FP 4109

FIRE RESISTANCE OF DOWNLIGHT PENETRATIONS IN A PLASTERBOARD CEILING CAVITY

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All tests reported herein have been undertaken at the BRANZ Ltd laboratories located in Judgeford, Porirua, New Zealand, unless stated otherwise.

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vi. The liability of BRANZ in respect of any claim for loss, damage or expense of any nature and howsoever arising shall in no circumstances exceed a total aggregate sum equal to 10 times the amount of the fee paid in respect of the specific service which gives rise to such claim or NZD$50,000 (or its equivalent in local currency), whichever is the lesser.

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- The date when the service should have been completed in the event of any alleged non-performance.

b. Indemnification: The Client shall guarantee, hold harmless and indemnify BRANZ and its officers, employees, agents or subcontractors against all claims (actual or threatened) by any third party for loss, damage or expense of whatsoever nature including all legal expenses and related costs and howsoever arising relating to the performance, purported performance or non-performance, of any Services.

c. Without limiting clause b above, the Client shall guarantee, hold harmless and indemnify BRANZ and its officers, employees, agents or subcontractors against all claims (actual or threatened) by any party for loss, damage or expense of whatsoever nature including all legal expenses and related costs arising out of:

i. any failure by the Client to provide accurate and sufficient information to BRANZ to perform the Services;

ii. any misstatement or misrepresentation of the Outputs, including Public Outputs;

iii. any defects in the Products the subject of the Services; or

iv. any changes, modifications or alterations to the Products the subject of the Services.

FIRE RESISTANCE OF DOWNLIGHT PENETRATIONS IN A PLASTERBOARD CEILING CAVITY

1. CLIENT

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2. INTRODUCTION

The purpose of the test is to determine the insipient spread of fire performance of the Trafalgar downlight covers when installed into a plasterboard ceiling.

The penetrations were installed in the plasterboard ceiling which did include a ceiling plenum.

3. TEST STANDARD

3.1 Test Specification

The test was conducted generally in accordance with AS 1530.4-2005, *Methods for fire tests on building materials, components and structures,* except that the specimen was not full size. The test standard states that the fire resistance of the specimen is the time, expressed in minutes, to failure under one or more of the following criteria:

3.2 Integrity

Failure shall be deemed to occur when cracks, fissures or other openings develop through which flames or hot gases can pass. Failure occurs;

(a) If a gap, crack or fissure develops, which exceeds 6 mm x 150 mm and allows unobstructed vision into the interior of the furnace from any viewing angle, or a 25 mm gap gauge can be passed through the specimen so that the gauge projects into the furnace; or

(b) If flaming on the unexposed surface of the specimen is sustained for longer than 10 seconds; or

(c) When flames and/or hot gasses cause flaming or glowing of the cotton fibre pad.

3.3 Insulation

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

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

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

3.4 Resistance to incipient spread of fire

Failure in relation to incipient spread of fire is deemed to have occurred when the average temperature on the unexposed face of the ceiling membrane exceeds an average temperature of 250°C.

4. DESCRIPTION OF TEST SPECIMEN

4.1 General

The specimen consisted of a reduced size non-loadbearing ceiling system with a 60 minute resistance to incipient spread of fire (RISF) into which was installed the downlight covers.

The specimen was constructed resting on top of a nominal 1,000 mm x 2,200 mm concrete lined specimen holder.

Figures 6 show construction details of the downlight cover.

4.2 Floor/Ceiling

The ceiling was constructed generally in accordance with a timber framed, fire rated ceiling system with a fire resistance rating (FRL) of 120/120/120 and incipient spread of fire 60 minutes. The construction consisted of two nominal 200 mm x 50 mm timber floor joists at 600 mm centres spanning 2,200 mm with a ceiling lining of three layers of 16 mm thick fire rated plasterboard. Two edge joists were resting on top of the specimen holder and rows of full depth blocking of 200 mm x 50 mm timber, on edge, were also provided between the joists either side of the downlight enclosure flush with the underside edge of the joists. The flooring was not fixed to the joists and consisted of a single layer of 20 mm particleboard flooring.

