FR 3492

FIRE RESISTANCE OF AN XFLAM INSULATED PANEL WALL

BRANZ

BUILDING ON KNOWLEDGE

BRANZ
BUILDING ON KNOWLEDGE

FR 3492

FIRE RESISTANCE OF AN XFLAM INSULATED PANEL WALL

Author: J. A. Hill
Fire Engineer

Reviewer: M. E. Godkin
Senior Fire Testing Engineer
IANZ Approved Signatory

Contact:
BRANZ Limited
Moonshine Road
Judgeford
Private Bag 50908
Porirua City
New Zealand
Tel: +64 4 237 1170
Fax: +64 4 237 1171
www.branz.co.nz

CONDITIONS OF ISSUE OF BRANZ REPORTS

The issue of this Report is subject to the conditions set out below:

Rights

- BRANZ reserves all rights in the Report. The Report is entitled to the full protection given by the New Zealand Copyright Act 1994 to BRANZ. Except as specified below, the client shall not publish any part of a Report.
- The Client will have no rights to use a Report unless full payment of the fees has been made to BRANZ.

Publication of Reports

- The Client shall accurately report any information from BRANZ and shall indemnify BRANZ against any damages related to misrepresentation.
- If the Client has proprietary rights to an Item reported on (e.g. is the manufacturer, accredited agent of the manufacturer, owner), the Client may:
  a) publish the Report verbatim and in full, or
  b) state that the Item has been the subject of a Report by BRANZ, provided a full copy of the Report is provided to any third Party requesting it. In New Zealand and Australia such reference to a Report is permitted in technical literature but not in advertising or electronic media, unless the item is BRANZ Appraised.*
- The CEO's prior written consent must be obtained before:
  a) any extract or abridgement of a Report is published.
  b) the Report is used in or referred to in connection with any company prospectus or publicly issued report.
- If the client does not have proprietary rights to an item, the CEO's prior written consent must be obtained before any reference to, extract from, or abridgement of a report is published.
- BRANZ reserves the right to confirm, to a third party, the validity of any written statement made by the Client which refers to a Report.
- A Report does not imply approval by BRANZ of any Item for any particular purpose and therefore no statement shall state or imply approval by BRANZ.

*In New Zealand and Australia BRANZ allows the use of the following means of referring to a BRANZ Report to support relevant technical claims in Technical Literature:

1. The publishing of a statement that the product has been the subject of a BRANZ Report, provided the statement includes the Report Number, date of issues and date of review.

or

2. The publishing of words of the Client's choice but only with the approval of BRANZ Chief Executive. Any alterations or amendments, or conditions imposed must be complied with.

(Technical Literature is defined as written material intended to support claims of compliance with a national Building Code and fitness for purpose. It would also be material containing, as a minimum, product specifications, installation instructions, and maintenance requirements.)

FIRE RESISTANCE OF AN XFLAM INSULATED PANEL WALL

1. CLIENT

Bondor NZ Ltd
60 O'Rourke Road
Penrose
Auckland 1131
New Zealand

2. TEST STANDARD

2.1 Test Specification

The test was conducted in accordance with AS 1530.4-1997 Methods for fire tests on building materials, components and structures, Part 4: Fire-resistance tests of elements of building construction, Section 3 Walls and partitions. This standard states that the fire resistance of a non-loadbearing test specimen is the time, expressed in minutes, to failure under one or more of the following criteria:

2.2 Integrity

For an element intended to separate spaces and resist the passage of flame from one space to another, failure in relation to integrity shall be deemed to have occurred upon collapse, or the development of cracks, fissures, or other openings through which flames or hot gases can pass.

2.3 Insulation

Failure in relation to insulation shall be deemed to have occurred when either:

(a) The average temperature of the relevant thermocouples attached to the unexposed face of the test specimen rises by more than 140K above the initial temperature; or

(b) The temperature of any of the relevant thermocouples attached to the unexposed face of the test specimen rises by more than 180K above the initial temperature.

JAH MG

3. DESCRIPTION OF THE TEST SPECIMEN

3.1 General

The test specimen consisted of a non-loadbearing, XFLAM insulated panel wall 3.0 m high by 3.0 m wide. The wall consisted of three panels, 3.0 m high x 100 mm thick. Two of the panels were 1200 mm wide and the third was 600 mm wide.

