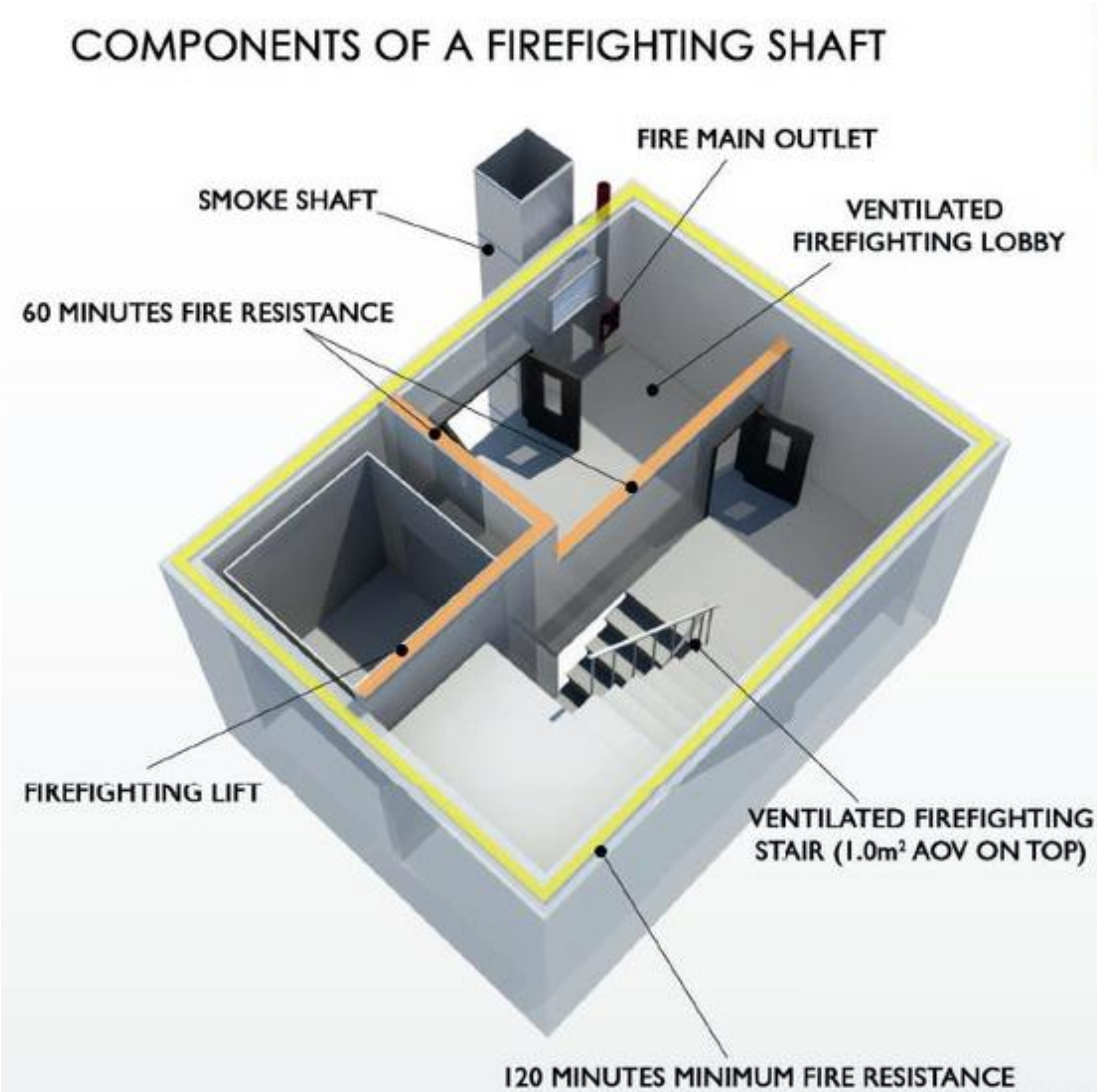
Designer's guide to firefighting operations

Firefighting shafts in taller buildings

F5-14 GD



Document Title: Firefighting shafts in taller buildings

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Status of this document

This document is issued by Fire and Emergency New Zealand.

Recommendations for change

The document, its content and specific processes are not to be altered except through Fire and Emergency New Zealand document management processes.

