

**The Performance of an Invotek
Steel Stud Screen Glazed with
Fivestar and Pyroswiss Glasses**

Report For

Vetrotech UK

THE PROFESSIONALS IN FIRE SAFETY •

Warrington
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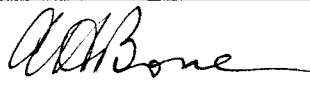

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**The Performance of an Invotek
 Steel Stud Screen Glazed with
 Fivestar and Pyroswiss Glasses**

Report For

Vetrotech UK
 Glenewes House
 Gateway Drive
 Yeadon
 Leeds
 LS19 7XY

Issue 2 : Width of glass panes increased such that the sight size area of each glass pane do exceed nominally 1.59 m² with the height restriction remaining as assessed.

Report	Name	Signature*	Date
Prepared By	A.H. Bone		28.03.96
Reviewed By	C.W. Miles		01.04.96

* For and on behalf of Warrington Fire Research Centre.

The assessment report is not valid unless it incorporates the declaration duly signed by the applicant. is included in Appendix 2 to this report.

The Performance of an Invotek Steel Stud Screen Glazed with Fivestar and Pyroswiss Glasses

1. Introduction

- 1.1 This report provides a considered opinion regarding the fire resistance performance of a previously fire tested proprietary steel stud glazed screen which may contain a different type of glass to that used for the fire tested specimen. Wire reinforced glass was used for the fire tested screen and the proposal is to use Fivestar, 5 mm thick or Pyroswiss 6 mm thick glass instead of the wire reinforced glass.
- 1.2 The proposed screen assembly is required to satisfy the integrity criterion for a period of 30 minutes if tested in accordance with BS 476: Part 22: 1987, Clause 10. Owing to the unique nature of the proposed glass, it will not be possible for the glazed screen to satisfy the insulation criterion of the testing standard for a period exceeding a few minutes.
- 1.3 The data referred to in Appendix 1 has been considered for the purpose of this appraisal and a report has been prepared in accordance with the Fire Test Study Group Resolution No. 64A 1995.

2. Assumptions

- 2.1 It is assumed that the Fivestar and Pyroswiss type glass panes will be bedded in a soft polyvinyl chloride glazing gasket, as manufactured by Rehau and intumescent material as supplied by Mann McGowan Fabrications Limited, all as used for the fire tested assembly reported in reference FR 1085.
- 2.2 It is also assumed that the Fivestar and Pyroswiss glass panes will be supported on settings similar to those used for the fire tested assemblies. In addition, similar clearances to those specified for the relevant fire tested assemblies will be incorporated between the perimeter edge of the Pyroswiss glass panes and the supporting steel framework and the edge cover to the glass panes will not exceed 12 mm.

3. Proposal

- 3.1 The proposal involves substituting Fivestar glass panes of 5 mm thickness or Pyroswiss glass panes of 6 mm thickness for the wire reinforced glass as tested with the Invotek screen.

4. Fire Test Data

Steel Screen

- 4.1 The report referenced FR 1085 provides test evidence about the ability of the proprietary Invotek steel stud screen when glazed with a wire reinforced glass to satisfy the stability, integrity and insulation criteria for periods of 32 minutes, 31 minutes and 0 minutes respectively when tested in accordance with BS 476: Part 8: 1972. The overall size of the screen was 2750 mm high by 2436 mm wide by 76 mm thick. The steel studs were spaced at 606 mm centres and the size of the wire reinforced glass panes was 2683 mm high by 592 mm wide.

Fivestar Glass

- 4.2 The report referenced WARRES No. R11801 provides test evidence about the ability of the proprietary steel screen when glazed with Fivestar glass panes of 5 mm thickness to satisfy the stability, integrity and insulation criteria for periods of 55 minutes and 4 minutes respectively. The screen contained a total of nine glass panes of which the largest was 1480 mm high by 980 mm wide.

Pyroswiss Glass

- 4.3 The report referenced J89414/2 provides test evidence about the ability of a proprietary Invotek steel screen, Signature, when glazed with Pyroswiss glass of 6 mm thickness to satisfy the integrity and insulation criterion of BS 476: Part 22: 1987 for a period of 32 minutes. The screen contained two glass panes of nominal size 2517 mm high by 1136 mm wide, ie 2.86 m².

5. Discussion

Steel Screen

- 5.1 The test referenced FR 1085 provides data to justify the use of the steel screen for the required period of 30 minutes. It can be seen from the construction of the screen that the majority of the components are made from steel. The only combustible parts are the polyvinyl chloride (PVC) cover trims at the studs and the glazing gasket.

- 5.2 Therefore, no doubts are expressed about the ability of the Invotek steel stud screen to perform satisfactorily during exposure to standardised fire test conditions for the required period of 30 minutes. There is other fire test available regarding the fire resistance performance of the Invotek steel screen for a period of 50 minutes which can be used as additional supporting evidence. However, it is not considered necessary to make reference to that data for the purpose of this appraisal.

Fivestar Glass

- 5.3 The test report referenced WARRES No. R11801 provides suitable evidence regarding the fire resistance performance of Fivestar glass when supported by a steel frame, ie Forster System.

