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Report Number **BTC 12033F**

# A FIRE RESISTANCE TEST ON A 5m HIGH X 3m WIDE GYPROC GYPWALL PARTITION INCORPORATING A DOUBLE LAYER OF 12.5mm GYPROC SOUNDBLOC EACH SIDE OF 70S50 STUDS, CONDUCTED IN ACCORDANCE WITH BS EN 1364-1:1999.

Test Date: 24th May 2002

www.btconline.co.uk

**Customer:** **British Gypsum Limited**
East Leake
Loughborough
Leicestershire
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0296

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## FOREWORD

This test report details a fire resistance test conducted on a sheet and stud partition system. The test sponsor was British Gypsum Limited.

The test specimen was installed by British Gypsum. The construction of the specimen took place between the 30th April and 1st May 2002. British Gypsum Limited designed and selected the materials comprising the test specimen.

The test date was carried out on the 24th May 2002.

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedures outlined in EN 1363-1, and where appropriate EN 1363-2. Any significant deviation with respect to size, constructional details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in EN 1364-1 is not covered by this report.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

## REPORT AUTHORISATION

| Report Author | Authorised by |
|---|---|
| B. Willson | |
| **Brian Willson**<br>*Test Report Writer* | **Eur Ing. Paul Howard**<br>BSc. (Hons.), CEng., MIOA<br>*Head of Laboratory* |



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## TEST CONSTRUCTION

The specimen was constructed in a refractory concrete lined steel restraint frame having an opening of 5000mm high x 3000mm wide.

Gypframe 72DC60 channel was fixed to the head and base of the test aperture at 600mm centres with 60mm Hilti Hus fixings. Gypframe 70S50 studs were positioned at 600mm centres between the channels. Each 5000mm length of stud comprised of one full 3000mm length plus a second length 2600mm long, overlapped by 600mm and fixed together using two Gyproc Wafer head screws, two to each flange. The right hand stud viewed from the unexposed face was not fixed to the perimeter test frame, but the gap between the stud and the lining was filled with a 50mm Rockwool Firebatt gasket. The left hand stud was fixed to the test frame at 600mm centres with 60mm Hilti Hus fixings.

The framework was lined both sides with a double layer of 12.5mm Gyproc SoundBloc board. The inner layer boards were fixed around the perimeter only, using 25mm Gyproc Drywall screws at 300mm centres. The outer layer boards were fully fixed to all the studs and channels using 36mm Gyproc Drywall screws at 300mm centres. Full width boards were positioned on the outer layer on the exposed face adjacent to the free edge. All vertical board joints were staggered.

Horizontal joints were positioned 3000mm from the base for the outer layer on both the exposed and unexposed faces of the construction. Horizontal joints were positioned 2400mm from the base for the inner layers on both the exposed and unexposed faces of the construction. Gypframe GFS1 fixing strap was used behind the horizontal board joints on the outer layers.

All outer layer joints were taped and filled using Gyproc Paper Joint Tape and Gyproc Joint Filler. All screw heads were spotted using Gyproc Joint Filler.

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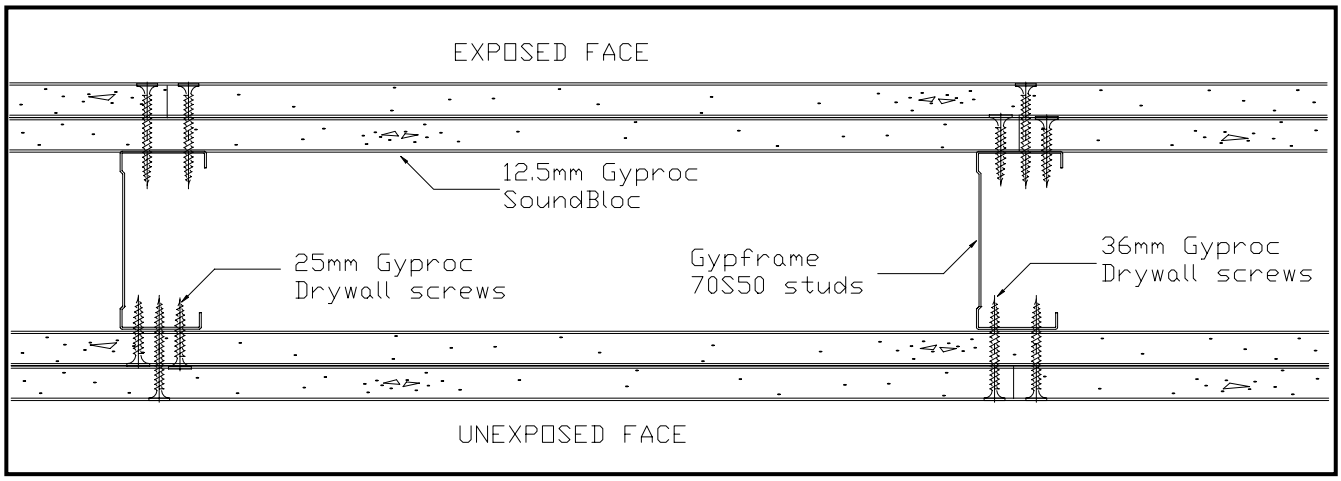


**Figure 1.** Cross-section through the partition.

*The descriptions of individual components making up the test specimen were provided by the customer and were checked for accuracy wherever possible.*

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## TEST MATERIALS

### Gyproc SoundBloc

Nominally, 3000mm (long) x 1200mm (wide) x 12.5mm (thick), Gyproc SoundBloc board manufactured and supplied by British Gypsum Limited ex East Leake Works.

| | |
|---|---|
| Measured surface density: | 10.86 kg/m$^2$. |
| Measured thickness: | 12.44 mm. |
| Board identification numbers: | 16 116 2 13:54 |
| Measured moisture content: | 0.81% |

The surface density and board thickness were calculated using the actual weight and size of a selection of boards used in the test specimen. The moisture content of the board was determined using samples dried to a constant weight in an oven at 40°C.

### Metal Components

(i) Gypframe 70S50 metal studs. Manufactured from galvanised mild steel nominally 0.5mm thick using the "Ultrasteel" process.
(ii) Gypframe 72DC60 metal channel. Manufactured from galvanised mild steel nominally 0.6mm thick using the "Ultrasteel" process.
(iii) Gypframe GFS1 fixing strap manufactured from galvanised mild steel nominally 0.5mm thick.

All metal components supplied by British Gypsum Limited.

### Fasteners

(i) 25mm Gyproc Drywall screws supplied by British Gypsum Limited.
(ii) 36mm Gyproc Drywall screws supplied by British Gypsum Limited.
(iii) 60mm Hilti Hus fixings supplied by Hilti Limited.

### Jointing Material

(i) Gyproc Joint Filler supplied by British Gypsum Limited.
(ii) Gyproc Paper Tape supplied by British Gypsum Limited.

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## TEST PROCEDURE

The test was conducted fully in accordance with BS EN 1364-1:1999. The specimen was subjected to fire from one side, as specified in BS EN 1364-1:1999. As the test specimen is considered to be symmetrical one test is adequate to cover the fire resistance performance in both directions.

The test procedure used was EN 1364-1 Issue 1.

The ambient temperature at the commencement of the test was 18°C.

The furnace pressure head was located at a height of 3 metres and the pressure was maintained at 1 ± 2 Pa positive with respect to the atmosphere, except during the first 4 minutes of the test and during 12 – 19 and 21 - 23 minutes.

The test conditions did not meet the full requirements of BS EN 1363-1:1999 as the furnace linings and test frame stiffness did not fully comply. The test centre is of the opinion that these deviations from the documented method will not unduly effect the result of the test.

## TEST RESULTS

The requirements of the standard were satisfied for the following periods:

| | |
|---|---|
| **Integrity:** | **100 minutes (Sustained flaming )** |
| | **102 minutes (6mm x 150mm gap gauge)** |
| **Insulation:** | **87 minutes (Roving thermocouple exceeded 180 deg C.)** |

The test was terminated at 103 minutes.

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## LIMITATIONS

The results only relate 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.

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 5 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.

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## TEST DATA

### Observations

Observers: Unexposed face R Evans
Exposed face M Fountain

| Time | | *Observations* |
|---|---|---|
| hrs | mins | All observations refer to the exposed face unless otherwise stated. |
| | 0 | Test Started |
| | 5 | Charring of face paper and jointing materials. |
| | 10 | Lower left hand and centre boards, two vertical cracks 100mm either side of left hand vertical joint, height of each approximately 500mm to 2500mm.<br>Further charring of face paper and jointing materials. |
| | 15 | Horizontal joint open to approximately 7mm.<br>Left hand vertical joint open to approximately 8mm (10mm max)<br>Right hand vertical joint open to approximately 5mm. |
| | 17 | Lower left hand board, vertical crack open to approximately 7mm.<br>Lower centre board, screw heads pulling away from left hand edge of board. |
| | 19 | Upper left hand board, hairline cracks along bottom edge. |
| | 20 | Horizontal joint open to approximately 12mm (15mm max).<br>Left hand vertical joint open to approximately 15mm (17mm max).<br>Right hand vertical joint open to approximately 5mm. |
| | 23 | Lower left hand board, vertical crack closed to approximately 4 – 5mm.<br>Lower centre board, vertical crack closed completely. |
| | 25 | Horizontal joint open to approximately 20mm (25mm max).<br>Left hand vertical joint open to approximately 15mm (20mm max).<br>Right hand vertical joint open to approximately 7mm (10mm max). |

