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Fire hydrant systems
Public comment draft

DRAFT

New Zealand Standard

Draft	SPEX #	Date

Committee:

P4510

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Standards New Zealand

PO Box 1473, Wellington 6140

Public comment information

Status

This document is a proposed New Zealand standard under the Standards and Accreditation Act 2015. Issued as a draft in this form, it provides the required statutory opportunity for consideration and comment by the bodies and persons having an interest in the standard.

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Closing date for comments **11 August 2021.**

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To help you send in your comments, please read the following:

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Editorial matters (that is, spelling, punctuation, grammar, numbering, references, and so on) will be corrected before final publication.

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When completing the public comment form, ensure that the number of this draft and your name and organisation (if applicable) are recorded. Please place relevant clause numbers beside each comment.

Please provide supporting reasons and suggested wording, for each comment. Where you consider that specific content is too simplistic, too complex, or too detailed, provide an alternative.

If the draft is acceptable without change, an acknowledgement to this effect would be appreciated.

Normally no acknowledgement of comment is sent. All comments received by the due date will be put before the relevant development committee. Where appropriate, changes will be incorporated before the standard is formally approved.

Postal address

Standards New Zealand
PO Box 1473
WELLINGTON 6140

Physical address

15 Stout Street
WELLINGTON 6011

Telephone: +64 3 943 4259

Enquiries: enquiries@standards.govt.nz

Email: SNZPublicComments@mbie.govt.nz

Website: www.standards.govt.nz

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Committee representation

This standard was prepared by the [P4510 Fire Hydrant Systems for Buildings Committee. The membership of the committee was approved by the New Zealand Standards Approval Board and appointed by the New Zealand Standards Executive under the Standards and Accreditation Act 2015.

The committee consisted of representatives of the following nominating organisations:

Association of Building Compliance

Auckland Council

Building Officials Institute of NZ

Engineering New Zealand

Fire and Emergency New Zealand

Fire Protection Association of New Zealand

Institution of Fire Engineers

Kāinga Ora – Homes and Communities

Ministry of Business, Innovation and Employment – Building System Performance

New Zealand Fire Equipment Manufacturers Association

Registered Master Builders Association of New Zealand Incorporated

Society of Fire Protection Engineers

Acknowledgement

Standards New Zealand gratefully acknowledges the contribution of time and expertise from all those involved in developing this standard.

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DZ 4510

New Zealand Standard

Fire hydrant systems

Superseding NZS 4510:2008

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Value statement

NZS 4510 will continue to prevent loss of life and provide protection of property for all New Zealanders and enhanced safety for firefighters by ensuring the appropriate facilities to apply water are available for firefighting in and around buildings.

Referenced documents

Reference is made in this document to the following:

New Zealand standards

NZS 1170:- - - -	Structural design actions
Part 5:2004	Earthquake actions – New Zealand
NZS/BS 1387:1985	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads
NZS 3501:1976	Specification for copper tubes for water, gas, and sanitation
NZS 4219:1983	Specification for seismic resistance of engineering systems in buildings
NZS 4510:2008	Fire hydrant systems for buildings
NZS 4510:1998	Fire hydrant systems for buildings
NZS 4510:1978	Riser mains for fire service use
NZS 4512:2021	Fire detection and alarm systems in buildings
NZS 4515:2003	Fire sprinkler systems for residential occupancies
NZS 4541:2020	Automatic fire sprinkler systems
NZS 4781:1973 A1	Code of practice for safety in welding and cutting: Amendment 1
NZS 5807:1980	Code of practice for industrial identification by colour, wording or other coding
SNZ PAS 4505:2007	Firefighting waterway equipment
SNZ PAS 4509: 2008	New Zealand Fire Service firefighting water supplies code of practice

Joint Australian/New Zealand standards

AS/NZS 1221:1997	Fire hose reels
AS/NZS 2980:2007	Qualification of welders for fusion welding of steels
AS/NZS 3013:2005	Electrical installations – Classification of the fire and mechanical performance of wiring system elements
AS/NZS 4130:2003	Polyethylene (PE) pipes for pressure applications
AS/NZS ISO/IEC 17020:2000	General criteria for the operation of various types of bodies performing inspection

International standards

IEC 60947:- - - -	Low voltage switchgear and control gear
Part 4:1990	Contactors and motor-starters

American standards

ASTM A106/A106M 2006	Standard specification for seamless carbon steel pipe for high-temperature service
ASTM A312/A312M Rev A 1995	Standard specification for seamless, welded, and heavy cold worked austenitic stainless steel pipes
ASTM A380 2006	Standard practice for cleaning, descaling, and passivation of stainless steel parts, equipment, and systems

Australian standards

AS 1074:1989	Steel tubes and tubulars for ordinary service

AS 1432:2004	Copper tubes for plumbing, gasfitting and drainage applications
AS 1572:1998	Copper and copper alloys – Seamless tubes for engineering purposes
AS 4041:2006	Pressure piping
AS 4809:2003	Copper pipe and fittings – Installation and commissioning
AS 60529:2004	Degrees of protection provided by enclosures (IP Code)

British standards

BS EN 837-1:1998	Pressure gauges. Bourdon tube pressure gauge dimensions, metrology requirements and testing
BS 2971:1991	Specification for class II arc welding of carbon steel pipework for carrying fluids
BS 4677:1984	Specification for arc welding of austenitic stainless steel pipework for carrying fluids
BS 5252:1976	Framework for colour co-ordination for building purposes
BS EN 10255:2004	Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions

German standard

DIN 16005:1995	General purpose pressure gauges with elastic pressure response elements; requirements and testing

Other publications

API Spec 5L:2004	Specification for line pipe

New Zealand Fire Service, Interim Code of Practice for Charged Riser Compliance 1990 Region 1

Fire and Emergency New Zealand *Designers' Guide to Firefighting Operations* (Draft at this stage.)

FM Global Datasheet 9-18 *Prevention of Freeze-Ups* Appendix C

FM Global Datasheet 3-10 *Private Fire Service Mains*

New Zealand legislation

Building (Forms) Regulations 2004

New Zealand Building Code

Fire and Emergency New Zealand Act 2017

Health and Safety at Work Act 2015

Health and Safety at Work (Hazardous Substances) Regulations 2017

Websites

www.building.govt.nz

Latest revisions

The users of this standard should ensure that their copies of the above-mentioned New Zealand standards are the latest revisions. Amendments to referenced New Zealand and joint Australian/New Zealand standards can be found on www.standards.govt.nz.

Review of standards

Suggestions for improvement of this standard will be welcomed. They should be sent to the National Manager, Standards New Zealand, PO Box 1473, Wellington 6140.

Foreword

This revision of NZS 4510 introduces a number of changes to the 2008 edition of the standard.

The purpose of this standard is to set out minimum technical and performance requirements for fire hydrant systems. Hydrant systems are primarily for fire brigade use when attending and dealing with fire emergencies in buildings, but they may also be located outside buildings for use on exteriors and to cover external fire exposure and risk.

Accepting that demands on building hydrant systems are likely to be less for sprinkler-protected buildings than for buildings without sprinklers has remained the basis for this revision of the standard. The demands for internal hydrant systems have been aligned with those specified under SNZ PAS 4509:2008 New Zealand Fire Service firefighting water supplies code of practice, with a maximum flow rate of 1500 L/min for buildings fitted with approved sprinkler systems. The demands for buildings not equipped with approved sprinkler systems have not changed from those specified in the 1998 edition of the standard. The committee preparing this standard has provided design requirements for combined sprinkler and hydrant risers to ensure a level of redundancy commensurate with the cost and benefits of combined systems in tall buildings (see Appendix A). This standard now includes the technical requirements for the installation of hydrants in certain low-rise building configurations. Given the complexity and design variations still observed within the design of low-rise buildings, those outside the scope of the standard will require specific approval from Fire and Emergency New Zealand (FENZ) as part of the design process.

Because this standard recognises the value of sprinklers in reducing the overall fire risk in buildings, hydrant requirements are relaxed where a sprinkler system is installed. Users of this standard should be aware that in the event of sprinkler system failure, the hydrant system's performance may not be sufficient to meet its design objectives. Concerns over the reliability of the sprinkler system, or the adverse consequences of system failure, may require additional consideration in system design. It is recommended to users of this standard that if a system is being installed (fully or in part) to meet property protection requirements, that advice be taken from key stakeholders, which would usually include the building's insurers.

As the purpose of the hydrant system is to provide firefighting water supplies to the location necessary for fire brigade use, it is expected that an adequate source of water will be provided. This standard assumes that the fire brigade will, on arrival, access the available water supply and couple-in to the riser system. However, in some industrial buildings, for example, the owner may opt to provide a permanently piped supply for use by a private fire brigade. This standard permits such a permanently piped supply and provides appropriate criteria. Where there is no reticulated supply provided, it is assumed that a static water supply in accordance with SNZ PAS 4509 is available.

On multi-storeyed buildings where the combination of pressure loss due to height (static) and friction means that fire service pumps cannot meet the performance criteria pressure at the highest building hydrant outlet, booster pumps are required. This standard now prescribes fire service pumping pressure to be used to calculate whether pumps are necessary.

Particular attention has been given to the problem of pressure control at the various levels within multi-storeyed buildings. It is important that firefighters not be confronted with excessively high pressures. Requirements have been included regarding the setting, calibration, and testing of pressure control valves in an effort to overcome the very serious problems that have arisen in overseas fires as a result of incorrectly set valves.

This standard provides incentives (for firefighter safety and operational efficiency) to locate building hydrant outlets in multi-storeyed buildings within a protected lobby. Location within stairwells, while permissible, creates congestion in a fire and reduces the effective reach of standard length hose lines because of the need to base the fire attack from the landing below.

Building hydrant systems need to be operational during both construction and demolition periods – both activities provide a heightened risk of fire. A number of construction fires in recent years have highlighted the challenges faced by FENZ where hydrant systems have not been available. This standard specifies that hydrant systems must be enlivened progressively (including pumps, if required) as construction advances.

The correct operation and function of hydrant and sprinkler systems during a fire will be of critical importance to firefighting safety. This standard therefore assumes that the hydrant system certifier, the designer, and the contractor installing the system have appropriate technical competencies and experience. Hydrant system certification by an accredited body is a requirement of this standard, as is consultation with FENZ at the design stage for certain aspects of system design, as well as systems outside the scope of this standard. Additional guidance is provided to support notification of planned impairments during the system's operating life.

1 General

1.1 Scope

1.1.1 Inclusions

This standard covers fire hydrant systems for buildings, including external hydrant systems, for use by FENZ in accordance with its standard operating procedures.

It specifies requirements for the design, installation, commissioning, and testing of hydrant systems.

1.1.2 Exclusions

The standard is not intended to provide a standardised solution for all situations. Hydrants on a water supply authority's public networks are not considered as part of a hydrant system complying with this standard. Examples of buildings where this standard does not provide a detailed design solution include the following:

(a) Process plants;
(b) Underground infrastructure, such as tunnels (road, rail, and infrastructure);
(c) Buildings with exposed intermediate floors/gantries; and
(d) Podiums and spaces such as external yard storage, external plants, and marinas.

NOTE –

(1) Guidance can be sought from international codes, standards, and data sheets to provide design criteria for such specialised risks.

(2) The location and design requirements for hydrant systems in these buildings should be specifically considered and agreed with FENZ during the design process.

1.1.3 Water supply

The primary purpose of the system shall be to allow water supplied by fire service pumping appliances to the inlet to be reticulated to hydrant outlets within or externally to the building. The system inlets and outlets are located to facilitate and ensure reasonable levels of safety for firefighter operations. Where the pressure available from fire service pumps is not able to deliver the nominated flows at the building hydrant outlets within the permitted pressure ranges, pumps shall be required to achieve those flows. It is necessary to ensure that maximum allowable hydrant pressure is not exceeded.

1.1.4 Systems

The type of system shall, unless otherwise approved by the hydrant system certifier (HSC), be a wet pipe system, charged and pressurised with water to ensure the integrity of the system and maintained in this condition. Where required by environmental conditions, the system may be a dry pipe riser.

The water supply for firefighting shall normally be supplied by the fire service through the hydrant inlet from an available water supply.

This standard supports hydrant systems incorporating a permanently connected pressurised water source to enable hydrant use before the main supply is supplied by the fire brigade. This standard also supports combined fire hydrant and fire sprinkler systems; see Appendix A for guidance.

1.1.5 Staff use of hydrants

A secondary option is the reticulation of firefighting water for use by adequately trained and equipped personnel, prior to the arrival of the fire brigade. In such cases, the hydrant system may be supplied with a permanently connected pressurised water source sufficient to allow staff to establish hose streams direct from the hydrant system outlets. Use of this secondary option shall not diminish the primary objective of the standard.

1.1.6 Manually controlled branches/nozzles

Hydrant systems complying with this standard are suited to firefighting operations using manually controlled branches/nozzles.

1.1.7 Automatic branches

Systems designed to this standard are not suitable for the use of automatic branches, that is, those which optimise flow rate in order to maintain a constant nozzle pressure.

1.1.8 Superseded standards

Hydrant systems may be installed to superseded standards; see Appendix B for information.

1.2 Objectives

The objective of this standard is to provide specifiers, users, manufacturers, suppliers, installers, and maintenance persons with requirements and guidance to assist in the design, construction, and maintenance of a fire hydrant system that will effectively aid fire service firefighting operations within the building during construction, demolition, and normal operation. It also applies to sites where hydrant systems are provided to cover external fire hazards.

1.3 Interpretation

For the purposes of this standard, the word 'shall' refers to requirements that are essential for compliance with the standard, while the word 'should' refers to practices that are advised or recommended.

Clauses prefixed 'C' and printed in italic type are intended as comments on the corresponding clauses. They are not to be taken as the only or complete interpretation. The standard can be complied with if the comment is ignored.

The terms 'normative' and 'informative' have been used in this standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a standard, while an 'informative' appendix is only for information and guidance.

However, where an informative appendix specifies a prescribed test procedure, the word 'shall' used in it means that if users elect to conduct this test, it shall be undertaken exactly as set out in the appendix.

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this standard.

1.4 Definitions

For the purposes of this standard, the following definitions shall apply:

Approved

Approved by the building consent authority (BCA) in accordance with the New Zealand Building Code (NZBC)

NOTE – The HSC is expected to provide evidence to the BCA that the installation meets the requirements of this standard.

Approved sprinkler system

A sprinkler system that has been approved by a sprinkler system certifier to comply with NZS 4541 or NZS 4515

NOTE –

(1) The intention is to ensure that the reliability of the sprinkler system water supplies complies with published sprinkler standards.

(2) A BCA or territorial authority (TA) may accept a sprinkler system complying with other standards as an alternative solution to these nominated standards.

Building hydrant inlet (BHI)

An assembly located at an external location connected to the hydrant system through pipework and comprising male hose couplings, clapper valves, and ancillary equipment, for the purposes of allowing the fire service to pump water into the hydrant system

Certified hydrant system

A hydrant system installed to this standard

Cold climate system

A supervised dry hydrant or trace heating system installed in regions where exposed to extended temperatures below 4°C where determined permissible by the HSC

Design engineer

A person who, on the basis of experience or qualifications, and their fundamental education and training, is competent to design the hydrant system elements of a building

Dry barrel pillar assembly	A listed dry barrel assembly connected to the hydrant system comprising two valves, each with listed dry pipe hydrant outlets to allow water to be supplied from a reticulated water supply. The pillar hydrant and installation shall allow for automatic draining below the frost line when closed
Dry pipe air pressure maintenance system	A listed dry pipe supervisory pressure maintenance assembly
Dry pipe air relief valves	A listed automatic float-operated air relief valve not less than 35 mm that sits in the normally open position to allow air in and out of the hydrant main piping system
Dry pipe direct acting pressure relief valve	A listed direct acting, spring loaded, diaphragm type relief valve not less than 25 mm that sits directly upstream of a dry pipe air relief valve in a cold climate supervised dry hydrant system to allow the discharge of the supervisory air pressure to atmosphere, enabling hydraulic flooding of the dry pipe system in combination with an air relief valve
Dry pipe hydrant outlet assembly	A listed outlet assembly complying with SNZ PAS 4505 that self-drains to atmosphere or back into the waterway and has no natural water traps that could cause an ice plug following flooding of the pipework.
Dry pipe supervision control panel	A control and indicating panel complying with NZS 4512 or NZS 4541 4.7.2.2.3 capable of a defect and fire call that may be incorporated into the fire hydrant index panel
Fire brigade	The expected first emergency responder to a fire alarm NOTE – At the time of publication, this would usually be FENZ.
Fire hydrant	An assembly usually contained in a pit or box below ground level and comprising a valve and outlet connection from a water supply main to permit controlled supply of water for firefighting. A pillar upstand connected to a water supply main and fitted with a valve and instantaneous coupling(s) adaptor will also constitute a fire hydrant
Fire hydrant outlet assembly	An assembly connected to the building hydrant system comprising two valves, each with female hose couplings and related fittings (including an enclosure where provided) to allow water to be supplied from the hydrant system through fire service hoses
Fire region	A geographical area of New Zealand established as such under the Fire and Emergency New Zealand Act 2017
Fire resistance rating (FRR)	The term used to classify fire resistance of primary and secondary elements as determined in the standard test for fire resistance, or in accordance with a specific calculation method verified by experimental data from standard fire resistance tests. It comprises three numbers giving the time in minutes for which each of the criteria stability, integrity, and insulation are satisfied, and is always presented in that order
Hydrant main, charged (charged riser)	A hydrant main installed in a building for firefighting purposes, fitted with inlet connections at fire brigade access level and building hydrant outlet assemblies at specified points. These are normally pressurised with

	water for monitoring purposes and provided with water by pumping fire service appliances for firefighting purposes NOTE – This is the type of hydrant main normally installed under this standard unless a 'dry type' system is installed to protect against freezing due to environmental conditions.
Hydrant main, cold climate dry (supervised dry system)	A dry system installed externally to a building's thermal envelope for firefighting purposes in geographical areas exposed to extended temperatures below freezing
Hydrant system certifier (HSC)	A person who has demonstrated competency to certify a hydrant system in accordance with this standard NOTE – It is recommended that the HSC be an internationally recognised accreditation body to AS/NZS ISO/IEC 17020 to verify and certify building hydrant systems for compliance with NZS 4510.
Landing valve	An assembly comprising a single valve and hydrant outlet connection from a wet or dry riser
Listed, listing	Specific makes and models of equipment and materials required or permitted by this standard, which have been determined by an HSC to be adequate for application where permitted or required by this standard, subject to any conditions or limitations specified in the listing
Low-rise building	A building with no more than one floor above and/or below the building's fire brigade attendance point NOTE – (1) It is intended that this also includes buildings such as typical shopping malls or warehouses with large floor plans and external fire brigade access to the building. (2) Engineering judgement may allow buildings with mezzanine floors to be deemed low-rise buildings.
Main waterway	Pipework serving a set of hydrant outlets 25 m or more in length
National Commander	The National Commander of FENZ, appointed under the Fire and Emergency New Zealand Act 2017
Protected lobby	An enclosed part of a floor at least 6 m^2 with no dimension less than 2 m, directly accessible from a stairwell with all elements having an FRR of the adjacent fire cell, with self-closing access doors of the same FRR as the enclosure
Ratio valve	A form of pressure reducing valve in which the ratio between the hydrant inlet and building hydrant outlet pressures is fixed irrespective of flow
Riser main, dry (dry riser)	A vertical pipe installed in a building for firefighting purposes, fitted with inlet connections at fire brigade access level and with landing valves at specified points. It is normally dry but can be charged with water, usually by pumping from fire service appliances NOTE – Dry risers were installed to NZS 4510:1978 and are no longer permitted for new buildings. It is recommended that existing dry risers be converted to a charged riser, on a reasonably practicable basis.

Riser main, wet (wet riser)	A vertical pipe installed in a building for firefighting purposes, permanently charged with water from a pressurised supply sufficient for firefighting, and fitted with landing valves at specified points NOTE – Wet risers were installed to superseded editions of this standard and are now not normally installed.
Safe path	That part of an exit way which is protected from the effects of fire by fire separations, external walls, or distance when exposed to open air

1.5 Abbreviations

Abbreviations have the following meanings:

BCA	Building consent authority
BHI	Building hydrant inlet
FENZ	Fire and Emergency New Zealand
FRR	Fire resistance rating
HSC	Hydrant system certifier
IQP	Independently qualified person
LED	Light-emitting diode
NRV	Non-return valve
NZBC	New Zealand Building Code
P_R	Additional pressure needed
TA	Territorial authority

NOTE – Some of these definitions are from the NZBC and may be amended from time to time. Users should check www.building.govt.nz for the latest definitions and revisions.

1.6 Notations

This standard uses the following notations:

C	**Constant according to the internal roughness of the piping as derived from Table 4**
d	Mean inside diameter (mm)
D_o	Outside diameter (mm)
f	Yield stress (kPa) as specified in the manufacturing standard
P_I	1000kPa
P_S	Pressure available at the pump suction inlet
P_w	Working pressure rating (kPa)
Q	Flow rate (L/min)

t	Tubing thickness (mm)
ΔP	Loss of pressure per metre of piping (kPa)
ΔP_H	Pressure gain or loss due to difference in height between the inlet assembly and the pump suction

1.7 Formal interpretations

1.7.1 Review requests

Requests for interpretations, rulings, or clarifications received by Standards New Zealand directly shall be reviewed by a subcommittee of the Fire Hydrant Systems Committee (P4510), which prepared this standard.

C1.7.1

The Fixed Fire Protection Formal Interpretation Committee, which was constituted to deal with queries and interpretations of a number of fire protection standards, has jurisdiction to interpret the wording of the current published edition of the relevant standard only. Matters not mentioned in the standard are outside the scope of this committee and should be dealt with according to normal business practice.

Requests for formal interpretations should be sent to the Manager, Standards Development, Standards New Zealand, PO Box 1473, Wellington 6140. An administration fee will be collected by Standards New Zealand for the processing of a request.

1.7.2 Formal interpretations

Formal interpretations of this standard shall be made when:

(a) An interpretation of a clause is required;
(b) Ambiguity requires clarification; or
(c) Clarification of wording is required because it does not achieve the intent agreed to by the committee.

1.7.3 Amendments

Amendments to this standard shall be considered upon a recommendation to Standards New Zealand when:

(a) Building hydrant system failures in fires indicate that the provisions of this standard are inadequate and need to be amended; or
(b) Changes to building construction standards or regulations pose a risk to firefighters and render provisions of this standard inadequate.

2 General requirements

2.1 Approval of building hydrant system

A building hydrant system shall be deemed to conform to this standard when:

(a) In the case of a new system or extension to an existing system, the system has been installed by a contractor and the contractor has submitted an application for its certification to the HSC;
(b) In the case of an existing system, whereby approval is sought in accordance with 2.7, application for approval has been submitted by a contractor to the HSC;
(c) The technical requirements of this standard are met;
(d) The HSC is satisfied that a testing and maintenance contract is in place with a contractor; and
(e) The HSC has certified the system and such certification remains in force.

2.2 Vehicular access

Vehicular access for the fire brigade shall comply with the requirements of the NZBC for fire service vehicular access.

NOTE – A method of achieving this is currently provided in the NZBC Compliance Document C/AS2 Acceptable Solution for Buildings other than Risk Group SH, Part 6.

2.3 Pipework

2.3.1 Appropriate materials

Materials and components shall be appropriate for ambient environmental conditions, service conditions which apply, and the intended service life.

2.3.2 Pipework materials

Pipework shall consist of the following materials manufactured to internationally recognised standards set out in 2.3:

(a) Mild steel – either black or galvanised and manufactured to a pressure tubing standard (see 2.3.3);
(b) Copper;
(c) Stainless steel; or
(d) Plastic (buried pipe only).

In buried applications, use of suitability rated plastic pipework, such as medium or high density polyethylene complying with AS/NZS 4130, shall be permitted. Attention is required to ensure that the manufacturer's recommendations for thrust blocks and the like are adhered to, and that backfill is free from sharp debris which could cause pipe failure through abrasion and the like.

Steel pipe shall not be used in buried applications.

2.3.3 Mild steel

Mild steel pipe shall comply with one of the following standards:

(a) AS 1074;
(b) AS 4041;
(c) ASTM A106/A106M – Grade B;
(d) BS EN 10255; or
(e) API Spec 5L – Grade B

or be any other pipe identified as suitable by the HSC.

2.3.4 Hose reels

2.3.5 Hydrant systems used to supply hose reels shall not be reticulated with black steel piping or fittings. In systems containing a booster pump, the pipework on the upstream side of the pump cooling water discharge shall not be black steel.Piping requirements

2.3.5.1 General

Pipework shall conform to the following requirements concerning standard of manufacture, pressure rating, and method of jointing:

(a) Piping to AS 1074 or BS EN 10255 shall not exceed the working pressures set out in Table 1;
(b) Acceptable methods of jointing are:
    (i) Lightweight piping – welded flange, mechanical coupling
    (ii) Medium or heavyweight piping – screwed and socketed, welded flange, mechanical coupling; and

(c) Flanges and mechanical couplings shall have a working pressure rating of at least 1.5 times the maximum working pressure to which they will be subject but not less than 1500 kPa.

2.3.5.2 Pressure rating calculation for carbon steel piping

The working pressure rating of carbon steel piping manufactured to other AS, ASTM, or BS pressure tubing standards shall be calculated using the following equation (Barlow's formula) to provide a safety factor of 8:

$$P_w = \frac{f \times 2t}{8 \times D_o} \quad \text{(Eq. 1)}$$

where

P_w is the working pressure rating (kPa)

f is the yield stress (kPa) as specified in the manufacturing standard

t is the tubing thickness (mm)

D_o is the outside diameter (mm).

2.3.5.3 Joints for steel piping

Piping shall be jointed using welded flanges or mechanical couplings with a working pressure rating of at least 1.5 times the maximum working pressure to which they will be subject but not less than 1500 kPa.

Where galvanised pipe is required, it shall be hot dipped or galvanised in the pipe mill as part of the manufacturing process. Welding of galvanised pipe is only permitted if the pipework is hot dipped galvanised after fabrication.

NOTE –

(1) Carbon steel piping requires a higher safety factor than copper or stainless pipe due to external corrosion factors.

(2) Black steel piping should have at least one coat of priming paint.

(3) Care is required when selecting mill galvanised pipe to ensure that the internal weld is adequately protected.

2.3.5.4 Copper piping

Copper piping shall meet the following requirements:

(a) It shall be manufactured to conform to NZS 3501, AS 1432, AS 1572, or AS 4809 and shall be jointed using brazed fittings or mechanical couplings;
(b) The minimum wall thickness shall be not less than the sizes stated in AS 1432;
(c) The working pressure rating of the piping shall be calculated by dividing the theoretical bursting pressure by 6 but shall not be less than 1500 kPa;
(d) Fittings shall have a working pressure rating of at least 1.3 times the maximum working pressure to which the fittings will be subject but not less than 1500 kPa.

2.3.5.5 Stainless steel piping

Stainless steel piping shall be manufactured to an ASTM pressure tubing standard, such as ASTM A312. A suitable grade of stainless steel shall be selected for the environment in order to avoid potential corrosion. Grade 316 shall be used in high corrosion areas or where threaded joints are used.

Stainless steel piping shall meet the following requirements:

(a) All sizes shall be jointed with welded flanges or threaded or mechanical couplings suitable for the working pressures involved;
(b) Post weld pickling and passivation shall be undertaken in accordance with ASTM A380;
(c) The working pressure rating of piping shall be calculated by dividing the theoretical bursting pressure by 4 but shall not be less than 1500 kPa. Flanges, couplings, and fittings shall have a working pressure rating of at least 1.2 times the maximum working pressure to which they will be subject but not less than 1500 kPa.