- 5.4 The largest pane of glass was of nominal sight size 1480 mm high by 980 mm wide. At minutes of testing, this largest pane was reaching its limit of self-supporting when developed at the top of the pane. The test was terminated after a period of 55 minutes a largest pane continued to slump towards the furnace chamber and revealed a large gap.
- 5.5 As there is no test evidence available regarding the fire resistance performance of Fivestar in panes in excess of nominal size 1500 mm high by 1000 mm wide it is considered reasonable to limit the size of the Fivestar glass panes to the maximum size as tested.
- 5.6 Although the allowable maximum width of the glass panes will be 1000 mm, the modular of the Invotek screen ie stud spacing is 606 mm. Therefore, the maximum nominal size Fivestar glass panes will be 1500 mm high by 600 mm wide. However, if it is practical to the stud spacing it is considered reasonable to increase the spacing to nominally 1000 mm.
- 5.7 The wire reinforced glass was bedded in a PVC glazing gasket for test referenced FR 1085 sight size area of each glass pane was nominally 1.59 m². The results of the test have indicated that the size of glass pane as tested is the limit which can be supported by the PVC arrangement.
- 5.8 Owing to the nominally 1000 mm maximum modular spacing of the vertical studs together with the height limit of 1500 mm for the panes of glass, the nominal area for each Fivestar glass pane will be 1.5 m². Being of similar area to the wire reinforced glass the Fivestar glass is expected to remain supported around its perimeter edges during exposure to standardised fire conditions for the required period of 30 minutes.

Pyroswiss Glass

- 5.9 The test report referenced J89414/2 provides suitable evidence regarding the fire resistance performance of Pyroswiss glass when supported by a steel frame proprietary screen known as Signature.
- 5.10 Each pane of glass was the same nominal size, 2517 mm high by 1136 mm wide. The panes were bedded on a ceramic fibre insulation gasket and retained by pressed mild steel mullions of 2 mm thickness. After 32 minutes of testing, a gap developed between the glass pane and mullion which exceeded the maximum allowed under the integrity criterion.
- 5.11 The test referenced J89414/2 has demonstrated that the size of glass pane tested is the limit in respect to satisfying the integrity criterion of the testing standard for the required period of 30 minutes.
- 5.12 Therefore, it appears reasonable to limit the height of the Pyroswiss glass to the same height as tested ie nominal size 2517 mm. The studs for the Invotek screen will be spaced at nominal 606 mm centres which means that the area of the Pyroswiss glass panes will be approximately the same as the wire reinforced glass. However, assuming it is possible to adjust the spacing of the studs it appears reasonable to allow a maximum pane width size of 1136 mm providing the height does not exceed nominally 1400 mm ie 1.59 m² tested and reported in reference FR 1085 ie nominally 1.59 m².

- 5.13 It has been previously mentioned that the wire reinforced glass for test referenced FR 108 bedded in a PVC glazing gasket. The area of each glass pane was nominally 1.59 m². results of the test have demonstrated that the size of glass pane as tested is the limit which can be supported by the PVC gasket arrangement. Therefore, it is reasonable to expect that a similar glazing arrangement would support a Pyroswiss glass pane of approximately the same size without detriment during exposure to standardised fire test conditions for the required period of 30 minutes.

6. Conclusion

- 6.1 A steel stud screen known as Invotek when glazed with either Fivestar glass of 5 mm thickness or Pyroswiss glass of 6 mm thickness in maximum heights of 1500 mm and 2517 mm respectively such that the nominal sight size area of each pane does not exceed 1.59 m² as discussed in this report should, if subjected to a test in accordance with BS 476: Part 22: 1987, Clause 4.2.1, be capable of satisfying the integrity criterion of that standard for the required period of 30 minutes.
- 6.2 For Fivestar glass, the insulation criterion would be exceeded after approximately 4 minutes as indicated by test referenced WARRES No. 11801.
- 6.3 Pyroswiss glass is a non-insulating glass and as such, the insulation criterion of the test standard is expected to be exceeded after only a few minutes of testing.

7. Validity

- 7.1 This assessment is issued on the basis of test data and information available at the time of issue. If contradictory evidence becomes available to Warrington Fire Research Centre the assessment will be unconditionally withdrawn and Vetrotech UK will be notified in writing. Similar assessments are invalidated if the assessed construction is subsequently tested because actual test results are deemed to take precedence over an expressed opinion. The assessment is valid initially for a period of two years ie until 1st April 1998, at which time it is recommended that it be re-assessed for re-appraisal.
- 5.2 The appraisal is only valid provided that no other modifications are made to the construction other than those described in this report.

18th April 1996

KC(4681)

Appendix 1

Summary of Supporting Data

A1.1 Timber Research and Development Association report reference FR 1085

A report on a fire resistance test carried out in accordance with BS 476: Part 8: 1972, on a loadbearing steel stud glazed screen of overall size 2750 mm high by 2436 mm wide by 76 mm thick consisting of vertical steel studs at 606 mm centres infilled with four full-height steel frame modules glazed with 6 mm thick Georgian wire reinforced glass. The modules were retained within steel abutment tracks. The steel stud to the right hand side was omitted. The modules were retained in position by external 'top-hat'/'omega' section steel clips screw fixed to the steel studs. Sealmaster and Mann McGowan intumescent materials were incorporated within the glazing system. The construction achieved the following results:

	Sealmaster Intumescent	Mann McGowan Intumescent
Stability	32 minutes	32 minutes
Integrity	26 minutes	31 minutes
Insulation	0* minutes	0* minutes

* Not measured

Test date : 1st May 1987
 Test sponsor : Poole Partitioning Limited

Poole Partitioning Limited have given their permission to use the above test report for the purpose of preparing this appraisal.

A1.2 Warrington Fire Research Centre WARRES No. R11801

A report on a fire resistance test carried out in accordance with BS 476: Part 22: 1987, Clause 10, on a steel framed multi-paned glazed screen, glazed with 5 mm thick Pyroswiss Fire glass. The specimen was of overall nominal size 2960 mm high by 2960 mm wide and the maximum sight size of the nine different size panes was 1480 mm high by 980 mm wide. The results of the test were as follows:

Integrity : 55 minutes
 Insulation : 4 minutes

Test date : 7th April 1995
 Test sponsor : Vetrotech AG

Appendix 1 (Continued)

**A1.3 SGS Yarsley Technical Services (Now Warrington Fire Research Centre)
report reference J89414/2**

A report on a fire resistance test carried out in accordance with BS 476: Part 10: 1987, Cl: 10, on a steel framed partition of overall nominal size 2700 mm high by 3000 mm long which contained two glazed openings. Each glazed opening was glazed with 6 mm thick Pyroswiss glass of nominal size 2517 mm high by 1136 mm wide. The results of the test were as follows

Integrity : 32 minutes
Insulation : not stated

Test date : 21st February 1992
Test sponsor : Vetrotech GmbH

Appendix 2

Declaration by Vetrotech UK

We the undersigned confirm that we have read and complied with the obligations placed on us by the Fire Test Study Group Resolution No. 64A: 1993.

