TEST REPORT

WARRES No.R13588
FIRE RESISTANCE TEST IN ACCORDANCE
WITH BS 476: PART 22: 1987, ON A
STEEL FACED PLASTERBOARD PARTITION

THE PROFESSIONALS IN FIRE SAFETY

Warrington FIRE research
CONSULTANCY • TESTING

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2 6 AUG. 1997

TEST REPORT

TEST SPONSOR : MAARS PRODUKTIE BV, PO Box 1000, NL-3840 BA Harderwijk, Netherlands.

SUMMARY : A single specimen of a 'Maars Micro-line 82mm' steel faced plasterboard partition has been subjected to a test in accordance with BS 476: Part 22: 1987, Clause 5 to determine its fire resistance performance.

The partition had overall dimensions of 2970mm height x 2960mm width by 83mm thickness and incorporated 4 No. steel faced plasterboard panels either side of a steel framework and a mineral wool core. The head of the specimen was lined with a 57mm leg, steel U-channel comprising two steel L-profiles connected by spot-welded steel strips and partly infilled with plasterboard strips. Additional plasterboard strips, 55mm x 12.5mm thick, were located between the studs at the head of the partition and glued to the internal flange on both sides of the head track. The base of the specimen was lined with a 70mm leg steel U-channel; an adjustable, 45mm leg with return, steel U-channel and plasterboard infill. The restrained edge of the specimen comprised two steel L-profiles connected by spot-welded steel strips, plasterboard infill and a 56mm wide, steel C-stud. The unrestrained edge of the specimen comprised a 56mm wide steel C-stud. The steel faced, gypsum panels were attached to each face, supported along their horizontal edges and fixed along their vertical edges, into a steel clamp stud. Down the full vertical height, each side of the clamp studs were fixed two strips of plasterboard. The void of the partition was infilled with nominally 35 kg/m^3 density mineral fibre insulation.

The specimen satisfied the performance requirements specified in Clause 5 of BS 476: Part 22, for the following periods:

Integrity : 70 minutes (maintained)
Insulation : 63 minutes

The test was discontinued after a period of 70 minutes.

DATE OF TEST : 26 June 1997.

REPORT ISSUED : 8 August 1997

CONTENTS

1. PURPOSE OF THE TEST

1.1 To determine the fire resistance of a specimen of a steel faced plasterboard partition in accordance with BS 476: Part 22: 1987.

2. INTRODUCTION

2.1 The partition was tested in accordance with Clause 5 of BS 476: Part 22: 1987 'Methods for determination of the fire resistance of non-loadbearing elements of construction'. This test report should be read in conjunction with that Standard and with BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)'.

2.2 The partition was symmetrical.

2.3 The specimen was judged on its ability to comply with the performance criteria for integrity and insulation, as required by BS 476: Part 22: 1987, Clause 5.

2.4 Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group has identified a number of such areas and has agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Group. Where such Resolutions are applicable to this test they have been followed.

2.5 The test was conducted on the 26 June 1997, at the request of Maars Produktie BV, the sponsor of the test.

2.6 The test was witnessed by Mr. J. Joseph, a representative of the sponsor of the test.

3. TEST SPECIMEN CONSTRUCTION

3.1 A comprehensive description of the test construction is given in Annex A. The description is based on a detailed survey of the specimen and information supplied by the sponsor of the test.

3.2 The specimen was stated to have been manufactured by the sponsor.

3.3 The specimen was supplied as components by the sponsor during week commencing 23 June 1997. Warrington Fire Research Centre was not involved in any selection or sampling procedures of the specimen or any of the components of the partition.

3.4 The partition was installed into a 3m x 3m internal opening of a steel reinforced concrete restraint frame. Installation was conducted by representatives of the sponsor during week commencing 23 June 1997.

4. INSTRUMENTATION AND MEASURING EQUIPMENT

4.1 The instrumentation was provided in accordance with the requirements of the Standard.

4.2 Nine thermocouples distributed over a plane 100 mm from the surface of the test construction, were provided to monitor the temperature of the furnace atmosphere.

4.3 Pressure sensors were provided within the furnace to monitor the furnace pressure.

4.4 Thermocouples were provided to monitor the temperature of the unexposed face of the specimen as follows:

4.4.1 At five positions, one approximately at the centre of the partition and one at approximately the centre of each quarter section of the partition. (Thermocouples 10 to 14)

4.4.2 At five positions on the surface of the partition, one at approximately mid-height on the restrained vertical edge, one at the top of the central vertical joint, one at the approximate mid-point at the top of the middle panel, one at the head above the right hand side vertical joint, one at approximately two-third height on the right hand side vertical joint (Thermocouples 15 to 19)

4.4.3 The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1 of Annex A.

4.5 A roving thermocouple was available to measure temperatures on the unexposed surface of the specimen at any position which might appear to be hotter than temperatures indicated by the fixed thermocouples.

4.6 Cotton pads and gap gauges were available to evaluate the impermeability of the specimen to hot gases.

5. TEST PROCEDURE

5.1 The test was conducted in accordance with the procedure specified in BS 476: Part 22: 1987.

5.2 The furnace was controlled so that its mean temperature complied with the requirements of BS 476: Part 20: 1987, Clause 3.1.

5.3 After the first five minutes of testing and for the remainder of the test, the furnace pressure was controlled so that it complied with the requirements of BS 476: Part 20: 1987, Clause 3.2.2. The calculated pressure differential relative to the laboratory atmosphere at the top of the specimen was 17 (±2) Pa.

5.4 Throughout the test the temperatures indicated by the thermocouples provided to monitor the furnace and the specimen were continuously monitored and were recorded at one minute intervals.

5.5 The thermocouples referred to in 4.2 were used to determine the mean furnace temperature.

7.1.2 Insulation - It is required that the mean temperature rise of the unexposed surface shall not be greater than 140°C and that the maximum temperature rise shall not be greater than 180°C. Insulation failure also occurs simultaneously with integrity failure. These requirements were satisfied for a period of 63 minutes. Failure was due to a temperature rise greater than 180°C being recorded, by a surface thermocouple at the top of the central vertical joint.

8. CONCLUSIONS

8.1 A specimen of a 'Maars Micro-line 82mm' steel faced plasterboard partition with a mineral wool core has been subjected to a fire resistance test in accordance with BS 476: Part 22: 1987, Clause 5.

8.2 The specimen satisfied the performance requirements specified in the Standard for the periods stated below:

Integrity	: 70 minutes (maintained)
Insulation	: 63 minutes

The test was discontinued after a period of 70 minutes.

9. LIMITATIONS

9.1 The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.

9.2 The test results relate only to the specimen tested. Appendix A of BS 476: Part 20: 1987 provides guidance information on the application of fire resistance tests and the interpretation of test data. Application of the results to specimens of different dimensions or incorporating different components should be the subject of a design appraisal.

10. REVIEW

10.1 The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

Responsible Officer

D. PIRKIS
Technical Assistant

Approved

N.T. ROWAN
for R.J. WILLIAMS
Manager, Redhill Centre
For and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date : 8 August 1997.

Warrington FIRE research CONSULTANCY • TESTING

5.6 The thermocouples referred to in 4.4.1 were used to determine the mean temperature of the unexposed surface of the specimen and compliance with the mean unexposed face temperature rise criterion of the Standard.

5.7 The thermocouples referred to in 4.4.1 and 4.4.2 were used to determine compliance with the maximum unexposed face temperature rise criterion of the Standard. The roving thermocouple was also used, if considered appropriate, to determine compliance with this criterion.

5.8 The cotton pads and gap gauges were used, if considered appropriate, to determine compliance with the integrity criterion of the Standard. The occurrence of any sustained flaming on the unexposed surface was also recorded to determine compliance with this criterion.

5.9 The deflection of the partition at specified positions was measured at selected times during the test.

6. TEST DATA AND INFORMATION

6.1 The following data, which was recorded during the test, is given in Annex B:

6.1.1 Mean furnace temperature, together with a comparison with the specified temperature/time relationship specified in the Standard.

6.1.2 The mean and maximum temperatures recorded by the thermocouples fixed to the unexposed surface of the specimen.

6.1.3 The internal furnace pressure as measured 600 mm from the top of the furnace.

6.1.4 The deflection of the partition at specified positions.

6.2 A summary of the observations made on the general behaviour of the specimen is given in Annex C.

6.3 Photographs taken of the specimen before, during and after the test are given in Annex D.

6.4 The ambient air temperature in the vicinity of the test construction was 15°C at the start of the test with very little variation during the test.

6.5 The test was discontinued after a period of 70 minutes at the request of the sponsor.

7. EVALUATION AGAINST THE PERFORMANCE CRITERIA

7.1 The performance of the specimen was judged against the following criteria of BS 476: Part 20: 1987:

7.1.1 **Integrity** - It is required that there is no collapse of the specimen, no sustained flaming on the unexposed surface and no loss of impermeability. These requirements were maintained for 70 minutes ie for the duration of the test.

ANNEX A

SPECIFICATION OF TEST CONSTRUCTION

SPECIFICATION OF THE TEST CONSTRUCTION

1. GENERAL DESCRIPTION

The specimen was of a 'Maars Micro-line 82mm' steel faced plasterboard partition with a mineral wool core. It was built into a 3m x 3m internal opening of a steel reinforced concrete restraint frame.

2. SCHEDULE OF COMPONENTS

(Refer to Figures 1 to 3)
(All values are nominal unless stated otherwise)
(All references are as stated by the sponsor)

1. Panels: 0.8mm thick steel panels, overall dimensions 2910 mm high x 900 mm wide, with an inner layer of 12.5mm thick plasterboard, type "LAFARGE GIPS-DZ-DIN18180 DIN 4102 23/3/97 SP41LA25 GKB12.5 A2 W FMPA BW 04:09", adhered to the steel using a PVB based glue. Vertical edges of the panels comprised a profiled flange which clamped into the flange of the clamp studs on both sides of the partition. A 20mm gap was left between the flange and plasterboard inner layer over the entire vertical height of the panels to accommodate the clamp stud. The top and bottom edge of the panels possessed a 10mm return to accommodate fixings to the head and floor track. The plasterboard inner layer was also absent in the top and bottom 10mm of the panels.

2. Insulation Core: 1200mm x 600mm x 40mm thick Rockwool slabs, 'type 201'; measured density 32.3kg/m³; extending in, and supported by, the C-studs and clamp studs; adhered to the back of the wallboard on the fire side.

3. Clamp studs: steel studs with overall dimensions 32mm x 80mm x 0.9mm thick forming the framing for the panels; slotted into steel stud extensions at the head and base to accommodate positioning in the head and floor track. The panel edges are located into the gap within the flange of the clamp stud. The stud is made up of two steel sections, spot-welded together. The web of the stud is slotted over its full height and infilled both sides with 1 No. 42mm x 15mm thick plasterboard strip. An additional plasterboard strip, 52mm x 12.5mm thick was also located each side of the stud down the full vertical height. The plasterboard strips were clamped to the stud both sides, via 30mm x 52mm x 1mm thick steel holding straps screwed into the stud using 59mm long self-drilling cross-head screws at approximately 470mm centres.

4. Steel stud extension: comprising a U-section, (27mm flange x 43mm web), with a locating slot part way down both flanges, and an integral foot, 52mm x 60mm x 1.6mm thick. The foot section was located in the perimeter head/base track and the clamp stud pushed into the locating slots of the U-section.

5. Galvanised steel C-studs: 36mm x 56mm x 34mm x 0.5mm thick and a 7mm return, overall dimensions, used as the vertical perimeter framing for the partition system; two service cut-outs at 300mm centres and with knurled flanges. At the free edge, the panels were screw fixed, each side, to the C-stud at a minimum of 200mm and an average of 300mm centres using drywall screws. At the restrained edge the C-stud was screw fixed through the plasterboard layers and wall track, into the restraint frame.

6. Steel U-channel (floor track): overall dimensions 52mm x 70mm x 1.5mm thick, used as a perimeter channel along the bottom edge of the partition system; bedded on three layers of Promat board. Infilled with one strip of 9.5mm thick plasterboard and secured to the test frame with NS x 80Z Fischer frame fixings.

SPECIFICATION OF THE TEST CONSTRUCTION - Continued

7. Adjustable floor track: comprising a U-channel of dimensions 55mm x 45mm x 1.25mm thick with an integral L-shaped flange each side; sitting within the floor channel along the bottom edge of the partition; slots into the floor U-channel and infilled with 3 No. layers of 12.5mm thick plasterboard to create an adjustable floor track. The bottom edge of the steel faced, plasterboard panels sat on the L-shaped flange, both sides of the adjustable floor track, and were screw fixed through the track into the returned flange at the base of the steel faced, plasterboard panels.

8. Steel head track: comprising 2 No. L-section angles of dimensions 57mm x 20mm x 0.5mm thick, connected by strips of galvanised steel, spot-welded to each angle; used as the perimeter channel along the top edge of the partition system. Infilled with 3 No. layers of 12.5mm thick plasterboard which were secured by 45mm x 20mm x 1mm thick metal strips, fixed through the plasterboard and track into the restraint frame using 60 x 6mm diameter screws. The track was secured to the test frame with 40 x 5mm diameter screws through the L-section angles.

9. Steel retaining brackets:50mm x 25mm x 1mm thick; provide support for hanging the steel faced, plasterboard panels along the top edges. The brackets were screw fixed to the flange each side of the head track using 2 No.18mm long self-drilling screws and located at 480mm centres.

10. Steel wall track: comprised 2 No. L-section angles of dimensions 23mm x 30mm x 0.5mm thick, connected via 10mm wide galvanised steel strips, spot-welded to the angles at approximately 780mm centres. Infilled with 2 No. layers of 12.5mm thick plasterboard and a C-stud; used as the vertical channel to the restraint frame along the fixed edge of the partition. The wall track was secured to the test frame with N6 x 60Z Fischer frame fixings through the L-section angles. At the fixed edge, the panels were clamped between an internal C-stud 7mm x 36mm x 56mm x 34mm x 0.5mm thick (bedded on 2 No. 12.5mm thick plasterboard strips) and the flange of the wall track. A C-stud also occurred at the unrestrained edge of the partition.

11. Plasterboard strips:12.5mm thick x 50mm wide strips, used as a channel infill at the head, base and fixed edge of the partition; 3 No. strips in the head and floor track and 2 No. strips in the wall track.

12. Promat boards: the floor track was bedded on three layers of 15mm thick Promat Calcium Silicate board; glued to each other and the test frame, using Promafix K84 adhesive.

13. Foam tape: 2 No.3mm thick by 9mm wide self-adhesive strips around the periphery of the partition, except the free edge, sandwiched between the steel tracks and the restraint frame/Promat wallboard.

