

AS 2419.1:2021



STANDARDS
Australia



Fire hydrant installations

Part 1: System design, installation and commissioning



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AS 2419.1:2021

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- Australian Institute of Building Surveyors
- Australian Stainless Steel Development Association
- Engineers Australia
- Facility Management Association of Australia
- Fire Protection Association Australia
- Hydraulic Consultants Association Australasia
- Insurance Council of Australia
- International Copper Association Australia
- Master Plumbers Australia and New Zealand
- National Fire Industry Association
- Plastics Industry Pipe Association of Australia
- Water Services Association of Australia

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Fire hydrant installations

Part 1: System design, installation and commissioning

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Preface

This Standard was prepared by the Standards Australia Committee FP-009, Fire Hydrant Installations, to supersede AS 2419.1:2017.

A list of all parts in the AS 2419 series can be found in the Standards Australia online catalogue.

The objective of this Standard is to specify the minimum requirements for the design, installation, and commissioning of fire hydrant systems which —

- (a) will facilitate the efficient extinguishment of fire within the boundaries of the site;
- (b) can be used to minimize fire spread within or between one building or site and another;
- (c) can be used by trained firefighting personnel; and
- (d) have inlet and outlet connections that are used with the local fire brigade's firefighting equipment.

The major changes in this edition are as follows:

- (i) Restructure of the document and content to improve its use and readability.
- (ii) Limit the scope to buildings having an effective height not more than 135 m to Class 7b or 8 buildings having a total volume not more than 108 000 m², and to buildings that do not include automatic racked storage systems.
- (iii) Include informative appendices to clarify the intent of sections and clauses.
- (iv) Include new technologies and industry best practices to enable competitive and cost-effective design and water conservation.
- (v) Divide the previous [Section 8](#) (Pipework and valves) into two sections.
- (vi) Acknowledge the benefits of installed sprinkler systems to control the development and spread of fire.
- (vii) Introduce a range of requirements for high-rise buildings based on internationally applied Standards.

Notes or footnotes to tables or figures that are expressed in mandatory terms are deemed to be requirements of this document.

Notes to clauses in this document are informative only and do not include requirements.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

Contents

Preface	ii
Introduction	ix
Section 1 Scope and general	1
1.1 Scope.....	1
1.2 Normative references.....	1
1.3 Terms and definitions.....	4
Section 2 System performance and design	12
2.1 General.....	12
2.2 System performance.....	12
2.2.1 Classification of fire hydrants.....	12
2.2.2 External fire hydrants.....	12
2.2.3 Internal fire hydrants.....	13
2.2.4 Feed, attack, and attack/feed fire hydrants.....	13
2.2.5 Number of fire hydrant outlets required to flow simultaneously.....	14
2.2.6 Pressure and flow.....	15
2.2.7 Multiple firefighting systems.....	17
2.2.8 Class 7a carparks.....	17
2.2.9 Gravity break tanks.....	17
2.2.10 Feed fire hydrants.....	17
2.2.11 Attack fire hydrants.....	18
2.2.12 On-site pumps.....	19
2.2.13 On-site tanks and pumps.....	19
2.2.14 Fire brigade booster assembly.....	20
2.2.15 Half-duty fire hydrant pumps.....	20
2.2.16 Full-duty fire hydrant pumps.....	20
2.3 Hydraulic design parameters.....	21
2.3.1 General.....	21
2.3.2 Design pressures.....	21
2.3.3 Design velocity.....	21
2.3.4 Hydraulic loss — Backflow prevention and metering.....	21
2.3.5 Hydraulic loss — Pipes, valves, and fittings.....	21
2.3.6 Ring main design.....	21
2.3.7 Fire brigade boost pressure.....	21
Section 3 Hydrant classification, location, and coverage	23
3.1 General.....	23
3.2 Fire hydrants.....	23
3.2.1 Classification.....	23
3.2.2 Features, accessibility, and clearances.....	23
3.3 Hardstands.....	25
3.4 Location of fire hydrants.....	25
3.5 External fire hydrants.....	25
3.5.1 General.....	25
3.5.2 Street hydrants.....	26
3.5.3 Location.....	27
3.5.4 Fire brigade booster assembly — Feed fire hydrants.....	28
3.5.5 Protection of fire hydrants.....	29
3.6 Internal fire hydrants.....	30
3.6.1 General.....	30
3.6.2 Location.....	30
3.6.3 Additional internal fire hydrants.....	31
3.7 Fire compartments.....	31
3.8 Rooftop plant rooms.....	31
3.9 Open yard protection.....	31

3.10	Marinas.....	32
3.11	Method of measurement and limitations.....	32
3.11.1	General.....	32
3.11.2	Doorways.....	33
3.11.3	Obstructions.....	34
3.11.4	Measurements from a fire brigade pumping appliance.....	34
Section 4	Water sources and supply.....	35
4.1	Water sources.....	35
4.1.1	General.....	35
4.1.2	Adequacy of water sources.....	35
4.1.3	Water quality.....	35
4.2	Water supply.....	36
4.2.1	Primary water supply requirements.....	36
4.2.2	Primary water supply options.....	36
4.2.3	Multiple firefighting systems.....	37
4.2.4	Recycling.....	37
4.2.5	Secondary water supply requirements.....	37
4.2.6	On-site water storage tanks.....	37
4.2.7	Water supply pressure.....	39
4.2.8	Arrangement of water supplies.....	40
4.3	Connections to water sources or supplies.....	41
4.3.1	Connection to a reticulated water supply.....	41
4.3.2	Connection to on-site private water supplies.....	42
4.3.3	Connection to water storage tanks.....	42
4.3.4	Connection to sea, river, lake or dam water.....	43
4.4	Fixed suction connection.....	43
Section 5	Water storage tanks.....	44
5.1	General.....	44
5.2	Tank construction.....	44
5.2.1	General.....	44
5.2.2	Concrete tanks.....	44
5.2.3	Steel tanks.....	44
5.3	Tank accessories.....	45
5.3.1	Fire brigade suction connections.....	45
5.3.2	Suction lines.....	46
5.3.3	Tank fill time.....	47
Section 6	Pumpsets.....	48
6.1	General.....	48
6.2	When a pumpset is required.....	48
6.2.1	Half-duty fire hydrant pumpsets.....	48
6.2.2	Full-duty fire hydrant pumpsets.....	48
6.2.3	Pressure maintenance pumps.....	48
6.2.4	Secondary water supply pumps.....	48
6.3	Pumpset design criteria.....	49
6.3.1	Half-duty fire hydrant pumpsets.....	49
6.3.2	Full-duty fire hydrant pumpsets.....	49
6.3.3	Jockey pumps.....	49
6.3.4	Secondary water supply pumpsets.....	49
6.4	Fire hydrant pumpsets.....	49
6.4.1	Pumpset configurations.....	49
6.4.2	One pump — Buildings having an effective height not more than 25 m.....	50
6.5	Full-duty fire hydrant pumpsets.....	50
6.6	Secondary water supply pumpsets.....	51
6.7	Fixed on-site pumpsets in parallel with the fire brigade booster assembly.....	51
6.8	Fixed on-site pumpsets in series with the fire brigade booster assembly.....	52
6.8.1	Connection requirements.....	52
6.8.2	Additional requirements.....	52

6.9	Pump control — Fire hydrant pumps	52
6.9.1	Primary starting arrangements	52
6.9.2	Secondary starting arrangements	53
6.10	Electric driver isolating switches	53
6.11	Pump room or enclosure	53
6.11.1	General	53
6.11.2	Internal pump rooms	53
6.11.3	External pump rooms or enclosures	54
Section 7	Fire brigade booster assembly	56
7.1	General	56
7.2	When a fire brigade booster assembly is required	56
7.3	Location	56
7.3.1	Position	56
7.3.2	Visual alarm device	57
7.3.3	Accessibility, clearance, and protection	57
7.3.4	Multiple buildings on-site	58
7.4	Types of fire brigade booster assemblies	58
7.5	Fire brigade booster assembly design and arrangement	58
7.5.1	General	58
7.5.2	Number of booster connection inlets required	59
7.5.3	H-pattern fire brigade booster assembly	59
7.5.4	In-line fire brigade booster assembly	62
7.5.5	I-pattern fire brigade booster assembly	63
7.5.6	Tank model fire brigade booster assembly	64
7.5.7	Tank suction fire brigade booster assembly	65
7.6	Protection of fire brigade booster assemblies	68
7.6.1	Sprinkler-protected buildings	68
7.6.2	Non-sprinkler-protected buildings — Passive protection requirements	68
7.6.3	Non-sprinkler-protected buildings — Passive and active protection requirements	69
Section 8	Pipework design and installation	70
8.1	General	70
8.2	Ground conditions	70
8.3	Fire mains	70
8.4	External pipework	70
8.5	Internal pipework	71
8.5.1	General	71
8.5.2	Copper pipe	71
8.6	Ring main	71
8.6.1	General	71
8.6.2	Design criteria	72
8.7	Isolating valves	72
8.7.1	General	72
8.7.2	Location	72
8.8	Interconnections	73
8.9	System monitoring	73
8.9.1	General	73
8.9.2	Class A monitoring devices	73
8.9.3	Class B monitoring devices	74
8.9.4	Monitoring devices required	
8.9.5	Components to be monitored	74
8.10	Test facility	74
8.10.1	General	74
8.10.2	Permanent test facility	75
8.10.3	Permanent test facility drainage	75
8.10.4	Reduced-capacity tank test facility	75
8.11	Fire hose reel service isolating valves	76

8.12	Pressure management.....	76
8.13	High-rise design criteria.....	76
8.13.1	General.....	76
8.13.2	Bottom-up fire hydrant system design.....	77
8.13.3	Cascade fire hydrant system design.....	77
8.13.4	Pressure-reducing valve station.....	78
Section 9	Pipes, valves and fittings.....	79
9.1	General.....	79
9.2	Pipe, valves and fittings specifications.....	79
9.2.1	Above-ground pipework.....	79
9.2.2	Below-ground pipework.....	79
9.2.3	Additional requirements for steel pipe and fittings.....	80
9.3	Valve specifications.....	81
9.3.1	Fire hydrant valves.....	81
9.3.2	Isolating valves.....	81
9.3.3	Non-return valves.....	82
9.3.4	Backflow prevention devices.....	82
9.4	Fire brigade booster connections.....	82
9.5	Metal pipe joints.....	83
9.5.1	General.....	83
9.5.2	Roll-grooved fittings and couplings.....	83
9.5.3	Shouldered fittings and couplings.....	83
9.5.4	Compression systems.....	83
9.5.5	Gasket seals.....	83
9.5.6	Brazed joints in copper pipework.....	84
9.5.7	Flange joints.....	84
9.6	Plastics pipe joints.....	84
9.7	Pipe marking.....	84
9.7.1	Steel pipe.....	84
9.7.2	Copper pipe.....	85
9.7.3	Stainless steel pipe.....	85
9.7.4	Plastics pipe.....	85
9.8	Corrosion protection.....	85
9.8.1	General.....	85
9.8.2	Polyethylene extruded plastics coating and tape.....	85
9.8.3	Petrolatum tape coating.....	85
9.8.4	Polymeric coating.....	85
9.8.5	Cement mortar lining.....	85
Section 10	Pipe supports.....	86
10.1	General.....	86
10.2	Pipe support design.....	86
10.2.1	General.....	86
10.2.2	Sway support.....	86
10.2.3	Pipe support in seismic areas.....	86
10.3	Materials for pipework support.....	87
10.4	Protection of pipe supports.....	87
10.4.1	Fire rating.....	87
10.4.2	Corrosion protection.....	87
10.4.3	Dissimilar metals.....	87
10.5	Requirements for pipe-support components.....	87
10.5.1	General.....	87
10.5.2	U-bolts used for clamping down.....	88
10.5.3	U-bolts for clamping up and threaded rods for supporting pipework.....	88
10.5.4	U-hangers/saddles (clips).....	88
10.5.5	Saddle brackets and girder or beam clamps.....	89
10.5.6	Pear hangers/pipe bands.....	89
10.5.7	Two-piece bolted clamps.....	89

10.5.8	Welded nut clips and split ring hangers	90
10.5.9	Riser clamps	90
10.5.10	Channel/strut clips	90
10.5.11	Pipe support beams (trapeze bar)	90
10.6	Spacing of supports	91
10.7	Location of supports	92
10.7.1	Horizontal pipework	92
10.7.2	Vertical pipework	92
10.8	Fixing of pipe supports	94
10.8.1	General	94
10.8.2	Fixing to concrete, masonry or steel	94
10.8.3	Fixing to timber	94
10.9	Thrust blocks and anchors	94
10.10	Penetration of pipework through structures	94
Section 11	Ancillary equipment, signage and baseline data	96
11.1	General	96
11.2	Cabinets, enclosures or recesses	96
11.2.1	Fire brigade booster assembly	96
11.2.2	Doors of fire brigade booster assembly cabinets and enclosures	98
11.2.3	Fire hydrant cabinets	98
11.3	Signage	99
11.3.1	Fire brigade booster assembly	99
11.3.2	Attack fire hydrants in fire brigade booster assembly cabinets	100
11.3.3	Large- and small-bore suction connection	100
11.3.4	Notice-of-pressure signs (baseline data)	100
11.3.5	Fire hydrants	101
11.3.6	Water storage tanks and equipment	101
11.3.7	Pumps	102
11.4	Pressure gauges	102
11.4.1	General	102
11.4.2	Location of pressure gauges	103
11.4.3	Pressure schedule (baseline data)	103
11.5	Block plan (baseline data)	104
11.6	Location plan — Additional fire hydrants (baseline data)	109
11.7	Location plan — Street fire hydrants (baseline data)	109
11.8	Pipework identification	109
Section 12	Commissioning	110
12.1	General	110
12.2	Hydrostatic testing — Feed fire hydrant systems	110
12.2.1	All joints accessible	110
12.2.2	All joints not accessible	110
12.3	Hydrostatic testing — Attack fire hydrant systems	110
12.3.1	Buildings having an effective height not more than 50 m	110
12.3.2	Buildings having an effective height more than 50 m	110
12.4	Flow and pressure performance testing	111
12.4.1	Maximum static pressure	111
12.4.2	Unassisted feed, attack or attack/feed fire hydrants	111
12.4.3	Fire brigade booster assemblies	111
12.4.4	Half-duty fire hydrant pumpsets	112
12.4.5	Full-duty fire hydrant pumpsets	112
12.4.6	Jockey pumps	112
12.4.7	Friction loss	112
12.4.8	Multiple firefighting systems	112
12.5	Commissioning and acceptance testing requirements	113
12.6	Inspection	113
12.7	Documentation	113
Appendix A	(informative) Means of demonstrating conformance	115

Appendix B (informative) Fire hydrant system design	123
Appendix C (informative) Fire hydrant system design — large isolated buildings with a total volume more than 108 000 m³ and automatic storage and retrieval systems	126
Appendix D (informative) Fire hydrant system design — Class 2 to 9 buildings having an effective height more than 135 m	134
Appendix E (informative) Special hazard areas	139
Appendix F (informative) Fire brigade operations and equipment — Design considerations for fire hydrant systems	141
Appendix G (informative) Guidance on system performance and design	155
Appendix H (informative) Guidance on fire hydrant location and related provisions	174
Appendix I (informative) Privately owned street fire hydrants	200
Appendix J (informative) Design guidance — Marinas	201
Appendix K (informative) Guidance on water sources and water supply	204
Appendix L (informative) Determination of water system supply pressure	218
Appendix M (informative) Water storage tanks	228
Appendix N (informative) Guidance on pumpset and pipework design	234
Appendix O (informative) Facilities for testing on-site fire hydrant pumps	253
Appendix P (informative) Design guidance — Fire brigade booster assembly	254
Appendix Q (informative) Fire hose couplings used in Australia	266
Appendix R (informative) Corrosion protection	269
Appendix S (normative) Commissioning — Hydrostatic test procedures	271
Appendix T (normative) Commissioning — Flow and pressure performance testing	276
Appendix U (informative) Adjustment for water supply pressure variation	283
Bibliography	286

Introduction

The availability of fire hydrants is essential to fire protection. Fire hydrants are used to control the spread of fire, protect neighbouring properties, extinguish an outbreak of fire, or extinguish a fire controlled by an automatic fire protection system, such as a sprinkler, gaseous or foam system.

Fire hydrants are installed within buildings or sites for use by the fire brigade and other trained firefighting personnel. Fire hydrant systems are only used for firefighting purposes.

The provision of firefighting services across Australia varies greatly between rural and metropolitan areas. Should a fire occur in a large metropolitan area, a vast array of resources and large numbers of personnel can be mobilized if needed. This resource capability is not available, however, in rural and country areas, with many such areas having access to a single pumping appliance and a limited number of personnel. In developing a fire hydrant design, the resources available to the attending fire brigade should be taken into account so that the design developed meets their needs.

In designing a fire hydrant system, external hydrants are provided wherever possible so that the attending fire brigade can enter the building under the protection of a charged hose line. Where internal fire hydrants are required to be installed, consistent and repeating hydrant patterns should be applied across floors so that firefighters can move confidently throughout the building in the knowledge that a fire hydrant can be found where expected. The application of this design approach will enable firefighters to enter buildings under the protection of a charged line of hose and to readily access fire hydrants as firefighters move throughout the building.

The water supply is a fundamental consideration in the design of a fire hydrant installation and may comprise water from more than one source.

NOTES

Australian Standard[®]

Fire hydrant installations

Part 1: System design, installation and commissioning

Section 1 Scope and general

1.1 Scope

This document specifies the requirements for the design, installation, commissioning and testing of fire hydrant installations.

This document applies to on-site fire hydrant installations for —

- (a) class 7b or 8 buildings having a total volume not more than 108 000 m³;

NOTE 1 See [Appendix C](#) for guidance on Class 7b or 8 buildings having a total volume more than 108 000 m³.

- (b) buildings that do not include automatic racked storage systems;

NOTE 2 See [Appendix C](#) for guidance on buildings that include automatic racked storage systems.

- (c) buildings having an effective height not more than 135 m; and

NOTE 3 See [Appendix D](#) for guidance on buildings having an effective height more than 135 m.

- (d) buildings and associated areas that do not include special hazards.

NOTE 4 See [Appendix E](#) for buildings and associated areas that include special hazards.

This document may apply, either in part or in full, to any —

- (i) buildings outside the scope of this document; or
(ii) sites, including any storage yard, marina, wharf, plant, or infrastructure.

This document does not apply to the design or performance of reticulated water supplies and street hydrants controlled by the network utility operator. However, this document does permit the use of street fire hydrants in lieu of on-site feed fire hydrants, provided they conform to the requirements for feed fire hydrants in relation to location, available pressure, and flow.

The flow requirements in this document, which are based on the floor area of a building, provide sufficient water to enable firefighting operations to commence at a single location within a building or site. Where a risk assessment of a building or site determines that multiple ignitions or rapid-fire growth and spread is probable, then additional provisions are considered.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

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

AS 1074, *Steel tubes and tubulars for ordinary service*

AS 1275, *Metric screw threads for fasteners*

AS 1281, *Cement mortar lining of steel pipes and fittings*

AS 1345, *Identification of the contents of pipes, conduits and ducts*

- AS 1349, *Bourdon tube pressure and vacuum gauges*
- AS 1432, *Copper tubes for plumbing, gasfitting and drainage applications*
- AS 1530.4, *Methods for fire tests on building materials, components and structures, Part 4: Fire-resistance test of elements of construction*
- AS 1572, *Copper and copper alloys—Seamless tubes for engineering purposes*
- AS 1579, *Arc-welded steel pipes and fittings for water and wastewater*
- AS 1674.1, *Safety in welding and allied processes, Part 1: Fire precautions*
- AS 1769, *Welded stainless steel tubes for plumbing applications*
- AS 2118.1, *Automatic fire sprinkler systems, Part 1: General requirements*
- AS 2118.4, *Automatic fire sprinkler systems, Part 4: Sprinkler protection for accommodation buildings not exceeding four storeys in height*
- AS 2118.6, *Automatic fire sprinkler systems, Part 6: Combined sprinkler and hydrant systems in multistorey buildings*
- AS 2129, *Flanges for pipes, valves and fittings*
- AS 2304, *Water storage tanks for fire protection systems*
- AS 2419.2, *Fire hydrant installations, Part 2: Fire hydrant valves*
- AS 2419.3, *Fire hydrant installations, Part 3: Fire brigade booster connections*
- AS 2941, *Fixed fire protection installations—Pumpset systems*
- AS 3672, *Wrought steel threaded pipe fittings*
- AS 3688, *Water supply and gas systems—Metallic fittings and end connectors*
- AS 3735, *Concrete structures retaining liquids*
- AS 4118.1.4, *Fire sprinkler systems, Part 1.4: Components—Valve monitors*
- AS 4321, *Fusion-bonded medium density polyethylene coating and lining for pipes and fittings*
- AS 4428.1, *Fire detection, warning, control and intercom systems—Control and indicating equipment, Part 1: Fire*
- AS 4728, *Electric resistance welded steel pipe for pressure purposes*
- AS 4794, *Non-return valves—Swing check and tilting disc*
- AS 4809, *Copper pipe and fittings—Installation and commissioning*
- AS 5200.053, *Plumbing and drainage products, Part 053: Stainless steel pipes and tubes for pressure applications*
- AS 7240.2, *Fire detection and alarm systems, Part 2: Fire detection control and indicating equipment (ISO 7240-2:2017, MOD)*
- AS/NZS 1167.1, *Welding and brazing—Filler metals, Part 1: Filler metal for brazing and braze welding*
- AS/NZS 1477, *PVC pipes and fittings for pressure applications*
- AS/NZS 1518, *External extruded high-density polyethylene coating system for pipes*

- AS/NZS 1668.1, *The use of ventilation and air conditioning in buildings, Part 1: Fire and smoke control in buildings*
- AS/NZS 2032, *Installation of PVC pipe systems*
- AS/NZS 2033, *Installation of polyethylene pipe systems*
- AS/NZS 2280, *Ductile iron pipes and fittings*
- AS/NZS 2312, *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings*
- AS/NZS 2638 (all parts), *Gate valves for waterworks purposes*
- AS/NZS 2845.1, *Water supply—Backflow prevention devices, Part 1: Materials, design and performance requirements*
- AS/NZS 3013, *Electrical installations—Classification of the fire and mechanical performance of wiring system elements*
- AS/NZS 3500 (all parts), *Plumbing and drainage*
- AS/NZS 3862, *External fusion-bonded epoxy coating for steel pipes*
- AS/NZS 4087, *Metallic flanges for waterworks purposes*
- AS/NZS 4129, *Fittings for polyethylene (PE) pipes for pressure applications*
- AS/NZS 4130, *Polyethylene (PE) pipes for pressure applications*
- AS/NZS 4158, *Thermal-bonded polymeric coatings on valves and fittings for water industry purposes*
- AS/NZS 4441, *Oriented PVC (PVC-O) pipes for pressure applications (ISO 16422:2014, MOD)*
- AS/NZS 4680, *Hot-dip galvanized (zinc) coatings on fabricated ferrous articles*
- AS/NZS 4765, *Modified PVC (PVC-M) pipes for pressure applications*
- AS/NZS 4792, *Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process*
- AS ISO 7240.3, *Fire detection and alarm systems, Part 3: Audible alarm devices*
- ASME B36.19M, *Stainless steel pipe*
- ASTM A53, *Standard specification for pipe, steel, black and hot-dipped, zinc-coated, welded and seamless*
- ASTM A106, *Standard specification for seamless carbon steel pipe for high-temperature service*
- ASTM A135/A135M, *Standard specification for electric-resistance-welded steel pipe*
- ASTM A234, *Standard Specification For Piping Fittings Of Wrought Carbon Steel And Alloy Steel For Moderate And High Temperature Service*
- ASTM A312, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*
- ASTM A403, *Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings*
- ASTM A795/A795M, *Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use*
- BS EN 10242, *Threaded pipe fittings in malleable cast iron*

FPAA101D. *Automatic Fire Sprinkler System Design and Installation – Drinking Water Supply*

FPAA101H. *Automatic Fire Sprinkler System Design and Installation – Hydrant Water Supply*

WSA 109, *Flanged gaskets and O-rings*

1.3 Terms and definitions

For the purposes of this document, the definitions given in the NCC Volume 1 and those below apply.

1.3.1

awning

roof-like structure, usually of limited extent, projecting from a wall of a building

Note 1 to entry: In this document, awning may include flexible membrane or similar.

1.3.2

balcony

open or covered platform attached to an upper floor of a building, projecting from or recessed into the face of the wall, and protected by a railing or balustrade, accessible from an adjacent room

1.3.3

block plan

two-dimensional drawing, schematic drawing or both detailing the fire hydrant system serving the building or site

1.3.4

boost

boosted

increase pressure, and consequently increase flow, in a fire hydrant system when a fire brigade pumping appliance connects to and pumps into the fire brigade booster connections of the fire brigade booster assembly

1.3.5

building classification

Refer to the *NCC*

1.3.6

cabinet

<fire brigade booster assembly> recess or enclosure within or affixed to the facade of a building or to a freestanding structure located remotely from the building that is used to enclose the fire brigade booster assembly

1.3.7

effective height

Refer to the *NCC*

1.3.8

facade

exterior surface of a wall enclosing a building

Note 1 to entry: It is usually non-loadbearing.

Note 2 to entry: It may include a curtain wall, cladding or other exterior finish.

1.3.9

fire brigade

fire service

Refer to the *NCC*

1.3.10

fire brigade booster assembly

configuration of fire hydrant valves, fire brigade booster connections, pipes, valves, and fittings for use by the fire brigade

Note 1 to entry: This assembly allows the attending fire brigade pumping appliance to draw water from the available water source and subsequently pressurize or pump water through the installed fire hydrant system while using the on-board pump of the fire brigade pumping appliance.

Note 2 to entry: For information on fire brigade booster assemblies, see [Section 7](#) or refer to AS 2419.2 and AS 2419.3.

1.3.11

fire brigade booster connection

self-contained mechanical device incorporating an integral spring-loaded check valve and body installed on a fire main enabling a pumping appliance to pressurise or pump water into a fire hydrant system

Note 1 to entry: For information on fire brigade boosters, refer to AS 2419.3.

Note 2 to entry: These connections are provided with one, two, four or six inlet configurations.

1.3.12

fire brigade pumping appliance

fire brigade emergency vehicle with on-board pumping equipment that is able to be used with a fire hydrant system

1.3.13

fire compartment

Refer to the *NCC*

1.3.14

fire hydrant

fitting installed on a fire main with a single-valve outlet or two single-valve outlets for the connection of fire hoses

Note 1 to entry: For information on fire hydrant valves, refer to AS 2419.2.

Note 2 to entry: In this document, unless otherwise specified, fire hydrants are above-ground valve type only.

1.3.14.1

additional fire hydrant

internal attack fire hydrant located to provide fire hose coverage to a floor area not otherwise covered by attack fire hydrants located within a fire-isolated stair or adjacent to a non-fire-isolated stair

1.3.14.2

attack fire hydrant

fire hydrant located downstream of the fire brigade booster connections of a fire brigade booster assembly

Note 1 to entry: It is for use by fire brigade or other trained firefighting personnel to directly attack a fire through the direct connection of fire hoses

1.3.14.3

attack/feed fire hydrant

external attack fire hydrant located not more than 20 m from a hardstand that is used to supply a fire brigade pumping appliance

Note 1 to entry: It is used either as an attack fire hydrant when the fire hydrant system is boosted by a fire brigade pumping appliance or as a feed fire hydrant.

1.3.14.4**feed fire hydrant**

external fire hydrant located not more than 20 m from a hardstand that is used to supply a fire brigade pumping appliance through the direct connection of fire hoses between the fire hydrant and the fire brigade pumping appliance

1.3.15**fire hydrant system**

assembly of pipes, fire hydrant valves and other components dedicated to firefighting that permits the fire brigade to access a controlled supply of water

1.3.16**fire hydrant valve**

self-contained mechanical device incorporating a loose jumper valve, installed on a fire main and used for the transfer of water to firefighting equipment

Note 1 to entry: For more information on fire hydrant valves, refer to AS 2419.2.

Note 2 to entry: In this document a reference to a fire hydrant is also a reference to a fire hydrant valve.

1.3.17**fire load**

Refer to the *NCC*

1.3.18**fire main**

water service pipe connected to the water mains and installed within buildings or sites specifically for fire-fighting purposes

1.3.19**fire resistance level****FRL**

Refer to the *NCC*

1.3.20**fire wall**

Refer to the *NCC*

1.3.21**floor area**

Refer to the *NCC*

1.3.22**hardstand**

clearly identifiable all-weather surface, providing access and support for a fire brigade pumping appliance during firefighting operations

1.3.23**high-rise building**

multi-storey building having an effective height of not less than 25 m measured from the lowest exit at or near ground level to the floor of the topmost storey (or eight storeys) and served by passenger lifts

1.3.24**high voltage**

As defined in AS/NZS 3000

1.3.25**isolating valve**

valve used to isolate part of a water system from the remainder

1.3.26**jumper valve**

component of a screw down valve or tap that forms the closing member of the valve

1.3.27**large isolated building****LIB**

Refer to the *NCC*

1.3.28**listed**

approved for fire protection application by an internationally recognized testing laboratory or approval body

Note 1 to entry: A register of accredited products is issued by the CSIRO ActivFire Scheme.

Note 2 to entry: Examples of internally recognized testing laboratories or approval bodies are:

- (a) Factory Mutual Insurance Company (FM Global).
- (b) Underwriters Laboratories (UL).
- (c) Loss Prevention Council (LPG).
- (d) Verband der Schadenverhütung (VdS).

1.3.29**location****1.3.29.1****downstream**

in a direction away from the water supply or in the direction of flow

1.3.29.2**upstream**

in a direction towards the water supply or against the direction of flow

1.3.30**low water level**

lowest level of a static water source before a vortex is created, causing a pump to draw air and lose prime when draughting

Note 1 to entry: The low water level for an open water source (e.g. sea, river, lake, dam) is also the average low tide mark.

1.3.31**monitoring device Class A**

<fire service installation> device that detects changes in status of system components and protects against deliberate measures to tamper with the valve-monitoring device

Note 1 to entry: The device should meet the requirements of AS 4118.1.4.

1.3.32**monitoring device Class B**

<fire service installation> device that detects changes in status of system components but does not protect against deliberate measures to tamper with the valve-monitoring device

1.3.33**open yard**

designated area in industrial or commercial premises that may be used for combustible storage or processing of any kind and having an area more than 500 m²

1.3.34**may**

indicates the existence of an option

1.3.35**network utility operator**

Refer to the *NCC*

1.3.36**pressure****1.3.36.1****boost pressure**

pressure required at the fire brigade booster connection inlets to achieve the required firefighting pressure at the required flow rate at the most hydraulically disadvantaged fire hydrants when the fire hydrant system water supply is being boosted

1.3.36.2**design pressure**

pressure, at a defined reference point used in the system design, necessary to maintain the required flow and pressure at the most hydraulically disadvantaged number of fire hydrants that are required to operate simultaneously

1.3.36.3**hydrostatic test pressure**

maximum pressure applied internally to pipework of a fire hydrant system during commissioning to test for strength and water tightness

1.3.36.4**residual pressure**

water pressure calculated or measured at a point within a system at a particular flow rate

1.3.36.5**working pressure**

maximum internal pressure that may be sustained by a pipeline component for its estimated useful life under anticipated working conditions

1.3.37**private water supply**

privately operated network of mains connected to a controlled water source that supplies water within a range of operating pressures to an area or pressure zone of the private network

Note 1 to entry: Private water supplies typically provide the requirements of domestic, industrial process and firefighting water demands.

