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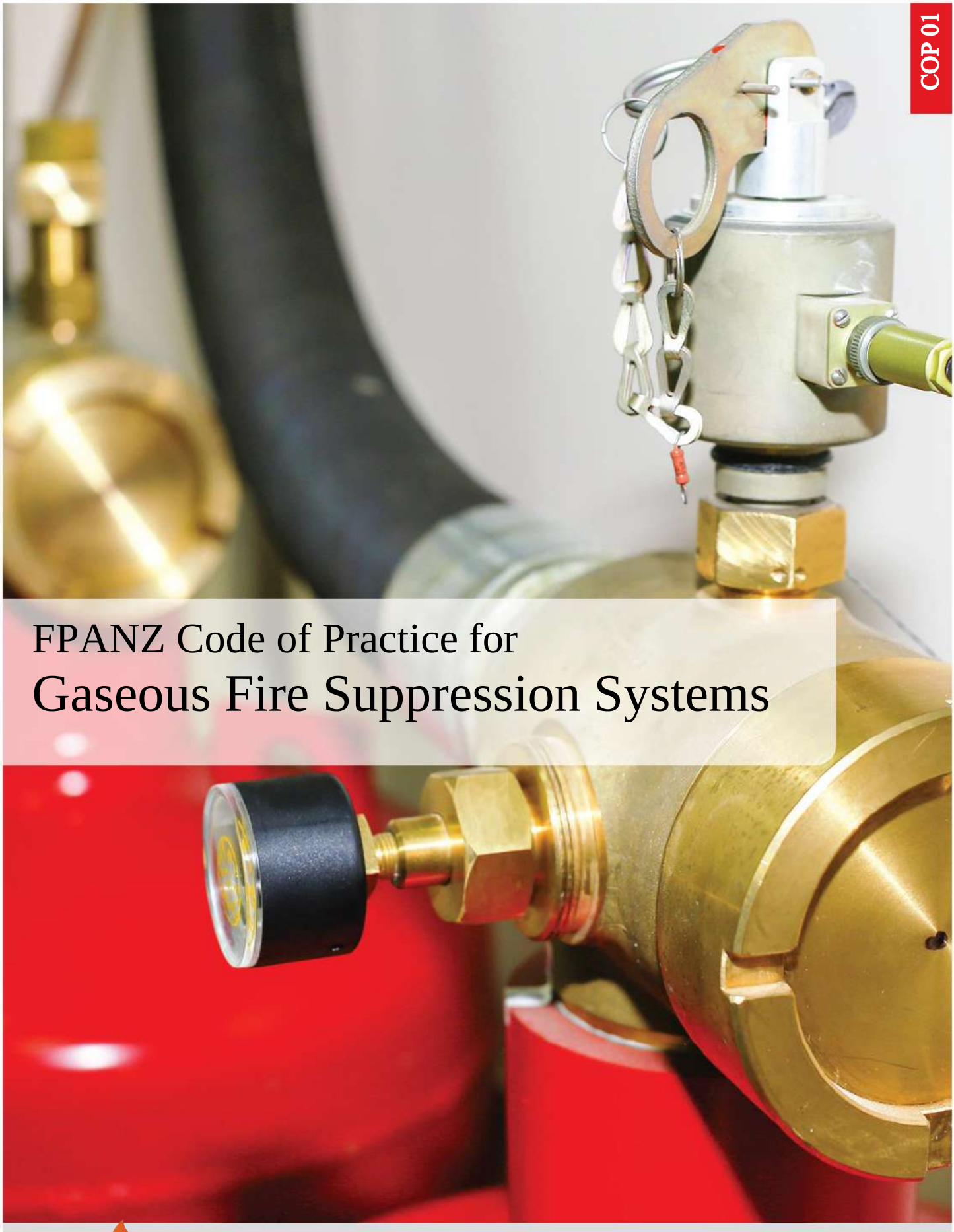

# FPANZ Code of Practice for
# Gaseous Fire Suppression Systems

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## 2. Table of contents



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| | |
|---|---|
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## 4. Introduction

This document is intended as an informative guide for specifiers, designers, installers, approvers, certifiers, service providers and owners of gaseous fire suppression systems in New Zealand.

At present there are no New Zealand Standards for gaseous fire suppression systems; therefore a range of international Standards are utilised within the market. The intent of this Code of Practice is to clarify that whichever Standard, or family of Standards, is selected for the gaseous fire suppression system then that Standard, or family of Standards, should be used for the system throughout, as opposed to a hybrid system comprising sections of different Standards.

Generally there will be two applicable Standards, or families of Standards, used in the overall system design and installation; a mechanical suppression hardware Standard and a detection control and monitoring equipment Standard. To meet certain requirements of the New Zealand Building Code, some gaseous fire suppression installations will include detection control and monitoring equipment compliant to a New Zealand fire alarm Standard where it can be demonstrated that this detection control and monitoring equipment is compatible with the mechanical suppression hardware being used under the international Standard referenced for that equipment.

