NZS 4517:2002

STANDARDS
NEW ZEALAND
Paerewa Aotearoa

NZS 4517:2002

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New Zealand Standard

Fire Sprinkler Systems for Houses

(Amendment No 1
Appended)

COMMITTEE REPRESENTATION

This Standard was prepared by the Fire Sprinkler for Domestic Occupancies (P 4517) committee for the Standards Council established under the Standards Act 1988.

Standards New Zealand wishes to thank the following nominating organizations for their contribution to Committee P 4517:

Building Industry Authority of New Zealand
Building Research Association of New Zealand Inc.
Corporation of Insurance Brokers of New Zealand
Fire Protection Association, New Zealand
Fire Protection Contractors Association of New Zealand
Institute of Professional Engineers of New Zealand
Institution of Fire Engineers
Insurance Council of New Zealand
Master Plumbers, Gasfitters and Drainlayers New Zealand Inc.
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New Zealand Fire Equipment Association
New Zealand Fire Service
New Zealand Council of Elders
Society of Fire Protection Engineers
and the other individuals who were co-opted onto the committee.

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AMENDMENTS

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RELATED 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:	Fire sprinkler systems for residential occupancies (in preparation)
NZS 4541:	Automatic fire sprinkler systems (in preparation)

JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

AS/NZS 4130:2001	Polyethylene (PE) pipes for pressure applications

AMERICAN STANDARDS

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

AUSTRALIAN STANDARDS

AS 2118.5:1995	Automatic fire sprinkler systems - Domestic
AS 2845.3:1993	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

BIA	The New Zealand Building Code Handbook and Approved Documents
BRANZ	The New Zealand Fire Service Report "Cost Effective Domestic Fire Sprinkler Systems", 2000
BRANZ	Design guide – Sprinklers for houses, 2002
NFPA 13 -1999	Installation of sprinkler systems

LATEST REVISIONS

The users of this Standard should ensure that their copies of the above New Zealand Standards and referenced overseas Standards are the latest revisions or include the latest amendments. Such amendments are listed in the annual Standards New Zealand Catalogue which is supplemented by lists contained in the monthly magazine Standards Update issued free of charge to committee and subscribing members of Standards New Zealand.

FOREWORD

This Standard has been prepared to specify the minimum requirements for a domestic fire sprinkler system which provides a significantly improved level of protection for the occupants of the building, and a reasonable measure of owner property protection compared to premises without such protection, at a minimal cost. It gives guidelines for the design, construction and maintenance of the system.

NZS 4517 is based on NZS 4515 *Fire sprinkler systems for residential occupancies* and incorporates findings from the New Zealand Fire Service report *Cost Effective Domestic Fire Sprinkler Systems* authored by BRANZ. As such it provides an adequate level of life safety but a number of cost reduction features have been included which will reduce the effectiveness of the sprinkler system and the protection of the owner's and neighbouring properties compared with sprinkler systems installed in commercial facilities. Further optional measures can be taken for property protection; these are covered in Appendix A, or refer to NZS 4541 or NZS 4515. The committee preparing this Standard did not intend providing the same level of protection specified in NZS 4541 or NZS 4515.

It is important to install sprinkler heads throughout the protected building with the exception of a few, carefully defined areas. The small design water flow permitted is entirely dependent for validity upon rapid control of fire wherever it occurs. If a fire grows, for example, because of a gap in the sprinkler head coverage, the water discharge rates from surrounding sprinkler heads would be insufficient to control the fire. More sprinkler heads would open and the water supply would be quickly overcome. It is also stressed that the Standard is an integrated set of requirements – each requirement is dependent on the others for technical validity.

This Standard recommends the use of residential sprinkler heads as a number of important benefits are derived from their rapid response and fire control:

(a) The amount of smoke and toxic gases produced by the fire is 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 fire load in domestic occupancies, combined with the responsiveness of the residential sprinkler heads, has permitted the use of domestic plumbing pipe.

In contrast with conventional sprinkler heads which have similar performance characteristics irrespective of make, residential sprinkler heads have markedly different water spray characteristics depending on the design pressure and make of head. This means the design of residential sprinkler systems is very “head specific” and is based on the approval listing data issued by the sprinkler head manufacturer.

Experimental evidence from the international use of this technology demonstrates that fatalities from fires in buildings protected by residential sprinkler heads are extremely unlikely due to achieving early control of the fire. Practical experience in New Zealand and North America confirms this. The overall improvement in life safety is further enhanced by the addition of smoke alarms and the preparation of effective evacuation procedures.

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.

NOTES

NEW ZEALAND STANDARD

FIRE SPRINKLER SYSTEMS FOR HOUSES

1 GENERAL

1.1 Scope

1.1.1
This Standard specifies minimum requirements for the design, material and installation of fire sprinkler systems for domestic occupancies, and advises on periodic testing and maintenance of these fire sprinkler systems. This Standard provides a specification for use by purchasers or specifiers of a fire sprinkler system for buildings used solely as a domestic occupancy. It is aimed at controlling a fire occurring in a building so that survivable conditions are maintained throughout the building for at least 10 minutes.

NOTE – In the selection of a 10-minute period during which fire control must be maintained, it is assumed that evacuation can and will be undertaken. It is envisaged that this will only be possible with the installation of systems that provide early warning of fire.

1.1.2
A domestic occupancy is the home of not more than one household and includes any attached self-contained unit (e.g. granny flat). Multiple adjoining occupancies are considered to be included provided they are separated by fire rated walls (e.g. townhouses).

1.1.3
This Standard does not apply to occupancies such as multi-storey apartments. Refer to NZS 4515 or NZS 4541.

1.1.4
This Standard provides a specification for voluntary compliance and for contractual purposes for use by purchasers.

1.2 Interpretation

1.2.1
For the purposes of this Standard the word "shall" refers to practices which are mandatory for compliance with the Standard. The word "should" refers to practices which are advised or recommended.

1.2.2
This Standard contains two types of appendices. A 'normative' appendix forms an integral part of the body of a Standard which, for reasons of convenience, is placed after the body of the Standard. An 'informative' appendix is only for information and guidance.

1.3 Definitions

For the purposes of this standard the following terms and definitions shall apply:

APPROVED. Approved or accepted by the territorial authority or their agent.

AUTHORITY HAVING JURISDICTION. The territorial authority or the body or organization nominated by the territorial authority responsible for approving equipment, an installation, or a procedure.

COMBINATION SYSTEM. A system in which a common system of pipework is used to supply both domestic water fixtures and appliances, and fire sprinklers.

DOMESTIC OCCUPANCY. A domestic occupancy is the home of not more than one household and includes any attached self-contained unit (e.g. granny flat). Multiple adjoining occupancies are considered to be included provided they are separated by fire rated walls (e.g. townhouses).

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.

LISTED. Equipment, components and materials that have been approved and listed for fire protection purposes by a recognized test and approval body, and which conform with the requirements of this Standard.

NOTE – Examples of test and approval bodies are the Insurance Council of NZ (ICNZ), Factory Mutual (FM), Loss Prevention Council (LPC), Scientific Services Laboratory (SSL) and Underwriters Laboratories (UL). ICNZ holds a register of listed equipment, components and materials.

QUICK RESPONSE SPRINKLER HEAD. A sprinkler head with a high thermal sensitivity and listed as a quick response sprinkler head.

REFERENCE POINT. The reference point is:

(a) For independent systems or independent anti-freeze systems, at the control valves;

(b) For combination systems, at the connection to the water supply.

RESIDENTIAL SPRINKLER HEAD. A sprinkler head designed and listed as a residential sprinkler head for the protection of residences.

STANDARD RESPONSE SPRINKLER HEAD. A sprinkler head listed as a standard response sprinkler head.

2 GENERAL DESIGN REQUIREMENTS

2.1 Extent of sprinklered protection

The building to be protected shall be sprinklered throughout except areas listed below for which protection is optional:

(a) Cupboards and wardrobes (less than 5 m^2);

(b) Concealed ceiling and roof spaces;

(c) Concealed floor spaces;

(d) Toilets and bathrooms;

(e) Pantries and linen cupboards;

(f) Open external porches, balconies, walkways and stairs, and other spaces created by architectural features;

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

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

2.2 Early fire warning system

The building to be protected shall have an early fire warning system installed.

NOTE – The safe evacuation of the building occupants is dependent on their receiving early warning of a fire. Examples of such systems include smoke detectors/alarms, thermal detectors or sprinkler water flow alarms. These systems may be linked into a monitoring service.

3 TYPES OF SYSTEM

3.1 General

Systems shall be independent or combination type.

3.1.1 *Independent system*

3.1.1.1

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

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

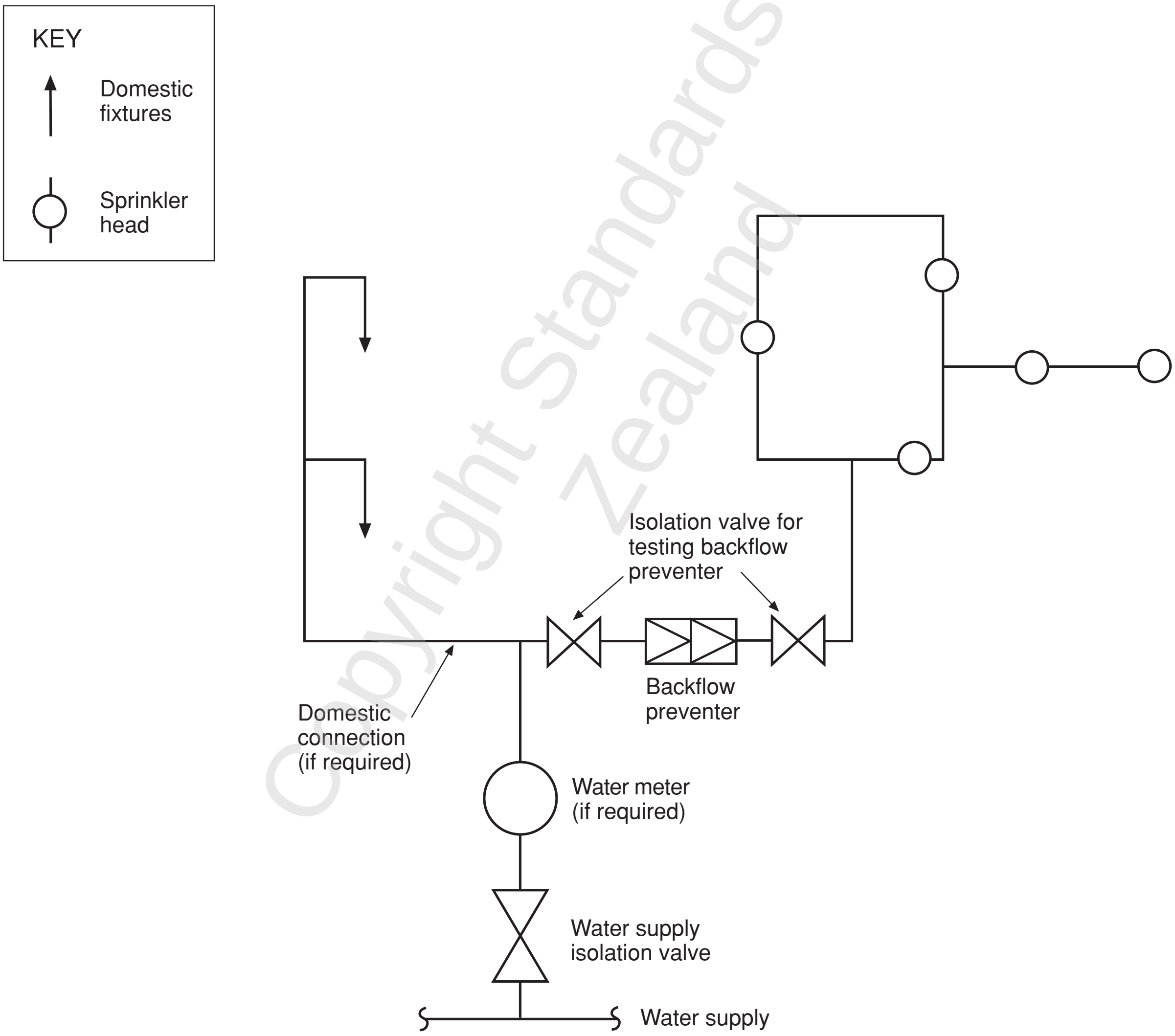


Figure 3.1 – Independent system

3.1.1.2
In frost-prone regions where pipes or valve sets are exposed on the outside of buildings or pipes are in uninsulated ceiling spaces, an independent anti-freeze system shall be used. Refer to Appendix B.

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. In areas that are prone to sub-zero temperatures, provision shall be made to protect the pipe work against freezing. A combination system will not normally be fitted with control valves other than the normal cold-water isolation valve. Refer figure 3.2.

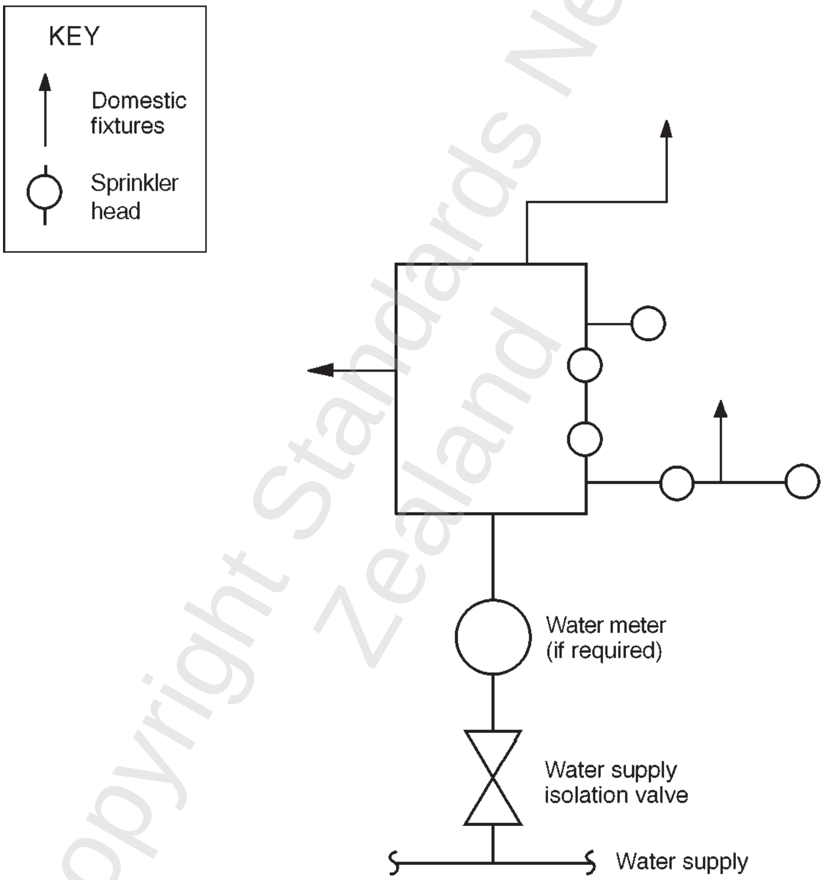


Figure 3.2 – Combination system

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.

NOTES –

(1) This requirement will be particularly relevant where there is a high standing pressure in the reticulated water supply.

(2) High temperatures in roof spaces may cause over-pressurization 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 anti-freeze) piped to an appropriate place;

(b) A gas over water hydraulic accumulator sized and fitted as per NFPA 13, clause 4.5.3.2.

