



# FPANZ Code of Practice for Water Mist Fire Protection Systems



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## 1. Document history

| Revision | Date of Issue | Description                  |
|----------|---------------|------------------------------|
| 1        | 25.09.2017    | Issued for first publication |
|          |               |                              |
|          |               |                              |
|          |               |                              |

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## 3. Acknowledgements

The Fire Protection Association New Zealand thanks the New Zealand Fire Equipment Manufacturers' Association for the development of this Code of Practice, and in particular the following individuals and companies:

|                  |  |
|------------------|--|
| David Boff       | Fire Protection Technologies                 |
| Daryl Brown      | Fire Safety Equipment Ltd                    |
| Robert Fenton    | Pertronic Industries Ltd                     |
| Simon Rosser     | Safeworld Ltd                                |
| Jason Dyer       | Trade Mark Design Ltd                        |
| David Prosser    | FPANZ lifetime member                        |
| Ovidi Lasheras   | Tyco Fire Protection Products, Australia     |
| Daniel Wilson    | UTC Climate Controls & Security, Australia   |
| Apratim Sengupta | UTC Climate Controls & Security, New Zealand |
| Mitchell Buckley | Victaulic NZ Ltd                             |

The following organisations are thanked for their review of this Code prior to final publication:

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

#### 4. Introduction

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

Water mist is water distributed in a mist form to achieve control, suppression and/or extinguishment of a fire. Water mist is generally more effective on fast burning or larger fires than smaller or smouldering fires as the benefits compound once the mist begins extracting heat and transforming to steam.

Three critical factors influence the effectiveness of a water mist system; droplet size/surface area, droplet momentum, and the droplet flux density used on the fire.

- The smaller the droplet size, the greater the surface area of water available for radiant heat absorption and rapid vaporisation (resulting in cooling). This combined with an oxygen depletion effect, caused by water droplets vaporising, results in less water being required.
- Sufficient droplet momentum (mass x velocity) must be provided to allow the droplets to effectively penetrate the seat of a fire.
- The flux density (usually expressed in lpm/m<sup>3</sup>) is the amount of water for a given volume and time delivered to reduce the amount of heat released by a fire.

Water mist systems will generally discharge a spectrum of different droplet sizes with each size having an influence on the water mist system’s ability to achieve fire extinguishment/control. Smaller droplets are more efficient at heat absorption while larger droplets are better able to maintain sufficient momentum to reach the seat of fire.

It is the combination of all these parameters that determines the effectiveness of a water mist system in fire control, suppression, or extinguishment. When selecting a system it is important that all characteristics are considered.

**Table 1: Indicative water mist droplet size and heat absorption characteristics**

|  | Typical Droplet Diameter (mm) | Number of Droplets per litre of water | Droplet Surface Area (m <sup>2</sup> ) per litre of water |
|--|-------------------------------|---------------------------------------|---|
| Conventional Sprinkler   | 1 to 5                        | 15 thousand to 2 million              | 1 to 6  |
| Low Pressure or Single Fluid Water Mist                        | 0.2 to 1                      | 2 million to 250 million              | 6 to 30   |
| High Pressure Water Mist or Low Pressure Twin Fluid Water Mist | 0.025 to 0.2                  | 250 million to 150 billion            | 30 to 250   |

Water mist systems are categorised into low, intermediate, and high pressure system groups, with low-pressure systems at 12.1 bar (175psi) or less, intermediate-pressure systems from 12.1 bar (175psi) to 34.5 bar (500psi), and high-pressure systems at 34.5 bar (500psi) and higher.

Water mist can be distributed in a variety of ways, the main types being:

**Deluge water mist systems** – a network of open water mist nozzles controlled by a quick opening valve (deluge valve) that is activated via a separate detection and control system. All nozzles in the protection network distribute fine water droplets. These systems are typically used in a total flooding or local application scenario.

**Dry pipe water mist systems** – a network of automatic (heat-activated) water mist nozzles in which the (dry) pipe network is permanently charged with pressurised gas above the alarm valve and with water beyond the valve. When an automatic water mist nozzle is activated by heat the gas pressure drops allowing the alarm valve to open and admit water to the installation which will flow through only the activated nozzle(s). To speed up the opening of the alarm valve an accelerator or exhaustor may be included in the installation.