4.3 Downlight covers

4.3.1 Large downlight, Trafalgar DLC 200

The downlight cover consisted of a ceramic fibre blanket impregnated with intumescent and formed into a cone shape. The bottom of the cone was nominally 200 mm diameter x 235 mm high. Approximately 130 mm from the bottom of the cover were 4 vents cut into the cone and approximately 35 mm from the top a further 2 vents were provided in the cone. The vents were approximately 18 mm high x 10 mm wide. Wrapped around the top of the cone at the approximate location of the upper vents was a piece of 1.2 mm thick wire. The ends of the wire extended down through two of the lower vent holes to the bottom of the downlight cover with a 10 mm step, then extended a further 100 mm from the bottom of the cover.

The downlight cover was positioned over a steel downlight with a 100 watt incandescent bulb and terminal box. The downlight was overall 132 mm wide x 110 mm high with a 110 mm diameter hole through the plasterboard lining. The bulb was installed prior to testing.

4.3.2 Small downlight, Trafalgar DLC 150

The downlight cover consisted of a ceramic fibre blanket impregnated with intumescent made into a cone shape. The bottom of the cone was nominally 150 mm diameter x 160 mm high. Approximately 75 mm from the bottom of the cover were 4 vents cut into the cone and approximately 35 mm from the top a further 2 vents were provided in the

cone. The vents were approximately 18 mm high x 10 mm wide. Wrapped around the top of the cone at the approximate location of the upper vents was a piece of wire. The wire, 1.2 mm thick, extended down through two of the lower vent holes to the bottom of the downlight cover with a 10 mm step then extended a further 100 mm from the bottom of the cover.

The downlight cover was positioned over a di-cast di-chroic downlight with a 12 volt bulb. The downlight was overall 100 mm wide x 37 mm high with a 90 mm diameter hole through the plasterboard lining.

5. TEST PROCEDURE

5.1 General

The specimen was tested on 25th February 2009 at BRANZ laboratories, Judgeford, New Zealand. The ambient temperature at the beginning of the test was 16°C.

The specimen was placed on the 2.2 m x 1 m horizontal furnace and the temperature and pressure conditions were controlled to the limits defined in AS 1530.4-2005.

5.2 Furnace Temperature Measurement

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

5.3 Specimen Temperature Measurement

The temperature on the unexposed face of the test specimen was measured using chromel-alumel thermocouples mounted on copper discs, in accordance with clause 2.2.3.1 of the test standard. A number of thermocouples were positioned on the downlight covers, plasterboard facing and flooring.

5.4 Temperature Recording

All the thermocouples described in sections 5.2 and 5.3 were connected to a computer controlled data acquisition unit which recorded the temperatures at 15 second intervals.

5.5 Pressure Measurement

As required by the test standard the differential pressure within the furnace was controlled to be not less than 20 Pa above the laboratory atmosphere at 100 mm below the exposed surface of the specimen. The differential pressure was monitored using a micromanometer connected to a computer controlled data logging system which recorded the pressure at 15 second intervals.

6. OBSERVATIONS

6.1 Duration

The test was stopped after 125 minutes.

6.2 Furnace Temperature

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

Figure 2 shows the percentage deviation of the mean furnace temperature from the Standard curve.

In summary the furnace temperatures complied with the test standard.

6.3 Integrity

6.3.1 Downlight covers

6.3.1.1 Trafalgar DLC 200

No Integrity failure associated with the downlight cover for the duration of the test as applied to the top of the flooring.

6.3.1.2 Trafalgar DLC 150

No Integrity failure associated with the downlight cover for the duration of the test as applied to the top of the flooring.

6.4 Resistance to the incipient spread of fire

6.4.1 Downlight covers

6.4.1.1 Trafalgar DLC 200

The average temperature as measured by the thermocouples on the surface of the downlight cover exceeded 250°C after 107 minutes.