The panels consisted of 0.59 mm thick steel faces on both sides of a 50 kg/m^3 XFLAM core to form a 100 mm thick panel. The leading vertical edge of each panel had a 15 mm lip which interlocked with a 15 mm channel on each adjacent panels trailing vertical edge.

3.2 Construction

The panels were joined together along their vertical edges with 4.8 mm diameter x 14.3 mm long stainless steel rivets at 500 mm centres. Flamex 1 sealant was used to seal between the panels on the fire exposed and unexposed faces.

Steel angles, 50 mm x 50 mm x 0.59 mm thick, were placed on the top and bottom horizontal edges and the right hand vertical edge (when viewed from the unexposed face) of the panel wall on both faces. The angles were attached to the panels with 4.8 mm diameter x 14.3 mm long stainless steel rivets at 150 mm centres and to the concrete specimen holder with M8 x 40 mm Dynabolts at 300 mm centres and 50 mm from each end. The left hand edge was faced with a 50 mm wide x 110 mm deep channel and was not secured to the specimen holder. The channel was secured to the panel edge with 4.8 mm diameter x 14.3 mm long stainless steel rivets at 150 mm centres on the exposed and unexposed faces. A strip of Formica, 5 mm thick x 40 mm wide x full height of the panel, was placed between the channel and the panel on the unexposed face.

Ceramic fibre was placed between the full depth of the panels and the concrete specimen holder, and between the steel angles and the specimen holder on the exposed face. It was also placed between the full depth of the channel on the left hand edge of the wall and the specimen holder.

Flamex 1 sealant was used between the angles and the panels, the angles and the specimen holder and between the panel and the left hand channel on the unexposed face.

The layout of the panel wall shown in Figure 6.

4. TEST PROCEDURE

4.1 General

The test was conducted on 22 September 2005, at the BRANZ laboratories at Judgeford, New Zealand in the presence of representatives of the client.

The frame containing the test specimen was sealed to the 3 m wide x 4 m high furnace, and the temperature and pressure conditions were controlled as specified in AS 1530.4-1997.

The ambient temperature at the beginning of the test was 11 °C.

JAH MG

4.2 Furnace Temperature Measurement

Temperature measurement within the furnace was made using twelve mineral insulated metal sheathed (MIMS) chromel-alumel thermocouples uniformly distributed in a vertical plane approximately 100 mm from the exposed face of the specimen.

4.3 Specimen Temperature Measurement

The temperature on the unexposed face of the test specimen was measured using chromel-alumel thermocouples mounted on copper discs and covered with insulating pads, in accordance with clause 2.2.3 of the test standard. Five thermocouples were placed on the panel wall, one at the centre point, and one at the centre of each quarter section. Four additional thermocouples were placed on the edges of the panel wall. The locations of the thermocouples are shown in Figure 6.

4.4 Temperature Recording

All the thermocouples described in sections 4.2 and 4.3 were connected to a computer controlled data logging system which recorded the temperatures at 15 second intervals.

4.5 Pressure Measurements

The pressure difference between the furnace and laboratory atmosphere was controlled to be neutral at 500 mm above the notional floor level. The differential pressure was monitored using a micromanometer connected to a computer controlled data logging system which recorded the pressure at 15 second intervals.

4.6 Deflection Measurements

The deflection of the unexposed face of the specimen was measured using a theodolite and rule. Measurements were taken at 10 minute intervals at the deflection points shown in Figure 6.

5. RESULTS

5.1 Duration

The test was stopped after 130 minutes.

5.2 Furnace Temperature

Figure 1 shows the standard curve in relation to the actual mean furnace temperature.

In accordance with the test standard the accuracy of control of the furnace was as follows:

	Variation of area under time-temperature curve (%)	
	Standard	**Actual**
End of first 10 minutes	± 15.0	4.5
End of first 30 minutes	± 10.0	1.9
After 30 minutes (max)	± 5.0	0.1 to 1.8
At end of test	± 5.0	0.1

	Variation of the mean furnace temperature (°C)	
	Standard	**Actual**
After 10 minutes	± 100	-40 to 32

	Variation of individual furnace temperatures (°C)	
	Standard	**Maximum Actual**
After first 10 minutes	± 200	-111 to 125

The furnace conditions complied with the test standard.