## 5. Scope & Limitations (applications)

This document contains general information to assist in the design, installation and maintenance of Total Flood and Local Application gaseous fire suppression systems.

Typical examples of applications for these types of systems include, but are not limited to, the following:

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|---|---|---|
| Electrical Switch Rooms | Server Rooms | Flammable Liquid Storage |
| Electrical Switch Boards | UPS Rooms | Telecommunications |
| Process Control Rooms | Archive Rooms | Art Galleries |
| Gas turbines | Laboratories | Motors and Generators |
| Data Centres | Museums | Industrial Equipment |

Caution needs to be exercised when designing gaseous fire suppression systems where the following risks are involved: chemicals and mixtures of chemicals, metal hydrides, reactive metals, and lithium ion batteries.

Consultation with the suppression agent supplier is recommended if there are any questions on its suitability for the risk being protected.

This Code of Practice does not include requirements for marine systems. The marine industry has its own requirements and approval agencies, which differ from land-based systems. It should be noted that in marine applications it is imperative that the correct approval agency has been identified and that a system is designed and installed to meet that approval agency's requirements. Approval agencies include, but are not limited to: Maritime Safety Authority NZ (MSANZ), Maritime Safety Authority Australia (MSAA), Lloyds Registry, DNV, ABS, Rina, and IMO (Solas).

## 6. Definitions

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| Authority Having Jurisdiction (AHJ) | The organization, office or individual responsible for approving equipment, installations or procedures. Generally this role will be occupied by the building owner, the owner's insurer or their designated representative. See also Building Consent Authority. |
| Building Consent Authority | A Building Consent Authority performs the following statutory functions:<br>• issues building consents (except consents subject to a waiver or modification)<br>• inspects building work for which it has granted a building consent<br>• issues notices to fix<br>• issues code compliance certificates<br>• issues compliance schedules.<br>This role will generally be filled by the local Territorial Authority. |
| Clean Agent | Clean Agent. Electrically non-conducting, volatile, or gaseous fire extinguishant that does not leave a residue upon evaporation. The word agent as used in this document means clean agent unless otherwise indicated. |
| Competent persons | A person who is able to demonstrate that they have acquired, through training and experience, the knowledge and skills necessary to be able to design, install, test and maintain the required system(s) according to the equipment suppliers' specific requirements and instructions. |
| Concentration | The concentration of suppressant gas achieved or to be achieved in the protected enclosure. Typically three different concentrations are relevant to the design of gaseous fire suppression systems; design concentration, extinguishing concentration, and the maximum achieved concentration. See definitions below. |
| Design Concentration | The concentration used for system design purposes and is the extinguishing concentration with the addition of a safety factor. |
| Extinguishant | Electrically non-conducting gaseous, volatile, or gaseous fire extinguishing material that does not leave a residue upon evaporation. Also referred to as "Extinguishing Agent". |
| Extinguishing Concentration | The minimum concentration of extinguishant required to extinguish a fire involving a particular fuel under defined experimental conditions and does not include any safety factor. |

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| Hold Time | The critical period of time during which a concentration of extinguishant in the area of risk is required to be greater than the fire extinguishing concentration. |
| Inert Gas Systems | Typically involve the storage of inert gases (Argon/Nitrogen/$CO_2$ or combinations thereof) in high pressure cylinders (150 – 300bar). On activation, the inert gas is released into the hazard volume via a piping system and delivered through specialist nozzles. Fire suppression is achieved through the reduction of oxygen within the hazard volume. Typical agent design concentrations are in the order of 35% to 45% by volume. |
| Listed | Equipment, materials, or services included in a list published by an organization that is acceptable to the Authority Having Jurisdiction, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.<br><br>Examples of listing organisations that may be relevant for the installation of gaseous fire suppression systems include, but are not limited to: CSIRO ActivFire, Underwriter's Laboratories (UL), FM Global Approvals, Loss Prevention Certification Board (LPCB), Verband der Schadenverhutung (VdS), Fire Protection Association New Zealand (FPANZ) Fire Alarm Equipment Register. |
| Local Application System | A system consisting of a supply of extinguishant arranged to discharge directly on the burning material. |
| Maximum (Achieved) Concentration | The concentration achieved from the actual extinguishant quantity used (the fill of the cylinders used) at the maximum ambient temperature in the protected area. |
| Synthetic Systems | Typically involve the storage of a chemical fire suppressant (e.g. HFC227ea, FK-5-1-12) within a pressurized container (typically 25 or 40bar). On activation, the agent is released into the hazard volume via a piping system and delivered through specialist nozzles. Typically fire suppression is achieved through chemical reaction, heat removal, or a combination of these. Typical agent design concentrations are in the order of 5% to 10% by volume. |
| Total Flooding System | System arranged to discharge extinguishant into an enclosed space to achieve the appropriate design concentration. |

## 7. Regulatory and Certification Considerations

### *7.1. NZ Building Act / Code*

Gaseous fire suppression systems are considered to be a "specified system" as detailed in Schedule 1 of the New Zealand Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005 and as such a building consent is required for their installation.

