NZS 4517:2010

New Zealand Standard

Fire sprinkler systems for houses

Superseding NZS 4517:2002

NZS 4517:2010

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This Standard was prepared under the supervision of the P 4517 Committee, the Standards Council established under the Standards Act 1988.

The committee consisted of representatives of the following nominating organisations:

BRANZ Ltd
Consumer representative
Department of Building and Housing
Fire Protection Association of New Zealand
Fire Protection Industry Contractors' Association of New Zealand
Institution of Fire Engineers
Insurance Brokers Association of New Zealand
Insurance Council of New Zealand
IPENZ – Institution of Professional Engineers New Zealand
Master Plumbers, Gasfitters and Drainlayers NZ Inc.
New Zealand Fire Equipment Manufacturers Association
New Zealand Fire Service
New Zealand Plumbers, Gasfitters and Drainlayers Board
Property Council of New Zealand Inc.
Society of Fire Protection Engineers New Zealand Chapter
Water New Zealand

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

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AMENDMENTS

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NZS 4517:2010

New Zealand Standard

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Superseding NZS 4517:2002

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REFERENCED DOCUMENTS

Reference is made in this document to the following:

NEW ZEALAND STANDARDS

NZS 3501:1976	Specification for copper tubes for water, gas, and sanitation
NZS 4515:2009	Fire sprinkler systems for life safety in sleeping occupancies (up to 2000 m$^{2)}$
NZS 4541:2007	Automatic fire sprinkler systems

JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

AS/NZS 2642.2:2008	Polybutylene pipe systems – Polybutylene (PB) pipe for hot and cold water applications
AS/NZS 2492:2007	Cross-linked polyethylene (PE-X) pipes for pressure applications
AS/NZS 4130:2001	Polyethylene (PE)pipes for pressure applications

AMERICAN STANDARD

ASTM – F442	Standard specification for chlorinated poly (vinyl chloride) (CPVC)
/F442M-1999	plastic pipe (SDR-PR)

AUSTRALIAN STANDARDS

AS 2118.5:2008	Automatic fire sprinkler systems – Domestic
AS 2845.3:1998	Water supply – Backflow prevention devices – Field testing and maintenance

GERMAN STANDARDS

DIN 1988-6:2002	Codes of practice for drinking water installations
Part 6:	Fire fighting and fire protection installations
DIN 8077:1999	Polypropylene (PP) pipes – Dimensions

OTHER PUBLICATIONS

BRANZ	The New Zealand Fire Service Commission Research Report 'Cost effective domestic fire sprinkler systems', 2000
BRANZ	Design guide – Sprinklers for houses, 2002
NFPA 13-2010	Standard for the installation of sprinkler systems
NFPA 13D-2010	Standard for the installation of sprinkler systems in one- and two-family dwellings and manufactured homes
UL 199:2005	Standard for automatic sprinklers for fire-protection service
UL1626:2008	Standard for safety residential sprinklers for fire-protection

LEGISLATION

Building Act 2004

Health Act 1956

New Zealand Building Code (NZBC) 1992 and Compliance Documents

Plumbers, Gasfitters and Drainlayers Act 2006

WEBSITE

http://www.legislation.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.co.nz.

REVIEW OF STANDARDS

Suggestions for improvement of this Standard will be welcomed. They should be sent to the Chief Executive, Standards New Zealand, Private Bag 2439, Wellington 6140.

FOREWORD

NZS 4517 was first published in 2002 and was based on NZS 4515 *Fire sprinkler systems for residential occupancies*, incorporating findings from the New Zealand Fire Service Commission report *Cost effective domestic fire sprinkler systems* authored by BRANZ. NZS 4517 gives guidance for the design, construction, owner documentation, and maintenance of the fire sprinkler system to clarify content that in the previous version of this Standard was confusing or open to misinterpretation.

There is no intention to limit the use of new and developing technologies for the sprinkler protection of houses. Rather NZS 4517 has been prepared to specify the minimum requirements for a house fire sprinkler system to provide a level of protection for the occupants of the building and a reasonable measure of property protection compared to premises without such protection. Life safety in houses is further enhanced by the addition of smoke alarms and the preparation of effective home escape plans.

Where a system designed to this Standard is connected to a reticulated town's main supply, it is important that the designer consult with the water supply authority on the available pressures and characteristics of the water supply.

This Standard recognises that the primary purpose of sprinkler systems is to control a fire so that survivable conditions are maintained long enough for the safe evacuation of the occupants.

The use of residential sprinkler heads is recommended as a number of important benefits are derived from their rapid response and fire control:

(a) The amounts of smoke and toxic gases produced by the fire are typically well below life threatening threshold levels;

(b) The amount of heat produced by the fire is smaller and less water is needed to cool and control the fire. This provides substantial cost benefits by way of reduced pipe sizing, easier installation, and smaller system water demand. In many cases, it should be possible to use the domestic water supply to feed the sprinkler system. The adequacy of any water supply must, however, be checked and proven by flow testing and hydraulic calculation; and

(c) The nature of the fire load in domestic occupancies, combined with the responsiveness of residential sprinkler heads, has permitted the use of domestic plumbing pipe.

The committee recognised that the size and architectural complexity of individual houses can vary and that this can present some problems for system designers. These differences highlight the need for designers and installers to have a greater knowledge of sprinkler design for property protection as well as life safety. For some houses, these will be more appropriately protected by applying the provisions of NZS 4515 *Fire sprinkler systems for life safety in sleeping occupancies (up to 2000* m^2*)*.

The committee is aware of a growing concern that there has been a general lack of understanding by building consent authorities and building owners of the importance of a verification or commissioning test to prove both the effectiveness and design of this life-safety system. The committee acknowledges that NZS 4517 is a voluntary Standard but suggests that the fire protection industry should take the lead in raising awareness among interested parties of the need to have sound evidence of an effective system.

OUTCOME STATEMENT

Systems conforming to the specified minimum requirements for the design, material, manufacture, and installation of fire sprinkler systems for domestic occupancies in NZS 4517:2010 will provide improved protection of domestic occupancies and contribute to the prevention of loss of life.

NOTES

New Zealand Standard

Fire sprinkler systems for houses

1 GENERAL

1.1 Scope

1.1.1 General

This Standard specifies minimum requirements for the design, material, and installation of fire sprinkler systems for houses, and advises on periodic testing and maintenance of these fire sprinkler systems. The sprinkler system is aimed at controlling a fire occurring in a house so that survivable conditions are maintained throughout the house for at least 10 minutes.

NOTE – In selecting a 10-minute period during which fire control must be maintained, it is assumed that evacuation can and will be undertaken. It is recommended that single point or interconnected mains powered smoke alarms are installed to give warning so that evacuation can begin.

1.1.2 Exclusions

This Standard does not apply to buildings such as multi-storey apartments, marae, motels, and churches. For these types of buildings refer to NZS 4515 or NZS 4541.

C1.1.2

This Standard was developed following the publication of the New Zealand Fire Service Commission research report 'Cost effective domestic fire sprinkler systems' published in 2000. The requirements of NZS 4517 drew on this report, as well as on technical guidance from NFPA 13D Standard for the installation of sprinkler systems in one- and two-family dwellings and manufactured homes.

The committee drafting NZS 4517 did not elect to adopt NFPA 13D in full as it wanted to best balance the least cost for greatest possible benefit, so pursued a risk-based approach to reduce unnecessary cost items, such as requiring the use of 'listed' pipe, full sprinkler protection, and so on. As part of the cost trade-off, the committee restricted the scope of this Standard to single family dwellings and decided to title the Standard 'Fire sprinkler systems for houses' to ensure its intent was clear. The cost-driven basis of NZS 4517 is balanced against the higher levels of reliability expected for commercial buildings under the Standards NZS 4515 and NZS 4541.

The committee is aware of occasions where earlier versions of NZS 4517 have been misapplied. It has been reported that sprinkler systems based on NZS 4517 have been installed in a variety of buildings other than homes, including wharenui, schools, motels, and even racing stables. The committee strongly recommends that designers give full consideration to the foreword and scope statements in this Standard.

The criteria in this Standard are based on full-scale fire tests in small rooms containing typical residential furnishings. The tests have been predominantly carried out below smooth flat ceilings 2.4 m high. Sprinkler systems to this Standard are expected to allow the owner and emergency services an extra 10 minutes of time before the onset of

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flashover within the compartment of fire origin. They cannot be expected to completely control a fire. This is especially so where the fire loads are higher than typically expected as average in homes, and where there are architectural features that may affect sprinkler performance or where the interior finishes have an unusually high flame-spread index. Gaining the occupiers 10 minutes evacuation time is the bleakest picture of what sprinklers achieve. In practice, the technology is very effective and efficient, and more often than not does control a fire, often completely extinguishing it.

Residential sprinklers are designed to use low quantities of water to minimise the cost of installation. This means that the margin between successful operation and failure can be small. As a result of this, residential sprinklers must be considered cutting edge technology, and careful attention to the detailed design and installation requirements of this Standard and the sprinkler manufacturer's data sheets cannot be dismissed as unnecessary, as the system is 'only for a home.' Thus those designing sprinkler systems for homes should be formally trained in the skill of home sprinkler-system design. The NZS 4517 committee hopes that, in the near future both the fire and plumbing industries will have a formal qualification for home sprinkler-system designers.

In order to help address concerns about the misapplication of the Standard and design versus installation variances, careful attention has been given to recommended documentation and commissioning testing. Guidance on these is given throughout the Standard.

1.1.3 Restricted work

Some aspects of the installation described in this Standard are categorised as sanitary plumbing under the Plumbers, Gasfitters and Drainlayers Act 2006 and shall be undertaken only by persons authorised to do so under that Act.

1.2 Interpretation

1.2.1

For the purposes of this Standard the word 'shall' refers to practices that are mandatory for compliance with the Standard. The word 'should' refers to practices that are advised or recommended.

1.2.2

Notes to tables form part of the mandatory requirements of the Standard, whereas notes elsewhere are for information and guidance only.

1.2.3

This Standard contains two types of appendices. A 'normative' appendix forms an integral part of the Standard. An 'informative' appendix is only for information and guidance.

1.2.4

Clauses prefixed by '*C*' and printed in italic type on a grey screen are intended as comments on the corresponding clauses. They are not the only or complete interpretation of the corresponding clause. They should be used only for guidance and are not mandatory.

1.3 Definitions

1.3.1 Definitions

For the purposes of this Standard, the following definitions apply:

Building consent authority	As defined in the Building Act
Combination system	A potable water reticulation system that supplies the combined fire sprinkler system water supply demand and some or all of the domestic water supply demand through a common system of pipework. See 3.1.2
Fire-separated	Part of a building separated from the rest by a construction that has a minimum fire resistance rating of 30/30/30
House	A house is the home of not more than one household and includes any attached self-contained unit. Multiple adjoining occupancies are included provided they are separated by fire-rated walls (for example, townhouses) and are not located one above the other
Independent system	A system in which the system of pipework used to supply fire sprinklers does not supply any sanitary fixture or appliance, or outlet for potable water. See 3.1.1
Listed	Specific makes and models of equipment, materials, procedures, organisations, and facilities required or permitted by this Standard, which have been examined by a sprinkler system certifier (SSC) and found to meet relevant standards and/or have otherwise been demonstrated to be adequate for the intended application NOTE – Examples of test and approval bodies are Factory Mutual Global (FM), Loss Prevention Council (LPC), Australian Commonwealth Scientific and Research Organisation (CSIRO), and Underwriters Laboratories (UL).
Point of supply	As defined in the Health Act
Quick response sprinkler	A sprinkler with a high thermal sensitivity and listed as a quick response sprinkler
Reference point	The physical location of the system pressure gauge
Residential sprinkler	A type of quick response sprinkler having a thermal element with a response time index of 50 $(m.s)^{1/2}$ or less, that has been specifically investigated to enhance survivability in the room of fire origin, and is listed as such

Standard response sprinkler	A sprinkler listed as a standard response sprinkler
Water supply authority	The network utility operator responsible for water supply as defined by 'networked supplier' under the Health Act

1.3.2 Abbreviations

Abbreviations used in this Standard have the following meaning:

CPVC	Chlorinated polyvinyl chloride
DC	Direct current
DN	Nominal external diameter
EPL	Equivalent pipe length
FM	Factory Mutual
ID	Internal diameter
NZBC	New Zealand Building Code
RPZ	Reduced pressure zone
SSC	Sprinkler system certifier
SDR	Standard dimension ratio
UL	Underwriters Laboratories

2 GENERAL DESIGN REQUIREMENTS

2.1 System description

A sprinkler system designed to this Standard comprises:

(a) Water supply (see section 6);

(b) Pipework (see 4.2);

(c) Sprinklers (see 4.4 and 5).

See Appendix A for an example of a sprinkler system compliance checklist.

2.2 Extent of sprinklered protection

The house to be protected shall be sprinklered throughout except areas listed in (a) to (g), for which protection is optional (see figure 2.1):

(a) Pantries, cupboards, and wardrobes (with a floor area less than 5 m^2), excluding those containing clothes driers;

(b) Concealed ceiling and roof spaces;

(c) Concealed floor spaces;

(d) Toilets and bathrooms;

(e) Open external areas such as porches, balconies, walkways, stairs, and other spaces created by architectural features;

(f) Small architectural features (with a floor area less than 5 m^2) such as planter box windows, bay windows;

(g) Detached or fire-separated garages/buildings unless used for sleeping purposes.

Where an additional sprinkler would be required in a room just to protect the door swing area, this additional sprinkler may be omitted if the area that would not be protected (combining adjacent door swing areas) is less than 5 m^2. See figure 2.1.

Measures to provide additional protection beyond the scope of this Standard are listed in Appendix B.

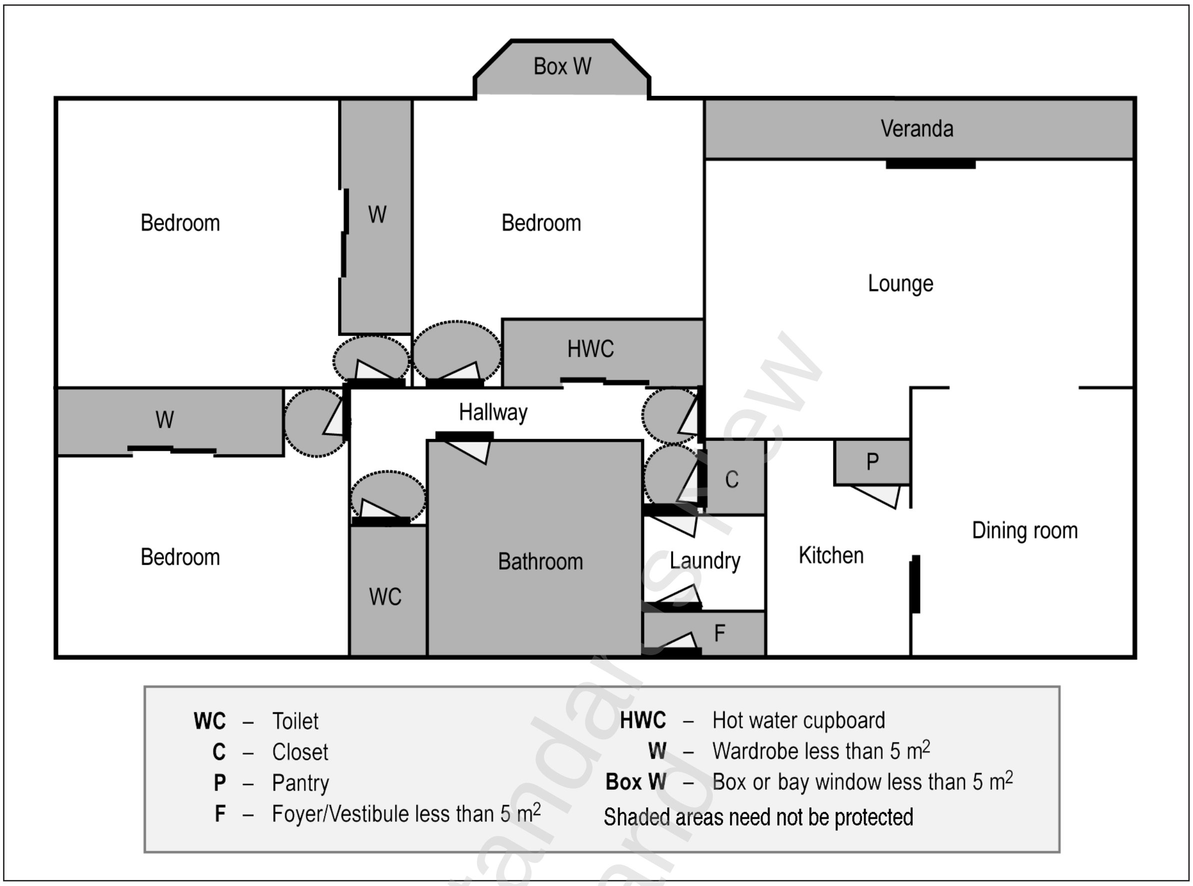

Figure 2.1 – Extent of sprinkler protection

2.3 Equipment data sheets

When the minimum requirements of the listed equipment manufacturer's data sheets exceed any of the requirements in this Standard the equipment manufacturer's data sheets shall take precedence.

2.4 New technology

It is not the intention of this Standard to limit the use of new and developing technologies for the sprinkler protection of houses.

3 TYPES OF SYSTEM

3.1 General

Systems shall be independent or combination type.

NOTE – Ideally the pipework inside the house should form a loop, with sprinkler heads connected off short droppers connected to this loop. This design methodology achieves the best flow efficiency and allows domestic plumbing to be most easily connected to the sprinkler system.

3.1.1 Independent system

An independent system shall be a system permanently charged with water both above and below the installation control valves. See figure 3.1.

Where there is the possibility of freezing the piping shall be protected.