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| Time | | *Observations* |
|---|---|---|
| hrs | mins | All observations refer to the exposed face unless otherwise stated. |
| | 28 | Lower left hand board, crack top left hand side approximately 60mm from edge, height 2400mm, 150mm long. Also screw heads pulling away from top and right hand edges of board. |
| | 31 | Horizontal joint open to approximately 23mm (28mm max).<br>Left hand vertical joint open to approximately 16mm (20mm max).<br>Right hand vertical joint open to approximately 10mm (15mm max). |
| | 35 | Horizontal joint open to approximately 25mm (30mm max).<br>Left hand vertical joint open to approximately 20mm (25mm max). |
| | 38 | Upper boards pulling away from screws heads along horizontal and vertical joints. |
| | 40 | Inner layer lower right hand board, crack visible through gap in right hand vertical joint. |
| | 41 | Horizontal joint open to approximately 30mm (35mm max).<br>Left hand vertical joint open to approximately 20mm (25mm max).<br>Right hand vertical joint open to approximately 15mm. |
| | 43 | Lower left hand board, top left crack extending towards top of board. |
| | 44 | Lower left hand and centre boards, cracks forming around screw heads in field of boards, approximately 300mm from horizontal joint. |
| | 46 | Horizontal joint open to approximately 30mm (35mm max).<br>Left hand vertical joint open to approximately 25mm (30mm max).<br>Right hand vertical joint open to approximately 15mm (20mm max).<br>Inner layer lower right hand board, crack visible in centre of board. |
| | 48 | Lower left hand board, top left hand corner coming away from frame. |
| | 50 | Horizontal joint open to approximately 35mm (40mm max).<br>Right hand vertical joint open to approximately 25mm (30mm max), stud visible. |

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| Time | | *Observations*<br><br>All observations refer to the exposed face unless otherwise stated. |
|---|---|---|
| hrs | mins | |
| | 52 | Lower left hand board, further cracking approximately 900mm long from top down the field of board. |
| | 53 | Lower centre board, cracking down the board centre from top, approximately 300mm long. |
| | 55 | Horizontal joint open to approximately 40mm (50mm max).<br>Right hand vertical joint open to approximately 30mm (35mm max). |
| | 57 | Board fall from lower centre board, left hand side approximately 1200mm x 500mm and top of board approximately 2000mm x 200mm. |
| 1 | 02 | Board fall from lower left hand board, top left hand corner approximately 900mm x 600mm. |
| 1 | 05 | Board fall from lower centre board, right hand side approximately mid-height 500mm x 300mm. |
| 1 | 06 | *Unexposed face*<br>Lower left hand board, screw heads pulling away from field of board.<br>Lower right hand board, base has come away from frame due to specimen deflection towards furnace.<br>Fixed edge on left hand side, glow visible due to specimen deflection pulling boards away from bonding. |
| 1 | 09 | Board fall from inner layer centre boards, mid-height of specimen. |
| 1 | 12 | *Unexposed face*<br>Lower centre board, screw heads pulling away from field of board. |
| 1 | 13 | Board fall from inner layer lower centre and lower right hand boards, total area approximately 2000mm x 2000mm. |
| 1 | 15 | Unexposed inner layer lower centre board, cracking to the right of centre stud. |

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| Time | | *Observations* |
|---|---|---|
| hrs | mins | All observations refer to the exposed face unless otherwise stated. |
| 1 | 16 | *Unexposed face*<br>Upper left hand board, screws pulling away from field of board. Also centre of board buckling approximately 350mm above horizontal joint. |
| 1 | 18 | Inner layer upper boards, random cracks appearing.<br><br>*Unexposed face*<br>Left hand vertical joint, screw heads visible through jointing material.<br>Lower left hand and lower centre boards, screw heads visible through jointing material in field of boards. |
| 1 | 20 | *Unexposed face*<br>Right hand vertical joint, screw heads visible through jointing material. |
| 1 | 27 | *Unexposed face*<br>**INSULATION FAILURE.** Roving thermocouple temperature rise exceeded 180°C on lower left hand board, glow visible around centre of board and discolouration to right hand edge, height approximately 2500mm.<br>Lower centre board, discolouration in field of board. |
| 1 | 28 | Board fall from unexposed inner layer, upper right hand of lower centre board. |
| 1 | 30 | *Unexposed face*<br>Lower left hand board, discolouration spreading from centre of board, height approximately 2500mm. |
| 1 | 32 | Unexposed outer layer lower centre board, light visible through screw head hole in top right hand corner.<br><br>*Unexposed face*<br>Lower left hand board, horizontal crack approximately 1 – 2mm long, height 2500mm.<br>Horizontal joint, screw heads visible through jointing material. |
| 1 | 34 | Unexposed outer layer lower centre board, horizontal cracks forming around top right hand corner. |

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| Time | | *Observations* |
|---|---|---|
| hrs | mins | All observations refer to the exposed face unless otherwise stated. |
| 1 | 35 | *Unexposed face*<br>Cotton pad was applied to horizontal crack on lower left hand board. It did not glow or ignite. |
| 1 | 36 | *Unexposed face*<br>Lower centre board, vertical crack in field of board. |
| 1 | 39 | *Unexposed face*<br>Left hand vertical joint cracking. |
| 1 | 40 | *Unexposed face*<br>**INTEGRITY FAILURE.** Sustained flaming on lower centre board. |
| 1 | 42 | *Unexposed face*<br>**INTEGRITY FAILURE.** 6mm x 150mm gap gauge on lower left hand board, height approximately 2500mm. |
| 1 | 43 | **TEST TERMINATED** |

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Furnace Temperature Graph

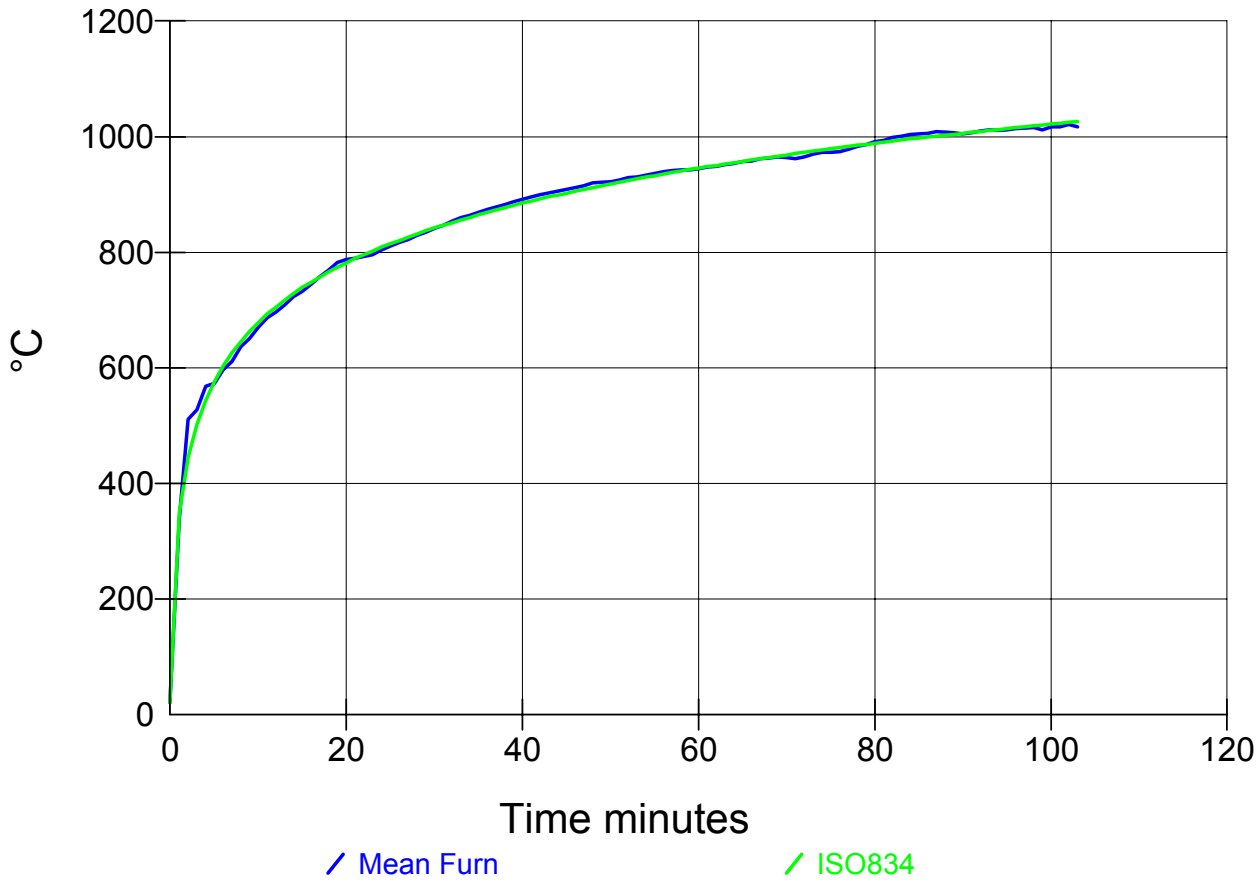


**Figure 2**. Furnace temperature graph

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Unexposed Face Temperature Graph