Additionally it is required that Gaseous Fire Suppression Systems be included in the Compliance Schedule for the building in which they are installed in order that they are maintained in accordance with the requirements of the Building Warrant of Fitness regime.

Note that while there are currently no New Zealand Standards for the design, installation and maintenance of gaseous fire suppression systems there are several New Zealand Standards referenced in the legislation that are relevant to aspects of gaseous fire suppression systems.

It is a requirement of Clause C5.7 of the New Zealand Building Code that "Buildings must be provided with means of giving clear information to enable firefighters to:

(a) establish the general location of the fire,
(b) identify the fire safety systems available in the building, and
(c) establish the presence of hazardous substances or process in the building."

Appropriate signage should be provided identifying the presence of a gaseous suppression system and the extinguishant used. A Safety Data Sheet (SDS) for the extinguishant should be available on site. The area protected by the gaseous suppression system and an indication of activation should be provided on the building fire alarm system.

### *7.2. Worksafe NZ Requirements*

Pressure vessels (cylinders) used in the storage of fire suppression agents are required to comply fully with the document "New Zealand Guide to Gas Cylinders" and Worksafe NZ requirements.

The New Zealand Guide to Gas Cylinders requires and outlines the steps necessary to gain certification for pressure vessels. Note that it is illegal to import pressure vessels that are not fully approved by Worksafe NZ. If non-approved cylinders are presented for pressure test or recharge they are required to be withdrawn from service.

The New Zealand Guide to Gas Cylinders can be downloaded from:
http://www.business.govt.nz/worksafe/information-guidance/all-guidance-items/hsno/guidance-docs-epa/guide-to-gas-cylinders-2013-502kb-pdf

#### *7.2.1. Cylinder Filling Requirements*

It is a legal requirement in New Zealand that cylinders being filled or tested in New Zealand post-1980 have a LAB or SP number. If a cylinder does not have a LAB or SP number it cannot be filled or tested and is required to be removed from service.

In accordance with Worksafe NZ requirements, filling of cylinders may be completed only by an Approved Filler and using the equipment required to undertake such work. The suppression system manufacturer's requirements must be followed when refilling the suppressant cylinders to ensure compliance with: listing criteria for the agent and the high pressures involved, the OSH risks involved, and avoidance of environmental risks that may exist in the event of accidental leakage or discharge.

At the time of any refill it will normally be necessary to undertake some form of maintenance to the cylinder head assembly. Only parts approved by the manufacturer should be used and the manufacturer's instructions should be strictly followed.

Note that specific provisions exist for cylinders on off-shore ships or aircraft to permit filling of these cylinders. Details of these provisions can be found in the Guide to Gas Cylinders referenced above.

#### *7.2.2. Cylinder Hydrostatic Pressure Test and Valve Overhaul Requirements*

The Guide to Gas Cylinders outlines the frequency that pressure tests and internal inspections are required on gas cylinders prior to their being permitted to be refilled, and who is permitted to undertake this work.

Additional requirements are provided in maintenance standards, such as AS 1851 (which is referenced in the New Zealand Building Code Compliance Schedule Handbook) and in some gaseous fire suppression system installation Standards.

AS 1851 requires that the cylinder valve is serviced at ten year intervals to ensure reliable operation of the valve. This will generally require that the cylinder be depressurised, and as a consequence hydrostatically pressure tested and internally inspected before recharging and returning to service.

Guidelines detailed in AS 1851 should be followed for the hydrostatic pressure test period for gaseous fire suppression system cylinders.

The frequencies specified in AS 1851 can/should be increased for equipment located in "aggressive environments" to ensure the continued reliability of the gaseous fire suppression system.

#### *7.2.3. Transportation of Cylinders*

The transportation of pressure vessels in New Zealand is governed by the Land Transport Rule: Dangerous Goods 2005. This can be downloaded from:
http://nzta.thomsonreuters.co.nz/DLEG-NZL-LTSA-T.LTR-45001_1.pdf

Additional guidance on safe handling procedures for the transportation of pressure vessels for fire suppression systems can be found in the Fire Protection Association of Australia guide, which can be downloaded from:
http://www.fpaa.com.au/media/38228/fpa_australia_-_rd_02_v1_cylinder_safety__transport__caps.pdf

### *7.3. Standards for Gaseous Fire Suppression Systems*

There are no New Zealand Standards for the design, installation and maintenance of gaseous fire suppression systems and therefore international Standards are utilised.

Most of the manufacturers supplying gaseous fire suppression systems in New Zealand are also active in Australia; therefore it is recommended that the AS/ISO suite of Standards be preferred for use in New Zealand. Note this does not preclude the use of other recognised international Standards. Standards commonly used in the New Zealand market are listed below.

