AS 1530.8.1—2007

Australian Standard®

Methods for fire tests on building materials, components and structures

Part 8.1: Tests on elements of construction for buildings exposed to simulated bushfire attack—Radiant heat and small flaming sources

This Australian Standard® was prepared by Committee FP-018, Fire Safety. It was approved on behalf of the Council of Standards Australia on 27 June 2007.
This Standard was published on 31 August 2007.

The following are represented on Committee FP-018:

- AWTA Textile Testing
- Australasian Fire Authorities Council
- Australian Building Codes Board
- Australian Industry Group
- Australian Institute of Building
- Building Research Association New Zealand (BRANZ)
- Bureau of Steel Manufacturers of Australia
- CSIRO Manufacturing and Materials Technology
- Fire Protection Association Australia
- Fire Protection Association New Zealand
- Plastics and Chemicals Industries Association
- Property Council of Australia

Additional Interests:

- Testing Interests (Australia)

This Standard was issued in draft form for comment as DR 06598.

Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

Keeping Standards up-to-date

Australian Standards® are living documents that reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued.

Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments that may have been published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting **www.standards.org.au**

Standards Australia welcomes suggestions for improvements, and encourages readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at **mail@standards.org.au**, or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

Australian Standard®

Methods for fire tests on building materials, components and structures

Part 8.1: Tests on elements of construction for buildings exposed to simulated bushfire attack—Radiant heat and small flaming sources

First published as AS 1530.8.1—2007.

Published by Standards Australia GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 8353 8

PREFACE

General

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee FP-018, Fire Tests on Building Components, Materials and Structures and developed by FP-018-05.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

Development

This Standard is based on Independent Fire Test Laboratories Test Procedure FSE 027 Part 1 Version 1.6 dated 24 October 2005. See also AS 1530.8.2, *Methods for fire tests on building materials, components and structures* Part 8.2: *Tests on elements of construction for buildings exposed to simulated bushfire attack—Large flaming sources.*

Referenced documents

This Standard references documents in clauses of both a normative and informative nature. Normative referenced documents are listed in Clause 6. Informative referenced documents are listed in Appendix B.

Normative and informative

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of the Standard, whereas an 'informative' appendix is only for information and guidance.

Notes

The use of Notes in this Standard is of an advisory nature only. They provide explanations and guidance on recommended design consideration or technical procedures, as well as an informative cross-reference to other documents or publications.

Commentary

This Standard incorporates a Commentary on some clauses. The Commentary directly follows the relevant clause is designated by 'C' preceding the clause number and is printed in italics in a panel. The Commentary is for information only and does not need to be followed for compliance with the Standard.

CONTENTS

		Page
1	SCOPE	4
2	OBJECTIVE	4
3	PRINCIPLE	4
4	APPLICATION	6
5	LIMITATIONS	6
6	NORMATIVE REFERENCES	7
7	DEFINITIONS	7
8	LINEAR DIMENSIONS	8
9	UNCERTAINTY OF MEASUREMENT	8
10	SAFETY PRECAUTIONS	8
11	TEST APPARATUS	8
12	CONDITIONING	10
13	PRE-TEST SET-UP FOR RADIANT HEAT TEST	10
14	TEST PROCEDURE	11
15	EXTERNAL WALLS	18
16	GLAZED VERTICAL ELEMENTS	20
17	ROOFS, FASCIA AND GUTTER DETAILS	23
18	SKYLIGHTS AND ROOF WINDOWS	24
19	DOORS	26
20	SERVICE PENETRATIONS	30
21	DECKS	33
22	SUB-FLOOR SPACES	35
23	REPORTING	38

APPENDICES

A	GUIDELINES FOR APPLICATION OF TESTS FOR BUILDINGS EXPOSED TO SIMULATED BUSHFIRE ATTACK	40
B	BIBLIOGRAPHY	41

STANDARDS AUSTRALIA

Australian Standard

Methods for fire tests on building materials, components and structures

Part 8.1: Tests on elements of construction for buildings exposed to simulated bushfire attack—Radiant heat and small flaming sources

1 SCOPE

This Standard provides methods for determining the performance of external construction elements when exposed to radiant heat, burning embers and burning debris.

NOTES:

1 The methods do not simulate engulfment by flames from the fire front or large burning items such as other burning buildings or adjacent isolated trees and shrubs (see AS 1530.8.2).

2 The peak level of radiant heat exposure is dependent upon the distance of the building from the potential fire front, the fire severity and the extent of shielding. The peak level can be based on an analysis of the specific site from first principles or from the classification of the site in accordance with the simple methods specified in AS 3959.

3 The results of the fire tests may be used to directly assess fire hazard, but it should be recognized that a single test method would not provide a full assessment of fire hazard under all fire conditions.

4 These fire tests provide data relating to the performance of the particular element and building system and do not provide a general assessment of the performance of a specific type of material.

2 OBJECTIVE

The objective of this Standard is to provide building designers, manufacturers, test laboratories and regulatory authorities with a set of uniform requirements for heating conditions, test procedures, and criteria for the determination of the resistance to fire of a single building element or multiple building elements. This will be to a radiant heat profile simulating exposure to radiant heat from the fire front of a bushfire with additional exposure simulating ember attack to external surfaces and exposure to direct flame impingement from small secondary fires simulating burning debris.

3 PRINCIPLE

3.1 General

A representative element of construction or combination of elements is exposed to conditions simulating exposure to radiant heat, burning debris and burning embers under controlled and repeatable conditions

Observations are made on the performance of the specimen while it is subjected to thermal and, where applicable, physical loading. The elapsed times at which various performance criteria are exceeded are recorded. The performance criteria are selected to address typical fire spread scenarios and to facilitate relatively safe movement around a property after the passage of the fire front.

3.2 Test exposure conditions

3.2.1 *Burning embers*

Exposure to burning embers impinging on the vertical and underside of exposed horizontal surfaces is simulated by application of a small gas flame to volatiles released from combustible materials.

3.2.2 *Burning debris*

Exposure to burning debris and the collection of burning embers on the upper surface of horizontal and near-horizontal surfaces is simulated by pre-ignited timber cribs.

Three sizes of timber crib are available. The selection of size of the crib and position for application are based on the potential for debris to collect. The crib size (Class A) is representative of debris that may collect around a building with reasonable levels of housekeeping/block maintenance and is the default size. Class B and C cribs simulate collections of debris that are representative of larger collections of debris, which may be more appropriate for facilities and structures that are not regularly maintained or where it is expected that accumulation of debris may occur, for example, a heat shield of sacrificial structure and remote infrastructure services.

The method does not apply to large volumes of combustible materials stored adjacent to the building or exposure to flames from adjacent structures. This test will identify excessive flammable elements of construction and elements susceptible to thermal shock from small flaming sources in addition to evaluating whether small fires may weaken the performance of an element of construction. If the impact of exposure to radiant heat is also being evaluated, the crib will have to be applied and exposure to the radiant heat profile commenced simultaneously.

3.2.3 *Radiant heat*

Element(s) of construction are exposed to a radiant heat profile under controlled conditions simulating the passage of the fire front adjacent to the structure.

During the test, a pilot ignition source is applied to exposed combustibles and volatiles on the exposed face (simulating ember attack and burning cribs) are applied to simulate burning debris as described in Clause 3.2.1. Conditions are monitored for a period of 60 min from commencement of radiant heat exposure to evaluate the risk of re-ignition and incipient spread of fire within an element of construction.

NOTES:

1 It is recognized that radiant heat profiles will vary from one bushfire to the next as will the extent and nature of attack from burning embers and debris. The radiant heat exposure conditions specified in this Standard have been selected to represent a rapidly approaching bushfire to maximize the potential for thermal shock, a constant peak radiant heat flux maintained for a period of 2 min and a slow reduction in radiant heat to maximize the total applied heat load. The specified profiles are expected to be conservative for most bushfire exposures except some glazed elements, which may be susceptible to thermal shock during the cooling phase.

2 The radiant heat test is adapted from the test procedure for wall systems exposed to radiant heat given in AS 1530.4, with modifications to the heating profiles to simulate the transient peak from the fire front, application of flaming sources to simulated burning debris, modified conditioning requirements and modified criteria applicable to bushfires.

4 APPLICATION

This test is applicable to a broad range of elements (and combinations of elements) of construction including the following:

(a) External walls.

(b) Glazed vertical elements.

(c) Roofs, fascia and gutter details.

(d) Skylights and roof windows.

(e) Doors.

(f) Service penetrations.

(g) Decks.

(h) Sub-floor spaces.

It may also be applied to exposed structural elements and miscellaneous attachments and building services such as airconditioning units, plastic pipes penetrating walls, verandas and carports.

NOTES:

1 Guidelines for application of the tests are given in Appendix A.

2 By incorporating combinations of elements, such as attachments to combustible walls, it is possible to assess the interaction between combustible walls and windows.

3 Verandas are regarded as covered decks and are included under roofs.

5 LIMITATIONS

5.1 General

Whilst this test method provides an assessment of the resistance of elements or combinations of elements to simulated bushfire attack, it should be recognized that there are limitations to the current state of knowledge with respect to the behaviour of buildings exposed to bushfires and that a single test method may not provide a full assessment of fire hazard under all conditions.

Known limitations include wind, radiant heat source and radiant heat profiles (see Clauses 5.2, 5.3 and 5.4).

5.2 Wind

The method does not evaluate the effects of wind. Winds may 'open up buildings' prior to or during exposure to embers or may affect ignition and flame propagation over combustible materials.

5.3 Radiant heat source and specimen

For testing to be practicable, a maximum radiant heat source size and specimen size of 3 m × 3 m has been specified, which is consistent with the requirements of AS 1530.4. It is recognized that the radiation levels will be greatest directly opposite the centre of the radiation source at any given distance and will reduce significantly towards the edges of the specimen. These variations will be further exaggerated when testing elements such as decks and roof eaves details that extend away from the source. This limitation has been addressed to some extent by specifying standard test arrangements with the central area of the specimen set back (see Figure 21.1).

5.4 Radiant heat profiles

To maintain the extent of testing required within practical limits, the specified radiant heat profiles include a rapid heating phase, maintain peak radiant heat levels for two minutes and then have a slow decay period with the total radiant heat exposure period lasting 10 minutes. For most applications (excluding some glazed elements such as toughened glass) these proposed profiles would be expected to be conservative when applied to AS 3959.

6 NORMATIVE REFERENCES

The following referenced documents are indispensable for the application of this Standard.

NOTE: For a list of informative documents referenced in this Standard, see Bibliography (Appendix B) at the end of the document.

AS		
1530	Methods for fire tests on building materials, components and structures	
1530.1	Part 1:	Combustibility test for materials
1530.4	Part 4:	Fire resistance test of elements of construction
AS		
3959	Construction of buildings in bushfire-prone areas	
1905	Components for the protection of openings in fire-resistant walls	
1905.1	Part 1:	Fire-resistant doorsets
BCA	Building Code of Australia	

7 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

7.1 Applicant

A company, corporation, organization, association, partnership, individual or manufacturer's authorized agent that proposes a test in accordance with this Standard.

7.2 Bushfire

An unplanned fire burning in vegetation, also referred to as wildfire.

7.3 Bushfire attack level (BAL)

The ability of an element of construction, component or structure to satisfy the applicable performance requirements stated in this Standard when exposed to a nominated radiant heat flux and size of burning crib or the standard fire resistance heating regime of AS 1530.4.

BALs determined in accordance with this Standard are expressed as follows:

BAL—Xnn

Where X is a letter specifying the Class of Crib applied and nn is a number relating to the peak radiant heat flux applied to the specimen.

NOTE: For example, a BAL of A40 indicates that the specimen satisfied the applicable performance criteria when exposed to a Class A crib and peak radiant heat flux of 40 kW/m^2.

7.4 Combustible

The classification of a material based on its reaction to defined elevated temperature conditions and which—

(a) has been deemed combustible in accordance with the BCA;

(b) has been subjected to the test conditions of AS 1530.1 and has exceeded flaming or temperature rise limits specified in that Standard.

7.5 Element of construction

Either—

(a) a distinct part of a building constructed by assembling material or materials; or

(b) a test specimen representing such a part.

7.6 Radiation (Radiant heat)

The transfer of energy associated with the electromagnetic radiation emitted by a body due to its temperature.

NOTE: Total heat flux meters are used to measure radiant heat in the tests where the radiant heat component is the dominant mode of heat transfer.

7.7 Shall

Indicates that a statement is mandatory.

7.8 Should

Indicates a recommendation.

7.9 Test specimen

An element (or part) of building construction including hangers, fixtures, insulating materials and features, such as lighting, ventilation ducts, joints and penetrations, provided for the purpose of determining either its BAL or its effect on the BAL of another building element.