Requests or recommendations for changes to this material should be sent to the National Manager Response Capability.

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1. Context

Scope	When we’re fighting a fire in a building, we rely on the building’s design to support our operations. In simple buildings, we can use the stairs to get to upper levels. In more complex buildings, we use additional systems, such as lift override, to take control of the lift so we can access upper levels or building hydrants to help bring water to the fire. In taller buildings, standard provisions for stairs and lifts won’t be adequate for our operations. Additional considerations need to be made.
Who this chapter is for	This chapter is for building owners, designers and other building practitioners and contractors. It provides guidance from Fire and Emergency’s perspective on firefighting shafts in buildings over eight floors.
What is not included in this chapter	This chapter gives building industry stakeholders an overview of aspects of our operations that relate to them. However, it is not an exhaustive guide to our operations, nor does it replace any statutory requirements. We recommend you read it alongside other chapters in the guide.
Legislative framework	We aim to reduce the risk to both firefighters and building occupants through encouraging appropriate building design which allows us to achieve our statutory objective (under the Fire and Emergency New Zealand Act 2017) to reduce the incidence of unwanted fire and the associated risk to life and property. Our functions include responding to and suppressing fires, and attending to other types of emergencies that may occur in a building. Read this guide alongside the: • mandatory requirements of the New Zealand Building Code (Building Code); • requirements of New Zealand Standards (Standards); and • Building Act 2004. This guide **does not** replace any part of the Building Code or Standards or other mandatory building requirements. The Building Code Fire Safety – C Protection from fire, clauses C1 – C6 defines Building Code performance requirements of the Building Act 2004. C5 is the performance requirement on ‘Access and Safety for Firefighting Operations’.

2. Definitions

The following definitions apply for the purposes of this guide. Defined terms used throughout this document are consistent with the Building Act 2004, Building Code and Acceptable solutions C/AS2.

Counterflow	Counter-flow can occur on the stairs during the evacuation from buildings when the downward flow of evacuating occupants passes the upward flow of firefighters heading to the fire floor.

Fire control centre (FCC)	The principal location where the status of a fire detection system, an alarm system, and a communications and control system are displayed, and from which all systems can be manually controlled. Some industry standards and publications refer to the fire control centre as ‘central control station’, ‘emergency command centre’, ‘fire service centre’ or ‘fire control room’ (although different standards exist amongst these).
Fire engineering brief (FEB)	A formal process as outlined in the International Fire Engineering Guidelines for all stakeholders to define and agree on the basis and scope of work for fire engineering analysis.
Firecell	Building Code clause C regarding protection from fire defines firecell as: Any space, including a group of contiguous spaces on the same or different levels within a building, which is enclosed by any combination of fire separations, external walls, roofs, and floors.
Fire floor	The floor of the building on which the fire is reported by automatic systems or observed/reported by occupants or other persons. The fire floor may change with new information and the initial reports by occupants may be inaccurate, if the observation is of the effects of fire (e.g. smoke spread), rather than the fire itself.
Fire resistance rating (FRR)	Building Code clause C regarding protection from fire defines FRR as: The term used to describe the minimum fire resistance of primary and secondary elements as determined in the standard test for fire resistance, or in accordance with specific calculation method verified by experimental data from standard fire resistance tests. It comprises three numbers giving the time in minutes for which each of the criteria stability, integrity and insulation are satisfied and is presented always in this order.
Firefighter access point	The place where firefighters gain access to a building. This must comply with New Zealand Building Code Clause C5.6: Buildings must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters’ personal protective equipment and standard training, to: (a) reach the floor of fire origin, (b) search the general area of fire origin, and (c) protect their means of egress.
Firefighting lift	A lift or elevator designed for use by firefighters during an emergency, fitted with systems to provide additional resilience to support emergency operations. A full description of firefighting lift features can be found within F5-08 GD FFO Lifts.
Forward control point (FCP)	A safe position inside the building from which to carry out firefighting operations. This is usually one to two floors below the lowest floor of the building that is affected by smoke and/or fire. The location becomes the last point to assemble personnel awaiting deployment. If the extent of the fire is unknown, or the fire develops and extends vertically, it creates a situation where the boundaries between zones become dynamic.