**Wet pipe water mist systems** – a network of automatic (heat-activated) water mist nozzles in which the pipe network is permanently charged with water. When an automatic water mist nozzle is activated by heat, water is discharged through only the activated nozzle(s).

**Pre-action water mist systems** – a dry pipe network of automatic (heat-activated) water mist nozzles, permanently charged with low-pressure gas above the alarm valve and with water beyond the valve. Water entry to the pipe network is controlled by a separate electronic detection system. Before water may be discharged, it is necessary that automatic water mist nozzle(s) and detection device(s) both operate. Water is discharged through only the activated nozzle(s).

Pre-action systems are commonly available as single interlock and double interlock designs. Single interlock installations admit water into the pipework on activation of the detection device(s). Double interlock installations will only admit water into the pipework upon activation of both the detection device(s) and automatic water mist nozzle(s).

A variety of technologies are used to develop the pressures needed to create water mist at the nozzle. These require different considerations when designing, installing and maintaining:

- **Diesel Pumps** – use diesel motors to supply power and to generate the pressures required at the nozzle. These are useful when there are longer discharges, larger flux densities are required, for multi-zone protection, and when an independent power supply is required. Note that if the water mist system is an alternative to sprinklers requiring compliance with NZS 4541 then any pump on the primary water supply must be a diesel engine driven pump compliant with NZS 4541.
- **Electric Pumps** – use electrically powered pumps to generate the pressures required at the nozzle. These can have a high voltage and current draw but are useful when there are longer discharges, larger flux densities are required, for multi-zone protection, and when electrical supply availability is not an issue. In some cases a backed-up emergency power supply may be required.

- **Gas-Powered Pumps** – use compressed gas (typically Nitrogen) to power a pump that draws water from a tank or cylinders to develop the pressure required at the nozzle. These are useful as stand-alone systems and are not dependent on external power to operate; they are also useful for industrial machinery spaces, or where power supply availability is an issue.
- **Pressurised Water Cylinders** – these typically have either water compressed or an independent Nitrogen supply to push water from a cylinder into a system; these are useful for small stand-alone systems.
- **Combination of Pressurised Water and Air (or Nitrogen)** – used with low-pressure twin fluid systems which incorporate a mixing chamber in the nozzle where the air/nitrogen shears water into micro droplets. This system type is sometimes also referred to as a hybrid system.

There are a variety of hazard types for which water mist systems are designed, and the selection of equipment is generally based on the hazard type and the listing of the system for the hazard.

Listings are based upon fire testing performed as part of the listing process.

**Light Hazard** – these are occupancies where the combustibility of the contents is low with relatively low rates of heat release.

**Ordinary Hazard** – these occupancies all have their own specific definitions but across the range the combustibility of material increases, and the amount of fuel increases with higher rates of heat release.

**Other Hazards** – these are specific applications for which there is an extensive variety (for example: machinery spaces, turbines, local application, semiconductor wet bench equipment, computer rooms, industrial cookers, etc.)

Occupancy classification schemes vary between Standards. It is important that the occupancy being protected is classified utilising the Standard against which the water mist system and its design criteria have been listed.

There are numerous applications for water mist (some examples are given in Section 5).

It is extremely important to ensure that there has been a full-scale fire test applicable to the design/application that is being considered for a water mist system. Fire tests form part of the listing of the system that suits the application, as evidence that the water mist system is fit for purpose.

The importance that full-scale fire tests play in a system and its application cannot be overstated. Unlike traditional systems (e.g. sprinklers) there are no specific water mist design Standards to cover a range of applications; instead, manufacturers submit their product for full-scale fire tests to demonstrate that the system works in a specific application; listings are then granted based on common test protocols that have been developed over time.

**Caution:** Deviating from listings and the limitations associated with the listing is not recommended and generally will not comply with the installation standards.

Section 7.6 provides recommended criteria for identifying whether suitable fire testing, typically performed by third party laboratories like VdS or FM Approvals, is applicable to the given situation a water mist system is being considered for.