NOTE – The burst pressure of pipework can be estimated using Barlow's formula.

$$P_w = \frac{f \times 2t}{6 \times D_o}$$

2.3.5.6 Plastic piping

Plastic piping shall meet the following requirements:

(a) Polyethylene pipe shall comply with AS/NZS 4130;
(b) Plastic pipe may only be used when buried;
(c) Plastic pipe shall have a working pressure rating of at least 1.3 times the maximum working pressure to which it will be subject but not less than 1500 kPa.

Table 1 – Maximum working pressures of pipes to BS 1387 or AS 1074

Piping weight and jointing method					
Nominal bore (mm)	**Welded flange or mechanical coupling**			**Screwed and socketed**	
	Light (kPa)	**Medium** (kPa)	**Heavy** (kPa)	**Medium** (kPa)	**Heavy** (kPa)
15	–	8700	10700	4500	6200
20	–	7000	8500	3500	5100
25	–	6800	8500	3400	5100
32	–	5400	7600	2700	4000
40	–	4700	5900	2400	3500
50	3600	4300	5300	2400	3400
65	3200	3400	4200	1900	2700
80	2700	3200	3800	1900	2600
100	2400	2800	3300	1800	2300
150	–	2100	2300	1400	1700

NOTE – Pipework in the main waterway path shall be a minimum 100 mm nominal bore. Information for smaller pipes provided in this table is for the convenience of the user of the standard for designing connections to hose reel systems, pump house trim, and associated pipework (see 6.2).

2.3.5.7 Welding on steel piping

All welding on steel piping shall comply with the requirements of BS 2971 for class 2 operating conditions. The provision in BS 2971 to allow alternative joint preparation is permitted by this standard whether or not there is a specific agreement between the contracting parties, provided that for butt-welded piping there is adequate weld penetration. For stainless steel pipework, welding shall comply with the requirements of BS 4677.

2.3.5.8 Certified welders

All welds shall be completed by welders holding current certification in terms of AS/NZS 2980 for the type of welding employed.

2.3.5.9 Heat and corrosion resistant piping supports

Piping supports shall be heat and corrosion resistant. Dissimilar metals shall be separated by an insulating material to prevent corrosion.

2.3.5.10 Piping supports and fixings

Piping supports and their fixings shall conform to NZS 1170.5 and 2.4 of this standard.

2.3.5.11 Explosive driven fasteners

Explosive driven fasteners shall not be used unless they are listed for use in fire protection services.

2.3.5.12 Threaded stubs welded to pipework

Hydrant outlet connections to pipework shall not use threaded stubs welded to the pipework.

NOTE –

(1) Field experience has indicated that many outlets incorporating welded threaded stubs are showing signs of leakage and corrosion.

(2) An alternative to a welded stub could include the use of mechanical tees or welded sockets.

2.4 Seismic resistance

2.4.1 General

Hydrant riser systems shall be designed, detailed, and installed so as to remain operational at the limit state derived from Table 8.1 of NZS 1170.5, or to a higher loading if specified by the building owner.

NOTE –

(1) AS/NZS 1170.0 requires New Zealand design and detail to NZS 1170.5 for earthquakes. In this context, the term 'importance level' refers to the building structure, not the sprinkler system itself.

(2) Hydrant systems are classified as parts category P.4 in Table 8.1 of NZS 1170.5.

(3) In new buildings, the seismic design of the hydrant system should be developed in conjunction with that of the building.

(4) The hydrant system should not be damaged or impaired by the movement or failure of non-structural components, or by the movement of structural elements at the relevant serviceability limit state.

2.4.2 Pipework design

Hydrant system pipework shall be provided with a support system designed to resist seismic loads appropriate to the site and importance level (IL) (as defined by clause A3 of the NZBC) of the building, by either:

(a) A qualified seismic analysis such that the pipework system performance shall be at least equal to that of the building structure under the earthquake loadings of NZS 1170.5 (parts category P.5); or

Complying with the design concepts in NZS 4541 4.3.12.2 to 4.3.13.7 inclusive.

If any part of the hydrant system is to be braced in common with any other trade, then the support system shall be in accordance with NZS 4541 4.3.12.1(a), taking into account the most onerous requirements of any element that is being supported.

NOTE – NZS 4541 refers to automatic sprinkler system pipework. The term 'design concepts' is intended to mean that where 'sprinkler pipework' is described in NZS 4541, in terms of this context it is synonymous with 'hydrant pipework'.

2.4.3 Heat and corrosion resistant materials

Piping supports and fixings shall be resistant to heat and corrosion.

2.4.4 Seismic restraint

Adequate horizontal restraint to meet the seismic loads specified in NZS 1170.5 shall be provided for all heavy components such as pumps, tanks, valves, engines, and batteries to ensure that connections to the plant are secure in a seismic event.

NOTE – NZS 4219 provides guidance in complying with this requirement.

2.5 Hydrant protection

2.5.1 General

Fire hydrant systems require protection from physical/mechanical damage and temperature changes that may occur due to heating from fire exposure and freezing environmental conditions.

NOTE –

(1) Hydrant system components located within a building's fire rated stairwell are generally considered to be protected and do not require additional consideration.

(2) Internally located hydrants not located within a fire rated stair need to consider both the potential for mechanical damage and the impact of heating caused by fire exposure on the system components.

(3) Externally located above-ground hydrant and system components require protection from possible mechanical damage by vehicles and other similar hazards. Bollards or other protection measures may be used to achieve this provided they do not obstruct fire brigade access.

2.5.2 Frost protection

2.5.2.1 General

In areas external to the building envelope, where system pipework is subject to freezing, the system shall be protected using one of the following approaches:

(a) Trace heating and lagging of pipework as detailed in Appendix D;
(b) Installation of a supervised dry pipe charged riser system as detailed in Appendix E; or
(c) Placement of external hydrant pipes underground, below the frost line, and fitted with listed dry pillar hydrants, as detailed in Appendix M.

2.5.2.2 Antifreeze solutions

The use of antifreeze solutions to prevent pipework freezing is not acceptable.

2.5.2.3 Trace heating system limit

Trace heating systems are limited to discrete sections of pipework not exceeding 25 m or two landings.

2.5.2.4 Subject to freezing inside building envelope

The use of supervised dry pipe charged riser systems is not permitted inside the building envelope unless the area is subject to freezing.

2.5.2.5 Refrigerated environments

The use of supervised dry pipe charged riser systems and trace heating systems is not permitted within refrigerated environments. The hydrant system shall be located outside the refrigerated space.

2.5.2.6 Booster pumps in supervised dry riser systems

Supervised dry pipe charged riser systems shall not incorporate a booster pump.

2.5.2.7 HSC approval of frost protection

The means of frost protection shall be approved by the HSC.

2.5.2.8 Freezing draining systems

Draining systems exposed to freezing conditions are not acceptable.

2.5.3 Fire protection

Where hydrant outlets are located externally to provide extended coverage (such as for large footprint buildings) and the building is not protected by a sprinkler system, hydrant outlets shall be protected either:

(a) By construction:
    (i) Having an FRR of the lesser of 60 minutes or the value derived from the calculated burnout for the exposed fire cell
    (ii) Extending 2 m each side of the building hydrant outlet (see Figure 1(a) and (b))
    (iii) Extending not less than 3 m above the ground adjacent to the building hydrant or the height of the building, whichever is the lesser (see Figure 1(c))
    (iv) No closer than 2 m to a non-rated opening into the building (see Figure 1(a)); or
(b) By a minimum 10 m horizontal separation between the nearest unrated portion of the building (including the canopy edge) and the hydrant position (see Figure 1(d) and (e)).

NOTE – A sprinklered building does not require the external hydrant to be protected with a fire separation (see Figure 1(f) and (g)).

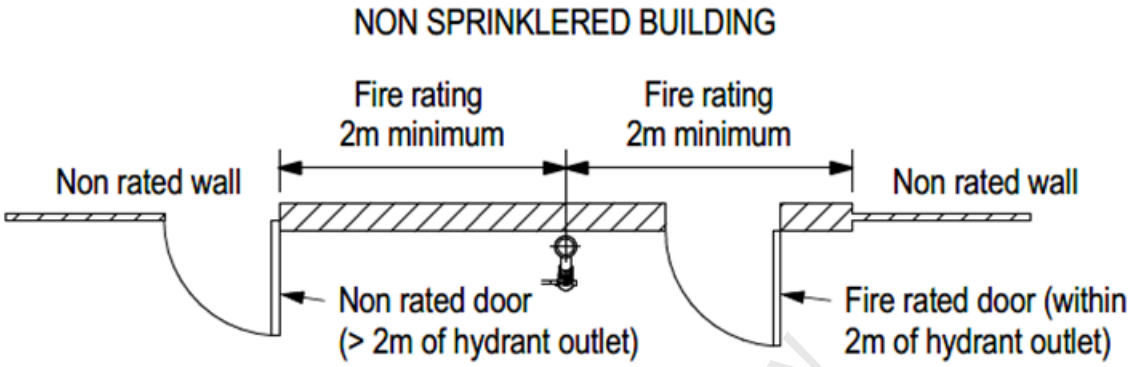


Figure 1(a) – Non sprinklered building – Hydrant outlet protection
Fire rating options with doors – Plan view

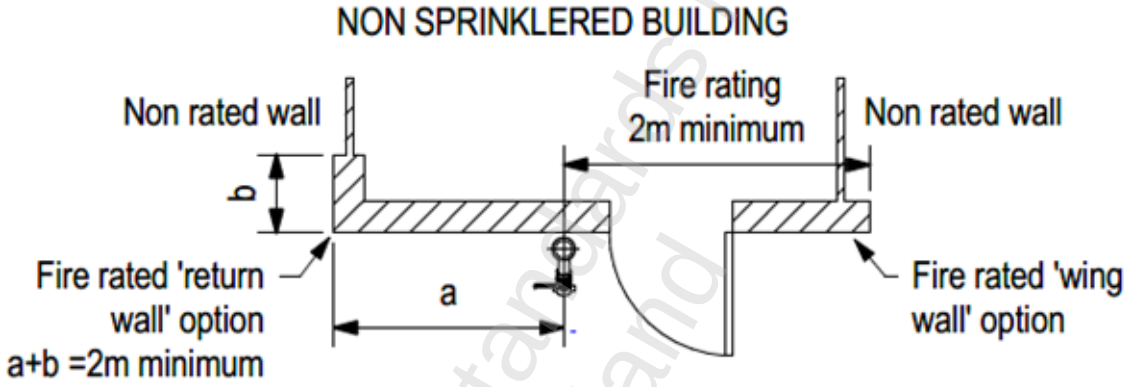


Figure 1(b) – Non sprinklered building – Hydrant outlet protection
Fire rating options at building corners – Plan view

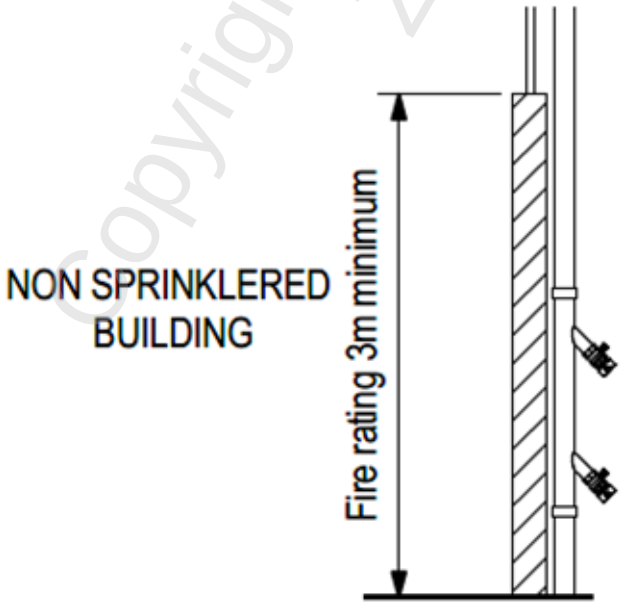


Figure 1(c) – Non sprinklered building – Hydrant outlet protection
Fire rating required – Section view

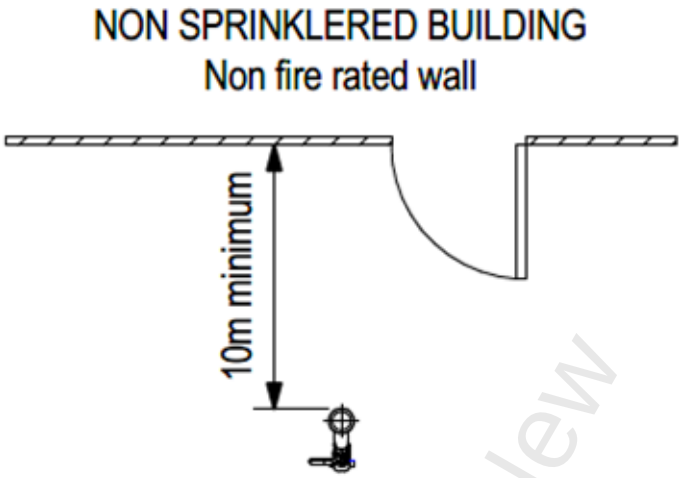


Figure 1(d) – Non sprinklered building – Hydrant outlet protection Separation distance option – Plan view

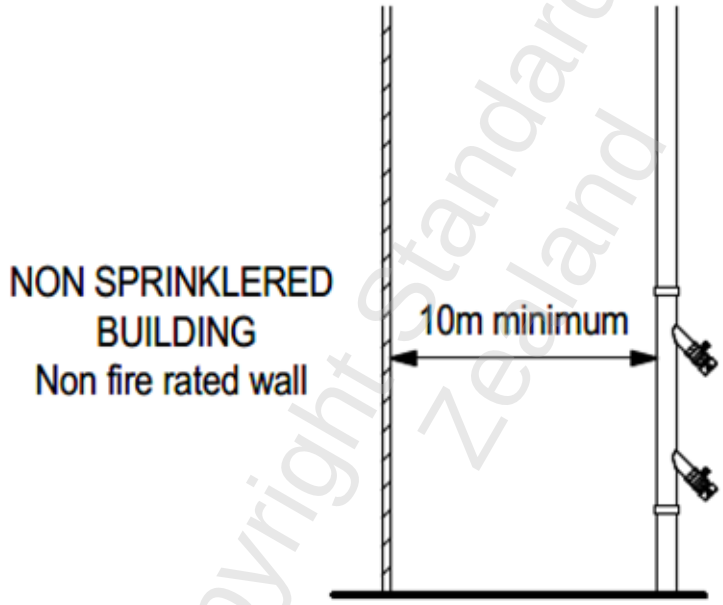


Figure 1(e) – Non sprinklered building – Hydrant outlet protection Separation distance option – Section view

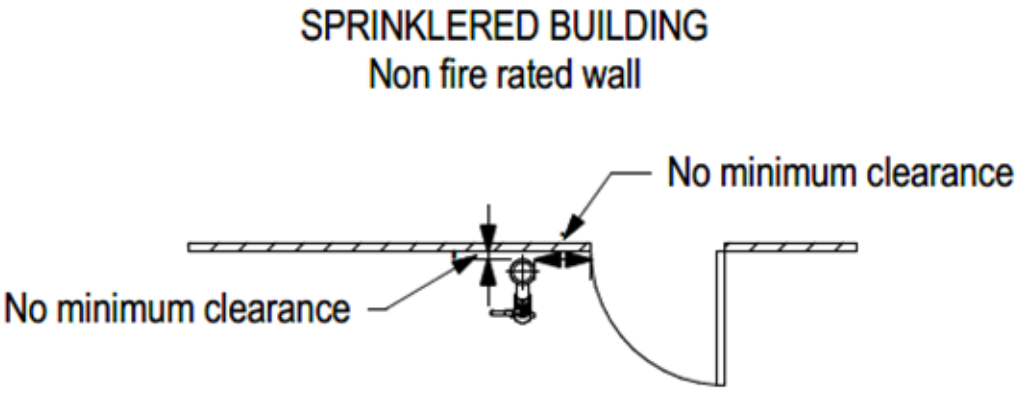


Figure 1(f) – Sprinklered building – Hydrant outlet protection
No distance required – Plan view

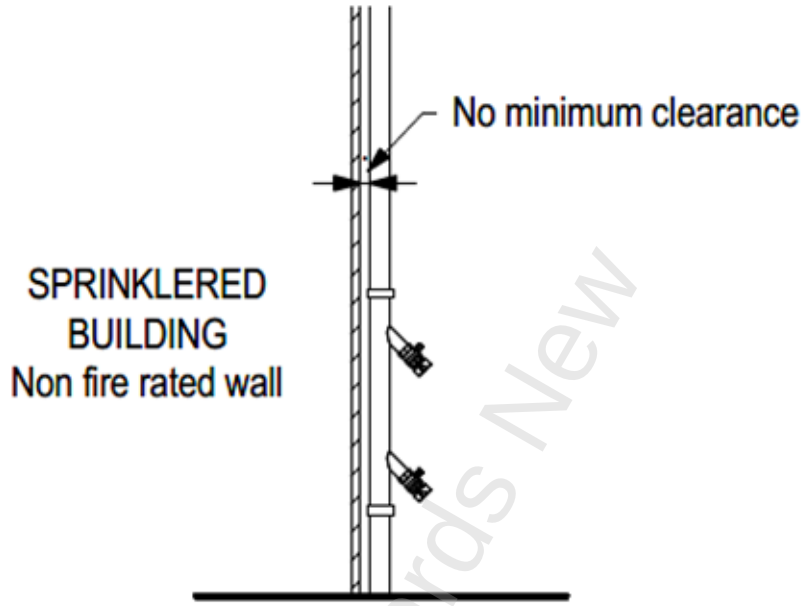


Figure 1(g) – Sprinklered building – Hydrant outlet protection
No distance required – Section view

2.6 Labelling and signs

2.6.1 Comply with the standard

All markings, signs, and labels required by this standard shall incorporate indelible markings and, unless otherwise specified or approved as a feature of listed equipment, shall comply with NZS 5807.

Signs shall have a red background with either reflective or non-reflective white lettering.

NOTE – The NZBC has requirements for certain signs which are subject to a building consent.

2.6.2 Hydrant inlet and outlet labelling

Labelling on the building hydrant inlet (BHI) and on building hydrant outlets (where enclosed) shall incorporate contrasting lettering at least 50 mm high.

2.6.3 Equipment in enclosed hydrant inlets

The flow gauge attachment point and the fire sprinkler inlet may be housed in the enclosure (see 5.2.4) and shall be separate assemblies, labelled 'HYDRANT TEST OUTLET', 'FIRE SPRINKLER INLET', and 'BUILDING HYDRANT INLET – KEEP CLEAR' respectively, in contrasting lettering at least 50 mm high.

2.6.4 Pump signage

2.6.4.1 General

Pumps forming part of the building hydrant system, housed in the enclosure, shall have:

(a) Start switch(es) labelled either 'HYDRANT DIESEL PUMP START' or 'HYDRANT ELECTRIC PUMP START';
(b) A red pump running lamp labelled 'HYDRANT PUMP RUNNING'; and
(c) A pressure gauge labelled 'HYDRANT SYSTEM PRESSURE'.

There shall also be a clearly visible sign stating 'CHARGE FEEDERS BEFORE STARTING PUMP' in lettering at least 25 mm high.

2.6.4.2 Electric motor isolation switches for pumps

All switches on the protected premises which are capable of isolating the pump shall be clearly labelled 'BUILDING HYDRANT PUMP – LEAVE ON' in white lettering on a red background.

2.6.4.3 Pump start buttons

A labelled green manual start button shall be provided on the building hydrant pump controller to directly energise the starter contactors.

Each pump start button shall be labelled 'HYDRANT PUMP START' in contrasting lettering at least 15 mm high.

2.6.4.4 Pump stop buttons

A red, clearly labelled, easily accessible stopping device that automatically resets or returns to its normal position shall be provided at the pump controller.

2.6.4.5 Pump alarm

The alarm which shows that the pump is running or if a malfunction has been detected (see 7.7.7) shall be labelled 'BUILDING HYDRANT PUMP RUNNING/MALFUNCTION ALARM', followed by instructions on whom to contact.

NOTE – It is suggested that the running/malfunction alarm be located at the BHI, unless another location can be shown to be more appropriate (such as one normally staffed).

2.6.5 External hydrant assemblies

Signs shall be provided adjacent to all external hydrant assemblies stating 'BUILDING HYDRANT OUTLET – KEEP CLEAR' in lettering at least 50 mm high.

2.6.6 Hydrant pipework identification

Pipework associated with hydrant systems shall be identified.

NOTE – NZS 5807 is an acceptable method of identification.

2.6.7 Pressure gauge and valve labelling

The function of pressure gauges and valves shall be clearly labelled, along with the correct normal position of valves.

2.6.8 Hydrant pump signage

The building hydrant pump shall be identified by a location plate fixed on the outside of an external wall adjacent to the fire brigade entry point and, if necessary, a further plate placed on any opaque door within the building which has to be opened in order to gain access to the building hydrant pump. Such plates shall state 'TO FIRE PUMPS' in reflective lettering at least 25 mm high.

NOTE – See Appendix F for further information.

2.6.9 Signage for stairwells without hydrant outlets

In stairwells which do not contain building hydrant outlets, signs shall be displayed (as required by 3.2.4) stating 'NO FIRE HYDRANTS IN THIS STAIRWELL' in reflective lettering at least 50 mm high. Signs shall be mounted on any door where the fire brigade is likely to gain entrance to the stairwell.

2.6.10 Hydrant inlet labelling for permanently piped connections

In instances where there is an approved permanently piped connection to a reliable pressurised water source (see 6.3.3), the BHI enclosure shall be labelled in accordance with 2.6.2.

2.6.11 Hydrant test point

For a flow test facility designed for a maximum flow not exceeding 3000 L/min, an appropriate fitting for the attachment of a flow test gauge shall consist of a 70 mm double lugged, female instantaneous coupling. Couplings for a flow test facility shall be fitted with a blanking cap and shall be labelled 'HYDRANT TEST POINT – NOT FOR FIRE SERVICE USE' in contrasting lettering at least 25 mm high.

2.7 Preliminary approval of basic design decisions

2.7.1 Hydrant system features to be approved before installation

Prior to commencement of installation, approval shall be sought from the HSC for the following features of a building hydrant system intended to comply with this standard:

(a) Location of building hydrant outlets;
(b) Location of BHI;
(c) Location of piping forming the main waterway;
(d) Location of pump units (where required);

(e) System design flow;
(f) Pressure required at the downstream connection of the inlet;
(g) Type of pump unit driver;
(h) Intended flow/pressure curve characteristics for each pump;
(i) Provisions for riser flow tests;
(j) Schedule of periodic inspections during construction (see 10.2.3); and
(k) Confirmation of water supplies available to the site.

2.7.2 Other features required

An application for such approval shall be in the form required by the HSC and shall include:
(a) Typical cross sections and floor plans showing hose arcs;
(b) Height of the highest building hydrant outlet above the BHI;
(c) A schematic drawing of the hydrant system;
(d) Hydraulic calculations that shall incorporate a dimensioned node diagram of the hydrant system waterway, as built, including details of pumps (where included), pressure control valves, and all fittings;
(e) Details of pump and driver selections;
(f) Details of pressure control facilities;
(g) Basis of seismic design;
(h) Fire brigade approval of attendance point;
(i) Schedule of progressive inspections and flow tests; and
(j) A block plan showing:

(i) Scale
(ii) North point
(iii) Location of building hydrant inlet
(iv) Location of hydrant outlets
(v) Location of pump sets
(vi) Power supply route for electric pumps.

2.8 Electrical bonding

All sections of the hydrant system conductive piping system shall be equipotentially bonded to the building's electrical installation main earth bar. The hydrant piping system shall not be used as an earth continuity conductor.

The cross-sectional size and conductor material requirements of the equipotential bonding cable shall be to AS/NZS 3000 requirements.

Each and every building on the installation that is fed downstream of an underground installation connection shall require earthing in accordance with this clause.

NOTE – Equipotential bonding means bonding together to prevent voltage differences between earthed items in the electrical installation and the fire sprinkler conductive piping system.

3 Design criteria

3.1 Pressure required at outlet

The pressure available at each hydrant outlet when the design number of hose streams are in simultaneous operation at the design flow shall be not less than 600 kPa, or more than that permitted by 6.3.1.

Where the building is low-rise and a 60 m arc is utilised to achieve coverage, as per 3.2.1, the pressure available at each hydrant outlet when the design number of hose streams are in simultaneous operation at the design flow shall be not less than 900 kPa, or more than that permitted by 6.3.1.

3.2 Number and spacing of outlets

3.2.1 Per floor

If a multi-storeyed building is provided with a building hydrant system, building hydrant outlets shall be located on every level, including the entrance/access level(s).

Sufficient hydrant outlet assemblies shall be installed in locations complying with 3.2.2 to ensure that every point on any floor is covered by an arc measured from the door entering the building/fire cell as outlined in Table 2.

Canopies are to be included in the arc coverage.

NOTE – Previous editions of this standard have exempted the need for hydrant outlets on the main entry level for the building. This exemption is no longer permitted in this edition of the standard.

Table 2 – Maximum allowed arc length[a]

	Sprinklered building	Non-sprinklered building
600 kPa outlet pressure, internally located outlet	40 m	32 m
900 kPa outlet pressure, externally located for low-rise buildings	60 m	60 m

NOTE –

(1) Figure 2(a)–(b) provides guidance in interpreting this clause.

(2) For low-rise buildings, the preferred approach is the use of a system of external hydrant outlets located close to the building's entry points, which provide an equivalent function. These hydrant outlets are intended for use for interior firefighting (building fire protection system), and are part of a hydrant system distinct from street hydrants, as may be required under SNZ PAS 4509.

(3) A system of external hydrants is exactly the same as an internal hydrant system in that the fire brigade is required to supply the necessary water flow and pressure into the hydrant system inlet.

(4) The use of 60 m arcs from an external hydrant allows for three lengths of hose to be used, as opposed to a 40 m arc from an internal hydrant allowing two lengths of hose.

(5) There are two reasons for differences in building hydrant outlet pressures specified for internal and external hydrants. The first relates to differences between branches used for external fire hose streams and branches used in hydrant riser packs. The second is that internal hydrant riser packs are supplied with two lengths of hose, while it is assumed that three lengths can be used at external hydrants.

a Where the hydrant outlet is located more than 5 m from the point of entry to the building/fire cell, the hose length between the hydrant and the door shall be allowed for. This distance is to be subtracted from the allowed arc length, and this reduced arc distance is to be used to calculate coverage from the point of entry to the building/fire cell.

