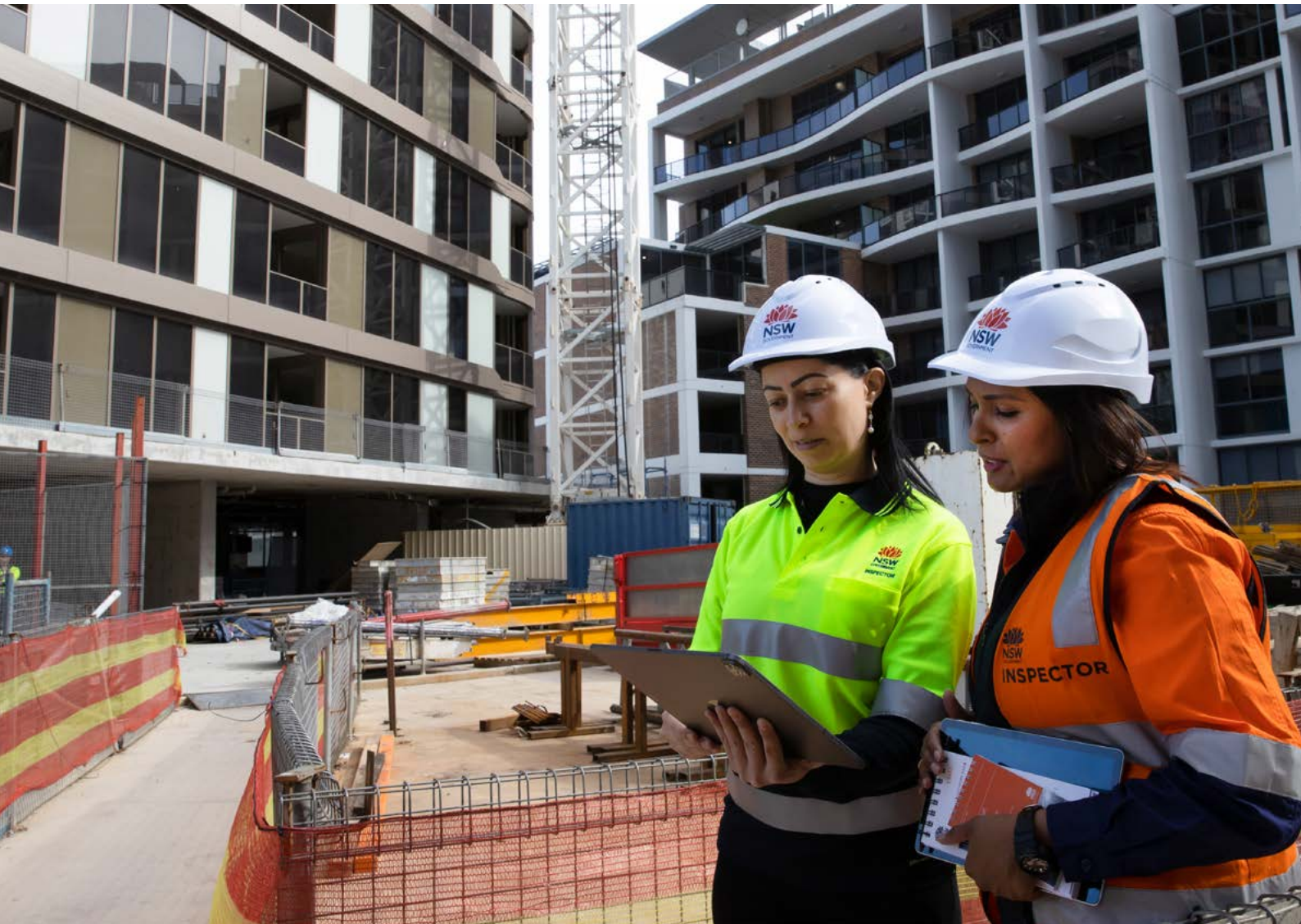
Building Commission NSW

NSW GOVERNMENT

Building Defects Library

A collection of common building defects affecting Class 2, 3 and 9c buildings

NCC 2022 Edition (Building Defects Library v1.0 –28 March 2024)



Contents

Acronyms and definitions

Term / Acronym	Description
BCA	Building Code of Australia.
Body corporate	Has the same meaning as in the Corporations Act 2001 of the Commonwealth, such as a company, or partnership.
Building element	Has the same meaning as section 6 of the DBP Act.
DBP Act	Design and Building Practitioners Act 2020.
Fire safety element	Has the same meaning as section 6(1)(a) of the DBP Act.
Waterproofing element	Has the same meaning as section 6(1)(b) of the DBP Act.
Structural element	Has the same meaning as section 6(1)(c) of the DBP Act.
Building enclosure element	Has the same meaning as section 6(1)(d) and 6(3) of the DBP Act.
Services element	Has the same meaning as section 6(1)(d) of the DBP Act.
Building work	Has the same meaning as section 4 of the DBP Act.
Class 2 building	Has the same meaning as in the NCC. A Class 2 building is a building containing two or more sole-occupancy units, where each sole-occupancy unit is a separate dwelling.
Class 3 building	Has the same meaning as in the NCC. A Class 3 building is a residential building providing long-term or transient accommodation for a number of unrelated persons, for example: a boarding house, guest house, hostel, lodging house, or the residential part of a hotel or motel.
Class 9c building	Has the same meaning as in the NCC. A Class 9c building is a residential care building where 10% or more of persons who reside there need physical assistance in conducting their daily activities and to evacuate, but does not include a hospital.
NCC	National Construction Code. The NCC includes the Building Code of Australia and the Plumbing Code of Australia.
RAB Act	Residential Apartment Buildings (Compliance and Enforcement Powers) Act 2020.

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Introduction and purpose

Background and history

In 2020, New South Wales witnessed a significant change in its approach to regulating the construction of residential apartment buildings with the introduction of the Residential Apartment Buildings (Compliance and Enforcement Powers) Act (RAB Act) and the Design and Building Practitioners Act (DBP Act).

Recognising the need for greater autonomy and focus, the NSW Government announced the establishment of Building Commission NSW. This new commission was officially launched on 1 December 2023. The purpose of Building Commission NSW is to consolidate building regulation, licensing, oversight, and enforcement under one independent body with dedicated staff and resources.

Introduction to the RAB Act

The RAB Act introduced stricter regulations and oversight across the construction process, focusing on proactive intervention before occupancy certificates are issued. It provides the Building Commission NSW with broad investigative and enforcement powers, including:

- Stopping construction to address serious defects.
- Requiring developers to rectify non-compliant work.
- Imposing fines and penalties for breaches.
- Increased transparency and accountability for developers, requiring them to notify authorities of building completion and potential delays.

Introduction to the DBP Act

The goal of the DBP Act is to improve building quality, safety, and consumer protection by:

- **Introducing a statutory duty of care:** Design and building practitioners now have a legal responsibility to avoid economic loss caused by defects in their work.
- **Implementing a mandatory registration scheme:** Most practitioners working on Class 2 buildings (multi-storey and multi-unit residential) must register with the government, demonstrating their qualifications and experience.
- **Enacting a compliance declaration scheme:** Design and building practitioners working on Class 2 buildings must declare that their designs and work comply with the Building Code of Australia.

RAB Act and DBP Act audit findings

As a result of the introduction of the above two Acts, Building Commission NSW (formerly Fair Trading) began proactive compliance audits of Class 2, 3 and 9c buildings. Proactive compliance started in September 2020 and continues to this day. This is a major shift for the regulator as previously the regulator was predominantly a reactive and complaints-driven organisation. The shift towards proactive enforcement is a recognition that the earlier a building defect is detected and resolved, the better the outcome for all parties (developers, builders, designers and future occupants).

During these audits, it became apparent that a small selection of defect types was responsible for a large proportion of the detected defects. The reasons why certain defects are recurring is multi-faceted and exploration of this topic is outside the scope of this document. The defects included in this document represent a collection of defects with the following properties:

- They have a high occurrence rate in buildings under construction (although they may not be the most common type for each building element).
- They can be easily recognised and verified without specialist testing or equipment.
- They are more cost-effective and easier to resolve during construction with the cost of rectification increasing exponentially post-occupation (i.e. these are defects which will have a big impact on the occupants).

Usage and purpose

It is intended that this resource be used by building professionals with a working knowledge of the NCC, the Australian Standards and general construction. It is envisaged that this would be a reference where different sources of information (such as the NCC and Australian Standards) are represented in one place for ease of comprehension.

The library is split into the five building elements as defined in the DBP Act. These elements are:

- Waterproofing
- Fire Safety
- Structure
- Building Enclosure
- Services

Within each element are the individual defects, in each defect there is a reference to the applicable NCC and/or applicable standards. Some defects have an additional information section to provide commentary or further information. It is written in such a way that the contents of each defect can be read in isolation.