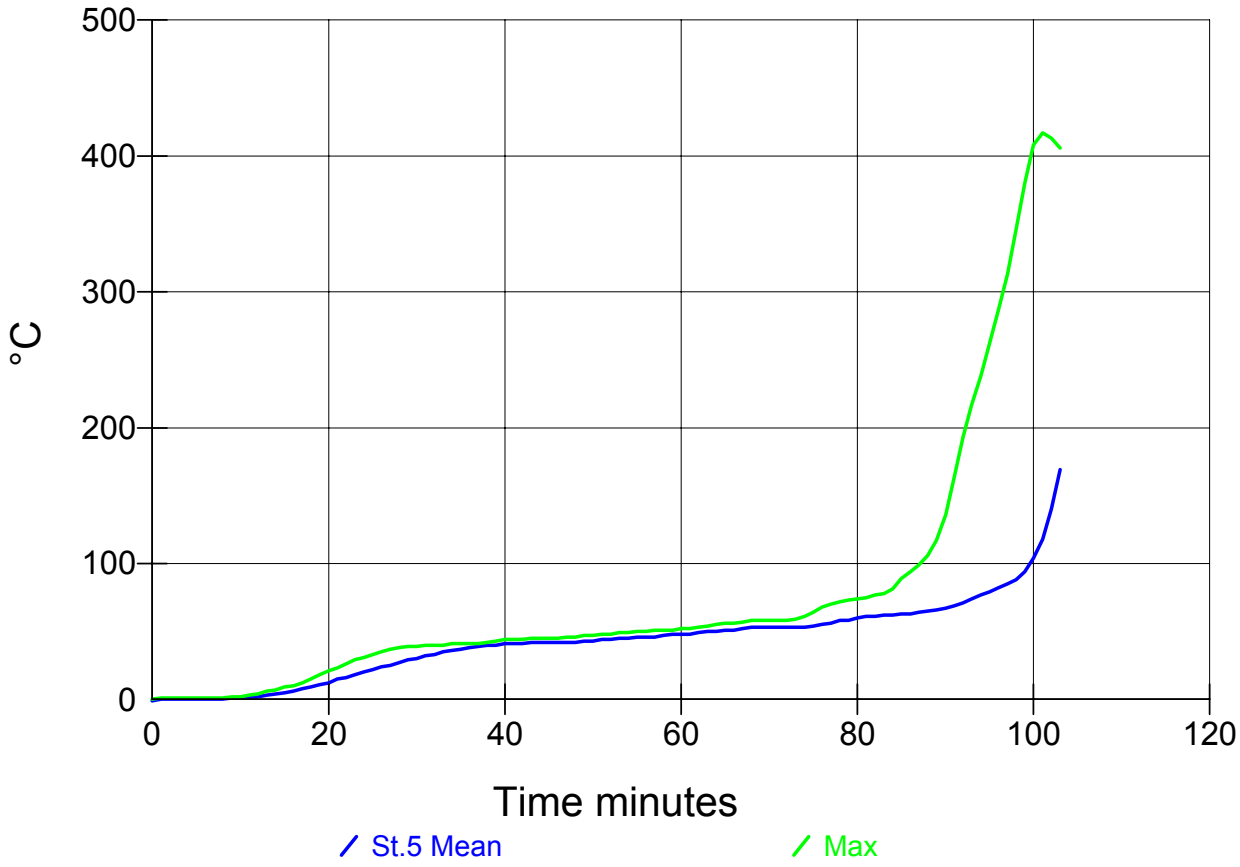


**Figure 3.** Unexposed face temperature graph.

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Pressure Graph

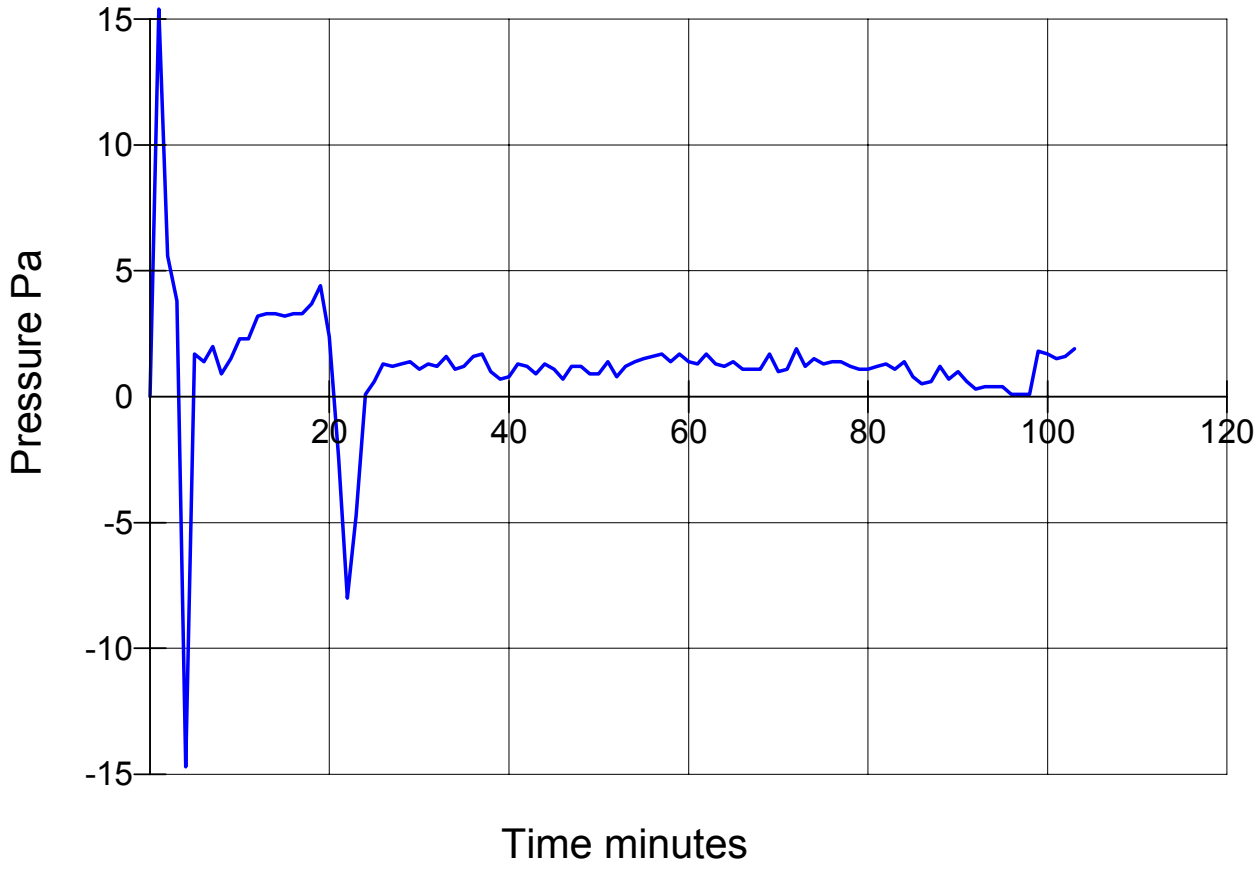


**Figure 4.** Pressure graph.

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## Unexposed Face Thermocouple Layout

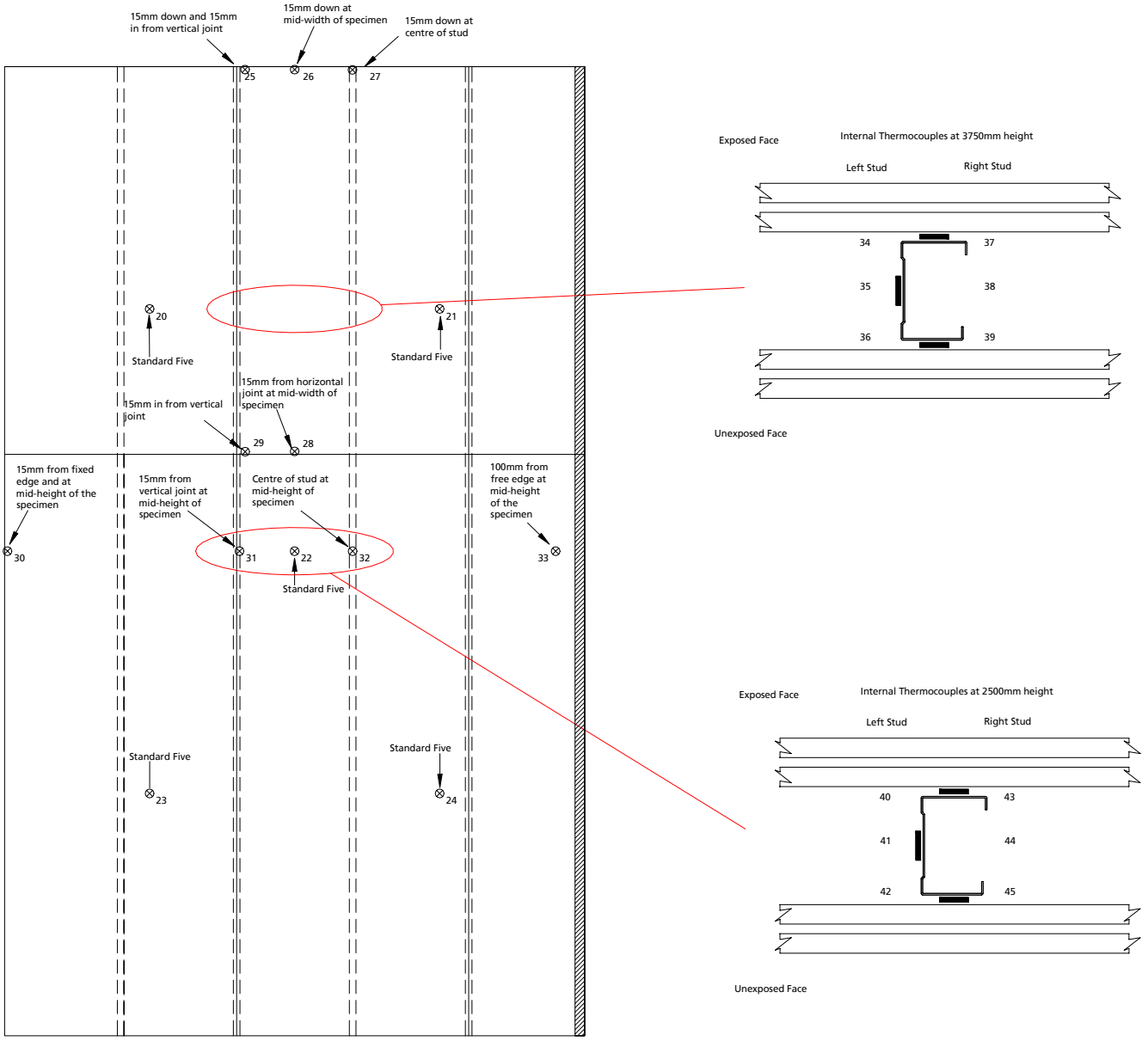


**Figure 5.** Unexposed face thermocouple layout.

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Unexposed Face Standard Five Temperature Data