Note 2 to entry: A controlled water source may include tanks or reservoirs.

1.3.38**pump duty**

required head corresponding to the required flow

Note 1 to entry: Duty head is expressed in kPa and duty flow is expressed in L/s.

1.3.39**pumpset**

assembly comprising a pump, driver, coupling and ancillary components on a common mounting base together with an integral or separate fire pump controller

1.3.39.1**full-duty fire hydrant pumpset**

automatic starting, fixed, on-site fire hydrant pumpset that is capable of delivering firefighting pressures at a flow of not less than 10 L/s for each fire hydrant outlet required to flow

1.3.39.2**half-duty fire hydrant pumpset**

automatic starting, fixed, on-site fire hydrant pumpset that is capable of delivering the required pressure and flow of not less than 5 L/s for each fire hydrant required to flow

1.3.39.3**jockey pumpset****pressure maintenance pumpset**

fixed, on-site pumpset that is capable of automatically maintaining the minimum static pressure in the fire hydrant system

1.3.40**relevant authority**

agency authorized by legislation or regulation to issue determinations, orders, or other instructions in respect of any subject covered by this document

1.3.41**resistance to the incipient spread of fire**

Refer to the *NCC*

1.3.42**reticulated water supply**

network of town mains connected to a controlled water source, such as tanks or reservoirs, that supply water within a range of operating pressures to an area or pressure zone of the network

Note 1 to entry: Network utility operator design standards allow for a basic contribution to firefighting being made through the pipe sizes specified.

Note 2 to entry: Reticulated water supply networks operated by a public network utility operator typically have legislated obligations that do not extend to delivering pressure and flow conforming to AS 2419.1.

1.3.43**roof**

construction that encloses a building or part of a building from above

1.3.44**shall**

indicates that a statement is mandatory

1.3.45**should**

indicates a recommendation

1.3.46**site**

allocation of owned land or property

EXAMPLE Buildings, storage yards, marinas and their associated moored vessels, wharves, plant, and other infrastructure.

1.3.47**sole occupancy unit****SOU**

Refer to the *NCC*

1.3.48**street hydrant**

self-contained mechanical device installed on a reticulated water supply that is used for the transfer of water to firefighting equipment and other municipal purposes

Note 1 to entry: Street hydrant valves have various configurations including spring, screw-down, L-type and pillar.

Note 2 to entry: For more information on spring hydrants, refer to AS 3952.

**1.3.49
suction connection**

fitting provided to an on-site tank or another static water source that enables the attending fire brigade to draught from this water source

**1.3.50
tank**
container for storing water

**1.3.50.1
break tank**

tank incorporating an air gap to prevent back flow, that limits the effects of a fire hydrant system drawing from a reticulated water supply and that controls the suction pressure for pumps within a fire hydrant system

Note 1 to entry: For more information on break tanks, refer to AS 2304.

**1.3.50.2
full-capacity tank**

tank sized to provide the required flow rate for not less than four hours and that serves as the primary water supply

**1.3.50.3
gravity break tank**

break tank in a fire hydrant system of a high-rise building, supplied from lower-level pumps or higher-level tanks, that provides gravity water supply to lower-level pressure zones at attack fire hydrant pressures and flows

Note 1 to entry: Where a gravity break tank is installed in a cascade fire hydrant system design, the tank delivers flows of not less than 10 L/s for each fire hydrant outlet required to flow and pressures of not less than 700 kPa to the pressure zones it serves.

**1.3.50.4
high-rise water storage tank**

tank having a minimum capacity of not less than 36 000 L installed in a building having an effective height more than 50 m

**1.3.50.5
reduced-capacity tank**

tank having a minimum capacity of not less than 24 000 L supplemented by automatic inflow from a secondary water supply, to deliver the required flow rate for not less than four hours, that serves as the primary water supply for the building

**1.3.51
trained firefighting personnel**

personnel who are not members of a fire brigade but who are trained to undertake firefighting as part of their duties on a building or site at which they are employed

**1.3.52
unassisted**

<fire hydrant system performance> without the assistance of on-site pumps or fire brigade pumping appliances

**1.3.53
water source**

reticulated water supply system, river, lake, dam, sea, reservoir or bore, from which water can be taken to supply a fire hydrant system

1.3.54**water supply**

water delivery components of a fire hydrant system that enable the system to provide the whole or partial performance necessary at the suction or upstream end of the system

Note 1 to entry: Components of a fire hydrant system may include on-site water storage.

1.3.54.1**make up water supply**

water provided to a water storage tank, through the automatic operation of a small float valve, to cater for evaporation and/or intermittent jockey pump usage

1.3.54.2**primary water supply**

water supply capable of delivering the minimum required flow rate and pressure for the required duration

Note 1 to entry: Points of connection to a primary water supply include street fire hydrants, feed fire hydrants, and tank suction connections.

1.3.54.3**secondary water supply**

water supply providing automatic inflow to reduced-capacity tanks that serve as the primary water supply

Section 2 System performance and design

2.1 General

A fire hydrant system designed in accordance with this document shall —

- (a) be a wet pipe system, except where a limited length of dry pipe is installed in accordance with [Clause 4.4](#) to allow a fire brigade pumping appliance to draught from a below-ground static water source;
- (b) be capable of delivering the pressure and flow for the number of fire hydrant outlets required to flow simultaneously; and
- (c) conform to the hydraulic design parameters for friction loss, velocity, flow and pressure specified in this section.

NOTE 1 For information on fire brigade operations and equipment, see [Appendix F](#).

NOTE 2 For information on system performance and design, see [Appendix G](#).

2.2 System performance

2.2.1 Classification of fire hydrants

All fire hydrants within the fire hydrant system shall be classified as either external or internal, and as feed, attack/feed or attack in accordance with [Clauses 2.2.2, 2.2.3](#) or [2.2.4](#).

2.2.2 External fire hydrants

Fire hydrants shall be classified as external fire hydrants if located —

- (a) in an area external to the enclosing walls of the building, where the building has enclosing walls;
- (b) on an area of a podium that is external to the enclosing walls of the building, and where external pedestrian access is provided to the fire hydrants from a hardstand;

NOTE For the purposes of this document, a podium is a part of a building that —

- (i) serves as a roof to part of a building;
 - (ii) has an FRL not less than 120/120/120 or that required by the Deemed-to-Satisfy provisions of the NCC, whichever is the greater;
 - (iii) meets the definition for open space in the Deemed-to-Satisfy provisions of the NCC;
 - (iv) has direct pedestrian access to a public road without entering the building; and
 - (v) has direct pedestrian access to the main building entry points.
- (c) in an area not covered by the roof and located outside the footprint of the building, where the building has no enclosing walls; and
 - (d) under an awning, roof overhang, or similar projection attached to the external wall of the building, under the awning or roof overhang where the awning or roof overhang has an effective depth not more than 3 m, and the area under the awning or roof overhang does not contribute to the fire load of the building.

2.2.3 Internal fire hydrants

Fire hydrants shall be classified as internal fire hydrants if located —

- (a) within the enclosing walls of a building or on the roof of a building, where the building has enclosing walls;
- (b) in an area covered by the roof or on the roof of a building, where the building has no enclosing walls;
- (c) on an area of a podium that is external to the enclosing walls of a building and where the area of the podium is not provided with external pedestrian access from a hardstand;
- (d) under an awning, roof overhang or similar projection having a depth more than 3 m;
- (d) under an awning, roof overhang or similar projection having a depth not more than 3 m, where the area under the awning, roof overhang or the projection contributes to the fire load of the building; and
- (e) under a balcony or similar horizontal floor projection.

2.2.4 Feed, attack, and attack/feed fire hydrants

Fire hydrants shall be in accordance with the following:

- (a) An external fire hydrant shall be classified as a feed fire hydrant where —
 - (i) the fire hydrant system does not incorporate a fire brigade booster assembly and the fire hydrant is located external to the building and not more than 20 m from a hardstand; or
 - (ii) the fire hydrant system incorporates a fire brigade booster assembly and the fire hydrant forms part of the booster assembly; and
 - (iii) the pressures and flows at the fire hydrant are in accordance with [Table 2.2.6\(A\)](#).
- (b) An external fire hydrant shall be classified as an attack fire hydrant where —
 - (i) the fire hydrant is located external to the building and downstream of the fire brigade booster assembly;
 - (ii) the fire hydrant is located —
 - (A) not more than 50 m from a hardstand; or
 - (B) not more than 100 m from a hardstand where located in accordance with [Clause 3.5.3.3](#).
 - (iii) the pressures and flows at the fire hydrant are in accordance with [Table 2.2.6\(B\) or \(C\)](#), and [Table 2.2.6\(F\)](#) in each case.
- (c) An external fire hydrant shall be classified as an attack/feed fire hydrant where —
 - (i) the fire hydrant is located external to the building and downstream of the fire brigade booster assembly;
 - (ii) the fire hydrant is located not more than 20 m from a hardstand; and
 - (iii) the pressures and flows at the fire hydrant are in accordance with [Tables 2.2.6\(A\) and \(F\)](#).

- (d) An internal fire hydrant shall be classified as an attack fire hydrant where —
- (i) the fire hydrant is located within the building and downstream of the fire brigade booster assembly; and
 - (ii) the pressures and flows at the fire hydrant are in accordance with [Tables 2.2.6\(B\), \(C\), \(D\), \(E\) and \(F\)](#), as applicable.

2.2.5 Number of fire hydrant outlets required to flow simultaneously

The number of fire hydrant outlets required to flow shall be determined in accordance with [Tables 2.2.5\(A\) and \(B\)](#) for buildings, [Table 2.2.5\(C\)](#) for open deck car parks, and [Table 2.2.5\(D\)](#) for open yards, as applicable.

Where any buildings on a site have multiple fire compartments, the fire hydrant system design shall satisfy the flow requirements specific to each fire compartment's floor area and classification. The flow requirements shall be achieved at each of the most hydraulically disadvantaged fire hydrant outlets required to flow within each fire compartment.

Simultaneous flows for firefighting within multiple fire compartments are not required to be provided for in the design.

NOTE Refer to the Deemed-to-Satisfy provisions of the NCC for requirements relating to fire compartment walls and/or floors with a fire resistance level not less than that required for a fire wall.

Table 2.2.5(A) — Determining the number of fire hydrant outlets required to flow simultaneously

Fire compartments	Number of building classifications	Basis for determining the number of fire hydrant outlets
Single	Single	Building classification and total floor area of the compartment
Single	Multiple	Building classification requiring the greatest number of fire hydrants and the total floor area of the compartment
Multiple	Single	Building classification and the floor area of the fire compartment

Table 2.2.5(B) — Number of fire hydrant outlets required to flow simultaneously — Class 2 to Class 9 buildings (excluding Class 7a open deck car parks)

NCC building classification	Fire compartment floor area, m ²	Number of fire hydrant outlets
NON-SPRINKLER-PROTECTED BUILDINGS		
2, 3, 5 and 9 (having a rise in storeys less than 2)	≤ 1 000	1
2, 3, 5 and 9 (having a rise in storeys less than 2)	> 1 000	2
	≤ 5 000	
2, 3, 5 and 9 (having a rise in storeys of more than 2)	≤ 500	1
	> 500	2
6, 7 and 8	< 5 000	
	≤ 500	1
6, 7 and 8	> 500	2
	≤ 5 000	
All classes	> 5 000	3
	≤ 10 000	

Table 2.2.5(B) (continued)

NCC building classification	Fire compartment floor area, m ²	Number of fire hydrant outlets
All classes	> 10 000	3, plus 1 additional fire hydrant for each additional 5 000 m ² or part thereof
SPRINKLER-PROTECTED BUILDINGS — Not more than 25 m in effective height		
All classes	≤ 1 000	1
All classes	> 1 000 ≤ 10 000	2
All classes	> 10 000	3
SPRINKLER-PROTECTED BUILDINGS — More than 25 m in effective height		
All classes	≤ 5 000	2
All classes	> 5 000	3

NOTE See [Table 2.2.5\(C\)](#) for the requirements for open deck car parks where the size of the largest storey, not the largest fire compartment, is used to determine the number of fire hydrants required to flow.

Table 2.2.5(C) — Number of fire hydrant outlets required to flow simultaneously — Class 7a open deck car parks

NCC building classification	Floor area of largest storey, m ²	Number of fire hydrant outlets
7a (open deck car park)	≤ 500	1
	> 500 ≤ 5 000	2
	> 5 000 ≤ 10 000	3
	> 10 000	3 plus 1 additional fire hydrant for each additional 5 000 m ² or part thereof

NOTE For the purpose of determining the number of fire hydrants required to flow simultaneously in an open deck carpark, the floor area of the largest single storey only may be used, irrespective of the openings formed by vehicular ramps between storeys.

Table 2.2.5(D) — Number of fire hydrant outlets required to flow simultaneously — Open yards

Yard area, m ²	Number of fire hydrant outlets
≤ 3 000	1
> 3 000 ≤ 9 000	2
> 9 000 ≤ 27 000	3
> 27 000	4

2.2.6 Pressure and flow

Fire hydrant systems shall be designed so that the number of feed fire hydrants, attack fire hydrants or attack/feed fire hydrant outlets required to flow simultaneously as specified in [Tables 2.2.5\(B\), \(C\) and \(D\)](#) deliver the required pressure and flow for not less than four hours in accordance with —

- (a) [Table 2.2.6\(A\)](#) for feed fire hydrants or attack/feed fire hydrants supplied from a public or private reticulated water supply system;

- (b) [Table 2.2.6\(B\)](#) for attack fire hydrants supplied from a public or private reticulated water supply system;
- (c) [Table 2.2.6\(C\)](#) for attack fire hydrants supplied from a fixed on-site half-duty fire hydrant pump;
- (d) [Table 2.2.6\(D\)](#) for attack fire hydrants supplied from a fixed on-site full-duty fire hydrant pump;
- (e) [Table 2.2.6\(E\)](#) for attack fire hydrants supplied from a gravity break tank; and
- (f) [Table 2.2.6\(F\)](#) for attack fire hydrants or attack/feed fire hydrants when boosted by a fire brigade pumping appliance.

Where the primary water supply is unable to provide the required unassisted pressure, flow or both as specified in [Table 2.2.6\(A\) or \(B\)](#) for the number of feed, attack or attack/feed fire hydrant outlets required to flow, on-site pumps in accordance with [Clause 2.2.12](#) or on-site tanks and pumps in accordance with [Clause 2.2.13](#) shall be installed.

Table 2.2.6(A) — Feed fire hydrant — Minimum unassisted outlet pressure and flow rate

Fire hydrant type	Minimum required flow rate	Minimum required residual pressure, kPa	
	L/s	NSW	Other States and Territories
External feed or attack/feed fire hydrant located not more than 20 m from a hardstand	10	150	200

NOTE 1 Minimum required flow = 10 L/s × number of hydrant outlets required to flow simultaneously.

NOTE 2 The different minimum required residual pressures in this table are partially attributable to the different size fire hoses used by fire brigades across Australia; in NSW, 70 mm fire hose is used while in other States and Territories 65 mm fire hose is used.

Table 2.2.6(B) — Attack fire hydrant — Minimum unassisted outlet pressure and flow rate

Fire hydrant type	Minimum required flow rate, L/s	Minimum required residual pressure, kPa	
		NSW	Other States and Territories
External or internal attack fire hydrant	10	250	350

NOTE Minimum required flow = 10 L/s × number of hydrant outlets required to flow simultaneously.

Table 2.2.6(C) — Half-duty fire hydrant pumps — Minimum outlet pressure and flow rate

Fire hydrant type	Minimum required flow rate, L/s	Minimum required residual pressure, kPa
External or internal attack fire hydrant supplied by an on-site half-duty fire hydrant pump.	5	700

NOTE 1 The minimum required flow = 5 L/s × number of hydrant outlets required to flow simultaneously, where the building has an effective height not more than 50 m.

NOTE 2 The 5 L/s flow rate is a concession applied specifically to on-site half-duty fire hydrant pumps. The flow assigned also allows the attending fire brigade to commence initial firefighting activities prior to the fire hydrant system being boosted by a fire brigade pumping appliance.

Table 2.2.6(D) — Full-duty fire hydrant pumps — Minimum outlet pressure and flow rate

Fire hydrant type	Minimum required flow rate, L/s	Minimum required residual pressure, kPa
External or internal attack fire hydrant supplied by an on-site full-duty fire hydrant pump.	10	700
NOTE Minimum required flow = 10 L/s × number of hydrant outlets required to flow simultaneously, where the building has an effective height more than 50 m.		

Table 2.2.6(E) — Gravity break tanks — Minimum outlet pressure and flow rate

Fire hydrant type	Minimum required flow rate, L/s	Minimum required residual pressure, kPa
Internal attack fire hydrant supplied from a gravity break tank.	10	700
NOTE Minimum required flow = 10 L/s × number of hydrant outlets required to flow simultaneously.		

Table 2.2.6(F) — Minimum fire hydrant outlet pressure and flow rate when boosted by a fire brigade pumping appliance

Fire hydrant type	Minimum required flow rate, L/s	Minimum required residual pressure, kPa
Internal and external attack fire hydrants boosted by a fire brigade pumping appliance	10	700

2.2.7 Multiple firefighting systems

Except where [Clause 2.2.8](#) applies, where an additional firefighting system, other than hose reels (e.g. wall-wetting sprinklers, automatic fire sprinklers) draws from the same water source or uses common pipework, the water source and supply shall be capable of providing for the simultaneous operation of the systems at the required pressures and flows.

2.2.8 Class 7a car parks

Where the Class 7a part of a building does not include a car stacker and the Class 7a part of the building is sprinkler-protected throughout, the simultaneous flow requirements of [Clause 2.2.7](#) are not applicable to the Class 7a part of the building. In such cases, the pressure and flow requirements of the firefighting system having the highest demand shall be met.

NOTE For the purposes of this clause, a car stacker is a mechanical system that stacks three or more cars vertically.

2.2.9 Gravity break tanks

Where a gravity break tank is installed, each attack fire hydrant in the pressure zone it serves shall deliver not less than the minimum residual pressure and flow specified in [Table 2.2.6\(E\)](#) for not less than four hours.

2.2.10 Feed fire hydrants

2.2.10.1 General

Feed fire hydrants shall —

- (a) be located in accordance with [Clauses 3.5.3.1](#) and [3.5.3.2](#);

- (b) be capable of delivering the pressure and flow specified in [Table 2.2.6\(A\)](#), for the number of fire hydrant outlets required to flow; and
- (c) achieve Item (b) above without the use of fixed, on-site pumps.

2.2.10.2 Street fire hydrants

Where street hydrants are used to provide total or partial hydrant coverage, they may be included in the fire hydrant system design provided —

- (a) they meet the requirements of [Clause 3.5.2](#);
- (b) they achieve the pressure and flow for feed fire hydrants specified in [Table 2.2.6\(A\)](#); and
- (c) a location plan is installed in accordance with [Clause 11.7](#).

NOTE For the purposes of design, a street hydrant may be treated as providing either a single or dual fire hydrant flow outlet provided the required pressure and flow is available. Multiple, single-outlet street hydrants may also be combined to provide the number of feed fire hydrant outlets required to flow simultaneously as specified in [Clause 2.2.5](#), providing they meet all other requirements.

2.2.11 Attack fire hydrants

2.2.11.1 External attack fire hydrants

Where external attack fire hydrants are installed, they shall—

- (a) be located in accordance with [Clause 3.5.3](#);
- (b) be capable of delivering the pressure and flow to the attack fire hydrant outlets required to flow, in accordance with —
 - (i) [Table 2.2.6\(B\)](#) where unassisted pressures and flows are provided; or
 - (ii) [Table 2.2.6\(C\)](#) where fixed, on-site half-duty fire hydrant pumps are required to be installed; and
- (c) be capable of delivering the pressure and flow specified in [Table 2.2.6\(F\)](#) when boosted by a fire brigade pumping appliance.

2.2.11.2 Internal attack fire hydrants

Where internal attack fire hydrants are installed, they shall —

- (a) be located in accordance with [Clause 3.6.2](#);
- (b) be capable of delivering the pressure and flow to the attack fire hydrant outlets required to flow specified in —
 - (i) [Table 2.2.6\(B\)](#) where unassisted pressures and flows are provided;
 - (ii) [Table 2.2.6\(C\)](#) where half-duty fire hydrant pumps are installed; or
 - (iii) [Table 2.2.6\(D\)](#) where full-duty fire hydrant pumps are installed; and
- (c) be capable of delivering the pressure and flow specified in [Table 2.2.6\(F\)](#) when boosted by a fire brigade pumping appliance.

NOTE For more information on half-duty and full-duty fire hydrant pumps, see [Section 6](#).

2.2.11.3 External attack/feed fire hydrants

External attack fire hydrants may be classified as external attack/feed fire hydrants and not subject to the unassisted pressure requirements of [Table 2.2.6\(B\)](#) provided they are —

- (a) located not more than 20 m from a hardstand that is constructed in accordance with [Clause 3.3](#);
- (b) capable of meeting the requirements of [Clause 2.2.10.1](#); and
- (c) capable of delivering the pressure and flow specified in [Table 2.2.6\(F\)](#) when boosted by a fire brigade pumping appliance.

2.2.12 On-site pumps

Where the primary water supply (typically a reticulated water supply) is unable to deliver the pressure specified in —

- (a) [Table 2.2.6\(A\)](#) to the most hydraulically disadvantaged feed fire hydrant outlets required to flow and the building has an effective height not more than 25 m, a fire brigade booster assembly and single half-duty fire hydrant pumpset shall be provided. The pumpset provided shall be capable of delivering the pressure and flow specified in [Table 2.2.6\(C\)](#) for the number of attack fire hydrant outlets required to flow.
- (b) [Table 2.2.6\(B\)](#) to the most hydraulically disadvantaged attack fire hydrant outlets required to flow and—
 - (i) the building has an effective height not more than 25 m, a single on-site half-duty fire hydrant pumpset shall be provided. The pumpset provided shall be capable of delivering the pressure and flow specified in [Table 2.2.6\(C\)](#) for the number of attack fire hydrant outlets required to flow; and
 - (ii) the building has an effective height more than 25 m and not more than 50 m, not less than two on-site half-duty fire hydrant pumpsets shall be provided. Each pumpset provided shall be capable of delivering the pressure and flow specified in [Table 2.2.6\(C\)](#) for the required number of hydrant outlets required to flow.

NOTE 1 For more information on the requirement to install a fixed on-site pump or on-site tank and pumps see [Appendix G](#).

NOTE 2 See [Clause 6.5](#) for more information on the requirements for full-duty fire hydrant pumps in buildings having an effective height more than 50 m.

2.2.13 On-site tanks and pumps

Where the primary water supply is unable to deliver the pressure or flow specified in [Table 2.2.6\(A\)](#) to the most hydraulically advantaged feed fire hydrant outlets required to flow (typically the feed fire hydrant outlets of a fire brigade booster assembly) and—

- (a) the building has an effective height not more than 50 m, a tank suction booster assembly, on-site tank and not less than two on-site half-duty fire hydrant pumpsets shall be provided. Each pumpset shall be capable of delivering the pressure and flow specified in [Table 2.2.6\(C\)](#) for the required number of attack fire hydrant outlets;
- (b) the building has an effective height more than 50 m, a tank suction booster assembly, on-site tank and not less than two full-duty fire hydrant pumpsets shall be provided. Each pumpset shall be capable of delivering the pressure and flow specified in [Table 2.2.6\(D\)](#) for the required number of hydrant outlets.

NOTE 1 For more information on the requirement to install an on-site tank and pumps, see [Appendix G](#).

NOTE 2 For more information on the requirements for full-duty fire hydrant pumps in buildings having an effective height more than 50 m, see [Clause 6.5](#).

2.2.14 Fire brigade booster assembly

2.2.14.1 Feed fire hydrants

Where an H-pattern, in-line, I-pattern, or tank model fire brigade booster assembly is installed, the feed fire hydrants of the booster assembly shall —

- (a) be capable of meeting the requirements of [Clause 2.2.10.1](#); and
- (b) be located in accordance with [Clause 7.3](#).

2.2.14.2 Suction connections

Where the primary water supply serving the fire hydrant system is from an on-site tank, seawater, river, lake or dam, the following shall be provided to allow the attending fire brigade to draught from this supply:

- (a) Hardstands in accordance with [Clause 3.3](#).
- (b) Either —
 - (i) fixed large-bore suction connections in accordance with [Clauses 4.4](#), [5.3.1](#) and [5.3.1.2](#); or
 - (ii) fixed large-bore suction connections in accordance with [Clauses 4.4](#), [5.3.1](#), and [5.3.1.2](#) and small-bore suction connections in accordance with [Clauses 5.3.1](#) and [5.3.1.3](#), where applicable.

NOTE 1 Where a suction connection is provided in an area serviced by a rural or country fire service, Item (b) (ii) should be provided except where the relevant fire service advises otherwise.

NOTE 2 If seawater, river, lake, dam, or below-ground tank water is proposed to be incorporated into the fire hydrant system design, the local fire brigade should be consulted.

2.2.14.3 Fire brigade booster connection inlets

Where a fire brigade booster assembly is installed, the number of fire brigade booster connection inlets provided shall allow fire brigade pumping appliances, when connected to these inlets, to deliver the pressure and flow specified in [Table 2.2.6\(F\)](#) for the number of fire hydrant outlets required to flow as specified in [Tables 2.2.5\(B\), \(C\), and \(D\)](#), as applicable.

NOTE 1 For more information on the minimum number of boost inlet connections, see [Section 7](#).

NOTE 2 For information on the required pressure and flow when commissioning a fire hydrant system with a fire brigade booster assembly, see [Clause 12.4.3](#).

2.2.15 Half-duty fire hydrant pumps

Where on-site half-duty fire hydrant pumps are installed, each attack fire hydrant when pressurized by the pump shall be capable of delivering the pressure and flow specified in [Table 2.2.6\(C\)](#) for the number of fire hydrant outlets required to flow as specified in [Table 2.2.5\(B\), \(C\), or \(D\)](#), as applicable.

2.2.16 Full-duty fire hydrant pumps

Where full-duty fire hydrant pumps are installed, each attack fire hydrant when pressurized by the pump shall be capable of delivering the pressure and flow specified in [Table 2.2.6\(D\)](#) for the number of fire hydrant outlets required to flow as specified in [Table 2.2.5\(B\), \(C\), or \(D\)](#), as applicable.

2.3 Hydraulic design parameters

2.3.1 General

Hydraulic calculations of a fire hydrant system shall be undertaken to demonstrate that the specified number of fire hydrant outlets required to flow simultaneously in accordance with [Table 2.2.5\(B\), \(C\) or \(D\)](#) are capable of delivering the residual pressure at each fire hydrant, at the flow rates specified in [Table 2.2.6\(A\), \(B\), \(C\), \(D\), \(E\) or \(F\)](#), as applicable.

2.3.2 Design pressures

Pressures within a fire hydrant system shall meet the following requirements:

- (a) The minimum discharge pressure at any hydrant outlet under design flow conditions shall be not less than those specified in [Clause 2.2.6](#).
- (b) The maximum discharge pressure at any hydrant outlet under design flow conditions shall not exceed 1 200 kPa.
- (c) The maximum static pressure at any fire hydrant outlet at no flow, with the pump running, shall not exceed 1 300 kPa.
- (d) The maximum pressure in the supply pipework to pressure zones shall not exceed 2 400 kPa.

2.3.3 Design velocity

The water velocity in pipework shall not exceed 4 m/s.

2.3.4 Hydraulic loss — Backflow prevention and metering

The hydraulic losses due to any backflow prevention device, strainer and water meter, associated pipework and fittings shall be included in flow and pressure calculations of the fire hydrant system design.

NOTE Refer to [Appendix G](#) for further information.

2.3.5 Hydraulic loss — Pipes, valves, and fittings

The total hydraulic loss due to friction in pipes, valves and fittings between the outlet connection of the fire brigade booster connection conforming to AS 2419.3 and the inlet connection of the fire hydrant valve conforming to AS 2419.2 of the most hydraulically disadvantaged fire hydrant valve shall not exceed 150 kPa when the required number of the most hydraulically disadvantaged fire hydrants are each discharging 10 L/s.

2.3.6 Ring main design

Where a ring main is installed, the total flow shall be taken in one direction through the ring main for velocity calculations in the system.

NOTE For hydraulic loss calculations in the system, flow may be taken through all paths of the ring main.

2.3.7 Fire brigade boost pressure

The fire brigade boost pressure is the pressure required at fire brigade booster connections to achieve the required pressure and flow rate at the most hydraulically disadvantaged fire hydrants in each

pressure zone when the fire hydrant system is being boosted by the fire brigade pumping appliance or other portable pumping appliance.

NOTE See [Clause 12.4.3](#) for more information on the required boost pressure when commissioning a fire hydrant system.

Section 3 Hydrant classification, location, and coverage

3.1 General

Fire hydrant systems designed and installed in accordance with this document shall provide fire hydrant coverage to—

- (a) all parts of the floor area of the building;
- (b) all parts of open yards; and
- (c) all parts of a marina gangway, walkway, or finger.

NOTE 1 Fire hydrants may be above-ground, with outlets suitable for connection of a fire hose, or in-ground street fire hydrants, with connections suitable for attachment of a fire brigade standpipe to which the fire hose may be connected.

NOTE 2 For information on fire brigade operations, equipment, and pumping appliances, see [Appendix F](#).

NOTE 3 For information on location of fire hydrants, see [Appendix H](#)

NOTE 4 For information on fire hydrants in streets and access-ways within private properties, see [Appendix I](#).

3.2 Fire hydrants

3.2.1 Classification

All fire hydrants within the fire hydrant system shall be classified as either external or internal, and as feed, attack/feed, or attack, in accordance with [Clause 2.2.1](#).

3.2.2 Features, accessibility, and clearances

3.2.2.1 General

All fire hydrants shall —

- (a) incorporate fire hydrant valves conforming to AS 2419.2;
- (b) have the centre line of the fire hydrant valve or outlet not less than 750 mm and not more than 1 200 mm above the ground, finished floor level or platform;
- (c) have the fire hydrant valve outlet horizontal or sloping not more than 35° below the horizontal;
- (d) have a 65 mm nominal diameter hose connection;
- (e) be identified by a metal or ultraviolet (UV) resistant disc of not less than 20 mm diameter displaying the fire hydrant number as shown on the block plan;
- (f) be equipped with protective caps and secured in accordance with AS 2419.2; and
- (g) be fitted with a fire hydrant valve security device as determined by the relevant authority.

NOTE 1 Where vandalism is deemed a legitimate risk, the hydrant outlet valve should be locked in the closed position by a fire hydrant valve security device that permits fire brigade access.

NOTE 2 The local fire brigade may nominate preferred fire hydrant valve security devices such as an oval spindle in accordance with AS 2419.2, an anti-tamper plug in accordance with AS 2419.4, valve handle lock-outs, lockable straps/chains, lockable valve enclosure devices, or lockable cabinets with or without frangible panels.

3.2.2.2 Clearances

All fire hydrants shall have —

- (a) a clearance of not less than 1 m directly in front of the fire hydrant outlet for the connection and laying of fire hose, except where the provisions of [Clause 7.3.3](#) apply;
- (b) a clearance of not less than 500 mm from any point of a door-swing arc and the fire hydrant outlet where installed in a fire isolated stair.
- (c) a clearance of not less than 100 mm around the handwheel of the fire hydrant valve, in both the fully closed and fully open positions, to allow for the turning on and off of the fire hydrant valve; and
- (d) a clearance around the fire hydrant valve outlet of not less than 300 mm through an arc of 225° in the plane of the valve outlet, to facilitate the use of a hose spanner for the connection and disconnection of fire hose.