NOTE –

(1) Backflow prevention, in accordance with the New Zealand Building Code, Clause G12, is required to separate an independent system from potable water.

(2) One method of protection is installation within the thermal envelope of the building (that is, within or covered by the wall and ceiling insulation material). Where this is not possible or additional protection is required, appropriately rated thermal insulation should be applied to the pipes. If there is a record of water supplies freezing from frosts persisting over more than 3 days then an antifreeze system may be required. Freezing zones in New Zealand should be confirmed with the building consent authority for the area where the home sprinkler is being installed.

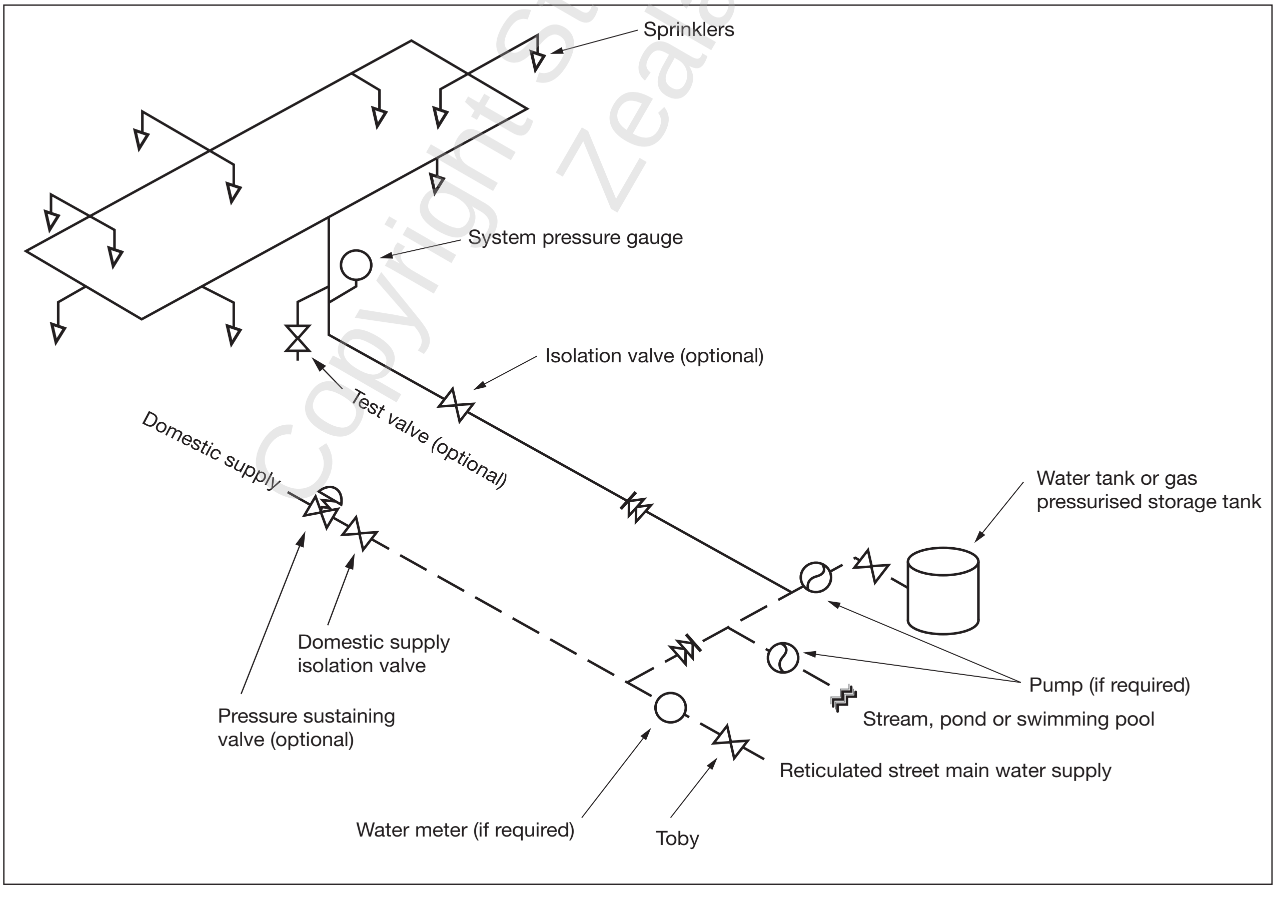

Figure 3.1 – Independent system

3.1.2 Combination system

A combination system shall be a potable water reticulation system that supplies the combined domestic water supply demand and the fire sprinkler system water supply demand through a common system of pipework. Where there is a likelihood of freezing in the pipe or valves sets, appropriate measures to prevent pipework freezing shall be taken. A combination system will not normally be fitted with control valves other than the normal cold-water isolation valve. See figure 3.2.

Alternative water supplies shall be of drinking water quality. If not, an independent system shall be used.

NOTE – Insulation does not necessarily prevent water in a pipe from freezing, it merely delays the process. If there is a record of water supplies freezing from frosts persisting over 2 or more days, a combination system may not be suitable and an independent antifreeze system may be required.

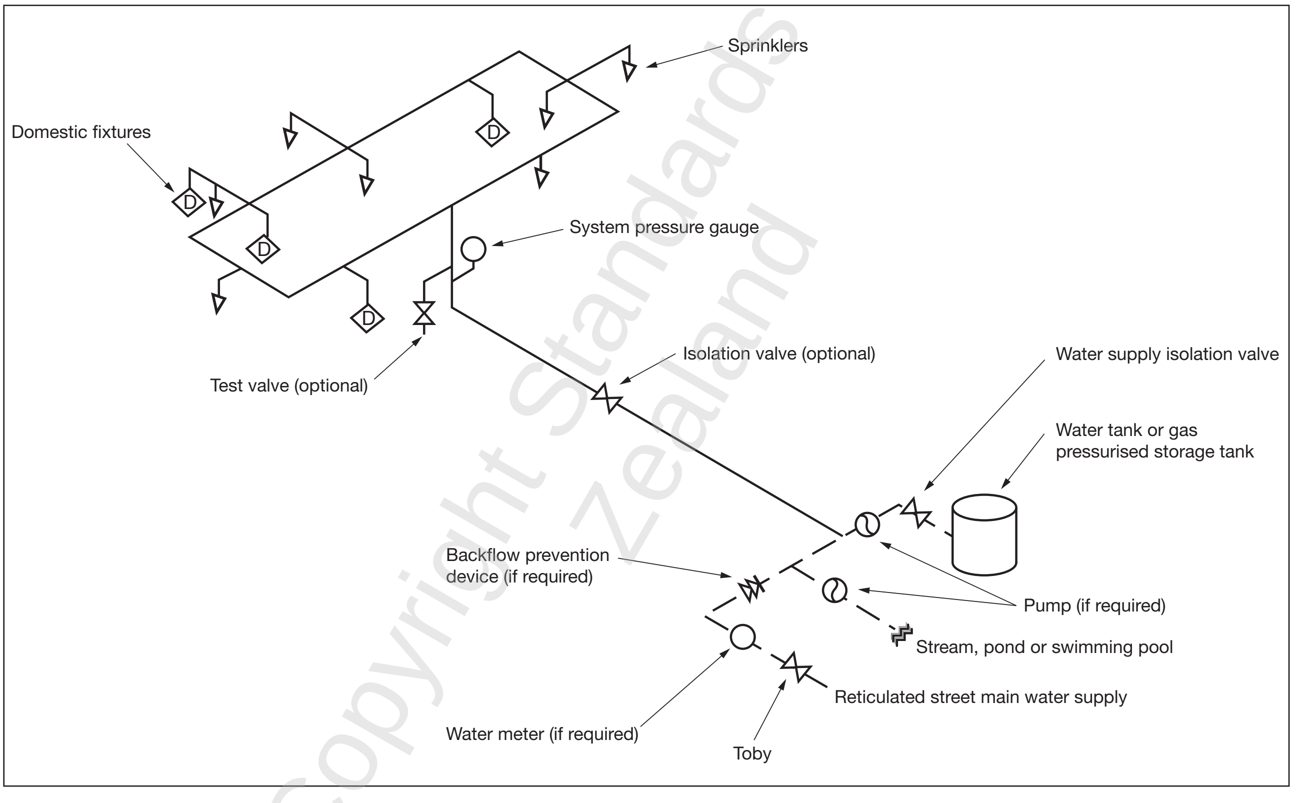

Figure 3.2 – Combination system

4 SYSTEM COMPONENTS

4.1 Maximum operating pressure

No component of a sprinkler system shall be subjected, either during normal conditions or during operation, to pressures in excess of that for which the component is rated.

NOTE –
This requirement is particularly relevant where there is a high standing pressure in the reticulated water supply.

High temperatures in roof spaces may cause over-pressurisation in independent systems of small total pipe volume unless means for limiting this are provided. Acceptable methods include:

(a) A pressure relief valve (not suitable for antifreeze) piped to an appropriate place;

(b) A gas over water hydraulic accumulator sized and fitted according to 7.6.3.2. of NFPA 13.

The normal maximum pressure rating for sprinkler systems is 1200 kPa.

4.2 Pipework

In this section of the Standard, pipe diameters are expressed to the nearest millimetre (mm).

4.2.1 General

4.2.1.1

In all systems, pipework shall have a rated working pressure of at least 900 kPa at a temperature of 50°C.

NOTE – Typically a plastic pipe rated at 1600 kPa at 20ºC will meet these requirements.

4.2.1.2

Pipework that could be exposed to hot gases from a fire in the sprinklered space shall be listed metal pipework or protected by fire resistant material.

NOTE – An example of protection is installation behind a wall or ceiling lining of 10 mm plasterboard.

4.2.1.3

The minimum size of pipe supplying water to a sprinkler system shall be 19 mm internal diameter (ID).

There are two exceptions to the minimum pipe size of 19 mm ID:

(a) The final 1000 mm length of pipe directly supplying a sprinkler may have an internal diameter smaller than 19 mm, but no smaller than 16 mm. The term ‘directly’ means that the only fitting allowed on this length of pipe is the one that permits the sprinkler to be attached (such as a hose plate, wingback, or transition piece);

(b) Pipes with an internal diameter of less than 19 mm may be used only if calculated by specific design using reliable data (see note 2).

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NOTE –

(1) Care should be taken in considering whether the use of the hydraulic equivalent length factors in table E3 are applicable for certain pipe fittings. This would be of particular concern when the internal diameter of the fitting is substantially less than the internal diameter of the pipe.

(2) Data for pipework of less than 19 mm should include an assessment of friction losses in pipe fittings. These friction loss figures may be available in pipe manufacturers' data sheets or from laboratory tests.

(3) If small bore pipes, such as pipes 19 mm or smaller, are used to supply a sprinkler, designers and installers are cautioned to ensure that any additional fittings used in the installation and not allowed for in the calculations do not have a significant detrimental impact on the performance of the system. It is unlikely that 19 mm ID or smaller pipe will be adequate to reticulate the whole system.

4.2.2 Specific piping requirements

4.2.2.1 Solvent-cemented pipework and fittings

Sprinklers shall not be fitted to solvent-cemented pipework before the joint has cured.

NOTE –

(1) This is to avoid solvent cement rundown into the sprinklers.

(2) It is essential to remove excess cement from pipes adjacent to the sprinkler to avoid sprinkler blockage.

4.2.2.2 Underground protection

Underground pipes shall be protected against external corrosion where necessary.

NOTE – Plastic pipe should be used underground.

4.2.2.3 Earthing

No metal sprinkler system pipe shall be used as an earthing continuity conductor.

4.2.2.4 Pipework not to be used as support

Electrical wiring or other services, fittings or fixtures shall not be attached to, or supported by, sprinkler pipework.

4.2.3 Pipework supports

4.2.3.1

Supports shall allow for thermal and seismic movement without failure of the system in normal service.

4.2.3.2

Copper or plastic pipes shall be supported according to the manufacturer's recommendations or to the New Zealand Building Code Compliance Document G12/AS1. Steel pipes shall be supported in accordance with table 4.1.

Table 4.1 – Pipework supports for steel pipes

Pipe size ID (mm)	Maximum spacing (m)
19	2.4
25	3.7
32 to 50 incl.	4.0

NOTE – The unsupported length between the end sprinkler and the last support on a pipe with two sprinklers or more shall not be more than 900 mm for 25 mm pipe, and 1200 mm for 32 mm pipe and larger. Supports are not required on steel pipes cantilevered up to 600 mm.

Notwithstanding the provisions of 4.2.3.2, the pipework adjacent and attached to the sprinkler shall be fixed to prevent movement of the sprinkler when it discharges.

4.3 Flow test facilities

4.3.1 Flow tests

4.3.1.1

A water pressure gauge and a flow test valve shall be included in all systems to establish water supply characteristics and to allow the periodic confirmation of adequate water supply.

NOTE – A 20 mm valve may serve as a flow test valve.

4.3.1.2

The flow test discharge shall be in a safe location where it will not create a hazard or cause water damage. The flow test line shall connect downstream of any check valves, metering valves or flow alarms.

4.3.1.3

Any pressure gauges that are part of the system shall be not less than 65 mm nominal size. The pressure gauge shall be labelled or permanently marked to indicate the minimum acceptable static (no-flow) water pressure. The gauge should also be marked with the design pressure (see 6.4).

4.3.2

The water flow detector, if fitted, shall be a listed item and shall operate at a flow less than the lowest single sprinkler design flow for the sprinkler system (see figure 4.1).

NOTE – As flow detectors can be triggered by normal domestic flows, many are not suitable for use in combination systems.

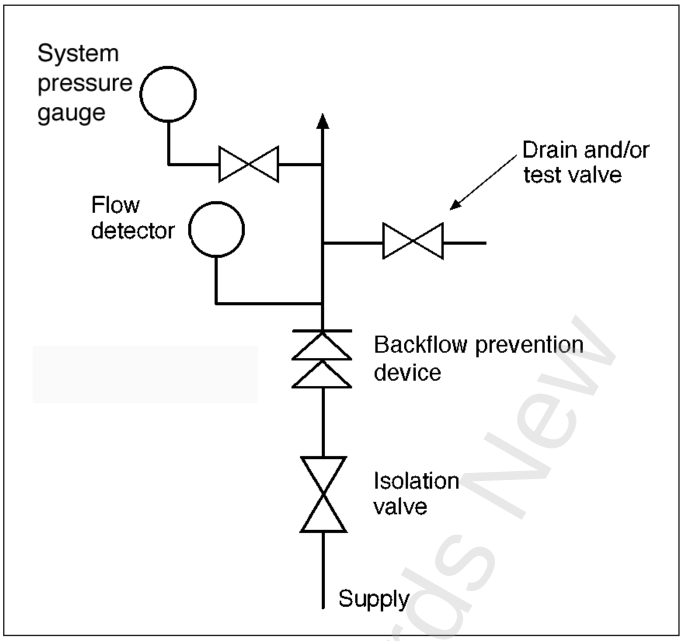


Figure 4.1 – Components and hydraulic layout of installation control valves for domestic occupancies

4.4 Sprinkler type

4.4.1

Sprinklers shall be listed items.

The types of sprinkler used shall be as specified in table 4.2.

Table 4.2 – Types of situation and sprinklers

Protection required	
Situation	**Type of sprinkler**
Rooms, hallways, and other habitable spaces	Residential or Quick response spray only in accordance with 4.4.4
Attached garages – non fire-separated	Quick response spray or Residential
Protection optional	
Situation	**Type of sprinkler**
Roof spaces, ceiling spaces, skylights, underfloor spaces	Standard response spray
Storage areas, and detached or fire-separated garages/buildings	Quick response spray or Residential
Cupboards, porches, and other spaces (see 2.2)	Residential or Standard response spray

4.4.2

The temperature rating of sprinklers shall be subject to the manufacturers' listed criteria.

Sprinkler selection and location shall be in accordance with the sprinkler listing criteria and manufacturers' installation guide in rooms where there are:

(a) Any heat sources;

(b) Sprinklers exposed to the rays of the sun; or

(c) Sprinklers located in an unventilated area.

All sprinklers installed in a room shall have the same heat response element and temperature rating except if installed adjacent to an area of elevated temperatures. Refer to the sprinkler listing criteria and installation guide. An example of the manufacturer's listed criteria is shown in table 4.3.

Table 4.3 – Example of manufacturer's listed criteria

Sprinkler nominal temperature rating*	Maximum ambient ceiling temperature	Bulb colour
68°C	38°C	Red
79°C	65°C	Yellow
93°C	65°C	Green

* The sprinkler temperature rating is stamped on the deflector.

4.4.3

Sprinklers shall not be painted by anyone other than the sprinkler manufacturer. Precautions shall be taken to prevent damage to sprinklers during: storage, handling, installation, and work associated with finishing trades (refer to the sprinkler manufacturer's technical data sheet for details).

NOTE –

(1) Failure to handle or install a sprinkler correctly can permanently damage a sprinkler and cause the sprinkler to fail to operate in a fire or cause it to operate prematurely.

(2) With concealed sprinklers special care should be taken with the installation and maintenance so as not to compromise the operation of the sprinkler for example ceiling subsidence or blockage by insulation.

4.4.4

Where the ceiling geometry or high ambient temperature precludes the use of residential sprinklers, quick response sprinklers instead of residential sprinklers shall be used to protect rooms. The quick response sprinklers shall be located with the thermal element positioned no more than 150 mm below the ceiling.

4.4.5 Protection of storage areas, garages and ancillary buildings

Protection of storage areas, garages and ancillary buildings may be with:

(a) Quick response sprinklers installed to a maximum spacing of 4.6 m (21 m^2 maximum coverage area per sprinkler head), apart with a minimum design criterion of two sprinklers flowing at 57 litres per minute; or

(b) Residential sprinklers. Where the ceiling is fully lined then residential sprinklers may be installed using a two-sprinkler design where appropriate. See table 4.2 for a summary of sprinkler use as required by specific situations.