| Time (mins) | Temperature Rise (°C) | | | | |
|---|---|---|---|---|---|
| | Thermocouple No. 20 | Thermocouple No. 21 | Thermocouple No. 22 | Thermocouple No. 23 | Thermocouple No. 24 |
| 0 | -1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 1 |
| 2 | 0 | 0 | 1 | 0 | 0 |
| 3 | 0 | 0 | 1 | 0 | 1 |
| 4 | 0 | 0 | 1 | 0 | 1 |
| 5 | 0 | 0 | 1 | 0 | 1 |
| 6 | 0 | 0 | 1 | 0 | 1 |
| 7 | 0 | 0 | 1 | 0 | 1 |
| 8 | 0 | 1 | 1 | 1 | 1 |
| 9 | 0 | 1 | 1 | 1 | 2 |
| 10 | 1 | 2 | 1 | 1 | 2 |
| 11 | 1 | 2 | 2 | 1 | 3 |
| 12 | 2 | 3 | 3 | 2 | 4 |
| 13 | 2 | 4 | 3 | 3 | 5 |
| 14 | 4 | 5 | 5 | 4 | 6 |
| 15 | 5 | 7 | 6 | 4 | 7 |
| 16 | 6 | 8 | 7 | 5 | 8 |
| 17 | 7 | 10 | 9 | 6 | 9 |
| 18 | 9 | 11 | 10 | 8 | 11 |
| 19 | 10 | 12 | 12 | 9 | 12 |
| 20 | 12 | 14 | 15 | 10 | 13 |
| 21 | 14 | 16 | 18 | 12 | 15 |
| 22 | 15 | 17 | 21 | 13 | 16 |
| 23 | 17 | 19 | 24 | 15 | 18 |
| 24 | 19 | 21 | 26 | 16 | 20 |
| 25 | 21 | 23 | 28 | 18 | 21 |
| 26 | 23 | 25 | 30 | 20 | 23 |
| 27 | 25 | 27 | 31 | 21 | 25 |
| 28 | 26 | 28 | 32 | 23 | 27 |
| 29 | 28 | 30 | 33 | 25 | 29 |
| 30 | 30 | 32 | 34 | 27 | 31 |
| 31 | 32 | 33 | 35 | 29 | 33 |
| 32 | 33 | 35 | 36 | 30 | 34 |
| 33 | 35 | 36 | 37 | 32 | 36 |
| 34 | 36 | 37 | 38 | 33 | 38 |

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| Time (mins) | Temperature Rise (°C) | | | | |
|---|---|---|---|---|---|
| | Thermocouple No. 20 | Thermocouple No. 21 | Thermocouple No. 22 | Thermocouple No. 23 | Thermocouple No. 24 |
| 35 | 37 | 38 | 39 | 35 | 39 |
| 36 | 38 | 39 | 40 | 36 | 40 |
| 37 | 39 | 40 | 41 | 37 | 41 |
| 38 | 40 | 40 | 41 | 38 | 42 |
| 39 | 40 | 41 | 42 | 38 | 43 |
| 40 | 41 | 41 | 42 | 39 | 44 |
| 41 | 41 | 41 | 43 | 40 | 44 |
| 42 | 41 | 41 | 43 | 40 | 44 |
| 43 | 41 | 41 | 43 | 41 | 45 |
| 44 | 41 | 41 | 43 | 41 | 45 |
| 45 | 41 | 41 | 43 | 41 | 45 |
| 46 | 41 | 41 | 43 | 42 | 45 |
| 47 | 40 | 41 | 44 | 42 | 46 |
| 48 | 40 | 41 | 44 | 43 | 46 |
| 49 | 40 | 41 | 44 | 43 | 47 |
| 50 | 40 | 42 | 45 | 44 | 47 |
| 51 | 41 | 42 | 45 | 45 | 48 |
| 52 | 41 | 42 | 46 | 45 | 48 |
| 53 | 42 | 43 | 46 | 46 | 49 |
| 54 | 42 | 43 | 47 | 46 | 49 |
| 55 | 43 | 44 | 47 | 47 | 50 |
| 56 | 44 | 44 | 48 | 47 | 50 |
| 57 | 45 | 44 | 48 | 47 | 50 |
| 58 | 45 | 45 | 49 | 47 | 50 |
| 59 | 46 | 45 | 50 | 48 | 51 |
| 60 | 46 | 46 | 50 | 48 | 51 |
| 61 | 47 | 46 | 51 | 48 | 51 |
| 62 | 48 | 47 | 53 | 49 | 52 |
| 63 | 48 | 47 | 54 | 49 | 52 |
| 64 | 49 | 48 | 55 | 49 | 53 |
| 65 | 50 | 48 | 56 | 49 | 53 |
| 66 | 51 | 49 | 56 | 50 | 53 |
| 67 | 51 | 49 | 57 | 50 | 54 |
| 68 | 52 | 50 | 58 | 51 | 54 |
| 69 | 52 | 50 | 58 | 51 | 54 |
| 70 | 52 | 50 | 58 | 52 | 54 |
| 71 | 52 | 51 | 58 | 52 | 54 |
| 72 | 52 | 51 | 58 | 53 | 54 |

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| Time (mins) | Temperature Rise (°C) | | | | |
|---|---|---|---|---|---|
| | Thermocouple No. 20 | Thermocouple No. 21 | Thermocouple No. 22 | Thermocouple No. 23 | Thermocouple No. 24 |
| 73 | 52 | 51 | 59 | 53 | 54 |
| 74 | 51 | 51 | 59 | 54 | 54 |
| 75 | 51 | 51 | 60 | 55 | 54 |
| 76 | 51 | 52 | 63 | 56 | 55 |
| 77 | 51 | 52 | 65 | 58 | 56 |
| 78 | 51 | 52 | 67 | 63 | 57 |
| 79 | 51 | 52 | 67 | 65 | 58 |
| 80 | 51 | 52 | 68 | 66 | 63 |
| 81 | 51 | 51 | 69 | 67 | 67 |
| 82 | 51 | 51 | 69 | 68 | 68 |
| 83 | 52 | 51 | 70 | 68 | 69 |
| 84 | 52 | 52 | 70 | 69 | 70 |
| 85 | 53 | 52 | 70 | 70 | 71 |
| 86 | 53 | 52 | 71 | 71 | 72 |
| 87 | 54 | 53 | 72 | 72 | 73 |
| 88 | 56 | 53 | 73 | 73 | 73 |
| 89 | 57 | 54 | 74 | 74 | 74 |
| 90 | 58 | 54 | 76 | 75 | 75 |
| 91 | 59 | 56 | 78 | 77 | 76 |
| 92 | 59 | 58 | 82 | 82 | 78 |
| 93 | 60 | 59 | 87 | 86 | 79 |
| 94 | 61 | 60 | 91 | 89 | 84 |
| 95 | 62 | 61 | 94 | 92 | 89 |
| 96 | 63 | 62 | 97 | 96 | 92 |
| 97 | 64 | 64 | 101 | 101 | 95 |
| 98 | 65 | 66 | 105 | 108 | 98 |
| 99 | 66 | 67 | 114 | 122 | 103 |
| 100 | 68 | 68 | 121 | 152 | 111 |
| 101 | 70 | 71 | 131 | 192 | 126 |
| 102 | 72 | 72 | 155 | 229 | 176 |
| 103 | 75 | 74 | 195 | 268 | 235 |

See figure 5 for thermocouple layout

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## Additional Unexposed Face Temperature Data

| Time (mins) | Temperature Rise (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Thermocouple No. 25 | Thermocouple No. 26 | Thermocouple No. 27 | Thermocouple No. 28 | Thermocouple No. 29 | Thermocouple No. 30 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 1 | 0 | 0 |
| 8 | 1 | 1 | 1 | 1 | 1 | 0 |
| 9 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | 2 | 2 | 2 | 2 | 1 | 1 |
| 11 | 3 | 3 | 3 | 2 | 2 | 1 |
| 12 | 4 | 4 | 4 | 3 | 2 | 1 |
| 13 | 6 | 5 | 5 | 4 | 3 | 2 |
| 14 | 7 | 7 | 7 | 5 | 4 | 3 |
| 15 | 9 | 9 | 8 | 6 | 5 | 3 |
| 16 | 10 | 10 | 10 | 7 | 6 | 4 |
| 17 | 12 | 12 | 12 | 8 | 7 | 5 |
| 18 | 13 | 14 | 15 | 9 | 8 | 6 |
| 19 | 15 | 15 | 18 | 11 | 10 | 7 |
| 20 | 16 | 17 | 21 | 12 | 11 | 8 |
| 21 | 17 | 19 | 23 | 13 | 12 | 9 |
| 22 | 19 | 20 | 26 | 15 | 14 | 10 |
| 23 | 20 | 22 | 29 | 16 | 15 | 12 |
| 24 | 21 | 23 | 31 | 18 | 17 | 13 |
| 25 | 22 | 25 | 33 | 19 | 19 | 14 |
| 26 | 24 | 27 | 35 | 21 | 20 | 15 |
| 27 | 25 | 28 | 37 | 22 | 22 | 16 |
| 28 | 26 | 29 | 38 | 24 | 23 | 18 |
| 29 | 28 | 30 | 39 | 25 | 25 | 20 |
| 30 | 29 | 32 | 39 | 27 | 26 | 22 |
| 31 | 31 | 33 | 40 | 28 | 27 | 25 |
| 32 | 32 | 34 | 40 | 30 | 29 | 27 |
| 33 | 34 | 35 | 40 | 31 | 30 | 30 |
| 34 | 35 | 36 | 41 | 33 | 31 | 32 |