At present, there are no New Zealand Standards for water mist fire protection 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 a water mist fire protection system then that Standard, or family of Standards, should be used for the system throughout, as opposed to a mixed system comprising sections of different Standards.

Note that NZS 4541 has certain requirements for water mist systems where they are utilised as an alternative to sprinklers under that Standard.

In some cases there will be two applicable Standards, or families of Standards, used in the overall system design and installation; a mechanical protection systems hardware Standard and, potentially, a detection control and monitoring equipment Standard. To meet certain requirements of the New Zealand Building Code, some water mist 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 water mist 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 water mist fire protection systems.

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

### Light or Ordinary Hazards protected with water mist

|                               |               |                               |
|-------------------------------|---------------|-------------------------------|
| High-rise buildings           | Hotels        | Healthcare facilities         |
| Laboratories                  | Offices       | Data Centres and Server Rooms |
| Cultural / Heritage buildings | Museums       | Art Galleries                 |
| Parking garages               | Archive Rooms |                               |

### Other Hazards protected with water mist

|  |                        |
|--|------------------------|
| Machinery and Manufacturing Spaces           | Industrial Fat Fryers  |
| Power Generation and Distribution Facilities | Diesel Generators      |
| Transformers                                 | Prisons                |
| Cable Tunnels                                | Conveyors / Escalators |
| Transportation (Trains, Stations, Tunnels)   | Structural Protection  |
| Flammable Liquid Storage                     |                        |

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

**Caution: Consultation with the water mist system supplier is essential to confirm its suitability for the risk being protected.**

**Hybrid systems** are a technology that utilises an inert compressed gas (typically Nitrogen) which is combined with water so that water mist is developed at the nozzle. The inert gas volumes used are sized to reduce the oxygen level in the protected risk in a similar method as a gaseous suppression system – these systems are therefore called *Hybrids* (effectively incorporating both gas suppression and water mist). For the purposes of this document, and because of the lack of international Standards to draw upon at present, Hybrid systems will fall within the scope of this document unless explicitly excluded.

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

The following definitions are provided for general guidance. When designing, specifying, installing, commissioning and maintaining a water mist system the definitions provided in the selected installation/maintenance Standard are to be utilised.

### Organisations / Persons

**Authority Having Jurisdiction (AHJ)** The organization, office or individual responsible for approving equipment, installations or procedures.

In the case of water mist systems designed as an alternative solution under NZS 4541 the SSC will effectively be the AHJ.

**Building Consent Authority** A Building Consent Authority performs the following statutory functions:

- issues building consents
- inspects building work for which it has granted a building consent
- issues notices to fix
- issues code compliance certificates
- issues compliance schedules.

This role will generally be filled by the local Territorial Authority.

**Competent person** 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.

**Sprinkler System Certifier (SSC)** An organisation accredited by an internationally recognised accreditation body to AS/NZS ISO/IEC 17020 as a Type A inspection body as competent to fulfil the roles as defined in NZS 4541.

In the case of water mist systems designed as an alternative solution under NZS 4541 the SSC will effectively be the AHJ.

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.

Examples of listing organisations that may be relevant for the installation of water mist systems include, but are not limited to: CSIRO ActivFire, Underwriter’s Laboratories (UL), FM Global Approvals, Loss Prevention Certification Board (LPCB), Verband der Schadenverhütung (VdS), Fire Protection Association New Zealand (FPANZ) Fire Alarm Equipment Register.

### General

Additive Any chemical or mixture of chemicals intentionally introduced into the system.

$D_{vf}$  A drop diameter such that the cumulative volume, from zero diameter to this respective diameter, is the fraction,  $f$ , of the corresponding sum of the total distribution.

Enclosure A confined or partially confined volume.

Propellant Compressed gas used as a prime mover to push water out of storage vessels, through pipe networks or through distribution components.

Water Mist A water spray for which the  $D_{v0.99}$ , for the flow-weighted cumulative volumetric distribution of water droplets is less than 1000  $\mu\text{m}$  within the nozzle operating pressure range.

### Design Objectives

Fire Control Limiting the size of a fire so as to decrease the heat release rate and pre-wet adjacent combustibles, while controlling ceiling gas temperatures to avoid structural damage.

Fire Extinguishment The complete suppression of a fire until there are no burning combustibles.

