



Automatic fire sprinkler systems

Part 1: General systems



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- Association of Hydraulic Services Consultants Australia
 - Australasian Fire and Emergency Service Authorities Council
 - Australian Building Codes Board
 - Australian Chamber of Commerce and Industry
 - Bulky Goods Retailers Association
 - Consumers Federation of Australia
 - CSIRO
 - Department of Human Services (VIC)
 - Engineers Australia
 - Fire Protection Association Australia
 - Insurance Council of Australia
-

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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Australian Standard[®]

Automatic fire sprinkler systems

Part 1: General systems

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PREFACE

This Standard was prepared by the Standards Australia Committee FP-004, Automatic Sprinkler Installations, to supersede AS 2118.1—2006.

This Standard incorporates Amendment No. 1 (December 2017). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this edition is to include changes that reflect recent advances in technology and to refine the content for clarity and conciseness.

Changes to this edition are the following:

- (a) Incorporation of amendments to the 2006 edition.
- (b) Section 12—now Section 14, Hydraulic calculation methods.
- (c) Significant changes to Section 3 concerning exposure protection, and to Section 5 relating to protection of concealed spaces.
- (d) Section 9, Light Hazard class systems, entirely rewritten to include more useable and up-to-date parameters for the design of this class of system.
- (e) New Sections 11, 12 and 13 (High Hazard).
- (f) Expanded definitions clause.
- (g) Inclusion of informative text for occupancy classification (Appendix A).

The revision to the AS 2118 suite of Standards has included Standards Australia's requirements to keep product and installation Standards separate. The series comprises the following:

AS

2118	Automatic fire sprinkler systems
2118.1	Part 1: General systems (this Standard)
2118.2	Part 2: Drencher systems
2118.3	Part 3: Deluge
2118.4	Part 4: Sprinkler protection for accommodation buildings not exceeding four storeys in height
2118.5	Part 5: Home fire sprinkler systems
2118.6	Part 6: Combined sprinkler and hydrant systems in multistorey buildings
4118	Fire sprinkler systems
4118.1.1	Part 1.1: Components—Sprinklers and sprayers
4118.1.2	Part 1.2: Components—Alarm valves (wet)
4118.1.3	Part 1.3: Components—Water motor alarms
4118.1.4	Part 1.4: Components—Valve monitors
4118.1.5	Part 1.5: Components—Deluge and pre-action valves
4118.1.6	Part 1.6: Components—Stop valves and non-return valves
4118.1.7	Part 1.7: Components—Alarm valves (dry)
4118.1.8	Part 1.8: Components—Pressure reducing valves
4118.1.9	Part 1.9: Components—Accelerators and exhausters
4118.2.1	Part 2.1: Piping—General

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

This Standard incorporates commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by 'C' preceding the clause number and is printed in italics in a box. The commentary is for information only and does not need to be followed for compliance with the Standard.

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FOREWORD

Automatic fire sprinkler systems provide an important level of fire protection to a building structure. Additionally, automatic fire sprinklers provide an important level of protection for the occupants of a building together with protection to the environment by minimizing the effects that a major structural fire could have. Sprinklers also safeguard against loss of plant, machinery, equipment and building contents generally as well as protecting a business by providing against loss of continuity of business operations. Sprinklers also conserve water during firefighting operations.

In modern buildings and indeed with older buildings that are being upgraded to meet the latest requirements in fire safety, there is need to consider other systems that impact on the function and operation of a sprinkler system. Other systems that can either interface with the sprinkler system, or be integrated in it, are automatic heat and smoke detectors, emergency warning and intercommunication systems and smoke control and air-handling systems. Hence, when designing sprinkler systems, it will be necessary to consider the interaction of sprinkler systems with other building fire safety systems in order to maximize protection and provide an optimal approach for the overall objectives of fire safety.

STANDARDS AUSTRALIA

Australian Standard

Automatic fire sprinkler systems

Part 1: General systems

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for the design, installation and commissioning of automatic fire sprinkler systems in buildings. It also provides for occupancy classification.

This Standard does not provide requirements for the design or installation of water mist fire protection systems.

NOTE: For details of occupancy classification, see Appendix A.

1.2 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard.

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

AS

- | | |
|--------|---|
| 1074 | Steel tubes and tubulars for ordinary service |
| 1281 | Cement mortar lining of steel pipes and fittings |
| 1349 | Bourdon tube pressure and vacuum gauges |
| 1432 | Copper tubes for plumbing, gasfitting and drainage applications |
| 1579 | Arc-welded steel pipes and fittings for water and waste-water |
| 1670 | Fire detection, warning, control and intercom systems—System design, installation and commissioning |
| 1670.1 | Part 1: Fire |
| 1670.3 | Part 3: Fire alarm monitoring |
| 1674 | Safety in welding and allied processes (series) |
| 1735 | Lifts, escalators and moving walks (series) |
| 1940 | The storage and handling of flammable and combustible liquids |
| 2118 | Automatic fire sprinkler systems |
| 2118.2 | Part 2: Drencher systems |
| 2118.3 | Part 3: Deluge systems |
| 2118.4 | Part 4: Sprinkler protection for accommodation buildings not exceeding four storeys in height |
| 2118.5 | Part 5: Home fire sprinkler systems |
| 2118.6 | Part 6: Combined sprinkler and hydrant systems in multistorey buildings |
| 2201 | Intruder alarm systems |
| 2201.2 | Part 2: Monitoring centres |

AS

- | | |
|------|---|
| 2304 | Water storage tanks for fire protection systems |
|------|---|

- 2419 Fire hydrant installations
- 2419.1 Part 1: System design, installation and commissioning
- 2941 Fixed fire protection installations—Pumpset systems
- 3688 Water supply and gas systems—Metallic fittings and end connectors
- 3735 Concrete structures retaining liquids
- 3772 Pre-engineered fire protection systems for cooking equipment
- 4041 Pressure piping
- 4118 Fire sprinkler systems (series)
- 4428 Fire detection, warning, control and intercom systems
- 4428.6 Part 6: Control and indicating equipment—Alarm signalling equipment
- 4254 Ductwork for air-handling systems in buildings (series)
- AS/NZS
- 1167 Welding and brazing—Filler metals (series)
- 1170 Structural design actions
- 1477 PVC pipes and fittings for pressure applications
- 1516 The cement mortar lining of pipelines in situ
- 1668 The use of ventilation and air conditioning in buildings
- 1668.1 Part 1: Fire and smoke control in buildings
- 2280 Ductile iron pipes and fittings
- 2544 Grey iron pressure fittings
- 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- 3013 Electrical installations—Classification of the fire and mechanical performance of wiring system elements
- 3500 Plumbing and drainage
- 3500.1 Part 1: Water services
- 3833 The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers
- 4129 Fittings for polyethylene (PE) pipes for pressure applications
- 4130 Polyethylene (PE) pipes for pressure applications
- 4158 Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
- 4441 Oriented PVC (PVC-O) pipes for pressure applications (ISO 16422:2014, MOD)
- 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
- 4765 Modified PVC (PVC-M) pipes for pressure applications
- 4792 Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
- BS EN
- 1256 Gas welding equipment. Specification for hose assemblies for equipment for welding, cutting and allied processes
- 10241 Steel threaded pipe fittings

1.3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.3.1 Alarm signalling equipment (ASE)

Equipment that routes an alarm and other signals from the sprinkler system to a fire alarm receiving station.

1.3.2 Alarm valve

A non-return valve that allows the water to enter the installation and operate the alarms when the installation pressure falls below the water supply pressure.

1.3.3 Automatic inflow

Automatic flow into a tank to make up, partially within a prescribed time, water drawn off under operational conditions.

1.3.4 Building owner

The owner of a building or the authorized representative of the owner.

1.3.5 Sprinkler compartment

A space that is completely enclosed by walls and a ceiling.

NOTE: The walls of the compartment enclosure may have openings to an adjoining space, provided there is a minimum depth of 200 mm from the ceiling to the top of the opening.

1.3.6 Design area

An area containing the maximum number of sprinklers likely to operate when involved in a fire determined by the hazard classification.

1.3.7 Design density

The minimum density of discharge of water in millimetres per minute (mm/min) for which a sprinkler installation is designed; which is determined by the discharge of the group of sprinklers in the design area, in litres per minute (L/min), divided by the area covered by that group in square metres (m²).

NOTE: Also known as 'Design density of discharge'.

1.3.8 Designated building entry point (DBEP)

A building entry point with ASE that provides firefighters with information identifying the location of the fire alarm.

1.3.9 Designated site entry point (DSEP)

A site entry point that provides firefighters with information identifying the location of the building from which the fire alarm originated.

1.3.10 Effective height

As defined in the NCC.

1.3.11 Fire and draught stop

A partition or bulkhead, extending from end to end and top to bottom of a concealed space, installed to delay the spread of fire and constructed from imperforate materials that are non-shatterable under fire conditions.

NOTES:

- 1 Examples of acceptable fire and draught stops include the following:
 - (a) Structural features such as a reinforced beam or steel joist extending to or through the ceiling, and a brick wall extended up through the ceiling to the floor above.

- (b) A purpose-built partition mounted on wood or steel framework, constructed of 10 mm gypsum board, 0.7 mm sheet steel or 7 mm high-density tempered hardboard.
- 2 The following apertures may be provided:
 - (a) Openings for the passage of individual pipes, conduits and air-conditioning ducts, provided that such openings are reasonably close fitting or sealed with non-flammable sealant.
 - (b) Openings not exceeding 2 m in width for the passage of groups of pipes, conduits and air-conditioning ducts, protected by a 'cut-off' sprinkler or sprinklers, as required to provide full protection to such openings.

1.3.12 High-rise

A multistorey building with storeys exceeding an effective height of 25 m.

1.3.13 Installation

The portion of a sprinkler system downstream from and inclusive of a control assembly.

1.3.14 *K* factor (nominal)

A constant that defines the pressure and flow characteristics of a sprinkler, as determined by the following formula:

$$K_m = \frac{Q}{\sqrt{P}}$$

where

K_m = *K* factor expressed in metric units (L/min/kPa^{0.5})

Q = flow, in litres per min

P = pressure, in kilopascals

NOTE: For Sections 11, 12 and 13, Clause 11.2.19 describes where US imperial units are also used.

1.3.15 Listed

Refers to a product listed for fire protection application by an internationally recognized testing laboratory or approval body.

NOTES:

- 1 A register of accredited products is issued by the CSIRO ActivFire Scheme.
- 2 The following are examples of internationally recognized testing laboratories or approval bodies:
 - (a) Factory Mutual Insurance Company (FM Global).
 - (b) Underwriters Laboratories (UL).
 - (c) Loss Prevention Council (LPC).
 - (d) Verband der Schadenverhütung (VdS).

1.3.16 Maximum flow rate

The maximum flow rate of the system is 130% of the flow demand for the most unfavourable area calculation that produces the largest flow demand.

1.3.17 Monitoring centre

A facility that receives signals from a monitored site and transmits signals to a fire brigade fire dispatch centre.

1.3.18 Monitoring service

A constantly attended remote controlling station that receives fire alarm signals and transfers the signals to a firefighting service via a permanently connected telecommunications link.

1.3.19 Multiple controls

Heat-sensitive sealed valves that control single or multiple outlets using either glass bulbs, or soldered links or levers as the heat-sensitive device.

1.3.20 Net positive suction head (NPSH)

The total inlet head, plus the head corresponding to the atmospheric pressure, minus the head corresponding to the vapour pressure.

NOTE: NPSH, as well as inlet total head, is referred to the reference plane. It is necessary to make a distinction between—

- (a) required net positive suction head (NPSHR)—a function of pump design; and
- (b) available net positive suction head (NPSHA)—a function of the system in which the pump operates, which can be calculated for any installation.

1.3.21 Network utility operator

A person who undertakes the piped distribution of drinking water or non-drinking water for supply.

NOTE: A Network utility operator in most States and Territories is the water and sewerage authority licensed to supply water and receive sewage and/or stormwater. The authority operates or proposes to operate a network that undertakes the distribution of water for supply and undertakes to receive sewage and/or stormwater drainage. This authority may be a licensed utility, local government body or council.

1.3.22 Open joists

A series of members spaced not more than 600 mm apart, measured from centre to centre of members.

1.3.23 Shall

Indicates that a statement is mandatory.

1.3.24 Should

Indicates that a statement is a recommendation.

1.3.25 Sprayers

Special purpose nozzles for use in water spray systems with capabilities of extinguishment, containment or control of fires involving hazards such as flammable liquids.

***C1.3.25** Sprayers generally are of two basic types, medium velocity and high velocity. Medium velocity sprayers are either open or sealed with a heat-responsive element, producing a fine droplet spray with a limited distance of direct impingement. They are designed for the extinguishment, containment or control of fires involving low flashpoint liquids as well as for cooling protected (adjacent) areas exposed to fire. High velocity sprayers are open type, producing a large droplet with high momentum and have a direct impingement distance of up to 5 m. High velocity sprayers are designed for extinguishment containment and control of fires involving high flashpoint liquids, principally by the emulsification of the burning fuel surface.*

1.3.26 Sprinkler, concealed

A sprinkler comprising a spray sprinkler that is fully recessed in a concealed housing and fitted with a cover plate assembly designed to release at or before the operating temperature of the sprinkler.

NOTE: Concealed sprinklers provide the same unobtrusive appearance as flush sprinklers.