5.3 Integrity

The specimen did not fail integrity for the 130 minute duration of the test

5.4 Insulation

The maximum temperature rise measured by any of the thermocouples exceeded the failure criterion of 180 K at three quarter height on the right hand edge of the specimen after 31 minutes.

The average temperature rise measured by the thermocouples exceeded the failure criterion of 140 K after 45 minutes.

Graphs of the face and edge thermocouples temperature rise are shown in Figures 2 and 3 respectively.

JAH

MG

5.5 Observations

Observations related to the integrity performance of the specimen were as follows at the times stated in minutes and seconds.

Mins:secs

3:00 Large quantities of smoke were exiting from upper corners of the wall.

3:30 A paint shrinkage pattern was appearing on the exposed face.

7:00 The panels were deflecting towards the furnace along the horizontal centre line.

9:00 The right hand panel joint on the exposed face had separated approximately 4 mm. A brown liquid was exiting the top of the panels, running down the panels and pooling on the bottom angle.

14:40 Flaming was occurring on the bottom left hand corner of the wall in short bursts of approximately 5 seconds.

17:00 There was an increase in the volume of smoke exiting the top of the panels

21:00 Flaming was still occurring in short bursts on the bottom left hand corner of the wall.

24:00 The wall had deflected in an S shape with the top quarter deflecting inwards and the horizontal centre line deflecting outwards.

35:00 The panels had deflected away from the top and bottom angles between fixings. This had caused the sealant to separate in approximately 10 places. Smoke was venting out at these places.

39:00 The quantity of smoke exiting the wall had reduced.

54:00 The left hand edge of the left hand panel was significantly warped. The sealant was separating between the left hand panel and the channel on its edge.

65:00 The panels were starting to discolour.

114:00 The sealant in the panel joints and between the panels and angles was discolouring and falling out in some sections.

The test was stopped after 230 minutes

5.6 Deflections

Deflections were measured along the vertical and horizontal centrelines and are shown in figures 4 and 5 respectively. Positive deflections are away from the furnace.

In general the wall deflected concave to the furnace. The maximum measured deflection was 111 mm at the centre of the wall at 110 minutes.

JAH MG

6. SUMMARY

The fire resistance, in accordance with AS 1530.4-1997, of a Bondor XFLAM insulated panel wall nominally 3.0 m high by 3.0 m wide was as follows :

Integrity:	130 minutes No Failure
Insulation:	31 minutes

The test standard requires the following statement to be included: "The results of this test may be used to directly assess fire hazard, but it should be recognized that a single test method will not provide a full assessment of fire hazard under all fire conditions."