Fire Suppression The sharp reduction of the rate of heat release of a fire and the prevention of regrowth.

## System Types

|   |   |
|---|---|
| Water Mist System                               | A distribution system connected to a water supply or water and atomizing media supplies that is equipped with one or more nozzles capable of delivering water mist intended to control, suppress, or extinguish fires and that has been demonstrated to meet the performance requirements of its listing and installation Standard.   |
| Deluge Water Mist System                        | A water mist system utilizing non-automatic (open) mist nozzles attached to a piping network connected to the fluid supply(ies) through a valve controlled by an independent detection system installed in the same area as the mist nozzles.   |
| Dry Pipe Water Mist System                      | A water mist system using automatic nozzles attached to a piping system containing air, nitrogen, or inert gas under pressure, the release of which (as from an opening of an automatic nozzle) allows the water pressure to open a dry pipe valve. The water then flows into the piping system and out through any open nozzles.   |
| Engineered Water Mist Systems                   | Those systems that need individual calculation and design to determine the flow rates, nozzle pressures, pipe size, area, or volume protected by each nozzle, discharge density of water mist, the number and types of nozzles, and the nozzle placement in a specific application.   |
| Local-Application Water Mist System             | A water mist system arranged to discharge directly on an object or hazard in an enclosed, unenclosed, or open outdoor condition.  |
| Occupancy Protection System                     | A water mist system utilizing automatic water mist nozzles installed throughout a building or a portion of a building and intended to control, suppress, or extinguish a fire.  |
| Pre-action Water Mist System                    | A water mist system using automatic nozzles attached to a piping system that contains air that might or might not be under pressure, with a supplemental detection system installed in the same areas as the mist nozzles. The actuation of the detection system opens a valve that allows water to flow into the piping system and discharge through all opened nozzles in the system. |
| Pre-Engineered Water Mist Systems               | Those systems that have predetermined pipe and tube sizes, maximum and minimum pipe lengths, number of fittings and numbers and types of nozzles, nozzle pressures, atomizing media, and water storage quantities and that do not require additional hydraulic calculations.  |
| Total Compartment Application Water Mist System | A deluge water mist system that provides complete protection of an enclosure or space by the simultaneous operation of all nozzles in the space by manual or automatic means. Also referred to as Total Flood application.  |

|                                     |  |
|-------------------------------------|--|
| Wet Pipe Water Mist System          | A water mist system using automatic nozzles attached to a piping system containing water and connected to a water supply so that water discharges immediately from nozzles operated by the heat from a fire.   |
| Zoned Application Water Mist System | A total compartment application water mist system utilizing non-automatic nozzles or intermixed non-automatic and automatic nozzles in which the piping network is subdivided into predetermined zones controlled by individual control valves and which protects a predetermined portion of the compartment by the manual or automatic activation of a selected group of nozzles. |
| High Pressure System                | A water mist system where the distribution system piping is exposed to pressures of 34.5 bar (500 psi) or greater.   |
| Intermediate Pressure System        | A water mist system where the distribution system piping is exposed to pressures greater than 12.1 bar (175 psi) but less than 34.5 bar (500 psi).   |
| Low Pressure System                 | A water mist system where the distribution piping is exposed to pressures of 12.1 bar (175 psi) or less.   |
| Single-Fluid System                 | A water mist system utilizing a single piping system to supply each nozzle.  |
| Twin-Fluid System                   | A water mist system in which water and an atomizing medium are supplied to the water mist nozzle utilizing a separate piping system for each medium or a single piping system for both.  |

## Nozzles

|   |   |
|---|---|
| Water Mist Nozzle                       | A special purpose device, containing one or more orifices, designed to produce and deliver a water spray meeting either the definition of water mist or meeting the specific requirements of an approved water mist fire test protocol. |
| Automatic Water Mist Nozzles            | Nozzles that operate independently of other nozzles by means of a detection/activation device built into the nozzle.  |
| Multi-functional Water Mist Nozzles     | Nozzles capable of operation using both automatic and non-automatic means.  |
| Non-automatic Water Mist Nozzles (Open) | Nozzles that operate as an entire system or grouping of nozzles, containing open orifices with activation of the water flow to the nozzles by an independent detection system.  |

