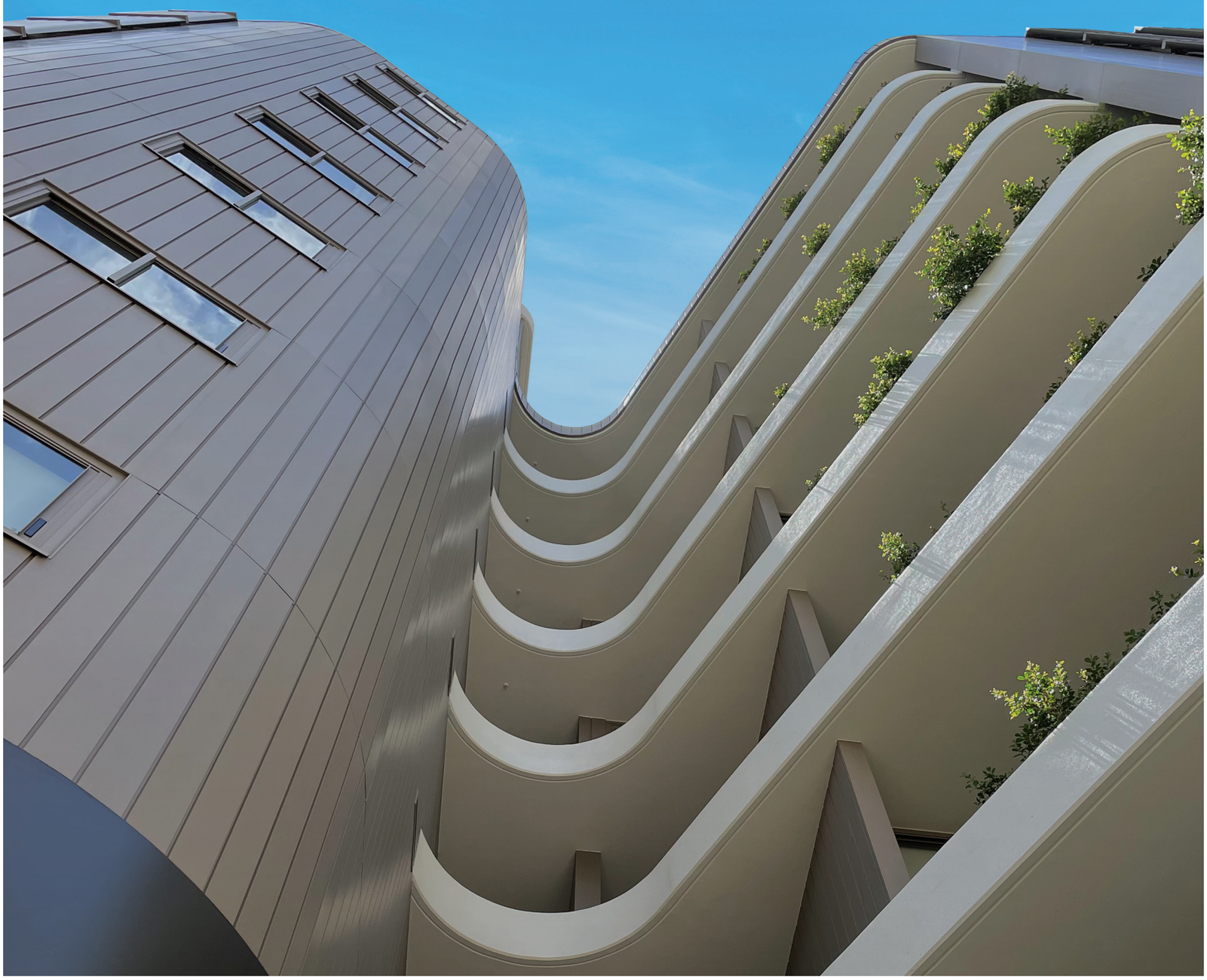
Pathways to Compliance

Understanding Cladding and the Requirements of the National Construction Code 2022



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Buildings clad in flammable materials have seen a significant increase in their insurance premiums and a decline in property value.