7. ATTACHMENTS

Figure 1 Furnace Temperature

Figure 2 Face Temperatures

Figure 3 Panel Edge Temperatures

Figure 4 Deflections on the Vertical Centreline

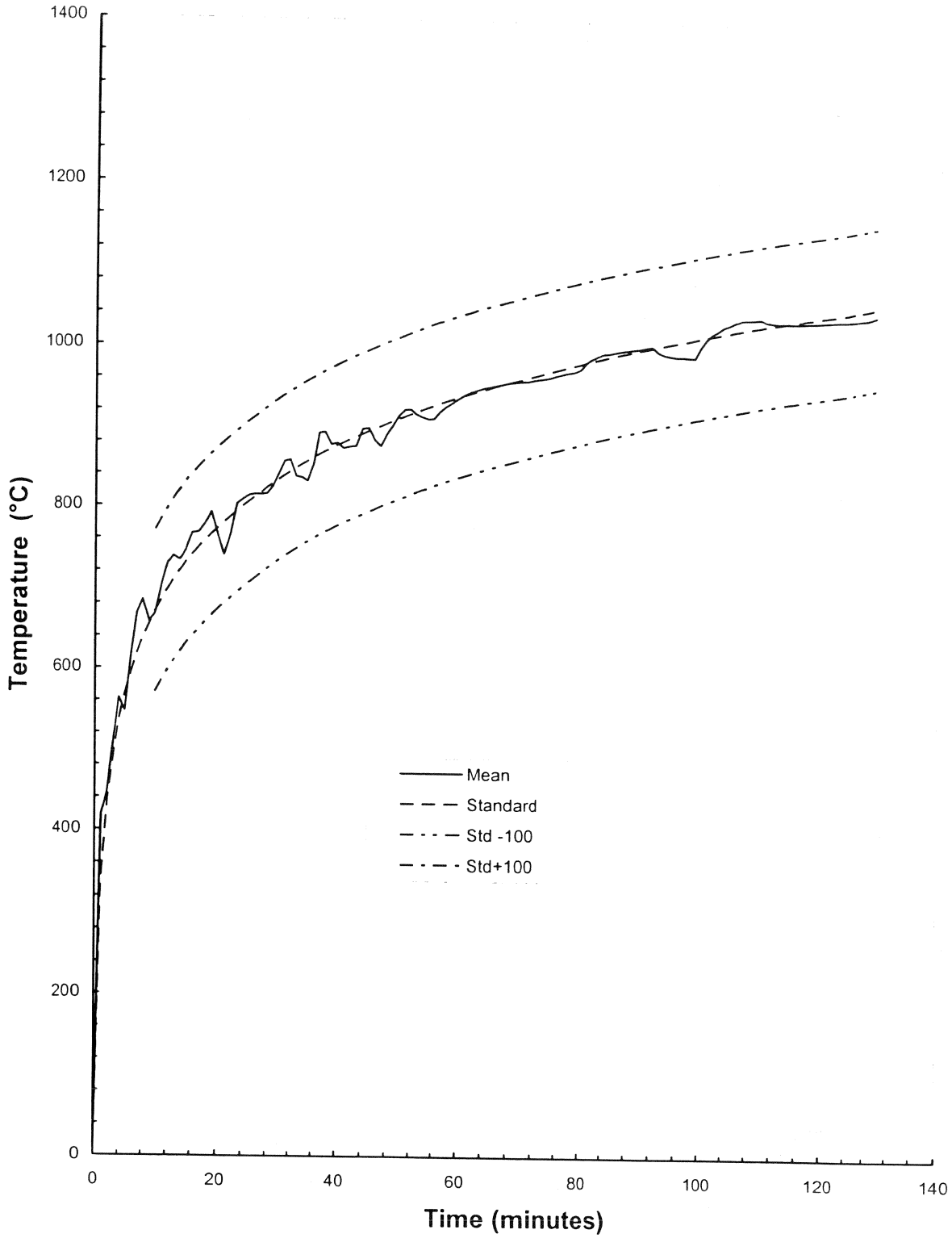
Figure 5 Deflections on the Horizontal Centreline