3.2.2.3 External on-site fire hydrants

External, on-site fire hydrants shall be above-ground and have two outlets each individually valve-controlled.

3.2.2.4 Orientation of external fire hydrants

External fire hydrants shall be orientated as follows:

- (a) Where external feed fire hydrants are installed, the hydrant outlets shall face the hardstand.
- (b) Where external attack fire hydrants are installed remotely from the building, the hydrant outlets shall face the building.
- (c) Where external attack fire hydrants are installed adjacent to the external wall of the building, the hydrant outlets shall face away from the external wall of the building.

3.2.2.5 Internal fire hydrants

Where internal fire hydrants are installed, each internal fire hydrant shall be above ground and—

- (a) have a single valve-controlled outlet if located within the area enclosed by the walls of a building;
- (b) have two outlets each individually valve-controlled if located at ground level and under a balcony, awning, roof overhang, horizontal or similar projection; or
- (c) have two outlets each individually valve-controlled if located on a podium as specified in [Clause 2.2.2](#).

3.2.2.6 Orientation of internal fire hydrants

Where an internal fire hydrant is located in a fire-isolated stair, passageway or ramp, the internal fire hydrant outlet shall —

- (a) face the descending stair, passageway, or ramp to facilitate the laying of firefighting hose within that area, where the landing on which the internal fire hydrant is located provides direct access to both an ascending and descending stair, passageway, or ramp; and
- (b) face the stair, passageway, or ramp to facilitate the laying of firefighting hose within that area, where the landing on which the internal fire hydrant is located provides access to only an ascending or descending stair, passageway, or ramp.

3.3 Hardstands

Any required hardstand and its vehicular approaches shall —

- (a) have a loadbearing capacity and unobstructed height to permit the operation and positioning of fire brigade pumping appliances;
- (b) have an all-weather surface for use by the fire brigade pumping appliance during firefighting operations and during rain periods;
- (c) be sized to allow the attending fire brigade to effectively position the fire brigade pumping appliances;
- (d) be identified by signage or permanent surface markings or both, where not otherwise obvious or where the hardstand may otherwise be obstructed by any parked vehicle or other temporary obstacle or barrier;
- (e) provide unobstructed access to any suction connection; and
- (f) incorporate a gradient less than 1 in 8.

NOTE 1 Refer to the fire brigade for information on the fire brigade pumping appliance specifications and requirements for a hardstand.

NOTE 2 The designated hardstand should provide a minimum safe working space for firefighters to exit the fire brigade pumping appliance and to use firefighting equipment. See [Appendix F](#) for dimensions of a fire crew workspace.

3.4 Location of fire hydrants

Fire hydrant systems shall be designed so that fire hydrants are located —

- (a) *externally* — in accordance with [Clauses 2.2.2, 2.2.4, 3.5, 3.7](#) and [3.9](#) to [3.11](#), as applicable; and
- (b) *internally* — in accordance with [Clauses 2.2.3, 2.2.4, 3.6](#) to [3.8](#) and [3.11](#), as applicable, where external fire hydrants do not provide coverage to all parts of the building.

3.5 External fire hydrants

3.5.1 General

Where external fire hydrants are installed, fire hydrant coverage shall meet the following requirements:

- (a) Except where the feed fire hydrants of a booster assembly are used in accordance with [Clause 3.5.4](#), fire hydrant coverage from fire brigade pumping appliances fed from external feed fire hydrants may be used to achieve coverage to the lowest four storeys included in the calculation of the rise in storeys in compliance with the Deemed-to-Satisfy provisions of the NCC, and the storey immediately below these storeys, provided all parts of the building are covered.
- (b) Fire hydrant coverage from an external attack fire hydrant shall be used to achieve coverage to the lowest four storeys included in the calculation of the rise in storeys in compliance with the Deemed-to-Satisfy provisions of the NCC and the storey immediately below these storeys, provided all parts of the building are covered.
- (c) Where all parts of the building are not covered by external fire hydrants in accordance with Items (a) or (b), coverage from a fire brigade pumping appliance fed from an external feed

fire hydrant or coverage from external attack fire hydrants shall only be used to achieve fire hydrant coverage —

- (i) to the lowest storey included in the calculation of the rise in storeys in compliance with the Deemed-to-Satisfy provisions of the NCC;
- (ii) to the storey immediately below the storey detailed in Item (i);
- (iii) to a mezzanine or mezzanines included within the fire compartment of the storey detailed in Item (i); and
- (iv) to the storey immediately above the storey detailed in Item (i), provided they are located in the same fire compartment.

Internal fire hydrants located in accordance with [Clause 3.6.2](#) shall be installed to provide coverage to those parts of the building not protected by external fire hydrants in accordance with Item (c).

NOTE Where fire hydrant coverage provided in accordance with Items (a) and (b) requires firefighters to enter a fire-isolated stair at ground level and exit the fire-isolated stair at the storey immediately below (i.e. basement 1 or lower ground Level 1) and the building has internal fire hydrants installed above and below these levels, internal fire hydrants should also be provided in the fire isolated stairs at each of these levels to facilitate fire brigade intervention activities.

3.5.2 Street hydrants

Where street fire hydrants are incorporated into a fire hydrant system design in lieu of the installation of on-site feed fire hydrants, the following shall apply:

- (a) Street hydrants shall —
 - (i) be classified as a feed fire hydrant;
 - (ii) be capable of delivering not less than the minimum flow and pressure for feed fire hydrants as specified in [Table 2.2.6\(A\)](#) for the number of fire hydrant outlets required to flow; and
 - (iii) only be used if located in a position that allows for the hydrant to conform to the location requirements for external feed fire hydrants detailed in [Clauses 3.5.3.1](#) and [3.5.3.2](#), except that the requirement of [Clause 3.5.3.1\(e\)](#) pertaining to bollards does not apply.
- (b) Not more than two street fire hydrants shall be used to provide fire hydrant coverage to a building.
- (c) Where multiple buildings are located on a site, more than two street fire hydrants may be used to provide fire hydrant coverage to the site provided not more than two street fire hydrants are used to protect each building.
- (d) A location plan indicating the location of street hydrants shall be provided in accordance with [Clause 11.7](#).
- (e) Where an on-site feed fire hydrant is installed, its location shall be included on the plan as required by Item (d).
- (f) Where a fire brigade booster assembly is installed, street hydrants shall not be used.
- (g) The requirements of [Clause 3.2.2](#) do not apply to street hydrants.

NOTE 1 Except where a fire brigade accesses a street hydrant, street hydrants typically cannot legally be accessed nor operated by third parties without prior approval from the network utility operator. It is recommended that any connection and access approvals required from the network utility operator be obtained prior to consideration of using street hydrants in lieu of an on-site hydrant arrangement, in order to meet the physical commissioning test requirements of [Section 12](#).

NOTE 2 Pressure results determined for the design flows from the reticulated water supply via street hydrants should be adjusted to consider the suitability of these hydrants for use as part of a fire hydrant system. Friction losses should be taken into account for the design flows through the hydrant riser from the main, the hydrant valve and typical standpipe fittings used by fire brigades.

3.5.3 Location

3.5.3.1 General

External fire hydrants shall be installed as follows:

- (a) Each external fire hydrant shall be located in a position that provides pedestrian access to the building.
- (b) Each external fire hydrant shall be located in a position —
 - (i) not less than 10 m from the building or fire compartment it is protecting, unless the fire hydrant is protected in accordance with [Clause 3.5.5](#);
 - (ii) not less than 10 m from any high voltage main electrical distribution equipment such as transformers and distribution boards;
 - (iii) not less than 10m from any Electric Vehicle Charging Station regardless of voltage unless protected by a wall or other construction having an FRL as defined in [Clause 3.5.5.2](#);
 - (iv) not less than 10 m from a stored quantity of dangerous goods (e.g. LPG, petroleum, propane);
 - (v) not less than 10 m from external combustible storage (e.g. palletized combustible storage items); and
 - (vi) not less than 3 m from the vent terminal of any gas assembly or gas measurement system.

NOTE For gas assembly and gas measurement systems, refer to AS/NZS 5601.1.

- (c) An external fire hydrant shall have an area extending 500 mm each side of the fire hydrant hand wheel and 1 m in front of the fire hydrant that is free from obstruction.
- (d) Where a fire hydrant is installed in a car park, or in an area where vehicles manoeuvre or park and the vehicles are able to come not more than 1 m from the fire hydrant, bollards shall be provided to protect the fire hydrant and allow for the connection and laying of fire hose.

3.5.3.2 External feed fire hydrants

The location and coverage provided from external feed fire hydrants shall meet the following requirements:

- (a) Each external feed fire hydrant shall be located not more than 20 m from a fire brigade pumping appliance located on a hardstand.
- (b) All parts of a building or open yard that are protected by an external feed fire hydrant shall be not more than 70 m from a fire brigade pumping appliance located on a hardstand and connected to the external feed fire hydrant.

3.5.3.3 External attack fire hydrants

The location and coverage provided from external attack fire hydrants shall meet the following requirements:

- (a) Each external attack fire hydrant shall be —
 - (i) located not more than 50 m from a fire brigade pumping appliance located on a hardstand; or
 - (ii) located less than 100 m from a fire brigade pumping appliance located on a hardstand when providing fire hydrant protection —
 - (A) from a podium (see [Clause 2.2.2](#));
 - (B) to a building that is provided with a sprinkler system conforming to AS 2118.1, AS 2118.4, AS 2118.6, FPAA 101D or FPAA 101H; and
 - (C) to a Class 9c building.
- (b) All parts of a building or open yard that are protected by an external attack fire hydrant located in accordance with Item (a)(i) shall be not more than 70 m from the external attack fire hydrant.
- (c) All parts of a building or open yard that are protected by an external attack fire hydrant, located in accordance with Item (a)(ii), shall be not more than 40 m from the external attack fire hydrant.

3.5.3.4 External attack/feed fire hydrants

The location and coverage provided from external attack/feed fire hydrants shall meet the following requirements:

- (a) An external attack/feed fire hydrant shall be located not more than 20 m from a fire brigade pumping appliance located on a hardstand.
- (b) An external attack/feed fire hydrant shall be located so that it may be used, when required, as either an attack or feed fire hydrant.
- (c) Fire hydrant coverage shall be determined from both the attack/feed fire hydrant and the location of the fire brigade pumping appliance.
- (d) All parts of a building or open yard that are protected by an external attack/feed fire hydrant shall be not more than 70 m from —
 - (i) the external attack/feed fire hydrant; and
 - (ii) a fire brigade pumping appliance located not more than 20m from the external attack/feed fire hydrant and not less than 10m from the building.

3.5.4 Fire brigade booster assembly — Feed fire hydrants

Coverage from a fire brigade pumping appliance fed from the feed fire hydrants located at the booster assembly shall only be used to achieve fire hydrant coverage to —

- (a) the lowest storey included in the calculation of the rise in storeys in compliance with the Deemed-to-Satisfy provisions of the NCC, provided all parts of this storey are protected;
- (b) the storey immediately below the storey detailed in Item (a), provided all parts of this storey are protected;

- (c) a mezzanine included within the fire compartment of the storey detailed in Item (a), provided all parts of the mezzanine are protected; and
- (d) the storey immediately above the storey detailed in Item (a), provided the storey is located within the same fire compartment and all parts of this storey are protected.

3.5.5 Protection of fire hydrants

3.5.5.1 Sprinkler-protected buildings

The requirements of [Clause 3.5.5.2](#) do not apply to external fire hydrants located not more than 10 m from the building, provided the building is sprinkler-protected throughout by a sprinkler system or a combination of sprinkler systems conforming to AS 2118.1, AS 2118.4 AS 2118.6, FPAA101D or FPAA101H.

3.5.5.2 Non-sprinkler-protected buildings

Where external fire hydrants are located not more than 10 m from a non-sprinkler-protected building, they shall be protected —

- (a) if located within or affixed to the external wall of a building by walls, floors and/or ceilings, as applicable, that —
 - (i) have an FRL not less than 90/90/90;
 - (ii) extend for a distance of not less than 2 m each side of the centre-line of the fire hydrant riser; and
 - (iii) extend to a height not less than 3 m above ground level.
- (b) if located not more than 3.5 m from the external wall and remote from the building, by either —
 - (i) the external wall of the building that conforms to Item (a); or
 - (ii) a freestanding wall or similar construction that —
 - (A) has an FRL not less than 90/90/90;
 - (B) extends not less than 2 m each side of the centre-line of the fire hydrant riser;
 - (C) extends to a height not less than 3 m above ground level; and
 - (D) is located immediately behind the fire hydrant and between the building and the fire hydrant.
- (c) if located not less than 3.5 m but not more than 10 m from the external wall of the building, by a freestanding wall or similar construction that —
 - (i) has an FRL not less than 90/90/90;
 - (ii) extends for a distance of not less than 1 m each side of the centre-line of the fire hydrant valve outlet;
 - (iii) extends for a height of not less than 2 m above ground level; and
 - (iv) is located immediately behind the fire hydrant and between the building and the fire hydrant.

3.6 Internal fire hydrants

3.6.1 General

Where internal fire hydrants are installed, fire hydrant coverage shall meet the following requirements:

- (a) Coverage from an internal hydrant shall be provided to those parts of the building not covered by external hydrants.
- (b) Coverage from an internal hydrant shall be provided to those parts of the building not able to be protected by the feed fire hydrants of a fire brigade booster assembly, subject to the limitations of [Clause 3.5.4](#).
- (c) Internal fire hydrants installed in accordance with [Clause 3.6.2](#) shall provide coverage only to the storey on which they are located, except where specified otherwise by Item (d) or the Deemed-to-Satisfy provisions of the NCC.
- (d) Internal fire hydrants installed in accordance with [Clause 3.6.2\(c\)](#) shall provide coverage only to the storey they are dedicated to protect except where otherwise permitted by the Deemed-to-Satisfy provisions of the NCC.
- (e) All parts of the floor shall be not more than 40 m from an internal fire hydrant installed in accordance with [Clause 3.6.2](#) except where otherwise specified in Item (f).
- (f) Where travel distances throughout the building are in compliance with the Deemed-to-Satisfy provisions of the NCC, all parts of the floor shall be not more than 45 m from an internal fire hydrant installed in accordance with [Clause 3.6.2](#).
- (g) Where a Class 2, Class 3 or Class 4 part of a building is sprinkler-protected throughout and fire hydrant coverage is not achieved to all parts of a sole occupancy unit in a Class 2, Class 3 or Class 4 part of a building in accordance with Item (e), additional fire hydrants shall be installed in accordance with [Clause 3.6.3](#).

NOTE Where internal fire hydrants are installed, the Deemed-to-Satisfy provisions of the NCC in certain circumstances permit internal fire hydrants to provide coverage to storeys on which they are not located e.g. a multi-level sole occupancy unit in a Class 2 or 3 building.

3.6.2 Location

Except where permitted by [Clause 3.6.3](#), internal hydrants shall be located in accordance with the following:

- (a) Where fire-isolated exits are provided or external stairs and/or ramps are used in lieu of fire-isolated stairs in compliance with the Deemed-to-Satisfy provisions of the NCC, internal fire hydrants shall be located —
 - (i) in every required fire-isolated exit, external stair, or ramp at every storey, except where installed in accordance with Item (c);
 - (ii) in every required fire-isolated exit, external stair or ramp at each storey, other than where coverage is provided in accordance with [Clause 3.5.1](#), regardless of the number of fire hydrants needed to provide coverage; or
 - (iii) in every required fire-isolated exit, external stair or ramp at each storey, other than where coverage is provided in accordance with [Clause 3.5.4](#), regardless of the number of fire hydrants needed to provide coverage.
- (b) Where required non-fire-isolated exits are provided, internal fire hydrants shall be located not more than 4 m from a required exit, except that internal fire hydrants need not be located adjacent to each required non-fire-isolated exit, provided fire hydrant coverage to all parts of the floor is achieved.

- (c) Where an internal fire hydrant is installed at a level that differs from the FFL of the storey it is dedicated to protect in accordance with Item (d), not less than one fire hydrant shall serve every level except where permitted otherwise by the Deemed-to-Satisfy provisions of the NCC.
- (d) An internal fire hydrant may be installed on a stair landing that is different from the finished floor level (FFL) of the storey it is dedicated to protect, provided —
 - (i) the stair landing does not differ in height from the FFL of the relevant storey by less than one flight of stairs below the FFL or more than two risers above the FFL for storeys above ground (i.e. ascending stairs); and
 - (ii) the stair landing does not differ in height from the FFL of the relevant storey by less than one flight of stairs above the FFL or more than two risers below the FFL for storeys below ground (i.e. descending stairs).

NOTE Where fire hydrant coverage provided in accordance with Items (a) and (b) requires firefighters to enter a fire-isolated stair at ground level and exit the fire-isolated stair at the storey immediately below (i.e. basement 1 or lower ground Level 1) and the building has internal fire hydrants installed above and below these levels, internal fire hydrants should also be provided in the fire isolated stairs at each of these levels to facilitate fire brigade intervention activities.

3.6.3 Additional internal fire hydrants

Where a Class 2, 3 or 4 part of a building is sprinkler-protected throughout and additional fire hydrants are required by [Clause 3.6.1\(g\)](#), the following shall apply:

- (a) Additional fire hydrants shall be in a path of travel leading from the sole occupancy unit (SOU) to an exit, but not within the SOU.
- (b) Additional fire hydrants shall be located not more than 25 m from an internal fire hydrant within a fire isolated stair.
- (c) No point on the floor of the SOU required to be protected shall be more than 30 m from additional fire hydrants located in accordance with Items (a) and (b).
- (d) The location of additional fire hydrants shall be indicated on a location plan in accordance with [Clause 11.6](#).

3.7 Fire compartments

Each fire compartment within a building shall contain a fire hydrant, unless covered by external fire hydrants or a fire hydrant within a fire-isolated exit.

3.8 Rooftop plant rooms

Enclosed rooftop plant rooms (excluding lift machine rooms) that are more than 250 m² floor area shall be served by fire hydrants in accordance with [Clause 3.6](#).

3.9 Open yard protection

Fire hydrants shall be provided and located so that all storage, production equipment and plant in the protected area is not more than 70 m from an external fire hydrant outlet.

NOTE For information on how to address an area that contains special hazards, see [Appendix E](#).

3.10 Marinas

Fire hydrant coverage to a marina shall be in accordance with the following:

- (a) Where fire brigade pumping appliances supplied from a feed fire hydrant, attack/feed fire hydrant or street hydrant provide fire hydrant coverage to a marina, all parts of the gangways, walkways and fingers shall be not more than 60 m from the fire brigade pumping appliance.
- (b) Where fire hydrant coverage cannot be provided to all parts of the gangways, walkways and fingers of a marina in accordance with Item (a), attack fire hydrants shall be located at the entrance to each walkway and at intervals of not more than 30 m along the walkways so that all parts of the marina gangways, walkways, and fingers are not more than 30 m from the attack fire hydrants, measured on the marina structure.
- (c) Where both attack and feed fire hydrants are provided to protect a marina, they shall be dual outlet fire hydrants.

NOTE For additional information and guidance on fire protection of marinas, see [Appendix J](#).

3.11 Method of measurement and limitations

3.11.1 General

Fire hydrant coverage shall be determined as follows:

- (a) Distances shall be measured along the most direct laid on-ground or floor route to, and within, the protected building, car park, marina, or open yard.
- (b) Distances shall be measured along a continuous path of travel providing pedestrian access between the following:
 - (i) A fire brigade pumping appliance located on a hardstand and an external feed fire hydrant or external attack/feed fire hydrant.
 - (ii) A fire brigade pumping appliance located on a hardstand, connected to an external feed fire hydrant or external attack/feed fire hydrant, and the protected building.
 - (iii) A fire brigade pumping appliance located on a hardstand and a fire brigade booster assembly.
 - (iv) An external attack fire hydrant and the protected building.
- (c) Distances within the protected building shall be measured along paths of travel specified in the Deemed-to-Satisfy provisions of the NCC.
- (d) Where fire hydrant coverage requires ascending or descending a ramp or stair, the distance shall be measured along the path of travel that the stairway or ramp follows. For a stairway, the path shall be taken as a line along the nosings of the treads at the outer perimeter of the stair enclosure. For a ramp, the path shall be taken along the outer perimeter of the ramp.

NOTE 1 For more information on the method of measurement on stair and ramp landings, see [Appendix H](#).

- (e) The horizontal distance from an external fire hydrant, a fire brigade booster assembly or a fire brigade pumping appliance to the external wall or facade of the building or to a projection from the building shall be measured as follows:
 - (i) From the external wall or facade of the building for a building with an awning, roof overhang or similar projection that is not more than 3 m in depth, and where the area under the awning, roof overhang or other projection does not contribute to the fire load of the building, see [Figure H.9.1\(B\)](#) (a).

- (ii) From the edge of the awning, roof overhang or projection for a building with an awning, roof overhang or similar projection that is more than 3 m in depth, and where the area under the awning, roof overhang or other projection does not contribute to the fire load of the building, see [Figure H.9.1\(B\)](#) (b).
- (iii) From the edge of the awning, roof overhang or projection for a building with an awning, roof overhang or similar projection of any depth, and where the area under the awning, roof overhang or other projection does contribute to the fire load of the building, see [Figure H.9.1\(B\)](#) (c).
- (iv) From the edge of the roof for a building without external walls.
- (v) For a building with a balcony, horizontal projection, or similar projection —
 - (A) where the protected building is of Type A construction (described in the Deemed-to-Satisfy provisions of the NCC) and the balcony, horizontal projection or similar projection is not more than 3 m in depth, measured from the external wall or facade of the building, see [Figure H.9.1\(C\)](#) (a);
 - (B) where the protected building is of Type A construction (described in the Deemed-to-Satisfy provisions of the NCC) and the balcony, horizontal projection or similar projection is more than 3 m in depth, measured from the edge of the balcony, horizontal projection or projection, see [Figure H.9.1\(C\)](#) (b); and
 - (C) where the protected building is of Type B or C construction (described in the Deemed-to-Satisfy provisions of the NCC) measured from the edge of the balcony, horizontal projection or similar projection, see [Figure H.9.1\(C\)](#) (c).
- (f) The horizontal distance from external fire hydrants, fire brigade booster assemblies or fire brigade pumping appliances to the risks detailed in [Clauses 3.5.3.1](#) and [7.3.3](#), and all similar risks shall be measured in a direct line.
- (g) Where external attack fire hydrants are located adjacent to the external wall or facade of the building, the fire hydrant coverage measurements shall be taken through a point 1 m from the face of the door that the fire hose is to be taken through, on the centre-line of that door.
- (h) Fire hydrant coverage measurements shall be taken through the centre of all doors.
- (i) Fire hydrant coverage in a car park shall be determined with all car parking spaces empty.

NOTE 2 Refer to the NCC for further information on Type A, B or C construction and the use of internal fire hydrants to provided fire hydrant coverage to a sole-occupancy unit in a Class 2 to 9 building

3.11.2 Doorways

Firefighting hose lay measurements—

- (a) shall be taken through the pedestrian entry and exit doors of the building;
- (b) shall not be taken through the revolving doors of a building; and
- (c) may be taken through roller shutter doors and sliding doors, provided these doors are permitted by the NCC for the purpose of egress.

NOTE Refer to the Deemed-to-Satisfy provisions of the NCC for requirements relating to acceptable doors.

3.11.3 Obstructions

Fire hydrant coverage throughout the building shall be measured around obstructions such as storage racking, shelving, internal walls, partitions, doors, fixed seating or any other fixed obstruction that would restrict normal fire hydrant coverage.

3.11.4 Measurements from a fire brigade pumping appliance

Where a fire brigade pumping appliance is to be connected to a street fire hydrant, external feed fire hydrant, external attack/feed fire hydrant or a fire brigade booster assembly for measurement purposes in determining fire hydrant coverage, it shall —

- (a) be located on a designated hardstand;
- (b) be located not less than 10 m from the protected building, substations, LPG, and gas storage;
- (c) not be located under an awning, roof overhang or similar projection;
- (d) not be located under a balcony, horizontal projection or similar projection;
- (e) not be located within the building; and
- (f) be positioned in a single location.

Section 4 Water sources and supply

4.1 Water sources

4.1.1 General

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

- (a) Reticulated water supply system.
- (b) River, reservoir, lake, dam or sea.
- (c) Stored rainwater.

NOTE 1 For information on water sources and supplies, see [Appendix K](#).

A bore shall only be used to provide water —

- (i) for the initial filling of an on-site tank; or
- (ii) to a make-up water supply that caters for evaporation and/or intermittent jockey pump usage only.

NOTE 2 Where a bore is used for the purposes of Items (i) or (ii), evidence should be provided of its suitability. In making this evaluation, the impact of neighbouring bores on the suitability and reliability of the bore in question should be taken into account.

4.1.2 Adequacy of water sources

Where a river, reservoir, lake, dam, or seawater is used as a water source, evidence of the reliability and suitability of the water source shall be provided. The water source selected shall be capable of providing —

- (a) the required flow rate for not less than four hours, except where required by the Deemed-to-Satisfy provisions of the NCC; or
- (b) the required automatic inflow to the primary water supply tanks.

NOTE 1 Where an electricity network substation is located, the NCC permits a water storage duration for a fire hydrant system to be less than four hours.

NOTE 2 The evidence of reliability and suitability may be in the form of a hydrogeology report or similar technical document.

NOTE 3 Where the capacity of a natural water source is subject to seasonal variation, it should not be used to provide a primary water supply. Such a water source may be used as a secondary water supply to provide automatic inflow to water storage tanks that provide the primary water supply.

4.1.3 Water quality

4.1.3.1 General

The materials in the fire hydrant system shall be compatible with the physical, chemical, and biological characteristics of the water used in the fire hydrant system.

NOTE 1 The water and materials used should support the long-term operation of the fire hydrant system.

NOTE 2 Water in a fire hydrant system should be suitable for human contact; such water includes drinking water and Class A recycled water.

NOTE 3 Only fresh water should be used to flush and charge a fire hydrant system when corrosive or saline (e.g. sea) water has been used during firefighting.

4.1.3.2 Water types

One or more of the following types of water shall be used in a fire hydrant system:

- (a) Water from a reticulated water supply.
- (b) Rainwater.
- (c) Class A recycled water.
- (d) Sea, river, lake, or dam water.
- (e) Bore water (treated and untreated).

4.2 Water supply

4.2.1 Primary water supply requirements

The primary water supply, or the primary water supply supplemented by a secondary water supply that provides automatic inflow to the primary water supply, shall deliver the following:

- (a) The minimum required flow rate for the fire hydrant system for not less than four hours.
- (b) The required assisted or unassisted pressures for the fire hydrant.

4.2.2 Primary water supply options

The primary water supply shall be provided from one of the following water supply options:

- (a) Reticulated water supply (street fire hydrants or directly connected pipework, or both).
- (b) Reticulated water supply with one on-site pump.
- (c) Reticulated water supply with an on-site break tank and pumps as specified in [Clauses 4.2.6.5](#) and [6.4.2](#).
- (d) Private on-site water mains capable of delivering the unassisted pressures and flows for the fire hydrant system.
- (e) Private on-site water mains with not less than two pumps.
- (f) A reduced-capacity partitioned tank in accordance with [Section 5](#) and provided with automatic inflow from a secondary water supply, fire brigade suction connections, fire brigade booster connections, and not less than two pumps.
- (g) One full-capacity partitioned tank in accordance with [Section 5](#) and provided with fire brigade suction connections, fire brigade booster connections, and not less than two pumps.
- (h) Two tanks in accordance with [Section 5](#) and provided with fire brigade suction connections, fire brigade booster connections, and not less than two pumps.
- (i) Elevated private reservoir or gravity tank capable of providing the unassisted pressures and flows for the fire hydrant system.
- (j) Elevated private reservoir or gravity tank with not less than two pumps.
- (k) River, reservoir, lake, or sea, on or within the site boundary, with not less than two vertical turbine pumps.

4.2.3 Multiple firefighting systems

Where multiple firefighting systems draw from the same water source, the water supply shall be capable of meeting the simultaneous demands for the required durations for each system as specified in [Clause 2.2.7](#).

4.2.4 Recycling

Where on-site water storage tanks are part of the fire hydrant system, the system shall be designed so that water used for commissioning and maintenance testing is capable of being returned to the water storage tanks as specified in [Clause 8.10](#), except where the water storage tanks also serve the domestic supply.

NOTE Water that has been in a fire hydrant supply system is not considered suitable for domestic uses such as drinking.

4.2.5 Secondary water supply requirements

Where reduced-capacity tanks are installed to serve as the primary water supply for the fire hydrant systems, automatic inflow shall be provided from a reticulated water supply, private water supply, other on-site tanks, river, reservoir, lake, dam, or sea so that the water supply requirements of [Clause 4.2.1](#) are met.

A means of measuring the inflow shall be provided in accordance with [Clause 8.10.4](#).

NOTE Pumps that provide automatic inflow to reduced-capacity tanks should have the same reliability as other primary water supply pumps detailed in [Section 6](#) and be capable of being controlled by a float valve.

4.2.6 On-site water storage tanks

4.2.6.1 General

Where an on-site water storage tank is provided it shall –

- (a) be either a full-capacity tank, reduced-capacity tank, high-rise water storage tank, break tank or gravity break tank, as applicable; and
- (b) conform to all applicable requirements of this section and [Section 5](#).

4.2.6.2 When an on-site water storage tank is required

On-site water storage tanks shall be provided where —

- (a) the available reticulated water supply is unable to serve as the primary water supply and provide —
 - (i) the required flow rate for the fire hydrant system; or
 - (ii) the required pressure to the most hydraulically advantaged feed fire hydrants of the fire hydrant system;
- (b) the on-site reservoir or dam is unable to serve as the primary water supply and provide the required flow rate for the fire hydrant system for not less than four hours;
- (c) the available river, lake or seawater is unable to serve as the primary water supply and provide the required flow rate for the fire hydrant system for not less than four hours;
- (d) the water supply as per Items (a), (b) or (c) is unable to provide for the simultaneous demand of the fire hydrant system and the operation of another firefighting system as required by [Clause 2.2.7](#);

- (e) the draughting requirements of [Clause 4.4](#) cannot be met by the provision of fixed suction connections drawing from an on-site reservoir or dam as required by Item (b) or an available river, lake, dam, or seawater as required by Item (c); or
- (f) the building has an effective height more than 50 m.

4.2.6.3 Full-capacity water storage tanks

Full-capacity tanks shall be sized to provide the minimum required firefighting flow rate for not less than four hours.

4.2.6.4 Reduced-capacity water storage tanks

The size of an on-site water storage tanks may be reduced, provided a secondary water supply can provide automatic inflow to an on-site water storage tank serving as the primary water supply. The reduced-capacity water storage tanks shall —

- (a) be capable of providing the minimum required flow rate for not less than four hours with the automatic inflow; and
- (b) have a capacity of not less than 24 000 L or deliver the minimum required flow rate for not less than 20 min duration, whichever is greater, except where [Clause 4.2.6.6](#) applies.

NOTE: For buildings having an effective height more than 50 m, see [Clause 4.2.6.6](#).