6.4.1.2 Trafalgar DLC 150

The average temperature as measured by the thermocouples on the downlight cover exceeded 250 C after 118 minutes.

6.5 Insulation

6.5.1 Downlight covers

6.5.1.1 Trafalgar DLC 200

The average temperature rise as measured by the thermocouples on the downlight cover exceeded an average of 140 K after 42 minutes.

The maximum temperature rise measured on the specimen exceeded 180 K rise after 41 minutes.

Temperatures measured on the unexposed face of the flooring did not exceed the insulation failure criteria for the duration of the test.

6.5.1.2 Trafalgar DLC 150

The average temperature rise as measured by the thermocouples on the downlight cover exceeded an average of 140 K after 58 minutes.

The maximum temperature rise measured on the specimen exceeded 180 K rise after 37 minutes.

Temperatures measured on the unexposed face of the flooring did not exceed the insulation failure criteria for the duration of the test.

6.6 Specimen Behaviour

Observations related to the integrity performance of the access panel is as follows at the times stated in minutes and seconds.

Mins:secs

15:00 The downlight covers had been pushed off the plasterboard by approximately 5 mm and there was a brown discolouration on the plasterboard paper facing but otherwise no significant change.

34:00 The DLC 200 downlight cover had expanded significantly as had the DLC 150 one except it had split along one side. It was not possible to see through the cover.

72:00 There was slight discolouration of the timber next to the DLC 200 downlight cover within the cavity, otherwise no significant change.

106:00 A red glow was visible between the downlight cover and plasterboard of the DLC 200 downlight. This occurred where the support spring of the downlight was resting.

125:00 Test stopped.

7. SUMMARY

The fire test of the specimens when installed into a reduced size plasterboard ceiling, and subject to the pressure, temperature conditions and failure criteria of AS 1530.4-2005 achieved the follow result.

7.1.1 Downlight covers

7.1.1.1 Large, Trafalgar DLC 200

The floor/ceiling with the downlight cover did not fail the Integrity criteria for the duration of the test. The floor/ceiling with the downlight cover did not exceed the insulation failure criteria to the unexposed face of the floor for the duration of the test.

The temperature measured on the downlight exceeded the RISF criteria after 107 minutes.

The downlight as part of the floor/ceiling achieved an FRL of -/120/120

7.1.1.2 Small, Trafalgar DLC 150

The floor/ceiling with the downlight cover did not fail the Integrity criteria for the duration of the test. The floor/ceiling with the downlight cover did not exceed the insulation failure criteria to the unexposed face of the floor for the duration of the test.

The temperature measured on the downlight exceeded the RISF criteria after 118 minutes.

The downlight as part of the floor/ceiling achieved an FRL of -/120/120

The test standard requires the following statements to be included:

"This report details methods of construction, the test conditions and the results obtained when the 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 difficult in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result."

8. ATTACHMENTS:

Figure 1. Furnace Temperature

Figure 2. Accuracy of Furnace Control

Figure 3 Specimen Temperatures – Downlight – Trafalgar DLC 200

Figure 4 Specimen Temperatures – Downlight – Trafalgar DLC 150

Figure 5 Specimen Temperatures – RISF

Figure 6 Client supplied drawing – Downlight Cover - General

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Figure 1 Furnace Temperature

