FIRE-RESISTANCE TEST ON DOWNLIGHT COVERS INSTALLED IN PLASTERBOARD CEILINGS

Report number FSP 1290A
CSIRO job number LP46ASP3085
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Client
EFFICIENCY MATRIX PTY LTD

and

YOUNGEN PTY LTD

Commercial-in-confidence

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SPONSORED INVESTIGATION No. FSP 1290
FIRE-RESISTANCE TEST ON DOWNLIGHT COVERS INSTALLED IN PLASTERBOARD CEILINGS

SUMMARY

IDENTIFICATION OF SPECIMEN:

The sponsor identified the specimen as four downlight covers – Youngen Fire Hoods, protecting downlight assemblies and an open cut-out in a plasterboard ceiling system.

SPONSOR:

Efficiency Matrix Pty Ltd 14 Ondine Drive Wheelers Hill VICTORIA	and	Youngen Pty Ltd 240 Cheltenham Road Keysborough VICTORIA

MANUFACTURER: Chengdu SHUOWU Technology Co. Ltd.
Guixi Industrial Zone, High-tech District,
Chengdu, Sichuan, China, 610041

TEST STANDARD: Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2005, Fire-resistance tests of elements of construction.

TEST NUMBER: FS 3941/3085

TEST DATE: The fire-resistance test was conducted on 16 October 2007.

DESCRIPTION OF SPECIMEN:

GENERAL

The specimen comprised Youngen Fire Hood down light covers, protecting three different downlight assemblies and one open round cut-out installed in an 1150-mm x 1150-mm sized plasterboard lined ceiling system.

CEILING SYSTEM

The ceiling system comprised 150-mm x 60-mm timber ceiling joists installed at nominally 600-mm centres, lined on the exposed face with three layers of 16-mm thick CSR Fyrcheck plasterboard sheets. The plasterboard sheeting was screw fixed to the timber ceiling joists using plasterboard screws at nominally 200-mm centres. Each downlight assembly was installed in the ceiling system centrally between ceiling joists and were separated from each other by a distance of nominally 575-mm.

Sample 1 – Youngen 150-mm Fire Hood

Sample 1 comprised a Youngen 150-mm Fire Hood protecting a standard “gimble type” recessed downlight assembly. The downlight assembly, 50-mm in diameter, was recessed into the plasterboard ceiling through a 70-mm diameter opening, and retained in place using spring metal clips.

On the unexposed face of the ceiling, the downlight assembly was protected by a 150-mm Youngen Fire Hood. The hood was made out of 10-mm thick intumescent based material, formed into a conical shape, measuring 150-mm in diameter at its base and 160-mm in height. The hood incorporated small oval openings, four of which were located at 85-mm from the base and two at 130-mm from the base.

The Fire Hood was fixed into position using a metal wire clip, threaded through the top two holes and secured between the exposed edge of the cut opening and the downlight metal fascia housing, as shown in drawing numbered 1, dated 16 October 2007, by Youngen Pty Ltd.

Sample 2 – Youngen 200-mm Fire Hood

Sample 2 comprised a Youngen 200-mm Fire Hood protecting a standard “gimble type” recessed downlight assembly. The downlight assembly, 65-mm in diameter, was recessed into the plasterboard ceiling through a 90-mm diameter opening, and retained in place using spring metal clips.

On the unexposed face of the ceiling, the downlight assembly was protected by a 200-mm Youngen Fire Hood. The hood was made out of 10-mm thick intumescent based material, formed into a conical shape, measuring 200-mm in diameter at its base and 210-mm in height. The hood incorporated small oval openings, four of which were located at 120-mm from the base and two at 195-mm from the base.

The Fire Hood was fixed into position using a metal wire clip, threaded through the top two holes and secured between the exposed edge of the cut opening and the downlight metal fascia housing, as shown in drawing numbered 1, dated 16 October 2007, by Youngen Pty Ltd.

Sample 3 – Youngen 250-mm Fire Hood

Sample 3 comprised a Youngen 250-mm Fire Hood protecting a standard “gimble type” recessed downlight assembly. The downlight assembly, 75-mm in diameter, was recessed into the plasterboard ceiling through a 105-mm diameter opening, and retained in place using spring metal clips.

On the unexposed face of the ceiling, the downlight assembly was protected by a 250-mm Youngen Fire Hood. The hood was made out of 12-mm thick in tumescent based material, formed into a conical shape, measuring 250-mm in diameter at its base and 270-mm in height. The hood incorporated small oval openings, four of which were located at 140-mm from the base and two at 235-mm from the base.

The Fire Hood was fixed into position using a metal wire clip, threaded through the top two holes and secured between the exposed edge of the cut opening and the downlight metal fascia housing, as shown in drawing numbered 1, dated 16 October 2007, by Youngen Pty Ltd.

Sample 4 – Youngen 200-mm Fire Hood

Sample 4 comprised a Youngen 200-mm Fire Hood protecting a clear 90-mm diameter opening in the plasterboard ceiling.

On the unexposed face of the ceiling, the opening was protected by a 200-mm Youngen Fire Hood. The hood was made out of 10-mm thick in tumescent based material, formed into a conical shape, measuring 200-mm in diameter at its base and 210-mm in height. The hood incorporated small oval openings, four of which were located at 120-mm from the base and two at 195-mm from the base.

The Fire Hood was fixed into position using a metal wire clip, threaded through the top two holes and secured between the plasterboard sheets.

DIMENSIONS

The overall dimensions of the plasterboard ceiling was 1150-mm square, to suit the opening in the specimen containing frame.

ORIENTATION

The specimen was tested with the ceiling and light fittings exposed to fire from underside.

DOCUMENTATION:

The following documents were supplied by the sponsor as a complete description of the specimen and should be read in conjunction with this report:

Drawings numbered 1, 2 and 3, all dated 16 October 2007, by Youngen Pty Ltd.

Confidential information about the test specimen has been submitted and is retained at CSIRO Materials Science and Engineering.

EQUIPMENT:

FURNACE

The furnace had a nominal opening of 1000-mm x 1000-mm for attachment of vertical or horizontal specimens.

The furnace was lined with refractory bricks and materials with the thermal properties as specified in AS 1530.4-2005 and was heated by combustion of a mixture of natural gas and air.

TEMPERATURE

The temperature in the furnace chamber was measured by four type K, 3-mm diameter, 310 stainless steel Mineral Insulated Metal Sheathed (MIMS) thermocouples. Each thermocouple was housed in high-nickel steel tubes opened at the exposed end.

The temperatures of the specimen were measured by glass-fibre insulated and sheathed K-type thermocouples with a wire diameter of 0.5-mm.

PRESSURE

The furnace pressure was measured by a differential low-pressure transducer with a range of ± 50 Pa.

MEASUREMENT SYSTEM

The primary measurement system comprised a multiple-channel data loggers, scanning at one minute intervals during the test.