8 LINEAR DIMENSIONS

All linear dimensions given in this Standard are nominal values, unless tolerances are specified.

9 UNCERTAINTY OF MEASUREMENT

There are many factors that may affect the result of a fire test. The factors concerned with the variability of the specimen include its materials, manufacture and installation, which are not related to the uncertainty of measurement.

10 SAFETY PRECAUTIONS

Fire testing may be hazardous and there is the possibility for exposure to high levels of radiant heat, direct flame contact and toxic and/or harmful smoke and gas that may evolve during the test. Mechanical and operational hazards may also arise during the construction of the test elements or structures, their testing and disposal of test residues.

An assessment of all potential hazards and risks to health shall be made and safety precautions identified and provided. Written safety instructions shall be issued. Appropriate training shall be given to relevant personnel. Laboratory personnel shall ensure that written safety instructions are followed at all times.

11 TEST APPARATUS

11.1 Apparatus—General

Unless otherwise specified, the requirements for the test apparatus shall be in accordance with AS 1530.4.

The test apparatus shall include the following:

(a) A radiant heat source capable of generating a heat flux greater than the required heat flux and at least 3000 mm × 3000 mm high or 400 mm wider and 400 mm higher than the element of construction being evaluated, as described in Clause 11.2.

NOTE: The procedure allows for reduced sized radiant heat sources subject to the test specimens being full size to allow for evaluation of small components. Smaller scale tests can be used to generate useful supporting information for assessment of variations from full scale tested prototypes and features such as facia interfaces; however, radiant heat source should be not less than 1000 mm × 1000 mm.

(b) An insulated test frame to house a representative section of the element constructed in accordance with the applicable requirements contained in AS 1530.4. The size of the specimen shall be full size or the largest size that can be accommodated in a 3000 mm × 3000 mm specimen frame.

(c) Means for moving the test frame or furnace, which in combination with appropriate control equipment enable the heat flux to be regulated as specified in Clause 16.1;

(d) An insulated shield at least 3000 mm × 3000 mm to protect the specimen prior to exposure, which can be removed within 10 s to achieve the required initial heating.

(e) Water-cooled total heat flux meter(s) to measure the total incident heat flux on the specimen and total heat flux received from the specimen with appropriate mountings.

The heat flux meter shall comply with the requirements of Table 11.1.

TABLE 11.1

HEAT FLUX METER REQUIREMENTS

Requirement	Total heat flux meter
Target	Not shielded by a window or subject to a gas purge, i.e., subject to convection as well as radiation
Suggested range	0 to 50 kW/m^2
Accuracy	±5% of maximum range
Time	<10 s
View angle	may vary depending on the specimen size

NOTE: In accordance with AS 1530.4.

(f) Shielding panels, if necessary, to prevent exposure of personnel to radiant heat.

(g) Specimen thermocouples and instrumentation, in accordance with the relevant requirements of AS 1530.4 and this Standard, to monitor the conditions on the non-fire side of the specimen.

(h) Arrangement for loading and restraint of the test specimen, as appropriate, including control and monitoring of loads.

(i) Timber cribs to simulate burning debris.

(j) A steel tube and gas supply for application of a small pilot ignition source simulating one of the effects of burning embers.

(k) Equipment for monitoring and evaluating test performance against the nominated criteria and for establishing the elapsed time.

11.2 Radiant heat source

A radiant heat source capable of generating the required heat flux and at least 3000 mm × 3000 mm high or 400 mm wider and 400 mm higher than the element of construction being evaluated is required

NOTE: To ensure this Standard is not restrictive, the means of generating the radiant heat source has not been specified. The required uniformity of the source has been specified together with a prescribed method of complying with the Standard by adapting a typical fire resistance furnace but this does not exclude the use of gas-fired radiant panels or the like.

A furnace, such as used for fire-resistance tests, with a sheet steel closure or equivalent forming a radiant heat source 3000 mm × 3000 mm (a smaller radiant heat source may be used to evaluate smaller scale features). If the plate extends beyond the furnace enclosure, the external face shall be insulated by 25 mm thick ceramic fibre blanket. The steel sheet shall be adequately stiffened to prevent excessive distortion.

11.3 Timber cribs

Timber cribs to evaluate the effects of burning debris and ember attack to horizontal surfaces shall be in accordance with Clause 14.2.1 of this Standard

11.4 Pilot ignition source simulating ember attack to vertical surfaces and the underside of exposed horizontal surfaces

A steel tube connected to an LPG supply or equivalent with a 25 mm long gas flame should be available to apply an ignition source to the fire-exposed face at positions where volatiles are being released.

11.5 Gap gauge

A 3 ±0.1 mm diameter gap gauge shall be available to assess gaps against the criteria for ember penetration.

12 CONDITIONING

12.11 Moisture content

If moisture content is considered to be critical to the performance of the specimen when exposed to the test conditions, external exposed elements in the test specimens shall be conditioned so as to approximate the moisture content they would achieve shortly before exposure to the fire front.

12.2 Temperature and humidity

All specimens with exposed combustible materials that are sensitive to moisture content shall be conditioned in an environment with an average temperature of 25 ±2°C and an average relative humidity (RH) of 45 ±5% for a period of at least 1 week prior to the fire test. Alternatively, external timber members shall be conditioned to a moisture content of 11 ±1.0% of the oven dry weight.

NOTE: The above conditioning requirements assume that the specimen moisture content has stabilized with normal laboratory environments prior to conditioning at 25°C and 45% RH for two weeks. Whilst maximum temperatures in excess of 40°C coincident with a RH below 20% can be experienced during a bushfire they only occur for a period of a few hours whilst 24 h averages would be of the order of 25°C and 45%.

13 PRE-TEST SET-UP FOR RADIANT HEAT TEST

13.1 Preheating

Prior to commencement of the test, the furnace and radiant panel shall be preheated to approximately steady state conditions with the specimen shielded from the radiant heat to ensure the rate of increase of radiant heat profile can be achieved.

13.2 Calibration run

A calibration run shall be undertaken to establish the position and radiometer reading that correspond to the required radiant heat flux at the surface of the specimen and, if necessary, the values measured by an additional control radiometer with an offset to avoid specimen interactions. The calibration run shall be carried out using an imperforate non-combustible panel of approximately the same size as the test specimen.

NOTE: Calcium silicate boards, ceramic fibre supported on a steel frame or equivalent have been found suitable for this purpose.

The temperature of the radiation source shall be monitored and the furnace temperature adjusted to establish approximately steady state conditions.

13.3 Radiation distribution

Radiation contours shall be established by taking measurements corresponding to the centre and the centre of each quarter section of the radiating source in a plane approximating to the intended position of the specimen such that the central value will be approximately equal to the test radiant heat flux.

NOTE: A steel plate will tend to bow towards the furnace at the centre due to temperature differentials. This cupping should be ignored when defining the plane of the radiant heat source.

The average of the four heat flux measurements at the quarter points shall be 0.75 ±15% of the value measured at the central position.

NOTE: The incident radiant heat flux on a specimen will be at a peak directly in front of the centre of the radiant heat source and will reduce as the point of interest moves away from the centre position. Thus, perimeter frames will potentially be subjected to substantially lower radiant heat fluxes than the centre of a specimen. Also, the magnitude of the received radiant heat flux will depend on the orientation of the receiver. These effects have been taken into account in the specification of test configurations in subsequent sections by adopting a relatively large radiant heat source (3000 mm × 3000 mm). For example, a number of configurations have the centre portion of the specimen set back; this reduces the incident radiant heat flux at the centre relative to the outer sections providing a more uniform exposure to radiant heat.

14 TEST PROCEDURE

14.1 General

This Clause sets out the general test procedure. Requirement for specific types of elements or combinations of elements are given in Clauses 14.2 to 14.7. If requirements are not provided for a specific type of element, the general requirements of this Clause and the most similar element(s) included in Clauses 14.2 to 14.7 shall be adopted.

Equipment used to measure temperatures and radiant heat shall comply with the relevant requirements AS 1530.4 with respect to accuracy and thermocouple construction.

When surfaces adjacent to the specimen, or forming part of the specimen, are inclined by 18° or less to the horizontal and are more than 110 mm wide, the specimen shall be exposed to burning timber cribs to evaluate the likely effects of burning debris coincident with exposure to radiant heat.

When surfaces adjacent to the specimen are inclined by more than 18° or are less than 110 mm wide, no burning timber cribs are required to be applied.

14.2 Procedures for timber cribs

14.2.1 *Crib sizes*

There are three options for timber crib sizes as specified in Table 14.1. The cribs size shall be selected based on the proximity to horizontal or near-horizontal surfaces on which debris may collect, the likely fuel load or as specified by the authority having jurisdiction. The test report shall clearly indicate the size of crib used.

C14.2 Data from tests conducted at Warrington Fire Research (WFRA 35016crib-I&II) on a range of debris pile sizes and the above crib types have shown that the burning behaviour in terms of the rate of heat release from the standard crib types may be characterized by the following range of debris piles:

Class A: debris pile not exceeding 0.12 kg (~150 mmW×300 mmD×75 mmH);

Class B: debris pile between 0.12 kg and 0.25 kg (~200 mmW × 400 mmD × 100 mmH); and

Class C: debris pile exceeding 0.25 kg but not exceeding 0.75 kg (~250 mmW × 425 mmD × 150 mmH).

NOTES:

1 To minimize the build-up of debris on or adjacent to occupied buildings with reasonable levels of regular maintenance, a Class A crib may be the most appropriate.

2 When testing some combinations of elements of construction or construction details it may be impracticable to apply a timber crib to the most likely seat of a fire involving debris. In such cases, the representative type and volume of debris should be determined by the test laboratory in consultation with the test sponsor and, if appropriate, the relevant regulatory bodies. The debris should be conditioned prior to the test to simulate the likely conditions at the time of a bushfire (refer to Clause 12).

TABLE 14.1

TIMBER CRIB DIMENSIONS

Characteristic	Class A	Class B	Class C
Thickness[a] of stick (m)	0.02	0.02	0.02
Length of stick (m)	0.1	0.15	0.23
No. sticks per row	4	6	9
No. of rows	3	3	3
Approx. mass[b] (±0.05 kg)	0.25	0.50	1.25

NOTE: Based on properties for Douglas Fir:

[a] dimension of square cross-section

[b] nominal density = 500 ±50 kg/m^2 (sticks may be added/removed to top layer to achieve mass requirements)

14.2.2 *Material*

The cribs shall be made from untreated Radiata pine (*Pinus Radiata*) and shall be free of knots or cracks. The sticks may be fixed together with staples

14.2.3 *Conditioning*

The cribs shall be conditioned in an oven with temperatures between 40°C and 50°C for at least 24 h and then removed for a period between 60 min and 120 min prior to testing.

14.2.4 *Crib ignition*

The cribs shall be ignited by subjecting them to the flames from a gas burner such that each surface is fully enveloped in the burner flame except as noted below. An oxy/acetylene type burner with a Type 551 Size 8 × 10 heating tip is suitable.

The test cribs shall be subjected to the required size of flame of the gas burner for the following periods of time:

(a) Class A test cribs shall be exposed to the flame for 3 min, during which time they shall be rotated so as to expose each surface, except the bottom face, to the flame in the following manner and sequence:

(i) Each 0.10 m × 0.10 m face for 30 s.

(ii) Each 0.06 m × 0.10 m face for 30 s.

(b) Class B test cribs shall be exposed to the flame for 4 min, during which time they shall be rotated so as to expose each surface, except the bottom face, to the flame in the following manner and sequence:

(i) Each 0.15 m × 0.15 m face for 30 s.

(ii) Each 0.06 m × 0.15 m face for 30 s.

(c) Class C test cribs shall be exposed to the flame for 5 min, during which time they shall be rotated so as to expose each surface, except the bottom face, to the flame in the following manner and sequence:

(i) Each 0.23 m × 0.23 m face for 30 s.

(ii) Each 0.06 m × 0.23 m face for 30 s.

14.2.5 *Crib application*

After exposure to the burner has been completed, the crib shall be positioned on the assembly within 15 s and the radiant heat exposure test commenced within a further 15 s. If the assembly has a vertical element of construction, the crib shall be positioned such that one of the sides of the burning crib is in contact with the face of the vertical element.

14.3 Radiant heat test procedures

14.3.1 *Exposure conditions*

Ignited timber crib(s) shall be applied to the specimen at the positions specified in Clause 14.2 and the requirements for specific elements of construction given in Clauses 14.3.2 to 14.3.7 a maximum of 15 s before exposure to the conditions shown in Figure 14.1 in the simplified form given in Table 14.2.

A radiometer, to measure the incident radiation at approximately the centre of the specimen, shall be mounted in the test specimen by agreement between the test sponsor and test laboratory provided the mounting is unlikely to affect significantly the performance of the test specimen and the radiometer readings are unlikely to be affected by flaming from the specimen.