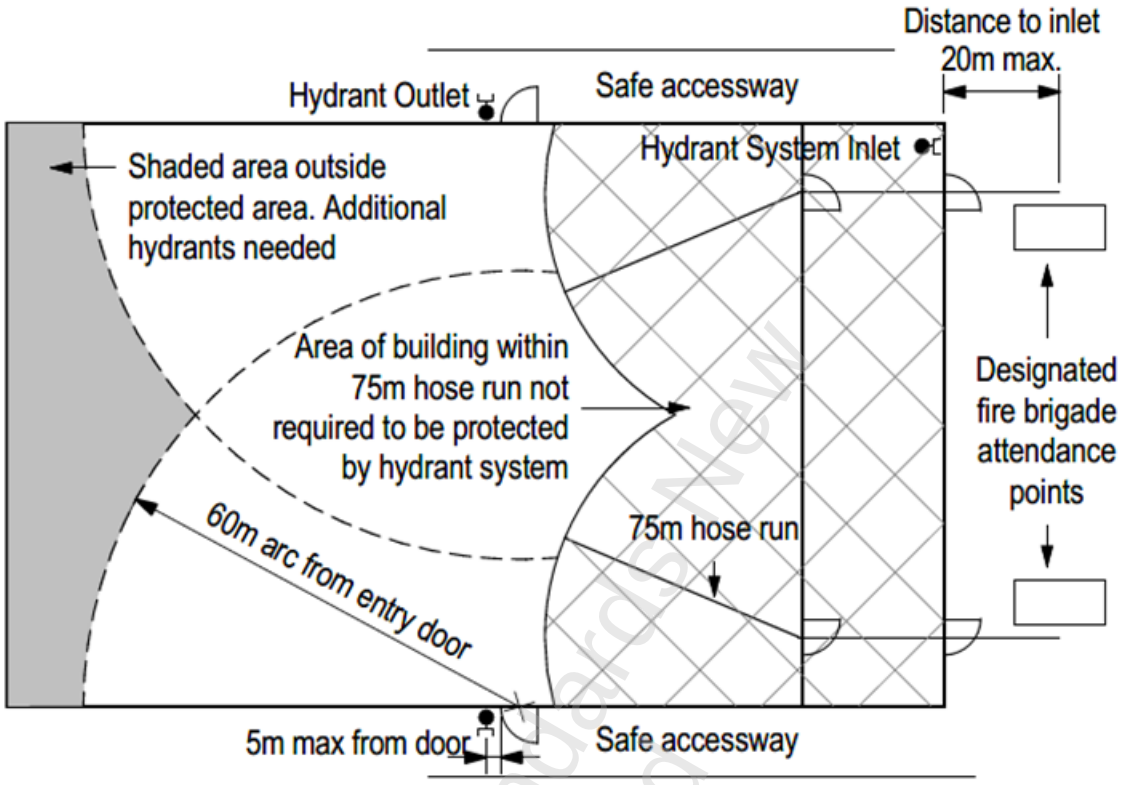


Figure 2(a) – Hose run/arc coverage shortage

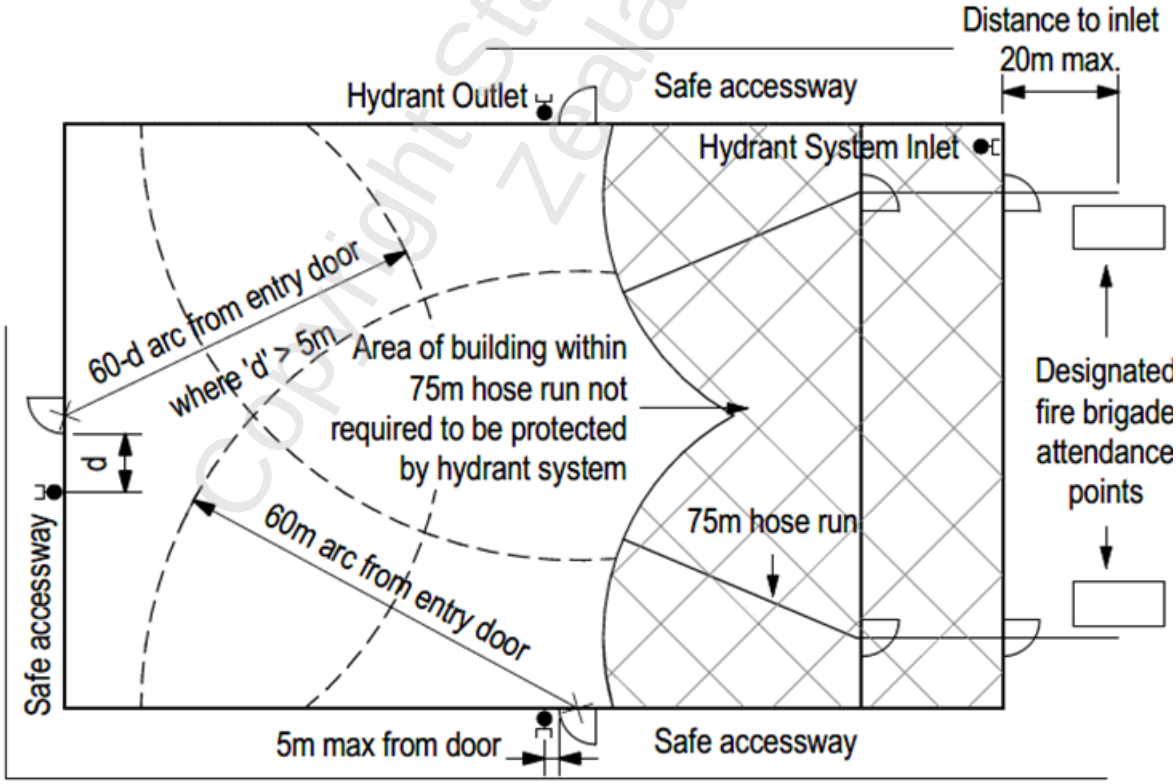


Figure 2(b) – Addition of external hydrant to provide hose run coverage

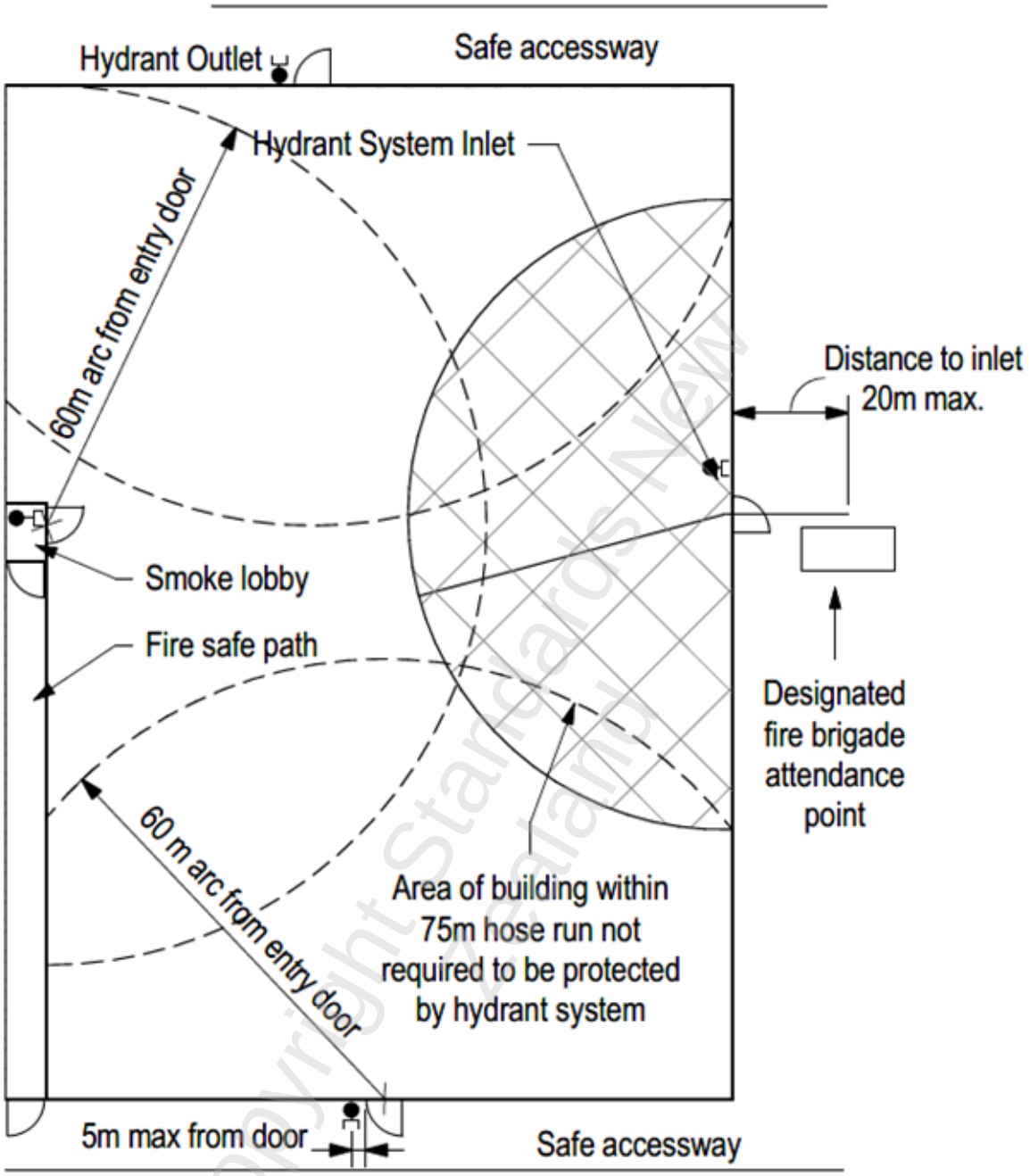


Figure 2(c) – Addition of safe path hydrant to provide hose run coverage

NOTE –

(1) 60m arc from safe path is based on 900 kPa outlet pressure.

(2) The Committee seeks public comment on this figure.

3.2.2 Outlet locations

Hydrant outlets shall be positioned in locations that are safe for the fire brigade to access and allow ready and efficient usage. Locations for hydrant outlets include:

(a) Building exteriors;
(b) Vertical safe paths, on floor or mid-floor landings;
(c) Protected lobbies, immediately adjacent to a vertical safe path that forms part of a firefighting shaft;
(d) Positions not less than 10 m from any high voltage main electrical distribution equipment such as transformers and distribution boards, and from liquefied petroleum gas and other combustible yard storage; and

(e) Positions unobstructed or obscured by obstacles such as stored goods, vehicles, and vegetation.

3.2.3 Performance design alternative

Where full coverage of every floor cannot be achieved based on the criteria in 3.2.1 and 3.2.2, the design may be approved on a performance basis. In such situations, compliance with this standard shall be subject to approval of the hydrant outlet layout and extent of coverage by the fire brigade. Appendix J provides guidance on considerations when developing a performance-based design solution. All other aspects of the standard shall be complied with.

3.2.4 Outlets in every stair

Building hydrant outlets are not required in every stair (or protected lobby directly accessible from the stair) provided that there is a warning sign, as specified in 2.6.9, indicating at each level with external access (or in the landing at that level) stairs which do not have hydrant outlets.

3.2.5 Scissor stairs

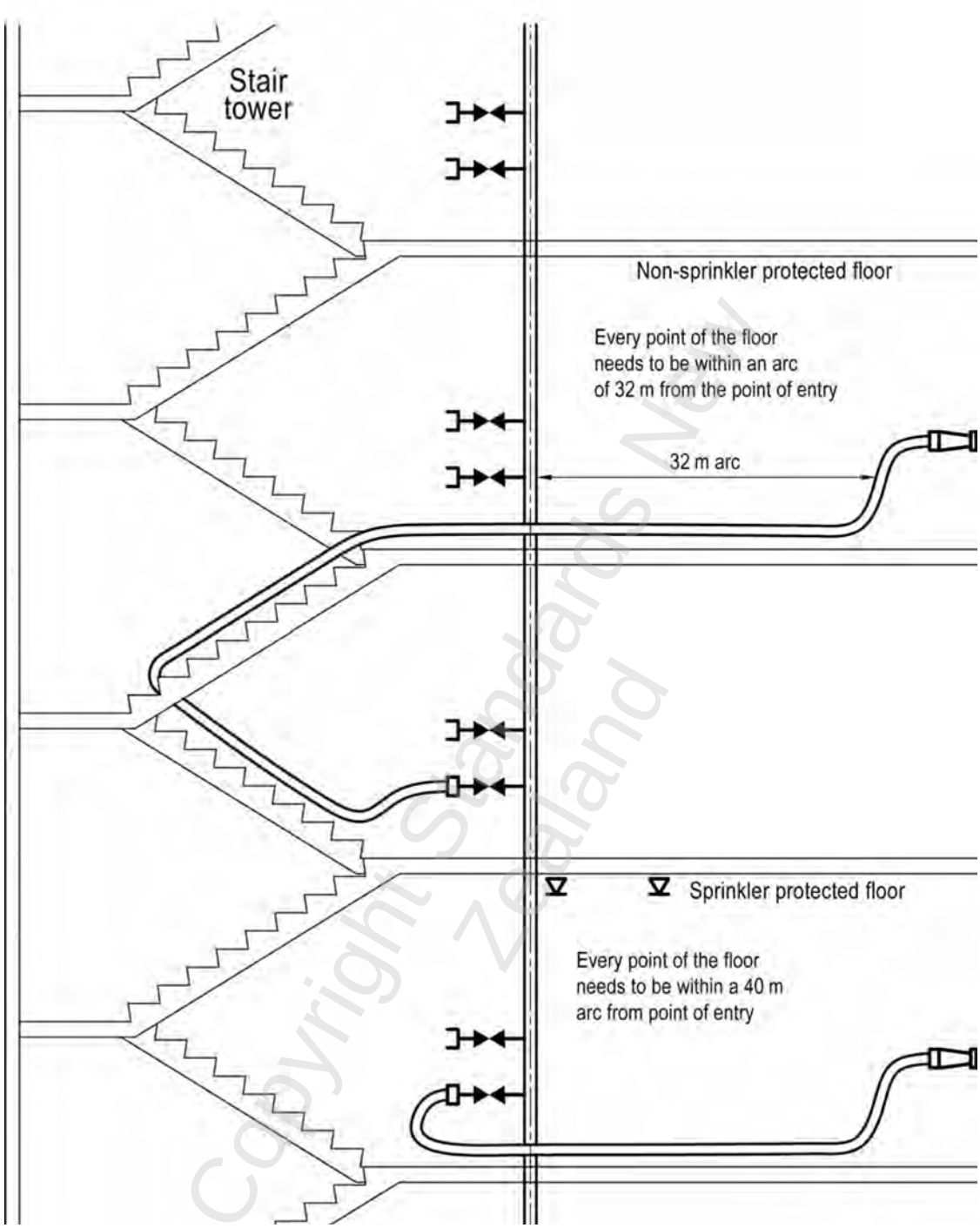
Where hydrants are located in a scissor stair serving a common protected lobby or floor area, building hydrant outlets shall be located at each floor level accessible from the stair designated for fire service use.

NOTE – The provisions requiring building hydrant outlets in both stairwells of a scissor stair have been deleted from this edition of the standard.

3.2.6 Hose stream numbers

The number of hose streams shall be taken from column 1 of Table 3, and need not include any additional hose stream flows in addition to the minimum number of outlets required to comply with this standard.

NOTE – See section 4 on the location of individual building hydrant outlets.



NOTE – See 1.5 and Appendix XX for meaning of abbreviations and graphical symbols.

Figure 3 – Measurement of hose length

3.3 Required flow rates

3.3.1 Buildings fitted with an approved fire sprinkler system

For buildings fitted with an approved sprinkler system, the design number of hose streams in simultaneous use shall be three flowing at 500 L/min each (total design flow shall be 1500 L/min).

The design number of flowing streams per floor shall be two on the hydraulically most remote floor, with the third stream on the floor immediately adjacent.

For single-storeyed buildings, the three most hydraulically remote hydrants shall be designed to flow.

3.3.2 Buildings not fitted with an approved fire sprinkler system

For multi-storeyed buildings not fitted with an approved sprinkler system, the design number of hose streams in simultaneous use shall be determined from Table 3. The minimum design flow rate for each hose stream shall be 440 L/min.

For low-rise buildings, the number of simultaneous hose streams operating is to be determined by the water requirements from SNZ PAS 4509. Up to 12 hose streams flowing at a minimum rate of 440 L/min are required.

Table 3 – Determination of design number of simultaneous hose streams in non-sprinklered buildings

Greatest number of building hydrant outlets required on any floor (see 3.2)	**Design number of flowing streams per floor**	**Number of simultaneous floors** (see NOTE)	**Design number of simultaneous hose streams**
1	2	2	4
2	4	2	8
3	5	2	10
4 or more	6	2	12
NOTE – In single-storeyed buildings, this value reduces to 1. See section 6 for design flow.			

3.4 Pressure requirement for booster pumps

3.4.1 Pressure calculation

If, in order to meet the pressure required at every building hydrant outlet (as specified in 3.1) the pressure required at the downstream side of the BHI (P_R) is greater than (P_R) as derived by the formula in Equation 2, then one or more booster pumps shall be provided in accordance with 3.4.2.

$$P_A = P_I - \Delta P_I \quad \text{(Eq. 2)}$$

where

P_A is the pressure available

P_I is the pressure downstream of the hydrant inlet check valve and, for design purposes, shall be assumed to be 1000kPa

ΔP_I is the loss or gain of pressure due to friction and elevation in the hose lines between the fire service pumping appliance and the BHI, and in the BHI assembly calculated in accordance with 6.3.4.

3.4.2 Booster pump requirement for buildings with a sprinkler system

In buildings protected by an approved sprinkler system, a single booster pump is required.

In buildings not fitted with an approved sprinkler system:
(a) If the required boost is less than 150 kPa, one booster pump shall be required; and
(b) If the required boost is greater than 150 kPa, 100% redundancy in pumping shall be provided.

3.5 Pipework to be charged with water

3.5.1 All sections at positive pressure

Unless the requirement for frost protection precludes this, every section of the hydrant system pipework shall be kept charged with water at a positive pressure of at least 15 kPa by means of a permanently connected pressurised water supply.

NOTE – If a pressurising pump is used to pressurise the system, a larger pressure differential may be required in order to detect the pressure drop required to start the pump.

3.5.2 Supply flow

The pressurised supply shall be through a pipe of not less than 15 mm diameter and be capable of maintaining a flow of 25 L/min. It shall be controlled only by a locked-open indicating valve labelled 'FIRE HYDRANT SYSTEM: NORMALLY OPEN'. A backflow prevention device or check valve (if not connected to a potable supply) shall be provided in this connection. The backflow prevention unit shall be provided in a position that allows access for inspection and maintenance.

3.5.3 Supply with booster pumps

With systems including a booster pump or pumps, the point of connection shall be in accordance with Figure 11 or Figure 12.

The flow rate shall also be sufficient to provide the total water required for pump and driver cooling when all pumps are operating at maximum load under test conditions (see 7.3).

3.5.4 Supply with hose reels

Where the hydrant system forms part of the reticulation for hose reels in the building, the required flow rate in 3.5.3 shall be increased by a flow equivalent to the simultaneous operation of the two most favourably placed hose reels. The required pressure shall be sufficient to ensure compliance with AS/NZS 1221 when any two reels are operating.

NOTE – The pressure limits of different hose reel assemblies vary.

3.6 Optional provision of pressurised water source

3.6.1 Permanently piped connections

An owner may elect to provide a permanently piped connection from a reliable pressurised water source to the hydrant system so that firefighting hose streams can be established prior to fire brigade arrival. This shall only be permitted if, with regard to the flow and pressure characteristics of the water source, there will be pressure of at least 600 kPa when the system is delivering a flow of 1500 L/min, sustained for at least 30 minutes, to any building hydrant outlet.

3.6.2 Booster pump for permanently piped connections

Should it be necessary to use a booster pump to meet the requirements of 3.6.1, either an electric motor or diesel driven pump, conforming to section 7 and arranged to start automatically on detection of a pressure drop, shall be provided for this purpose. The pump may also function as a booster pump for the primary function of the hydrant system.

The automatic starting arrangements and components shall be of a type listed in NZS 4541.

NOTE – Incorporation of a pressurised water source is not recommended unless, associated with the hydrant system outlets, there are cabinets containing adequate hose and branches, so that such equipment is routinely maintained in good condition, and staff are trained in the safe and correct use of the equipment. The fire brigade should be consulted on these matters.

4 Building hydrant outlets

4.1 Enclosures

4.1.1 Dimensions

Where located in an enclosure or recess, a hydrant outlet shall be configured and arranged to ensure that delivery hoses can be connected to the couplings without kinking. The enclosure shall be of such dimensions to allow a solid cone having an included angle of 45° to be placed in each connection coaxially with the connection, without the cone touching any part of the enclosure or open door. No part of the enclosure or the door when open shall be a lesser distance than 125 mm from the axis of any connection projected. Clear space around valves is to be maintained as in 4.2.3.

See Figure 4.

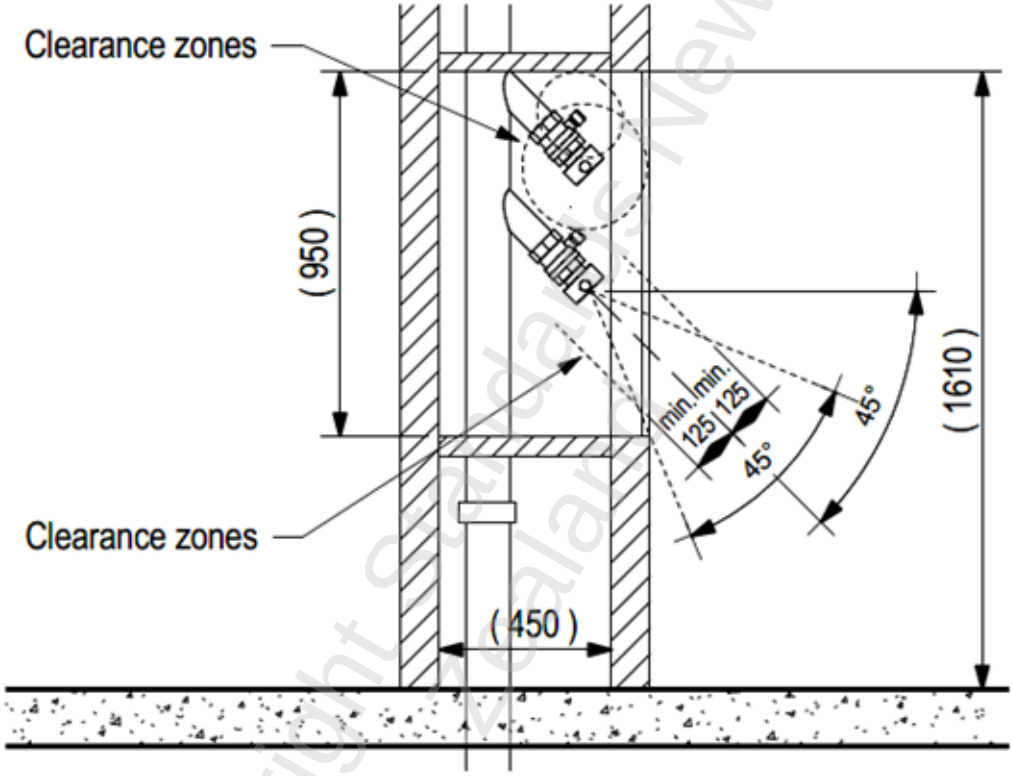


Figure 4 – Hydrant outlet enclosure – Section view

NOTE –

(1) Enclosures are permitted but not required by this standard.

(2) Dimensions in brackets are indicative only – subject to component selection, construction methods etc.

4.1.2 Door clearance

Doors shall open to allow free and clear access and efficient operation of the hydrant outlet.

4.1.3 Locks

Locks on enclosures, where fitted, shall comply with Figure 7. The door of any such enclosure shall be frangible.

4.1.4 Hose reels

Building hydrant outlet enclosures may incorporate a hose reel or other fire equipment, but in all cases the clearances specified in 4.2.3 shall be maintained and in such cases the door shall not be locked. Hose reels shall not be mounted on the enclosure door.

NOTE – Hydrant outlet enclosures should not be used to house services other than those related to fire safety.

4.2 Outlet assembly

4.2.1 General

Each building hydrant outlet shall incorporate two 70 mm double-lugged instantaneous female hose couplings conforming to SNZ PAS 4505. Each coupling shall be controlled by either:
(a) A lever-operated ball valve;
A hand wheel-operated landing valve; or

A pressure reducing valve incorporating a handwheel shut-off (one per coupling), and a tool-adjusted pressure reducing setting which shall be sealed at the set pressure. Where there are multiple BHI assemblies within a single building complex, they shall be interlinked so that any inlet may be used to serve any building hydrant outlet.

NOTE –

(1) An example of a location where lever-operated ball valves may not be fit for purpose is an area where environmental conditions could cause corrosion which could seize the operating lever.

(2) Lever-operated ball valves are not suitable for throttling purposes. The type of building hydrant outlet specified in this standard is based on the expectation that that the fire service fully open the building hydrant outlet and control flow at hose nozzles. Where building hydrant outlets may be used by the building's occupants for non-firefighting purposes, and flow is required to be controlled at the building hydrant outlet, the use of alternative valves such as landing valves described in SNZ PAS 4505 may be required.

4.2.2 Coupling position

The axis of each coupling shall be 45° down from the horizontal with lugs positioned horizontally. Lever-operated ball valves shall be positioned so the lever opens towards the operator.

NOTE – Couplings need not be side by side.

4.2.3 Clearances

There shall be a 150 mm clear space around the outer edge of the lugs. There shall be a 100 mm clear space around the operating arc of the lever of the ball valves (and, on existing systems, the handwheel). See Figure 5.

Unobstructed access shall be provided to a clear space of 1200 mm in front of the couplings. Couplings shall be installed between 550 mm and 1350 mm above the finished floor level (see Figure 5).

4.2.4 Operating levers

The operating lever of the ball valve shall be configured so that the hydrant opens by pulling the lever towards the user. The ball valve handle shall be in the horizontal plane.

4.2.5 Blanking caps

Although not required, if blanking caps are fitted to hydrant outlets, they shall be provided with a nominal 5 mm hole.

NOTE – The purpose of the hole is to relieve pressure behind the blanking cap should the hydrant be inadvertently opened with the cap in place. It may be dangerous to attempt to remove the cap if the pressure cannot be relieved.

4.2.6 Valve locks

Where required by the building owner, valves may be locked using the type of lock shown in Figure 8. Alternatively, they may be secured using keyed alike standard padlocks specified in FENZ's *Designers' Guide to Firefighting Operations*.