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| Time (mins) | Temperature Rise (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Thermocouple No. 25 | Thermocouple No. 26 | Thermocouple No. 27 | Thermocouple No. 28 | Thermocouple No. 29 | Thermocouple No. 30 |
| 35 | 36 | 37 | 41 | 34 | 32 | 34 |
| 36 | 38 | 38 | 41 | 35 | 33 | 36 |
| 37 | 39 | 38 | 41 | 36 | 34 | 38 |
| 38 | 39 | 39 | 41 | 37 | 35 | 39 |
| 39 | 40 | 39 | 41 | 38 | 36 | 41 |
| 40 | 40 | 39 | 41 | 38 | 36 | 42 |
| 41 | 41 | 39 | 41 | 39 | 36 | 42 |
| 42 | 41 | 39 | 40 | 39 | 37 | 43 |
| 43 | 41 | 39 | 40 | 39 | 37 | 43 |
| 44 | 41 | 39 | 40 | 39 | 37 | 43 |
| 45 | 41 | 39 | 40 | 40 | 37 | 43 |
| 46 | 42 | 39 | 40 | 40 | 38 | 43 |
| 47 | 41 | 39 | 41 | 40 | 38 | 42 |
| 48 | 42 | 39 | 41 | 40 | 38 | 42 |
| 49 | 42 | 39 | 42 | 41 | 39 | 41 |
| 50 | 42 | 39 | 42 | 42 | 40 | 40 |
| 51 | 42 | 39 | 43 | 43 | 40 | 40 |
| 52 | 43 | 40 | 44 | 44 | 41 | 39 |
| 53 | 44 | 40 | 45 | 45 | 43 | 39 |
| 54 | 44 | 41 | 46 | 45 | 43 | 39 |
| 55 | 45 | 42 | 47 | 46 | 44 | 38 |
| 56 | 46 | 43 | 48 | 47 | 45 | 38 |
| 57 | 47 | 45 | 49 | 47 | 45 | 39 |
| 58 | 48 | 48 | 50 | 48 | 46 | 39 |
| 59 | 49 | 50 | 50 | 48 | 47 | 39 |
| 60 | 49 | 51 | 51 | 49 | 47 | 40 |
| 61 | 50 | 52 | 52 | 49 | 48 | 40 |
| 62 | 50 | 53 | 52 | 50 | 49 | 41 |
| 63 | 51 | 53 | 53 | 50 | 50 | 42 |
| 64 | 51 | 54 | 54 | 51 | 50 | 42 |
| 65 | 52 | 55 | 54 | 51 | 50 | 43 |
| 66 | 52 | 55 | 55 | 51 | 50 | 43 |
| 67 | 53 | 55 | 55 | 52 | 50 | 44 |
| 68 | 53 | 56 | 56 | 52 | 50 | 44 |
| 69 | 54 | 56 | 57 | 53 | 50 | 45 |
| 70 | 54 | 56 | 57 | 54 | 49 | 45 |
| 71 | 54 | 57 | 58 | 54 | 49 | 46 |
| 72 | 55 | 57 | 58 | 54 | 50 | 46 |

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| Time (mins) | Temperature Rise (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Thermocouple No. 25 | Thermocouple No. 26 | Thermocouple No. 27 | Thermocouple No. 28 | Thermocouple No. 29 | Thermocouple No. 30 |
| 73 | 55 | 57 | 58 | 55 | 50 | 46 |
| 74 | 55 | 57 | 59 | 55 | 51 | 47 |
| 75 | 55 | 58 | 59 | 56 | 51 | 47 |
| 76 | 56 | 58 | 60 | 57 | 52 | 47 |
| 77 | 56 | 58 | 61 | 58 | 53 | 48 |
| 78 | 56 | 59 | 61 | 60 | 54 | 49 |
| 79 | 57 | 59 | 62 | 62 | 54 | 49 |
| 80 | 57 | 60 | 62 | 63 | 56 | 50 |
| 81 | 57 | 60 | 63 | 64 | 58 | 50 |
| 82 | 57 | 60 | 63 | 65 | 61 | 51 |
| 83 | 58 | 61 | 64 | 66 | 62 | 51 |
| 84 | 58 | 61 | 65 | 67 | 63 | 52 |
| 85 | 58 | 61 | 65 | 68 | 64 | 52 |
| 86 | 58 | 62 | 66 | 69 | 65 | 52 |
| 87 | 59 | 62 | 67 | 71 | 67 | 52 |
| 88 | 59 | 63 | 69 | 72 | 68 | 53 |
| 89 | 60 | 64 | 70 | 74 | 69 | 53 |
| 90 | 60 | 65 | 72 | 75 | 71 | 53 |
| 91 | 60 | 66 | 73 | 77 | 72 | 53 |
| 92 | 61 | 67 | 75 | 78 | 74 | 54 |
| 93 | 62 | 68 | 77 | 79 | 76 | 54 |
| 94 | 63 | 70 | 78 | 81 | 77 | 55 |
| 95 | 64 | 71 | 79 | 82 | 79 | 56 |
| 96 | 65 | 73 | 81 | 83 | 81 | 56 |
| 97 | 66 | 74 | 82 | 84 | 83 | 57 |
| 98 | 68 | 76 | 84 | 86 | 85 | 58 |
| 99 | 69 | 77 | 85 | 87 | 87 | 59 |
| 100 | 71 | 79 | 88 | 89 | 90 | 60 |
| 101 | 73 | 81 | 90 | 92 | 91 | 61 |
| 102 | 75 | 83 | 92 | 94 | 93 | 62 |
| 103 | 77 | 84 | 94 | 96 | 94 | 63 |

See figure 5 for thermocouple layout.

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Additional Unexposed Face Temperature Data (continued)

| Time (mins) | Temperature Rise (ºC) | | |
|---|---|---|---|
| | Thermocouple No. 31 | Thermocouple No. 32 | Thermocouple No. 33 |
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 |
| 6 | 1 | 0 | 0 |
| 7 | 1 | 0 | 1 |
| 8 | 1 | 0 | 1 |
| 9 | 1 | 1 | 1 |
| 10 | 2 | 1 | 2 |
| 11 | 2 | 1 | 2 |
| 12 | 3 | 2 | 3 |
| 13 | 4 | 3 | 4 |
| 14 | 5 | 4 | 5 |
| 15 | 6 | 5 | 6 |
| 16 | 7 | 6 | 7 |
| 17 | 8 | 8 | 9 |
| 18 | 9 | 9 | 10 |
| 19 | 10 | 11 | 11 |
| 20 | 11 | 13 | 13 |
| 21 | 12 | 15 | 15 |
| 22 | 14 | 17 | 16 |
| 23 | 15 | 19 | 18 |
| 24 | 17 | 21 | 20 |
| 25 | 18 | 23 | 22 |
| 26 | 20 | 25 | 24 |
| 27 | 21 | 27 | 25 |
| 28 | 23 | 29 | 27 |
| 29 | 24 | 31 | 29 |
| 30 | 26 | 32 | 31 |
| 31 | 27 | 33 | 32 |
| 32 | 29 | 34 | 34 |
| 33 | 30 | 35 | 35 |
| 34 | 32 | 36 | 37 |

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| Time (mins) | Temperature Rise (°C) | | |
|---|---|---|---|
| | Thermocouple No. 31 | Thermocouple No. 32 | Thermocouple No. 33 |
| 35 | 33 | 36 | 38 |
| 36 | 34 | 37 | 39 |
| 37 | 35 | 37 | 40 |
| 38 | 36 | 37 | 40 |
| 39 | 37 | 38 | 41 |
| 40 | 38 | 38 | 42 |
| 41 | 39 | 39 | 42 |
| 42 | 40 | 40 | 42 |
| 43 | 40 | 40 | 42 |
| 44 | 41 | 41 | 42 |
| 45 | 41 | 42 | 42 |
| 46 | 42 | 43 | 42 |
| 47 | 42 | 44 | 42 |
| 48 | 43 | 44 | 42 |
| 49 | 43 | 45 | 42 |
| 50 | 44 | 46 | 43 |
| 51 | 45 | 47 | 43 |
| 52 | 45 | 48 | 44 |
| 53 | 46 | 49 | 45 |
| 54 | 47 | 49 | 46 |
| 55 | 48 | 50 | 47 |
| 56 | 48 | 50 | 48 |
| 57 | 49 | 51 | 49 |
| 58 | 49 | 51 | 49 |
| 59 | 50 | 51 | 50 |
| 60 | 50 | 52 | 51 |
| 61 | 51 | 52 | 52 |
| 62 | 52 | 52 | 53 |
| 63 | 53 | 53 | 54 |
| 64 | 54 | 53 | 55 |
| 65 | 55 | 54 | 55 |
| 66 | 55 | 54 | 56 |
| 67 | 56 | 54 | 57 |
| 68 | 56 | 55 | 57 |
| 69 | 56 | 55 | 57 |
| 70 | 56 | 56 | 57 |
| 71 | 56 | 56 | 57 |
| 72 | 56 | 57 | 56 |