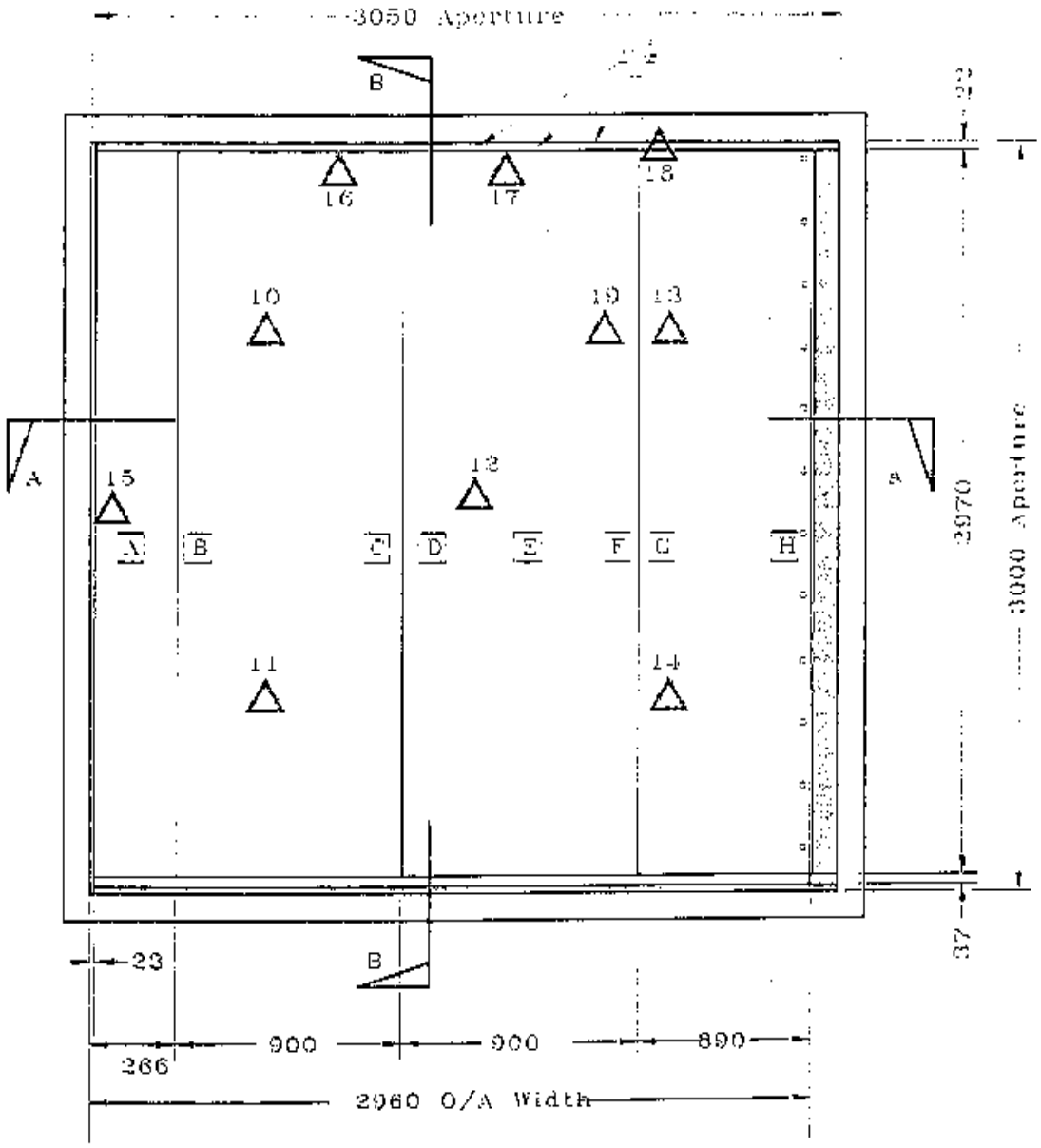
14. Screws: 3 No. x 18mm long, fixing the head of the middle right panel on the non-fire side to the head track at approximately 250mm centres.

15. Promafix K84 adhesive: used as a perimeter sealant at the base and head of the partition.

16. Folded metal strips, approximately 25mm wide x 25mm high; 2 No. fixed at 480mm centres to the base of one panel, on the fire side, using 18mm long self-drilling screws; returned edge hooks over the floor track.

17. Plasterboard strips, 55mm x 12.5mm thick, located between the studs at the head of the partition, glued to the internal edge of the flange of the head track, both sides of the partition, using Promafix K84 adhesive.

GENERAL ELEVATION, NON FIRE SIDE.



△ Thermocouple Positions

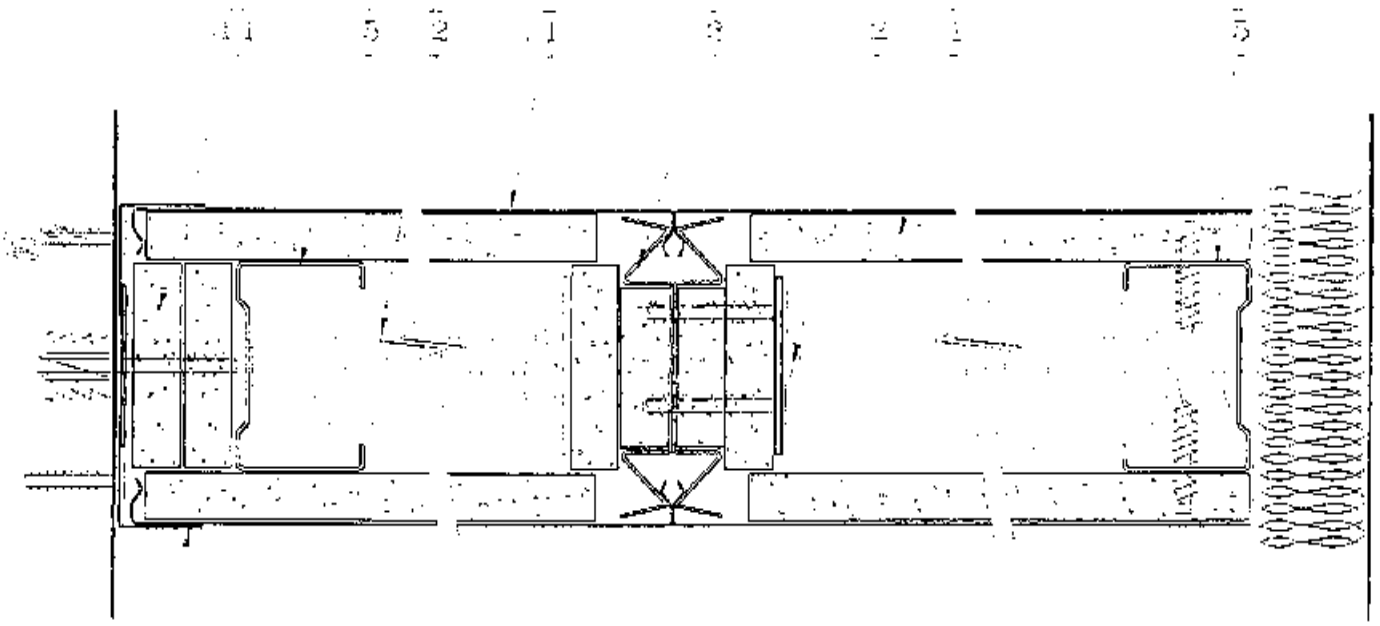
[D] Deflection Measurement Positions

Do not scale
All dims in mm

Figure 1

HORIZONTAL SECTION

FIRE SIDE

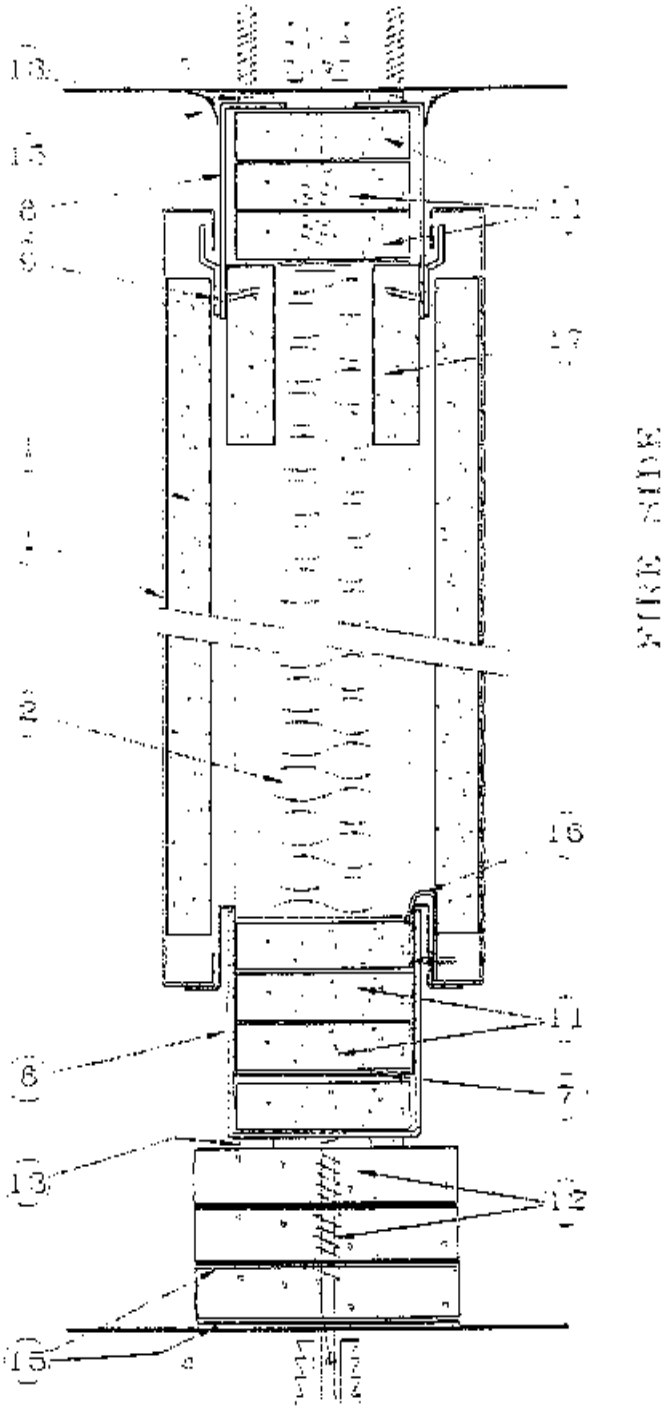


Section at 'A' 'A'

Do not scale

Figure 2

VERTICAL SECTION



Section at 'B' 'B'

Do not scale

Figure 3

ANNEX B

DATA RECORDED DURING TEST

FURNACE TEMPERATURE/TIME CURVES

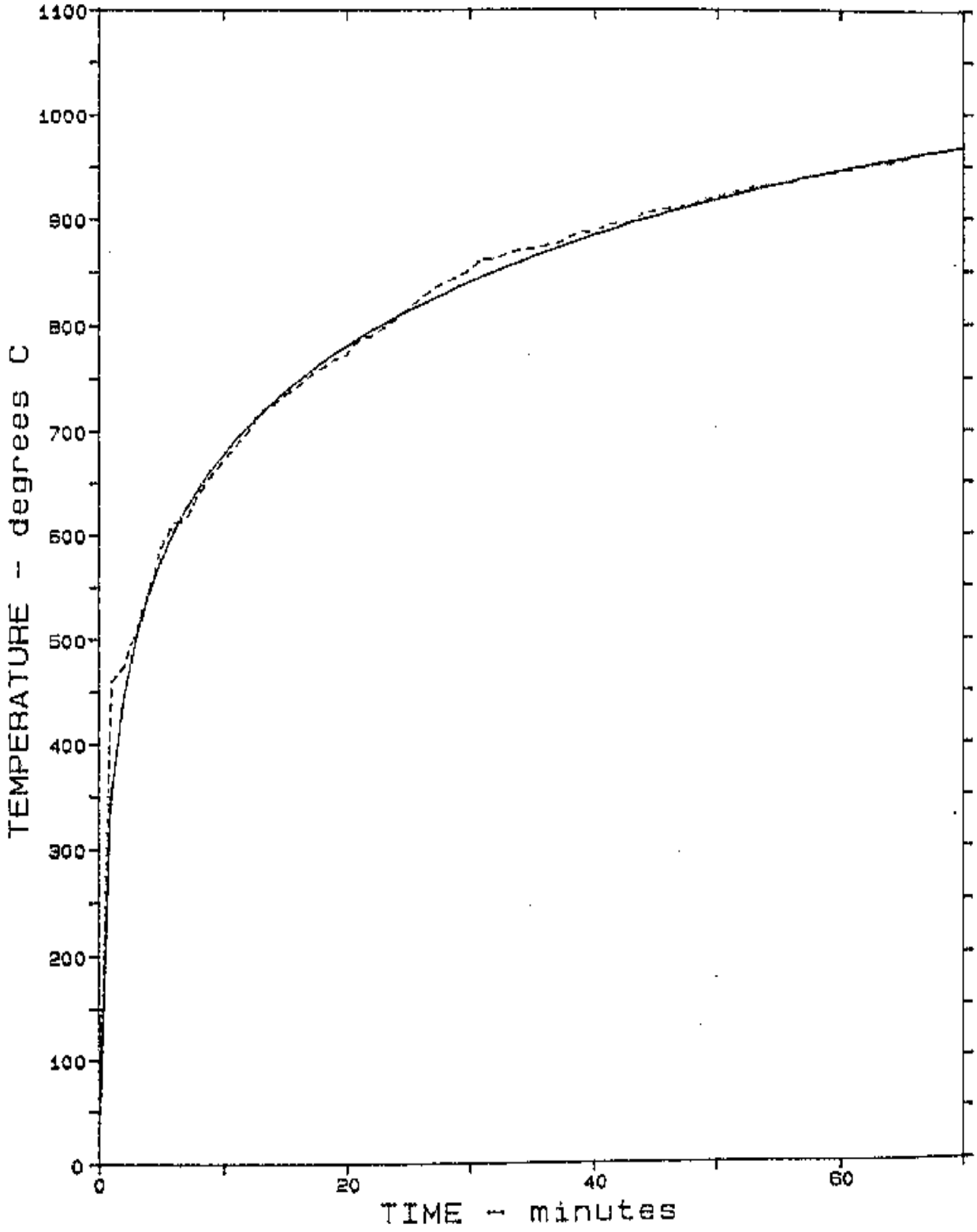


Figure 4

TABLE 1

Variation between specified and actual time temperature curve.