Dimensions in millimetres

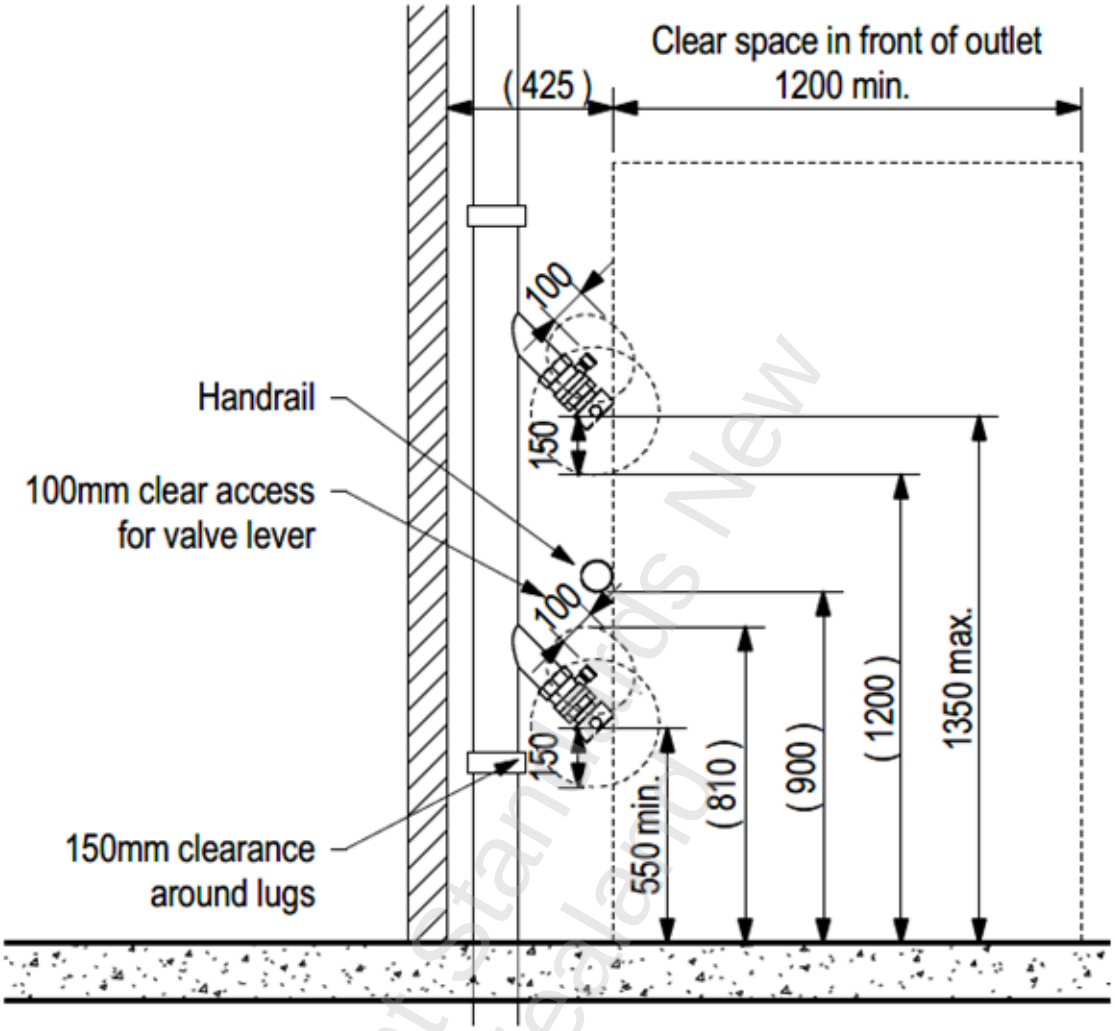


Figure 5(a) – Hydrant outlet – Section view

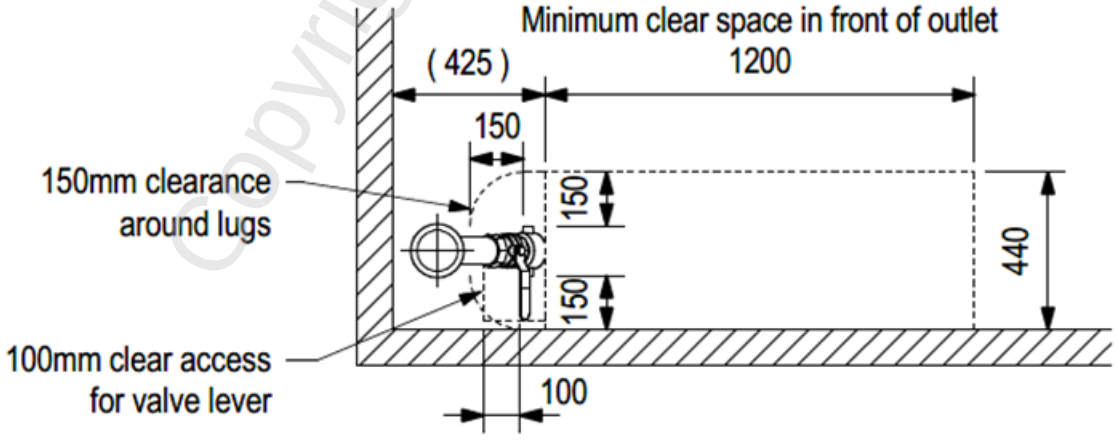


Figure 5(b) – Hydrant outlet – Plan view

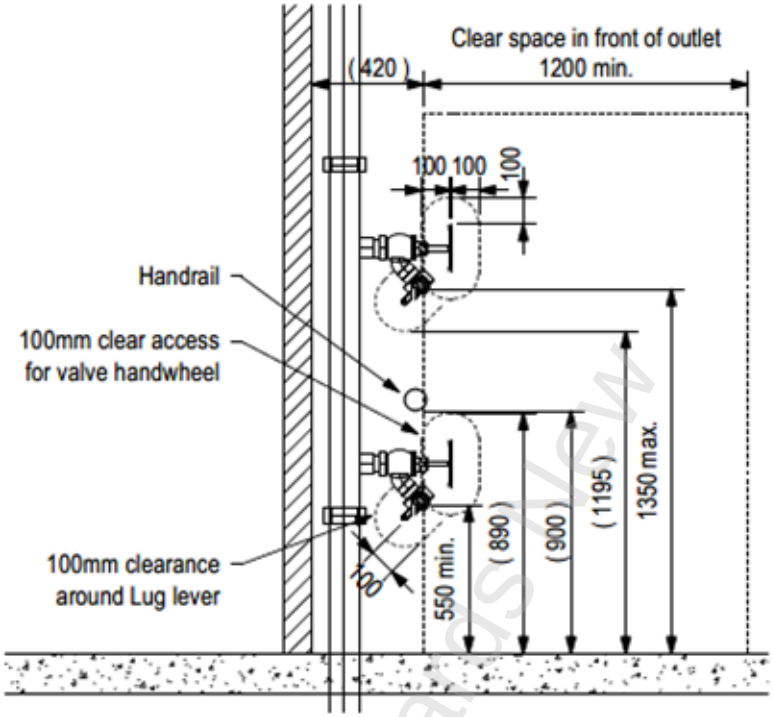


Figure 5(c) – Hydrant outlet – Handwheel and Lever action lug outlet – Section view

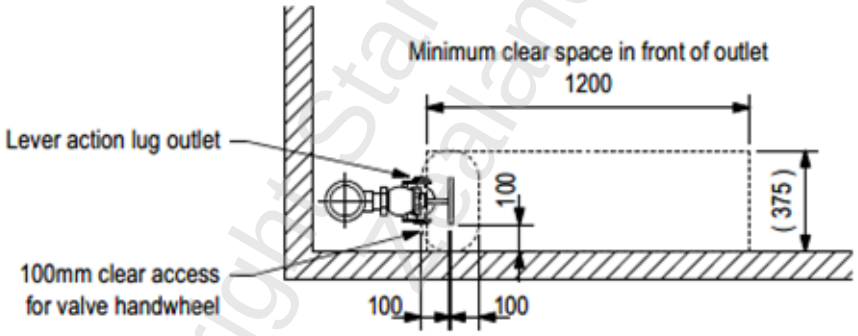


Figure 5(d) – Hydrant outlet – Handwheel and Lever action lug outlet – Plan view

NOTE – Dimensions in brackets are indicative only – subject to component selection, construction methods etc.

5 Building hydrant inlet

5.1 Location

The BHI shall be on the outside of the protected premises in a location approved by the fire brigade. The BHI assembly shall be within 18 m, and in clear view, of a point on a roadway, or area of hardstanding, which is readily accessible by a fire appliance. Access to the inlet shall be unobstructed. The BHI may be located away from the building provided that all criteria of the standard are met.

NOTE –

(1) FENZ publishes a *Designers' Guide to Firefighting Operations* which provides useful background advice on fire brigade requirements for building hydrant systems.

(2) In certain situations it may be appropriate, or even necessary, to provide two or more BHIs. Such situations may include buildings on steep terrain accessible from two sides at different levels or large buildings. Where more than one BHI is provided, the system shall comply with the provisions of 5.7.

5.2 Enclosure

5.2.1 Construction

5.2.1.1 Dimensions

The BHI shall be housed in an enclosure constructed to ensure that delivery hoses can be connected to the couplings without kinking. The enclosure shall be of such dimensions to allow a solid cone having an included angle of 45° to be placed in each connection coaxially with the connection, without the cone touching any part of the enclosure or open door. No part of the enclosure or the door when open shall be a lesser distance than 125 mm from the axis of any connection projected. Couplings shall be located no more than 150 mm from the internal face of the enclosure door.

5.2.1.2 Axis of couplings

The axis of the couplings shall be between 15° and 30° down from the horizontal. See Figure 6.

Dimensions in millimetres

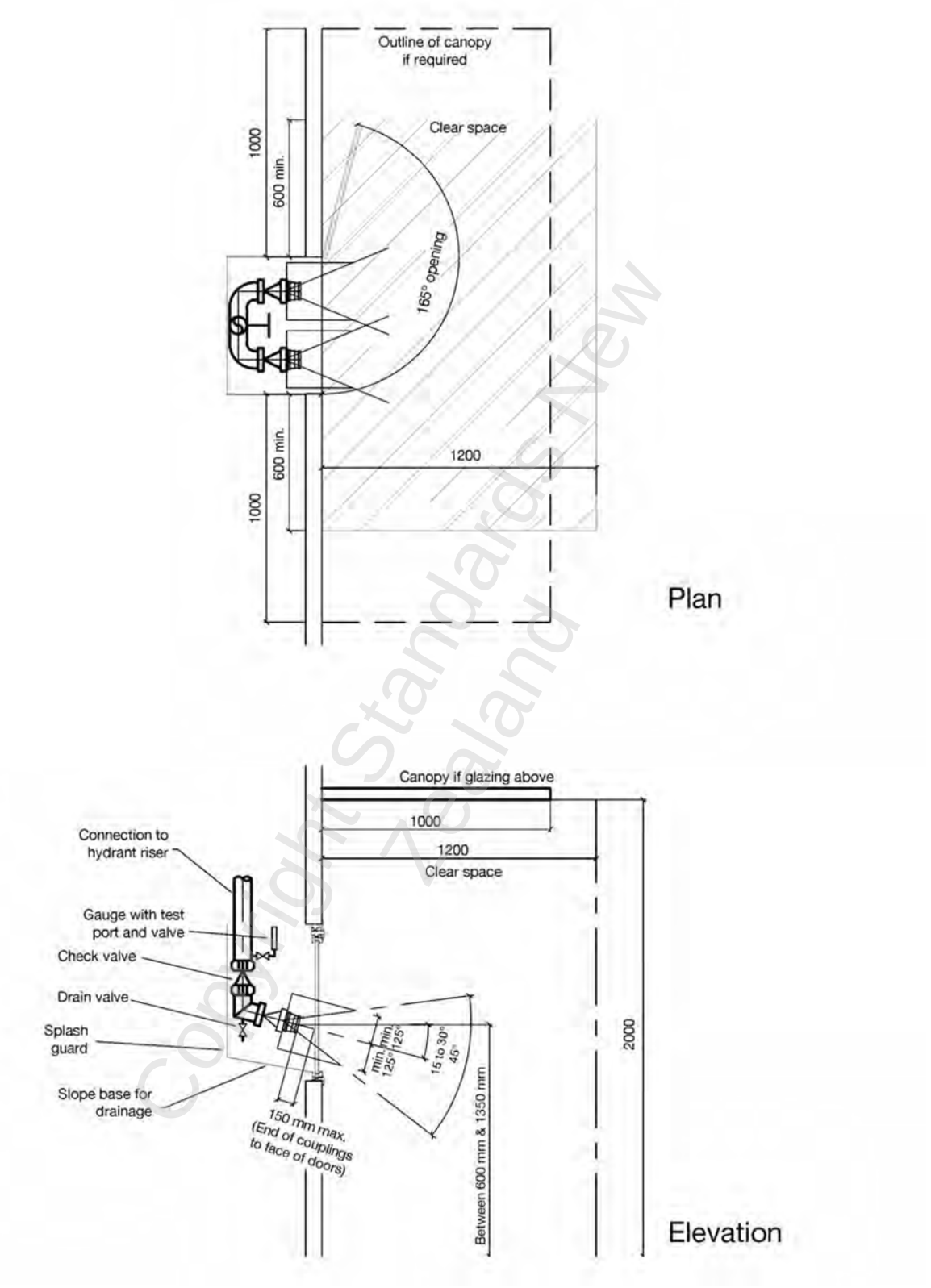


Figure 6 – BHI standard requirements

5.2.1.3 Doors

Doors may be side-hung or bottom-hung and shall in either case open through not less than 165º. The door shall be locked by a triangular key locking device, as shown in Figure 8, requiring no more than five revolutions to open the lock.

Dimensions in millimetres

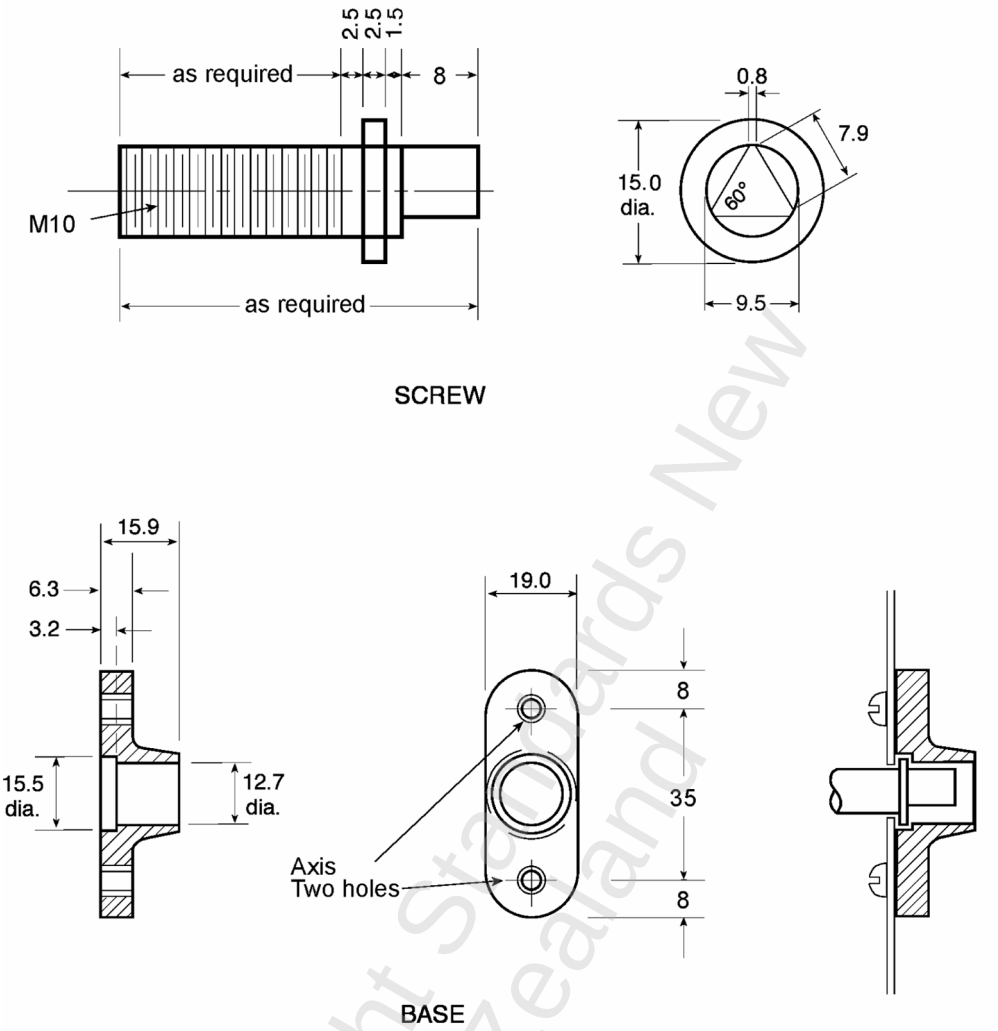


Figure 7 – Details of box lock

Alternatively, they may be secured using keyed alike standard padlocks specified in FENZ's *Designers' Guide to Firefighting Operations*.

5.2.1.4 Break-out panel size

The door shall have a break-out panel large enough to enable the connection of delivery hoses without kinking in the event that the door cannot be opened and emergency access has to be made by breaking out the panel.

5.2.1.5 Break-out panel design safety

The break-out panel shall be designed so that on removal no sharp edges remain.

5.2.2 Splash guards

A splash guard shall be provided to the sides, rear, and bottom of the enclosure to ensure that the risk of water damage to the interior of the building is minimised. The splash guard shall be provided with suitable drainage.

5.2.3 Usage

The enclosure may also be used to house the flow gauge attachment point for flow testing the hydrant system, and the fire sprinkler inlet for any fire sprinkler system serving the building. Other than indication and control panels for the control of building hydrant systems, as per 5.4, the enclosure shall not be used to house any other equipment.

5.2.4 Clear working space

A space measuring 600 mm either side of the inlet enclosure, 1200 mm out from the face of the enclosure, and extending up 2000 mm from the surrounding standing surface, shall be clear of all objects.

5.2.5 Building access

The orientation of the enclosure and inlets within shall be carefully considered to prevent obstructing access in and out of the building when in use. In particular, attention shall be given to space occupied by the hose connecting into the inlets to ensure that it does not obstruct the movement of building occupants and firefighters.

5.2.6 Falling glass

Where the door of the enclosure is on a glazed exterior wall of a multi-storeyed building, either a veranda or another assembly shall be provided extending at least 1 m in front and 1 m either side of the enclosure to provide protection from falling glass.

The Committee seeks feedback on performance criteria for this clause

5.3 Inlets

5.3.1 Specifications

Each inlet shall consist of a 70 mm male instantaneous hose connection and comply with SNZ PAS 4505. Each individual male connection shall be fitted with a clapper valve of the swing-hinged type (see Figure 6).

5.3.2 Number of inlets

The required number of inlets shall be not less than half the design number of simultaneous hose streams specified in 3.3.2 and in no case less than two inlets.

5.3.3 Height of couplings

The hydrant inlet shall be positioned so that the axis of the couplings is between 600 mm and 1350 mm above the surrounding ground level.

5.4 Other equipment in enclosure

5.4.1 Pumps

Pumps forming part of the building hydrant system, as part of a unit conforming to IP 65 of AS 60529, shall be housed in the enclosure. See 2.6.3.1 for pump signage requirements.

5.4.2 Pump pressure gauges

On hydrant systems incorporating pumps, there shall be within the enclosure a 100 mm pressure gauge fed from a tapping on the hydrant system downstream of the pump delivery check valve.

Hydrant systems not incorporating pumps shall have a 100 mm pressure gauge installed downstream of the system check valve.

Gauges shall be provided with an isolating valve.

5.4.3 Combined hydrant and sprinkler system equipment

The enclosure shall only contain equipment associated with the building hydrant system, except in cases of joint enclosure with a sprinkler system. Where hydrant and sprinkler systems are collocated, the enclosure shall be configured such that each system is allocated a side of the enclosure and all associated equipment is contained within its allocated space.

5.5 Connection pipe to system

Inlet couplings shall be connected to a manifold and these shall in turn be connected to the hydrant system via a non-return valve (NRV). Alternatively, individual inlet couplings may be fitted direct to individual resilient seated NRVs. No part of the waterway shall be of a diameter smaller than the inlet coupling. A 15 mm stop valve shall be provided in the enclosure to release pressure in the pipework between the inlet flap valves and the NRV.

5.6 Fire brigade reference documents

A laminated/waterproof block plan shall be permanently fixed at the inlet in a location that allows it to be easily read (for example, on the inside of the cabinet door or on the splashback behind if accessible), with reference information showing the following:

(a) Pipework route;
(b) Inlet and outlet locations;
(c) Valve locations;
(d) Design criteria;
(e) Design demand flow and pressure at the inlet;
(f) Testing provisions; and
(g) Commissioning flow test results.

5.7 Duplicated building hydrant inlets

Where there are multiple BHI assemblies within a single building complex, they shall be interlinked so that any inlet may be used to serve any building hydrant outlet and comply in all respects with 5.1 to 5.6 inclusive.

Hydrant block plans shall clearly identify inlet locations and show links between inlets.

Where multiple buildings/systems are present, links between inlets shall be clearly identified. Separate systems shall be identified physically and labelled on the block plan.

6 Pipework and pressure control

6.1 Piping location

When it is reasonably practicable, vertical sections of the main waterway shall be located in a fire rated stair.

6.2 Piping sizing

Piping forming the waterway of the hydrant system shall be sized using hydraulic calculations so that the design criteria set out in section 3 will be achieved, taking account of the available pressure provided by the fire brigade (see 3.4) and by booster pumps (where installed). However, the main waterway shall not be less than 100 mm nominal bore.

The method of calculation shall conform to 6.3.4.

6.3 Pressure control and test facilities

6.3.1 Outlet coupling pressure ratings

The pressure at every building hydrant outlet coupling shall, under any conditions of flow from zero to the highest building hydrant outlet design flow (see 3.3) at the coupling (and from zero to the system design flow in the array of which the coupling forms part), be in the range of 600 kPa to 1200 kPa. For extensions to existing systems where building hydrant outlet couplings are single-lugged, the permissible pressure range shall be 600 kPa to 1050 kPa.

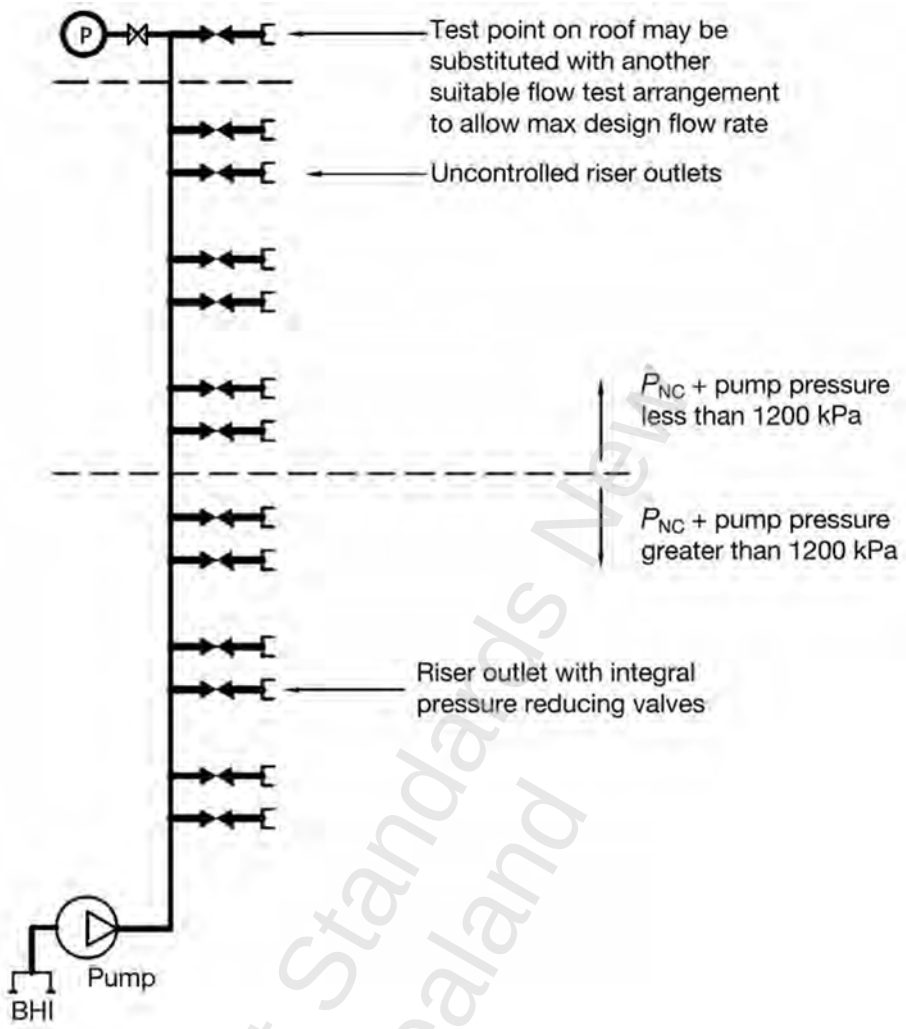
6.3.2 Pressure control devices

If conformance to 6.3.1 requires pressure control devices, these shall conform to the following:

(a) Orifice plates, ratio valves, and parity valves are not permitted;
(b) Individual building hydrant outlets may be controlled by a pressure reducing valve unique to that building hydrant outlet (see Figure 8);
(c) Several building hydrant outlets arranged in a pressure zone may have common pressure control using a single pressure reducing valve, provided that:
    (i) The pressure reducing valve is not located in a position vulnerable to impact damage
    (ii) Pressure reducing valves are accessible for inspection (without causing damage to the building or interior finishes) and provided with facilities for testing for correct operation in situ while allowing a range of flows between a single hose stream as specified in 3.3 and the design flow for that zone. Suitable provisions to permit this testing shall be provided (see Figure 9)
    (iii) Isolation valves shall be fitted to both sides of each pressure reducing valve to permit isolation, commissioning, testing, and maintenance. These shall be locked open. The stop valves shall be supervised for interference via any building fire alarm system, or sprinkler control system;
(d) Pressure reducing valves shall have the intended pressure settings indelibly marked using an engraved label; and
(e) Multi-staged pumps shall have multiple pump discharge nozzles (see Figure 10).

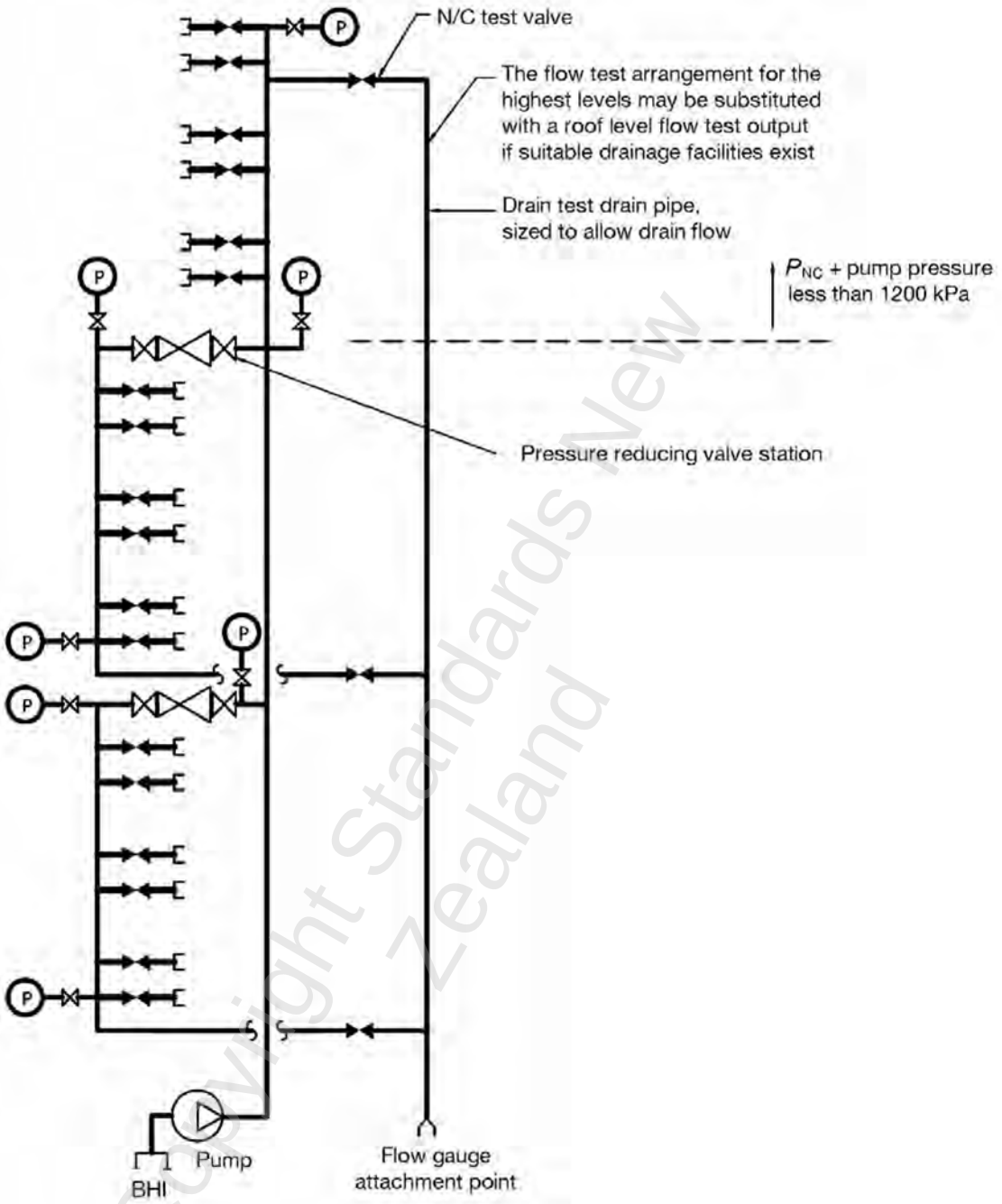
Combinations of the options given in (b) to (e) shall be permitted.