We confirm that the component or element of structure, which is the subject of this assessment, has to our knowledge been subject to a fire test to the Standard against which the assessment is being made.

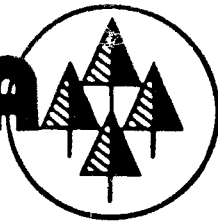
We agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test to the Standard against which this assessment is being made.

We are not aware of any information that could adversely affect the conclusions of this assessment.

If we subsequently become aware of any such information we agree to cease using the assessment and ask Warrington Fire Research Centre to withdraw the assessment.

Signed : *J. Clarksw*

For and on behalf of : *Vetrotech UK.*

TRADA

INVOTEK
SINGLE
GLAZED

CONFIDENTIAL

FR 1085

Page 1 of 14

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NATLAS F

FIRE TEST SECTION

INVOTEK GLAZED FULL HEIGHT

(MANN
MCGOWAN
INTUMESCENT
ONLY IS USED)

REPORT OF A FIRE RESISTANCE TEST PERFORMED
ON A NON-LOADBEARING STEEL STUD, GLAZED SCREEN (INVOTEK)

TEST NO: FR 1085

SPONSOR: Poole Partitioning Ltd.,
Parkstone Works,
29 Church Road,
Parkstone,
Poole,
Dorset BH14 8UF.

DATE OF TEST: 1st May 1987

STANDARD: BS476: Part 8: 1972

SUMMARY:

A test was performed on a non-loadbearing steel stud glazed screen of overall size 2750mm high by 2436mm wide by 76mm thick consisting of vertical steel studs at 606mm centres infilled with four full-height steel framed modules glazed with 6mm thick Georgian wired glass. The modules were retained within steel abutment tracks. The steel stud on the right hand side was omitted. The modules were retained in position by external 'top hat'/'omega' section steel clips screwed through to the studs. Sealmaster and Mann McGowan intumescent materials were incorporated within the glazing bead system. The construction achieved the following fire performance ratings.

	Sealmaster intumescent	Mann McGowan intumescent
Stability:	32 minutes	32 minutes
Integrity:	26 minutes	31 minutes
Insulation:	0* minutes	0* minutes

*No insulation rating may be claimed for constructions which incorporate non-insulating glazed elements.

The legal validity of this report can only be claimed on presentation of the complete report. This frontispiece in isolation does not constitute an endorsement of the result indicated above. All pages of original copies of this document are embossed with the TRADA name and tree device.

FOREWORD

This test was performed at the request of the sponsor to determine the resistance performance of a non-loadbearing steel stud glazed screen which was tested in accordance with the conditions specified in BS476: Part 8: The specimen was mounted in a plasterboard clad timber stud surround forming one side of the test furnace.

The procedures adopted during test followed the resolutions of the Fire Study Group, where appropriate. These resolutions provide the basis of common agreements between the consultant fire test laboratories in the areas of the test specification which may be ambiguous or open to interpretation.

CONSTRUCTION

The specimen was supplied and constructed for test by the sponsor and was overall size 2750mm high by 2436mm wide.

The prefinished perimeter frame designated 'Invotek System' consisted of a 76mm wide by 33mm deep by 0.8mm thick 'U' section steel head track, two deep 'U' section wall abutment tracks designated 115L and a 76mm wide by 33mm deep by 0.8mm thick 'U' section steel recessed floor track, designated 115L. The perimeter frame was fixed to the associated furnace construction using 25mm long No.10 panhead screws at 600mm centres. Four vertical 47mm diameter by 30mm wide by 0.55mm thick galvanised 'C' section steel studs designated 115L were positioned between the head and floor tracks at nominal 606mm centres, the outermost left hand stud being fitted within the wall abutment track and the right hand one being omitted to facilitate assembly. Each stud was 23mm short at the head to allow for expansion. The studs were slotted on to a 50mm high by 74.5mm deep by 68.5mm wide by 0.9mm thick steel stud locator designated SP218, slotted into the head track and centrally fixed in position with a 19mm long screw through the track into the surrounding construction. The panels each rested centrally on a 73mm wide by 30mm deep by 1mm thick steel plate laid across, within, and pop-riveted at either end to the floor track. A 9mm wide by 3mm thick flexible foam cellular plastic self-adhesive gasket strip designated 156 was fixed to the outside of the head and wall abutment channels but not under the floor track, 3mm in from each outside edge of the channel.

Four 2682mm high by 592mm wide by 73.5mm deep factory-made glazed panel modules were positioned between the 'C' section studs and located within the head and floor tracks. The panels incorporated a pre-finished 73.5mm diameter by 35.25mm wide by 0.8mm thick profiled 'C' section steel channel designated 'Glazing frame - Invotek system', with a 12mm wide by 9mm deep rebate to retain the glass, clipped together at each node. A 15mm wide by 11.3mm overall flexible plasticised PVC glazing gasket manufactured by Rehau and designated SK-5184 was pressed into the rebate to hold the 6mm thick Gex wired glass inserted into the gasket. Each panel was of exposed glass : 2602mm high by 512mm wide. The gaps between the vertical butt joints of successive panel modules were covered by 27mm wide by 11mm deep by 0.8mm thick prefinished steel 'top hat' section compression clips, designated 115L, slotted into the joint and fixed to the underlying 'C' section studs with 19mm long No.6 countersunk screws at 300mm centres. The compression clips were decorated with a 10mm wide by 7mm deep by 0.7mm thick extruded PVC

cover trim infill designated 133B. This snapped into the compression channel and carried up into the head track, but leaving a 23mm gap to allow for expansion and terminating at the bottom of the top of the floor track. cavities in the perimeter frame and within the glazing frames and within 'C' studs were all filled with Rockwool RWA rockfibre insulation matts, ensuring that there were no voids.