4.5 Stock of replacement sprinklers

Two spare sprinklers of each type used on the system shall be provided and should be installed in a permanent bracket or stored in a box labelled 'spares box'. When replacing sprinklers, the same type of sprinkler or one of the same design criteria shall be used. Spanners should be supplied for the replacement of sprinklers.

NOTE –

(1) The purpose of the spare sprinkler is to permit rapid recommissioning of the system.

(2) Sprinklers are not interchangeable with sprinklers of different performance characteristics.

5 LOCATION OF SPRINKLERS

5.1 General

The impact of beams, light fittings, smoke detectors, shaped ceilings or other features may adversely affect the distribution of water from the sprinkler. To counter this, such features shall be considered in locating sprinklers. (See table 5.1 and figure 5.1.)

NOTE – Information provided in the manufacturer's data sheet and installation guidelines will provide guidance on the application of this clause. The manufacturer's data sheet should take precedence for the location of sprinklers.

5.2 Residential sprinklers

Sprinklers shall be located strictly in accordance with the manufacturer's listed instructions for the particular type of sprinkler and intended operating pressure. The listed requirements include:

(a) Coverage area;

(b) Distance between sprinklers;

(c) Distance from walls and obstructions;

(d) Distance from underside of ceiling;

(e) Location of sprinklers under sloping ceilings;

(f) Coordination with beamed ceiling geometry;

(g) Distances from obstructions (especially, but not limited to, on the ceiling), for example, light fittings, vent covers, decorative ceiling patterning, and fixtures;

(h) Distances from heat sources, for example, stoves, cook tops, fire places, heaters.

NOTE – The designer should be supplied with a 'reflective ceiling plan' from the homeowner or their agent that details what fixtures (and panelling) are on the ceiling. This will enable the designer to develop the sprinkler design and establish where the locations of the sprinklers should be.

The listed requirements in 5.2 may vary according to operating pressure.

5.3 Specific requirements for spray sprinklers

5.3.1

Sprinklers other than residential type shall be installed only when allowed by 4.4.1.

Table 5.1 – Distances from obstructions for quick response and standard response sprinklers

Minimum horizontal distance from sprinkler to side of obstruction (A) (mm)	Maximum height of sprinkler deflector above bottom of obstruction (B) (Sprinkler) (mm)
100	17
200	40
300	70
400	100
500	150
700	250
800	300
900	360
1000	415
1100	440
1200	460
1300	460
1400	460
1600	460
1700	460
1800	460

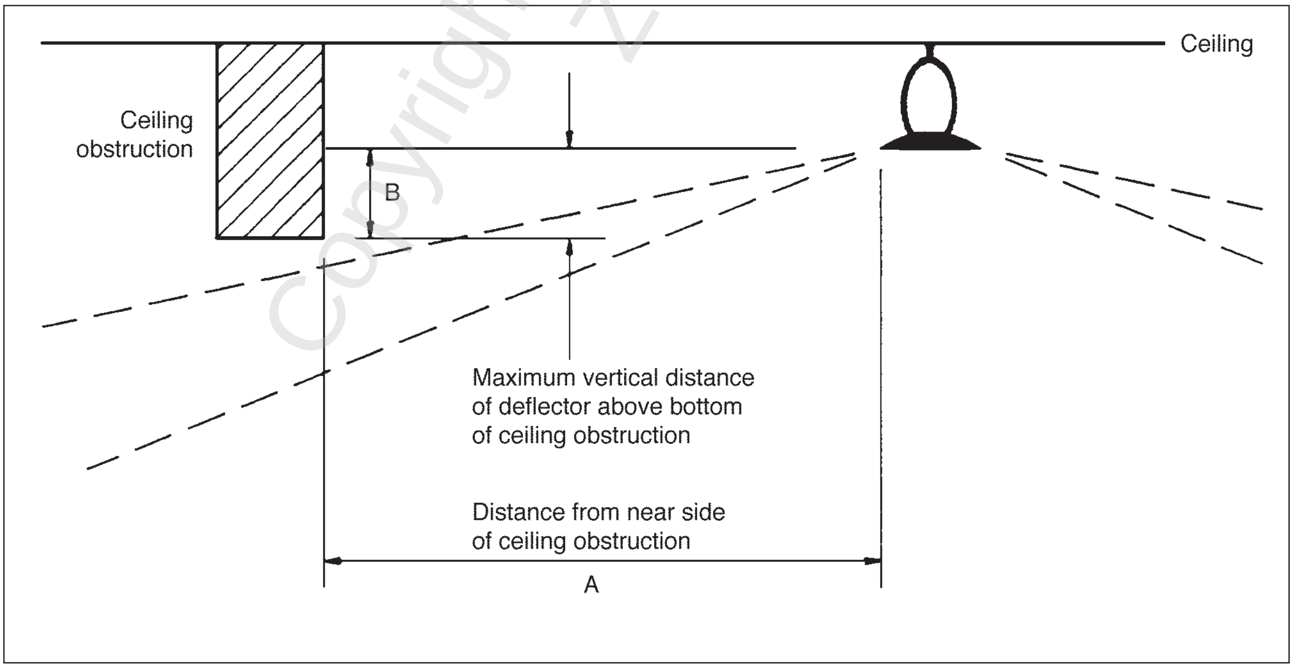


Figure 5.1 – Position of a spray sprinkler deflector, pendant (or upright), when located above the bottom of a ceiling obstruction

5.3.2

Sprinklers other than residential type shall be located as in table 5.2.

Table 5.2 – Maximum distance and coverage of quick response and standard response sprinklers

Sprinkler type	Maximum distance between sprinklers	Maximum area of coverage	Minimum orifice pressure
	(m)	(m^2)	(kPa)
10 mm	4.6	21	100
10 mm	4.0	16	70
15 mm	4.6	21	50

5.3.3

Sprinklers other than residential type shall not be closer to one another than 1.8 m or as specified in manufacturer's data sheet if the discharge from one could wet the adjacent sprinkler.

5.3.4

The maximum distance between sprinklers and walls or partitions shall be one-half of the distances specified in table 5.2.

5.3.5

Where sprinklers are installed in roof spaces, they shall be:

(a) Located as close as practicable to the underside of roof cladding but with the deflectors not closer than 25 mm;

(b) Positioned so that the discharge is not obstructed by the roof structure or other items; and

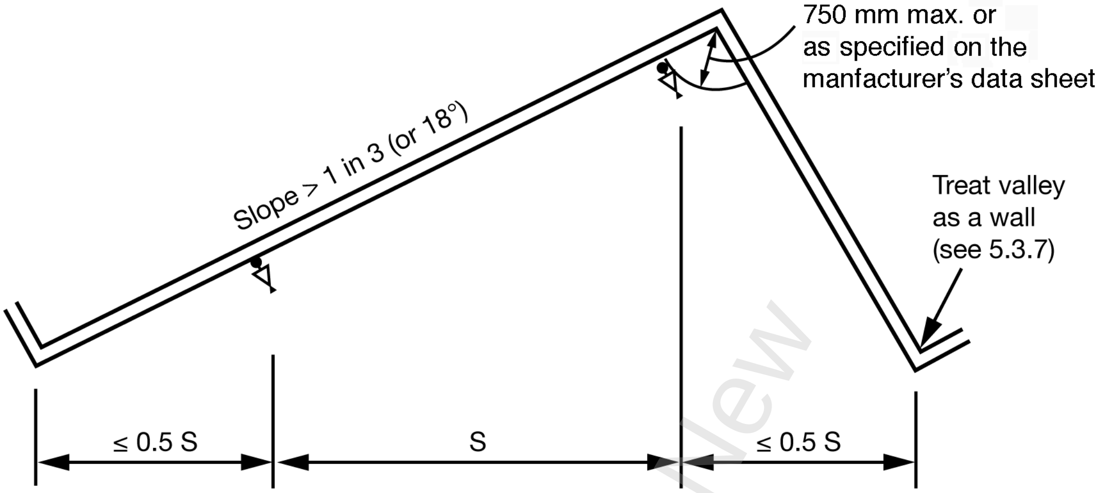
(c) Located in accordance with the requirements of table 5.1.

5.3.6

Under sloping ceilings or roofs, the spacing measurements shall be taken horizontally.

5.3.7

On sloping ceilings where both the slopes are steeper than 1 in 3, a line of sprinklers shall be fixed at the apex unless there is a row of sprinklers not more than 750 mm distant radially from the apex. The valley at the intersection of the projection of such roof slopes shall be the line of a wall for the purpose of 5.3.4 (see figure 5.2). A sloping ceiling steeper than 1 in 3 intersecting a wall shall be treated in an identical manner.



S x D = Design area per sprinkler

Where:
S = Design spacing of sprinklers on range pipes
D = Distance between adjacent row of sprinklers

NOTE – Design area distances are horizontal.

Figure 5.2 – Location of spray sprinklers in sloping roofs

6 WATER SUPPLY

6.1 Method

The design flow and design pressure (system demand) shall be calculated in accordance with table 6.1 using the procedures set out in section 7.

Table 6.1 – Water supply design flow and design pressure

Areas where residential sprinklers are used (rooms other than basements and vehicle garages)	
No. of sprinklers in room	**Basis of calculation**
1	1 sprinkler operating at the listed pressure
More than 1	2 sprinklers operating at the listed pressure
Areas where quick response or standard response sprinklers are used	
No. of sprinklers in room	**Basis of calculation**
1	1 sprinkler at the minimum pressure required by 5.3.2
More than 1	2 sprinklers at the minimum pressure required by 5.3.2

NOTE –

(1) The basis for system demand calculation is according to the number of sprinklers in the room. For roofs, ceilings, and underfloor spaces (not used for storage), where more than 1 sprinkler is present, the basis for calculation is 2 sprinklers operating at the minimum pressure required by 5.3.2.

(2) For the purposes of determining water supply requirements, 'room' shall mean a space enclosed by walls, ceiling or roof, floor, and a door lintel at least 200 mm deep. Where any space does not fulfil these criteria, the spaces on either side of the doorway are part of the same room.

6.2 Interpolation and extrapolation of listed data

Listed data for sprinklers shall not be interpolated between or extrapolated beyond the values provided.

6.3 Design flows

The design flows are defined as the water flow calculated in accordance with table 6.1 appropriate to the area concerned.

6.4 Design pressures

The design pressures are defined as the pressures required at the reference point to produce the design flows for the appropriate areas when calculated in accordance with section 7.

6.5 Water supply

6.5.1 General

6.5.1.1

Each sprinkler system shall have at least one water supply which is automatically available on sprinkler activation. The water supply may be from:

(a) A reticulated supply;

(b) A pump taking water from a tank, stream, pond, or a reticulated supply;

(c) An elevated tank or reservoir; or

(d) A gas pressurised storage tank.

NOTE – In the case of pumps, a reliable priming connection will be required if the pump suction pipe inlet is below the centreline of the pump. It is essential to protect the pump from sediment and debris by use of suitable debris screens.

6.5.1.2

Water supplied to sprinkler systems shall be free from particulate or dissolved matter that could adversely affect any part of the system.

6.5.1.3

The water supply shall be able to maintain the design flow at the design pressure for at least 10 minutes.

6.5.1.4

The water supply pipework to the protected house shall:

(a) Be in sound condition, adequately buried or protected against freezing, impact damage, subsidence, corrosion, and malicious damage;

(b) Be no smaller than 19 mm ID;

(c) Have every valve which controls the supply of water to the sprinkler system labelled to indicate the direction of closing and be affixed with a label bearing the embossed or engraved words 'FIRE SPRINKLER SUPPLY – CLOSURE WILL REMOVE SPRINKLER PROTECTION'.

6.5.1.5

The water supply shall be designed so that either:

(a) The water supply downstream of any meter is capable of simultaneously supplying the design flow and pressure requirements of the sprinkler system plus an additional 12 L/min. Exceptional demands from, for instance, lawn sprinklers and hose reels, shall be added to the design flow; or

(b) There is installed a listed automatic pressure sustaining valve, or listed domestic priority valve, with adequate fittings for testing and demonstrating its correct function. The valve shall cause the restriction or shut off of the domestic water supply so as to maintain the design pressure required for the sprinkler system (see figure 6.1).

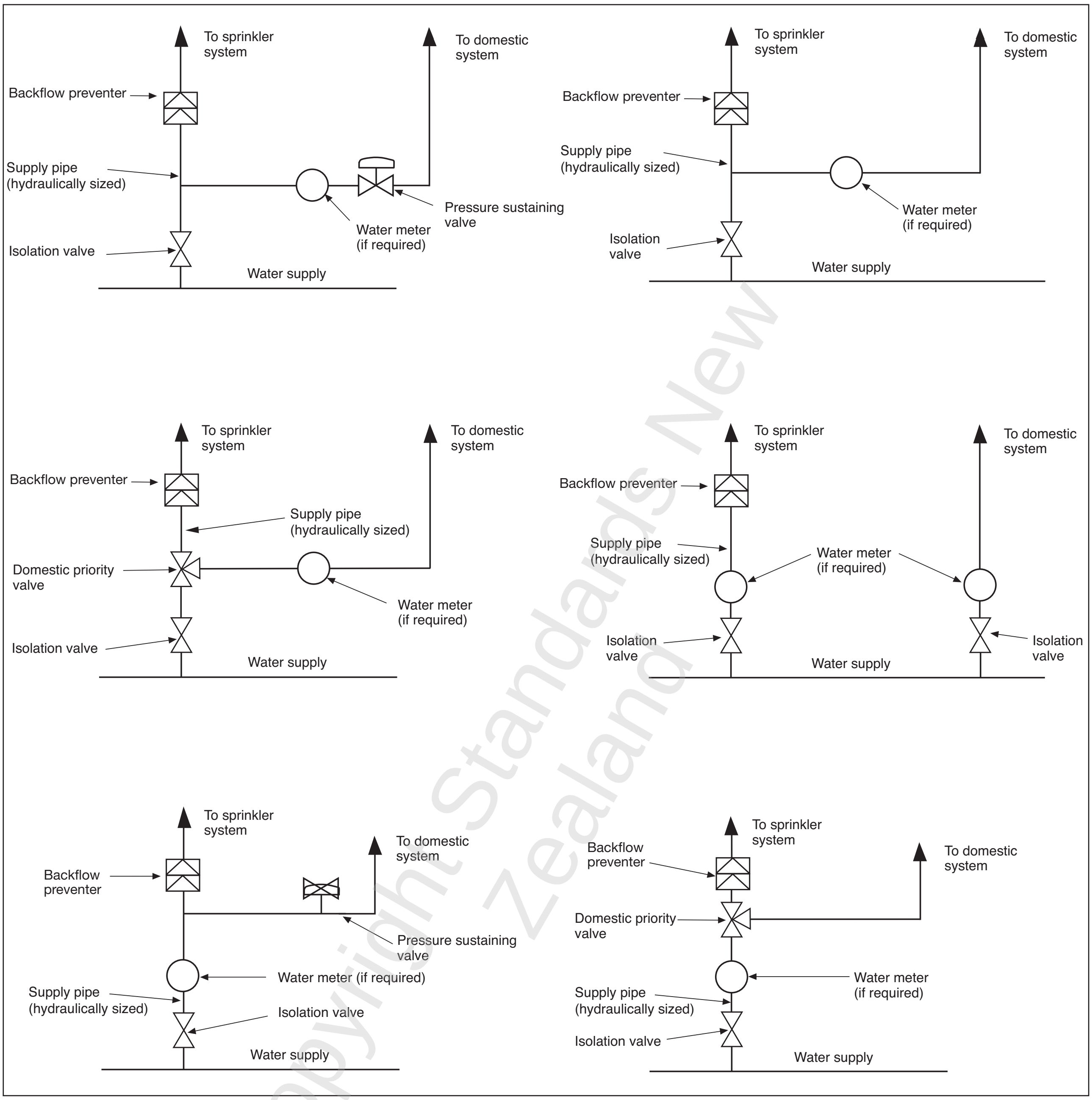


Figure 6.1 – Examples of reticulated water supply arrangements for independent systems

6.5.1.6

The flow and pressure characteristics of the reticulated water supply shall be determined. The pressure at the point of supply should be determined after consultation with the water supply authority. The design shall be based on 80% of this pressure. The 80% must be included whether Appendix D or the water supply authority is used to establish the water supply characteristics.

NOTE –

(1) The flow and pressure characteristics may be provided by the water supply authority or established by the method in Appendix D.

(2) A 20 mm water meter is not expected to be capable of supplying the sprinkler demand.

The flow and pressure characteristics of other water supplies shall be established by flow test, pump curve, or calculation.

NOTE – Alternative water supplies are not required to be derated.

C6.5.1.6

Many reticulated water supplies experience significant fluctuations in the inherent water pressure within the system and at the point of supply, both diurnal (between day and night) and seasonal (between winter and summer). For fire sprinkler systems to be connected to a reticulated supply the water supply authority should be consulted in order for the designer to determine the appropriate design pressure and flow at the point of supply, taking into account diurnal and seasonal pressure fluctuations.

6.5.1.7

Where flow meters are installed or specified to be installed in either the water supply connection or any part of the internal pipe system, then reference shall be made to the flow meter manufacturer's data to confirm the expected pressure drop through installation of the meter. This pressure drop shall be taken into account in the design of the system.

NOTE – Positive displacement flow meters, where specified, cause a considerable pressure drop which has to be considered for any potential application.

6.5.2 Backflow prevention

Backflow prevention is required for independent systems.

NOTE –

(1) In Acceptable Solution G12/AS1 of Compliance Document for New Zealand Building Code, Clause G12, sprinkler systems that do not contain hazardous or toxic antifreeze are included as a medium hazard. See Appendix C. A double check valve backflow preventer is suitable for medium hazard situations.

(2) Adding a plumbing fixture to induce regular flushing flow will effectively change an independent system (without antifreeze) into a combination system and a backflow preventer may be omitted.