## Pressures

|                           |  |
|---------------------------|--|
| Nozzle Operating Pressure | The pressure range at which nozzles are listed to control, suppress, or extinguish a fire. |
|---------------------------|--|

|                        |   |
|------------------------|---|
| Standby Pressure       | The pressure that exists in the distribution system in the static state, prior to nozzle discharge. |
| System Design Pressure | The maximum pressure a system or component is rated to withstand.                                   |
| Working Pressure       | The maximum anticipated pressure applied to the system components exclusive of surge pressures.     |

## 7. Regulatory and Certification Considerations

### 7.1. NZ Building Act / Code

Water mist fire protection 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 water mist 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 water mist fire protection systems there are several New Zealand Standards referenced in the legislation that are relevant to aspects of water mist fire protection 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 water mist system. A Safety Data Sheet (SDS) for the propellant (and any additives) should be available on site. The area protected by the water mist system and an indication of activation should be provided on the building fire alarm system.

### 7.2. Worksafe NZ Requirements

Where pressure vessels (cylinders) are used as part of the of the water mist fire protection system they 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 number, or are UNRTDG compliant. If a cylinder is not compliant 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 water mist system manufacturer's requirements must be followed when refilling the cylinders to ensure compliance with: listing criteria for the agent and the high pressures involved, the OSH risks involved, and avoidance of any 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 therefore 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 water mist 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 water mist 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](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](http://www.fpaa.com.au/media/38228/fpa_australia_-_rd_02_v1_cylinder_safety_transport_caps.pdf)

### **7.3. Recognised Standards and Design Guides for Water Mist Fire Protection Systems**

There are no New Zealand Standards for the design, installation and maintenance of water mist fire protection systems and therefore international Standards and design guides are utilised. The most commonly utilised Standards and design guides are:

- AS 4587 Water mist fire protection systems – System design, installation and commissioning
- BS 8489-1 Fixed fire protection systems. Industrial and commercial watermist Systems. Code of practice for design and installation
- CEN/TS 14972 Fixed firefighting systems — Watermist systems — Design and installation
- FM Global Loss Prevention Data Sheet DS 4-2 Water Mist Systems
- NFPA 750 Standard on Water Mist Fire Protection Systems

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

Where used, the detection control and monitoring system is a key component of the overall water mist system and is responsible for the detection of a fire, the activation of the water mist system, occupant warning, notification to Fire and Emergency New Zealand 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 water mist 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 is available from a number of suppliers/manufacturers within the Australia/New Zealand region. It is generally recommended that equipment to this Standard 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**

Some water mist systems incorporate proprietary control and monitoring equipment as part of their listing. Where this is the case, the listed equipment should be used unless this is impracticable (e.g. due to the equipment not being compliant with New Zealand legislation).

Where there is no proprietary control and monitoring equipment incorporated as part of the systems' listing, it is recommended that detection control and monitoring equipment compliant with NZS 4512 be utilised. Equipment compliant with Standards other than NZS 4512 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 water mist fire protection 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, water mist, 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 Fire and Emergency New Zealand) 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 water mist system includes ancillary equipment (e.g. power supplies and detectors), such equipment and detectors must be compatible and consistent with the applicable technical Standard(s) for the water mist control system, and must be supervised by the water mist control system. Defect (fault) events registered by the water mist 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 water mist fire protection 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 water mist fire protection system, NZS 4512 requires that the water mist control system be independently connected to Fire and Emergency New Zealand (i.e. it must not transmit a fire alarm via the main building fire alarm system). The connection to Fire and Emergency New Zealand remote receiving centre must comply with the provisions of NZS 4512 Appendix A.

Where a water mist fire protection 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 and Emergency New Zealand attendance point) on activation of the water mist system.

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

NZS 4541 clause 304 specifically includes provision for water mist systems to be used as an equivalent to sprinkler systems. NZS 4541 requires that water mist systems may only be used if listed by an SSC.

NZS 4541 specifically notes that the SSC's listing criteria may take precedence over other requirements of NZS 4541. It is critical when designing a water mist system that the listing details are obtained and reviewed in detail to ensure a compliant installation.