Lift

A moving compartment (also known as the lift car) housed in a shaft, for raising and lowering people or things to different levels in a building. For the purposes of this document, the terms 'lift' and 'elevator' are interchangeable.

3. Design guidance for tall buildings

Limits of standard design guidance

Standard design guidance doesn't currently capture lift design in taller buildings.

Clauses C1–6 of the Building Code outlines how buildings are expected to perform in a fire. Clause C5 is particularly relevant, as it sets out clear expectations that buildings should both facilitate access for and protect firefighters.

There are two ways for designers to comply with these requirements:

- by following a deemed-to-comply approach, such as Acceptable Solutions or Verification Method documents, or
- through an engineered approach, which means using an alternative method supported by appropriate evidence to demonstrate compliance with the Building Code performance criteria.

The current deemed-to-comply solutions have a limit of 20 floors for the Acceptable Solution C/AS2, or 60 m for the Verification method C/VM2. Buildings taller than those limits are outside the scope of these documents. These must be designed as engineered alternative solutions, in which case it is important to demonstrate that the objectives of the Building Code are met.

Unfortunately, even for buildings lower than those limits, the compliance documents don't adequately address our operational needs for buildings over a certain size.

4. Challenges

4.1. Why standard solutions don't suit taller buildings

Stairs limitations

F5-07 GD FFO Stairs in buildings outlines firefighting procedures in multi-storey buildings. This procedure relies on setting up the Breathing Apparatus Entry Control Officer (ECO) in the stairway, one or two floors below the fire. The ECO's location becomes the interface between fully protected firefighters and incoming/outgoing resources. If the ECO's location becomes compromised by smoke, it must be relocated.

The worst-case scenario is that the entire stair fills with smoke and the ECO has to move outside the building. If this happens, firefighters must have enough air to reach the fire floor, perform various tasks and retreat to the ECO's location without running out of air.

The BA cylinder typically allows us to breathe for 20 to 30 minutes, although this varies greatly depending on individual fitness and the work required.

In practice, we would only be able to reach around level 6 to 8 of a multi-storey building with sufficient air remaining to perform meaningful tasks and retreat. The actual limit would depend on factors including the location of stairs, complexity of the internal layout and floor area. We would not have enough air to perform search and rescue or firefighting operations in levels above this limit.

This means that in taller buildings, it is essential that the ECO location is protected and can remain in the stair.

Physical limitations

Even if the stair is adequately protected so that we don't have to use up our BA resource on our way to the fire floor, it still limits our abilities. As we climb the stair, we expend energy and become fatigued, which makes it more difficult to perform tasks once we reach the fire. Carrying equipment upstairs makes fatigue even worse.

The higher we need to climb, the harder it is for us to work.

Lift limitations

F5-08 GD FFO Lifts describes how firefighters use lifts and sets out the specifications for the lift to be suitable for our needs.

Certain lifts require an emergency recall switch (sometimes referred to as firefighter override). This lets us to take control of the lift and use it to support our operations. If safe to do so, we will use the lift to access the upper floors of a building and ferry equipment. Even then, we do not use the lift to reach the fire floor, only the floor where the ECO is located. All travel from this floor up is via the stairs.

Even if lift controls are provided, the Building Code doesn't require building design to protect the lift itself or increase its resilience. This can cause problems during a fire because multiple factors can stop us from using the lift, including:

- water from sprinklers or firefighting
- smoke entering the lift shaft
- power failure.

Relationship between lift and stair

Since we use the stair to reach the fire floor, the lift's location in relation to the stair is critical to our ability to use it. We must be able to easily access the stair from the lift and vice versa, otherwise we can't use the lift.

There must also be a protected path between the lift and stairs to keep us safe. However, the layout of most buildings doesn't allow this.

Access to back of house or intermediate floors

In taller buildings, it is common to have one or more floors dedicated to services. Buildings occupants would typically not need access to such levels. It may not be obvious to us how we can access these levels.

Services levels may have separate access provisions that aren't directly accessible from the lifts or from stairs that serve other floors. For example:

- Services levels can be sandwiched between other floors but have reduced access provisions. Passenger lifts may not stop, or stairs may not have a door on this floor.
- Services can be located at the top of a building, or in the basement, with reduced access provisions for maintenance only. This could mean that only one of the stairs serving the other levels may continue to the services levels.