Intumescent materials were placed between the PVC glazing gasket and the steel glazing channel rebate as follows. Mann McGowan Pyromas BSM500M intumescent paste was fitted within the glazing rebate of the left hand and the centre right hand glazing panel modules. Sealmaster intumescent paste was used on the right hand and centre left hand glazing panels.

Details of the construction are shown in Figures 1085-1, 2 and 3.

TEST PROCEDURE

Thermocouples were fitted in accordance with BS476: Part 8: 1972. Six suitably distributed thermocouples monitored the furnace temperature. Thermocouple positions are shown in Figure No.1085-4.

The furnace was operated to follow as closely as possible the time/temperature relationship specified in BS476: Part 8: 1972 and the temperatures recorded are shown graphically in Figure No.1085-6.

The furnace pressure was measured 200mm from the top of the furnace and controlled after the first five minutes to provide a positive pressure of approximately 1.5mm watergauge for the duration of the test. This represents a pressure of approximately 1.0mm watergauge at the head of the specimen

At the conclusion of the test the furnace was shut down and the specimen cooled with water.

Observations were made during the test and these are recorded below.

A heat flux meter was positioned 3.2m away from the specimen. The radiation level recorded is shown in Figure 1085-5.

OBSERVATIONS

Time (min/sec)	Comment	Pressure (mm water)
00.00	Test started.	
01.00	Exposed PVC strips falling.	
02.00	Glass cracking.	
03.00	Panel starting to bow towards furnace.	
05.00	Centre stud bowing 22.5mm towards furnace.	

- 07.00 Intumescent material exuding around studs.
- 07.40 Foam gasket coming out and melting from the tops of all modules.
- 10.00 Centre stud now bowed 42.5mm towards furnace.
- 16.00 Centre stud bowed 46mm towards furnace.
- 18.30 (Bow measuring device moved.)
- 26.06 Continuous flaming of PVC seal at bottom of inner left hand module constituting integrity failure.
- 28.02 Intermittent flaming from PVC at bottom of common stud between the two right hand modules.
- 28.40 Continuous flaming from bottom of right hand module, constituting further integrity failure.
- 29.00 Flaming on inner left hand module ceased.
- 30.30 Flaming on right hand module ceased.
- 31.28 Glazing in inner right hand module buckling 500mm from top of module. Gap exceeding 150mm by 6mm developed constituting integrity failure. Glass fell out.
- 32.00 Test terminated.

ANALYSIS

The inner left hand module which incorporated Sealmaster intumescent paste failed integrity at 26 minutes when continuous flaming occurred. The right hand module which also incorporated Sealmaster intumescent paste failed integrity by continuous flaming at 29 minutes. The failures were associated with the PVC frame falling and accumulating. The flaming ceased on the left hand module at 29 minutes and at 31 minutes on the right hand module. Both modules were maintaining stability at the end of the test at 32 minutes.

The inner right hand module incorporated Mann McGowan Pyromas intumescent paste and failed integrity at 31 minutes when the glass softened and slumped out of the framing causing a gap exceeding 150mm by 6mm to develop. The glass slumped and sheared off at midheight causing stability failure to occur at 32 minutes.

Since the specimen contained non-insulating glass, no insulation rating can be claimed.

CONCLUSION

When tested in accordance with BS476: Part 8: 1972, the non-loadbearing, steel stud glazed screen described in the construction section of this report achieved the following fire resistance performance ratings:

	Sealmaster intumescent	Mann McGowan intumescent
Stability:	32 minutes	32 minutes
Integrity:	26 minutes	31 minutes
Insulation:	0* minutes	0* minutes

No insulation rating may be claimed for elements containing non-insulating glass.


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R. J. WILLIAMS
Officer responsible for Test