AMBIENT TEMPERATURE:

The temperature of the test area was 26°C at the commencement of the test.

DEPARTURE FROM STANDARD:

There were no departures from the requirements of AS 1530.4-2005.

TERMINATION OF TEST:

The test was terminated at 121 minutes by agreement with the sponsor.

TEST RESULTS:

CRITICAL OBSERVATIONS

The following observations were made during the fire-resistance test:

3 minutes -	Smoke is being emitted from Samples 1, 2 and 4.
4 minutes -	Smoke quantity has increased from Sample 2.
6 minutes -	Smoke is being emitted from the base of Sample 3.
10 minutes -	Charring on the plasterboard, around the base of Sample 3.
11 minutes -	Smoke quantity emitted from Sample 3 has decreased.
22 minutes -	Some discolouration of plasterboard is visible around the bases of Samples 1 and 3 (photograph 3).
32 minutes -	All samples have risen up from the unexposed face of the plasterboard ceiling, as the specimen material intumesces.
44 minutes -	Red glow is visible around the base of Sample 3 (photograph 4).
54 minutes -	Cotton wool pad test (CWPT) applied to the base of Sample 3 – no ignition of cotton wool noted.
62 minutes -	Roving thermocouple applied to the area adjacent to the base of Sample 3.
63 minutes -	Insulation Failure of Sample 3 – maximum temperature rise limit of 180K is exceeded on the plasterboard adjacent to the sample.
79 minutes -	Red glow is visible around the base of Sample 4.
86 minutes -	Cotton wool pad test (CWPT) applied to the base of Sample 3 – no ignition of cotton wool noted.
100 minutes -	Red glow is visible around the base of Sample 1.
102 minutes -	Insulation Failure of Sample 4 – maximum temperature rise limit of 180K is exceeded on the plasterboard adjacent to the specimen.
104 minutes -	Large red glow is visible around the base of Sample 4.
105 minutes -	Insulation Failure of Sample 1 – maximum temperature rise limit of 180K is exceeded on the face of the specimen.
	Cotton wool pad test (CWPT) applied to the base of Sample 4 – no ignition of cotton wool noted.
108 minutes -	Two thin cracks have developed at the base of Sample 3.
109 minutes -	One thin crack has developed at the base of Sample 4.
111 minutes -	Insulation Failure of Sample 2 – maximum temperature rise limit of 180K is exceeded on the plasterboard adjacent to the specimen.
121 minutes -	Test terminated.

FURNACE TEMPERATURE

Figure 1 shows the standard curves of temperature versus time for heating the furnace chamber and the actual curves of average and maximum temperature versus time recorded during the heating period.

SPECIMEN TEMPERATURE

Figure 2 shows the curve of maximum temperature versus time associated with Sample 1.

Figure 3 shows the curve of maximum temperature versus time associated with Sample 2.

Figure 4 shows the curve of maximum temperature versus time associated with Sample 3.

Figure 5 shows the curve of maximum temperature versus time associated with Sample 4.

PERFORMANCE

Performance observed in respect of the following AS 1530.4-2005 criteria:

SAMPLE 1 - Youngen 150-mm Fire Hood

Structural adequacy	-	not applicable
Integrity	-	no failure at 121 minutes
Insulation	-	105 minutes

SAMPLE 2 – Youngen 200-mm Fire Hood

Structural adequacy	-	not applicable
Integrity	-	no failure at 121 minutes
Insulation	-	111 minutes

SAMPLE 3 – Youngen 250-mm Fire Hood

Structural adequacy	-	not applicable
Integrity	-	no failure at 121 minutes
Insulation	-	63 minutes

SAMPLE 4 – Youngen 200-mm Fire Hood

Structural adequacy	-	not applicable
Integrity	-	no failure at 121 minutes
Insulation	-	102 minutes

This report details methods of construction, the test conditions and the results obtained when specific element of construction described herein was tested following the procedure outlined in this standard. Any significant variation with respect to size, constructional details, loads, stresses, edge or end conditions, other than those allowed under the field of direct application in the relevant test method, 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.

FIRE-RESISTANCE LEVEL (FRL):

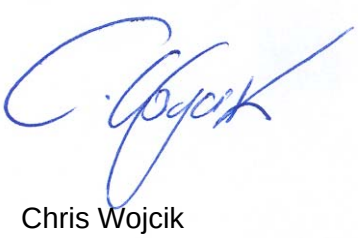
For the purpose of building regulations in Australia, the FRL's of the test specimen were as follows:

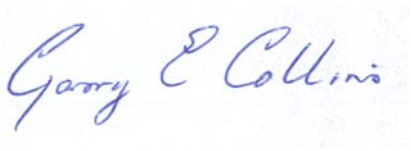
Sample 1	-	-/120/90;
Sample 2	-	-/120/90;
Sample 3	-	-/120/60 and
Sample 4	-	-/120/90

The fire-resistance level of the specimen is applicable when the system is exposed to fire from the same side as tested.

For the purposes of AS 1530.4-2005 the results of these fire tests may be used to directly assess fire hazard, but it should be noted that a single test method will not provide a full assessment of fire hazard under all fire conditions.

TESTED BY:





Chris Wojcik
Testing Officer

Garry E Collins
Manager, Fire Testing and Assessments

30 November 2007

APPENDICES

APPENDIX 1

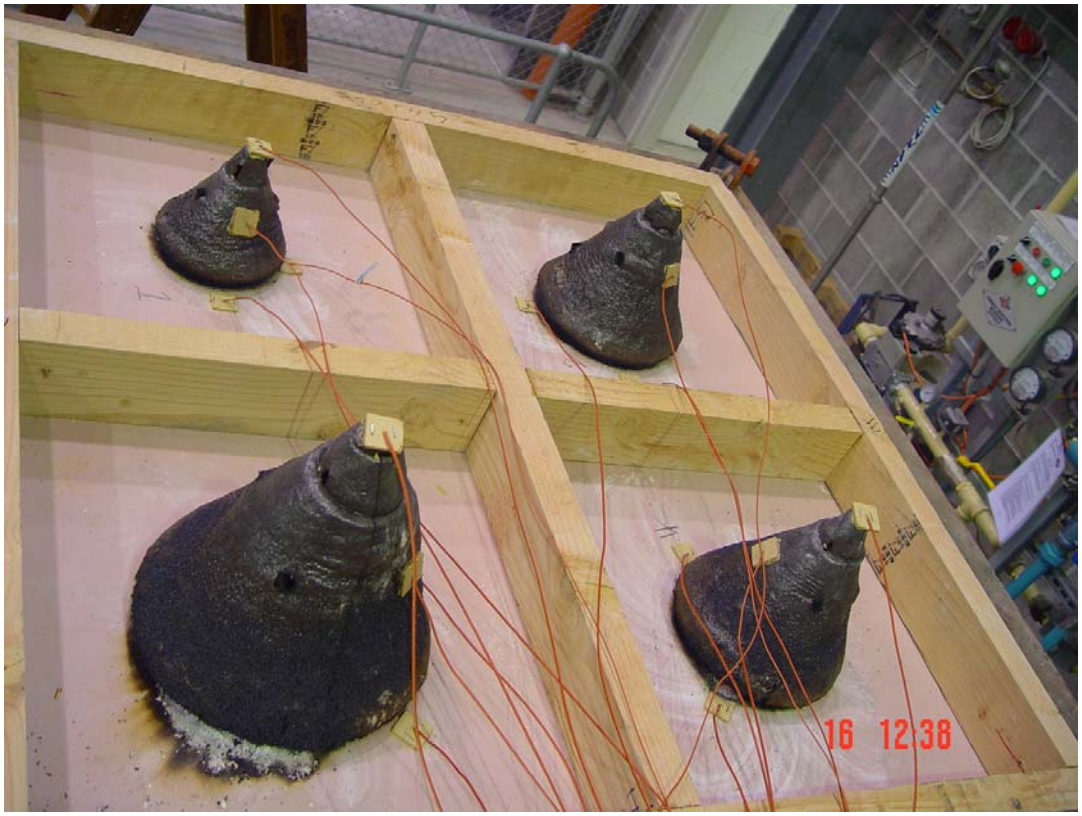
Photograph 1 - Exposed face of the specimen prior to testing