(3) The normal minimum pressure rating for sprinkler systems is 1200 kPa.

4.2 Pipework

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.

4.2.1.2

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

NOTE – An example of protection is installation behind a wall or ceiling lining of 9.5 mm plasterboard.

4.2.1.3

The minimum pipe size shall be 20 mm nominal bore (NB) unless part of a listed system.

4.2.2 *Specific piping requirements*

4.2.2.1 *Solvent-cemented pipework and fittings*

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

NOTES –

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

(2) Excess cement must be removed from pipes adjacent to the sprinkler head to avoid sprinkler head blockage.

4.2.2.2 *Underground protection*

Underground pipes shall be protected against external corrosion where necessary.

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
Fixings shall be heat and corrosion resistant, and installed so that they will not deflect more than 5 mm when loaded to 5 times the weight of the water-filled pipe to be supported. 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 the Acceptable Solution G12/AS1 of Approved Document for New Zealand Building Code, Clause G12. Steel pipes shall be supported in accordance with table 4.1.

Table 4.1 – Pipework supports for steel pipes

Pipe size (mm)	**Maximum spacing** (m)
20	2.4
25	3.7
32 to 50 incl.	4.0

NOTE –The unsupported length between the end sprinkler head and the last support on a pipe with 2 sprinkler heads 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.

4.2.3.3
Notwithstanding the provisions of 4.2.3.2, the pipework adjacent and attached to the sprinkler head shall be fixed to prevent movement of the sprinkler head 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. The flow test valve shall be capable of discharging approximately the design flow.

NOTE – A 25 mm valve may serve as a flow test valve.

4.3.1.2
The flow test discharge should be in a safe location where it will not create a hazard or cause water damage.

4.3.1.3
For independent systems or combination systems, the flow test line shall connect downstream of any check valves, metering valves or flow alarms. For combination systems only, the test valve should be as close as possible to the most hydraulically demanding area.

4.3.1.4
Pressure gauges shall not be 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.

4.3.2
Any isolating valve that is part of the sprinkler system should be secured in the open position and clearly identified (see 6.5.1.4(d)).

4.3.3
The water flow detector, if fitted, shall be a listed item and shall operate at a flow less than the lowest single head design flow for the sprinkler system (refer figure 4.1).

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

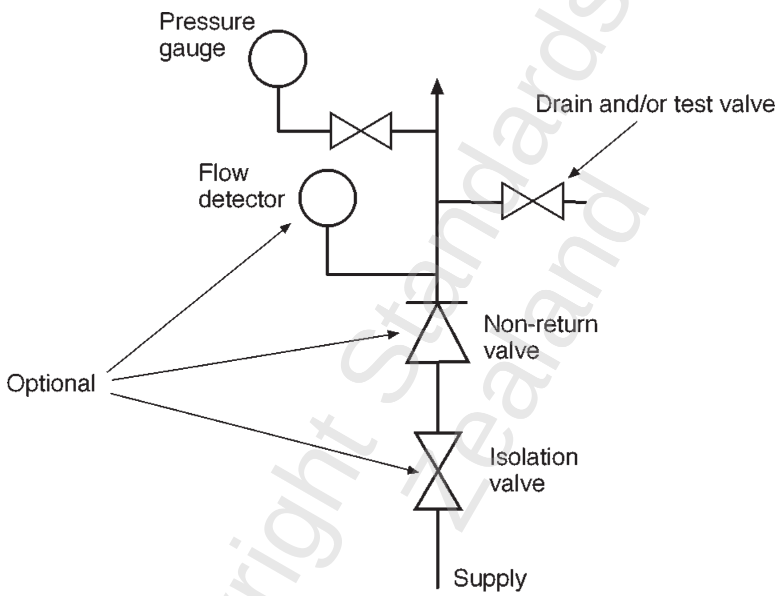


Figure 4.1 – Components and hydraulic layout of installation control valves for domestic occupancies

4.4 Sprinkler heads

4.4.1
Sprinkler heads shall be listed items.

The types of sprinkler head used to satisfy 2.1 shall be as specified in table 4.2.

Table 4.2 – Types of situations and sprinkler heads

Protection required	
Situation	**Type of sprinkler head**
Rooms, hallways and other habitable spaces	Residential (Quick response spray pattern only in accordance with 4.4.4)
Attached garages	Quick response conventional or Quick response spray pattern
Protection optional	
Situation	**Type of sprinkler head**
Roof spaces, ceiling spaces, skylights, underfloor spaces and high temperature environments	Standard response conventional or Standard response spray pattern
Basements, storage areas, and detached or fire separated garages/buildings	Quick response conventional or Quick response spray pattern
Cupboards and porches	Residential, Conventional or Spray pattern

NOTES –
(1) Conventional or spray pattern heads shall be 10 mm or 15 mm orifice.
(2) Sprinkler system discharge coefficients (*K* factors) shall be as follows:
10 mm sprinkler head .... 5.7 ± 0.3 L/min.kPa$^{0.5}$
15 mm sprinkler head .... 8.0 ± 0.4 L/min.kPa$^{0.5}$
Residential .... as per listing
(3) Concealed sprinkler heads of the above types are available but may have restricted installation and special maintenance requirements.

4.4.2
The temperature rating of sprinkler heads shall be at least 30 °C above the highest ambient temperature.

In rooms in which there is a solid fuel burning heating appliance, only sprinkler heads with an operating temperature of 68 °C or higher shall be used. Such heads shall not be located closer than 1.5 m, and preferably 2 m, from the edge of the appliance or flue measured horizontally, or as per their listing requirements.

All sprinkler heads installed within a room shall have the same heat response element and temperature rating except if installed adjacent to an area of elevated temperatures, necessitating a higher temperature rating.

4.4.3
Sprinkler heads shall be painted only by the manufacturer.

4.4.4

Where the ceiling geometry requires an excessive number of residential sprinkler heads, quick response spray sprinkler heads instead of residential sprinkler heads may be used to protect rooms. The quick response spray sprinkler heads shall be located with the thermal element positioned no more than 150 mm below the ceiling. In any other situation, the authority having jurisdiction shall be consulted.

NOTES –

(1) The number of residential sprinkler heads would be considered excessive if the coverage is less than 9 m^2 per head.

(2) An example where excessive numbers of residential sprinkler heads may need to be installed to comply with head listing criteria is the protection of rooms with exposed timber beam construction.

4.5 Stock of replacement sprinkler heads

Two spare sprinkler heads of each type used on the system shall be installed in a permanent bracket or labelled spares' box. When replacing sprinkler heads, the same type of sprinkler head or one of the same design criteria shall be used.

NOTES –

(1) The purpose of the spare heads is to permit rapid re-commissioning of the system.

(2) Sprinkler heads are not interchangeable with heads of different performance characteristics.

(3) Special purpose spanners are required for the replacement of sprinkler heads.

5 LOCATION OF SPRINKLER HEADS

5.1 Residential sprinkler heads

Sprinkler heads shall be residential sprinkler head type and be located strictly in accordance with the manufacturer's listing instructions for the particular type of head and intended operating pressure. The listing requirements include:

(a) Distance between sprinkler heads;

(b) Distance from walls and obstructions;

(c) Distance from underside of ceiling;

(d) Location of sprinkler heads under sloping ceilings

and (a) – (d) may vary according to operating pressure.

5.1.1

Beams, light fittings, shaped ceilings or other features may adversely affect the distribution of water from the sprinkler head. To counter this, additional sprinkler heads may be used to achieve proper sprinkler system coverage.

NOTE – Information provided in the manufacturer's data sheet and installation guidelines will provide guidance as to the application of this clause.

5.2 Specific requirements for sprinkler heads other than residential type

5.2.1

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

5.2.2

Beams, light fittings, shaped ceilings or other features may adversely affect the sprinkler's distribution of water. To counter this, sprinkler heads shall be located away from obstructions in accordance with the sprinkler head listing. Alternatively, additional sprinkler heads may be used to achieve proper sprinkler system coverage. (Refer to figure 5.1 and table 5.1.)

Table 5.1 – Distances from obstructions for sprinkler heads other than residential type

Minimum horizontal distance from sprinkler head to side of obstruction (mm)	Maximum height of sprinkler head deflector above bottom of obstruction	
	Conventional sprinkler heads installed upright (mm)	Spray sprinkler head (upright and pendant types) and conventional sprinkler head installed pendant (mm)
100	–	17
200	17	40
300	25	70
400	34	100
500	42	150
600	51	200
700	60	250
800	68	300
900	78	360
1000	90	415
1100	110	440
1200	135	460
1300	170	460
1400	200	460
1500	230	460
1600	265	460
1700	300	460
1800	340	460

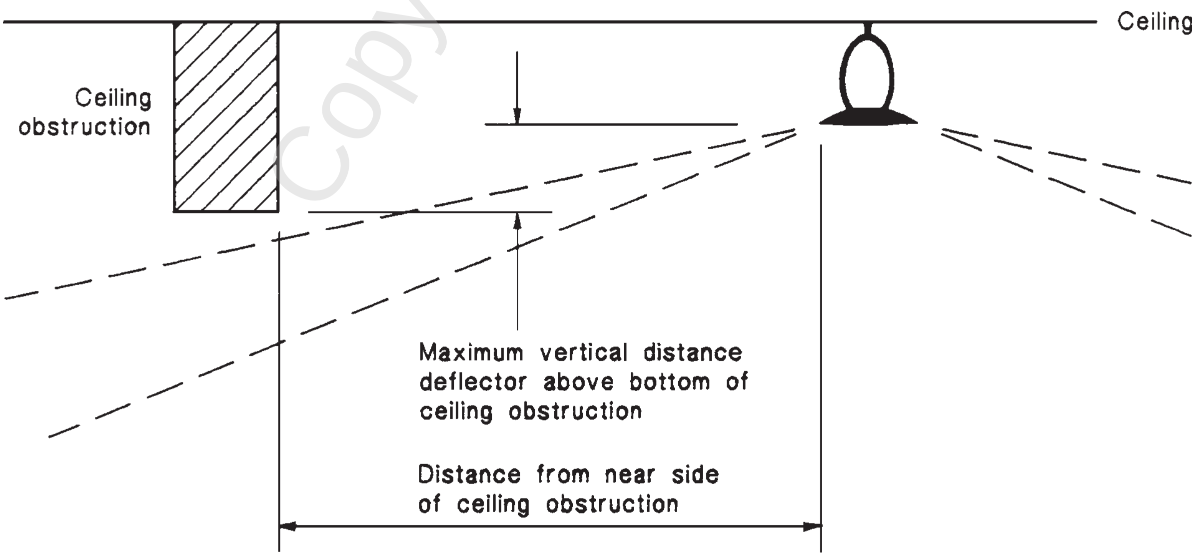


Figure 5.1 – Position of a sprinkler head (other than a residential type) deflector, upright or pendant, when located above the bottom of a ceiling obstruction

5.2.3
Sprinkler heads other than residential type shall be located as in table 5.2.

Table 5.2 – Maximum distance and coverage of sprinkler heads other than residential type

Sprinkler head	Maximum distance between sprinkler heads (m)	Maximum area of coverage (m^2)	Minimum orifice pressure (kPa)
10 mm spray pattern	4.6	21	100
10 mm spray pattern	4.0	16	70
15 mm spray pattern	4.6	21	50
15 mm conventional pattern	4.0	16	50

5.2.4
Sprinkler heads shall not be closer to one another than 2 m if the discharge from one could wet the adjacent sprinkler head.

5.2.5
The maximum distance between sprinkler heads and walls or partitions shall be one-half of the distances specified in table 5.2.

5.2.6
Where sprinkler heads are installed in roof spaces, they shall be:

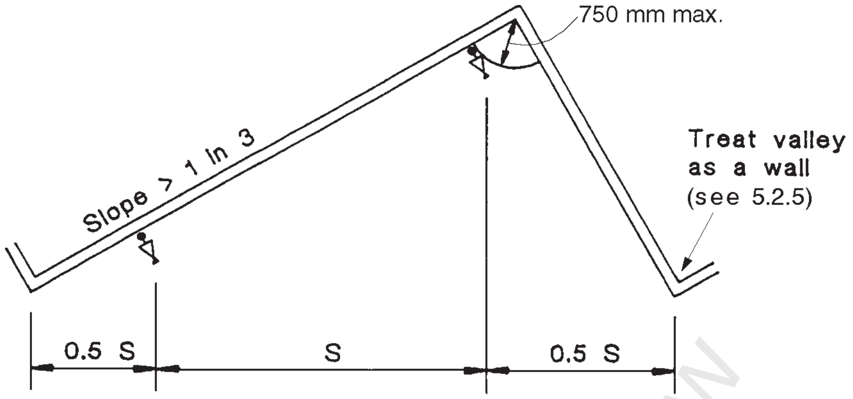
(a) Located as close as practicable to the underside of roof cladding but with the deflectors not closer than 25 mm;

(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.

5.2.7
Under sloping ceilings or roofs, the spacing measurements shall be taken horizontally.

5.2.8
On sloping ceilings where both the slopes are steeper than 1 in 3, a line of sprinkler heads shall be fixed at the apex unless there is a row of sprinkler heads not more than 750 mm distant radially therefrom. The valley at the intersection of the projection of such roof slopes shall be the line of a wall for the purpose of 5.2.5 (refer figure 5.2). A sloping ceiling steeper than 1 in 3 intersecting a wall shall be treated in an identical manner.



0.5 SxD=0.5 design area/sprinkler
SxD=Design area/sprinkler

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

NOTE – Design area distances are horizontal.

Figure 5.2 – Location of sprinkler heads other than residential type in sloping roofs

6 WATER SUPPLIES

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 sprinkler heads are used (rooms other than basements and vehicle garages)	
No. of sprinkler heads in room	**Basis of calculation**
1	1 sprinkler head operating at the listing pressure
More than 1	2 sprinkler heads operating at the listing pressure
Areas where sprinkler heads other than residential type are used	
No. of sprinkler heads in room	**Basis of calculation**
1	1 sprinkler head at the minimum pressure required by 5.2.3
More than 1	2 sprinkler heads at the minimum pressure required by 5.2.3

NOTES –

(1) The basis for system demand calculation is according to the number of sprinkler heads in the room. For roofs, ceilings and underfloor spaces (not used for storage), where more than 1 sprinkler head is present, the basis for calculation is 2 sprinkler heads operating at the minimum pressure required by 5.2.3.

(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 door does not fulfil these criteria, the spaces on either side of the door are part of the same room.

6.2 Extrapolation

Listing data for sprinkler heads shall not be interpolated between or extrapolated beyond the values provided in the listing.

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 respective to the appropriate areas when calculated in accordance with section 7. However, the design pressure shall not be less than the pressure required at the reference point to operate any single sprinkler head at its listed pressure. The reference point shall be:

(a) For independent systems or independent anti-freeze systems, at the control valves;

(b) For combination systems, at the connection to the water supply.

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, 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 building shall be:

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

(b) No smaller than 20 mm NB;

(c) Connected downstream of any valve, which if closed will interrupt the supply of domestic water to the protected building; and

NOTE – This is to ensure that any interruption of water supply to the protected building will become apparent to the occupant.

(d) Labelled such that every valve which controls the supply of water to the sprinkler system shall 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 and any meter are capable of supplying simultaneously 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).

NOTE – It would not be expected that a 20 mm water meter would be capable of supplying the sprinkler head demand.