#### *7.3.1. Australian Standards*

- AS ISO 14520 Gaseous Fire-Extinguishing Systems -- Physical Properties and System Design (see Appendix A for a full list of Standards in this suite)
- AS 6183 – Carbon dioxide extinguishing systems for use on premises - Design and installation

- AS 1851 – Routine service of fire protection systems and equipment - Section 7 Special Hazard Systems

#### *7.3.2. Other International Standards*

- NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems
- NFPA 12 Standard on Carbon Dioxide Extinguishing Systems
- ISO 14520 Gaseous Fire-Extinguishing Systems -- Physical Properties and System Design (see Appendix A for a full list of Standards in this suite)
- BS EN 15004 (suite of Standards) Fixed firefighting systems - Gas extinguishing systems

### *7.4. Standards for Detection Control and Monitoring Systems*

The detection control and monitoring system is a key component of the overall gaseous fire suppression system and is responsible for the detection of a fire, the activation of the suppression system, occupant warning, notification to the Fire Service and other parties, and interfaces to associated plant and equipment.

As a matter of best practice, particularly to facilitate servicing arrangements, it is strongly recommended that detection control and monitoring equipment associated with gaseous suppression system(s) be separate from the main building fire detection and alarm system.

#### *7.4.1. New Zealand Standards*

Detection, control and monitoring equipment that meets the requirements of NZS 4512 and AS ISO 14520 is available from a number of suppliers/manufacturers within the Australia/New Zealand region. It is generally recommended that equipment to these Standards be utilised where practicable. Note this does not preclude the use of equipment compliant to other recognised international Standards.

#### *7.4.2. Other International Fire Alarm Standards*

While it is recommended that detection control and monitoring equipment is compliant with NZS 4512, equipment compliant with other Standards may be used provided it is completely separated from the main building fire detection and alarm system. International Fire Alarm Standards for this equipment include, but are not limited to:

- AS 1670.1 – 2015 Fire detection, warning, control and intercom systems - System design, installation and commissioning
- AS 1670.5 – 2016 Fire detection, warning, control and intercom systems - System design, installation and commissioning - Special hazards systems
- NFPA 72 – 2016 National Fire Alarm and Signalling Code
- ISO 7240-2 – Fire detection and alarm systems -- Part 2: Control and indicating equipment
- EN 54 part 2 – Fire detection and fire alarm systems. Control and indicating equipment

### *7.5. Requirements from New Zealand Standards Needing Consideration*

There are a number of other requirements of New Zealand Standards that will impact on the design and installation of a gaseous fire suppression system; some key considerations are outlined below.

#### *7.5.1. NZS 4512 - Fire Detection and Alarm Systems in Buildings*

As summarised in Appendix C and clause 218.9, NZS 4512 permits, but does not require, other fire protection systems (for example sprinkler, deluge, gas flooding) that comply in all

respects with the requirements of the applicable technical Standard for such systems to be connected to the main building fire alarm system to operate the building's alerting devices, provided that evacuation of the building is an appropriate and prudent response to the activation of the other fire protection system. In such cases the interconnection between the two systems must be supervised by the main building fire alarm system. The other fire protection system must not, however, initiate a fire alarm (i.e. a Fire signal to the Fire Service) through the main building fire alarm system.

Where any other fire protection system is interfaced to the main building fire alarm system to operate alerting devices throughout the building, it is necessary to have a labelled silence alarms switch, operable by a 'Bulgin 6083/C' patterned key fitted to the outside of the other fire protection system's control unit, as specified in NZS 4512 (clause 205.5).

If a suppression control system includes ancillary equipment (e.g. power supplies and detectors, including aspirating smoke detectors), such equipment and detectors must be compatible and consistent with the applicable technical Standard(s) for the suppression control system, and must be supervised by the suppression control system. Defect (fault) events registered by the suppression control system should be transmitted either to the main building fire alarm system, or directly to a remote receiving centre.

Any detectors which form part of a suppression control system must be in addition to full coverage by the main building fire alarm system.

Where brigade calling is a declared functional requirement for a suppression control system, NZS 4512 requires that the suppression control system be independently connected to the Fire Service (i.e. it must not transmit a fire alarm via the main building fire alarm system). The connection to the Fire Service remote receiving centre must comply with the provisions of NZS 4512 Appendix A.

Where a suppression control system is installed with a building, it should be interconnected to the main building fire alarm system so as to illuminate a (non-latching) red zone indicator on the main indicating unit (principal Fire Service attendance point) on activation of the suppression control system.

#### *7.5.2. NZS 4541 – Automatic Fire Sprinkler Systems*

NZS 4541 specifically requires that, where a building is sprinkler protected, the building is sprinkler protected throughout. An exemption exists for removing sprinklers from a compartment only where the compartment is a fire cell with a (120)/120/120 fire rating on all surfaces.

Where it is not practicable to provide a (120)/120/120 fire rating other options such as pre-action sprinklers could be considered.

It should be noted that the New Zealand Building Code does not recognise a gaseous suppression system as being equivalent to a sprinkler system; as such sprinklers cannot be replaced by a gaseous suppression system.

#### *7.5.3. NZS 4219 – 2009 Seismic Performance of Engineering Systems in Buildings*

The installation is required to comply with the requirements of NZS 4219. This will generally require restraint against seismic forces and clearances to other services.