1.3.27 Sprinkler, conventional

A sprinkler designed to produce a spherical type of discharge with a proportion of water being thrown upwards to the ceiling.

NOTE: A conventional sprinkler is usually designed with a universal type deflector enabling the sprinkler to be used in either the upright or pendent position; however, some conventional sprinklers are made in two types, one suitable for use in the upright position and other for use in the pendent position.

1.3.28 Sprinkler, dry pendent and dry sidewall

A sprinkler designed for use in portions of premises protected by a dry or an alternate wet and dry system where it is not practicable to install sprinklers in the upright position, or on a wet system where the sprinklers may be subject to frost.

NOTES:

- 1 Dry pendent and dry sidewall sprinklers are designed having either conventional or pendent spray type deflectors.
- 2 Dry pendent and dry sidewall sprinklers are manufactured integral with drop pipes of varying lengths, the valve being so placed that there is no pocket or depression where water can be trapped.

1.3.29 Sprinkler, dry upright

A sprinkler essentially the same as the dry pendent types except that an upright type deflector is incorporated.

NOTE: A dry upright sprinkler is designed for use in wet systems for the protection of concealed spaces subject to freezing.

1.3.30 Sprinkler, enlarged orifice

A sprinkler having a nominal 20 mm diameter orifice $K_m 11.5$.

1.3.31 Sprinkler, extended coverage (EC)

A type of spray sprinkler with a higher pressure requirement and a modified deflector specifically developed to achieve an extended maximum protected area.

1.3.32 Sprinkler, flush

A sprinkler designed for use with concealed piping where it is required, for reasons of appearance, to make the sprinklers inconspicuous, and installed pendent, with the base flush to the ceiling, but has an exposed heat-responsive element and retractors deflectors that drop down to the normal position on actuation.

NOTES:

- 1 Flush sprinklers are normally used in hotel lobbies, dining rooms, offices, boardrooms and parts of retail stores.
- 2 Flush sprinklers are not suitable for use in atmospheres that are corrosive or subject to a high dust content.
- 3 Flush sprinklers utilizing chains to locate the deflector are only suitable for use with level ceilings unless specifically listed otherwise.

1.3.33 Sprinkler-protected area

An area of a building equipped with a sprinkler system installed in accordance with Clause 3.1.1, and separated from non-sprinkler-protected areas in accordance with this Standard.

1.3.34 Sprinkler-protected building

A building equipped throughout with a sprinkler system installed in accordance with this Standard.

1.3.35 Sprinkler, recessed

A sprinkler comprising a spray sprinkler provided with a separate escutcheon housing, usually two-piece adjustable, where part of the sprinkler yoke and heat-responsive element are mounted within the recessed housing.

NOTE: Escutcheon housings are used with the spray sprinkler to ensure that the response time of the heat-responsive element is not unduly impeded and that the discharge spray pattern is not obstructed.

1.3.36 Sprinkler, residential (RES)

A type of quick response sprinkler, developed for the type of fire hazards found in dwellings, with spray patterns and discharge rates specifically designed for life safety applications.

1.3.37 Sprinkler, sidewall

A sprinkler designed for installation along the walls of a room close to the ceiling.

NOTES:

- 1 A sidewall sprinkler provides a one-sided (half-paraboloid) discharge pattern directed outwards with a small proportion discharging on the wall behind the sprinkler.
- 2 Sidewall pattern sprinklers are not normally a substitute for conventional or spray pattern sprinklers and their use is limited to such locations as offices, entrance halls, lobbies and corridors.
- 3 A sidewall sprinkler may be used with advantage in drying tunnels and hoods over papermaking machines where condensate dripping from sprinklers and pipework at the ceiling could be troublesome and also in certain other locations such as shop windows and under platforms having low headroom where sprinklers would be subject to damage.

1.3.38 Sprinkler, spray

A sprinkler designed to produce a parabolic discharge below the plane of the deflector with little or no water being discharged upwards to the wet ceiling.

NOTE: A spray sprinkler is made in two types: one suitable for use in the upright position and the other for use in the pendent position.

1.3.39 Sprinkler, storage

Sprinkler used specifically for High Hazard storage applications with increased orifice sizes to permit high flow rates.

1.3.40 Sprinkler system

A system comprising components such as valves, alarms, pipework, sprinklers and water supplies designed to control a developing fire, which includes the following:

- (a) *Wet system* A system permanently charged with water both above and below the installation alarm valve (wet) (see Clause 8.10.1).
- (b) *Alternate wet and dry system* A system that incorporates either a composite alarm valve, or a combination valve set comprising an alarm valve (wet) and an alarm valve (dry).

- (c) *Dry system* A system permanently charged with air or inert gas under pressure, above the alarm valve (dry) and with water below.
- (d) *Pre-action system* A combination of a sprinkler system and an independent system of heat or smoke detectors installed in the same area as the sprinklers.
NOTE: Operation of a heat or smoke detector allows the pre-action valve to open and water to flow into the sprinkler piping, although water flow delay is possible until sprinkler also activates.
- (e) *Recycling pre-action system* A system with heat detectors and incorporating pre-action flow control valve capable of repeated on/off cycles appropriate to the possible redevelopment of fire in the protected area.
NOTE: The cycling occurs as a result of heat detector operation which, as an electric interlock, causes the pre-action flow control valve to open and close.
- (f) *Deluge system* A system of open sprinklers controlled by a quick-opening valve (deluge valve) that is operated by a system of heat detectors or sprinklers installed in the same areas as the open sprinklers (see AS 2118.3).
- (g) *Tail-end system* A system essentially similar to dry, alternate wet and dry, pre-action and deluge systems, with the limitation that it only forms an extension to the sprinkler system.
- (h) *Tail-end anti-freeze system* A system essentially similar to wet systems with the limitation that it only forms an extension to the sprinkler system and contains anti-freeze solution.

NOTE: Sprinkler systems may be arranged to operate as one or a combination of the above.

1.3.41 Thermal sensitivity

A measure of the response time index (RTI) and the conductivity factor (C) expressed in categories of RTI, being fast response, quick response or standard response (see AS 4118.1.1).

NOTE: The life safety aspects of a sprinkler system are improved by using fast response sprinklers. The term 'fast response' refers to the sprinkler element, while the term 'quick response' refers to the sprinkler in its installed position, hence the same sprinkler may be listed as both 'standard response' or 'quick response' based on its spacing.

1.3.42 Transmission path

Connection, external to the cabinet of the control and indicating equipment, for the transmission of information and/or power between—

- (a) Fire Detection Control Indicating Equipment (FDCIE) or Emergency Warning Control Indicating Equipment (EWCIE) and other components of a Fire Detection Alarm System (FDAS); and/or
- (b) Parts of control and indicating equipment contained in different cabinets.

NOTE: Examples include electrical cables, fibre optic cable and electromagnetic radiation (radio, microwave, and infrared light).

SECTION 2 CLASSIFICATION OF SPRINKLER SYSTEMS AND DESIGN DATA

2.1 CLASSIFICATION OF SYSTEMS

Sprinkler systems shall be classified on the basis of the hazard classes of occupancy and shall be designated accordingly.

All new sprinkler systems shall be hydraulically designed in accordance with the requirements of Section 14. The specific criteria for required system performance are contained in Sections 9, 10, 11, 12 and 13, as appropriate.

2.2 CLASSIFICATION OF OCCUPANCIES

Occupancy classifications for sprinkler system design shall be determined having regard to the expected rate of heat release within a building compartment together with the fuel loading and burning characteristics of materials within that compartment. The quantity and combustibility of contents, the total potential for energy release, the height of stockpiles and the presence of flammable and combustible liquids shall also be taken into consideration.

Occupancy classifications are as follows:

- (a) Light Hazard occupancies.
- (b) Ordinary Hazard occupancies:
 - (i) Ordinary Hazard 1;
 - (ii) Ordinary Hazard 2;
 - (iii) Ordinary Hazard 3; and
 - (iv) Ordinary Hazard 3 Special.
- (c) High Hazard occupancies:
 - (i) High Hazard—Process risks.
 - (ii) High Hazard—High-piled storage risks:
 - (A) Categories 1, 2 and 3.
 - (B) Category 4 and cartoned Category 5 (unexpanded plastics).
 - (C) Cartoned Category 6 (expanded plastics).
 - (D) Uncartoned Category 5 (unexpanded plastics).
 - (E) Uncartoned Category 6 (expanded plastics).
- (d) Commodities requiring special consideration:
 - (i) Rubber tyre storage.
 - (ii) Roll paper storage.
 - (iii) Baled fibres and waste paper storage.
 - (iv) Hanging garment storage.
 - (v) Carpet storage.

- (vi) Aerosol storage.
- (vii) Distilled spirits (barrel) storage.
- (e) Flammable and combustible liquids storage.

The classification of occupancies shall be as given in Appendix A.

2.3 TYPES OF SPRINKLER SYSTEMS

2.3.1 General requirements

2.3.1.1 General

Sprinkler system shall be arranged to operate as one or a combination of the following:

- (a) Wet system.
- (b) Alternate wet and dry system.
- (c) Dry system.
- (d) Pre-action system.
- (e) Recycling pre-action system.
- (f) Deluge system.
- (g) Tail-end system.
- (h) Tail-end anti-freeze system.

2.3.1.2 Wet systems [see Clause 1.3.40(a)]

Wet systems shall not be installed in premises where there is danger, at any time, of the water in the pipes freezing.

Wet systems shall be designed so that the maximum floor area, excluding concealed spaces but including mezzanine floor areas, is controlled by one control valve, including tail-end extensions, does not exceed 9000 m², except for a single installation controlling intermediate level sprinklers in storage racks, and made up of the floor area occupied by the racks and the aisles combined, in which case the maximum floor area shall not exceed 4500 m².

2.3.1.3 Alternate wet and dry systems [see Clause 1.3.40(b)]

An alternate wet and dry sprinkler system shall incorporate either a composite alarm valve (see Clause 8.10.3) or a combination set comprising an alarm valve (wet) and an alarm valve (dry) (see Clauses 8.10.1 and 8.10.2). During winter months, the installation piping above the composite alarm valve, or alarm valve (dry), shall be charged with air and the remainder of the system, below the valve, shall be charged with water and, at other times, the system shall operate as a wet system as described in Clause 2.3.1.2.

Sprinklers in alternate wet and dry systems shall be installed in the upright position, above the line of pipe, except where dry pendent and dry sidewall sprinklers (see Clause 1.3.28) are installed or where sprinklers have an anti-freeze device incorporated therein.

Piping shall be arranged with slope for drainage (see Clause 7.5.2).

Alternate wet and dry systems shall be designed so that the water transit times from valve trip to discharge of water at the most remote sprinkler, when only it is operating, shall not exceed 60 s. The maximum floor area, including mezzanine floor areas, controlled by one control assembly, including tail end extensions (see Clauses 2.3.1.8 and 2.3.1.9) shall not exceed the following:

- (a) Where an accelerator or exhauster is used—
 - (i) 3700 m² for Ordinary Hazard and Light Hazard systems; and
 - (ii) 2100 m² for High Hazard systems.
- (b) Where an accelerator or exhauster is not used—
 - (i) 2500 m² for Ordinary Hazard and Light Hazard systems; and
 - (ii) 1400 m² for High Hazard systems.

2.3.1.4 *Dry systems [see Clause 1.3.40(c)]*

Dry sprinkler systems shall be permanently charged with air or inert gas under pressure above the alarm valve (dry) and with water below the valve.

Dry systems shall only be installed in buildings where the temperature conditions are maintained close to or below freezing, such as in cool stores, or fur vaults, or where the temperature is maintained above 70°C, such as in drying ovens (see Clause 5.9.11).

The water transit time limitation and the floor area controlled by one control assembly in a dry system shall be in accordance with Clause 2.3.1.3 for alternate wet and dry systems.

Piping shall be galvanized and arranged with slope for drainage (see Clause 7.5.2). Sprinklers shall only be installed in the upright position above the line of the pipe.

2.3.1.5 *Pre-action systems [see Clause 1.3.40(d)]*

Pre-action systems shall remain dry with atmospheric air above the alarm valve when they protect areas not exceeding 200 m²; otherwise, they shall be permanently charged with air or inert gas under pressure. Where the systems are pressurized above the alarm valve, they shall be monitored so that an alarm is given on a reduction of pressure.

The pre-action alarm valve shall be operated as follows:

- (a) *For a single interlock pre-action configuration*—solely by the system of heat or smoke detectors to allow the sprinkler piping to become charged with water prior to or following the operation of a sprinkler.
- (b) *For a double interlock pre-action configuration*—by both the system of detectors and the monitored low-pressure alarm resulting from the operation of a sprinkler.

The pre-action detection system shall utilize a heat or smoke detection system complying with AS 1670.1 or, where electrical supply is to be avoided, a sprinkler detection system charged with either air or water under pressure. In each case the detection system shall automatically initiate an alarm.

The heat or smoke detection system shall operate a solenoid valve or trip mechanism as one action to release the pre-action alarm valve. Solenoid valve wiring system elements shall be rated WS5XW as defined in AS/NZS 3013, and supervised for faults that prevent the transmission of signals on any path by the FDCIE in accordance with Clause 3.5 when the solenoid is not continuously energized as 'fail-safe', that is, set to release when de-energized.

Pre-action systems shall be designed so that the water transit times from valve trip to discharge of water at the most remote sprinkler, when only it is operating, shall not exceed 60 s.

