Pathways to Compliance

Understanding Cladding and the Requirements of the National Construction Code

CPD LIVE
Free CPD education online

alspec
ALUMINIUM SYSTEMS SPECIALISTS

ALUMINIUM FACADE SYSTEMS
POWERED BY ALSPEC

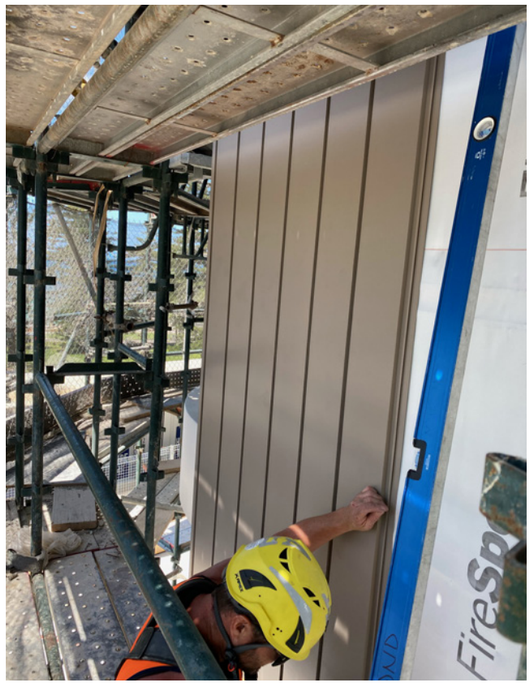
Compliance with fire performance requirements is especially important given the recent focus on fire safety in the aftermath of the catastrophic 2017 Grenfell and 2014 Lacrosse tower fires.

The facade and cladding system is one of the most important aspects of a building from a design perspective. It is required to manage condensation, protect the building from inclement weather, resist the spread of fire and has a significant impact on energy efficiency. However, despite its critical role, facade and cladding design, specification and installation has been the subject of a variety of recent compliance issues in Australia.

A 2019 Australian study conducted by Deakin University in conjunction with Griffith University found that defects relating to building facades and cladding systems were commonplace in buildings across the country.[1] These defects ranged from ineffective weatherproofing to the use of flammable cladding. Not only are such defects costly to resolve, they impact property values and can make buildings unsafe.

Against this backdrop, a thorough understanding of the performance requirements and testing procedures that impact facade and cladding systems is critical. Compliance with fire performance requirements is especially important given the recent focus on fire safety in the aftermath of the catastrophic 2017 Grenfell and 2014 Lacrosse tower fires.

In this whitepaper, we identify the compliance pathways provided by the National Construction Code (NCC) and some of the key requirements and testing procedures relevant to building facades and cladding. In doing so, we provide information necessary to evaluate different facade and cladding systems and highlight the benefits of solid aluminium as a compliant cladding solution.



Pathways to Compliance

Governing Requirements – Section A

In the NCC Vol. 1, Section A sets out the three pathways for complying with Performance Requirements, specifically:

- Performance Solutions;
- Deemed-to-Satisfy Solutions; or
- a combination thereof.

Deemed-to-Satisfy Solution

A Deemed-to-Satisfy (DtS) Solution follows all the DtS Provisions set out in the NCC for a particular Performance Requirement.[2] The DtS Provisions are a prescriptive list of requirements, akin to a checklist, that enable compliance if followed.[3]

A DtS Solution must comply with the relevant Performance Requirements and is verified using the following Assessment Methods:

- evidence of suitability; and/or
- expert judgement.

Performance Solution

A Performance Solution is a tailored solution that is designed to meet the intended objective of the Performance Requirements.[4] Compliance with the relevant Performance Requirements must be verified using one or a combination of the following Assessment Methods:[5]

- evidence of suitability;
- Verification Methods;
- expert judgement; and or
- comparison with the DtS Provisions.

Combination – DtS and Performance Solution

Under A2.4 of the NCC Vol. 1, both DtS and Performance Solutions can be used to satisfy a single Performance Requirement. This may include Performance Requirements that cover several elements within a building. The appropriate Assessment Methods must be used.