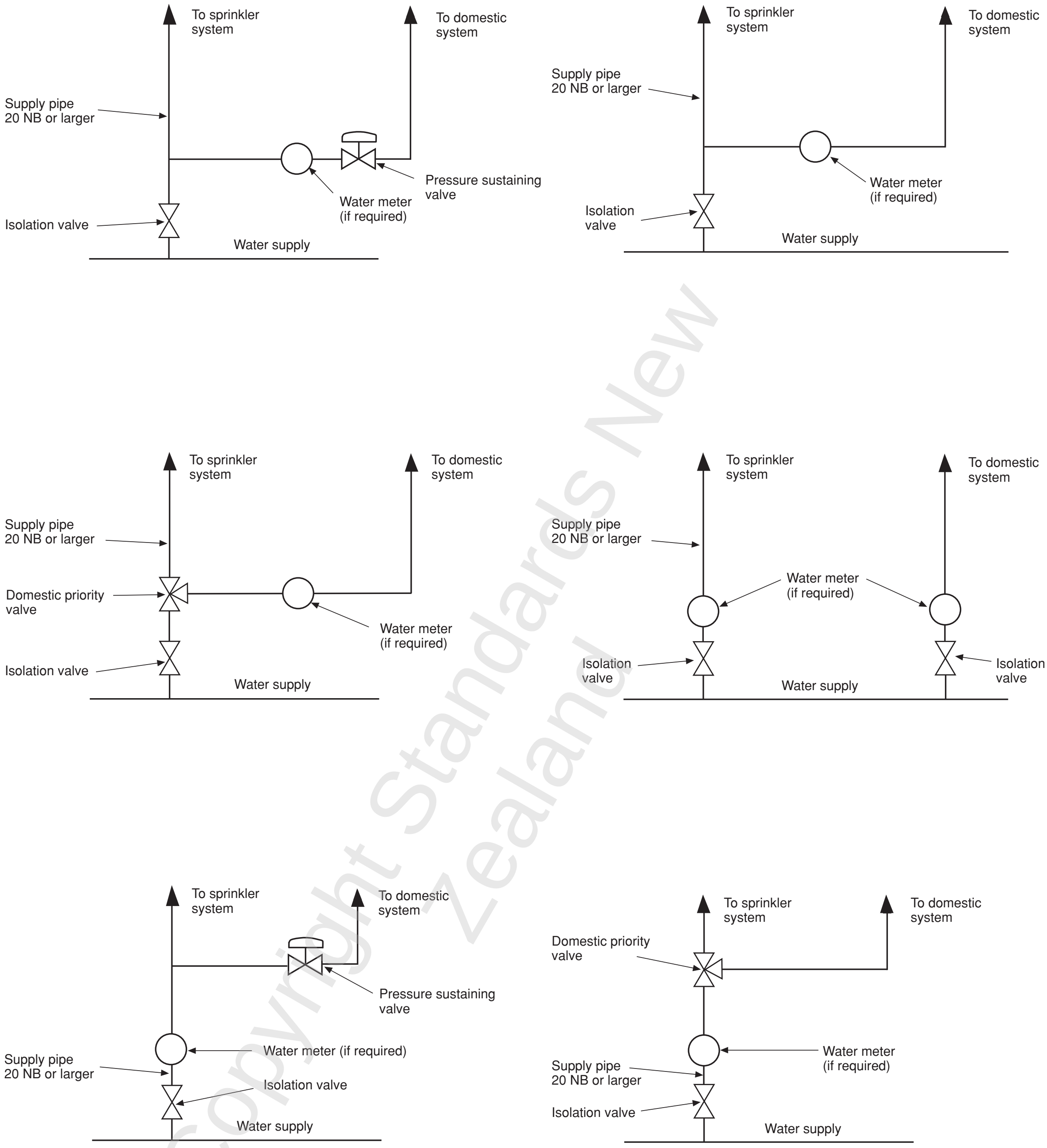


Figure 6.1 – Acceptable reticulated water supply arrangements for independent systems

6.5.1.6
The flow and pressure characteristics of the reticulated water supply shall be determined. The pressure available to meet the design requirements shall be 80 % of the pressure available at the reference point. Where it can be established that proposed upgrading of the reticulation by the water supply authority will result in an improvement in the pressure and flow characteristics obtained at the time of the test, 100 % of the pressure may be taken subject to the approval of the authority having jurisdiction.

NOTE – The flow and pressure characteristics may be provided by the water supply authority or by the method in Appendix C.

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

NOTE – Alternative water supplies do not require to be derated.

6.5.2 Backflow protection

6.5.2.1
Backflow protection is required for independent systems.

NOTES –
(1) Acceptable Solution G12/AS1 of Approved Document for New Zealand Building Code, Clause G12 requires a double check valve backflow preventer for systems that do not contain hazardous or toxic anti-freeze.

(2) Acceptable Solution G12/AS1 of Approved Document for New Zealand Building Code, Clause G12 requires a reduced pressure zone backflow preventer for systems that contain hazardous or toxic anti-freeze.

(3) Adding a plumbing fixture to induce regular flushing flow will effectively change an independent system into a combination system and a backflow preventer may be omitted.

6.5.2.2
Backflow prevention is not usually required for combination systems.

7 HYDRAULIC CALCULATIONS

7.1 General

Pipe diameters shall be such as to 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 D and a worked example is provided in Appendix E.

7.2 General calculation methods

7.2.1

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

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

(b) Pipe diameters;

(c) Sprinkler head listing requirements;

(d) Number of sprinkler heads in operation; and

(e) Elevation of the sprinkler heads.

7.2.2 Domestic demands

When 6.5.1.5 requires that the water supply be capable of meeting a simultaneous domestic and fire sprinkler head 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. Refer figure 7.1.

7.2.3 Listed residential sprinkler heads

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

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 door does not fulfil these criteria the spaces on either side of the door are part of the same room.

The following calculation procedure applies:

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

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

(c) Determine the minimum pressure and flow for the sprinkler heads from the listing criteria;

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

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

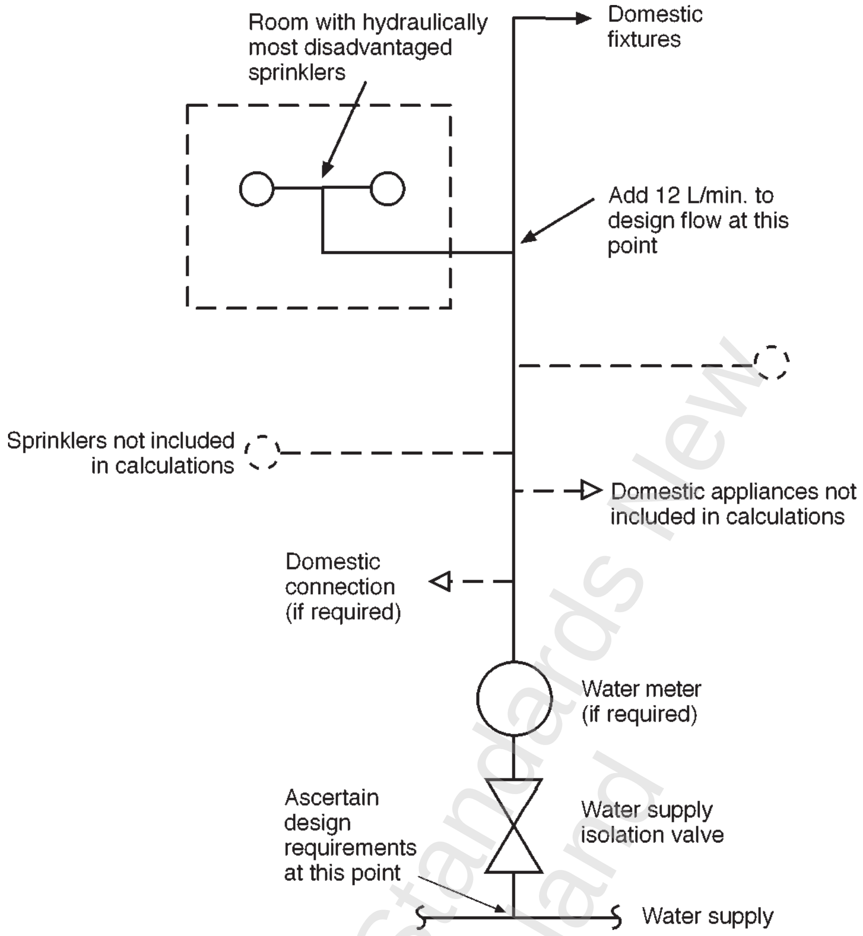


Figure 7.1 – Calculation of hydraulic demands

7.2.4 Sprinkler heads other than residential type

Where such heads are required an additional calculation to that described in 7.2.3 is necessary as follows:

(a) Determine the number of sprinkler heads (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 head (see table 5.2);

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

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

8 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 all interior piping 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 (refer Appendix F); and

(e) Ensure the correct function of all other 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.

9 DOCUMENTATION

The following documentation shall be provided in a durable form to the building owner and placed in a permanent holder located in a convenient position (e.g. adjacent to the spare sprinklers):

(a) Producer statement (refer to Appendix G);

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

(c) A copy of the as-built drawings and design documentation (refer to Appendix H);

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

(e) A copy of the maintenance instructions including details of routine inspection and maintenance to be carried out (refer to Appendix I); and

(f) An owner's guide (refer Appendix J).

APPENDIX A
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. Such a feature will not only provide a remote indication of a fire, but will also provide an alarm signal should a pipe or pipe joint fail which will minimize water damage.

NOTE – At the time of preparation of this Standard, such a feature was not possible for combination systems.

(b) Protection of areas of the building where sprinkler protection are not mandated by this Standard. Such areas include, but are not limited to:

(i) Concealed ceiling spaces

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

(ii) Cupboards and wardrobes

(iii) Under floor spaces where accessible for storage

(iv) Toilets and bathrooms and

(v) Detached or fire-separated garages/buildings.

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

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

APPENDIX B
INDEPENDENT ANTI-FREEZE SYSTEMS

(Normative)

B1

An independent anti-freeze 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 anti-freeze solution complying with table B1. No toxic anti-freeze materials shall be permitted.

NOTES –

(1) The anti-freeze design temperature must be 10 ºC lower than the expected lowest external temperature.

(2) Thoroughly premix anti-freeze mixtures before putting them into the sprinkler system pipework.

(3) For additional design guides on anti-freeze systems refer to NFPA 13, chapter 4, section 5 anti-freeze systems.

Table B1 – Anti-freeze solutions

Material	**Solution (by volume)**	**Freezing point** (ºC)	**Density**			
			5 ºC	**10 ºC**	**15 ºC**	**20 ºC**
Glycerine	50 % water	–26.1	–	–	1.133	–
Propylene glycol	70 % water	–12.8	1.030	1.028	1.027	1.023
	60 % water	–21.1	1.039	1.037	1.034	1.031
	50 % water	–32.2	1.048	1.045	1.041	1.038

NOTES –

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

(2) The temperature of the anti-freeze mixture is critical when measuring the density and shall be plus or minus 1 ºC.

(3) Hydrometer scale for glycerine should be 1.000 to 1.200, in 0.005 increments.

(4) Hydrometer scale for propylene glycol should be 1.000 to 1.120, in 0.002 increments.

B2

Anti-freeze shall be compatible with the materials of the piping systems.

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

B3

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

B4

The anti-freeze mixtures listed have a thermal expansion co-efficient greater than water. Natural seasonal or daily temperature variations may cause under or over pressure in a system downstream of any check valve to a backflow prevention unit. An expansion chamber shall be sized and fitted, as per 4.5.3.2 of NFPA 13, where maximum pressures exceed the design pressure of the sprinkler system components.

B5

Where the entire installation is filled with anti-freeze, the installation shall comply with the requirements of figure B1.

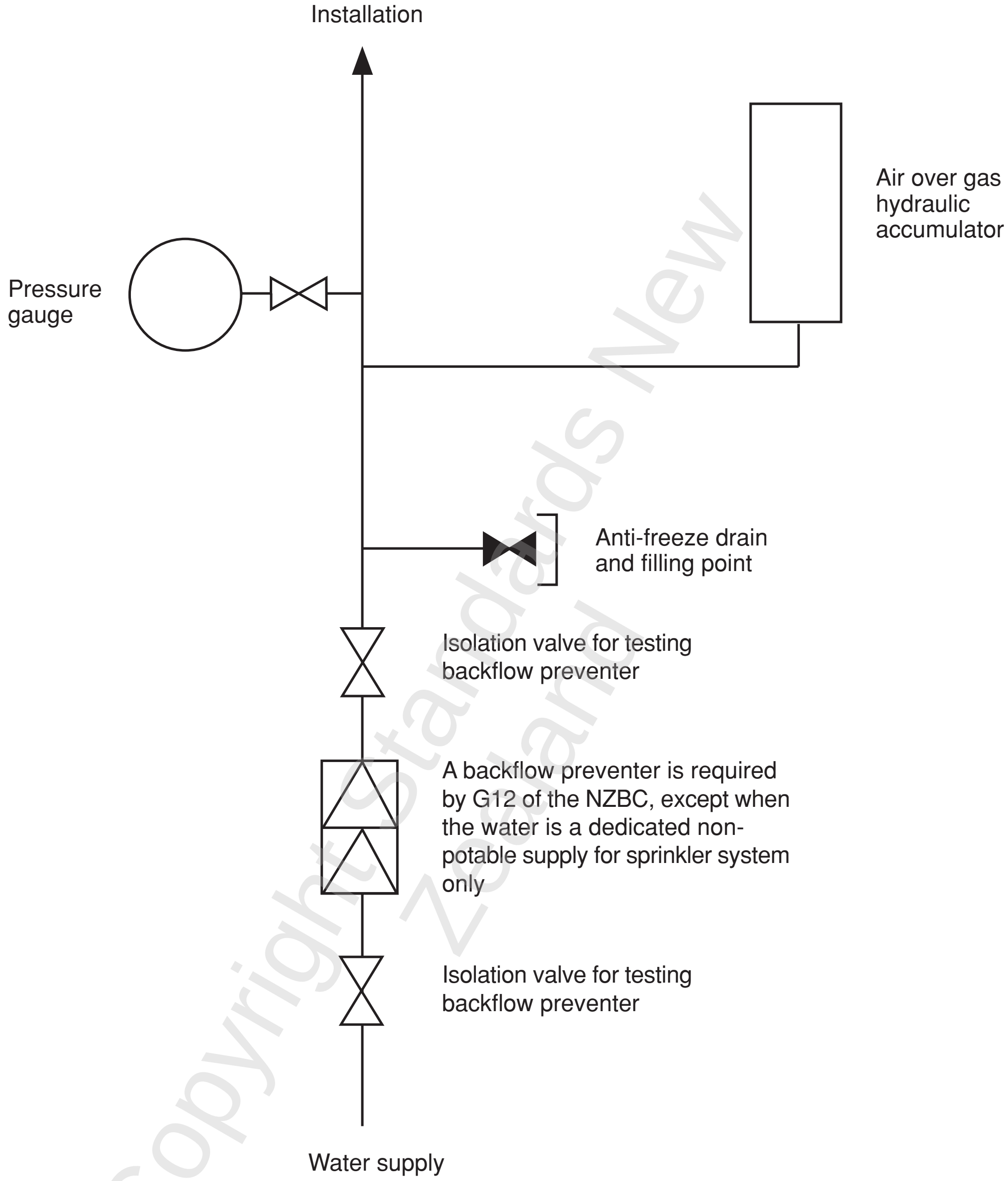
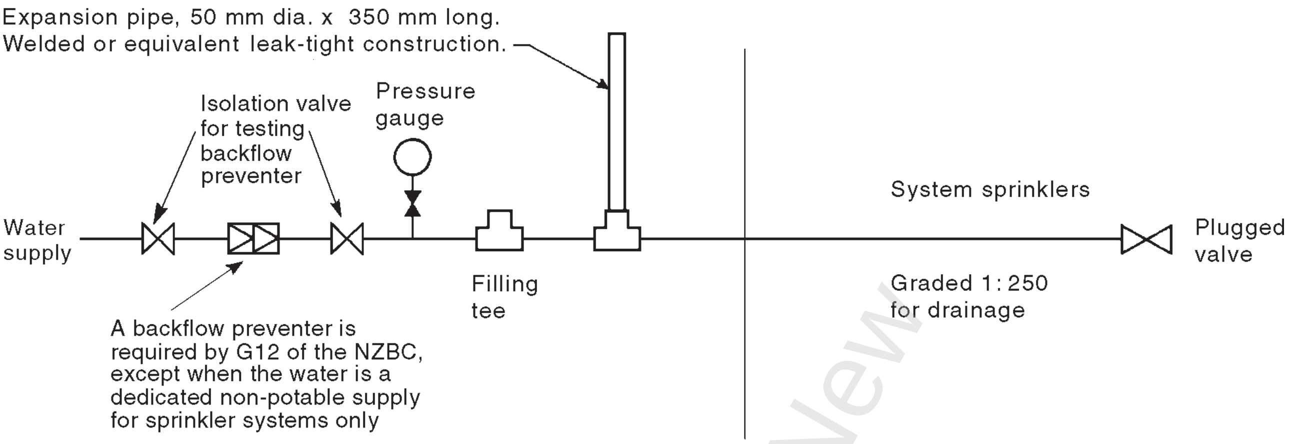


Figure B1 – Required components for anti-freeze installation control valves

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.