The floor area controlled by one control assembly in a pre-action system shall not exceed that prescribed in Clause 2.3.1.2 for wet systems.

Piping shall be galvanized and, where subject to freezing, it shall be arranged with slope for drainage (see Clause 7.5.2) and standard response sprinklers shall be installed in the upright position above the line of pipe.

The installation spacing and location of heat or smoke detectors shall comply with the requirements of AS 1670.1.

C2.3.1.5 *A single interlock system only becomes a wet system following the operation of the detection system, the objective being to prevent a discharge of water from piping or sprinklers that may have suffered mechanical damage.*

A double interlock system offers the greatest safeguard against inadvertent water discharge by requiring that both the system of detectors and the sprinkler installation be activated before water is admitted to the installation piping.

2.3.1.6 *Recycling pre-action systems [see Clause 1.3.40(e)]*

Where required, a recycling pre-action system shall incorporate a pre-action system (Clause 2.3.1.5) with a feedback loop from the heat detector system to an automatic flow control valve where, if the temperature measured by the detectors drops to a pre-determined setting, a signal is sent to the flow control valve to close. Re-closing the flow control valve shall be delayed for a period of 5 min by means of an automatic timer (as a safety measure). Should the fire rekindle and re-actuate the heat detectors, the flow control valve shall reopen immediately and water shall again flow from the open sprinklers.

The floor area controlled by one control assembly in a recycling pre-action system shall not exceed that prescribed in Clause 2.3.1.2 for wet systems.

Piping shall be galvanized and arranged in accordance with Clause 7.5.2. Standard response sprinklers shall be installed in the upright position above the line of the pipe.

The installation and spacing of heat detectors in recycling pre action systems shall comply with the requirements of AS 1670.1.

2.3.1.7 *Deluge systems [see Clause 1.3.40(f)]*

Deluge systems shall be in accordance with AS 2118.3.

C2.3.1.7 *Deluge systems are designed primarily for Special Hazards such as those listed as High Hazard in Clause 2.2, where any fire could be anticipated to be intense and with a fast rate of propagation. In these circumstances, it is desirable to apply water simultaneously over a complete zone in which a fire may originate by admitting water to open sprinklers or to medium or high velocity sprayers.*

2.3.1.8 *Tail-end systems [see Clause 1.3.40(g)]*

Tail-end systems shall form extensions to sprinkler systems.

The following limitations and specific requirements shall apply for tail-end installations:

- (a) The total area of tail-end systems on one wet pipe installation shall not exceed 2500 m². Any one tail-end system shall not exceed 1000 m².
- (b) The subsidiary stop valve shall be monitored in accordance with Clause 3.5.
- (c) Suitable drainage shall be provided.
- (d) Tail-end systems connected to dry and alternate wet and dry installations shall be limited to dry systems.

2.3.1.9 *Tail-end anti-freeze solution systems [see Clause 1.3.40(h)]*

Tail-end anti-freeze solution systems shall only be connected to wet pipe installations.

Anti-freeze solutions greater than 30% by volume shall only be used for installations where temperatures are lower than -4°C and the system does not exceed 185 m².

In addition to the requirements of Clause 2.3.1.8, the following requirements shall apply for tail-end systems incorporating anti-freeze solutions:

- (a) Piping within the area subject to freezing shall be filled with anti-freeze solution and shall be arranged to prevent diffusion of water into that area.
- (b) Anti-freeze solutions shall have a freezing point of not less than 10°C below the minimum temperature possible in the area subject to freezing.
- (c) The area covered by any tail-end anti-freeze solution system shall not exceed 250 m².
- (d) The piping shall be arranged so that the interface between the anti-freeze solution and the water in the wet system is lower than the point of connection to the wet system.
- (e) The following valves and fittings shall be incorporated in the piping:
 - (i) A subsidiary stop valve monitored in accordance with Clause 3.5.
 - (ii) A drain valve.
 - (iii) An upper test valve, not more than 350 mm nor less than 250 mm below the filling connection in the wet system.
 - (iv) A lower test valve, not less than 1.2 m below the upper test valve.
 - (v) A filling connection.
 - (vi) A non-return valve. The disc of the non-return valve shall have a 1 mm hole to allow for expansion of the solution during a temperature rise and thus prevent damage to sprinklers. All valves in the system piping shall be metal-faced.

NOTES:

- 1 For an arrangement of the above, see Figure 2.3.1.9.
- 2 These systems are suitable for use in small coolrooms and freezing chambers and other areas such as loading docks and outhouses in localities subject to freezing conditions.

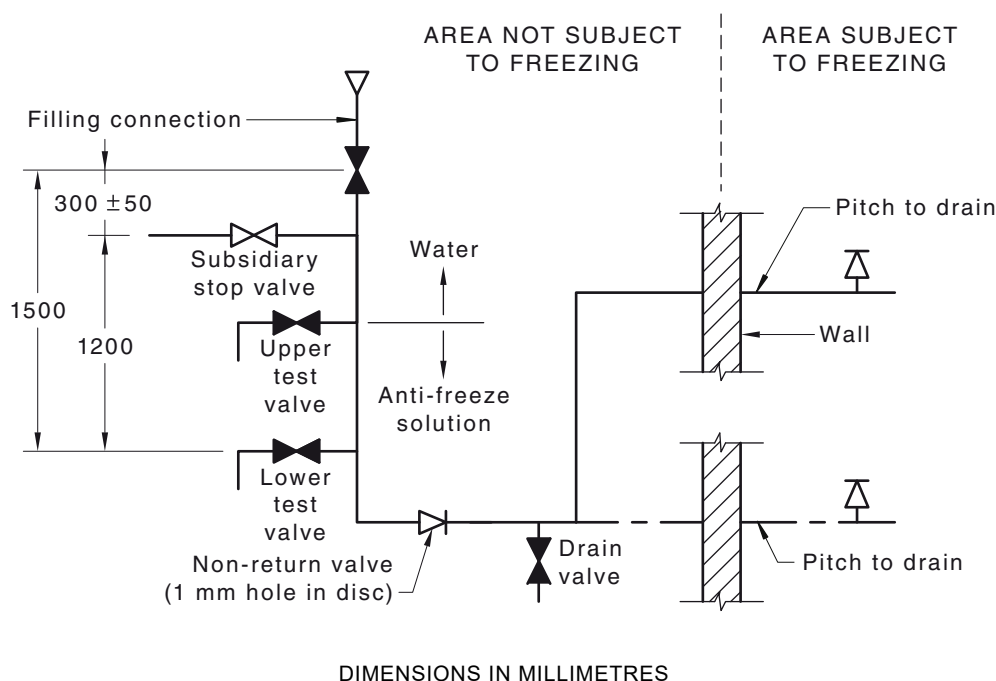


FIGURE 2.3.1.9 ARRANGEMENT OF SUPPLY PIPING AND VALVES, TAIL-END ANTI-FREEZE SOLUTION SYSTEM

2.3.1.10 *Sprinkler compatibility*

Sprinklers installed in a compartment shall be of the same category of thermal sensitivity (RTI), and temperature rating for Light Hazard and Ordinary Hazard, except—

- (a) where localized higher than normal ambient temperatures exist (see Clause 6.5); and
- (b) where car stackers are installed in accordance with Clause 10.6.

NOTES:

- 1 For High Hazard requirements, see Section 11; for special commodities, see Section 12 and for flammable and combustible liquids, see Section 13.
- 2 Differing *K* factor sprinklers may be used in one compartment for different sprinkler types or where nominal thread size varies.
- 3 For the purposes of this Clause, draft curtains conforming to Clause 11.2.10, centred over a clear aisle a minimum of 3 m width, may be considered the boundary of a compartment.

SECTION 3 INSTALLATION

3.1 SPRINKLER-PROTECTED BUILDINGS

3.1.1 Extent of protection

Sprinkler protection shall extend to bounding walls or other barriers designed to resist the spread of fire into the sprinkler-protected area and constructed in accordance with the National Construction Code (NCC).

Sprinkler protection shall extend throughout any non-fire-separated roofed passageway, roofed ramp or tunnel connecting to non-sprinkler-protected areas.

3.1.2 Classification as sprinkler-protected building

To be classified as a sprinkler-protected building, a building shall be sprinkler-protected throughout, other than the exceptions given in Clause 3.1.3 (see Clause 5.9.7).

3.1.3 Safety and compatibility—Omitted protection

Sprinklers shall be omitted from the following areas for reasons of safety or incompatibility:

- (a) High-voltage, normally unoccupied areas such as rooms used for no purposes other than to contain transformers, electrical switch or control gear (non-oil filled), bounded by walls or other barriers to resist the spread of fire, and fitted with multiple controls for alarm purposes only with the drain discharging to an open tundish, or a detection and alarm system installed in accordance with the requirements of AS 1670.1.

NOTE: Low-voltage electrical equipment, computers and the like are excluded from this omission (see Clause 5.9.16).

- (b) Silos or bins for the storage of grain, inside buildings forming part of corn mill, distillery, malting or oil mill premises.
- (c) Ovens, hovels and kilns in potteries, including earthenware, brick, tile and glassworks.
- (d) The undersides of screens or shields erected over the wet ends of papermaking machines.
- (e) Over salt baths and metal melt pans.
- (f) Over uncovered potable water storage wherever there is a danger of contamination of that water.
- (g) Commercial type cooking equipment, excluding their ventilation systems, protected with a dedicated fire-extinguishing system complying with AS 3772 (see Clause 5.9.14).
- (h) Fire-isolated stairways, fire-isolated passageways and fire-isolated ramps constructed in accordance with the NCC.

3.2 PROTECTION AGAINST EXPOSURE HAZARDS

3.2.1 Extent of application

Where compliance with the NCC requires an opening in a wall to be protected by a sprinkler system, Clauses 3.2.2 to 3.2.7 shall apply.

External bounding walls or opening infills shall be provided with external protection if the wall or opening—

- (a) faces an exposure hazard;
- (b) is less than 6 m to the exposure hazard; and
- (c) is not constructed in accordance with NCC requirements to resist the penetration of fire for 30 min.

Where external protection is required, it shall be in accordance with Clauses 3.2.2 to 3.2.7.

NOTE: Exposure hazards include the following:

- (a) Non-sprinkler-protected combustible buildings.
- (b) Combustible yard storage.

C3.2.1 *External sprinklers that are an integral part of a building's sprinkler network serve to wet down vulnerable areas of a building's exterior (e.g. roof overhangs and roof lanterns, combustible soffit/eave linings, windows, combustible panelling) if combustibles stored in the open (flammable liquid drums, parked vehicles, idle pallets, tyres, etc.), burning vegetation or adjacent non-sprinkler-protected buildings, in close proximity ignite. If these areas are not wet down, fire may enter the sprinkler-protected building and overwhelm the sprinkler system. Experience has clearly demonstrated the value of external sprinklers in minimizing fire penetration from such exposures and, therefore, in minimizing the number of internal sprinklers that may operate. The use of sprinklers to modify the fire resistance level (FRL) of the wall element is outside the scope of this Standard.*

3.2.2 Sprinklers

All sealed sprinklers used for exposure protection shall be rated as fast response as defined in AS 4118.1.1 and shall have a temperature rating of 93°C.

Sprinklers shall be any of the following types and orientation:

- (a) *Pendent spray (SP)*—mounted horizontally with the deflector towards the window or wall.
- (b) *Upright spray (SU)*—mounted horizontally with the deflector away from the window or wall.
- (c) *Pendent sidewall (WP)*:
 - (i) Mounted vertically and oriented to direct the spray towards the window or wall.
 - (ii) Mounted horizontally and oriented to direct the spray downwards and parallel to the window or wall.
- (d) *Horizontal sidewall (WH)*—mounted vertically and oriented to direct the spray downwards and parallel to the window or wall.
- (e) Sprinklers specifically designed for the purpose.

Conventional sprinklers (CU/P) shall not be used, except in the case of protection beneath roof overhangs. Sprinklers beneath roof overhangs shall not be considered a substitute for protection of walls.

3.2.3 Shielding

Where building features do not shield sprinklers to prevent cooling from sprinklers operating above, such sprinklers shall be fitted with metal shields not less than 80 mm diameter, or greater than 100 mm diameter.

C3.2.3 *The use of sprinkler shields as a device for heat collection has been shown in fire tests to be of no value or even detrimental as an aid for sprinkler operation compared to a non-shielded sprinkler.*

3.2.4 Sprinkler spacing and location

Sprinklers shall be located in accordance with Tables 3.2.4(A) and 3.2.4(B).

In addition to the requirements of Tables 3.2.4(A) and 3.2.4(B), a sprinkler shall be positioned not more than 1.25 m horizontally from—

- (a) the vertical extremities of the protected surface;
- (b) the vertical extremities of each glazed opening, with the sprinkler located within the opening; and
- (c) the centre of any building feature such as downpipes and glazing bars or mullions that project more than 40 mm from the protected surface.

Where vertical glazing bars or mullions project more than 40 mm from the glazed surface and are spaced not more than 1660 mm centre to centre, every alternate sprinkler shall be positioned on the centre-line of a mullion or glazing bar, provided the sprinklers are positioned within 1.25 m of each side of any vertical glazing bar or mullion that exceeds 40 mm in width.

Where windowsills or horizontal mullions result in recesses or projections exceeding 25 mm in depth, separate sprinklers shall be provided for each window on each level.

