Demystifying Smoke Doors

 \mathbb{S}

Designing for Safety, Compliance and Performance



111

INTRODUCTION

Fires not only produce heat, but also a lethal concoction of poisonous gases and dense smoke. Due to the large-scale production and long-distance spread of smoke, it is frequently the main cause of fatalities in major fire events. Smoke can impair vision, cause pain and breathing difficulties, hide exit signs, and make it more difficult to flee a burning building. According to various expert reports, exposure to toxic smoke was a significant contributor to incapacitation and fatalities in the infamous Grenfell tower fire incident in 2017.¹

Maximising occupant egress time from the building in the event of a fire emergency is essential for fire safety. To create safe spaces inside a building, ambient and medium-temperature smoke produced by a fire needs to be effectively and quickly contained. This is why smoke compartmentation is a requirement in the New Zealand Building Code as well as other similar building regulation schemes overseas, such as the Australian National Construction Code.

Recent fire events, such as Grenfell, have heightened scrutiny over fire safety compliance and performance issues in the design and construction of buildings. One area of particular concern is the specification of fire and smoke doors.

It is the responsibility of designers, specifiers to specify smoke door assemblies that are appropriately performing and compliant with the necessary New Zealand standards and building code requirements. In many cases, smoke leakage performance is a crucial component of building design and will impact the development of an effective fire safety strategy.

However, the design and performance requirements for smoke doors is not well known. In this whitepaper, we demystify smoke doors and the relevant regulatory requirements, highlighting what you need to know to create a safe space for all occupants.





An analysis of residential fire casualties in New Zealand found that between 40 and 70% of fire fatalities are attributed to smoke inhalation every year, and it is also the cause of between 33 and 60% of serious injuries.

WHY YOU SHOULD CARE ABOUT SMOKE DOORS

According to news reports, many commercial buildings in New Zealand do not meet fire safety standards and are putting people and property at risk.² Among the issues being uncovered include, unprotected penetrations through fire walls and floors, missing smoke dampers, and fire and smoke control doors with incorrect seals.³ Industry stakeholders suggest that there is a potential systemic passive fire non-compliance problem across the country.⁴

Due to recent high-profile fire incidents, heightened regulatory attention has meant that designing and constructing non-compliant buildings carries increased risks for all stakeholders. If a smoke door is not properly specified, for example, it will likely cause building approvals to be delayed and work to be redone. Remediation work will often entail pulling out the noncompliant door and replacing it with a compliant one, requiring extra cost, labour and construction time.

The consequences of smoke door non-compliance will be at their gravest during a fire emergency. An analysis of residential fire casualties in New Zealand found that between 40 and 70% of fire fatalities are attributed to smoke inhalation every year, and it is also the cause of between 33 and 60% of serious injuries.⁵

Elderly people, people with disabilities and children are the groups most disproportionately affected by smoke inhalation. Burning embers that land on upholstered furniture can cause fires to start and spread throughout a building. Modern furniture is often made of plastic and foam, which can produce toxic fumes as they burn.

WHAT ARE SMOKE DOORS?

Passive fire safety measures in a building are crucial as they control the spread of heat and smoke and provide more time for building occupants and emergency services to respond. Effective passive fire protection measures seal cavities, openings, and service penetrations throughout the building to prevent the spread of fire between designated fire compartments.

As one such passive fire protection measure, smoke door assemblies are specially made to prevent smoke from spreading through door openings and to keep egress routes clear during a fire event. Common applications for smoke doors include within publicly accessible areas, such as lift lobbies, hospital corridors, hotels and unit entry doors in multi-residential apartments.

There is often confusion between smoke and fire doors. It is important to use the correct terminology and to refer to the appropriate code requirements in order to specify doors, frames, and hardware for fire door and/or smoke door assemblies. Fire doors must meet different performance criteria and standards than nonfire-rated smoke doors. It is possible for fire doors to serve as smoke doors. But a smoke door might not always meet the requirements for being a fire door, and vice versa.

Smoke doors are intended to impede the spread of smoke, toxic fumes and combustible gases from one area to another, whereas fire doors are meant to contain the fire itself. They are typically constructed from similar materials as fire doors but are equipped with smoke seals. The smoke rating associated with a door specifies how long the door can prevent smoke from passing through.

REGULATORY REQUIREMENTS

Note that the following section provides a general summary of the relevant requirements pertaining to smoke doors in New Zealand with specific reference to Acceptable Solution C/AS2 (applicable to buildings other than Risk Group SH). Practitioners should always consult the relevant regulations and standards in relation to their specific project.

Under the New Zealand Building Code (NZBC), Clause C3 "Fire affecting areas beyond the fire source" requires design and construction for a low risk of injury or illness to people not close to a fire and specifies requirements against vertical or horizontal fire spread. For the building to function affect affect and smoke separations must function as required under the NZBC.