Photograph 2 - Unexposed face of the specimen prior to testing

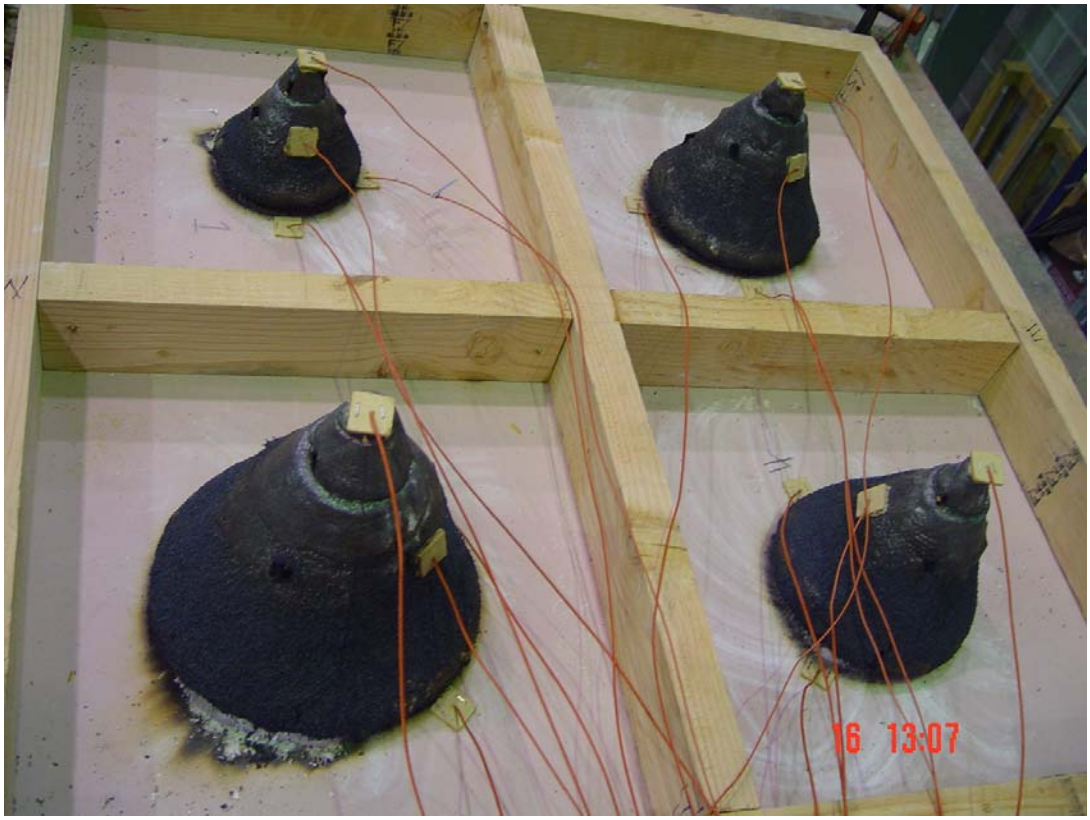
Photograph 3 - Specimen at 24 minutes into the test

Photograph 4 - Sample 3 at 53 minutes into the test

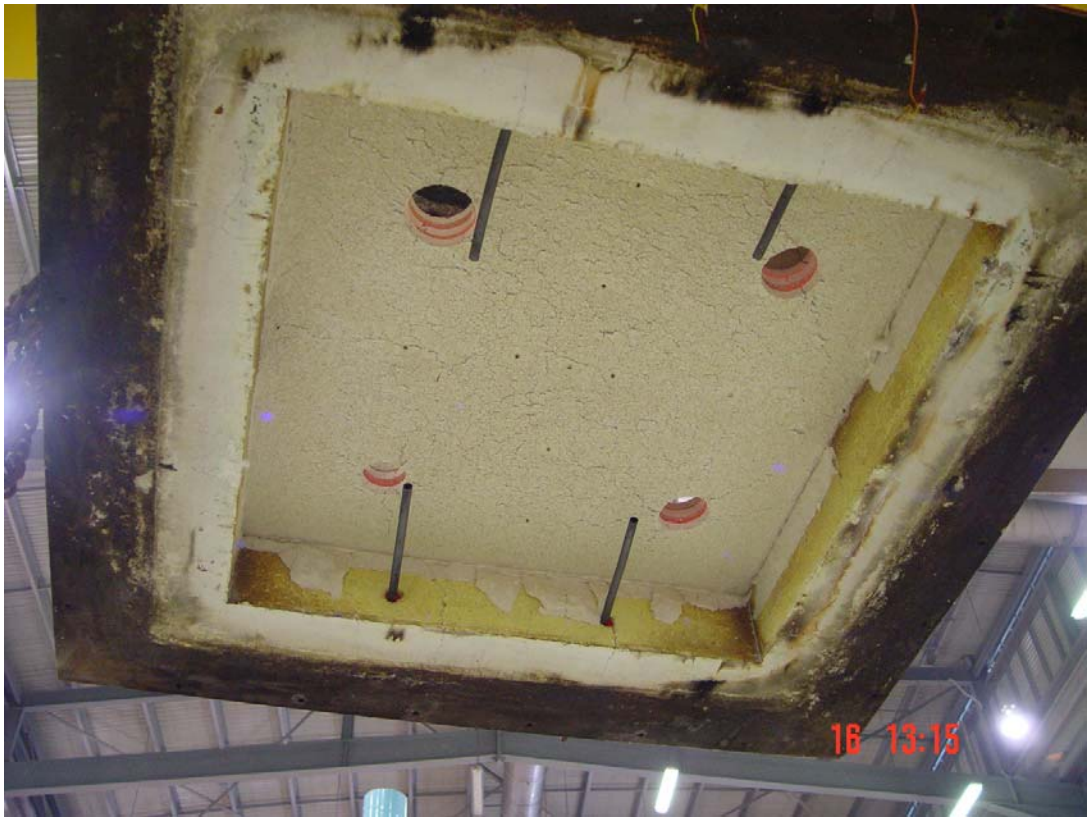
Photograph 5 - Specimen at 60 minutes into the test