NOTES:

- 1 For typical orientation and location of sprinklers in glazed openings, see Figure 3.2.4(A).
- 2 For typical spacing of sprinklers in glazed openings, see Figure 3.2.4(B).
- 3 For typical spacing of sprinklers in glazed openings shielded by mullions, see Figure 3.2.4(C).

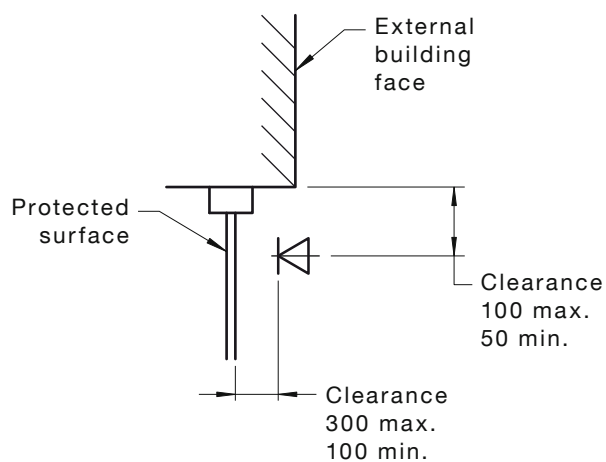
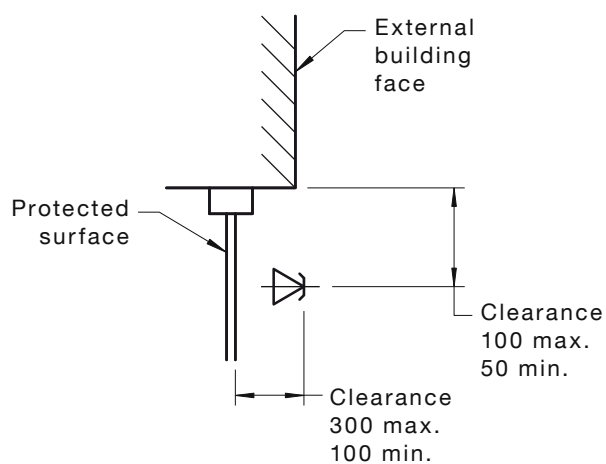
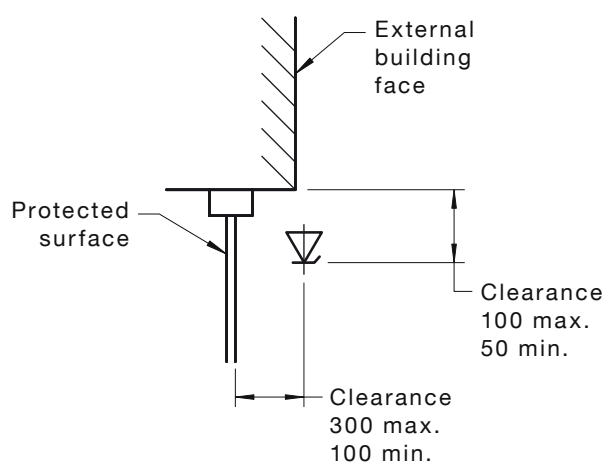
TABLE 3.2.4(A)
SPRINKLER SPACING

Spacing	Measured	Measurement		Point of measurement
		Max.	Min.	
Horizontal	Horizontal	2.5 m	1.8 m (see Note)	Centre of sprinkler
Vertical	Vertically	4.0 m	N/A	Deflector to deflector

NOTE: The 1.8 m minimum distance may be reduced where sprinklers are separated by a baffle or building feature that will prevent cooling from an adjacent operating sprinkler.

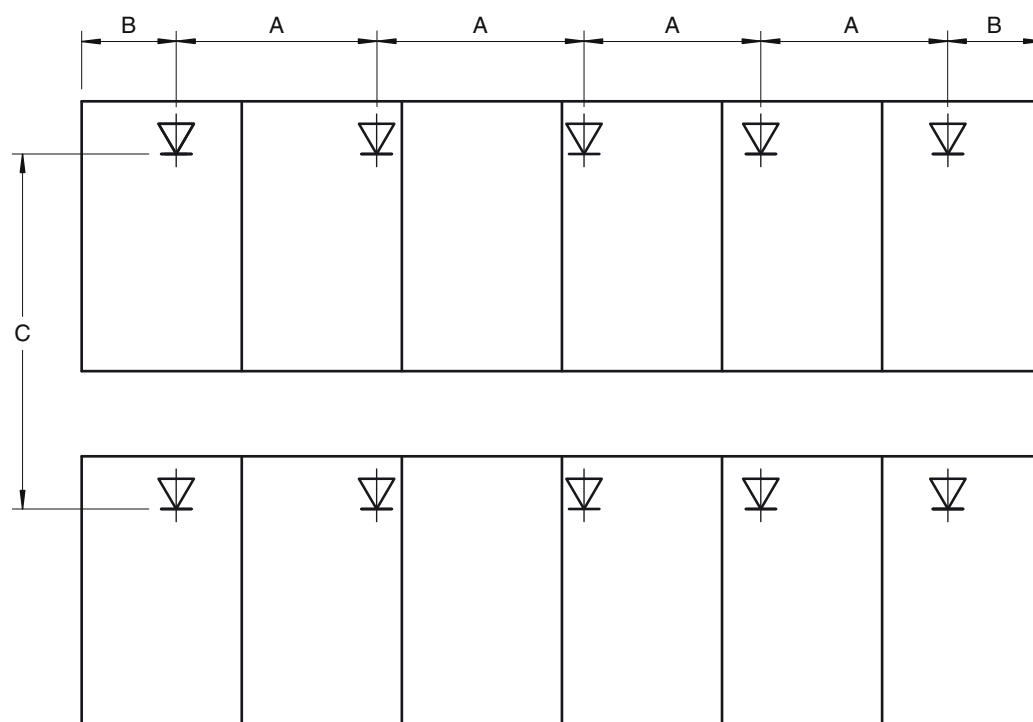
TABLE 3.2.4(B)
SPRINKLER LOCATION

Orientation	Measured	Measurement, mm		Point of measurement
		Max.	Min.	
Horizontal	Vertically below top of protected surface	100	50	Centre of sprinkler
Vertical	Vertically below top of protected surface	100	50	Sprinkler deflector
SP and SU horizontal (spray towards wall)	Horizontal from wall	300	100	Sprinkler deflector
WP vertical (spray towards wall)	Horizontal from wall	300	100	Centre of sprinkler
WP horizontal (spray parallel to wall)	Horizontal from wall	100	50	Sprinkler deflector
WH vertical (spray parallel to wall)	Horizontal from wall	100	50	Centre of sprinkler

**Spray pendent sprinkler****Spray upright sprinkler****Pendent sidewall sprinkler**

DIMENSIONS IN MILLIMETRES

FIGURE 3.2.4(A) GLAZED OPENINGS—TYPICAL ORIENTATION AND LOCATION OF SPRINKLERS



Elevation

LEGEND:

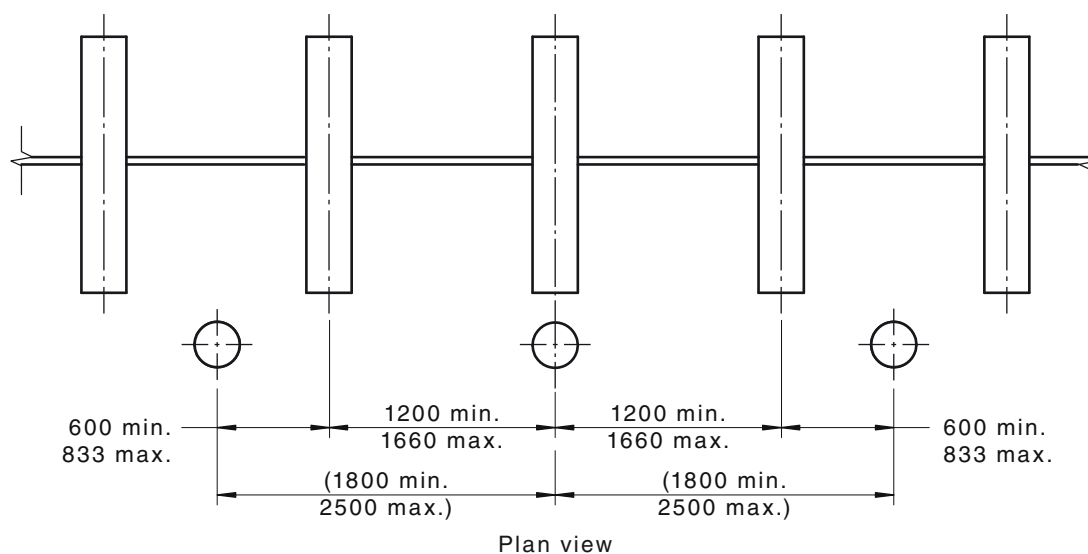
A = 2.50 m max. and 1.80 min.

B = 1.25 m max.

C = 4.00 m max.

Mullions or glazing bars projecting not more than 40 mm from the glazed surface.
Maximum spacing of sprinklers.

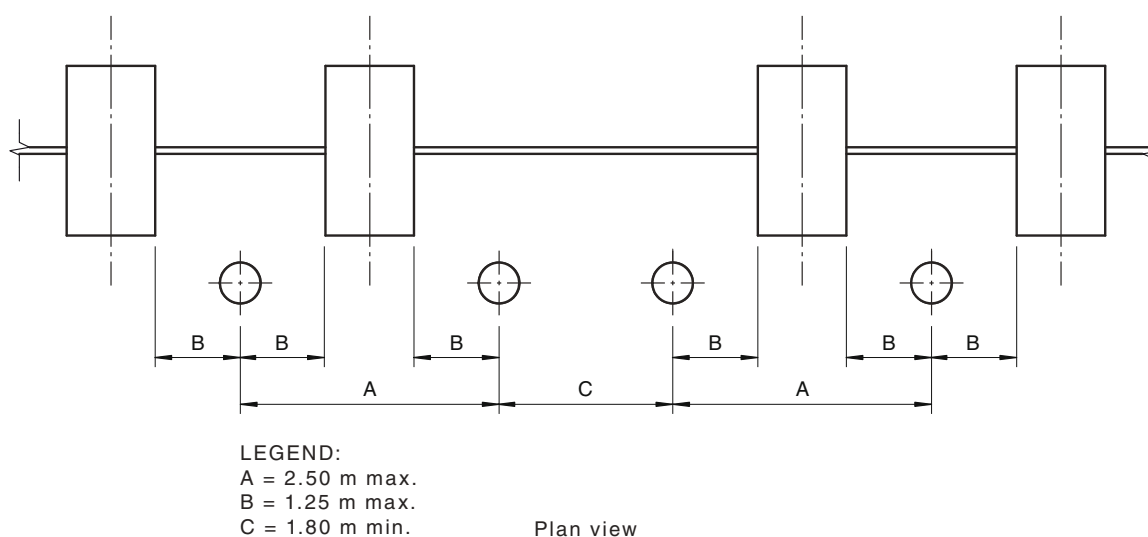
FIGURE 3.2.4(B) GLAZED OPENINGS IN EXTERNAL WALL—SPACING OF SPRINKLERS



Maximum spacing of sprinklers

Mullions less than 40 mm wide and projecting
more than 40 mm from protected surface
spaced not more than 1660 mm centre to centre

(a) Measured



Maximum spacing of sprinklers

Mullions less than 40 mm wide and projecting
more than 40 mm from protected surface

(b) Point of measurement

DIMENSIONS IN MILLIMETRES

FIGURE 3.2.4(C) GLAZED OPENINGS—SHIELDED BY MULLIONS—
SPACING OF SPRINKLERS

3.2.5 Piping

External sprinklers shall be fed either individually by range pipes or as groups by dedicated distribution pipes connected to a distribution pipe of the internal sprinkler system.

NOTE: In cases where excessive sprinkler system downtime may be occasioned by the post-fire replacement of external sprinklers, groups of external sprinklers should be connected by dedicated distribution pipes fitted with locked-open isolation valves. The fitting of locked open sectional stop valves on connections to external protection can greatly decrease the time taken to recommission a system following an operation of the external sprinklers and should be considered for all such installations.

3.2.6 Performance

Sprinkler systems that incorporate exposure protection shall be hydraulically designed so that the flow from any external sprinkler shall be not less than 75 L/min when the required maximum number of external sprinklers are operating.

Where the area to be protected by an individual sprinkler is less than 2.5 m wide, the flow rate shall be reduced proportionally subject to a minimum end head pressure of 70 kPa.

The required number of sprinklers designed in simultaneous operation shall be the number of sprinklers opposed to each exposure hazard, up to a maximum of 18.

Hydraulic calculation methods shall be in accordance with the requirements of Section 14, as appropriate.

3.2.7 Water supply

If the maximum calculated demand of the exposure protection is in excess of that required for the internal sprinklers alone, the water supply shall be increased to cover the excess.

3.3 ALARM SIGNALLING

3.3.1 General

Alarm signalling equipment shall comply with the requirements of AS 1670.3 and AS 4428.6.

3.3.2 Transmission of the alarm signal

3.3.2.1 General

Upon actuation of the sprinkler system, an alarm signal shall be automatically transmitted to an alarm monitoring and dispatch centre in accordance with Clause 8.13 and AS 1670.3.