Figure 6 Specimen Layout

JAH

MG

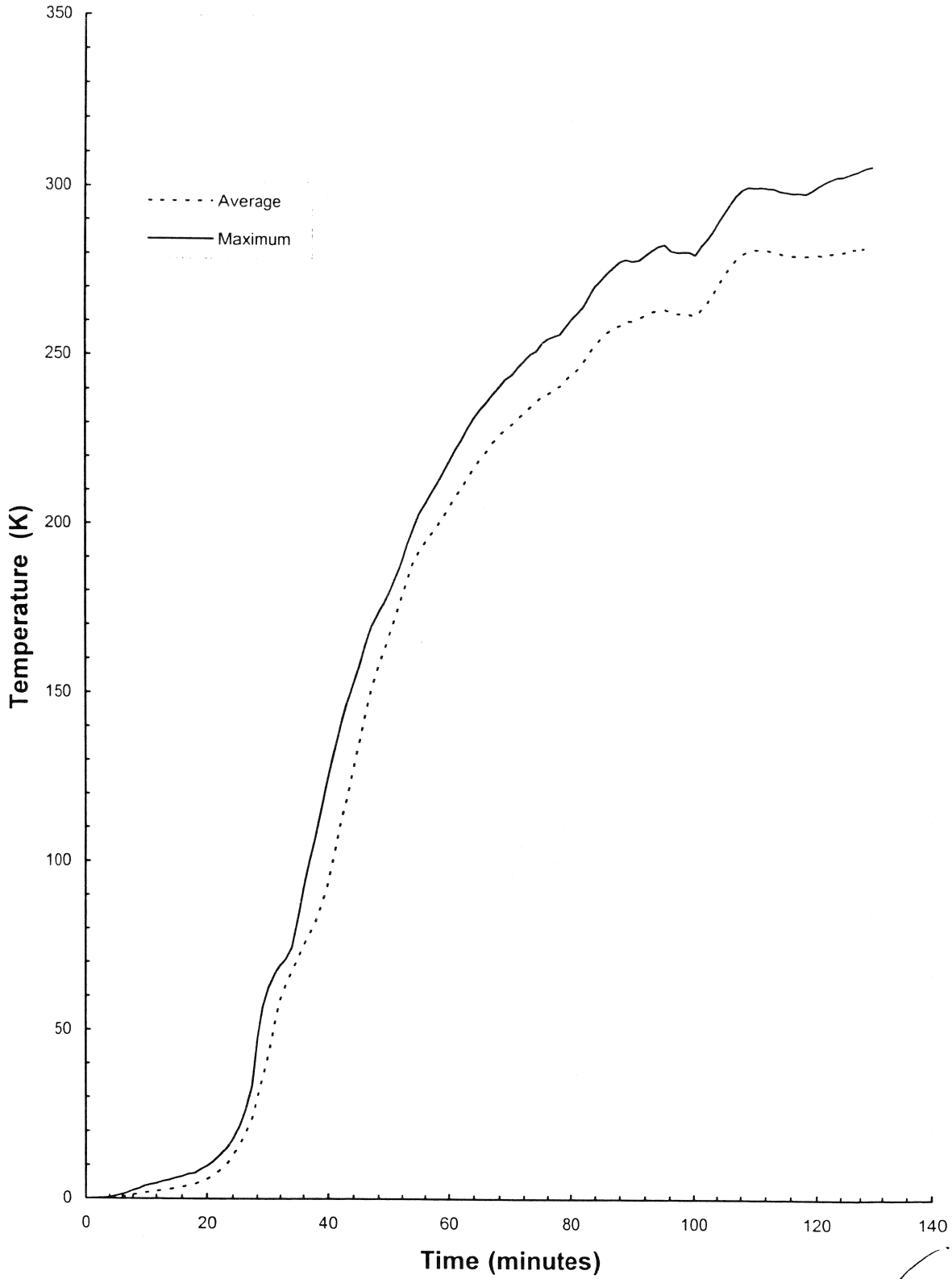
Figure 1 Furnace Temperature



JAH