Photograph 6 - Specimen at 91 minutes into the test



Photograph 7 - Specimen at the completion of testing



Photograph 8 - Exposed face of the specimen after the completion of testing

APPENDIX 2

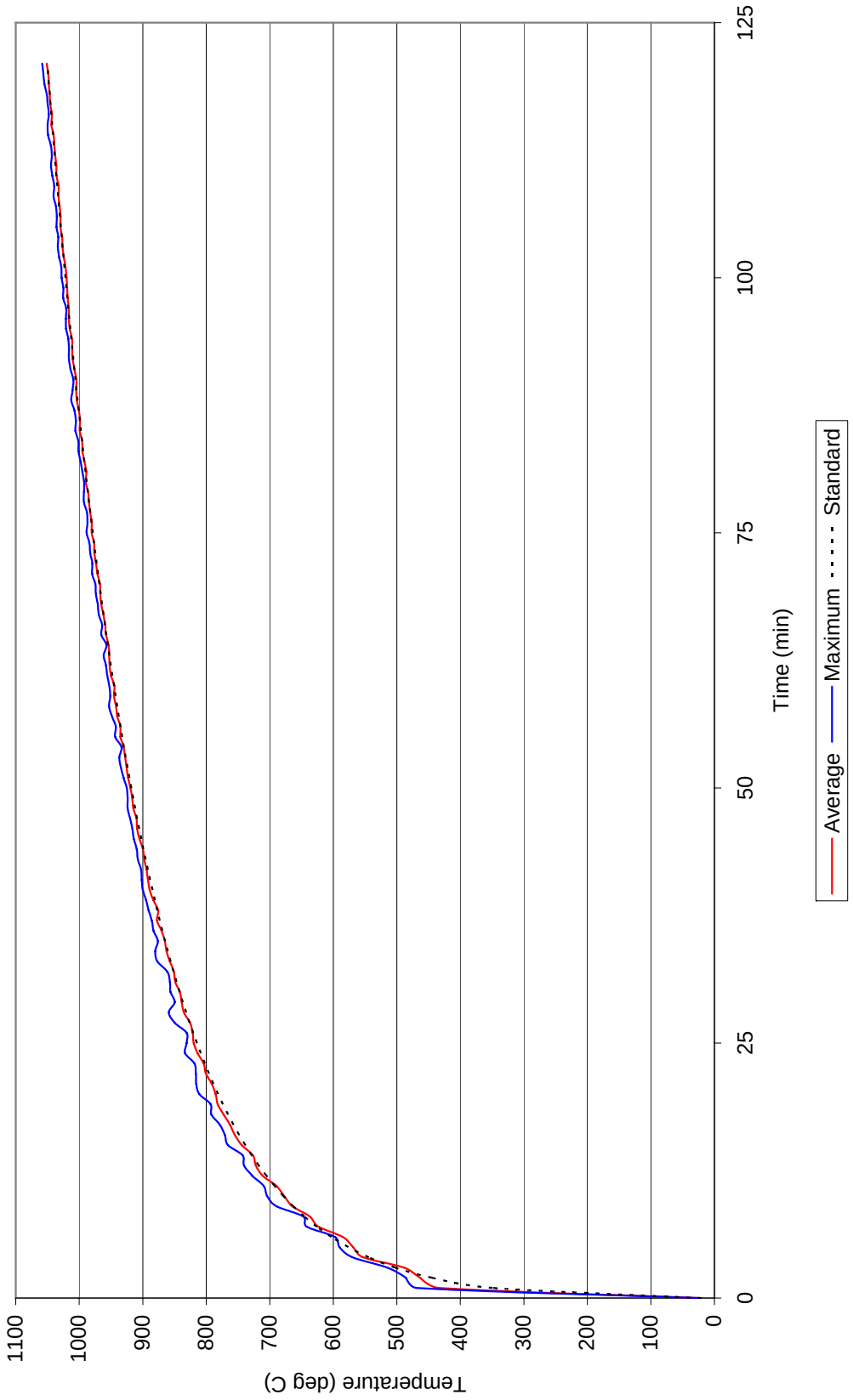


Figure 1- Furnace temperature

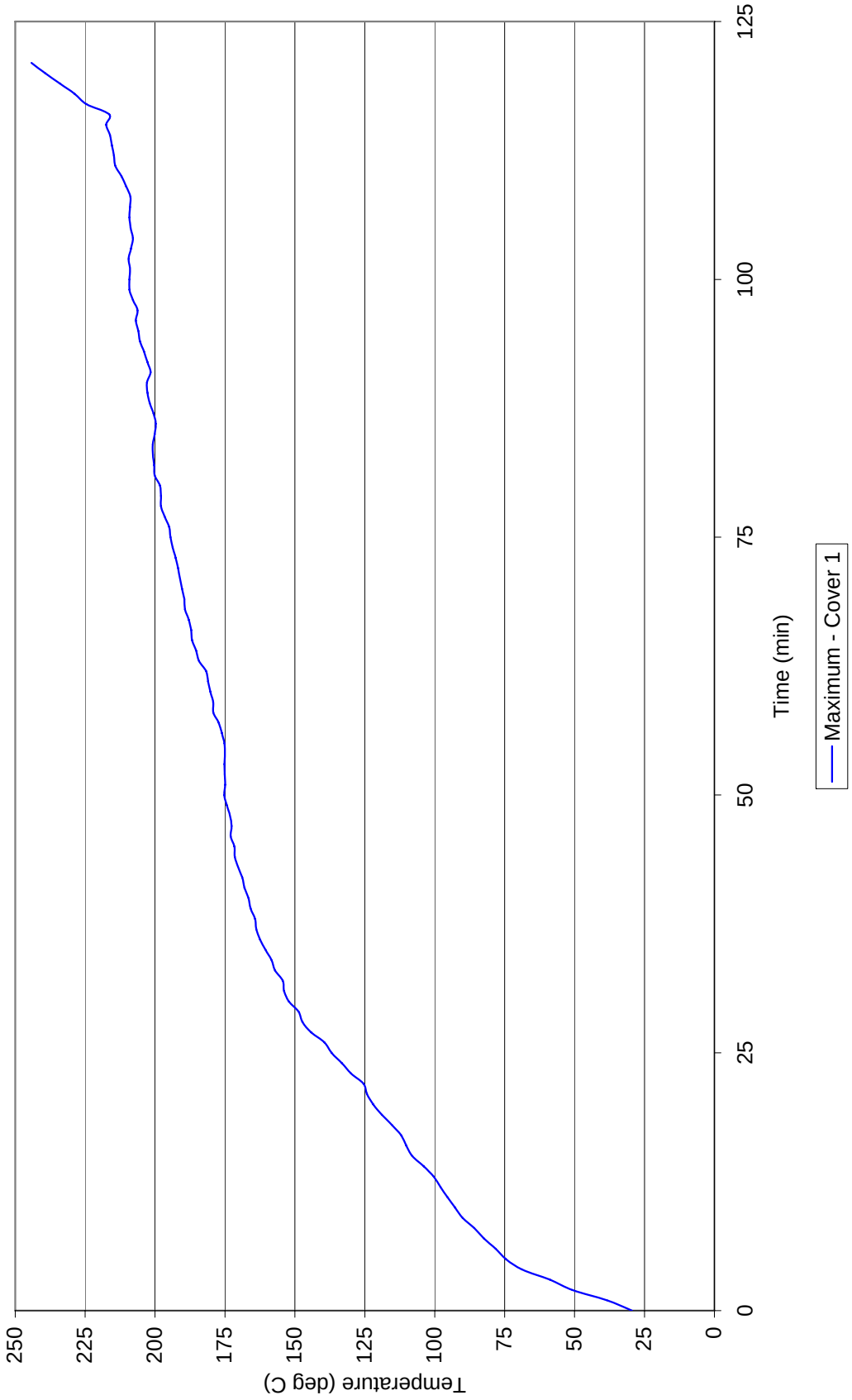


Figure 2 - Specimen temperature – SAMPLE 1

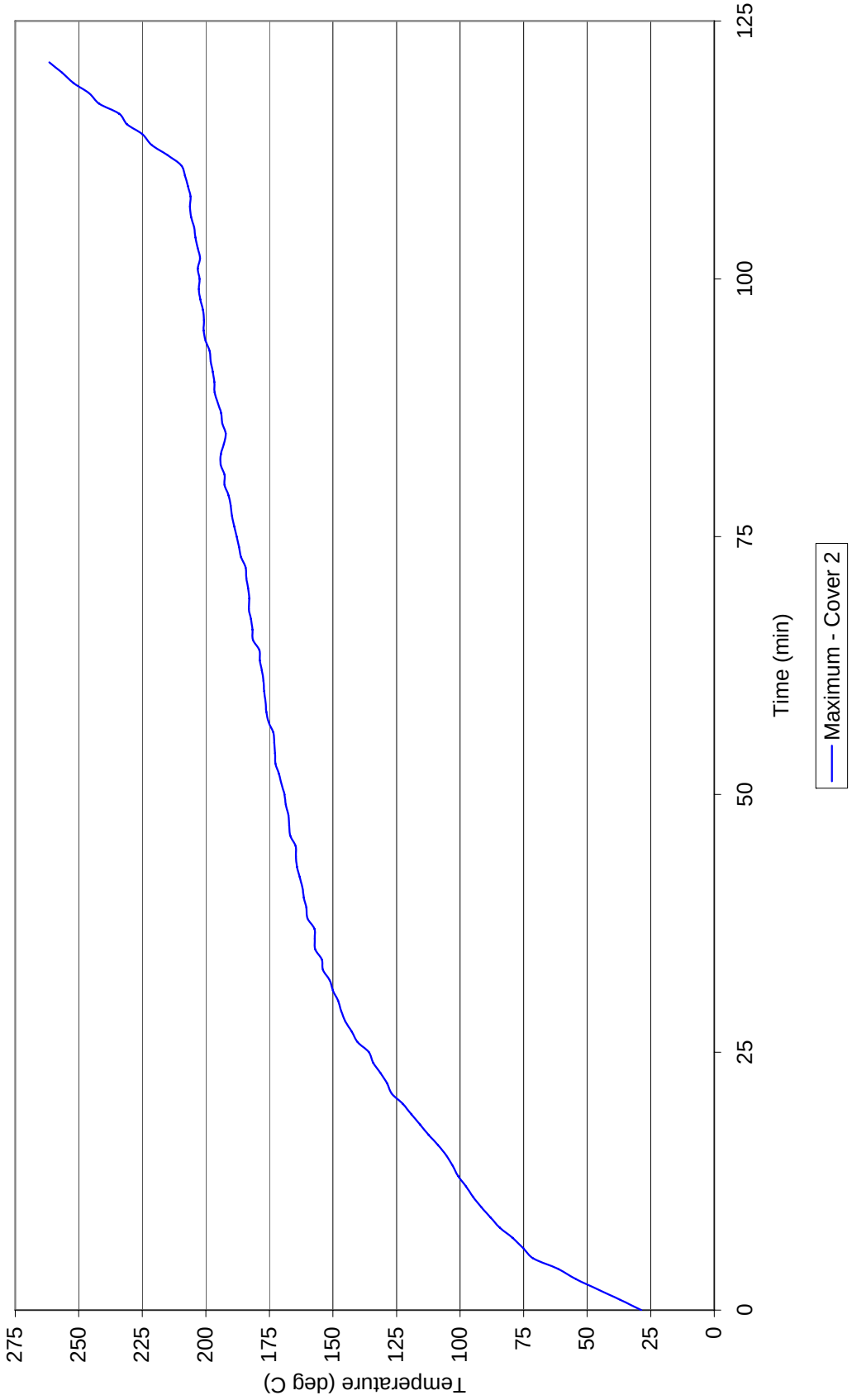