Fires can happen in service levels, so we need the same access provisions to them as to anywhere else in the building. It could be dangerous for us to be forced to exit the designated access stair or lift and transfer to another one.

Bringing it together

Given the challenges described above, buildings over six to eight floors require additional provisions for us to be able to effectively carry out our work. In summary:

- We must be able to gain access to a safe location one or two floors below the fire.
- This must be done in a quick and efficient manner, so we need a lift.
- However, travel between the ECO location and the fire floor will not be via a lift so a stair remains necessary.

- Lift and stair must be co-located to facilitate transfer between the two.
- The ECO location will become the forward control point and it must remain safe for the duration of the incident.
- Access to and from this location, including both lift and stairs must also remain safe for the duration.
- Lift and stairs must be continuous and serve all floors of the building.

The firefighting shaft concept

Although it is not currently mandated by the New Zealand compliance documents, firefighting shafts are a standard requirement in several other countries for buildings over a specified height. They provide a robust solution that addresses the challenges identified above.

A firefighting shaft is a vertical shaft that serves all levels of the building and contains a firefighting stair, firefighting lift and a joint firefighting lobby. The following diagram illustrates the simplest form although it can be varied to suit the specific characteristics of the design.

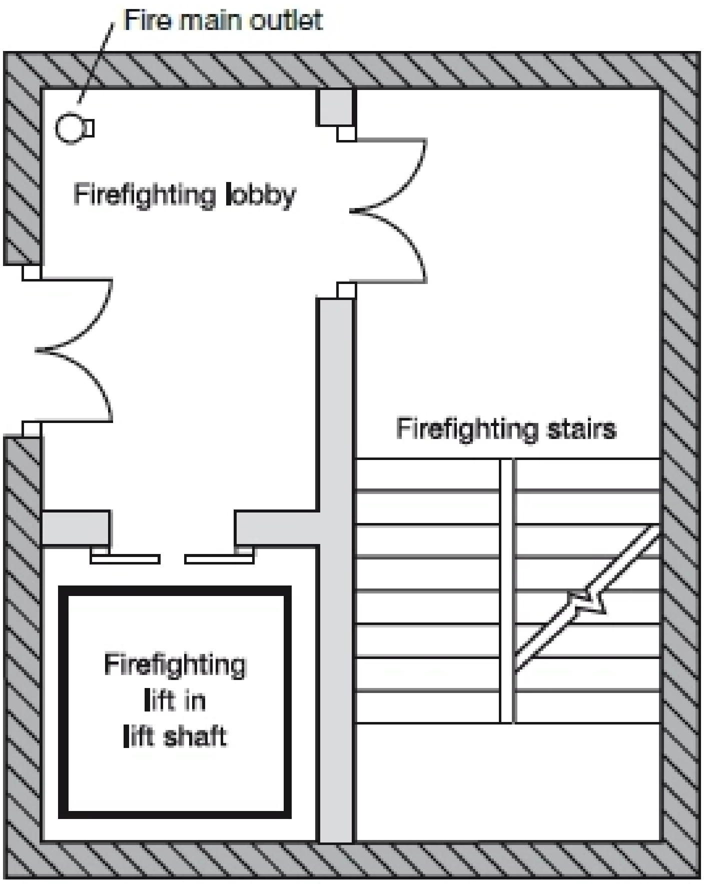


Figure 1 – Basic firefighting shaft design where the FRR would be 120/120/120

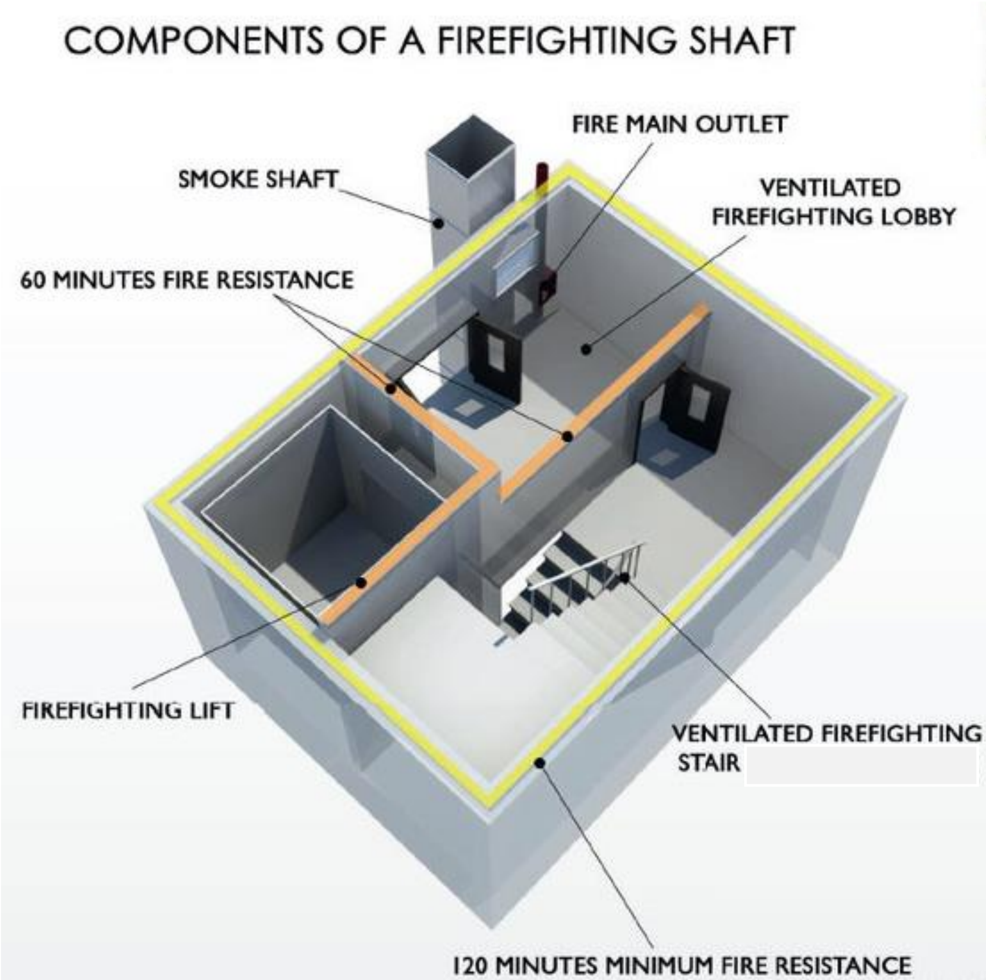
The firefighting shaft is a tried and tested concept, with the following benefits:

- It increases protection to the stair, making it safer for firefighters and evacuating occupants.
- It reduces delays to us gaining access to the fire floor and starting firefighting.
- It facilitates the incident management and staging of additional resources where needed.
- It reduces the risk of smoke or fire spread disrupting our operations.

5. Recommendations

General	• Buildings over eight floors to have a minimum of one firefighting shaft. • You should seriously consider providing a firefighting shaft for buildings over six floors, particularly where the building's size or complexity will impact on our operations. • The firefighting shaft to include a designated firefighting stair, firefighting lift and a protected firefighting lobby serving both stair and lift. • Larger footprint buildings may need a second firefighting shaft. This will primarily depend on whether adequate hose run coverage can be achieved from a single firefighting shaft. Regardless of coverage, you should provide a second firefighting shaft if the floor area of individual levels of your buildings exceeds 900 m^2.