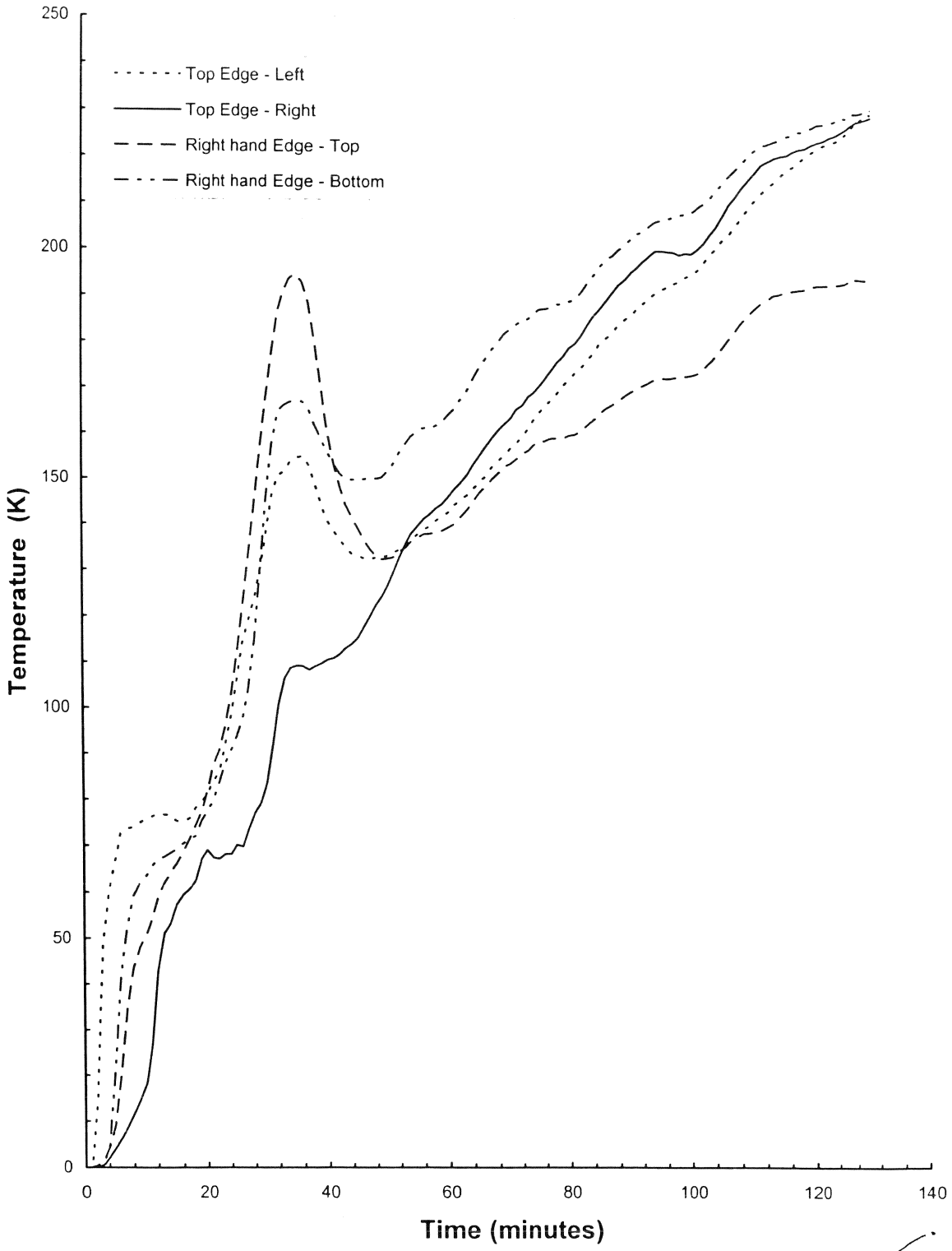
MG

Figure 2 Face Temperatures



JAH MG

Figure 3 Panel Edge Temperatures



JAH MG