4.2.6.5 Break tanks

Where a break tank is installed, it shall —

- (a) have a capacity of not less than 20 min at the required flow rate specified in [Table 2.2.6\(A\) or \(B\)](#), as applicable;
- (b) be provided with not less than two half-duty fire hydrant pumps except where the provisions of [Clause 6.4.2](#) apply; and
- (c) be capable of delivering the minimum required flow rate as specified in [Table 2.2.6\(A\) or \(B\)](#), as applicable, for not less than four hours with the automatic inflow.

NOTE See [Clause 6.4.2](#) for information on the provision of one pump where a break tank is installed.

4.2.6.6 High-rise water storage tanks

Where a building has an effective height more than 50 m, on-site water storage tanks shall be provided. Water storage tanks shall —

- (a) serve as the primary water supply for the full-duty pumps required for the building in accordance with [Clause 6.2.2](#); and
- (b) have a minimum capacity of not less than 36 000 L or be capable of delivering the minimum required flow rate for the building as specified in [Table 2.2.6\(D\)](#) for not less than 30 min, whichever is the greater.

NOTE See [Clause 6.5](#) for more information on water supply configurations for full-duty pumps.

4.2.6.7 Gravity break tank

Where a gravity break tank is installed as part of a cascade fire hydrant system to control and manage pressure, the gravity break tank shall —

- (a) have a capacity of not less than 20 min at the required flow rate;

- (b) be capable of delivering the minimum required pressure and flow specified in [Table 2.2.6\(E\)](#);
- (c) be capable of delivering the minimum required flow rate for not less than four hours with the automatic inflow.

4.2.7 Water supply pressure

4.2.7.1 General

4.2.7.1.1 Reticulated water supply system

Where a reticulated water supply system is to be used as the source for all or part of the primary water supply, the following items shall be applied in determining the residual pressure available for design:

- (a) The residual pressure used in the fire hydrant system design shall be that determined as being available at the point of connection, under 95th percentile demand conditions in the reticulated water supply system while the applicable firefighting demands are being drawn.
- (b) The point of connection used in any calculation shall be at the reticulated water supply, where the fire hydrant system pipework is directly connected, or at the outlet of street fire hydrants, where standpipes will be used to access the water supply.
- (c) Hydraulic calculations performed on the reticulated water supply system by a network utility operator and/or other party shall be used to determine the adequacy of the selected primary water supply option outlined in [Clause 4.2.2](#) to meet the unassisted flow and pressure specified in [Table 2.2.6\(A\) or \(B\)](#) as applicable, as well as the flow from another firefighting system as per the simultaneous demand requirements of [Clause 2.2.7](#).
- (d) The results of these hydraulic calculations shall be used in conjunction with additional calculations specified in [Clause 2.3](#), including accounting for additional hydraulic losses, in the fire hydrant system, from the connection point at the reticulated water supply, to confirm the water supply arrangement will meet flow, pressure and velocity requirements.
- (e) Where the reticulated water supply is unable to deliver the required unassisted pressure and flow to serve as the primary water supply specified in [Clause 4.2.2\(a\), \(b\) or \(c\)](#), another option from [Clause 4.2.2](#) shall be selected. Where the selected water supply requires the reticulated water supply to provide automatic inflow or make-up water to the primary water supply, the pressure and flow available from the reticulated water supply shall be that available at the point of connection, under 95th percentile demand conditions in the reticulated water supply system while the applicable firefighting demands are being drawn. This point of connection shall be at the reticulated water supply.

NOTE See [Appendix L](#) for further guidance on water supply pressure.

4.2.7.1.2 Minimum design residual pressure

The minimum design residual pressure shall be calculated by one of the following in order of availability:

- (a) A network utility operator's water supply network hydraulic model that has been calibrated for fire flow friction losses, background network demands and local network boundary conditions. The network hydraulic model shall accurately calculate the available reticulated water supply residual pressures under 95th percentile demand conditions together with the total firefighting flows to the connection point of the fire hydrant system at the reticulated water supply.
- (b) A network utility operator's uncalibrated water supply network hydraulic model supported by suitable field tests to verify and adjust the hydraulic model's reticulation mains fire flow friction losses to the connection point of the fire hydrant system at the reticulated water supply.

- (c) A network utility operator's water supply network hydraulic model or equivalent network hydraulic calculation that can accurately calculate the 95th percentile available reticulated water supply's residual pressures to a nearby system reference point, such as a large diameter distribution main offtake, local service reservoir outlet, pressure pump or pressure regulation valve outlet, for the total firefighting flows. The additional hydraulic losses from the system reference point to the connection point of the fire hydrant system at the reticulated water supply shall be determined by suitable field tests and any required supporting hydraulic calculations to derive the design residual pressure.
- (d) A reticulated water supply residual pressure calculation method assessed or recommended by the network utility operator as being appropriate for the site.

NOTE For residual pressure calculation and testing methodologies, see [Appendix L](#).

4.2.7.2 Tanks

The residual pressure used in the design of the fire hydrant system shall be that resulting from the required flow rate being drawn from the tank at the low water level of the tank. The design pressure shall be that available at the outlet pipework of the tank.

4.2.7.3 River, lake, dam, or sea

Where a river, lake, dam or sea is used as a water source, the residual pressure used in design of the fire hydrant system shall be determined considering the variation of the source during the design life of the fire hydrant system. The water level used to determine the residual pressure shall be assessed as that reliably available, such as average low tide or river level, at the point of connection to the source.

4.2.8 Arrangement of water supplies

The water supply or combination of water supplies shall be in accordance with [Tables 4.2.8\(A\) and \(B\)](#).

Table 4.2.8(A) — Water supplies — Buildings having an effective height not more than 50 m

Primary water supply	Automatic inflow water supply	Requirements
Reticulated water supply, private water supply system, full-capacity tank, river, lake, dam, or sea water	Not applicable	The primary water supply serving the fire hydrant system shall be capable of providing the required flow rate for not less than 4 h. The required pressures shall be achieved either unassisted or assisted.
Reduced-capacity tank	Reticulated water supply, river, reservoir, lake, dam, sea, or stored rainwater with pumps as required	The reduced-capacity tank and the secondary water supply inflow rate to the tank shall be capable of providing the required flow rate of water for not less than 4 h. The required pressures shall be achieved either unassisted or assisted.

Table 4.2.8(B) — Water supplies — Buildings having an effective height more than 50 m

Primary water supply	Automatic inflow water supply	Requirements
High-rise water storage tank and reticulated water supply	Reticulated water supply, river, reservoir, lake, dam, sea or stored rainwater with pumps as required	<p>The reduced-capacity tank and the secondary water supply inflow rate to the tank shall be capable of providing the required flow rate for not less than 4 h to the full-duty pumps.</p> <p>The required pressures and flow shall be achieved through the use of not less than two on-site full-duty hydrant pumps.</p> <p>The reticulated water supply shall provide the required pressure and flow to the feed fire hydrants of the installed fire brigade booster assembly.</p>
High-rise water storage tank		<p>Full-capacity tank shall be capable of providing the required flow rate for not less than 4 h to the full-duty pumps.</p> <p>The required pressures and flow shall be achieved through the use of not less than two on-site full-duty fire hydrant pumps.</p>

4.3 Connections to water sources or supplies

4.3.1 Connection to a reticulated water supply

4.3.1.1 General

Fire hydrant system water supply designs that are to be connected to a reticulated water supply shall be provided with backflow prevention to maintain the integrity and water quality of the reticulated water supply system.

Where a fire hydrant system is connected to a reticulated water supply controlled by a network utility operator, separate water supply network connection standards, contractual obligations and approval requirements exist, covering requirements for backflow prevention, pipework, metering requirements and valving for isolation purposes.

No isolating valves shall be included between a water agency required backflow prevention arrangement and the first feed fire hydrant of the fire hydrant system.

NOTE 1 The network utility operator should be consulted to determine the network connection approval requirements for the fire systems.

NOTE 2 Refer to AS 3500.1 and to the NCC for requirements relating to backflow prevention.

4.3.1.2 Backflow prevention devices

Where a backflow prevention device is installed —

- (a) all pipework between the reticulated water supply and the backflow prevention device shall conform to AS/NZS 3500.1; and
- (b) the backflow prevention device shall —
 - (i) conform to AS/NZS 2845.1;
 - (ii) be installed in accordance with AS/NZS 3500.1; and

- (iii) be located —
 - (A) in a system that does not incorporate a fire brigade booster assembly, upstream of the feed fire hydrants; or
 - (B) in a system that does incorporate a fire brigade booster assembly, upstream of the fire brigade booster connections.

Where butterfly valves are provided to the backflow prevention device, the valves shall be lugged- or grooved-type and hand wheel gear operated. Where the body of the valve is wafer style, it shall be lugged-type.

4.3.2 Connection to on-site private water supplies

4.3.2.1 General

Private water supplies that provide the combined requirements of domestic and industrial process water systems, in addition to the firefighting (hydrant or sprinkler) flow and pressure requirements, shall be in accordance with one of the following:

- (a) They shall be sourced from a reticulated water supply with the capacity to supply the full firefighting demand at the required pressure, the probable simultaneous domestic demand and any process water demands concurrently, without the use of pumps.
- (b) They shall be sourced from a reticulated water supply that has the capacity to supply the full firefighting demand, the probable simultaneous domestic demand and any process water demand, with fire pumps conforming to AS 2941 supplying the full firefighting demand as well as the probable simultaneous domestic demand and process water demand concurrently.
- (c) They shall be sourced from on-site water storage tanks that have the capacity to supply the full firefighting demand, the probable simultaneous domestic demand and any process water demand, through the use of not less than two fire pumps conforming to AS 2941 supplying the full firefighting demand as well as the peak domestic and process water demands concurrently. The domestic and process water demands shall be provided from either separate storage tanks or the upper non-reserved sections of the firefighting tanks, connected to domestic/process water pumps.

4.3.2.2 Ring mains for private water supplies

A private water main supply configured as a ring main shall meet the following requirements:

- (i) The ring main shall be capable of providing the combined peak flow requirements of all connected systems in addition to meeting the hydrant flow and pressure requirements for the specified time.
- (ii) The ring main valving shall be in accordance with [Clauses 8.6](#) and [8.7](#), as applicable.

4.3.3 Connection to water storage tanks

Where fire brigade pumping appliances are required to connect to a water storage tank that provides the primary water supply, the water storage tank shall —

- (a) where located on or above ground, have pipework to the large- or small-bore suction connections that has a total friction head loss not exceeding 20 kPa at the required flow rate; and
- (b) where located partially or wholly below ground, have a fixed suction connection for the water storage tank that conforms to [Clause 4.4](#).

NOTE For requirements for large- and small-bore suction connections, see [Section 5](#).

4.3.4 Connection to sea, river, lake or dam water

Where water is sourced from a sea, river, lake, or dam to directly supply the fire hydrant system, the connection shall include pumps and pipework as follows:

- (a) A fixed suction connection in accordance with [Clause 4.4](#) or provision for direct draughting by a fire brigade pumping appliance.
- (b) Not less than two vertical turbine pumps conforming to AS 2941 that provide the pressure and flow as specified in [Table 2.2.6\(C\)](#).

NOTE 1 For information on direct draughting and the capabilities of fire brigade pumping appliances, see [Appendix F](#) and [Appendix K](#).

NOTE 2 For more information on inflow to a reduced-capacity tank, see [Clause 4.2.5](#).

4.4 Fixed suction connection

Where a fixed suction connection is provided for a fire brigade pumping appliance to draught from a water source, the following design parameters shall apply:

- (a) The maximum friction loss shall be 20 kPa.
- (b) The maximum vertical lift shall be 3 m from the low water level.
- (c) The maximum volume of permanently fixed on-site dry pipe (above the low water level) shall be 0.07 m³.

NOTE 1 As the pump performance of fire brigade pumping appliances differs across Australia, where a flow rate of more than 30 L/s is required through a fixed suction connection, consultation with the local fire brigade should be undertaken to confirm if these flows can be provided under suction lift conditions.

NOTE 2 For more information on the draughting capabilities of fire brigade pumping appliances and fixed suction connections, see [Appendix F](#) and [Appendix K](#).

Section 5 Water storage tanks

5.1 General

Water storage tanks shall —

- (a) conform to AS/NZS 3500.1;

NOTE 1 A network utility operator may specify additional requirements where it is proposed to install on-site water storage tanks.
- (b) be configured so that during maintenance not less than 50 % of the required minimum volume is available at all times, except where the tank is a break tank installed in accordance with [Clause 4.2.6.5](#);
- (c) where the water storage tank has been sized to also include water for other purposes and classified as a shared use tank, be configured so that the required quantity of water for use by the fire hydrant system remains available at all times except during maintenance in accordance with Item (b);
- (d) be provided with fire brigade connections, where required;
- (e) be constructed to withstand all expected internal and external design loads likely to be imposed on the structure;
- (f) be constructed of new materials;
- (g) be sized so that the required flow for the required duration is provided; and
- (h) be identified by signage in accordance with [Clause 11.3](#), as applicable.

NOTE 2 For information on water storage tanks, see [Appendix M](#).

5.2 Tank construction

5.2.1 General

On-site water storage tanks shall be —

- (a) constructed from concrete or steel; and
- (b) designed and constructed to withstand the expected design loads and environmental conditions including seismic activity, mine subsidence, unstable ground or alpine area loadings and conditions.

5.2.2 Concrete tanks

Where concrete tanks are used as either full-capacity tanks, reduced-capacity tanks or break tanks, they shall conform to AS 3735. These tanks shall be provided with the tank access and with the hydraulic and miscellaneous components specified in AS 2304.

5.2.3 Steel tanks

Where steel tanks are used as either full-capacity tanks, reduced-capacity tanks or break tanks, they shall conform to AS 2304.

5.3 Tank accessories

5.3.1 Fire brigade suction connections

5.3.1.1 General

Except where an elevated water storage tank is capable of delivering the unassisted pressure and flow for feed fire hydrants as specified in [Table 2.2.6\(A\)](#), fire brigade suction connections shall —

- (a) be installed on a water storage tank that provides the primary water supply;
- (b) be located not less than 10 m from a non-sprinkler protected building;
- (c) be orientated to face the hardstand so that the fire brigade pumping appliance, when connected to the large- or small-bore suction connections and the fire brigade booster connections, is located not less than 10 m from the protected building;
- (d) be located in a position so the hydraulic losses associated with the pipe, valves and fittings that serve suction connections do not exceed those detailed in [Clause 4.3.3](#) or [Clause 4.4](#), as applicable;
- (e) be located not more than 4.5 m from a hardstand;
- (f) be located not more than 10 m from the fire brigade booster connections of the tank suction booster assembly;
- (g) have an isolating valve installed upstream of the suction connection and locked in the closed position, where the suction connection is subjected to a positive pressure;
- (h) not incorporate valves with loose jumpers; and
- (i) be fitted with a protective cap and chain.

5.3.1.2 Large-bore suction connections

Where large-bore suction connections are required, the following shall apply:

- (a) Where the flow rate is less than or equal to 40 L/s, one large-bore suction connection shall be provided.
- (b) Where the flow rate is more than 40 L/s but less than or equal to 80 L/s, two large-bore suction connections shall be provided.
- (c) Where two large-bore suction connections are required in accordance with Item (b), the large-bore suction connections shall be separated to facilitate the connection of two fire brigade pumping appliances located on the hardstand.
- (d) Each large-bore suction connection shall —
 - (i) have a nominal diameter of 150 mm (DN 150) and be fed by a pipe having an internal pipe diameter of not less than DN 150;
 - (ii) have an isolating valve in accordance with [Clause 9.3.2](#); and
 - (iii) be located with a centre line between 450 mm and 600 mm above the finished surface of the hardstand.

NOTE 1 Metropolitan fire brigades use large-bore suction connections.

NOTE 2 See [Clause 4.4](#) for limitations related to below-ground tanks.

NOTE 3 For information on the dimensions of typical fire brigade pumping appliances and considerations for draughting from a large-bore suction connection, see [Appendix F](#).

5.3.1.3 Small-bore suction connections

Where small-bore suction connections are provided, the following shall apply:

- (a) Where required, not less than two small-bore suction connections shall be provided.
- (b) Where required, the number of small-bore suction connections provided shall be capable of providing the required flow rate.
- (c) Each small-bore suction connection shall have —
 - (i) a nominal diameter of 65 mm (DN 65); and
 - (ii) an isolating valve comprising a lever-operated ball valve, butterfly valve or a gate valve in accordance with [Clause 9.3.2](#).
- (d) The centre-line of each small-bore suction connection shall be located not less than 400 mm above the large-bore suction connection.

NOTE The decision to provide small-bore suction connections and the type of coupling or connection required should be made in consultation with the relevant fire brigade.

5.3.2 Suction lines

5.3.2.1 Fixed on-site pump suction line

Where a fixed on-site pump is installed, the following shall apply:

- (a) Suction lines supplying the pump shall be arranged so that air will not accumulate in the pipework between the on-site tank (or other water source) and the fixed on-site pump.
- (b) Suction lines supplying the pump shall be arranged so they are terminated with a vortex inhibitor in accordance with AS 2304.
- (c) Where suction lines incorporate a check valve, the valve shall be of a low-pressure loss swing check-valve type and be calculated so that with all pumps operating at maximum flow, the net positive suction head available (NPSHA) at the pump inlet shall be not less than 1.0 m in excess of net positive suction head required (NPSHR) under all supply conditions.

NOTE Refer to AS 2941 for the requirements relating to the installation of air release valves.

5.3.2.2 Large- and small-bore suction lines

Suction lines serving large- or small-bore suction connections shall —

- (a) be not less than DN 150;
- (b) be arranged so that air will not accumulate in the pipework between the tank and the suction connection;
- (c) be arranged so that they are terminated with a vortex inhibitor in accordance with AS 2304; and
- (d) be sized in accordance with [Clauses 4.3.3](#) or [4.4](#) or both, where applicable.

5.3.3 Tank fill time

The supply to a water storage tank shall be capable of refilling 50 % of the effective capacity of the tank within the following times:

- (a) For a high-rise tank that does not serve as a reduced-capacity tank with automatic inflow, within three hours.
- (b) For a water storage tank that provides the primary water supply with a capacity less than 144 000 L, within eight hours.
- (c) For a water storage tank that provides the primary water supply with a capacity more than 144 000 L and less than 288 000 L, within 16 h.
- (d) For a water storage tank that provides the primary water supply with a capacity more than 288 000 L, within 24 h.
- (e) For a water storage tank where refill water is not permanently reticulated to the tank, provision shall be made for the tank to be refilled within 24 h.
- (f) For a water storage tank that also supplies an automatic sprinkler system, the water supply to the tank shall be capable of completely refilling the tank in accordance with AS 2118.1.

Section 6 Pumpsets

6.1 General

All pumpsets incorporated into a fire hydrant system shall —

- (a) conform to, and be installed in accordance with, AS 2941; and
- (b) be provided with an electrical supply or quantity of fuel to enable them to operate for not less than the required duration.

Positive displacement pumps shall not be used.

NOTE 1 For information on high-rise pump configurations, see [Appendix N](#).

NOTE 2 For information on facilities for testing on-site fire hydrant pumps, see [Appendix O](#).

6.2 When a pumpset is required

6.2.1 Half-duty fire hydrant pumpsets

Where a building has an effective height not more than 50 m, half-duty fire hydrant pumpsets shall be installed where—

- (a) the primary water supply is unable to deliver the unassisted pressure or flow to the most hydraulically disadvantaged feed fire hydrants specified in [Table 2.2.6\(A\)](#);
- (b) the primary water supply is unable to deliver the unassisted pressure to the most hydraulically disadvantaged attack fire hydrants specified in [Table 2.2.6\(B\)](#); and
- (c) an on-site water storage tank is installed in accordance with [Clause 4.2.6.2\(a\) to \(e\)](#).

NOTE 1 Where Item (a) applies, see [Clause 4.2.6.2](#) regarding the requirement to provide an on-site water storage tank.

NOTE 2 Where Items (a) and (b) apply, see [Clause 6.4](#) regarding the number of pumpsets to be provided.

6.2.2 Full-duty fire hydrant pumpsets

Where a building has an effective height more than 50 m, not less than two full-duty fire hydrant pumpsets shall be provided in accordance with [Clause 6.5](#).

6.2.3 Pressure maintenance pumps

Where a fire hydrant system is required to maintain a uniform pressure so that any installed pressure-responsive device used for initiating the automatic starting of on-site fire hydrant pumpsets operates accordingly, a jockey pump shall be installed.

6.2.4 Secondary water supply pumps

Where a river, lake, dam, or sea is used as a secondary water supply, not less than two pumpsets conforming to AS 2941 shall be installed to provide the automatic inflow to a reduced-capacity tank that serves as the primary water supply for the fire hydrant system.

6.3 Pumpset design criteria

6.3.1 Half-duty fire hydrant pumpsets

Where half-duty fire hydrant pumpsets are installed —

- (a) the number of fire hydrant outlets required to flow simultaneously shall be as specified in [Tables 2.2.5\(B\), \(C\), and \(D\)](#) as applicable; and
- (b) the pressure and flow delivered from the number of fire hydrant outlets required to flow as per Item (a) shall be as specified in [Table 2.2.6\(C\)](#).

6.3.2 Full-duty fire hydrant pumpsets

Where full-duty fire hydrant pumpsets are installed —

- (a) the number of fire hydrant outlets required to flow simultaneously shall be determined by [Tables 2.2.5\(B\), \(C\), and \(D\)](#), as applicable; and
- (b) the pressure and flow delivered from the number of fire hydrant outlets required to flow as per Item (a) shall be as specified in [Table 2.2.6\(D\)](#).

6.3.3 Jockey pumps

Where a jockey pump is provided, the required duty flow and pressure shall conform to the specific requirements for jockey pumps in AS 2941.

6.3.4 Secondary water supply pumpsets

Where secondary water supply pumps are installed, the following requirements shall be met:

- (a) The automatic inflow from these pumps shall enable the reduced-capacity tank serving as the primary water supply to provide the required firefighting flow as specified in [Table 2.2.6\(B\), \(C\), or \(D\)](#), as applicable, for the required duration in accordance with [Clause 4.2.1](#).
- (b) The duty pressure of the pumps shall be determined based on the maximum difference in elevation between the reservoir, dam, river, lake or sea and the storage in the reduced-capacity tank and the frictional head loss associated with providing the required duty flow.

6.4 Fire hydrant pumpsets

6.4.1 Pumpset configurations

Where fire hydrant pumpsets are provided in accordance with [Clause 6.2.1](#), they shall be configured as follows:

- (a) Three pumps driven by compression ignition engines, any two of which shall meet the pump duty requirements.
- (b) Two pumps, each capable of providing the duty requirements, in one of the following combinations:
 - (i) One driven by an electric motor, the other by a compression ignition engine.
 - (ii) Both driven by compression ignition engines.
 - (iii) Both driven by an electric motor at least one of which is supplied by an automatic start emergency power generator.
 - (iv) Both driven by electric motors connected to independent power sources.

or

- (c) Where [Clause 6.4.2](#) is applied, one pump, capable of providing the pump duty requirements, comprising one of the following:
- (i) A compression ignition engine.
 - (ii) An electric motor supplied by an automatic start emergency power generator.
 - (iii) An electric motor connected to two independent power sources through an automatic changeover facility.

6.4.2 One pump — Buildings having an effective height not more than 25 m

Where a building has an effective height not more than 25 m and the reticulated water supply is capable of delivering the required pressure and flow for the feed fire hydrants of the fire brigade booster assembly in accordance with [Table 2.2.6\(A\)](#), one half-duty fire hydrant pumpset may be provided in accordance with [Clause 6.4.1](#), provided —

- (a) the inlet of the pumpset is connected to the reticulated water supply; or
- (b) the inlet of the pumpset is connected to a break tank that has a bypass incorporating an H-pattern fire brigade booster assembly or other booster assembly with feed fire hydrants as specified in [Table 2.2.6\(A\)](#).

NOTE 1 Where the primary water supply is unable to provide the required pressure and flow for the feed fire hydrants of the booster assembly, the water storage tank may serve as a reduced-capacity tank and be provided with not less than two pumps and fire brigade suction connections.

NOTE 2 See [Appendix B](#) for guidance on fire hydrant system design for buildings having an effective height not more than 25 m.

6.5 Full-duty fire hydrant pumpsets

Where full-duty fire hydrant pumpsets are installed in accordance with [Clause 6.2.2](#), the following requirements shall apply:

- (a) Not less than two full-duty fire hydrant pumps shall serve each pressure zone within the building, except where the pressure zone is served by a gravity break tank.
- (b) Each full-duty fire hydrant pumpset shall—
 - (i) be capable of delivering the pressure and flow specified in [Table 2.2.6\(D\)](#) for not less than four hours;
 - (ii) be of variable speed and driven by —
 - (A) a compression ignition engine;
 - (B) an electric motor supplied by an automatic start emergency power generator; or
 - (C) an electric motor connected to two completely independent power sources through an automatic changeover facility;
 - (iii) start automatically in accordance with [Clause 6.9.1](#); and
 - (iv) be provided with a pressure relief valve, with the discharge piped to waste or recycled. The pressure relief valve shall be set so that the pressure in the system

pipework does not exceed 2 400 kPa as specified in [Clause 2.3.2\(d\)](#) or the maximum system test pressure, whichever is the lesser.

- (c) The water supply for the full-duty pumps shall be provided from—
 - (i) a partitioned full-capacity water storage tank;
 - (ii) a partitioned reduced-capacity water storage tank;
 - (iii) two separate water storage tanks; or
 - (iv) a tank and reticulated water supply.
- (d) The water supply serving each full-duty fire hydrant pumpset shall be configured so that no single point of failure is incorporated into the supply.
- (e) The dual-purpose pumps shall be connected in parallel with the fire brigade booster assembly.
- (f) A permanently affixed mimic pump controller panel that includes separate pump running indicator lights for each pumpset shall be installed adjacent to the fire brigade booster assembly.
- (g) The wiring to the indicator lights detailed in Item (f) shall be protected from fire and physical damage by cabling with ratings of WS5X and WS51 to WS54, as appropriate, conforming to AS/NZS 3013.
- (h) Signage shall be provided in accordance with [Clause 11.3](#).

6.6 Secondary water supply pumpsets

Where secondary water supply pumpsets are provided in accordance with [Clause 6.2.4](#), they shall be configured in accordance with [Clause 6.4.1](#).

6.7 Fixed on-site pumpsets in parallel with the fire brigade booster assembly

Where a fixed on-site fire hydrant pumpset has a parallel connection with a fire brigade booster assembly, the pipework shall be configured so that —

- (a) the inlet side of the pumpset is connected directly to —
 - (i) the fire hydrant system pipework supplying the feed fire hydrants of the fire brigade booster assembly; or
 - (ii) a fixed on-site tank or other acceptable water source serving as a primary water supply; and
- (b) the outlet side of the pumpset is connected directly to the fire hydrant system pipework at a point downstream of the fire brigade booster connections.
- (c) a fire brigade pumping appliance connected to the fire brigade booster assembly cannot pressurize the inlet side of the on-site fire hydrant pump through the inlet pipework referred to in Item (a).

6.8 Fixed on-site pumpsets in series with the fire brigade booster assembly

6.8.1 Connection requirements

Where a fixed on-site pump has a serial connection with a fire brigade booster assembly, the pipework serving the pumpset shall be configured so that —

- (a) the inlet side of the pumpset is connected to the fire hydrant pipework at a point downstream of the fire brigade booster connections.
- (b) the outlet side of the pumpset is connected to the fire hydrant system pipework at a point downstream of the connection point made by the application in Item (a).
- (c) a fire brigade pumping appliance connected to the fire brigade booster assembly is able to pressurize the inlet side of the on-site fire hydrant pump through the inlet pipework referred to in Item (a).

6.8.2 Additional requirements

Where a fixed on-site pump has a serial connection with a fire brigade booster assembly, the following provisions shall be made:

- (a) The pump shall be designed to withstand the variations in pressure that may be applied when a fire brigade pumping appliance is connected in series with the pumps.
- (b) A full flow rate bypass with non-return valve of equal diameter to that of the incoming fire main shall be connected between the pump suction and pump discharge pipe/manifold.
- (c) Either a 150 mm diameter liquid-filled pressure gauge or digital readout display of not less than 10 mm, which will indicate the pressure in kilopascals (kPa) at the pump discharge pipe/manifold, shall be located at the fire brigade booster assembly. The digital readout display shall be connected to an emergency power supply.
- (d) Signage in accordance with [Clause 11.3](#) shall be provided.

NOTE Where a fire brigade booster assembly is installed in series with the pumpset of a sprinkler system conforming to AS 2118.1, the additional requirements of Items (c) and (d) do not apply.

6.9 Pump control — Fire hydrant pumps

6.9.1 Primary starting arrangements

Where a fire hydrant pumpset is installed —

- (a) each pump controller shall start automatically through the actuation of a separate pressure sensor set to operate when the pressure in the installation has fallen to a nominated value below the pressure requirement for the system or pressure zone;
- (b) where more than one pump is provided, the pumps shall be arranged to start sequentially; and
- (c) each automatic starting of the pumpset, initiated by a fall in water pressure in the fire hydrant system, shall activate a visible and audible indication at the fire detection control and indicating equipment (FDCIE) or fire brigade panel (FBP) where installed within the protected building.

NOTE For guidance on pump starting arrangements, see [Appendix N](#).

6.9.2 Secondary starting arrangements

The secondary starting arrangements of a fire hydrant pump shall be located at the pump and be configured such that any failure in the system does not prevent the correct operation and function of the primary starting arrangement specified in [Clause 6.9.1](#).

NOTE Where a fire control room (FCR) is required by the Deemed-to-Satisfy provisions of the NCC, additional secondary starting arrangements should be provided within the FCR.

6.10 Electric driver isolating switches

Switches in circuits supplying the driver shall be locked “ON” and clearly labelled “HALF-DUTY FIRE HYDRANT PUMP — DO NOT SWITCH OFF” or “FULL-DUTY FIRE HYDRANT PUMP – DO NOT SWITCH OFF”.

NOTE This requirement does not apply to the separate main switches provided in accordance with AS/NZS 3000.

6.11 Pump room or enclosure

6.11.1 General

Pumpsets and associated equipment shall be installed within a weatherproof room or enclosure that —

- (a) only contains firefighting pumpsets and associated equipment;
- (b) is secured to prevent the entry of unauthorized persons;
- (c) is ventilated with fresh air to maintain the aspiration and cooling of pump drivers for the required duration of pump operation;
- (d) is heated and insulated, where necessary, to prevent freezing and condensation from forming;
- (e) is identified by —
 - (i) a fade- and weather-resistant sign, permanently affixed to the pumproom door, stating in capital letters not less than 50 mm high, in a colour contrasting with the background, FIRE PUMP ROOM; and
 - (ii) a red strobe light, activated by the operation of the fixed on-site pumps, located outside the building, adjacent to the door providing access to the pump room;
- (f) is constructed with an internal clearance of not less than 2.1m; and
- (g) is sized to allow for pump maintenance and replacement to occur.

6.11.2 Internal pump rooms

Where the pump room is located within the protected building, the following shall apply:

- (a) Where a building is protected throughout by a sprinkler system conforming to AS 2118.1, AS 2118.4, AS 2118.6 or FPAA101H, the requirements of Item (b) need not apply.
- (b) A pump room shall have the following:
 - (i) A fire resisting construction including walls and, where applicable, floor and roof that have an FRL not less than that required for a firewall for the building classification and type of construction applied to the building.