Where the radiometer cannot be mounted within the specimen, a pre-calibration run shall be undertaken to establish the relationship between distance and incident radiant heat flux at the centre of the element/feature under investigation, and an additional control radiometer shall be mounted at approximately the specimen's mid-height with an offset such that the radiometer will not be affected by flames or impact on the performance of the specimen. The calibration run shall establish the measured heat flux by the additional offset control radiometer that corresponds to the required incident heat flux at the centre of the specimen in accordance with Clause 13.

The furnace temperature and radiant panel shall be controlled so that the average heat flux, measured or calculated at the centre of the panel at no more than 5 s intervals, is maintained within the prescribed radiant heat flux limits specified above.

For a given time interval in Table 14.2 above, average heat flux for the given period shall be no less than the value in Table 14.2 and not exceed the given values by more than 20% or 1 kW/m^2, whichever is the greater.

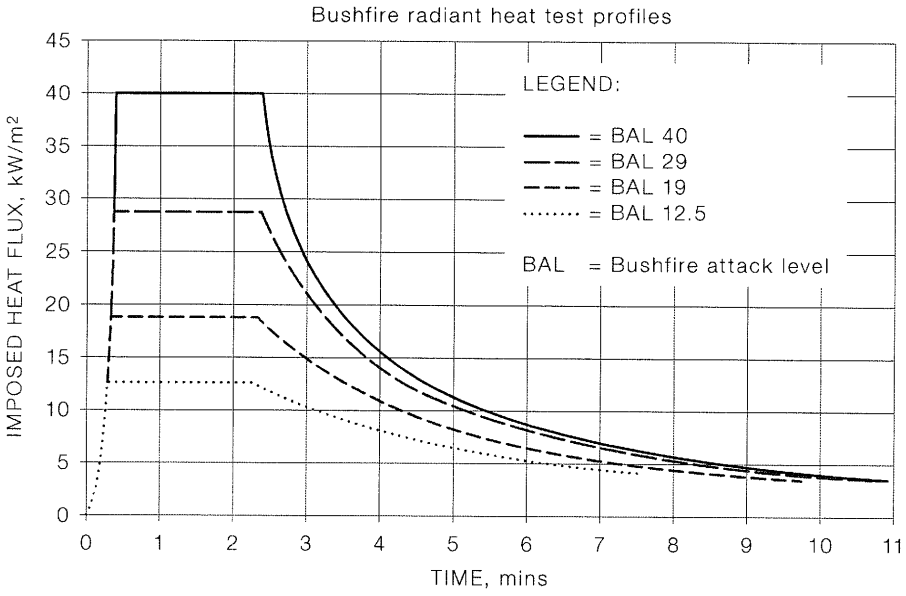


FIGURE 14.1 TYPICAL EXPOSURE CONDITIONS FOR RADIANT HEAT TEST

TABLE 14.2

BUSHFIRE RADIANT HEAT TEST PROFILES— TIME FROM START OF TEST

Bushfire Attack Level (BAL)	Incident Radiation kW/m²	Time from start of test (s)								
		20–140	140–180	180–240	240–300	300–360	360–420	420–480	480–540	540–600
Severe [1]	40	Min 40	24	16	12	8.5	7	5	4	3
Very high	29	Min 29	21	14	11	8	6.5	5	3.5	3
High	19	Min 19	15	11	8	7	5	4	3	3
Medium	12.5	Min 12.5	10	8	6	5	4	3	3	3

NOTES:

1 Refer to AS 1530.8.2 for the BAL FZ

2 Whilst in most applications the exposure will drop rapidly after the 2 min plateau, the extended decay phase has been added to provide a total heat load greater than that caused by a slowly approaching fire, allowing a single profile to be applied to all cases.

14.3.2 *Temperature data*

Temperature data and the radiant heat flux shall be recorded at a maximum of 5 s intervals. The temperatures of the test specimen shall be measured at the positions indicated in Clauses 14.3.3 to 14.3.7. For elements not specifically addressed in Clauses 14.3.3 to 14.3.7 the positions indicated in AS 1530.4 for determining the insulation performance of separating elements of the same type and the most similar elements in the following clauses may be used for guidance.

14.3.3 *Heat flux data*

The incident heat flux data shall be recorded at a maximum of 5 s intervals. The remaining radiant heat flux readings shall be recorded at a maximum of 30 s.

14.3.4 *Glazed specimens*

For glazed and uninsulated specimens, the rear heat flux meter receiving radiation transmitted by the specimen may be positioned off-centre by not more than 200 mm from the centre of the specimen.

NOTE: The rear heat flux meter should be placed within 365 mm of the non-fire-side surface. A heat flux meter with a wide viewing angle should be used to measure the radiation received at this point from the whole specimen.

14.3.5 *Visible events*

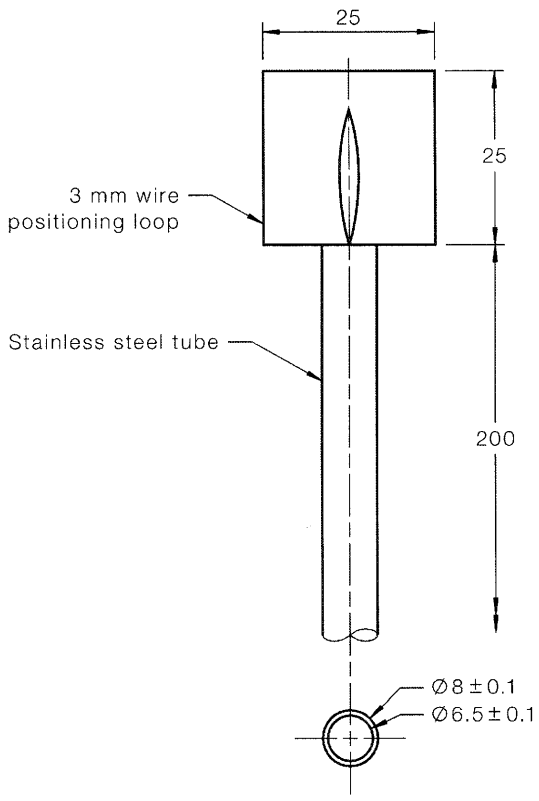
Any significant visible events shall be recorded, including observations regarding the performance criteria specified in Clause 18.

14.3.6 *Recording data*

Specimen data shall be recorded from commencement of the test for a period of at least 60 min.

14.3.7 *Pilot ignition*

The pilot ignition source shall be applied for a period of at least 10 s to any areas releasing significant quantities of volatiles that may be likely to ignite. The ignition flame shall be applied at a distance of 6 mm from the surface of the specimen. This can be achieved by fitting spacers to the steel tube, as shown in Figure 14.2.



DIMENSIONS IN MILLIMETRES

FIGURE 14.2 PILOT IGNITION—STEEL TUBE ASSEMBLY

14.4 Performance criteria

When exposed to the design bushfire conditions, the building exterior shall not permit the following:

(a) Formation of an opening from the fire-exposed face to the non-fire-exposed face of the element through which a 3 mm diameter probe can penetrate during the 60 min test period.

(b) Sustained flaming for more than 10 s on the non-fire side during the 60 min test period.

(c) Flaming on the fire-exposed side at the end of the 60 min test period.

(d) Radiant heat flux 365 mm from the non-fire side of the specimen in excess of 15 kW/m^2 from glazed and uninsulated areas during the 60 min test.

(e) Mean and maximum temperature rises greater than 140 K and 180 K, respectively, on the non-fire side during the 60 min test, except for glazed/uninsulated areas for which the radiant heat flux limits are applicable.

(f) Radiant heat flux 250 mm from the fire-exposed face of the specimen, greater than 3 kW/m^2 between 20 min and 60 min after the commencement of the test.

(g) Mean and maximum temperatures of the internal faces of construction including cavities, exceeding 250°C and 300°C respectively between 20 min and 60 min after the commencement of test.

Where elements of construction may interact with other elements of construction, the test specimen shall incorporate representative associated construction. The above performance criteria apply to the associated construction as well as the specific element under consideration and failure of the associated construction constitutes failure of the total system.

14.5 Expression of results

A report shall be prepared and the results shall be expressed in a tabular format in the report. If no failure occurs this should be stated in the time to failure column. If failure occurs under a single performance criterion at several positions, the time of each occurrence shall be noted in the table. If a criterion is not applicable it should also be stated in the time to failure column.

NOTE: Table 14.3 provides an example of the required tabular format. Example results for a wall system that satisfied all the required criteria are also included in the Table.

The BAL for elements that satisfy the appropriate performance criteria at a nominated radiant heat flux shall be expressed in the following form:

BAL: A40

Where the first letter indicates the crib class and the second number the peak radiant flux for which all relevant performance criteria were satisfied.

TABLE 14.3

EXAMPLE OF RESULTS FOR A WALL SYSTEM SATISFYING ALL RELEVANT CRITERIA

Performance Criteria		Time to failure (min)	Position of failure
Formation of through-gaps greater than 3 mm		No failure	—
Sustained flaming for 10 s on the non-fire side		No failure	—
Flaming on the fire-exposed side at the end of the 60 min test period		No failure	—
Radiant heat flux 365 mm from the non-fire side exceeding 15 kW/ m^2		Not applicable	—
Mean and maximum temperature rises greater than 140 K and 180 K		No failure	—
Radiant heat flux 250 mm from the specimen, greater than 3 kW/m^2 between 20 min and 60 min		No failure	—
Mean and maximum temperature of internal faces exceeding 250°C and 300°C respectively between 20 min and 60 min after commencement of test		No failure	—
Crib class	A	Peak heat flux	40 kW/m^2

14.6 Application of results

The results achieved at a particular peak heat flux level automatically apply to lower heat flux levels with the same size or smaller crib.

Example 1: If a specimen achieves a BAL of A40 it automatically qualifies for BALs of A29, A19 and A12.5 but not B and C levels because Class B and Class C cribs are larger.

Example 2: if a specimen achieves a BAL of C19 it automatically qualifies for BALs of A19, B19, A12.5, B12.5 and C12.5 but it does not qualify for BALs with higher peak radiant heat fluxes.

14.7 Additional requirements

Clauses 15 to 22 provide requirements for testing specific types of elements or combinations of elements of construction and also define direct fields of application for the results.

If load-bearing structural components are exposed to temperatures that may compromise their structural adequacy, the element of construction shall be tested as a load-bearing element following the principles of AS 1530.4.

15 EXTERNAL WALLS

15.11 General

This Clause sets out specific procedures for determining the BAL of external walls. It shall be read in conjunction with Clauses 1 to 14 and Clause 23 of this Standard. The performance of doorsets, glazing, dampers, service penetrations and similar components, often found in walls, are covered by other clauses of this Standard.

15.2 Test specimen

The wall system shall be installed and tested in a manner representative of the intended application. The wall shall include corner details by incorporating a rebate in the centre of the specimen with an eaves detail and non-combustible sill as shown in Figure 15.1. It shall also be tested with horizontal or vertical joints where these form part of the wall in practice. Stiffeners (or the like) that form part of the wall shall be incorporated and tested in the test specimen.

NOTE: In-built features such as service penetrations and attachments may be incorporated and tested in accordance with the relevant sections in addition to this clause.

The eaves and window details shall be constructed in accordance with the minimum prescribed solutions specified in AS 3959 for the applicable BAL (Radiation Level) being evaluated, to demonstrate that the wall system will not compromise the performance of the eaves and window details. Alternative eave and window details may be included but these will be required to be installed as part of the wall system.