### *7.6. Listing of Equipment*

All components of a gaseous fire suppression system should be listed. Often there will be two applicable listing systems; one governing the mechanical suppression hardware and the other governing the detection control and monitoring equipment.

The mechanical suppression system components of a gaseous fire suppression system form a listed system for use with a particular extinguishant, and this includes the listing of its individual component parts. Only equipment listed as part of the specific system should be used. It is not acceptable to mix and match components between systems and/or manufacturers as this invalidates their listing and creates a risk of unforeseen consequences/failures.

Only systems and components that have been tested and approved by an internationally recognized fire protection test and approval body should be used. Examples of recognized testing and approval bodies are:

- ActivFire (CSIRO)
- Factory Mutual (FM)
- Loss Prevention Certification Board (LPCB)
- Underwriters Laboratories (UL)
- Verband der Schadenverhutung (VdS).

## 8. Competency / Training

All persons who are involved with inspection, testing, maintenance and operation of special hazards systems should be adequately trained and competent in the functions they are expected to perform.

It is recommended that all personnel who are expected to install, commission, test or maintain a gaseous fire suppression system seek training from the system supplier prior to any work commencing.

## 9. Installation Requirements

### *9.1. Installation Standards and Manufacturer's Listing Requirements*

Gaseous fire suppression systems must be installed in accordance with the requirements of the selected installation Standard and the manufacturer's listing and documentation for the suppression system. There should be no mixing and matching between suppression system Standards, and only components listed for use with the system should be used.

### *9.2. Pressure Piping Design*

Pipework utilised in a gaseous fire suppression system is subjected to high pressures and therefore needs to be suitably rated for the purpose. This includes the pipe, fittings, jointing materials and jointing procedures.

Pressure piping should be designed in accordance with the international Standard being utilised for the installation and also in accordance with the manufacturer's listed system.

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| **Caution:** | The pipe and fittings typically used in fire sprinkler systems will generally not have adequate pressure ratings for use in a gaseous fire suppression system. |

### *9.3. Integrity of the Protected Enclosure (Total Flooding Systems Only)*

In order for a gaseous fire suppression system to be effective in suppressing a fire the flooded enclosure must be sufficiently air-tight to contain the suppressant gas mix for the duration of the required hold time.

Generally the hold time should not be less than 10 minutes, although longer hold times may be needed for some risks (e.g. deep-seated fires) to allow combustibles to cool below their auto ignition temperature.

Where applicable, consideration should be given to interfacing with the mechanical plant to prevent air changes occurring within the protected enclosure which would dilute the suppressant gas.

### *9.4. Pressure Relief Venting*

During a discharge of a gas suppression system, the pressure inside the protected enclosure changes and, depending on the type of agent and other factors, it is possible for this pressure to damage the enclosure/room itself. Pressure Relief Vents or Dampers may be required to equalise the pressure differential between inside and outside the risk. These devices generally consist of a balanced barometric damper installed in the wall of the risk leading to outside air.

During a discharge of an inert agent (e.g. IG-55, IG-541 etc.), there is always a positive pressure increase in the area of risk and therefore a damper that opens outwards should be utilised.

In the case of synthetic agents (e.g. HFC227ea, FK-5-1-12, etc.) discharge characteristics are generally an increase in negative pressure at start of discharge, created in part from the quick drop in temperature, changing to an increase in positive pressure later in the discharge. A dual-flow damper may therefore be required. A dual-flow damper has both a positive (outward) opening damper and also a negative (inward) opening damper.

The pressure excursion for each agent type (non-liquefiable gases, $CO_2$ and liquefiable gases) can be calculated from equations provided in the FIA document "Guidance on the pressure relief and post discharge venting of enclosures protected by gaseous fire fighting systems."

http://www.fia.uk.com/resourceLibrary/guidance-gaseous-systems-pdf.html

Assistance in selection and sizing of pressure relief dampers can also be obtained from suppression agent suppliers. Sizing is dependent on the unique pressure excursion from each valve/system/agent combination.

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| **Note:** | It is critical for the success of the installation to correctly determine the allowable pressure differential the protected enclosure(s) can withstand without sustaining damage. Failure to quantify this correctly could lead to damage to the enclosure(s) / building, failure of the gaseous suppression system due to the extinguishant leaking from the damaged enclosure(s), and possible injury to personnel in the event of a suppression system discharge.<br><br>If the allowable pressure differential that the protected enclosure(s) can withstand is not known or readily apparent then the Owner, with the assistance of the System Designer, if required, should seek advice from a suitably qualified engineer to establish a safe pressure for design. |

Another key consideration is the location of the pressure relief damper, with the preferred location being at high level on the enclosure wall venting out to the external atmosphere (i.e. outside the building). Where it is not possible to vent directly (or via a duct) to the external atmosphere it will be necessary to cascade from the protected enclosure through the adjoining enclosures to the external atmosphere using pressure relief dampers in series; this is referred to as “cascade venting.”