- (ii) Doorways protected with self-closing doors that have an FRL not less than that required for a fire wall as required in Item (i), except that the door shall have an insulation level of not less than 30 min.
- (iii) Construction joints, service penetrations and other openings protected in a manner that maintains the FRL for the wall, roof or floor as required by Item (i).

NOTE 1 Refer to the NCC for requirements relating to the FRL of a fire wall, roof, or floor for different building classifications.

NOTE 2 Refer to the NCC for requirements relating to construction joints, service penetrations and other openings in a fire wall, roof, or floor.

- (c) The pumphouse shall have a door leading directly to —
 - (i) road or open space;
 - (ii) an airlock or smoke lobby that leads to —
 - (A) a fire-isolated passageway or stair, leading to road or open space; and
 - (B) a fire-isolated passageway or stair, pressurized in accordance with AS/NZS 1668.1, leading to road or open space.

NOTE 3 Refer to the NCC for more information on the construction of an airlock or smoke lobby.

- (d) Where a compression ignition engine pumpset is installed —
 - (i) the exhaust system from the pumpset shall discharge outside the building or to a mechanical exhaust system capable of safely discharging the pump exhaust gases;
 - (ii) the discharge outlet from the exhaust system shall be not less than 2.7 m above a path of travel or road.

NOTE 4 The exhaust gases from the exhaust system discharge outlet should discharge clear of any ventilation, door or window openings within the building for the health and safety of persons within the building and at a height and orientation so as not to affect any person in the vicinity of the discharge outlet.

6.11.3 External pump rooms or enclosures

Where a pump room or enclosure is located external to the protected building, the following apply:

- (a) Where a building is protected throughout by a sprinkler system conforming to AS 2118.1, AS 2118.4, AS 2118.6 or FPAA101H or the pumphouse is located more than 6 m from the protected building, the requirements of Item (b) do not have to be applied.
- (b) Any parts of the pump room or enclosure located not more than 6 m from the protected building shall have the following:
 - (i) A fire resisting construction including walls and, where applicable, floor and roof that has an FRL not less than that required for a firewall for the building classification and Type of Construction applied to the building.
 - (ii) Doorways protected with self-closing doors having an FRL not less than that required for a fire wall as required in Item (i), except that the door shall have an insulation level of at least 30 min.
 - (iii) Construction joints, service penetrations, service penetrations for ventilation that face the protected building and other openings, protected in a manner that maintains the FRL for the wall, roof or floor as required by Item (i).

NOTE 1 Refer to the NCC for requirements relating to the FRL of a fire wall, roof, or floor for different building classifications.

NOTE 2 Refer to the NCC for requirements relating to construction joints, service penetrations and other openings in a fire wall, roof, or floor.

- (c) The pumphouse shall be located not more than 20 m from a hardstand.
- (d) The pumphouse shall be located not less than 10 m from —
 - (i) any high voltage electrical distribution equipment, such as transformers and distribution boards;
 - (ii) any stored dangerous goods (e.g. LPG, petroleum, propane); and
 - (iii) any external combustible storage (e.g. palleted combustible storage items).
- (e) Where a compression ignition engine pumpset is installed —
 - (i) the exhaust system from the pumpset shall discharge outside the building or to a mechanical exhaust system that is capable of safely discharging the pump exhaust gases; and
 - (ii) the discharge outlet from the exhaust shall be located not less than 2.7 m above a path of travel or road.

NOTE 3 The exhaust gases from the exhaust system discharge outlet should discharge clear of any ventilation, door or window openings within the building for the health and safety of persons within the building and at a height and orientation so as not to affect any person in the vicinity of the discharge outlet.

Section 7 Fire brigade booster assembly

7.1 General

A fire brigade booster assembly shall —

- (a) be located, designed, and arranged in accordance with this section;
- (b) be identified and have signage in accordance with [Clause 11.3.1](#); and
- (c) incorporate fire hydrant valves and fire brigade booster connections conforming to AS 2419.2 and AS 2419.3 respectively.

NOTE 1 For guidance on the location of booster assemblies, see [Appendix P](#).

NOTE 2 For figures throughout this section, not all required signage is shown. See [Clause 11.3](#) for signage requirements.

7.2 When a fire brigade booster assembly is required

A fire brigade booster assembly shall be installed to serve a fire hydrant system where —

- (a) internal fire hydrants are installed;
- (b) external on-site fire hydrants are installed more than 20 m from a fire brigade pumping appliance hardstand;
- (c) more than two feed fire hydrants are required to deliver fire hydrant coverage to all parts of the building;

NOTE For the purpose of this clause, fire hydrant coverage may be provided to a building using any combination of more than two feed fire hydrants (i.e. street hydrants or on-site feed fire hydrants).

- (d) on-site pumpsets are installed;
- (e) on-site storage tanks are installed;
- (f) more than one street fire hydrant or one external on-site fire hydrant is required to serve a building where the floor area of any fire compartment is more than 2 000 m²; or
- (g) a ring main is required in accordance with [Clause 8.6](#).

7.3 Location

7.3.1 Position

A fire brigade booster assembly shall be located —

- (a) within or affixed to the facade of the building containing the principal pedestrian entrance and not more than 20 m from the principal pedestrian entrance;
- (b) within or affixed to the facade of the building containing the principal pedestrian entrance and identified by a visual alarm device (VAD) in accordance with [Clause 7.3.2](#); or
- (c) remote from the building and within sight of the principal pedestrian entrance to the building —
 - (i) adjacent to the site boundary and the principal vehicle access for the fire brigade pumping appliance to the building or site; or

- (ii) not more than 20 m from the facade of the building containing the principal pedestrian entrance and not more than 20 m from the main pedestrian entrance.

7.3.2 Visual alarm device

Where a visual alarm device (VAD) is used to identify the location of the fire brigade booster assembly specified in [Clause 7.3.1](#), the device shall —

- (a) conform to AS ISO 7240.3 and have a minimum rating of W3-7.5;
- (b) be activated by an alarm signal from an FDCIE system that serves —
 - (i) an automatic smoke detection and alarm system, installed throughout the building;
 - (ii) a sprinkler system, installed throughout the building; or
 - (iii) a combination of Items (a) and (b), provided the building is protected throughout;
- (c) be external to the building, adjacent to the fire brigade booster assembly and within sight of the main pedestrian entrance to the building; and
- (d) be red in colour.

7.3.3 Accessibility, clearance, and protection

Where a fire brigade booster assembly is installed it shall —

- (a) be located not more than 10 m from a hardstand;
- (b) be located in a position that provides pedestrian access to the hardstand and the building;
- (c) have fire hydrant outlets and fire brigade booster connection inlets facing the hardstand;
- (d) be located not less than 10 m from —
 - (i) any high voltage electrical distribution equipment, such as transformers and distribution boards;
 - (ii) any Electric Vehicle Charging Station regardless of voltage unless protected by an FRL defined in [Clause 7.6.2](#).
 - (iii) any stored quantity of dangerous goods (e.g. LPG, petroleum, propane); and
 - (iv) any external combustible storage (e.g. palleted combustible storage items).
- (e) be located not less than 3 m from the vent terminal of any gas assembly or gas measurement system;

NOTE 1 The vent terminal may be extended via a pipe conforming to AS/NZS 5601.1.

NOTE 2 Gas assembly and gas measurement systems are defined in AS/NZS 5601.1.
- (f) be located not less than 3 m from the discharge outlet of any building exhaust system when operating in fire mode;
- (g) be unobstructed by stored goods, vehicles, vegetation or similar;
- (h) be protected from possible mechanical damage by vehicles;
- (i) be provided with an area free from all obstructions extending —
 - (i) not less than 1.5 m immediately in front of the cabinet containing the fire brigade booster assembly; and

- (ii) not less than 250 mm either side of the fire brigade booster assembly; and
- (j) be protected from radiant heat in accordance with [Clause 7.6](#).

NOTE 3 For information on the protection of the fire brigade booster assembly, see [Appendix P](#).

7.3.4 Multiple buildings on-site

Where multiple buildings are located on a site —

- (a) a separate fire brigade booster assembly shall be provided for each building on the site where the provisions of [Clause 7.2](#) apply, and be located in accordance with [Clauses 7.3.1](#) and [7.3.3](#); or
- (b) a fire brigade booster assembly shall be provided to serve all buildings on the site; and be located —
 - (i) adjacent to the site boundary and the principal vehicle access for the fire brigade pumping appliance to the building or site; and
 - (ii) in accordance with [Clause 7.3.3](#).

7.4 Types of fire brigade booster assemblies

The following fire brigade booster assembly configurations shall be deemed acceptable for use in a fire hydrant system:

- (a) H-pattern.
- (b) In-line.
- (c) I-pattern.
- (d) Tank model.
- (e) Tank suction.

7.5 Fire brigade booster assembly design and arrangement

7.5.1 General

A fire brigade booster assembly shall be in accordance with the following:

- (a) Where a reticulated water supply provides the primary water supply for a fire hydrant system, an H-pattern, in-line, I-pattern, or tank model fire brigade booster assembly shall be provided.
- (b) Where an H-pattern, in-line or I-pattern fire brigade booster assembly is installed —
 - (i) an isolating valve in accordance with [Clause 9.3.2.1](#) and a full flow non-return valve in accordance with [Clause 9.3.3](#) shall be installed above ground and between the fire hydrant valves and the fire brigade booster connections of the fire brigade booster assembly;
 - (ii) the full flow non-return valve shall be installed downstream of the isolating valve; and

- (iii) the direction of water flow through the fire brigade booster assembly shall be indicated in accordance with AS 1345.
- (c) Where a water storage tank provides the primary water supply for a fire hydrant system —
 - (i) a tank suction fire brigade booster assembly shall be provided; or
 - (ii) a fire brigade booster assembly in accordance with [Clause 7.5.1\(a\)](#) shall be provided if the tank has been elevated so that the unassisted pressure and flow for a feed fire hydrant can be provided.
- (d) Fire brigade booster assemblies shall be designed and arranged to enable a fire main to be pressurized without recourse to the manual operation of the isolating valves associated with the fire brigade booster assembly and the fire hydrant system except where the provisions of [Clause 8.7.1\(a\)](#) apply.
- (e) The fire hydrant valves and fire brigade booster connections of a fire brigade booster assembly shall be positioned horizontally or sloping not more than 35° below the horizontal.
- (f) A minimum clearance of 100 mm shall be provided around the hand-wheel of a fire hydrant valve when in the fully opened position.
- (g) An isolating valve as specified in [Clause 9.3.2.1](#) shall be installed immediately downstream of the boost inlet connections. No other isolating valves shall be installed between this valve and a connection to a ring main.
- (h) Where a fire brigade booster assembly incorporates two fire brigade booster connection inlets the pipework of the assembly shall not be less than DN 100.
- (i) Where a fire brigade booster assembly incorporates more than two and less than four fire brigade booster connection inlets, the pipework of the assembly shall not be less than DN 150.
- (j) For every four fire brigade booster connection inlets provided or part thereof, a hardstand shall be provided to allow for the movement and positioning of the required number of fire brigade pumping appliances.

7.5.2 Number of booster connection inlets required

Where a fire brigade booster assembly is installed, the following shall apply:

- (a) A maximum flow rate of 12.5 L/s may be allocated to each fire brigade booster connection inlet.
- (b) Not less than two fire brigade booster connection inlets shall be provided.
- (c) The total number of fire brigade booster connection inlets provided at a fire brigade booster assembly shall be determined by [Equation 7.5.2](#).
- (d) Where a fire hydrant system is combined with any other system, additional fire hydrant valves and booster connection inlets shall be provided so the required flow can be provided.

$$\text{Number of booster connection inlets required} = \frac{\text{Fire hydrant system demand (L/s)}}{12.5 \text{ L/s}} \quad 7.5.2$$

7.5.3 H-pattern fire brigade booster assembly

Where an H-pattern fire brigade booster assembly is installed, the following shall apply:

- (a) An equal number of fire hydrant valve outlets and fire brigade booster connection inlets shall be provided.
- (b) A maximum of eight fire hydrant valve outlets and eight fire brigade booster connection inlets shall be provided on the fire brigade booster assembly.

- (c) Not more than four fire hydrant valve outlets or four fire brigade booster connection inlets shall be provided on a single pipe riser of the fire brigade booster assembly.
- (d) The fire hydrant valve outlets and fire brigade booster connection inlets shall be configured as follows:
- (i) The height of the fire hydrant valve outlets and the fire brigade booster connection inlets shall be not less than 750 mm and not more than 1 200 mm, above the floor or standing surface in front of the fire brigade booster assembly.
 - (ii) The distance between the nearest fire hydrant valve outlet and fire brigade booster connection inlet, measured between centres, shall be not less than 450 mm.
 - (iii) The distance between the furthest fire hydrant valve outlet and fire brigade booster connection inlet, measured between centres, shall be not more than 5 m.
 - (iv) The minimum distance between fire hydrant valve outlets, measured between centres, shall be not less than 225 mm.
 - (v) The minimum distance between fire brigade booster connection inlets, measured between centres, shall be not less than 225 mm.
 - (vi) Where two pipe risers are provided to serve up to eight fire hydrant valves, the distance between fire hydrant valve outlets on separate risers, measured between centres, shall be not less than 450 mm where the fire hydrant valves are arranged to face forward; and
 - (vii) Where two pipe risers are provided to serve up to eight fire brigade booster connection inlets, the distance between fire brigade booster connection inlets on separate risers, measured between centres, shall be not less than 450 mm where the fire brigade booster connection inlets are arranged to face forward.

NOTE For typical H-pattern fire brigade booster assembly configurations, see [Figures 7.5.3\(A\) and \(B\)](#).

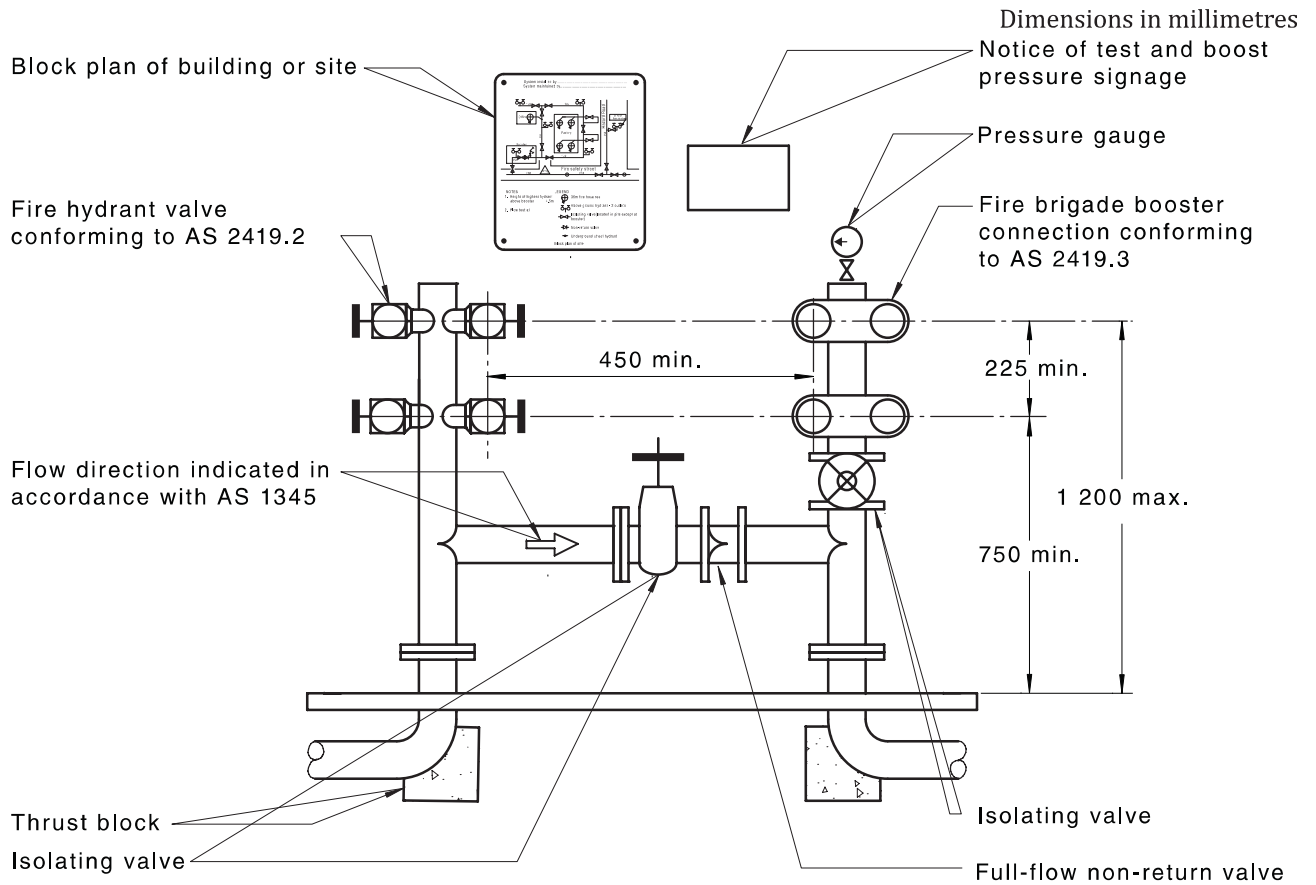


Figure 7.5.3(A) — H-pattern fire brigade booster assemblies — Design flow rate 30 L/s to 40 L/s

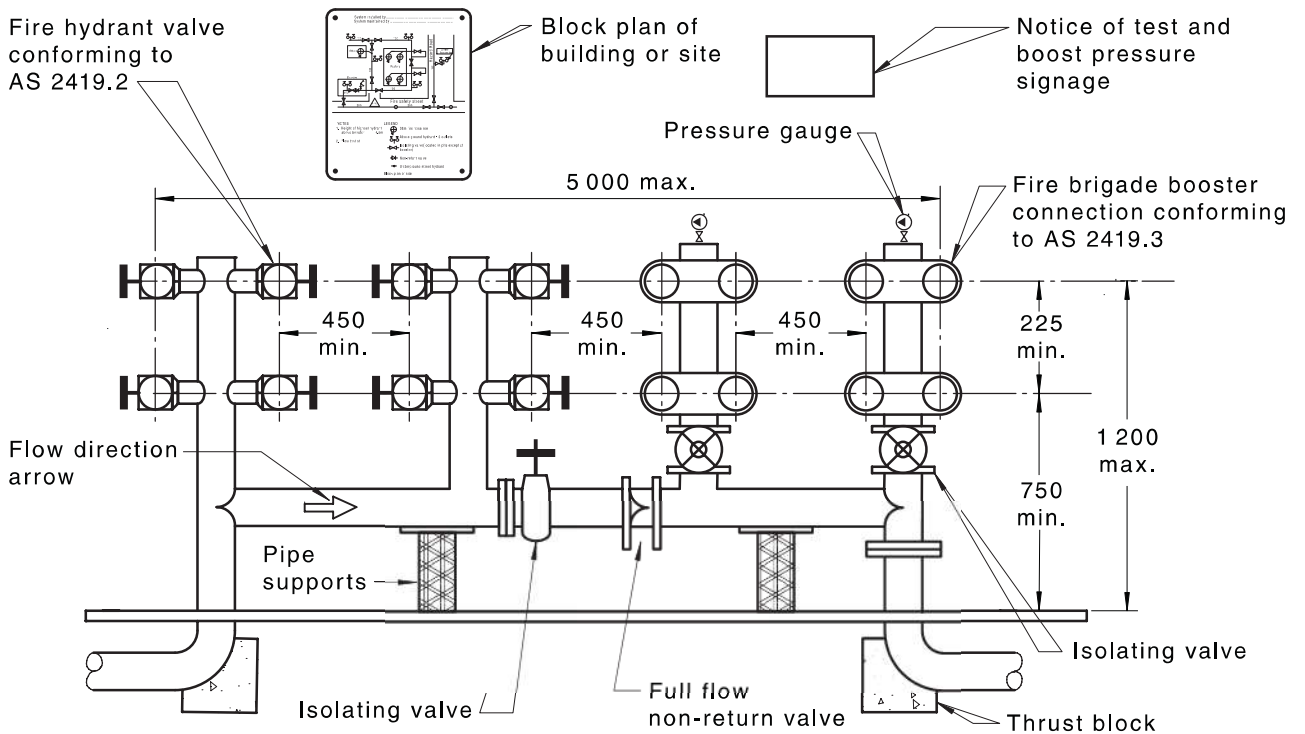


Figure 7.5.3(B) — H-pattern fire brigade booster assemblies — Design flow rate 60 L/s to 80 L/s

7.5.4 In-line fire brigade booster assembly

Where an in-line fire brigade booster assembly is installed, the following shall apply:

- (a) An equal number of fire hydrant valve outlets and fire brigade booster connection inlets shall be provided.
- (b) A maximum of eight fire hydrant valve outlets and eight fire brigade booster connection inlets shall be provided on the fire brigade booster assembly.
- (c) The fire hydrant valve outlets and fire brigade booster connection inlets shall be configured as follows:
 - (i) The height of the fire hydrant valve outlets and the fire brigade booster connection inlets shall be not less than 750 mm and not more than 1 200 mm above the floor or standing surface in front of the fire brigade booster assembly.
 - (ii) The distance between the nearest fire hydrant valve outlet and fire brigade booster connection inlet, measured between centres, shall be not less than 450 mm.
 - (iii) The distance between the furthest fire hydrant valve outlet and fire brigade booster connection inlet, measured between centres, shall be not more than 5 m.
 - (iv) The minimum distance between fire hydrant valve outlets, measured between centres, shall be not less than 225 mm.
 - (v) The minimum distance between fire brigade booster connection inlets, measured between centres, shall be not less than 225 mm.

NOTE For a typical in-line fire brigade booster assembly configuration, see [Figure 7.5.4](#).

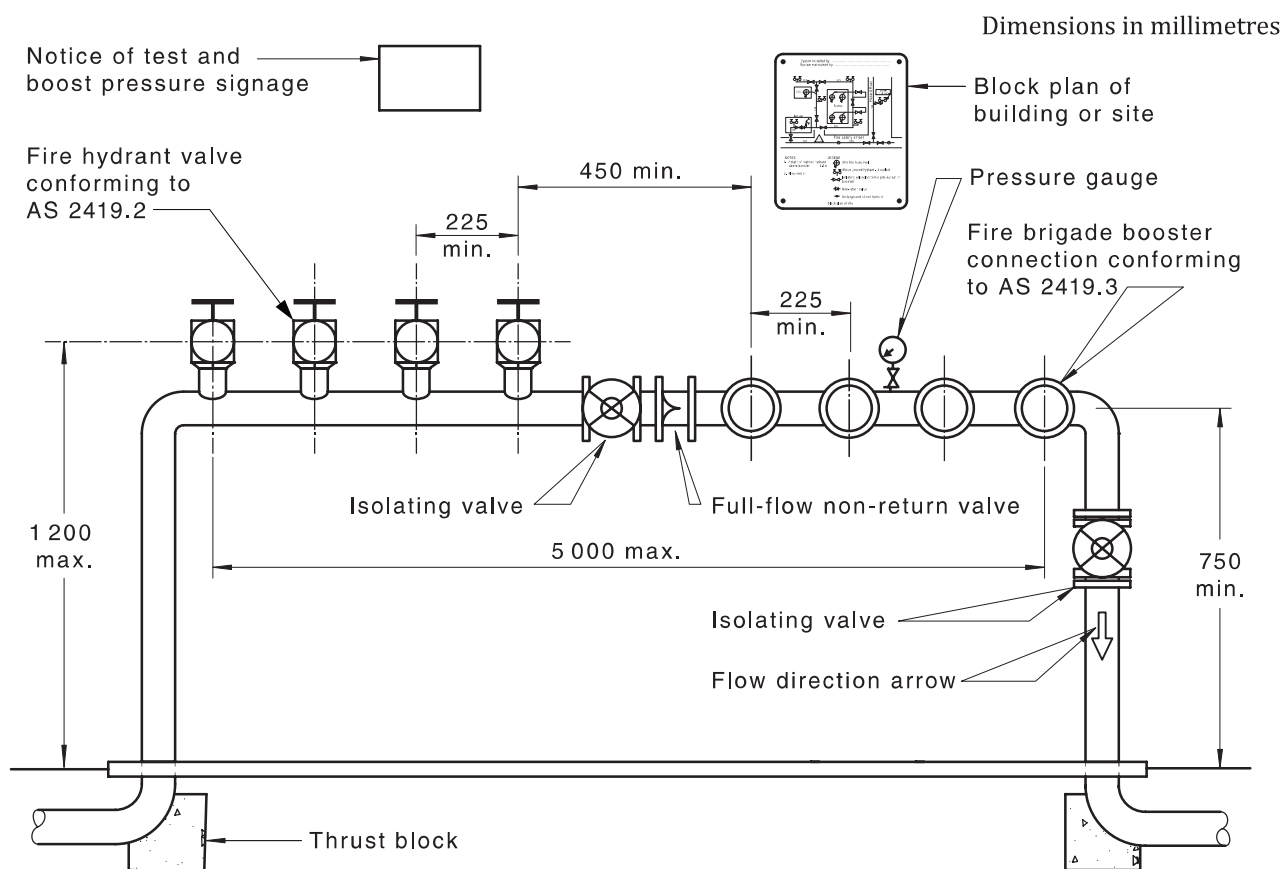


Figure 7.5.4 — In-line fire brigade booster assembly

7.5.5 I-pattern fire brigade booster assembly

Where an I-pattern fire brigade booster assembly is installed, the following shall apply:

- (a) The I-pattern fire brigade booster assembly shall be installed within or affixed to the facade of the building containing the principal pedestrian entrance.
- (b) An equal number of fire hydrant valve outlets and fire brigade booster connection inlets shall be provided.
- (c) A maximum of two fire hydrant valve outlets and two fire brigade booster connection inlets shall be provided.
- (d) The fire hydrant valve outlets and fire brigade booster connection inlets provided to the I-pattern booster assembly shall be configured as follows:
 - (i) The maximum height of the fire brigade booster connection inlets shall be not more than 1 200 mm to the centre of the fire brigade booster connection inlet.
 - (ii) The minimum height of the fire hydrant valve outlets shall be not less than 600 mm above the floor or standing surface in front of the fire brigade booster assembly to the centre of the fire hydrant valve outlets.
 - (iii) The minimum distance between fire hydrant valve outlets, measured between centres, shall be not less than 225 mm.
 - (iv) The minimum distance between fire brigade booster connection inlets, measured between centres, shall be not less than 225 mm.
 - (v) The centres of fire hydrant valve outlets shall be aligned horizontally.
 - (vi) The centres of fire brigade booster connection inlets shall be aligned horizontally.

NOTE See [Figure 7.5.5](#) for typical I-Pattern fire brigade booster assembly configuration.

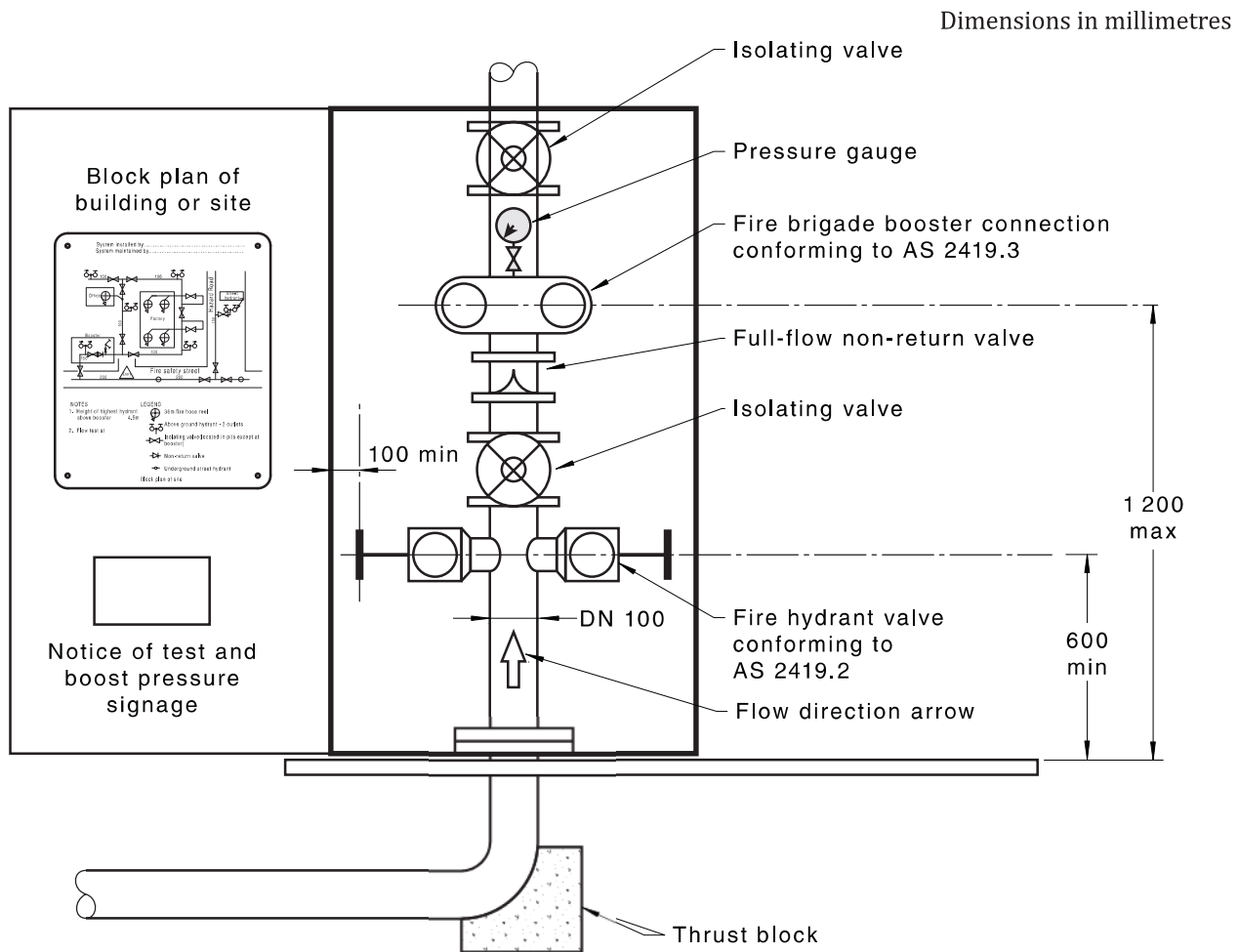


Figure 7.5.5 — I-pattern fire brigade booster assembly

7.5.6 Tank model fire brigade booster assembly

Where a tank model fire brigade booster assembly is installed, the following shall apply:

- (a) An equal number of feed fire hydrant valve outlets and fire brigade booster connection inlets shall be provided.
- (b) A maximum of eight feed fire hydrant valve outlets and eight fire brigade booster connection inlets shall be provided on the fire brigade booster assembly.
- (c) Not more than four feed fire hydrant valve outlets or four fire brigade booster connection inlets shall be provided on a single pipe riser or dropper.
- (d) The fire hydrant valve outlets and fire brigade booster connection inlets shall be configured as follows:
 - (i) The height of the feed fire hydrant valve outlets and the fire brigade booster connection inlets shall be not less than 750 mm and not more than 1 200 mm, above the floor or standing surface in front of the fire brigade booster assembly.
 - (ii) The distance between the nearest feed fire hydrant valve outlet and fire brigade booster connection inlet, measured between centres, shall be not less than 450 mm.
 - (iii) The distance between the furthest feed fire hydrant valve outlet and fire brigade booster connection inlet, measured between centres, shall be not more than 5 m.