Figure 4 Deflections on the Vertical Centreline

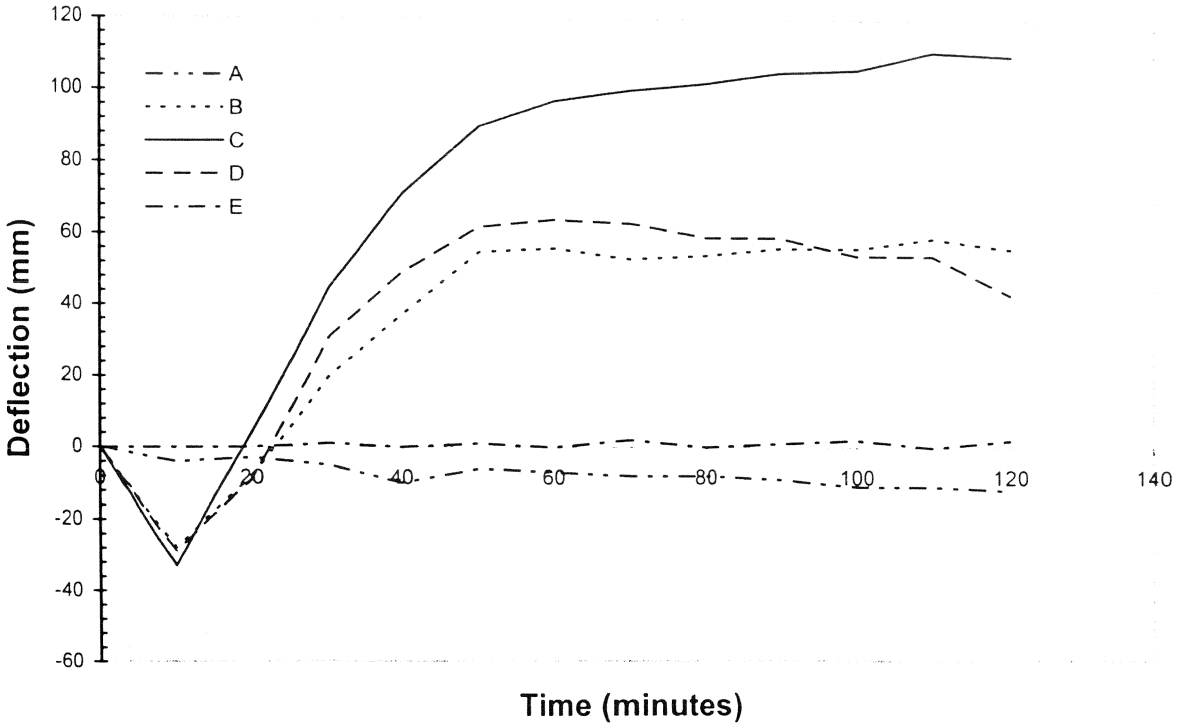
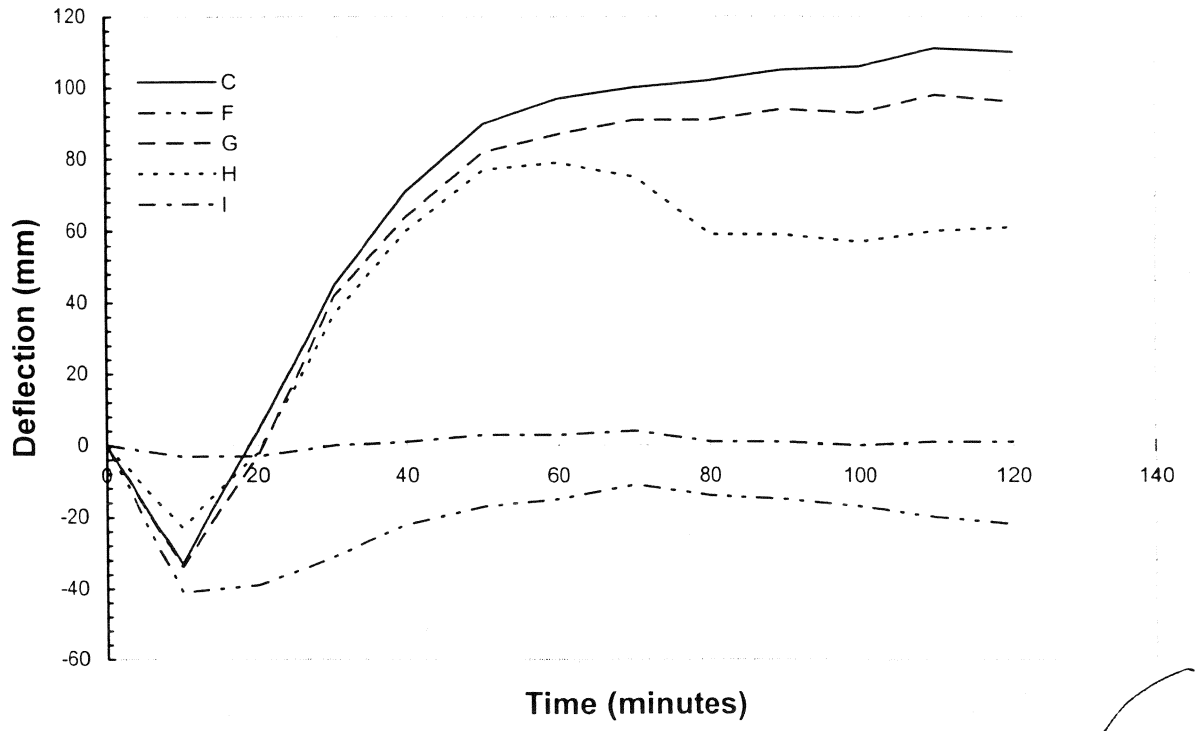


