



Centre for Fire Research
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TNO report

2005-CVB-R0289[Rev.1]

**Determination of the resistance to fire of a glazed
partition of Glaverbel with a PYROBELITE
EW60/12 type 2 in IGU fixed in a Jansen frame
following NEN-EN 1364-1, for an external fire**

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Project name Fire resistance glazed partition construction
Project number 006.45152/01.01

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1 SUBJECT

Non-loadbearing glazed partition construction of Glaverbel with a PYROBELITE EW60/12 type 2 in IGU fixed in a Jansen Janisol 2 steel frame.

2 TEST PERFORMED

Fire resistance according to NEN-EN 1364-1:2001 (and EN 1363-2:2001).

3 CONTRACTOR

Glaverbel S.A.
Parc Industriel – Zone C
B 7180 Seneffe
Belgium

4 PLACE AND DATE OF TEST

4.1 Place of test

The test was performed at the Centre for Fire Research of TNO Building and Construction Research, in Rijswijk, The Netherlands.

4.2 Dates regarding the test

The construction was assembled on July 6, 2005.
The test was performed on July 13, 2005.

5 DATE AND NUMBER OF REPORT

Date of report: August 2005
Number of report: 2005-CVB-R0289

6 TEST CONSTRUCTION

6.1 General

The test was performed on a glazed partition construction in a concrete testing frame with internal dimensions (w x h) 4000 x 3000 mm. The frame was reduced in size by a cellular concrete pier, thickness 150 mm, to accommodate the 3000 mm wide steel frame. The partition was constructed from a steel frame (Jansen Janisol 2) with glass panes, type Glaverbel PYROBELITE EW60/12 type 2 insulated fire protective double glass units.

6.2 Window construction

For the window construction, see figures 1 – 5.

The window was constructed from:

- A steel frame, outside dimensions (w x h) 3000 x 3000 mm. The frame was constructed (by De Rollecate B.V.) from steel Jansen Janisol 2 shaft profiles. The frame was divided into 6 separate panels, see figure 1, of the following inside dimensions (w x h): 1635 x 1010 mm; 795 x 1830 mm; 795 x 1245 mm; 795 x 535 mm; 1215 x 535 mm; 1215 x 2305 mm. The frame members consisted of 2 separate steel profiles, joined by special polyamide-based insulating material, and filled with 8.5 mm thick strips of gypsum-based cooling material placed over the full length and width of the profiles. The width of the frame beams was 52.5 mm, with a raised edge of 20 mm. Steel thickness was 2 mm.
- Double-glazed units from Glaverbel, consisting of fire resisting glass type Pyrobelite EW60/12 type 3, a gap of 15 mm, and thermoplus ENERGY 6mm. The test was performed with the energy glass towards the fire. The pane dimensions were (w x h) 1626 x 1006 mm; 784 x 1826 mm; 784 x 1241 mm; 786 x 526 mm; 1206 x 526 mm; and 1206 x 2306 mm. Between the panes and the frame a distance of about 5 mm was kept. Supporting blocks of compressed mineral fibre, dimensions (l x w x t) 80 x 15 x 5 mm, density 990 kg/m³, were placed below the panes, 4 below each large pane, a single block below the two small panes.
- In order to mount the panes in the frame, ceramic fibre glazing tape, 5 x 20 mm and 3 x 20mm, was put on the edges of the panes and on the glass beads. The panes were fixed in the frame with steel glass beads, type R402.1127. The beads were mounted by clicking over steel screws, type 450.009, in-between distance approximately 175 mm. The joints between glass and frame were sealed with Dow Corning 815 sealing compound.

6.3 Connection to the testing frame

One vertical side of the test specimen was not attached to the test frame, to allow free movement of the test specimen. The other vertical side, as well as both horizontal sides of the specimen, were attached to the concrete testing frame by means of $\varnothing 7.5$ x 120 mm window screws ('kozijnschroeven'). These screws were positioned at centre-to-centre distance of approximately 500 mm, starting at 150 mm from the edge. The gaps between the test frame and the test specimen were filled with rockwool and sealed with Dow Corning sealant.

For more information regarding the construction, please refer to the drawings.

6.4 Assembly of the construction

The glazed separation construction was mounted as follows:

- Placement of the pre-fabricated frame in the testing frame, fastening the window frame with window screws.
- Filling the gaps between the frame and the supporting construction with rockwool.
- Placement of the window panes in the frame. Glazing tape was placed against the edges of the panes.
- Fixing of the panes with glass beads, clicking the beads over the screw heads.
- Applying Dow Corning sealing compound to the joints of the panes.

7 SAMPLING AND PREPARATION OF TEST SPECIMEN

Centre for Fire Research
TNO Building and Construction Research
Rijswijk, the Netherlands

Test frame

De Rollecate B.V.
Staphorst, the Netherlands

Manufacturing of the window frame

Glaverbel S.A.
Seneffe, Belgium

Assembly of the test specimen

The samples of the panes were identified by the supplier as follows:

- sample #1	1206x526	BX04726-01-501	1205100723/2
- sample #2	1626x1006	BX04726-02-501	1205100723/3
- sample #3	784x1826	BX04726-03-501	1205100723/4
- sample #4	784x526	BX04726-04-501	1205100723/5
- sample #5	784x1241	BX04726-05-501	1205100723/6
- sample #6	1206x2306	BX04740-01-501	2421055091/1

8 MODE OF TESTING

8.1 Verification of test sample

During the assembly the parts and materials were verified from the supplied drawings.

TNO Centre of Fire Research has not been involved in the sampling procedure of the test specimen components.

8.2 Conditioning

In the period between assembling and testing the construction was stored in ambient conditions of temperature (20 ± 5 °C) and relative humidity (50 ± 10 %) in the testing laboratory of the Centre for Fire Research.

8.3 Fire test

8.3.1 Test conditions

The test was performed under the conditions as specified in NEN-EN 1363-1 and 1363-2 and NEN-EN 1364-4

The initial ambient temperature was 21 °C.