Applicable version of the NCC

We have used the 2022 version of the NCC, which has a phased adoption scheme. General adoption was 1 May 2023, with the new liveable housing requirements deferred until 1 October 2023 and the new lead-free plumbing requirements deferred until 1 September 2025.

You should refer to the Principal Certifying Authority to confirm which version of the NCC is applicable for a particular building. Note, the Environmental Planning & Assessment Act 1979 (EP&A Act) was amended in 2023 to clarify which version of the NCC is applicable. The amendment applies to construction certificate applications made on or after 3 February 2023.

Intended audience

The first version of the defects library is intended for Certifiers, Councils and other relevant industry members.

Waterproofing defects

2.1 Membrane not terminated into a puddle flange draining the external roof or balcony

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

The conveying of surface water is required to satisfy NCC Volume 1, Section F health and amenity, Part F1 Surface water management, rising damp and external waterproofing, F1P2 Preventing rainwater from entering buildings, which states:

"F1P2 Preventing rainwater from entering buildings
Surface water, resulting from a storm having an annual exceedance probability of 1% must not enter the building."

And/or

"F1P3 Rainwater drainage systems
A drainage system for the disposal of surface water resulting from a storm having an annual exceedance probability of—
(a) 5% must—
i. convey surface water to an appropriate outfall; and
ii. avoid surface water damaging the building; and
(b) 1% must avoid the entry of surface water into a building.

In the absence of a documented Performance Solution, the pathway to satisfy F1P2 and/or F1P3 is via F1D5 External waterproofing membranes, which states:

"F1D5 External waterproofing membranes
A roof, balcony, podium or similar horizontal surface part of a building must be provided with a waterproofing membrane—
a. consisting of materials complying with AS 4654.1; and
b. designed and installed in accordance with AS 4654.2."

The failure to turn down the membrane into the drain demonstrates a failure to comply with Australian Standard AS4654.2-2012 Waterproofing membranes for external above-ground use, Part 2: Design and installation, Section 2 Design and Installation, 2.10 Drains, which states:

"The membrane shall be connected to the stormwater drainage system through a turn down of the membrane into the inlet of the system as shown in Figure 2.15.

An alternative connection may have a flange to which the membrane is clamped or attached.

To minimize blockage from debris, the drain shall have a sump, inlet pit, grate or cage.

Notes:
1. *The flange may be part of the inlet to the stormwater system or a separate item fitted on site.*
2. *Where the finished surface is above the level of the membrane, a variable level inlet or grate is used to provide surface drainage.*
3. *The variable level inlet should allow sub-surface drainage at the membrane level.*

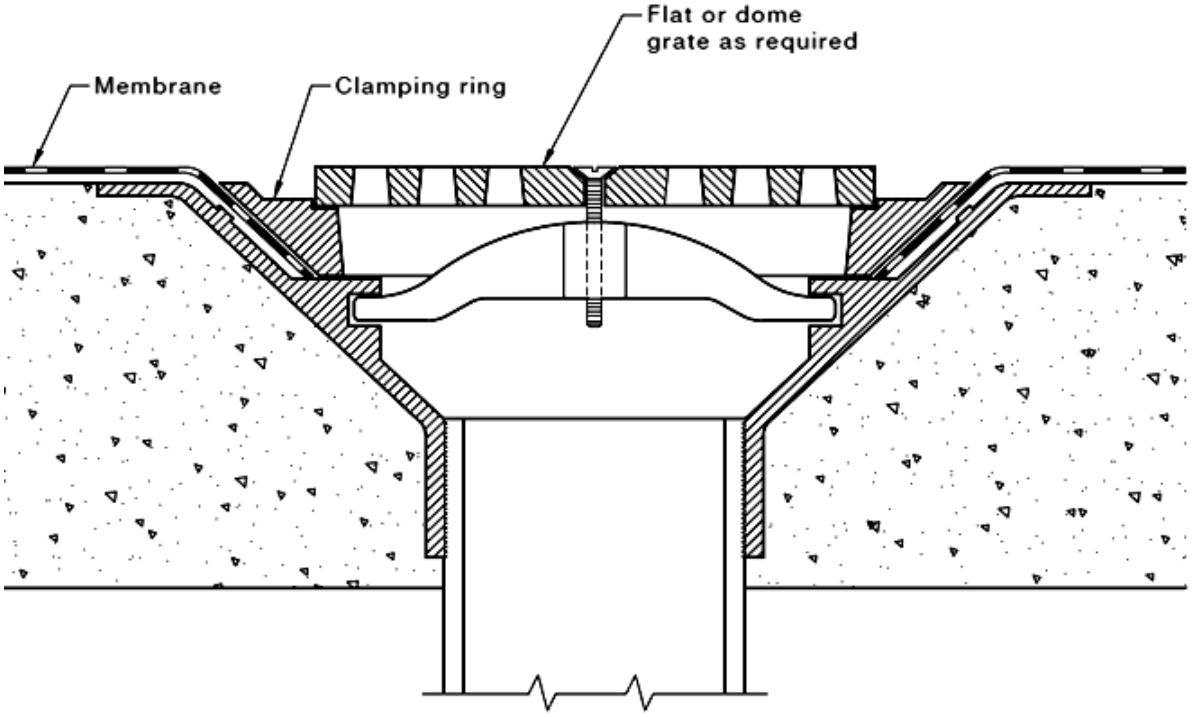


FIGURE 2.15 DRAINAGE DETAIL FOR AN EXPOSED MEMBRANE

Additional information

Membranes should be turned down into the stormwater drain. The figure from AS4654.2 is for a clamped system (typically used for sheet membranes). In the case of a liquid, the liquid is simply applied onto the puddle flange and continued downwards.

2.2 Membrane not terminated into an overflow

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

A roof or external wall is required to satisfy NCC Volume 1, Section F health and amenity, Part F1 Surface water management, rising damp and external waterproofing, F1P2 Preventing rainwater from entering buildings, which states:

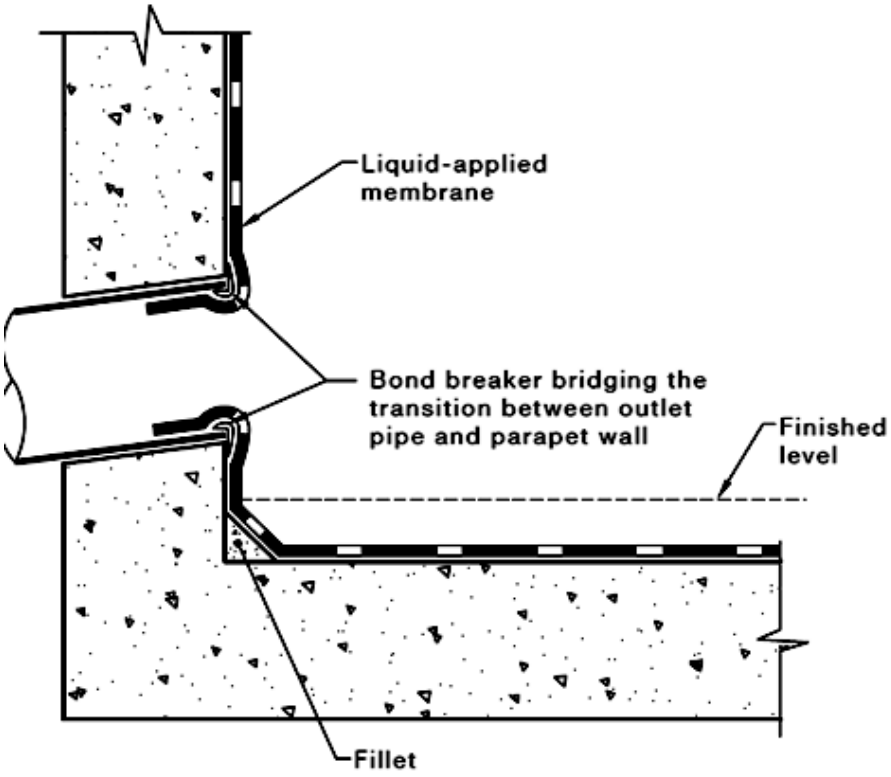
"F1P2 Preventing rainwater from entering buildings
Surface water, resulting from a storm having an annual exceedance probability of 1% must not enter the building."