NOTE: For requirements for the initiation of a fire alarm signal, see Clause 8.13.4.

3.3.2.2 Grouped alarms

Where control assemblies are grouped in a single location, and each is fitted with a manually resettable 'system operated' indicating device, at least one alarm signal shall be provided to the monitoring centre for the group.

3.3.2.3 Signal to monitoring centre

Where control assemblies are distributed in several locations on the premises, individual alarms signals to the monitoring centre shall be provided. Where activation of distributed control assemblies is indicated at a single point within the premises, a single signal shall be provided to the monitoring centre for the control assemblies.

3.3.2.4 Identification

For multiple installations identification, signage shall be provided in accordance with Section 8.

3.3.2.5 Placarding

A permanently affixed fade-resistant and water-resistant sign shall be located adjacent to the sprinkler system control assemblies and state—

- (a) the name of the monitoring centre; and
- (b) other relevant information.

C3.3.2 The fundamental object of an automatic fire sprinkler system is to detect, control and report a developing fire to the fire brigade. Therefore, it is an intrinsic part of a sprinkler's design to alert the fire brigade upon activation of the sprinkler system, to maximize its effectiveness.

3.3.3 Integrity and transmission paths

System interface alarm signal transmission paths to other building fire services that require a fire mode response shall comply with AS 1670.1.

3.3.4 Labelling of control equipment

Electrical control equipment such as pressure switches, flow switches and similar equipment shall be clearly labelled to show their function, voltage and current.

3.4 LOCAL ALARM

Every installation shall be fitted with an externally mounted alarm indicator.

NOTES:

- 1 Where alarm valves are grouped, an externally mounted alarm indicator may serve all installations in any one location (see also Clauses 8.1.1 and 8.13).
- 2 Acceptable types of alarm indicator are—
 - (a) an audible warning device;
 - (b) a visual warning device; as required by AS 1670.1; or
 - (c) water motor alarm complying with AS 4118.1.3.

C3.4 The purpose of the alarm indicator is to attract the attention of passers-by. It is not intended to alert occupants of the building. Sprinkler systems required to be installed in accordance with the NCC are required to be connected to and activate a building's occupant warning system.

3.5 SYSTEM COMPONENT MONITORING

3.5.1 General

In addition to the requirements of AS 1670.3, isolation monitoring of system components shall be provided in accordance with Clauses 3.5.2 to 3.5.5.

3.5.2 Monitoring devices

3.5.2.1 General

Class A monitoring devices shall be installed except that Class B devices are permitted where the monitored components are located within a ceiling space, a secure area or a room with access restricted by means of a security device or system.

Class A valve-monitoring devices, complying with AS 4118.1.4, shall be installed to provide tamper resistance and monitoring as required by Clause 3.5.2.2. Class B valve monitoring devices shall be in accordance with Clause 3.5.2.3.

3.5.2.2 *Class A monitoring devices*

Class A monitoring shall transmit a signal upon—

- (a) a change of status of the monitored component;
- (b) any attempt to tamper with or bypass the monitoring device; and
- (c) any attempt to tamper with or bypass the connection back to the receiving centre.

3.5.2.3 *Class B monitoring devices*

Class B monitoring shall transmit a signal upon—

- (a) a change of status of the monitored component; and
- (b) any attempt to tamper with or bypass the connection back to the receiving centre.

3.5.3 **Systems to be monitored**

Continuous system monitoring shall be installed—

- (a) in systems containing High Hazard portions greater than 300 m²; and
- (b) in buildings greater than 25 m effective height.

3.5.4 **Components to be monitored**

The following components shall be monitored:

- (a) Water supply stop valves, including backflow prevention isolating valves but excluding underground key-operated valves.
- (b) Main stop valves.
- (c) Subsidiary stop valves (see Clause 8.2.4).
- (d) Power supply for each electric-motor-driven pump.
- (e) Controller 'ready to start condition' and battery voltage.
- (f) At the 4 h fuel level for each compression-ignition engine-driven pump.

3.5.5 **Installation**

Control and indicating equipment shall comply with the requirements for fire detection control and indicating equipment (FDCIE) specified in AS 1670.1. Electrical monitoring equipment shall be clearly labelled to show its function, voltage and current.

Fault signals from monitored components shall be connected to—

- (a) monitoring centre (see Clause 1.3.17); or
- (b) a Grade 2 central station complying with AS 2201.2, including a monitoring service;
or
- (c) a constantly attended in-house security facility.

If the connection is severed, attention shall be drawn at the receiving station.

SECTION 4 WATER SUPPLIES

4.1 WATER SOURCES

4.1.1 General

Water for use in a fire sprinkler system shall be drawn from one or more of the following water sources:

- (a) Reticulated water supply systems.
- (b) Rivers, reservoirs, lakes or dams.
- (c) Bores.

Where bores are used, they shall only be used to provide water for the initial filling of an onsite tank and/or as a make-up water source. A bore shall not be used as a water supply (see Clause 4.2.2.2) or an automatic inflow for a reduced capacity tank or break tank.

NOTES:

- 1 Where provided, recycled water may be used subject to approval from the relevant water authority and provided it is suitable for human contact.
- 2 Where a river, reservoir, lake, dam or bore is used as a water source, evidence of the reliability and suitability of the water source should be provided—
 - (a) in the form of a hydrogeology report or similar technical assessment; or
 - (b) where a bore is used as a water source, consideration of the impact of neighbouring bores on the reliability of the bore.
- 3 The quality of the water to be used in a fire sprinkler system should be suitable for the long-term operation of the system.
- 4 Water in fire sprinkler system should be suitable for human contact.

4.1.2 Acceptable water

The following types of water shall be deemed to be acceptable for a fire sprinkler system:

- (a) Drinking water from a public water supply.
- (b) Treated rain water (i.e. drinking, filtered rain water).
- (c) Bore water—treated and untreated.
- (d) River, lake or dam water.

NOTE: The materials in the fire sprinkler system should be compatible with the water in the sprinkler system (i.e. chemical composition of the water, pH, etc.) through chemical analysis when the water source is other than a reticulated potable water supply.

4.2 WATER SUPPLY

4.2.1 General

All sprinkler systems shall be provided with at least one water supply drawn from an acceptable source and arranged to facilitate verification testing (see Clause 4.12).

NOTES:

- 1 Water that has been in a fire sprinkler supply system is not considered suitable for domestic uses such as drinking water. Where acceptance testing and maintenance testing water is to be recycled, it should not be recycled to a domestic water service. Alternatively, the water may be used to augment rainwater supplies or other site uses.
- 2 For typical water supply and valve arrangements, see Appendix C.

- 3 The water supply should be designed so that the water used for acceptance testing of the system is not wasted, but is re-used for some useful purpose.
- 4 Where on-site water storage tank(s) are part of the system, water should be returned to the water storage tank(s).

4.2.2 Water supply requirements

4.2.2.1 Flow and residual pressure

A water supply shall be capable of supplying the flow and pressure requirements of the sprinkler system for the required time.

Calculations for the sprinkler system design shall be based on the residual pressure available to the system from the source of supply at the required flow. Where the source of supply is a town main, the residual pressure shall take into account the effect of the required flow on the water supply system.

The residual pressure shall be—

- (a) determined from local water agency modelling confirming that the pressure shall be maintained for 95% of the time;
- (b) a minimum pressure obtained or calculated from local water agency records adjusted for the effect of the system demand (excluding the pressures on the 5% of days having the lowest pressures); or
- (c) determined by testing the water supply system using a method approved by the network utility operator.

NOTE: The network utility operator may nominate a residual pressure limit at the point of connection to the town main, below which draw-off will not be permitted.

***C4.2.2** The grading of water supplies has been discontinued in this Edition of the Standard. Supply from a town main satisfying the criteria detailed in this Clause is considered for the purpose of this Standard to be the benchmark for 'a water supply'. Other acceptable sources of water are selected to equate with this level of reliability. A dual supply (as distinct from a duplicate supply) increases the reliability to a higher level but not to that assuring 100% redundancy. This higher level of reliability is intended to cater for more severe evacuation problems associated with high-rise buildings.*

4.2.2.2 Acceptable water supplies

One or more of the following water supplies shall be provided:

- (a) Reticulated town main (see Clause 4.3.1).
- (b) Reticulated town main with automatic pumps (see Clause 4.3.2).
- (c) Private on-site water mains (see Clause 4.4.1).
- (d) Private on-site water mains with automatic pumps (see Clause 4.4.2).
- (e) Suction tank with automatic pumps (see Clause 4.5).
- (f) Reticulated town main with a break tank and automatic pumps (see Clause 4.3.3).
- (g) Reduced capacity tanks with pump(s) and an automatic inflow from a reticulated town main or other inflow water supply with pumpset(s) (see Clause 4.2.7).
- (h) Elevated private reservoir or gravity tank (see Clause 4.6).
- (i) Elevated private reservoir or gravity tank with automatic pumps (see Clause 4.7).
- (j) River, reservoir or lake, on or within the site boundary, with automatic pumpsets (see Clause 4.8).

4.2.3 Pressure considerations

The pressure applied to any sprinkler or component shall not exceed 1200 kPa or the maximum working pressure of the component.

Maximum pressure calculations shall include allowance for anticipated maximum water supply pressures.

NOTE: Such pressures include a high pressure fluctuation in the town mains and while pumps are operating at churn in a closed system condition.

4.2.4 Additives

Corrosive chemicals such as sodium silicate (or derivatives of sodium silicate), brine or other chemicals shall not be used for stopping leaks.

4.2.5 Backflow prevention

Where backflow prevention is required by AS/NZS 3500.1, it shall be located within the property near the boundary, upstream of the sprinkler control valve and the fire brigade booster assembly, and fitted with above-ground multi-turn isolation valves chained and padlocked in the open position. The hydraulic characteristics of the backflow prevention device shall be considered when determining the available system supply pressure (see Section 14).

4.2.6 Shared water supplies

Sprinkler systems under separate ownership shall not share private water supplies, nor shall they share connections to public water supplies.

Sprinkler system piping (with the exception of water supply connections to town mains) shall not traverse ground that is not under the control of the owner.

NOTES:

- 1 Water supplies, other than those parts under the control of the network utility operator, should be under the control of the owner of the building containing the installation.
- 2 Where there is a ring main or loop within the system, isolating stop valves should be provided, so situated as to maintain the maximum possible service in the event of fracture or, if it is necessary, to close down part of the ring main.

4.2.7 Automatic inflow water supply

Where reduced capacity tanks are installed, automatic inflow shall be provided from a connected reticulation system or other water source so that the water supply requirements of Clause 4.2.2 are met. Where automatic inflow incorporates pumps, they shall meet the requirements of Clause 4.9.1.1.

A means of measuring the inflow rate shall be provided in accordance with Clause 4.12.

NOTE: Pumps that provide automatic inflow to reduced capacity tanks should have the same reliability as other sprinkler water supply pumpsets.

4.3 WATER SUPPLY FROM RETICULATED TOWN MAIN

4.3.1 General

A water supply from a reticulated town main system to be used for supplying a sprinkler system shall comply with the following requirements:

- (a) The town main system shall be fed from a source of at least 1 ML capacity.
- (b) Any stop valves on the branch connection from the town main and under the control of the occupier of the building containing the installation shall be multi-turn type secured in the open position.

- (c) The town main shall be capable of supplying simultaneously the hydrant flow demand and the sprinkler system demand. To provide for this demand, the hydrant flow demand, as derived in accordance with AS 2419.1, shall be deducted from the minimum town main hydraulic characteristic [see Clause 14.7.2(a)].
- (d) The town main shall be capable of supplying the pressure demands of the sprinkler system at the combined hydrant flow and sprinkler flow demands.
- (e) As an exception to (c) and (d) above, where only a car parking compartment of a building is provided with sprinkler protection, then the town main shall be capable of applying pressure and flow demands for the sprinkler system without considering simultaneous hydrant flows.

C4.3.1 *Where a town main supplies a sprinkler system, it should be capable of providing simultaneously the required flow for fire hydrants. It is expected that the fire brigade would not isolate the sprinkler system until the fire is extinguished and may use the hydrants to supplement sprinkler operation.*

4.3.1.2 Metering

Where metering is required, the meter shall be installed—

- (a) on a bypass such as around a backflow prevention device; or
- (b) in-line, provided the meter—
 - (i) does not limit flow, including in the event of meter failure;
 - (ii) does not include a strainer; and
 - (iii) has the same nominal bore as the fire service.

The hydraulic effect of the meter and associated pipework and fittings shall be included in flow and pressure calculations of the fire sprinkler system design.

NOTE: A water agency may specify requirements differing from the above as a condition of connection to its reticulated water supply system.

4.3.2 Pumps drawing from a town main supply

Where pumps draw directly from a town main, the following criteria shall be met:

- (a) The town main shall comply with Clause 4.3, except Clause 4.3.1(d).
- (b) Pumpset configurations shall be in accordance with Clause 4.9.
- (c) The combined output of the town main and either pump (or any two pumps if three are installed) meets the maximum pressure requirements of the sprinkler system. The available town main pressure shall be calculated using the combined hydrant flow and sprinkler flow demands. (See Clause 4.9.5.)

NOTE: If a network utility operator has specific requirements, these should also be met.