15.3 Instrumentation

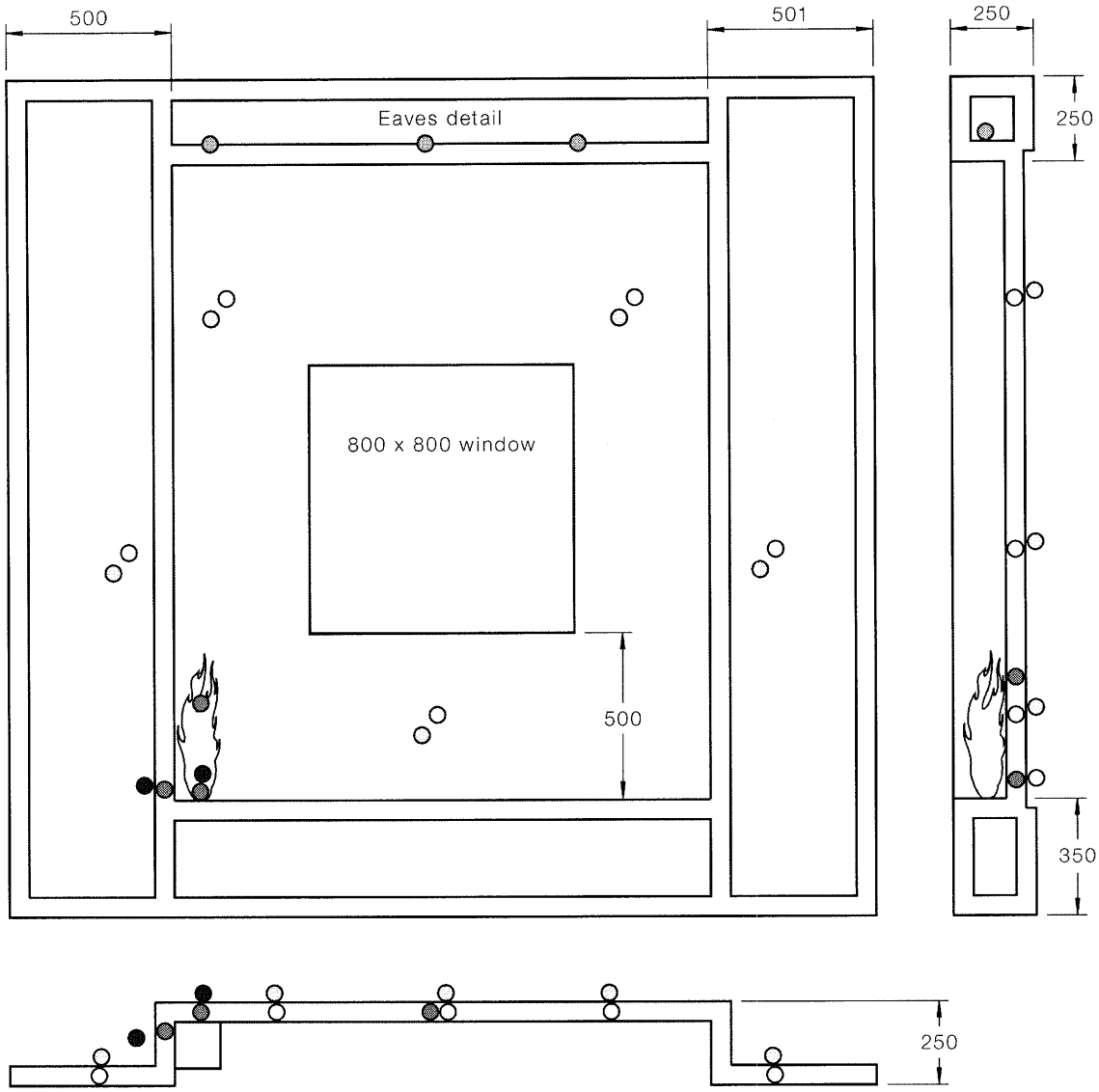
Thermocouples used to measure non-fire-side temperatures of the specimen and internal surface temperatures shall comply with AS 1530.4.

To measure the average temperature rise on the unexposed face of the specimen and average temperature of the internal surface of an external skin, five thermocouples shall be used. One thermocouple shall be placed close to the centre and the rest shall be placed close to the centre of each quarter section, where practicable. If a window is included in the wall, the five thermocouples shall be positioned as shown in Figure 15.1. These thermocouples shall not be attached to the specimen over thermal bridges, joints, junction, through-connections and fixings such as bolts, screws or nails. Thermocouples shall not be placed over a ridge or in a depression unless it is wide enough for a disc to make full contact. For specimens of non-uniform thickness, for example surfaces with corrugations or ribs, the thermocouples may be appropriately positioned in order to determine average temperatures.

Additional thermocouples shall be attached to the specimen to measure the maximum temperature rise at locations that are considered to have a higher heat transfer; however, as a minimum, thermocouples shall be fitted at the positions shown in Figure 15.1.

A roving thermocouple shall be provided for measuring the maximum temperature at any point on the surface of the specimen during the test.

The first 25 mm of each thermocouple used to measure temperatures inside the wall, where practicable, shall be in the isothermal plane.



LEGEND:

○ = Incipient fire spread thermocouple positions—Mean temperature rise
◉ = Incipient fire spread thermocouple positions—Maximum temperature rise
◉ = Incipient fire spread thermocouple positions—Eaves mean and maximum
○ = Non fire side thermocouple positions—Mean temperature rise
● = Non fire side thermocouple positions—Maximum temperature rise

DIMENSIONS IN MILLIMETRES

FIGURE 15.1 CONFIGURATION AND MINIMUM THERMOCOUPLE REQUIREMENTS FOR EVALUATION OF EXTERNAL WALLS

15.4 Specimen orientation and crib positions

The wall system shall be tested in the orientation shown in Figure 15.1 with the external side exposed to the radiant heat and cribs. The crib shall be positioned in the corner of the rebate, as shown in Figure 15.1.

15.5 Measurements and observations

In addition to observing compliance with the performance criteria specified in Clause 14.4, observations shall be recorded of any behaviour or occurrence considered to be relevant to the performance of the specimen.

15.6 Performance criteria

The BALs shall be determined in accordance with Clause 14.4.

15.7 Permissible variations to the tested specimen

The results of the fire test contained in the test report are directly applicable, without reference to the testing authority for a technical opinion, to similar constructions where one or more of the following changes have been made, provided no individual component is removed or reduced:

(a) Increase in the length of a wall of identical construction to the specimen

(b) Increase in thickness of the wall.

(c) For framed walls—

  (i) increase in timber density;

  (ii) increase in cross-sectional dimensions of the framing element(s);

  (iii) increase in steel thickness, up to a maximum of 2 mm;

  (iv) decrease in sheet or panel sizes;

  (v) decrease in stud spacing; or

  (vi) decrease in fixing centres of wall sheet materials.

16 GLAZED VERTICAL ELEMENTS

16.1 General

This Clause sets out specific procedures for determining the BALs of glazed vertical elements. It shall be read in conjunction with Clauses 1 to 14 and Clause 23 of this Standard. It applies to fixed and openable windows and glazed doorsets, and glazing protected by mesh and shutters.

16.2 Test specimen

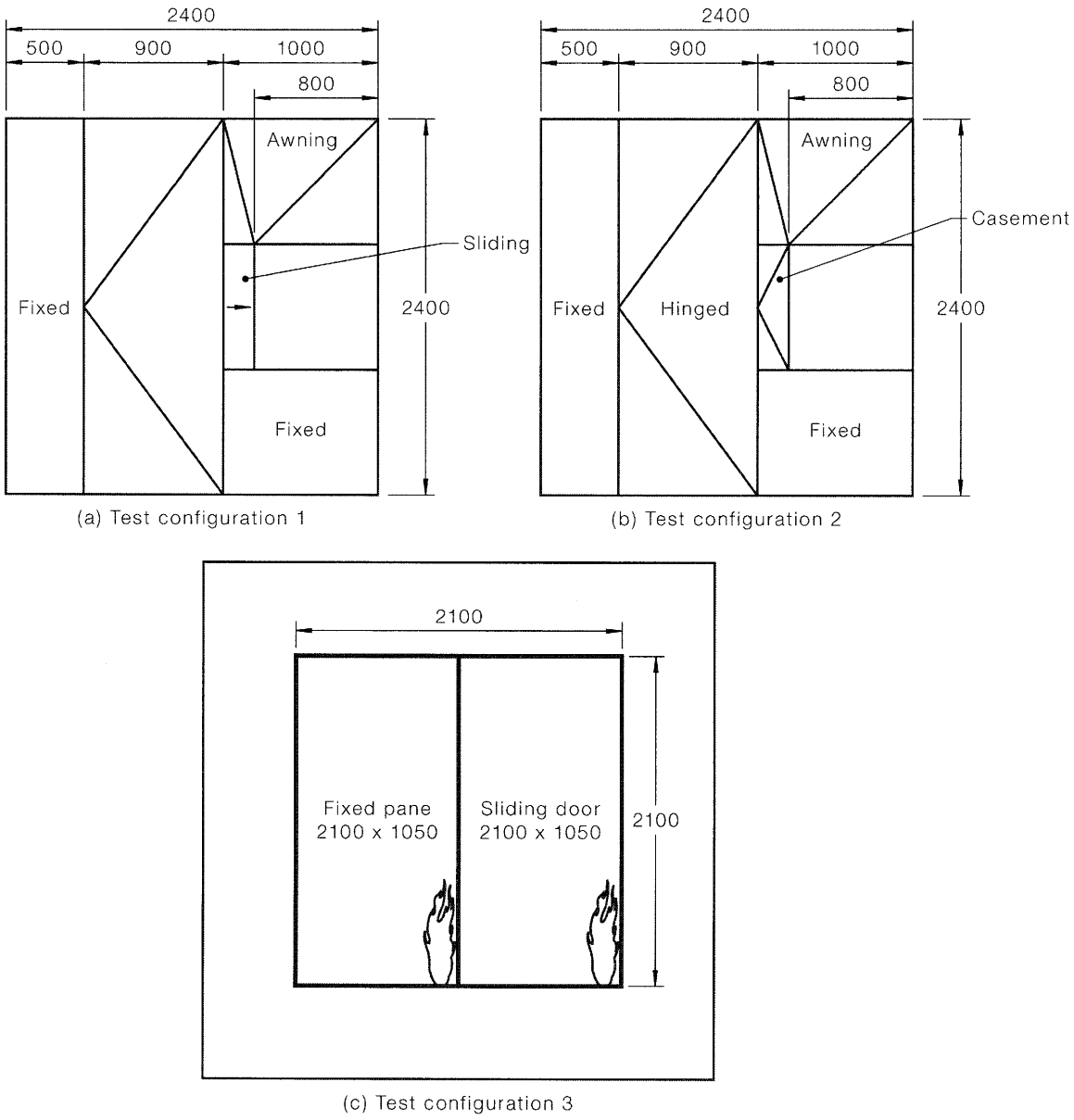
The glazing system shall be installed and tested in a manner representative of the intended use in a representative section of wall. For general approval of a system, both standard configurations shown in Figure 16.1 shall be tested.

For single configurations, the maximum size of a glazed assembly intended for use in service shall be tested up to a maximum size of 2400 mm × 2400 mm

If the glazing system incorporates combustible elements that may compromise the performance of an eaves or wall system, the test specimen shall incorporate an eaves/wall detail similar to that shown in Figure 15.1. The eaves and wall detail shall be constructed in accordance with the minimum prescribed solutions specified in AS 3959 for the applicable BAL (Radiation Level) being evaluated. The intent is to demonstrate that the wall system will not compromise the performance of the eaves. Alternative eaves details may be included but these will be required to be installed in conjunction with the window system.

Failure of the eaves or wall detail attributable in whole or part to the glazing system would constitute failure of the glazing system.

Where radiant heat sources smaller than 3000 mm × 3000 mm are used, the maximum size of the specimen shall comply with the requirements of Clause 11.1 of this Standard and the glazed element shall be built into a representative form of construction, to ensure appropriate restraint conditions are applied.



DIMENSIONS IN MILLIMETRES

FIGURE 16.1 STANDARD CONFIGURATIONS FOR GLAZING SYSTEMS

16.3 Instrumentation

Thermocouples used to measure non-fire-side temperatures of the specimen and internal surface temperatures shall comply with AS 1530.4.

If eaves and wall systems are incorporated to evaluate the potential for combustible parts of the glazing system to compromise their performance, instrumentation shall be in accordance with Clause 15, as appropriate, and this Clause.

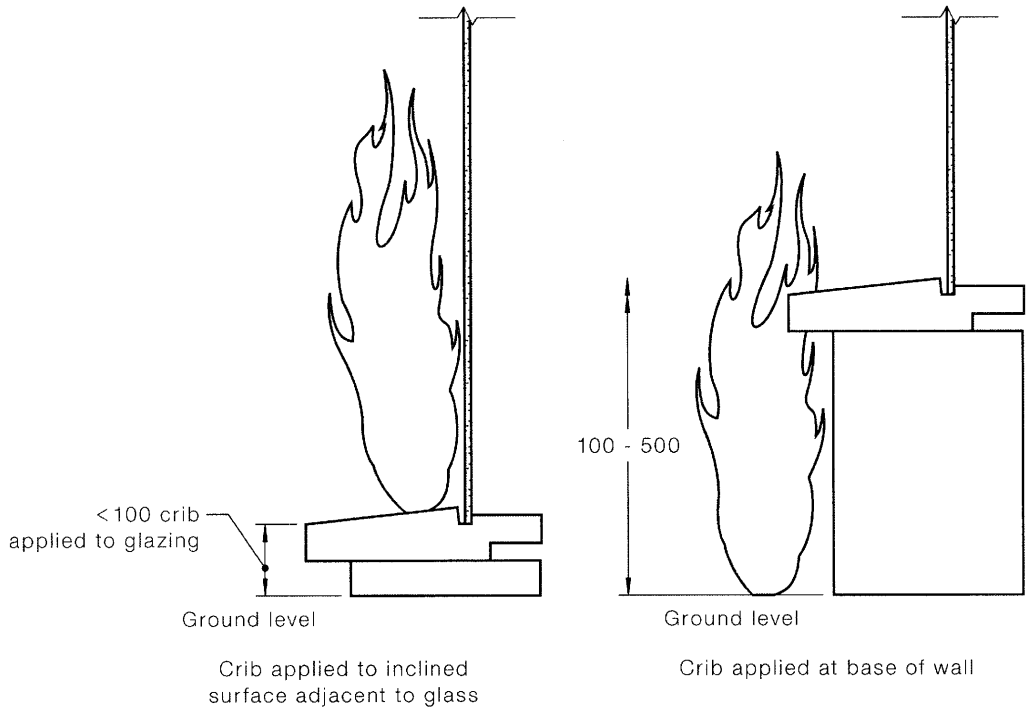
A heat flux sensor shall be located at 365 mm from the centre of the glazed element.

