- Fire prevention. Precautions are taken to prevent fires from starting, for example installation of traps for oil and fat wastes from commercial kitchens, and the safe storage of flammable materials.
- Passive fire protection. Containment and slowing the spread of fire, for example with fire walls and fire cells, which break the building into compartments and allow safe passage for people to exit the building.
- Active fire protection. Systems that require a level of motion and response, for example alarms, sprinklers, and fire extinguishers.

We will also look at fire exit systems.

By completing this module you will be able to understand the principle of fire protection services for a light commercial project by:

- interpreting the operating principles of fire

- interpreting the operating principles of fire protection systems
- analysing the internal and external environmental impacts of fire protection systems
- interpreting layouts for a passive and active fire protection system
- coordinating services and architectural plans for passive and active fire protection systems.

Thoughts on this page?

Fact Sheets: Introduction

1m

Fact sheet 4.1: Fire protection systems

This fact sheet covers passive and active fire protection systems, the regulations to ensure compliance, how fires are caused, and the potential impact. It also provides an overview of how you determine the best fire protection system.

Fact sheet 4.2: Operating principles of passive and active fire protection systems

This fact sheet provides examples of passive and active
fire protection equipment components and systems. It shows you how fire protection systems work and outlines the escape route requirements for buildings.

Fact sheet 4.3: Service

fire protection equipment components and systems. It shows you how fire protection systems work and outlines the escape route requirements for buildings.

Fact sheet 4.3: Service layout requirements of passive and active fire protection systems

This fact sheet focuses on the sequence of activities to install passive and active fire protection systems, who can install the systems, and testing and inspection provisions necessary to maintain compliance.

Fact sheet 4.1: Fire protection systems

1m

What are fire protection systems?

Fire sprinkler

© iStock

The fundamental purpose of fire protection is to ensure that sufficient warning and time is given to the occupants of a building to get out safely.

For a commercial project a fire report is normally prepared by a fire engineer. The report is based

Regulations and compliance

The New Zealand Building Code outlines the compliance requirements of the Building Act 2004. Go to MBIE's website to view the individual sections of the Code.

In particular, have a look at the following clauses of the Code as they relate to fire safety and protection.

- C1-C6 Protection from fire.
- F6 Visibility in escape routes.
- F7 Warning systems

- F7 Warning systems.
- F8 Signs.

The responsibilities of building owners are outlined in:

- The Fire Service Act 1975 (refer to Part 2 Fire Safety, sections 21B, 21C and 21E)
- Fire and Emergency New Zealand (Fire Safety, Evacuation Procedures, and Evacuation Schemes) Regulations 2018 (refer to Part 1 Fire safety and evacuation procedures, sections 5, 7 and 9).

The New Zealand Standards relevant to this module are:

- NZS: 4512 Fire Detection and Alarm Systems in Buildings
- NZS: 4541 Automatic Fire Sprinkler Systems
- NZS: 4517 Fire Sprinkler Systems for Houses
- NZS: 4515 Fire Sprinkler Systems for Residential Occupancies
- NZS: 4510 Fire Hydrant Systems for

- NZS: 4510 Fire Hydrant Systems for Buildings
- NZS: 4503 Hand Operated Fire-fighting Equipment
- NZS: 4520 Fire-resistant Doorsets
- AS/NZS: 1668.1 The Use of Ventilation and Airconditioning in Buildings - Fire and smoke control in multi-compartment buildings
- AS/NZS: 1841.5 Portable Fire Extinguishers
- AS/NZS: 1221 Fire Hose Reels
- AS/NZS: 3504 Fire Blankets
- AS/NZS: 1905 Components for the Protection of Openings in Fire-resistant Walls
- AS/NZS: 4521 Specification Boxes for Fire Brigade Connections

For the requirements relating to evacuation plans and procedures, refer to the New Zealand Fire Service.

Thoughts on this page?

How do fires start, and where are they likely to occur?

1m

The main causes of fire are:

- combustible construction
- poor protection and alarm systems
- equipment fault
- bad housekeeping or carelessness.

It's important that the building structure meets fire containment and protection regulations.

Many house fires start in the kitchen. The reasons are more varied for commercial buildings, but they include fires starting in commercial kitchens, overloading of electrical outlets, lack of maintenance on equipment such as boilers, and improper storage of flammable materials.

Fires can be confined or unconfined. Where they are confined, the expectation is that the fire will not spread beyond the container in which it

materials.