TIME mins	B.S.476 FURNACE TEMP. Deg C	ACTUAL FURNACE TEMP. Deg C	AREA UNDER STANDARD CURVE Deg C min	AREA UNDER ACTUAL CURVE Deg C min	PERCENTAGE DIFFERENCE	PERCENTAGE TOLERANCE + or -
0	20	22				
1	349	460				
2	445	476				
3	502	511				
4	544	546				
5	576	590				
6	603	612				
7	626	617				
8	645	640				
9	663	658				
10	678	673	5302	5458	2.9	15
12	705	701				
14	728	726				
16	748	744				
18	766	761				
20	781	774				
22	796	791				
24	809	807				
26	820	827				
28	831	842				
30	842	854	15488	15473	-0.1	10
35	865	873				
40	885	888				
45	902	907				
50	918	921				
55	932	933				
60	945	945				
65	957	956				
70	968	968	36545	36670	0.3	5

SURFACE THERMOCOUPLE TEMPERATURE/TIME CURVES

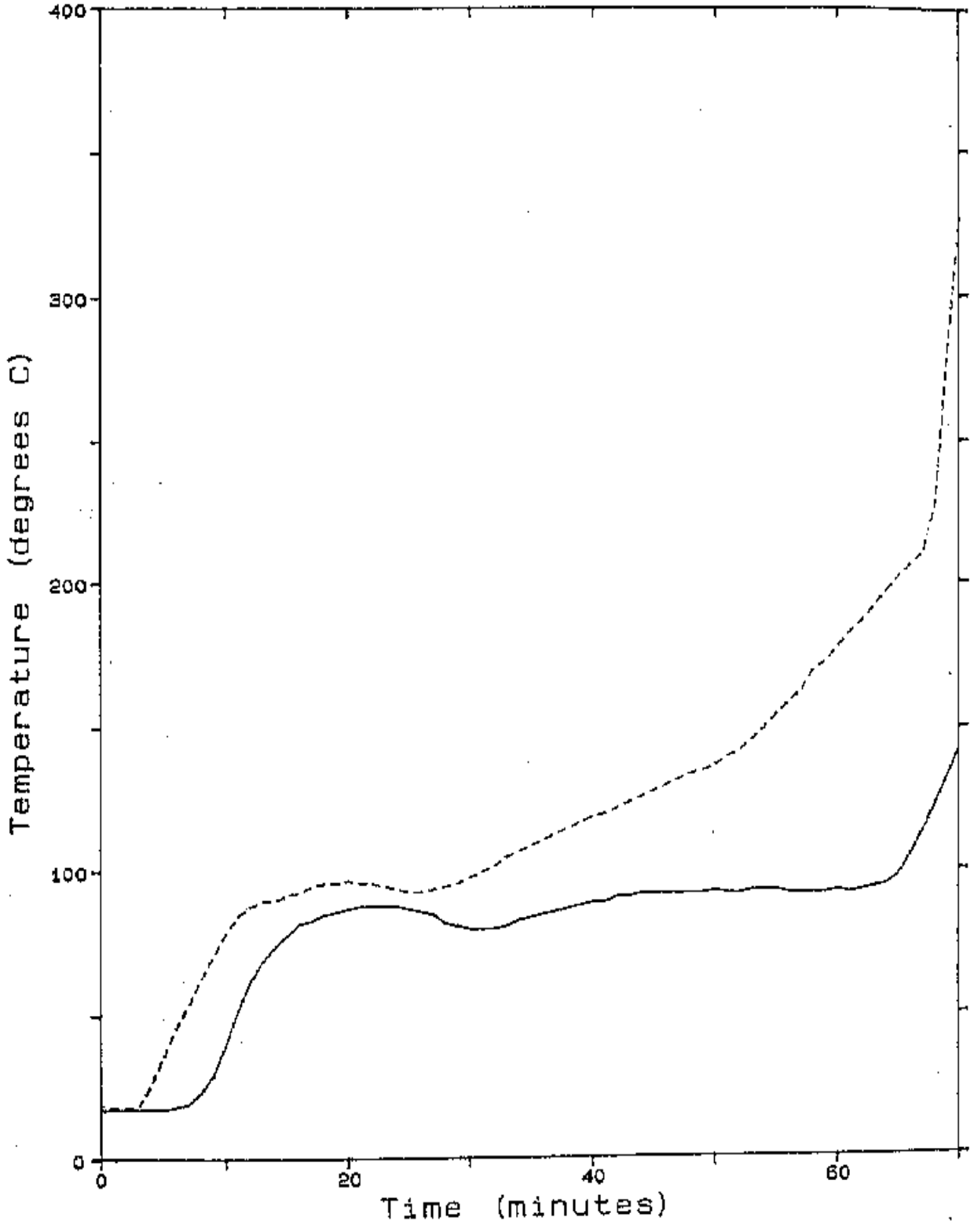


Figure 5

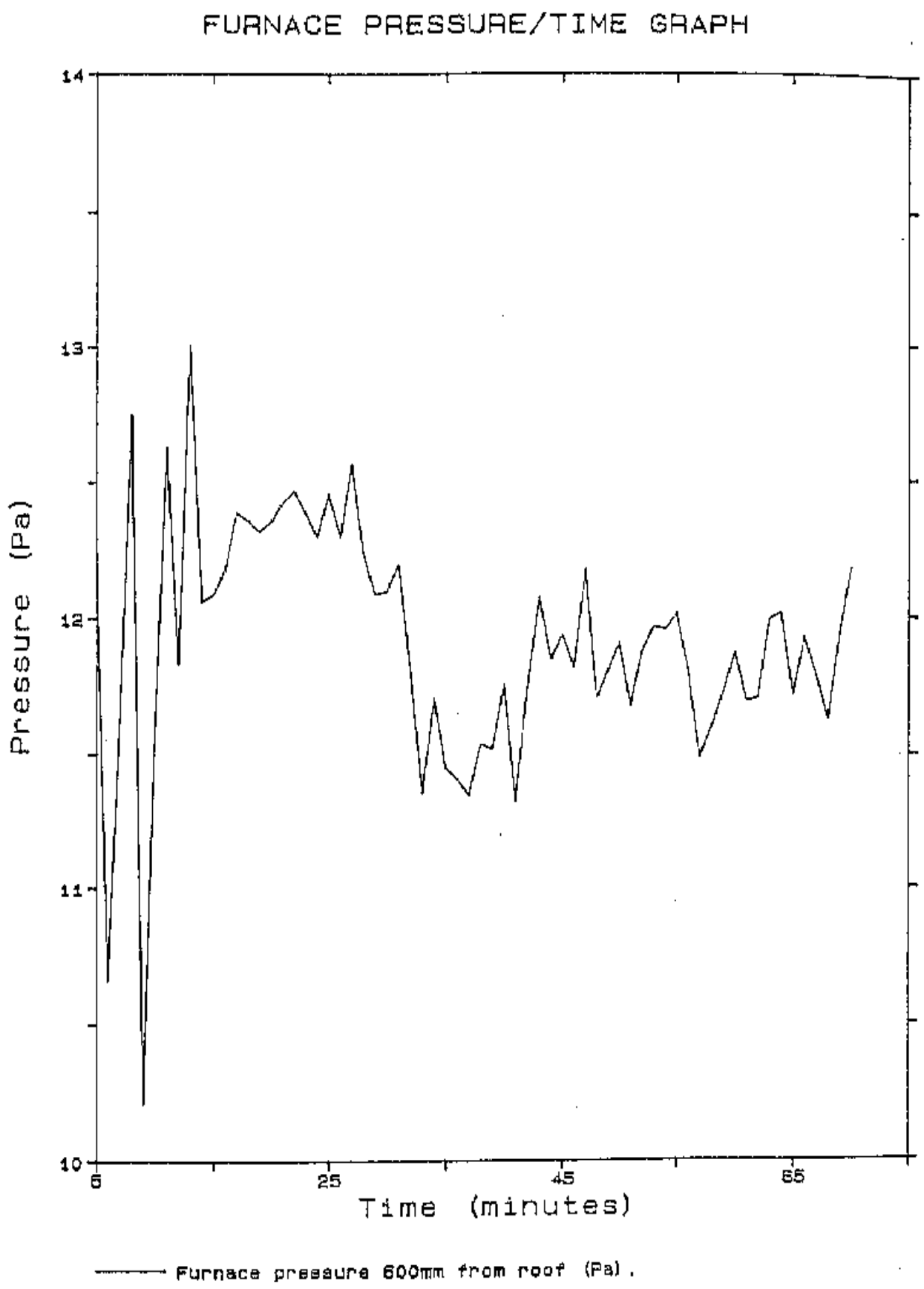

FURNACE PRESSURE/TIME GRAPH
Pressure (Pa)
14
13
12
11
10
6
25
45
65
Time (minutes)
Furnace pressure 600mm from roof (Pa).

Figure 6

TABLE 2

Deflection of the partition during testing

Time (minutes)	Deflection measurements at points							
	A	B	C	D	E	F	G	H
0	0	0	0	0	0	0	0	0
10	5	31	48	49	44	40	39	5
20	9	74	96	98	95	93	89	5
29	-	105	124	125	119	117	113	11
40	-	109	123	124	118	114	110	18
50	-	110	119	121	114	112	107	19
60	-	109	117	119	111	110	107	22

A negative value indicates deflection away from the furnace

ANNEX C

OBSERVATIONS MADE DURING THE TEST

OBSERVATIONS MADE DURING THE TEST

The following observations were made during the test by Warrington Fire Research Centre

E - Observations from exposed side
U - Observations from unexposed side

Panel (A) - Panel adjacent to the fixed edge.
Panel (B) - Middle left panel as viewed from non-fire side.
Panel (C) - Middle right panel as viewed from non-fire side.
Panel (D) - Panel adjacent to the free edge.

Time			Observations
mins	secs		
00	00		The test is started.
06	00	U	Smoke/steam is emitting from the top edge of the panels and along the free edge.
07	00	U	Smoke/steam is emitting from the vertical joint in the centre of the partition and the bottom edge of panel B.
08	00	U	Smoke is starting to emit from both the left and right hand side vertical joints, whilst the emission of smoke from the bottom of panel B has ceased.
09	00	U	Moisture can be seen leaking from the bottom edge of the panels.
12	00	U	Smoke/steam emission is increasing from the vertical joints and head of the partition.
13	00	U	Smoke is emitting from the bottom corners of the partition.
15	00	U	Discolouration is evident along the head track.
16	00	U	A gap is starting to develop along the vertical joint between panels C and D, which is approximately 4mm wide at the mid-height position.
17	00	U	Displacement of panel A away from the perimeter channel is evident along the fixed edge. Localised buckling of the surface is evident on panel A around the position of thermocouple 15, which has created a 7mm wide gap between the panel face and the perimeter channel.
23	00	U	The gap seen at 16 minutes has increased and is now approximately 5mm wide at the mid-height position.
24	00	U	The gap seen at 17 minutes is increasing, with the panel face disconnecting from the perimeter channel and inner layer of plasterboard, and bowing outwards by a distance of 25mm.
26	00	U	Localised distortion is evident at the free edge.

OBSERVATIONS MADE DURING THE TEST - Continued

Time			Observations
mins	secs		
28	00	U	Billowing smoke is emitting from the gap seen at 24 minutes. A discolouration spot is forming at the bottom right corner of panel B.
31	00	U	A gap is developing along the vertical joint between panels B and C, which is approximately 4mm wide at the mid-height position.
37	00	U	The plasterboard layer within the gap seen at 24 minutes, is starting to disconnect from the perimeter channel.
41	00	U	Discolouration is starting to occur at the top of the vertical joints.
43	00	U	Hissing/spitting noises can be heard at the bottom edge of the specimen. A discolouration spot is evident at the bottom left corner of panel C.
58	00	U	Localised distortion is occurring at the top left corner of panel C due to expansion of the panels at the head of the partition. Glowing is visible within the gap in the right hand side vertical joint at the mid-height position.
62	00	U	Discolouration is increasing along the top half of the central and right hand side vertical joints
63	00	U	Discolouration is starting along the bottom edge of panel D. A temperature rise greater than 180 deg C is recorded by thermocouple No. 16 at the top of the central vertical joint. Insulation failure is deemed to have occurred.
65	00	U	Localised buckling is occurring across the panel face at the top of panel B and a discolouration stain is spreading across the surface at this position.
67	00	U	A discolouration stain is evident on panel A, adjacent to the gap seen at 24 minutes.
68	00	U	Discolouration is occurring on the perimeter channel at the fixed edge of the partition. Charring/glowing of the plasterboard inner layer is visible within the gap seen at 24 minutes.
70	00		The test is terminated at the request of the sponsor.

ANNEX D

PHOTOGRAPHS

PHOTOGRAPHS

Plate 1 - Exposed surface of the partition prior to testing.

Plate 2 - Unexposed surface of the partition after 20 minutes of testing.

Plate 3 - Unexposed surface of the partition after 40 minutes of testing.

Plate 4 - Unexposed surface of the partition after 61 minutes of testing.

Plate 5 - Unexposed surface of the partition at the end of the test.

Plate 6 - Close up view of the exposed surface of the partition at the end of the test, looking at the head track.