16.4 Specimen orientation and crib positions

The wall system shall be tested with the external side exposed to the radiant heat and cribs. If glazing is to be located within 500 mm of the ground level, a crib should be positioned at the corner of each glazed element, as shown in Figure 16.1.

In applications where the threshold or sill is within 100 mm of a horizontal external surface, the crib shall be applied against the glazing. For applications where the threshold or sill is between 100 mm and 500 mm, the crib shall be applied at the base of the wall, as shown in Figure 16.2. Glazing that is restricted to applications where the lowest level of glazing is more than 500 mm above an external horizontal or near-horizontal (less than 18° incline) surface need not be subjected to exposure to burning cribs.

C16.4 The crib against the glass simulates debris build-up against glazing close to ground level. The crib at ground level simulates potential flame contact from burning debris at ground level since it is assumed the sill will shed leave litter and debris. Above 500 mm the risk to glazed elements from burning debris at ground level is considered negligible provided the wall facing is non-combustible.



DIMENSIONS IN MILLIMETRES

FIGURE 16.2 CRIB POSITIONS FOR VERTICAL GLAZED ELEMENTS

16.5 Measurements and observations

In addition to observing compliance with the performance criteria specified in Clause 14.4, observations shall be recorded of any behaviour or occurrence considered to be relevant to the performance of the specimen.

16.6 Performance criteria

BALs shall be determined in accordance with Clause 14.4.

16.7 Permissible variations to the tested specimen

The results of the fire-resistance test contained in the test report are directly applicable, without reference to the testing authority for a technical opinion, to similar constructions where a decrease in any linear dimension of the individual panes of glazing is made and/or variations of less than 15° are made to the angle of tested inclination.

NOTE: Glazing inclined at an angle of 18° or less should be evaluated in accordance with Clause 18.

If both the standard configurations shown in Figure 16.1 qualify for a particular BAL, the results are directly applicable to all common housing applications and window types up to a maximum height of 3000 mm and indefinite length, provided individual pane sizes do not exceed 2.4 m^2 and provided there are no changes to the framing and glazing systems

17 ROOFS, FASCIA AND GUTTER DETAILS

17.1 General

This Clause sets out specific procedures for determining the BAL of roof elements including fascias and gutters. It shall be read in conjunction with Clauses 1 to 14 and Clause 23 of this Standard. Guards protecting gutters from leaf litter may be evaluated with this test method.

17.2 Test specimen

A representative section of the roof, of minimum size 2000 mm wide × 1500 mm deep, with representative roofing joints shall be evaluated. A pitched roof should have a gradient of nominally 45° unless the maximum gradient is less, in which case the maximum gradient shall be evaluated. The underside of the roof shall be enclosed except for a 100 mm × 100 mm square relief vent provided in the base of the rear wall. Representative joints shall be provided in the roofing material.

Roofs with gradients of 18° or less shall be treated as flat roofs and a separate evaluation applies.

A radiant heat source 3000 mm × 3000 mm is required to provide a representative radiant heat field for the evaluation. A typical test configuration is shown in Figure 17.1.

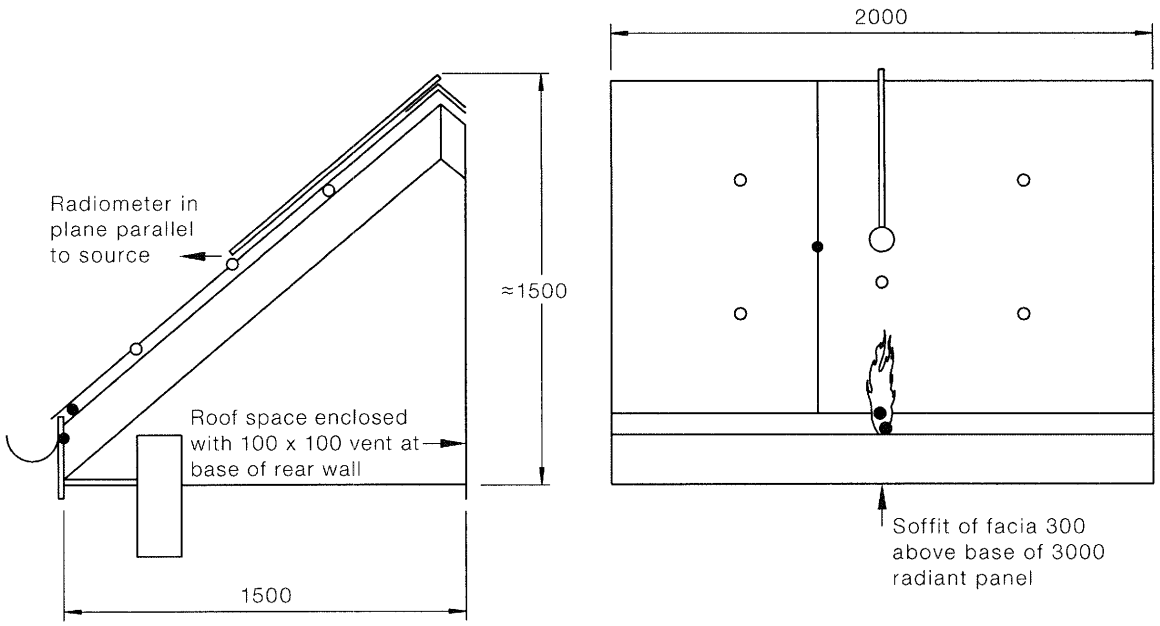
17.3 Instrumentation

Thermocouples used to measure non-fire-side temperatures of the specimen and internal surface temperatures shall comply with AS 1530.4. The internal temperature thermocouples shall be fixed to the underside of the external roof lining above the sarking, unless the sarking or lining is non-combustible, in which case the thermocouples shall be fixed to the internal surface of the lining/sarking.

The control heat flux sensor shall be located as shown in Figure 17.1 with its receiving sensor parallel to the plane of the radiant heat source.

17.4 Specimen orientation and crib positions

The roofing system shall be tested with the external side exposed to the radiant heat. A burning crib shall be located at mid-span of the guttering. If the roof gradient is less than 18°, a second crib shall be positioned over a joint at mid-height.



LEGEND:

○ = Incipient fire spread thermocouple positions—Mean temperature rise
◉ = Incipient fire spread thermocouple positions—Maximum temperature rise

DIMENSIONS IN MILLIMETRES

FIGURE 17.1 STANDARD CONFIGURATIONS FOR ROOFING SYSTEMS

17.5 Measurements and observations

In addition to observing compliance with the performance criteria specified in Clause 14.4, observations shall be recorded of any behaviour or occurrence considered to be relevant to the performance of the specimen.

17.6 Performance criteria

BALs shall be determined in accordance with Clause 14.4.

17.7 Permissible variations to the tested specimen

The results of the fire-resistance test contained in the test report are directly applicable, without reference to the testing authority for a technical opinion, to roof systems of any size.

If a roof with a gradient of 45° has been tested, the results shall apply to roofs with gradients between 25° and 75°.

NOTE: Elements with gradients greater than 75° should be evaluated as walls.

18 SKYLIGHTS AND ROOF WINDOWS

18.1 General

This Clause sets out specific procedures for determining the BALs of skylights, roof windows and similar glazed elements. It shall be read in conjunction with Clauses 1 to 14 and Clause 23 of this Standard.

Skylights/roof windows fitted in flat (gradient less than 15°) and pitched roofs shall be evaluated separately, because the potential for burning debris has to be evaluated for flat roofs whereas higher incident radiant heat fluxes occur with pitched roofs.

18.2 Test specimen

A full size skylight or roof window, of minimum size 2000 mm wide × 1500 mm deep, shall be mounted in a representative section of the roof of minimum size 2000 mm wide × 1500 mm deep. For pitched roofs, the skylight and roof window shall be mounted in a roof with a gradient of nominally 45° and for flat roof applications the skylight/roof window shall be mounted in a roof with a gradient of nominally 18°. The underside of the roof shall be enclosed, except that a 100 mm × 100 mm square relief vent shall be provided in the base of the rear wall. Representative joints shall be provided in the roofing material.

A radiant heat source 3000 mm × 3000 mm is required to provide a representative radiant heat field for evaluation of the skylights/roof window. A typical test configuration is shown in Figure 18.1.

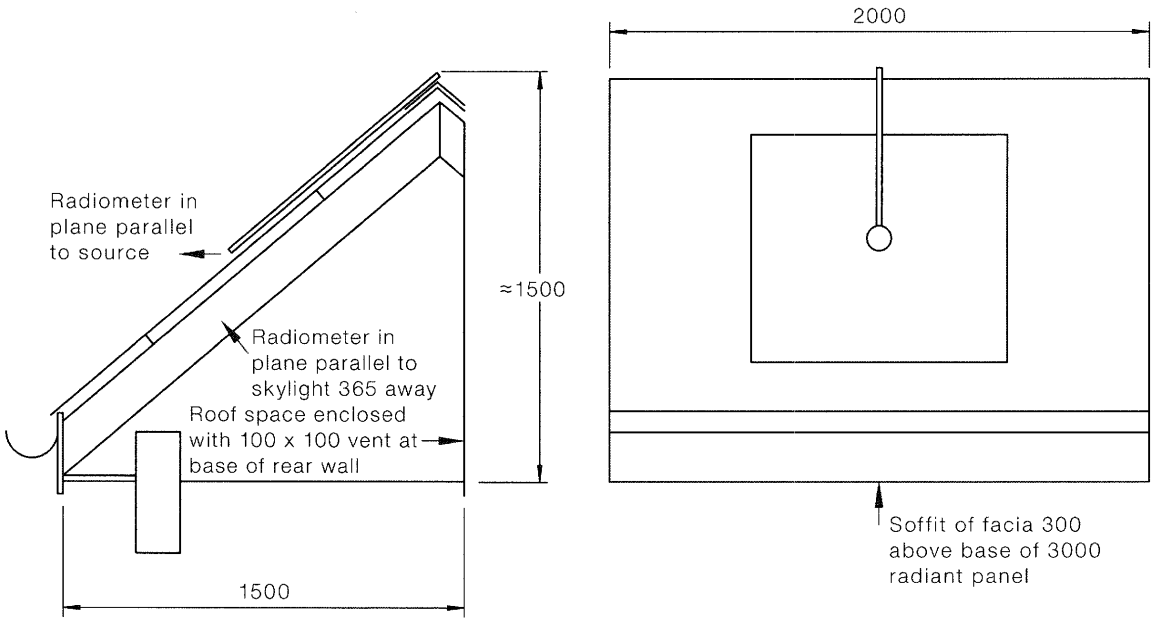
18.3 Instrumentation

The control heat flux sensor shall be located as shown in Figure 18.1 with its receiving sensor parallel to the plane of the radiant heat source.

An internal radiometer shall be positioned with its receiver parallel to the plane of the skylight and roof window and 365 mm from its face as shown in Figure 18.1.

18.4 Specimen orientation and crib positions

The skylight and roof window system shall be tested with the external side exposed to the radiant heat. Burning cribs shall be located at the mid-point of the skylight and roof window system and a lower corner if installed in a flat roof (gradient less than 18°). Cribs are not required to be applied to pitched roofs (gradient greater than 18°).



DIMENSIONS IN MILLIMETRES

FIGURE 18.1 STANDARD CONFIGURATIONS FOR ROOFING SYSTEMS

18.5 Measurements and observations

In addition to observing compliance with the performance criteria specified in Clause 14.4, observations shall be recorded of any behaviour or occurrence considered to be relevant to the performance of the specimen.

18.6 Performance criteria

BALs shall be determined in accordance with Clause 14.4.

18.7 Permissible variations to the tested specimen

The results of the fire-resistance test contained in the test report are directly applicable, without reference to the testing authority for skylights/roof windows smaller than the tested size, provided there are no other changes to the element.