In the absence of a documented Performance Solution, the pathway to satisfy F1P2 is via F1D5 External waterproofing membranes, which states:

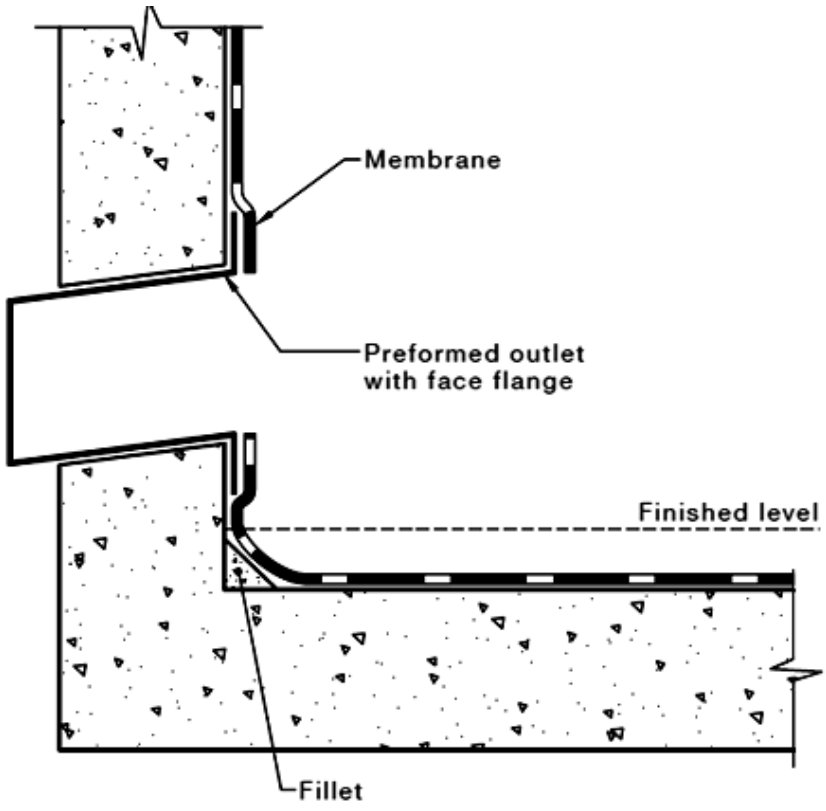
"F1D5 External waterproofing membranes
A roof, balcony, podium or similar horizontal surface part of a building must be provided with a waterproofing membrane—
a. consisting of materials complying with AS 4654.1; and
b. designed and installed in accordance with AS 4654.2"

The failure to turn the membrane into the overflow demonstrates a failure to comply with Australian Standard AS4654.2-2012 Waterproofing membranes for external above-ground use, Part 2: Design and installation, Section 2 Design and Installation, 2.11 Overflows, which states:

"The membrane shall be turned into the overflow, to prevent moisture from tracking behind the membrane. The finished floor level shall not reduce the design flow of an outlet.



(a) Overflow through parapet



(b) Preformed overflow through parapet

Additional Information

There are two acceptable solutions, the membrane does not need to be turned into the overflow only if the pre-formed outlet has a flange.

2.3 Retained water, ponding or inadequate falls on a roof or balcony

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

A roof or external wall is required to satisfy NCC Volume 1, Section F health and amenity, Part F1 Surface water management, rising damp and external waterproofing, F1P2 Preventing rainwater from entering buildings, which states:

"F1P2 Preventing rainwater from entering buildings
Surface water, resulting from a storm having an annual exceedance probability of 1% must not enter the building."

In the absence of a documented Performance Solution, the pathway to satisfy F1P2 is via F1D5 External waterproofing membranes, which states:

"F1D5 External waterproofing membranes
A roof, balcony, podium or similar horizontal surface part of a building must be provided with a waterproofing membrane—
a. consisting of materials complying with AS 4654.1; and
b. designed and installed in accordance with AS 4654.2"

The failure to provide adequate falls demonstrates a failure to comply with Australian Standard AS4654.2-2012 Waterproofing membranes for external above-ground use, Part 2: Design and installation, Section 2 Design and Installation, 2.5 Substrate, 2.5.2 Falls, which states:

"Falls in finishes shall ensure water drains to the drainage outlet. Water shall not be retained on the finished surface with the exception of residual water remaining due to surface tension.

The fall shall be in the structural substrate, or formed by a screed over the structural substrate.

Note: Falls for surface drainage should be no flatter than 1 in 100."

2.4 Inadequate surface preparation on an external surface/roof

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

A roof or external wall is required to satisfy NCC Volume 1, Section F health and amenity, Part F1 Surface water management, rising damp and external waterproofing, F1P2 Preventing rainwater from entering buildings, which states:

"F1P2 Preventing rainwater from entering buildings
Surface water, resulting from a storm having an annual exceedance probability of 1% must not enter the building."

In the absence of a documented Performance Solution, the pathway to satisfy F1P2 is via F1D5 External waterproofing membranes, which states:

"F1D5 External waterproofing membranes
A roof, balcony, podium or similar horizontal surface part of a building must be provided with a waterproofing membrane—
a. consisting of materials complying with AS 4654.1; and
b. designed and installed in accordance with AS 4654.2"

The failure to provide adequate falls demonstrates a failure to comply with Australian Standard AS4654.2-2012 Waterproofing membranes for external above-ground use, Part 2: Design and installation, Section 2 Design and Installation, 2.5 Substrate, which states:

"2.5.1 General
The substrate material in contact with the waterproofing shall be suitable for and compatible with the waterproofing membrane system."

And

"2.5.3 Types of substrates
2.5.3.1 Fully bonded or liquid-applied
The preparation of the substrate for fully bonded or liquid-applied membranes shall result in the surface of the substrate being smooth, without protrusions, voids or formwork distortions, and clean, dry, and free from dust and contamination.

The preparation of the substrate shall result in a moisture content applicable to the type of membrane to be applied.

The substrate shall be resistant to moisture damage that is caused by condensation forming on the underside of the substrate."

Additional information

The above references only apply to fully bonded or liquid-applied membranes. Other membrane types may not need the same level of substrate preparation. Refer to the membrane manufacturer's specifications.

2.5 Inadequate termination of membrane at sliding door

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

A roof or external wall is required to satisfy NCC Volume 1, Section F health and amenity, Part F1 Surface water management, rising damp and external waterproofing, F1P2 Preventing rainwater from entering buildings, which states:

"F1P2 Preventing rainwater from entering buildings
Surface water, resulting from a storm having an annual exceedance probability of 1% must not enter the building."

In the absence of a documented Performance Solution, the pathway to satisfy F1P2 is via F1D5 External waterproofing membranes, which states:

"F1D5 External waterproofing membranes
A roof, balcony, podium or similar horizontal surface part of a building must be provided with a waterproofing membrane—
a. consisting of materials complying with AS 4654.1; and
b. designed and installed in accordance with AS 4654.2"

The failure to terminate the membrane vertically such that it can prevent water entry demonstrates a failure to comply with Australian Standard AS4654.2-2012 Waterproofing membranes for external above-ground use, Part 2: Design and installation, Section 2 Design and Installation, 2.8 Terminations of Membranes which states:

"2.8.1 Upward terminations
2.8.1.1 Height
Where the membrane termination is to prevent water entry, the finished height of the membrane above the finished surface level shall be sufficient to prevent water, including wind driven, flowing over the top of the membrane."

And

"2.8.3 Doors and windows onto external waterproofed areas
For doors and windows onto external waterproofed areas, the following apply:

(a) Sub-sill flashing shall be included as part of the membrane system (see Note 1).

(b) Where the internal and external finished floor levels do not allow an upturn, the membranes shall be fixed under the sill and terminate in the stormwater system (see Note 2)."

Additional information

There is a requirement to extend the membrane up vertically to a sufficient degree to prevent water entry. However, the Standard does not necessarily specify the height of the membrane upturn, instead, it points to Appendix A. Appendix A is not a normative requirement, rather, it is an informative clause. The height of membrane termination should be determined by the façade engineer.

Refer to Figure 2.8 in AS4654.2 for options of terminating the membrane at a sliding door.

2.6 Retained water, ponding or inadequate falls in the general bathroom area

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

An internal wet area is required to satisfy NCC Volume 1, Section F health and amenity, Part F2 Wet areas and overflow protection, F2P2 Wet areas, which states:

"F2P2 Wet areas
To protect the structure of the building and to maintain the amenity of the occupants, water must be prevented from penetrating—
(a) behind fittings and linings; and

(b) into concealed spaces, of sanitary compartments, bathrooms, laundries and the like."

In the absence of a documented Performance Solution, the pathway to satisfy F2P2 is via F2D2 Wet area construction, which states:

"(a) In a Class 2 and 3 building and a Class 4 part of a building, building elements in wet areas must—
i. be water resistant or waterproof in accordance with Specification 26; and

ii. comply with AS 3740."

And F2D4 Floor Wastes, which states:

1. *"In a Class 2 or 3 building or Class 4 part of a building, a bathroom or laundry located at any level above a sole-occupancy unit or public space must have a floor waste.*

2. *Where a floor waste is installed—*
   a. *the minimum continuous fall of a floor plane to the waste must be 1:80; and*
   b. *the maximum continuous fall of a floor plane to the waste must be 1:50."*

Additional information

The minimum fall requirements have changed in the 2022 version of the NCC and now there is a potential disagreement between AS3740-2021 and the NCC. Under 3740 the minimum falls are 1:100. In cases where the Australian Standard contradicts the NCC, the NCC overrules the Standard.