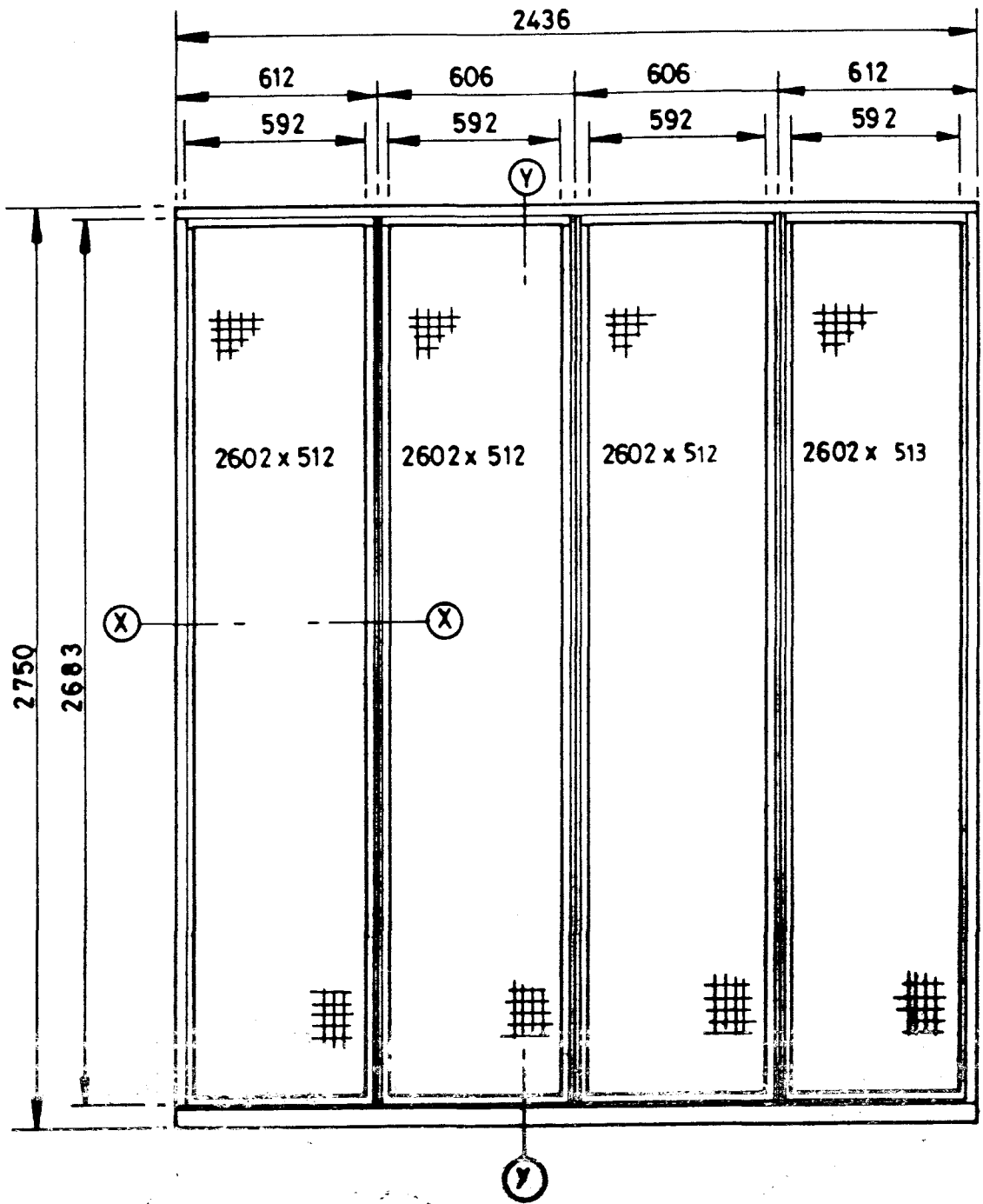

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DR. C. J. GILL
Deputy Director (Research and Development)

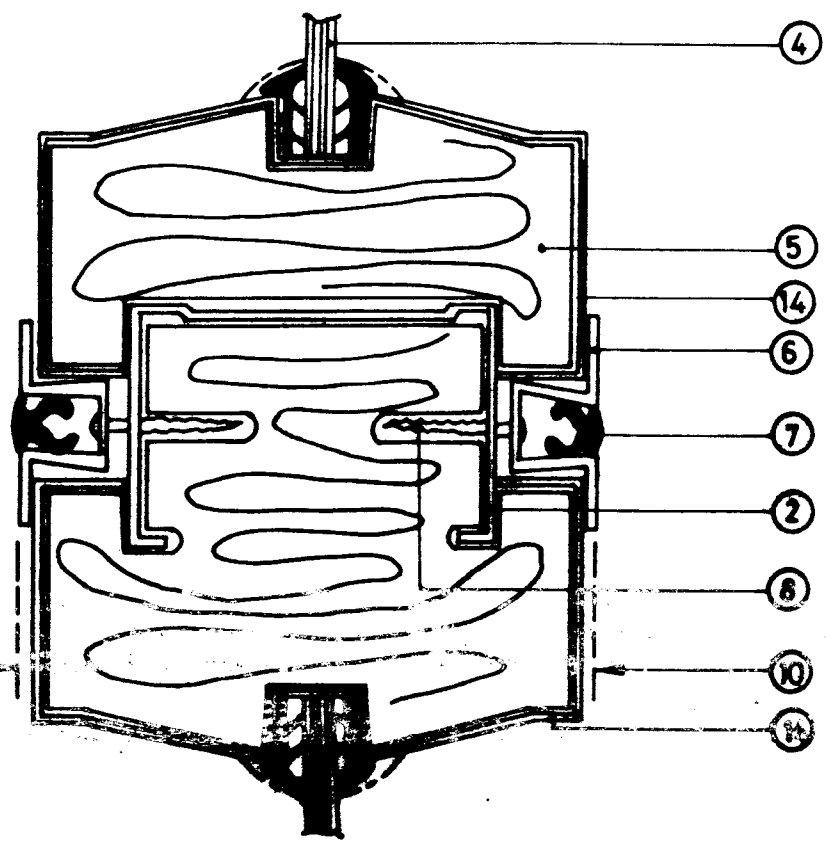
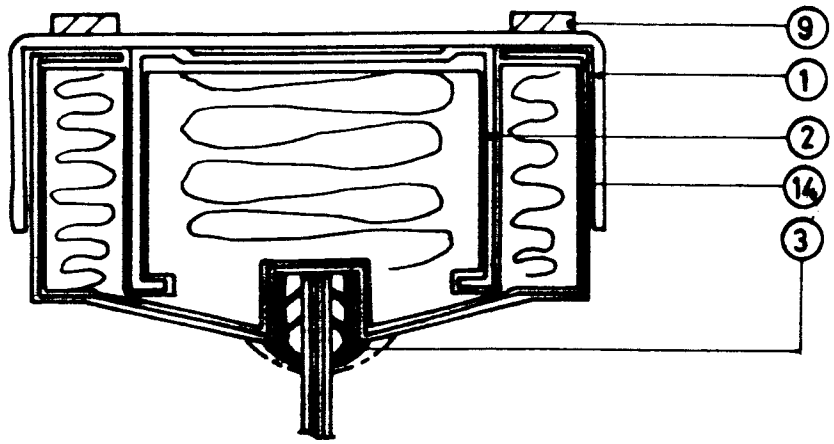
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KEY TO FIGURES FR 1085-3, 4, and 5
All dimensions on Figures in millimetres. Do not scale.