Figure 3 - Specimen temperature – SAMPLE 2

Figure 4 - Specimen temperature – SAMPLE 3

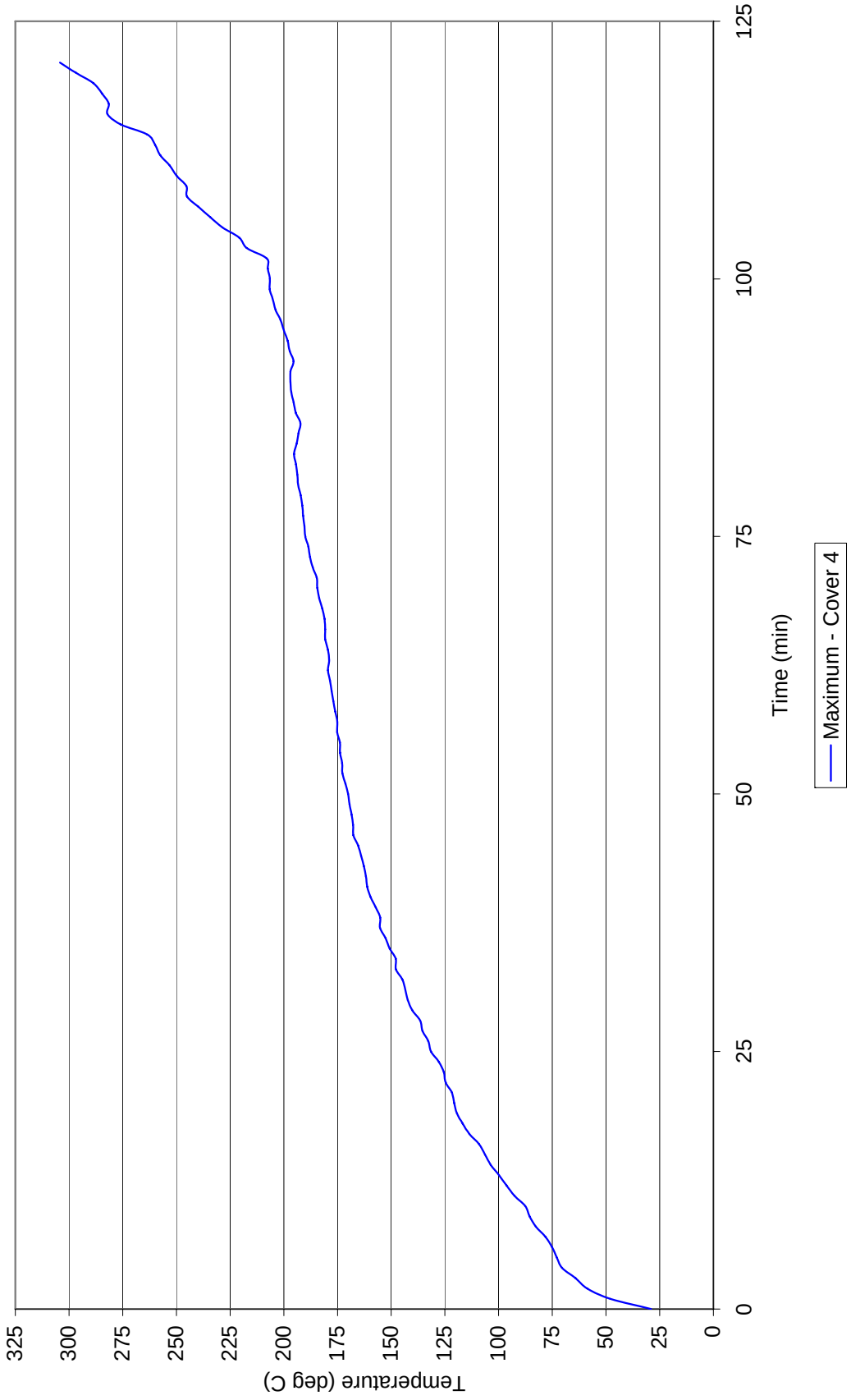


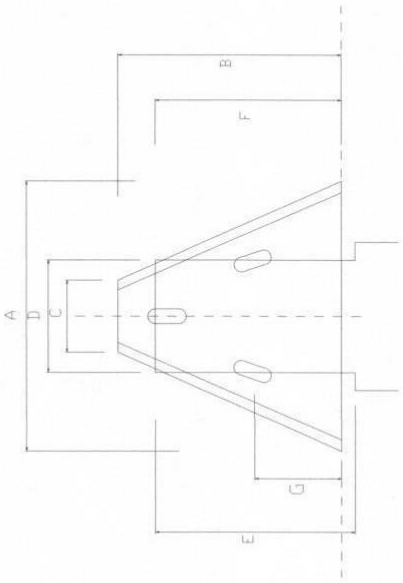
Figure 5 - Specimen temperature – SAMPLE 4