Performance Requirements for Cladding Systems

Structural Provisions – Section B

In Section B of the NCC Vol. 1, BP1.1 provides that a building or structure, during construction and use, with appropriate degrees of reliability, must perform adequately under all reasonably expected design actions and withstand extreme or frequently repeated design actions. The actions covered by BP1.1 include dead loads, imposed actions (live loads arising from occupancy), wind actions, earthquake, snow, differential earth movements, and thermal effects.

The DtS Solution for BP1.1 is provided in B1.1 and B1.2. As per B1.1, the resistance of the building must be greater than the most critical action effect resulting from different combinations of actions. The most critical action effect is determined in accordance with B1.2 and the general design procedures contained in AS/NZS 1170. The resistance of a building or structure is determined in accordance with B1.4.

B1.2 sets out how the magnitude of individual actions are determined with reference to the different parts of AS/NZS 1170.

Weatherproofing – Section F

The weatherproofing requirement for facade and cladding systems is set out in FP1.4 of the NCC Vol. 1. Under FP1.4, an external wall must prevent the penetration of water that would cause unhealthy or dangerous conditions, or loss of amenity for occupants and undue dampness or deterioration of building elements. There are no DtS Provisions with respect to FP1.4 for external walls, however FV1.1 sets out the testing procedure for verifying whether an external wall is compliant.

Fire Resistance – Section C

Under Section C of the NCC Vol. 1, buildings must have elements (including external walls) that resist the spread of fire and maintain structural stability during a fire. These requirements are found in CP1 to CP9 along with other provisions relating to the protection of openings, protection of service and emergency equipment, evacuation, and fire brigade access.

The DtS Provisions in C1.9 require that, in buildings of Type A or B construction, external and common walls and all components incorporated in them must be non-combustible. Not to be confused with building class, type of construction is determined by the building's class and rise in storeys.

In accordance with Specification C1.1 of the NCC, external walls of Type A and B buildings must be non-combustible, notwithstanding any requirement for fire rating.

Testing for Compliance

Structural and Weatherproofing Tests

AS/NZS 1170 outlines procedures and criteria for the structural design of buildings. The various parts of AS/NZS 1170 specify the design values of permanent, imposed and other actions, wind action, snow and ice actions, and earthquake actions to be used in structural design. Two basic limit states are defined by AS/NZS 1170 – the Serviceability Limit State (SLS) and the Ultimate Limit State (ULS) – which are relevant to structural testing.

AS/NZS 4284:2008 Testing of building facades outlines the regime for testing multiple aspects of a facade system's performance, including its structural strength and weatherproofing. The method in AS/NZS 4284 is based on the SIROWET test, which was developed by the CSIRO to cope with wind driven weather conditions likely to be experienced over the life of a building.[6] The weathertightness aspect of AS/NZS 4284 looks at whether water is leaking through to the interior of the building and visible on the inside surface of the facade.[7]

Under AS/NZS 4284, the building facade is subjected to various tests to determine the performance of a facade under wind and other optional loadings. Tests include:

- displacement and deflection of the facade or prototype;
- positive and negative wind and static and cyclic water pressure;
- structural testing (at serviceability limit and at ultimate limit);
- air infiltration; and
- water penetration testing by static pressure followed by cyclic pressure testing.

Other tests include building maintenance unit (BMU) restraint, seismic loading and seal degradation.

Fire Tests

Under the NCC, "non-combustible" is applied to a material that is not deemed combustible under AS 1530.1:1994 Combustibility test for materials. The AS 1530.1 small scale test involves immersing a sample in a furnace held at 750°C for 30 min.[8] A material is deemed combustible if:[9]

- the material flames for 5 seconds or longer anytime during the test;
- the mean furnace thermocouple temperature rise exceeds 50°C; and
- the mean specimen surface thermocouple temperature rise exceeds 50°C.

The DtS Provisions in C1.9(e) provide a list of materials that may be used whenever a non-combustible material is required.