- (iv) The minimum distance between feed fire hydrant valve outlets, measured between centres, shall be not less than 225 mm.
- (v) The minimum distance between fire brigade booster connection inlets, measured between centres, shall be not less than 225 mm.
- (vi) Where two pipe risers are provided to serve up to eight fire hydrant valves the distance between feed fire hydrant valve outlets on separate risers, measured between centres, shall be not less than 450 mm, where the fire hydrant valves are arranged to face forward.
- (vii) Where two pipe droppers are provided to serve up to eight fire brigade booster connection inlets the distance between fire brigade booster connection inlets on separate droppers, measured between centres, shall be not less than 450 mm, where the fire brigade booster connection inlets are arranged to face forward.

NOTE For typical tank model fire brigade booster assembly configurations, see [Figure 7.5.6](#).

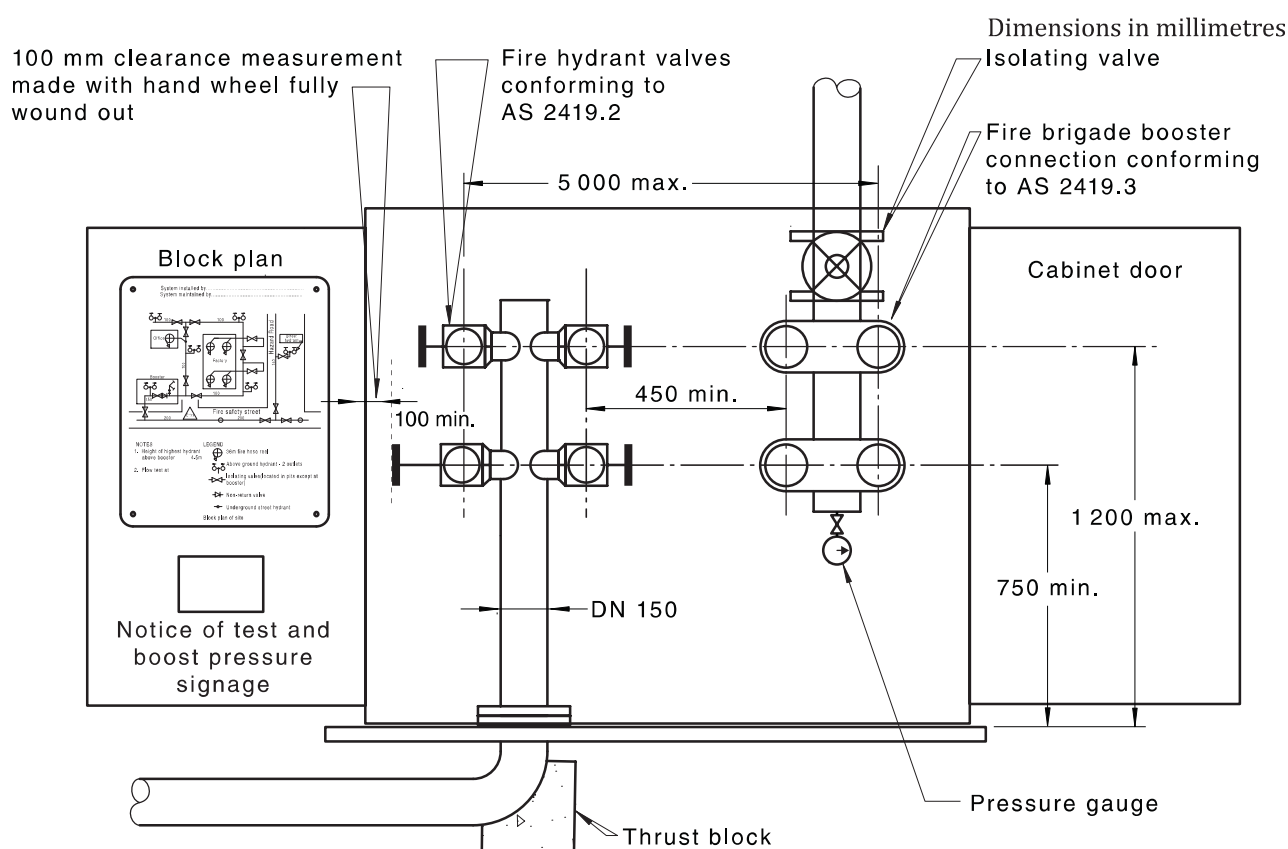


Figure 7.5.6 — Tank model fire brigade booster assembly

7.5.7 Tank suction fire brigade booster assembly

Where a tank suction fire brigade booster assembly is installed, the following shall apply:

- (a) The large- and small-bore suction connections provided to the on-site tank or static water supply shall be in accordance with [Sections 4](#) and [5](#), as applicable.

- (b) The large-bore suction connections shall be configured as follows:
- (i) The minimum distance between the fire brigade suction connections and fire brigade booster connection inlets, measured between centres, shall be not less than 900 mm.
 - (ii) The minimum distance between multiple large-bore fire brigade suction connections, measured between centres, shall be not less than 10 m.
 - (iii) A clearance around the large-bore fire brigade suction connection of not less than 450 mm, in the plane of the suction connection, shall be provided to facilitate the use of a hose spanner for the connection and disconnection of a large-bore suction hose.
- (c) The fire brigade booster connection inlets shall be located not more than 10 m from the fire brigade suction connection(s) provided to the tank or static water supply.
- (d) The fire brigade booster connection inlets shall be configured as follows:
- (i) A maximum of eight fire brigade booster connection inlets shall be provided.
 - (ii) Not more than four fire brigade booster connection inlets shall be provided on a single pipe riser.
 - (iii) Where two pipe risers are provided to serve a group of eight fire brigade booster connection inlets the distance between fire brigade booster connection inlets on separate risers, measured between centres, shall be not less than 450 mm, where the fire brigade booster connection inlets are arranged to face forward.
- (e) The fire brigade booster connection inlets shall be configured as follows:
- (i) The height of the fire brigade booster connection inlets shall be not less than 750 mm and less than 1 200 mm, above the floor or standing surface in front of the fire brigade booster assembly.
 - (ii) The minimum distance between fire brigade booster connection inlets, measured between centres, shall be not less than 225 mm.

NOTE For typical tank suction fire brigade booster assembly configurations, see [Figures 7.5.7\(A\) and \(B\)](#).

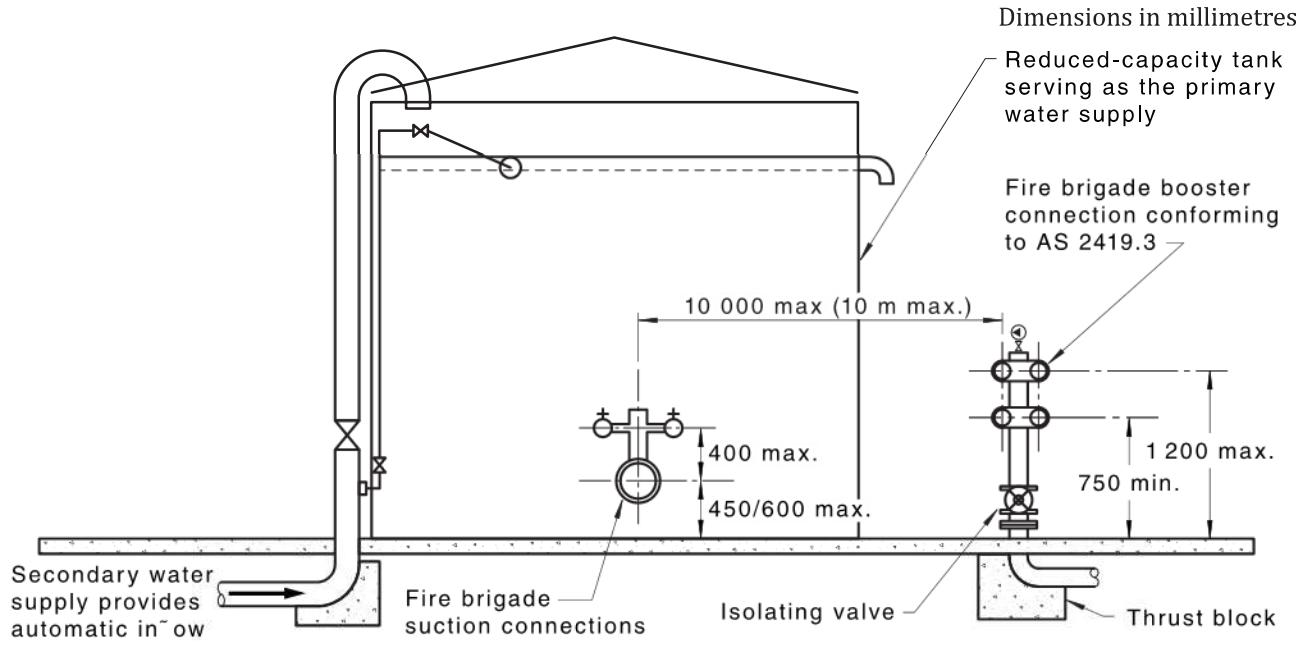


Figure 7.5.7(A) — Tank suction fire brigade booster assembly serving above-ground, freestanding tank

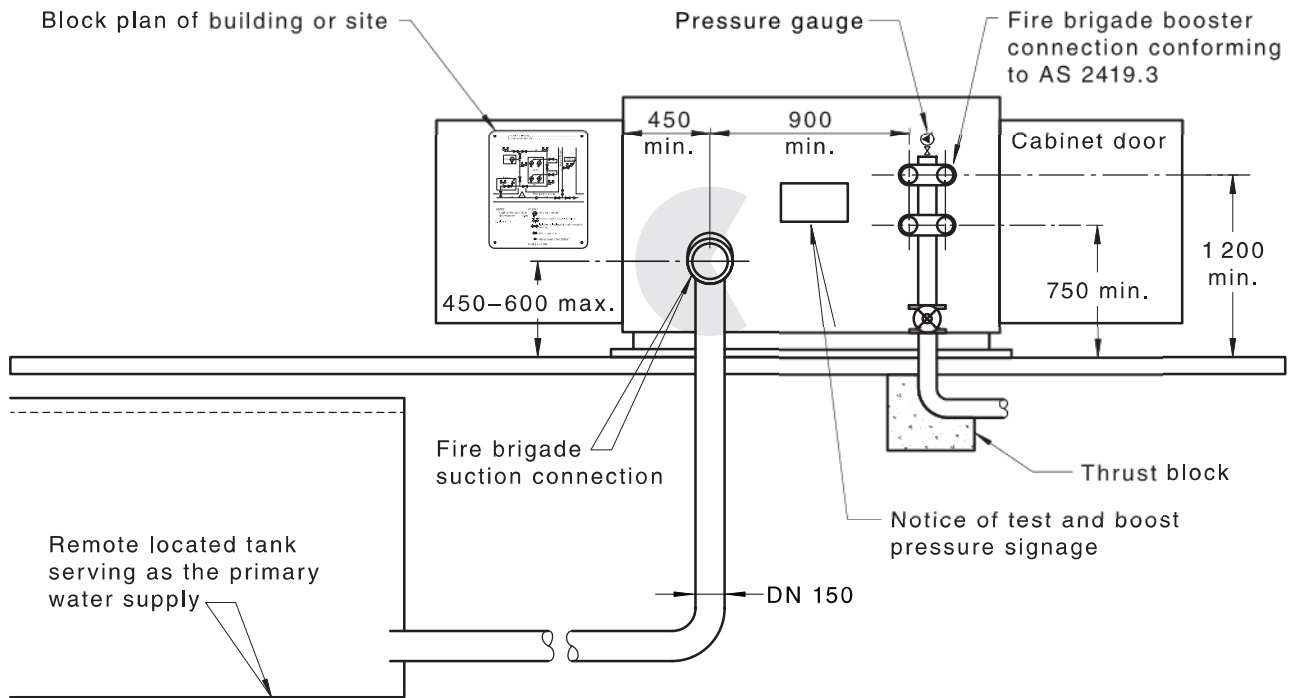


Figure 7.5.7(B) — Tank suction fire brigade booster assembly located within a cabinet, enclosure or recess serving below-ground tank

7.6 Protection of fire brigade booster assemblies

7.6.1 Sprinkler-protected buildings

The protection requirements of [Clauses 7.6.2](#) and [7.6.3](#) need not be applied, where a sprinkler system is installed throughout a building in accordance with AS 2118.1, AS 2118.4, AS 2118.6, FPAA101D or FPAA101H.

7.6.2 Non-sprinkler-protected buildings — Passive protection requirements

Where a fire brigade booster assembly is located not more than 10 m from a non-sprinkler protected building it shall be protected as follows:

- (a) If located within or affixed to the external wall of a building, it shall be protected by walls, floors and/or ceilings, as applicable, that —
 - (i) have an FRL not less than 90/90/90;
 - (ii) extend to a distance of not less than 2 m each side of the centre-line of the outermost fire hydrant pipe risers within the assembly; and
 - (iii) extend to a height not less than 3 m above ground level.
- (b) If located not more than 3.5 m from the external wall and remote from the building, it shall be protected by —
 - (i) the external wall of the building that conforms to Item (a); or
 - (ii) a freestanding wall or similar construction that —
 - (A) has an FRL not less than 90/90/90;
 - (B) extends to a distance of not less than 2 m each side of the centre-line of the outermost fire hydrant pipe risers within the assembly;
 - (C) extends to a height not less than 3 m above ground level; and
 - (D) is located immediately behind the fire hydrant and between the building and the fire hydrant.
- (c) If located more than 3.5 m and not more than 10 m from the external wall of the building, it shall be protected by a freestanding wall, fire brigade booster assembly cabinet or similar construction that —
 - (i) has an FRL not less than 90/90/90;
 - (ii) extends to a distance of not less than 1 m each side of the centre-line of the outermost fire hydrant pipe risers within the assembly, provided a minimum width of 3 m is achieved;
 - (iii) extends to a height not less than 2 m above ground level; and
 - (iv) is located immediately behind the fire hydrant and between the building and the fire hydrant.

7.6.3 Non-sprinkler-protected buildings — Passive and active protection requirements

Where a fire brigade booster assembly is within or affixed to the facade of a non-sprinkler-protected building containing the principal pedestrian entrance, the provisions of [Clause 7.6.2](#) need not be applied, if —

- (a) the fire brigade booster assembly adjoins a fire compartment that has a floor area less than 500 m²;
- (b) the external wall of the fire compartment that adjoins the fire brigade booster assembly has an FRL not less than -/60/60;
- (c) any opening in the external wall of the fire compartment that adjoins the fire brigade booster assembly is protected as follows:
 - (i) The doors are self-closing or automatic closing, protected by internal wall wetting sprinklers, for the whole of the doorway, or a -/60/30 fire door.
 - (ii) The windows are permanently fixed in the closed position or automatic closing and protected by internal wall-wetting sprinklers for the whole of the window.
 - (iii) Ventilation intake, service penetration, void or other openings are protected internally by construction having an FRL not less than -/60/- for the whole of the opening.
 - (iv) In relation to any glazed part of openings, doors or walls, the glazed part of the opening or wall is not less than 6 mm toughened glass.
- (d) The wall-wetting sprinklers detailed in Items (c)(i) and (c)(ii) and installed in compliance with the Deemed-to-Satisfy provisions of the NCC are directly connected to the fire hydrant system, capable of being boosted and separately isolated, so that —
 - (i) the isolating valve to the wall wetting sprinklers is provided within the fire brigade booster assembly cabinet; and
 - (ii) the connection of the wall wetting sprinklers to the fire hydrant system is provided downstream of the fire brigade booster connections.

NOTE Where wall wetting sprinklers are proposed to be installed, refer to the NCC for acceptable methods of protection.

- (e) the isolating valve of the wall wetting sprinklers shall be identified by a permanently affixed, fade- and weather-resistant sign, stating the following in uppercase letters not less than 25 mm high, in a colour contrasting with the background:

WALL WETTING SPRINKLERS ISOLATING VALVE

- (f) the fire brigade booster assembly is located not less than 2 m from another fire compartment.
- (g) the internal walls of the fire compartment achieve the fire resistance level for a fire wall for the relevant building class as required by the NCC.

Section 8 Pipework design and installation

8.1 General

Pipework used in a fire hydrant system shall be —

- (a) capable of withstanding the range of pressures the system will be subjected to during commissioning and testing; and
- (b) sized to provide the design flows;
- (c) installed in accordance with AS/NZS 3500.1;
- (d) supported and anchored in accordance with [Section 10](#); and
- (e) protected from mechanical damage.

NOTE Pipes, valves and fittings should be selected to suit the expected soil conditions (e.g. corrosive soils), the temperature range (e.g. freezing), the conditions of the area and the water to be used within the system.

8.2 Ground conditions

Where the fire hydrant system pipework will be installed in ground, provision shall be made in the fire hydrant system design to support the pipework and cater for the effects of ground movement, including mine subsidence.

8.3 Fire mains

The fire main shall be sized by hydraulic analysis so that the hydraulic design parameters of the fire hydrant system are in accordance with [Section 2](#). Additionally, the fire main shall have nominal diameters of not less than —

- (a) DN 100;
- (b) DN 80 for any pipe or fitting, not exceeding 10 m hydraulic equivalent length, connecting a single fire hydrant outlet to a fire main (see Note 3); and
- (c) DN 65 for the hydrant valve connection where it connects to a reducer and shall not exceed 100 mm in length between the reducer and the fire hydrant valve.

NOTE 1 DN in this document refers to nominal internal diameter (ID) of pipe and fittings.

NOTE 2 Polyethylene (PE) pipe conforming to AS/NZS 4130 is classified by outside diameter (OD), in accordance with international standards, not internal diameter (ID). Accordingly, where a polyethylene (PE) fire main is required to satisfy [Clause 8.3\(a\)](#), then DN 125PE should be specified.

NOTE 3 The length of DN 80 pipe permitted to be used, including fittings, is to have a friction loss not exceeding that for 10 m of straight DN 80 pipe.

8.4 External pipework

Where the characteristics of the site or building allow, external pipework shall be located below ground, however where site or building constraints prevent the pipework being installed below ground, the following shall apply.

- (a) Where the external pipework is supported by the external wall or roof of the subject building, the pipework shall be protected from damage by fire by one of the following methods:
 - (i) The building shall be protected by an automatic fire sprinkler system in accordance with AS 2118.1, AS 2118.4, AS 2118.6, FPAA101D or FPAA101H; or

- (ii) The walls, columns, floors, beams, or roof of the building shall have an FRL not less than 60/-/-.
- (b) Where external pipework is situated in an area subject to freezing, the pipework shall be protected from the effects of freezing.

8.5 Internal pipework

8.5.1 General

Where internal above-ground pipework is installed, it shall be protected from damage by fire by one or more of the following:

- (a) An automatic fire sprinkler system that conforms to AS 2118.1, AS 2118.4, AS 2118.6 FPAA101D or FPAA101H.
- (b) Support by walls, columns, floors, beams, or roofs having an FRL not less than 60/-/- and pipe supports and hangers having an FRL not less than 60/-/-.
- (c) Installation in a fire-isolated stair or fire-resisting shaft.
- (d) Protection by construction capable of resisting the effects of fire for not less than 60 min.

NOTE For fire rating of pipework support, see [Clause 10.4.1](#).

8.5.2 Copper pipe

Where copper pipe is used internally within a building that is not protected throughout by a fire sprinkler system conforming to AS 2118.1, AS 2118.4, AS 2118.6, FPAA101D or FPAA101H, the pipework shall be —

- (a) protected using materials that provide an FRL not less than -/60/60/;
- (b) installed in a fire-isolated stair or fire-resisting shaft; or
- (c) located above a ceiling system that achieves a resistance to the incipient spread of fire for a period of not less than 60 min.

8.6 Ring main

8.6.1 General

Where a building has an effective height more than 25 m or the building is classified as a large isolated building, the following shall apply:

- (a) Ring mains shall be provided to supply the fire hydrants of the building.
- (b) If two or more ring mains are installed within the building, subject to the limitation detailed in Item (c), the ring mains shall be interconnected by not less than 2 pipe feeds.
- (c) If a cascade fire hydrant system design is installed, not more than three ring mains shall be interconnected within the building.

NOTE The inclusion of a ring main in a design increases the reliability of a fire hydrant system and results in a fire hydrant system that can still operate in cases where localized damage occurs in a fire.

8.6.2 Design criteria

8.6.2.1 Buildings having an effective height more than 25 m

Where a building has an effective height more than 25 m or a tower in a multi-tower development has an effective height more than 25 m, the following shall apply:

- (a) Each ring main shall be able to be isolated in 20 % to 33 % increments and maintain not less than 50 % of the fire hydrants for each fire compartment.
- (b) Pipe risers shall be installed in fire-isolated stairs or fire-isolated shafts.
- (c) Pipe risers feeding the same zone of protection shall not be located in the same shaft except where scissor stairs are provided.
- (d) Interconnection of the ring main pipe risers shall be located at intervals less than 45 m and be within the physical limits of the pressure zone they serve.

8.6.2.2 Large isolated buildings

Where a building is classified as a large isolated building and has an effective height not more than 25 m, the following shall apply:

- (a) Each ring main shall be able to be isolated in 20 % to 33 % increments and maintain not less than 50 % of the fire hydrants for each fire compartment.
- (b) Where fire hydrant pipe risers are required, risers shall be installed in fire-isolated stairs or fire-isolated shafts, where provided.
- (c) Where an external ring main is installed, it shall surround the entire building.

8.7 Isolating valves

8.7.1 General

Isolating valves shall be secured or locked in the open position, except —

- (a) where fitted to a large- or small-bore suction as required in [Clause 5.3.1.1\(f\)](#), the valve shall be secured or locked in the closed position; and
- (b) where a key-operated sluice valve is installed below-ground as specified in [Clause 9.3.2.2\(a\)](#), the valve shall not be locked.

8.7.2 Location

Isolating valves shall be located as follows:

- (a) Where installed within a building, located not more than 2.4 m to the valve handle above the FFL of the building and in accordance with [Clause 9.3.2.1](#) for above-ground isolating valves.
- (b) Where installed within a building —
 - (i) in a fire-isolated stair;
 - (ii) in a plant, tank, or pump room; or

- (iii) where fire-isolated stairs are not provided, not more than 4 m from an exit that leads to a road or open space.
- (c) Where installed in a fire hydrant system incorporating a ring main —
 - (i) on each arm of the ring main, adjacent to the connection with the supply pipe;
 - (ii) on branches into buildings, adjacent to the tapping in the ring main;
 - (iii) on branches supplying more than one fire hydrant, adjacent to the tapping in the ring main;
 - (iv) on branches supplying a sub-ring main, adjacent to the tapping in the ring main;
 - (v) on any supply pipe feeding a ring main, adjacent to the tapping in the ring main;
 - (vi) on any interconnection within the ring main, on the cross-connecting pipe adjacent to the ring main, and on the ring main on each side of the cross-connecting pipe; and
 - (vii) on the ring main so that the isolating requirements of [Clauses 8.6.2.1\(a\)](#) and [8.6.2.2\(a\)](#) are met, as applicable.
- (d) Where a fire brigade booster assembly is installed in accordance with [Clause 7.5.1](#).
- (e) Where a pressure-reducing valve station is installed in accordance with [Clause 8.13.3](#).

8.8 Interconnections

Where interconnections occur between different water sources, the integrity and water quality of the different water sources shall not be compromised by the connections.

NOTE Refer to the NCC and AS/NZS 3500.1 for information on interconnections between different water sources.

8.9 System monitoring

8.9.1 General

Where a building has an effective height more than 25 m, the following shall apply:

- (a) The fire hydrant system shall be continuously monitored.
- (b) All signals from any of the components to be monitored in accordance with [Clause 8.9.5](#) shall initiate both an audible and LED visual alarm at the fire detection control and indicating equipment (FDCIE) conforming to Item (f).
- (c) Fire hydrant system valve monitoring tamper events may be displayed as a common LED indication but must provide individual tamper location identification at the FDCIE.
- (d) Monitored pump fault conditions may be displayed as a common LED indication for each pump but must provide individual fault condition indication at the pump controller.
- (e) The severing of a connection to a monitored component shall initiate an audible and visual fault condition at the FDCIE conforming to Item (f).
- (f) The FDCIE shall conform to AS 4428.1 or AS 7240.2.

8.9.2 Class A monitoring devices

Class A monitoring devices shall conform to AS 4118.1.4 and 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 FDCIE.

8.9.3 Class B monitoring devices

Class B monitoring devices 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 FDCIE.

8.9.4 Monitoring devices required

Class A monitoring devices shall be installed except where a component to be monitored in accordance with [Clause 8.9.5](#) can be located within a secured area or room with access restricted by means of a security device or system. In such cases, a Class B monitoring device may be installed.

8.9.5 Components to be monitored

The FDCIE detailed in [Clause 8.9.1\(f\)](#) shall monitor for the following:

- (a) The tampering of any water supply isolating valve, including those at the backflow prevention device but excluding underground key operated valves.
- (b) The tampering of any isolating valve on the fire hydrant system fire main, including those at the fire brigade booster assembly but excluding underground key operated valves.
- (c) The tampering of any water supply isolating valve at a pressure-reducing valve station.
- (d) The failure of the power supply of each electric motor-driven pump.
- (e) All conditions that may prevent the starting or running of each compression ignition engine-driven pump including low battery voltage, PSE battery charger failure, and oil pressure.
- (f) The fuel level at or below the required four hour level for each compression ignition engine-driven pump.

8.10 Test facility

8.10.1 General

Where the building has a rise in storeys not more than two, and flow testing is able to be undertaken from an external fire hydrant, and the water from this testing can be discharged safely into the building's drainage system, a permanent test facility within the building and associated drainage is not required. In all other cases, permanent test facilities and associated drainage shall be provided to serve each pressure zone.

Where multiple stairs serve the upper most storey, the test facility and associated drainage shall be provided in the stair that allows for the testing of the most hydraulically disadvantaged fire hydrants in the pressure zone. Where scissor stairs are provided, the test drain may cross over between stairs as it descends.

NOTE For more information on commissioning and flow and pressure testing, see [Section 12](#).

8.10.2 Permanent test facility

Permanent test facilities shall —

- (a) provide a point at which a portable test gauge and flow sensing element are able to be connected;
- (b) include valving to allow the connection, disconnection and operation of the test gauge and flow sensing element;
- (c) provide a permanent test drain in accordance with [Clause 8.10.3](#);
- (d) include fittings with pressure rated blank cap or plug that allow for the connection of firefighting hose to the permanent test drain;
- (e) be provided at the most hydraulically disadvantaged point or points serving each pressure zone to enable the required number of fire hydrant(s) to be tested; and
- (f) enable the fire hydrant system to be flow tested at not less than 130 % of the highest system design pressure and flow rates shown on the block plan.

NOTE 1 For more information on the test facility to be provided, see [Appendix N](#).

NOTE 2 The pressure-rated blank cap or plug provided should be capable of remaining watertight when subjected to the pressures likely to be applied in their location within the drainage system.

8.10.3 Permanent test facility drainage

Where test facilities provided under [Clause 8.10.2](#) are located within or need to drain through the building, drainage provisions shall be permanently provided to each pressure zone for the purposes of commissioning and routine service. Permanently fixed test drains shall —

- (a) conform to the requirements for above-ground pipe specified in [Clause 9.2.1](#), to point of discharge to atmosphere;
- (b) have a pressure rating and a flow capacity in accordance with [Clause 8.10.1](#);
- (c) be suitably treated to resist corrosion such as galvanising or be of a material that is resistant to the effects of corrosion; and
- (d) enable the fire hydrant system to be flow tested at not less than 130 % of the highest system design pressure and flow rates shown on the block plan.

NOTE 1 Wherever possible the test drainage facility should be arranged to allow for the recycling or reuse of the discharge water.

NOTE 2 The permanent test facility drainage provided may be shared with other fire systems.

Where the permanent test facility drainage discharges to atmosphere the design documentation shall nominate the maximum flow, pressure, and velocity at the point of discharge.

8.10.4 Reduced-capacity tank test facility

Where a reduced-capacity tank is used as part of the fire hydrant system water supply, a flow test facility shall be installed at the automatic infill supply pipe work to the tank.

The permanent test facility installed shall —

- (a) provide an element socket located less than 2.4 m above the ground or floor level at which a residual pressure gauge and flow sensing element is able to be connected;

- (b) include valving to allow the connection, disconnection and operation of the test gauge and flow sensing element; and
- (c) be sized to measure the automatic infill rate as shown on the block plan.

NOTE 1 Where automatic diaphragm valves are installed external of the tank, a DN 15 drain valve may be fitted to the diaphragm to operate the valve so that the flow can be initiated during flow testing from ground level.

NOTE 2 Where inflow testing requires access to the top of the tank for valve operation, a safe and permanent access facility should be provided to safeguard the technician undertaking the test.

NOTE 3 Where an element socket is required to be located more than 2.4 m above the ground or floor level, a permanent access platform should be provided.

NOTE 4 For more information on flow test facility configurations serving a reduced-capacity tank, see [Appendix N](#).

8.11 Fire hose reel service isolating valves

Where a fire hose reel service exceeds DN 25 or serves two or more fire hose reels and is connected to a fire hydrant system, it shall have —

- (a) an isolating valve fitted at the point of connection above ground or in an accessible pit; and
- (b) each isolating valve shall be secured in the open position by a padlocked metal strap or device and have attached an engraved non-ferrous metal tag having capital letters of not less than 8 mm high stating the following:

FIRE SERVICE VALVE
CLOSE ONLY TO SERVICE FIRE HOSE REELS.

8.12 Pressure management

Where pressure is required to be controlled or reduced within a fire hydrant system, the pressure within the system shall be controlled by one or a combination of the following devices:

- (a) Pressure-reducing valves (PRV).
- (b) Proportional pressure-reducing valves (PPRV).
- (c) Ratio-reduction valves (RRV).
- (d) Break tanks.
- (e) Pressure-reducing fire hydrant valves.

8.13 High-rise design criteria

8.13.1 General

Where a building has an effective height more than 50 m and not more than 135 m, each pressure zone shall —

- (a) be not more than 45 m in height, measured from the most hydraulically advantaged to the most hydraulically disadvantaged points;
- (b) be supplied from not less than two independent pipe risers, located in separate fire stairs or shafts, except where scissor stairs are provided then the pipe risers may be located within the same fire stair; and

- (c) not include pressure-reduction valves on the pipework between the fire brigade booster connection and the ring main.

8.13.2 Bottom-up fire hydrant system design

Where a bottom-up fire hydrant system design is implemented, the following shall apply:

- (a) Each pressure zone shall be fed from not less than two independent pipe riser feeds conforming to [Clause 8.13.1\(b\)](#).
- (b) The fire brigade booster assembly and associated pipework shall be configured so that a fire brigade pumping appliance can boost each pressure zone.

NOTE For information on bottom-up system design, see [Figures N.5\(A\)](#) and [N.5\(B\)](#).

