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Fire resistance of 200-mm Efficiency Matrix light hood in accordance with AS 1530.4-2014

Assessment Report

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Important disclaimer

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1 Introduction

This report is an assessment of the fire resistance of an Efficiency Matrix 200-mm light hood when tested in accordance with AS 1530.4-2014.

This report is prepared for the purpose of meeting the evidence of suitability requirements of NCC Vol 1 Schedule 5 clause 2 (c) as appropriate for FRL.

This report reviews and confirms the extent to which the reference fire resistance test listed in section 2 meets the requirements of the standard fire test standard listed in section 4 of the report. The proposed variations to the tested construction presented in section 3 are subject to an analysis in Appendix B and the conclusions are presented in Section 5 of this report.

The field of direct applicability of the results of this assessment report are presented in Section 6.

2 Supporting Data

This assessment report refers to various test reports to support the analysis and conclusions of this report. They are listed below:

Report Reference	Test Standard	Outline of Test Specimen
FSP 1290a	AS 1530.4-2005	Fire resistance test on four downlight covers Youngen Fire Hoods protecting downlight assemblies and an open cut-out in a plasterboard ceiling system.

The test report FSP 1290A was undertaken by CSIRO and sponsored by Efficiency Matrix Pty Ltd and Youngen Pty Ltd who have provided permission for CSIRO to refer to the test data on this report.

3 Proposed Variations

The proposed construction shall be as tested in FSP 1290a specimen 2 and subject to the variations listed below:

- Any light fitting may be fitted to the 90-mm hole that is protected with Efficiency Matrix 200-mm light hood.
- The ceiling may be varied from the tested 3 x 16mm fire grade plasterboard to a ceiling lining system capable of achieving an FRL of 60/60/60 and a RISF of 60 minutes.

4 Referenced Standards

Standards:

AS 1530.4-2014 Methods for fire tests on building materials, components and structures Part 4: Fire resistance tests of elements of building construction.

5 Conclusion

On the basis of the analysis presented in this report, it is the opinion of this Testing Authority that the tested prototype described in Section 2 when varied as described in Section 3 will achieve the Fire Resistance stated below when submitted to a standard fire test in accordance with the test methods referenced in Section 4 and subject to the requirements of Section 7.

FRL of floor system when fitting included – not detrimentally affected up to 60/60/60

Resistance to the incipient spread of fire (RISF) 60 minutes

6 Field of direct applicability of the results

The results of this report are applicable to the ceiling exposed to fire from below.

7 Requirements

It is required that the ceiling system supported by its own test or assessment that confirms an FRL of 60/60/60 and RISF of 60 minutes without the light fitting in accordance with AS 1530.4.

Any variations with respect to size, constructional details, loads, stresses, edge or end conditions that are other than those identified in this report, may invalidate the conclusions drawn in this report.

8 Term of Validity

This assessment report will lapse on 31 May 2026. Should you wish us to re-examine this report with a view to the possible extension of its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to amend or withdraw this assessment in the light of new knowledge.

9 Limitations

The conclusions of this assessment report may be used to directly assess the fire resistance performance under such conditions, but it should be recognised that a single test method will not provide a full assessment of the fire hazard under all fire conditions.

Because of the nature of fire resistance testing, and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment report does not provide an endorsement by CSIRO of the actual products supplied to industry. The referenced assessment can therefore only relate only to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of constructions of subsequent manufacture.

This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are the subject of constant review and improvement and it is recommended that this report be reviewed on or, before, the stated expiry date.

The information contained in this assessment report shall not be used for the assessment of variations other than those stated in the conclusions above. The assessment is valid provided no modifications are made to the systems detailed in this report. All details of construction should be consistent with the requirements stated in the relevant test reports and all referenced documents.

Appendix A Supporting Test Data

A.1. CSIRO Test Report No. FSP 1290a

The specimen comprised of 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.

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 Fyrecheck 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.

Specimen 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.

Specimen 2 maintained integrity without failure for 121 minutes duration of the test and insulation for 111 minutes.