All parts of a smoke or fire separation must be able to achieve the necessary fire or smoke resistance (or both). Therefore, any doorset installed in the separation must have an appropriate resistance to fire and/or smoke. To maintain the required rating of the separation, any breaches through it (including those through the doors) must be smoke and/or fire-stopped.

Smoke separations contain the spread of smoke by adding smoke-resisting elements to adjacent areas. In the NZBC, C/AS2 Acceptable Solution for Buildings other than Risk Group SH, Clause 4.16.8 provides that smoke control doors shall be provided at smoke separations in vertical safe paths; where a corridor or an escape route passes a smoke separation; and between an open path and a smoke lobby.

Other relevant provisions regarding smoke doors from C/AS2 include:

- Fire doors with smoke control capability shall be provided where open paths and horizontal safe paths provide access to internal vertical safe paths (Clause 3.9.9);
- Doorsets installed in fire separations between firecells and vertical safe paths or protected shafts shall have smoke seals on all edges (Clause 4.16.3); and
- Doorsets shall be clearly marked to show their Fire Resistance Rating and, if required, to show their smoke stopping capability (Clause 4.16.5).

To see the full detail of these requirements and more, refer to the NZBC and C/AS2.

QUANTIFYING SMOKE DOOR PERFORMANCE

Smoke leakage rates provide a way to measure and compare the performance of smoke doors. They are typically expressed in volume of smoke per unit of time (e.g. m3/hr).

A 2006 BRANZ Study examined leakage through door assemblies at ambient, medium and furnace temperatures. This information was used as the basis for recommendations as to the suitability of the relevant NZBC fire safety requirements. It was suggested, for life safety purposes, that the maximum allowable leakage rate corrected to Standard Reference Conditions at a cross-door pressure difference of 25 Pa does not exceed 25 and 40 m3/h for single and two leaf doorsets, respectively.⁶

AS/NZS 1530.7:1998 sets out a method to measure the leakage of cold and warm smoke from one side of a door assembly to the other under specified test conditions. There is no specific air permeability pass or fail criteria but,

in the Standard, it is noted that a maximum leakage rate of 20 m3/h - 25 m3/h is often used where life-safety is the main consideration in other jurisdictions.

The test procedure entails attaching a full-size door assembly, complete with all necessary hardware, to a certified test chamber with controlled temperature and pressure conditions. In the chamber, regular air is used to mimic the carrier gases of actual smoke. To assess the test assembly's efficacy as a smoke barrier, pressures are applied, and the resulting "leakages" are measured.

Thanks to AS/NZS 1530.7:1998, fire engineers and building professionals can now specify smoke doors with quantifiable levels of performance with the assurance that the installed assemblies will satisfy their building design and performance requirements.

Note that C/AS2 also refers to AS 1530.4:2014 in relation to the fire-resistance materials that are used to seal gaps through fire and smoke separations.

Smoke doors are intended to impede the spread of smoke, toxic fumes and combustible gases from one area to another, whereas fire doors are meant to contain the fire itself.



Choosing a high-performing smoke control door

CSR Potters Interior Systems: DS Series Hinged Door and Raven Seals

Choosing the right manufacturer is critical when specifying a product or assembly that meets the regulatory requirements for smoke control doors. Product manufacturers need to confirm that their systems have been independently tested in accordance with the relevant standards and meet required levels of performance.

Potter Interior Systems are experts in the distribution of quality products and proven solutions to the commercial construction market throughout New Zealand. The company's services include aluminium partitions, suspended ceiling grid and panels, insulation, passive fire protection, whiteboards, pinboards and acoustic wall coverings.

The Potter Interior Systems team is well-equipped to help you find the right smoke control door solution for your fire safety needs. Recently, the smoke control door DS Series Hinged door with self-closing mechanism and Raven Seals was tested under AS/NZS 1530.7:1998.

DS Series Doors are designed to fit with other Potter aluminium partition suites. Available in 38mm thick doors only, they are an ideal solution for any commercial environment to create either an open space or a completely new room.

REFERENCES

- ¹ Purser, David A. "Phase 2 Report Effects of exposure of Grenfell Tower occupants to toxic fire products Causes of incapacitation and death." Grenfell Tower Inquiry. https://www.grenfelltowerinquiry.org.uk (accessed on 21 August 2023).
- ² Steeman, Marta. "Many NZ commercial buildings do not meet fire safety standards, Insurance Council warns." Stuff.
- https://www.stuff.co.nz/business/106433137/many-commercial-buildings-do-not-meet-fire-safety-standards-insurance-council-warns (accessed on 21 August 2023).

4 Ibid

- 5 Edwards, APR and CA Wade. "Study Report No. 151 (2006): Leakage of Smoke Control Door Assemblies." BRANZ.
- https://www.branz.co.nz/pubs/research-reports/sr151 (accessed on 21 August 2023).

⁶ Above n 5.

All information provided correct as of October 2023