8.3.2 Measurements

During the heating the following data were measured and registered:

- temperatures inside the furnace with 6 plate thermometers, regularly spread over the directly heated surface of the partition;
- the pressure inside the furnace at 0.5 m and 2.7 m height from the floor;
- surface temperatures on the non-directly heated side of the test sample with 27 thermocouples;
- radiation at 1 m from the centre of the test specimen;

- displacement of the test specimen at the centre of the test specimen and at mid height at the free edge;
- temperature and air velocity outside the furnace.

Furnace temperatures and pressure are given in graphs B1 to B2.

The placement of the thermocouples on the test specimen is given in fig. C1.

9 OBSERVATIONS DURING HEATING

After heating for 51 minutes, thermocouple 27 indicated the frame temperature had increased $>180\text{ }^{\circ}\text{C}$ (**end of thermal insulation**).

For a more detailed description of the observations please refer to Annexe A.

10 TEST RESULTS OF THE MEASUREMENTS OF THE FIRE TESTS

Test results are given in graphs C2 to C6 of annexe C.

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.

11 SUMMARY

Table 1 summarises the most important results of the test.

Table 1. Test results.

	Time from the start of the heating, during which the criterion was just fulfilled.
Criterion	NEN-EN 1364-1
Insulation regarding temperature -average temperature rise $>140\text{ }^{\circ}\text{C}$ -maximum temperature rise $>180\text{ }^{\circ}\text{C}$ (glass) -maximum temperature rise $>180\text{ }^{\circ}\text{C}$ (frame)	59 minutes 73 minutes 51 minutes
Insulation regarding radiation	> 120 minutes
Integrity - continuous flaming - gap gauges - ignition of cotton pad	not occurred not occurred not occurred

The test was discontinued after 120 minutes.

12 CONCLUSIONS

The fire resistance of the tested glazed partition construction following NEN 6069:2001, in the case of an external fire, with respect to its separation function is as follows: **more than 120 minutes**.

13 FIELD OF APPLICATION AND CONDITIONS

The conclusions are only valid for glazed partition constructions which are in detail the same as the construction tested;

- with connections and joints as described in this report;
- for walls with a maximum height of 3.00 m; the width is not limited.

Regarding these conclusions it is also required that the construction elements to which these are connected have a fire resistance which is at least equal to that of the glazed partition.