2.7 Retained water, ponding or inadequate falls in the shower area

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

An internal wet area is required to satisfy NCC Volume 1, Section F health and amenity, Part F2 Wet areas and overflow protection, F2P2 Wet areas, which states:

"F2P2 Wet areas
To protect the structure of the building and to maintain the amenity of the occupants, water must be prevented from penetrating—
(a) behind fittings and linings; and

(b) into concealed spaces, of sanitary compartments, bathrooms, laundries and the like."

In the absence of a documented Performance Solution, the pathway to satisfy F2P2 is via F2D2 Wet area construction, which states:

"(a) In a Class 2 and 3 building and a Class 4 part of a building, building elements in wet areas must—
   i. be water resistant or waterproof in accordance with Specification 26; and
   ii. comply with AS 3740."

The failure to provide sufficient falls to allow surface water to drain without ponding demonstrates a failure to comply with Australian Standard AS3740-2021 Section 2 Design, 2.3 Requirements for fall, 2.3.2 Falls in shower area floor finishes (Category 1), which states:

"The fall to the floor waste in the shower area shall be a minimum of 1:80.

Note: See Appendix B for additional information regarding falls in floor finishes."

2.8 No waterstop angle at a doorway to a wet area

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

An internal wet area is required to satisfy NCC Volume 1, Section F health and amenity, Part F2 Wet areas and overflow protection, F2P2 Wet areas, which states:

"F2P2 Wet areas
To protect the structure of the building and to maintain the amenity of the occupants, water must be prevented from penetrating—
(a) behind fittings and linings; and

(b) into concealed spaces, of sanitary compartments, bathrooms, laundries and the like."

In the absence of a documented Performance Solution, the pathway to satisfy F2P2 is via F2D2 Wet area construction, which states:

"(a) In a Class 2 and 3 building and a Class 4 part of a building, building elements in wet areas must—
i. be water resistant or waterproof in accordance with Specification 26; and
ii. comply with AS 3740."

The failure to install a waterstop angle demonstrates a failure to comply with Australian Standard AS3740-2021 Section 4 Installation, 4.9 Door openings, 4.9.1 Perimeter flashing at floor level openings, which states:

"4.9.1 Perimeter flashing at floor level openings
The following requirements apply to perimeter flashing at floor level openings:

(a) Whole wet area floor waterproofing shall incorporate –
(i) a waterstop that has a vertical leg finishing flush with the top of the finished floor level shall be installed at floor level openings; and
(ii) a floor membrane terminated to create a waterproof seal to the waterstop and to the perimeter flashing.

(b) Waterproofing other than whole wet area floor waterproofing shall incorporate a waterstop that –
(i) has a vertical leg finishing flush with the top of the finished floor level installed at floor level openings; and
(ii) is integral with the perimeter flashing.

(c) Perimeter flashing to wall, floor surfaces, and door openings shall –
(i) be continuously sealed to the horizontal surface;
(ii) have a vertical leg or a minimum of 25mm above the finished floor level, except across doorways; and
(iii) have a horizontal leg with a minimum width of 50mm.

(d) Waterstops at cavity sliders shall –
(i) be returned across the cavity opening; and
(ii) have a membrane applied to form a continuous perimeter flashing."

2.9 Puddle flange for an internal membrane is not recessed into substrate

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

An internal wet area is required to satisfy NCC Volume 1, Section F health and amenity, Part F2 Wet areas and overflow protection, F2P2 Wet areas, which states:

"F2P2 Wet areas
To protect the structure of the building and to maintain the amenity of the occupants, water must be prevented from penetrating—
(a) behind fittings and linings; and

(b) into concealed spaces, of sanitary compartments, bathrooms, laundries and the like."

In the absence of a documented Performance Solution, the pathway to satisfy F2P2 is via F2D2 Wet area construction, which states:

"(a) In a Class 2 and 3 building and a Class 4 part of a building, building elements in wet areas must—
i. be water resistant or waterproof in accordance with Specification 26; and
ii. comply with AS 3740."

Australian Standard AS3740-2021 Waterproofing of domestic wet areas, Section 4 Installation, 4.3 Membrane to drainage connection, 4.3.1 Leak control flanges states:

"For a membrane to drainage connection, the following shall apply:

...

(b) Leak control flanges shall be recessed into the substrate and not protrude above it. Leak control flanges shall be sealed to the riser and be secured to the substrate to prevent movement. The diameter of the leak control flange (DN) shall match the diameter of the riser pipe (DN). The transition from leak control flange to substrate shall have a fillet sealant applied.

..."

2.10 Incorrect fillet size at wall to floor junction

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

An internal wet area is required to satisfy NCC Volume 1, Section F health and amenity, Part F2 Wet areas and overflow protection, F2P2 Wet areas, which states:

"F2P2 Wet areas
To protect the structure of the building and to maintain the amenity of the occupants, water must be prevented from penetrating—
(a) behind fittings and linings; and

(b) into concealed spaces, of sanitary compartments, bathrooms, laundries and the like."

In the absence of a documented Performance Solution, the pathway to satisfy F2P2 is via F2D2 Wet area construction, which states:

"(a) In a Class 2 and 3 building and a Class 4 part of a building, building elements in wet areas must—
i. be water resistant or waterproof in accordance with Specification 26; and

ii. comply with AS 3740."

The failure to provide a suitable bond braker demonstrates a failure to comply with Australian Standard AS3740-2021 Section 4 Installation, 4.10 Fillets and bond breakers – bond breaker installation for bonded membranes, which states:

"At any change of plane or materials, and at movement joints, fillets or bond breakers shall be used where the membrane is bonded to the substrate. Bond breakers shall be of the type compatible with the flexibility class of the membrane to be used in accordance with Table 4.10."

Reproduction of Table 4.10 – Bond breakers:

Membrane Class	Elongation at break	Minimum bond breaker/tape width
1	10% to 59%	100mm
2	60% to 299%	35mm
3	More than 300%	12mm

Note 1: Bond breakers for Class 1 membranes (low extensibility) allow the membrane to flex rather than stretch.

Note 2: Bond breakers for Class 2 membranes (medium extensibility) allow the membrane to stretch. If a tape is used as a bond breaker, either the membrane will not bond to the tape or the tape will have elastic properties similar to the membrane.

Note 3: Bond breakers for Class 3 membranes (high extensibility) allow the membrane to have even thickness.

3. Fire safety defects

3.1 The internal wall separating two compartments does not extend to the underside of the floor or roof above

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A fire safety system (or element of a building forming part of a fire safety system) is required to satisfy the performance requirements specified under NCC Volume 1, Section C Fire resistance, C1P2 Spread of fire, which states:

"(1) A building must have elements which will, to the degree necessary, avoid the spread of fire—
(a) to exits; and

(b) to sole-occupancy units and public corridors; and

(c) between buildings; and

(d) in a building."

In the absence of a documented performance solution, the pathway to satisfy C1P2 is via satisfying the Deemed-to-Satisfy provisions. The applicable Deemed-to-Satisfy provision is C3D8 Separation by fire walls, which states:

"(3) Separation of fire compartments — A part of a building separated from the remainder of the building by a fire wall may be treated as a separate fire compartment if it is constructed in accordance with (a) and the fire wall extends to the underside of—
(i) a floor having an FRL required for a fire wall; or

(ii) the roof covering."

3.2 There are unprotected services penetrations in a wall, floor or ceiling required to have an FRL (Fire Resistance Level). The installation does not match those of a tested system

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

A fire safety system (or element of a building forming part of a fire safety system) is required to satisfy the performance requirements specified under NCC Volume One, Section C Fire Resistance, Performance Requirement C1P8 Fire protection of openings and penetrations, which states:

"C1P8 Fire protection of openings and penetrations
Any building element provided to resist the spread of fire must be protected, to the degree necessary, so that an adequate level of performance is maintained—
a. where openings, construction joints and the like occur; and

b. where penetrations occur for building services."

In the absence of a documented performance solution, the pathway to satisfy C1P8 is via satisfying the Deemed-to-Satisfy provisions. The applicable Deemed-to-Satisfy provision is BCA Clause C4D13 Openings in floors and ceilings for services, which state:

"C4D13 Openings in floors and ceilings for services

1. *Where a service passes through—*
   a. *a floor that is required to have an FRL with respect to integrity and insulation; or*
   b. *a ceiling required to have a resistance to the incipient spread of fire, the service must be installed in accordance with (2).*
2. *A service must be protected—*
   a. *in a building of Type A construction, by a shaft complying with Specification 5; or*
   b. *in a building of Type B or C construction, by a shaft that will not reduce the fire performance of the building elements it penetrates; or*
   c. *in accordance with C4D15.*
3. *Where a service passes through a floor which is required to be protected by a fire-protective covering, the penetration must not reduce the fire performance of the covering."*

3.3 A required fire door does not self-close and latch shut

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

Requirements for the construction of fire doors is specified under NCC Volume One, Section C Fire resistance, Specification 12 Fire doors, smoke doors, fire windows and shutters, S12C2 Fire doors, which states:

"Fire doors
A required fire door must—
(a) comply with AS 1905.1; and

(b) ...."