B6

Sections of independent systems may be protected from freezing by means of tail-end anti-freeze systems which shall be in the form shown in figure B2.



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

Figure B2 – Small, tail-end, anti-freeze systems

B7

Pipes filled with anti-freeze shall be sloped to drain. Roof space sprinkler heads and external sprinkler heads on pipes filled with anti-freeze shall be installed upright.

B8

For reliable performance, the anti-freeze mixture should be drained from the system and checked annually.

APPENDIX C
TESTING OF RETICULATED WATER SUPPLY

(Informative)

C1
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.

C2
The flow and pressure characteristics of the reticulated water supply are determined using a flow gauge and pressure gauge attached by independent connections each going directly to the reticulated water supply, as close together as is practicable. Normally two adjacent fire hydrants will provide the points of attachment.

NOTE – Ensure that the design of sprinkler hydraulics is based upon minimum water supply pressure as stated in the (territorial authority's) district plan.

C3
The test is made during periods of maximum daily draw-off. The flow gauge is so placed with respect to 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.

C4
Values of pressure and flow are recorded at not less than 2 and preferably 3 flow rates, with one being between two and three times the maximum design flow. These results are used to prepare a graph relating pressure and flow. Pressure is plotted to a suitable scale on the ordinate ('y' axis) and the 1.85 power of the flow on the abscissa ('x' axis). The line relating pressure and flow (line A) should be drawn (see figure C1).

C5
An adjustment is made to all test pressure readings to allow for the difference in height between the proposed reference point and the test 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.

C6
A further adjustment is now made, using the Hazen-Williams formula and the known 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 D, 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.

C7
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.

C8

Where it can be established that proposed upgrading of the reticulation by the water supply authority will result in an improvement in the pressure and flow characteristics obtained at the time of the test, 100 % of the pressure indicated by line C of the graph may be taken subject to the approval of the authority having jurisdiction.

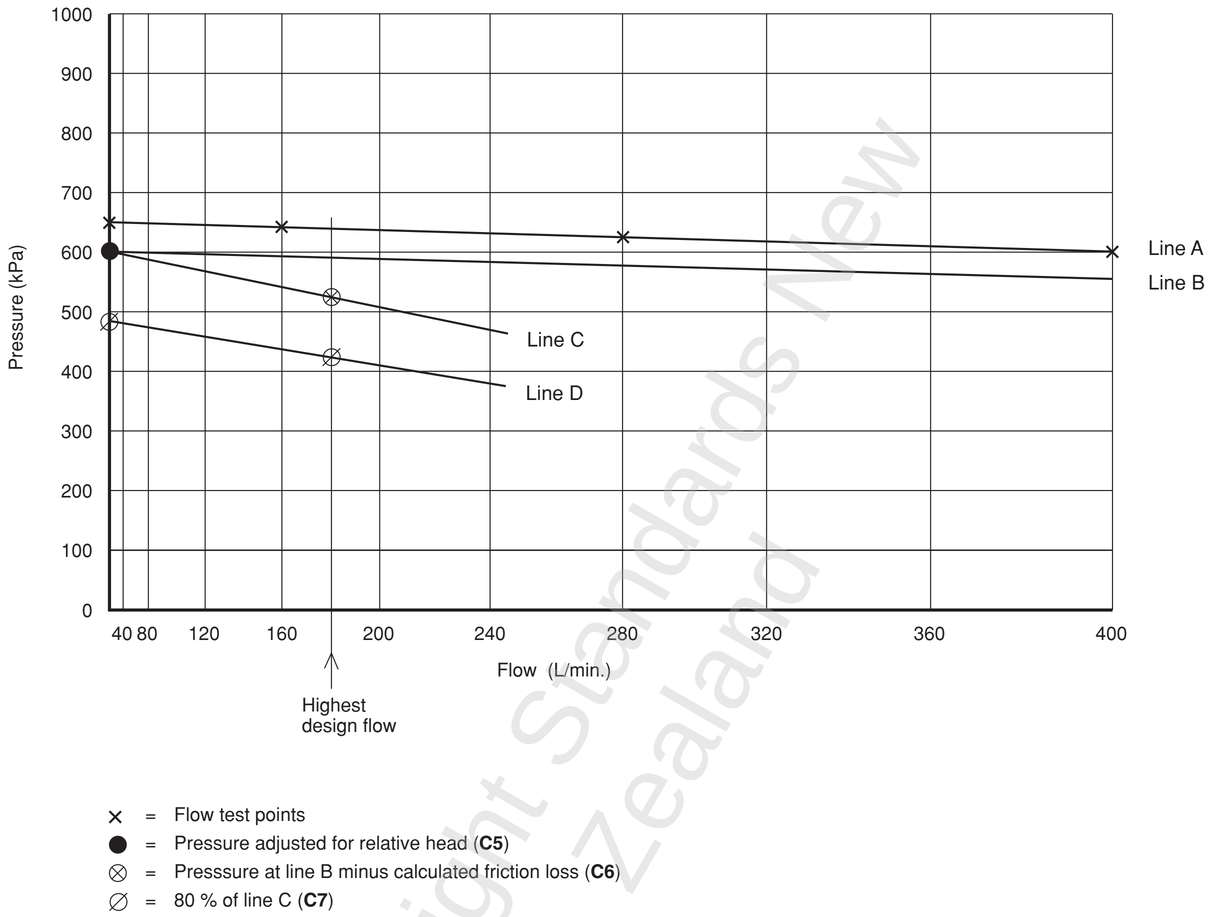


Figure C1 – Water supply flow graph

APPENDIX D
METHOD OF HYDRAULIC CALCULATION

(Normative)

D1 Accuracy

The following dimensions shall be expressed in the units and to the accuracy shown in table D1.

Table D1 – Calculation accuracy

Dimension	Unit	Accuracy
Length and elevations	m	nearest 0.1 m
Flow rate	L/min	nearest 1 L/min
Pressure	kPa	nearest whole unit

D2 Checking that the available pressure is sufficient

Having established the location of the sprinkler heads, and the layout and dimensions of the proposed supply pipework, the 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 sprinkler heads being used;

(b) Establish the location of the most hydraulically disadvantaged single sprinkler head, and (if used) multiple sprinkler heads;

(c) Measure the length of pipe to the above location(s) and the number and type of fittings thus enabling the calculation of TOTAL EQUIVALENT PIPE LENGTH;

(d) Using the required sprinkler flow, and if a combination system the domestic flow, establish the pressure losses due to flow (dynamic loss);

(e) Calculate static pressure loss due to the height difference between reference point and sprinkler head(s);

(f) Find the pressure loss due to any water meter, backflow devices etc (see Appendix K);

(g) Add dynamic, static and water meter loss to find the total pressure loss;

(h) Subtract the total pressure loss from the pressure at the reference point to determine the available pressure for sprinkler head flow; and

(i) Compare the available pressure with the pressure required by the sprinkler head(s). The former should be greater than or equal to the required pressure. If not, review the design.

D3 Required pressure and flow for residential sprinkler heads

The pressure required and the associated flow of residential sprinkler heads 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.

D4 Most hydraulically disadvantaged sprinkler head(s)

This sprinkler head(s) is in the location for which the pressure loss will be the greatest due to:

(a) Height above reference point;

(b) Distance from reference point; and

(c) Number of fittings in the pipe run.

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

D5 Pressure loss in fittings and valves

Allow for loss of pressure due to water flow through pipe elbows, tees and bends where the direction of water flow is changed through an angle of 45º or more (other than the change of direction into a sprinkler head or sprinkler assembly, or drop from an elbow or tee into which the sprinkler head 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 can be obtained from manufacturer's data sheets or table D2. 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 K.

Table D2 – Typical hydraulic equivalent length factors for pipe fittings

Pipe diameter	Equivalent pipe length in metres				
	20 mm	25 mm	32 mm	40 mm	50 mm
Tees into branches	1.2	1.5	2.0	2.4	3.0
Tees, flow through	0.5	0.5	0.6	0.8	1.0
Elbows	0.7	0.9	1.2	1.4	1.8
Bends (less than 90º)	0.4	0.5	0.6	0.7	0.9

D6 Calculation of pressure loss in pipes

Pressure losses due to water flow through pipes shall be determined using the Hazen-Williams formula below, or the tables and graphs in Appendix K.

NOTE – Guidance on the Hazen-Williams calculation method can be obtained 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 bore diameter (mm)
C is a constant for the type of pipe, i.e.
Steel (black or galvanised) $C = 120$
Plastic and non-ferrous pipe $C = 150$
The constant for other types of pipe shall be as per its listing.

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

D7 Calculation of static pressure head

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

$$P = h \times 10$$

where

P is the gain or loss due to head (kPa)
h is the difference in height between sprinkler heads and the reference point (m).

D8 Calculation of discharge from a sprinkler head

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

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

where

Q is the discharge from the sprinkler head (L/min)
P is the pressure at entry to sprinkler orifice (kPa)
K is the constant having the values as shown in table D3

Table D3 – Sprinkler *K* values

Nominal sprinkler head size	*K* value
10 mm	5.7
15 mm	8.0
Residential sprinkler heads	As per listing

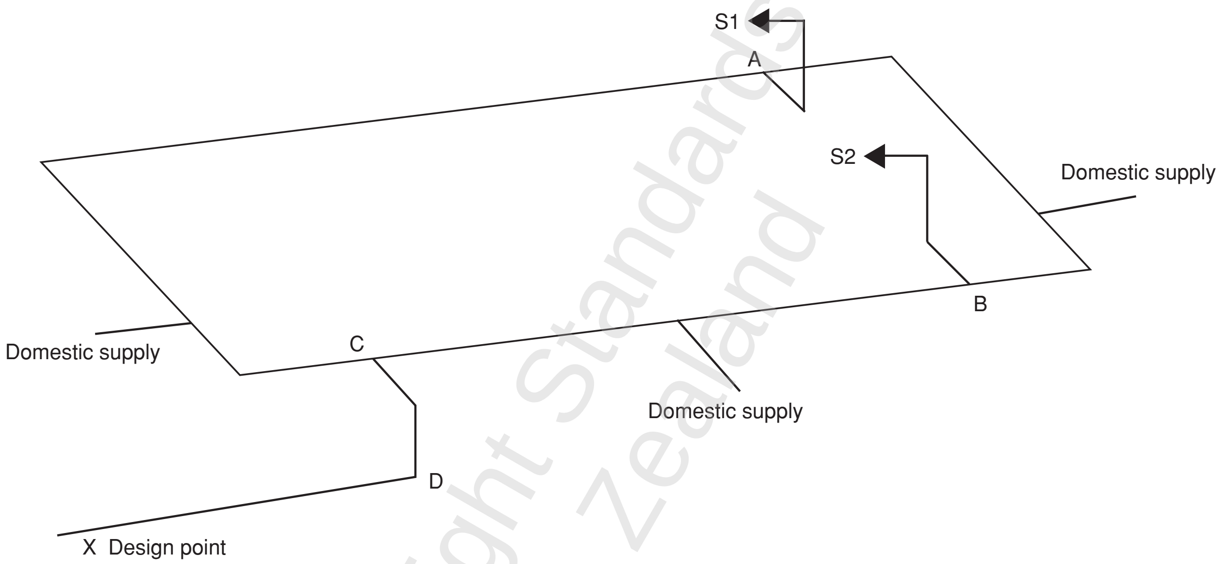
APPENDIX E
WORKED EXAMPLE

(Informative)

NOTE – This calculation has been created from content of the publication BRANZ: Design guide – Sprinklers for houses, 2002 with the kind permission of BRANZ.

E1
This worked example has been prepared to demonstrate how to calculate the design requirement for a domestic sprinkler system.

E2
The example design is for a house of two floors. The lower floor is 23 m wide by 12 m long and the upper floor is 10 m by 5 m. The accommodation comprises three bedrooms, study, lounge, and open plan dining, kitchen and family areas with a rumpus on the upper floor.



A loop system is proposed with single pendant sprinkler heads in each of the bedrooms, study and lounge and three pendant sprinkler heads in the open plan area on the ground floor. The upper floor will be protected with four sidewall sprinkler heads.

E3
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	NB (mm)	Material	Length (m)
S1-A	20	Copper	5.5
S2-B	20	Copper	3.8
Loop	25	Copper	59.3
C-D	25	Copper	4.3
D-X	40	PE80	5.0

The system includes the following fittings:

Section	Elbows	Tees (branch)	Tees (run)
S1-A	1	1	–
S2-B	1	1	–
Loop	12	2	16
C-D	2	1	–
D-X	–	–	–

The ground floor sprinkler heads are 2.3 m above the reference point; the upper floor sprinkler heads are 5.6 m above the reference point.

The residential sprinkler heads to be used have the following specifications:

Sprinkler head	Coverage area	Pressure (kPa)	Flow (L/min)
Pendant	5.5 m x 5.5 m	70	60
Sidewall	4.9 m x 4.9 m	100	80

For the purposes of this example it is assumed that the sprinkler heads in the rumpus room are the most hydraulically disadvantaged sprinkler heads. This is by virtue of the fact that they are the highest, have a longer pipe run from the loop and are sidewall sprinkler heads, which require greater pressure than the pendant sprinkler heads being used. If there is any doubt about which sprinkler heads are the most disadvantaged, further calculations to check the required pressure will be necessary.