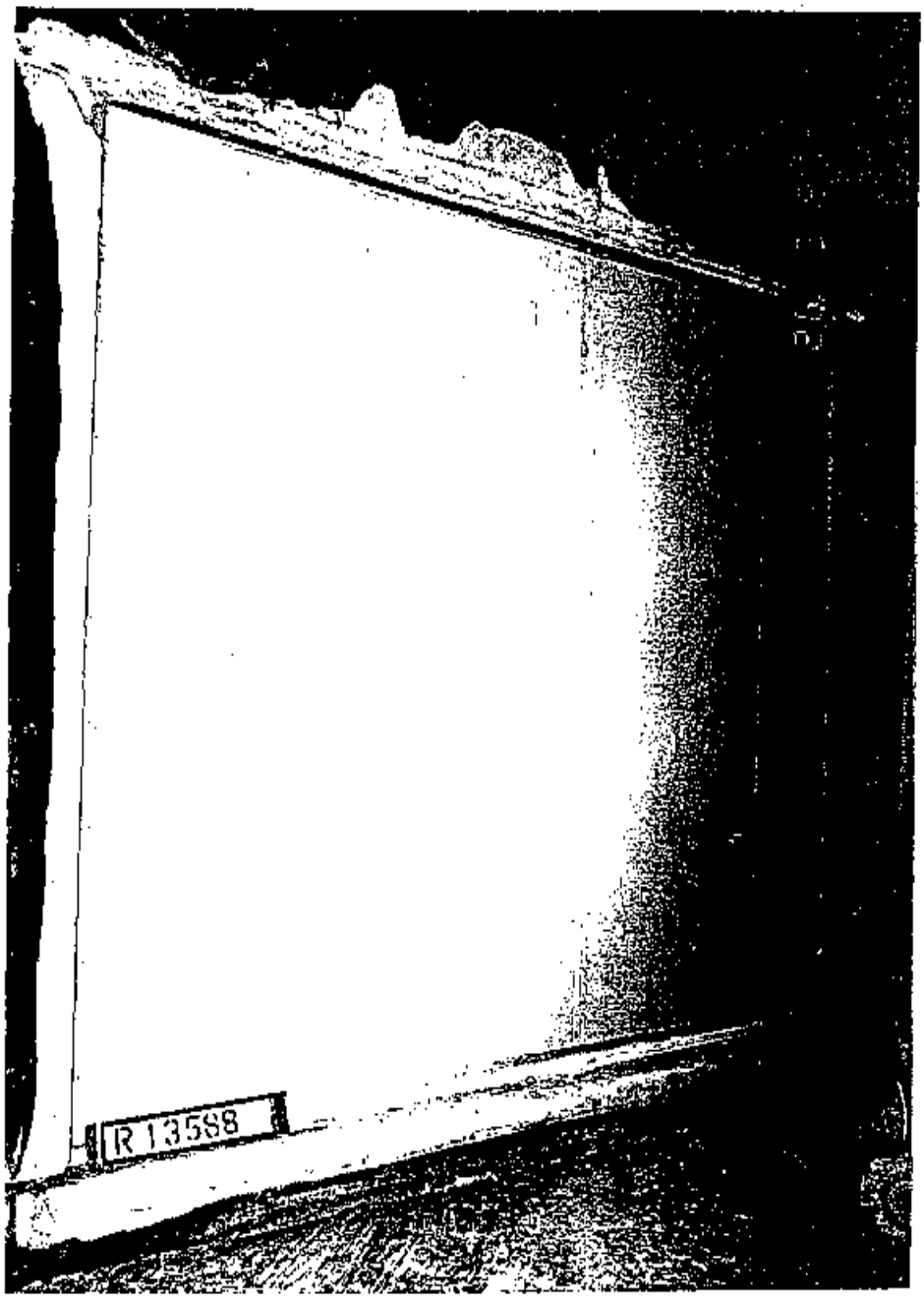


Plate 1

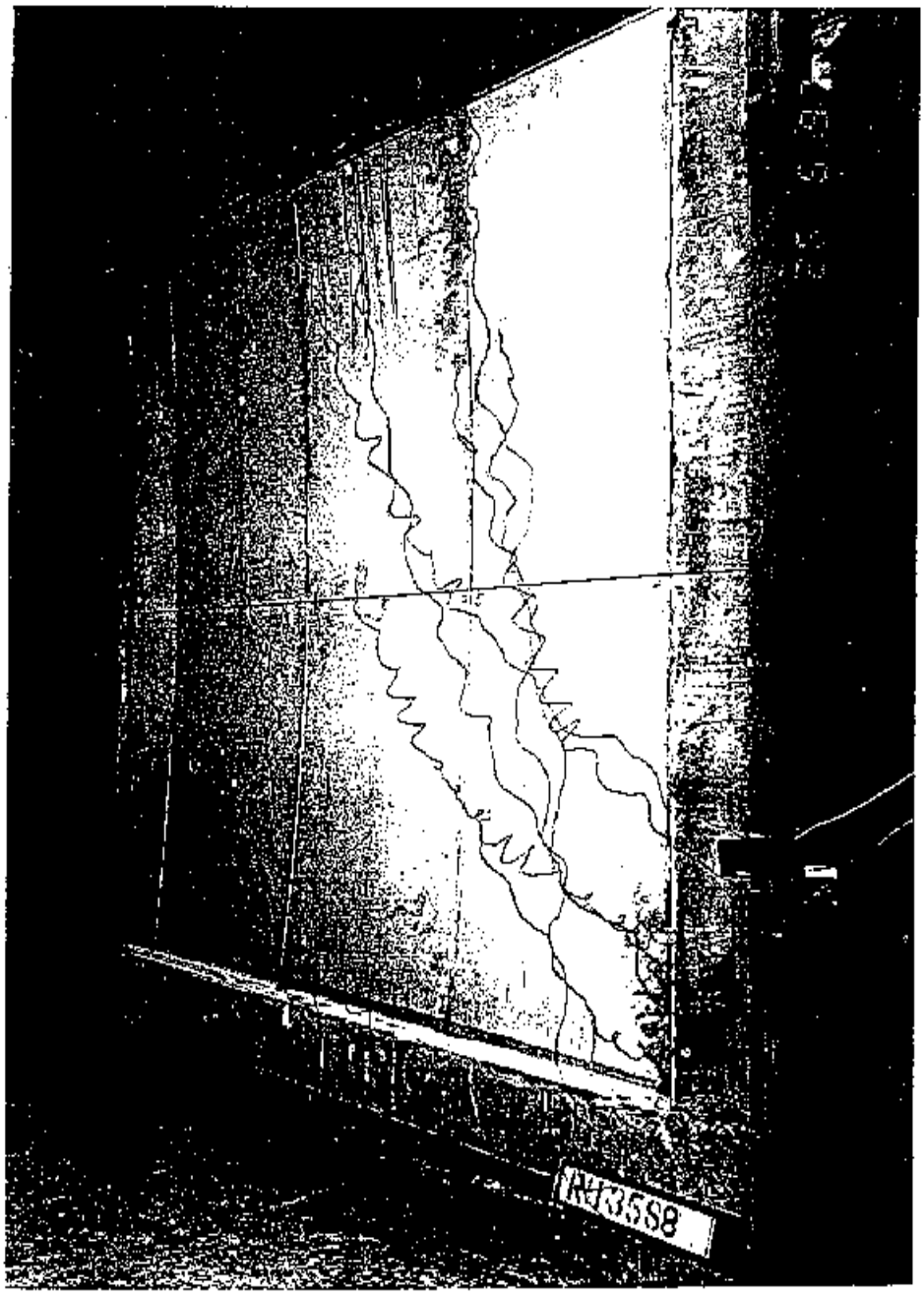
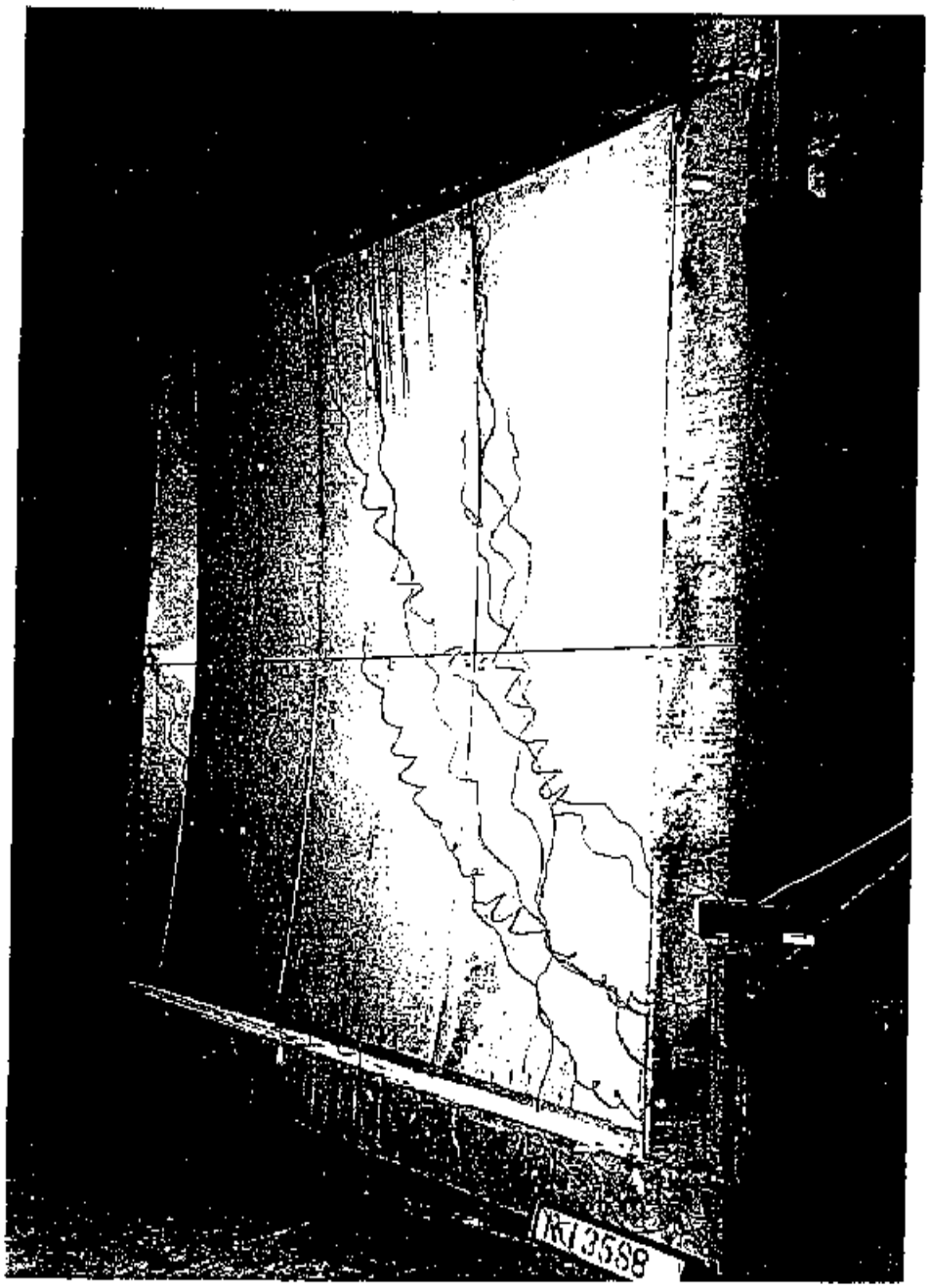


Plate 2



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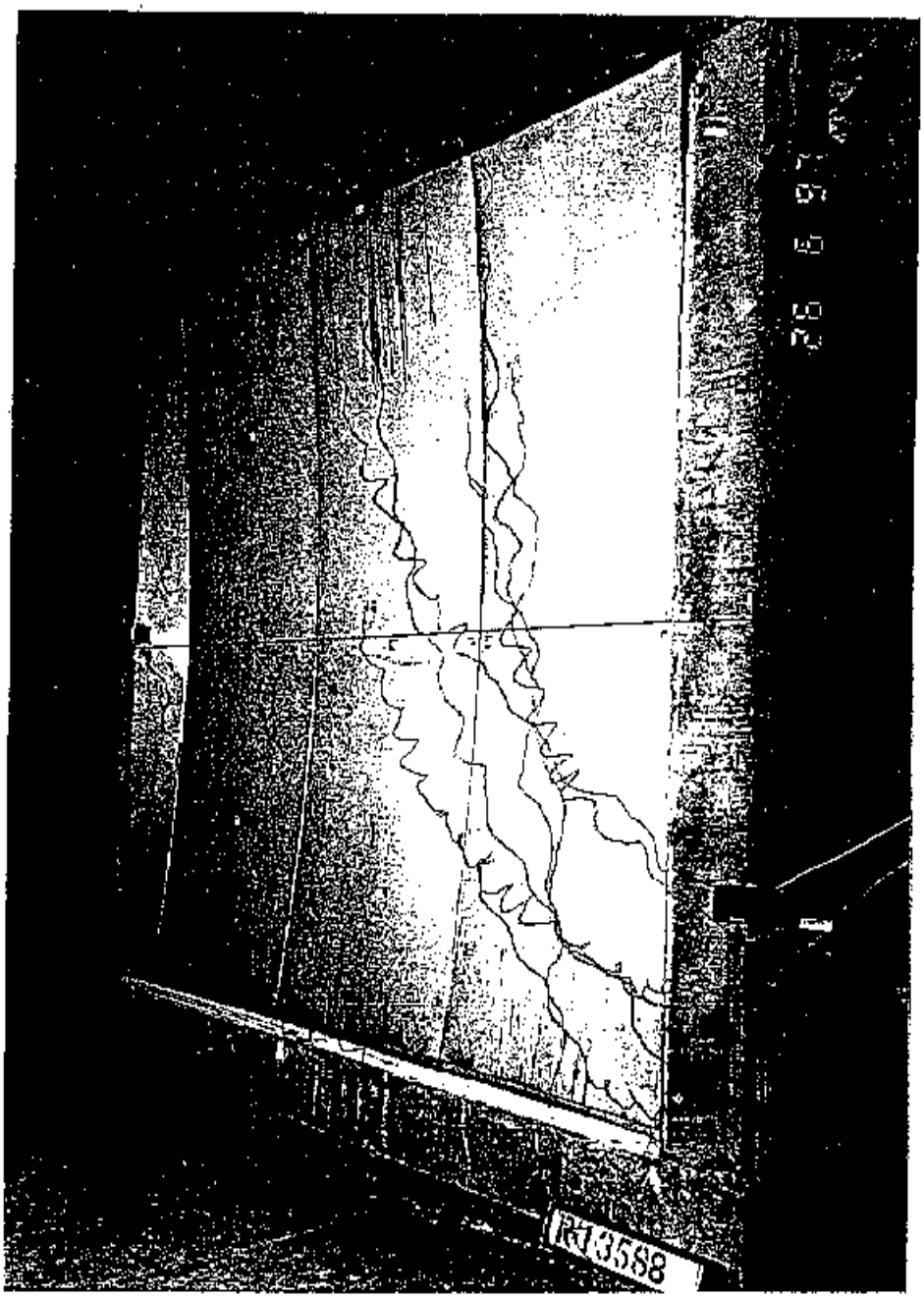

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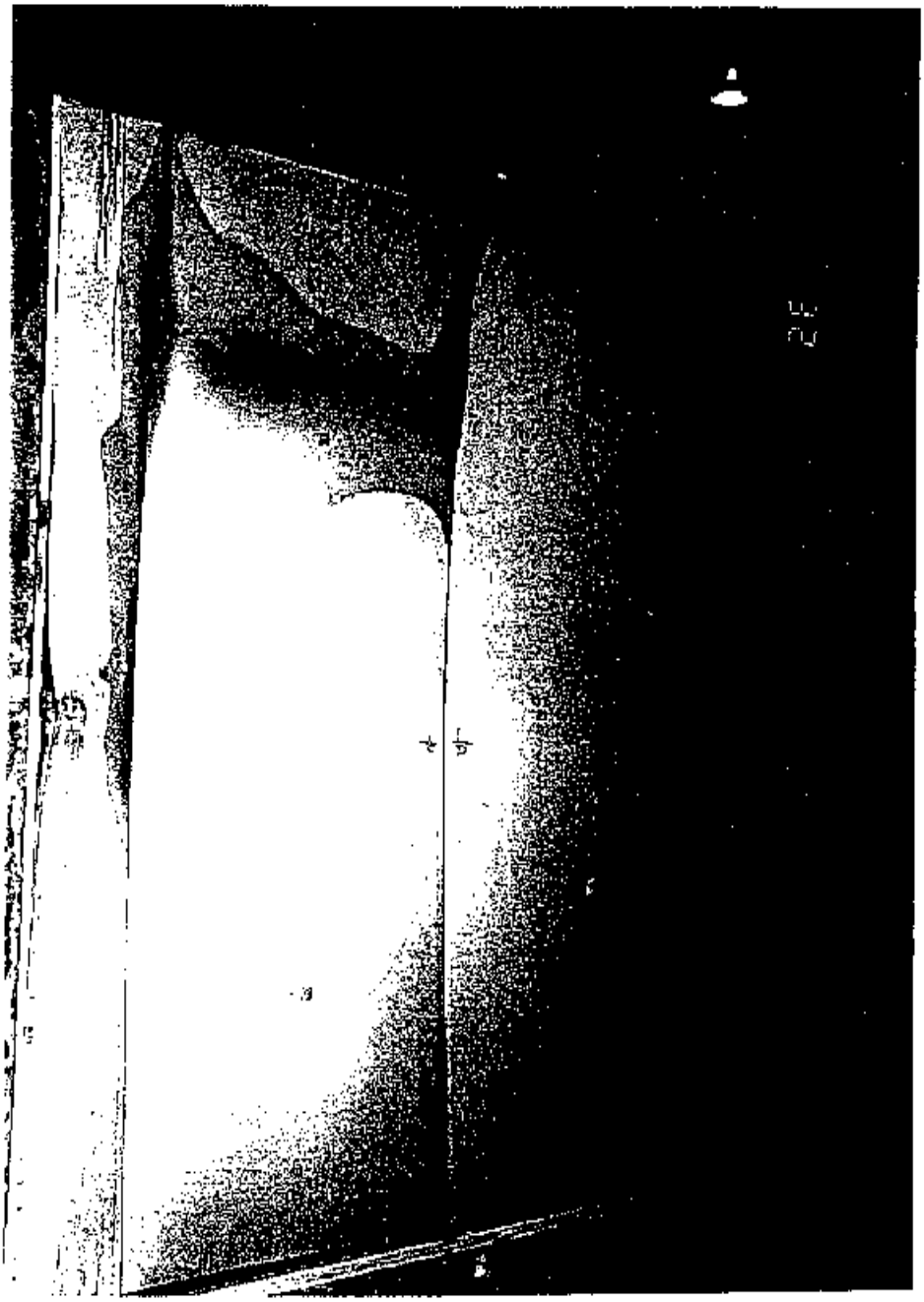