AS 1905.1:2015 Components for the protection of openings in fire-resistant walls Part 1: Fire-resistance doorsets, Section 2 Design Requirements, Clause 2.1.3 Self Closure and self-latching states:

"2.1.3 Self-closure and self-latching
The doorset shall be self-closing and all doorsets other than sliding doorsets shall be self-latching"

3.4 A required fire door has excessive gaps between the leaf, frame and floor

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A fire safety system (or element of a building forming part of a fire safety system) is required to satisfy the performance requirements specified under NCC Volume 1, Section C Fire Resistance, C1P8 Fire protection of openings and penetrations, which states:

"Any building element provided to resist the spread of fire must be protected, to the degree necessary, so that an adequate level of performance is maintained—
(a) where openings, construction joints and the like occur; and

(b) where penetrations occur for building services."

In the absence of a documented performance solution, the pathway to satisfy C1P8 is via satisfying the Deemed-to-Satisfy provisions. The applicable Deemed-to-Satisfy provision is C4D5 Acceptable methods of protection, which states:

"(2) Fire doors, fire windows and fire shutters must comply with Specification 12."

Specification 12 Fire doors, smoke doors, fire windows and shutters states:

"S12C2 Fire doors
A required fire door must—
(a) comply with AS 1905.1; and

(b) not fail by radiation through any glazed part during the period specified for integrity in the required FRL."

Australian Standard AS 1905.1 – 2015, Components for the protection of openings in fire-resistant walls Part 1: Fire-resistant doorsets Section 5 Installation, 5.5 Clearances around door leaves, 5.5.1 Threshold and floor finish, which states:

Clearances between the bottom of all door leaves and the floor shall be as follows:
(a) Between the leaf and the top surface of the floor including any floor covering—not less than 3 mm and not more than 10 mm.

(b) Between the leaf and the top of the non-combustible threshold—not more than 25 mm.

5.5.2 Side-hung door, leaf-to-frame
Door leaves side-hung into rebated frames shall be installed to swing clear of the doorframe and shall have mean clearances, in the closed position, between the leaf and the head and between the leaf and each stile, of not more than 3 mm.

5.5.3 Side-hung door, leaf-to-doorstop
Door leaves side-hung into rebated frames shall be installed to swing clear of the doorframe and shall have mean clearances, in the closed position, between the face of the leaf and the doorstop, not more than 3 mm, and the maximum shall be not more than 5 mm at any location.

5.5.4 Double-acting doorsets
Clearances between the edges of the door leaf and the wall, floor, head and frame shall not exceed the clearances as tested or assessed.

5.5.5 Sliding doorsets
When closed, the clearances of sliding doorsets shall—
(a) be between the wall and the door leaf shall be the same as those demonstrated by the fire resistance test of AS 1530.4 or by assessment as described in Section 4 of this Standard; and

(b) have a clearance between the bottom of the door leaf and the floor as specified in Clause 5.5.1.

3.5 Fire door frame has not been filled and is hollow

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

Requirements for the construction of fire doors is specified under NCC Volume One, Section C Fire resistance, Specification 12 Fire doors, smoke doors, fire windows and shutters, S12C2 Fire doors, which states:

"Fire Doors
A required fire door must—

(a) comply with AS 1905.1; and

(b) …."

AS 1905.1:2015 Components for the protection of openings in fire-resistant walls Part 1: Fire-resistance doorsets, Section 5 Installation, Clause 5.3.2 Backfilling of metal doorframes states:

"5.3.2 Backfilling of metal doorframes
Unless an alternative method of fixing has been demonstrated by a full-scale standard fire resistance test, metal doorframes used in the construction of a fire-rated doorset for masonry construction, frame head and jamb cavities shall be backfilled by thoroughly and progressively grouting with cement mortar, concrete, a non-shrink grout or with material with a temperature of fusion not less than 1000°C."

3.6 There are non-compliant services installed in the fire isolated exit

References to the NCC and applicable standards

The National Construction Code is a performance based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A fire safety system (or element of a building forming part of a fire safety system) is required to satisfy the performance requirements specified under NCC Volume 1, Section C Fire Resistance, C1P2 Spread of Fire, which states:

"(1) A building must have elements which will, to the degree necessary, avoid the spread of fire—
(a) to exits; and

(b) to sole-occupancy units and public corridors; and

(c) between buildings; and

(d) in a building."

In the absence of a documented performance solution, compliance with C1P2 can be demonstrated by constructing in accordance with Part C4 Protection of openings, Deemed-to-Satisfy provision Clause C4D10 Service penetrations in fire-isolated exits, which states:

"Fire-isolated exits must not be penetrated by any services other than –
a. electrical wiring permitted by D3D8(6) to be installed within the exit; or

b. ducting associated with a pressurisation system if it –
i. is constructed of material having an FRL of not less than –/120/60 where it passes through any other of the building;
...

c. for fire services, water supply and test drain pipes."

3.7 There is a step at the threshold to the entry to a fire isolated exit

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A fire safety system (or element of a building forming part of a fire safety system) is required to satisfy the performance requirements specified under NCC Volume 1, Section D Access and egress, D1P2 Safe movement to and within a building, which states:

"So that people can move safely to and within a building, it must have—
(a) walking surfaces with safe gradients; and

(b) any doors installed to avoid the risk of occupants—
(i) having their egress impeded; or

(ii) being trapped in the building; and

(c) any stairways and ramps with—
(iv) landings where a door opens from or onto the stairway or ramp so that the door does not create an obstruction"

In the absence of a documented performance solution, the pathway to satisfy DP2 is via satisfying the Deemed-to-Satisfy provisions. The applicable Deemed-to-Satisfy provision is D3D16 Thresholds, which states:

"The threshold of a doorway must not incorporate a step or ramp at any point closer to the doorway than the width of the door leaf unless—
(a) in patient care areas in a Class 9a health-care building, the door sill is not more than 25 mm above the finished floor level to which the doorway opens; or

(b) in resident use areas in a Class 9c building, a ramp is provided with a maximum gradient of 1:8 for a maximum height of 25 mm over the threshold; or

(c) in a building required to be accessible by Part D4, the doorway—
(i) opens to a road or open space; and

(ii) is provided with a threshold ramp or step ramp in accordance with AS 1428.1; or

(d) in other cases—
(i) the doorway opens to a road or open space, external stair landing or external balcony; and

(ii) the door sill is not more than 190 mm above the finished surface of the ground, balcony, or the like, to which the doorway opens."

Additional information

The NCC allows for steps if it goes to an external area, this is a concession intended for weatherproofing.

3.8 Inadequate head height in a fire exit

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A fire safety system (or element of a building forming part of a fire safety system) is required to satisfy the performance requirements specified under NCC Volume 1, Section D Access and egress, D1P4 Exits which states:

"D1P4 Exits
Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to—
(a) the travel distance; and

(b) the number, mobility and other characteristics of occupants; and

(c) the function or use of the building; and

(d) the height of the building; and

(e) whether the exit is from above or below ground level."

In the absence of a documented performance solution, the pathway to satisfy D1P4 is via satisfying the Deemed-to-Satisfy provisions. The applicable Deemed-to-Satisfy provision is D2D7 Height of exits, paths of travel to exits and doorways, which states:

"In a required exit or path of travel to an exit the unobstructed height throughout must be not less than 2 m, except the unobstructed height of any doorway maybe reduced to not less than 1980 mm."

3.9 Inconsistent risers and goings in a required exit

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A fire safety system (or element of a building forming part of a fire safety system) is required to satisfy the performance requirements specified under NCC Volume 1, Section D Access and egress, D1P2 Safe movement to and within a building which states:

"So that people can move safely to and within a building, it must have—
...
(c) any stairways and ramps with—
...
(v) in the case of a stairway, suitable safe passage in relation to the nature, volume and frequency of likely usage."

In the absence of a documented performance solution, the pathway to satisfy D1P2 is via satisfying the Deemed-to-Satisfy provisions. The applicable Deemed-to-Satisfy provision is D3D14 Goings and risers, which states:

"(1) A stairway must have—
(c) constant goings and risers throughout each flight, except as permitted by (2) and (3), and the dimensions of goings (G) and risers (R) in accordance with (1)(b) are considered constant if the variation between—
(i) adjacent risers, or between adjacent goings, is no greater than 5 mm; and
(ii) the largest and smallest riser within a flight, or the largest and smallest going within a flight, does not exceed 10 mm;"

"Table D3D14: Riser and going dimensions

Stairway location	***Riser (R)***		***Going (G)***		***Quantity (2R + G)***	
	Max	***Min***	***Max***	***Min***	***Max***	***Min***
Public	*190*	*115*	*355*	*250*	*700*	*550*
Private	*190*	*115*	*355*	*240*	*700*	*550*

3.10 Fire hydrant valve outlets are sloping more than 35 degrees below the horizontal

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

A fire hydrant system is required to satisfy the performance requirement E1P3 Fire hydrants, specified under NCC Volume One, Section E Fire Services and equipment, Part E1 Firefighting equipment Performance Requirements which states:

"E1P3 Fire hydrants
A fire hydrant system must be provided to the degree necessary to facilitate the needs of the fire brigade appropriate to—
(a) fire-fighting operations; and
(b) the floor area of the building; and
(c) the fire hazard."