E4 Calculating equivalent pipe lengths

Section S1-A – 20 mm copper

Fittings	Number	Factor (from table D2)	Equivalent length (m)
Tees (branch)	1	1.2	1.2
Tees (run)	0	0.5	–
Elbows	1	0.7	0.7
Bends	0	0.4	–
Length of pipe run			5.5
Total equivalent pipe run			7.4

Section S2-B – 20 mm copper

Fittings	Number	Factor (from table D2)	Equivalent length (m)
Tees (branch)	1	1.2	1.2
Tees (run)	0	0.5	–
Elbows	1	0.7	0.7
Bends	0	0.4	–
Length of pipe run			3.8
Total equivalent pipe run			5.7

Section Loop – 25 mm copper

Fittings	Number	Factor (from table D2)	Equivalent length (m)
Tees (branch)	0	1.5	–
Tees (run)	16	0.5	8.0
Elbows	12	0.9	10.8
Bends	0	0.5	–
Length of pipe run			59.3
Total equivalent pipe run			78.1
For a loop, equivalent length = equivalent run x 0.14			10.9

Section C-D – 25 mm copper

Fittings	Number	Factor (from table D2)	Equivalent length (m)
Tees (branch)	1	1.5	1.5
Tees (run)	0	0.5	–
Elbows	1	0.9	0.9
Bends	0	0.5	–
Length of pipe run			4.3
Total equivalent pipe run			6.7

Section D-X – 40 mm PE80B

Fittings	Number	Factor (from table D2)	Equivalent length (m)
Tees (branch)	0	2.4	–
Tees (run)	0	0.8	–
Elbows	0	1.4	–
Bends	0	0.7	–
Length of pipe run			5.0
Total equivalent pipe run			5.0

E5 Flow from the most hydraulically disadvantaged sprinkler heads

By inspection, the most hydraulically disadvantaged sprinkler head is S1 (it is furthest from the loop). It is necessary to calculate the flow through S2 when sprinkler head S1 is operating at its listed pressure and flow.

Calculate the pressure loss in section S1-A and balance with S2-B.

Section	Size (mm)	Equivalent length (m)	Difference in height to loop (m)
S1-A	20	7.4	2.8
S2-B	20	5.7	2.8

Pressure loss (ΔP) = (Loss per metre x length of pipe) + static head loss

From the Hazen-Williams formula (or by interpolation in table K5), loss per metre, for a flow of 80 L/min in 20 mm copper pipe = 11.2 kPa/m. (The graph cannot be read precisely enough for these calculations.)

Pressure loss $(\Delta P)_{S1\text{-}A}$ = (11.2 kPa/m x 7.4 m) + (10 kPa/m x 2.8 m) kPa
= 110.9 kPa

Therefore pressure required at A to give listed pressure at sprinkler head = 100 + 110.9 = 210.9 kPa.

Assume the pressure at B is the same, 210.9 kPa.

It is now necessary to find the flow in S2-B that will result from a pressure at B of 210.9 kPa. This can be achieved by making a number of estimates of the pressure at S2 and using an iterative process to find the appropriate flow.

K factor of sprinkler heads = Q/√P
for S1 and S2, *K* = 80/√100 = 8.0

S1 and S2 are at the same height and the equivalent length of S2-B is less than that for S1-A. Therefore the pressure at sprinkler S2 will be greater than that at S1. Take the first estimate as 120 kPa.

Q = *K*√P
= 8.0 x √120
= 87.6 L/min

From the Hazen-Williams formula (or by interpolation in table K5), at this flow, the pressure loss per metre = 13.26 kPa/m.

Friction loss + static loss, $\Delta P_{S2\text{-}B}$ = (13.26 x 5.7) + (10 x 2.8)
= 103.6 kPa

Therefore estimated pressure at B = 103.6 + 120 = 223.6 kPa *The estimated pressure is too high!*

Estimate pressure at S2 = 110 kPa

Q = 8 x √110
= 83.9 L/min

From table K5, the pressure loss per metre = 12.23 kPa/m
$\Delta P_{S2\text{-}B}$ = (12.23 x 5.7) + (10 x 2.8)
= 97.7 kPa

Therefore estimated pressure at B = 97.7 + 110 = 207.7 kPa *The estimated pressure is too low!*

Estimate pressure at S2 = 112 kPa

Q = 8 x √112
= 84.7 L/min

From table K5, the pressure loss per metre = 12.44 kPa/m

$\Delta P_{S2\text{-}B}$ = (12.44 x 5.7) + (10 x 2.8)
= 98.9 kPa

Therefore estimated pressure at B = 98.9 + 112 = 210.9 kPa *The estimated pressure is correct!*

Therefore sprinkler S2 is flowing at 84.7 L/min, and the two sprinklers that are most hydraulically disadvantaged require a flow of 80 + 84.7 L/min = 164.7 L/min.

NOTE – Section S2-B (in E4 above) can now be ignored because the two sprinkler branches have been balanced.

E6 Calculating dynamic loss
Total flow rate for the multiple sprinkler head operation is 164.7 L/min plus the domestic load (taken as 12 L/min) is 176.7 L/min. This applies to the PE80B, 25mm copper to the loop and the loop.
Flow rate for branch S1-A to sidewall sprinkler head is the single sprinkler head flow, 80 L/min.

From the formula or tables the following loss per metre of pipe applies for the pipe sections at the flow rates.

Section	**Flow rate** (L/min)	**Pressure loss per metre** (kPa/m)	**Equivalent pipe length** (m)	**Dynamic pressure loss** (kPa)
S1-A – 20 mm copper	80	11.2	7.4	82.9
Loop – 25 mm copper	176.7	11.8	10.9	128.6
C-D – 25 mm copper	176.7	11.8	6.7	79.0
D-X – 40 mm PE80B	176.7	3.66	5.0	18.3
Total dynamic pressure loss for system, kPa				308.8

E7 Calculating static pressure loss
Using the formula given in D7, for the multiple sprinkler head operation, static loss = 5.6 x 10 = 56 kPa.

E8 Total pressure loss
There is no water meter proposed for this design. Available pressure at the design point is 500 kPa.

For the most hydraulically disadvantaged sprinkler head with multiple sprinkler head operation:

Pressure loss	kPa
dynamic loss	308.8
static loss	56.0
meter loss	0
Total	364.8
Pressure at design point	500.0
Pressure available for sprinkler head	135.2

As the pressure required by the sprinkler head is 100 kPa, the system design is satisfactory.

If the pressure available for the most hydraulically disadvantaged sprinkler head is insufficient, then adjustments will need to be made to the design. With larger pipe diameters or different sprinkler heads there may be sufficient pressure available to operate the sprinkler heads. A more rigorous design undertaken by an experienced sprinkler designer could result in the design as laid out being adequate.

APPENDIX F
VERIFICATION FLOW TEST

(Normative)

F1 General

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

F2 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 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 rod, a 25 mm female to 15 mm female socket is attached, into which can be screwed a sprinkler head 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 head has the glass bulb and deflector removed. Figure F1 shows the test branch.

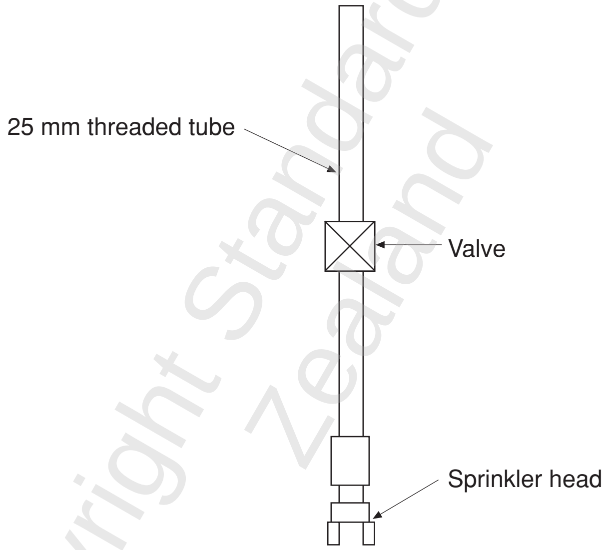


Figure F1 – Test branch

F3 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 multiple 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 pressure gauge. The system should be charged slowly to avoid a false reading due to surge.

Step 3. Position the containers beneath the branches, with the graduated container placed under the outlet which was nominated as the primary most disadvantaged head.

Step 4. Open the valves 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 installed pressure gauge.

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. The verification test is deemed satisfactory provided the tested flow rate is equal to or exceeds the flow rate as published in the manufacturer's listing.

Step 7. On completion of the verification test, fully open the flow test valve and allow water to flow. Note the pressure while the water is flowing. This pressure is deemed the system pressure.

F4 Recording of verification flow tests

Step 8. Mark the following points on a $Q^{1.85}$ abscissa graph (see example figure F2):

(a) Each minimum calculated design flow and pressure (sprinkler design points);

(b) The static water supply pressure (point "A");

(c) 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");

(d) The pressure and flow recorded at the control valve gauge when the sprinkler verification flow was discharging (step 5) (point "B").

Draw a line from the static water supply pressure through this point to the X axis. This is the water supply characteristic line.

From the zero point on the graph, draw a line crossing the water supply characteristic line at the pressure corresponding to the system reference pressure (point "D"). This is the flow test valve characteristic line.

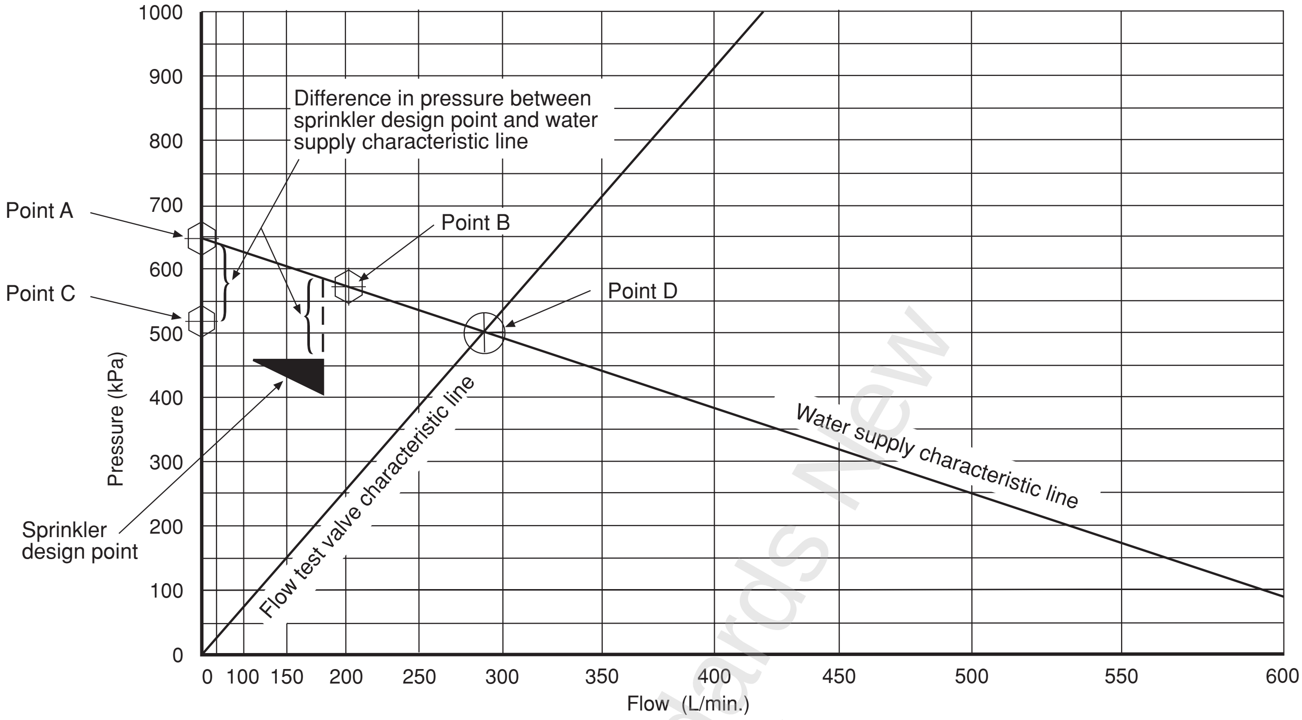


Figure F2 – Example of a verfication flow test record (see **F4**)

APPENDIX G
DOMESTIC SPRINKLER SYSTEM PRODUCER STATEMENT (DESIGN AND CONSTRUCTION)

(Normative)

DOMESTIC SPRINKLER SYSTEM PRODUCER STATEMENT (DESIGN AND CONSTRUCTION)

The sprinkler system installed in accordance with

....(Building Consent number)

on the ....(Date)

at: ....

....

(Full street address)

complies with the requirements of NZS 4517:2002 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 organization ....

Qualification ....

Date ....

(Copyright of this form has been waived by Standards New Zealand and may be reproduced only from an original version of this Standard.)

APPENDIX H
AS-BUILT DRAWINGS AND DESIGN DOCUMENTATION

(Normative)

H1
As-built sprinkler head 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, sprinkler heads and other pipe fittings which require hydraulic consideration;

(b) Type of pipes used;

(c) Pipes supplying hydraulically disadvantaged sprinkler heads;

(d) Sprinkler heads assumed to be operating; and

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

H2
Calculation data sheets shall be provided to support the as-built sprinkler head and pipe layout drawings, and which contain the following:

(a) Sprinkler head data:

(i) Node or reference number

(ii) Flow from sprinkler head (L/min)

(iii) Pressure at sprinkler head (kPa)

(b) Hydraulically significant pipe:

(i) Node or reference numbers

(ii) Nominal bore (mm)

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

(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 head change in pipe (kPa)

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

(x) Friction loss in pipe (kPa)

(c) Any other relevant information.

APPENDIX I
ROUTINE TESTING AND MAINTENANCE

(Informative)

I1 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 building alterations or changes to the water supply will require changes to the sprinkler system in order to maintain performance.

I2 Monthly checks

The following checks should be carried out monthly:

(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 system reference pressure. If this is less than the pressure recorded at commissioning, carry out the following using the record of the verification flow tests (Appendix F).

Draw a line from a point on the y-axis corresponding to the present static pressure through the point on the drain 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; and

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

I3 Annual checks

The following checks should be carried out annually:

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

(b) Backflow prevention device should be tested to AS/NZS 2845.3.

APPENDIX J
EXAMPLE OF OWNER'S GUIDE

(Informative)

J1 General

J1.1
Your home fire sprinkler system is designed to:

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

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

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

(d) Prevent fire within the home becoming a threat to life;

(e) Allow 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 extinguish or control a fire within a sprinkler protected room.

J1.2
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 customizing.

(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 work-bench.

J2 Sprinkler system components

J2.1 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 e.g. install alarms into an attached garage etc. It is recommended that you familiarize yourself with the location of all smoke alarms.

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 due to the 230 Volt supply.

If the smoke alarms use batteries, it is recommended that they be changed on 'daylight saving' changeover days.

J2.2 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 sprinkler heads. 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 preventer, 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.

J2.3 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.

J2.4 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 etc.

J2.5 Sprinkler system pressure gauge

A pressure gauge will be fitted which will provide a 24-hour reading of the water pressure. The minimum pressure required to operate the sprinkler system will be marked on the gauge so that you can always check to ensure the system is supplied with the correct water pressure.

J2.6 Sprinkler system pipework

The sprinkler system pipework may be run off the normal domestic water to supply the sprinkler heads. 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.

J2.7 "Residential" sprinkler head

Residential sprinkler heads 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 sprinkler heads used for commercial applications.

The fire sprinkler heads fitted in your home are "Quick Response" sprinklers. These are small, high-sensitivity devices activated by heat that either melts a specialized solder link or shatters a small liquid filled bulb. "Quick response" means that the sprinkler head is fitted with a "Fast Response" element and must operate within 75 seconds under test conditions when the pre-set temperature is breached.