8.13.3 Cascade fire hydrant system design

Where a cascade fire hydrant system design is implemented, the following shall apply:

- (a) A maximum of three pressure zones shall be linked by pressure-reducing devices.
- (b) The uppermost pressure zone (ring main), in each group of three pressure zones, shall be supplied from not less than two independent pipe feeds conforming to [Clause 8.13.1\(b\)](#).
- (c) The pressure between the interconnected pressure zones shall be controlled by one, or a combination, of the following pressure-reducing devices:
 - (i) Pressure-reducing valve (PRV).
 - (ii) Proportional pressure-reducing valve (PPRV).
 - (iii) Ratio-reduction valve (RRV).
 - (iv) Break tanks.
- (d) Not less than two pressure-reducing devices shall be installed in parallel on the same storey between interlinked pressure zones so an appropriate level of redundancy is provided and to facilitate the removal of either valve for servicing.
- (e) Each pressure-reducing device shall be located in a different fire-isolated stair and be connected to a different pipe supplying the ring main below.
- (f) Where three pressure zones are connected, and pressure-reducing devices are required to be installed in series to control pressure across the three zones, only one pilot regulator controlled PRV may be installed in each descending pipe “leg” of the cascade fire hydrant system design.
- (g) Where a pilot regulator controlled PRV is installed in accordance with Item (e), the other valves connected in series in the descending pipe leg shall be either a ratio reduction valve or proportional PRV.
- (h) Where a pressure-reducing valve station is installed, pressure relief valves or pressure relief valves and air release valves shall be installed on the low pressure side of the valve.
- (i) The fire brigade booster assembly and associated pipework shall be configured so that a fire brigade pumping appliance can boost each pressure zone.

NOTE For information on cascade systems design, see [Figures N.5\(C\)](#) and [N.5\(D\)](#).

8.13.4 Pressure-reducing valve station

Where a dual PRV, PPRV or RRV is provided as specified in [Clause 8.13.3\(c\)\(i\)](#), [8.13.3\(c\)\(ii\)](#) or [8.13.3\(c\)\(iii\)](#) to manage pressure, the following shall apply:

- (a) The PRV, PPRV or RRV shall be of the type in which the controlling mechanism is operated in conjunction with water flow through the valve from —
 - (i) the low-pressure side; or
 - (ii) the differential pressure across the valve.
- (b) Isolating valves shall be installed on either side of each PRV, PPRV or RRV to facilitate the removal of the valve for servicing.
- (c) Test facilities in accordance with [Clause 8.10](#) shall be provided for —
 - (i) monitoring the pressure on the pressure-reduced side of the valve; and
 - (ii) testing the pressure-reducing valve.
- (d) Where reverse flow under boost conditions is required as part of the fire hydrant system design approach, each PRV or RRV shall be provided with a full flow bypass incorporating —
 - (i) a full flow non-return valve; and
 - (ii) two isolating valves, one on either side of the non-return valve detailed in Item (i).

Section 9 Pipes, valves and fittings

9.1 General

The pipes, valves and fittings used in the fire hydrant system shall be supplied new and have a pressure rating that will ensure the fire hydrant system design is capable of meeting the system performance pressures and flows required by [Section 2](#).

Pipes, valves and fittings shall be listed or conform to the relevant product Standards specified in [Clauses 9.2.1](#), [9.2.2](#) and [9.2.3](#).

NOTE Manufacturers, fabricators and suppliers that make declarations of conformance to these requirements or designated Australian Standards in relation to the suitability of a product should be able to substantiate such conformance.

9.2 Pipe, valves and fittings specifications

9.2.1 Above-ground pipework

Pipes and fittings used in above-ground fire hydrant installations shall meet the requirements of one of the following, as applicable:

- (a) Steel tubes and pipes shall conform to AS 1074, AS 1579, AS 1769, AS 4728, ASTM A53, ASTM A106, ASTM A135/A135M, or ASTM A795/A795M, as applicable.

NOTE For more information on steel fittings, see [Clause 9.2.3](#).

- (b) Steel butt weld fittings shall conform to ASTM A234.
- (c) Malleable cast iron threaded pipe fittings shall conform to BS EN 10242.
- (d) Ductile iron pipes and fittings shall conform to AS/NZS 2280.
- (e) Ductile iron fittings shall be coated and lined in accordance with AS/NZS 4158 or hot dipped galvanised in accordance with AS/NZS 3500.1.
- (f) Copper tubes shall conform to AS 1432 or AS 1572 and be installed in accordance with AS 4809. The wall thickness of copper tubes shall be not less than stated in AS 1432 for Type B material.
- (g) Fittings for copper pipes shall conform to AS 3688.
- (h) Stainless steel pipes and tubes shall conform to AS 5200.053.
- (g) Stainless steel fittings shall conform to AS 3688.

9.2.2 Below-ground pipework

Pipes and fittings used in below-ground pipework shall meet the requirements of one of the following, as applicable:

- (a) Steel tubes and pipes shall conform to AS 1074, AS 1579, AS 1769, AS 4728, ASTM A135/A135M, ASTM A53 or ASTM A106, as applicable.

NOTE For more information on steel fittings see [Clause 9.2.3](#).

- (b) Steel butt weld fittings shall conform to ASTM A234.
- (c) Malleable cast iron threaded pipe fittings shall conform to BS EN 10242.
- (d) Ductile iron pipes and fittings shall conform to AS/NZS 2280.

- (e) Ductile iron fittings shall be coated and lined in accordance with AS/NZS 4158 or hot dipped galvanised in accordance with AS/NZS 3500.1.
- (f) Copper tubes shall conform to AS 1432 or AS 1572 and be installed in accordance with AS 4809. The wall thickness of copper tubes shall not be less than stated in AS 1432 for Type B material.
- (g) Fittings for copper pipes shall conform to AS 3688.
- (h) Stainless steel pipes and, tubes and fittings of Grades 316 and 304 shall conform to ASTM A312, ASME B36.19M or ASTM A403. AS 5200.053.
- (i) Stainless steel fittings shall conform to AS 3688.
- (j) Plastics pipe and pipe fittings shall conform to AS/NZS 1477, AS/NZS 4129, AS/NZS 4130, AS/NZS 4441 or AS/NZS 4765, as applicable.

Where rubber ring-jointed pipes and fittings or any plastics pipe and fittings are used in buried applications, they shall have a detectable marking tape laid in the trench and attached to the hydrants at either end of systems and branches.

NOTE In some circumstances, water agencies may not approve the use of certain types of pipes below ground.

9.2.3 Additional requirements for steel pipe and fittings

9.2.3.1 General

Where steel pipes and fittings are used in a fire hydrant system the following additional provisions apply:

- (a) Where steel pipes and fittings are not cement lined and polymeric coated, or both polymeric lined and coated, they shall be hot-dip galvanized in accordance with AS/NZS 4792 or AS/NZS 4680 with a minimum zinc coating of 300 g/m². Any disturbance of the galvanized coating by cutting, roll-grooving or handling shall be repaired with a zinc-rich coating or equivalent in accordance with AS/NZS 4792.
- (b) Where steel pipes and fittings are used below ground, they shall be protected from corrosion in accordance with [Clause 9.8](#).
- (c) Where steel pipes and fittings are used, they shall meet the wall thickness requirements specified in [Table 9.2.3.1](#).
- (d) Where shouldered fittings and couplings are used, shoulder rings shall be welded to the pipes and fittings prior to hot-dip galvanizing.

Table 9.2.3.1 — Steel pipe and fittings — Minimum wall thickness

Connection method	Welded, threaded, cut grooved or roll grooved		Roll grooved
	Heavy mm	Medium mm	Light/sched 10-20 mm
DN 65	4.5	3.6	3.05
DN 80	5.4	4.0	3.05
DN 100		4.5	3.05
DN 125, DN 150		5.0	3.40
DN 200, DN 250		6.35	4.78
> DN 250		9.5	6.35

9.2.3.2 Galvanized steel pipe and fittings

Galvanized steel pipes, fittings, flanges and couplings shall only be used —

- (a) downstream of a non-return valve or backflow prevention device in the water supply from the network utility operator main, or
- (b) belowground for individual fire hydrant pipe risers that—
 - (i) do not exceed 1.5 m in length;
 - (ii) are double wrapped with a petrolatum tape in accordance with [Clause 9.8.3](#) for the entire length containing the fitting, flange or coupling;
 - (iii) are heavy duty for sizes up to and including DN 80 and not less than medium duty for sizes greater than DN 80; and
 - (iv) do not include roll groove fittings or couplings.

9.3 Valve specifications

9.3.1 Fire hydrant valves

Above-ground fire hydrant valves shall —

- (a) be DN 65;
- (b) have outlet connections for use with the local fire brigades' firefighting equipment; and
- (c) conform to AS 2419.2.

NOTE For information on fire hose couplings used in Australia, see [Appendix Q](#).

9.3.2 Isolating valves

9.3.2.1 Above-ground isolating valves

Where isolating valves are installed above-ground, the following apply:

- (a) The valve shall be in accordance with [Clause 9.2](#).
- (b) The valve shall be weather-resistant.
- (c) The valve shall be either —
 - (i) a full-flow OS&Y wheel-operated gate valve of the indicating type conforming to AS/NZS 2638.1 or AS/NZS 2638.2;
 - (ii) a low-torque wheel-operated multi-turn post-indicator ball valve; or
 - (iii) a gear-operated butterfly valve with all metal actuating mechanisms.
- (d) The valve shall be closed by rotating the wheel clockwise.
- (e) Where used as a pump isolating valve, the valve shall be installed in accordance with AS 2941.
- (f) Where required to be secured in the open position, the valve shall have a fade and weather resistant plate permanently affixed to the valve body with uppercase letters not less than 8 mm high, in a colour contrasting with the background, stating "FIRE MAIN VALVE *nn* — SECURE OPEN", where *nn* denotes the valve number as per the block plan.

9.3.2.2 Below-ground isolating valves

Where isolating valves are installed below ground, the following apply:

- (a) If not installed in a fully drained pit, the valve shall be a key-operated sluice valve conforming to the relevant parts of AS/NZS 2638.1 and AS/NZS 2638.2.
- (b) If installed in a fully drained pit, the valve shall be —
 - (i) weather resistant full-flow OS&Y wheel-operated gate valves of the indicating type conforming to AS/NZS 2638.1 or AS/NZS 2638.2;
 - (ii) weather resistant low torque wheel-operated multi-turn post-indicator ball valves; or
 - (iii) weather resistant gear-operated butterfly valves with all metal actuating mechanisms.
- (c) The valve shall be closed by rotating the wheel clockwise.
- (d) Each valve shall be identified by either a post, reflective marker, reflective paint (on access covers) or permanent ground marking indicating the valve number on the block plan. The marking shall be fade- and weather-resistant and —
 - (i) state, in uppercase letters not less than 25 mm high, in a colour contrasting with the background, "FIRE MAIN VALVE *nn* — SECURE OPEN", where *nn* denotes the valve number as per the block plan; and
 - (ii) include, a directional arrow that indicates the direction of operation (open or closed).

9.3.3 Non-return valves

Non-return valves shall be single-disc full-flow swing check or tilting disc check valves conforming to AS 4794 or the requirements of [Clause 9.2](#).

NOTE Swing check or tilting disc check valves installed vertically should have upwards flow direction.

9.3.4 Backflow prevention devices

Backflow prevention devices shall conform to AS/NZS 2845.1.

9.4 Fire brigade booster connections

Fire brigade booster connections shall —

- (a) have DN 65 inlet/s;
- (b) have inlet connections compatible for use with the local fire brigades' firefighting equipment;
- (c) have outlet connections as follows:
 - (i) Minimum DN 65 for single inlet booster connection.
 - (ii) Minimum DN 100 for dual (2) inlet booster connection.
 - (iii) Minimum DN 150 for quad (4) inlet booster connection.
- (d) have a PN rating suitable for use with the fire brigade boost pressures specified in [Table 12.4.3](#); and
- (e) conform to AS 2419.3.

NOTE 1 For information on fire hose couplings used in Australia, see [Appendix Q](#).

NOTE 2 The PN rating for fire brigade booster connections is PN14, PN21 or PN35.

9.5 Metal pipe joints

9.5.1 General

Metal pipes, valves and fittings used in the fire hydrant system shall —

- (a) be joined by screwed, grooved, shouldered or flanged ends, welding, brazing or by use of compression systems; and
- (b) conform to AS/NZS 3500.1 and the requirements of this section.

9.5.2 Roll-grooved fittings and couplings

9.5.2.1 Galvanized steel pipe

Where galvanized steel pipe is used, fittings shall be hot-dip galvanized and coupling housings shall be either hot-dip galvanized or polymeric-coated ductile iron. Where the galvanising occurs post-grooving of the pipework, the groove depth shall be measured post galvanising and verified to be within rolled groove coupling manufacturer's tolerances for the applicable pipe diameter.

9.5.2.2 Stainless steel

Where stainless steel pipe is used, fittings shall be stainless steel and couplings shall be either stainless steel or polymeric-coated ductile iron and conform to AS 3688.

9.5.2.3 Copper tube

Where copper tube is used, fittings shall be either copper or copper alloy and couplings shall be either copper paint-treated ductile iron or polymeric-coated ductile iron and conform to AS 3688.

9.5.3 Shouldered fittings and couplings

Shouldered fittings and couplings shall be made from galvanized steel or either galvanized or polymeric-coated ductile iron.

9.5.4 Compression systems

9.5.4.1 Compression type couplings

Compression type couplings shall be stainless steel, hot-dip galvanized or polymeric-coated in accordance with [Clause 9.8.4](#).

9.5.4.2 Press fit type systems

Press fit type systems shall only be used on copper or stainless steel pipework conforming to AS 3688.

9.5.5 Gasket seals

All rubber gasket seals used in roll-grooved or compression-type couplings shall be ethylene propylene diene monomer (EPDM) or nitrile moulded synthetic rubber.

9.5.6 Brazed joints in copper pipework

Brazed joints, either in copper piping or between copper pipe and fittings, shall be made using a silver brazing filler material conforming to Types B2, B3 or B4 of AS/NZS 1167.1 and to AS 4809.

On-site brazing shall be carried out in accordance with AS 1674.1.

Soft solder shall not be used in the jointing of copper pipe or fittings.

9.5.7 Flange joints

Where flange joints are used in a fire hydrant system —

- (a) Flanges shall conform to AS 2129 or AS/NZS 4087.
- (b) Flanges shall be compatible with one another, including material, face profile, pitch circle diameter (PCD), number and orientation of bolt holes.
- (c) Bolting shall conform to AS/NZS 4087.
- (d) Nuts shall be fully engaged with bolts, with a maximum five threads visible beyond the nut.
- (e) Any disturbance of the galvanized coating of bolts by cutting shall be repaired with a zinc-rich coating or equivalent conforming to AS/NZS 4792.
- (f) Sealing gaskets and O rings for flanges shall conform to WSA 109.

NOTE For further information on bolting compatibility between flanges conforming to either AS 2129 or AS/NZS 4087, refer to AS/NZS 4087.

9.6 Plastics pipe joints

Jointing of polyvinyl chloride (PVC-U, O and M) pipe and associated fittings shall conform to the jointing methods specified in AS/NZS 2032.

Jointing of polyethylene (PE) pipe and associated fittings shall be in accordance with the jointing methods specified in AS/NZS 2033.

9.7 Pipe marking

9.7.1 Steel pipe

Each straight length of pipe shall be marked permanently, throughout its length, with the information given below, at intervals not exceeding 2 m, in lettering with a minimum height of 10 mm:

- (a) Manufacturer's name (e.g. XYZ Steel Company).
- (b) Diameter (e.g. DN 100 or 114.1).
- (c) Thickness (e.g. medium or 3.04 mm or SCH 10).
- (d) Standard number (e.g. AS 1074 or ASTM A53 Grade B).
- (e) Maximum working pressure (in kPa WP).
- (f) Brand.
- (g) Listing reference (e.g. CSIRO, UL or FM number) and associated conforming specification (e.g. AS 2419.1 and AS/NZS 4792.).
- (h) Galvanizing specification (e.g. AS/NZS 4680).

- (i) Traceability number (e.g. heat number, manufacture date).
- (j) Other information.

9.7.2 Copper pipe

Marking of copper pipe shall conform to AS 1432.

9.7.3 Stainless steel pipe

Marking of stainless steel pipe shall conform to AS 5200.053.

9.7.4 Plastics pipe

Marking of plastics pipe shall conform to AS/NZS 1477, AS/NZS 4130, AS/NZS 4441 or AS/NZS 4765, as appropriate, for the type of pipe used.

9.8 Corrosion protection

9.8.1 General

Fire hydrant pipework and supports shall be protected against corrosion.

NOTE 1 For guidance on iron and steel pipe, refer to AS/NZS 2312 and AS 2832.2.

NOTE 2 For information on corrosion protection, see [Appendix R](#).

9.8.2 Polyethylene extruded plastics coating and tape

For below-ground fire mains that are polyethylene coated, the extruded sleeve or tape shall be of high-density polyethylene plastics, applied over the hot-dip galvanized pipe. Minimum coating thickness for all hydrant pipe diameters shall be 1.0 mm thickness polyethylene, applied in accordance with AS/NZS 1518.

Loose polyethylene sleeving shall not be used as in-ground corrosion protection of stainless steel or galvanized pipe and fittings.

9.8.3 Petrolatum tape coating

Where galvanized steel pipe risers are installed in ground and copper, and stainless steel pipe are installed in aggressive soils, they shall be double wrapped in petrolatum tape. The second wrapping shall be in the opposite direction and overlap by 50 %. The coating shall then be overwrapped with a self-adhesive polyethylene tape.

9.8.4 Polymeric coating

Where a polymeric coating is applied to pipe, couplings or fittings, it shall conform to AS/NZS 3862, AS/NZS 4158 or AS 4321.

9.8.5 Cement mortar lining

Where cement mortar lining is applied for internal corrosion protection, it shall conform to AS 1281.

Section 10 Pipe supports

10.1 General

Pipe supports for a fire hydrant system shall be —

- (a) capable of withstanding the stresses, loads and permanent actions that may be imposed on the support system from all external causes, including—
 - (i) the differential movement of the building structure under normal and fire conditions;
 - (ii) the transmission of vibration from the building to the fire hydrant system pipework and from the pipework to the building; and
 - (iii) if located in an area where a seismic event is likely, the actions imposed by such an event;
- (b) capable of withstanding the stresses, loads and permanent actions that may be imposed on the support system from all internal causes, including —
 - (i) pressure reactions, hydraulic shock and the transmission of vibration resulting from the commissioning of the system, ongoing maintenance, and the normal operational use by the attending fire brigade; and
 - (ii) the dead loading resulting from the combined weight of piping and the water within a fire hydrant system and any other system if applicable (for example, the dead loads imposed by a sprinkler system sharing the same pipe support);
- (c) protected from the effects of corrosion; and
- (d) isolated from the fire hydrant pipework where dissimilar metals are used.

NOTE It is good practice to support each pipe so that mechanical couplings are not loadbearing.

10.2 Pipe support design

10.2.1 General

Pipework associated with fire hydrant systems shall be supported by either —

- (a) a pipe support system, the individual components of which are in accordance with [Clause 10.5](#); or
- (b) pipe supports and fasteners that are capable of supporting twice the mass of the pipework filled with water plus a mass of 115 kg at each point of support.

10.2.2 Sway support

Any sway support system provided shall be independent of the pipe support system.

10.2.3 Pipe support in seismic areas

Where a fire hydrant system is located in an area where a seismic event is likely —

- (a) the sway support system shall be determined by engineering analysis; and
- (b) the importance level used for structural design of the building shall be used to determine the pipe support requirement.

NOTE 1 Refer to the NCC for information on the designation of importance levels.

NOTE 2 For information on the support of non-structural elements and their fastenings in areas of seismic activity, refer to AS 1170.4.

10.3 Materials for pipework support

Pipework supports and components shall be of ferrous material.

The minimum material requirements for the expected range of environments in which a fire hydrant system may be installed shall be as specified in [Table 10.3](#).

Table 10.3 — Minimum material requirements

Environment	Minimum material requirement
Marine atmospheres	316 Stainless steel
Heavy industrial	Stainless steel Hot-dip galvanized or Mechanically plated galvanized
External	Stainless steel Hot-dip galvanized or Mechanically plated galvanized
Internal moist	Hot-dip galvanized or Mechanically plated galvanized

10.4 Protection of pipe supports

10.4.1 Fire rating

In a non-sprinkler-protected building where pipework is likely to be exposed to fire, the pipe supports shall have an FRL not less than 60/-/-, while maintaining a pipe support temperature less than 500 °C when tested in accordance with AS 1530.4 or other measures shall be taken to prevent early collapse of the pipework and supports when exposed to fire.

10.4.2 Corrosion protection

In aggressive environments, or where exposed to weather, all components of supporting systems, including anchors, shall be protected against corrosion.

10.4.3 Dissimilar metals

Except for stainless steel, pipe supports shall be protected from direct contact with copper pipe or pipe fittings.

10.5 Requirements for pipe-support components

10.5.1 General

Pipe support components shall —

- (a) be listed;
- (b) conform to the relevant product Standards specified in [Clauses 9.2.1](#), [9.2.2](#) and [9.2.3](#); or

(c) be tested to confirm that load ratings are in accordance with [Clause 10.2.1\(b\)](#).

All pipe support components shall be marked or stamped with the manufacturer’s name or trademark to provide traceability of components.

NOTE The manufacturer should make available pipe support component installation instructions to reduce the risk of improper installation, misuse or misapplication of support components.

10.5.2 U-bolts used for clamping down

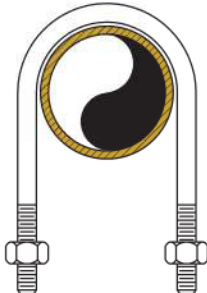
The dimensions of U-bolts that are used for clamping down pipes shall be in accordance with [Table 10.5.2](#).

The thread of the U-bolt shall conform to AS 1275:1985, Table 3.3.

NOTE A typical U-bolt for clamping down is shown in [Table 10.5.2](#).

Table 10.5.2 — U-Bolts used for clamping down — Dimensions

Pipe size DN	Minimum nominal diameter of material mm
80	10
100	10
150	10
200	12
250	12
300	15



10.5.3 U-bolts for clamping up and threaded rods for supporting pipework

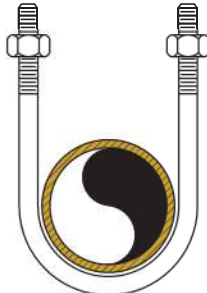
The dimensions for U-bolts that are used for clamping up and for threaded rods for supporting pipework shall be in accordance with [Table 10.5.3](#).

The thread of the threaded rod or U-bolt shall conform to AS 1275:1985 Table 3.3.

NOTE A typical U-bolt for clamping up is shown in [Table 10.5.3](#).

Table 10.5.3 — U-bolts and threaded rods — Dimensions

Pipe size DN	Minimum nominal diameter of material mm
80	12
100	12
150	12
200	15
250	15
300	20

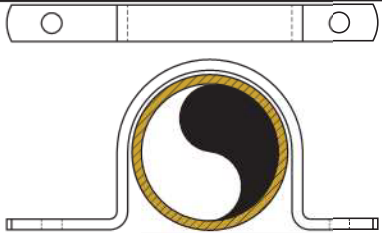


10.5.4 U-hangers/saddles (clips)

The dimensions for U-hangers/saddles shall be in accordance with [Table 10.5.4](#).

NOTE A typical U-hanger/saddle (clip) is shown in [Table 10.5.4](#).

Table 10.5.4 — U-hangers/saddles (clips) — Dimensions

Pipe size DN	Minimum material thickness and width mm	
80	6 × 30	
100	6 × 30	
150	6 × 30	

10.5.5 Saddle brackets and girder or beam clamps

Saddle brackets and girder or beam clamps shall be fabricated from material not less than 6 mm thick and not less than 30 mm wide. For a saddle bracket, the distance between the centres of the fixing holes shall not exceed 240 mm. For a girder or beam clamp, the distance from the edge of the support member to the centre of the rod shall not exceed 80 mm.

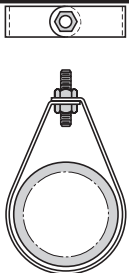
10.5.6 Pear hangers/pipe bands

Pear hangers/pipe bands shall be fabricated as follows:

- For non-corrosive atmospheres, the material shall be in accordance with [Table 10.5.6](#).
- For corrosive atmospheres, the material shall be not less than 3 mm thick.
- The material shall suit the threaded rod sizes specified in [Clause 10.5.3](#).

NOTE A typical pear hanger/pipe band is shown in [Table 10.5.6](#).

Table 10.5.6 — Pear hangers/pipe bands — Dimensions

Pipe size DN	Minimum material thickness and width mm	
80	2 × 32	
100	2 × 32	
150	3 × 40	

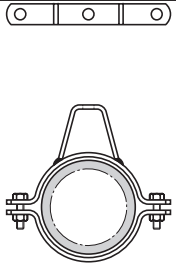
10.5.7 Two-piece bolted clamps

The dimensions for two-piece bolted clamps shall be in accordance with [Table 10.5.7](#).

NOTE A typical two-piece bolted clamp is shown in [Table 10.5.7](#).

Fasteners used for the clamps shall be in accordance with [Table 10.5.3](#).

Table 10.5.7 — Two-piece bolted clamps — Dimensions

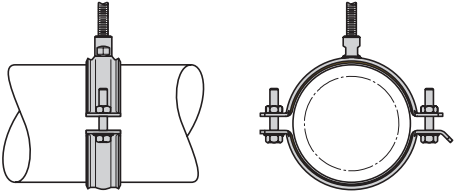
Pipe size DN	Minimum material thickness and width mm	
80	6 × 40	
100	6 × 40	
150	6 × 40	

10.5.8 Welded nut clips and split ring hangers

The dimensions for welded nut clips or split ring hangers shall be in accordance with [Table 10.5.8](#). Welded net clips or split ring hangers shall be formed in accordance with the design requirements of [Clause 10.2](#).

NOTE A typical welded nut clip and split ring hanger are shown in [Table 10.5.8](#).

Table 10.5.8 — Welded nut clips and split ring hangers — Dimensions

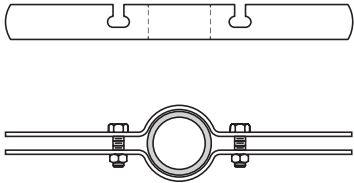
Pipe size DN	Minimum material thickness and width mm	
80	3 × 20	
100	5 × 25	
150	5 × 25	

10.5.9 Riser clamps

The dimensions for riser clamps shall be in accordance with [Table 10.5.9](#).

NOTE A typical riser clamp is shown in [Table 10.5.9](#).

Table 10.5.9 — Riser clamps — Dimensions

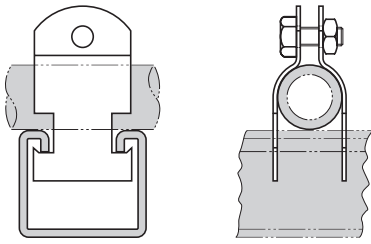
Pipe size DN	Minimum material thickness and width mm	Minimum overall clamp length mm	
80	5 × 30	298	
100	6 × 35	330	
150	6 × 50	406	

10.5.10 Channel/strut clips

The dimensions for channel/strut clips shall be in accordance with [Table 10.5.10](#).

NOTE A typical channel/strut clip is shown in [Table 10.5.10](#).

Table 10.5.10 — Channel/strut clips — Dimensions

Pipe size DN	Minimum material thickness and width mm	Minimum fastener diameter	
80	2.5 × 32	M8	
100	2.5 × 32	M10	
150	3 × 32	M10	

10.5.11 Pipe support beams (trapeze bar)

Pipe support beams shall —

- be fabricated from ferrous material with section modulus equal to or more than those calculated from the material sections specified in [Table 10.5.11\(B\)](#); and
- conform to the dimensions specified in [Table 10.5.11\(A\) or \(B\)](#).

Table 10.5.11(A) — Pipe support beams — Dimensions

Pipe size DN	Nominal size of material, mm	
	Minimum span 2 m	Minimum span 3 m
80	100 × 65 × 8	100 × 75 × 8
100	100 × 65 × 8	100 × 75 × 8
150	100 × 65 × 8	100 × 75 × 8

Table 10.5.11(B) — Pipe support beams — Section modulus

Section modulus required for trapeze members, cm ³								
Trapeze span	Pipe schedule	Nominal diameter of pipe being supported						
		80 mm	90 mm	100 mm	125 mm	150 mm	200 mm	250 mm
0.46 m	10	1.80	1.97	2.13	2.46	2.95	3.93	5.24
	40	1.97	2.13	2.46	2.95	3.61	4.92	6.72
0.61 m	10	2.46	2.62	2.79	3.28	3.93	5.24	7.05
	40	2.62	2.95	3.28	3.93	4.75	6.55	9.01
0.76 m	10	2.95	3.28	3.44	4.10	4.92	6.55	8.85
	40	3.44	3.61	4.10	4.92	5.90	8.19	11.14
0.91 m	10	3.61	3.93	4.26	5.08	5.90	7.87	10.65
	40	4.10	4.42	4.92	5.90	7.05	9.83	13.44
1.2 m	10	4.75	5.24	5.57	6.72	7.87	10.49	14.26
	40	5.41	5.90	6.55	7.87	9.50	13.11	17.86
1.5 m	10	6.06	6.55	7.05	8.36	9.67	13.11	17.70
	40	6.72	7.37	8.03	9.83	11.80	16.39	22.45
1.8 m	10	7.21	7.87	8.36	10.00	11.63	15.90	21.30
	40	8.03	8.85	9.67	11.80	14.26	19.66	26.87
2.1 m	10	8.52	9.01	9.83	11.63	13.60	18.52	24.91
	40	9.50	10.32	11.31	13.77	16.55	23.11	31.46
2.4 m	10	9.67	10.32	11.14	13.27	15.57	21.14	28.35
	40	10.82	11.80	12.95	15.73	19.01	26.38	35.89
2.7 m	10	10.82	11.63	12.62	15.08	17.53	23.76	31.95
	40	12.13	13.27	14.58	17.70	21.30	29.66	40.31
3.0 m	10	12.13	12.95	13.93	16.71	19.50	26.38	35.56
	40	13.44	14.75	16.22	19.66	23.60	32.94	44.90

NOTE Where an unequal angle is used, the longer arm should be vertical.

10.6 Spacing of supports

For copper tubing, the maximum distance between supports for horizontal and vertical pipework shall not exceed 4 m.

For all other piping/tubing, the distance between supports for horizontal and vertical steel fire hydrant pipework shall not exceed those specified in [Table 10.6](#).

Table 10.6 — Spacing of supports

Pipe size DN	Maximum spacing m
≤ 150	4
> 150	5

10.7 Location of supports

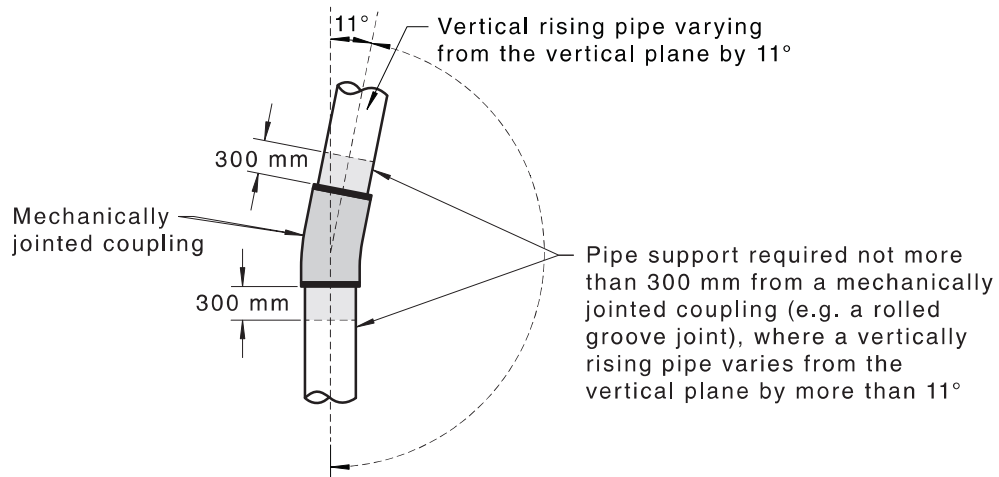
10.7.1 Horizontal pipework

Supports shall be located not further than 1 m from any change in direction or a junction in the pipework (e.g. a bend, elbow, or tee). The distance from the last support to the end of any horizontal pipe shall not exceed 1 m.