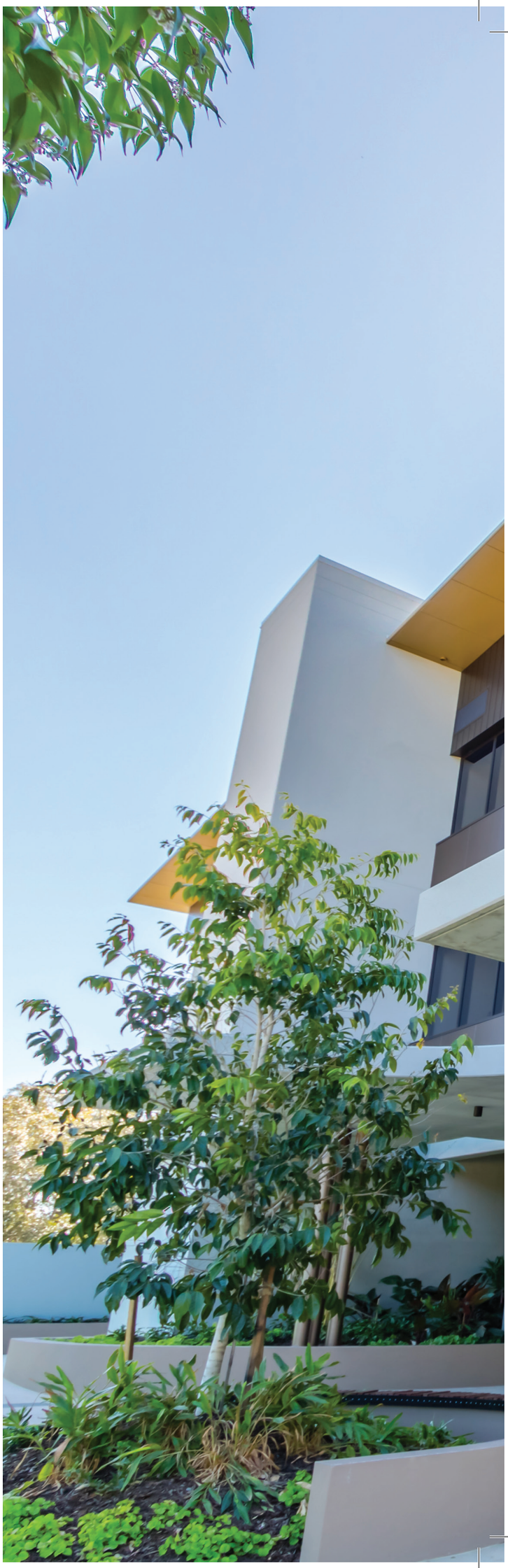
INTRODUCTION

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 their critical role, facade and cladding design, specification and installation have 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 2022** (NCC 2022) 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 be 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 A2G4 of the NCC 2022 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 2022 Vol. 1, B1P1 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 B1P1 include:

(a) permanent actions (dead loads) including, for a Class 7b building, an additional notional permanent roof load of not less than 0.15 kPa to support the addition of solar photovoltaic panels; and

(b) imposed actions (live loads arising from occupancy and use); and

(c) wind action; and

(d) earthquake action; and

(e) snow action; and

(f) liquid pressure action; and

(g) ground water action; and

(h) rainwater action (including ponding action); and

(i) earth pressure action; and

(j) differential movement; and

(k) time dependent effects (including creep and shrinkage); and

(l) thermal effects; and

(m) ground movement caused by—

  (i) swelling, shrinkage or freezing of the subsoil; and

  (ii) landslip or subsidence; and

  (iii) siteworks associated with the building or structure; and

(n) *construction activity actions*; and

(o) termite actions.

Source: https://ncc.abcb.gov.au/editions/ncc-2022

The DtS Solution for B1P1 is provided in B1D2 and B1D3. As per B1D2, 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 B1D3 and the general design procedures contained in AS/NZS 1170. The resistance of a building or structure is determined in accordance with B1D4.

B1D3 sets out how the magnitude of individual actions is 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 F3P1 of the NCC 2022 Vol. 1. Under F3P1, 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.

Note that F3P1 does not apply to:

- a Class 7 or 8 building where, in the particular case, there is no necessity for compliance; or
- a garage, tool shed, sanitary compartment, or the like, forming part of a building used for other purposes; or
- an open spectator stand or open-deck carpark.

F3V1 sets out the relevant testing procedures for verifying whether an external wall is compliant.

The DtS Provisions with respect to F3P1 cover roof coverings (F3D2), sarking (F3D3), glazed assemblies (F3D4) and wall cladding (F3D5). Per F3D5, metal cladding that satisfies the requirements of AS 1562 “Design and installation of metal roof and wall cladding” is deemed to comply.

Fire Resistance – Section C

Under Section C of the NCC 2022 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 Parts C1 to C4.

C1P2 requires buildings to have elements that will, to the degree necessary, avoid the spread of fire; this includes external walls. Verification Method C1V3 applies when determining whether an external wall is compliant with C1P2.

C2D10 is another notable provision as it mandates that for Type A or B construction, all 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 (see C2D2).

Note that C2D10(5) specifies materials that, when entirely composed of that material, are non-combustible and may be used wherever a non-combustible material is required. This list includes aluminium. Further, under C2D10(6), 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, may be used when a non-combustible material is required.

There is also a notable exception in C2D10(6)(g) for bonded laminate materials where each lamina, including any core, is non-combustible, among other conditions.

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 are as follows:

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

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.

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 to 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 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 are fire resistant, 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 lifespan 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.

PROJECT REMEDIATE APPROVED PRODUCTS

The New South Wales government’s Project Remediate is one of Australia's largest cladding rectification programs. Project Remediate offers 10-year interest-free loans for cladding rectification projects along with up to $139 million in funding for program management and quality assurance.

All products used in Project Remediate need to be authorised. The Cladding Product Safety Panel (CPSP) offers the New South Wales Cladding Taskforce and the Cladding Support Unit expert advice on the suitability of replacement cladding products and external wall assembly techniques. The following is a list of four product categories that are suitable replacements for non-compliant cladding per the CPSP's initial report:[15]

- solid aluminium;
- solid metal sheets;
- fibre cement; and
- non-combustible cement render.

ALUMINIUM FACADE SYSTEMS

Aluminium Facade Systems specialises in high-quality, fully compliant, non-combustible aluminium facade solutions. The company is backed and serviced nationally by Alspec, Australia's market-leading aluminium system specialists with over 46 years of experience.

With four decades of experience, Aluminium Facade Systems prides itself on giving the customer a unique experience with the ability to design, manufacture and perform tests at its NATA-accredited testing centre.

Aluminium Facade Systems **ProClad™** range 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™ is the perfect solution for any new construction as well as the 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.

Reference

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