J2.8 Areas not covered by the sprinkler system

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

(a) Unattached garages (unless used for sleeping);

(b) Toilets and bathrooms;

(c) Laundry;

(d) Wardrobes;

(e) Conservatories;

(f) Sub-floor area; and

(g) Ceiling void.

The decision on whether or not to install sprinklers in these areas is made on the risk assessment that considers 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.

J3 Modifications to plumbing system after installation

Any system extension, modification or alteration to the domestic plumbing should be carried out by a qualified installer who is responsible for ensuring that the sprinkler system remains fully functional.

J4 Recommended day-to-day practices

The following are recommended:

(a) Familiarize 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) Inspect the sprinkler heads on a regular basis for obstructions, paint or mechanical damage. If sprinkler heads 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 the head 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;

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

(e) Do 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 head 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 head should be covered with a small paper bag and/or carefully masked off to prevent paint splatter or spray drift onto the sprinkler. The protective covering should be removed as soon as painting is completed in the compartment;

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

(f) Check and clean smoke alarms every month as per the manufacturer's instructions;

(g) The sprinkler heads fitted in your home will require testing by a qualified installer every twenty years. Other maintenance may be required only when a sprinkler head has either been mechanically damaged or following activation and/or exposure to fire.

J5 In the event of a fire

In the event of a fire:

(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 re-assembled and must be replaced;

Check with the installer for minimum replacement requirements.

J6 Sprinkler head operation under fire conditions

During fire conditions, the temperature around a sprinkler head 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 head 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 spray will immediately cool the hot gases from the fire, other adjacent sprinkler heads may not be activated. The water spray will reach the burning material, cooling it below its combustion temperature to extinguish or control the fire.

APPENDIX K
TYPICAL HYDRAULIC DESIGN DATA

(Informative)

K1

The data in the following tables and graphs have been prepared to provide typical design data for use in hydraulic calculations of domestic sprinkler systems.

K2

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 D. Specialist advice or assistance may be available from the sprinkler head supplier.

K3

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.

K4

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 K1 – Pressure losses for PE 80B pipe to AS/NZS 4130

Flow rate (L/min)	**Pressure loss** (kPa) **Internal diameter** (mm)				
	25	**32**	**40**	**50**	**63**
30	1.49	0.44	0.15	0.05	0.02
35	1.97	0.58	0.20	0.07	0.02
40	2.50	0.73	0.25	0.09	0.03
45	3.10	0.91	0.31	0.11	0.04
50	3.75	1.10	0.38	0.13	0.04
55	4.46	1.30	0.45	0.15	0.05
60	5.23	1.52	0.52	0.18	0.06
65	6.06	1.76	0.60	0.20	0.07
70	6.94	2.01	0.69	0.23	0.08
75	7.88	2.28	0.78	0.26	0.09
80	8.87	2.57	0.88	0.29	0.10
85	9.92	2.87	0.98	0.33	0.11
90	11.02	3.18	1.09	0.36	0.12
95	12.18	3.51	1.20	0.40	0.13
100	13.40	3.86	1.32	0.44	0.14
105	14.67	4.22	1.44	0.48	0.16
110	15.99	4.60	1.56	0.52	0.17
115	17.37	4.99	1.70	0.57	0.19
120	18.81	5.39	1.83	0.61	0.20
125	20.30	5.81	1.97	0.66	0.22
130	21.84	6.25	2.12	0.71	0.23
135	23.44	6.70	2.27	0.76	0.25
140	25.09	7.17	2.43	0.81	0.27
145	26.79	7.65	2.59	0.86	0.28
150	28.55	8.14	2.76	0.92	0.30
155	30.37	8.65	2.93	0.97	0.32
160	32.24	9.18	3.10	1.03	0.34
165	34.16	9.72	3.28	1.09	0.36
170	36.13	10.27	3.47	1.15	0.38
175	38.16	10.84	3.66	1.21	0.40
180	40.24	11.42	3.85	1.28	0.42
185	42.38	12.02	4.05	1.34	0.44
190	44.57	12.63	4.26	1.41	0.46
195	46.82	13.26	4.47	1.48	0.48
200	49.11	13.90	4.68	1.55	0.50
205	51.46	14.56	4.90	1.62	0.53
210	53.87	15.23	5.12	1.69	0.55
215	56.33	15.91	5.35	1.77	0.58
220	58.84	16.61	5.58	1.84	0.60
225	61.40	17.33	5.82	1.92	0.63
230	64.02	18.05	6.06	2.00	0.65
235	66.69	18.80	6.31	2.08	0.68
240	69.42	19.56	6.56	2.16	0.70
245	72.20	20.33	6.81	2.24	0.73

Table K2 – Pressure losses for PE-X SDR 7.4 pipe to DIN 1988

Flow rate (L/min)	Pressure loss (kPa) Internal diameter (mm)				
	20	25	32	40	50
30	7.53	2.54	0.75	0.26	0.09
35	9.98	3.36	0.98	0.34	0.12
40	12.75	4.28	1.25	0.43	0.15
45	15.83	5.30	1.54	0.53	0.18
50	19.23	6.43	1.87	0.63	0.22
55	22.95	7.65	2.22	0.75	0.26
60	26.98	8.98	2.60	0.88	0.30
65	31.31	10.40	3.01	1.02	0.35
70	35.96	11.93	3.44	1.16	0.40
75	40.92	13.55	3.90	1.32	0.45
80	46.18	15.27	4.39	1.48	0.51
85	51.75	17.09	4.91	1.65	0.56
90	57.63	19.01	5.45	1.83	0.63
95	63.81	21.02	6.02	2.02	0.69
100	70.30	23.13	6.62	2.22	0.76
105	77.10	25.33	7.24	2.43	0.83
110	84.20	27.64	7.89	2.64	0.90
115	91.61	30.03	8.56	2.87	0.98
120	99.32	32.53	9.26	3.10	1.05
125	107.33	35.12	9.99	3.34	1.13
130	115.65	37.81	10.74	3.59	1.22
135	124.27	40.59	11.52	3.85	1.30
140	133.20	43.47	12.33	4.11	1.39
145	142.43	46.44	13.16	4.39	1.49
150	151.96	49.51	14.02	4.67	1.58
155	161.80	52.68	14.90	4.96	1.68
160	171.94	55.94	15.81	5.26	1.78
165	182.38	59.29	16.74	5.57	1.88
170	193.13	62.74	17.70	5.88	1.99
175	204.18	66.29	18.69	6.21	2.10
180	215.53	69.93	19.70	6.54	2.21
185	227.18	73.67	20.74	6.88	2.32
190	239.14	77.50	21.80	7.23	2.44
195	251.40	81.42	22.89	7.59	2.56
200	263.96	85.44	24.01	7.95	2.68
205	276.83	89.56	25.15	8.32	2.80
210	290.00	93.77	26.31	8.71	2.93
215	303.47	98.08	27.50	9.10	3.06
220	317.24	102.48	28.72	9.49	3.19
225	331.31	106.97	29.96	9.90	3.32
230	345.69	111.56	31.23	10.31	3.46
235	360.37	116.24	32.52	10.73	3.60
240	375.35	121.02	33.84	11.16	3.74
245	390.64	125.90	35.19	11.60	3.89

Table K3 – Pressure losses for PP-R SDR 11 pipe to DIN 8077

Flow rate (L/min)	Pressure loss (kPa) Internal diameter(mm)				
	20	25	32	40	50
30	4.24	1.39	0.43	0.15	0.05
35	5.61	1.83	0.57	0.19	0.07
40	7.16	2.33	0.72	0.24	0.08
45	8.88	2.88	0.89	0.30	0.10
50	10.77	3.49	1.08	0.36	0.12
55	12.84	4.15	1.28	0.43	0.15
60	15.08	4.87	1.49	0.50	0.17
65	17.48	5.63	1.73	0.58	0.20
70	20.06	6.45	1.98	0.66	0.22
75	22.80	7.32	2.24	0.75	0.25
80	25.72	8.25	2.52	0.84	0.28
85	28.80	9.22	2.81	0.94	0.32
90	32.04	10.25	3.12	1.04	0.35
95	35.46	11.33	3.45	1.15	0.39
100	39.04	12.45	3.79	1.26	0.42
105	42.79	13.63	4.14	1.37	0.46
110	46.70	14.86	4.51	1.50	0.50
115	50.78	16.15	4.89	1.62	0.55
120	55.02	17.48	5.29	1.75	0.59
125	59.43	18.86	5.70	1.89	0.64
130	64.01	20.29	6.13	2.03	0.68
135	68.75	21.78	6.57	2.17	0.73
140	73.65	23.31	7.03	2.32	0.78
145	78.72	24.89	7.50	2.48	0.83
150	83.96	26.53	7.99	2.63	0.88
155	89.36	28.21	8.49	2.80	0.94
160	94.92	29.94	9.00	2.97	0.99
165	100.65	31.73	9.53	3.14	1.05
170	106.54	33.56	10.08	3.31	1.11
175	112.60	35.44	10.63	3.50	1.17
180	118.82	37.37	11.21	3.68	1.23
185	125.20	39.36	11.79	3.87	1.29
190	131.75	41.39	12.39	4.07	1.36
195	138.47	43.47	13.01	4.27	1.43
200	145.34	45.60	13.64	4.47	1.49
205	152.38	47.78	14.28	4.68	1.56
210	159.59	50.02	14.94	4.89	1.63
215	166.96	52.30	15.61	5.11	1.70
220	174.49	54.63	16.30	5.33	1.78
225	182.18	57.01	17.00	5.56	1.85
230	190.04	59.43	17.71	5.79	1.93
235	198.07	61.91	18.44	6.03	2.01
240	206.26	64.44	19.18	6.27	2.08
245	214.61	67.02	19.94	6.51	2.17

Table K4 – Pressure losses for PP-R SDR 7.4 pipe to DIN 8077

Flow rate (L/min)	Pressure loss (kPa)				
	Internal diameter (mm)				
	20	25	32	40	50
30	7.53	2.54	0.78	0.26	0.09
35	9.98	3.36	1.02	0.35	0.12
40	12.75	4.28	1.30	0.44	0.15
45	15.83	5.30	1.61	0.54	0.18
50	19.23	6.43	1.95	0.66	0.22
55	22.95	7.65	2.32	0.78	0.26
60	26.98	8.98	2.71	0.91	0.30
65	31.31	10.40	3.14	1.05	0.35
70	35.96	11.93	3.59	1.20	0.40
75	40.92	13.55	4.07	1.36	0.45
80	46.18	15.27	4.58	1.53	0.51
85	51.75	17.09	5.12	1.71	0.56
90	57.63	19.01	5.69	1.90	0.63
95	63.81	21.02	6.28	2.09	0.69
100	70.30	23.13	6.90	2.30	0.76
105	77.10	25.33	7.55	2.51	0.83
110	84.20	27.64	8.23	2.74	0.90
115	91.61	30.03	8.93	2.97	0.98
120	99.32	32.53	9.67	3.21	1.05
125	107.33	35.12	10.43	3.46	1.13
130	115.65	37.81	11.21	3.71	1.22
135	124.27	40.59	12.03	3.98	1.30
140	133.20	43.47	12.87	4.26	1.39
145	142.43	46.44	13.73	4.54	1.49
150	151.96	49.51	14.63	4.83	1.58
155	161.80	52.68	15.55	5.13	1.68
160	171.84	55.94	16.50	5.44	1.78
165	182.38	59.29	17.48	5.76	1.88
170	193.13	62.74	18.48	6.09	1.99
175	204.18	66.29	19.51	6.42	2.10
180	215.53	69.93	20.57	6.77	2.21
185	227.18	73.67	21.65	7.12	2.32
190	239.14	77.50	22.76	7.48	2.44
195	251.40	81.42	23.90	7.85	2.56
200	263.96	85.44	25.06	8.23	2.68
205	276.83	89.56	26.25	8.61	2.80
210	290.00	93.77	27.47	9.01	2.93
215	303.47	98.08	28.72	9.41	3.06
220	317.24	102.48	29.99	9.82	3.19
225	331.31	106.97	31.28	10.24	3.32
230	345.69	111.56	32.61	10.67	3.46
235	360.37	116.24	33.96	11.11	3.60
240	375.35	121.02	35.34	11.55	3.74
245	390.64	125.90	36.74	12.01	3.89

Table K5 – Pressure losses for copper pipe to NZS 3501

Flow rate (L/min)	**Pressure loss** (kPa) **Internal diameter** (mm)				
	15	**20**	**25**	**32**	**40**
30	13.69	1.92	0.48	0.17	0.07
35	18.08	2.53	0.63	0.22	0.09
40	23.03	3.21	0.80	0.27	0.11
45	28.52	3.97	0.99	0.34	0.14
50	34.55	4.80	1.20	0.41	0.17
55	41.12	5.69	1.42	0.48	0.20
60	48.21	6.66	1.66	0.56	0.24
65	55.83	7.69	1.91	0.65	0.27
70	63.97	8.80	2.18	0.74	0.31
75	72.62	9.97	2.47	0.84	0.35
80	81.80	11.21	2.77	0.94	0.39
85	91.48	12.51	3.09	1.05	0.44
90	101.68	13.88	3.43	1.17	0.48
95	112.38	15.32	3.78	1.28	0.53
100	123.60	16.82	4.15	1.41	0.58
105	135.31	18.38	4.53	1.54	0.64
110	147.54	20.01	4.93	1.67	0.69
115	160.26	21.71	5.34	1.81	0.75
120	173.49	23.47	5.77	1.95	0.81
125	187.22	25.29	6.21	2.10	0.87
130	201.45	27.17	6.67	2.26	0.94
135	216.17	29.12	7.15	2.42	1.00
140	231.40	31.13	7.63	2.58	1.07
145	247.12	33.21	8.14	2.75	1.14
150	263.34	35.35	8.66	2.92	1.21
155	280.06	37.55	9.19	3.10	1.28
160	297.27	39.81	9.74	3.29	1.36
165	314.97	42.13	10.30	3.47	1.44
170	333.17	44.52	10.87	3.67	1.52
175	351.87	46.97	11.47	3.87	1.60
180	371.06	49.48	12.07	4.07	1.68
185	390.74	52.05	12.69	4.28	1.77
190	410.91	54.68	13.33	4.49	1.86
195	431.57	57.37	13.98	4.71	1.94
200	452.73	60.13	14.64	4.93	2.04
205	474.38	62.95	15.32	5.15	2.13
210	496.52	65.82	16.01	5.38	2.22
215	519.15	68.76	16.71	5.62	2.32
220	542.27	71.76	17.43	5.86	2.42
225	565.88	74.82	18.17	6.11	2.52
230	589.98	77.95	18.92	6.35	2.62
235	614.57	81.13	19.68	6.61	2.73
240	639.65	84.37	20.46	6.87	2.83
245	665.22	87.67	21.25	7.13	2.94