APPENDIX 3

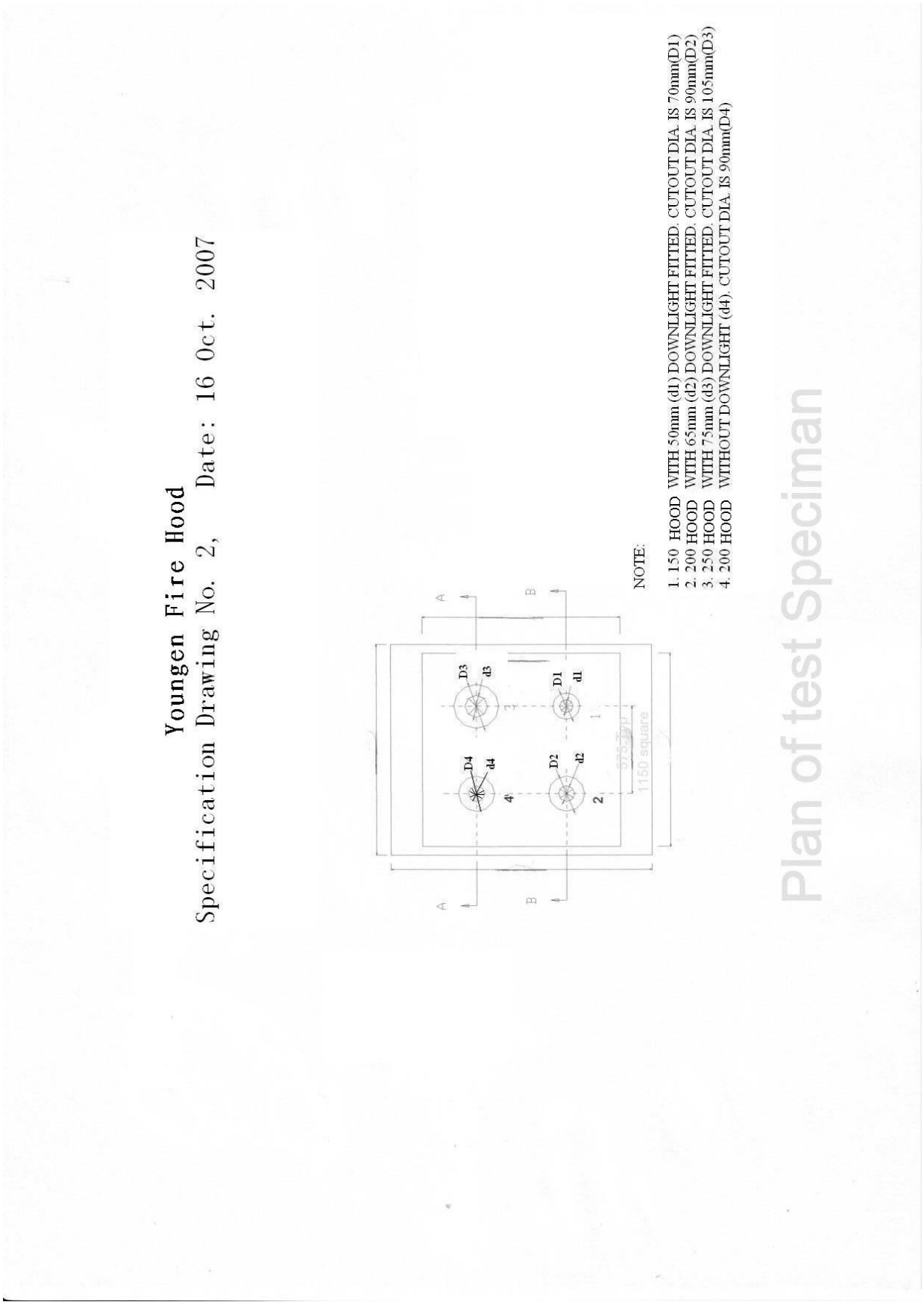
Youngen Fire Hood

Specification Drawing No. 1, Date: 16 Oct. 2007

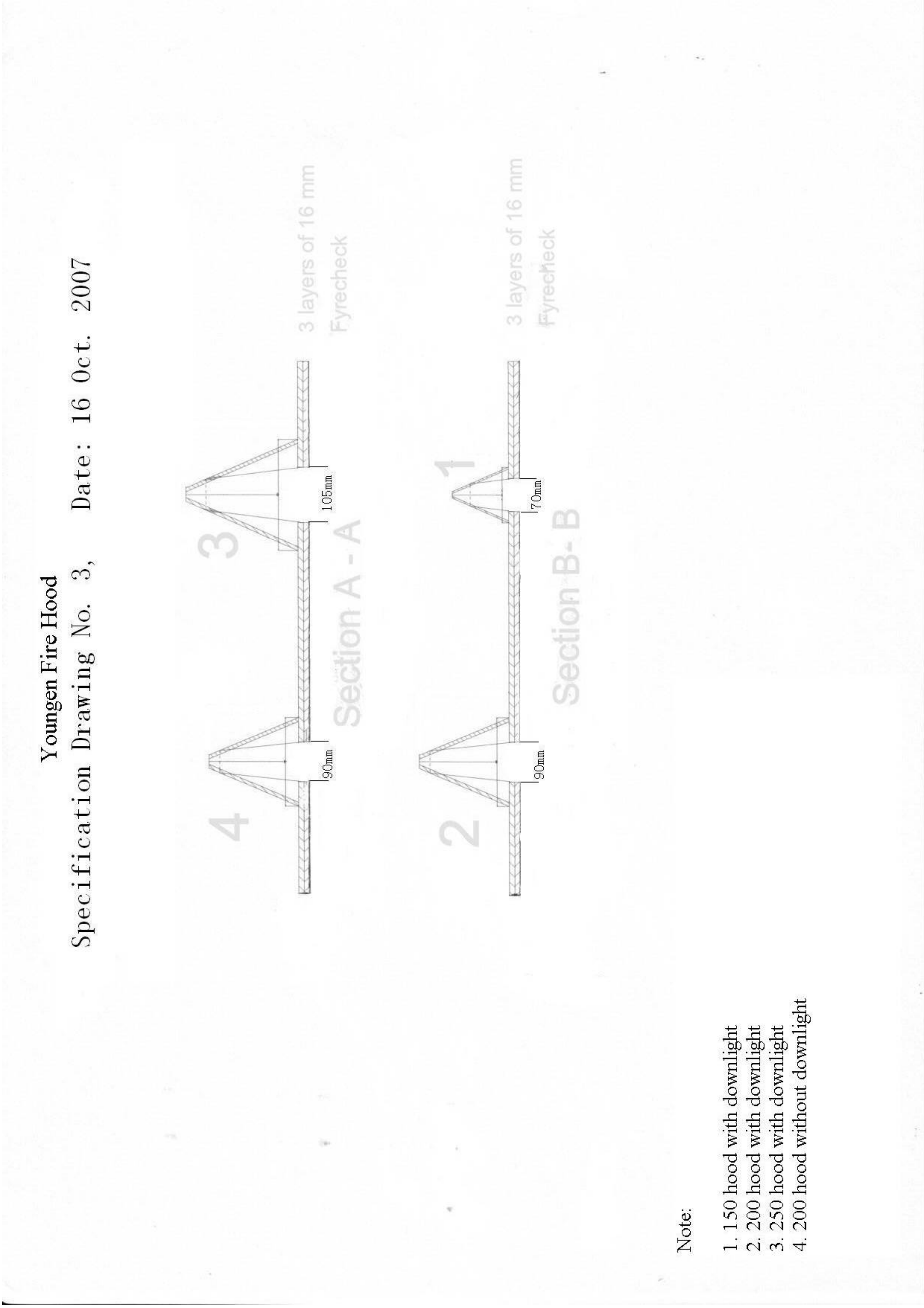
Hood	Small	Middle	Large
A	150	200	250
B	160	210	270
C	30	30	30
D	50	50	70
E	130	195	235
F	125	190	230
G	85	120	140
Wall Thk	10	10	12



Drawing 1


Youngen Fire Hood
Specification Drawing No. 2, Date: 16 Oct. 2007
NOTE:
1. 150 HOOD WITH 50mm (d1) DOWNLIGHT FITTED. CUTOUT DIA. IS 70mm(D1)
2. 200 HOOD WITH 65mm (d2) DOWNLIGHT FITTED. CUTOUT DIA. IS 90mm(D2)
3. 250 HOOD WITH 75mm (d3) DOWNLIGHT FITTED. CUTOUT DIA. IS 105mm(D3)
4. 200 HOOD WITHOUT DOWNLIGHT (d4). CUTOUT DIA. IS 90mm(D4)
D3
d3
D1
d1
D4
d4
D2
d2
1150 square
Plan of test Speciman

Drawing 2


Youngen Fire Hood
Specification Drawing No. 3, Date: 16 Oct. 2007
3 layers of 16 mm Fyrecheck
3 layers of 16 mm Fyrecheck
3
4
105mm
90mm
Section A - A
1
2
70mm
90mm
Section B- B
Note:
1. 150 hood with downlight
2. 200 hood with downlight
3. 250 hood with downlight
4. 200 hood without downlight

Drawing 3

APPENDIX 4

Certificate of Test

No. 2060A

This is to certify that the element of construction described below was tested by the CSIRO Division of Manufacturing and Infrastructure Technology in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2005 on behalf of:

Efficiency Matrix Pty Ltd 14 Ondine Drive Wheelers Hill VICTORIA	and	Youngen Pty Ltd 240 Cheltenham Road Keysborough VICTORIA

A full description of the test specimen and the complete test results are detailed in the Division's sponsored investigation report numbered FSV 1290A.