Fires can be confined or unconfined. Where they are confined, the expectation is that the fire will not spread beyond the container in which it started and there will be no damage to the building structure as a result. There could be, however, property damage due to smoke and water. For example, a fire that has started inside a kitchen pot with a lid, where the fire has not extended beyond the pot and is able to be put out by the use of a fire extinguisher is deemed to be a confined fire.

Thoughts on this page?

What are the internal and external factors you need to consider?

1m

Internal factors

The first priority in a fire is safe removal of people from the building. But to prevent both loss of life and to minimise damage to the building, the following need to be taken into consideration.

- Fire separations to create internal fire cells and safe paths.
- Fire separations between floors where the building has more than one level.
- Sprinklers, fire extinguishers, fire hoses, warning systems, smoke detectors.
- Fire resistant materials and systems for floors, walls, ceilings and glass.

- Fireproof cladding systems.
- Fire stops, dampers, and shutters for penetrations through fire floors, walls and ceilings.
- Fire and smoke doors.

All of the above considerations are included in a fire report.

External factors

To protect the spread of fire to other property, you will need to install fire containment systems. Examples include:

- fire resistant external walls to avoid vertical fire spread outside the building
- fire resistant external walls to limit horizontal fire spread by thermal radiation.

The protection of 'other property' requires elimination of:

- fire spreading to other buildings
- building collapse
- damage to boundaries

- building collapse
- damage to boundaries
- damage to adjacent sleeping spaces.

Active and passive protection

Some measures, such as having fire extinguishers on hand, are active fire protection. Other measures, such as installing fire resistant walls, are passive fire protection.

See examples of active fire protection systems on the Wormald website.

For examples of passive fire protection systems, read the basics of passive fire protection.

Thoughts on this page?

How do you determine the best fire protection system?

1m

To determine the passive and active protection systems to be installed, the fire safety and protection requirements to ensure compliance will need to be met.

Have a look at the commentary relating to the Acceptable Solutions to ensure that Building Code compliance is met. This commentary will help you gain a better understanding of the fire safety and protection requirements. Note the need to identify the risk group or nature of occupancy. For example, is the building a residential dwelling, an office or a car parking building? Each of these has a different risk group.

A Fire Fighting Facilities Checklist will help guide you through the requirements you need to meet as part of the building consent process.

Example

Let's have a look at the café from our earlier scenario. The New Zealand Building Code clauses C1 - C7 identifies Acceptable Solution 2 (AS2) as being relevant to a café.

The risk group is identified as CA '... activities in buildings that involve people in groups where a proportion of those people are not working'.

Therefore, you will need to refer to the following sections of this acceptable solution to:

- calculate occupant loads (refer section 1.4)
- determine the fire safety system required (refer section 2.2). Note: the different types of alarm system i.e. Type 1, 2, 3 etc. are detailed in the New Zealand Building Code Clause F7/AS1 section 1
- calculate the number of escape routes, definition, locations, height-width requirements and measures required to maintain clear access of

- calculate occupant loads (refer section 1.4)
- determine the fire safety system required (refer section 2.2). Note: the different types of alarm system i.e. Type 1, 2, 3 etc. are detailed in the New Zealand Building Code Clause F7/AS1 section 1
- calculate the number of escape routes, definition, locations, height-width requirements and measures required to maintain clear access of exits (refer section 3).

How do you write a brief specification for a fire protection system?

1m

Have a look at the Masterspec guide to writing specifications. However as fire is a specialist service, the fire report and fire specification for commercial buildings are typically prepared by someone qualified, usually a fire engineer.

The supply and installation of fire protection systems are normally performance based, which means the final design and layout of the fire system is drawn by the fire subcontractor and submitted as shop drawings for the engineer's approval. The subcontractor is responsible for ensuring that their designed layout meets the criteria identified in the fire report and specification.

- standards and regulations
- scope requirements
- shop drawings
- installation
- certification
- manual fire alarm system
- automatic fire alarm system
- main indicator / control panel
- automatic detectors
- hold open devices
- interface with mechanical and security
- manual call points
- wiring
- connection to the fire service
- maintenance
- commissioning
- as-built drawings and operations manual
- warranties
- defects liability period.

To see how this works in practice, have a look at the following examples of a fire report and fire alarm specification.

1. Fire Report

- connection to the fire service
- maintenance
- commissioning
- as-built drawings and operations manual
- warranties
- defects liability period.

To see how this works in practice, have a look at the following examples of a fire report and fire alarm specification.

1. Fire Report

2. Fire Alarm Specification

Thoughts on this page?

Need to know more?

1m

For the Fire Fighting Water Supplies - Code of Practice (SNZ PAS 4509).

For passive fire protection features and compliance schedule requirements.