Dr. F. Paap



Dr. Ir. G. van den Berg

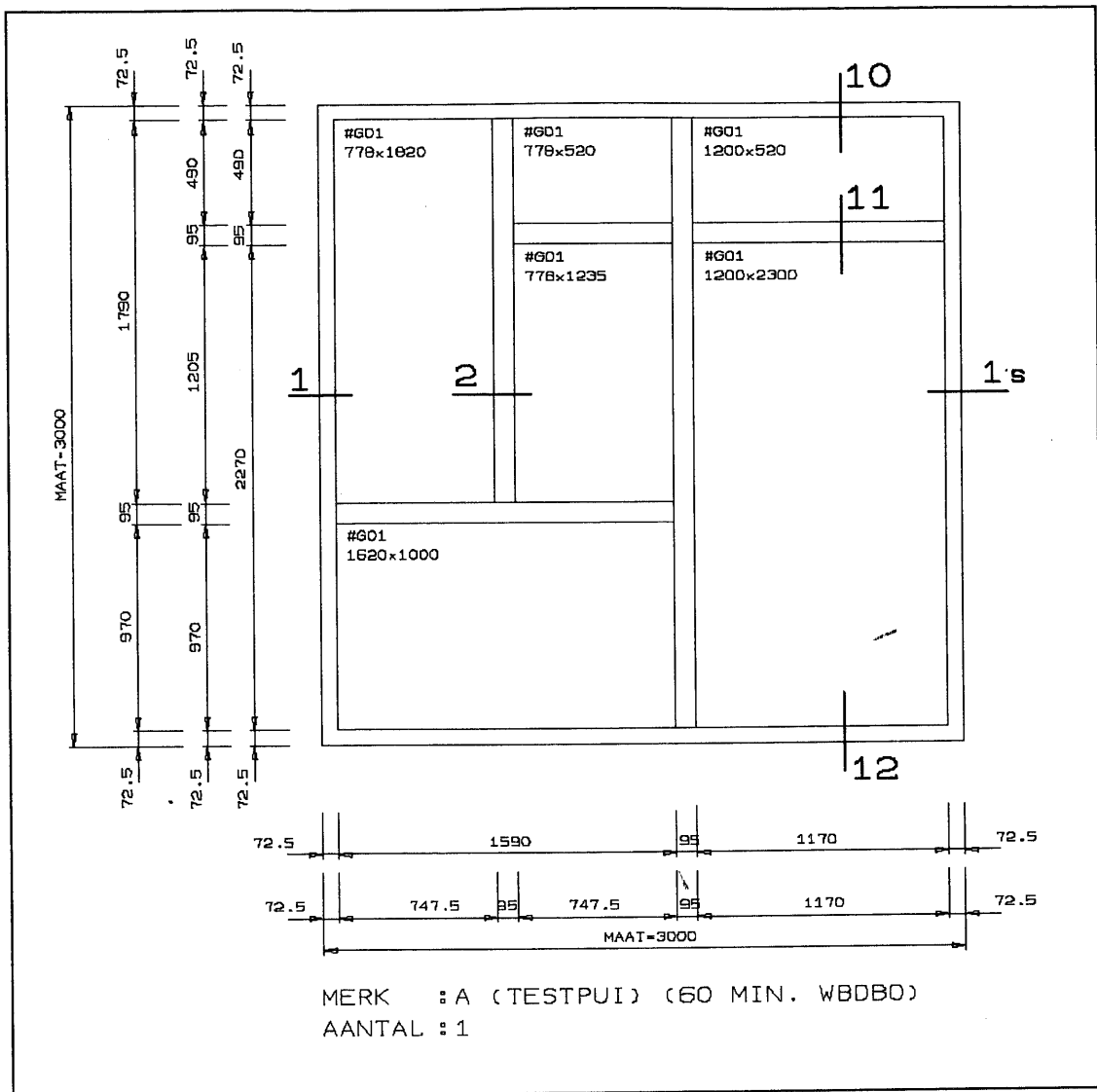


Figure 1, test specimen overview

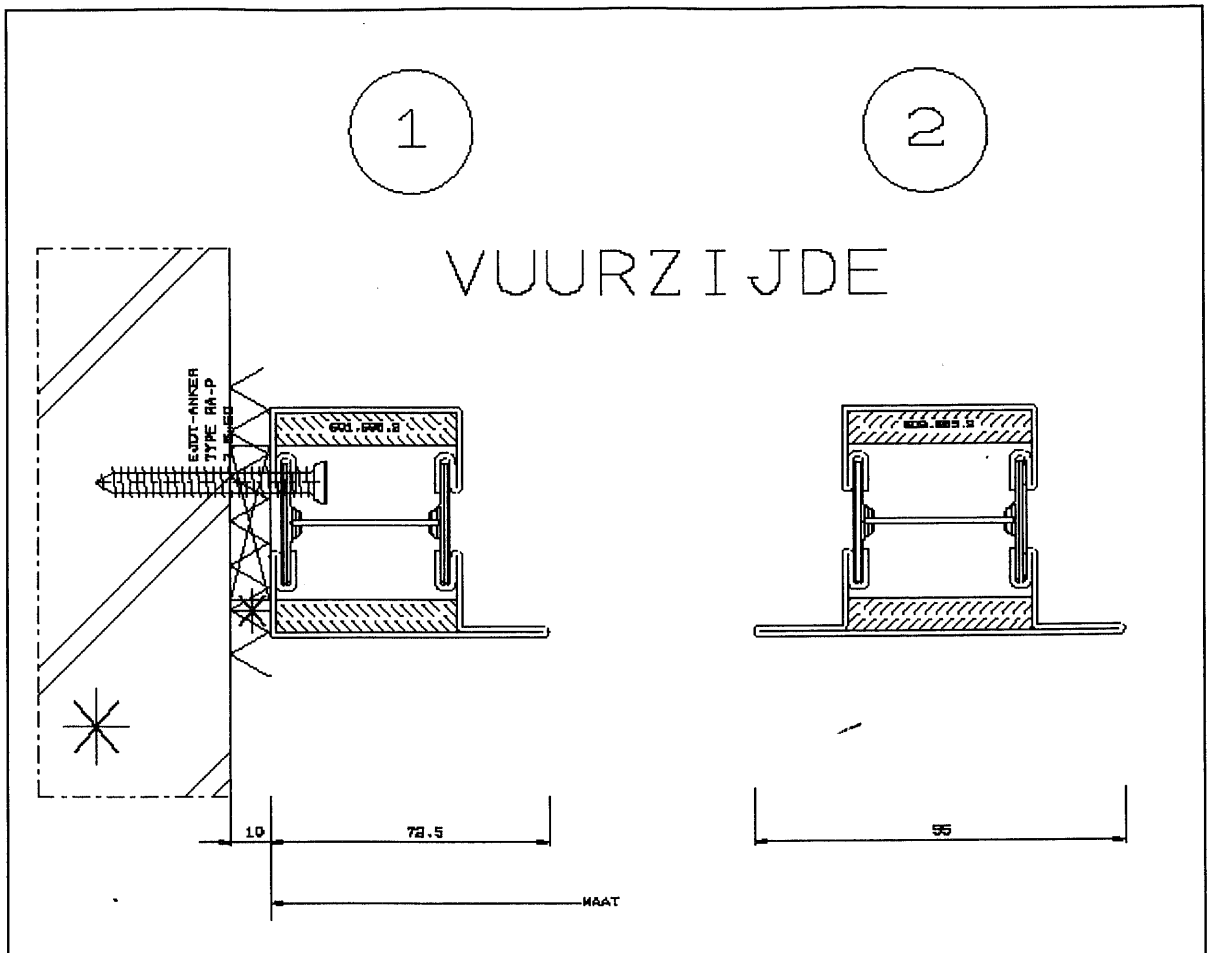


Figure 2, details of frame members and connections.

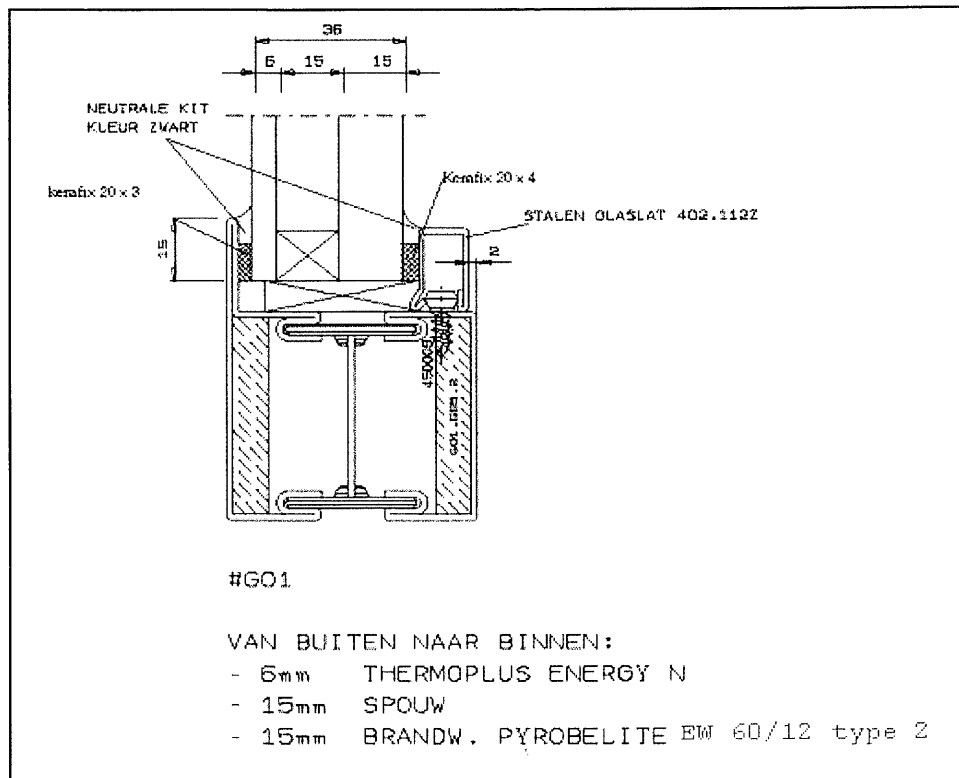


Figure 3, details of glass setting.