Plate 5

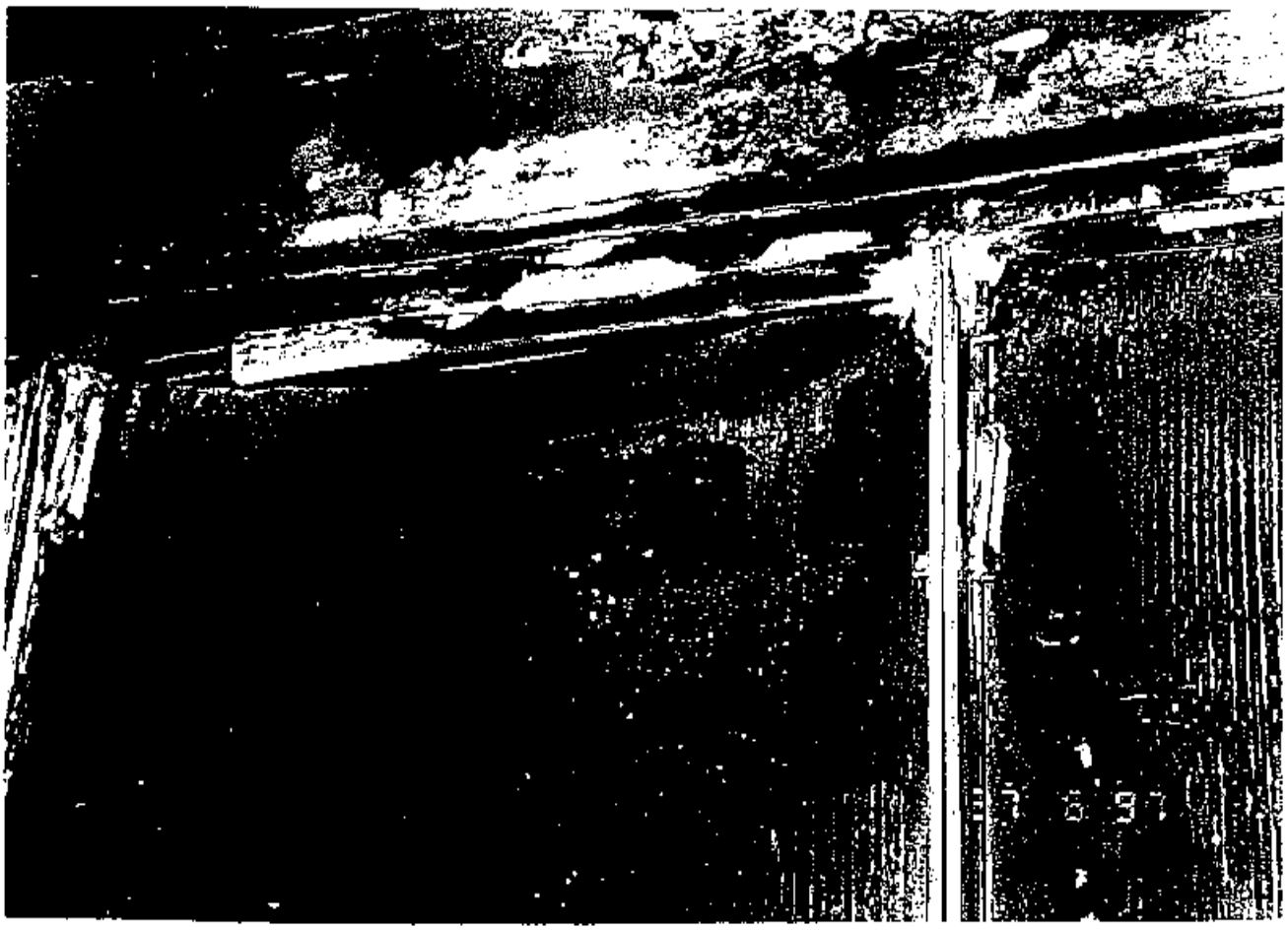

Plate 6

TEST REPORT

WARRES No.R13580
FIRE RESISTANCE TEST IN ACCORDANCE
WITH BS 476: PART 22: 1987, ON A
STEEL FACED PLASTERBOARD PARTITION

THE PROFESSIONALS IN FIRE SAFETY •

Warrington FIRE research
CONSULTANCY • TESTING

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TEST REPORT

TEST SPONSOR : MAARS PRODUKTIE BV, PO Box 1000, NL-3840 BA Harderwijk, Netherlands.

SUMMARY :

A single specimen of a 'Maars Micro-line 82mm' steel faced plasterboard partition has been subjected to a test in accordance with BS 476: Part 22: 1987, Clause 5 to determine its fire resistance performance.

The partition had overall dimensions of 2995mm height x 2981mm width by 83mm thickness and incorporated 4 No. steel faced plasterboard panels either side of a steel framework and a mineral wool core. The head of the specimen was lined with a 57mm leg, steel U-channel partly infilled with plasterboard strips. The base of the specimen was lined with a 70mm leg steel U-channel; an adjustable, 45mm leg with return, steel U-channel and plasterboard infill. The restrained edge of the specimen comprised an 85mm wide, steel U-channel, plasterboard infill and a 56mm wide, steel C-stud. The unrestrained edge of the specimen comprised a 56mm wide steel C-stud. The steel faced, gypsum panels were attached to each face, supported along their horizontal edges and clamped along their vertical edges, into a steel clamp stud. The void of the partition was infilled with nominally 35kg/m³ density mineral fibre insulation.

The specimen satisfied the performance requirements specified in Clause 5 of BS 476: Part 22, for the following periods:

Integrity : 57 minutes
Insulation : 37 minutes

The test was discontinued after a period of 58 minutes.

DATE OF TEST : 25 June 1997.

REPORT ISSUED : 8 August 1997

Warrington FIRE research CONSULTANCY • TESTING

CONTENTS

1. PURPOSE OF THE TEST

1.1 To determine the fire resistance of a specimen of a steel faced plasterboard partition in accordance with BS 476: Part 22: 1987.

2. INTRODUCTION

2.1 The partition was tested in accordance with Clause 5 of BS 476: Part 22: 1987 'Methods for determination of the fire resistance of non-loadbearing elements of construction'. This test report should be read in conjunction with that Standard and with BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)'.

2.2 The partition was symmetrical.

2.3 The specimen was judged on its ability to comply with the performance criteria for integrity and insulation, as required by BS 476: Part 22: 1987, Clause 5.

2.4 Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group has identified a number of such areas and has agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Group. Where such Resolutions are applicable to this test they have been followed.

2.5 The test was conducted on the 25 June 1997, at the request of Maars Produktie BV, the sponsor of the test.

2.6 The test was witnessed by Mr. J. Joseph, a representative of the sponsor of the test.

3. TEST SPECIMEN CONSTRUCTION

3.1 A comprehensive description of the test construction is given in Annex A. The description is based on a detailed survey of the specimen and information supplied by the sponsor of the test.

3.2 The specimen was stated to have been manufactured by the sponsor.

3.3 The specimen was supplied as components by the sponsor during week commencing 23 June 1997. Warrington Fire Research Centre was not involved in any selection or sampling procedures of the specimen or any of the components of the partition.

3.4 The partition was installed into a 3m x 3m internal opening of a steel reinforced concrete restraint frame. Installation was conducted by representatives of the sponsor during week commencing 23 June 1997.

4. INSTRUMENTATION AND MEASURING EQUIPMENT

4.1 The instrumentation was provided in accordance with the requirements of the Standard.

4.2 Nine thermocouples distributed over a plane 100 mm from the surface of the test construction, were provided to monitor the temperature of the furnace atmosphere.

4.3 Pressure sensors were provided within the furnace to monitor the furnace pressure.

4.4 Thermocouples were provided to monitor the temperature of the unexposed face of the specimen as follows:

4.4.1 At five positions, one approximately at the centre of the partition and one at approximately the centre of each quarter section of the partition. (Thermocouples 10 to 14)

4.4.2 At five positions on the surface of the partition, one at the top of the left hand vertical joint, one at the approximate mid-point at the top of the middle panel, one on the head above the middle vertical joint, one at approximately two third height on the middle vertical joint and one at approximately mid-height on the restrained vertical edge. (Thermocouples 15 to 19)

4.4.3 The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1 of Annex A.

4.5 A roving thermocouple was available to measure temperatures on the unexposed surface of the specimen at any position which might appear to be hotter than temperatures indicated by the fixed thermocouples.

4.6 Cotton pads and gap gauges were available to evaluate the impermeability of the specimen to hot gases.

5. TEST PROCEDURE

5.1 The test was conducted in accordance with the procedure specified in BS 476: Part 22: 1987.

5.2 The furnace was controlled so that its mean temperature complied with the requirements of BS 476: Part 20: 1987, Clause 3.1.

5.3 After the first five minutes of testing and for the remainder of the test, the furnace pressure was controlled so that it complied with the requirements of BS 476: Part 20: 1987, Clause 3.2.2. The calculated pressure differential relative to the laboratory atmosphere at the top of the specimen was 17 (±2) Pa.

5.4 Throughout the test the temperatures indicated by the thermocouples provided to monitor the furnace and the specimen were continuously monitored and were recorded at one minute intervals.

5.5 The thermocouples referred to in 4.2 were used to determine the mean furnace temperature.

5.6 The thermocouples referred to in 4.4.1 were used to determine the mean temperature of the unexposed surface of the specimen and compliance with the mean unexposed face temperature rise criterion of the Standard.

5.7 The thermocouples referred to in 4.4.1 and 4.4.2 were used to determine compliance with the maximum unexposed face temperature rise criterion of the Standard. The roving thermocouple was also used, if considered appropriate, to determine compliance with this criterion.

5.8 The cotton pads and gap gauges were used, if considered apropriate, to determine compliance with the integrity criterion of the Standard. The occurrence of any sustained flaming on the unexposed surface was also recorded to determine compliance with this criterion.

5.9 The deflection of the partition at specified positions was measured at selected times during the test.

6. TEST DATA AND INFORMATION

6.1 The following data, which was recorded during the test, is given in Annex B:

6.1.1 Mean furnace temperature, together with a comparison with the specified temperature/time relationship specified in the Standard.

6.1.2 The mean and maximum temperatures recorded by the thermocouples fixed to the unexposed surface of the specimen.

6.1.3 The internal furnace pressure as measured 600 mm from the top of the furnace.

6.1.4 The deflection of the partition at specified positions.

6.2 A summary of the observations made on the general behaviour of the specimen is given in Annex C.

6.3 Photographs taken of the specimen before, during and after the test are given in Annex D.

6.4 The ambient air temperature in the vicinity of the test construction was 15°C at the start of the test with very little variation during the test.

6.5 The test was discontinued after a period of 58 minutes at the request of the sponsor.

7. EVALUATION AGAINST THE PERFORMANCE CRITERIA

7.1 The performance of the specimen was judged against the following criteria of BS 476: Part 20: 1987:

7.1.1 **Integrity** - It is required that there is no collapse of the specimen, no sustained flaming on the unexposed surface and no loss of impermeability. These requirements were satisfied for 57 minutes. Failure occurred when a cotton wool pad applied at the head of the middle left panel was observed to be glowing.

7.1.2 **Insulation** - It is required that the mean temperature rise of the unexposed surface shall not be greater than 140°C above the maximum temperature rise shall not be greater than 180°C. Insulation failure did occurs simultaneously with integrity failure. These requirements were satisfied for a period of 37 minutes. Failure was due to a temperature rise greater than 180°C being recorded, by the surface thermocouple at the top of the left hand vertical joint.

8. CONCLUSIONS

8.1 A specimen of a 'Maars Micro-line 82mm' steel faced plasterboard partition with a mineral wool core has been subjected to a fire resistance test in accordance with BS 476: Part 22: 1987, Clause 5.

8.2 The specimen satisfied the performance requirements specified in the Standard for the periods stated below:

Integrity : 57 minutes
Insulation : 37 minutes

The test was discontinued after a period of 58 minutes.

9. LIMITATIONS

9.1 The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.

9.2 The test results relate only to the specimen tested. Appendix A of BS 476: Part 20: 1987 provides guidance information on the application of fire resistance tests and the interpretation of test data. Application of the results to specimens of different dimensions or incorporating different components should be the subject of a design appraisal.

10. REVIEW

10.1 The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

Responsible Officer

D. PIRKIS
Technical Assistant

Approved

R.J. WILLIAMS
Manager, Redhill Centre
For and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date : 8 August 1997

Warrington FIRE research CONSULTANCY • TESTING

ANNEX A

SPECIFICATION OF TEST CONSTRUCTION

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SPECIFICATION OF THE [illegible]

1. GENERAL DESCRIPTION

The specimen was of a 'Maars Micro-line 82mm' steel faced plasterboard partition with a mineral wool core. It was built into a 3m x 3m internal opening of a steel reinforced concrete restraint frame.

2. SCHEDULE OF COMPONENTS

(Refer to Figures 1 to 3)
(All values are nominal unless stated otherwise)
(All references are as stated by the sponsor)

1. Panels:0.8mm thick steel panels, overall dimensions 2910 mm high x 900 mm wide, with an inner layer of 12.5mm thick plasterboard, type "LAFARGE GIPS-DZ-DIN18180 DIN 4102 23/3/97 SP41LA25 GKB12.5 A2 W FMPA BW 04:09", adhered to the steel using a PVB based glue. Vertical edges of the panels comprised a profiled flange which clamped into the flange of the internal clamp studs on both sides of the partition. A 20mm gap was left between the flange and plasterboard inner layer over the entire vertical height of the panels to accommodate the clamp stud. The top and bottom edge of the panels possessed a 10mm return to accommodate fixings to the head and floor track. The plasterboard inner layer was also absent in the top and bottom 10mm of the panels.

2. Insulation Core:1200mm x 600mm x 40mm thick Rockwool slabs, 'type 201', measured density 32.3kg/m³; extending in, and supported by, the C-studs and double clamp studs.

3. Clamp stud: steel studs with overall dimensions 32mm x 80mm x 0.9mm thick forming the framing for the panels; slotted into steel stud extensions at the head and base to accommodate positioning in the head and floor track. The panel edges are located into the gap within the flange of the clamp stud. The stud is made up of two steel sections, spot-welded together. The web of the stud is slotted over its full height.

4. Steel stud extension: comprising a U-section, (27mm flange x 43mm web), with a locating slot part-way down both flanges, and an integral foot, 52mm x 60mm x 1.6mm thick. The foot section was located in the perimeter head/base track and the clamp stud pushed into the locating slots of the U-section.

5. Galvanised steel C-studs:56mm x 34mm x 0.5mm thick overall dimensions, used as the vertical perimeter framing for the partition system; service cut-outs at 300mm centres. At the free edge, the panels were screw fixed, each side, to the C-stud at approximately 300mm centres using 35mm long self-drilling screws.

6. Steel U-channel (floor track): overall dimensions 52mm x 70mm x 1.5mm thick, used as a perimeter channel along the bottom edge of the partition system; bedded on two layers of Promat board. Infilled with two strips of 12.5mm thick plasterboard and secured to the test frame with N8 x 80Z Fischer frame fixings.

7. Adjustable floor track: comprising a U-channel of dimensions 55mm x 45mm x 1.25mm thick with an integral L-shaped flange each side; sitting within the floor channel along the bottom edge of the partition; slots into the floor U-channel and infilled with 2 No.layers of plasterboard to create an adjustable floor track. The bottom edge of the steel faced, plasterboard panels sat on the L-shaped flange, both sides of the adjustable floor track, and were screw fixed through the track into the returned flange at the base of the steel faced, plasterboard panels.

SPECIFICATION OF THE TEST CONSTRUCTION - Continued

8. Steel U-channel (head track): overall dimensions 55mm x 57mm x 1.5mm thick; used as the perimeter channel along the top edge of the partition system; infilled with 3 No. layers of plasterboard, and secured to the test frame with N8 x 80Z Fischer frame fixings..

9 Steel retaining brackets:45mm x 25mm x 1.5mm thick; provide support for hanging the steel faced, plasterboard panels along the top edges. The brackets were screw fixed to the flange of the head track using 2 No.18mm long self-drilling screws and located at approximately 300mm centres.

10. Steel wall track:U-channel of overall dimensions 85mm x 23mm x 1.2mm thick with a 4mm return at the end of each flange and 45mm long slots punched out of the web at approximately 75mm centres; infilled with 1 No. layer of plasterboard and a C-stud; used as the vertical channel to the restraint frame along the fixed edge of the partition. At the fixed edge the panels are clamped between an internal C-stud 8mm x 34mm x 56mm x 0.5mm thick and the flange of the wall track, and fixed to the test frame with N6 x 60Z Fischer frame fixings. A C-stud also occurs at the unrestrained edge of the partition.