Table K6 – Pressure losses for CPVC Pipe to ASTM F442

Flow rate (L/min)	**Pressure loss** (kPa/m) **Internal diameter** (mm)				
	20	**25**	**32**	**40**	**50**
20	0.4	0.1	0.0	0.0	0.0
25	0.6	0.2	0.1	0.0	0.0
30	0.9	0.3	0.1	0.0	0.0
35	1.1	0.4	0.1	0.1	0.0
40	1.5	0.5	0.1	0.1	0.0
45	1.8	0.6	0.2	0.1	0.0
50	2.2	0.7	0.2	0.1	0.0
55	2.6	0.9	0.3	0.1	0.0
60	3.1	1.0	0.3	0.2	0.1
65	3.6	1.2	0.4	0.2	0.1
70	4.1	1.3	0.4	0.2	0.1
75	4.7	1.5	0.5	0.2	0.1
80	5.2	1.7	0.5	0.3	0.1
85	5.9	1.9	0.6	0.3	0.1
90	6.5	2.1	0.7	0.3	0.1
95	7.2	2.3	0.7	0.4	0.1
100	7.9	2.6	0.8	0.4	0.1
105	8.7	2.8	0.9	0.5	0.2
110	9.5	3.1	1.0	0.5	0.2
115	10.3	3.3	1.1	0.5	0.2
120	11.1	3.6	1.1	0.6	0.2
125	12.0	3.9	1.2	0.6	0.2
130	12.9	4.2	1.3	0.7	0.2
135	13.8	4.5	1.4	0.7	0.2
140	14.8	4.8	1.5	0.8	0.3
145	15.8	5.1	1.6	0.8	0.3
150	16.8	5.4	1.7	0.9	0.3
155	17.8	5.8	1.8	0.9	0.3
160	18.9	6.1	1.9	1.0	0.3
165	20.0	6.5	2.1	1.1	0.4
170	21.2	6.9	2.2	1.1	0.4
175	22.3	7.2	2.3	1.2	0.4
180	23.5	7.6	2.4	1.2	0.4
185	24.7	8.0	2.5	1.3	0.4
190	26.0	8.4	2.7	1.4	0.5
195	27.3	8.9	2.8	1.4	0.5
200	28.6	9.3	2.9	1.5	0.5
205	29.9	9.7	3.1	1.6	0.5
210	31.3	10.2	3.2	1.7	0.6
215	32.7	10.6	3.4	1.7	0.6
220	34.1	11.1	3.5	1.8	0.6
225	35.5	11.5	3.7	1.9	0.6
230	37.0	12.0	3.8	2.0	0.7
235	38.5	12.5	4.0	2.0	0.7
240	40.1	13.0	4.1	2.1	0.7
245	41.6	13.5	4.3	2.2	0.7
250	43.2	14.0	4.4	2.3	0.8

Table K7 – Water meters

Flow (L/min)	Meter size (mm) 15		20		25		32		40	
	Maximum flow rate									
	(L/min) 50	(m^3/hr) 3	(L/min) 83	(m^3/hr) 5	(L/min) 116	(m^3/hr) 7	(L/min) 166	(m^3/hr) 10	(L/min) 333	(m^3/hr) 20
	Pressure loss (kPa)									
50	100		39		17		9		2	
55	–		47		23		11		3	
60	–		56		27		13		3	
65	–		66		32		16		4	
70	–		77		37		18		4	
75	–		88		43		21		5	
80	–		100		48		24		6	
85	–		–		55		27		7	
90	–		–		61		30		7	
95	–		–		68		33		8	
100	–		–		76		37		9	
105	–		–		83		40		10	
110	–		–		91		44		11	
115	–		–		100		49		12	
120	–		–		–		53		13	
125	–		–		–		57		14	
130	–		–		–		62		15	
135	–		–		–		67		16	
140	–		–		–		72		18	
145	–		–		–		77		19	
150	–		–		–		83		20	
155	–		–		–		88		22	
160	–		–		–		94		23	
165	–		–		–		100		25	
170	–		–		–		–		26	
175	–		–		–		–		28	
180	–		–		–		–		29	
185	–		–		–		–		31	
190	–		–		–		–		33	
195	–		–		–		–		34	
200	–		–		–		–		36	
205	–		–		–		–		38	
210	–		–		–		–		40	
215	–		–		–		–		42	
220	–		–		–		–		44	
225	–		–		–		–		46	
230	–		–		–		–		48	
235	–		–		–		–		50	
240	–		–		–		–		52	
245	–		–		–		–		54	
250	–		–		–		–		56	

NOTES –
(1) This table provides typical losses through water meters.
(2) Specific reference should be made to the manufacturer's data sheet for the water meter installed for actual design losses.
(3) 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.
(4) Typically, this chart indicates that a 25 mm or 32 mm water meter is required for domestic sprinkler service.

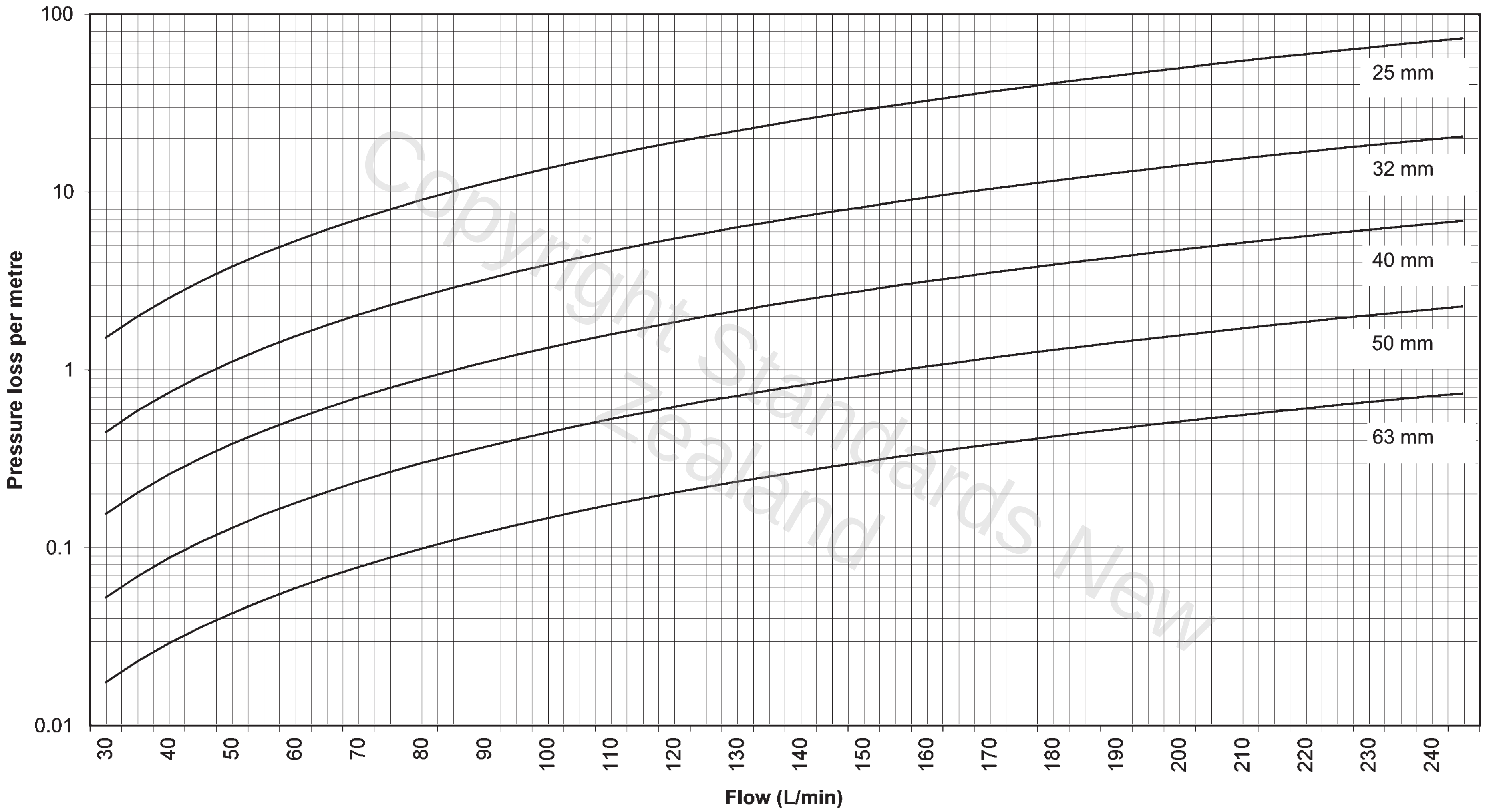


Figure K1 – Pressure loss from PE 80B pipe to AS/NZS 4130

NOTE– This graph has been created from tables in the publication BRANZ Design guide– Sprinklers for houses, 2002 with the kind permission of BRANZ.

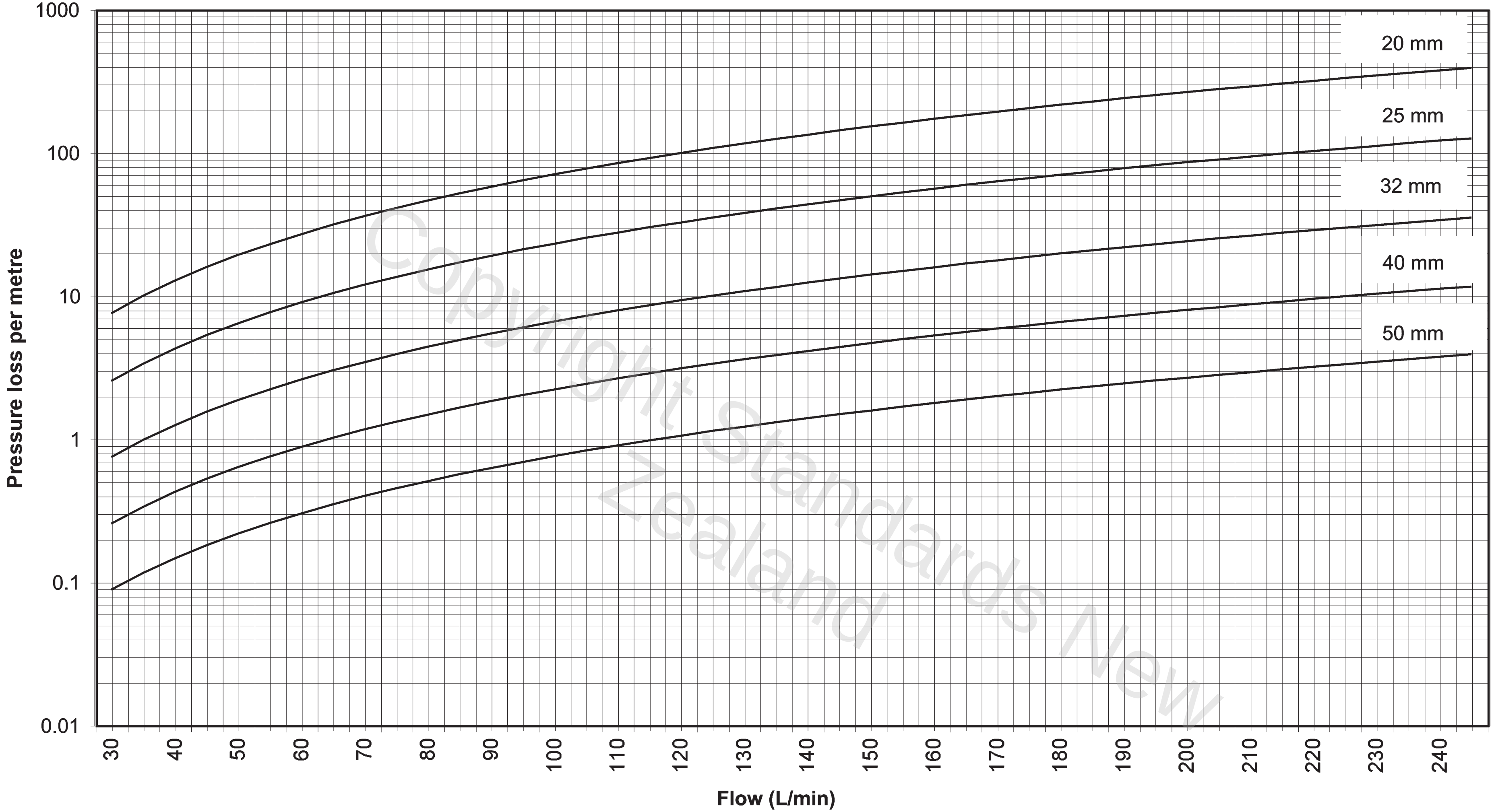


Figure K2 – Pressure loss from PE-X SDR 7.4 pipe to DIN 1988

NOTE– This graph has been created from tables in the publication BRANZ Design guide– Sprinklers for houses, 2002 with the kind permission of BRANZ.

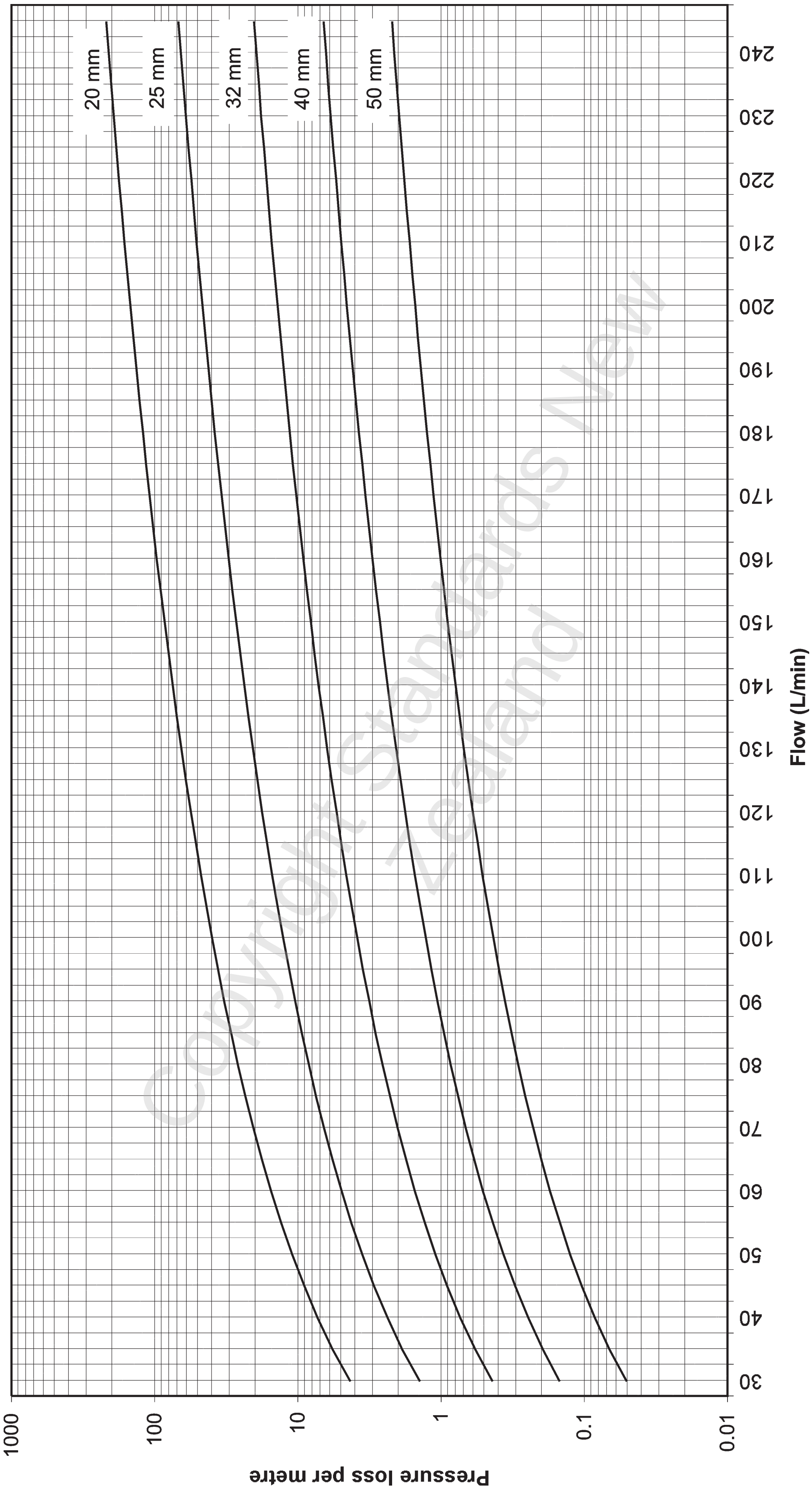


Figure K3 – Pressure loss from PP-R SDR 11 pipe to DIN 8077

NOTE– This graph has been created from tables in the publication BRANZ Design guide– Sprinklers for houses, 2002 with the kind permission of BRANZ.