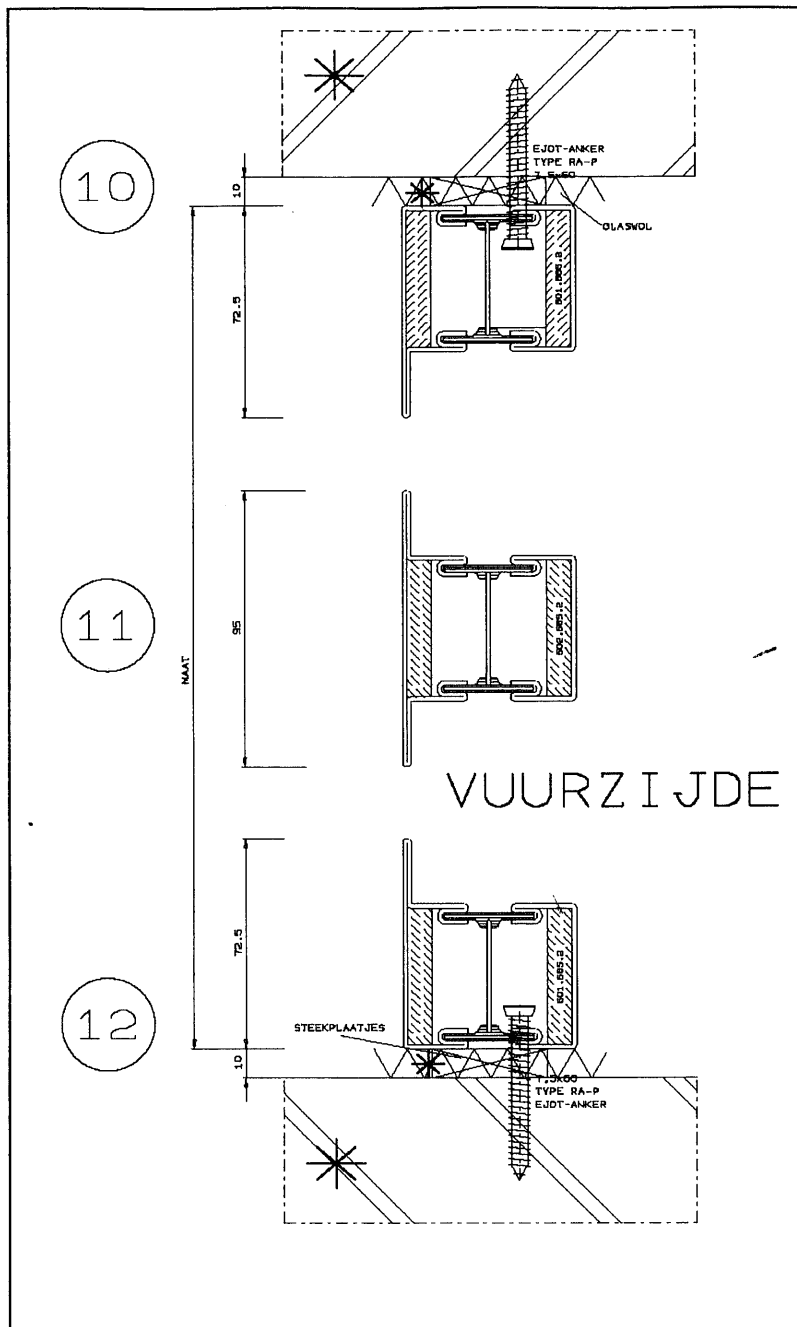


Figure 4, details of frame members and connections.

Annex A: Observations during the test.

0	start of heating
2	first cracks appear in the (inner) panes
5	all (inner) panes are cracked
6	the largest pane becomes gradually white
7	the large pane in the bottom right corner becomes gradually white
15	the two larger panes are white
23	except for the two smallest panes, all panes are white
30	all panes are white
120	test stopped after consultation with contractor

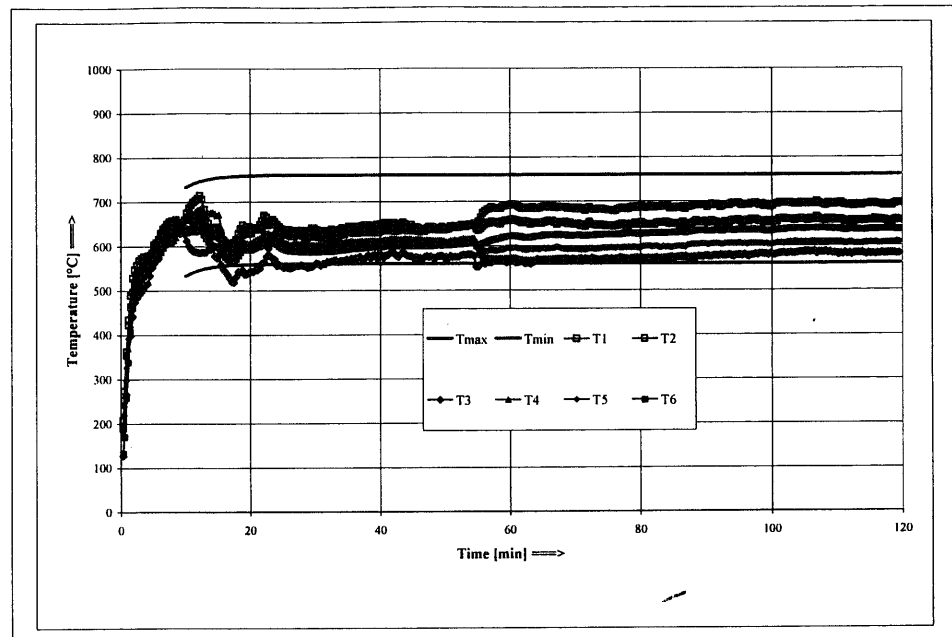
Annex B: Measured gas temperatures and pressure in the furnace.