Pumps are required to comply with NZS 4541 and any pump on the primary water supply must have a diesel driver. Attention is drawn to NZS 4541 section 610.5.6 which requires specific provision to be made where Fire and Emergency New Zealand are required to provide water at a pressure higher than 1050 kPa at the Fire Service Inlet.

### **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 water mist systems and their components should be listed as part of the system certification. Often there will be two applicable listing systems; one governing the mechanical water mist hardware and the other governing the detection control and monitoring equipment.

As the listings for water mist systems are based on a specific application, with associated specific fire test protocols, care needs to be taken to ensure that the fire test protocols utilised for the listing are representative of the actual installation conditions for which the water mist system is being considered. In order to determine suitability of a water mist or hybrid system for a particular application the following should be considered:

- Is the fuel similar to the test protocol (liquid or solid fuel, flash point, combustibility, quantity, arrangement)?
- Is the compartment volume equal to or less than the volume of the test protocol?
- Is the compartment height equal to or less than the test protocol?
- Are the compartment ventilation conditions similar (presence of fans, forced ventilation, etc., area of openings, position of openings)?
- Are there more obstructions to the distribution of mist than the test protocol?
- Is the duration of protection provided by the listed system appropriate for the actual level of protection needed?
- Any other considerations specific to the application or the fire test?

It is expected that the evaluation will be carried out in conjunction with the water mist system supplier.

The mechanical suppression system components of a water mist 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 and/or failures.

Only systems and components that have been tested and listed 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 Schadenverhütung (VdS).

**Caution: Deviating from listings and the limitations associated with the listing is not recommended and generally will not comply with the installation standards.**

## 8. Competency / Training

All persons who are involved with design, installation, commissioning, inspection, testing and maintenance of water mist fire protection systems should be adequately trained and competent in the functions they are expected to perform.

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

## 9. Installation Requirements

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

Water mist fire protection systems need to be installed in accordance with the requirements of the selected installation Standard and the manufacturer's listing and documentation for the specific system involved. There should be no mixing and matching between water mist fire protection system Standards, and only components listed for use with the system should be used.

### **9.2. Pressure Piping Design**

Pipework utilised in a water mist fire protection system may be subjected to high pressures and therefore needs to be suitably rated for the purpose. This includes the pipe/tube, fittings, jointing materials and jointing procedures. Due to considerations such as the small flow passages in water mist nozzles the listing of some system may require the installation of strainers and the use of clean and corrosion-resistant pipe such as stainless steel. The manufacturer's listed design guide and the installation Standard should be consulted to ensure that the correct type of pipe / tube and fittings are utilised for the system being installed.

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.

**Caution: The pipe and fittings typically used in fire sprinkler systems may not be suitable for use in some water mist fire protection systems.**

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

Many water mist systems have specific requirements for the protected risk to be within an enclosure of suitable air-tightness and limited or no air movement. It is critical to review the listing of the system to determine the specific requirements of the system for the protected enclosure.

Note that there may also be limitations based on ceiling height and enclosure volume which should be adhered to.

Where there is any ambiguity, the system manufacturer should be consulted to ensure that the risk and enclosure fit within the limitations of the listing, or in the case of a performance-based design within the limitations of the manufacturer's testing.

Where applicable, consideration should be given to interfacing with the mechanical plant to prevent air movement or changes occurring within the protected enclosure once the suppression system has activated.

### **9.4. Detection, Control and Monitoring Equipment (where required)**

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

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

Where the installation Standard does not prescribe the configuration of the detection and control system, the designer should consider and account for the following:

- The detection and control system needs to be consistent with any requirements in the system's listing.
- The detection and control system needs to be appropriate for the type of water mist system installed. Some water mist systems have a configuration similar to a fire sprinkler system and may be best served by a sprinkler FBA compliant with NZS 4541. Other systems may require a dedicated suppression control panel compliant with NZS 4512. Some will require the use of the water mist system manufacturer's proprietary control system. The appropriate system should be chosen in consultation with the system manufacturer and any relevant authority (for example, the SSC in the case of a system proposed as an alternative to sprinklers under NZS 4541).
- The detection and control system should provide suitable warnings and alarms to ensure that the occupants of the premises understand what the system is doing, and any actions required of them (e.g. to investigate in the event of a pre-activation alarm, or to evacuate the area in the event of an activation).
- The overall system needs to provide appropriate communication and notification to ensure that Fire and Emergency New Zealand are aware of the system, its state of operation, and any hazards presented.
- Where the discharge of the water mist system may create hazardous conditions (e.g. the lowering of the compartment's oxygen concentration due to gas discharge from a hybrid system) an evacuation warning (illuminated signs and audible warning/message) should be provided for occupied areas along with a time delay sufficient to permit safe egress of the occupants prior to discharge.

