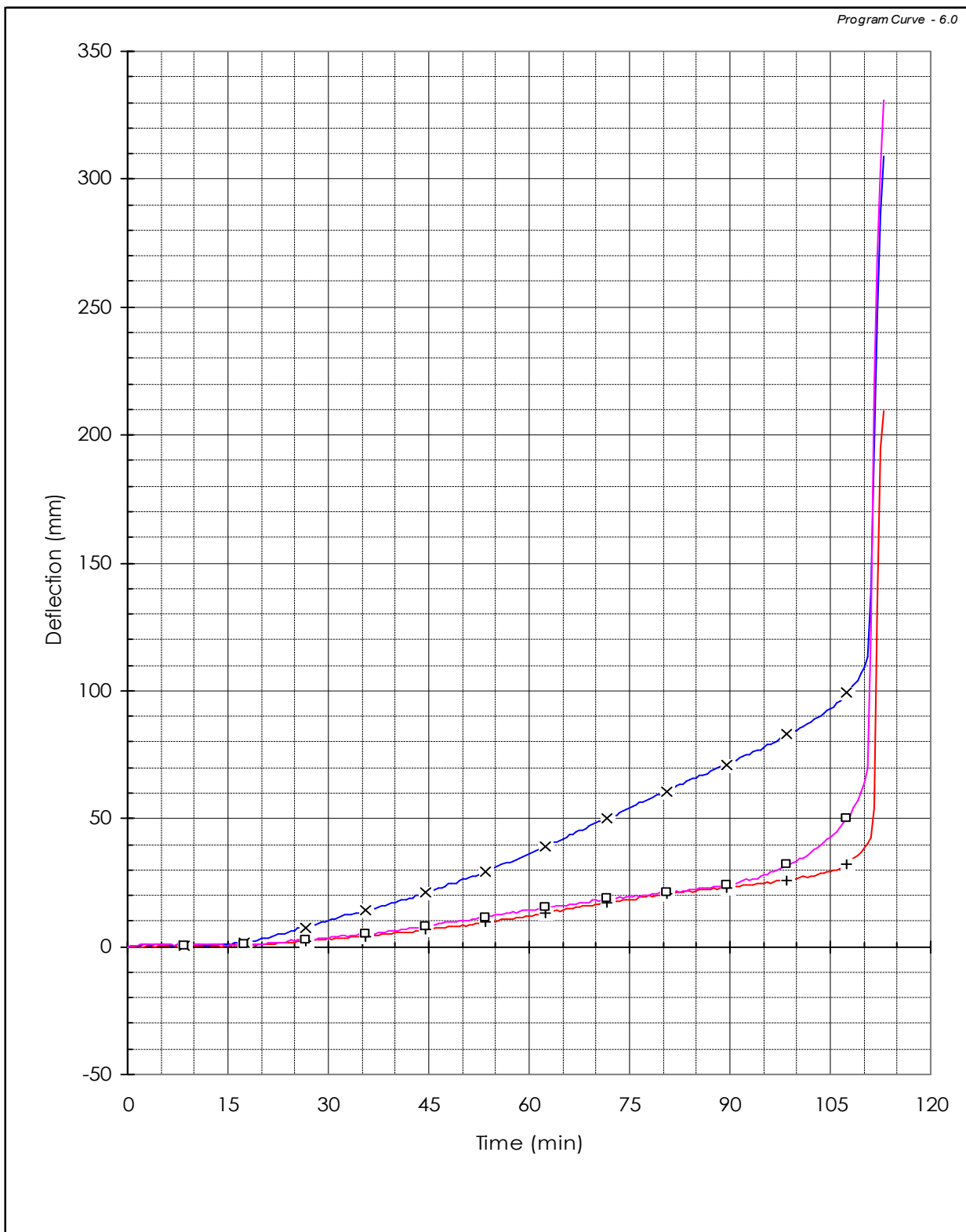





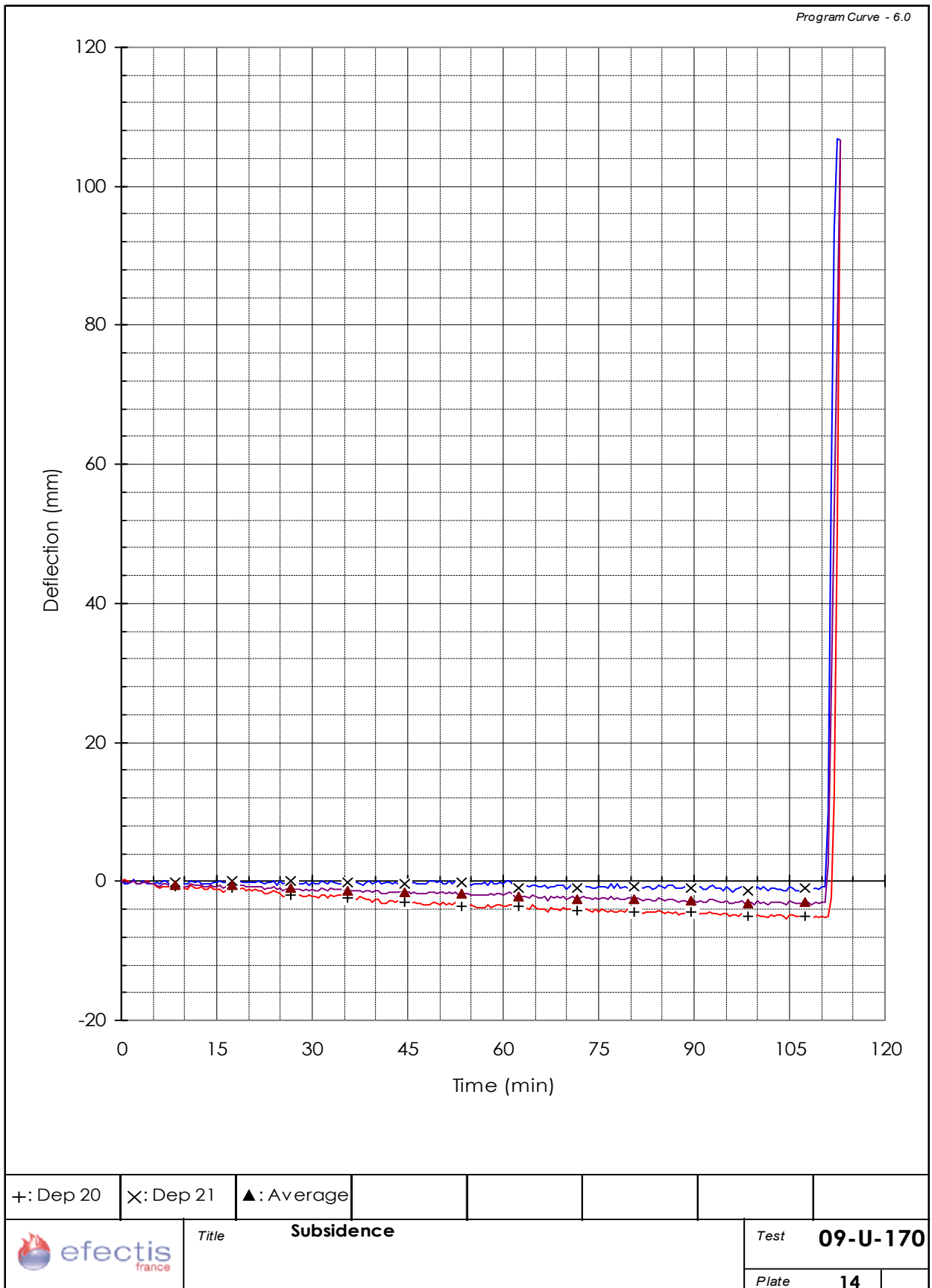


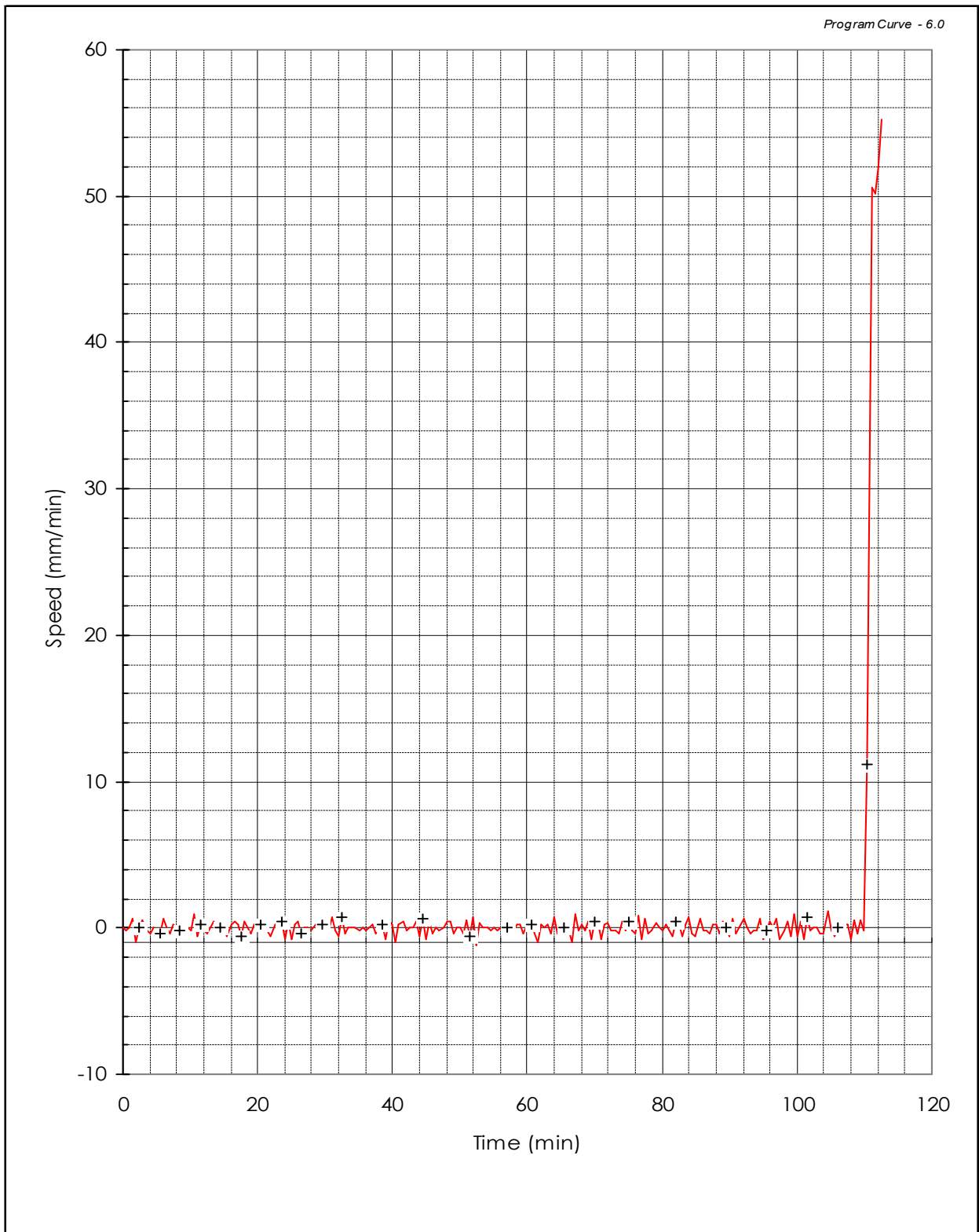






+: Dep 17	x: Dep 18	□: Dep 19				
		Deflection				Test 09-U-170
						Plate 13






+ : Subsidence speed						
	Subsidence speed				Test	09-U-170
						Plate



Photo A (up) Unexposed side before the test
Photo B (down) Breaking of the wall (112 th minute).