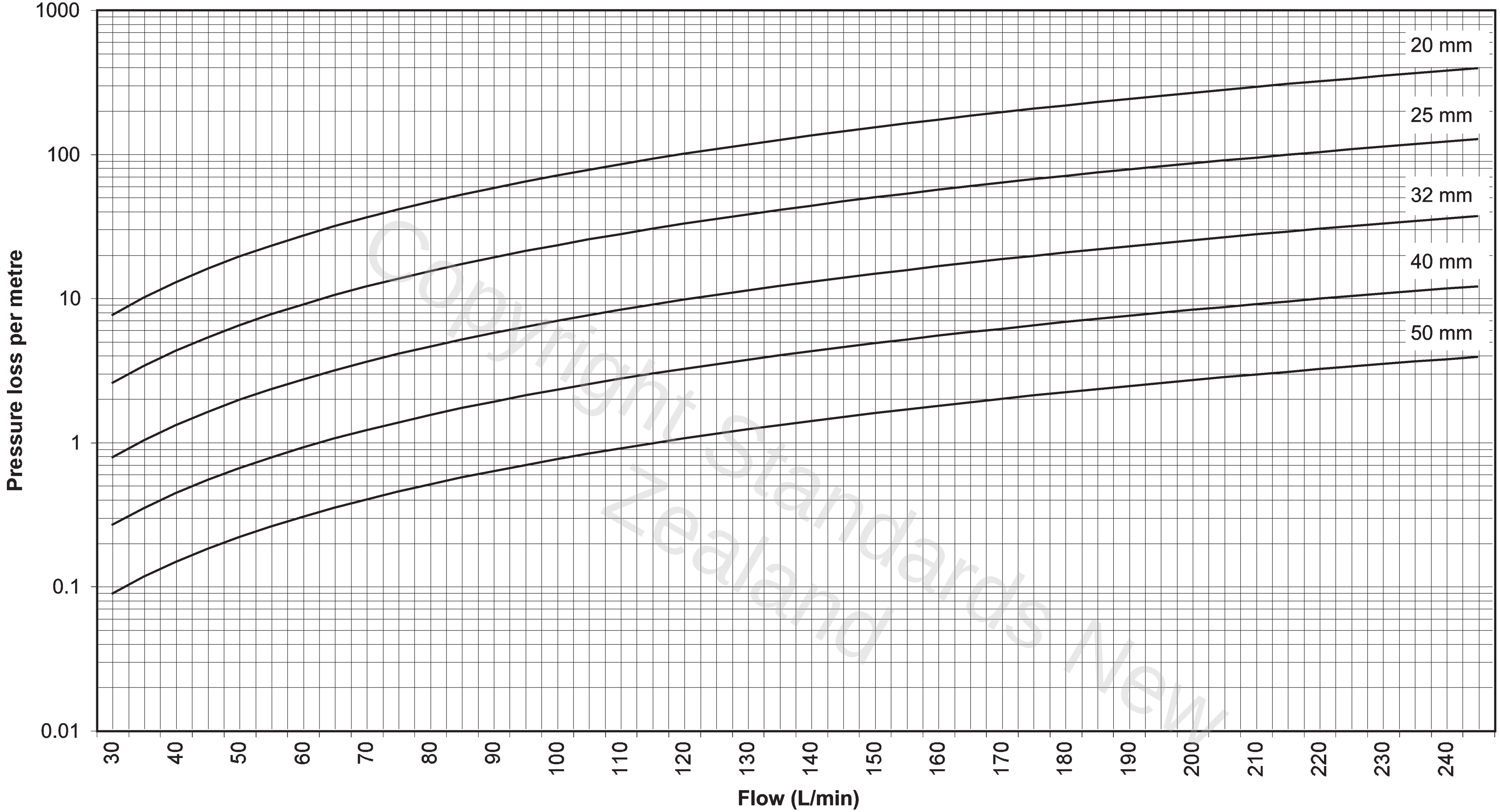


Figure K4 – Pressure loss from PP-R SDR 7.4 pipe to DIN 8077

NOTE– This graph has been created from tables in the publication BRANZ Design guide– Sprinklers for houses, 2002 with the kind permission of BRANZ.

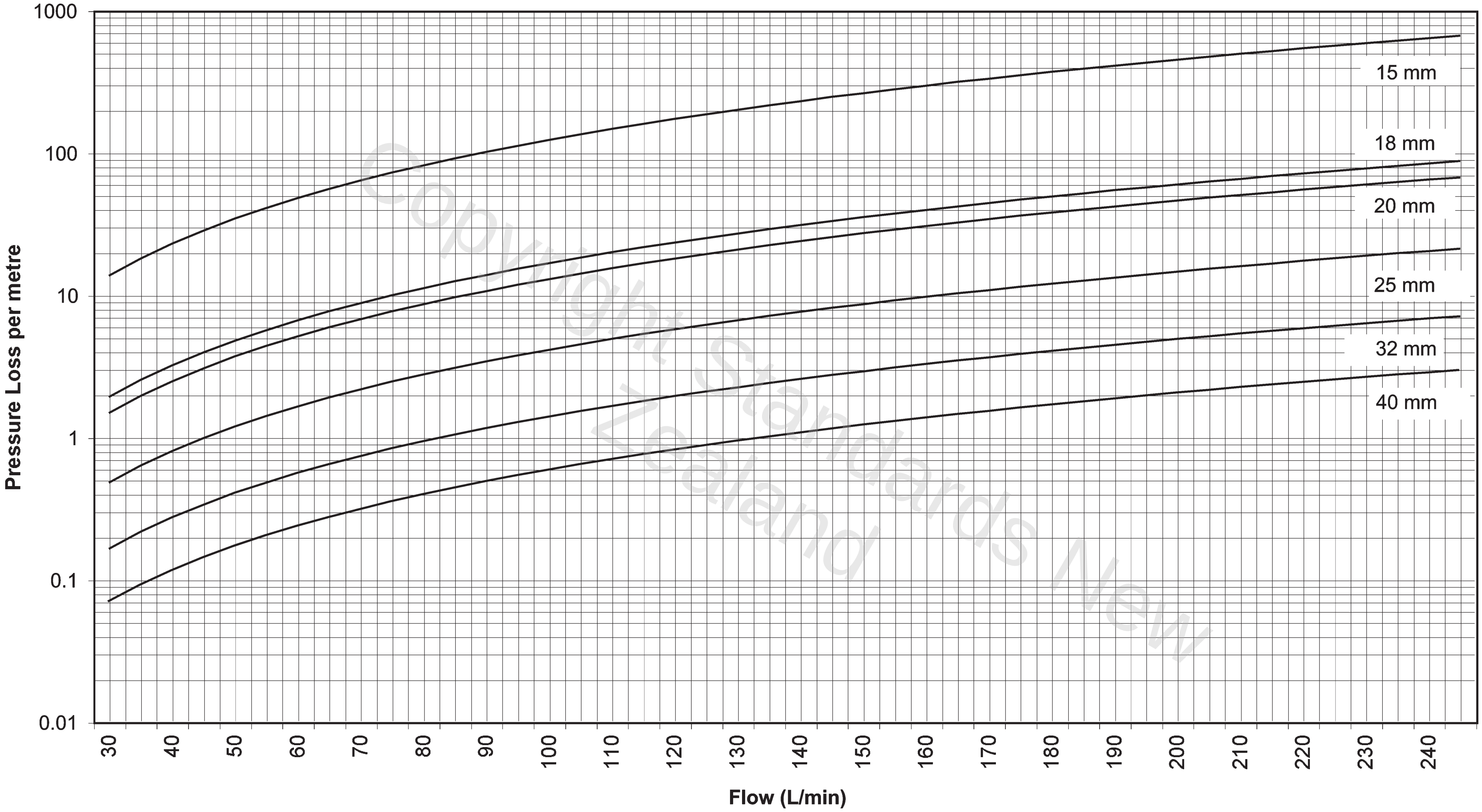


Figure K5 – Pressure loss from copper pipe to NZS 3501

NOTE– This graph has been created from tables in the publication BRANZ Design guide– Sprinklers for houses, 2002 with the kind permission of BRANZ.

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NZS 4517:2002

Pr Gratis

FIRE SPRINKLER SYSTEMS FOR HOUSES

AMENDMENT NO. 1

July 2003

CORRECTION

EXPLANATORY NOTE

This amendment corrects the titles, descriptors and notes for tables K1 – K6, and figures K1 – K5 in Appendix K.

APPROVAL

Amendment No. 1 was approved on 8 July 2003 by the Standards Council to be an amendment to NZS 4517:2002.

4.1 Maximum operating pressure (page 12)
Delete NOTE (3) and **substitute**:

"(3) The normal maximum pressure rating for sprinkler systems is 1200 kPa."

(Amendment No. 1, July 2003)

D6 Calculation of pressure loss in pipes (page 36)
Delete "*d* is the mean bore diameter (mm)" and **substitute** "*d* is the mean internal diameter (mm)"

(Amendment No. 1, July 2003)

Table K1 – Pressure losses for PE 80B pipe to AS/NZS 4130 (page 54)
Delete "**Pressure losses for PE 80B pipe to AS/NZS 4130**" and **substitute**:

"**Pressure losses for PE 80B PN 12.5 (SDR 11) pipe to AS/NZS 4130**"

(Amendment No. 1, July 2003)

Table K1 – Pressure losses for PE 80B pipe to AS/NZS 4130 (page 54)
Delete "**Pressure loss** (kPa)" and **substitute** "**Pressure loss** (kPa/m)"

(Amendment No. 1, July 2003)

Table K1 – Pressure losses for PE 80B pipe to AS/NZS 4130 (page 54)
Delete "**Internal diameter** (mm)" and **substitute** "**Nominal outside diameter** (mm)"

(Amendment No. 1, July 2003)

Table K2 – Pressure losses for PE-X SDR 7.4 pipe to DIN 1988 (page 55)
Delete "**Pressure loss** (kPa)" and **substitute** "**Pressure loss** (kPa/m)"

(Amendment No. 1, July 2003)

Table K2 – Pressure losses for PE-X SDR 7.4 pipe to DIN 1988 (page 55)
Delete "**Internal diameter** (mm)" and **substitute** "**Nominal outside diameter** (mm)"

(Amendment No. 1, July 2003)

Table K3 – Pressure losses for PP-R SDR 11 pipe to DIN 8077 (page 56)
Delete "**Pressure loss** (kPa)" and **substitute** "**Pressure loss** (kPa/m)"

(Amendment No. 1, July 2003)

Table K3 – Pressure losses for PP-R SDR 11 pipe to DIN 8077 (page 56)
Delete "**Internal diameter** (mm)" and **substitute** "**Nominal outside diameter** (mm)"

(Amendment No. 1, July 2003)

Table K4 – Pressure losses for PP-R SDR 7.4 pipe to DIN 8077 (page 57)
Delete "**Pressure loss** (kPa)" and **substitute** "**Pressure loss** (kPa/m)"

(Amendment No. 1, July 2003)

Table K4 – Pressure losses for PP-R SDR 7.4 pipe to DIN 8077 (page 57)
Delete "**Internal diameter** (mm)" and **substitute** "**Nominal outside diameter** (mm)"

(Amendment No. 1, July 2003)

Table K5 – **Pressure losses for copper pipe to NZS 3501** (page 58)
Delete "**Pressure loss** (kPa)" and **substitute** "**Pressure loss** (kPa/m)"

(Amendment No. 1, July 2003)

Table K5 – **Pressure losses for copper pipe to NZS 3501** (page 58)
Delete "**Internal diameter** (mm)" and **substitute** "**Nominal internal diameter** (mm)"

(Amendment No. 1, July 2003)

Table K6 – Pressure losses for CPVC Pipe to ASTM F442 (page 59)
Delete "**Internal diameter** (mm)" and **substitute** "**Nominal internal diameter** (mm)"

(Amendment No. 1, July 2003)

Figure K1 – Pressure loss from PE 80B pipe to AS/NZS 4130 (page 61)
Delete "**Pressure loss from PE 80B pipe to AS/NZS 4130**" and **substitute**:

"**Pressure loss from PE 80B PN 12.5 (SDR 11) pipe to AS/NZS 4130**"

(Amendment No. 1, July 2003)

Figure K1 – Pressure loss from PE 80B pipe to AS/NZS 4130 (page 61)
Delete the NOTE and **substitute**:

"NOTES –

(1) This graph has been created from tables in the publication BRANZ Design guide – Sprinklers for houses, 2002 with the kind permission of BRANZ;

(2) Pipe size is nominal outside diameter."

(Amendment No. 1, July 2003)

Figure K2 – Pressure loss from PE-X SDR 7.4 pipe to DIN 1988 (page 62)
Delete the NOTE and **substitute**:

"NOTES –

(1) This graph has been created from tables in the publication BRANZ Design guide – Sprinklers for houses, 2002 with the kind permission of BRANZ;

(2) Pipe size is nominal outside diameter."

(Amendment No. 1, July 2003)

Figure K3 – Pressure loss from PP-R SDR 11 pipe to DIN 8077 (page 63)
Delete the NOTE and **substitute**:

"NOTES –

(1) This graph has been created from tables in the publication BRANZ Design guide – Sprinklers for houses, 2002 with the kind permission of BRANZ;

(2) Pipe size is nominal outside diameter."

(Amendment No. 1, July 2003)

Figure K4 – Pressure loss from PP-R SDR 7.4 pipe to DIN 8077 (page 64)
Delete the NOTE and **substitute**:

"NOTES –

(1) This graph has been created from tables in the publication BRANZ Design guide – Sprinklers for houses, 2002 with the kind permission of BRANZ;

(2) Pipe size is nominal outside diameter."

(Amendment No. 1, July 2003)

Figure K5 – Pressure loss from copper pipe to NZS 3501 (page 65)
Delete the NOTE and **substitute**:

"NOTES –

(1) This graph has been created from tables in the publication BRANZ Design guide – Sprinklers for houses, 2002 with the kind permission of BRANZ;

(2) Pipe size is nominal internal diameter."

(Amendment No. 1, July 2003)

STANDARDS NEW ZEALAND
PRIVATE BAG 2439
WELLINGTON 6020

Approved by the Standards Council on 17 September 2002 to be a New Zealand Standard pursuant to the provisions of section 10 of the Standards Act 1988.

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NZS 4517:2002

NZS 4517:2002

STANDARDS
NEW ZEALAND
Paerewa Aotearoa

NZS 4517:2002

New Zealand Standard

Fire Sprinkler Systems for Houses