As a guideline the final location being vented to, either directly or via cascade venting, should preferably be the external atmosphere. Where it is not practicable to vent to the external atmosphere, then the volume being vented into needs to be significantly larger than the protected enclosure to avoid over-pressurising the enclosure. Care should be taken in order to ensure the integrity of the destination room for overpressure venting, its volume, and that its occupancy does not create any hazard or dangerous overpressure effects.

While there is no agreed or codified universal formula for determining the size of the volume being vented into, when it is not possible to vent to external atmosphere, some references indicate that this volume might need to be up to 100 times larger than the protected enclosure.

Note that leakage should be taken into account when designing venting and cascade venting systems.

More information on designing cascade venting systems can be found in the FIA document “Guidance on the pressure relief and post discharge venting of enclosures protected by gaseous fire fighting systems.”

The pressure relief vents should be adequately fire rated to preserve the fire rating of the room (if applicable) and where venting to the exterior of the building the vents need to be secure and weather tight.

### *9.5. Detection, Control and Monitoring Equipment*

The detection control and monitoring equipment needs to be installed in accordance with the selected installation Standard; it is not acceptable to mix and match between Standards.

Some installation Standards provide prescriptive requirements regarding how the detection control and monitoring system is to operate, others are more general.

Typically detection and control equipment is configured for co-incidence (also referred to as double-knock) detection with two detectors being required to activate before the extinguishant gas is released. The "first stage" alarm is a general fire warning alarm and the "second stage" alarm is confirmation of a fire event which will initiate a discharge sequence. It is expected that the detection control and monitoring system will provide at least the following functionality:

On 1st detector activation:

- An audible alarm is triggered to alert occupants.
- A visual warning may be triggered to alert occupants.
- Mechanical services switched to a recirculating mode or shut down.
- External signals to an operator control station or auto-pager may be provided.
- If required, an alarm signal is sent to the Fire Service monitoring centre if the system is remotely connected.

On 2nd detector activation:

- An audible alarm with a different tone is triggered to alert occupants of the impending extinguishant gas release.
- A visual warning is provided to notify occupants to evacuate the protected enclosure and to warn others not to enter the enclosure.
- A time delay runs for a time period long enough to allow occupants to evacuate before the extinguishant gas is released. At the expiry of the time delay the extinguishant gas is released.
- External signals to an operator control station or auto-pager may be provided.
- An alarm signal is sent to the Fire Service monitoring centre if the system is remotely connected (and not sent as a stage 1 requirement).

Following extinguishant gas release:

- A visual warning is provided confirming that the extinguishant gas has been discharged into the protected enclosure.

#### *9.5.1. Detection in High Air Movement Environments*

Occupancies such as computer server rooms may have high air movement which can delay detection due to dilution of smoke and other effects. When designing detection systems for these spaces specific consideration needs to be given to the effects of high air movement to ensure that the detection system is able to operate effectively.

#### *9.5.2. Interfaces to Other Plant*

It may be necessary for the detection control and monitoring system to be interfaced to other services to shut down or change modes of operation on detection of a fire and activation of the suppressant system (e.g. mechanical services may be shut down or changed to a recirculating-only mode to prevent dilution of the extinguishant gas).

Such interfaces should be direct from the suppression control panel to the affected services, and not via another panel or system (such as the main building fire alarm panel), which might be isolated for work elsewhere within the building, thereby resulting in the unexpected impairment of the gaseous suppression system.

The operation of the suppression system and all related interfaces should be clearly detailed in a Cause and Effect matrix, which forms part of the design documentation.

When designing interfaces it is critical that consideration be given to how the interface is to be periodically tested, and also to how the rest of the gaseous suppression system is to be tested if the interface cannot normally be tripped as part of routine testing. Any interface isolate or by-pass arrangements need to be supervised to ensure that the interface cannot inadvertently be left in an impaired state.

Clear instructions and means of resetting any interfaced services should be provided so that services can readily be restored once it is safe to do so.

### *9.6. Commissioning Requirements*

Gaseous fire suppression systems, including their control systems, should be subjected to a commissioning test consistent with the requirements of the selected design and installation Standard. A written record of these tests should be made and supplied to the building owner to establish a benchmark for the future testing and maintenance of the system.

An example of a suitable commissioning checklist can be found in AS ISO 14520 Appendix ZZ.

On successful completion of all commissioning tests the installer should provide a certificate of completion for the installation. A suitable example can be found in AS ISO 14520 Appendix ZZ.

### *9.6.1. Discharge Tests and Enclosure Integrity Tests*

A discharge test (to verify), or an enclosure integrity test (to simulate), is conducted to ensure a protected area is sealed well enough to maintain an extinguishing concentration surrounding the protected equipment for the required hold time. A Discharge Test or an Enclosure Integrity Test should be performed when the system is commissioned.

#### *9.6.1.1. Discharge Test*

A discharge test is where the agent is released and concentrations (and other variables) are measured to confirm that the gaseous fire suppression system performs as designed and retains the required suppressant concentration(s) for the required hold time.

All sensors used should be calibrated and suitable for the suppressant gas installed.