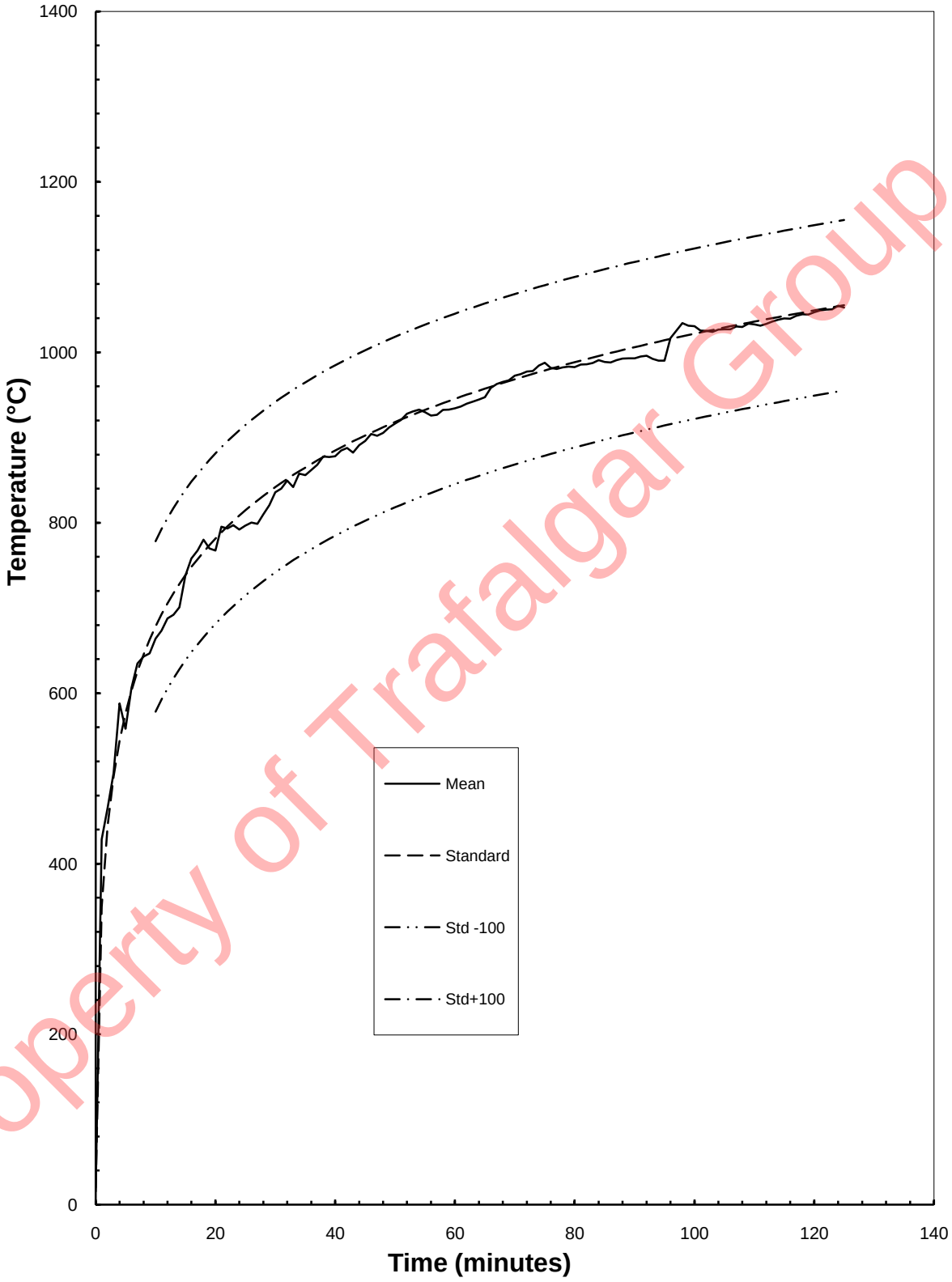

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Figure 2 Accuracy of Furnace Control