Figure B1: Furnace temperatures with standard fire temperatures. The larger spread in temperature after 50 minutes is caused by switching off 2 out of 4 burners.

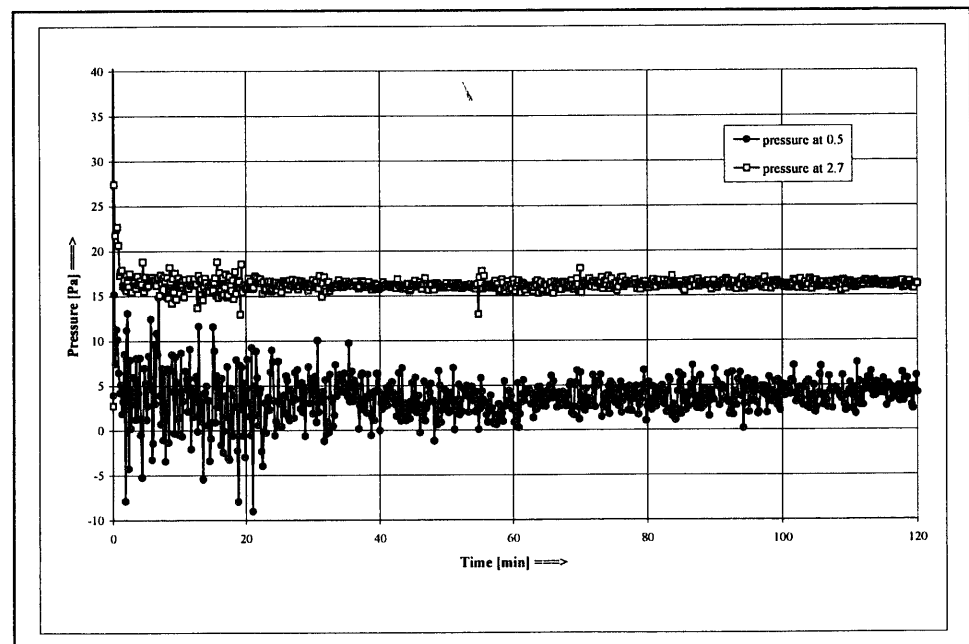
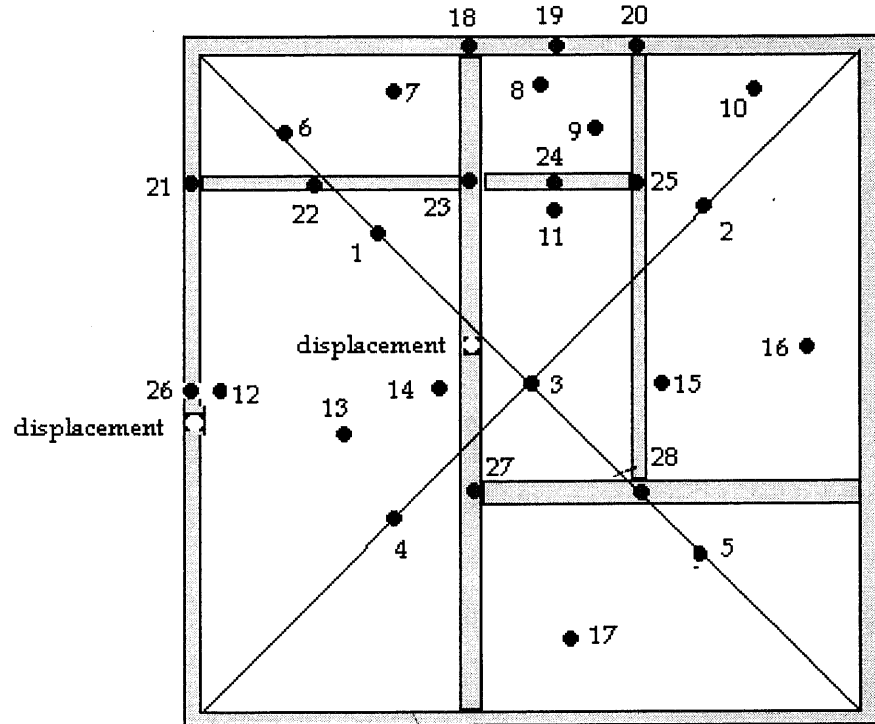


Figure B2: Furnace pressure at 0.50 and 2.70 m above floor level.

Annex C: measured test specimen temperatures, radiation and displacement

Figure C1: Schematic drawing of placing of thermocouples and displacement measurements.



Temperature measurements 21 and 26 were positioned too close to the free edge and are not used for evaluation. Upon movement of the free edge, thermocouple 12 was influence too much by hot gases coming directly from the furnace, and the readings were not used for evaluation.