11 Plasterboard strips:12.5mm thick x 50mm wide strips, used as a channel infill at the head, base and fixed edge of the partition; 3 and 4 No.strips in the head and floor track respectively and 1 No. strip in the wall track.

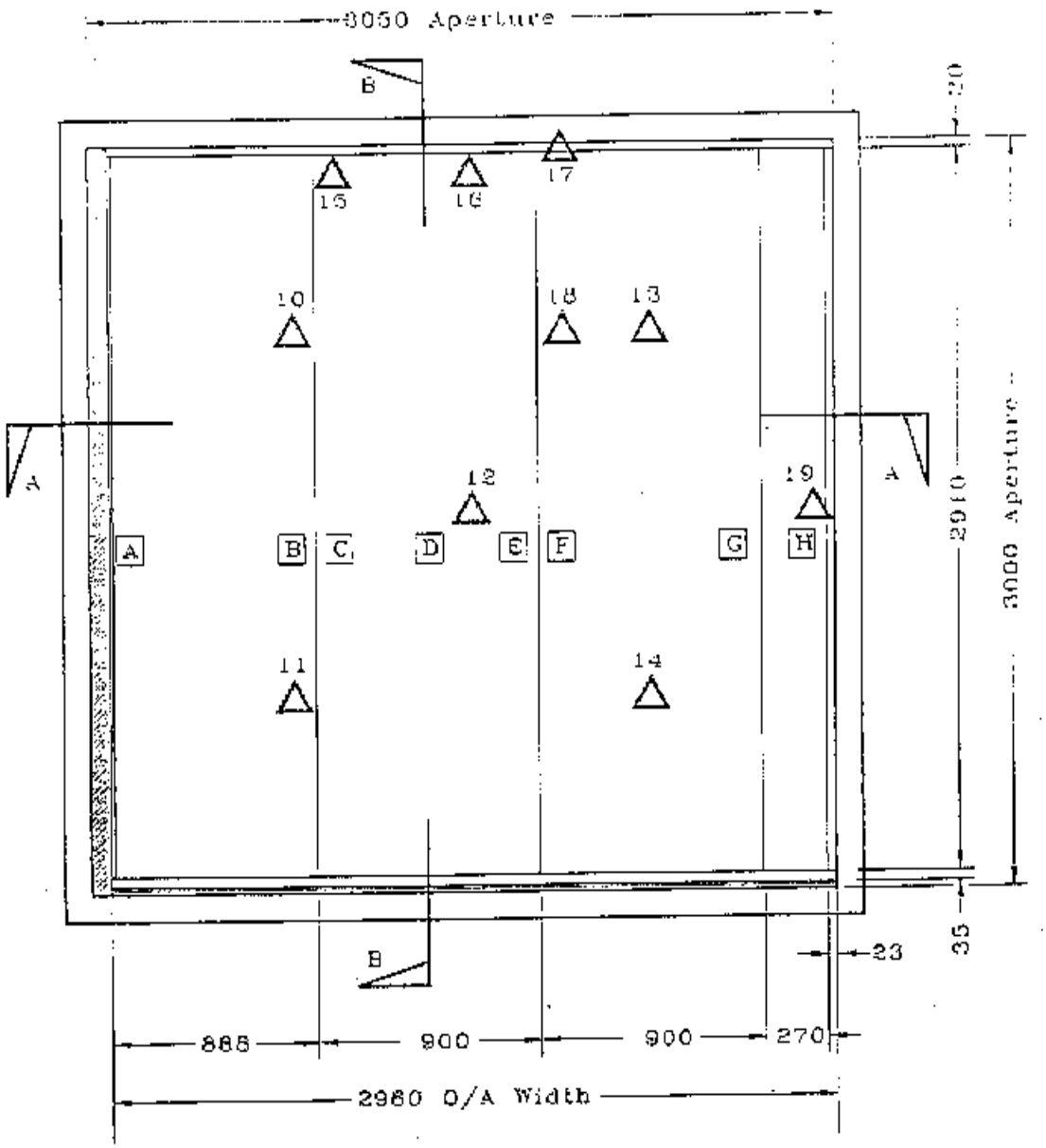
12 Promat boards: the floor track was bedded on two layers of 15mm thick Promat Calcium Silicate board; glued to each other and the test frame, using Promafix K84 adhesive.

13 Foam tape: 2 No.3mm thick by 9mm wide self-adhesive strips around the periphery of the partition, (excluding the free edge of the specimen), sandwiched between the steel tracks and the restraint frame/Promat board.

14. PVC plugs and Fischer, type "N6 x 60Z" and "N8 x 80Z", screws used for perimeter fixing. The head track was secured to the test frame using N8 x 80Z Fischer screws with a 43mm x 25mm rectangular metal washer fixed through the plasterboard infill at approximately 450mm centres. The floor track was fixed using N8 x 80Z Fischer screws through the plasterboard infill and Promat boarding into the test frame. The wall track was screw fixed to the test frame using N6 x 60Z Fischer screws at approximately 300mm centres.

15 Promafix K84 adhesive:used as a perimeter sealant at the base and head of the partition.

GENERAL ELEVATION, NON FIRE SIDE.



△ Thermocouple Positions

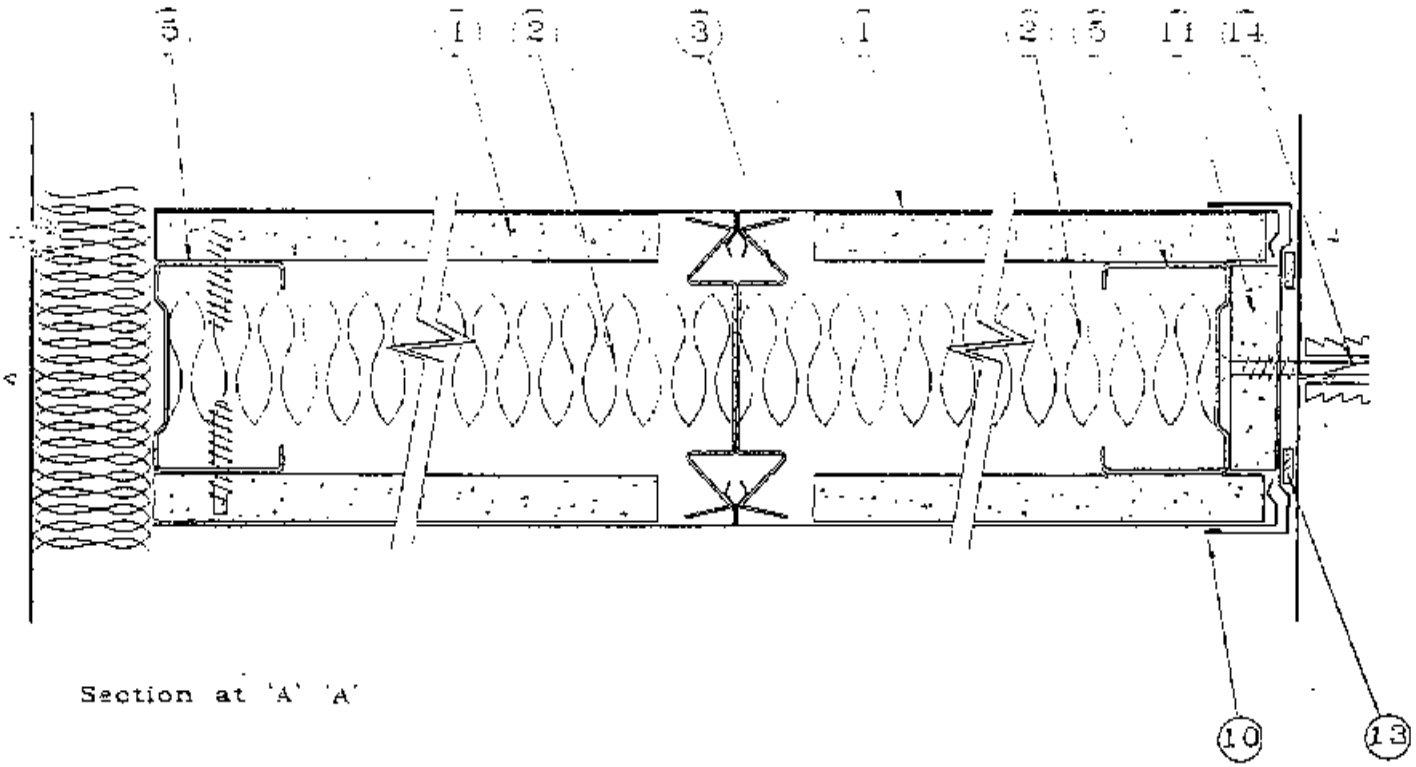
[D] Deflection Measurement Positions

Do not scale
All dims in mm

Figure 1

HORIZONTAL SECTION

FIRE SIDE

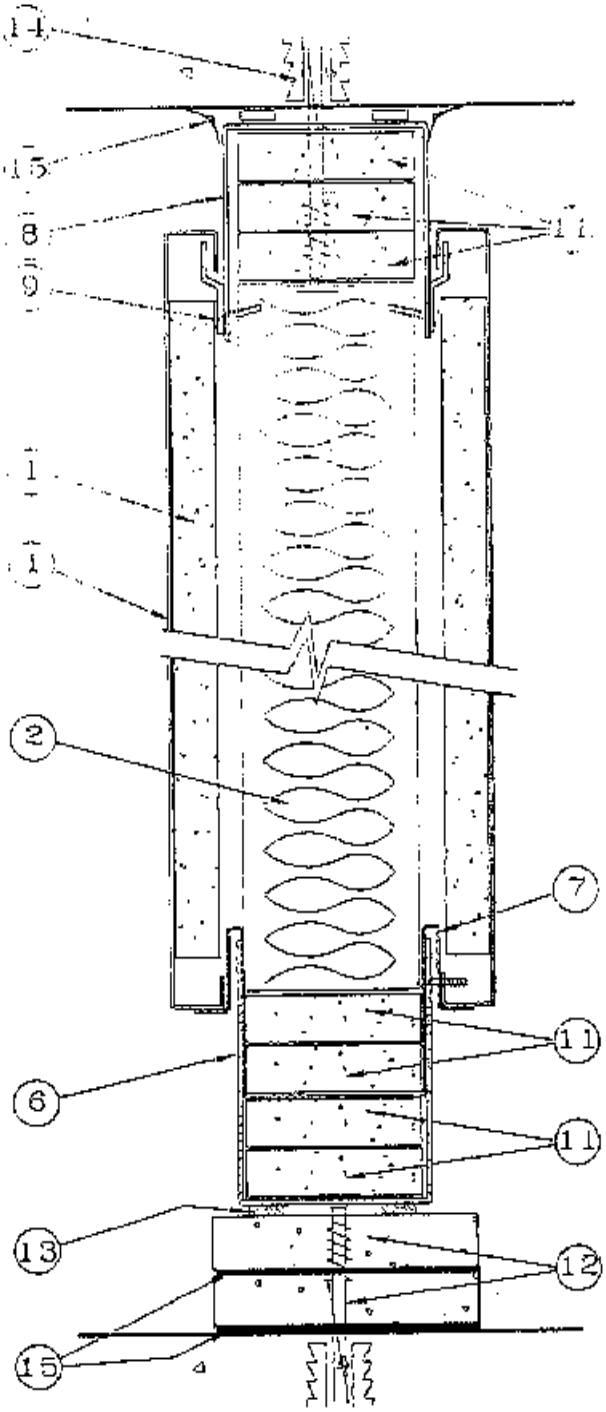


Section at 'A' 'A'

Do not scale

Figure 2

VERTICAL SECTION



Section at 'B' 'B'

Do not scale

Figure 3

ANNEX B

DATA RECORDED DURING TEST

FURNACE TEMPERATURE/TIME CURVES

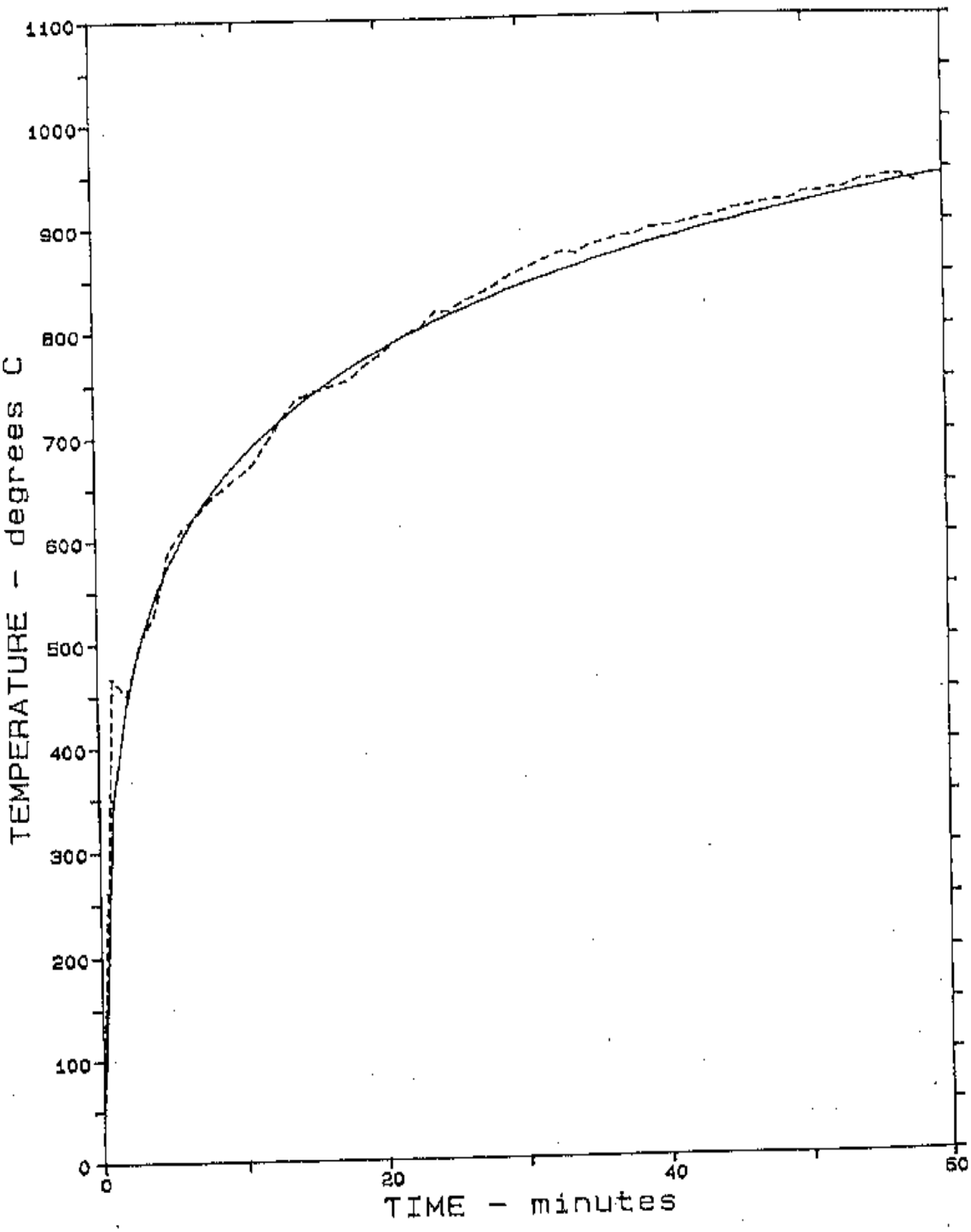


Figure 4

Warrington Fire Research
CONSULTANCY • TESTING

TABLE 1

Variation between specified and actual time temperature curve.