C6.5.2

Regardless of the requirements of this Standard, the water supply authority may require backflow prevention to be provided where a combination system is installed.

6.6 Storage tank water supply

6.6.1 Storage tank capacity

6.6.1.1

Where a water supply incorporates a storage tank, the minimum capacity shall be:

(a) 10 minutes at the water supply design flow as required in table 6.1; and

(b) According to 6.5.1.5, for any domestic supply requirements that apply to the system.

6.6.1.2

Where a storage tank provides water for domestic and fire sprinkler service, and the sprinkler reticulation is independent of the domestic reticulation, it is recommended that the domestic take-off is above the volume dedicated for the sprinkler system.

6.6.2 Refilling and topping up

6.6.2.1

Provision shall be made to keep water supply tanks topped up.

6.6.2.2

Tanks should be fitted with a water level indicator.

6.6.2.3

Where rainwater or other unfiltered water is used to top up or refill, it shall first pass through a debris and sludge trap.

6.6.2.4

Where conditions may cause the water to freeze, the tank, together with the inlet and suction pipes and level indicator, if fitted, shall be protected to prevent freezing.

6.6.2.5

The following requirements apply for suction pipes:

(a) A lockable stop valve fitted with an open and shut indicator, chained and padlocked open, shall be located in the suction pipe upstream of any flexible coupling; and

(b) Provision shall be made to accommodate differential settlement and seismic movement between the tank and pump, and between tanks that are interconnected.

6.6.3 Pumped supplies – pump units

6.6.3.1

The sprinkler pump shall be selected to demonstrate 110% of the necessary design pressure at the highest design flow. It is recommended that the end of the pump curve be at least 150% of the highest design flow.

6.6.3.2

Automatic starting shall be provided. Every time a drop in pressure closes the contacts of a start pressure switch, the pump, if it is not already running, shall start. Automatic pump stopping may be provided. Provisions shall be made to ensure that frequent cyclic pump starts and stops do not occur in cases of low flow, such as may occur if the pump also provides a domestic demand.

6.6.3.3

Where the pump is mains powered, the power supply to the motor should be taken directly from the main switchboard, by a dedicated circuit.

DC powered pumps should have a means to keep the battery supply topped up, such as an appropriately rated solar panel or similar.

6.6.3.4

Every switch controlling the pump shall be indelibly labelled 'SPRINKLER FIRE PUMP – DO NOT SWITCH OFF' in white letters on a red background.

6.6.3.5

The pump enclosure shall be of sufficient size to allow free access for testing and maintenance of all equipment kept in it.

7 HYDRAULIC CALCULATIONS

7.1 General

Pipe diameters shall enable the available water supply characteristics to satisfy the demand requirements set out in section 6. Hydraulic calculations shall be carried out using the Hazen-Williams formula. A method for hydraulic calculations is set out in Appendix E and a worked example is provided in Appendix F.

C7.1

Since NZS 4517 was originally published in 2002, a review of existing systems has shown that one of the most common errors in design and installation occurs because of pipe diameter nomenclature.

Traditionally, sprinkler systems have been installed using either steel pipe or CPVC plastic pipe. These pipes are specified by nominal bore, with the internal pipe diameter exceeding the specified bore.

Traditional plumbing pipes are usually specified as outside diameter. The nominal size (nominal outside diameter) can be significantly greater than the actual bore (inside diameter).

Designers of sprinkler systems for houses are urged to ensure that the minimum pipe specification used in their design is clearly communicated to those installing these systems.

7.2 Water meters

Where the water supply authority has committed to installation of water meters, consideration of the altered hydraulic characteristics post meter installation shall be taken into account in the design of the sprinkler system.

C7.2

A common design error is failing to account for the maximum flows and pressure losses through water meters. The requirements of the sprinkler design must be taken into account when selecting the water meter size, which in some cases may be one size larger than the incoming pipe.

7.3 General calculation methods

7.3.1

In determining the most hydraulically disadvantaged sprinkler, the following shall be taken into account:

(a) Pipe length and number of pipe fittings from the reference point;

(b) Pipe diameters;

(c) Sprinkler listed requirements;

(d) Number of sprinklers in operation; and

(e) Elevation of the sprinklers.

7.3.2 Domestic demands

When 6.5.1.5 requires that the water supply is capable of meeting a simultaneous domestic and fire sprinkler demand, then this demand shall be allowed for at the most remote point of domestic draw-off. For combination systems, this shall be at the hydraulically most remote domestic branch connection. For independent systems, this shall be at the branch connection between the sprinkler system and the domestic system, see figure 7.1.

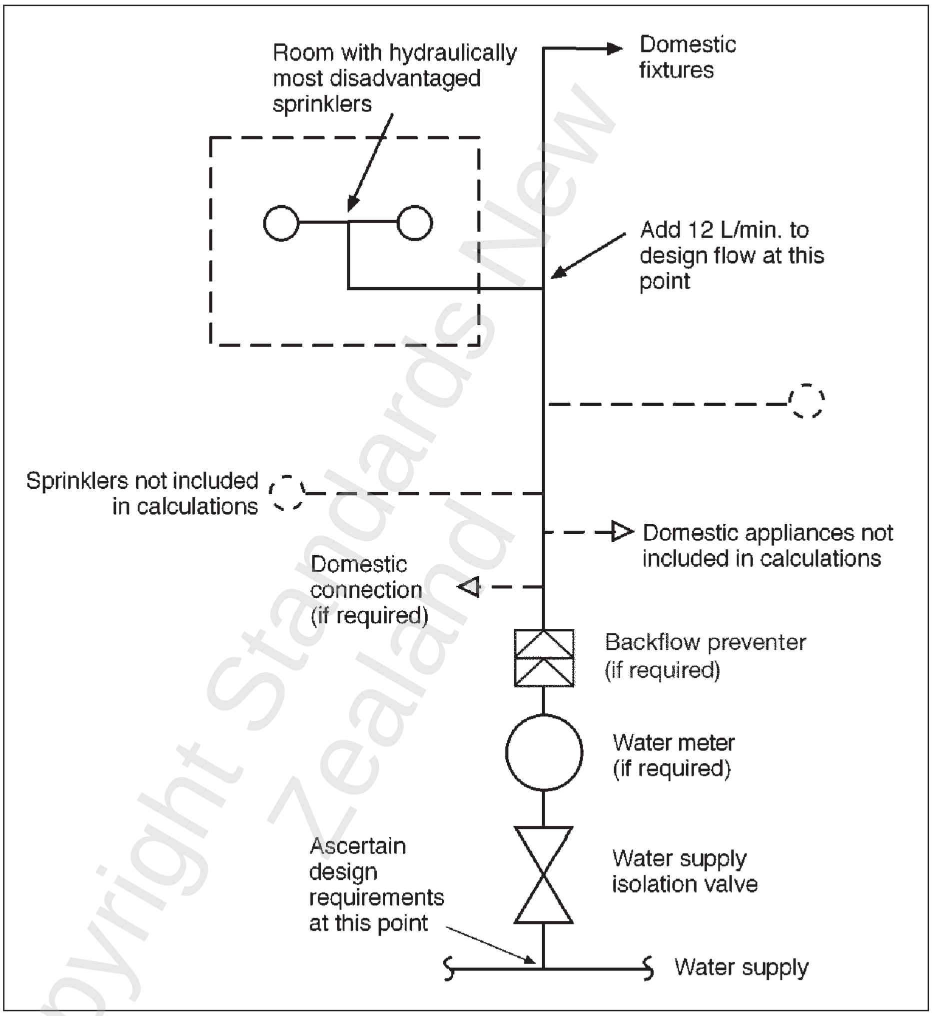


Figure 7.1 – Calculation of hydraulic demands

7.3.3 Listed residential sprinklers

Calculations shall be provided to identify the flow and pressure required at the reference point for operation of the most hydraulically disadvantaged single sprinkler or, where rooms contain two or more sprinklers, multiple sprinklers.

NOTE – For the purposes of determining water supply requirements, a 'room' means a space enclosed by walls, ceiling or roof, floor, and a door lintel at least 200 mm deep. Where any space does not fulfil these criteria the spaces on either side of the doorway form part of the same room for this Standard.

The following calculation procedure applies:

(a) Identify the most hydraulically disadvantaged sprinkler(s);

(b) Establish the number of sprinklers (1 or 2) to be considered in accordance with table 6.1;

(c) Determine the minimum pressure and flow for the sprinklers from the listed criteria;

(d) Starting with the most hydraulically disadvantaged sprinkler, calculate the total flow from the number of sprinklers assumed to be in operation, and establish the pressure required at the reference point;

(e) If the calculations show that the water supply characteristic is insufficient for the demand, then the pipe sizes or arrangements shall be adjusted and the calculations repeated.

7.3.4 Sprinklers other than residential type

Where sprinklers other than residential type are required, an additional calculation to that described in 7.3.3 is necessary, as follows:

(a) Determine the number of sprinklers (1 or 2) considered to be in operation in the room or space as defined in table 6.1;

(b) Consider the discharge at the minimum pressure appropriate to the sprinkler (see table 5.2);

(c) Starting at the most hydraulically disadvantaged sprinkler calculate the total flow from the number of sprinklers considered to be in operation and establish the pressure required at the reference point;

(d) If the calculations show that the water supply is insufficient for the demand, then the pipe sizes or arrangements shall be adjusted and the calculations repeated.

8 COMMISSIONING AND INSPECTION

8.1 Commissioning

The installing contractor shall perform the following:

(a) Completely flush all mains and lead-in connections to system risers before connection is made to sprinkler piping;

(b) Test the completed system, including sprinklers, hydrostatically at a pressure of 1,500 kPa for 15 minutes;

(c) Rectify the cause of any drop in gauge pressure or visual evidence of leakage;

(d) Establish water supply characteristics and conduct verification flow tests (see Appendix G). This becomes the benchmark flow test for future comparisons;

(e) Confirm that the installed sprinklers provide adequate coverage, are clear of any obstructions, and are installed as per the manufacturer's listed data; and

NOTE – A final check for adequate coverage should be made after the installation of fittings, furniture, and such like.

(f) Ensure the correct installation and function of all systems or components critical to the correct functioning of the sprinkler system.

NOTE – This may include automatic warning and monitoring systems, pumps, and pressure control valves.

8.2 Final inspection

A final inspection shall be carried out. See Appendix A for a typical checklist which can be used for this purpose.

9 HOUSE OWNER DOCUMENTATION

The following documentation shall be provided in a durable form to the house owner and placed in a permanent holder located in a convenient position (for example, adjacent to the spare sprinklers):

(a) Final inspection checklist (see Appendix A);

(b) Sprinkler system declaration (design and construction) (see Appendix H);

(c) A copy of the as-built drawings and design documentation (see Appendix J);

(d) Identification of type and manufacturer of sprinkler, including manufacturer's data sheet for each type of sprinkler (see 4.4);

(e) A copy of the maintenance instructions including details of routine testing and maintenance to be carried out (see Appendix K); and

(f) An owner's guide (see Appendix L).

See Appendix M for guidelines on documentation for other parties having an interest in ensuring that the end product complies with the Standard.

APPENDIX A – FINAL INSPECTION CHECKLIST

(Informative)

NAME	
ADDRESS	
DATE AND TIME	

NOTE – All section and clause references are to NZS 4517:2010

Extent of protection (2)

Areas not required to be protected. Confirm areas and conformance with NZS 4517:2010, below (under 'acceptable omissions'), or annotate in space provided here:

Acceptable omissions (2.2)

Tick one			Are there any unprotected –
Yes	No	N/A	Cupboards and wardrobes (less than 5 m^2)?
Yes	No	N/A	Concealed ceiling and roof spaces?
Yes	No	N/A	Concealed floor spaces?
Yes	No	N/A	Toilets and bathrooms?
Yes	No	N/A	Pantries and linen cupboards?
Yes	No	N/A	Open external porches, balconies?
Yes	No	N/A	Detached or fire-separated garages or other buildings not intended for sleeping purposes?
Yes	No	N/A	Architectural features (such as bay windows, and so on) less than 5 m^2?
Yes	No	N/A	Areas of otherwise protected rooms because of door swings (less than 5 m^2 combined with adjacent door swing areas)?

Smoke detectors (1.1.1 NOTE)

Tick one		
Yes	No	Are smoke detectors installed?
Yes	No	Are there other warning or detection systems, for example, flow switches?

Type of system (3)

Tick one		Reference	
Yes	No	3.1.1	Is this an independent system (as in figure 3.1)?
Yes	No	3.1.2	Is this a combination system (as in figure 3.2)?
Yes	No	6.5.2	Is backflow prevention required?
Yes	No	3.1.1	Is freezing a risk? What protective/preventive measures are in place?
Yes	No	4.1	Are there preventive measures for over pressurisation?

System components (4)
Pipework (4.2)

Tick one		Reference	
Yes	No	4.2	Do the pipe specifications comply with NZS 4517?
Yes	No	4.2.1.3	Is the incoming pipe size 19 mm ID or greater?

Flow test facilities (4.3)

Tick one			Reference	
Yes	No		4.3.1.1	Have the water pressure gauge and flow test valve been installed?
Yes	No		4.3.1.2	Are water pressure gauge(s) downstream of any check valves, meters or flow alarms?
Yes	No		4.3.1.3	Are the pressure gauges 65 mm or greater?
Yes	No		4.3.1.2	Will the system discharge to a suitable and safe location?
Yes	No		6.5.1.4(c)	Is the main stop valve secure and clearly identified?

Sprinkler type (4.4)

Input sprinkler details:	*Max distance / sprinkler*	*Make*	*Model*	*Temperature*

Tick one			Reference	
Yes	No	N/A	4.4	Are the installed sprinklers the same as those on the design plans?
Yes	No	N/A	4.5	Are two spare sprinklers for each type installed present?
Yes	No	N/A	4.5	Is there a suitable sprinkler spanner present?
Yes	No	N/A	4.5	Are these items in a suitable rack or labelled cabinet?

Location of sprinklers (5)

Tick one		Reference	
Yes	No	5.2	Do the sprinklers as installed comply with the manufacturer's listing?
Yes	No	App M	Is the data sheet attached for records?

Water supply (6) and hydraulic calculations (7)

Tick one			Reference	***Have hydraulic calculations been supplied for:***
Yes	No	N/A	7.3.3	One residential sprinkler operating at listed pressure for the most hydraulically remote room with a single sprinkler?
Yes	No	N/A	7.3.3	Two residential sprinklers operating at listed pressure for the most hydraulically remote room with more than one sprinkler?
Yes	No	N/A	7.3.4	One non-residential sprinkler operating at listed pressure for most hydraulically remote room with a non residential single sprinkler?
Yes	No	N/A	7.3.4	Two non-residential sprinklers operating at listed pressure for the most hydraulically remote room with more than one non-residential sprinkler?
Yes	No		App E3	Have the correct *K* factors been used in the calculations?
Yes	No		App E2	Has the minimum pressure at the sprinkler been checked?
Yes	No		8.2	Have the pipe sizes, lengths, fittings, and locations been inspected on site against plans and calculations?
Yes	No	N/A	6.5.1.5(a)	Are calculations included for an additional 12 L/min?
Yes	No		6.5.1.5(b)	Is a listed pressure sustaining valve or listed domestic priority valve installed?
Yes	No	N/A	6.5.1.6	Is there sufficient flow and pressure available when the pressure is derated to 80%?
Yes	No		App D	Have the flow characteristics also been reviewed against the requirements of Appendix D?

➤

Available water supply (6.5)				
Tick one			**Reference**	***Is the water supply one of the following?***
Yes	No		6.5.1.1(a)	A reticulated supply?
Yes	No		6.5.1.1(b)	A pump taking water from a tank system, stream, pond, or reticulated supply?
Yes	No		6.5.1.1(c)	An elevated tank or reservoir?
Yes	No		6.5.1.1(d)	A gas pressurised storage tank?
Yes	No	N/A	6.5.1.4(b)	From a pipe of 19 mm ID or greater?
Yes	No		–	Are there any risks identified with these supplies? (If yes, list below)
Risks:				
Yes	No	N/A	6.5.1.3	Can the water supply be maintained for 10 minutes minimum?
Yes	No	N/A	6.5.1.4 (c)	Is the water supply piped to the house labelled 'Fire Sprinkler Supply – Closure Will Remove Sprinkler Protection'?
Verification flow test (Appendix G)				
Yes	No		App G	Has the verification flow test been completed?
Yes	No		App G	Is the result acceptable when compared to the design flow?
Documentation (9)				
Tick one			**Reference**	
Yes	No		9	Has documentation been provided to the owner (including this checklist when completed)?
Additional comments and systems information				

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APPENDIX B – ADDITIONAL PROTECTION

(Informative)

Features to provide additional protection may include:

(a) The provision of a water flow alarm connected to the New Zealand Fire Service or a private security company monitoring equipment;

(b) Protection of areas of the house where sprinkler protection is not mandated by this Standard;

NOTE – Protection of concealed ceiling spaces is highly recommended in older houses particularly where chimneys pass through such spaces.

(c) Provision of external drenchers to protect against exposure to fires from adjacent houses or external fire loads;

(d) Enhanced water supplies, including an increase in minimum water storage volumes, and independence from any electrical supply.

APPENDIX C – INDEPENDENT ANTIFREEZE SYSTEMS

(Normative)

C1

An independent antifreeze system, if required, shall be a system in which the whole or part of the system downstream of the installation control valves is charged with antifreeze solution complying with table C1. No toxic antifreeze materials shall be permitted.

NOTE –

(1) The antifreeze design temperature must be 10°C lower than the expected lowest external temperature.

(2) Thoroughly premix antifreeze mixtures before putting them into the sprinkler system pipework.

(3) For additional design guidance on antifreeze systems refer to NFPA 13, chapter 7, section 6 antifreeze systems.