Specimen 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 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.

Specimen 4 maintained integrity without failure for 121 minutes duration of the test and insulation for 102 minutes.

A.2. The relevance of tests in accordance with AS 1530.4-2005 to AS 1530.4-2014

For the test FSP1290a referenced that was conducted in accordance with AS 1530.4– 2005, this test method differs slightly from AS 1530.4–2014. These variations and the potential effect of these differences on specimen performance is discussed below.

Standard heating conditions

The furnace heating regime in fire resistance test conducted in accordance with AS 1530.4- 2014 follows the same trend as in AS 1530.4-2005.

$T = 345\log_{10}(8t + 1) + 20$

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4-2014 and AS 1530.4-2005 are not appreciably different.

Furnace Pressure

The specification for the furnace pressure differential in AS1530.4-2014 is the same as those specified in AS1530.4-2005.

Specimen size and construction

The size and construction of ceiling systems providing resistance to the incipient spread of fire in AS1530.4-2014 is the same as those specified in AS1530.4-2005.

Temperature measurement of ceilings systems with penetrations required to have resistance to incipient spread of fire

Where a ceiling system is required to have resistance to the incipient spread of fire to a space between ceiling and roof or ceiling and the floor above and incorporates penetrations, AS 1530.4-2014 requires additional thermocouples to be added on and around the services in the cavity of the specimen. The additional thermocouple locations are specified in AS 1530.4-2014 Clause 4.4.4.2.

Application of cotton pad

The differences in the AS 1530.4-2005 and AS 1530.4-2014 in regard to the application of the cotton pad have been considered and it is confirmed these differences would not have affected the fire integrity performance of the referenced test.

Criteria for failure

The criteria for the referenced tests in terms of structural adequacy, integrity and insulation are not appreciably different between AS 1530.4-2005 and AS 1530.4-2014.

AS 1530.4-2014 specified that failure in relation to incipient spread of fire shall be deemed to have occurred when the maximum temperature of the thermocouples at the unexposed side of the specimen exceeds 250°C whereas AS 1530.4-2005 specified that failure in relation to incipient spread of fire shall be deemed to have occurred when the average temperature of the thermocouples at the unexposed side of the specimen cavity exceeds 250°C.

AS 1530.4-2014 also has the additional thermocouples for ceiling penetrations to determine if the penetrations would cause a failure to the resistance to the incipient spread of fire criteria when the maximum temperature of the thermocouples in the cavity around the penetration exceeds 250°C.

Application of Test Data to AS 1530.4-2014

In light of the above, it is considered that the results of the referenced test need to be examined on a case by case basis for the purpose of assessment of structural adequacy, integrity, insulation and resistance to the incipient spread of fire and in accordance with AS 1530.4-2014.

Appendix B Analysis of Variations

B.1 Variations to ceiling system with light fitting

The proposed construction shall be as tested in FSP 1290a and subject to the variations listed below:

- The ceiling may be varied from the tested 3 x 16 fire grade plasterboard to ceiling system capable of achieving an FRL of 60/60/60 and an RISF of 60 minutes;
- The inclusion of any light fitting in place of the light fitting as tested in FSP 1290a Specimen 2.

Variation to ceiling from that tested in FSP 1290a

The proposed construction comprise any ceiling system with a tested or assessed FRL of 60/60/60 and an RISF of 60 minutes when penetrated by specimens as tested in FSP 1290a.

If the ceiling system will vary from the one tested, it is a requirement that the proposed ceiling have a tested or assessed FRL of 60/60/60 and an RISF of 60 minutes. This practically will mean the plasterboard ceiling could be constructed either 2 layers of 16mm fire grade plasterboard or one layer of 16mm and one layer of 13mm fire grade plasterboard. Provided the light fitting can maintain at least the RISF performance of the ceiling, it is considered reasonable and conservative that the light fitting will not alter the heating conditions within the floor cavity. It is understood that the mode of degradation of ceiling systems is heavily reliant upon the falloff time of the first layer of plasterboard and it is considered the protected light fitting will not affect this critical performance parameter of the proposed ceiling system.