TIME mins	B.S.476 FURNACE TEMP. Deg C	ACTUAL FURNACE TEMP. Deg C	AREA UNDER STANDARD CURVE Deg C min	AREA UNDER ACTUAL CURVE Deg C min	PERCENTAGE DIFFERENCE	PERCENTAGE TOLERANCE + or -
0	20	15				
1	349	467				
2	445	451				
3	502	504				
4	544	529				
5	576	590				
6	603	611				
7	626	625				
8	645	641				
9	663	652				
10	678	663	5302	5409	2.0	15
12	705	697				
14	728	735				
16	748	746				
18	766	755				
20	781	777				
22	796	797				
24	809	818				
26	820	828				
28	831	840				
30	842	856	15488	15505	0.1	10
35	865	880				
40	885	897				
45	902	913				
50	918	928				
55	932	939				
58	940	936	25093	25390	1.2	5

SURFACE THERMOCOUPLE TEMPERATURE/TIME CURVES

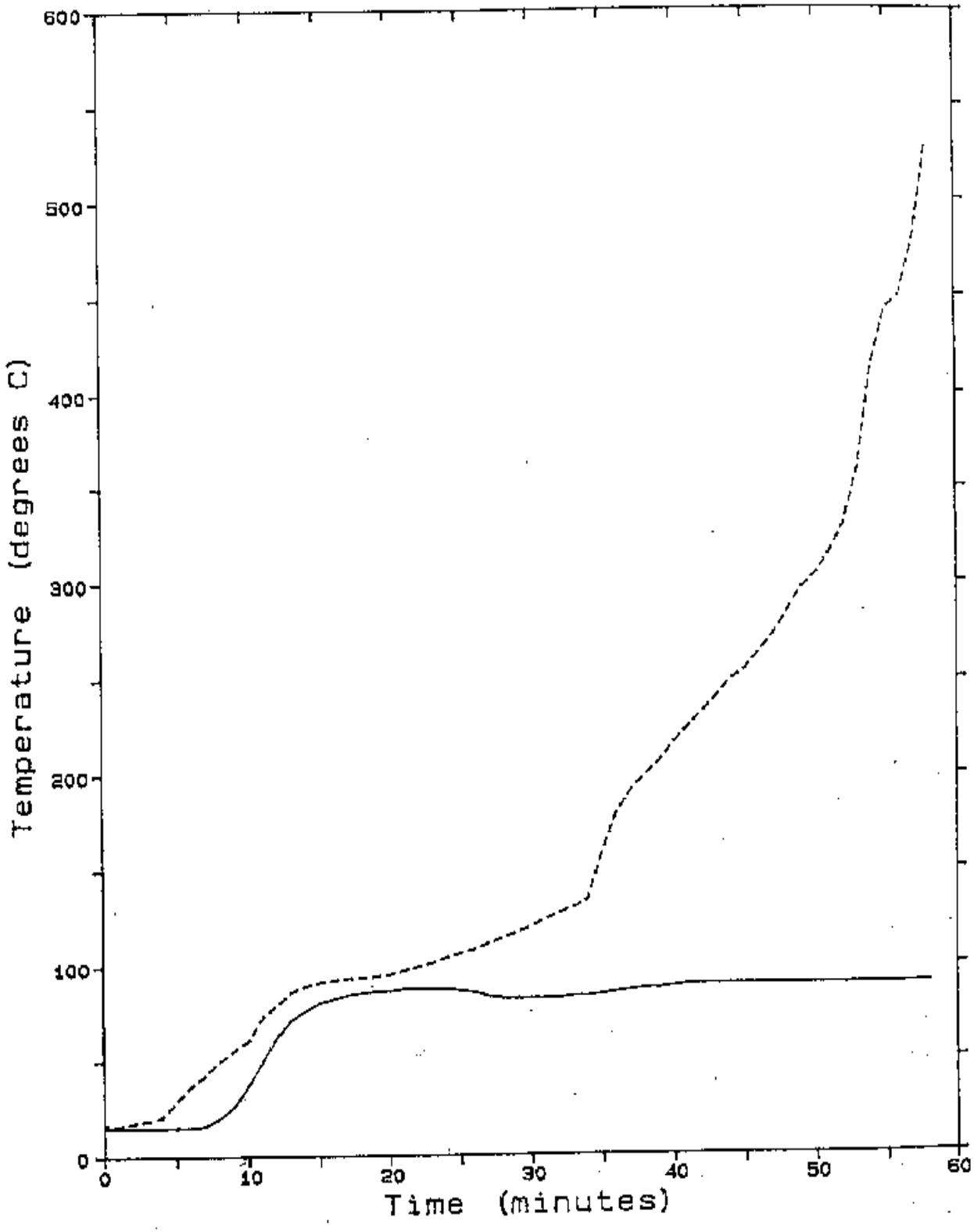


Figure 5

FURNACE PRESSURE/TIME GRAPH

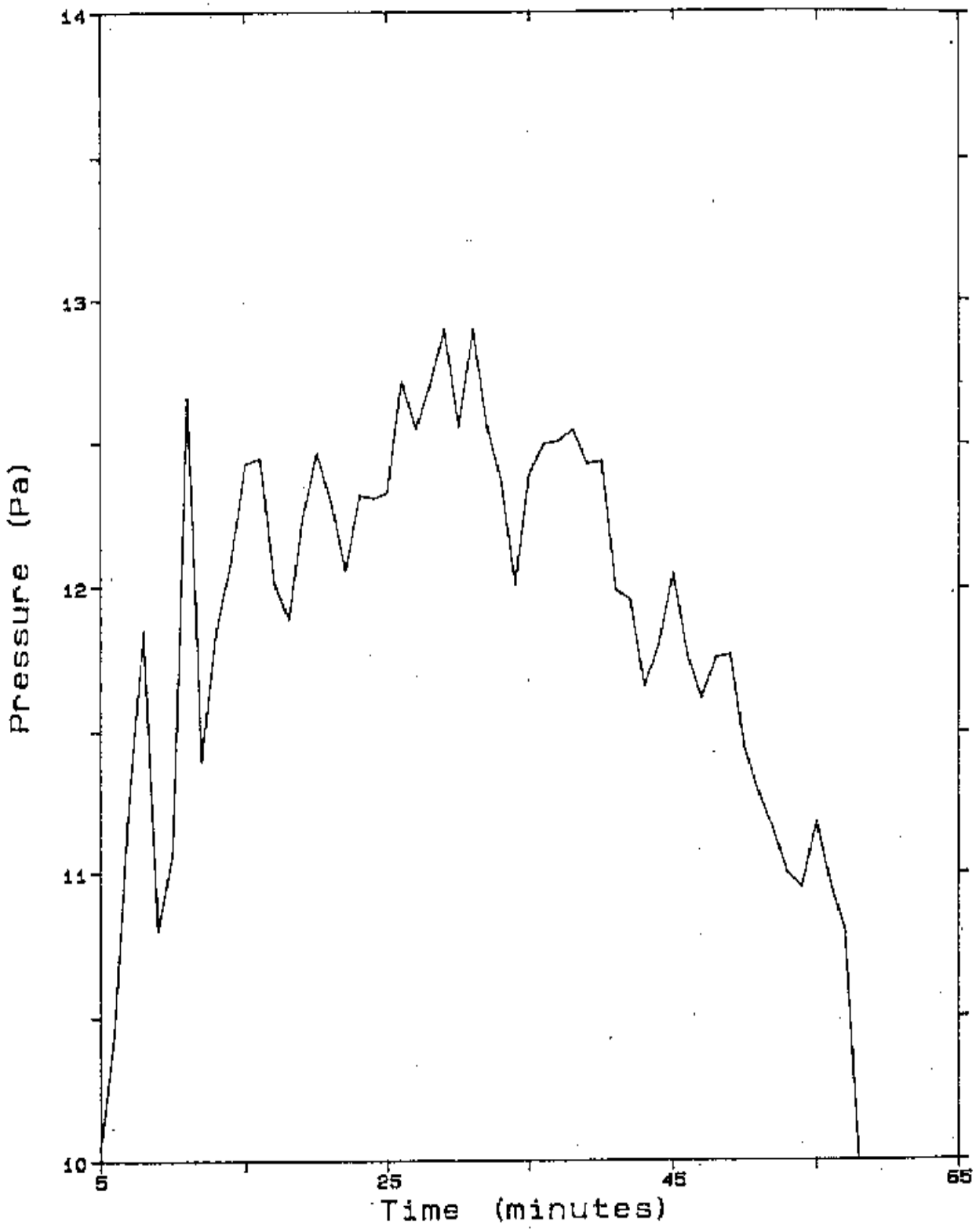


Figure 6

TABLE

Deflection of the parti

Time (minutes)	Deflection m			
	A	B	C	
0	0	0	0	
9	8	51	51	
19	8	103	105	
30	16	115	118	
40	25	115	118	
52	34	125	129	

A negative value indicates deflection away from the

ANNEX C

OBSERVATIONS MADE DURING THE TEST

OBSERVATIONS MADE DURING THE TEST

The following observations were made during the test by Warrington Fire Research Centre

E - Observations from exposed side
U - Observations from unexposed side

Panel (A) - Panel adjacent to the free edge.
Panel (B) - Middle left panel as viewed from non-fire side.
Panel (C) - Middle right panel as viewed from non-fire side.
Panel (D) - Panel adjacent to the fixed edge.

Time			Observations
mins	secs		
00	00		The test is started.
03	00	U	Crackling noises can be heard from the specimen.
05	00	U	Smoke/steam is emitting from the top left corner of Panel (A).
06	00	U	Smoke/steam emission is evident from the vertical joint on the left-hand side of the partition, the top right corner of Panel (D) and along the free edge.
08	00	U	Moisture can be seen leaking from the bottom edge of the panels.
09	00	U	"Popping" noises can be heard from the specimen.
11	00	U	Smoke/steam emission is increasing from the left-hand side vertical joint. Smoke is starting to emit from both the central and right-hand side vertical joints and along the bottom edge of the partition.
13	00	U	A gap is starting to develop along the vertical joint between Panels (A) and (B), which is approximately 4mm wide at the mid-height position.
16	00	U	The gap seen at 13 minutes has increased and is now approximately 6mm wide at the mid-height position.
17	00	U	A loud "popping" sound can be heard from the specimen. Gaps are starting to develop along the central and right-hand side vertical joints.
21	00	U	The gap seen at 16 minutes is now 7mm wide at the mid-height position. The surface of Panel (D) is buckling around the position of thermocouple No.19 and has disconnected from the perimeter channel exposing the plasterboard inner layer.
26	00	U	Discolouration is evident down the vertical joint on the right-hand side of the partition.
27	00	U	A gap is developing along the vertical joint between Panels (C) and (D) which is approximately 8mm wide at the mid-height position. "Popping" noises can still be heard from the specimen.

OBSERVATIONS MADE DU[illegible]

Time			Observations
mins	secs		
30	00	U	The buckling of Panel (D) seen [illegible] has now disconnected from [illegible]
33	00	U	The gap seen at 27 minutes i[illegible]
34	00	U	Panel (B) has disconnected fr[illegible] the top edge creating a gap o[illegible]
36	00	U	Glowing is visible within the [illegible]
37	00	U	A temperature rise greater th[illegible] left-hand vertical joint. Insu[illegible]
39	00	U	Glowing is visible at the top [illegible] Discolouration is starting to [illegible]
46	00	U	A brown coloured liquid is [illegible] Discolouration is evident at [illegible]
47	00	U	The glowing is increasing a[illegible]
49	00	U	Glowing is evident within the [illegible] Discolouration is occurring [illegible] central vertical joints.
53	00	U	Discolouration is evident on [illegible] minutes.
55	00	U	The head track has distorted [illegible]
57	00	U	A cotton wool pad applied to [illegible] is deemed to have occurred.
58	00		The test is stopped at the [illegible]

ANNEX D

PHOTOGRAPHS

PHOTOGRAPHS

Plate 1 - Exposed surface of the partition prior to testing.

Plate 2 - Unexposed surface of the partition prior to testing.

Plate 3 - Unexposed surface of the partition after 15 minutes of testing.

Plate 4 - Unexposed surface of the partition after 30 minutes of testing.

Plate 5 - Unexposed surface of the partition after 45 minutes of testing.

Plate 6 - Close up view of the exposed surface of the partition at the end of the test, looking at the head track.