BRANZ bulletins related to this topic are:

- BRANZ Bulletin BU510 *Introduction to passive fire protection*
- BRANZ Bulletin BU420 *Designing for fire safety*

Thoughts on this page?

Fact sheet 4.2: Operating principles of passive and active fire protection systems

1m

What are the operating principles of fire protection systems?

Remember the fundamental purpose of fire protection is to ensure that sufficient warning and time is given to the occupants of a building to get out safely.

Active fire protection systems

For details about the various types of systems available, have a look at the Argus Fire Protection website.

This website provides detail and schematic drawings covering:

- fire alarms
- sprinklers
- hydrant and charged risers
- emergency lighting
- special risks:
  - water spray systems
  - dry systems
  - gaseous fire suppression
  - foam systems
  - pre-action sprinkler systems.

Passive fire protection systems

Check out the BRANZ website for information relating to fire containment. You can also view and download the Guide to Passive Fire Protection in Buildings for free on the BRANZ website.

Note how the fire in the video is confined within the container.

This website provides information relating to:

- fire coating spray polyurethane foams
- cable trays
- steel pipework
- PVC and other plastics
- duct work
- seismic joints
- redundant holes
- lift door surrounds
- smoke baffles
- multiple penetrations (e.g. risers)
- fire doors
- steel beams or brackets

- conduits passing through any fire wall
- two-way fire wall construction
- retrofitting existing solid core doors to achieve a fire rating.

Structural steel such as beams and columns supporting a floor in a multiple level building require fire protection. This is typically provided through the application of intumescent paint. For examples of fire protection of structural steel work, have a look at the Steel Construction website.

The New Zealand fire doors design guide will give you the specifications and features for a range of fire doors.

Thoughts on this page?

What components make up a fire exit system?

1m

The purpose of a fire exit system is to ensure that occupants of a building are able to quickly identify the safe route to use to exit the building safely in the minimum time.

The three components to a fire exit system are:

- accessibility to escape routes (added in building design)
- exit signage (supplied and installed by the electrical contractor)
- emergency lighting (supplied and installed by the electrical contractor).

Accessibility to escape routes

The New Zealand Building Code defines escape routes as 'a continuous unobstructed route from any occupied space in a building to a final exit to enable occupants to reach a safe place, and shall comprise one or more of the following: open paths, smoke lobbies and safe paths'.

The number of escape routes, their locations, height/width requirements and obligations to maintain clear access to exitways are outlined in the Acceptable Solutions referred to in:
Fact sheet 4.1: Fire protection systems

Exit signage

The New Zealand Building Code Clause F8 covers signage requirements.

In summary, signage is required at:

- exits and emergency exits
- call points (fire alarms)
- fire doors
- smoke control doors
- fire hydrants.

> **Note:** The lettering of an exit or emergency exit sign (including a direction arrow if necessary) is to be in white on a safety green background (refer to section 4.4).

Emergency lighting

Emergency lighting must be provided in all exits. The New Zealand Building Code

Emergency lighting

Emergency lighting must be provided in all exits. The New Zealand Building Code clause F6 Visibility in Escape Routes defines exits as 'all parts of an escape route protected by fire or smoke separations, or by distance when exposed to open air, and terminating at a final exit'. A final exit is 'the point at which an escape route terminated by giving direct access to a safe place'.

The duration of the lighting is based on escape height, evacuation time and occupant load (refer to section 1.6).

Need to know more?

1m

To design and make an escape plan for where you live, check out these links from the New Zealand Fire Service.