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| Time (mins) | Temperature Rise (°C) | | |
|---|---|---|---|
| | Thermocouple No. 31 | Thermocouple No. 32 | Thermocouple No. 33 |
| 73 | 56 | 59 | 56 |
| 74 | 56 | 61 | 56 |
| 75 | 57 | 64 | 57 |
| 76 | 59 | 68 | 60 |
| 77 | 63 | 70 | 64 |
| 78 | 67 | 72 | 65 |
| 79 | 69 | 73 | 66 |
| 80 | 71 | 74 | 66 |
| 81 | 72 | 75 | 67 |
| 82 | 73 | 77 | 67 |
| 83 | 73 | 78 | 68 |
| 84 | 74 | 81 | 69 |
| 85 | 74 | 89 | 70 |
| 86 | 75 | 94 | 71 |
| 87 | 76 | 99 | 72 |
| 88 | 77 | 106 | 74 |
| 89 | 80 | 117 | 76 |
| 90 | 87 | 136 | 81 |
| 91 | 96 | 164 | 85 |
| 92 | 101 | 193 | 87 |
| 93 | 107 | 217 | 88 |
| 94 | 111 | 238 | 89 |
| 95 | 118 | 262 | 90 |
| 96 | 136 | 286 | 92 |
| 97 | 155 | 313 | 95 |
| 98 | 180 | 346 | 98 |
| 99 | 206 | 380 | 104 |
| 100 | 228 | 408 | 110 |
| 101 | 249 | 417 | 121 |
| 102 | 267 | 413 | 139 |
| 103 | 285 | 406 | 166 |

See figure 5 for thermocouple layout.

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## Additional Internal Temperature Data

| Time (mins) | Actual Temperature (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Left Stud at 3750mm height | | | Right Stud at 3750mm height | | |
| | Hot Flange Thermocouple No. 34 | Web Thermocouple No. 35 | Cold Flange Thermocouple No. 36 | Hot Flange Thermocouple No. 37 | Web Thermocouple No. 38 | Cold Flange Thermocouple No. 39 |
| 0 | 18 | 19 | 18 | 19 | 19 | 18 |
| 1 | 19 | 19 | 19 | 19 | 19 | 19 |
| 2 | 20 | 19 | 19 | 19 | 19 | 19 |
| 3 | 29 | 25 | 21 | 20 | 20 | 19 |
| 4 | 46 | 36 | 26 | 24 | 24 | 20 |
| 5 | 61 | 44 | 32 | 30 | 29 | 23 |
| 6 | 69 | 50 | 39 | 38 | 38 | 28 |
| 7 | 74 | 56 | 45 | 46 | 45 | 34 |
| 8 | 78 | 62 | 51 | 54 | 52 | 41 |
| 9 | 80 | 66 | 56 | 60 | 57 | 47 |
| 10 | 82 | 69 | 59 | 64 | 61 | 53 |
| 11 | 83 | 71 | 62 | 68 | 64 | 57 |
| 12 | 84 | 73 | 64 | 72 | 67 | 60 |
| 13 | 84 | 75 | 66 | 75 | 69 | 63 |
| 14 | 85 | 76 | 69 | 78 | 71 | 65 |
| 15 | 86 | 77 | 71 | 81 | 73 | 68 |
| 16 | 87 | 78 | 73 | 83 | 75 | 70 |
| 17 | 88 | 80 | 75 | 85 | 78 | 72 |
| 18 | 91 | 82 | 76 | 87 | 80 | 74 |
| 19 | 93 | 84 | 79 | 89 | 83 | 77 |
| 20 | 95 | 86 | 81 | 91 | 85 | 79 |
| 21 | 97 | 88 | 83 | 93 | 87 | 81 |
| 22 | 98 | 89 | 84 | 94 | 89 | 82 |
| 23 | 100 | 91 | 85 | 95 | 90 | 84 |
| 24 | 101 | 92 | 86 | 97 | 91 | 86 |
| 25 | 103 | 94 | 88 | 99 | 93 | 88 |
| 26 | 105 | 95 | 89 | 101 | 95 | 90 |
| 27 | 108 | 97 | 91 | 103 | 97 | 91 |
| 28 | 110 | 98 | 92 | 105 | 99 | 92 |
| 29 | 112 | 100 | 93 | 107 | 100 | 93 |
| 30 | 115 | 101 | 93 | 109 | 102 | 92 |

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| Time (mins) | Actual Temperature (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Left Stud at 3750mm height | | | Right Stud at 3750mm height | | |
| | Hot Flange Thermocouple No. 34 | Web Thermocouple No. 35 | Cold Flange Thermocouple No. 36 | Hot Flange Thermocouple No. 37 | Web Thermocouple No. 38 | Cold Flange Thermocouple No. 39 |
| 31 | 118 | 102 | 94 | 112 | 103 | 92 |
| 32 | 122 | 104 | 94 | 115 | 105 | 93 |
| 33 | 126 | 105 | 94 | 119 | 108 | 93 |
| 34 | 130 | 107 | 95 | 124 | 111 | 94 |
| 35 | 134 | 110 | 94 | 130 | 115 | 95 |
| 36 | 139 | 113 | 94 | 136 | 120 | 96 |
| 37 | 145 | 116 | 94 | 145 | 127 | 98 |
| 38 | 152 | 119 | 94 | 157 | 135 | 98 |
| 39 | 160 | 123 | 95 | 171 | 144 | 99 |
| 40 | 170 | 129 | 95 | 184 | 154 | 101 |
| 41 | 180 | 136 | 95 | 198 | 165 | 101 |
| 42 | 191 | 144 | 95 | 212 | 176 | 103 |
| 43 | 202 | 153 | 95 | 226 | 188 | 105 |
| 44 | 212 | 162 | 95 | 240 | 201 | 109 |
| 45 | 223 | 172 | 95 | 254 | 213 | 119 |
| 46 | 235 | 182 | 96 | 267 | 224 | 136 |
| 47 | 248 | 192 | 96 | 280 | 233 | 153 |
| 48 | 260 | 203 | 97 | 293 | 244 | 170 |
| 49 | 273 | 215 | 97 | 304 | 255 | 186 |
| 50 | 287 | 228 | 97 | 313 | 263 | 199 |
| 51 | 300 | 240 | 98 | 322 | 271 | 209 |
| 52 | 313 | 252 | 99 | 330 | 279 | 220 |
| 53 | 326 | 264 | 101 | 338 | 288 | 229 |
| 54 | 340 | 276 | 104 | 347 | 297 | 238 |
| 55 | 354 | 289 | 109 | 355 | 305 | 247 |
| 56 | 367 | 301 | 118 | 361 | 313 | 255 |
| 57 | 383 | 314 | 138 | 369 | 320 | 264 |
| 58 | 399 | 328 | 180 | 376 | 328 | 272 |
| 59 | 435 | 347 | 234 | 386 | 338 | 281 |
| 60 | 496 | 379 | 282 | 399 | 350 | 293 |
| 61 | 543 | 409 | 328 | 414 | 363 | 305 |
| 62 | 567 | 437 | 370 | 434 | 375 | 317 |
| 63 | 585 | 464 | 402 | 452 | 391 | 332 |
| 64 | 602 | 486 | 427 | 471 | 408 | 349 |
| 65 | 615 | 504 | 449 | 493 | 423 | 365 |

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| Time (mins) | Actual Temperature (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Left Stud at 3750mm height | | | Right Stud at 3750mm height | | |
| | Hot Flange Thermocouple No. 34 | Web Thermocouple No. 35 | Cold Flange Thermocouple No. 36 | Hot Flange Thermocouple No. 37 | Web Thermocouple No. 38 | Cold Flange Thermocouple No. 39 |
| 66 | 631 | 523 | 471 | 508 | 438 | 380 |
| 67 | 644 | 541 | 491 | 522 | 451 | 394 |
| 68 | 657 | 558 | 511 | 534 | 462 | 406 |
| 69 | 667 | 571 | 529 | 546 | 472 | 418 |
| 70 | 899 | 908 | 912 | 557 | 487 | 429 |
| 71 | 886 | 887 | 887 | 573 | 532 | 451 |
| 72 | 886 | 888 | 899 | 593 | 585 | 506 |
| 73 | 879 | 884 | 885 | 618 | 632 | 616 |
| 74 | 875 | 885 | 874 | 653 | 728 | 746 |
| 75 | 880 | 874 | 886 | 886 | 892 | 893 |
| 76 | 930 | 924 | 923 | 955 | 924 | 934 |
| 77 | 942 | 941 | 936 | 968 | 927 | 940 |
| 78 | 946 | 945 | 937 | 974 | 941 | 960 |
| 79 | 954 | 951 | 950 | 971 | 950 | 967 |
| 80 | 966 | 962 | 962 | 1002 | 977 | 989 |
| 81 | 964 | 963 | 952 | 1006 | 992 | 1004 |
| 82 | 966 | 966 | 950 | 1024 | 1006 | 1017 |
| 83 | 963 | 966 | 945 | 1029 | 1017 | 1025 |
| 84 | 942 | 953 | 921 | 1031 | 1022 | 1031 |
| 85 | 952 | 962 | 934 | 1010 | - | - |
| 86 | 967 | 973 | 953 | 1013 | - | - |
| 87 | 992 | 993 | 980 | - | - | - |
| 88 | 992 | 997 | 992 | - | - | - |
| 89 | 997 | 996 | 996 | - | - | - |
| 90 | 1002 | 990 | 1005 | - | - | - |
| 91 | 1009 | 997 | 1013 | - | - | - |
| 92 | 1021 | 1008 | 1022 | - | - | - |
| 93 | 1025 | 1019 | - | - | - | - |
| 94 | 1026 | 1022 | - | - | - | - |
| 95 | 1027 | - | - | - | - | - |
| 96 | 1029 | - | - | - | - | - |
| 97 | 1029 | - | - | - | - | - |
| 98 | - | - | - | - | - | - |
| 99 | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - |

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| Time (mins) | Actual Temperature (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Left Stud at 3750mm height | | | Right Stud at 3750mm height | | |
| | Hot Flange Thermocouple No. 34 | Web Thermocouple No. 35 | Cold Flange Thermocouple No. 36 | Hot Flange Thermocouple No. 37 | Web Thermocouple No. 38 | Cold Flange Thermocouple No. 39 |
| 101 | - | - | - | - | - | - |
| 102 | - | - | - | - | - | - |
| 103 | - | - | - | - | - | - |

See figure 5 for the location of the thermocouples.