C4.3.2 *Water conservation recommendations*

(a) To conserve water during periodic run and load testing of pumps drawing from a town main supply, a recirculation tank and associated piping [see Figure C4.3.2] may be provided to permit re-use of water during pump testing. In use the circulation tank is filled as required, the town main supply is isolated and test water is recirculated via the tank. On completion of the test run, the town main supply is restored. Tank capacity and dimensions are selected to accommodate maximum pump duty flow and to prevent turbulence from tank return lines. See HB 233, Fire Protection Systems Testing, Water Conservation Handbook. This does not preclude the requirement to prove the town main water supply.

(b) Where discharge of some water is unavoidable, it should be captured and returned to the sprinkler installation or redirected to another use. This may be accomplished through the use of temporary on-site recirculating storage tank, greywater recycling plant where it exists on site, or discharge directly to a tanker for off-site use in council gardens and the like.

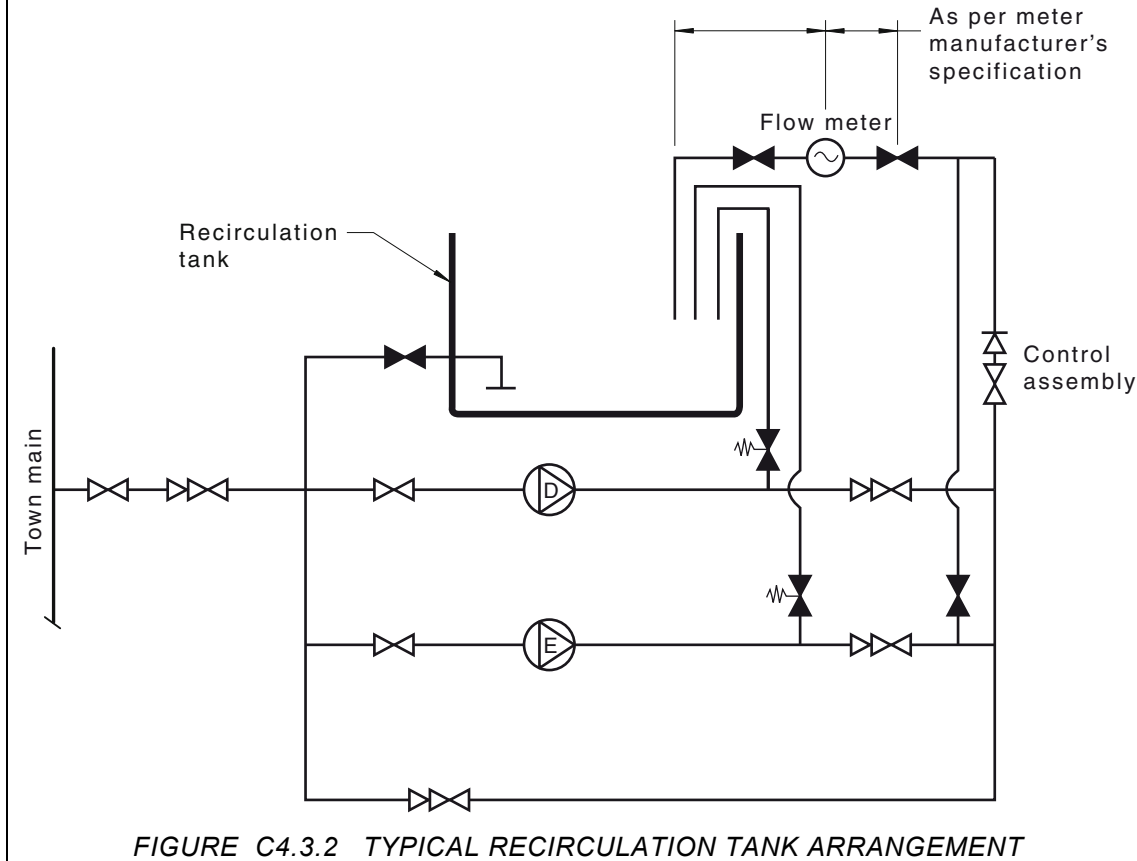


FIGURE C4.3.2 TYPICAL RECIRCULATION TANK ARRANGEMENT

4.3.3 Break tanks

Where a break tank is installed as either a condition of connection to a reticulated water supply by a water agency or to control and manage suction pressure for pumps within a fire sprinkler system, the break tank shall comply with the requirements of AS 2304.

Pumpset configurations shall be in accordance with Clause 4.9.

4.4 WATER SUPPLY FROM PRIVATE ON-SITE WATER MAIN

4.4.1 General

Water supply from private water mains that provide the combined requirements of fire, domestic and industrial systems, in addition to the sprinkler flow and pressure requirements, shall be in the form of a ring main complying with the following:

- The private water mains shall be fed from a source of at least 1 ML capacity.
- The ring main shall be capable of providing the combined peak flow requirements of all connected systems in addition to meeting the hydrant and sprinkler system flow and pressure requirements for the specified time.
- Any stop valves on branch connections to a sprinkler system from the ring main, apart from those underground, shall be secured in the open position.
- Flow and pressure tests to establish the adequacy of the water supply to the sprinkler system shall be carried out with the allowance for the draw-off for other purposes to be at their peak.

4.4.2 Pumps drawing from a private on-site water main supply

Where pressure boosting is required for a private on-site main supply to satisfy Clause 4.4.1 fire pumps shall draw directly from a private system water supply, or from a private site ring main, provided the pumpset configurations are as specified in Clause 4.9.

4.5 WATER SUPPLY FROM PUMP SUCTION TANK

4.5.1 General

Pump suction tanks shall—

- (a) have an effective capacity not less than that specified in Sections 9, 10, 11, 12 and 13 as appropriate; and
- (b) be constructed from concrete or steel.

4.5.2 Concrete tanks

Concrete tanks shall be designed to withstand structural design actions as given in the AS/NZS 1170 series, including permanent actions, liquid pressure actions imposed by fluid contents filled to just overflowing, imposed actions and wind actions. In addition, tanks that are located in areas in which seismic events are likely to occur or tanks that are located in alpine regions shall be designed to withstand the anticipated earthquake and snow actions respectively.

An importance level of 2, as specified in AS/NZS 1170.0, shall be used to determine the probability of design events. Applicable combinations of design actions and loads as given in the AS/NZS 1170 series shall also be evaluated to assess the stability and strength of the structure proposed.

Concrete tanks shall comply with the requirements of AS 3735.

4.5.3 Steel tanks

Bolted steel tanks shall comply with the requirements of AS 2304.

4.5.4 Water storage tank

4.5.4.1 Accessories

The following accessories shall be provided for water storage tanks in accordance with the requirements of AS 2304:

- (a) Tank access.
- (b) Hydraulic components.
- (c) Miscellaneous components.

Fire brigade suction connections shall be provided in accordance with the requirements of AS 2419.1.

4.5.4.2 Tank filling

The water supply for suction tank filling shall be capable of completely refilling the tank within the following times:

- (a) Single supply tanks:
 - (i) Light Hazard 6 h.
 - (ii) Ordinary Hazard 12 h.
 - (iii) High Hazard and special commodities 18 h.

If the water supply is not capable of completely refilling the tank within the time specified, the effective capacity of the tank shall be increased so that the required minimum capacity (see Clause 4.5.1) is available in the specified time.

- (b) Dual supply tanks—One tank.....18 h.

Where the supply water enters the tank, provision shall be made to minimize the entrainment of air.

4.5.4.3 Tank suction

Suction piping drawing from more than one pump suction tank, or more than one compartment of a sectional tank, shall be fitted with a stop valve adjacent to each tank outlet.

4.5.4.4 Water conservation

Except where hydraulically precluded due to tank elevation, wastewater from the water supply flow test, pressure relief, and circulation relief facilities shall be piped separately to the tank. Where water returns to the tank, provision shall be made to minimize the entrainment of air (see AS 2941 and AS 2304).

C4.5.4.4 To conserve water at time of tank maintenance, the provision of dual compartment (sectional) tanks or two half-capacity tanks is strongly recommended. Such a tank arrangement not only permits conservation of half the stored water at time of tank draining for maintenance (by pumping from one compartment or tank to the other) but also ensures that at least half the required stored capacity is available during tank maintenance.

4.5.5 Effective capacity

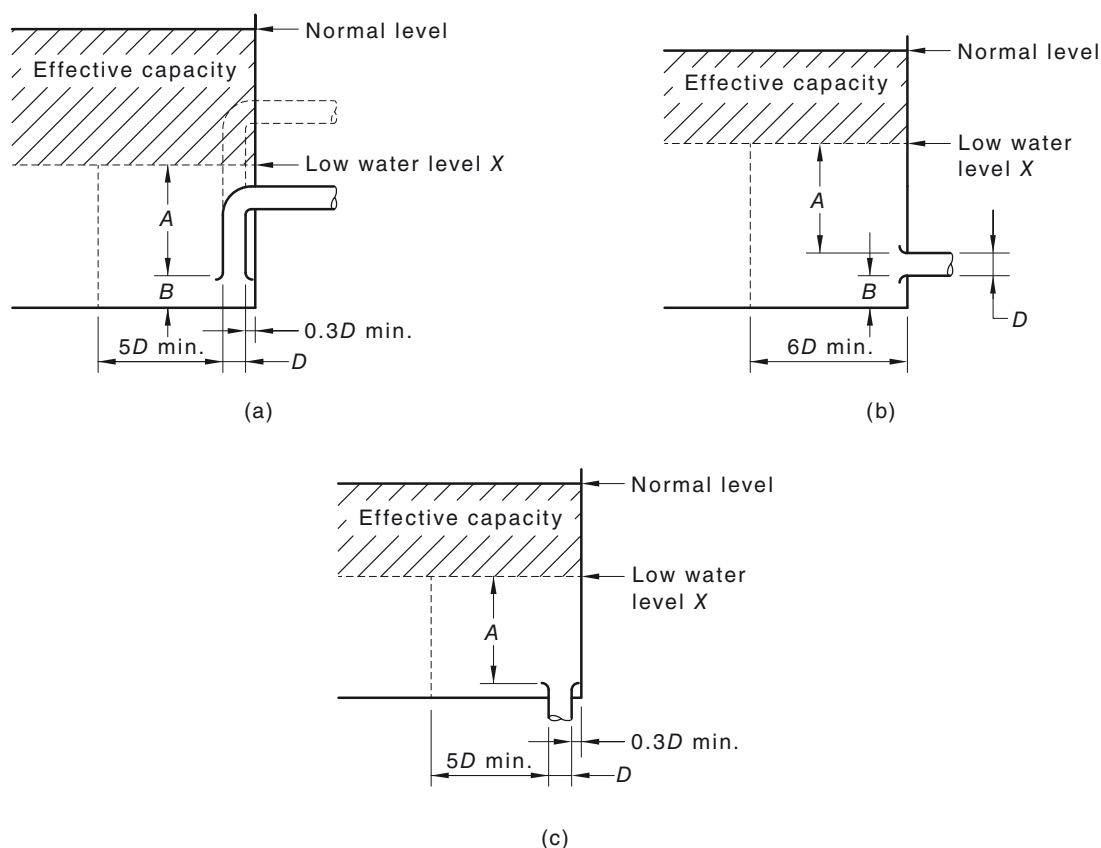
When calculating the effective capacity of a pump suction tank, the depth shall be taken as the measurement between the normal water level in the tank and the low water level *X*. Low water level *X* shall be calculated to be the lowest level before a vortex is created causing the pump to draw air (see Figure 4.5.5).

Where a vortex plate is used, the low water level *X* shall be the top of the vortex plate. The vortex plate shall comply with the requirements of AS 2304.

Where a vortex plate meeting AS 2304 requirements or a sump is not provided, the low water level *X* shall be located above the suction pipe inlet at least the distance given by dimension A in illustration (a), (b) or (c) of Figure 4.5.

Where the suction pipe is taken from the side of the tank as shown in illustrations (a) and (b) of Figure 4.5.5, the clearance between the base of the tank and the lowest level of the pump suction pipe inlet shall be not less than dimension B in illustration (a) or (b) of Figure 4.5.5.

Where a sump is formed in the base of a suction tank from which the suction pipe draws water, the length of the sump shall be not smaller than indicated in Figure 4.5.5(a) in which the position of the sump is shown with broken lines. In addition, the sump width shall be not less than $3.6d$, where d is the nominal diameter of the suction pipe. The point of entry of water to the suction pipe shall be located centrally across the width of the sump.



Nominal diameter of suction pipe	Dimension A	Dimension B
65	250	80
80	310	80
100	370	100
150	500	100
200	620	150
250	750	150
300	900	200
350	1 050	250
400	1 200	300

DIMENSIONS IN MILLIMETRES

FIGURE 4.5.5 EFFECTIVE CAPACITY OF PUMP SUCTION TANK

4.5.6 Pumps drawing from pump suction tanks

Pumps drawing from pump suction tanks shall comply with any pumpset configuration specified in Clause 4.9.

4.5.7 Capacity for other purposes

Where the capacity of the tank exceeds the system requirements, any other water use (e.g. water for domestic and industrial purposes) shall be drawn upon by means of an outlet pipe on the side of the tank above the level of the quantity to be reserved for the sprinkler installation and any connected hydrant system.

NOTE: This does not apply to situations where a tank capacity has been increased in accordance with Clause 4.5.4.2(a) to compensate for slow tank-filling times.