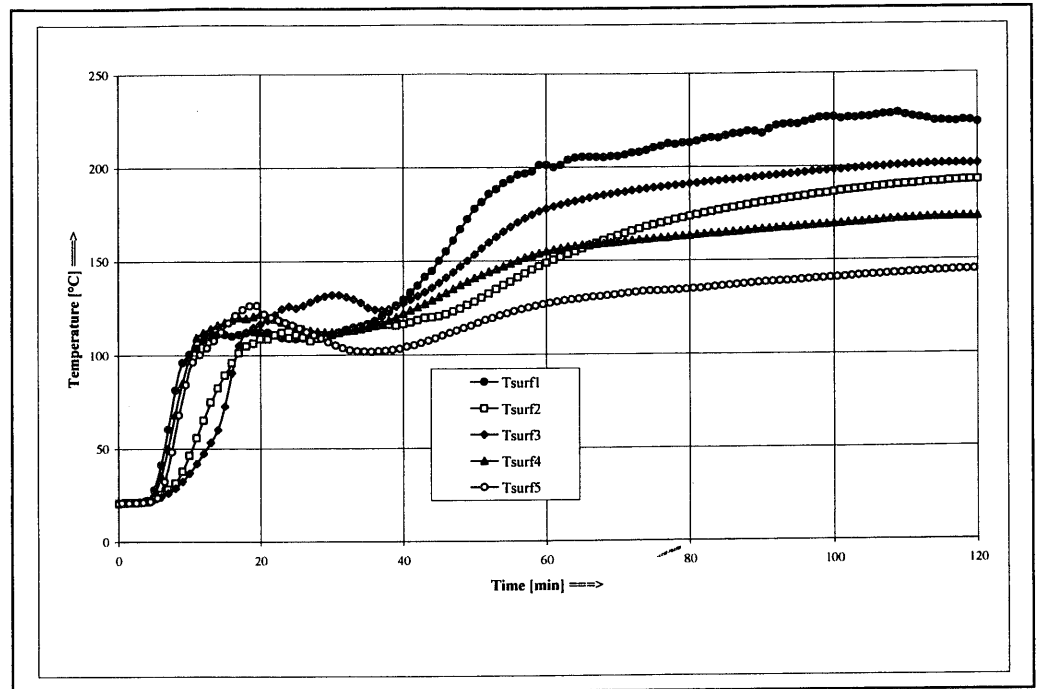


Figure C3: Surface temperature readings for determining average temperature.

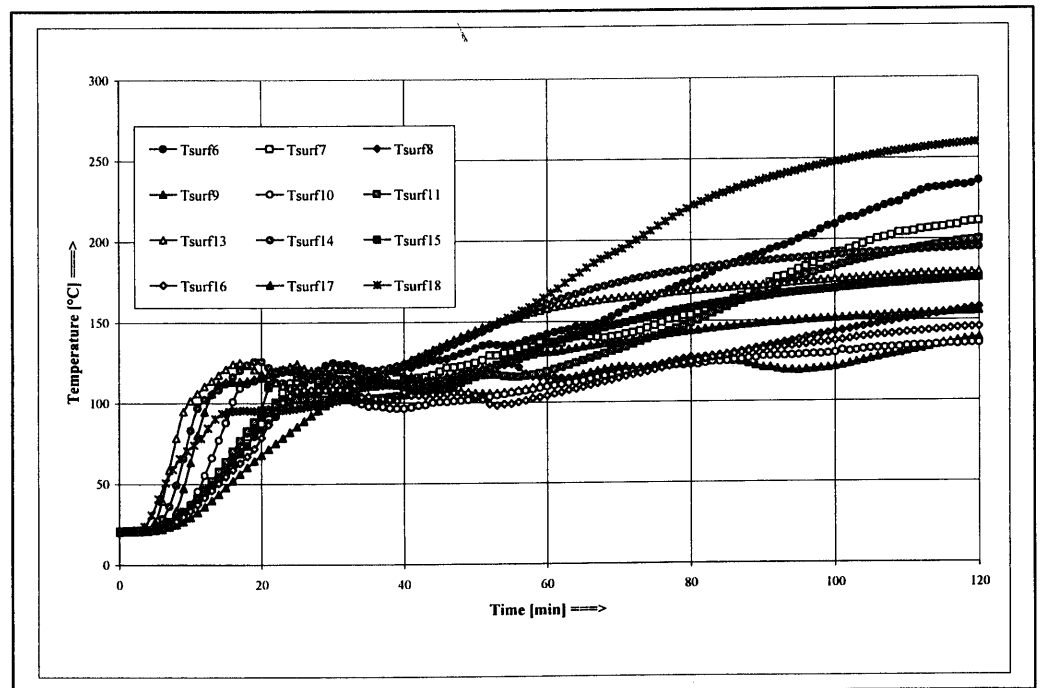


Figure C4: Surface temperature readings on the glass.

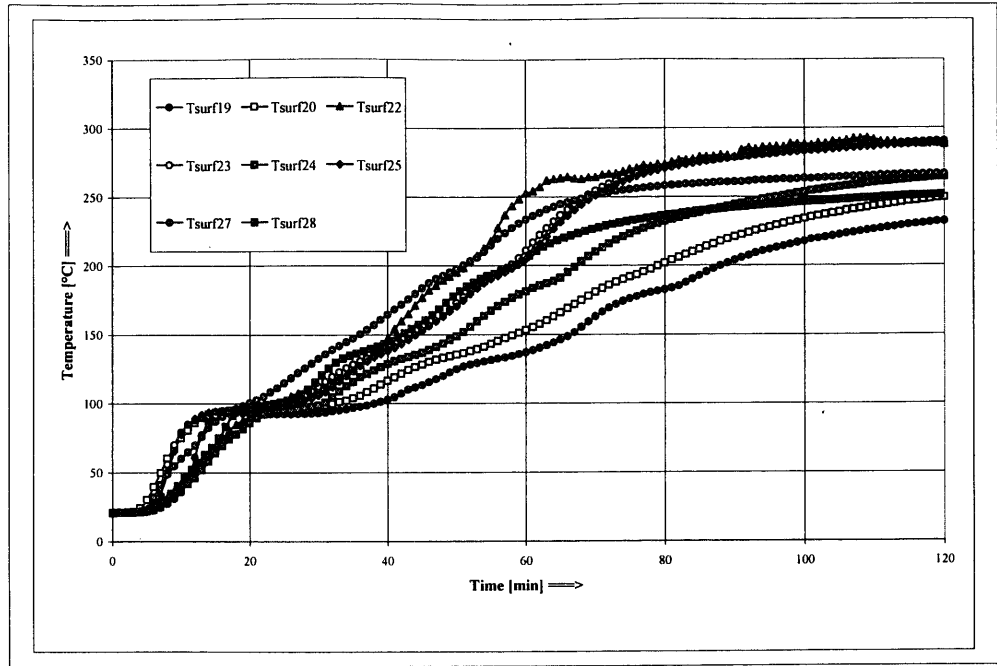


Figure C4: Temperatures on steel profiles.