Thermocouple No. 34 did not work after 97 minutes.
Thermocouple No. 35 did not work after 94 minutes.
Thermocouple No. 36 did not work after 92 minutes.
Thermocouple No. 37 did not work after 86 minutes.
Thermocouple No. 38 did not work after 84 minutes.
Thermocouple No. 39 did not work after 84 minutes.

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Additional Internal Temperature Data (continued)

| Time (mins) | Actual Temperature (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Left Stud at 2500mm height | | | Right Stud at 2500mm height | | |
| | Hot Flange Thermocouple No. 40 | Web Thermocouple No. 41 | Cold Flange Thermocouple No. 42 | Hot Flange Thermocouple No. 43 | Web Thermocouple No. 44 | Cold Flange Thermocouple No. 45 |
| 0 | 18 | 18 | 18 | 19 | 19 | 18 |
| 1 | 19 | 19 | 19 | 19 | 19 | 19 |
| 2 | 19 | 19 | 18 | 19 | 19 | 19 |
| 3 | 27 | 20 | 19 | 21 | 19 | 19 |
| 4 | 66 | 32 | 22 | 25 | 22 | 20 |
| 5 | 74 | 41 | 27 | 34 | 29 | 24 |
| 6 | 78 | 49 | 33 | 45 | 39 | 30 |
| 7 | 78 | 54 | 39 | 55 | 47 | 37 |
| 8 | 84 | 59 | 45 | 62 | 53 | 43 |
| 9 | 88 | 64 | 50 | 68 | 59 | 49 |
| 10 | 89 | 67 | 54 | 73 | 63 | 54 |
| 11 | 90 | 70 | 58 | 77 | 66 | 58 |
| 12 | 91 | 73 | 61 | 80 | 69 | 62 |
| 13 | 91 | 74 | 63 | 82 | 72 | 64 |
| 14 | 91 | 76 | 66 | 84 | 73 | 67 |
| 15 | 91 | 77 | 68 | 85 | 75 | 69 |
| 16 | 91 | 78 | 69 | 87 | 76 | 70 |
| 17 | 90 | 79 | 71 | 88 | 78 | 72 |
| 18 | 91 | 80 | 73 | 90 | 80 | 74 |
| 19 | 93 | 82 | 75 | 93 | 82 | 76 |
| 20 | 94 | 84 | 77 | 95 | 84 | 79 |
| 21 | 94 | 86 | 79 | 97 | 86 | 80 |
| 22 | 95 | 87 | 81 | 99 | 88 | 82 |
| 23 | 95 | 88 | 82 | 100 | 90 | 83 |
| 24 | 95 | 90 | 84 | 101 | 92 | 85 |
| 25 | 95 | 91 | 85 | 101 | 93 | 86 |
| 26 | 95 | 92 | 87 | 100 | 95 | 87 |
| 27 | 96 | 94 | 88 | 101 | 96 | 88 |
| 28 | 96 | 95 | 89 | 101 | 97 | 89 |
| 29 | 98 | 96 | 90 | 99 | 98 | 90 |
| 30 | 102 | 97 | 91 | 101 | 99 | 91 |

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| Time (mins) | Actual Temperature (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Left Stud at 2500mm height | | | Right Stud at 2500mm height | | |
| | Hot Flange Thermocouple No. 40 | Web Thermocouple No. 41 | Cold Flange Thermocouple No. 42 | Hot Flange Thermocouple No. 43 | Web Thermocouple No. 44 | Cold Flange Thermocouple No. 45 |
| 31 | 108 | 99 | 92 | 110 | 101 | 91 |
| 32 | 112 | 101 | 93 | 114 | 102 | 92 |
| 33 | 117 | 103 | 93 | 115 | 103 | 92 |
| 34 | 123 | 106 | 94 | 117 | 104 | 92 |
| 35 | 129 | 109 | 94 | 121 | 105 | 92 |
| 36 | 136 | 111 | 95 | 127 | 107 | 93 |
| 37 | 144 | 114 | 95 | 138 | 111 | 93 |
| 38 | 154 | 119 | 95 | 151 | 117 | 95 |
| 39 | 166 | 124 | 95 | 172 | 125 | 97 |
| 40 | 180 | 129 | 97 | 195 | 134 | 100 |
| 41 | 193 | 136 | 97 | 216 | 142 | 102 |
| 42 | 206 | 143 | 99 | 236 | 153 | 102 |
| 43 | 217 | 150 | 99 | 251 | 165 | 102 |
| 44 | 228 | 158 | 99 | 264 | 176 | 103 |
| 45 | 241 | 167 | 100 | 276 | 187 | 103 |
| 46 | 258 | 176 | 100 | 287 | 197 | 103 |
| 47 | 280 | 187 | 101 | 296 | 207 | 104 |
| 48 | 300 | 199 | 101 | 307 | 217 | 104 |
| 49 | 314 | 210 | 102 | 318 | 228 | 104 |
| 50 | 326 | 219 | 102 | 330 | 239 | 104 |
| 51 | 338 | 228 | 102 | 337 | 247 | 104 |
| 52 | 348 | 238 | 103 | 340 | 253 | 106 |
| 53 | 355 | 248 | 103 | 346 | 260 | 113 |
| 54 | 367 | 262 | 103 | 352 | 266 | 123 |
| 55 | 380 | 273 | 109 | 358 | 273 | 139 |
| 56 | 390 | 283 | 124 | 362 | 280 | 156 |
| 57 | 403 | 296 | 161 | 368 | 288 | 191 |
| 58 | 412 | 308 | 230 | 373 | 295 | 221 |
| 59 | 413 | 313 | 262 | 379 | 304 | 238 |
| 60 | 412 | 317 | 279 | 384 | 312 | 248 |
| 61 | 410 | 320 | 290 | 389 | 318 | 256 |
| 62 | 414 | 330 | 303 | 393 | 322 | 263 |
| 63 | 419 | 338 | 315 | 399 | 328 | 269 |
| 64 | 423 | 343 | 323 | 406 | 335 | 275 |
| 65 | 427 | 349 | 330 | 411 | 342 | 283 |

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| Time (mins) | Actual Temperature (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Left Stud at 2500mm height | | | Right Stud at 2500mm height | | |
| | Hot Flange Thermocouple No. 40 | Web Thermocouple No. 41 | Cold Flange Thermocouple No. 42 | Hot Flange Thermocouple No. 43 | Web Thermocouple No. 44 | Cold Flange Thermocouple No. 45 |
| 66 | 434 | 357 | 340 | 417 | 348 | 289 |
| 67 | 441 | 366 | 350 | 422 | 353 | 295 |
| 68 | 449 | 375 | 359 | 426 | 359 | 302 |
| 69 | 459 | 383 | 369 | 429 | 364 | 308 |
| 70 | 468 | 392 | 379 | 432 | 369 | 315 |
| 71 | 485 | 414 | 405 | 436 | 375 | 321 |
| 72 | 498 | 428 | 426 | 442 | 381 | 329 |
| 73 | 512 | 445 | 443 | 452 | 389 | 341 |
| 74 | 525 | 464 | 460 | 460 | 396 | 353 |
| 75 | 533 | 476 | 470 | 473 | 403 | 369 |
| 76 | 532 | 474 | 466 | 479 | 413 | 376 |
| 77 | 540 | 484 | 475 | 489 | 422 | 387 |
| 78 | 551 | 501 | 493 | 499 | 432 | 399 |
| 79 | 555 | 508 | 496 | 508 | 444 | 411 |
| 80 | 562 | 522 | 505 | 522 | 457 | 431 |
| 81 | 564 | 529 | 513 | 530 | 468 | 445 |
| 82 | 570 | 541 | 525 | 540 | 484 | 462 |
| 83 | 579 | 554 | 538 | 553 | 501 | 480 |
| 84 | 591 | 570 | 550 | 564 | 528 | 497 |
| 85 | 613 | 595 | 568 | 583 | 557 | 524 |
| 86 | 631 | 609 | 582 | 602 | 587 | 550 |
| 87 | 646 | 626 | 594 | 624 | 619 | 578 |
| 88 | 659 | 647 | 613 | 648 | 662 | 596 |
| 89 | 670 | 679 | 656 | 669 | 698 | 637 |
| 90 | 685 | 696 | 667 | 694 | 716 | 650 |
| 91 | 707 | 711 | 683 | 713 | 710 | 672 |
| 92 | 719 | 722 | 692 | 733 | 715 | 738 |
| 93 | 738 | 742 | 710 | 753 | 715 | 750 |
| 94 | 769 | 778 | 749 | 783 | 759 | 774 |
| 95 | 1016 | 1012 | 1034 | 1012 | 1062 | 1003 |
| 96 | 1012 | 1012 | - | 1017 | - | 1008 |
| 97 | 1018 | 1019 | - | 1021 | - | - |
| 98 | 1020 | 1018 | - | - | - | - |
| 99 | 1016 | - | - | - | - | - |
| 100 | - | - | - | - | - | - |

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| Time (mins) | Actual Temperature (ºC) | | | | | |
|---|---|---|---|---|---|---|
| | Left Stud at 2500mm height | | | Right Stud at 2500mm height | | |
| | Hot Flange Thermocouple No. 40 | Web Thermocouple No. 41 | Cold Flange Thermocouple No. 42 | Hot Flange Thermocouple No. 43 | Web Thermocouple No. 44 | Cold Flange Thermocouple No. 45 |
| 101 | - | - | - | - | - | - |
| 102 | - | - | - | - | - | - |
| 103 | - | - | - | - | - | - |

See figure 5 for the location of the thermocouples.