Figures 8 to 10 show possible options for pressure control of individual building hydrant outlets (when required).



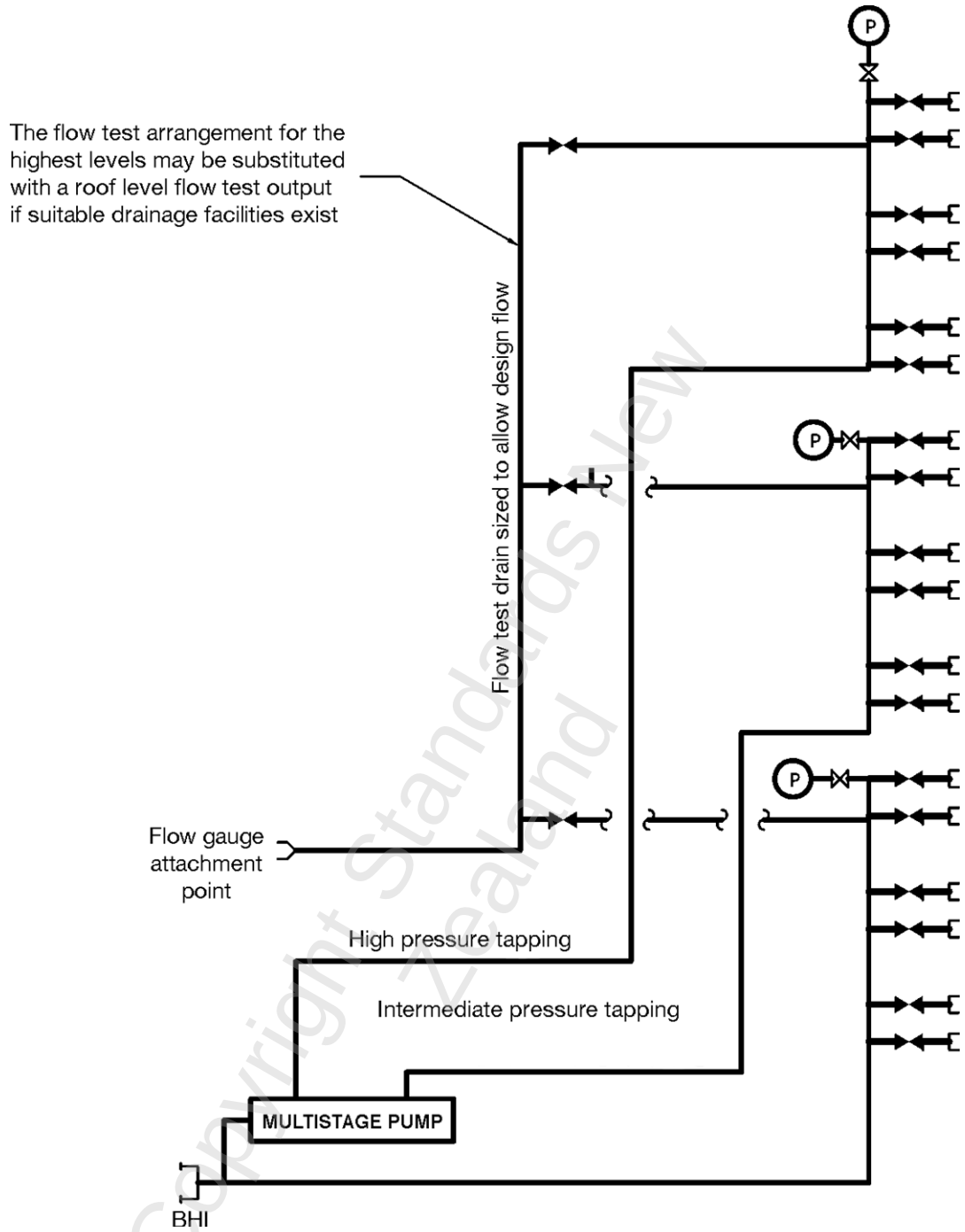
NOTE – See 1.5 and Appendix XX for meaning of abbreviations and graphical symbols.

Figure 8 – Pressure control on individual outlets



NOTE – See 1.5 and Appendix XX for meaning of abbreviations and graphical symbols.

Figure 9 – Zone pressure replacing zones



NOTE – See 1.5 and Appendix XX for meaning of abbreviations and graphical symbols.

Figure 10 – Multistage pump pressure control

6.3.3 Permanent facilities

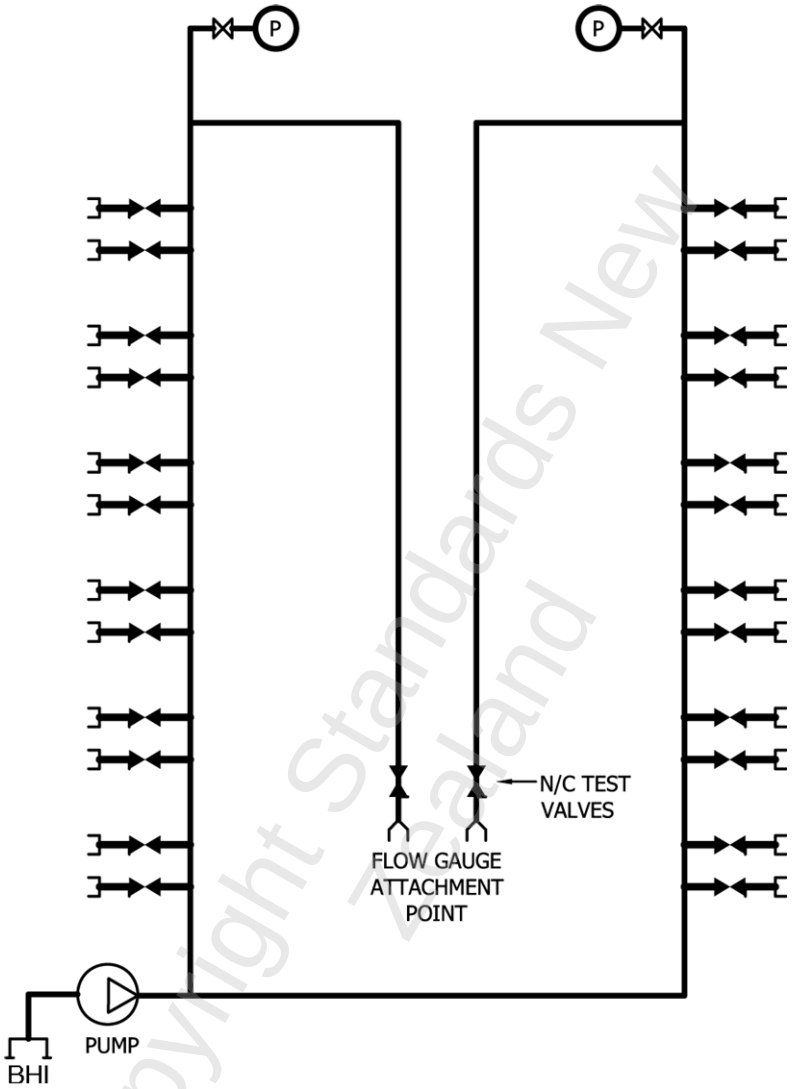
In addition to test facilities referred to in 6.3.2, permanent facilities shall be provided to allow the design flow through each main waterway, including each pressure zone of the hydrant system (see Figures 8 to 10), or the facility shall be sized to allow a flow range of between zero and 110% of the design flow through the system to be safely discharged to waste.

The test facilities shall be located exterior to the building to minimise the probability of water damage to the building during flow testing.

6.3.4 Flow test facility requirements

The flow test facility shall include the following arrangements:

(a) A 15 mm valved tapping for a pressure gauge at the discharge point, located upstream of the isolation valve;
(b) Valved tappings of 15 mm for pressure gauges at the high points of each leg of the hydrant system, located in an area accessible to testing staff; and
(c) Appropriate fittings as specified in 6.2.4 to allow flow test facilities to be temporarily connected without having to shut down the hydrant system.



NOTE – See 1.5 and Appendix XX for meaning of abbreviations and graphical symbols.

Figure 11 – Indicative flow test arrangements for buildings with multiple risers

6.3.5 Flow test gauges

For a flow test facility designed for a maximum flow not exceeding 3000 L/min, an appropriate fitting for the attachment of a flow test gauge shall consist of a 70 mm double lugged, female instantaneous coupling. This coupling shall be fitted with a blanking cap and shall be labelled as per 2.6.10.

For hydrant systems designed for flows exceeding 3000 L/min, an appropriate flow test gauge attachment point shall consist of a 100 mm roll groove connection. This roll groove connection shall be fitted with a blanking cap.

The flow test gauge attachment outlets shall be controlled by a handwheel-operated, resilient-seated isolation valve.

The flow test attachment outlets shall allow for the safe disposal of water used for flow testing.

If the discharge from testing falls in part or in total on the roof of the building, adequate permanent drainage shall be available so that no damage will occur at 110% of the design flow. In such cases, a

written statement from the designer of the building stating that the roof guttering system will cater for the expected testing flows shall be provided to the HSC.

6.4 Gauges and valves

6.4.1 Pressure gauges

Pressure gauges shall comply with BS EN 837-1 or DIN 16005, or equivalent, be calibrated in kPa and have a scale range not more than 150% of the highest pressure to which the gauge will be subject (see 2.6 on labelling). Dampening shall be provided where required, to avoid excessive needle fluctuation. A stop valve shall be provided at each pressure gauge to allow removal without shutdown of the piping to which it is connected.

The requirement for gauge isolation valves also applies to gauges fitted as part of a pump controller.

6.4.2 Manually operated valves

Manually operated valves (other than quarter-turn valves) shall be right hand closing with the direction of closing clearly indicated, and ball valves and other quarter turn valves shall have a stop to prevent operation through greater than a 90° arc.

6.4.3 Valve indicators

Each valve shall have an indicator so that it is evident whether the valve is fully open or fully closed. The valve shall be labelled for the correct normal position.

6.4.4 Valve padlocks

Valves associated with the waterway, and drain and test valves, shall be padlocked in the normal operating position (see 2.6 on labelling).

6.4.5 Exceptions for placement of isolating valves in the waterway

Isolating valves are not permitted in the waterway, other than:

(a) Those on the suction and delivery of pumps;
(b) Those located on either side of a pressure reducing valve; and
(c) Those fitted to allow the isolation of waterways with multiple branches to permit maintenance on part of the hydrant system.

In such cases these valves shall be supervised via the building fire alarm panel.

NOTE – In (c), such valves are permitted but not mandated.

6.4.6 Listed valves

Pressure reducing valves and isolating valves shall be of a listed type.

6.4.7 Correct pressure ratings

All valves shall be rated for the pressure range to which they will be subject.

6.5 Hydraulic calculation

6.5.1 Pressure and flow requirements

The pressure and flow requirements of a hydrant system shall be calculated with pressure loss determined in accordance with 3.4.1. The HSC may accept computer calculations generated by a program suitable for hydraulic calculations, subject to receiving a printout of inputs and outputs.

6.5.2 Pressure loss calculation for piping friction

Pressure loss due to friction in piping shall be calculated using the (Hazen Williams) formula in Equation 3:

$$\Delta P = \frac{0.605Q^{1.85}\times 10^{8}}{C^{1.85}\times d^{4.87}} \quad \text{..... (Eq. 3)}$$

where

ΔP is the loss of pressure per metre of piping (kPa)

Q is the flow rate (L/min)

d is the mean inside diameter (mm)

C is a constant according to the internal roughness of the piping as derived from Table 4.

Table 4 – Hazen Williams 'C' values

Type of piping	'C' value
Steel, black, or galvanised	120
Copper	140
Stainless steel	140
Polyethylene	150

6.5.3 Piping friction constant by material

Pressure loss in piping fittings shall be based on Equation 3 with the equivalent length (in metres) determined by multiplying the nominal diameter (mm) of the smallest piping connected to the fitting by the factor obtained from Table 5.

Table 5 – Equivalent length factors for various fittings

'C' value (from Table 4)	120	140
Tees into branches	0.060	0.080
Elbows	0.030	0.040
Bends (see Note 1)	0.015	0.020
NOTE – (1) A 'bend' is a fitting where the radius of the turn divided by the nominal piping diameter is at least 1.5. (2) Pressure loss arising from flow through valves or other waterway devices including hydrant inlet fittings shall be calculated according to published manufacturer's data.		

6.5.4 Pressure loss due to elevation

Pressure loss or gain due to difference in elevation shall be calculated as 10 kPa per metre difference in height.

6.5.5 Alternative pressure and flow calculations

The following shall also be an acceptable method of calculating pressure and flow characteristics:

(a) Determine the most hydraulically remote array of building hydrant outlets required by section 3 to be considered in simultaneous operation;

Assume a single hose stream flow as specified in 3.3 at 600 kPa at each coupling of the most hydraulically remote building hydrant outlet;

Calculate the loss/gains of pressure (ΔP_3) between the couplings of the building hydrant outlet (with both couplings flowing) to the piping junction serving the next building hydrant outlet in the array under consideration;

Repeat step (c) for the next building hydrant outlet to give ΔP_4 but adjust the flow in the branch having the lower calculated pressure loss using the formula:

$$Q_2 = \sqrt{\frac{\Delta P_4}{\Delta P_3}} \times Q_1 \quad \text{(Eq. 4)}$$

Add Q_2 and Q_1 and calculate to the next junction, then repeat the process for the balance of the array;

(i) Assume that 1 x 30 m length of 90 mm lined hose will be used between the fire appliance and each coupling of the BHI required by 6.5.2 and Table 4

(ii) Assume that the flow in each such hose connection is 1760 L/min (or in some single-storeyed buildings 880 L/min – see Table 5) according to the total system design flow, and that the pressure loss due to friction is accordingly 60 kPa (or 20 kPa for 880 L/min)

(iii) Assume the flow rate through each inlet coupling in service is equal and not greater than 1760 L/min, and calculate the pressure loss across the assembly between the level of the inlet and the surface of the hardstanding area within 25 m of the inlet which may be used by the fire service appliance.

NOTE – This provides an example of a calculation method based on flows for non-sprinklered buildings. The flows would need to be adjusted to those specified in this standard for the respective system design.

6.5.6 Pressure requirement at every outlet

The hydraulic calculation shall also demonstrate that the available pressure at every building hydrant outlet on the hydrant system will comply with 6.3.1. For systems incorporating booster pump(s), this shall be demonstrated with pump(s) operating.

7 Pumps

7.1 Pump set compliance

Fire pump sets shall comply with the provisions of NZS 4541 6.7 except where modified by this standard.

7.2 Pump casing pressure rating

Where the pump outlet is fitted with a pressure relief valve to regulate the hydrant system pressure, the pump casing rating shall be not less than the set pressure of the relief valve plus 300 kPa.

Where no pressure relief valve is fitted, the pump casing rated pressure shall be at least equal to the highest head on the pump curve at duty speed (no flow) plus P_{NC}, plus the static difference between the BHI and the pump suction, plus 300 kPa.

7.3 Pump selection

The published manufacturer's curve of the selected pump shall demonstrate that:

(a) At the hydrant system design flow, the pump will produce 110% of the additional pressure needed (P_R) at the point of connection to the water supply of the pump inlet flange in order to meet the pressure required at the reference point (see 6.3.1);

(b) At 150% of the hydrant system design flow, the pump will produce at least 65% of the pressure available (on the manufacturer's curve) at the P_R and when driven by the selected driver, the pressure will fall progressively with the rate of flow;

(c) The maximum head of the pump curve shall not be greater than 120% of P_R. However, to achieve this, it shall be permissible to use a pressure relief valve on the pump discharge, arranged to relieve to the pump suction;

(d) Where there are pumps in parallel, the curve of each pump shall show a constantly reducing head as flow increases; and

(e) If more than one pump is diesel driven, the pumps shall have identical curves.

7.4 Pump performance

The pressure available at the pump suction inlet (P_S) shall be calculated using Equation 5.

$$P_S = P_I - \Delta P_I - \Delta P_2 \pm \Delta P_H \quad \text{(Eq. 5)}$$

where

P_I 1000 kPa

ΔP_I is the pressure loss in the feeder hose and inlet assembly (see 3.4.1).

ΔP_2 is the pressure loss in the waterway between the inlet and the pump suction at the design flow (Q) using the formula given in Equation 3 in 6.5.2.

ΔP_H is the pressure gain or loss due to difference in height between the inlet assembly and the pump suction.

7.5 Drivers

7.5.1 Single pump arrangements

Where only one pump is required (see 3.4), the driver may be either:

(a) A diesel driven pump; or

Where the required pump duty is less than 0.15 P_{NC}, an electric motor driven pump with the power supply from an electrically reliable and physically secure source.

7.5.2 Twin pump arrangements

If two pumps are required, one shall be a diesel driven pump and the other may be either:

(a) A diesel driven pump; or

An electric motor driven pump.

NOTE – in 7.5.1 and 7.5.2, the use of an engine driven emergency generator in conjunction with an electrically driven pump does not constitute a substitute for a direct coupled diesel driven pump.

7.5.3 Governing

The engine shall be provided with a governor to control the engine speed within 10% of its rated value under all stable conditions of load up to full load rating.

7.5.4 Speed Control

Variable speed controllers shall not be used to limit pump output pressure.

7.6 Pump starting and stopping

7.6.1 Remote starting

Each pump shall have a remote control panel located in the BHI enclosure.

The remote control panel shall conform to 5.4.1 and be connected to the building hydrant pump controller by means of fire rated cable. The cable shall have a minimum 30-minute circuit integrity rating and shall comply with AS/NZS 3013 Classification WS22. Alternatively, the cable may be run in a fire rated conduit or a fire rated duct used solely for cabling and non-combustible services. The conduit, duct, or wall cavity shall have a minimum FRR of -/30/-. The cable shall be protected from mechanical damage.

7.6.2 Start buttons

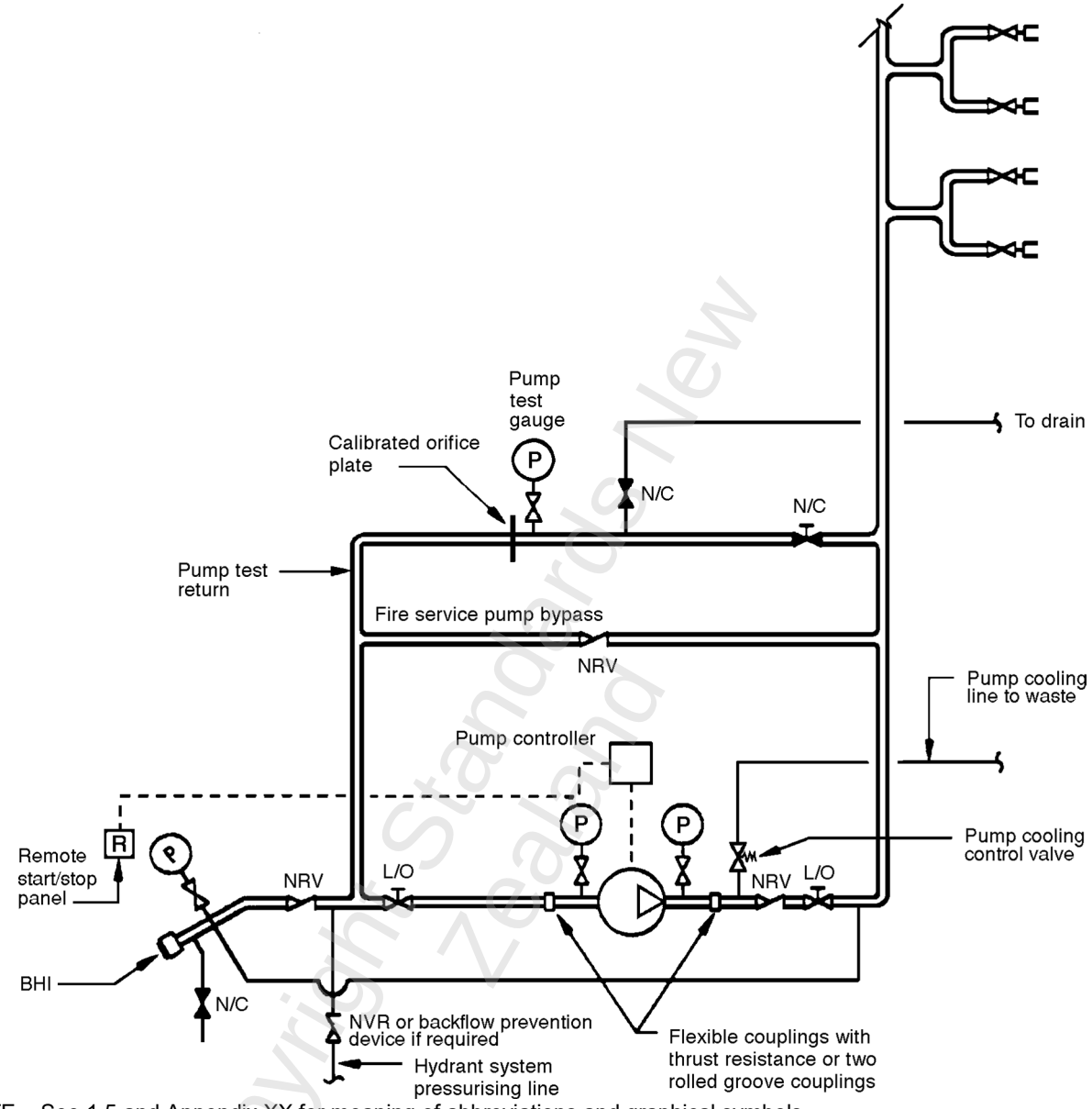
If the hydrant inlet and sprinkler inlet are located in the same enclosure, the hydrant pump start buttons shall be located immediately adjacent to the hydrant inlet. See 2.6.4.3 for labelling requirements.

7.6.3 Stopping

Once started, every pump unit shall run until manually stopped. The use of a failsafe device such as an 'energised to stop' solenoid is acceptable providing it meets the other requirements of this clause.

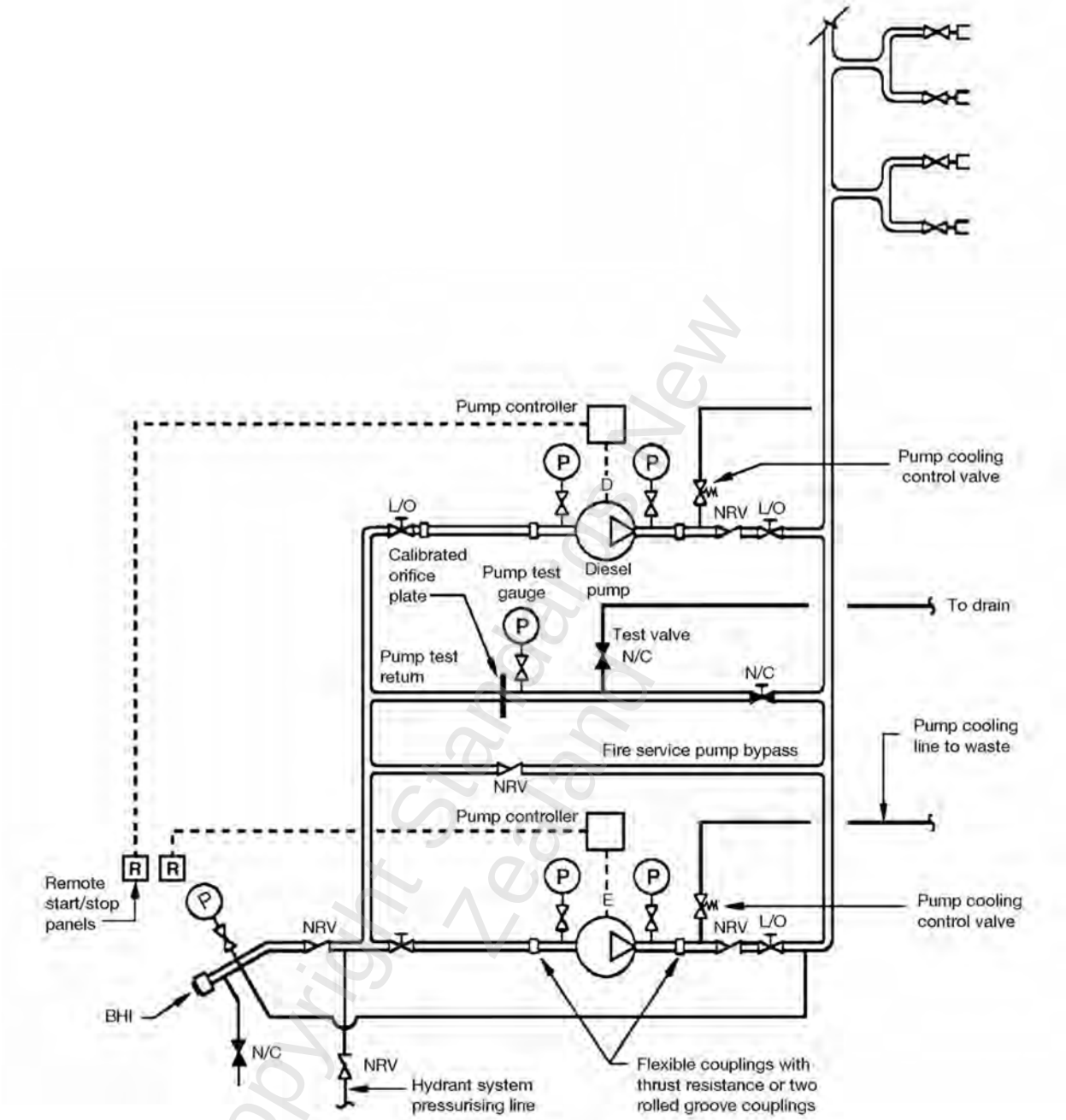
Automatic stopping is not permitted. A red, easily accessible stopping device that automatically resets or returns to its normal position shall be provided at the pump controller. See 2.6.4.4 for labelling requirements.

Additionally, for electric motors, there shall be a lockable ON/OFF switch to isolate the power supply to the contactor.



NOTE – See 1.5 and Appendix XX for meaning of abbreviations and graphical symbols.

Figure 12 – Pump unit installation – Arrangement for single booster



NOTE – See 1.5 and Appendix XX for meaning of abbreviations and graphical symbols.

Figure 13 – Pump unit installation – Arrangement for dual boosters

7.7 Pump set installation

7.7.1 Connection

Each pump shall be installed in the waterway according to Figure 12 or Figure 13.

The following requirements apply:

(a) The pump suction and delivery shall be connected to the fixed piping through flexible couplings to prevent transmission of running vibration and seismic movement, and to ensure that the pump alignment is not stressed by the pipes. Any elastomeric type couplings shall be mechanically restrained;

(b) Any valves or fittings constructed so that turbulence may be introduced through change in direction or obstruction of the waterway shall be located at least 5 nominal diameters of the suction inlet

from the entry to the pump. An uninterrupted length of 5 nominal diameters of pipe, the same diameter as the pump suction, shall be installed immediately upstream of the pump suction flange to affect this requirement; and

(c) The suction pipe shall be installed to ensure that air cannot become trapped upstream of the pump suction. When a reducer is required in the pump suction pipework, it shall be installed so that no air will be trapped in it – which usually necessitates the use of eccentric style reducers.

7.7.2 Priming

Each pump shall be kept primed by means of a connection to the suction side of the pump capable of providing the following flows (simultaneously where there is more than one pump) at not less than 20 kPa residual pressure:

(a) Diesel engine driver 1.0 L/min/kW; and
(b) Electric motor driver 0.25 L/min/kW.