The inclusion of any light fitting that may be fitted to the 90-mm hole

The proposed construction comprise any light fitting in place of the light fitting as tested in FSP 1290a Specimen 2.

With reference to FSP 1290a, Specimen 4 and Specimen 2 both had a 90-mm diameter opening in the plasterboard ceiling. Specimen 2 had a standard gimble type recessed downlight assembly covering the hole, whereas Specimen 4 had no light fitting. Both were protected by a 200-mm Youngen Fire Hood. Specimen 2 maintained integrity without failure for 121 minutes duration of the test and failed insulation at 111 minutes. Specimen 4 maintained integrity without failure for 121 minutes duration of the test and failed insulation at 102 minutes.

A comparison of the two specimens showed that when the 90mm hole contains a downlight, it provided some insulation improvement to the specimen's insulation performance compared to the 90-mm hole without any light fitting.

Therefore, any light fitting that can fit through the 90-mm diameter opening with a casing that covers the hole and protected by 200-mm Youngen Fire Hood will also provide marginal insulation improvement to the 90mm hole protected by a 200-mm Youngen Fire Hood.

Based on the discussion above, it is expected that the proposed construction will not detrimentally affect the integrity and insulation performance of FSP 1290a Specimen 2 when tested in accordance with AS 1530.4 – 2014.

The incipient spread of fire

With reference to FSP 1290a, Specimen 4 comprised a Youngen 200-mm Fire Hood protecting a clear 90-mm diameter opening in the plasterboard ceiling. Specimen 4 was able to maintained integrity without failure for 121 minutes duration of the test and failed insulation at 102 minutes.

With reference to AS 1530.4-2014 Clause 4.4.4.2 for penetrations in ceiling membranes of floor/ceiling and roof/ceiling systems when tested unloaded where a ceiling system is required to have resistance to incipient spread of fire (RISF) to a space between ceiling and roof or ceiling and floor above and

incorporates penetrations, the penetrations shall include thermocouples positioned at locations specified below:

a) At not less than two points located approximately 25-mm from the edge of the hole made for the passage of the service;
b) Attached to adjacent structural members and those elements that support the penetrating service;
c) At points on the surface of the penetrating service or its fire-stopping encasement, as follows:
    i. At least two thermocouples located approximately 25-mm from the plane of the general surface of the ceiling and its insulating topping, if any.
    ii. Where the seal or protection around a service is tapered or stepped, two additional thermocouples beyond the step or the end of any taper if it is expected that temperatures will be higher at these points.
d) Where practicable, at two points on the seal or protection around a service.
e) One in the centre of the top surface.

Based on FSP 1290a, the thermocouples were placed on Specimen 4 only at four points: at the centre of the specimen (e), two points at 25-mm from the edge of the hole (a), and on the surface of the light hood (c). Thermocouples at two points which should be on the timber joists were not present.

The criterion of failure in relation to incipient spread of fire shall be deemed to have occurred when the maximum temperature of the thermocouples as specified in Clause 4.4.4.2 exceeds 250°C.

Upon review of the temperature readings on Specimen 4, the maximum temperature on the thermocouple placed on the hood surface was 178°C at 60 minutes which is considerably lower than the failure temperature of 250°C. As mentioned earlier, thermocouples on the timber joists were not installed.

It is observed in FSP 1290a Specimen 4, there were no gaps or cracks that formed on the specimen near the joists and the surrounding area. Also, the highest temperature measured at 60 minutes on the specimen would not have generated sufficient radiant heat so as to raise the temperature on the joist to 250°C for 60 minutes.

Based on the above discussion it is considered that the proposed construction would achieve insulation and integrity performance of at least 60 minutes, and a resistance to incipient spread of fire (RISF) for up to 60 minutes when exposed to fire from below and tested in accordance with AS 1530.4-2014.

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