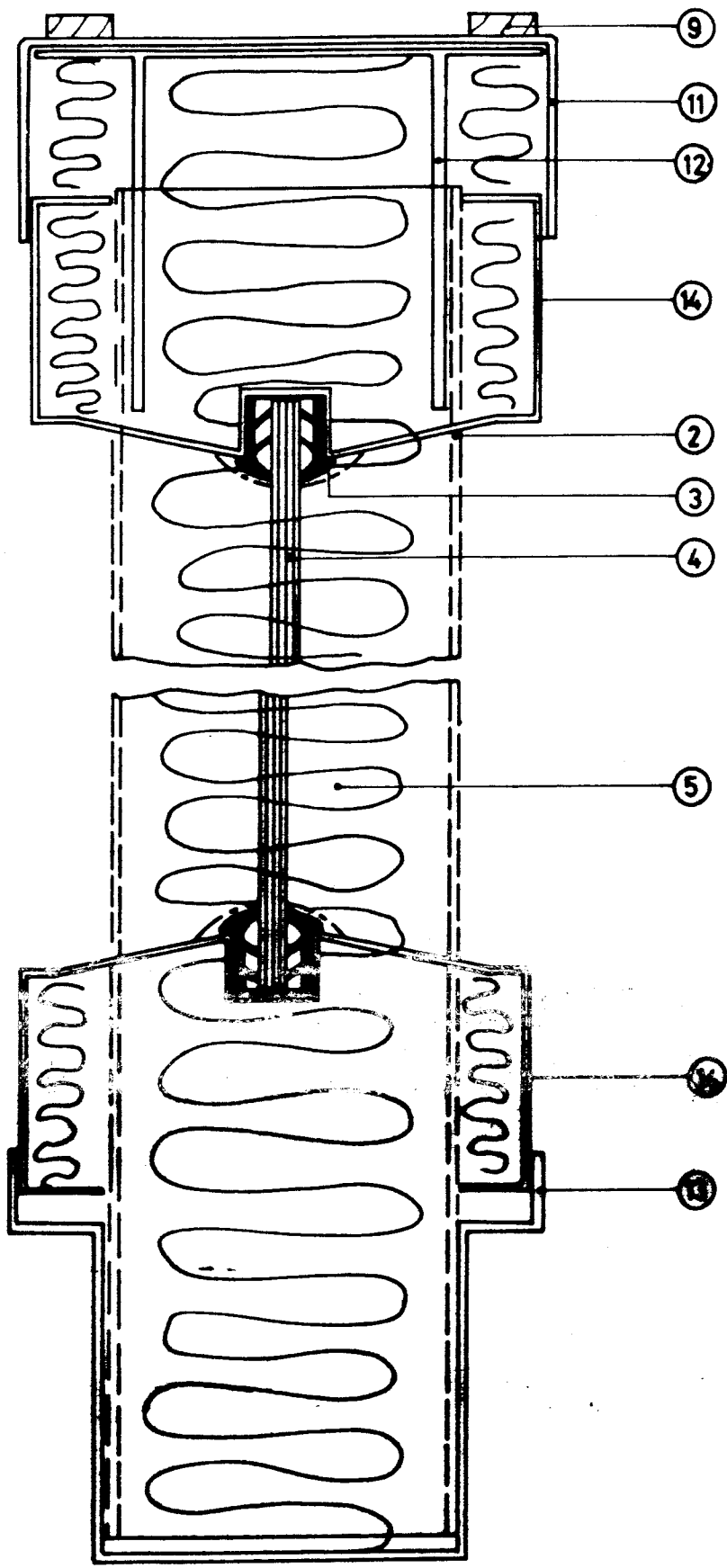
1. 76 wide by 25 deep by 0.8 thick prefinished steel 'U' section abutment track.
2. 47 deep by 30 wide by 0.55 thick galvanised 'C' section steel designated 120.
3. 15 wide by 11.3 deep flexible plasticised PVC glazing gasket, manufactured by Rehau, designated SK-5184, with intumescent material, Sealmaster or Mann McGowan, between it and the rebate in the glazing frame.
4. 6 thick Georgian wired glass.
5. 50 thick Rockwool RWA rockfibre insulation batts.
6. 27 wide by 11 deep by 0.8 thick prefinished steel 'tophat' section compression clip, designated 115D.
7. 10 wide by 7 deep extruded 0.7 thick PVC cover trim infill, designated 133B.
8. 19 long No. 6 countersunk screws at nominal 300 centres.
9. 9 wide by 3 thick flexible foam cellular plastic self-adhesive gasket strip, designated 156.
10. 76 thick.
11. 76 wide by 33 deep by 0.8 thick prefinished steel 'U' section channel head abutment track, designated 115L.
12. 50 high by 74.5 deep by 68.5 wide by 0.9 thick steel stud locally screwed through the track to the surrounding construction with 19 long screw designated SP218.
13. 76 wide by 60 deep by 0.8 thick prefinished steel 'U' section recessed floor channel abutment track, designated 116D.
14. 73.5 deep by 36 wide by 0.8 thick 'C' section steel channel, designated 'Glazing frame - Invotek system' incorporating a 12 wide by 9 deep rebate to retain the glass.