NOTE – In terms of this clause, the power rating is the power absorbed by the pump at the highest design flow.

7.7.3 Test return

The pump test return around the pump (see Figures 12 and 13) shall be taken from the pump delivery (downstream of the flexible coupling) to the pump suction (upstream of the flexible coupling). This pipe shall be fitted with a normally closed, locked, and labelled indicating stop valve fitted with a supervisory device. An orifice plate, sized to induce approximately 110% of the design flow, shall be fitted in the pump test return, unless the hydraulic characteristic of the pipework causes 110% of the design flow to be induced. The pump test return valve shall be supervised to signal defects in accordance with 7.7.7 when more than 5% open.

7.7.4 Bypass

A bypass shall be provided around the pump of the same diameter as the main waterway and shall be fitted with a NRV to prevent recirculation.

7.7.5 Temperature

Means shall be provided to prevent the temperature of the water in the pump casing rising to more than 35°C during nil or low-flow discharge conditions over a 1-hour period. Acceptable means of achieving this include:

(a) A differential pressure valve; and

The diesel motor cooling water supply.

7.7.6 Gauges

The following gauges shall be provided:

(a) A pressure gauge, complete with gauge cock, connected to the suction of every pump far enough from the pump not to be influenced by pump entry turbulence; and

A pressure gauge complete with gauge cock connected to the pump delivery.

Gauges shall comply with 6.4.

7.7.7 Alarms

Every pump unit shall be provided with a device which shows at an approved location that the pump is running or if a malfunction has been detected. A self-resetting device may be incorporated to suppress an electrically operated alarm for up to 60 minutes. Where the indication is made at a location which is not staffed at all times, a defect signal to the fire brigade's receiving equipment shall be generated in accordance with 7.10.1.

See 2.6.4.5 for alarm labelling requirements

7.8 Diesel fuel supply

The nominal fuel duration for a diesel driven pump shall be for a minimum of 8 hours. The tank shall be fitted with a fuel gauge indicating that the top half of the tank is fuel for test running and the bottom half for fire duty running.

7.9 Pump unit enclosure

7.9.1 General

The pump unit shall be installed in a clean, dry, weathertight enclosure with secure access.

The pump enclosure shall be suitably fire rated as required by the NZBC's compliance documents.

The enclosure shall be readily accessible to the fire brigade via doors signposted as required in 2.6.4.

NOTE –

(1) The relevant requirements of the Health and Safety at Work (Hazardous Substances) Regulations 2017 must be complied with, specifically those dealing with tank size and attachments, pipes, protection of fuel lines, oil level gauges, and fuel secondary containment provisions. If the volume of fuel contained within any enclosure is 500 L or greater, the provisions of Health and Safety at Work (Hazardous Substances) Regulations 2017 may exceed the requirements of this standard. In such cases a compliance certificate under those regulations will be required.

(2) It is recommended that the pump unit enclosure be provided with direct external access.

(3) The intent of this clause is not to require the fire rating of a building containing a hydrant pump that is separated from a protected building by a distance of not less than 10 m.

7.9.2 Protection from hazards

The enclosure shall be situated where it is as free as possible from exposure to fire, explosion, flooding, and wind damage.

If situated below ground and subject to potential flooding, the enclosure shall be at least one floor above the lowest floor.

No liquid or gaseous fuels, except those required as a fuel source for fire pump unit prime movers, shall be reticulated or stored in the enclosure. A fire extinguisher appropriate to the hazard shall be provided.

7.9.3 Plant rooms

A pump unit may be located in a screened area of a plant room if:
(a) There is no boiler or other explosion hazard;
(b) There is no uncontrolled dust problem;
(c) There is no likelihood of water from other services discharging over the pump unit;
(d) There is no uncontrolled access by unauthorised persons to the pump unit; and
(e) All other requirements for pump unit enclosures required by this standard are met.

7.10 Equipment supervision

7.10.1 Defect calls

Where equipment is required to be supervised in accordance with 7.3.6.1, 7.5.3, and/or 7.5.7, off-normal signals shall be generated as ‘defect calls‘ through a fire brigade monitoring station.

This shall be achieved by:
(a) A signal generating device installed as part of the hydrant systems; or
(b) In a sprinklered building, a sprinkler system direct brigade alarm; or
(c) In a building not protected with a sprinkler system, a brigade connected fire alarm system.

8 Building construction and demolition

8.1 Hydrant system availability

8.1.1 Construction

8.1.1.1 General

Where building construction includes installation of a permanent hydrant system, the system shall be installed and brought into commission progressively as building work proceeds. The constructed hydrant riser shall be progressively charged with water.

8.1.1.2 Height requirement

A hydrant riser system shall be progressively made functional as close as practicable to the highest floor in construction, but no more than 7 m below the highest floor in construction.

8.2 Precautions during installation

8.2.1 Capping

As each section of the waterway is installed, it shall be immediately capped to prevent entry of foreign material into the pipework.

8.2.2 Pump connection to hydrant system

Once the highest building hydrant outlet above the road surface closest to the hydrant system inlet exceeds 40 m in height, at least one pump, having the performance characteristics specified in 7.2, shall be connected to the hydrant system. The pump unit may be part of a permanent pumping installation, in which case it shall, at the stage that it is required to comply with this clause, conform with all aspects of section 7 as reasonably practicable.

8.2.3 Pressure control

Where pressure control arrangements are required to conform to 6.3, they shall be progressively installed.

8.2.4 Ease of access

The area around building hydrant outlets shall be kept clear and readily identifiable, during both construction and demolition.

8.2.5 Highest functional hydrant tag

In multi-storeyed buildings, the highest building hydrant outlet shall be provided with a temporary tag: 'HIGHEST FUNCTIONAL OUTLET'.

8.3 Temporary inlets

8.3.1 General

During the course of construction, demolition, and building alterations, the BHI shall remain accessible for fire service use. This may require installation of a temporary inlet, for example, at the site security fence. Where the inlets are not readily accessible and are not located in their final approved location, temporary inlet locations shall be approved by FENZ.

8.3.2 Temporary inlet signage

The location of such temporary inlets shall be marked by a 1 m by 1 m sign with the words clearly marked in contrasting colour: 'BUILDING HYDRANT INLET – KEEP CLEAR'.

8.4 Progressive inspections

For buildings greater than eight floors above ground level in height, a progressive inspection shall be carried out when the riser reaches every eighth level to ensure that it is functional.

8.5 NOTE – Appendix A provides specific guidance for the provision of construction hydrants for combined sprinkler and hydrant systems.Demolition

8.5.1 General

In buildings under demolition which are fitted with a building hydrant system, the system shall be maintained in a functional state for as long as possible and should be the last service removed.

8.5.2 Combustible contents

Removal shall not occur before the combustible contents of the building have been removed.

8.5.3 Functional height requirement

In multi-storeyed buildings, the hydrant system shall remain functional on the floor below the highest intact floor.

9 Impairments, extensions, and alterations

9.1 Extensions and alterations

9.1.1 General

Appropriate alterations shall be made to the building hydrant systems in cases where building alterations affecting the location of building hydrant outlets, signage, the setting of pressure control devices, or other matters, result in the hydrant system no longer conforming to this standard.

9.1.2 Hydrants remain operational

During the course of building alterations, building hydrant systems shall remain operational where reasonably practicable.

9.1.3 Consents

Prior to any alterations to the hydrant system, confirmation shall be gained from the BCA whether a building consent is required. This provision is not required for routine maintenance.

9.2 System impairments

9.2.1 General

This section provides minimum guidelines for parties involved in shutdown and impairment of fire hydrant systems. All work and communications must, in addition to the requirements here, meet all requirements of the Health and Safety at Work Act 2015.

Fire hydrant systems may be rendered temporarily inoperative for maintenance and repairs or alterations, or they may be permanently disabled. Before isolating or disabling a hydrant system, hydrant contractors shall follow these procedures, taking the precautions specified in this section as well as others required by the HSC or building owner.

Risk assessmentExcept for the purposes of emergency repairs, a full risk assessment shall be undertaken prior to disabling a hydrant system.

9.2.2 Contributors to the risk assessment

A risk assessment should consider the safety of workers, occupants, other property, and overall building fire and life safety provisions. Amongst others, this risk assessment may need to include input and agreement from:

(a) The fire brigade;
(b) The building owner(s) and occupier(s); and
(c) The building owner's risk consultants/insurers.

9.2.3 Risk mitigation

Mitigating measures are required when systems are to be rendered inoperative and/or parts of the system isolated for extended durations, or overnight, in buildings that contain sleeping accommodation, treatment and care, or similar facilities. Adequate mitigating measures should be implemented before the isolation, and identified risks should be reassessed.

9.2.4 Hydrant systems with common or shared components

Where a hydrant system has any component that affects more than one property, or has a common ownership arrangement, and the property is owned by separate parties, or is subject to maintenance by different contractors, the risk assessment shall consider the interests of all parties who may be affected by, and need to be notified of, the impairment.

NOTE – In instances of common ownership, a statement detailing the common ownership and the names and contact details of the relevant persons should be prominently displayed adjacent to the relevant component.

9.2.5 Notification and authorisation period

Notification shall be delivered at least 24 hours before the start of planned work that will isolate or render a hydrant system inoperative. Hydrant systems shall not be isolated or rendered inoperative overnight in buildings that contain sleeping accommodation without giving at least 24 hours' notice to the building owner, building occupier, fire brigade, and building insurers.

Except in an emergency, the system shall not be rendered inoperative until the owner or their authorised representative has authorised the work by signing the appropriate section of the form set out in Appendix G. If an emergency compels immediate action to render a system inoperative, such notification shall be given as soon as possible afterwards.

9.2.6 Shutdown notice recipients

Notification in writing shall be delivered to the following:
(a) Building owner(s) or their agent or nominated representative;
(b) Building occupiers; and
(c) The fire brigade or their authorised agent (See Appendix L).

These notifications shall also advise building owner(s) that they are to inform their insurers of any isolation that exceeds 12 hours, or any lesser period if the system is within buildings that contain sleeping accommodation, treatment and care facilities, or similar facilities, or if specified by the building owner.

If instructed by the owner, the contractor shall provide a copy of the signed authorisation to another specified party, such as the owner's insurer or risk management consultant, and the fire brigade.

9.2.7 Shutdown notice information

Shutdown notification shall include the following information:
(a) The name and address of the premises;
The type of occupancy, for example, daytime occupancy, commercial, industrial, sleeping accommodation, treatment and care facilities;
The reason for rendering the system inoperative, giving details of extensions or alteration work;
The date and times the system will be off;
Whether blanking pieces or sectional valves will be used to isolate a section of a system; and
Whether the work will involve cutting or welding and, if so, details of the precautions that will be taken.

9.2.8 Notification to the fire brigade and building insurers

Information may be provided to the fire brigade and building insurers in the form shown in Appendix F.

9.2.9 Isolation tags for sections of a hydrant system

A tag card as shown in Appendix G, or similar, shall be used to identify sections of a hydrant system left isolated. This shall be attached by the contractor to the main hydrant system inlet and the sectional valve controlling the isolated area. Where multiple systems or multiple buildings are affected, an isolation tag shall be placed on every system affected by the impairment.

The contractor placing isolation tags shall maintain a written record of them, and these records shall be available for inspection by an HSC.

Part A shall be completed whenever a hydrant system is isolated.

When a section of a hydrant system is isolated, Part B shall be completed by the contractor and the isolation card affixed to the hydrant system inlets and the sectional valve controlling the isolated area.

Tags shall remain attached to the hydrant system inlets and sectional valves controlling isolated areas until the whole system is restored. The party responsible for placing the tags shall also be responsible for ensuring they are removed.

9.2.10 Hot work precautions

Any hot work required on hydrant systems shall be carried out according to the provisions of the Health and Safety at Work Act 2015.

Cutting or welding involving hot work should normally not be carried out on the hydrant system. It shall not be carried out without the contractor first obtaining specific approval from the building owner.

Such approval, if granted, may specify precautions to be taken by the contractor to minimise the risk of ignition while the installation is inoperative.

These precautions will normally include:
(a) Having charged hose reels or suitable types of extinguishers on hand;
Removing or covering combustibles in the immediate vicinity of the work;
Posting a watchman during the actual hot work;
Re-checking the area 30 minutes after completion of the hot work; and
Complying with NZS 4781:1973 A1 where cutting or welding is undertaken.

9.2.11 Methods of temporarily isolating system sections

9.2.11.1 Tagging

Requirements for use of isolation tags when zones or sections of a hydrant system are isolated are provided in 9.2.10.

Where screwed plugs, screwed or grooved end caps, or blank flanges are used for temporary isolation, a coloured tag of sufficient length shall be attached so as to be clearly visible from the occupied area of the building. This tag shall have stencilled on it the words: 'TEMPORARY HYDRANT ISOLATION'.

9.2.11.2 Sectional valves

Where provided, sectional valves should be used if practicable to keep to a minimum the area in which the hydrant system installation is inoperative.

Great care shall be taken to ensure that sectional valves are reopened after completion of work.

9.2.11.3 Blanking pieces or 'frying pans'

Blanking pieces or frying pans inserted between the flanges of a pipe joint may be used to temporarily isolate sections of a hydrant system installation.

The contractor shall maintain a written record of the use of all frying pans, and this record shall be available for inspection by an HSC and the building owner.

Frying pans shall be cut from a single piece of sheet steel or the handle shall be welded. The handle shall:
(a) Project at least 300 mm from the edge of the pan;
Be painted with fluorescent paint;
Be stamped and painted with an identification number; and
Be drilled and, when used in a concealed space, be connected with a coloured tag of sufficient length to be clearly visible from the occupied area of the building.

9.2.11.4 Discs not permitted in union joints

Discs inserted in union joints to effect temporary isolation are not permitted.

9.3 Interruption to water supplies

9.3.1 Caused by work on hydrant system

Where work on hydrant systems requires a town's main supplies to be made inoperative, this work shall be planned and executed in accordance with the by-laws and guidelines of local authorities for the area. Communications, planning, and execution of this work shall ensure minimum disruption to provision of services to neighbouring properties and other users of the water supply, ensure the safety of property and persons in the vicinity, and be executed in compliance with regulations of the Health and Safety at Work Act 2015.

9.3.2 Alternative temporary supply

In the event of all the water supplies to a hydrant system becoming inoperative for a long period, a temporary supply from an alternative water source shall be made and supplied through the fire brigade inlet, where possible.

9.3.3 Main supply becomes inoperative

In the event of a town's main supplies becoming inoperative through drought or other reason, special attention should be given to keeping any other supply in efficient working condition.

Notification of an inoperative town's main water supply shall be made in writing and delivered to the building owner or their agent or representative, the owner's insurer or risk management consultant, and the fire brigade or their authorised agent 24 hours in advance of the work commencing.

If an emergency compels immediate action to render the system inoperative, such notification shall be given as soon as possible thereafter.

10 Inspection, testing, and maintenance

10.1 Acceptance tests and inspections

10.1.1 General

A building hydrant system shall not be deemed to comply with this standard unless a certificate of compliance has been issued by an HSC.

10.1.2 Acceptance tests

The following acceptance tests shall be carried out in accordance with this standard:
(a) A physical inspection of the entire system, including components, fastenings, supports, and braces;
A low pressure air test on the system prior to the hydraulic static test;
A hydraulic static test of at least 1 hour's duration to 150% of the highest design pressure of each section of piping without leakage;
The design flow rate shall be achieved at the hydraulically most distant points, consistent with the as-built hydraulic calculations;

NOTE – The intention of this clause is for each pressure zone to be flow tested to ensure that the hydraulic requirements are met. This may necessitate simultaneously flow testing adjacent zones.

The correct functioning of all stop valves;
A check of the settings of all pressure reducing valves to confirm conformity with the as-built drawings and hydraulic calculations;
Full inspection of pump sets including power supplies and equipment. This shall include a 1-hour continuous run of any diesel driven pumps, with the pump house ventilation provisions in the normal state;

NOTE – All doors to the pump house would normally be closed during the 1-hour run test.

Inspection and check of all required signs;
Inspection and check of the contents of the 'Building hydrant system – Details' manual (see 5.6); and
Defect alarms.

10.1.3 Flow and pressure measurement

Flow and pressure measurement associated with acceptance tests shall be by means of certified test gauges.

10.1.4 Completion statement

Prior to final inspection the contractor shall provide to the HSC, in the form specified by the HSC, a completion statement, including as-built drawings and hydraulic calculations.

10.1.5 Systems to be tested

Acceptance tests shall be undertaken on:
(a) New systems; and
(b) Existing systems required to comply with this standard which, in the opinion of the HSC, have been substantially altered or extended since original installation.

10.2 Routine tests and inspections

10.2.1 General

Routine tests and inspections set out in 10.2.3 shall be undertaken by an independently qualified person (IQP).

All tests and inspections shall be completed at the specified frequency. A record of all tests and results shall be made in a logbook kept within the premises.

Before issuing a compliance certificate in order for a building warrant of fitness to be issued, the IQP shall be satisfied that the system is performing, and will continue to perform, in accordance with the design requirements of the original standard to which the system was installed. All deficiencies shall be notified to the owner and rectified in a timely manner, taking account of the impact that the deficiency will have on the probability that the system's performance will be compromised.

NOTE –

(1) A compliance certificate is commonly referred to as a 'Form 12A' as defined in the Building (Forms) Regulations 2004.

(2) Deficiencies which would lead to a significant probability of system failure should be urgently attended to, to ensure that the system will operate reliably. Examples of such deficiencies include a significant fault in the water supply, such as poor pump performance, or pressure control valves causing excessively high or low pressures at the building hydrant outlet(s). A compliance certificate should not be issued if such deficiencies exist.

(3) Minor deficiencies which are in the process of being rectified should not preclude the issue of a compliance certificate. Such deficiencies could include a minor water supply fault, minor pressure reducing valve adjustment, pressure gauges requiring recalibration, and the like. If such deficiencies appear on subsequent inspection reports, a compliance certificate should not be issued until they are rectified.

(4) An element of judgement may be required in ascertaining if other deficiencies should preclude the issuing of a compliance certificate.

10.2.2 Defect label

If routine tests and inspections disclose conditions which would prevent the correct functioning of the hydrant system, a rectangle of a minimum of 150 mm sides, coloured buff, with the word 'DEFECT' in black on one side and details of the defect and date of inspection on the reverse, shall be displayed in the BHI enclosure for as long as the condition remains.

10.2.3 Test and procedure frequency

The following tests and procedures shall be carried out at the specified intervals (see Appendix G for a suitable checklist):

(a) Monthly:

(i) Each diesel pumping unit shall be checked for correct start, run (not less than 5 seconds), and stop functions

NOTE – It is strongly recommended that all fluid levels be checked before start-up.

(ii) Any tank water supply shall be checked, and the level recorded. If the level is less than required, the building owner or designate shall be notified and the report annotated to that effect;

(b) Quarterly:

(i) Each diesel pumping unit shall be exercised under load for a period of at least 15 minutes and shall be checked for correct start, run, and stop functions; pressure characteristics; battery acid density; age; external cleanliness; belt tightness; filter state; and fuel, oil, and water levels

(ii) Electric motor driven pumps shall be exercised under load for a period of at least 5 minutes and shall be checked for correct start, run, and stop functions and pressure characteristics

(iii) The correct position of valves associated with the pump shall be checked;

(c) Annually:

(i) All parts of the system and components shall be visually inspected for defects and for compliance with this standard. Such inspection shall take into account building changes or other issues external to the system which relate to compliance

(ii) All hydrant outlets and hydrant inlets shall be checked to ensure they are not obstructed or obscured

(iii) All hydrant outlet valves shall be exercised in the full open and closed positions to ensure correct operation

(iv) Hydrant outlet gaskets shall be checked and, if they have deteriorated, replaced

(v) All padlocks shall be checked to ensure they are in operable condition;

NOTE – If padlocks are seized shut, they should be removed and either they should be replaced or the building owner(s) should be notified that they have been removed and require replacement.

(vi) The waterway shall be hydrostatically tested to a pressure not less than the maximum working pressure, that is, N plus the maximum pressure from the pump curve

(vii) On systems with pressure reducing valves controlling zones, a flow test of the system over the range of a single hose stream flow as specified in 3.3 to the design flow through the full length of each main waterway and through each pressure reducing valve controlling a zone. The correct operation of each pressure reducing valve shall be checked

(viii) Every diesel engine forming part of a diesel driven pump unit shall be serviced by the engine manufacturer's agent every year, the oil changed, and a check made of the air filter, the coolant for corrosion, and the fuel for bacterial sludging

(ix) Any pump set flexible couplings that rely on elastomeric elements for transmission of drive shall be inspected for obvious wear and deterioration. If any evidence of wear or deterioration is evident, the coupling's elastomeric element shall be replaced

(x) Water storage tanks are to be inspected and maintained in accordance with the recommendations of the suppliers of the tank;

(d) Biennially:

(i) The diesel driven pump service shall include changing the oil filters, fuel filters, belts, and thermostats. This service shall be followed by a full load run of the pump unit for at least 2 hours

(ii) Each battery of each diesel driven pump set shall be routinely replaced every 4 years, except that one of the batteries shall be initially replaced after 2 years so that, from then on, one battery is replaced every 2 years; and

NOTE – In this context, 'battery' means a set of cells connected to a single charger.

(e) 5-yearly:

(i) Systems without pressure reducing valve controlled zones shall be flow tested over the range of a single hose stream flow as specified in 3.3 to the design flow through the full length of each main waterway

(ii) Any building hydrant pump unit shall be tested for operation, flow, and pressure characteristics compared with performance at the time of initial installation and the manufacturer's data sheets

NOTE – Comparison with original characteristics will not necessarily identify the need for remedial action but could forecast the need for future remedial work.

(iii) Pump set flexible couplings which rely on the integrity of the elastomeric element shall have the element replaced

(iv) The elastomeric elements of all pilot-operated pressure reducing valves shall be replaced. The pilot valves shall be disassembled and cleaned, and any maintenance necessary, through either inspection or manufacturer's recommendations, shall be carried out. The valves shall be flow tested after reassembly to ensure that the desired control function is provided. All check valves shall be inspected and tested and any elastomeric seals and seats replaced

(v) Every water supply tank shall be visually checked for cleanness and, if necessary, emptied and cleaned out.

NOTE – Suitable underwater cleaning regimes may preclude the need to drain the tank for this purpose.

10.3 Maintenance

10.3.1 General

Building hydrant systems shall be maintained at all times in correct working order.

10.3.2 Tampering

During any routine or other inspection, if there is any indication that the BHI assembly has been tampered with, such as unlocked enclosures or physical damage to enclosure doors, a visual inspection of the BHI shall be carried out to ensure that no foreign debris has been lodged inside the pipework system. This may necessitate a partial dismantling of the assembly.

APPENDIX A – COMBINED SPRINKLER AND HYDRANT RISER FOR INCREASED RESILIENCE

(Normative)

A1 Introduction

For low-rise buildings, firefighters have the option of fighting the fire internally, externally, or a combination of both. They have the option of providing water into the building either from the fixed systems (sprinklers and hydrants) or externally via their fire appliances. This potential to utilise external fire attack provides a level of redundant capacity and resilience should the internal systems fail. The provisions of this appendix are intended to provide an installation that meets or exceeds the levels of resilience of separate fire sprinkler or fire hydrant systems.

For high-rise buildings, the firefighters' external resources (for example, provision of water from the fire appliance) are lost and firefighters must commit to internal firefighting operations.

To ensure that it is safe for them to enter a high-rise building, firefighters need to know if the building has a functioning fire sprinkler and fire hydrant riser system. Given this, careful consideration needs to be given to the design of these systems to ensure that they possess suitable resilience and redundancy to allow firefighters to safely carry out their rescue and firefighting operations.

This appendix describes a combined system configuration that is intended to provide a combined fire sprinkler and fire hydrant riser that has a level of resilience higher than separate fire sprinkler and fire hydrant risers.

The combined sprinkler and hydrant riser consists of a class A2 (as defined in NZS 4541) water supply and a ladder riser that has been designed so that the combined functions of the fire sprinklers and the hydrant flow can be still be met in the event of the failure of:

(a) The infill supply;
(b) One tank;
(c) One pump;
(d) One pipe section; or
(e) One pressure reducing station.

Additionally, the combined fire sprinkler and fire hydrant riser has been designed to allow testing by returning the test water back to the water supply tanks through a flow meter to reduce water wastage and for ease of testing and proving of the system.

The use of the combined fire sprinkler and fire hydrant riser shall only be permitted for fully sprinkler protected buildings. Except as modified by this appendix, the fire sprinkler system shall comply with the provisions of NZS 4541.

A2 Scope

A2.1

Combined fire sprinkler and fire hydrant riser systems may be installed in:

(a) Buildings of greater than six levels; and
(b) Buildings with a fire sprinkler system categorisation including extra light hazard, ordinary hazard groups 1, 2, and 3, ordinary hazard group 3, special and discrete storage areas of no greater than ordinary hazard group 4, as defined in NZS 4541.

A2.2

This appendix is not envisaged to allow combined fire sprinkler and fire hydrant systems to be installed in large low-rise buildings or buildings containing occupancies defined as extra high hazard by NZS 4541.

A3 Definitions

A3.1

Listed is as defined in NZS 4541.

A3.2

Supervised is as defined by NZS 4541.

A3.3

Sprinkler system certifier (SSC) is as defined in NZS 4541.

A4 Certification

As both NZS 4541 and NZS 4510 require that systems are certified, the SSC and HSC shall be the same person.

A5 Water supply

A5.1

The combined fire sprinkler and fire hydrant riser shall have a class A2 water supply, as defined in NZS 4541.

A5.2

Unless additional storage volume is required by Z5.3, the water storage shall be divided between two tanks, each storing 50% of the required water to meet the sprinkler system duty for the period required by NZS 4541 6.4.3.2, plus 22.5m^3 in each tank for the hydrants.

A5.3

Each tank shall be provided with an in-fill connection from an inexhaustible water source, such as a town main. The in-fill rate shall be sufficient to meet the highest sprinkler duty flow of the system and be achievable by flowing into either tank individually to allow for the possibility that one tank is out of service. If an inexhaustible water supply is not available to meet the highest sprinkler duty flow, the volume of each tank specified in Z5.2 shall be increased to 75% of the sprinkler duty flow plus 22.5m^3 in each tank for the hydrants.

A6 Riser general arrangement

A6.1

Figure A1 shows a typical schematic for a combined fire sprinkler and fire hydrant riser system complying with the requirements of this standard.

A6.2

Figure A2 shows a suitable arrangement should a third riser stack be required.

A6.3

The water supply shall be independently piped from the discharge of each pump to the riser isolation valves at the top of the building (see Figures A1 and A2).

A6.4

If the building has two independent vertical safe paths, the water supply risers and hydrant outlet risers shall be run with one water supply riser and one hydrant outlet riser in each safe path.

A6.5

If the building has a scissor stair arrangement, both water supply risers can be run in the scissor stair and one hydrant outlet riser shall be run on each side of the scissor stair.

A6.6

Where there is only one vertical safe path stair, one water supply riser and one hydrant outlet riser shall be run in the vertical safe path stair and the other water supply riser plus a dummy hydrant outlet riser shall be run in in a separate services riser.

NOTE – To achieve the required resilience, the combined fire sprinkler and fire hydrant riser system will need a minimum of two riser stacks.

A6.7

Where more than two riser stacks are required to meet the required hydrant coverage, these additional riser stacks shall be tied in to form an additional loop at each pressure zone.

A6.8

A cross over link shall be provided between the risers at each pressure zone. This link shall be fitted with two supervised, locked isolation valves, to allow one valve to be removed for repairs, while maintaining protection to the building.

A7 Pressure control zones

The hydrant system shall be divided into pressure zones each of not more than 25 m height and configured into a ring main at each zone as shown in Figure A1 or Figure A2.