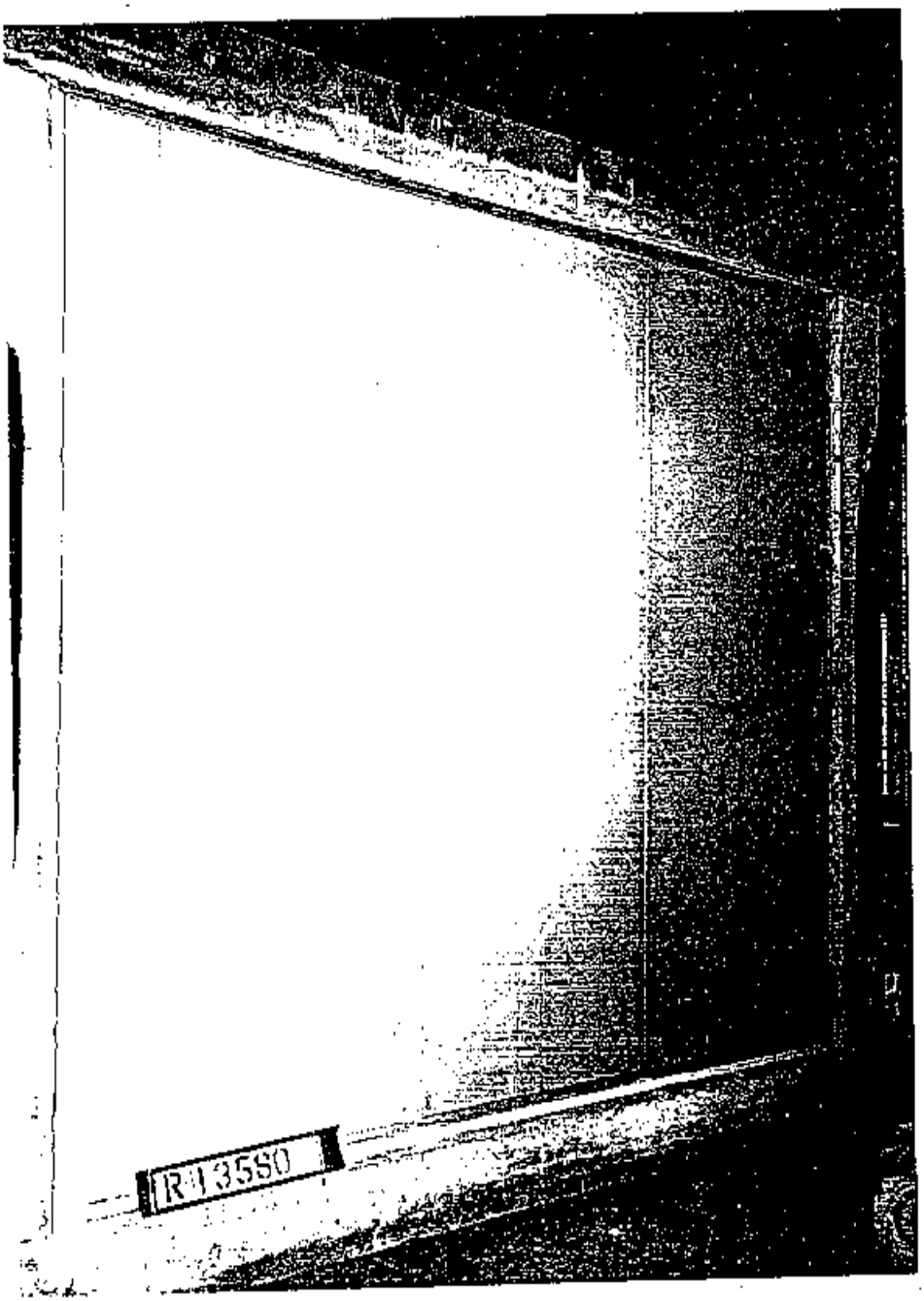


Plate 1

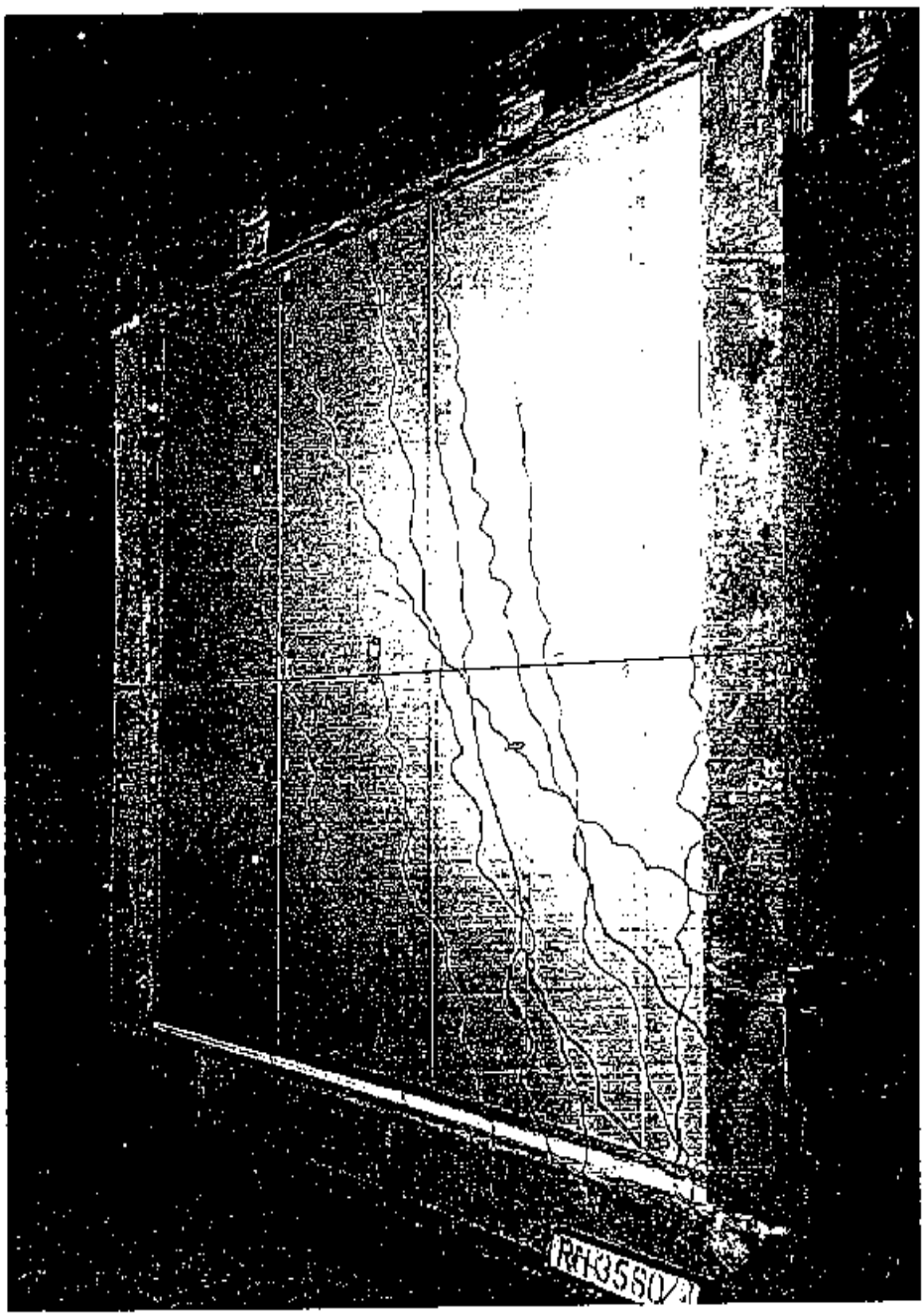


Plate 2

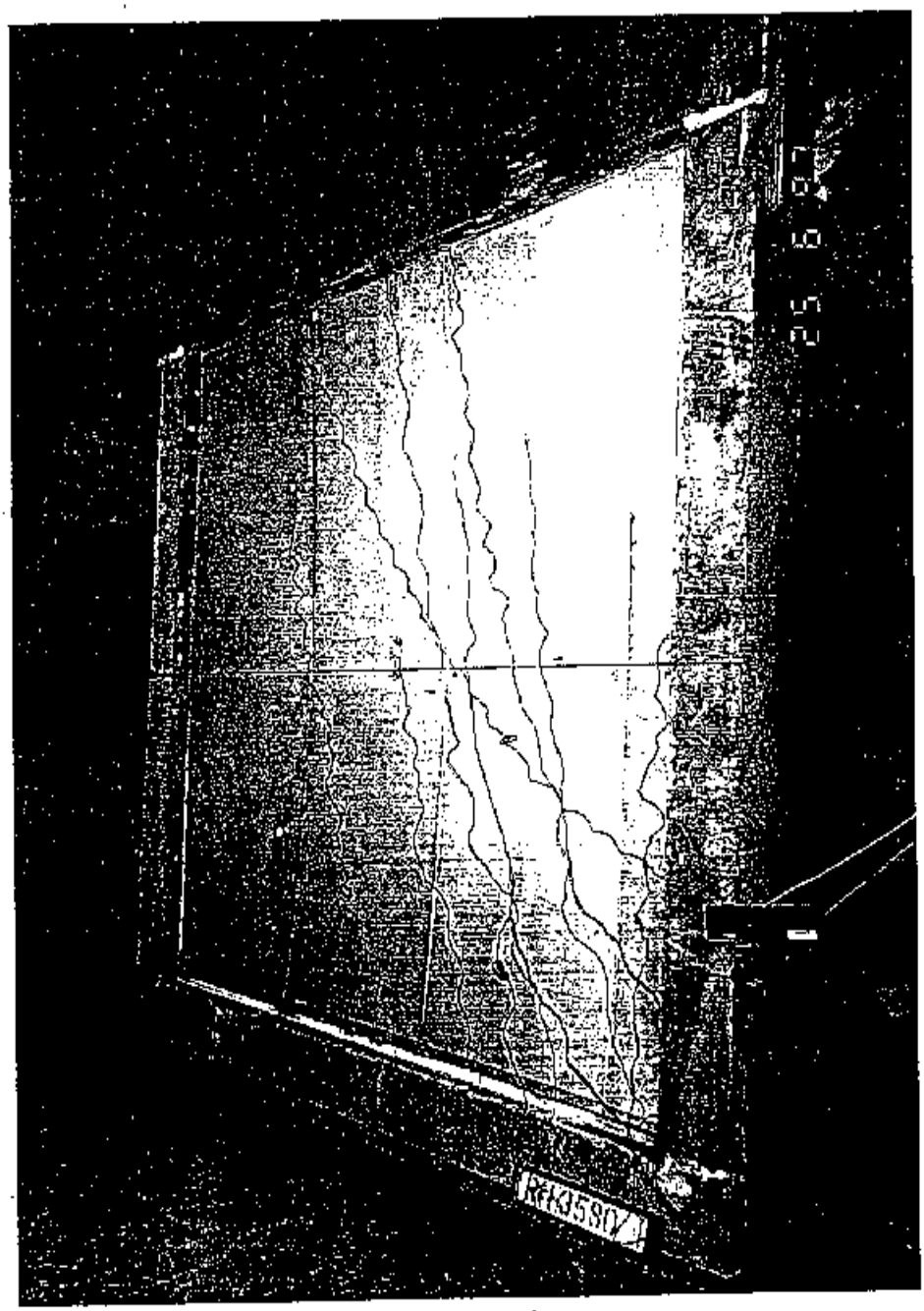


Plate 3

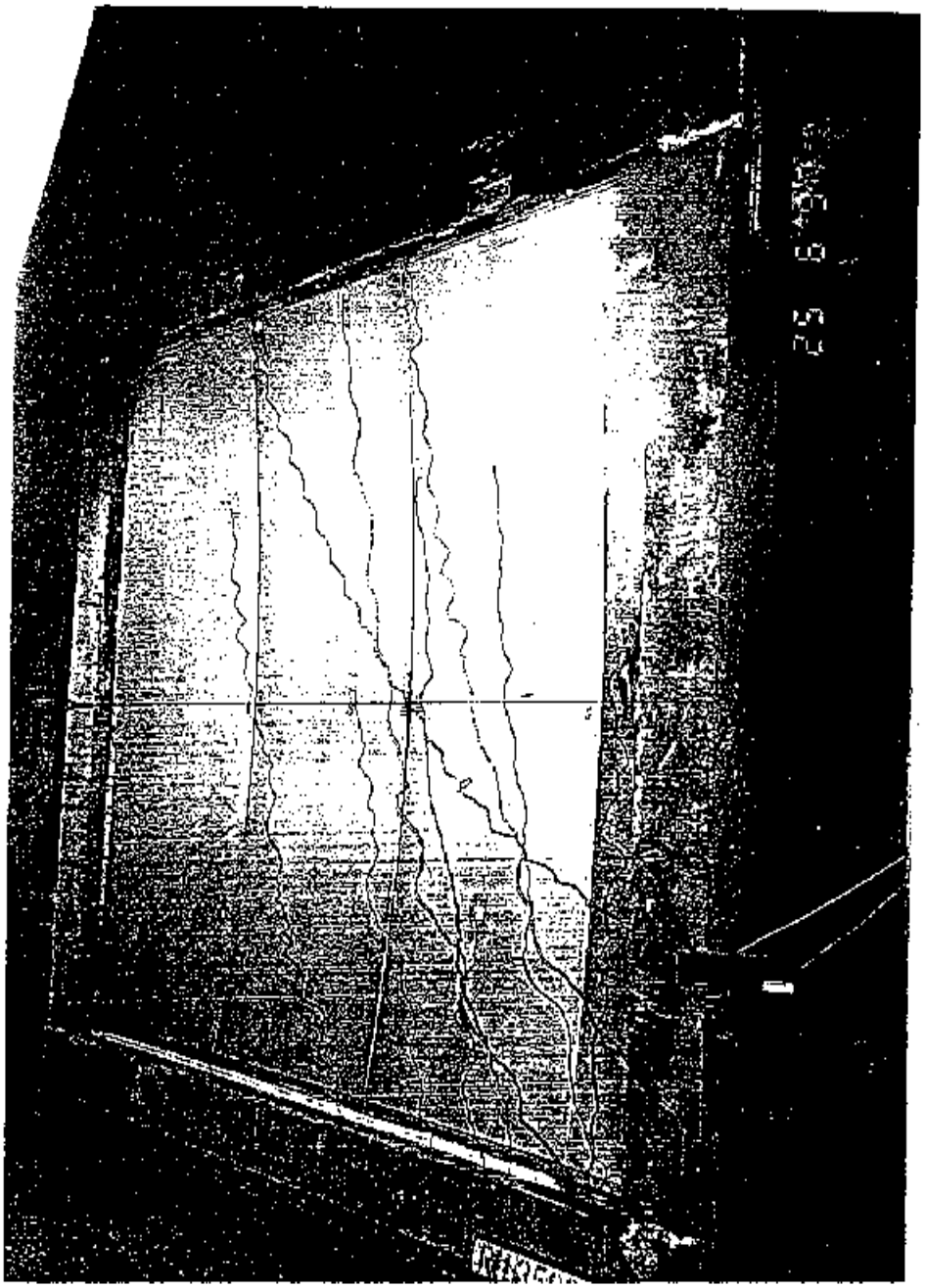


Plate 4

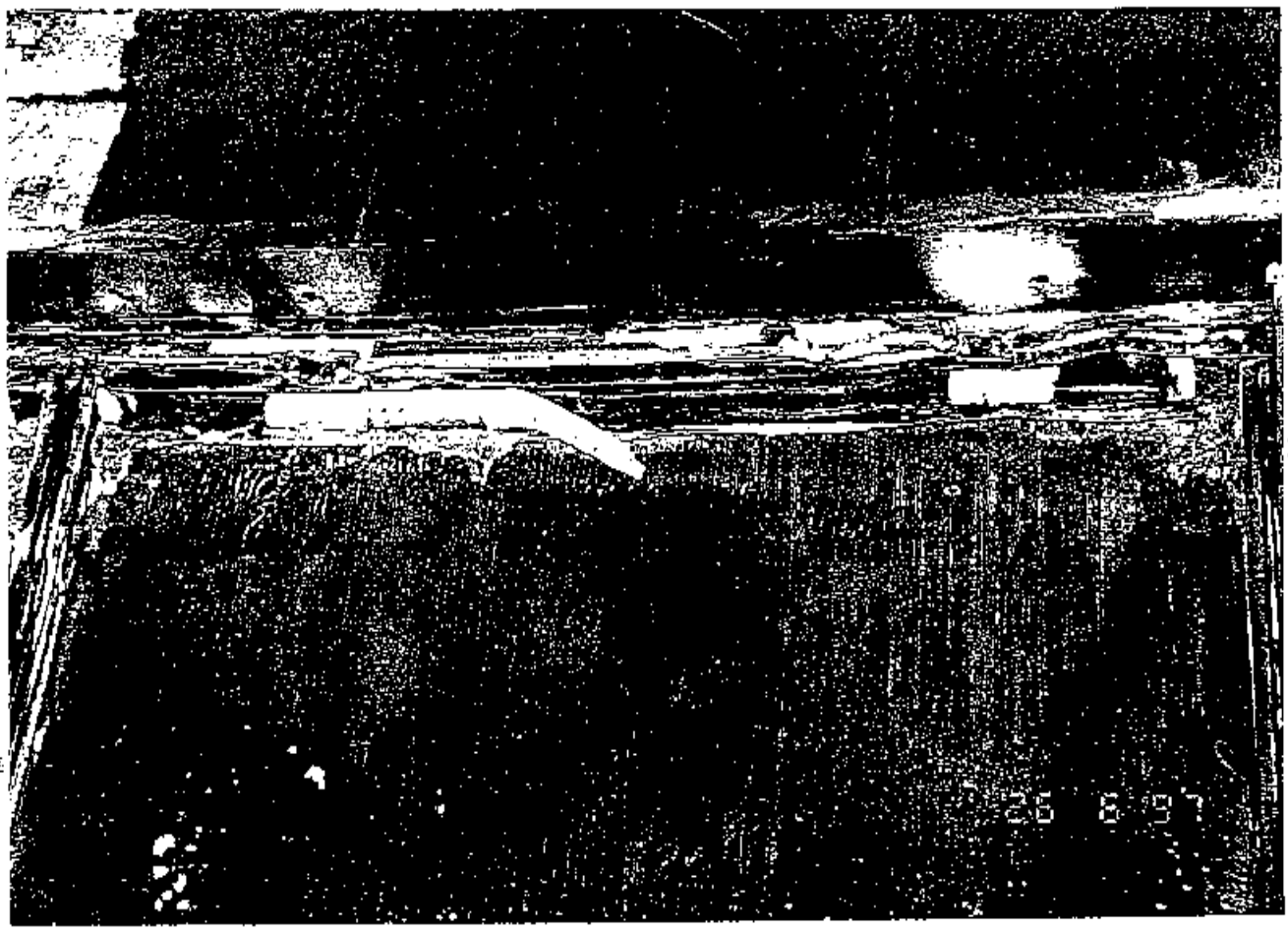


Plate 6