The discharge test procedure from the installation Standard utilised should be followed. More information on test procedures can be found in AS ISO 14520 Appendix ZC.

Discharge tests should only be carried out by trained and competent personnel using calibrated equipment suitable for the suppressant gas installed.

#### *9.6.1.2. Enclosure Integrity Test*

Due to the cost associated with discharge testing the majority of gaseous suppression systems utilise an enclosure integrity test as an alternative means to prove the enclosure integrity, holding time, operation of vents, etc.

The enclosure integrity test procedure from the installation Standard utilised should be followed. More information on test procedures can be found in AS ISO 14520 Appendix E and NFPA 2001 Annex C.

An enclosure integrity test should also be conducted on an annual basis as detailed in section 10.1.

Enclosure integrity tests should only be carried out by trained and competent personnel using calibrated equipment.

## *9.7. Third Party Certification*

Where the detection, control and monitoring system is to be interfaced to a NZS 4512 compliant fire alarm system, or is to be directly connected to Fire Service remote monitoring, the control system will require third party inspection and certification by a Type A inspection body accredited to ISO 17020, certified for inspecting to NZS 4512.

It is recommended that all gaseous fire suppression systems receive third party inspection and certification from an ISO 17020 Type A accredited inspection agency, accredited to inspect and certify against the applicable installation Standard.

Where there is no inspection agency with ISO 17020 accreditation to inspect and certify against the installation Standard utilised, it is recommended that an agency with ISO 17020 accreditation to inspect against a similar gaseous fire suppression Standard, and with familiarity of the installation Standard that has been utilised, be appointed to carry out the inspections.

## 10. Maintenance & testing requirements

The installer should provide the building owner with design documentation which should include: as-built drawings, Cause and Effect matrix, design calculations (suppression and detection), commissioning test results (including enclosure integrity test), control equipment configuration/database, manufacturers' installation/maintenance information, and details of the applicable installation/maintenance Standards. It is recommended that a copy of these documents be placed in a document pouch and permanently affixed adjacent to the installation.

As gaseous fire suppression systems are Specified Systems, their maintenance requirements are required to be written into the building's Compliance Schedule in order that these requirements are properly documented and form part of the Building Warrant of Fitness (BWOF) for the building in which the system is installed. Although it is ultimately the building owner's obligation to ensure that maintenance requirements are written into the building's Compliance Schedule, the designer/installer has a duty of care to assist the building owner to achieve this.

Gaseous fire suppression systems are required to be maintained in accordance with the Compliance Schedule to ensure that a Form 12A can be issued by the maintaining IQP and a BWOF issued at the building's annual anniversary.

In the event of there being an existing Compliance Schedule which does not contain sufficient detail to ensure the proper maintenance of any installed gaseous fire suppression system, it is recommended that the IQP draft a suitable Compliance Schedule which takes into account the requirements of the manufacturer's listed system and the installation. Where the installation Standard is not known, it is recommended that the manufacturer's requirements and/or AS 1851 are followed. In consultation with the building owner, or their designated representative, the drafted Compliance Schedule should be lodged with the Building Consent Authority as part of a Form 11 application to amend the building's Compliance Schedule to include the maintenance requirements of the gaseous fire suppression system(s).

### *10.1. Enclosure Integrity Test*

An enclosure integrity test should be conducted on an annual basis as part of the maintenance of the system to ensure that the enclosure remains suitably sealed and able to contain an extinguishing concentration for the required hold time.

This test should be benchmarked against the original commissioning test.

Enclosure integrity tests should only be carried out by trained and competent personnel using calibrated equipment.

## 11. Implementation and Review

### *11.1. Implementation*

A final draft of this Code of Practice was distributed for review to the following organisations:

Aon New Zealand
Fire Protection Inspection Services Ltd
New Zealand Fire Service
Ministry of Business, Innovation and Employment
Society of Fire Protection Engineers, New Zealand Chapter
The Institution of Fire Engineers, New Zealand Branch
Worksafe NZ

The document is available from the Fire Protection Association of New Zealand (FPANZ) web site http://www.fireprotection.org.nz/online-resources/articles-and-publications or via the secure members-only section of the FPANZ website.

### *11.2. Review, interpretation and update process*

An individual or organisation may write to the FPANZ Executive Director, requesting an amendment to, or an interpretation of, this Code of Practice.