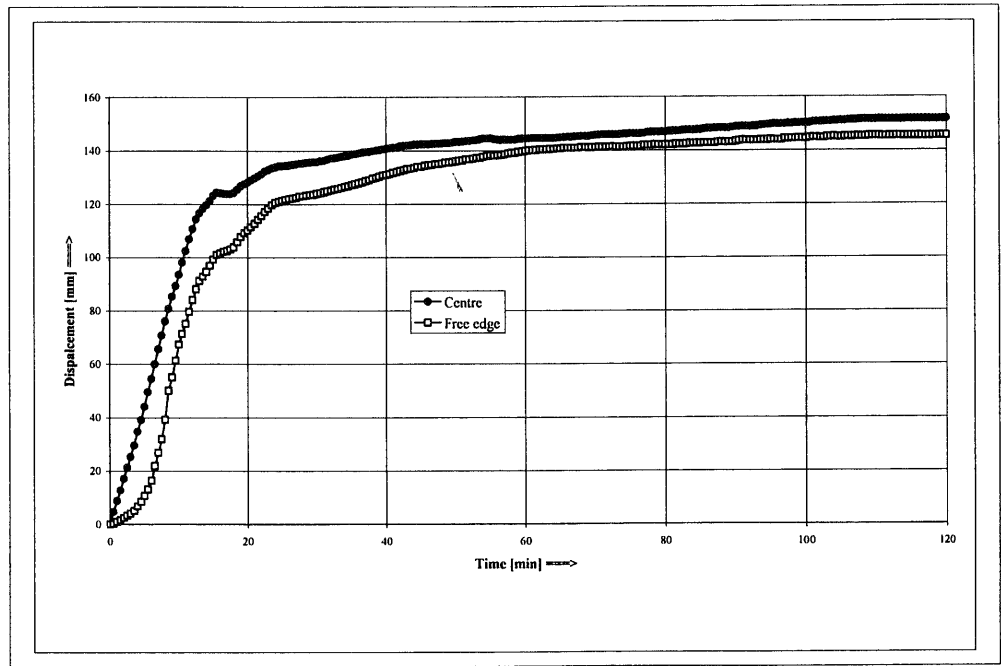


Figure C5: Frame displacement.

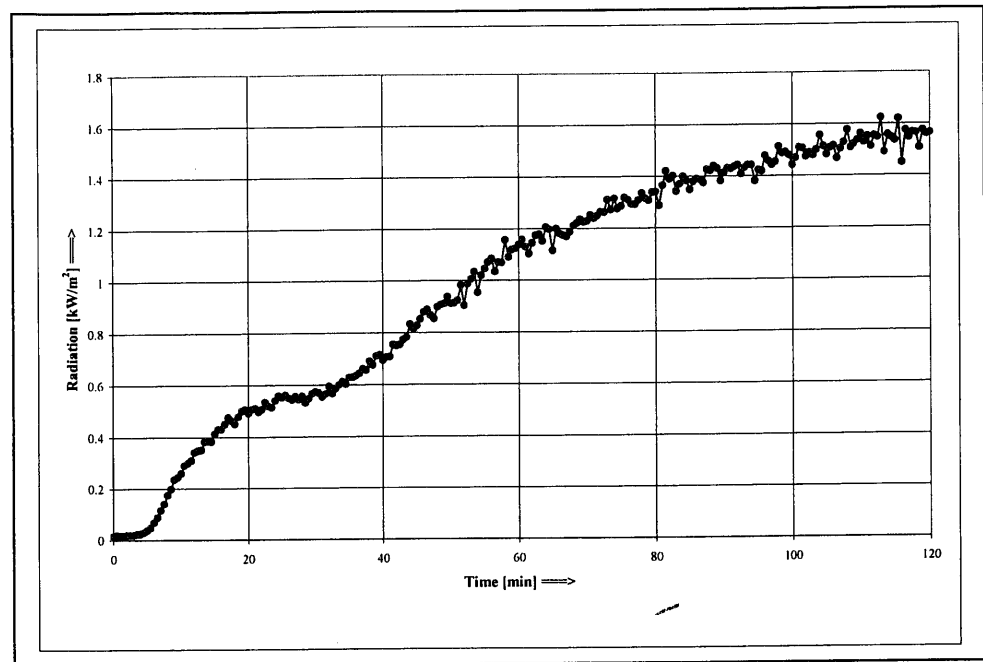
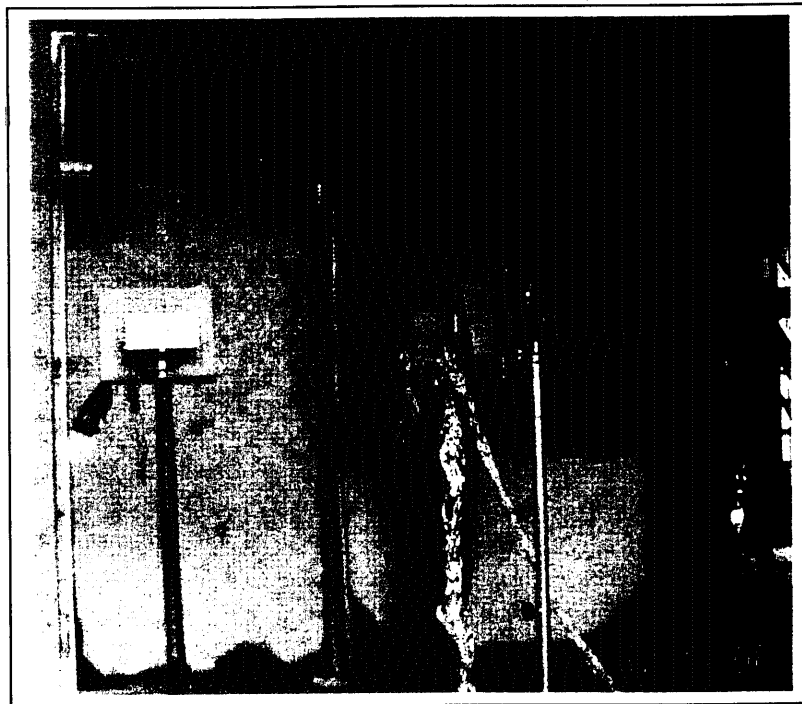


Figure C6: Radiation at 1 m distance from centre of test specimen.