If the skylight and roof window has been tested in a roof with a gradient of 45°, the results shall apply to roofs with gradients between 18° and 75°.

NOTE: Elements with gradients greater than 75° should be evaluated as vertical glazed elements.

19 DOORS

19.1 General

This Clause sets out specific procedures for determining the BALs of external walls. It shall be read in conjunction with Clauses 1 to 14 and Clause 23 of this Standard.

The test applies to the following assemblies, except for glazed doors assemblies where the requirements of Clause 15 of this Standard also apply:

(a) Doorsets with hinged or pivoted leaves.

(b) Doorsets with horizontally sliding or vertically sliding leaves or panels, including articulated sliding panels or sectional leaves.

(c) Steel, single-skin folding shutters.

(d) Other sliding folding door leaves or panels.

(e) Tilting doorsets.

(f) Rolling shutter doors.

19.2 Test specimen

The wall and eaves systems shall be constructed in accordance with the minimum prescribed solutions specified in AS 3959 for the applicable BAL (Radiation Level) being evaluated, which are intended to demonstrate that the wall system will not compromise the performance of the eaves and wall systems.

For doorsets that are of non-combustible construction, the eaves details and rebated wall details may be omitted.

The doorset shall be installed in the orientation intended for the application. Where this is unknown, the doorset shall be tested from each direction if it is asymmetrical.

A typical test configuration is shown in Figure 19.1.

19.3 Instrumentation

Thermocouples used to measure non-fire-side temperatures of the specimen and internal surface temperatures shall comply with AS 1530.4.

To measure the average temperature rise on the unexposed face of the specimen, five thermocouples shall be used. One thermocouple shall be placed close to the centre and four shall be placed close to the centre of each quarter section of the door leaf, where practicable. If the centre and quarter section positions will provide unrepresentative temperatures due to localized variations in the leaf construction, the positions shall be offset.

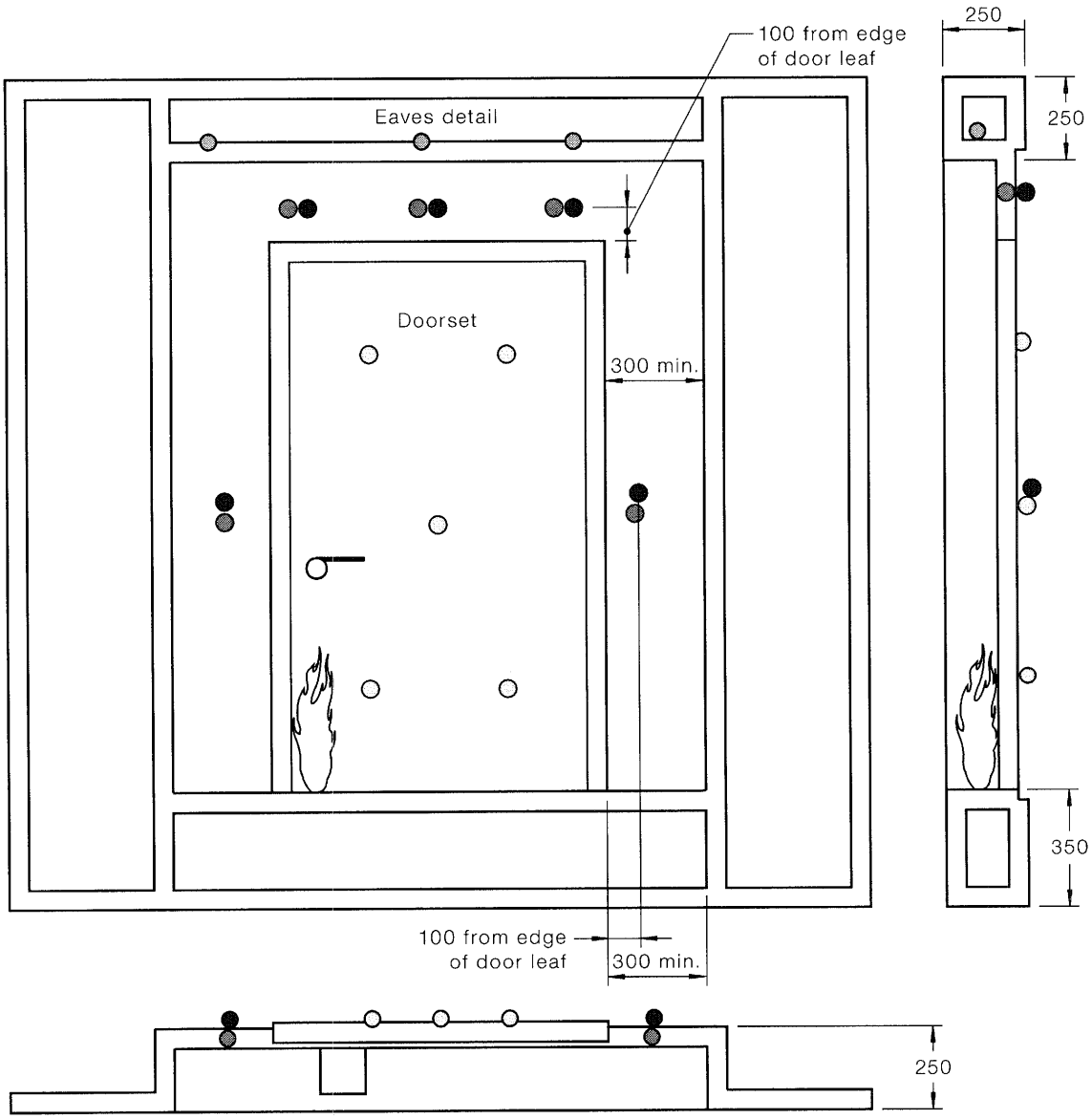
Five internal thermocouples and five surface thermocouples shall be located 100 mm from the doorframe, as shown in Figure 19.1, to determine if the door assembly will compromise the performance of the wall system. Similarly for combustible door assemblies, the eaves detail shall include instrumentation as shown in Figure 19.1, to ascertain if the performance of the eaves detail will be compromised due to the flaming of the doorset.

Additional thermocouples shall be attached to the specimen to measure the maximum temperature rise at locations that are considered to have a higher heat transfer, except for the door leaf and doorframe where the maximum temperature rise criterion is not applicable.

A roving thermocouple shall be provided for measuring the maximum temperature, at any point on the wall surface, during the test.

Where practicable, the first 25 mm of each thermocouple used to measure temperatures inside the wall shall be in the isothermal plane.

A heat flux sensor shall be located at 365 mm from the centre of the non-fire-exposed face of the doorset.



LEGEND:

● = Incipient fire spread thermocouple positions—Maximum temperature rise
◎ = Incipient fire apread thermocouple positions—Eaves mean and maximum
○ = Non fire side thermocouple positions—Mean temperature rise
● = Non fire side thermocouple positions—Maximum temperature rise

DIMENSIONS IN MILLIMETRES

FIGURE 19.1 CONFIGURATION AND MINIMUM THERMOCOUPLE REQUIREMENTS FOR EVALUATION OF DOORSETS

19.4 Specimen orientation and crib positions

The doorset shall be installed in the orientation intended for the application. Where this is unknown, the doorset shall be tested from each direction if the doorset is asymmetrical.

The crib shall be positioned in the corner of the opening edge (or side of a roller shutter or other upward opening door assembly), as shown in Figure 19.1, with the crib placed against the door leaf and doorframe.

19.5 Measurements and observations

In addition to observing compliance with the performance criteria specified in Clause 14.4, observations shall be recorded of any behaviour or occurrence considered to be relevant to the performance of the specimen.

The incident radiant heat flux shall be measured or calculated at the centre of the specimen and comply with the requirements of Clause 14.3.1.

19.6 Performance criteria

BALs may be determined in accordance with Clause 14.4.

NOTE: The internal radiant heat flux limit of 250 mm from the specimen is applicable to doorsets in lieu of the maximum non-fire side, and incipient temperature rise criteria do not apply to the door leaf or doorframe.

19.7 Permissible variations to the tested specimen

The results of the fire test contained in the test report are directly applicable, without reference to the testing authority for a technical opinion, to similar constructions where one or more of the following permissible variations have been made:

(a) *Door leaf variations* Variations to the door leaf may be made as follows:

  (i) Facings of low-carbon steel substituting for facings of stainless steel, provided—

    (A) such facings are fixed by adhesive to the face or faces of the door leaf and are not returned around any edge; and

    (B) the clearances between the main body of the door leaf and the doorframe are not increased.

  (ii) Adding decorative laminates and timber veneers, up to 1.5 mm thick, to the faces (but not edges) of hinged doors. For all products tested with decorative laminate faces the only variations shall be within similar types and thickness of material (e.g., colour, pattern, manufacturer).

  (iii) Increasing door leaf thickness.

  (iv) Decreasing height or width.

  (v) Increasing height or width, provided the area of the door leaf is not increased.

(b) *Variations to wall systems* Variations to the wall system in which the doorset is mounted may be made as follows:

  (i) Increasing the BAL of the wall system.

  (ii) For doorsets built into framed walls the results may be applied to the following wall variations:

    (A) Increasing timber density.

    (B) Increasing cross-sectional dimensions of the framing element(s).

    (C) Increasing steel thickness up to a maximum of 2 mm.

    (D) Decreasing in sheet or panel sizes.

    (E) Decreasing in stud spacing.

    (F) Decreasing in fixing centres of wall sheet materials.

(G) Increasing in the external facing thickness.

(H) Doorsets mounted in masonry and concrete walls.

(c) *Variations to the doorframe* Variations to the doorframe may be made as follows:

(i) Interchanging single-rebated and double-rebated doorframes.

(ii) Increasing the doorstop depth and width.

(iii) Increasing or decreasing the metal thickness by ±15%.

(iv) Fixing in accordance with AS 1905.1.

(v) Where the paint finish is not expected to contribute to the performance of the door, alternative paint or surface finish to the door leaves or frame provided the thickness does not exceed 0.5 mm.

(vi) Increasing the number of fixings used to attach fire-resisting doorsets to supporting constructions (but not decreasing) and reducing the distance between fixings may be reduced (but not be increasing)

NOTE: The dimensions of steel wraparound frames may be increased to accommodate increased supporting construction thickness.

(d) *Variations to hardware* Variations to hardware may be made as follows:

(i) Substitution of locksets, provided there is no decrease in the dimensions of critical latching components, no increase in the cut-out required in the doorset, no reduction in the sizes of cover plates, no reduction in the melting point of the materials used and no increase in the volume or exposure of any combustible materials.

(ii) The addition/substitution of non-latching hardware, provided it is non-combustible and does not require any increase in cut-outs.

(iii) Varying the location of the latchset or lockset up to 80 mm vertically up or 80 mm vertically down.

NOTE: It is recommended that the latch handle be located between 900 mm and 1100 mm above the finished floor.

(iv) Reducing the backset of a mortice lockset or mortice latchset.

(v) Varying the backset of a cylindrical lockset or latchset, provided no additional encroachment is made on any structural framework of the door leaf and the fixing method remains identical.

20 SERVICE PENETRATIONS

20.1 General

This Clause sets out specific procedures for determining the BALs of service penetrations, such as electrical and plumbing services and construction joints, through external elements of construction walls. It shall be read in conjunction with Clauses 1 to 14 and Clause 23 of this Standard. The method is also applicable to services mounted externally to buildings, such as airconditioning equipment.

The general principle is that service penetrations not significantly compromise the performance of the element of construction they penetrate nor they be a means to allow the passage of burning embers or heat transfer such that fire may spread to the interior of a structure.

Service penetrations may be incorporated in wall or roof and sub-floor, eaves and roof specimens or may be evaluated using small scale sections of separating elements having minimum dimensions of 1 m × 1 m the incident radiant heat flux at the point of provided penetration is at the nominated BAL (see Note). Whilst more than one penetration may be evaluated in a single test, the services shall be separated by at least 500 mm to avoid significant shielding.

NOTE: For a BAL: A40 the incident radiant heat should be 40 kW/m^2.

20.2 Test specimen

The service penetrations shall be mounted in separating elements constructed in accordance with the minimum prescribed solutions specified in AS 3959 for the applicable BAL (Radiation Level) being evaluated.

Typical test configurations are shown in Figure 20.1.

The services shall penetrate the fire and non-fire side faces of the separating element by a minimum of 200 mm. The end outside the furnace is normally capped to simulate an extension of the service unless the end of the service is open in practice, such as roof exhaust vents, in which case they shall be terminated as in practice.

20.3 Instrumentation

Thermocouples used to measure non-fire-side temperatures of the specimen and internal surface temperatures shall comply with AS 1530.4.