- Fire and Emergency NZ
- Escape My House

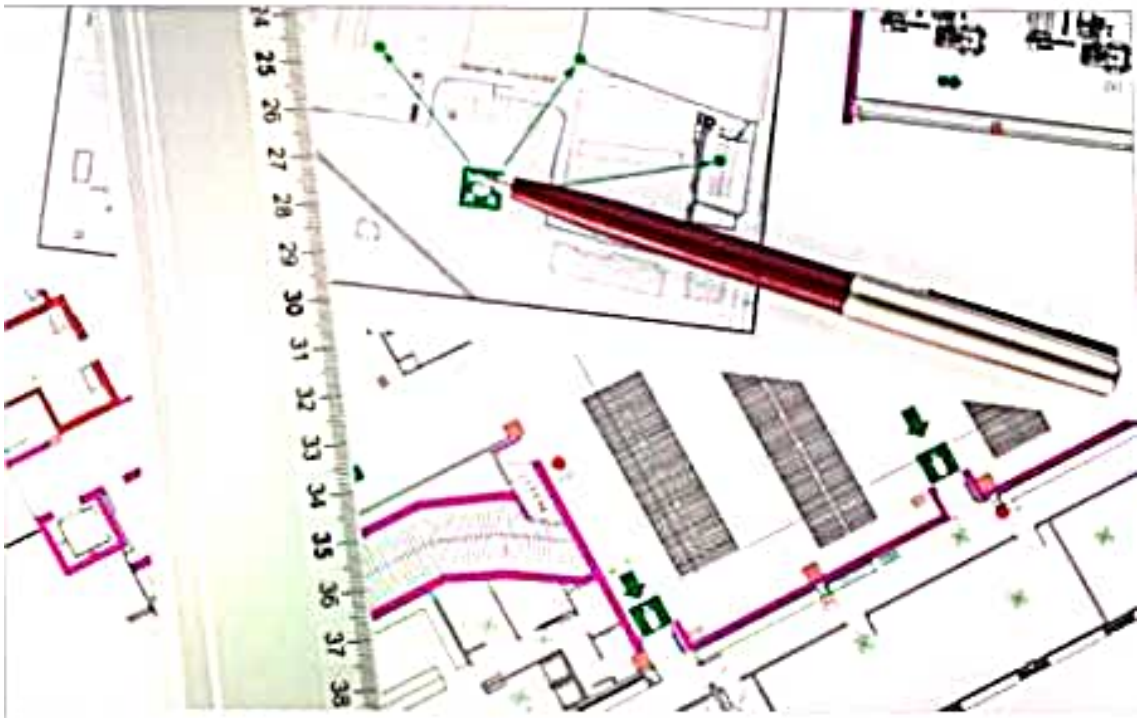
Have a look at the Discount Safety Signs NZ website for examples of fire and emergency exit signs – note the colour coding.

Thoughts on this page?

Fact sheet 4.3: Requirements of passive and active fire systems

1m

What are the requirements for fire protection systems?



Building plans

© iStock

The installation and commissioning requirements of fire protection systems are

requirements of fire protection systems are covered in:

- NZS: 4512 Fire Detection and Alarm Systems in Buildings
- NZS: 4541 Automatic Fire Sprinkler Systems

Fire detection and alarm systems must comply with these Standards and the sited building compliance requirements. To ensure this occurs, compliance with NZS: 4512 part 6 must be maintained. Regular testing must be conducted by appropriately qualified persons. This involves monthly testing with an annual survey of the entire system, including functional tests of some equipment.

At the commissioning stage of a new fire protection system, an independent inspection and certification of the installed fire system is done. This is normally carried out by Fire Protection Inspection Services (FPIS) New Zealand's largest accredited inspection company. The local authority will require a copy of the FPIS certify before issuing the code of compliance.

At the commissioning stage of a new fire protection system, an independent inspection and certification of the installed fire system is done. This is normally carried out by Fire Protection Inspection Services (FPIS) New Zealand's largest accredited inspection company. The local authority will require a copy of the FPIS certify before issuing the code of compliance.

In addition to the commissioning inspection and certification process, ongoing testing of all fire sprinkler systems must comply with NZS: 4541 part 12. Inspections must be conducted biennially at intervals not exceeding 28 months.

How do you select the correct device?

1m

When a fire protection system is being designed, you need to be aware of the legal requirements and performance criteria of the devices installed. There is a range of systems and devices available to meet compliance.

Fire alarms and smoke detection devices

NZS: 4512 determines the requirements for an alarm, smoke and heat detection system. For an overview of alarms and detection devices, check out the Fire Protection Association of New Zealand website.

Fire extinguishers, fire blankets, fire hose reels

The contents of a fire extinguisher varies, therefore its selection is based upon the expected use, and there may be several different types of extinguishers required in the building. For a guide on the classification of fires and which extinguisher should be used have a look

which extinguisher should be used, have a look at the Wormald website.

An overview of fire extinguishers, fire blankets, fire hose reels and their features can be found on the Fire Systems NZ website.

Sprinkler systems

The sizes of pipe for supplying water to a sprinkler system will depend on the design of the building, but will be selected to ensure the right amount of water pressure is supplied to every sprinkler head. Likewise there are different types of sprinkler heads that can be selected.

There are different types of sprinkler systems, for example water or foam, and this link gives a general overview of a sprinkler system layout and components.

What are the installation requirements, and who can install?

1m

Active fire protection systems

The installation of a fire alarm can only be done by a certified fire alarm contractor. Similarly, the sprinkler system should be installed only by an approved sprinkler contractor. Both systems can normally be provided by the same company, though they will be separate divisions.