In the absence of a documented performance solution, the pathway to satisfy E1P3 is via satisfying the Deemed-to-Satisfy provisions. The applicable Deemed-to-Satisfy provision is BCA Clause E1D2 Fire hydrants which states:

"... (2) The fire hydrant system must be installed in accordance with AS 2419.1..."

AS 2419.1-2021 Fire hydrant installations Part 1: System design, installation and commissioning, Section 3 Hydrant classification, location and coverage, Clause 3.2 Fire hydrants, Clause 3.2.2 Features, accessibility and clearances, Clause 3.2.2.1 General, states:

"All fire hydrants shall –
...
(c) have the fire hydrant valve outlet horizontal or sloping not more than 35° below the horizontal;
..."

3.11 Fire hydrant does not have the minimum 1m clearance at the front

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both.

A fire hydrant system is required to satisfy the performance requirement E1P3 Fire hydrants, specified under NCC Volume One, Section E Fire Services and equipment, Part E1 Firefighting equipment Performance Requirements which states:

"E1P3 Fire hydrants
A fire hydrant system must be provided to the degree necessary to facilitate the needs of the fire brigade appropriate to—
(a) fire-fighting operations; and

(b) the floor area of the building; and

(c) the fire hazard."

In the absence of a documented performance solution, the pathway to satisfy E1P3 is via satisfying the Deemed-to-Satisfy provisions. The applicable Deemed-to-Satisfy provision is BCA Clause E1D2 Fire hydrants which states:

"... (2) The fire hydrant system must be installed in accordance with AS 2419.1..."

AS 2419.1-2021 Fire hydrant installations Part 1: System design, installation and commissioning, Section 3 Hydrant classification, location and coverage, Clause 3.2 Fire hydrants, Clause 3.2.2 Features, accessibility and clearances, Clause 3.2.2.2 Clearances, states:

"All fire hydrants shall have –
(a) a clearance of not less than 1 m directly in front of the fire hydrant outlet for the connection and laying of fire hose, except where the provisions of Clause 7.3.3 apply;
..."

4. Structural defects

4.1 Unreinforced masonry not supported by a lintel over an opening

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1, Section B Structure, Part B1 Structural provisions, B1D4 Determination of structural resistance of materials and forms of construction, states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(a) Masonry (including masonry-veneer, unreinforced masonry and reinforced masonry): AS 3700 … "

Australian Standard AS3700:2018 Masonry Structures is a relevant Australian Standard for masonry structures. AS3700 Section 4 General Design Requirements, 4.13 Arches and Lintels, states:

"Unreinforced masonry over openings shall be supported by arches, lintels or frames. Lintels shall comply with the following:

(a) End bearings of lintels on each side of an opening shall be not less than 100 mm in length for openings up to 1000 mm wide and 150 mm for wider openings. … "

4.2 Inadequate cover, exposed reinforcement and honeycombing in a reinforced concrete element

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1, Section B Structure, Part B1 Structural provisions, B1D4 Determination of structural resistance of materials and forms of construction, states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(b) Concrete:

(i) Concrete construction (including reinforced and prestressed concrete): AS 3600.

Australian Standard AS3600 – 2018 is a relevant Australian Standard for reinforced concrete structures.

The voids, honeycombing and exposed reinforcement demonstrates a failure to comply with AS 3600 – 2018 Section 17 Material and Construction Requirements, Subsection 17.1 Material and Construction Requirements for Concrete and Grout, Clause 17.1.3 Handling, placing and compacting of concrete, which states:

"Concrete shall be handled, placed and compacted so as to –

...

(a) limit segregation or loss of materials;

(b) limit premature stiffening;

(c) produce a monolithic mass between planned joints or the extremities of members, or both;

(d) completely fill the formwork to the intended level, expel entrapped air, and closely surround all reinforcement, tendons, ducts, anchorages, embedments and fixings;
..."

Additional information

The required cover for a concrete element is related to its compressive strength and exposure classification. Additional information is available under Section 4 of AS3600.

A complimentary requirement to cover is the effective axis distance for reinforcement, this is governed by the required fire rating. Additional information is available under Section 5 of AS3600.

4.3 Concrete placed in rain or inclement weather

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1, Section B Structure, Part B1 Structural provisions, B1D4 Determination of structural resistance of materials and forms of construction, states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(b) Concrete:

(i) Concrete construction (including reinforced and prestressed concrete): AS 3600.

Australian Standard AS3600 – 2018 is a relevant Australian Standard for reinforced concrete structures.

The failure to adequately protect the cast concrete demonstrates a failure to comply with Australian Standard AS3600 – 2018 Concrete Structure, Section 17 Material and Construction Requirements, 17.1 Material and Construction Requirements for Concrete and Grout, 17.1.5 Curing and protection of concrete, 17.1.5.2 Protection, which states:

"Freshly cast concrete shall be protected from the effects of rain, running water and freezing or drying prior to hardening. During the initial curing period the concrete shall be protected from freezing or drying."

4.4 Required reinforcement in a concrete element has been cut or damaged

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1, Section B Structure, Part B1 Structural provisions, B1D4 Determination of structural resistance of materials and forms of construction, states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(b) Concrete:

(i) Concrete construction (including reinforced and prestressed concrete): AS 3600.

Australian Standard AS3600-2018 Concrete Structures is a relevant Australian Standard for concrete structures. When designing a concrete beam for strength, AS3600-2018 Section 8 Design of beams for strength and serviceability, 8.1 Strength of beams in bending, 8.1.2 Basis of strength calculations, Clause (c) states:

"The concrete has no tensile strength."

And

When designing a concrete slab for strength, Section 9 Design of slabs for strength and serviceability, 9.1 Strength of slabs in bending, 9.1.1 General states:

"The strength of a slab in bending shall be determined in accordance with Clauses 8.1.1 to 8.1.8..."

And

When designing a concrete column for strength Section 10 Design of columns for strength and serviceability, 10.6 Strength of columns in combined bending and compression, 10.6.1 Basis of strength calculations, Clause (b) states:

"The concrete has no tensile strength."

Therefore, in all cases (slabs, beams, columns) the concrete is taken to have no tensile strength. The resistance to tensile stresses (when assessing for strength) is wholly reliant on the provision of steel reinforcement. The cutting of steel reinforcement demonstrates defective or faulty workmanship because mitigation measures (such as scanning the concrete to locate the steel prior to cutting) were not enacted to avoid the cutting of reinforcement.

The failure of this element to resist tensile forces compromises the structural integrity of the element and therefore will cause or is likely to cause the inability to inhabit or use the building (or part of the building) for its intended purpose, or the destruction of the building or any part of the building, or a threat of collapse of the building.

4.5 Non-compliant movement or expansion joint in a suspended concrete element

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A load bearing element of the building must satisfy NCC 2022, Volume One Section B Structure, Part B1 Structural provisions Performance Requirements, B1P1 Structural reliability, which states:

"(a) By resisting the actions to which it may reasonably be expected to be subjected, a building or structure, during construction and use, with appropriate degrees of reliability, must—

(i) perform adequately under all reasonably expected design actions; and

(ii) withstand extreme or frequently repeated design actions; and

(iii) be designed to sustain local damage, with the structural system as a whole remaining stable and not being damaged to an extent disproportionate to the original local damage; and

(iv) avoid causing damage to other properties."

In the absence of a documented performance solution, compliance with B1P1 can be demonstrated by complying with B1D4 Determination of structural resistance of materials and forms of construction, which states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(b) Concrete:

(i) Concrete construction (including reinforced and prestressed concrete): AS 3600."

Australian Standard AS3600 – 2018 Concrete Structures, Section 19 Joints, embedded items and fixings, 19.1 Joints, 19.1.1 General states:

"A joint in a structure or member shall be designed and constructed so the load-carrying capacity and serviceability of the structure or member is maintained while serving its design function."

And

19.1.3 Movement Joints, 19.1.3.1 General, which states:

"Movement joints shall be designed and constructed to –
(a) control movement at a joint;

(b) control cracking at design locations; or

(c) provide articulation and separation between concrete members in a structure and meet their designed function without impairing the load-carrying capacity or serviceability of either the structure or member. "

The failure to construct in accordance with the approved plans and AS3600 demonstrates a failure to show compliance with the performance requirements of the NCC.