NOTE – The intention of this configuration is that if one pressure reducing valve fails in the closed position, the other pressure reducing valve admitting water to the zone shall allow the system duties for the zone, and those below, to be met. Then, in the event of one pressure reducing valve failing in the open position, the pressures developed within the zone will be within the safe working pressure limitations of the fire brigade's equipment.

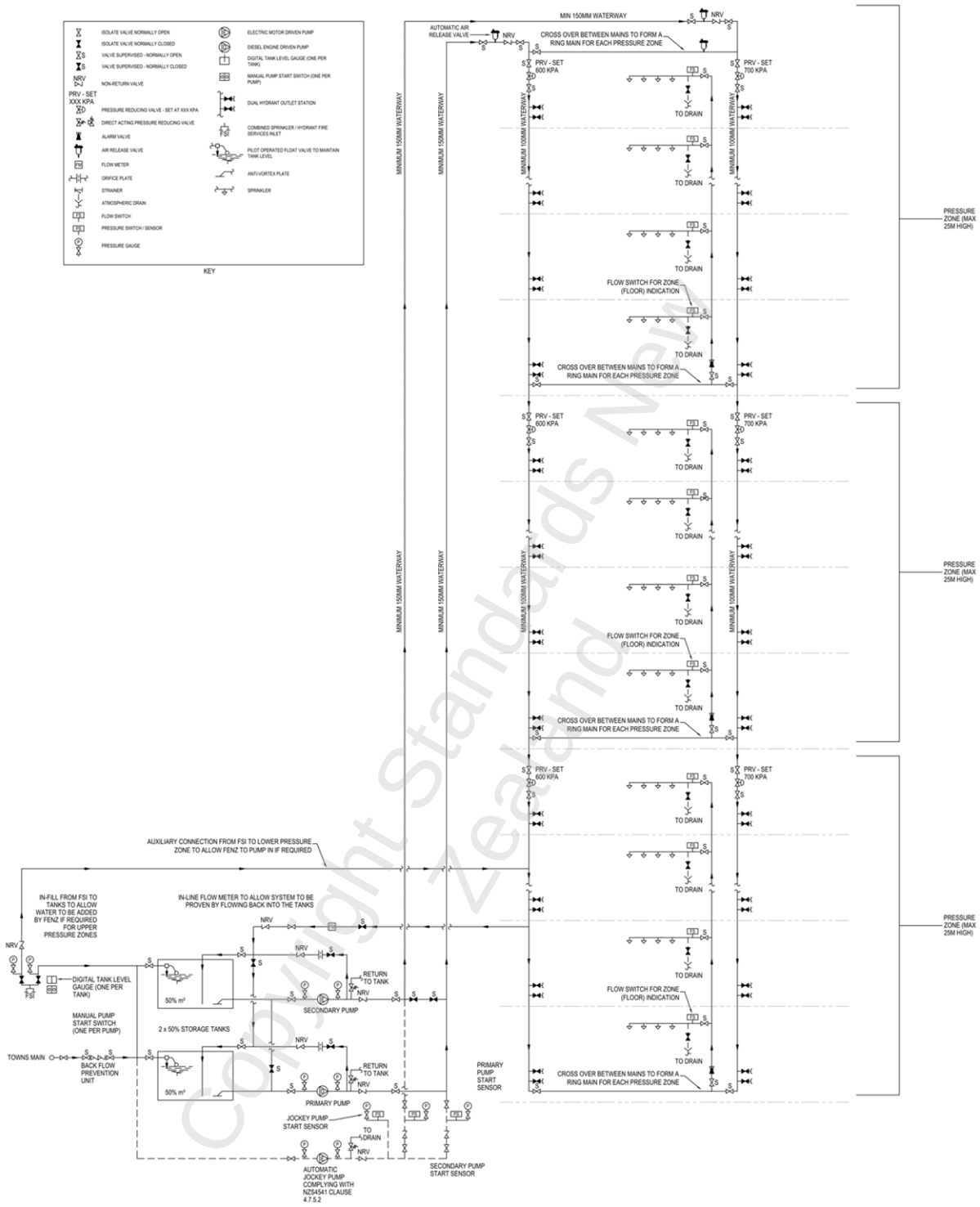


Figure A1 – Combined fire sprinkler and fire hydrant riser for increased resilience – Two riser layout

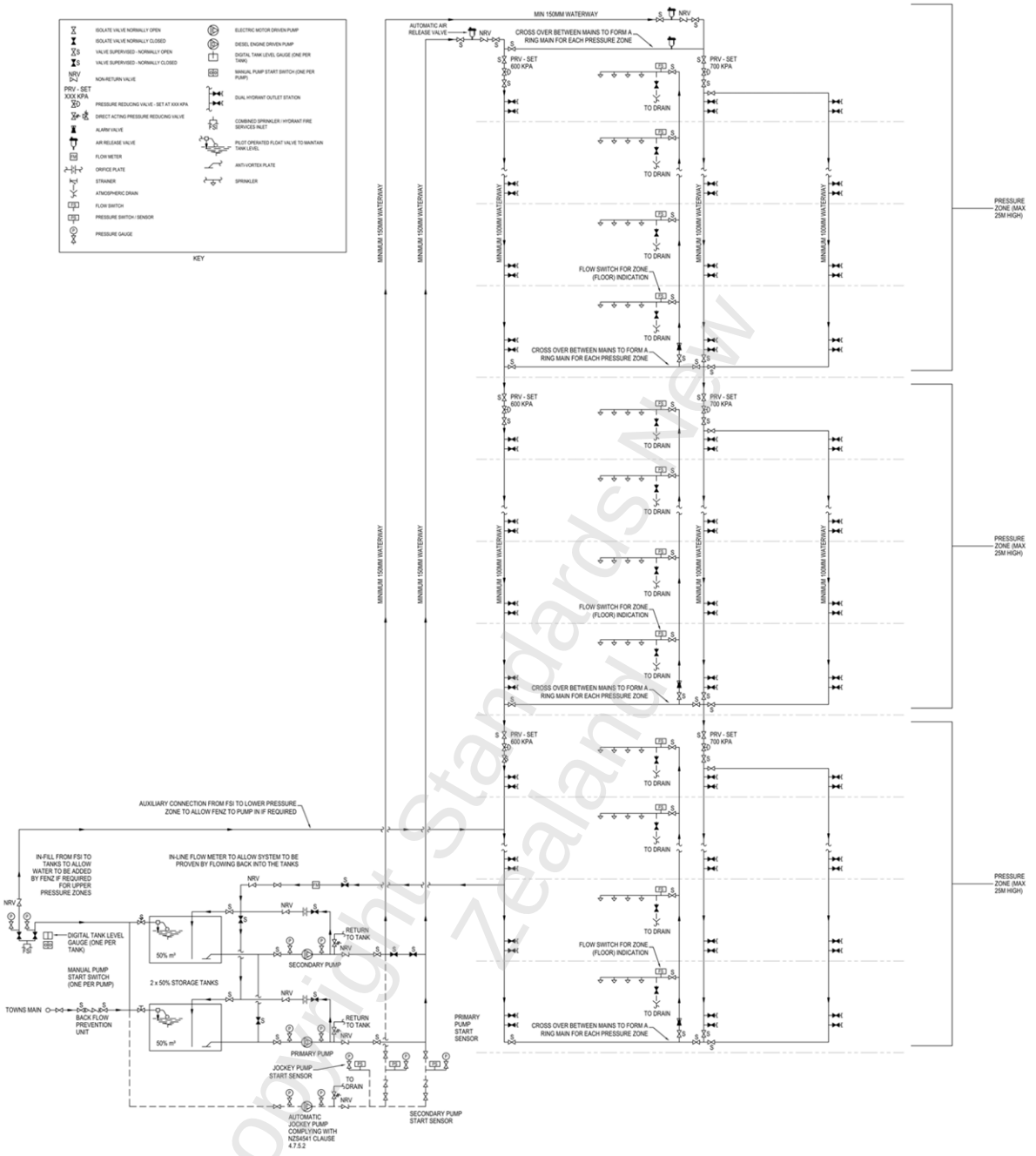


Figure A2 – Combined fire sprinkler and fire hydrant riser for increased resilience – Three riser layout

A8 Riser control valves

A8.1

The control valves shall be arranged as shown in Figure A1 or Figure A2. The control valves shall include:

(a) A listed automatic air relief valve at the top of each riser stack and the top cross over link;
(b) A NRV at the top of each riser stack;
(c) Listed pressure control valves at the entry of each pressure zone;
    (i) The pressure control valves on one riser stack shall be factory set at 600 kPa
    (ii) The pressure control valves on the alternate riser stack shall be factory set at 700kPa

NOTE – The 100 kPa pressure differential between the two riser stacks is intended to prevent hunting between the two pressure control valves.

(iii) A listed 25 mm pressure relief valve set at 900 kPa and piped to waste via a tundish or sight glass shall be provided downstream of each pressure control valve
(iv) Pressure gauges meeting the requirements of NZS 4541 shall be provided upstream and downstream of each pressure control valve; and

(d) A listed supervised isolation valve shall be installed on both sides of the non-return and pressure control valves required by (b) and (c).

A8.2

Figure A3 shows a typical set up for a pressure control valve arrangement.

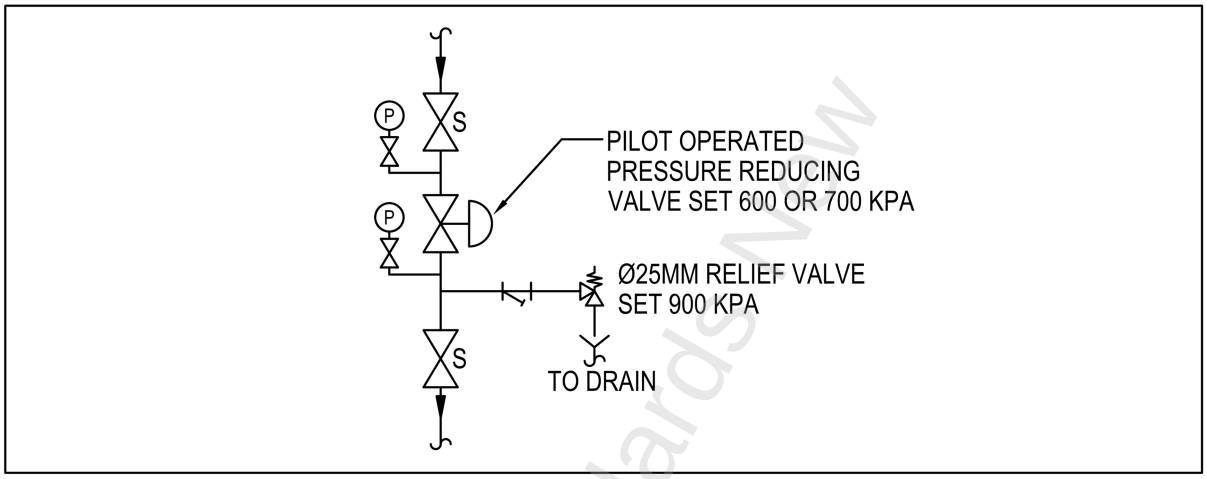


Figure A3 – Typical pressure reducing station

A9 Sprinkler zone control valves

A9.1

Each sprinkler zone shall consist of a 'shotgun riser' assembly, consisting of:

(a) A listed supervised locked isolation valve;
(b) A listed alarm valve;
(c) A drain valve piped to waste of:
  (i) Ø32mm nominal bore for alarm valves less than Ø100mm nominal bore
  (ii) Ø50mm nominal bore for alarm valves Ø100mm nominal bore or larger;
(d) A rise-in-pressure switch/sensor with a maximum 60 second electronic time delay:
  (i) The pipe downstream of the rise-in-pressure switch shall drain through a maximum Ø3.2mm orifice to a tundish or sight glass to allow the pressure switch to reset when the alarm valve re-seats
  (ii) A test valve shall be provided to allow for the pressure switch to be tested;
(e) A drop-in-pressure switch/sensor installed downstream of a maximum Ø2mm drilled check valve; and
(f) A test drain installed and piped to a tundish or sight glass to allow for testing of the pressure switch.

A9.2

A typical arrangement is shown in Figure A4.

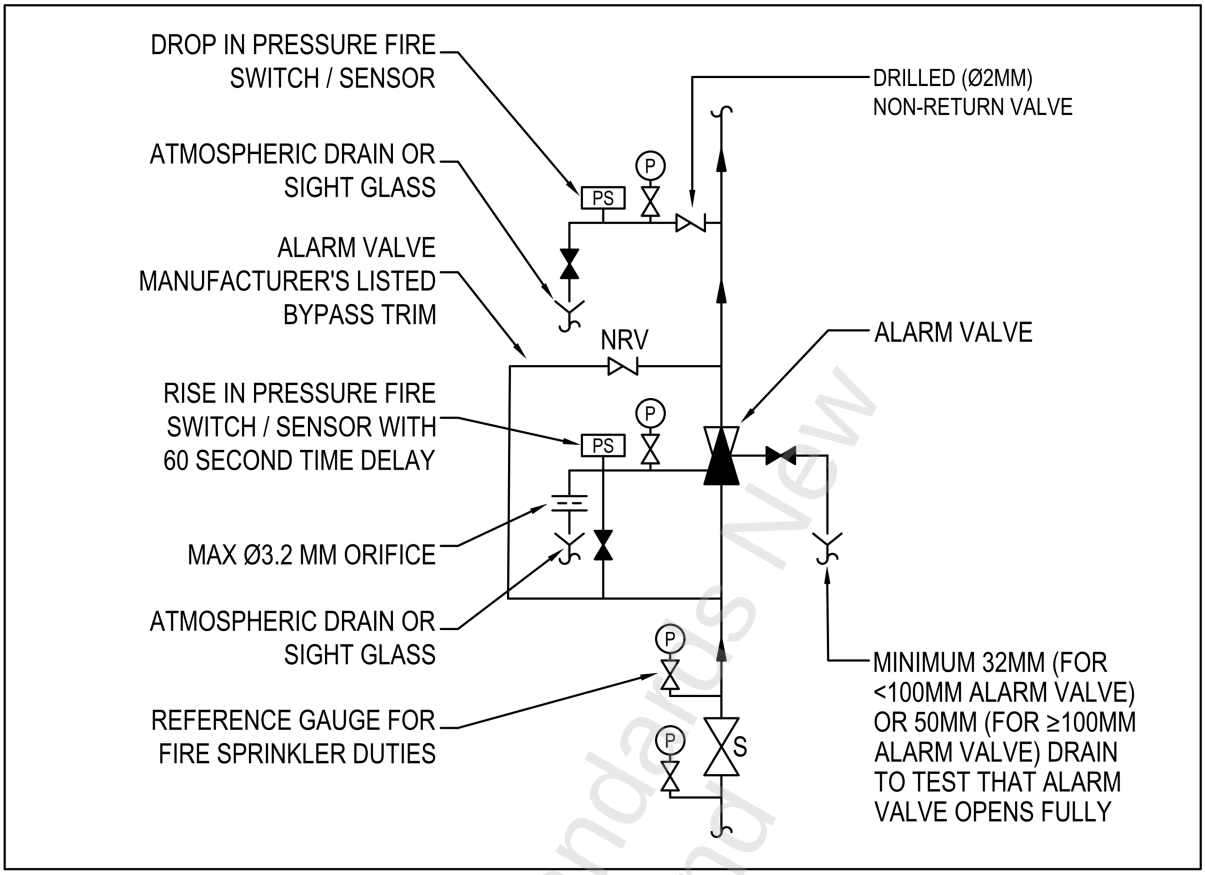


Figure A4 – Typical zone contol valve station

A9.3

The sprinkler zone control valves shall be located in either:
(a) A vertical safe path; or
(b) A services duct or cupboard in close proximity and visible to the entry to a vertical safe path.

A9.4

If the valves are located in a safe path, where it is practical to do so, one entry used by firefighters or service personnel to access the stair shall provide access to all sprinkler zone control valves.

A9.5

The door or access panel to a services duct or cupboard shall be labelled ‘SPRINKLER ZONE CONTROL VALVE’ in reflective lettering at least 25 mm high.

A9.6

The isolation, drain, and test valve handles shall be located between 1150 mm and 1800 mm above floor level.

A10 Hydraulic duties and calculations

A10.1

The duties for the sprinkler system shall be determined in accordance with the requirements of NZS 4541 sections 7 and 8 as appropriate to the hazard, and calculated using the methodology given in NZS 4541 section 10.

A10.2

Additionally, the sprinkler system shall be designed to allow a simultaneous hydrant flow of 1500 L/min from the most hydraulically disadvantaged hydrants on the floor for which the sprinklers have been calculated.

NOTE –

(1) The design basis for unusual situations, such as atria and internal drenchers, should be agreed by the HSC.

(2) In order for pressure reducing valves to regulate correctly, they must have a differential across the valve (that is, the inlet pressure must exceed the outlet pressure sufficiently to allow for operation of the valve). This needs to be considered in the hydraulic design.

A10.3

The hydraulic design shall demonstrate that the simultaneous sprinkler and hydrant duties can be met with each of the following scenarios:

(a) One pump impaired;
(b) One pipe section impaired (that is, closed off with adjacent isolate valves to deal with a leak);
(c) One pressure reducing station impaired and failed in the closed position; and
(d) One pressure reducing station impaired and failed in the open position.

NOTE –

(1) Failure analysis should only consider one component or pipe failure for each scenario.

(2) When calculating the scenario of a pressure reducing valve failed in the open position, it should be considered that the adjacent pressure reducing valves supplying water to the zone will be closed due to the downstream pressure being higher than their set pressure.

A10.4

The design duties shall be carried out to a reference datum point located immediately below the alarm valve for each sprinkler zone control valve, immediately below the highest hydrant outlet, and at the discharge of each pump. A calibrated reference gauge shall be provided at this location.

A10.5

The design duties shall be tabulated in a water resistant format and located in the fire pump room.

A11 Fire sprinkler control panel – signalling/supervision/operation

A11.1

The combined hydrant and sprinkler system shall be monitored and supervised by a fire sprinkler control panel complying with NZS 4541:2020 4.7.2.2.3.

A11.2

Each valve, pressure switch, flow switch, pump, and device monitored by the fire sprinkler control panel shall have its own independent address at the panel. The address shall have a descriptor displayed on the panel LCD display indicating what the devices is (for example, a hydrant valve) and the location (for example, L30 stairwell).

A11.3

All off-normal, defect, and fire events triggered by equipment supervised by the fire sprinkler control panel shall be indicated on the panel.

A11.4

The sprinkler rise and drop-in-pressure switches shall be configured to generate a fire call on operation.

A11.5

Unauthorised closure of the isolation valves shown in Figures A1, A2, A3, and A4 as ‘supervised normally open’ shall generate a ‘fire’ signal to the fire brigade’s alarm monitoring station.

A11.6

Unauthorised opening of the isolation valves shown in Figures A1, A2, A3, and A4 as ‘supervised normally closed’ shall generate a ‘defect’ signal to the fire brigade’s alarm monitoring station.

A11.7

A ‘defect’ signal shall be generated on the running of any fire pump or from any pump fault condition reported by the fire pump controller.

A11.8

A light-emitting diode (LED) display shall be located adjacent to each sprinkler zone control valve station with a labelled LED to give local indication of rise-in-pressure switch operation, rise-in-pressure switch

time delay completed, drop-in-pressure switch operation and off-normal operation of the isolate valves associated with the sprinkler zone control station. The LEDs shall be fitted with engraved labels indicating their function.

NOTE – The purpose of the LEDs is to assist with routine testing of the sprinkler zone control valve station.

A11.9

Where flow switch operation is used for control of evacuation sequencing, or other building services, the fire sprinkler control panel shall be configured to require double knock operation of both the flow switch can and either the sprinkler zone control rise-in-pressure switch or the drop-in-pressure switch.

A11.10

The fire sprinkler control panel shall be provided with a key-operated switch labelled 'ISOLATION VALVE OVER-RIDE'. Operation of this switch shall:

(a) Place the fire sprinkler control panel into a 'defect' state;
(b) Allow the isolation valves to be closed without generating a fire signal;
(c) Allow the control panel to generate a fire signal should a sprinkler control zone pressure switch operate;
(d) Be operable by a Bulgin 6083/C patterned key.

A11.11

The requirement for a hydraulic water motor alarm ('gong') given in NZS 4541 shall be deleted. Instead, a red electric bell shall be located at the main fire brigade attendance point to sound on sprinkler operation. This bell shall be labelled 'SPRINKLER OPERATING' in white lettering at least 50 mm high on a red background.

A12 Pump starting

A12.1

Both pumps shall be simultaneously started by an electronic signal from the dedicated fire sprinkler control panel required by A11.1.

A12.2

As a back-up to the sprinkler system, the pumps shall also be fitted with a pressure switch to start on drop in pressure of the riser downstream of the pumps.

A12.3

Manual pump start switches for each pump shall also be provided at the sprinkler and hydrant system inlet as required by 7.6.2.

A13 Pressure maintenance (jockey) pump

An automatic pressure maintenance pump (complying with NZS 4541 4.7.5.2) shall be installed and configured to maintain the pressure at the top of the riser of not less than 850 kPa.

A14 In-line flow meter

A14.1

An inline flow meter shall be provided to allow the pumps and pressure control valves to be tested by discharging back into the water supply tanks.

A14.2

The flow meter shall be a proprietary device installed in accordance with the manufacturer's recommendations.

A14.3

Flow meter gauges shall be selected so that the highest flow rate is in the centre third of the scale.

A14.4

The gauge shall be correct within 2% over the centre third of its scale and within 3% over the remaining two thirds.

NOTE –

(1) Flow meters approved by FM Global meet this requirement.

(2) Gauges should be calibrated prior to the annual pump and pressure control valve flow tests being carried out.

A15 Tank level gauges

A15.1

A tank sight glass or level gauge complying with the requirements of NZS 4541 shall be located at each water tank.

A15.2

A remote digital tank level gauge shall be located adjacent to the fire service inlet at the main fire brigade attendance point for each water tank.

NOTE – The intention of the remote gauge is to allow the firefighters to monitor the tank level and determine whether they need to provide additional top-up water via the fire appliance.

A16 Signage and labelling

The combined sprinkler and hydrant fire brigade inlet shall be labelled ‘COMBINED SPRINKLER AND HYDRANT INLET – KEEP CLEAR’ in contrasting lettering at least 50 mm high.

A17 Very tall buildings

A17.1

Where the height of the building is such that it is not practicable to pump water from the base, it shall be permitted to install a second set of water tanks and pumps higher up the building and install a second combined sprinkler hydrant riser to supply the higher levels.

A17.2

The additional tanks shall be sized as in-fill tanks with the in-fill water being supplied by the combined sprinkler hydrant riser serving the levels below. Each high-level tank shall be served by only one of the water supply pumps/tanks below to maintain independence and redundancy.

A17.3

The riser system above the new tanks shall follow the design approach documented in this standard for a combined fire sprinkler and fire hydrant riser system. The design shall be agreed with the SSC and HSC.

A18 Routine testing, maintenance, and inspections

A18.1

The combined sprinkler and hydrant system shall be routinely tested, maintained, and inspected in accordance with the provisions of NZS 4541:2020 Part 11. In addition to these provisions, additional provisions required for compliance to this standard require that the following tests be carried out annually:

(a) All hydrant outlet valves shall be exercised to full open and closed positions to ensure correct operation;
(b) Each pressure control valve shall be flow tested through the riser back to the tank to ensure it is correctly modulating the pressure;
(c) Each fire sprinkler alarm valve shall be subjected to a full flow drain test to ensure it is operating correctly;
(d) Each fire pump shall be independently flow tested back to its tank through the in-line gauge;
(e) Pressures shall be checked immediately upstream of each sprinkler zone control valve and at the pump discharge; and
(f) Each section of the hydrant system shall be individually flow tested at its full duty flow to verify correct operation and performance.

A18.2

In addition to the documentation required by other parts of this standard and NZS 4541, the following documentation shall be provided:

(a) A gauge schedule, in a water-resistant format, shall be provided within the fire pump room. This document shall provide a schedule of design duties which, considering the requirements of Z8, should be checked on an annual/biennial basis; and
(b) A system schematic, in a water-resistant format, shall be provided within the fire pump room.

NOTE – It is envisaged that the two documents required to be provided within the fire pump room will be laminated or protected in a similar manner. The documents should be mounted in a frame and mechanically (with screws, cavity anchors, bolts, masonry anchors, or similar) affixed to the pump house walls.

A18.3

A detailed compliance schedule shall be prepared, with a copy submitted to the SSC and HSC. This compliance schedule shall clearly outline the inspection and test programme required to meet the provisions of A16.

NOTE – It is envisaged that the compliance schedule will list a combined sprinkler and hydrant system under 'Automatic systems for fire suppression (for example, sprinkler systems)'. The system would not also be expected to fall under 'Riser mains for use by fire services'.

A18.4

Valve overhauls shall be carried out at 5-yearly frequency for all key valves.

A19 Construction riser

During construction it will be necessary to make a temporary connection from one of the high-pressure risers to the bottom level of a riser pressure zone. The temporary connection shall be fitted with a pressure reducing valve set at 900 kPa, to ensure that a minimum hose pressure of 600 kPa is available at the top of the construction zone.

As the building progresses up, the temporary connection will need to be relocated up the building at each 30 m pressure zone increment.

Figure A5 shows a typical schematic that will meet the requirements of this standard for a construction riser.

APPENDIX B – SYSTEMS INSTALLED TO SUPERSEDED STANDARDS

(Informative)

B1

For extensions to existing systems where building hydrant outlet couplings are single-lugged, the permissible pressure range shall be 600 kPa to 1050 kPa.

B2

Existing riser systems have been installed to superseded standards, which may include the following:

(a) NZS 4510:2008;
(b) NZS 4510:1998;
(c) NZS 4510:1978;
(d) The 1990 Interim Code of Practice for Charged Riser Compliance issued by the Commander Region 1, New Zealand Fire Service; and
(e) Other specifications or standards.

B3

It is recommended that existing riser systems, other than those complying with NZS 4510:1998, be upgraded to meet the relevant criteria of this standard specified in either (a) or (b) below as appropriate:

(a) Hydrant systems designated as ‘dry risers’ which:
  (i) Are charged with water and comply with 3.5
  (ii) Are provided with booster pumps as required by 3.4, and conform to section 7
  (iii) Have pressure control devices, where required, installed to conform with section 6 to ensure pressures at building hydrant outlets are within the limits specified in 6.3
  (iv) Incorporate in the riser inlet assembly a pressure gauge to conform to 5.4.2 and 6.3.2
  (v) In areas having a seismic factor greater than 0.13, as defined in NZS 1170 Part 5, either conform to 2.4 or, in the opinion of a design engineer, are capable of remaining functional at the earthquake loadings specified in NZS 1170 Part 5
  (vi) Have the BHI enclosure labelled in conformance with 2.6
  (vii) Have fire service reference documents provided in conformance with 5.6; or

(b) Hydrant systems designated as ‘wet risers’ which:
  (i) Are provided with one or more booster pumps capable of developing the pressure required at each building hydrant outlet as specified in section 3 when flowing either:
    (A) The number of simultaneous hose streams required in 3.2.6 at the design flow rate specified in 3.3; or
    (B) At a flow calculated as 1200 L/min multiplied by the largest number of building hydrant outlets on any one floor, whichever is the lesser flow
  (ii) Have pressure control devices, where required, installed to conform to section 6 to ensure pressures at building hydrant outlets are within the limits specified in 6.2
  (iii) Have each booster pump unit found on inspection, and to the satisfaction of the HSC, to be in good working order
  (iv) Incorporate in the riser inlet assembly a pressure gauge to conform to 5.4.2 and 6.3.2
  (v) In areas having a seismic factor greater than 0.13, as defined in NZS 1170 Part 5, either conform to 2.4 or, in the opinion of a design engineer, be capable of remaining functional at the earthquake loadings specified in NZS 1170 Part 5
  (vi) Have the BHI enclosure labelled in accordance with 2.6
  (vii) Have fire service reference documents provided in accordance with 5.6.