ELEVATION



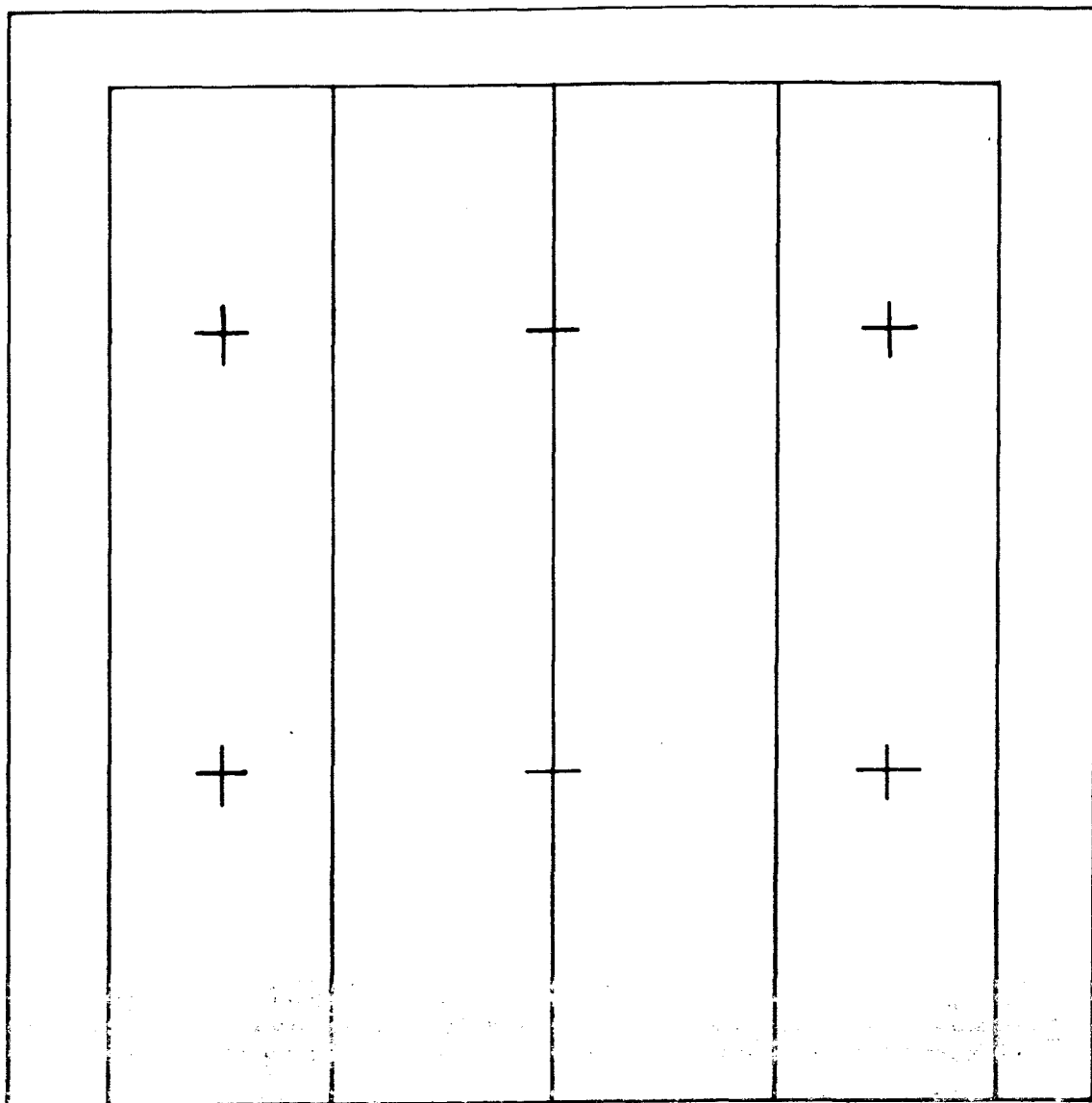
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SECTIONS

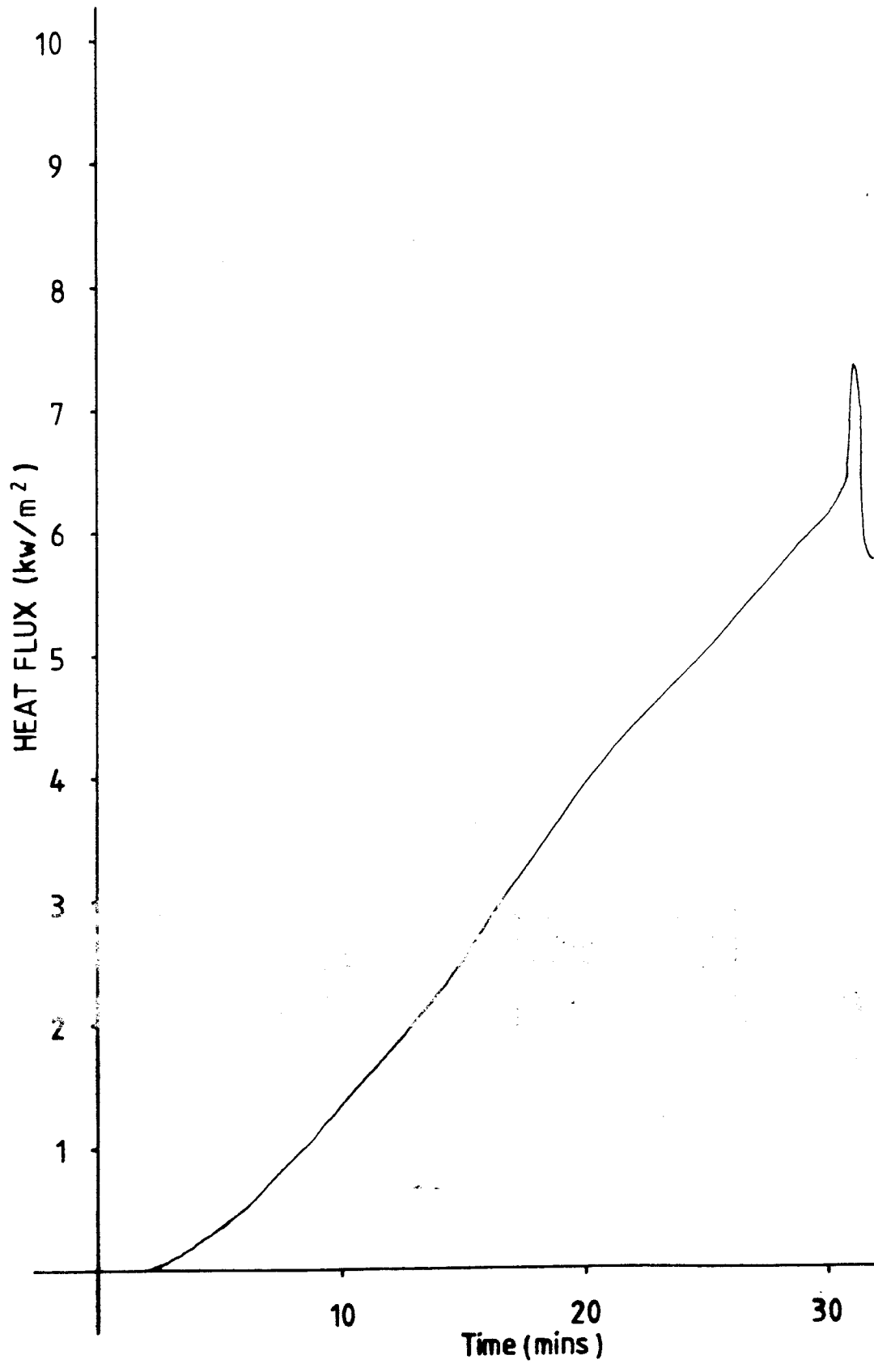
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FIG 1