Additional information

There are generally two types of movement joints:

- Permanent movement joints (PMJ)
- Temporary movement joints (TMJ)

PMJs are designed to be free to move for the rest of the building's life and is generally used in larger buildings where thermal expansion/contraction becomes significant or where two elements may move independent of each other (eg the main tower may sway in the wind but the basement shoring wall will remain fixed). PMJs can be sleeved dowels or corbels.

TMJs are designed to give temporary movement during construction. It is generally used in large slab pours where the initial shrinkage from concrete may be significant, or where there is post-tensioning. TMJs are usually made up of a series of dowels in sleeves where the sleeve then becomes grouted after 56 days (where most of the shrinkage has occurred). In the long-term, TMJs are not expected to move and the slab should act monolithically (unlike PMJs).

It's important to cross-reference the approved plans, the references to the Standards do not give definitive requirements for PMJs or TMJs.

4.6 The slab on ground does not have saw-cut joints/isolation joints in accordance with the approved plans

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A load bearing element of the building must satisfy NCC 2022, Volume One Section B Structure, Part B1 Structural provisions Performance Requirements, B1P1 Structural reliability, which states:

"(a) By resisting the actions to which it may reasonably be expected to be subjected, a building or structure, during construction and use, with appropriate degrees of reliability, must—

(i) perform adequately under all reasonably expected design actions; and

(ii) withstand extreme or frequently repeated design actions; and

(iii) be designed to sustain local damage, with the structural system as a whole remaining stable and not being damaged to an extent disproportionate to the original local damage; and

(iv) avoid causing damage to other properties."

In the absence of a documented performance solution, compliance with B1P1 can be demonstrated by complying with B1D4 Determination of structural resistance of materials and forms of construction, which states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(b) Concrete:

(i) Concrete construction (including reinforced and prestressed concrete): AS 3600."

Australian Standard AS3600 – 2018 Concrete Structures, Section 21 Slab-on-ground floors, pavements and footings, 21.2 Design considerations, which states:

"The design of pavements and slabs supported by the ground and any joints therein shall take into account, *but not be limited to, the following considerations:*

(a) The determination of design loading.

(b) Soil-structure interaction

...

(h) Techniques to control and minimise cracking.

(i) Techniques to minimise shrinkage warping.

..."

The failure to construct in accordance with the approved plans and AS3600 demonstrates a failure to comply with the performance requirements of the NCC.

Additional information

Care should be used when using this defect reference, the lack of isolation and saw-cut joints is not necessarily a defect.

Firstly, not all slabs on ground require saw-cut joints and in some instances, these joints may be detrimental to the structure. Such examples may include hydrostatic slabs (where the slab needs to be water-tight) or where the slab has been constructed over low strength soil – in which the slab is designed to operate as a suspended slab rather than a slab on ground. In both these cases, there is sufficient reinforcement in the slabs to control cracking or the slab is not designed to crack.

Secondly, there is often a misunderstanding that saw cut joints somehow stop cracks. Rather, saw-cut joints are designed to induce cracks at the saw-cut locations. If there were no saw-cuts the cracks would propagate randomly and be very unsightly.

It's also important that the approved plans are referenced because the standard does not give set requirements for where joints should be created.

4.7 Entrained debris and other contaminants in a concrete element

References to the applicable standards

Australian Standard AS1379-2007 Specification and supply of concrete is the relevant Australian Standard for the supply of concrete.

The inclusion of debris and other materials in the concrete mix demonstrates a failure to comply with AS1379, Section 2 Concrete constituents, 2.6 Other materials, which states:

"Other materials, such as fibres, pigments and special additives, shall be used in accordance with the material manufacturer's specifications. Materials that are not compatible shall not be used in the same volume of plastic concrete."

5. Building enclosure defects

5.1 Cavity flashing does not protrude from the face of the brickwork

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1, Section B Structure, Part B1 Structural provisions, B1D4 Determination of structural resistance of materials and forms of construction, states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(a) Masonry (including masonry-veneer, unreinforced masonry and reinforced masonry): AS 3700 … "

Australian Standard AS3700-2018 Masonry Structures is a relevant Australian Standard for masonry walls.

The failure to install the flashings such that they project the face of the masonry demonstrates a failure to comply with AS3700-2018 Masonry Structures 12.4 Workmanship, 12.4.16 Damp-proof course and flashing (DPC), which states:

"Flashings, including overflashings, shall be built-in with projections that are of sufficient size and orientation to direct the moisture from the masonry in the required manner."

5.2 Weepholes in a cavity masonry wall are absent or exceed the maximum spacings

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1, Section B Structure, Part B1 Structural provisions, B1D4 Determination of structural resistance of materials and forms of construction, states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(a) Masonry (including masonry-veneer, unreinforced masonry and reinforced masonry): AS 3700 … "

Australian Standard AS3700-2018 Masonry Structures is a relevant Australian Standard for masonry walls.

The failure to provide weepholes at 1200mm centres demonstrates a failure to comply with AS3700-2018 Masonry Structures 4 General Design Aspects, 4.7 Prevention of moisture penetration, 4.7.2 Weepholes which states:

"Weepholes shall be provided to drain moisture from or through masonry construction. Where flashings are incorporated in the masonry, weepholes shall be provided in the masonry course immediately above the flashing, at centres not exceeding 1200 mm."

5.3 An external window or door has not been installed with adequate flashings

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1, Section F Health and Amenity, Part F3 Roof and wall cladding, F3P1 states:

"A roof and external wall (including openings around windows and doors) must prevent the penetration of water that could cause –
(a) unhealthy or dangerous conditions, or loss of amenity for occupants; and

(b) undue dampness or deterioration of building elements."

The DTS pathway to satisfying F3P1 is via F3D4, which states:

"(1) Subject to (2) and (3), the following glazed assemblies in an external wall, must comply with AS 2047 requirements for resistance to water penetration:

(a) Windows

(b) Sliding and swinging glazed doors with a frame, including French and bi-fold doors with a frame.

(c) Adjustable louvres.

(d) Shopfronts.

(e) Window walls with one piece framing."

Australian Standard AS2047-2014 Windows and external glazed doors in buildings is a relevant Australian Standard for external windows and doors.

The failure to incorporate flashings into the building envelope and install in accordance with the approved plans demonstrates a failure to comply with AS2047-2014 Windows and external glazed doors in buildings, Section 7 Installation, 7.2 Installation, 7.2.2 Flashing, which states:

"Flashing shall be incorporated into the building envelope where it is necessary—
(a) to restrict water from entering into the interior of a building from the exterior;

(b) to restrict water passing across a cavity to the inner leaf; or

(c) to shed water through cladding to the outer face."

Additional information

Refer to Figure 7.1 within AS2047 for typical flashing construction.

5.4 The weepholes in a cavity masonry wall is below the level of the floor

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1, Section B Structure, Part B1 Structural provisions, B1D4 Determination of structural resistance of materials and forms of construction, states:

"The structural resistance of materials and forms of construction must be determined in accordance with the following, as appropriate:

(a) Masonry (including masonry-veneer, unreinforced masonry and reinforced masonry): AS 3700 … "

Australian Standard AS3700-2018 Masonry Structures is a relevant Australian Standard for masonry walls.

Weepholes are required in cavity masonry construction to allow moisture in the cavity to drain. Moisture cannot drain from the cavity if the invert of the weephole is located below the adjoining external finished floor level. The failure to allow for adequate drainage demonstrates a failure to comply with Australian Standard AS3700-2018 Masonry Structures Section 12 Construction, 12.4 workmanship which states:

"12.4.14 Weepholes
Weepholes shall be free from any mortar or other material that will prevent their proper functioning. Weepholes shall be formed either by the inclusion of a pipe or duct at the given location or by omission of mortar (partially or fully) in the perpend joint."

The adjoining finished floor level and floor finishes would be considered material that will prevent the weephole from proper functioning in the context of Clause 12.4.14.

5.5 Use of combustible cladding

References to the NCC and applicable standards

The National Construction Code (NCC) is a performance-based document where compliance can be demonstrated either through the Deemed to Satisfy pathway or the Performance Solution pathway. In the absence of a performance solution, it is assumed that the Developer intended to satisfy the NCC via the Deemed to Satisfy pathway.

NCC 2022 Volume 1 Section C Fire, Part C1 Fire resistance Performance Requirement C1P2 Spread of fire states:

"A building must have elements which will, to the degree necessary, avoid the spread of fire—
a) to exits; and

b) to sole-occupancy units and public corridors; and

c) between buildings; and

d) in a building."

The Deemed-to-Satisfy pathway for C1P2 is C2D10 which states:

"(1) In a building required to be of Type A or B construction, the following building elements and their components must be non-combustible:

a) External walls and common walls, including all components incorporated in them including the facade covering, framing and insulation.

b) The flooring and floor framing of lift pits.

c) Non-loadbearing internal walls where they are required to be fire-resisting."