C2

Antifreeze shall be compatible with the materials of the piping systems.

NOTE – For example, propylene glycol solutions are not compatible with CPVC pipe systems.

Table C1 – Antifreeze solutions

Material	Solution concentration	Density at 15.6°C	Freezing point (°C)	Scale
Glycerine (1)	50% water (v/v) 40% water (v/v) 30% water (v/v)	1.133 1.151 1.165	–26.1 –30.0 –40.0	Hydrometer scale 1.000 to 1.200
Propylene glycol	70% water (v/v) 60% water (v/v) 50% water (v/v) 40% water (v/v)	1.027 1.034 1.041 1.045	–12.8 –21.1 –32.2 –51.1	Hydrometer scale 1.000 to 1.120 (Subdivisions 0.002)
Diethylene glycol	50% water (v/v) 45% water (v/v) 40% water (v/v)	1.078 1.081 1.086	–25.0 –32.8 –41.1	Hydrometer scale 1.000 to 1.120 (Subdivisions 0.002)
Ethylene glycol	61% water (v/v) 56% water (v/v) 51% water (v/v) 47% water (v/v)	1.056 1.063 1.069 1.073	–23.3 –28.9 –34.4 –40.0	Hydrometer scale 1.000 to 1.120 (Subdivisions 0.002)

NOTE –

(1) Glycerine to be not less than 96.5% purity.

(2) Previous editions of this Standard allowed the use of calcium chloride-based antifreeze solutions. Installations installed to such superseded Standards shall be maintained with solution concentrations as specified by those Standards.

C3

In independent antifreeze systems, installation control valves and fittings, and the water supply shall be protected against freezing. Backflow prevention is required in accordance with the Compliance Document for the New Zealand Building Code, Clause G12.

C4

An expansion chamber of appropriate size, precharged with air pressure, shall be fitted to compensate for thermal expansion of the antifreeze solution.

NOTE – Refer to A 7.6.3.2 of NFPA 13.

C5

Where the entire installation is filled with antifreeze, the installation shall comply with the requirements of figure C1.

NOTE – If a reduced pressure zone (RPZ) type of backflow preventer is fitted, the pressure relief valve vent drain is to be piped to a suitable location.

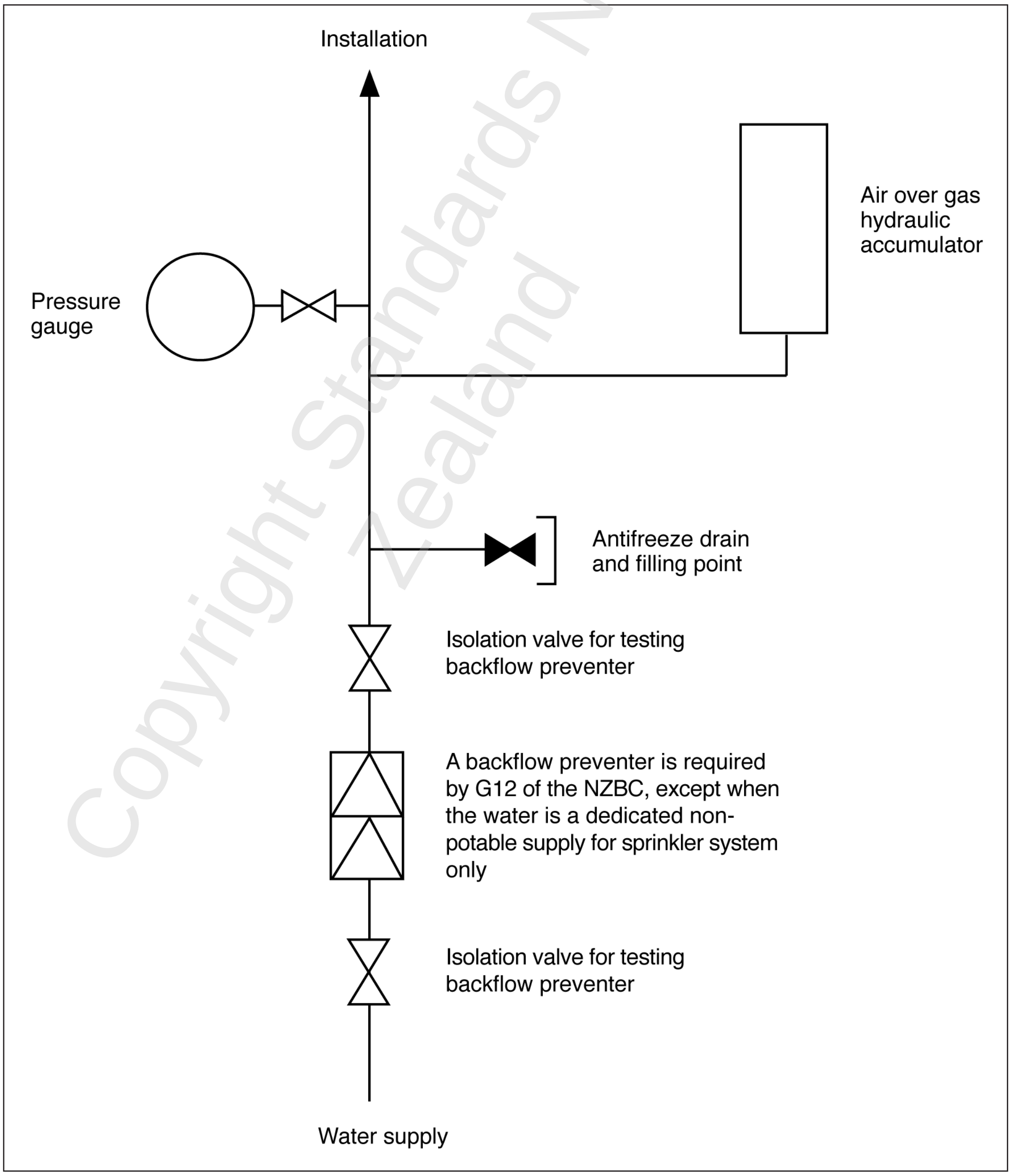

Figure C1 – Required components for antifreeze installation control valves

C6

Sections of independent systems may be protected from freezing by means of tail-end antifreeze systems which shall be in the form shown in figure C2.

NOTE – Dimensions typical for small systems of up to 12 sprinklers. A larger system may require a larger volume expansion pipe.

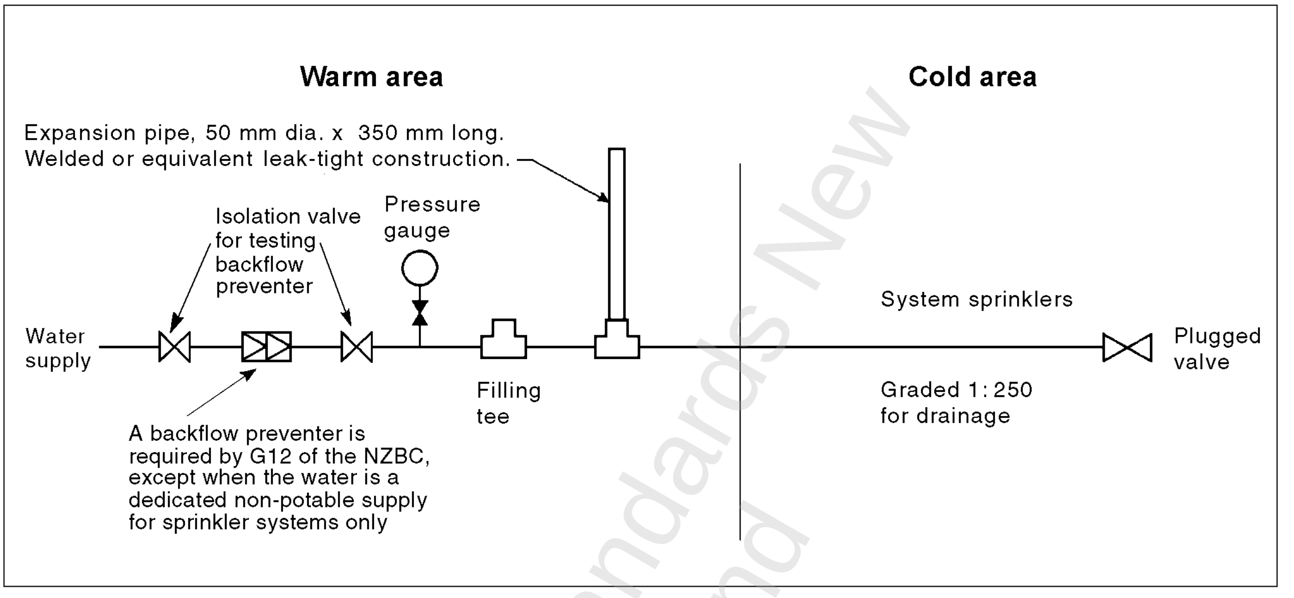

Figure C2 – Small, tail-end, antifreeze systems

C7

Pipes filled with antifreeze shall be sloped to drain. Roof space sprinklers and external sprinklers on pipes filled with antifreeze shall be installed upright.

C8

For reliable performance, the antifreeze mixture should be drained from the system and checked annually.

APPENDIX D – TESTING OF RETICULATED WATER SUPPLY

(Informative)

D1

Suitable arrangements for the test should be made with the water supply authority before the test. The water supply authority requirements should be observed during the test. Hydrants should be opened and closed slowly to avoid possible damage through water hammer.

D2

The flow and pressure characteristics of the reticulated water supply are determined using a flow gauge and pressure gauge attached by independent connections as close together as practicable, each going directly to the reticulated water supply. Normally two adjacent fire hydrants will provide the points of attachment.

NOTE –

(1) Ensure that the design of sprinkler hydraulics is based upon an actual water supply pressure determined in consultation with the water supply authority.

(2) Where diurnal and seasonal pressure fluctuations could be significant then these should be taken into account in establishing the pressure characteristics.

D3

The test should be made at periods of most adverse supply conditions. These will be either periods of maximum daily draw-off or periods of minimum supply pressure, for example, if the supplier reduces pressure overnight. The flow gauge is placed for the direction of water flow when the test is being conducted to give the lower reading on the pressure gauge. This is important for a reticulated water supply that is fed from one end only.

D4

Values of pressure and flow are recorded at not less than two and preferably three flow rates, with one being between two and three times the maximum design flow. Pressure is plotted to a suitable scale on the vertical axis (y-axis) and the 1.85 power of the flow on the horizontal axis (x-axis). The line relating pressure and flow (line A) should be drawn (see figure D1).

D5

An adjustment is made to all test pressure readings to allow for the difference in height between the proposed reference point and the pressure gauge. The difference (calculated at 1 m = 10 kPa) should be marked on the y-axis of the graph above or below line A (as applicable). Line B is now drawn through this point parallel to line A.

D6

A further adjustment is now made, using the Hazen-Williams formula and the pipe diameter(s) and length(s), to allow for frictional pressure loss in all pipework from the reticulated water supply test point up to the reference point.

This will include all reticulated water supply pipe from the pressure test point up to and including the domestic water supply toby valve, plus pipework between the toby valve and the reference point in the case of independent systems. Where the domestic supply is taken from a small diameter rider main, rather than the large diameter main being tested, the loss in the rider main must also be included.

This loss is calculated at the highest design flow, in accordance with Appendix E, and is plotted below line B at that flow. A new line (line C) is now drawn through this plotted point and the intersection of line B and the y-axis.

D7

The pressure available to meet the design requirements is taken as 80% of the pressure indicated by line C and is plotted as line D. Design pressures must be below line D for all design flows.

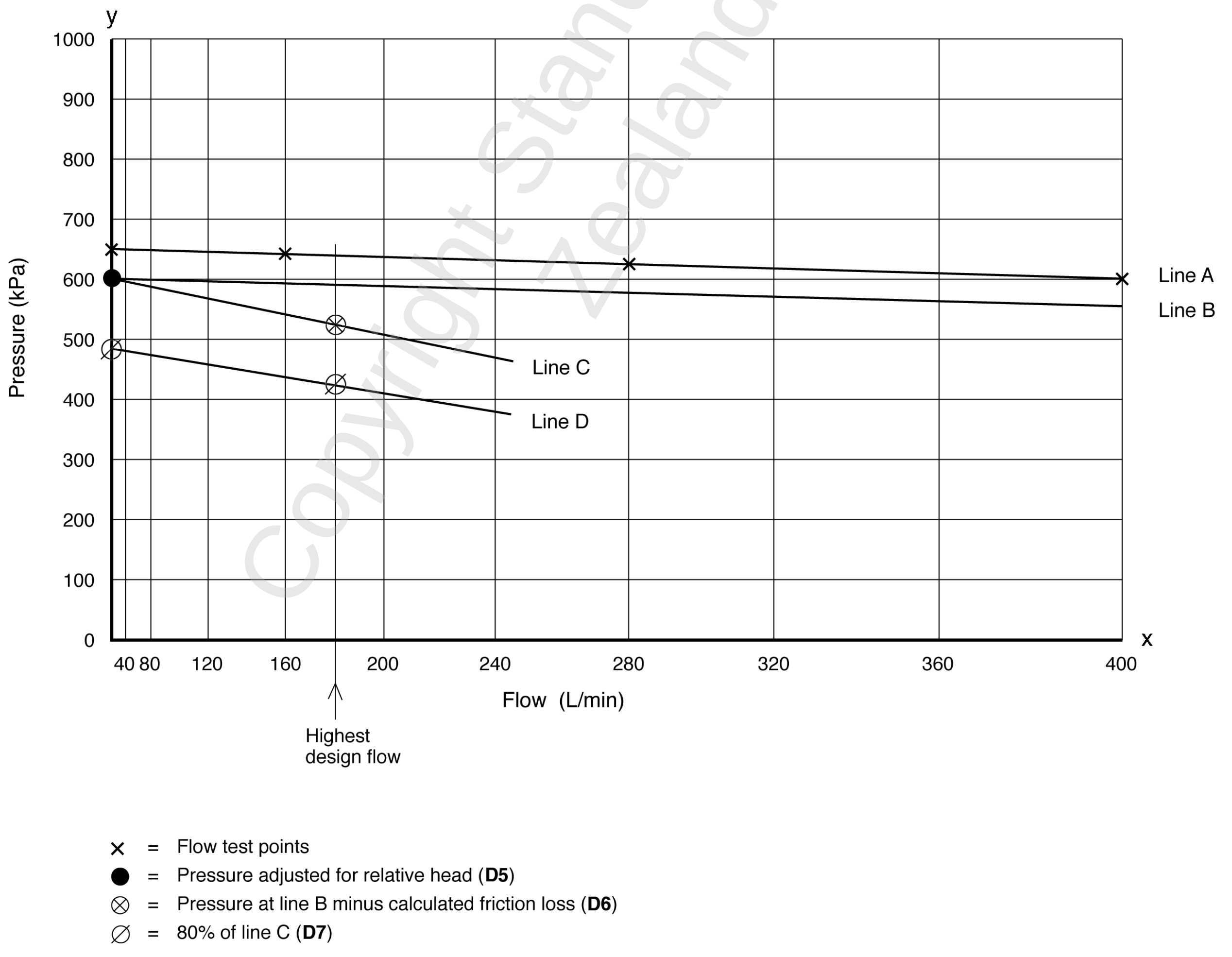

Figure D1 – Water supply flow graph

APPENDIX E – METHOD OF HYDRAULIC CALCULATION

(Normative)

E1 Accuracy

The following dimensions shall be expressed in the units and to the accuracy shown in table E1.

Table E1 – Calculation accuracy

Dimension	Unit	Accuracy
Length and elevations	m	nearest 0.1 m
Flow rate	L/min	nearest L/min
Pressure	kPa	nearest whole unit

E2 Checking that the available pressure is sufficient

Having established the location of the sprinklers, the layout, and dimensions of the proposed supply pipework, the available pressure at the reference point shall be checked to ensure it is sufficient.

To achieve this:

(a) Confirm the required pressure and flow for the sprinklers being used;

(b) Determine the most hydraulically remote area;

(c) Calculate the pressure loss at the flow rate of one sprinkler or two sprinklers from the reference point to the sprinklers located in the hydraulically remote area. This must take account of the following:

  (i) Static losses or gains due to elevation differences

  (ii) Friction losses due to bends

  (iii) Friction losses due to valves or other fittings

  (iv) Pipe friction losses;

(d) The sum of the losses derived from (c) above shall be added to the minimum required sprinkler pressure in order to give the design pressure required at the reference point (see 6.4);

(e) Determine the pressure losses at the flow rate of one sprinkler or two sprinklers in the case where multiple sprinklers are used from the town's main supply or from a pumped supply to the reference point. This must take into account the following;

  (i) Static losses or gains due to elevation differences

  (ii) Friction losses due to bends

  (iii) Friction losses due to valves, back flow preventers and other fittings

  (iv) Pipe friction losses;

(f) Subtract the sum of the pressure losses obtained in (e) above from the town's main supply or pumped supply at the design flow rate (one or two sprinkler flow) (see 6.3); this figure is the 'pressure available' at the reference point;

(g) The pressure available at the reference point obtained in (f) above must be greater that the pressure required at the reference point as obtained in (d) above.

E3 Calculation of discharge from a sprinkler

The discharge from a sprinkler shall be calculated using the following formula:

$$Q = K\sqrt{P}$$

where:

Q is the discharge from the sprinkler (L/min)
P is the pressure at entry to sprinkler orifice (kPa)
K is the constant having the values as shown in table E2.

Table E2 – Sprinkler *K* values

Nominal sprinkler size	*K* value
10 mm	5.7
15 mm	8.0
Residential sprinklers	As listed

E4 Required pressure and flow for residential sprinklers

The pressure required and the associated flow of residential sprinklers are available from the manufacturer's data or specification sheets. These are usually given in the form of tables listing the pressures and flows for area of sprinkler coverage.