Continuity	• The firefighting shaft should extend from the lowest level of the building to the topmost enclosed floor (i.e. rooftop plant can be excluded). • The firefighting shaft is to serve all floors in between.
Fire resistance rating	• The enclosure of the firefighting shaft is to be designed to achieve a 120-minute fire resistance rating. • The firefighting shaft should be separated internally so that the stair, lift and lobby are distinct spaces. • The internal construction within the firefighting shaft should be designed to achieve a 60-minute fire resistance rating.
Smoke control	• To reduce the risk of smoke contaminating the stair, the firefighting shaft must have a smoke control system. This can be stair pressurisation, or mechanical extraction from the lobby. • As an alternative, if the building layout is suitable, you can use a mechanical smoke control system serving the floor, or area directly outside the firefighting lobby, for the same purpose.
Firefighting stairs	• The stair component of the firefighting shaft should follow the recommendations set out in F5-07 GD FFO Stairs in buildings. • The firefighting stair should open into a firefighting lobby on every floor so that it doesn't compromise the firefighting shaft. • Firefighting stairs should not be scissor stairs. Scissor stairs have entry/exit points that alternate on different floors, so it is difficult to design a joint lobby also serving the firefighting lift.
Firefighting lift	• The lift component of the firefighting shaft should follow the recommendations set out in F5-08 GD FFO Lifts. • The firefighting lift should open into a firefighting lobby on every floor so that it doesn't compromise the firefighting shaft.
Firefighting lobby	• The firefighting lobby should be big enough to allow us to work. However, it shouldn't be large enough to contain furniture or be used for storage. It should be at least 5 m^2 but no bigger than 20 m^2. • We prefer that only firefighting lifts serve the firefighting lobby and not other lifts such as passenger lifts. If you can't avoid this, it is important to protect the other lifts to the same level as the firefighting lift on every floor they serve so as not to compromise the firefighting shaft. • You may omit the firefighting lobby on the ground floor only, provided that both the stair and lift are only accessible from outside. If these are accessible from the building side, a lobby will be required.