Two internal thermocouples and two surface thermocouples shall be located 100 mm from the service, as shown in Figure 20.1, to determine if the service penetration has compromised the performance of the wall system. In addition, one thermocouple shall be located on the surface of the non-fire-exposed face 25 mm from the internal surface of the element.

The first 25 mm of each thermocouple used to measure temperatures inside the wall, where practicable, shall be in the isothermal plane.

20.4 Specimen orientation and crib positions

If services penetrations are located within 500 mm of ground level or a horizontal and near-horizontal surface (less than 18°), then a crib shall be applied to evaluate the effect of burning debris.

The services shall be tested with exposure from the external side.

NOTE: For example, penetrations through sub-floor assemblies and eaves would require evaluation of the system with exposure to fire conditions from the underside, whereas a penetration through a roof system would require exposure from above.

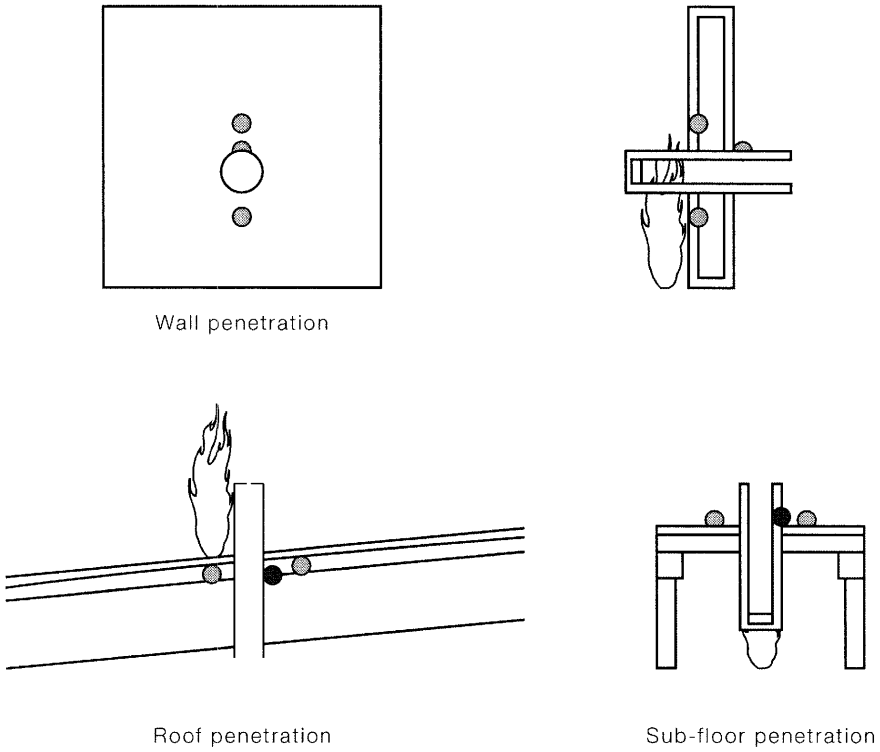


FIGURE 20.1 TYPICAL CONFIGURATIONS AND MINIMUM THERMOCOUPLE REQUIREMENTS FOR EVALUATION OF SERVICE PENETRATIONS

20.5 Measurements and observations

In addition to observing compliance with the performance criteria specified in Clause 14.4, observations shall be recorded of any behaviour or occurrence considered to be relevant to the performance of the specimen.

20.6 Performance criteria

BALs shall be determined in accordance with Clause 14.4.

20.7 Permissible variations to the tested specimen

The results of the fire test contained in the test report are directly applicable, without reference to the testing authority for a technical opinion, to similar constructions where one or more of the following permissible variations have been made:

(a) *Service penetration variations* Variations to the service penetrations may be made as follows:

(i) Changing the material of a non-combustible pipe provided the melting point is increased and thermal conductivity reduced.

(ii) Increasing the wall thickness of metallic pipes.

(iii) Decreasing the pipe diameter of metallic pipes.

(iv) Reducing a cable diameter and power rating.

(v) Reducing the size of service penetrations provided there are no changes to individual component thicknesses and provided there is no increase in the clearances between a protection device and the services and the protection device does not require any modifications to accommodate the smaller size.

(b) *Variations to wall systems* Variations to the wall system in which the penetration is mounted may be made as follows:

(i) Increasing the BALs of the wall system.

(ii) For service penetrations built into framed walls:

(A) Increasing timber density.

(B) Increasing cross-sectional dimensions of the framing element(s).

(C) Increasing steel thickness up to a maximum of 2 mm.

(D) Decreasing sheet or panel sizes.

(E) Decreasing stud spacing.

(F) Decreasing fixing centres of wall sheet materials.

(G) Increasing the external facing thickness.

Results are applicable to service penetrations mounted in masonry and concrete walls.

21 DECKS

21.1 General

This Clause sets out specific procedures for determining the BALs of combustible decks. Because, combustible decks do not serve a fire separating function, decks are tested in conjunction with an external wall and eaves detail to ascertain if the deck will degrade the performance of the wall system. Supplementary requirements limit the extent of fire spread to maintained evacuation paths. This method shall be read in conjunction with Clauses 1 to 14 and Clause 23 of this Standard.

21.2 Test specimen

The representative section of deck, nominally 750 mm deep × 1800 mm wide × 400 mm high, shall be constructed within a 250 mm alcove in a wall system as shown in Figure 21.1. The eaves and wall details shall be constructed in accordance with the minimum prescribed solutions specified in AS 3959 for the applicable BAL (Radiation Level) being evaluated and are intended to demonstrate that the deck system will not compromise the performance of the eaves and wall systems. The wall shall include corner details by incorporating a rebate in the centre of the specimen with an eaves detail and non-combustible sill supporting the deck as shown in Figure 21.1.

Alternative eave and wall details may be included but these will be required to be installed as part of the wall system.

21.3 Instrumentation

Internal thermocouples only are required to evaluate the impact of the deck on the wall and eaves details and shall comply with of AS 1530.4.

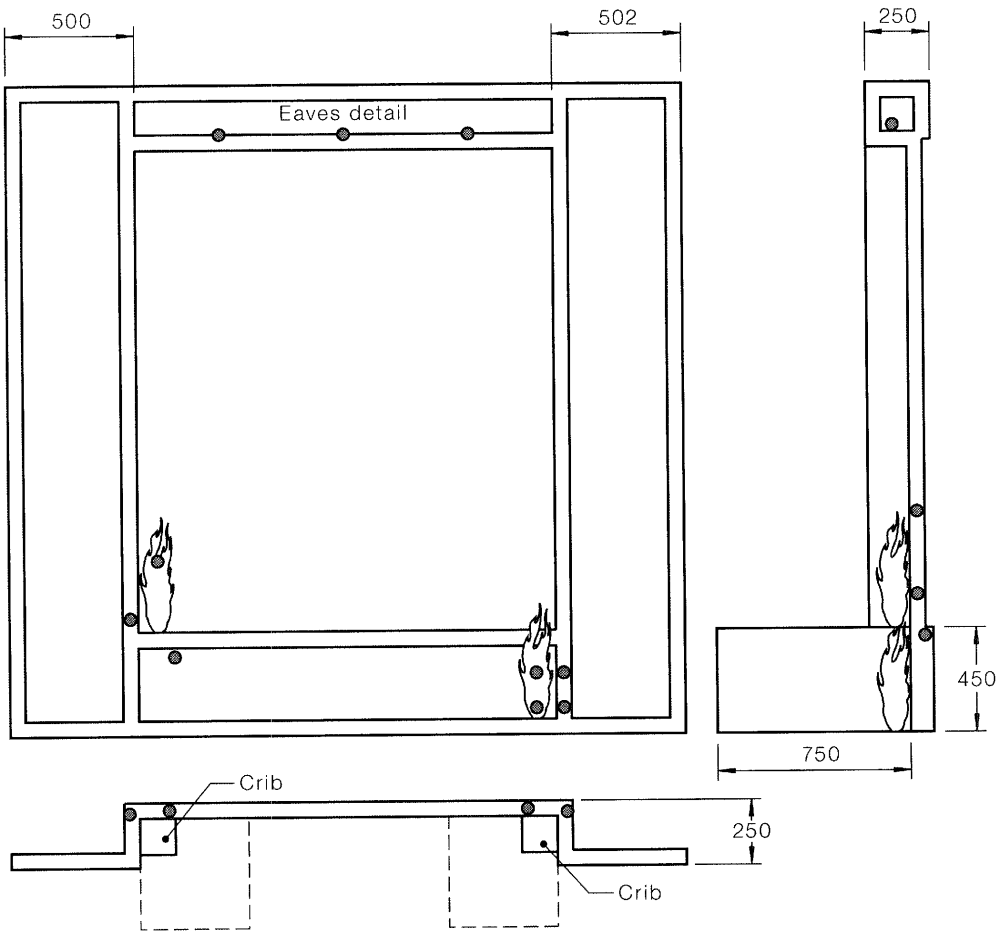
Thermocouples shall be attached to the internal face of the lining sheets of the walls and eaves to measure the maximum temperature rise at locations that are considered to have a higher heat transfer. As a minimum, thermocouples shall be fitted at the positions shown in Figure 21.1. Where practicable, the first 25 mm of each thermocouple used to measure temperatures inside the wall shall be in the isothermal plane.

A control radiometer shall be fitted in the front face of the deck, as shown in Figure 21.1, and the incident radiant heat flux shall be maintained at the nominated level at this location.

A second radiometer shall be provided at the centre of the wall to provide additional information.

21.4 Specimen orientation and crib positions

The deck system shall be tested in the orientation shown in Figure 21.1. A crib shall be located at a rebate corner on the upper surface of the deck. If the deck underside is not to be enclosed a second crib shall be positioned as near as practicable to the other rebate corner under the deck adjacent to bearers and joists.



LEGEND:

● = Incipient fire spread thermocouples
[ ] = Flame spread limit

DIMENSIONS IN MILLIMETRES

FIGURE 21.1 TEST CONFIGURATION FOR DECK ASSEMBLIES

21.5 Measurements and observations

In addition to observing compliance with the performance criteria specified in Clause 14.4 and Clause 21.6, observations shall be recorded of any behaviour or occurrence considered to be relevant to the performance of the specimen.

21.6 Performance criteria

BALs shall be determined in accordance with Clause 14.4 together with additional criteria applying specifically to deck assemblies comprising flaming of the deck assembly to extend more than 500 mm from the rear and side walls as shown in Figure 21.1.

NOTE: This criterion is intended to minimize the potential for fire spread to other materials and elements.

21.7 Permissible variations to the tested specimen

The results of the fire test contained in the test report are directly applicable, without reference to the testing authority for a technical opinion, to similar constructions where one or more of the following changes have been made provided no individual component is removed or reduced:

(a) Increase in thickness of solid decking material.

(b) Increase in cross-section of bearers and joists.

(c) Increase in the size of the deck.

22 SUB-FLOOR SPACES

22.1 General

This Clause sets out specific procedures for determining the BALs of sub-floor assemblies and evaluates the risk of burn-through from the underside. Two test specimen configurations are specified. Configuration 1 (shielded sub-floor spaces) relates to enclosed/protected sub-floor spaces and the areas of sub-floor spaces located at a distance greater than the maximum ground clearance level from the building facade. In this instance it is considered that exposure to radiant heat is minimal and only the risk of fire spread from burning debris need be considered. Configuration 2 relates to unprotected sub-floor spaces where there is potential for elements to be subjected to significant levels of radiant heat.

22.2 Test specimen

22.2.1 *Configuration 1*

For Configuration 1 (shielded sub-floor spaces) the configuration shown in Figure 22.1 shall be tested. The height of the deck above ground level shall be the minimum height used in practice. Cribs 1 and 2 shall be applied on the upper surface of the bearers adjacent to the joists. If the bearers are less than 70 mm wide, they shall be doubled up locally to allow application of the cribs to a stable surface. Cribs 3, 4 and 5 shall be applied at ground level adjacent to stumps/poles.

22.2.2 *Configuration 2*

For Configuration 2, a representative section of flooring, nominally 750 mm deep × 1800 mm wide, with supports positioning the deck approximately 1500 mm above the base shall be located within a 250 mm alcove in a wall system as shown in Figure 22.2. The wall system should be capable of resisting exposure to radiant heat and flaming sources. A temporary baffle should be provided to shield the upper surface of the flooring from radiant heat.