Attention is drawn to the local Standards requirements detailed in section 7.5 for the fire alarm component of the system and Fire and Emergency New Zealand notification, and additionally for the SSC in respect of systems that are an alternative solution to a sprinkler system under the requirements of NZS 4541.

Detection can be configured for co-occurrence (also known as double-knock) detection where the control equipment requires two detectors to activate before the water mist system is activated. Alternatively, single detector (single-knock) activation is used.

The activation protocol for deluge and pre-action water mist systems should be decided after consideration of such factors as: expected fire growth rate based on the protected fuel loads, the risk for occupants in front of a discharge of water mist, visibility during a discharge of water mist and evacuation time needs, need for stopping forced ventilation, and risk of explosion or flashover.

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

Occupancies such as computer server rooms and generator enclosures 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.

#### **9.4.2. 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 water mist system (e.g. mechanical services may be shut down or the deceleration process for a protected turbine may be initiated).

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

The operation of the water mist 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 water mist system is to be tested if the interface cannot normally be tripped as part of routine testing. Any interface isolation or by-pass arrangements need to be supervised to ensure that the interface cannot be inadvertently 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.

### **9.5. Commissioning Requirements**

Water mist fire protection systems, including their control systems, should be subjected to a commissioning test consistent with the requirements of the selected design and installation Standard and the equipment manufacturers' recommended commissioning procedure. 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.

On successful completion of all commissioning tests the installer should provide a certificate of completion for the installation.

#### **9.5.1. Discharge Test**

A discharge test for a water mist system is used to validate that each of the key components (detectors, pump/s, valves, nozzles, water feed from tanks, etc.) is working as intended, and to confirm that the overall system performs as designed.

Adequate measures should be put in place to protect any room contents and to clean up afterwards.

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

Note that discharge tests would generally not be required for closed nozzle wet pipe systems.

### **9.6. Third Party Certification**

Where the water mist system is being installed as an alternative to sprinklers under NZS 4541 the water mist system will require inspection and certification by the Sprinkler System Certifier (SSC). See Section 6 (Definitions) for details of the accreditations required by the SSC.

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 and Emergency New Zealand 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 water mist 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 this is not possible, inspection should be by a competent and experienced engineer familiar with the water mist system selected.

## **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, control equipment configuration/database, manufacturers' installation/maintenance information, and details of the applicable installation/maintenance Standards and/or procedures. It is recommended that a copy of these documents be placed in a document pouch and permanently affixed adjacent to the installation.

As water mist fire protection 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 (BWOFF) 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.

Water mist 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 BWOFF 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 water mist 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 water mist system(s).

## **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
- Fire and Emergency New Zealand
- 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 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 4587 Water mist fire protection Systems – System design, installation and commissioning

### Other International Standards and Design Guides

- EN 54 part 2 – Fire detection and fire alarm systems – Control and indicating equipment
- ISO 7240-2 – Fire detection and alarm systems – Part 2: Control and indicating equipment
- NFPA 72 – 2016 National Fire Alarm and Signalling Code
- FM Global Loss Prevention Data Sheet DS 4-2 Water Mist Systems
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- BS 8489-1 Fixed fire protection systems. Industrial and commercial watermist Systems. Code of practice for design and installation
- CEN/TS 14972 Fixed firefighting systems — Watermist systems — Design and installation
- NFPA 750 Standard on Water Mist Fire Protection Systems

### Other Documents

- Environmental Protection Agency NZ – Guide To Gas Cylinders
- Fire Protection Association of Australia – Cylinder Safety (Transport) Caps
- Land Transport Rule: Dangerous Goods 2005

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