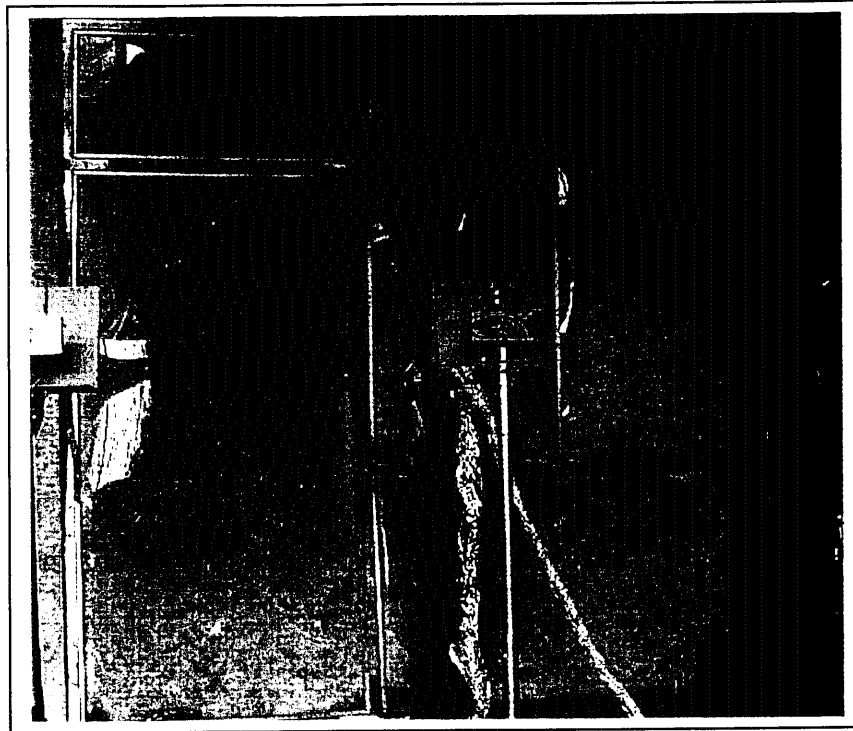
Annex D: pictures



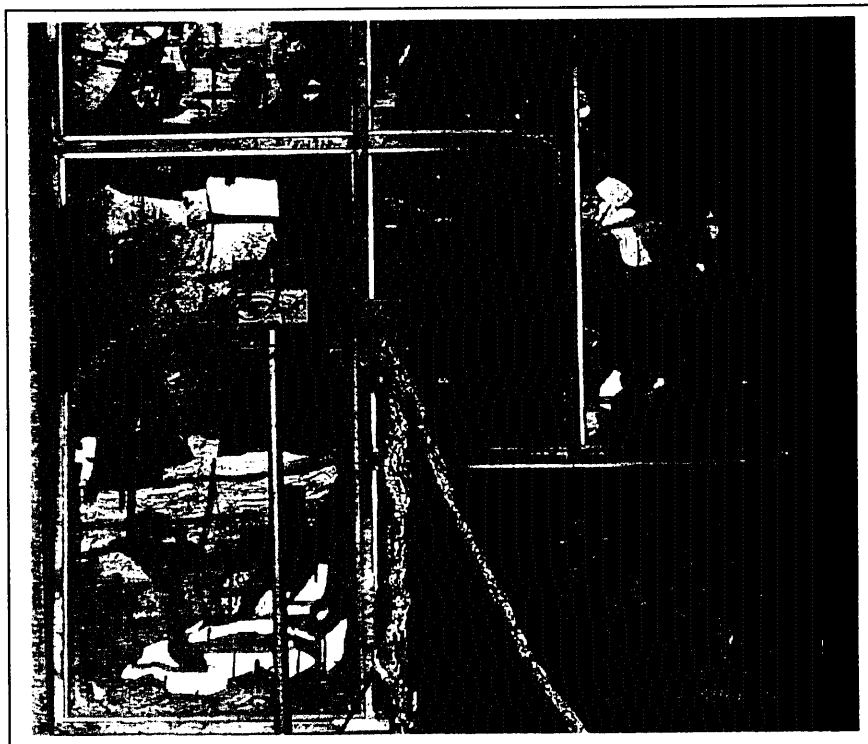
Picture 1. Test specimen at start of test.



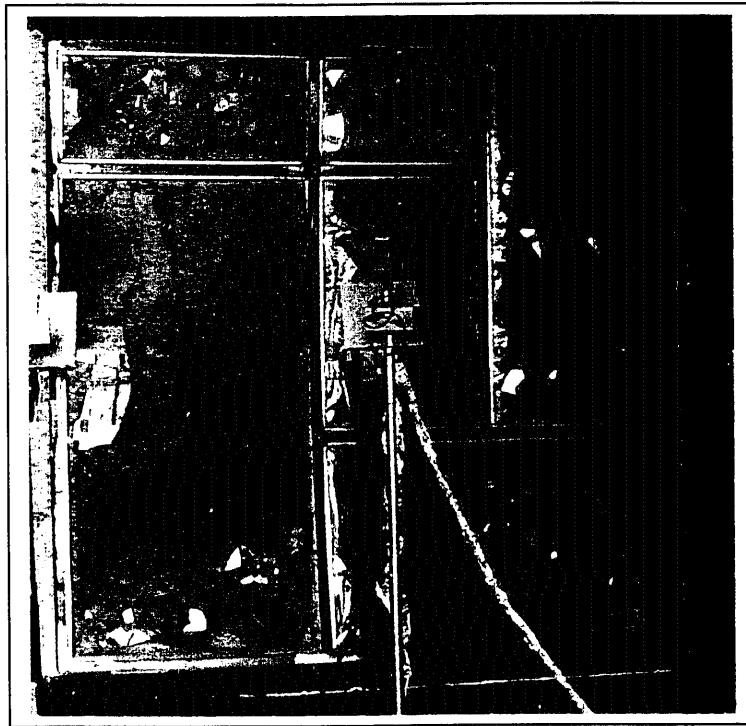
Picture 2. Test specimen after 15 minutes.



Picture 3, test specimen after 30 minutes.



Picture 4, test specimen after 60 minutes



Picture 5, test specimen after 120 minutes.