Building with Polymer Formwork

A Guide to NCC Fire Compliance

DINCEL
STRUCTURAL WALLING

Introduction

With fire regulations constantly evolving, fire compliance is critical for building professionals. It is thus timely to examine current fire compliance requirements, the methods to prove compliance with the National Construction Code (NCC), and how these issues relate to polymer formwork wall systems for internal and external walls.

Inadequate wall systems, poor construction or a lack of awareness of the relevant fire performance requirements can result in non-compliance, which can have serious repercussions, such as expensive litigation and repairs. In light of the rise of building defects, it is incumbent on practitioners to identify risk factors and take the necessary steps to design and construct safe, healthy and functional buildings.

Polymer formwork has emerged as an efficient and high-performing method of construction, but there are misconceptions about its performance in a fire event. Below, we highlight the relevant NCC fire performance requirements for Class 2 to 9 buildings and methods to demonstrate compliance.

Type of construction

In Vol. 1 of the NCC, Section C “Fire Resistance” sets out the minimum fire-resisting construction requirements for all Class 2 to 9 buildings. The “type of construction” of a building affects the level of fire resistance expected for both its structural and non-loadbearing components.

The NCC classifies buildings into three types of construction—A, B and C—which are in descending order according to fire resistance. The required minimum type of construction is determined by two factors:

- Class of building: This is a measure of the building’s likely use, fire load and occupants. The class of building also indicates the risk level associated with the building.
- Rise in storeys: This is a measure of the building’s height and the likely time and difficulty for evacuation.

In principle, the higher risks of fire and greater building heights require more resistant types of construction.

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Fire performance requirements

The Deemed-to-Satisfy (DTS) provisions in the NCC contain three sets of requirements aimed at mitigating the effects of fire on external walls or elements that form an integral part of an external or internal wall. We discuss these requirements in more detail below.

Fire Resistance Level (FRL)

In the event of a fire, the NCC requires building components to be fire resistant in order to stop the spread of the fire and delay structural collapse. This principle is reflected in the "Fire Resistance Level" or FRL requirements.

There are three different components of FRL, and it is crucial to understand how they are determined and how they contribute to fire protection. The three components are:

- Structural Adequacy: An assembly's ability to support or carry a specific load under fire conditions.
- Integrity: An assembly's ability to restrict the passage of flames and hot gases.
- Insulation: An assembly's ability to resist temperature rise on the non-fire-exposed side of a fire-resistant separating barrier.

The testing requirements for FRL are set out in AS 1530.4:2014 "Methods for fire tests on building materials, components and structures, Part 4: Fire-resistance tests for elements of construction". The process of conducting fire testing involves setting up a finished wall or ceiling test specimen—the same assembly that would be utilised in the field—onto one face of a fire furnace. The specimen's performance in fire conditions is then assessed using a standardised time-temperature curve.

As per AS 1530.4, the number of minutes without a failure is used to determine the passing value under the three FRL test criteria. Note that Structural Adequacy is also allowed to be determined in accordance with AS 3600:2018 "Concrete structures", particularly where the load on the wall exceeds the maximum test load applicable to AS 1530.4. FRL is expressed in increments of 30 minutes separated by forward slashes (e.g. FRL 90/90/90).

Beyond small-scale combustibility testing?

The DTS condensation and fire requirements of the National Construction Code (NCC) have been written in consideration of conventional building materials that are porous or homogenous in nature. Innovations in the Australian construction industry would never take place if the NCC did not recognise that DTS Solutions and Performance Solutions are equal as compliance solutions.

In relation to fire performance, DTS compliance for combustibility can only be achieved with the small-scale AS 1530.1 test, which is not considered adequate by fire brigades in representing how systems will perform. Prescriptive large-scale test methods are, however, available in the United Kingdom and New Zealand for external walls.

All new Australian residential apartment buildings above three storeys are required to have automatic fire sprinklers installed. The availability of only one DTS test as a solution is significantly affecting the cost of Australian buildings. Similar solutions to those available in the United Kingdom and New Zealand for fire compliance requirements for external walls should be considered by the relevant regulatory bodies.

CodeMark Certificates of Conformity are designed to provide certainty to regulatory authorities and the market that certified products are compliant with specific requirements of the NCC.

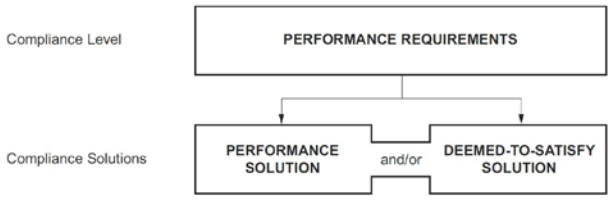
Non-combustible building elements (external wall)

A “non-combustible” material, as defined by the NCC, is a material that has not been deemed combustible in accordance with AS 1530.1:1994 “Methods for fire tests on building materials, components and structures, Part 1: Combustibility test for materials”. When used to describe construction or part of a building, it means that all of the materials used in the construction are non-combustible.

The AS 1530.1 non-combustibility test involves placing five test samples in a furnace for 30 minutes. During this timeframe, any sample that flames for longer than five seconds is deemed combustible.