	• The firefighting lobby must include provisions to prevent water ingress into the lift.
Building hydrant	• Building hydrant systems should follow the recommendations of F5-05 GD FFO Building hydrant systems. • If the building has a fully rated firefighting shaft, the building hydrant outlet should be located within the firefighting lobby on all floors. This allows firefighters to mount activities from the lobby, ensuring that the stair door remains closed, which prevents smoke contamination.
BS9999 design	• For further information on firefighting shafts and a full set of specific technical requirements, refer to BS 9999: 2017 Fire safety in the design, management and use of buildings – Code of practice, Section 20.



6. Related information

6.1. Designers' guide to firefighting operations

- F5 01 GD FFO Introduction
- F5-02 GD FFO Emergency vehicles access
- F5-03 GD FFO Radio communications
- F5-04 GD FFO Fire alarm panels
- F5-05 GD FFO Building hydrant systems
- F5-06 GD FFO Automatic sprinkler systems
- F5-07 GD FFO Stairs in buildings
- F5-08 GD FFO Lifts
- F5-09 GD FFO Fire Control Centres
- F5-10 GD FFO Evacuation and rescues
- F5-11 GD FFO Water supplies
- F5-12 GD FFO Construction, refurbishment and demolition sites
- F5-13 GD FFO Multi-tiered vehicle stacking buildings
- F5-14 GD FFO Firefighting shafts in taller buildings

6.2. Legislation

- Fire and Emergency New Zealand Act 2017
- Building Act 2004
- Building Regulations 1992 > NZ building code > Fire safety

6.3. Standards

- AS/NZS 1668.1:2015 The use of ventilation and air conditioning in buildings – Part 1 Fire and smoke control in multi-compartment buildings
- BS9999:2017 Code of practice for fire safety in the design, management and use of buildings
- EN81-72:2015 Safety rules for the construction and installation of lifts – Particular applications for passenger and goods passenger lifts – Part 72: Firefighters lifts
- NZS 4332:1997 Non-domestic passenger and goods lifts
- SNZ PAS 4509:2008 New Zealand Fire Service firefighting water supplies code of practice
- NZS 4510:2008 Fire hydrant systems for buildings
- NZS 4510:2022 Fire hydrant systems
- NZS 4512:2021 Fire detection and alarm systems in buildings
- NZS 4541:2020 Automatic fire sprinkler systems

Note re NZS 4510:2008 and NZS 4510:2022:

NZS 4510:2022 Fire hydrant systems has superseded NZS 4510:2008 Fire hydrant systems for buildings.

Fire and Emergency therefore encourages all designers and building industry practitioners to use NZS 4510:2022.

However, C/AS2 Acceptable solutions (C/AS2) still cites NZS 4510:2008, so until MBIE updates C/AS2 replacing NZS 4510:2008 with NZS 4510:2022, NZS 4510:2008 may still be used.

6.4. References

- Australasian Building Codes Board, *International fire engineering guidelines*, Edition 2005, Canberra Australia

Note: The legislation and Standards referred to in this guide (including the above links) are relevant at the time that this document was published. Note however that the legislation/links may have been updated since the publishing of this document.

Document information

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Date	Brief description of amendment
July 2025	Review period changed to three years, added note clarifying use of superseded hydrant standard.
January 2022	Format update and SME content review
March 2018	Initial version