E5 Most hydraulically disadvantaged sprinkler(s)

The sprinkler(s) is in the location for which the pressure loss will be the greatest because:

(a) Height above reference point;

(b) Distance from reference point;

(c) Number of fittings in the pipe run;

(d) Sprinkler flow.

To establish the location, examine the system and determine which sprinkler(s) is most disadvantaged. If there is any doubt then a calculation should be made for each of the likely candidates.

E6 Pressure loss in fittings and valves

Allow for loss of pressure from water flow through pipe elbows, tees, and bends where the direction of water flow is changed through an angle of 45° or more (other than the change of direction into a sprinkler or sprinkler assembly, or drop from an elbow or tee into which the sprinkler or sprinkler assembly is fitted) by adding an equivalent length for each such fitting to the actual length of pipe run. Equivalent lengths for fittings should be obtained from manufacturers' data sheets. In the absence of this data, Appendices F and N can be used for full bore fittings. Fittings that are inserted into the pipe reduce the pipe bore. The total equivalent length is then multiplied by the pressure loss per metre obtained from the Hazen-Williams formula, or the tables and graphs in Appendix N.

Table E3 – Typical hydraulic equivalent length factors for pipe fittings

	Equivalent pipe length (m)					
Maximum internal diameter of pipe (mm)	**20**	**25**	**30**	**40**	**50**	**60**
Tees (branches)	1.5	1.8	2.4	3.0	3.6	4.5
Tees (flow)	0.5	0.6	0.8	1.0	1.2	1.5
Elbows	0.9	1.1	1.4	1.8	2.2	2.7
Bends	0.5	0.5	0.7	0.9	1.1	1.4
Gate valves	0.2	0.2	0.3	0.4	0.5	0.6
NOTE – Where the pipe diameter is not shown in the table, the value for the next larger size shall be used.						

E7 Calculation of pressure loss in pipes

Pressure losses from water flow through pipes shall be determined using the Hazen-Williams formula, or the tables and graphs in Appendix M.

NOTE – Guidance on the Hazen-Williams calculation method is provided in NZS 4541.

$$P = \frac{0.605 \times Q^{1.85} \times 10^8}{C^{1.85} \times d^{4.87}}$$

where:

P is the loss of pressure per metre of pipe (kPa)
Q is the flow rate of water through the pipe (L/min)
d is the mean internal diameter (mm)
C is a constant for the type of pipe, for example,
Steel (black or galvanised) $C = 120$
Plastic and non-ferrous pipe $C = 150$
The constant for other types of pipe shall be as its listing.

Pressure losses for a single sprinkler, two sprinklers and single and/or two sprinklers plus the domestic load may need to be calculated using the appropriate pipe diameter.

Where there is a loop in the pipe layout, the pressure drop may be assessed based on the flow in each direction being half the inflow, and the pipe length being half the total effective hydraulic length of the loop. As a conservative estimate the pressure drop to any offtake from the loop may be assessed as 14% of the loss calculated using the Hazen-Williams formula for the full effective hydraulic length of the loop and the full flow rate of water.

E8 Calculation of static pressure

The static pressure equivalent of differences in height between sprinklers, and the reference point shall be taken as:

$P = h \times 10$

where:

P is the gain or loss due to sprinkler (kPa)

h is the difference in height between sprinklers and the reference point (m).

APPENDIX F – WORKED EXAMPLE

(Informative)

F1

This worked example has been prepared to demonstrate how to calculate the design requirement for a domestic sprinkler system. All fittings must be included in the design, including any water meters and valves if they are downstream of the design point. The reference point 'X' is chosen as the point where the water flow characteristics, such as available pressure at the total design flow, are known.

F2

The example design in figure F1 is for a single-floor house.

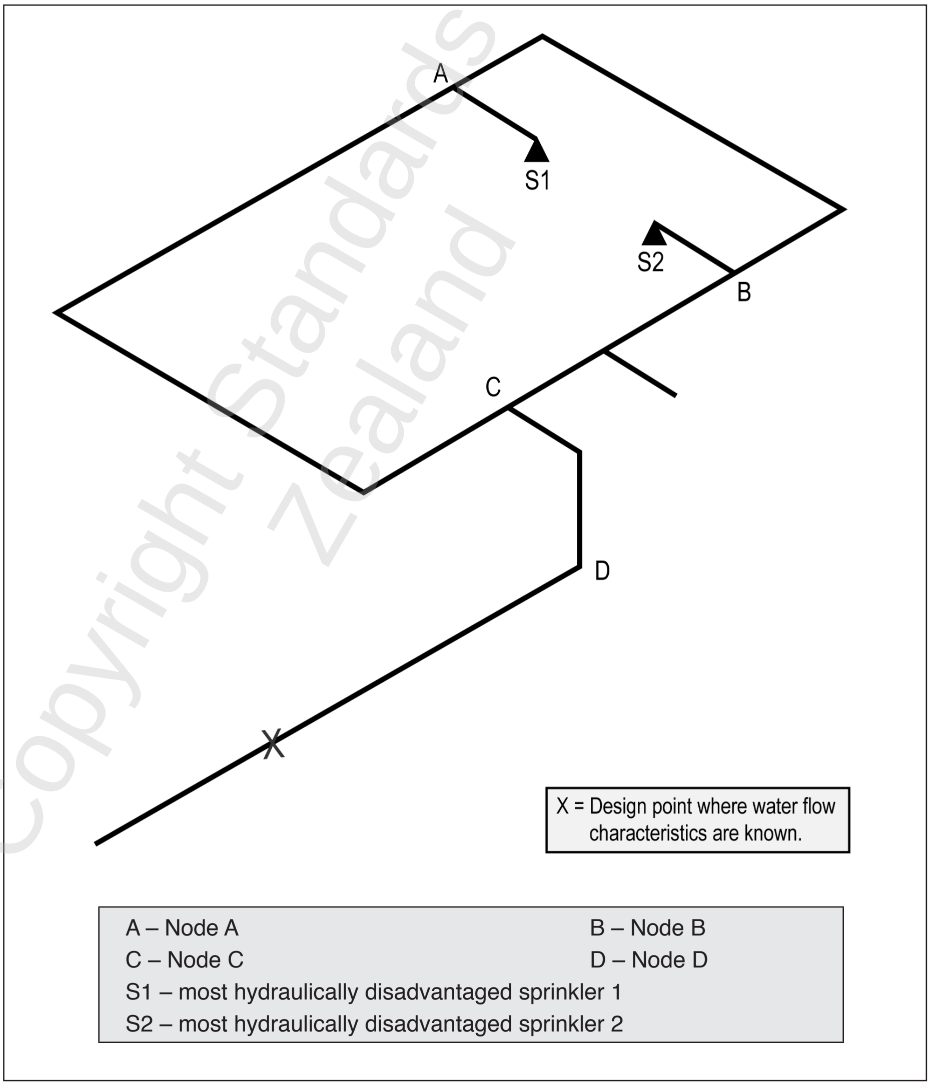

Figure F1 – Single floor house example design

A loop system is proposed with single pendant sprinklers in each of the bedrooms, study, and lounge, and two pendant sprinklers in the open plan area.

F3

Prepare a node diagram which shows the hydraulically relevant pipework for the most hydraulically disadvantaged sprinkler or sprinklers.

The proposed design uses the following lengths of pipe.

Section name	**Section number**	**DN** (mm)	**ID** (mm)	**Material**	**Length** (m)
S1-A	1	20	19	Copper	2.0
S2-B	2	20	19	Copper	2.0
Loop	3	25	25.35	Copper	59.3
C-D	4	25	25.35	Copper	4.3
D-X	5	40	32.3	PE80B	5.0

The system includes the following fittings.

Section name	**Section number**	**Elbows**	**Tees (branch)**	**Tees (flow)**
S1-A	1	0	1	0
S2-B	2	0	1	0
Loop	3	4	1	16 (not shown in figure F1)
C-D	4	2	1	0
D-X	5	0	0	0

The sprinklers are 3.0 m above the reference point.

The residential sprinklers to be used have the following specifications.

Sprinkler	**Coverage area**	**Pressure** (kPa)	**Flow** (L/min)
Pendant	3.7 m x 3.7 m	48	49.2
Pendant	4.9 m x 4.9 m	48	49.2

For the purposes of this example it is assumed that the sprinklers in the open plan area are the most hydraulically disadvantaged sprinklers. They have the longest pipe run from the loop, and because there are two in the room both can activate and therefore a two-flow calculation must be made. The hydraulic disadvantage is because of the two-flow design and distance from the loop, not distance from the supply. Located anywhere in the loop these two sprinklers would still be the most hydraulically disadvantaged. If there is any doubt about which sprinklers are the most disadvantaged, further calculations to check the required pressure will be necessary. Avoid unbalanced systems where, in a two sprinkler calculation the branch pipe lengths to each sprinkler are different.

F4 Calculating equivalent pipe lengths

Section S1-A – 20 mm copper (19 mm ID)

Fitting	**Number**	**Factor** (from table E3)	**Equivalent length** (m)
Tee (branch)	1	1.5	1.5
Tee (flow)	0	0.5	0.0
Elbow	0	0.9	0.0
Bends	0	0.5	0.0
Total equivalent pipe length of fittings			1.5
Length of pipe			2.0
Grand total equivalent pipe length			3.5
NOTE – For 19 mm in table E3, the higher value of 20 mm has been used.			

Section S2-B – 20 mm copper (19 mm ID)

Fitting	**Number**	**Factor** (from table E3)	**Equivalent length** (m)
Tee (branch)	1	1.5	1.5
Tee (flow)	0	0.5	0.0
Elbow	0	0.9	0.0
Bends	0	0.5	0.0
Total equivalent pipe length of fittings			1.5
Length of pipe			2.0
Grand total equivalent pipe length			3.5
NOTE – For 19 mm in table E3, the higher value of 20 mm has been used.			

Section Loop – 25 mm copper (25.4 mm ID)

Fitting	**Number**	**Factor** (from table E3)	**Equivalent length** (m)
Tee (branch)	1	2.4	2.4
Tee (flow)	16	0.8	12.8
Elbow	4	1.4	5.6
Bends	0	0.7	0.0
Total equivalent pipe length of fittings			20.8
Length of pipe			59.3
Grand total equivalent pipe length			80.1
For a loop, equivalent pipe length = equivalent pipe length x 0.14			11.2
NOTE – 25.35 mm falls between 25 mm and 30 mm in table E3, therefore the higher value has been used.			

Section C-D – 25 mm copper (25.4 mm ID)

Fitting	**Number**	**Factor** (from table E3)	**Equivalent length** (m)
Tee (branch)	1	2.4	2.4
Tee (flow)	0	0.8	0.0
Elbow	2	1.4	2.8

➤

Bends	0	0.7	0.0
Total equivalent pipe length of fittings			5.2
Length of pipe			4.3
Grand total equivalent pipe length			9.5
NOTE – 25.35 mm falls between 25 mm and 30 mm in table E3 therefore the higher value has been used.			

Section D-X – 40 mm PE80B (32.3 mm ID)

Fitting	**Number**	**Factor** (from table E3)	**Equivalent length** (m)
Tee (branch)	0	3.0	0.0
Tee (flow)	0	1.0	0.0
Elbow	0	1.8	0.0
Bends	0	0.9	0.0
Total equivalent pipe length of fittings			0.0
Length of pipe			5.0
Grand total equivalent pipe length			5.0
NOTE – 32.3 mm falls between 30 mm and 40 mm in table E3, therefore the higher value has been used.			

F5 Calculating dynamic loss

Total flow rate for the multiple sprinkler operation is 98.4 L/min plus the domestic load (taken as 12 L/min) is 110.4 L/min. This applies to the PE80B, 25 mm copper to the loop, and the loop.

Flow rate for branch S1-A to sidewall sprinkler is the single sprinkler flow, 49.2 L/min.

Section name	**Section number**	**Flow rate** (L/min)	**Pressure loss per metre** (kPa/m)	**Equivalent pipe length** (m)	**Dynamic pressure loss** (kPa)
S1-A	1	49.2	5.3	3.5	18.6
S2-B	2	49.2	5.3	3.5	18.6
Loop	3	110.4	5.6	11.2	62.7
C-D	4	110.4	5.6	9.5	53.2
D-X	5	110.4	1.5	5.0	7.5
Total dynamic pressure loss, kPa					142

In this calculation, only the pressure loss to one of the two active sprinklers is included because the total pressure loss to the other one will be the same. Where the pressure losses of the two active sprinklers are different, then the greater pressure loss is used and the lesser pressure loss discarded.

F6 Calculating static pressure loss

Using the formula given in E8, static loss = 3 x 10 = 30 kPa.

F7 Total pressure loss

There is no water meter proposed for this design. Available pressure at the reference point is 400 kPa.

For the most hydraulically disadvantaged sprinkler with multiple sprinkler operation:

Pressure loss	**kPa**
Dynamic loss	142*
Static loss	30
Meter loss	0
Total	172
Design pressure at reference point at total design flow of 110.4 L/min	400
Pressure available for sprinkler	228
*Value of pressure loss to the nearest 1 kPa.	

As the pressure required by the sprinkler is 48 kPa, the system design is satisfactory.

If the pressure available for the most hydraulically disadvantaged sprinkler is insufficient, then adjustments will need to be made to the design. Larger pipe diameters or different sprinklers may be necessary to limit pressure losses and make sufficient pressure available to operate the sprinklers.

APPENDIX G – VERIFICATION FLOW TEST

(Normative)

G1 General

The verification flow test shall be conducted during the commissioning process and following the pressure test.

G2 Apparatus

The apparatus shall consist of two test branches, a 100 L container which is graduated at 10 L intervals, a non-graduated 100 L container approximately (such as a wheelie bin), and a stop watch.

The test branches shall consist of a 25 mm threaded tube of about 1 m in length with a quarter turn valve inserted. At one end of the threaded tube, a 25 mm female to 15 mm female socket is attached, into which can be screwed a sprinkler of the same type as that installed in the system; at the other end is a 15 mm male to 25 mm female socket. The sprinkler has the glass bulb and deflector removed. Figure G1 shows the test branch.

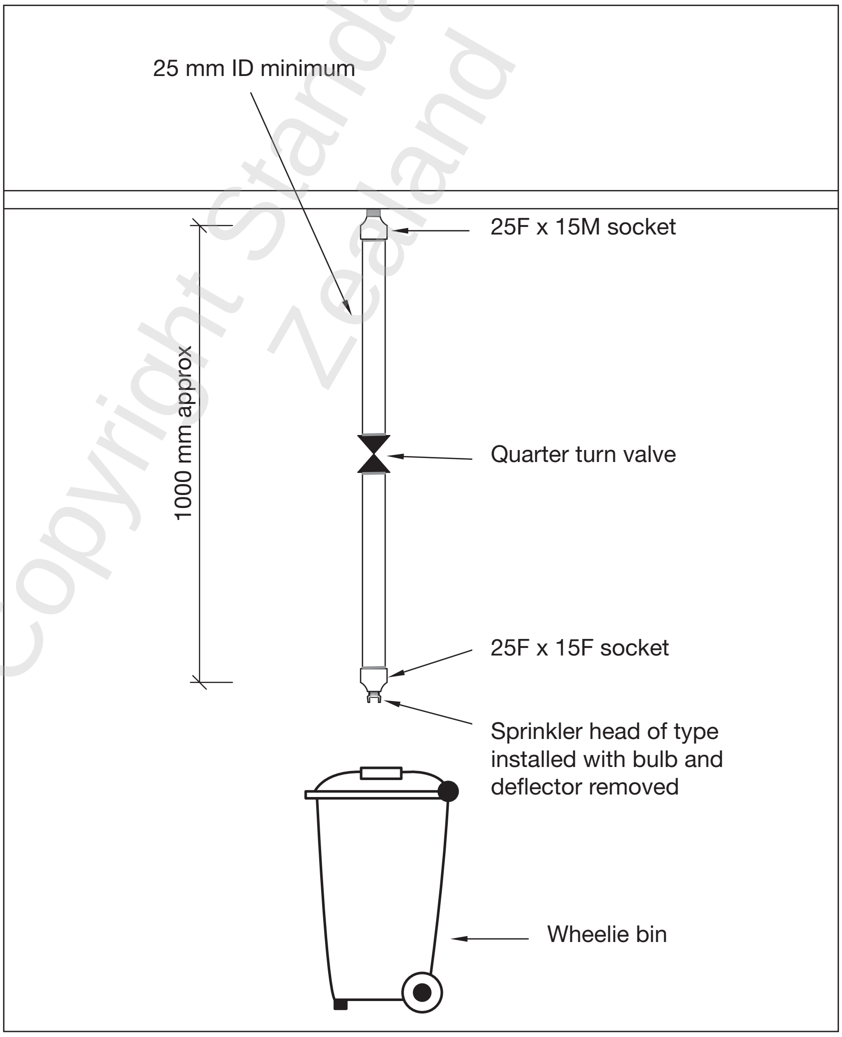

Figure G1 – Test branch

G3 Method

Step 1.
Screw the test branch into the outlet nominated as the most hydraulically disadvantaged sprinkler. If the system has been designed with multiple sprinklers flowing, the test needs to flow from two outlets concurrently and thus the second test branch is screwed into the other sprinkler outlet.

Step 2.
Charge the system with water. When the system is fully charged and there is no water flowing, note the static pressure indicated on the installed system pressure gauge. The system should be charged slowly to avoid a false reading due to surge.

Step 3.
Position the container(s) beneath the branches, with the graduated container placed under the outlet which was nominated as the primary most disadvantaged sprinkler.

Step 4.
Open the valve(s) and note the time it takes to fill the graduated container to a convenient level. This could be 50 L, 60 L, or 100 L, provided the quantity of water is known. While the water is flowing, note the pressure indicated on the system pressure gauge installed at the reference point.