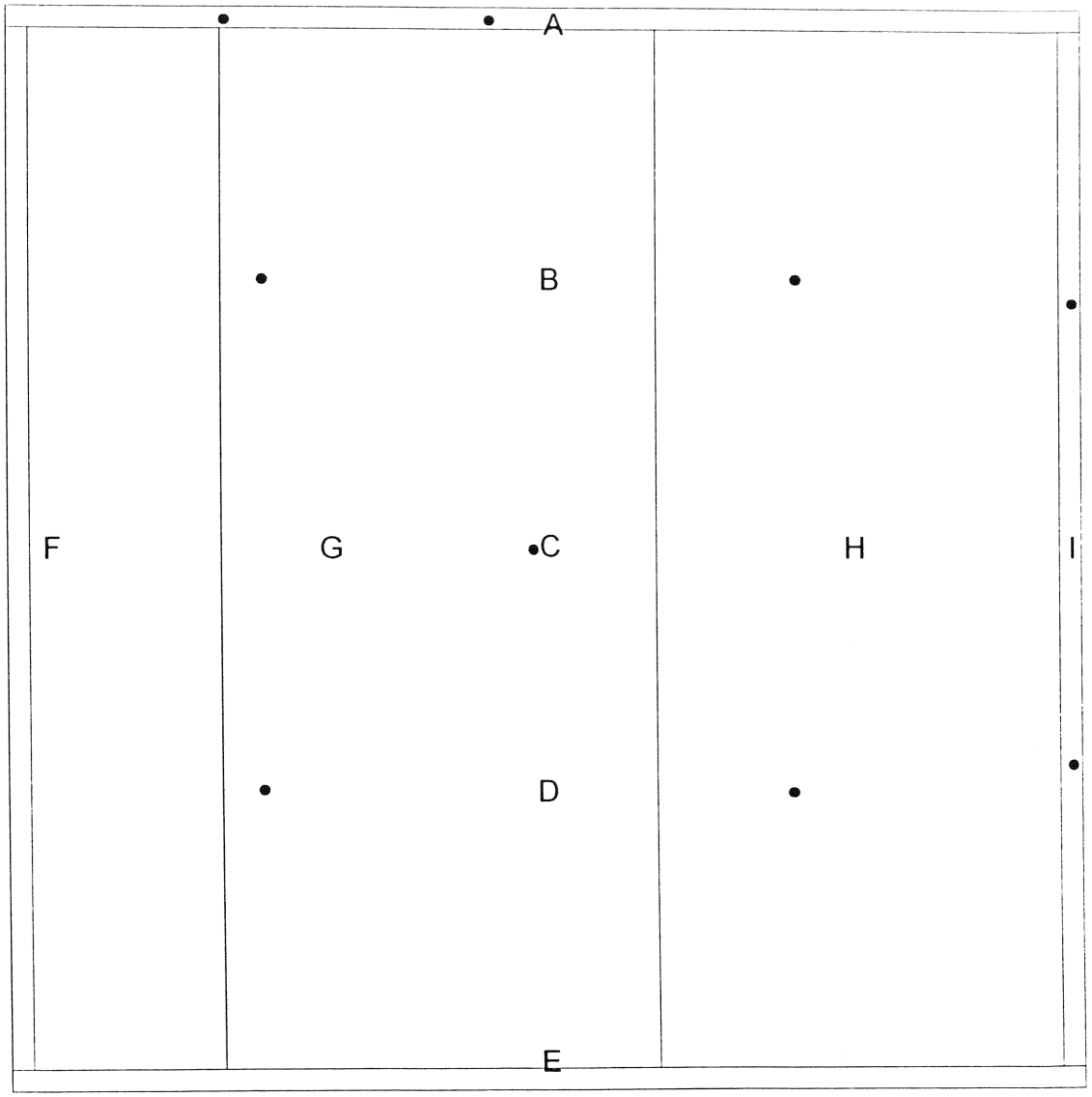
Figure 5 Deflections on the Horizontal Centreline



JAH

MG

Figure 6 Specimen Layout



• = Thermocouple

JAH

MG