When developing a Performance Solution, Verification Method CV3 applies when determining whether an external wall is compliant with CP2 to avoid the spread of fire. This Verification Method includes additional sprinkler requirements and refers to the testing method in AS 5113:2016 Fire propagation test of external walls.

The AS 5113 external wall test simulates two storeys with an opening with various temperature measures. The criteria for the AS 5113 test includes but is not limited to:

- no flame spread beyond the edge of the specimen;
- no flaming on ground (debris or molten material) for more than 20s; and
- not more than 2kg of fallen debris.

Other Tests

A range of other tests are applicable to building facade systems. This includes, for example:

- hail impact testing (ASTM E822);
- cyclonic debris impact testing (AS 1170.2); and
- Bushfire Attack Level (BAL) rating (AS 1530.8.1:2007 and AS 1530.8.2:2007).

Building audits after the Grenfell and Lacrosse fires found that thousands of Australian buildings were clad with combustible facades.

Evaluating Facade and Cladding Systems

General

In addition to structural integrity, weatherproofing and fire resistance, acoustic performance, heat transmission, thermal expansion, paint finish durability and accelerated weathering should also be assessed. Careful consideration must be given for all of the common factors, including wind load, thermal cycling, thermal expansion and contraction of components, water ingress or penetration, corrosion due to contact with dissimilar metals, building movement, earthquake and fire.

Oil Canning

Visible distortion of cladding or waviness can occur on some metal cladding systems due to differential stresses within the metal -- this is known as “oil canning”. Thermal expansion and contraction of the metal and temperature changes can contribute to this phenomenon.

Several other factors contribute to oil canning:

- Type of material: Materials have different properties and behave differently in relation to thermal expansion and contraction.
- Panel dimensions: Larger panels and thin materials are more likely to ripple.
- Joint design: Must be wide enough to allow for thermal expansion and contraction.
- Fixings: Over-tightened fixings will prevent movement.
- Stiffeners: Inappropriate or improperly attached stiffeners on the rear of metal cladding panels may contribute to distortion.

Note that cladding products have their own preferred fixing method and the manufacturer’s installation guidelines should be followed. The above factors should be considered when specifying metal cladding systems.

Aluminium Panels – Solid vs Composite Panels

Two high profile tower fires, Grenfell in 2017 and Lacrosse in 2014, put a spotlight on the dangers of flammable cladding. It was determined that the use of lightweight aluminium composite panels (ACPs) with a combustible polyethylene (PET) core played a major role in the spread of fire in both tower incidents. In a fire, PET ignites, melts and drips, increasing the fire and quickly spreading it beyond the initial fire source.

Building audits after the Grenfell and Lacrosse fires found that thousands of Australian buildings were clad with combustible facades. In New South Wales alone, over 440 buildings were reported to be potentially clad in flammable material, although the list has not been made public.[10] Buildings clad in flammable materials have seen a significant increase in their insurance premiums and a decline in property value. Furthermore, the cost of rectifying flammable cladding is extremely high.

How has this impacted facade and cladding design?
In 2018, the use of ACPs with a core of over 30% PET in external facade and cladding applications was banned in New South Wales[11] and Victoria.[12] Note that there are exceptions, including where the product is not deemed combustible under AS 1530.1.[13]

When specifying facade and cladding materials, it is critical to verify that the materials are non-combustible in accordance with AS 1530.1. Evidence of testing and certification by independent laboratories should be readily available to confirm the performance characteristics of the product and whether it is compliant with the NCC.

A distinction should be made between ACPs and solid aluminium panels. Unlike ACPs with a PET core, solid aluminium panels will prevent the spread of flames as aluminium is inherently non-combustible.[14] Aluminium also offers a range of additional performance benefits including strength, durability, light weight, flexibility, and corrosion-resistance.

Building Life Considerations

All components used in a facade or cladding system need to be considered for life and durability. For example, gaskets and sealants may have a warranty for up to 10 years. However, if they are not replaced at regular intervals there could be issues with water penetration, mould growth and structural damage leading to component failure.