4.6 WATER SUPPLY FROM ELEVATED PRIVATE RESERVOIR OR GRAVITY TANK

4.6.1 General

An elevated private reservoir or gravity tank shall comply with the following requirements:

- (a) The capacity shall be in accordance with the requirements of Clause 4.5.1.
- (b) It shall be located at a height to provide the maximum pressure requirement of the system.
- (c) An elevated tank shall be constructed in accordance with Clauses 4.5.2 or 4.5.3.
- (d) The effective capacity of an elevated tank shall be calculated in accordance with Clause 4.5.5.
- (e) A tank-isolating valve and non-return valve shall be provided at each tank outlet.
- (f) An elevated private reservoir shall have a capacity of at least 1 ML.
- (g) Each elevated private reservoir or gravity tank shall be fitted with a device to indicate the depth of water, that is, full, three-quarters, half, quarter and empty.
- (h) The quantity of water required for the sprinkler installation shall be automatically maintained. If the elevated tank or reservoir forms the sole supply to the sprinkler system, the supply to the tank or reservoir shall be capable of refilling the tank or reservoir to the capacity required within 6 h. If the rate of input of the supply to the tank or reservoir is less than that required to refill it within 6 h, the capacity of the tank or reservoir shall be increased by the amount of the shortfall.

4.6.2 Capacity for other purposes

Where the capacity of the tank or reservoir exceeds the system requirements, any other water use (e.g. water for domestic and industrial purposes) shall be drawn upon by means of an outlet pipe on the side of the tank or reservoir above the level of the quantity to be reserved for the sprinkler installation.

4.7 WATER SUPPLY FROM ELEVATED PRIVATE RESERVOIR OR GRAVITY TANK WITH AUTOMATIC PUMPS

Where an elevated private reservoir or gravity tank is located at a height that will not provide pressure to satisfy the system demand, the pressure shall be boosted by automatic pumps.

An elevated tank or reservoir shall be sized and arranged in accordance with Clause 4.6, except Clause 4.6.1(b).

Pumpset configurations shall be in accordance with Clause 4.9.

By-pass pipework shall be fitted in accordance with Clause 4.9.2(h).

4.8 WATER SUPPLY FROM NATURAL SOURCE

4.8.1 General

Where an on-site automatic pump draws from a suction chamber fed from a natural water source whose reliability and adequacy has been verified in accordance with the requirements of Clause 4.1.2, the design and dimensions of the suction chamber shall comply with the requirements of AS 2941.

4.8.2 Pumps drawing from a natural source

Pumps drawing from a natural source of water supply shall consist of one of the pumpset configurations specified in Clause 4.9.

4.9 PUMP SYSTEM DESIGN AND INSTALLATION

4.9.1 Pumpset configurations

4.9.1.1 *Single supply*

Where pumps are required to satisfy the pressure demand of a single supply to sprinkler systems, any one of the following shall apply:

- (a) *Two automatic pumps*—at least one shall be compression-ignition engine driven. Each pump shall be capable of providing independently the necessary flow and pressure requirement of the sprinkler system.
- (b) *Three automatic pumps*—at least two shall be compression-ignition engine driven, and any two of which shall be capable of providing, in aggregate, the necessary flow and pressure of the sprinkler system. In each case, the pumps shall be capable of operating in parallel, that is, they shall have similar pressure and flow characteristics.
- (c) *Single automatic fire pump*—either electric or compression-ignition driven, capable of providing the required flow and pressure of the sprinkler system, shall be used for hazard classifications up to and including OH2 with a maximum sprinklered area of 9000 m².

4.9.1.2 *Dual supply*

A dual supply from two reticulated town mains with automatic pumps [see Clause 4.11.1(b)] shall be jointed at the pump house to form a manifold supplying the pumps (see Clause 4.11.2.2). A dual supply from two suction tanks with automatic pumps [see Clause 4.11.1(e)] shall be arranged so that either tank shall be isolated without disrupting the supply from the other tank, with a manifold supplying the pumps. The pumps shall be capable of drawing from either supply and shall comprise either one of the following:

- (a) *Two automatic pumps*—at least one shall be compression-ignition engine driven. Each pump shall be capable of providing independently the necessary flow and pressure of the sprinkler system.
- (b) *Three automatic pumps*—at least two shall be compression-ignition engine driven, and any two of which shall be capable of providing, in aggregate, the necessary flow and pressure of the sprinkler system. In each case, the pumps shall be capable of operating in parallel, that is, they shall have similar pressure and flow characteristics.

Dual supplies from different sources that both include automatic pumps shall each be fitted with at least one automatic pump, and at least one shall be compression-ignition engine driven. Each pump shall be capable of providing independently the necessary flow and pressure suited to the supply it serves.

Where a booster pump is required to satisfy the pressure demand for only one part of a dual supply to a sprinkler system, that pump shall be compression-ignition engine driven and be capable of providing the necessary flow and pressure.

4.9.2 General

Pumpsets shall be designed and installed to comply with the requirements of AS 2941 and the following:

- (a) Compression-ignition engine driven pumps shall be housed in a sprinkler-protected area.
- (b) Electric motor-driven pumps shall be housed in—
 - (i) a sprinkler-protected area; or

- (ii) a separate building of non-combustible construction, which shall be used only for the housing of fire protection water supplies.
- (c) Pump motors and electrical controls shall not be installed in pits or tunnels.
- (d) Where a pump house that is required to be sprinkler-protected is situated remote from the sprinkler-protected premises such that it is impracticable to supply the pump house sprinklers from the installation control assembly, the pump house sprinklers shall be supplied from a point on the downstream side of the non-return valve on the discharge pipe from the pump. The supply pipe to the sprinklers shall be provided with a controlling stop valve locked in the open position fitted together with an alarm device that activates when there is water flow with visible and audible indication of the operation of sprinklers provided at some suitable location (e.g. in the gatehouse or at the installation control assembly). A DN 15 drain valve shall be provided downstream of the flow alarm to permit testing of the alarm.

NOTE: This alarm should be connected to a monitoring centre.

- (e) Where operation of a pump is necessary to provide the flow and pressure requirements of the pump house sprinklers, pump starting shall be initiated by pressure sensors located on the pump discharge pipe upstream of the control valve assembly.
- (f) A full-flow stop valve, padlocked in the open position, shall be fitted in the pump suction pipe to permit removal of the pump without draining water from the supply.
- (g) Piping between the supply and the pump shall be arranged to prevent airlocks.
- (h) A bypass shall be provided around the pumps with a non-return valve and an isolation valve on the bypass for water sources drawn from any of the following:
 - (i) Town main water supply.
 - (ii) Elevated private reservoir or gravity tank water supply.

The diameter of the bypass shall be not less than the diameter of the pump discharge manifold.

- (i) Pressure-relief valve drains, recirculating relief drains and flow test drains shall be galvanized and shall run separately to their point of discharge that is they shall not be jointed to a common pipe and run to the point of discharge.
- (j) Each pumpset shall comply with Clause 4.10.

4.9.3 Pump operating conditions

Sprinkler pumps shall not be installed under suction lift conditions. Sprinkler pumps shall be supplied with intake water under positive head.

For pumps to be considered under positive head, the suction pipe opening shall be flooded and the NPSHA shall be 1 m greater than the NPSHR for the pump (see also Clause 4.5.5).

Where a pump draws from a natural unlimited water supply, such as a river, canal or lake, it shall be deemed to be under positive head when the centre-line of the pump is located not less than 850 mm below the lowest known water level.

4.9.4 Suction piping

The diameter of the water supply connection to the pumps shall be such that a velocity of 4.0 m/s is not exceeded when either pump (or two pumps where three are installed) is operating at its maximum flow rate.

Suction pipe diameter shall comply with the requirements in AS 2941 and be not less than the suction inlet size of the pump.

Where a pump draws from pump suction tanks, the location of the entry point to the suction piping shall conform to the dimensions given in Figure 4.5.5.

Pump suction pipes shall be interconnected by a common manifold. This interconnection manifold shall be located adjacent to the pumps and shall be at least equal in diameter to the individual pump suction pipes. Each pump shall be fitted with an isolating (stop) valve at its inlet.

Means shall be provided to prevent any operating pump from drawing air from any non-operating interconnected pump through—

- (a) the pump air vent pipes;
- (b) the pressure-relief valve piping;
- (c) the pump circulation relief valve; and
- (d) the tank infill line drawing from the same source as the pump.

NOTE: See Figure C2, Appendix C.

4.9.5 Pumpset performance criteria

Pumpsets shall be capable of satisfying the flow and pressure requirements of all design areas of the system under consideration, calculated at the lowest available suction pressure and the maximum flow rate of the system.

Each pump driver shall be capable of meeting the power requirements of AS 2941.

NOTE: For descriptions and graphical representations of typical pumped water supply performance curves, see Appendix D.

C4.9.5 *The requirement for the calculation of the hydraulically most favourable area has been removed from this edition. In its place, for systems incorporating pumpsets, the pump duty flow is to be determined from the highest sprinkler flow rate, and the duty pressure is to be determined from ensuring the pump curve is at least 50 kPa higher than the highest pressure of all other system demand pressures. The pump is required to meet 130% of the duty flow at 80% of the duty pressure, which is now the requirement for sprinkler pumpsets in AS 2941.*

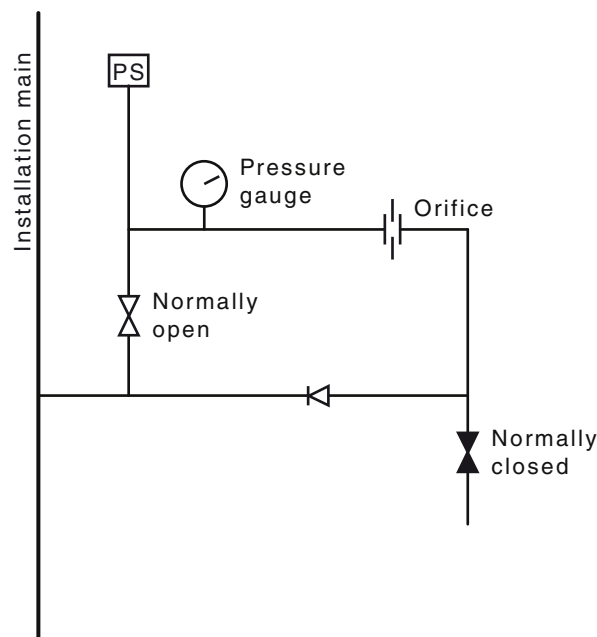
4.10 PUMP START CONTROLLERS

In addition to the requirements of AS 2941, pumpsets and automatic jacking pumpsets shall comply with the following:

- (a) At least one pump controller shall be actuated by a separate pressure sensor set to operate when the pressure in the installation has fallen to a value of not less than the highest pressure requirement for the system. Where two or more pumps are provided, the primary pump shall be set to operate in this manner and the other pumps shall be set to operate at a minimum 100 kPa lower pressure, provided this pressure is still higher than that required when 50% of sprinklers in the area of operation activate.
- (b) Where more than one pump is provided, the pumps shall be arranged to start sequentially at a pressure not less than that stated in Item (a), or in minimum 100 kPa increments.
- (c) Where pressure sensors are installed on a water supply manifold serving more than one installation, they shall be duplicated (wired in parallel) for each pump.

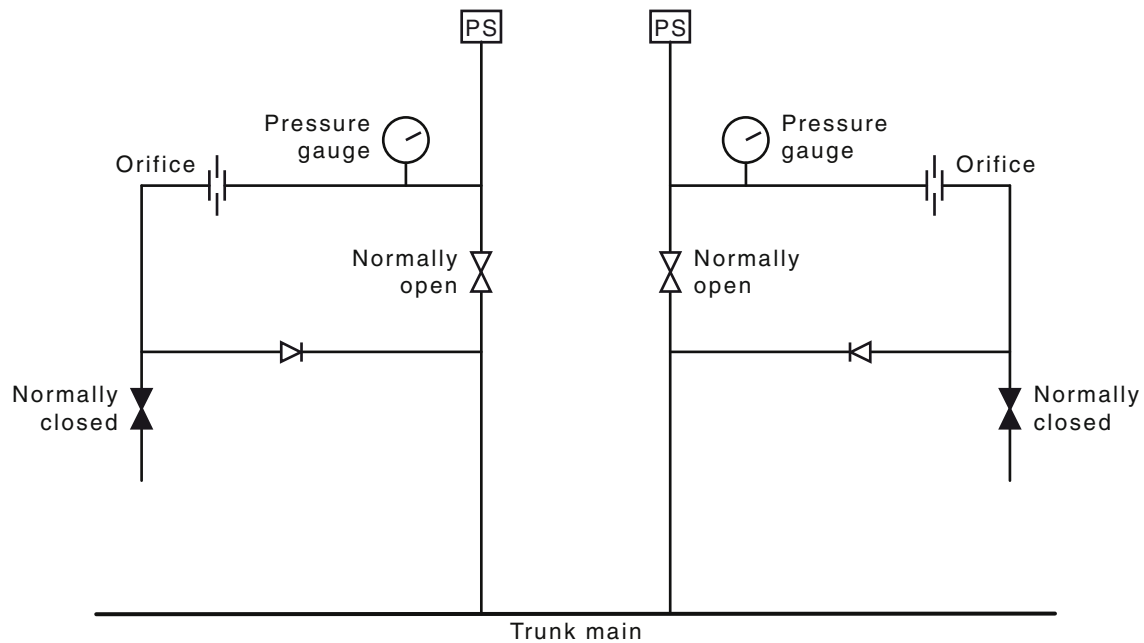
- (d) A fall in water pressure in the sprinkler system, which is intended to initiate the automatic starting of the pump, shall at the same time provide a visible and audible alarm at some suitable location (e.g. in the gatehouse or at the installation control assembly). The starting of the pump(s) shall not cause the cancellation of the alarm. Where the pump is situated remote from the protected premises, visible and audible indication of the pump operation shall be provided at a similar suitable location. This alarm shall share a common indicator with the pump running alarm [see also Clause 4.9.2(d)].
- (e) Facilities shall be provided to reduce the applied water pressure to each starting device to simulate the condition of automatic starting at the required pressure. A separate hydraulic circuit shall be provided for each starting device. This shall take the form of a drain valve on the hydraulic connection to the pump start pressure switch with the provision of suitable permanent drainage facilities. To enable the cut-in pressure to be judged accurately, the drain valve shall be fitted with an orifice plate to reduce the rate of pressure drop. To facilitate testing and servicing, an isolating valve shall be fitted on the hydraulic connection. A bypass and non-return valve, allowing flow towards the main, shall be provided to ensure pump starting is not disabled if the isolating valve is inadvertently left closed. A pressure gauge to indicate the pressure at which the pump starts shall be located between the isolating and drain valves so that it can be read during the pump starting test.