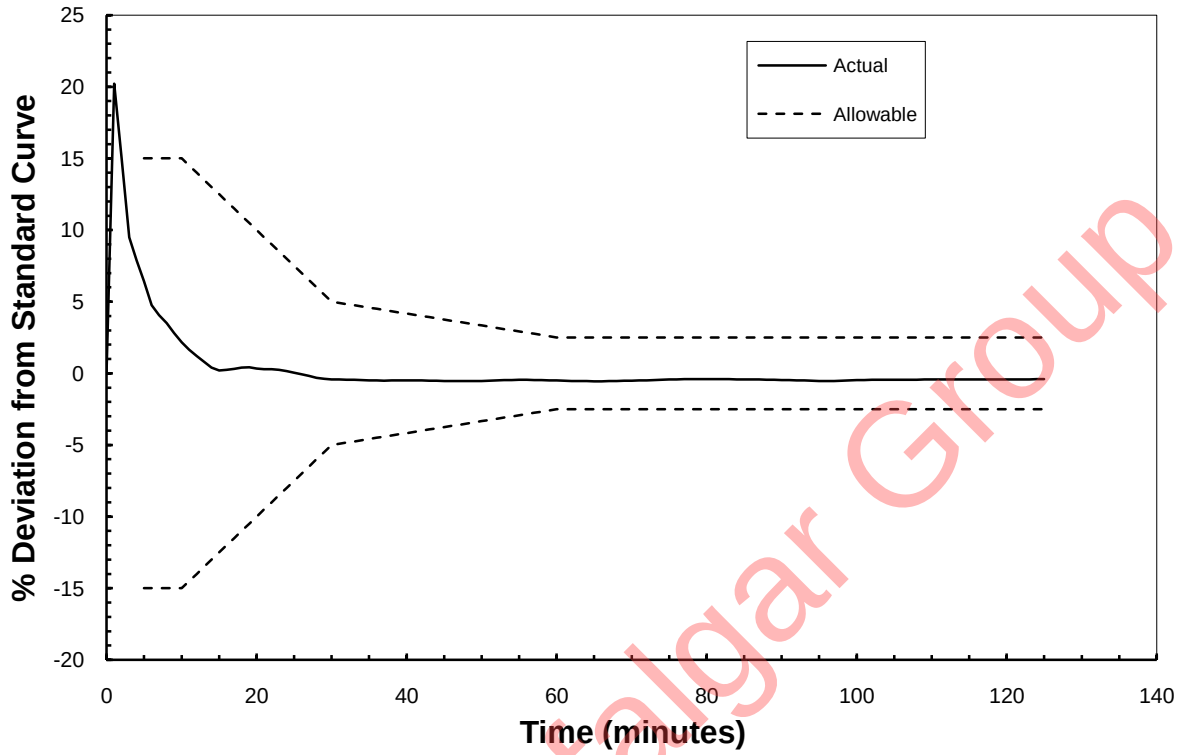

Figure 3 Specimen Temperatures - Downlight - Trafalgar DLC 200

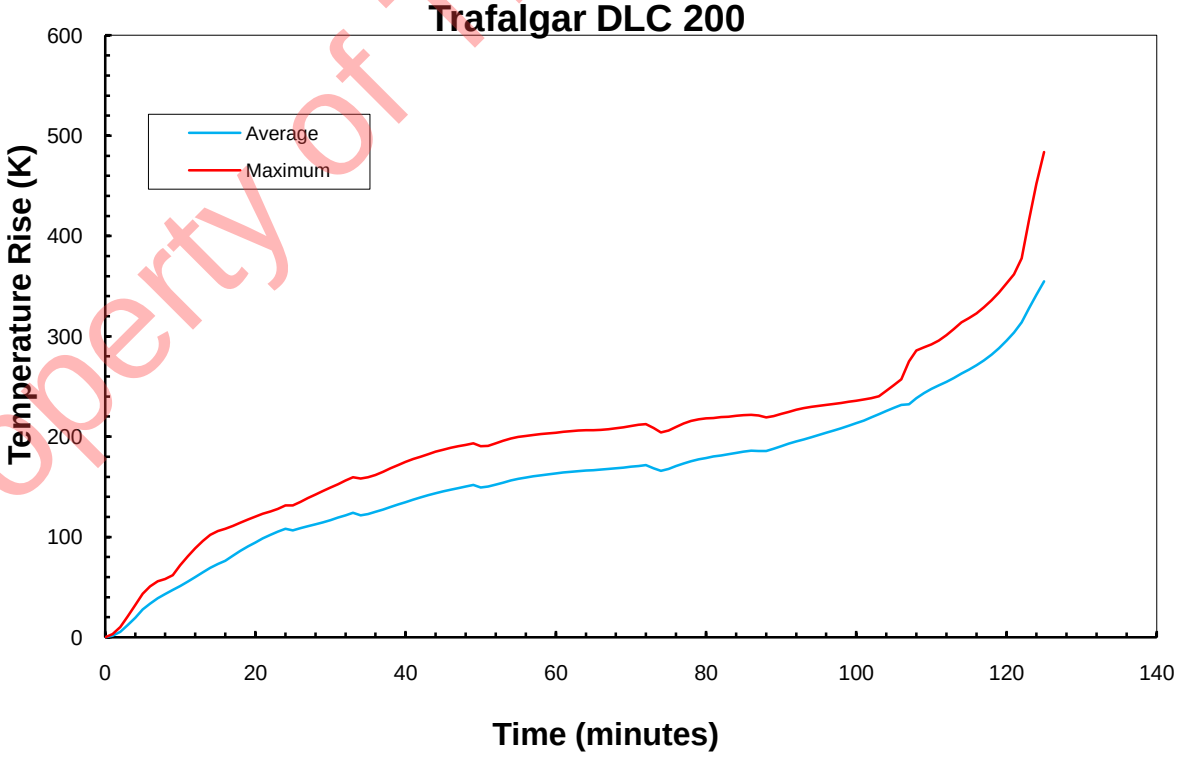

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Figure 4 Specimen Temperatures - Downlight - Trafalgar DLC 150