Step 5.
Calculate the flow rate using the following formula:

$$Q = \frac{60 \times V}{t}$$

where

Q is the flow rate in L/min

V is the volume of water collected in litres

t is the time taken to collect the given volume in seconds.

Step 6.
Check that the tested flow rate is equal to or exceeds the flow rate as published in the manufacturer's listing plus the domestic demand as specified in the design (for example, 12 litres per minute)

Step 7.

On completion of the verification test, fully open the flow test valve and allow water to flow. Record the pressure while the water is flowing. This pressure is the system reference pressure.

G4 Recording of verification flow tests

Mark the following points on a $Q^{1.85}$ abscissa graph (see example in figure G2):

(a) Sprinkler design points (each of the calculated design flow and design pressure requirements;

(b) The static water supply pressure at the reference point (point ‘A’);

(c) The pressure recorded at the reference point when carrying out the verification flow test (see figure G1) (point ‘B’). Figure G1 demonstrates how to establish the flow, and the pressure for point B is the pressure at the control valves during the verification flow;

(d) The minimum acceptable static (no flow) water pressure. This is the recorded static pressure minus the difference between the maximum design point required pressure and the value of the pressure indicated on the water supply characteristic line at the design point flow (point ‘C’) (see also figure J1);

(e) A straight line drawn from the static water supply pressure (point A) through Point B to the end of the graph. This is the water supply characteristic line;

(f) The flow test valve water pressure at the reference point (point ‘D’). With the flow test valve open, record the pressure at the reference point. Mark on the water supply characteristic line the intersection (Point D) with the recorded pressure. Draw a straight line from zero,zero intersecting through point D. This is the flow test valve characteristic line.

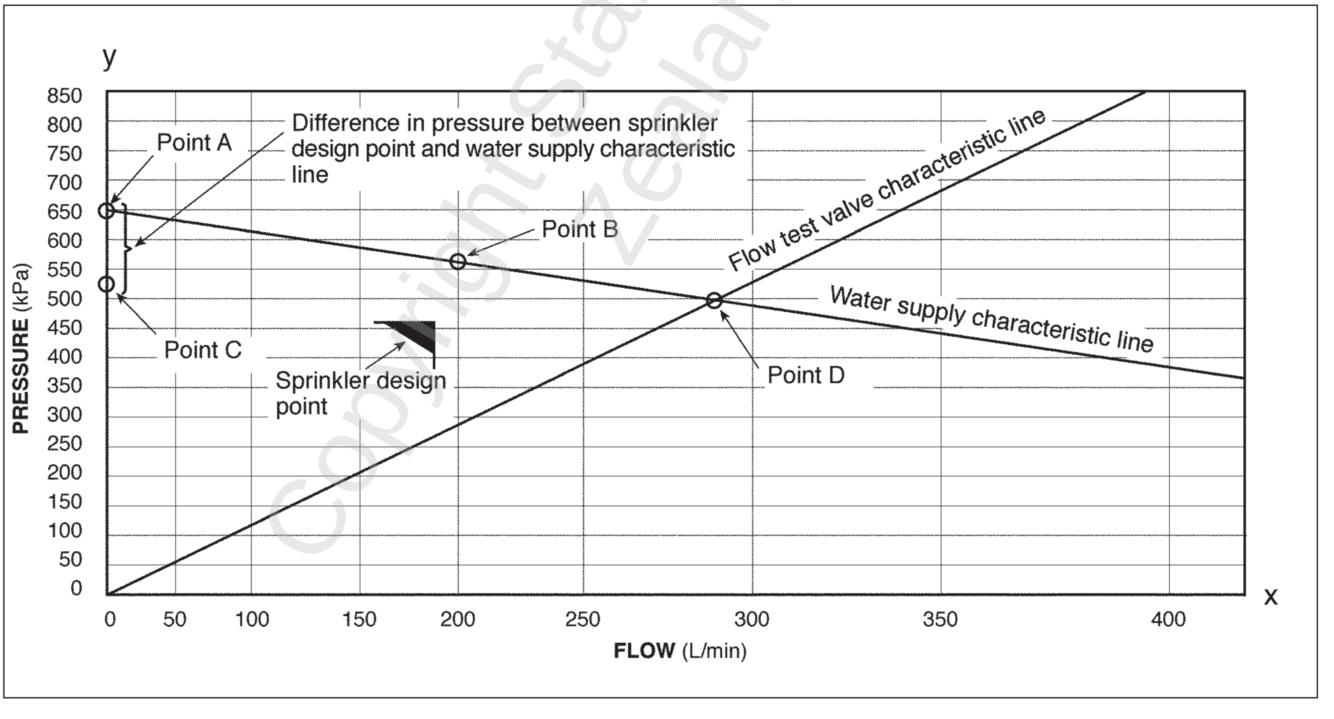

Figure G2 – Example of a verification flow test record (see G4)

APPENDIX H – SPRINKLER SYSTEM DECLARATION (DESIGN AND CONSTRUCTION)

(Normative)

DOMESTIC SPRINKLER SYSTEM DECLARATION (DESIGN AND CONSTRUCTION)

The sprinkler system installed in accordance with

....(Design number)

on the ....(Date)

at: ....

....

(Full street address)

complies with the requirements of NZS 4517:2010 in all respects.

The required flow at the reference point is .... L/min at a pressure of ....kPa,

which includes an allowance of .... L/min for simultaneous domestic flow.

Signed ....Name ....

(Print)

Company or organisation ....

Qualification/position ....

Date ....

(Copyright of this form has been waived by Standards New Zealand.)

APPENDIX J – AS-BUILT DRAWINGS AND DESIGN DOCUMENTATION

(Normative)

J1

As-built sprinkler and pipe layout drawings shall be provided which show the following:

(a) A node or pipe reference system that indicates pipe diameters and provides unique identification for pipes, bends, junctions, sprinklers and other pipe fittings which require hydraulic consideration;

(b) Type of pipes used;

(c) Pipes supplying hydraulically disadvantaged sprinklers;

(d) Sprinklers assumed to be operating; and

(e) Height above or below the reference point of each sprinkler assumed to be operating.

J2

Calculation data sheets shall be provided to support the as-built sprinkler and pipe layout drawings, containing the following:

(a) Sprinkler data:

(i) Node or reference number

(ii) Flow from sprinkler (L/min)

(iii) Pressure at sprinkler (kPa);

(b) Hydraulically significant pipe:

(i) Node or reference numbers

(ii) Internal diameter (mm)

(iii) Method used to determine pressure loss (see Appendix E)

(iv) Flow through pipe (L/min)

(v) Length (m)

(vi) Number of tees, elbows, crosses, and other hydraulically significant fittings

(vii) Total hydraulic length (m)

(viii) Static change in pipe (kPa)

(ix) Pressure at each end of pipe (kPa)

(x) Friction loss in pipe (kPa);

(c) Any other relevant information.

J3

Water supply reference graph (see figure J1 as an example) and site plan shall be supplied, including, as applicable to the design:

(a) Verification flow test record;

(b) Pump start pressure;

(c) Minimum static pressure;

(d) Minimum test discharge pressure;

(e) Water supply – point of supply from a reticulated supply, if applicable, and the location of any alternative supplies;

(f) Location of control valves and isolation valves;

(g) Location of backflow prevention devices;

(h) Locations of pump; and

(i) Any other site specific information not shown on as-built plans.

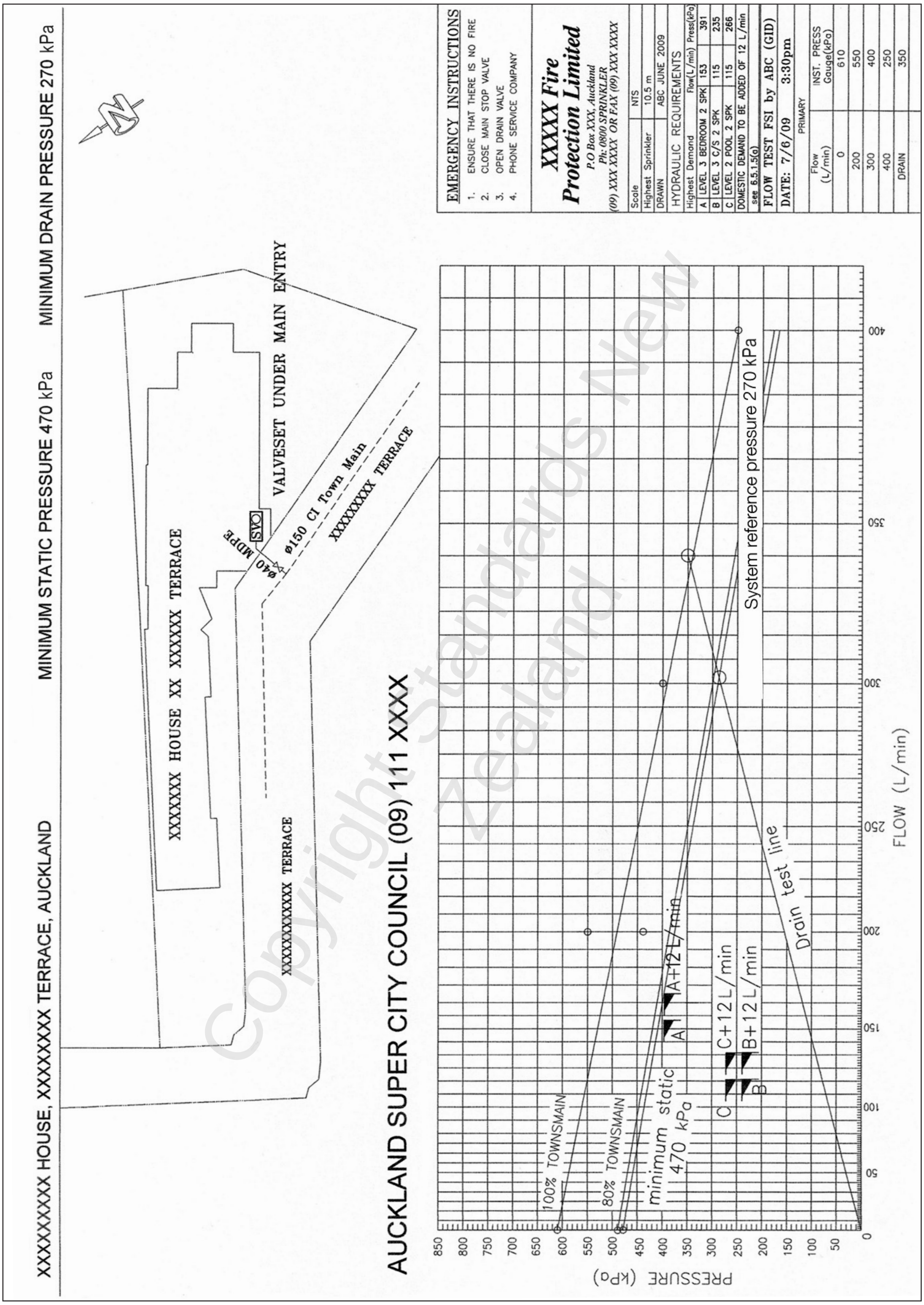

Figure J1 – Example check graph

APPENDIX K – ROUTINE TESTING AND MAINTENANCE

(Informative)

K1 Introduction

Routine checks should be provided to ensure that the system will perform as required. These may be carried out by a specialist contractor or the home owner. If the routine checks indicate conditions that may impact on the reliability of the system, specialist advice should be sought.

It is also important to check whether any house alterations or changes to the water supply will require changes to the sprinkler system in order to maintain performance.

K2 Monthly checks

The following checks should be carried out monthly by the owner:

(a) Check the sprinkler water supply pressure gauge to ensure that the water supply pressure has not deteriorated below the minimum required water supply pressure.

Open the test valve and record the pressure shown on the water supply pressure gauge. If this is less than the pressure recorded at commissioning (system reference pressure), carry out the following using the record of the verification flow tests (Appendix G).

Draw a line from a point on the y-axis corresponding to the present static pressure through the point on the test valve characteristic line corresponding to the new pressure noted when the test valve is fully open. If this line is below any system design point the water supply is inadequate for the system design and the reason for the deficiency should be determined and the defect corrected without delay;

(b) Check that pumps start correctly in sprinkler systems that depend on a pump;

(c) Where pumps are used, clean the filter and check the pressure vessel;

(d) Ensure all isolation valves that affect system water supplies are fully open.

K3 Annual checks

The following checks should be carried out annually:

(a) Inspect the sprinkler system to ensure that the sprinklers have not been damaged, painted or unduly obstructed;

(b) Backflow prevention device, if fitted, should be tested to AS 2845.3.

APPENDIX L – EXAMPLE OF OWNER'S GUIDE

(Informative)

L1 General

L1.1

Your home fire sprinkler system is designed to:

(a) Activate quickly once the operating temperature (57ºC – 77ºC) is reached;

(b) Discharge water only from the sprinkler that is activated by the fire;

(c) Discharge water at a rate of 30 to 80 litres per minute when activated;

(d) Reduce the likelihood of fire within the home becoming a threat to life;

(e) Assist in extending time available for you and other occupants of your home to escape from the fire;

(f) Use the same water for fire suppression that comes into the home for normal living use; and

(g) Automatically help to control or limit a fire within a sprinkler protected room.

L1.2

Your home fire sprinkler system is **not** designed to:

(a) Provide early warning to the occupants by means of a water flow alarm. (In some cases, it will be possible to provide such an alarm, which may be linked into a home security system.) For this reason, smoke alarms are considered an integral part of the total life-safety system within the home;

NOTE – If a water flow alarm is fitted, this part of the owner's guide may need customising.

(b) Automatically notify the Fire Service;

(c) Be shut off or shut down separately from the normal domestic water supply;

(d) Automatically shut the sprinkler water flow off after activation;

(e) Fully control or extinguish a fire:

(i) Which originates in an unsprinklered area before spreading to a sprinklered area

(ii) Where combustible material is not the amount or type of material normally found in a home

(iii) Where unauthorised changes have been made to the plumbing system after installation

(iv) When the fire starts under an obstruction such as a desk or workbench.

L2 Sprinkler system components

L2.1 Smoke alarms

Smoke alarms form an integral and necessary part of the whole life safety system although they are not connected in any way to the sprinkler system.

Smoke alarm coverage may extend beyond sprinkler coverage to provide an enhanced fire early warning system. You should familiarise yourself with the location of all smoke alarms in your home.

With hard-wired smoke alarms, a registered electrician should carry out any electrical wiring work required and care should be taken with any modification to a smoke alarm position or replacement of a smoke alarm connected to the 230 Volt supply.

If the smoke alarms use batteries, you should replace these on 'daylight saving' changeover days, as recommended by the New Zealand Fire Service.

L2.2 Water supply

The domestic water supply is used for both domestic use and for fire suppression via the sprinkler system if and when required. The system has been designed to ensure that the amount of water required to control the fire is available at the most remote sprinklers. The system has also been operationally tested and has been certified as meeting all design specification requirements.

If the reticulated water supply is shut off, the sprinkler system will not function. The sprinkler system may also not function if a water meter, backflow prevention device, water purifier, or any other restrictive device is added to the water supply connection. If such devices are installed, it is recommended that you contact your installer to see if any changes are required to your sprinkler system to allow it to function correctly.

L2.3 Water supply shut-off valve

The water supply shut-off valve outside your house will shut off water to your home. It will also shut down the sprinkler system.

L2.4 Domestic water isolating valve

A domestic water isolating valve may be fitted. This will shut down the domestic water supply but leave the sprinkler system still operational. This is used when changing tap washers, and so on.

L2.5 Sprinkler system pressure gauge

A pressure gauge is fitted which will provide a 24-hour reading of the water pressure. The minimum static (no flow) pressure required for the sprinkler system to operate correctly will be marked on the gauge so that you can always check to ensure the system is supplied with the correct water pressure.

L2.6 Sprinkler system pipework

The sprinkler system pipework may be run off the normal domestic water to supply the sprinklers. These pipes are the same types of pipes that supply water to the bathroom, laundry, and kitchen areas. All pipework is normally full with water at all times.

L2.7 Residential sprinkler

Residential sprinklers have a high trajectory to ensure coverage of walls and floors that may be constructed of, or covered with, combustible materials, as opposed to a conventional 'umbrella' pattern given by sprinklers used for commercial applications.

The fire sprinklers fitted in your home are 'quick response' sprinklers. These are small, high-sensitivity devices activated by heat that either melt a specialised solder link or shatter a small liquid-filled bulb. The sprinklers have an accurate preset temperature at which they operate, which is significantly higher than the temperature that is expected in the area under normal conditions.

L2.8 Areas not covered by the sprinkler system

The following areas have been assessed as not requiring sprinkler coverage:

(a) Pantries, cupboards, and wardrobes (with a floor area less than 5 m^2), excluding those containing clothes driers;

(b) Concealed ceiling and roof spaces;

(c) Concealed floor spaces;

(d) Toilets and bathrooms;

(e) Open external areas such as porches, balconies, walkways, stairs, and other spaces created by architectural features;

(f) Small architectural features such as planter box windows, bay windows; and

(g) Detached or fire-separated garages/buildings unless used for sleeping purposes.

NOTE – Where an additional sprinkler would be required in a room just to protect the door swing area, this additional sprinkler may be omitted. See figure 2.1.

The decision on whether or not to install sprinklers in these areas is made on the risk assessment that evaluates the likelihood of a fire in this type of space based on past fire statistics, actual intended use of the space in question, and floor area of the actual space itself. This does not mean that sprinklers cannot be fitted, if required, which will further increase the degree of fire protection.

L3 Modifications to plumbing system after installation

Any system extension, modification or alteration to the domestic plumbing, including garden watering systems, should be carried out by a licensed plumber experienced in fire sprinkler installation. This plumber is responsible for ensuring that the sprinkler system remains fully functional.