According to DTS provision C2D10 in the NCC 2022, certain building elements and their constituent parts must be non-combustible. Non-combustible materials must be used for the facade covering, framing, and insulation of both external and common walls (i.e., walls other than between Sole Occupancy Units). It should however be noted that a building element that does not comply with the DTS provision does not necessarily make it a non-compliant system. As defined by the NCC there are two paths that can be taken to prove compliance of a building element – DTS and/or Performance Solution. Provided a building element meets the requirements stipulated for a Performance Solution, a building element will be compliant even if there are combustible components of that building element.

Figure A2G1: NCC compliance structure



Fire hazard properties for linings, materials and assemblies

Under the NCC, Group Number is applied to materials used as a finish, surface, lining, or attachment to a wall or ceiling. It refers to one of four groups of materials used in the regulation of fire hazard properties. For Class 2 to 9 buildings, Group Number classification determines where and when the material can be used in the walls and ceilings.

The ease with which a material ignites and releases heat determines its classification into Groups 1 (best performing), 2, 3, or 4 (worst performing). This classification is important as a fire will develop more slowly with greater resistance to heat release and lower heat release, giving first responders and evacuators more time.

AS 5637.1:2015 “Determination of fire hazard properties, wall and ceiling linings” specifies the testing method for determining Group Numbers for wall and ceiling linings. There are two primary tests: the full-size room burn test as per AS ISO 9705 “Fire tests – Full-scale room test” and small-scale sample tests under AS/NZS 3837:1998 “Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter”. Note that AS 5637.1 limits the use of the AS/NZS 3837 test to certain materials.

Evidence of Suitability and CodeMark Certification

In relation to demonstrating compliance with fire performance requirements, the NCC requires “Evidence of Suitability” for products, materials, systems or designs used in the construction of buildings. There are several options that may be used to establish Evidence of Suitability, including:

- Certificate of Accreditation;
- report issued by an Accredited Testing Laboratory;
- CodeMark Australia or CodeMark Certificate of Conformity;
- report from a professional engineer or appropriately qualified person;
- certificate issued by a JAS/ANZ-accredited certification body; and/or
- manufacturer’s Product Technical Statement.

Note that when relying on Evidence of Suitability provided by a supplier or manufacturer, designers and specifiers should always make sure that the relevant testing has been done by a NATA-registered or accredited body. Additionally, it is critical to determine that the evidence is current and genuine.

CodeMark Certificates are particularly useful in demonstrating compliance. CodeMark is a voluntary third-party building product certification scheme administered by the Australian Building Codes Board. CodeMark Certificates of Conformity are designed to provide certainty to regulatory authorities and the market that certified products are compliant with specific requirements of the NCC.

With the CodeMark scheme now embedded within State and Territory building legislation, obtaining a CodeMark Certificate of Conformity for a product or system will be the only way to gain mandatory acceptance of a product or system in compliance with the NCC. Should a certifier decline to allow you to use a valid CodeMark certificate in your project, they must provide you with a valid reason.

Dincel Polymer Formwork

A Compliance Summary

Committed to constant innovation, Dincel Structural Walling continues to solve the industry's permanent polymer formwork needs.

A Dincel wall consists primarily of concrete, which is a safe and proven material used within almost all multi-storey buildings. What makes a Dincel wall unique is that it also contains a stay-in-place polymer shell, which is not only used for formwork purposes but also enhances the properties of a conventional concrete wall (such as by providing waterproofing, increased durability, crack control mechanisms, ductility, higher concrete strength due to increased curing time, and so on). The Dincel wall system has been meticulously tested and assessed by some of Australia's largest NATA-accredited laboratories and renowned fire professionals in order to prove its safety and compliance with the NCC.

The Dincel polymer is a proprietary formulation and significantly different from common PVC. It is composed of certain organic additives that enhance fire performance. In the event of a fire, the Dincel polymer safely chars and intumesces (it does not form molten droplets or spread fire). The Dincel wall has been verified as being suitable for use for both internal and external loadbearing walling applications within Australia.

Is it compliant?

Under the NCC, DTS Solutions and Performance Solutions are treated as being equal in meeting the relevant Performance Requirements. The only DTS test for non-combustibility, AS 1530.1, is a small-scale test and is only applicable for homogenous materials. In other words, AS 1530.1 is not appropriate or applicable for composite products, such as a Dincel wall, which consists of permanent PVC-faced encapsulation and concrete infill. Alternative prescriptive test methods for composite products are, however, available in the United Kingdom and New Zealand for external walls.

In the absence of a large-scale DTS test related to external walls in Australia and in order to promote innovation in the construction industry, the Performance Solution pathway is equally allowed by the NCC to demonstrate compliance. Dincel wall has been issued a CodeMark Certificate of Conformity by SAI Global for Class 2 to 9 buildings. When the Dincel CodeMark Certificate is relied on, you do not need a site-specific Performance Solution for the use of Dincel external and internal loadbearing walls in apartments, commercial, or industrial buildings.

All information provided correct as of April 2024

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