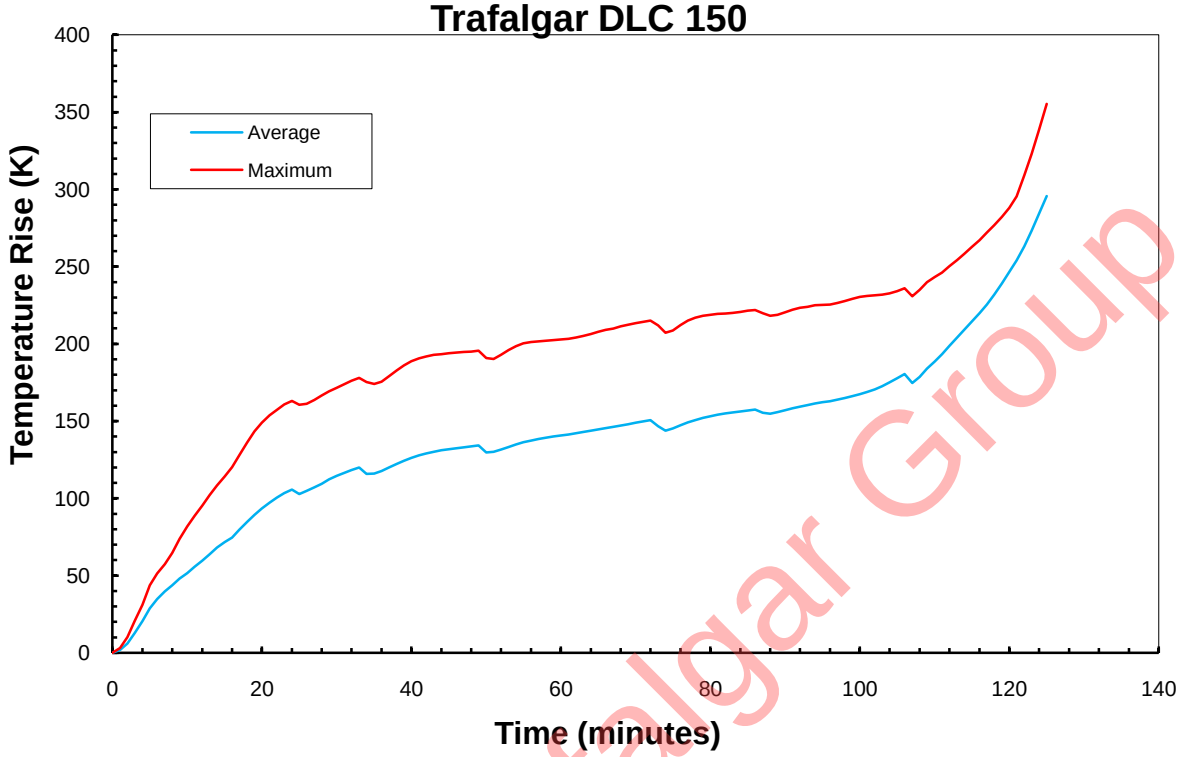

Figure 5 Specimen Temperatures - RISF

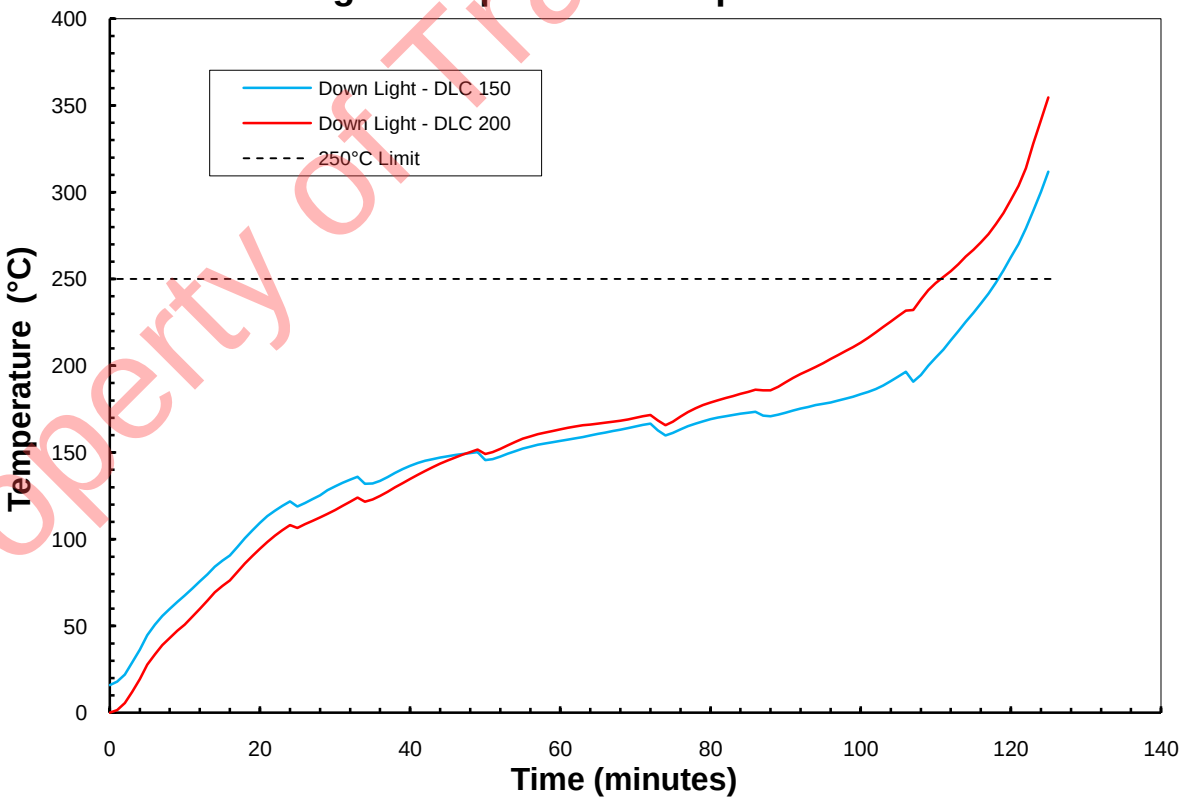