L4 Recommended day-to-day practices

You should:

(a) Familiarise yourself with the location and operation of the water supply shut-off valve, the sprinkler system pressure gauge and the sprinkler system isolating valve, if fitted;

(b) Discuss the exit drill with all the occupants of your home in case of fire;

(c) See Appendix K for guidance on routine testing and maintenance;

(d) Inspect the sprinklers on a regular basis for obstructions, paint or mechanical damage. You should do this after undertaking any redecorating or building alterations in areas where sprinklers are present. If sprinklers are mechanically damaged or painted, they must be replaced. Pay careful attention to the sprinkler bulb. It will normally be fitted with a red, yellow or orange liquid, and contain a small air bubble, around the size of a pin. If the bulb is empty, or the bubble is appreciably bigger than this, the sprinkler has been damaged and will not work;

(e) Carefully inspect concealed sprinkler plates to ensure that:

(i) They have not been repainted

(ii) They are free from mechanical damage, and

(iii) The small gap between the plate and the ceiling has not been filled with paint or another substance;

(f) Record any maintenance, servicing or modification to your sprinkler system on the back page of this guide;

(g) Not do anything to your sprinkler system that will hinder its performance, such as painting any part of the assembly or hanging objects from the sprinkler or cover plate if fitted – the sprinkler discharge pattern is critical for proper fire protection. If any painting is being carried out adjacent to a sprinkler, the sprinkler should be covered with a small paper bag and/or carefully masked off to prevent paint splatter or drift onto the sprinkler. The protective covering should be removed as soon as painting is completed;

NOTE – Sprinklers are delicate devices: be careful not to knock or damage the bulbs, to ensure that the sprinklers do not activate accidentally.

(h) Check and clean smoke alarms every month according to the manufacturer's instructions;

(i) Consider either replacing or having a sample of sprinklers tested by a recognised laboratory after they have been installed for a period of 20 years. This is typically recommended by sprinkler manufacturers. A sprinkler installer or supplier will be able to advise you on which organisations can undertake the testing. Other maintenance may be required either when a sprinkler has been mechanically damaged or following activation and/or exposure to fire;

(j) Check that, if the system uses a water supply tank, the minimum water level is present at all times.

L5 In the event of a fire

Should a fire occur:

(a) Ensure that all occupants are alerted, have exited the house, and remain outside;

(b) Phone 111 and ask for the Fire Service. Give your address, nearest cross street, and any other information required;

(c) The water supply should not be turned off until it is confirmed that the fire is completely out;

(d) Sprinklers that have operated in a fire cannot be reassembled and must be replaced. Check with the installer for minimum replacement requirements.

L6 Sprinkler operation under fire conditions

During fire conditions, the temperature around a sprinkler will approach the operating temperature as hot gases rise to the ceiling. At this time with concealed type sprinkler models, a cover plate will detach and fall away.

Continued heating of a sprinkler at the operating temperature will cause it to operate, releasing the water seal. Water will immediately flow through the sprinkler orifice and strike the deflector, discharging water over a specific area of coverage as determined by the water supply pressure and type of deflector fitted.

The water discharge may cover an area of up to 6 m by 6 m. Because the water will immediately cool the hot gases from the fire, other adjacent sprinklers may not be activated. The water will reach the burning material, cooling it below its combustion temperature to extinguish or control the fire.

APPENDIX M – DOCUMENTATION FOR INTERESTED PARTIES

(Informative)

The following documentation should be provided to any parties who have an interest in ensuring that a correctly designed and installed sprinkler system has been installed:

(a) Final inspection checklist (see Appendix A);

(b) Declaration and completion documentation (see Appendix H);

(c) Reference data including water reference chart, minimum system static (no flow) pressure, pump start pressure (if applicable), and test valve flow pressure (see Appendix J);

(d) A copy of the as-built drawings and design documentation (see Appendix J);

(e) Identification of type and manufacturer of sprinkler, including the manufacturer's data sheet for each type of sprinkler (see 4.4).

APPENDIX N – TYPICAL HYDRAULIC DESIGN DATA

(Informative)

N1

The data in tables N1 to N8 have been prepared to provide typical design data for use in hydraulic calculations of domestic sprinkler systems.

N2

Pressure loss data have been provided for typical pipe types that may be expected to be used in the installation of domestic sprinkler systems. If other types of pipes are being used, equivalent data may be calculated using the Hazen-Williams formula as provided in Appendix E (see E7). Specialist advice or assistance may be available from the sprinkler supplier.

N3

Losses in items such as water meters and backflow prevention devices should be sought from the manufacturer or supplier. The information provided in this appendix is indicative only and is based on information provided in AS 2118.5. It is essential that the manufacturer's recommended maximum design flows for water meters are not exceeded. If the sprinkler hydraulics indicate a flow in excess of the water capacity, then the meter must be upsized. Typically, a 25 mm or 32 mm water meter is required for domestic sprinkler service.

N4

The information presented in this appendix is not intended to restrict the selection of pipe materials. However, it is imperative that the designer is aware of the characteristics of the pipe work and fittings used while carrying out hydraulic design of domestic sprinkler systems. For example, the reduced bore of some polybutylene pipe fittings could make them impracticable for use in domestic sprinkler systems. The nature of these fittings could make the pressure losses through these fittings excessive and not tolerable within the hydraulic design of the system.

Table N1 – Pressure losses for PE 80B PN 12.5 (SDR 11) pipe to AS/NZS 4130

	Pressure loss (kPa/m)				
DN (mm)	25	32	40	50	63
ID (mm)	20.2	26.0	32.3	40.4	51.0
Flow rate (L/min)					
30	1.4	0.4	0.1	0.0	0.0
35	1.8	0.5	0.2	0.1	0.0
40	2.3	0.7	0.2	0.1	0.0
45	2.9	0.8	0.3	0.1	0.0
50	3.5	1.0	0.4	0.1	0.0
55	4.2	1.2	0.4	0.1	0.0
60	4.9	1.4	0.5	0.2	0.1
65	5.7	1.7	0.6	0.2	0.1
70	6.6	1.9	0.7	0.2	0.1
75	7.5	2.2	0.7	0.3	0.1
80	8.4	2.5	0.8	0.3	0.1
85	9.4	2.7	0.9	0.3	0.1
90	10.5	3.1	1.1	0.4	0.1
95	11.6	3.4	1.2	0.4	0.1
100	12.7	3.7	1.3	0.4	0.1
105	13.9	4.1	1.4	0.5	0.2
110	15.2	4.4	1.5	0.5	0.2
115	16.5	4.8	1.7	0.6	0.2
120	17.8	5.2	1.8	0.6	0.2
125	19.2	5.6	1.9	0.6	0.2
130	20.7	6.0	2.1	0.7	0.2
135	22.1	6.5	2.2	0.7	0.2
140	23.7	6.9	2.4	0.8	0.3
145	25.3	7.4	2.5	0.9	0.3
150	26.9	7.9	2.7	0.9	0.3
155	28.6	8.3	2.9	1.0	0.3
160	30.3	8.8	3.0	1.0	0.3
	EPL (m)				
Tees (branches)	1.8	2.4	3.0	3.6	4.5
Tees (flow)	0.6	0.8	1.0	1.2	1.5
Elbows	1.1	1.4	1.8	2.2	2.7
Bends	0.5	0.7	0.9	1.1	1.4
Gate valves	0.2	0.3	0.4	0.5	0.6

Table N2 – Pressure losses for PE-X SDR 7.4 pipe to AS/NZS 2492

	Pressure loss (kPa/m)			
DN (mm)	25	32	40	50
ID (mm)	18.0	23.2	28.8	36.2
Flow rate (L/min)				
30	2.4	0.7	0.2	0.1
35	3.2	0.9	0.3	0.1
40	4.0	1.2	0.4	0.1
45	5.0	1.5	0.5	0.2
50	6.1	1.8	0.6	0.2
55	7.3	2.1	0.7	0.2
60	8.6	2.5	0.9	0.3
65	9.9	2.9	1.0	0.3
70	11.4	3.3	1.2	0.4
75	12.9	3.8	1.3	0.4
80	14.6	4.2	1.5	0.5
85	16.3	4.7	1.7	0.5
90	18.1	5.3	1.8	0.6
95	20.0	5.8	2.0	0.7
100	22.0	6.4	2.2	0.7
105	24.1	7.0	2.4	0.8
110	26.3	7.6	2.7	0.9
115	28.5	8.3	2.9	0.9
120	30.9	9.0	3.1	1.0
125	33.3	9.7	3.4	1.1
130	35.8	10.4	3.6	1.2
135	38.4	11.1	3.9	1.3
140	41.0	11.9	4.2	1.4
145	43.8	12.7	4.4	1.5
150	46.6	13.5	4.7	1.6
155	49.5	14.4	5.0	1.6
160	52.5	15.3	5.3	1.7
	EPL (m)			
Tees (branches)	1.5	1.8	2.4	3.0
Tees (flow)	0.5	0.6	0.8	1.0
Elbows	0.9	1.1	1.4	1.8
Bends	0.5	0.5	0.7	0.9
Gate valves	0.2	0.2	0.3	0.4

Table N3 – Pressure losses for PP-R SDR 11 pipe to DIN 8077

	Pressure loss (kPa/m)				
DN (mm)	20	25	32	40	50
ID (mm)	16.2	20.4	26.0	32.6	40.8
Flow rate (L/min)					
30	4.0	1.3	0.4	0.1	0.0
35	5.3	1.7	0.5	0.2	0.1
40	6.8	2.2	0.7	0.2	0.1
45	8.4	2.7	0.8	0.3	0.1
50	10.2	3.3	1.0	0.3	0.1
55	12.2	4.0	1.2	0.4	0.1
60	14.3	4.7	1.4	0.5	0.2
65	16.6	5.4	1.7	0.6	0.2
70	19.0	6.2	1.9	0.6	0.2
75	21.6	7.0	2.2	0.7	0.2
80	24.3	7.9	2.4	0.8	0.3
85	27.2	8.9	2.7	0.9	0.3
90	30.3	9.9	3.0	1.0	0.3
95	33.5	10.9	3.3	1.1	0.4
100	36.8	12.0	3.7	1.2	0.4
105	40.3	13.1	4.0	1.3	0.4
110	43.9	14.3	4.4	1.5	0.5
115	47.6	15.5	4.8	1.6	0.5
120	51.5	16.8	5.1	1.7	0.6
125	55.6	18.1	5.6	1.8	0.6
130	59.8	19.4	6.0	2.0	0.7
135	64.1	20.9	6.4	2.1	0.7
140	68.5	22.3	6.8	2.3	0.8
145	73.1	23.8	7.3	2.4	0.8
150	77.9	25.3	7.8	2.6	0.9
155	82.7	26.9	8.3	2.7	0.9
160	87.8	28.6	8.8	2.9	1.0
	EPL (m)				
Tees (branches)	1.5	1.8	2.4	3.0	3.6
Tees (flow)	0.5	0.6	0.8	1.0	1.2
Elbows	0.9	1.1	1.4	1.8	2.2
Bends	0.5	0.5	0.7	0.9	1.1
Gate valves	0.2	0.2	0.3	0.4	0.5

Table N4 – Pressure losses for PP-R SDR 7.4 pipe to DIN 8077

	Pressure loss (kPa/m)			
DN (mm)	25	32	40	50
ID (mm)	18.0	23.2	28.8	36.2
Flow rate (L/min)				
30	2.4	0.7	0.2	0.1
35	3.2	0.9	0.3	0.1
40	4.0	1.2	0.4	0.1
45	5.0	1.5	0.5	0.2
50	6.1	1.8	0.6	0.2
55	7.3	2.1	0.7	0.2
60	8.6	2.5	0.9	0.3
65	9.9	2.9	1.0	0.3
70	11.4	3.3	1.2	0.4
75	12.9	3.8	1.3	0.4
80	14.6	4.2	1.5	0.5
85	16.3	4.7	1.7	0.5
90	18.1	5.3	1.8	0.6
95	20.0	5.8	2.0	0.7
100	22.0	6.4	2.2	0.7
105	24.1	7.0	2.4	0.8
110	26.3	7.6	2.7	0.9
115	28.5	8.3	2.9	0.9
120	30.9	9.0	3.1	1.0
125	33.3	9.7	3.4	1.1
130	35.8	10.4	3.6	1.2
135	38.4	11.1	3.9	1.3
140	41.0	11.9	4.2	1.4
145	43.8	12.7	4.4	1.5
150	46.6	13.5	4.7	1.6
155	49.5	14.4	5.0	1.6
160	52.5	15.3	5.3	1.7
	EPL (m)			
Tees (branches)	1.5	1.8	2.4	3.0
Tees (flow)	0.5	0.6	0.8	1.0
Elbows	0.9	1.1	1.4	1.8
Bends	0.5	0.5	0.7	0.9
Gate valves	0.2	0.2	0.3	0.4

Table N5 – Pressure losses for copper pipe (for water and gas) to NZS 3501

	Pressure loss (kPa/m)				
DN (mm)	20	25	32	40	50
ID (mm)	19.0	25.4	31.7	38.	50.8
Flow rate (L/min)					
30	2.1	0.5	0.2	0.1	0.0
35	2.8	0.7	0.2	0.1	0.0
40	3.5	0.9	0.3	0.1	0.0
45	4.4	1.1	0.4	0.1	0.0
50	5.3	1.3	0.4	0.2	0.0
55	6.4	1.6	0.5	0.2	0.1
60	7.5	1.8	0.6	0.3	0.1
65	8.7	2.1	0.7	0.3	0.1
70	9.9	2.4	0.8	0.3	0.1
75	11.3	2.8	0.9	0.4	0.1
80	12.7	3.1	1.1	0.4	0.1
85	14.2	3.5	1.2	0.5	0.1
90	15.8	3.9	1.3	0.5	0.1
95	17.5	4.3	1.4	0.6	0.1
100	19.2	4.7	1.6	0.7	0.2
105	21.0	5.2	1.7	0.7	0.2
110	22.9	5.6	1.9	0.8	0.2
115	24.9	6.1	2.1	0.8	0.2
120	26.9	6.6	2.2	0.9	0.2
125	29.1	7.1	2.4	1.0	0.2
130	31.2	7.7	2.6	1.1	0.3
135	33.5	8.2	2.8	1.1	0.3
140	35.8	8.8	3.0	1.2	0.3
145	38.2	9.4	3.2	1.3	0.3
150	40.7	10.0	3.4	1.4	0.3
155	43.3	10.6	3.6	1.5	0.4
160	45.9	11.3	3.8	1.6	0.4
	EPL (m)				
Tees (branches)	1.5	2.4	2.4	3.0	4.5
Tees (flow)	0.5	0.8	0.8	1.0	1.5
Elbows	0.9	1.4	1.4	1.8	2.7
Bends	0.5	0.7	0.7	0.9	1.4
Gate valves	0.2	0.3	0.3	0.4	0.6

Table N6 – Pressure losses for CPVC pipe to ASTM F442

	Pressure loss (kPa/m)		
DN (mm)	20	25	32
ID (mm)	22.2	28.0	35.4
Flow rate (L/min)			
30	0.9	0.3	0.1
35	1.1	0.4	0.1
40	1.5	0.5	0.2
45	1.8	0.6	0.2
50	2.2	0.7	0.2
55	2.6	0.8	0.3
60	3.1	1.0	0.3
65	3.6	1.2	0.4
70	4.1	1.3	0.4
75	4.7	1.5	0.5
80	5.2	1.7	0.5
85	5.9	1.9	0.6
90	6.5	2.1	0.7
95	7.2	2.3	0.7
100	7.9	2.6	0.8
105	8.7	2.8	0.9
110	9.5	3.1	1.0
115	10.3	3.3	1.1
120	11.1	3.6	1.1
125	12.0	3.9	1.2
130	12.9	4.2	1.3
135	13..8	4.5	1.4
140	14.8	4.8	1.5
145	15.8	5.1	1.6
150	16.8	5.4	1.7
155	17.8	5.8	1.8
160	18.9	6.1	1.9
	EPL (m)		
Tees (branches)	1.8	2.4	3.0
Tees (flow)	0.6	0.8	1.0
Elbows	1.1	1.4	1.8
Bends	0.5	0.7	0.9
Gate valves	0.2	0.3	0.4

Table N7 – Pressure losses for Polybutylene (PB) pipe to AS/NZS 2642.2

	Pressure loss (kPa/m)	
DN (mm)	22	28
ID (mm)	17.6	22.2
Flow rate (L/min)		
30	2.6	0.9
35	3.5	1.1
40	4.5	1.5
45	5.6	1.8
50	6.8	2.2
55	8.1	2.6
60	9.5	3.1
65	11.1	3.6
70	12.7	4.1
75	14.4	4.7
80	16.3	5.2
85	18.2	5.9
90	20.2	6.5
95	22.3	7.2
100	24.6	7.9
105	26.9	8.7
110	29.3	9.5
115	31.8	10.3
120	34.4	11.1
125	37.1	12.0
130	39.9	12.9
135	42.8	13.8
140	45.8	14.8
145	48.9	15.8
150	52.0	16.8
155	55.3	17.8
160	58.6	18.9
	EPL (m)	
Tees (branches)	1.5	1.8
Tees (flow)	0.5	0.6
Elbows	0.9	1.1
Bends	0.5	0.5
Gate valves	0.2	0.2

Table N8 – Typical losses through water meters

Flow (L/min)	**Meter size** (mm)					
	25		**32**		**40**	
	Maximum flow rate					
	116 (L/min)	**7** (m^3/hr)	**166** (L/min)	**10** (m^3/hr)	**333** (L/min)	**20** (m^3/hr)
	Pressure loss (kPa)					
50	17		9		2	
60	27		13		3	
70	37		18		4	
80	48		24		6	
90	61		30		7	
100	76		37		9	
110	91		44		11	
120	–		53		13	
130	–		62		15	
140	–		72		18	
150	–		83		20	
160	–		94		23	

NOTES

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