Smoke detectors, fire extinguishers and heat blankets can be installed by the building owner or contractor. However, their location must be in accordance with the fire report and manufacturer's recommendations.

Fire hydrants and charge risers are installed by specialist fire protection contractors as part of a sprinkler system in a large commercial building.

Passive fire protection systems

1m

The purpose of passive fire protection systems is to contain or slow down the spread of fire in a building, primarily so that people can safely exit the building during a fire. This is done through the use of building materials to create separate compartments (fire cells) throughout the building.

The materials are specially fire rated and used in lieu of standard building materials. For example, Fyreline gib board in lieu of standard gib board.

A fire rating is expressed in minutes and shown as three numbers: XX/XX/XX.

- The first set is for stability - how long before the material collapses.
- The second set is integrity - how long before smoke can penetrate the material.
- The third set is insulation - how long before heat transfers through the material causin a harmful temperature rise.

For instance, a fire rated wall with a rating of 60/60/60 means the wall has to prevent the flames, smoke and heat getting to the other side of the wall for a minimum of one hour. A fire door with a rating of -/30/- has to prevent smoke from passing through the door for half an hour.

For a general overview of passive fire protection, refer to the passive fire protection features and compliance schedule requirements.

Refer to the Gib Fire Rated Systems Specification and Installation Manual for information relating to:

- wall, floor and ceiling systems
- riser, shaft and duct systems
- steel column and beam protection systems
- junction details
- penetration requirements (cables, pipes).

The installation of a fire cell complying with the New Zealand Building Code is undertaken by a licensed building practitioner.

The installation of a fire protection system

1m

What is the schedule of activities required to coordinate the installation of a fire protection system?

Table 4.1 shows components of a passive fire protection system, indicating when the components are to be installed and their maintenance and inspection requirements.

System component	When will it be installed	Maintenance/ inspections schedule
Fire cell including floor, wall, ceiling, cable trays, duct work/fire stops/dampers, smoke baffles, fire doors, fire resistant glass, escape	1st fix after structure completed. 2nd fix once structure is watertight.	On completion with minimum annual building compliance inspections.

route paths, emergency lighting, emergency exit signage.		
Fireproof cladding, fire coating, steel pipework, seismic joints, penetrations, steel beams or brackets.	1st fix after structure completed.	On completion with minimum annual building compliance inspections.

Table 4.2 has components of an active fire protection system, indicating when these components are to be installed and their maintenance and inspection requirements.

System component	**When will it be installed**	**Maintenance/ inspections schedule**
Sprinklers, hydrants, charged risers and fire alarms.	1st fix piping provision once roof is completed.	In accordance with NZS: 4512 Part 6 or NZS: 4541 Part 12.

hydrants, charged risers and fire alarms.	piping provision once roof is completed. 2nd fix & testing on completion.	with NZS: 4512 Part 6 or NZS: 4541 Part 12.
Fire extinguishers and blankets.	On completion.	Minimum annual maintenance schedule required in accordance with manufacturers recommendations

Thoughts on this page?

Need to know more?

1m

- BRANZ Bulletin BU512 *Passive fire protection/roles and responsibilities*
- BRANZ Bulletin BU514 *Passive fire protection/onsite installation*
- BRANZ Bulletin BU517 *Passive fire protection/maintenance and ongoing compliance*

Fire and Emergency New Zealand provides information on the design, components and cost of sprinkler systems in the home.

Thoughts on this page?

Your brief

For our previous café scenario, your brief is to ensure the safety and protection of surrounding properties. Two egress or fire exit systems are required to comply with escape route requirements.

As supervisor for a commercial dwelling you have been asked to coordinate the installation of the fire protection system and maintain the fire protection systems integrity throughout the build process.

- What are the areas in which fire is most likely to occur?
- What contractors would be involved in creating a fire cell and escape route?
- How will you schedule the tasks to ensure structural integrity of the building is maintained?

The café was formerly a single level shop with fire resistant external walls to prevent the spread of fire to the neighbouring businesses. The shop

The café was formerly a single level shop with fire resistant external walls to prevent the spread of fire to the neighbouring businesses. The shop had a very small kitchen for tea making, and one toilet cubicle for the two staff. The café will have a seating plan for 20 patrons and employ six staff (four in the kitchen and two front of house). Therefore, major renovations are required to create a full working commercial kitchen and provide adequate toilet facilities for both staff and patrons.

Your task

Complete the following questions.

1

Bearing in mind the high risk of a fire starting in the kitchen, what additional passive fire protection methods would you recommend for the rebuild?