Thermocouple No. 40 did not work after 99 minutes.
Thermocouple No. 41 did not work after 98 minutes.
Thermocouple No. 42 did not work after 95 minutes.
Thermocouple No. 43 did not work after 97 minutes.
Thermocouple No. 44 did not work after 95 minutes.
Thermocouple No. 45 did not work after 96 minutes.

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Specimen Lateral Deflection

| Time (mins) | Deflection (mm) | |
|---|---|---|
| | Centrally | On free end |
| 0 | -0.1 | 0 |
| 1 | 0.7 | -0.4 |
| 2 | 1.4 | -0.3 |
| 3 | 5.4 | -0.1 |
| 4 | 10.4 | 0.5 |
| 5 | 12.1 | 0.8 |
| 6 | 14 | 1 |
| 7 | 15.7 | 1.2 |
| 8 | 17.1 | 1.3 |
| 9 | 18 | 1.4 |
| 10 | 19.1 | 1.5 |
| 11 | 20.4 | 1.7 |
| 12 | 21.5 | 1.8 |
| 13 | 22.4 | 2 |
| 14 | 23.4 | 2.1 |
| 15 | 23.9 | 2.2 |
| 16 | 24.6 | 2.2 |
| 17 | 25 | 2.3 |
| 18 | 25.8 | 2.3 |
| 19 | 26.6 | 2.3 |
| 20 | 27.8 | 2.3 |
| 21 | 29.6 | 2.4 |
| 22 | 31.7 | 2.5 |
| 23 | 33.2 | 2.6 |
| 24 | 34.4 | 2.6 |
| 25 | 35.6 | 2.6 |
| 26 | 37.1 | 2.6 |
| 27 | 38.8 | 2.6 |
| 28 | 40.7 | 2.7 |
| 29 | 43.1 | 2.8 |
| 30 | 46 | 2.9 |
| 31 | 50.3 | 3.2 |
| 32 | 54.9 | 3.6 |
| 33 | 59.9 | 4.3 |
| 34 | 65 | 5.6 |

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| Time (mins) | Deflection (mm) | |
|---|---|---|
| | Centrally | On free end |
| 35 | 70.4 | 7.7 |
| 36 | 76.1 | 11.9 |
| 37 | 82.5 | 19.6 |
| 38 | 88.4 | 27.5 |
| 39 | 93.7 | 35.5 |
| 40 | 99 | 44.3 |
| 41 | 104.3 | 53.9 |
| 42 | 109.5 | 65.2 |
| 43 | 114.9 | 76.9 |
| 44 | 120.1 | 90 |
| 45 | 125 | 102.4 |
| 46 | 130.4 | 113.8 |
| 47 | 135 | 123.6 |
| 48 | 139.4 | 133.2 |
| 49 | 143.9 | 143.8 |
| 50 | 146.7 | 147.3 |
| 51 | 148.9 | 149.9 |
| 52 | 151.4 | 152.5 |
| 53 | 154 | 155.3 |
| 54 | 156.9 | 158.4 |
| 55 | 159.5 | 162 |
| 56 | 161.9 | 165.4 |
| 57 | 164.4 | 168.5 |
| 58 | 166.6 | 171.4 |
| 59 | 169.5 | 174 |
| 60 | 173 | 177.4 |
| 61 | 176.2 | 180.4 |
| 62 | 178.4 | 182 |
| 63 | 180.7 | 183.6 |
| 64 | 182.8 | 185.7 |
| 65 | 184.8 | 187.9 |
| 66 | 186.3 | 189.8 |
| 67 | 187.4 | 192 |
| 68 | 188.3 | 194 |
| 69 | 189.1 | 196.2 |
| 70 | 189 | 197.7 |
| 71 | 188.9 | 197.7 |
| 72 | 188.3 | 197.7 |
| 73 | 187.7 | - |

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| Time (mins) | Deflection (mm) | |
|---|---|---|
| | Centrally | On free end |
| 74 | 186.6 | - |
| 75 | 185.5 | - |
| 76 | 184 | - |
| 77 | 183.3 | - |
| 78 | 182.8 | - |
| 79 | 182.5 | - |
| 80 | 182.7 | - |
| 81 | 182.9 | - |
| 82 | 183.2 | - |
| 83 | 183.7 | - |
| 84 | 183.9 | - |
| 85 | 184.1 | - |
| 86 | 184.3 | - |
| 87 | 184.6 | - |
| 88 | 185.1 | - |
| 89 | 183.6 | - |
| 90 | 182 | - |
| 91 | - | - |
| 92 | - | - |
| 93 | - | - |
| 94 | - | - |
| 95 | - | - |
| 96 | - | - |
| 97 | - | - |
| 98 | - | - |
| 99 | - | - |
| 100 | - | - |
| 101 | - | - |
| 102 | - | - |
| 103 | - | - |

The deflection was recorded at the approximate centre of the specimen and at mid-height on the free edge.

Positive readings indicate deflection into the furnace.

The free end deflection transducer was no longer in contact with the specimen at 72 minutes.

Both deflection transducers were removed at 90 minutes to prevent possible damage.

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## PHOTOGRAPHS


**Photo 1.** Exposed face prior to test.

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**Photo 2.** Unexposed face prior to test.

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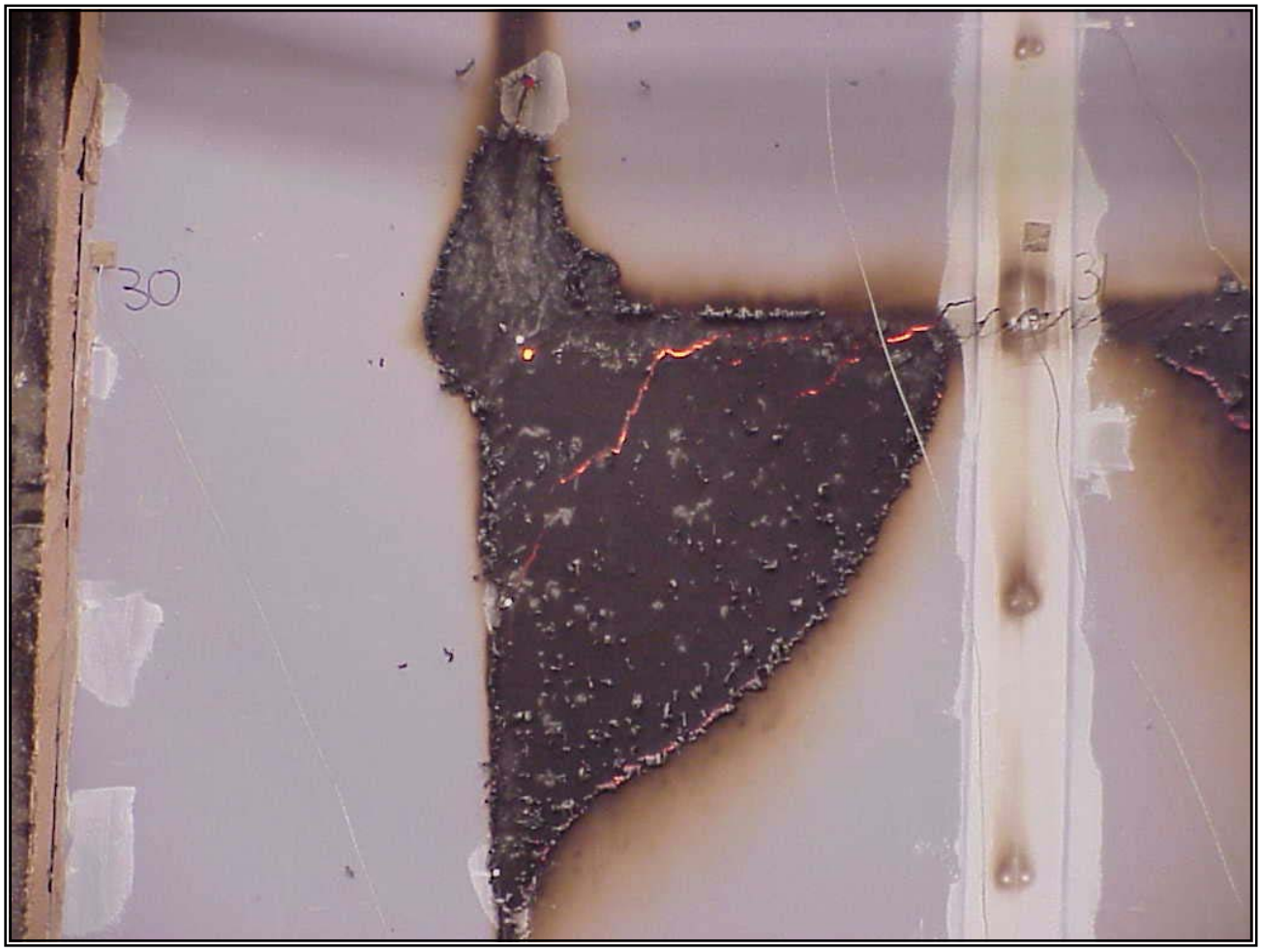


**Photo 3.** View of unexposed face showing insulation failure after 87 minutes.

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**Photo 4.** View of the unexposed face at Test Termination.