**Appendix A – Documents Referenced in this Code of Practice**

**New Zealand Standards**

- NZS 4219 – 2009 Seismic Performance of Engineering Systems in Buildings
- NZS 4512 – 2010 Fire Detection and Alarm Systems in Buildings
- NZS 4541 – 2013 Automatic Fire Sprinkler Systems

**Australian Standards**

- AS ISO 14520.1 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – General Requirements Gaseous Fire Suppression
- AS ISO 14520.2 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – CF31 Extinguishant
- AS ISO 14520.5 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – FK-5-1-12 Extinguishant
- AS ISO 14520.6 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – HCFC Blend A Extinguishant
- AS ISO 14520.8 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – HFC 125 Extinguishant
- AS ISO 14520.9 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – HFC 227ea Extinguishant
- AS ISO 14520.10 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – HFC 23 Extinguishant
- AS ISO 14520.11 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – HFC-236fa Extinguishant
- AS ISO 14520.12 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – IG-01 Extinguishant
- AS ISO 14520.13 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – IG-100 Extinguishant
- AS ISO 14520.14 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – IG-55 Extinguishant
- AS ISO 14520.15 – 2009 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – IG-541 Extinguishant
- AS 1670.1 –2015 Fire Detection, Warning, Control and Intercom Systems – System Design, Installation and Commissioning
- AS 1670.5 – 2016 Fire Detection, Warning, Control and Intercom Systems – System Design, Installation and Commissioning – Special Hazards Systems
- AS 1851 – 2012 Routine Service of Fire Protection Systems and Equipment – Section 7 Special Hazard Systems
- AS 6183 – 2011 Carbon Dioxide Extinguishing Systems for Use on Premises – Design and Installation

**Other International Standards**

- BS EN 15004.1 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Design, Installation and Maintenance
- BS EN 15004.1 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for FK-5- 1-12 Extinguishant
- BS EN 15004.2 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for HCFC Blend A Extinguishant
- BS EN 15004.3 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for HFC 125 Extinguishant

- BS EN 15004.4 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for HFC 227ea Extinguishant
- BS EN 15004.5 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for HFC 23 Extinguishant
- BS EN 15004.6 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for IG-01 Extinguishant
- BS EN 15004.7 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for IG-100 Extinguishant
- BS EN 15004.8 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for IG-55 Extinguishant
- BS EN 15004.9 – 2008 Fixed Firefighting Systems – Gas Extinguishing Systems. Physical Properties and System Design of Gas Extinguishing Systems for IG-541 Extinguishant
- BS 7273.1 – 2006 Code of Practice for the Operation of Fire Protection Measures. Electrical Actuation of Gaseous Total Flooding Extinguishing Systems
- EN 54 part 2 – Fire detection and fire alarm systems – Control and indicating equipment
- ISO 14520.1 – 2015 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 1: General Requirements
- ISO 14520.2 – 2006 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 2: CF3I Extinguishant
- ISO 14520.5 – 2006 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 5: FK-5-1-12 Extinguishant
- ISO 14520.6 – 2006 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 6: HCFC Blend A Extinguishant
- ISO 14520.8 – 2006 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 8: HFC 125 Extinguishant
- ISO 14520.9 – 2006 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 9: HFC 227ea Extinguishant
- ISO 14520.10 – 2005 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 10: HFC 23 Extinguishant
- ISO 14520.11 – 2005 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 11: HFC 236fa Extinguishant
- ISO 14520.12 – 2015 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 12: IG-01 Extinguishant
- ISO 14520.13 – 2015 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 13: IG-100 Extinguishant
- ISO 14520.14 – 2015 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 14: IG-55 Extinguishant
- ISO 14520.15 – 2015 Gaseous Fire-Extinguishing Systems – Physical Properties and System Design – Part 15: IG-541 Extinguishant
- ISO 7240-2 – Fire detection and alarm systems – Part 2: Control and indicating equipment
- NFPA 12 – 2015 Standard on Carbon Dioxide Extinguishing Systems
- NFPA 72 – 2016 National Fire Alarm and Signalling Code
- NFPA 2001 – 2015 Standard on Clean Agent Fire Extinguishing Systems

**Other Documents**

- Environmental Protection Agency NZ – Guide To Gas Cylinders
- Fire Industry Association – Guidance on the pressure relief and post discharge venting of enclosures protected by gaseous fire fighting systems
- Fire Protection Association of Australia – Cylinder Safety (Transport) Caps
- Land Transport Rule: Dangerous Goods 2005

**Appendix B – Extinguishant Gases Commonly Used In New Zealand**

Types of extinguishant gases commonly used in New Zealand include, but are not limited to:

| Extinguishant | Trade Name | Chemical | Type | Standard |
|---|---|---|---|---|
| IG-01 | Argotec | Argon (100%) | Inert | AS ISO 14520.12 |
| IG-541 | Inergen | Carbon Dioxide (8%)<br>Argon (40%)<br>Nitrogen (52%) | Inert | AS ISO 14520.15 |
| IG-55 | Argonite<br>Pro-Inert<br>iFlow | Argon (50%)<br>Nitrogen (50%) | Inert | AS ISO 14520.14 |
| IG-100 | Nitrogen | Nitrogen (100%) | Inert | AS ISO 14520.13 |
| $CO_2$ | Carbon Dioxide | Carbon Dioxide | Inert | AS ISO 6183 |
| HFC227ea | FM-200 | Heptafluoropropane | Halocarbon (synthetic) | AS ISO 14520.9 |
| FK-5-1-12 | NOVEC1230 | Dodecafluoro-2-methylpentan-3-one | Fluoroketone (synthetic) | AS ISO 14520.5 |

Note: the above is not an exhaustive list of trade names.