NOTE: For typical representations, see Figure 4.10.



(a) Connected to an installation

FIGURE 4.10 (in part) TYPICAL PRESSURE SWITCH TEST ARRANGEMENT



(b) Connected to an installation water supply manifold

FIGURE 4.10 (in part) TYPICAL PRESSURE SWITCH TEST ARRANGEMENT

4.11 DUAL WATER SUPPLIES

4.11.1 General

Where a dual water supply is required, it shall comprise any two of the following:

- Reticulated town main (see Clause 4.3 and Clause 4.11.2.1).
- Reticulated town main with automatic pump (see Clause 4.3.2).
- Private on-site water main (see Clause 4.4.1).
- Private on-site water main with automatic pumps (see Clause 4.4.2).
- Suction tank with automatic pumps (see Clause 4.5).
- Reticulated town main with a break tank and automatic pumps (see Clause 4.3.3).
- Reduced capacity tank(s) with automatic pump(s) where each tank contains at least $\frac{2}{3}$ the usable water quantity required (see Clauses 9.3.2, 10.3.1.2 and 11.6.6).
- Elevated private reservoir or gravity tank (see Clause 4.6).
- Elevated private reservoir or gravity tank with automatic pumps (see Clause 4.7).
- Natural sources such as rivers or lakes with automatic pumps, subject to the conditions set out in Clause 4.8.

C4.11.1 *Dual water supplies may be mandated by a regulatory authority for sprinkler systems serving high-rise buildings (buildings exceeding 25 m effective height) where they are generally considered beyond the reach of fire brigade aerial appliances. However, dual water supplies are also frequently specified by insurers and fire engineers for risks involving substantial loss exposure and/or potential environmental hazard.*

4.11.2 Arrangements

4.11.2.1 Independent arrangement

Dual water supplies shall be connected to duplicate water sources. Each source shall be capable of providing the required pressure and rate of flow for the required time according to the hazard class.

Where two town mains are used as a dual supply, the following additional requirements shall apply to ensure continuity of supply:

- (a) The mains shall either be independent or form part of an interconnected town mains system having stop valves so arranged that in the event of a breakdown *anywhere in the system*, at least one of the mains to the installation shall remain operative; and
- (b) The town mains system shall be connected to more than one source.

4.11.2.2 Individual connections

Where dual water supplies consist of two individual connections from a town main system, the pipe from each connection shall be carried separately into the building structure, as follows:

- (a) Where pumps are installed, the pipe from each connection from the town main system shall be carried separately to the pump suction manifold specified in Clause 4.9.4. An isolating valve shall be installed upstream of the pump suction manifold on the pipe from each connection from the town main system. Each of these two isolating valves shall be secured open and shall be positioned adjacent to the pump suction manifold in accordance with the requirements of Clause 4.9.4 at each pump inlet, as shown in Figure 4.11.2(a).
- (b) Where pumps are not installed, the pipe from each connection from the town main system shall be carried separately to a point adjacent to the sprinkler-protected building, where they may be interconnected. A single pipe shall be carried from the interconnection point into the building, as shown in Figure 4.11.2(b).

NOTE: Where there are two or more installations in one building, the second and subsequent installation may be supplied by a single pipe taken downstream of the interconnection of the two supplies [see Figure 4.11.2(b)].

Isolating valves shall be provided upstream on each pipe connection within 5 m of the point of connection.

C4.11.2.2(a) *The isolating valve on each of the two connections from the town main system, required upstream and in close proximity to the pump suction manifold, provide a means of closing off any damaged or non-operational town main connection, thus preventing any operating pump from drawing air (see also Clause 4.9.4).*

4.11.2.3 Pumps

Pumps forming part of a dual water supply shall be in accordance with Clause 4.9.

C4.11.2.3 *Where pumps are required, it is not the intent of this Standard to require duplication of pumps on each supply. Where a town main and a suction tank provide the dual supply, a single pump (if required) on the town main and a single pump drawing from the tank would meet the intent of this Standard, provided that at least one pump is compression-ignition engine driven. Figure 4.11.2(a) shows an acceptable arrangement in the case of two town mains.*

4.11.2.4 Tanks

Where both supplies are comprised of tanks, with or without pumps, the tanks shall be either separate units or a single unit partitioned to hold the required water storage capacity in each compartment.

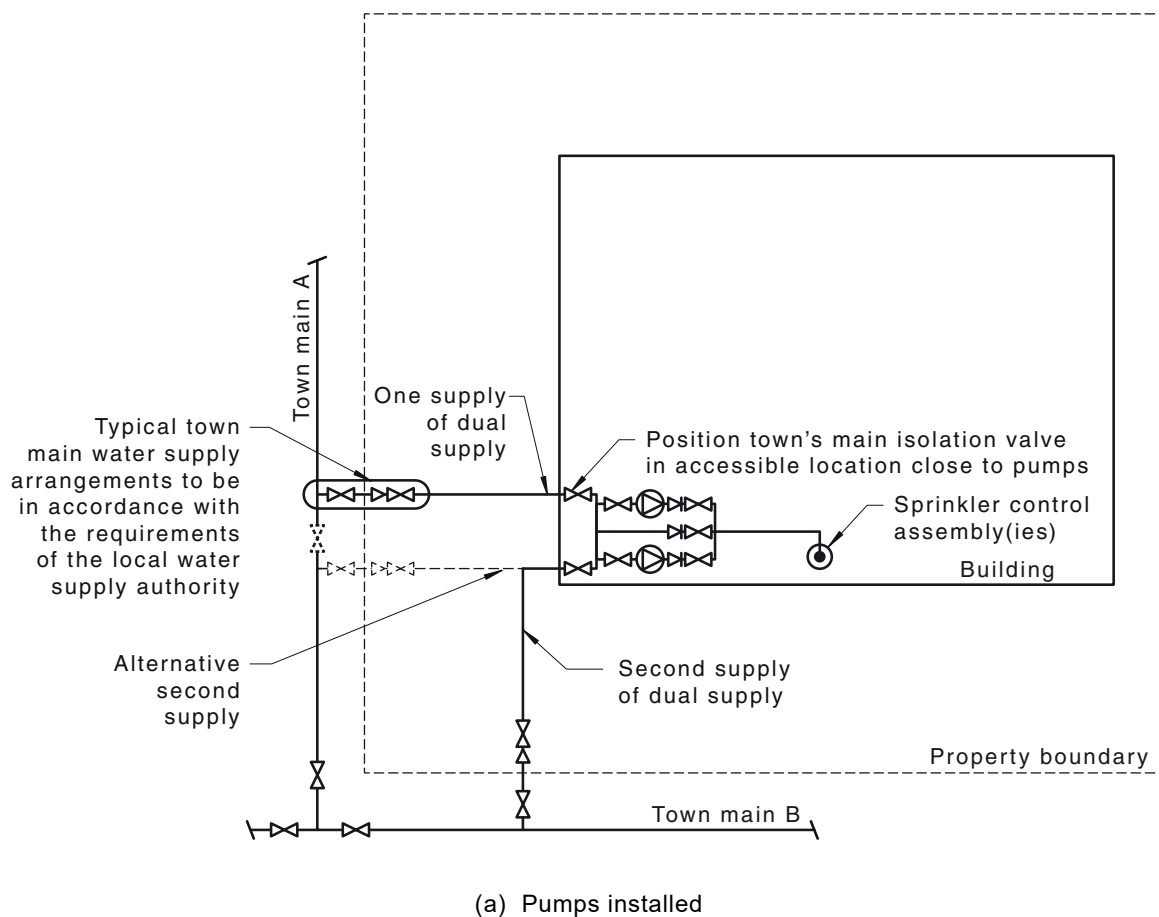
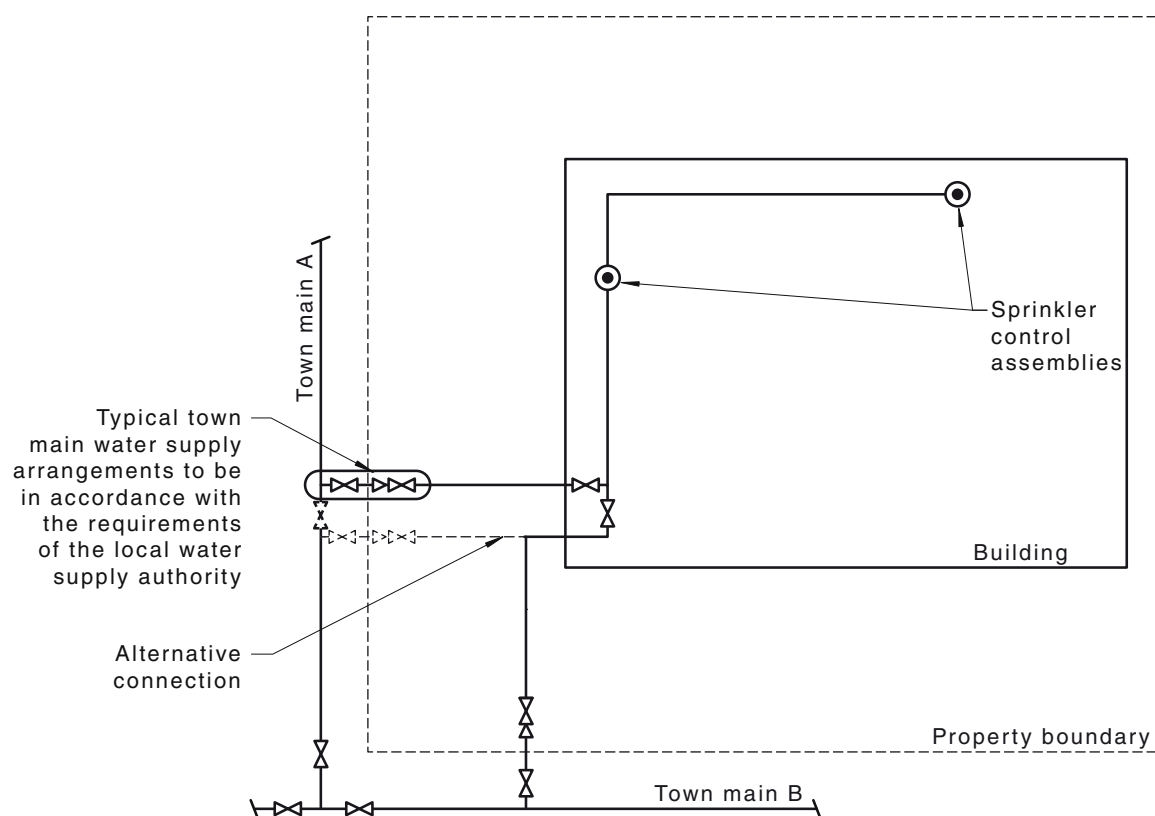


FIGURE 4.11.2 (in part) DUAL TOWN MAIN WATER SUPPLIES



(b) No pumps installed

FIGURE 4.11.2 (in part) DUAL TOWN MAIN WATER SUPPLIES

4.12 PROVING OF WATER SUPPLIES

Facilities shall be provided on each sprinkler system to test the water supplies to verify that they satisfy the calculated flow and pressure requirements of the installed system.

Pipework downstream of the test pipe-isolating valve shall be galvanized.

For systems not fitted with pumps, the flow-measuring device shall be installed at any point on the system downstream of the datum point to which the hydraulic calculations are referenced. Where pumps are fitted, the flow-measuring device shall be located in accordance with the requirements of AS 2941.

Where limited capacity water tanks rely on an automatic inflow, facility shall be provided to test the rate of inflow to the water tank.

Testing facilities shall be provided on the inflow line, to enable the full range of flows to be measured.

The test pressure gauge shall be installed at or immediately adjacent to the system hydraulic calculation datum point.

Where there are no pumps installed and a number of installation control assemblies are sited together, a testing facility shall be on at least one installation control assembly, provided it is fitted to the assembly requiring the highest flow.

NOTE: Care should be taken when water supplies are marginal, to ensure that pressure losses in the drainpipe are not so high as to restrict the flow across the testing facility below the required test flow and pressure. This applies particularly where the required flow rate is high, or where the highest sprinklers are below the installation gauge or only slightly above it.