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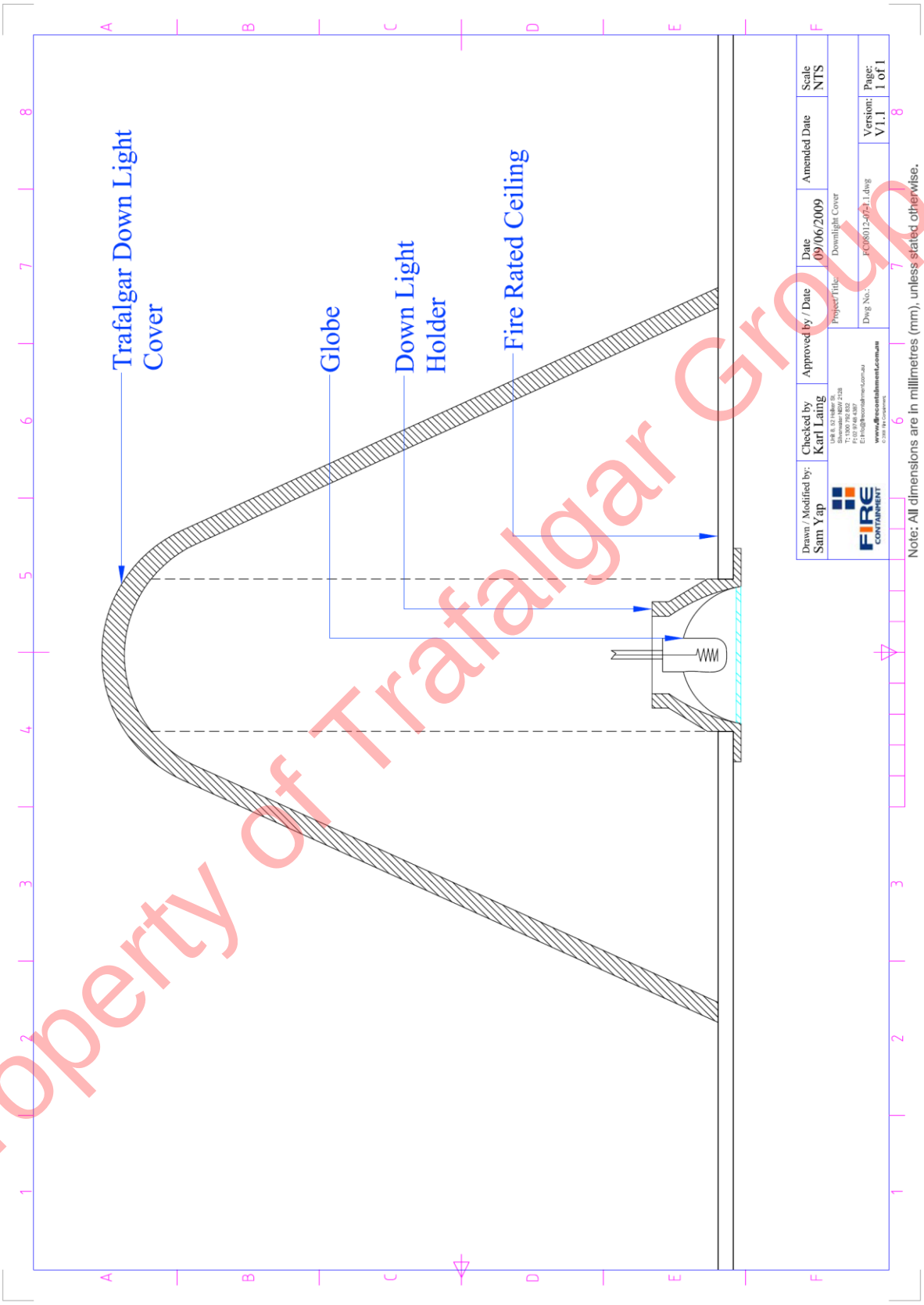
Figure 6 Client supplied drawing – Downlight Cover – General



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