Aesthetics and durability are often related considerations. For example, cladding may have a 25-year paint performance warranty but will at some stage require additional work or total replacement to preserve a quality appearance or maintain expected levels or performance.

ALSPEC

Aluminium Facade Systems
powered by Alspec

With locations across the country, Alspec is an Australian-owned, forward looking company that works in-house to design, develop and test reliable aluminium systems, hardware and accessories to meet evolving market needs for a wide range of building applications.

Alspec sources the most advanced and highest quality materials from its two extruding facilities in Victoria and Queensland. With a national research and development team based in Queensland, the company has direct access to a NATA-accredited testing facility. This provides the customer with fully tested systems that meet and/or exceed current and relevant Australian standards and also deliver on-trend aesthetics.

Alspec’s ProClad™ System is a complete non-combustible aluminium facade system, incorporating intelligent fixing methods to ensure maximum performance and lifespan of a facade.

This range includes:

- ProClad SOLID: Non-combustible PVDF pre-finished solid aluminium panels.
- ProClad LINEAR: An intelligent interlocking facade system in three different profiles and an array of powder-coated colors.
- ProClad FIXINGS: Non-combustible aluminium fixings for compliant and safe installation.

ProClad™ is the perfect solution for any new constructions as well as recladding of existing projects. Architects, designers, developers, builders and contractors can feel confident when specifying ProClad™ products as they are 100% non-combustible (as tested in accordance with AS 1530.1 and AS 1530.3), require low maintenance, are backed by extensive warranties and have a high level of safety and durability.

For more information, please visit **www.aluminiumfacadesystems.com.au**

ALSPEC.COM.AU

References

1 Johnson, Nicole and Sacha Reid. “An Examination of Building Defects in Residential Multi-owned Properties.” Griffith University. https://www.griffith.edu.au/__data/assets/pdf_file/0030/831279/Examining-Building-Defects-Research-Report.pdf (accessed 25 October 2020).

2 Australian Building Codes Board. “Understanding the NCC.” ABCB. https://www.abcb.gov.au/-/media/Files/Resources/Education-Training/HowToComplyWithTheNCC.pdf (accessed 25 October 2020).

3 Ibid.

4 Ibid.

5 Ibid.

6 Roonan, WW and JF Howell. “Sirowet — A comprehensive dynamic full scale curtain wall testing procedure.” Journal of Wind Engineering and Industrial Aerodynamics Vol. 36, Pt. 2 (1990): 1173-1179.

7 Overton, Greg. “Shaking up façade testing.” Build Magazine. https://www.buildmagazine.org.nz/assets/PDF/Build-155-72-Feature-Exteriors-Shaking-Up-Facade-Testing.pdf (accessed 25 October 2020).

8 Webb, A and N White. “Fire safety guideline for external walls.” CSIRO. https://www.csiro.au/~/media/Do-Business/Files/Services/CSIRO-External-Wall-Safety-Guide-18-04-2016-PDF.pdf (accessed 25 October 2020).

9 Ibid.

10 Rabe, Tom and Nick Bonyhady. “Cladding list kept secret amid demands for action on ‘construction crisis’.” Sydney Morning Herald. https://www.smh.com.au/national/nsw/cladding-list-kept-secret-amid-demands-for-action-on-construction-crisis-20191104-p537dg.html (accessed 25 October 2020).

11 New South Wales Government. “Aluminium composite panel ban.” Fair Trading. https://www.fairtrading.nsw.gov.au/trades-and-businesses/construction-and-trade-essentials/building-products/aluminium-composite-panel-ban (accessed 25 October 2020).

12 Bleb, Michael. “Victoria bans high-content polyethylene cladding.” Australian Financial Review. https://www.afr.com/property/victoria-bans-highcontent-polyethylene-cladding-20180312-h0xd10 (accessed 25 October 2020).

13 Above n 11.

14 Aluminium Federation. “Aluminium and Fire.” ALFED. http://www.alfed.org.uk/files/Fact%20sheets/11-aluminium-and-fire.pdf (accessed 25 October 2020).