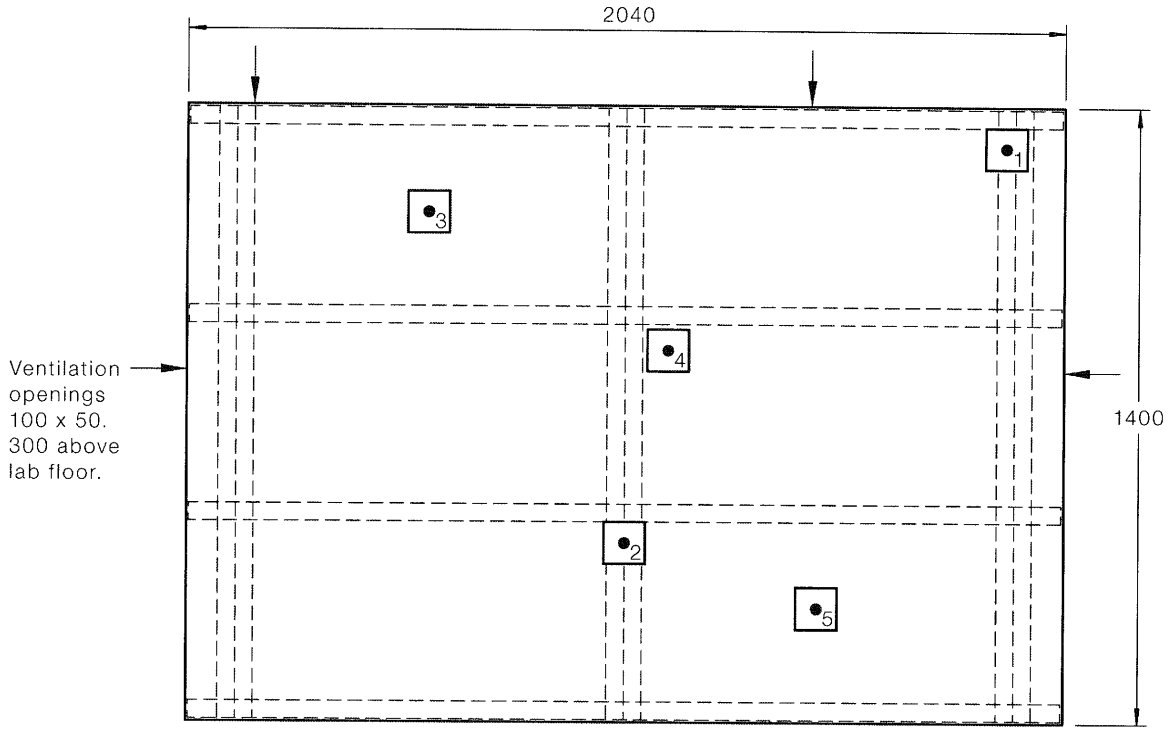
22.3 Instrumentation

Thermocouples shall be attached to the upper surface of the floors at the positions shown in Figure 22.1 and Figure 22.2.

A control radiometer shall be fitted in the front face of the deck for Configuration 2 as shown in Figure 22.1 and the incident radiant heat flux shall be maintained at the nominated level at this location.

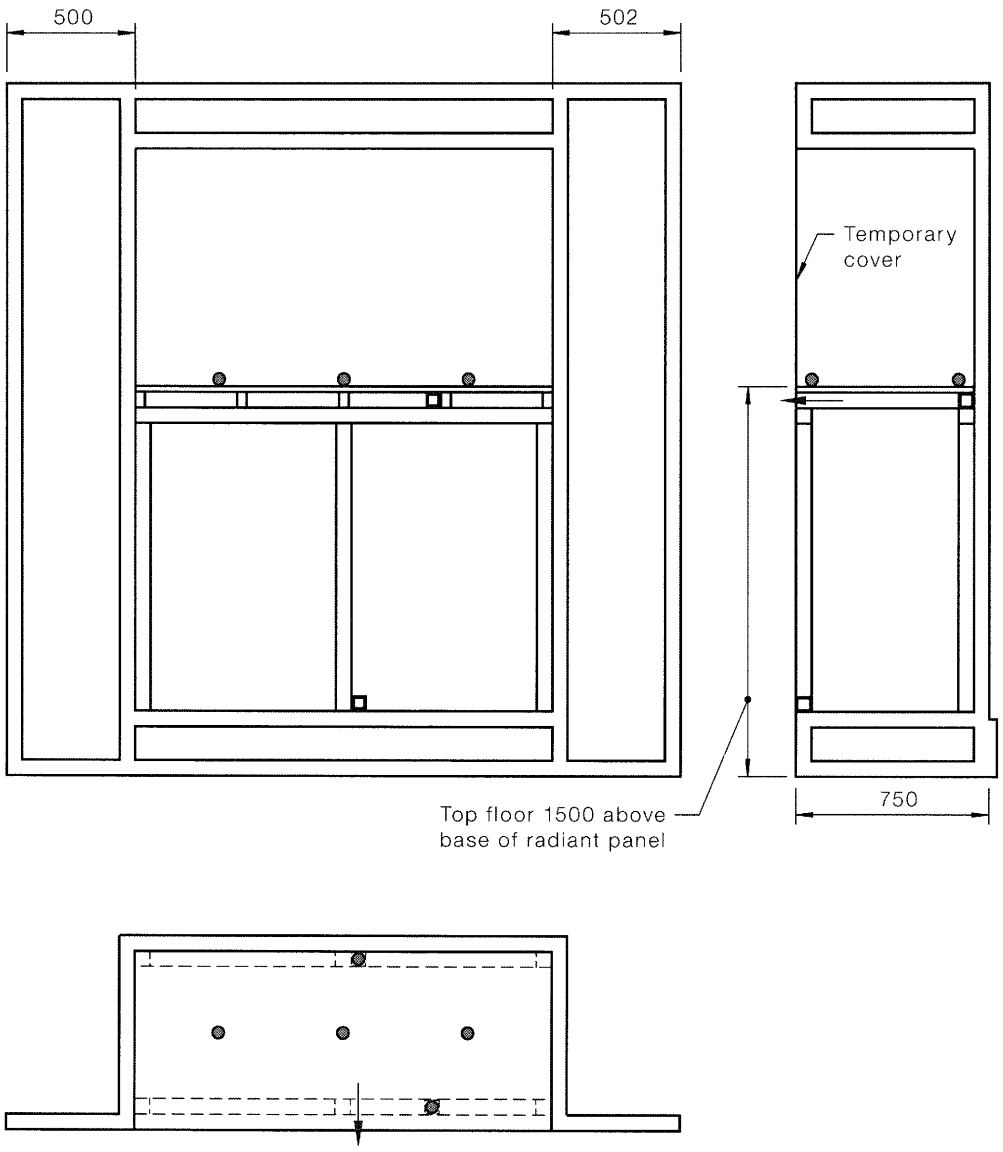
22.4 Specimen orientation and crib positions

The floor systems shall be tested in the orientations shown in Figure 22.1 or Figure 22.2, as appropriate. Cribs shall be located at the positions shown in the Figure. For Configuration 1, each crib shall be applied individually and allowed to burn out prior to application of the next crib. For Configuration 2, both cribs shall be applied at the commencement of the radiation exposure



DIMENSIONS IN MILLIMETERS

FIGURE 22.1 TEST CONFIGURATION 1—SHIELDED SUB-FLOOR ASSEMBLIES



DIMENSIONS IN MILLIMETERS

FIGURE 22.2 TEST CONFIGURATION 2—SUB-FLOOR ASSEMBLIES EXPOSED TO RADIANT HEAT

22.5 Measurements and observations

In addition to observing compliance with the performance criteria specified in Clause 14.4 and Clause 21.6, observations shall be recorded of any behaviour or occurrence considered to be relevant to the performance of the specimen.

22.6 Performance criteria

BALs shall be determined in accordance with Clause 14.4. The upper surface of the floor shall be treated as the non-fire-exposed face when applying the performance criteria. In addition, the performance criteria relating to continuing combustion of the sub-floor assembly more than 60 min after exposure to radiation or burning debris shall be applied to the underside of the floor assembly and supporting members.

22.7 Permissible variations to the tested specimen

The results of the fire test contained in the test report are directly applicable, without reference to the testing authority for a technical opinion, to similar constructions where one or more of the following changes have been made provided no individual component is removed or reduced:

(a) Increase in thickness of solid flooring material.

(b) Increase in cross-section of bearers and joists.

(c) Increase in the size of the deck.

(d) Variations to the height of the assembly above ground level.

23 REPORTING

23.1 General

The following observations shall be recorded:

(a) Appearance of sustained flaming on the fire-exposed face of the assembly and any flaming on the non-fire-exposed face.

(b) Displacement of the test assembly such that portions of the assembly fall away.

(c) Development of 2 mm to 3 mm gaps through openings in the assembly.

(d) Size, location and number of cribs.

(e) Time to failure under the performance criteria stated in Clause 14.4.

23.2 Test report

The test report shall contain the following information:

(a) The name and address of the testing authority.

(b) The name and address of the applicant.

(c) The date of the test.

(d) The unique reference number of the test.

(e) The name of the manufacturer (if known) of the test specimen and of the products and components used in the construction, together with identification marks and trade names.

(f) The construction details of the test specimen, including description and drawings and principal details of the components.

The description and the drawings that are included in the test report shall, as far as practicable, be based on information provided by the sponsor and verified by a survey of the test specimen. When full and detailed drawings are not produced by the laboratory to be included in the report, then the sponsor's drawing(s) of the test specimen shall be authenticated by the laboratory and at least one copy of the authenticated drawing(s) shall be included in the report. References shall be given in the report that the drawings are those provided by the sponsor.

(g) The relevant properties of materials or components that have a bearing on the fire performance of the test specimen. Where it is impracticable to measure some of these properties, this shall be reported.

(h) The method of assembly and installation of the test specimen.

(i) Details of pre-test conditioning of the test specimen.

(j) A statement concerning the laboratory's involvement in the selection of the test specimen.

(k) For asymmetrical separating elements, the direction in which the specimen was tested and the reason for this choice.

(l) The ambient temperature of the laboratory at the commencement of the test.

(m) Imposed radiant heat flux measurements.

(n) The reasons for validating the test in the event of the tolerances on the temperature/time curve, pressure conditions or ambient laboratory conditions being inadvertently exceeded.

(o) The result stated in terms of the elapsed time, in completed minutes, between the commencement of the test and the time of failure with respect to the relevant criteria in the format specified in Clause 14.5 together with the BAL achieved if all relevant performance criteria have been satisfied in the format specified in Clause 14.6.

(p) Tabulated or graphical depiction of the output from radiometers, unexposed face thermocouples and, where applicable, internal thermocouples.

(q) A description of any significant behaviour of the test specimen.

(r) The following statement:

'*This report details methods of construction, the test conditions and the results obtained when the specific element of construction described herein was tested in accordance with test method of AS 1530.8.1*'.

23.3 Regulatory information report

In addition to the full test report, an abbreviated version (Regulatory Information Report) may be provided, at the specific request of the sponsor. The Regulatory Information Report shall include all the items listed above, except that Items (i), (m), (o) (p) and (q) may be abbreviated.

APPENDIX A

GUIDELINES FOR APPLICATION OF TESTS FOR BUILDINGS EXPOSED TO SIMULATED BUSHFIRE ATTACK

(Informative)

The method specified in this Standard may be applied to miscellaneous attachments and building services such as airconditioning units, plastic pipes penetrating walls, verandas and carports, etc. When testing these elements, the assessment criteria should be applied to the building envelope, if the attachment serves a non-critical role during a fire emergency, and not the attachment. For example, the impact of an attached veranda should be assessed by exposing a representative section of the building envelope (wall and eaves) with a representative section of the veranda to the test conditions appropriate to the particular application (e.g., BAL: A19).

The acceptance criteria would then be applied to the building envelope. If combustibles are likely to be stored under a veranda the risk of secondary fires should be assessed separately.

The 3 kW/m^2 Radiant Heat Flux limit 250 mm from the specimen was introduced to address the potential need for people to pass close to the elements of construction approx 10 min after the passage of the fire front to evacuate a building and/or undertake first aid firefighting.

Assuming that people would only evacuate when the general external environment is tolerable it is only important that the occupants be able to travel a sufficient distance close to the building facade until they reach a point that will enable them to move away from the building facade easily. Calculations based on the SFPE Engineering Guide, *Predicting 1st and 2nd Degree Skin Burns from Thermal Radiation,* indicate that occupants without any significant protection from clothing would experience pain after approximately 18 s exposure to a radiant heat flux of 4 kW/m^2.

If a travel speed of 1.2 m/s is assumed, the maximum distance of travel before an occupant would need to head away from the facade will be approximately 20 m or 10 m if a safety factor of 2 is applied. The onset of blistering would occur significantly after that period.

APPENDIX B

BIBLIOGRAPHY

(Informative)

The following documents referenced in this Standard are of an informative nature.

AS

1530 Methods for fire tests on building materials, components and structures

1530.8.2 Part 8.2: Tests on elements of construction for buildings exposed to simulated bushfire attack—Large flaming sources

SFPE SFPE Engineering Guide—Predicting 1st and 2nd Degree Skin Burns from Thermal Radiation

NOTES

NOTES

NOTES