Product Name: SAMPLE 1 – Youngen 150-mm Fire Hood protecting a 50-mm diameter downlight assembly.

Description: Sample 1 comprised a Youngen 150-mm Fire Hood protecting a standard "gimble type" recessed downlight assembly. The downlight assembly, 50-mm in diameter, was recessed into the plasterboard ceiling through a 70-mm diameter opening, and retained in place using spring metal clips. On the unexposed face of the ceiling, the downlight assembly was protected by a 150-mm Youngen Fire Hood. The hood was made out of 10-mm thick in tumescent based material, formed into a conical shape, measuring 150-mm in diameter at its base and 160-mm in height. The hood incorporated small oval openings, four of which were located at 85-mm from the base and two at 130-mm from the base. The Fire Hood was fixed into position using a metal wire clip, threaded through the top two holes and secured between the exposed edge of the cut opening and the downlight metal fascia housing, as shown in drawing numbered 1, dated 16 October 2007, by Youngen Pty Ltd.
The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	-	not applicable
Integrity	-	no failure at 121 minutes
Insulation	-	105 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/120/90. The FRL is applicable for exposure to fire from the same side as tested.

This certificate is provided for general information only and does not comply with the regulatory requirements for evidence of compliance.

Testing Officer: Chris Wojcik Date of Test: 16 October 2007.

Issued on the 14th day of October 2010 without alterations or additions.

Garry E Collins
Manager, Fire Testing and Assessments

CSIRO Materials Science and Engineering
14 Julius Avenue, Riverside Corporate Park, North Ryde NSW 2113 AUSTRALIA
Telephone: 61 2 9490 5444 Facsimile:61 2 9490 5555

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Certificate of Test

No. 2061A

This is to certify that the element of construction described below was tested by the CSIRO Division of Manufacturing and Infrastructure Technology in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2005 on behalf of:

Efficiency Matrix Pty Ltd 14 Ondine Drive Wheelers Hill VICTORIA	and	Youngen Pty Ltd 240 Cheltenham Road Keysborough VICTORIA

A full description of the test specimen and the complete test results are detailed in the Division's sponsored investigation report numbered FSV 1290A.

Product Name: SAMPLE 2 – Youngen 200-mm Fire Hood protecting a 65-mm diameter downlight assembly.

Description: Sample 2 comprised a Youngen 200-mm Fire Hood protecting a standard "gimble type" recessed downlight assembly. The downlight assembly, 65-mm in diameter, was recessed into the plasterboard ceiling through a 90-mm diameter opening, and retained in place using spring metal clips. On the unexposed face of the ceiling, the downlight assembly was protected by a 200-mm Youngen Fire Hood. The hood was made out of 10-mm thick in tumescent based material, formed into a conical shape, measuring 200-mm in diameter at its base and 210-mm in height. The hood incorporated small oval openings, four of which were located at 120-mm from the base and two at 195-mm from the base. The Fire Hood was fixed into position using a metal wire clip, threaded through the top two holes and secured between the exposed edge of the cut opening and the downlight metal fascia housing, as shown in drawing numbered 1, dated 16 October 2007, by Youngen Pty Ltd.

Structural Adequacy	-	not applicable
Integrity	-	no failure at 121 minutes
Insulation	-	111 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/120/90. The FRL is applicable for exposure to fire from the same side as tested.

This certificate is provided for general information only and does not comply with the regulatory requirements for evidence of compliance.

Testing Officer: Chris Wojcik Date of Test: 16 October 2007.

Issued on the 14th day of October 2010 without alterations or additions.

Garry E Collins
Manager, Fire Testing and Assessments

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Certificate of Test

No. 2062A

This is to certify that the element of construction described below was tested by the CSIRO Division of Manufacturing and Infrastructure Technology in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2005 on behalf of:

Efficiency Matrix Pty Ltd 14 Ondine Drive Wheelers Hill VICTORIA	and	Youngen Pty Ltd 240 Cheltenham Road Keysborough VICTORIA

A full description of the test specimen and the complete test results are detailed in the Division's sponsored investigation report numbered FSV 1290A.

Product Name: SAMPLE 3 – Youngen 250-mm Fire Hood protecting a 75-mm diameter downlight assembly.

Description: Sample 3 comprised a Youngen 250-mm Fire Hood protecting a standard "gimble type" recessed downlight assembly. The downlight assembly, 75-mm in diameter, was recessed into the plasterboard ceiling through a 105-mm diameter opening, and retained in place using spring metal clips. On the unexposed face of the ceiling, the downlight assembly was protected by a 250-mm Youngen Fire Hood. The hood was made out of 12-mm thick in tumescent based material, formed into a conical shape, measuring 250-mm in diameter at its base and 270-mm in height. The hood incorporated small oval openings, four of which were located at 140-mm from the base and two at 235-mm from the base. The Fire Hood was fixed into position using a metal wire clip, threaded through the top two holes and secured between the exposed edge of the cut opening and the downlight metal fascia housing, as shown in drawing numbered 1, dated 16 October 2007, by Youngen Pty Ltd.

Structural Adequacy	-	not applicable
Integrity	-	no failure at 121 minutes
Insulation	-	63 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/120/60. The FRL is applicable for exposure to fire from the same side as tested.

This certificate is provided for general information only and does not comply with the regulatory requirements for evidence of compliance.

Testing Officer: Chris Wojcik Date of Test: 16 October 2007.

Issued on the 14th day of October 2010 without alterations or additions.

Garry E Collins
Manager, Fire Testing and Assessments

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No. 2063A

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Efficiency Matrix Pty Ltd 14 Ondine Drive Wheelers Hill VICTORIA	and	Youngen Pty Ltd 240 Cheltenham Road Keysborough VICTORIA

A full description of the test specimen and the complete test results are detailed in the Division's sponsored investigation report numbered FSV 1290A.

Product Name: SAMPLE 4 – Youngen 200-mm Fire Hood protecting a 90-mm diameter cut-out opening.

Description: Sample 4 comprised a Youngen 200-mm Fire Hood protecting a clear 90-mm diameter opening in the plasterboard ceiling. On the unexposed face of the ceiling, the opening was protected by a 200-mm Youngen Fire Hood. The hood was made out of 10-mm thick in tumescent based material, formed into a conical shape, measuring 200-mm in diameter at its base and 210-mm in height. The hood incorporated small oval openings, four of which were located at 120-mm from the base and two at 195-mm from the base. The Fire Hood was fixed into position using a metal wire clip, threaded through the top two holes and secured between the plasterboard sheets.

Structural Adequacy	-	not applicable
Integrity	-	no failure at 121 minutes
Insulation	-	102 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/120/90. The FRL is applicable for exposure to fire from the same side as tested.

This certificate is provided for general information only and does not comply with the regulatory requirements for evidence of compliance.

Testing Officer: Chris Wojcik Date of Test: 16 October 2007.

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