The NCC defines non-combustible as:

"Non-combustible

Applied to—
a) a material — means not deemed combustible as determined by AS 1530.1 — Combustibility Tests for Materials; or

b) construction or part of a building — means constructed wholly of materials that are not deemed combustible."

Additional information

In NSW, ACP (Aluminium Composite Panel) with a core comprised of more than 30% PE (Polyethylene) by mass has been banned for use in any external cladding, external wall, external insulation, facade or rendered finish in buildings with the following classification:

- Type A construction as defined in the Building Code of Australia:
  - Class 2, 3 and 9 buildings with a rise in storeys of three or more
  - Class 5, 6, 7 and 8 buildings with a rise in storeys of four or more
- Type B construction as defined in the Building Code of Australia:
  - Class 2, 3 and 9 buildings with a rise in storeys of two or more
  - Class 5, 6, 7 and 8 buildings with a rise in storeys of three or more

Any person or corporation who does not comply with the ban can be subject to fines. A corporation can be fined up to $1.1 million and individuals can be fined up to $220,000.

The ban took effect on 15 August 2018. More information about the ban can be found on the Fair Trading website.[1]

1 https://www.fairtrading.nsw.gov.au/trades-and-businesses/construction-and-trade-essentials/building-products/aluminium-composite-panel-ban

Refer to C2D10(5) and C2D10(6) for a list of materials that are considered to comply C2D10(1). Note this exemption has changed between the 2019 version of the NCC and the 2022 version of the NCC.

C2D10(5) states:

"(5) The following materials, when entirely composed of itself, are non-combustible and may be used wherever a non-combustible material is required:

- *a) Concrete.*
- *b) Steel, including metallic coated steel.*
- *c) Masonry, including mortar.*
- *d) Aluminium, including aluminium alloy.*
- *e) Autoclaved aerated concrete, including mortar.*
- *f) Iron.*
- *g) Terracotta.*
- *h) Porcelain.*
- *i) Ceramic.*
- *j) Natural stone.*
- *k) Copper.*
- *l) Zinc.*
- *m) Lead.*
- *n) Bronze.*
- *o) Brass."*

C2D10(6) states:

"(6) The following materials may be used wherever a non-combustible material is required:

- *a) Plasterboard.*
- *b) Perforated gypsum lath with a normal paper finish.*
- *c) Fibrous-plaster sheet.*
- *d) Fibre-reinforced cement sheeting.*
- *e) Pre-finished metal sheeting having a combustible surface finish not exceeding 1 mm thickness and where the Spread-of-Flame Index of the product is not greater than 0.*
- *f) Sarking-type materials that do not exceed 1 mm in thickness and have a Flammability Index not greater than 5.*
- *g) Bonded laminated materials where—*
  - *i. each lamina, including any core, is non-combustible; and*
  - *ii. each adhesive layer does not exceed 1 mm in thickness and the total thickness of the adhesive layers does not exceed 2 mm; and*
  - *iii. the Spread-of-Flame Index and the Smoke-Developed Index of the bonded laminated material as a whole do not exceed 0 and 3 respectively; and*
  - *iv. when located externally, are fixed in accordance with C2D15."*

6. Building services defects

6.1 Jet fans (impulse fans) obstructed by fire protection devices

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. In the absence of a documented performance solution, compliance with the NCC can be demonstrated via compliance with Deemed-to-Satisfy provision Section E Services and equipment, Part E2 Smoke hazard management, E2D3 General requirements and E2D12 provisions, which states:

"A Class 7a building, including a basement, provided with a mechanical ventilation system in accordance with AS 1668.2 must comply with clause 5.5 of AS 1668.1

Australian Standard AS1668.1-2015 The use of ventilation and air conditioning in buildings Part 1: Fire and smoke control in buildings is a relevant Australian Standard for mechanical ventilation systems in buildings. The installation of fire detection devices and sprinkler heads in the path of a jet fan demonstrates a failure to comply with AS1668.1-2015 Section 5 Miscellaneous systems, 5.5 Car park ventilation systems, which states:

"Where an additional air-moving device, installed in accordance with AS 1668.2, is a fan (such as a jet fan), it—
(a) shall be located centrally and discharge centrally between rows of fire protection

devices, e.g. sprinkler heads and smoke or heat detectors;
..."

Additional information

Refer to the Guideline for impulse fans in car parks published by Fire & Rescue NSW.

6.2 A room does not have natural or mechanical ventilation

References to the NCC and applicable standards

The National Construction Code is a performance-based document where compliance with a performance requirement is achieved through a Performance Solution, a Deemed-to-Satisfy solution or a combination of both. A building must comply with the following performance requirements:

NCC 2022 Volume One, Section F Health and amenity, Part F4 Light and ventilation Performance Requirements F6P3 Outdoor air supply, which states:

"A space in a building used by occupants must be provided with means of ventilation with outdoor air which will maintain adequate air quality."

And

"F6P4 Mechanical ventilation to control odours and contaminants
A mechanical air-handling system installed in a building must control—

(a) the circulation of objectionable odours; and

(b) the accumulation of harmful contamination by micro-organisms, pathogens and toxins."

And

"F6P5 Disposal of contaminated air
Contaminated air must be disposed of in a manner which does not unduly create a nuisance or hazard to people in the building or other property."

In the absence of a documented performance solution, compliance with F6P3 to F6P5 can be demonstrated by constructing in accordance with Part F4 Light and ventilation, F6D6 Ventilation of rooms, which states:

"A habitable room, office, shop, factory, workroom, sanitary compartment, bathroom, shower room, laundry and any other room occupied by a person for any purpose must have—
(a) natural ventilation complying with F4.6; or

(b) a mechanical ventilation or air-conditioning system complying with AS 1668.2 and AS/NZS3666.1."

Additional information

Natural ventilation must be provided directly via a door or a window which opens to an outdoor area or it may be borrowed from an adjoining room. Refer to DtS F46D8 for the rules around ventilation from an adjoining room.

6.3 A flexible duct seal is not airtight

References to the applicable standards

Australian Standard AS4254.1-2012 Ductwork for air-handling systems in buildings-flexible duct is a relevant Australian Standard for flexible ducting.

The improper installation demonstrates a failure to comply with AS4254.1 Section 2 Construction and installation, 2.2 Flexible duct sealing, 2.2.7 Leakage, which states:

"An insulated flexible duct's outer jacket/sleeve shall be airtight.

When flexible duct is installed uninsulated, it shall be airtight."

6.4 A flexible duct does not have compliance markings

References to the applicable standards

Australian Standard AS4254.1-2012 Ductwork for air-handling systems in buildings-flexible duct is a relevant Australian Standard for flexible ducting.

The improper installation demonstrates a failure to comply with AS4254.1 Section 2 Construction and installation, 2.7 Labelling of flexible duct, which states:

"Labelling of the outer jacket/sleeve of all insulated flexible duct shall comply with the following:
(a) Labelling shall

(i) be repeated along with the total length of the duct at 1000 mm intervals;

(ii) be legible for the flexible duct's service life; and

(iii) have characters at least 10 mm high.

(b) The label on the outer jacket/sleeve of all insulated flexible ductwork shall include the following information:

(i) Name of manufacturer.

(ii) Compliance with AS 4254.1.

(iii) The R value of the flexible duct."

6.5 Non-compliant rigid duct sealing

References to the applicable standards

Australian Standard AS4254.2-2012 Ductwork for air-handling systems in buildings-Rigid duct is a relevant Australian Standard for rigid ducting.

The improper installation demonstrates a failure to comply with AS4254.2 Section 2 Duct construction and installation, 2.2 Duct Sealing, which states:

"2.2.1 General
Where sealing is a requirement of this Standard, the following criteria apply to the sealing of ducts:

(a) Adhesives, mastics, gaskets, or combination thereof shall be used to close openings in the surface of the ductwork through which air leakage would otherwise occur.

(b) Where welding is used for sealing, it shall be continuous."

And Table 2.2.1 Duct sealing requirements specifies which joints are to be sealed for a corresponding static pressure.

Seal Class	Sealing required	Static pressure classification, Pa
A	All transverse joints, longitudinal seams and duct wall penetrations	≥1000
B	All transverse joints and longitudinal seams	501-999
C	Transverse joints and longitudinal seams for 50mm from the end of each piece of duct	≤500

6.6 A rigid duct has not been adequately supported

References to the applicable standards

Australian Standard AS4254.2-2012 Ductwork for air-handling systems in buildings-Rigid duct is a relevant Australian Standard for rigid ducting.

The improper installation demonstrates a failure to comply with AS4254.2 Section 4 Function criteria, 4.1 Deflection, which states:

"4.1.5 Beam strength of duct section
A duct section between adjacent hangers shall be capable of carrying its own weight and resist external loads for which it is constructed."

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