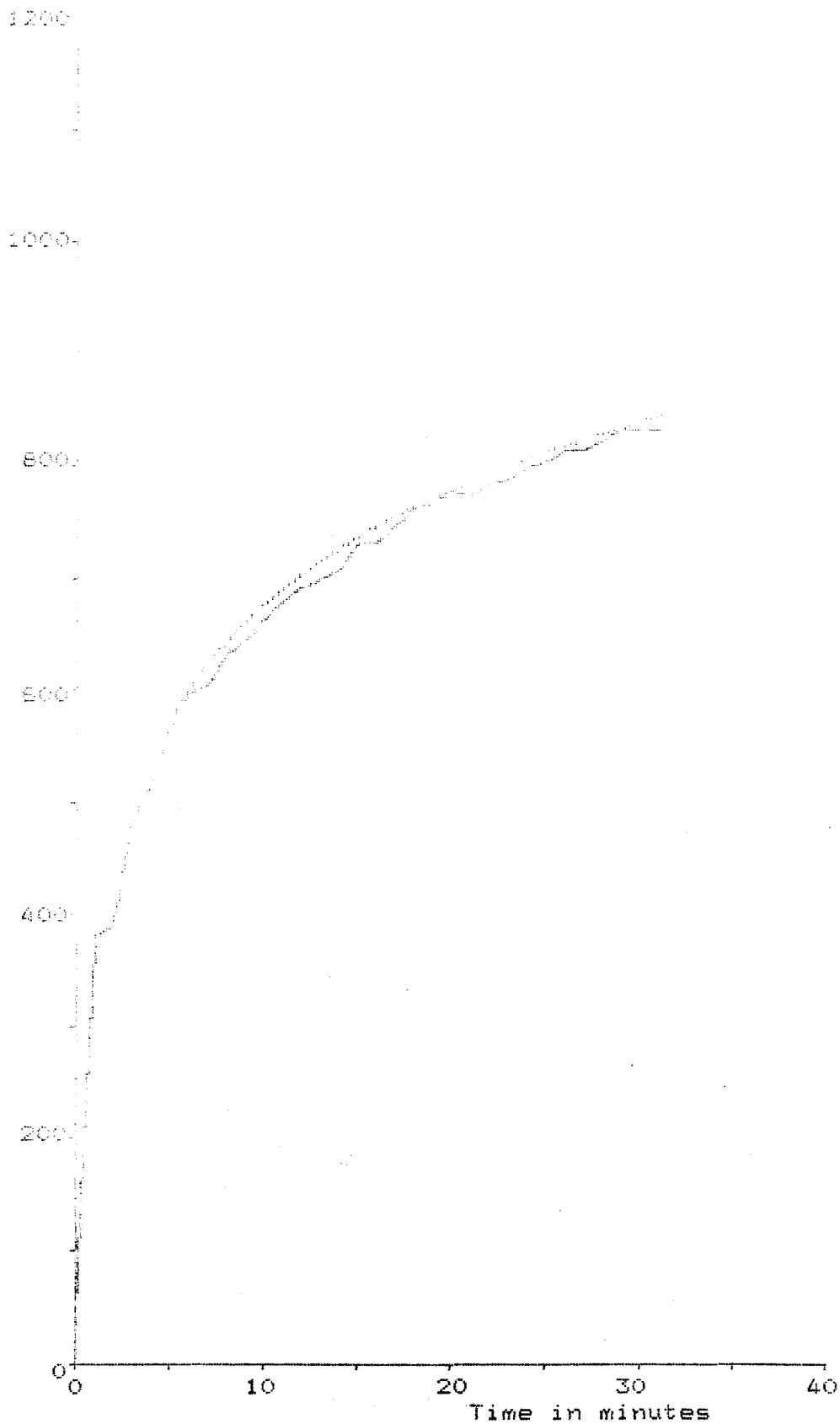


+ : Furnace thermocouples

POSITION OF THERMOCOUPLES



Temperature
deg. C



—— Mean furnace temperature
..... Nominal furnace temperature

Time / temperature graph



General elevation before test



7 minutes into test



31 minutes into test



Exposed elevation after test