B4

In the event that an existing system requires substantial extension or alteration as a consequence of building alterations, the TA may require the system to be suitably altered for new systems to comply with the requirements of this standard. In such cases, it shall be a permitted exception, subject to the agreement of the TA, to reuse components of the original system which remain in good order.

B5

It is recommended that systems installed to any previous standards be tested against this standard as reasonably practicable. Where this is not practicable, the testing requirements of the standard to which the system was installed should be referenced.

B6

It is recommended that any existing building hydrant outlets with single-lugged connections be replaced with double-lugged connections. In such cases the use of double building hydrant outlets controlled by ball valves is encouraged.

B7

In systems without pumps and pressure control facilities, provisions may be provided to allow a visual (camera) inspection of all sections of the hydrant systems that cannot be safely flow tested to demonstrate that the pipe is unobstructed.

APPENDIX C – RECOMMENDATIONS FOR FROST PROTECTION MEASURES FOR FIRE HYDRANT SYSTEMS IN COLD CLIMATE REGIONS

(Informative)

C1 General

The need to protect a fire hydrant system from the effects of freezing is easily understood. Freezing of water within hydrant waterways could result in two effects:

(a) Damage to the pipework and fittings of ancillary equipment, causing subsequent water leakage and property damage; and
(b) Systems rendered inoperative due to ice blockage and hence not able to deliver water to the fire brigade for firefighting purposes.

Predicting when a fire hydrant system, or part of a system, will freeze is not always obvious, and careful consideration of the relevant environmental and other consequential factors is required. For a building located in an area subject to freezing ambient temperatures, for example, it does not necessarily follow that the fire hydrant system installed within that building will also be subject to those temperatures.

Examples of areas prone to freezing include:

(a) Cold climate areas;
(b) Unheated or inadequately heated buildings and structures;
(c) Parts of heated buildings exposed to frost, such as ceiling voids, areas near open doors at loading bays, or external hydrant outlets;
(d) External pipelines;
(e) The fire brigade inlet and pump house enclosure; or
(f) Areas normally heated but temporarily unheated during out-of-hours, weekends, or winter holidays.

NOTE – Hydrant systems, including the outlets, inside the thermal envelope of a heated building will normally be adequately protected against low ambient temperatures where they are maintained above 4°C at all times. Where this is not the case, such as out-of-hours, weekends, or winter holidays, an assessment will need to be carried out to ascertain what freeze protection options may be required. Current building practice tends to ignore heating to buildings during periods of non-occupancy that will allow heating to maintain a background temperature of 4°C during out-of-hour periods.

In certain types of buildings, current practices lean toward the building insulation membrane being placed directly above the ceiling as opposed to under the roof cladding. This leaves the ceiling space outside of the heated area of the building and potentially subjects services to low ambient temperatures. In buildings that will be provided with an internal fire hydrant system, the requirement for the system to be located within the thermal envelope will need to be stressed to building designers to ensure the operation of the fire hydrant system.

Where the hydrant system is generally inside a heated building but some parts of it are exposed to low ambient temperatures, such as unheated roof spaces, or an unheated annex or loading dock, these parts of the system should be trace heated and lagged. Careful consideration should be given to the bulkiness of pipe lagging, as it is essential that hydrant inlets and outlets, their operating valves, and any other ancillary devices are not obstructed by lagging or trace heating cables.

C2 Frost protection methods

For more information on frost protection, see the following;

(a) Appendix D for trace heating and lagging;
(b) Appendix E for supervised dry system installation.

NOTE –

(1) Informative guidance on the installation of trace heating systems can be found in FM Global Datasheet 9-18 *Prevention of Freeze-Ups* Appendix C.

(2) Because the foregoing is not an authoritative guideline, more or less onerous measures may be applicable to reflect both local climatic conditions and topography (such as low-lying areas and micro-climates). Therefore, the hydrant designer and/or installation contractor is responsible for ensuring that the installation is not susceptible to freezing.

APPENDIX D – TRACE HEATING

(Normative)

D1 Trace heating and/or lagging

Trace heating and/or lagging is permissible where:
(a) It is constrained to two landings and 25 m of pipe; or
(b) It is used for above-ground pipework between buildings.

D2 Electrical requirements

D2.1

Listed trace heating systems shall be permitted in accordance with this appendix.

D2.2

Trace heating systems shall be designed to maintain a temperature between 4°C and 49°C.

D2.3

The calibration and the setting of the thermostat shall be checked at the time of installation.

D2.4

The trace heating system shall operate automatically.

D2.5

Trace heating shall utilise self-regulating heating cable.

D2.6

The trace heating system shall be supervised by either the fire alarm panel or the sprinkler fire brigade alarm to generate defect signals in any of the following off-normal conditions:
(a) Short circuit or shock faults; and
(b) Loss of power.

D2.7

The electrical supply for the trace heating systems shall be from a reliable source via a separately fused, switched, and labelled circuit with a tell-tale indicator light from the main switchboard to ensure that supplies are not inadvertently switched off during holiday shutdowns or maintenance periods. There shall be a label at the switch stating 'FIRE PROTECTION TRACE HEATING SYSTEM – DO NOT SWITCH OFF'.

D2.8

In addition to the installation of the trace heating cable, the pipe shall be overwrapped with suitable insulation in accordance with the trace heating manufacturer's listed system.

D2.9

Ongoing maintenance at a minimum shall include:
(a) Monthly – power check;
(b) Quarterly – power defect check; and
(c) Annually – inspection of pipework, mega test, end-of-line LED operation, and thermostat setting.

NOTE – Informative guidance on the installation of trace heating systems can be found in FM Global Datasheet 9-18 *Prevention of Freeze-Ups* Appendix C.

APPENDIX E – SUPERVISED DRY HYDRANT SYSTEM

(Normative)

E1 Supervised dry pipe system

Where installed, the following requirements shall apply:

(a) Fire brigade inlet connection(s) shall comply with section 5.
(b) Each fire brigade hydrant inlet shall serve any dry and wet riser hydrant outlet;
(c) Check valves shall be provided immediately upstream of the inlets on each dry and wet hydrant pipework branch;
(d) Building hydrant outlet connection(s) shall comply with 3.1, 3.2, 3.3, and 3.4;
(e) The pipework system shall be graded back to a drainage points that ensure all water can be drained after pipework flooding;
(f) An automatic normally open air relief valve shall be installed in combination directly upstream with a listed direct acting, spring loaded, diaphragm type relief valve at every high point in the auxiliary portion of the system reticulation;
(g) The air pressure maintenance system shall be supervised with fault and activation monitoring;
(h) Minimum system air pressure shall be 70 kPa;
(i) Maximum directing acting pressure relief valve pressure shall be 300 kPa;
(j) Pipework volume shall be limited to 1900 L;
(k) There shall be drainage points at every low point in the system reticulation;
(l) Site procedures shall be provided for draining of the system after flooding of the pipework to ensure all water is removed from the installation and the system is recommissioned; and
(m) Flooding of the installation shall generate a maintenance agent service call.

E2 Installation

E2.1

Dry pipe hydrant systems shall comply with the requirements of NZS 4541 for dry pipe installation including pipe jointing methods.

E2.2

Roll groove joints shall be of the flush seal type.

E2.3

Hemp shall not be used to seal threaded joints.

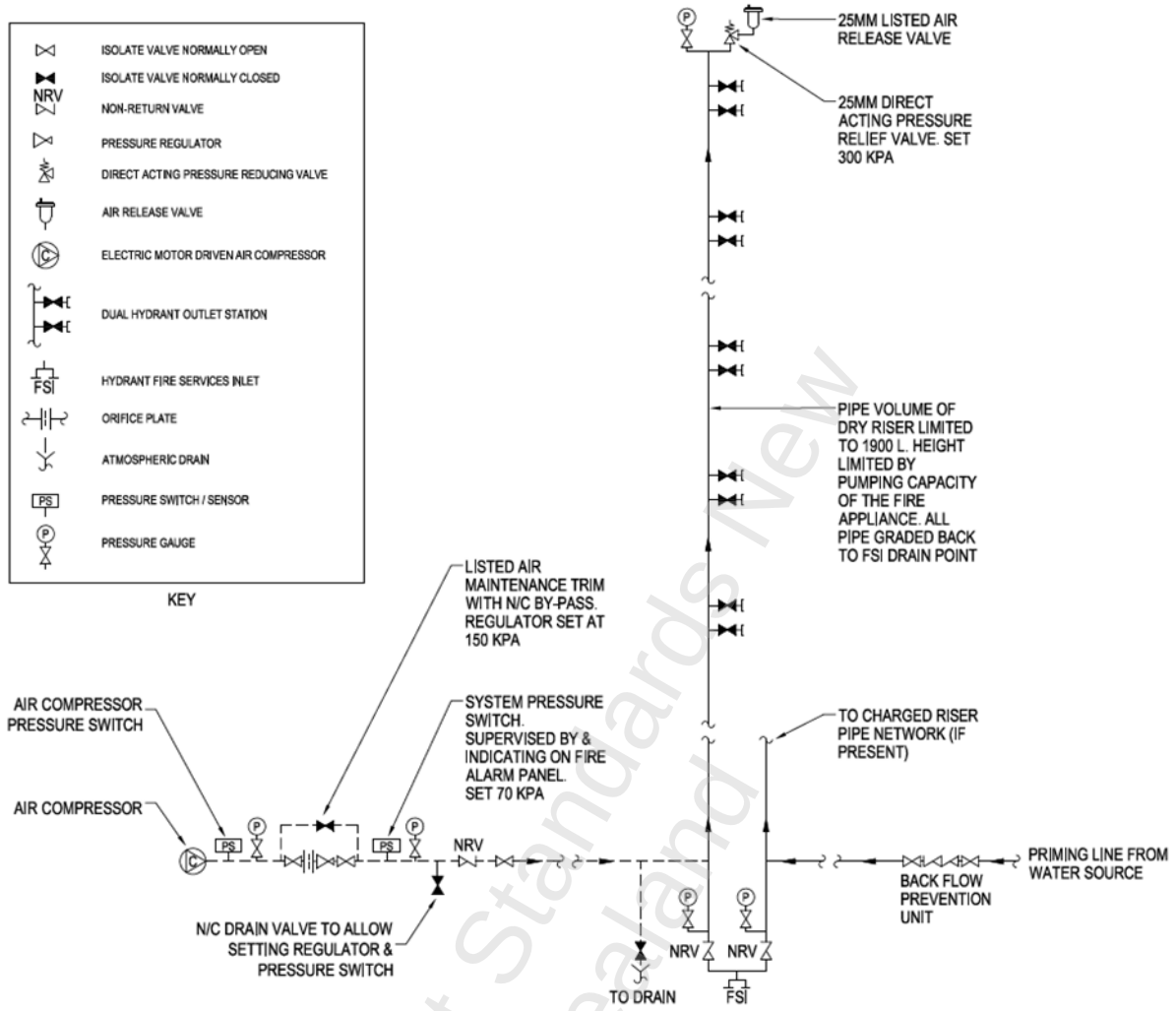


Figure E1 – Supervised dry pipe hydrant system

E2.4 Additional commissioning provisions for supervised dry pipe hydrant systems

Supervised dry pipe systems shall require a pneumatic air test in compliance with NZS 4541 Appendix A.

A maximum pressure drop of 10 kPa over a 24-hour period after being adjusted for temperature fluctuations is permitted.

E2.5 Additional maintenance provisions for supervised dry pipe hydrant systems

The minimum requirements for maintenance shall include the following additional items:

(a) Quarterly:

  (i) Any alarm functions, such as low air pressures and the like, should function and indicate correctly

  (ii) An inspection should be carried out of any ancillary plant, such as air dryers, compressors, and the like, to ensure they are functioning correctly; and

(b) Annually – a hydrostatic test of the riser.

APPENDIX F – SIGNS

(Informative)

F1 Introduction

This appendix sets out the signage requirements that should be followed in applying this standard.

F2 Lettering type and proportioning of signs

Lettering type and proportioning of signs should be as follows:
(a) Vertical block type lettering using full strokes;
(b) Letter proportions as set out in Table F1 and Figure F1; and
(c) Thickness of the letter (d) may vary between 15% and 30% of the height of the letter (h).

NOTE –

(1) Acceptable typesets are Helvetica and Univers.

(2) Helvetica bold d=0.3h and Helvetica condensed d=0.15h.

Table F1 – Proportion of lettering

Dimensions	Ratio	Examples of dimensions (mm)							
h	(10/10) h	10	20	25	40	50	75	100	125
c	(7/10) h	7	14	17.5	29	35	52.5	70	87.5
a	(2/10) h	2	4	5	9	10	15	20	25
b	(14/10) h	14	28	35	56	70	105	140	175
e	(6/10) h	6	12	15	24	30	45	60	75

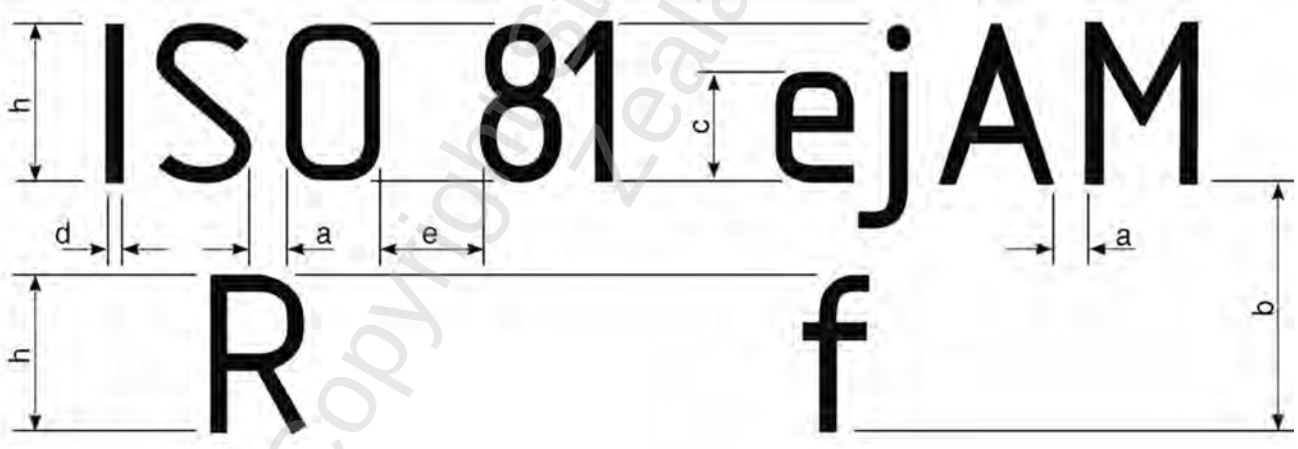


Figure F1 – Proportion of lettering

F3 Safety colours

The colours for safety signs should comply with Table F2.

Table F2 – Safety colours

Safety colour	Specification	
	Reference standard	Colour number
Safety Red	BS 5252	04E53
Safety Yellow	BS 5252	08E51
Safety Green	BS 5252	14E53

F4 Stairs used by fire service personnel

Stairs used by fire service personnel should be provided with signs to identify the floor level. They should be clearly visible from each floor level landing.

Where building hydrants are located in spaces containing a stairwell, stair doors which give access to those hydrants should be identified. This requirement only applies to those doors located on floors to which fire service personnel have direct access from the street and where one or more stairs leads away from these floors. An acceptable sign is shown in Acceptable Solution F8/AS1.

Where building hydrants are located in spaces using scissor stairs, the stairwell door at each level providing direct access from the street for fire service personnel should display a sign indicating the floor level location of hydrants which can be accessed from that particular door. An acceptable sign is shown in Acceptable Solution F8/AS1.

Signs should comply with the requirements of this appendix and have lettering not less than 50 mm in height. Signs required to identify the location of hydrants on stairwells should comprise white lettering on a red background.

APPENDIX G – FIRE SYSTEM SHUTDOWN NOTIFICATION FORM

(Informative)

Notification to the fire brigade shall include all Section A details. The building owner shall be advised to inform their insurers of Sections A and B.

Fire System Shutdown Form

Form from	Company and author	Date / /
Building Name		
Contractor		
Contractor details	Phone number	Email address
To	Building owner	
	FENZ	Insurer/Broker

Instructions: At least 24 hours' notification of all programmed isolations shall be given in writing to FENZ and the building owner prior to a hydrant system being rendered inoperative. If an emergency compels immediate action to render a system inoperative, such notification shall be given as soon as possible thereafter.

NZ Standard 4510 Sections A and B to be completed prior to a hydrant system shutdown and sent to the following: 1) FENZ or their agents, and 2) Building owner or their agent.

Section B requires 'OWNER'S APPROVAL' and for the owners to notify their insurers if the systems are isolated for more than 12 hours.

Note: **Partially isolated systems** – If a section or zone of a hydrant system is isolated, blanked off, or left impaired whilst the main system is restored, a tag label shall be attached to the hydrant system inlets indicating which sections are affected. Building owners must inform FENZ and their insurers that the system has been partially restored. They must also inform FENZ and their insurers when the isolated sections have been restored.

OWNER (or agent) Please sign your approval of this shutdown in Section B of this form and send to your Insurers/Broker/Agent

Building owner's email:	Date / /		
FENZ email:	Date / /	Insurer/broker's email:	Date / /

Section A	**Fire system/building/site details**	**PFA No**
Building name		
Building street address		
Building occupancy		
Number of occupied floors		

Type of system

Fire sprinkler system NZS 4541 ☐	Sprinkler pumps ☐	Fire sprinkler system NZS 4515 ☐	
Water supply ☐	Fire alarm ☐	Fire hydrants in buildings NZS 4510 ☐	
Fire alarm system NZS 4512 ☐	Automatic fire detection ☐	Heat detectors ☐	Smoke detectors ☐

Areas or zones affected

Alarms monitored by

Shutdown

Shutdown date start / /	Shutdown time	System will be reinstated daily	Continuous shutdown for /days
Reinstatement date / /	Reinstatement time		

Section of system left isolated whilst main system restored	**Area or zone to be isolated**	
	Date due for completion / /	Date completed whole system restored / /

Work to be completed during shutdown	Alterations ☐	Repair / replace damage to system ☐	Routine maintenance work ☐
	Other:		

Please use this form to notify your 'BUILDING INSURERS' of all shutdowns, reinstatements and of any sections of a system left isolated.

Note: If a section of a fire hydrant system is isolated, blanked off or left impaired whilst the main system is restored a tag label must be attached to the main hydrant system inlet indicating which sections are affected.

Section B – Owner's approval			
Date / /	Name	Insurer(s) notified YES ☐ NO ☐	
Time	Signature	Date / /	
Note: Failure by the owner to notify insurer(s) of an impairment or partial isolation of hydrant system may void insurance cover.			
Owner's safety precautions to be taken during fire system shutdown			
	Forbid smoking in the area affected by the fire system shutdown.		
	No hot work during shutdown.		
	Detail Fire Wardens to patrol affected areas (one person per 1000 m²).		
	Stop hazardous processes.		
	Notify all staff and contractors working on site of the impairments.		
Service company name		Telephone number	Email address
Contact name for any queries		Telephone number	Cell phone

NOTE – Copyright waived.

Form G1 – Fire system shutdown form

APPENDIX H – HYDRANT SYSYTEM ISOLATION TAG

(Informative)

DO NOT REMOVE THIS NOTICE UNTIL THE SYSTEM HAS BEEN FULLY RESTORED

Part A

Impairment notice number:

Date: _____/ _____/ _____

Contractor: _____

Work permit number: _____

Hydrant system number _____ isolated

Part B

Section of hydrant system isolated:

(Give details of location for isolated valve or blanking plate used) and area/zone of building not covered):

Date of isolation: ____/ _____/ _____

Proposed date of reinstatement:

____/ _____/ ____

Contractor: _____

Signed: _____

Form H1 – Typical isolation tag card

APPENDIX J – GUIDELINES FOR PERFORMANCE-BASED DESIGNS

(Informative)

J1 Fire safety strategy

Performance-based designs should be an integral part of the building's fire safety strategy.

Where full coverage of the floor cannot be achieved via the provision of building hydrant outlets located within protected spaces (that is, horizontal or vertical safe paths), additional provisions may be necessary to ensure that the building hydrant system is fit for purpose and will allow firefighters to safely and efficiently carry out their duties.

The range of situations where this may occur means that it is not possible to prescribe a set solution in this standard. Further, such solutions if provided may prove too constraining and limit design flexibility. The use of a performance-based approach is therefore deemed the most pragmatic.

J2 Design fundamentals

J2.1 General

When developing a design on a performance basis to address shortfalls in hydrant coverage, designers must recognise that:

(a) Ultimately, the design should achieve fitness for purpose and that the fire brigade, as the end user, will be key to determining this. Early and regular engagement with them is therefore essential; and

(b) Fire brigade considerations will be driven by equipment limitations, standard operating procedures, and firefighter safety. Understanding those aspects will assist the designer in developing alternative solutions. FENZ publishes a *Designers' Guide to Firefighting Operations* which provides useful insight into these points.

J2.2 Key design considerations

Firefighters cannot operate in an environment that is deemed risky without the protection of breathing apparatus and firefighting water. These factors combine to dictate distances firefighters can reach inside a building. Building hydrant outlets help by providing firefighting water, but only if they can be reached without exposure to the risky environment. A hydrant outlet is not likely to be fit for purpose unless firefighters are able to meet the following three key objectives:

(a) Reach it safely;
(b) Operate it efficiently; and
(c) Retreat safely from the location.

J2.3 Performance requirements

For the purpose of developing the design, the following criteria should be regarded as performance requirements:

(a) A building hydrant outlet located in an open space within the building is not likely to achieve the three key objectives above without additional provisions;
(b) The use of passive fire separations can assist in reducing distances firefighters have to travel while exposed to fire conditions, and in protecting building hydrant outlets from other parts of the building. If relying on passive systems, the designer should give consideration to how such systems may be affected by the actions of firefighters. For example, a hose passing through a door will generally prevent it from closing;
(c) The use of active systems can also assist by improving conditions within the building. Various systems can be used, either individually or in combination, to affect any (or all) of the three key objectives identified above. Active systems could be used for a range of purposes including controlling the fire size and/or limiting the spread of smoke.

APPENDIX K – MATTERS DECLARED BY FIRE AND EMERGENCY NEW ZEALAND NATIONAL COMMANDER

(Normative)

The National Commander may declare such fire service standard operating procedures for the use of hydrant systems as are necessary and require consideration in the application of this standard. To the extent that this standard provides for such consideration, the National Commander's declaration shall be binding and form part of this standard.

APPENDIX L – CONTACT DETAILS OF AGENCIES TO BE INFORMED WHEN A HYDRANT SYSTEM IS RENDERED INOPERATIVE

(Informative)

At the time of publication, the following available contact details were valid for the agencies detailed below for notification of hydrant systems rendered inoperative.

The building owner and hydrant contractor should ensure that these contact details are still valid at the time of sending.

Fire and Emergency New Zealand (FENZ):

(a) Notification of the hydrant system impairment: Comcen.notifications@fireandemergency.nz; and

(b) For submitting the risk assessment for the hydrant system impairment: Fireinfo@fireandemergency.nz.

NOTE – The subject title of the email should be 'Risk assessment for hydrant system impairment'.

APPENDIX M – DRY BARREL PILLAR HYDRANTS FOR EXTERNAL USE

(Informative)

M1

External dry pillar hydrants shall be permitted for use on a wet hydrant system or as part of a site fire water main such as an NZS 4541 class B2 water supply in accordance with this appendix. The arrangement shall be approved by the HSC or SSC.

M2

The hydrant shall be of a type that only admits water into the barrel when the hydrant is opened and drains automatically via weep holes below the frost line when closed.

M3

Each hydrant shall be installed on an isolatable spur from the water supply.

M4

The underground water supply shall be installed below the frost line.

M5

The following installation requirements shall apply:

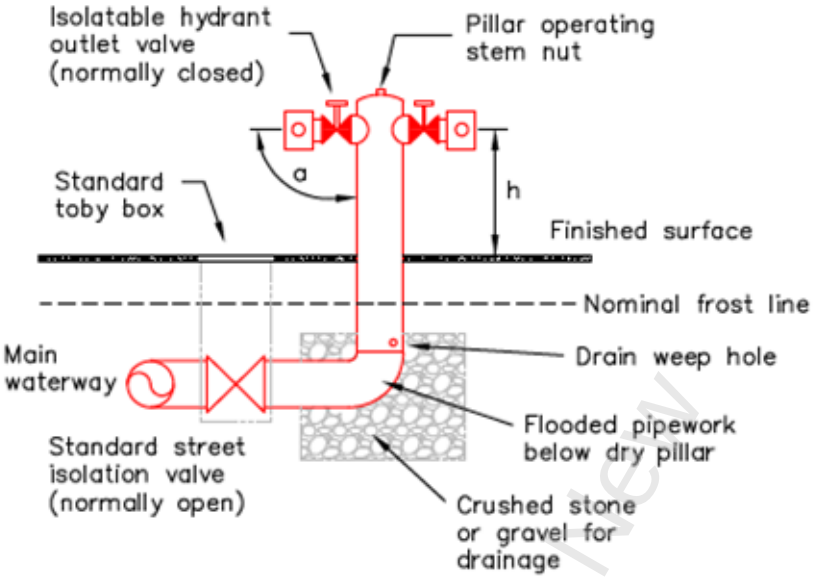
(a) Independently operated dual dry pipe outlet assemblies and dual lugged female instantaneous couplings complying with SNZ PAS 4505 shall be used;
(b) All parts of the assembly shall be installed in such a manner that no residual water can remain in the outlets, valves, and dry pillar waterway after use, causing the potential for freeze-ups;
(c) Drainage bedding, such as crushed rock or gravel below the frost line for the weep holes, shall be provided;
(d) A 33.5 mm square stem nut shall be used; and
(e) A minimum of two pillar hydrant stem nut keys shall be readily available, either secured to the hydrant, within the fire service inlet enclosure, or within the main fire pump rooms, up to a quantity the design number of dual outlets determined to operate. They shall be provided with a dedicated cabinet or rack and suitable signage.

M6

Additional testing, maintenance, and impairments shall be in accordance with the listing criteria and as a minimum shall include:

(a) Acceptance tests that include inspection and check of the automatic pillar drain after use; and
(b) Annual exercising of all hydrant outlets and pillars to ensure correct operation of flooding and subsequent automatic draining, including correct operation of the seat ring.

NOTE – Informative guidance on the installation and maintenance of dry pillar hydrants can be found in FM Global Datasheet 3-10 *Private Fire Service Mains.*



Key:

a = Nominal outlet angle

h = Distance from ground to outlet

Note: a and h shall be approved by the fire brigade

Figure M1 – Dry pillar hydrant

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Minor amendment to NZS 4541:2020

Background – to allow combined sprinkler and hydrant riser systems to be specified, without the need to uplift the building consent as an alternative solution, we require a minor amendment to NZS 4541:2020:

New clause 1.19.3
NZS 4510:2021 Appendix Z provides guidance for the design and installation of a combined sprinkler and hydrant riser system. A combined sprinkler and riser system designed and certified as complying to the requirements of NZS 4510:2021 Appendix Z is deemed to comply with NZS 4541:2020.
A number of provisions of NZS4510:2021 Appendix Z are not aligned with the provisions of NZS 4541:2020. In such cases, the requirements of NZS 4510:2021 will take precedence over the requirements of NZS 4541:2020.
Note: An example of such provisions includes the use of an electronic bell instead of a water motor alarm

Note: We may take the opportunity to rectify NZS 4541's seismic issue at the same time