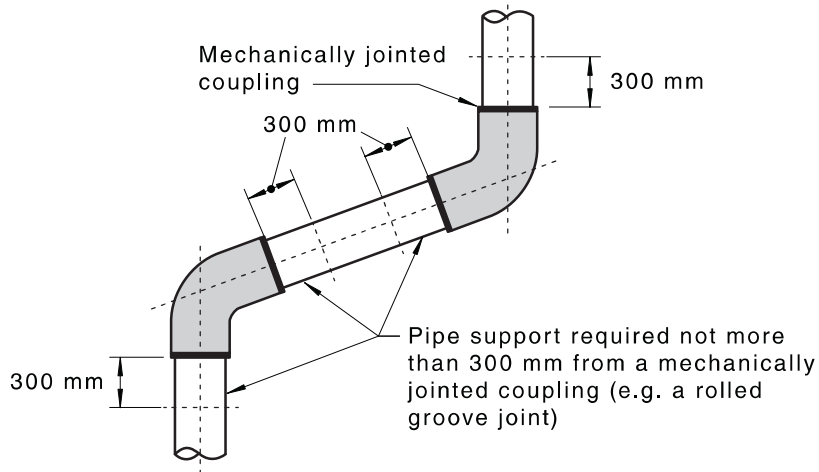
10.7.2 Vertical pipework

Vertical pipework shall be installed as follows:

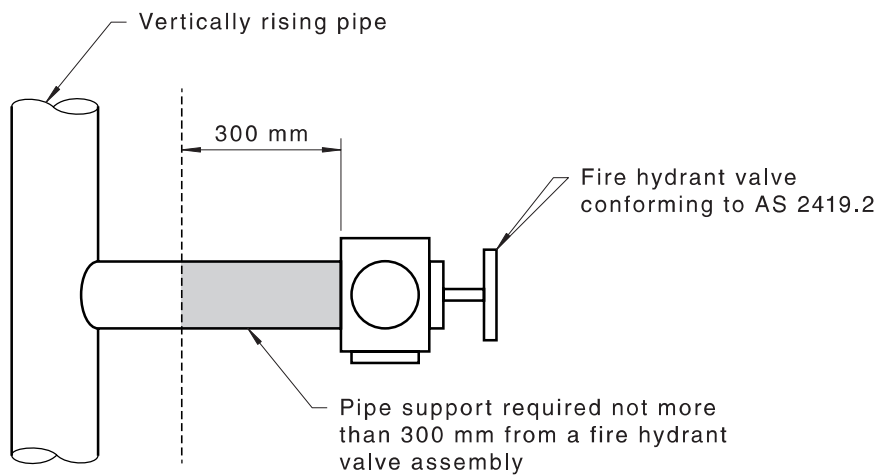
- (a) Vertical pipe risers shall be supported by hangers or riser clamps at each floor level and at intermediate locations, as required. Distances between supports shall be in accordance with [Table 10.6](#).
- (b) Where a vertical rising pipe varies from the vertical plane by more than 11° [see [Figure 10.7.2\(a\)](#)], for the purpose of pipe support, it shall be considered as a change of direction or offset to the vertical rising pipe.
- (c) Where a vertical rising pipe incorporates a change of direction or offset, it shall be supported less than 300 mm from any mechanically jointed coupling of the fitting as shown in [Figure 10.7.2\(b\)](#).
- (d) Where the vertical rising pipe incorporates two changes of direction and the distance between the mechanically jointed couplings is less than 600 mm, a single pipe support shall be provided between couplings.
- (e) Where a welded or braised jointing system is used, it shall be supported in accordance with AS 4809.
- (f) Where a fire hydrant branch or valve assembly is taken off a vertical pipe/riser, it shall be supported not more than 300 mm above or below the fire hydrant branch or valve assembly as shown in [Figure 10.7.2\(c\)](#).
- (g) Where hanger or riser clamps are used to support vertical pipe risers with a diameter of 300 mm or greater, the hanger or riser clamps shall support the pipe riser.
- (h) Hangers and riser clamps shall not be anchored to walls using threaded rod in the horizontal position.



(a) Vertically rising pipe support



(b) Offset pipe support



(c) Fire hydrant valve branch support

Figure 10.7.2 — Vertical pipe support

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10.8 Fixing of pipe supports

10.8.1 General

Fire hydrant pipework may be supported from a building structure provided the structure can support the loads specified in [Clause 10.2](#). Fire hydrant pipework shall be supported independently of ceiling sheathing and any associated suspension system.

10.8.2 Fixing to concrete, masonry or steel

Explosive-powered fasteners, wooden plugs or plugs of plastics materials shall not be used for fixing pipe supports to concrete or masonry.

Fixings used shall be capable of supporting the design load specified in [Clause 10.2](#).

10.8.3 Fixing to timber

Where fire hydrant pipework is fixed to timber with coach screws or coach bolts, the screws and bolts shall be in accordance with the following:

- (a) The fixing method shall be capable of supporting the design load specified in [Clause 10.2](#).
- (b) The coach bolts and coach screws shall conform to the dimensions specified in [Table 10.8.3](#).

Nails shall not be used for fixing pipe supports to timber.

Table 10.8.3 — Timber fixing

Pipe size	Nominal diameter of coach bolt or coach screw	Nominal length of coach screw
DN	mm	mm
80	12	75
100	12	75
150	12	75
200	16	75

10.9 Thrust blocks and anchors

Thrust blocks and anchors shall be installed in systems with unrestrained joints. They shall be designed to counteract the forces imposed by the maximum pressures and flows generated in the fire hydrant system, including the test and commissioning water pressures, water hammer, ground pressures and soil conditions.

NOTE 1 For unrestrained joints, refer to AS/NZS 3500.1.

NOTE 2 Mechanical or fusion joints connecting polyethylene pipework are typically self-restraining and therefore do not require thrust blocks.

10.10 Penetration of pipework through structures

Where pipes penetrate a wall or slab, the core hole shall have a minimum clearance of 10 mm around the pipe. The core hole shall accommodate pipe and pipe settlement after commissioning.

NOTE 1 For a diagrammatic explanation of the above, see [Figure 10.10](#).

NOTE 2 Refer to the NCC for more information on the protection of a service penetration through a building element required to have an FRL.

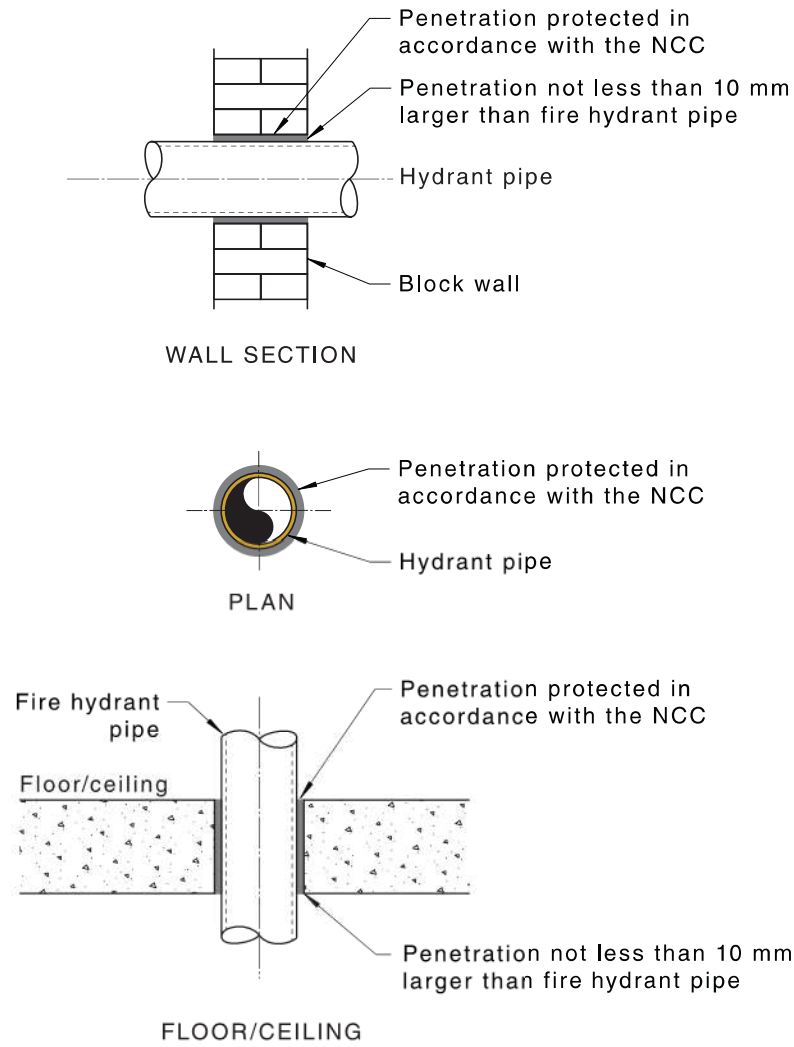


Figure 10.10 — Penetration of pipework through structures

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Section 11 Ancillary equipment, signage and baseline data

11.1 General

Ancillary equipment and signage installed in a fire hydrant system shall be in accordance with this section.

Clauses identified as baseline data, include information required to confirm the performance of the fire hydrant system over the life of the system.

NOTE For servicing of fire protection systems, refer to AS 1851.

11.2 Cabinets, enclosures or recesses

11.2.1 Fire brigade booster assembly

11.2.1.1 General

Where a cabinet, enclosure or recess is used to house a fire brigade booster assembly, it shall —

- (a) only contain firefighting pipework and equipment associated with —
 - (i) the fire brigade booster assembly of the fire hydrant system; and
 - (ii) a booster assembly of a sprinkler system, if installed within the cabinet, enclosure or recess.
- (b) be capable of housing all the equipment;
- (c) be identified by signage in accordance with [Clause 11.3.1](#); and
- (d) be signal red in colour conforming to AS 1345 if located remote from the building.

NOTE 1 Equipment associated with a fire brigade booster assembly may also include water meters or backflow prevention devices.

NOTE 2 For an example of a metal fire brigade booster cabinet, see [Figure 11.2.1.1](#).

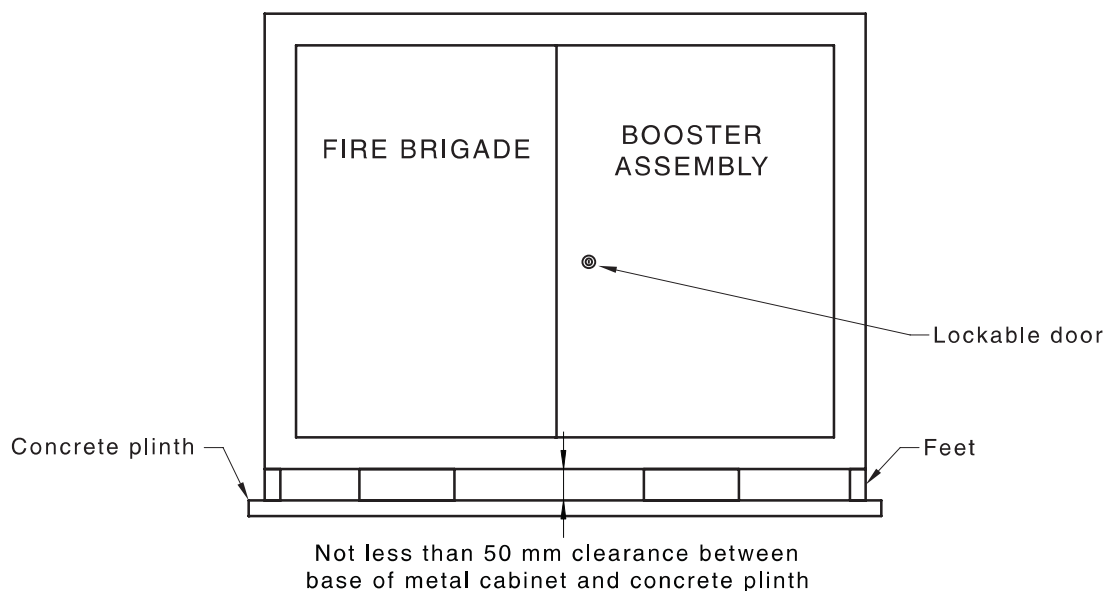
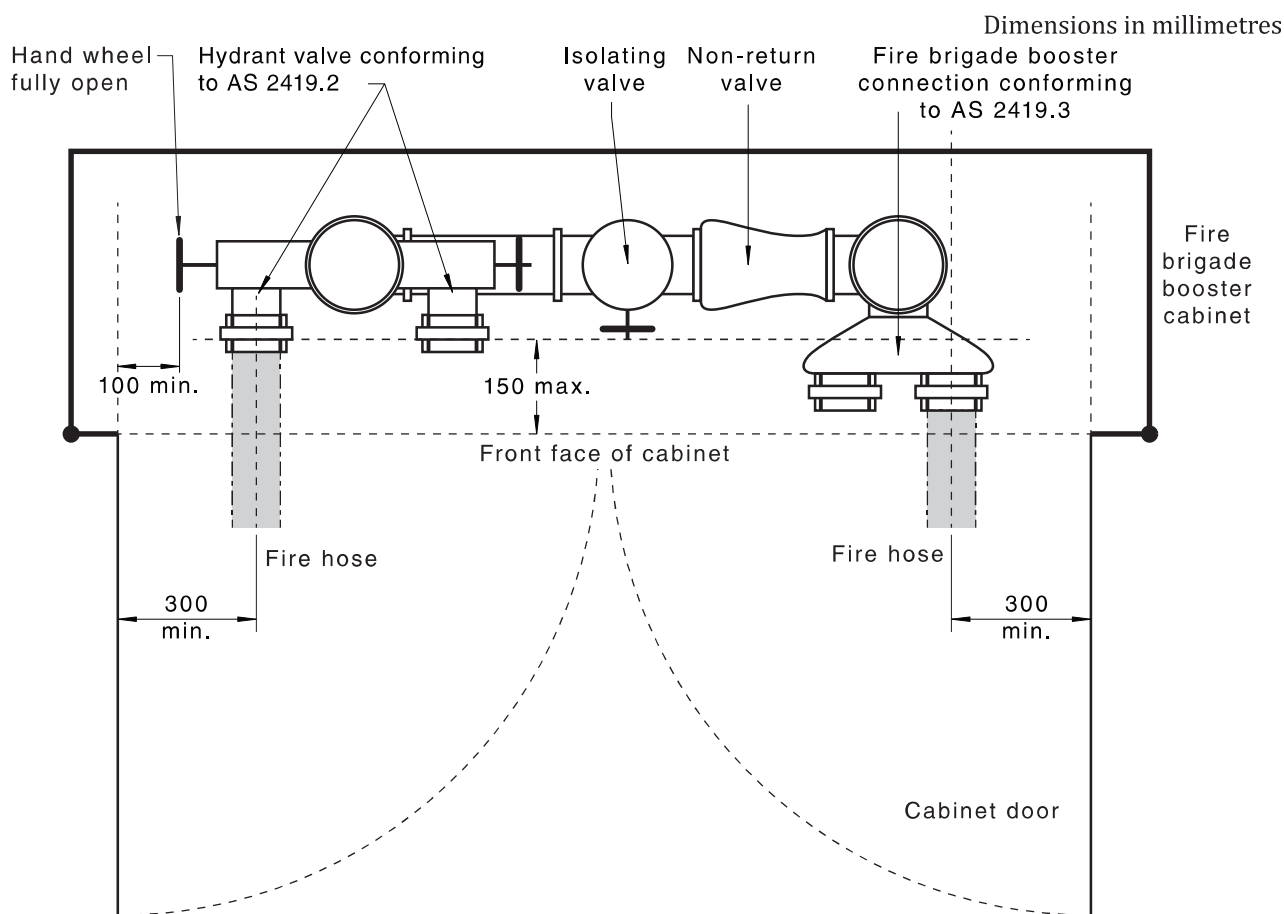


Figure 11.2.1.1 — Freestanding metal fire brigade booster cabinet

11.2.1.2 Construction

A fire brigade booster assembly cabinet, enclosure or recess shall —

- (a) be of a weatherproof design and corrosion-resistant materials;
- (b) be provided with doors in accordance with [Clause 11.2.2](#);
- (c) be installed so that water is not retained within the cabinet;
- (d) provide clearances between the installed fire equipment and the inside of the cabinet as shown in [Figures 11.2.1.2](#) (a) and (b);
- (e) provide a clearance of not less than 150 mm from the highest component part of the fire brigade booster assembly to the top of the cabinet door; and
- (f) if free standing —
 - (i) be located on an all-weather plinth; and
 - (ii) have a clearance of not less than 50 mm between the base of the fire brigade booster cabinet and the all-weather plinth.



(a) Plan view

- (b) be sized to —
 - (i) house all equipment; and
 - (ii) provide clearances shown in [Figure 11.2.3](#);
- (c) have doors fitted that do not encroach on exits or inhibit access to firefighting equipment when open;
- (d) be identified by signage in accordance with [Clause 11.3.2](#); and
- (e) be of a weatherproof design and of corrosion-resistant materials if external.

NOTE Where fire hose reels conforming to AS/NZS 1221 are installed in conjunction with a fire hydrant, they may be enclosed in the same cabinet, where practicable.

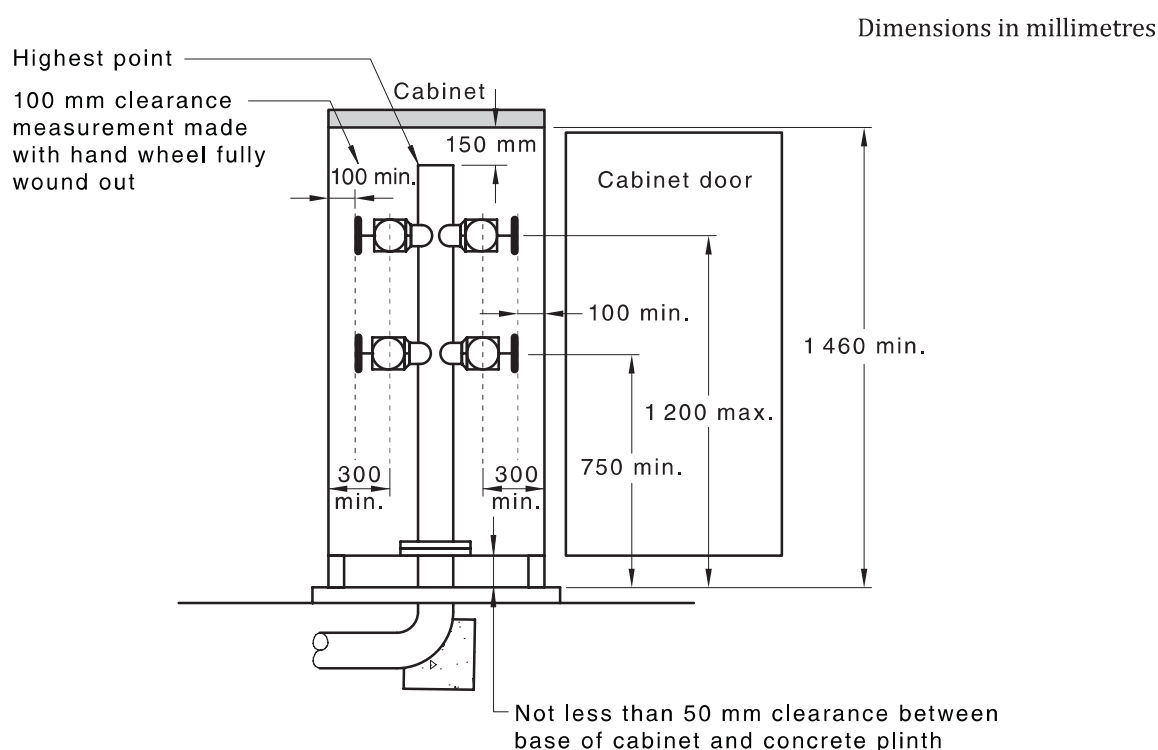


Figure 11.2.3 — Clearances between firefighting equipment and the opening of a fire hydrant cabinet

11.3 Signage

11.3.1 Fire brigade booster assembly

A fire brigade booster assembly shall be clearly identified by fade- and weather-resistant signage that —

- (a) is permanently affixed;
 - (i) adjacent to the fire brigade booster assembly; or
 - (ii) adjacent to the fire brigade booster connection where a tank suction fire brigade booster assembly is provided;

- (iii) to the external face of the door or lift-off panel of the cabinet or enclosure, if provided; and
- (b) states in uppercase letters not less than 50 mm high, in a colour contrasting with the background, as applicable —
 - (i) FIRE HYDRANT BOOSTER ASSEMBLY;
 - (ii) FIRE HYDRANT BOOSTER AND SPRINKLER BOOSTER ASSEMBLY; or
 - (iii) COMBINED FIRE HYDRANT AND SPRINKLER BOOSTER ASSEMBLY.

11.3.2 Attack fire hydrants in fire brigade booster assembly cabinets

Where an attack fire hydrant is located within a fire brigade booster assembly cabinet, enclosure or recess, the attack fire hydrant shall be identified by fade and weather resistant signage that —

- (a) is permanently affixed either behind or adjacent to the attack fire hydrant; and
- (b) states in uppercase letters of not less than 25 mm high in a colour contrasting with the background, "ATTACK HYDRANT".

11.3.3 Large- and small-bore suction connection

Where a tank suction booster assembly is installed or a fixed suction connection is provided to draught from a river, reservoir, lake, dam or sea, the suction connections shall be clearly identified by fade- and weather-resistant signage that —

- (a) is permanently affixed or adjacent to large- or small-bore suction connections and fire brigade booster connections; and
- (b) in uppercase letters of not less than 50 mm in a colour contrasting with the background, and state, as applicable, the following:
 - (i) Tank suction connection (for above-ground tanks):
 - (A) FIRE HYDRANT SYSTEM TANK CONNECTION;
 - (B) FIRE SPRINKLER SYSTEM TANK CONNECTION; or
 - (C) COMBINED FIRE HYDRANT AND SPRINKLER SYSTEM TANK CONNECTION.
 - (ii) Fixed suction connection in accordance with [Clause 4.4](#):
 - (A) FIRE HYDRANT SYSTEM DRAUGHTING POINT;
 - (B) FIRE SPRINKLER SYSTEM DRAUGHTING POINT; or
 - (C) COMBINED FIRE HYDRANT AND SPRINKLER SYSTEM DRAUGHTING POINT.

11.3.4 Notice-of-pressure signs (baseline data)

11.3.4.1 Test pressure signage

Where a fire brigade booster assembly is provided, a fade- and weather-resistant test pressure sign shall be provided that —

- (a) is permanently affixed —
 - (i) adjacent to the fire brigade booster assembly; or

- (ii) in a prominent location within the cabinet, enclosure or recess, if provided.
- (b) states in uppercase letters not less than 25 mm high, in a colour contrasting with the background, the maximum test pressure the fire hydrant system has been tested to, as follows:
TEST PRESSURE KPA.

11.3.4.2 Boost pressure signage

Where a fire brigade booster assembly is installed, permanently affixed fade- and weather-resistant boost pressure signage shall be provided adjacent to the fire brigade booster assembly; or in a prominent location within the cabinet, enclosure, or recess, that —

- (a) indicates the number of storeys and the relative heights of each pressure zone; and
- (b) states in uppercase letters not less than 25 mm high, in a colour contrasting with the background, the boost pressure the fire hydrant system has been tested to, as follows:
BOOST PRESSURE KPA

11.3.5 Fire hydrants

Where a fire hydrant is installed in a cabinet, the cabinet shall be clearly identified by fade- and weather-resistant signage that —

- (a) is permanently affixed to the external face of the cabinet door; and
- (b) states in uppercase letters not less than 50 mm high, in a colour contrasting with the background, as applicable —
 - (i) FIRE HYDRANT; and
 - (ii) where a fire hose reel is enclosed within the cabinet, FIRE HYDRANT—
FIRE HOSE REEL.

11.3.6 Water storage tanks and equipment

11.3.6.1 Water storage tank general signage

Where a water storage tank is installed, it shall be identified by permanently affixed fade- and weather-resistant signs that state in uppercase letters of not less than 100 mm high, in a colour contrasting with the background —

- (a) the type of water supply (e.g. PRIMARY WATER SUPPLY FOR FIRE HYDRANT SYSTEM); and
- (b) the effective storage capacity of the tank in litres (e.g. EFFECTIVE CAPACITY 144 000 L).

11.3.6.2 Water storage tank quick-fill valve

Quick-fill valves for a fire hydrant tank shall be identified by a permanently affixed fade- and weather-resistant sign that states, in uppercase letters not less than 25 mm high, in a colour contrasting with the background; “QUICK FILL VALVE”.

11.3.6.3 Water storage tank access

All tank access points (roof access covers and shell access covers) shall be identified by a confined space warning sign.

NOTE Refer to the relevant legislation for information on confined space and the requirements for signage and other items.

11.3.6.4 Warning signs

Fire tanks shall be clearly marked with a warning or prohibition sign conforming to AS 2304.

11.3.7 Pumps

11.3.7.1 Pumps in series

Where a fixed on-site pump is connected in series with a fire brigade booster assembly, a fade- and weather-resistant warning sign shall —

- (a) be permanently affixed in a prominent location adjacent to the pressure gauge of the fire brigade booster assembly required by [Clause 6.8](#);
- (b) state in uppercase letters not less than 25 mm, in a colour contrasting with the background WARNING; and
- (c) state in uppercase letters not less than 15 mm high, in a colour contrasting with the background:

THIS BOOSTER IS CONNECTED IN SERIES (RELAY) WITH THE FIXED ON-SITE FIRE PUMPS, WHICH MAY BE RUNNING. THIS GAUGE SHOWS THE DISCHARGE PRESSURE AT THE OUTLET OF THE FIXED ON-SITE PUMP.

11.3.7.2 Full-duty fire hydrant pumps

Where full-duty fire hydrant pumps are installed, a fade- and weather-resistant sign shall —

- (a) be permanently affixed adjacent to the fire brigade booster assembly;
- (b) state in upper case letters not less than 25 mm high, WARNING — AUTOMATIC STARTING FULL-DUTY FIRE HYDRANT PUMPS INSTALLED; and
- (c) state in upper case letters not less than 15 mm high, in a colour contrasting with the background:

IF PUMP INDICATOR LIGHTS ARE NOT OPERATING, REFER TO TACTICAL FIRE PLANS IN FIRE CONTROL ROOM FOR THE OPERATION OF PUMPS AND BOOSTING BY A FIRE BRIGADE PUMPING APPLIANCE.

NOTE Refer to the NCC for more information on the requirement to provide tactical fire plans in a building having an effective height more than 50 m.

11.4 Pressure gauges

11.4.1 General

Fire hydrant system pressure gauges shall —

- (a) conform to AS 1349;
- (b) have a full-scale reading of not less than 125 % of the system hydrostatic test pressure at the point where the gauge is located;
- (c) be fitted with a gauge isolation valve; and
- (d) have a dial face diameter of not less than 65 mm except where required by [Clause 6.8.2](#); and
- (e) have a window made of glass.

11.4.2 Location of pressure gauges

Pressure gauges installed on a fire hydrant system shall —

- (a) conform to AS 2419.3, where a fire brigade booster connection is installed;
- (b) conform to AS 2941, where a fixed on-site pump is installed;
- (c) be adjacent to the test facility, where a test facility is installed as required by [Clause 8.10](#);
- (d) be adjacent to the most hydraulically disadvantaged fire hydrant in the fire hydrant system, where a building has an effective height not more than 25 m and more than six fire hydrants are installed; and
- (e) for buildings having an effective height more than 25 m —
 - (i) be adjacent to the most hydraulically disadvantaged fire hydrant in any pressure zone; and
 - (ii) be immediately upstream and downstream of any pressure-reducing valve.

11.4.3 Pressure schedule (baseline data)

A pressure schedule expressed in kilopascals (kPa) in the form of a permanent chart that is water- and fade-resistant shall be located within the pump room, adjacent to any installed pumpsets. The schedule shall include the following:

- (a) Minimum and maximum pressure maintained at the most hydraulically disadvantaged hydrant outlet, when flowing at the design flow and at zero flow.
- (b) Minimum and maximum primary water supply pressure at the design flow and at zero flow.
- (c) If applicable, the automatic inflow water supply pressure at the design inflow rate.
- (d) Jockey pump cut-in and cut-out pressures.
- (e) Duty and standby pump cut-in pressures.
- (f) If applicable, for pressure-reducing valve stations —
 - (i) upstream pressure;
 - (ii) downstream (reduced) pressure; and
 - (iii) relief valve operating pressure.
- (g) The suction and discharge pressure at the booster connection, at the design flow and pressure from the most hydraulically disadvantaged hydrant outlets.
- (h) The maximum system design pressure and the hydrostatic test pressure.

NOTE 1 A typical pressure schedule is shown in [Table 11.4.3](#).

NOTE 2 In AS 1851 the maximum system design pressure is known as the system working pressure.

Table 11.4.3 — Typical pressure schedule

Item	Pressure, kPa	
	Minimum	Maximum
Pressure maintained at most hydraulically disadvantaged hydrant outlet at the design and zero flow		
Pressure provided by the primary water supply at the feed fire hydrants of the fire brigade booster assembly or the suction connections of an on-site tank at the design and zero flow		
Pressure at upstream end of automatic inflow water supply pipework (if applicable) at the design flow		
Electric pump delivery pressure at shut-off (pump running at no flow)		
Diesel pump delivery pressure at shut-off (pump running at no flow)		
Electric pump delivery pressure at design flow		
Diesel pump delivery pressure at design flow		
System maximum design pressure		
System hydrostatic test pressure		
System boost pressure at design flow		
Pumps	Cut-in pressure kPa	Cut-in pressure kPa
Pressure maintenance jockey pump		
Electric pump		
Diesel pump		
Pressure-relief valves	Opening kPa	Closing kPa
Pump pressure-relief valve		

11.5 Block plan (baseline data)

Where a fire brigade booster assembly is installed, there shall be water-, fade- and weather-resistant block plans that meet the following requirements, as applicable:

- (a) The block plan shall be legible.
- (b) A “You are here” indication shall be provided on the block plan.
- (c) The block plan shall be permanently affixed adjacent to the fire brigade booster assembly or where a cabinet, enclosure or recess is provided in a prominent location that allows the attending fire brigade or other trained firefighting personnel to access and read the plan.
- (d) Where a fire control room or pump room is provided, an additional copy of the block plan shall be permanently affixed within the room.
- (e) The block plan shall be sized not less than A3 and have a maximum scale of 1 to 250.
- (f) The block plan shall be oriented in a manner that reflects the aspect of the fire hydrant installation as it is presented to the reader, with reference to the cardinal points, identifiable surrounding landmarks and features (such as streets, roads, fire-isolated stairs, fire indicator panels).
- (g) The block plan shall include a diagram showing —
 - (i) the layout of the protected buildings or open yards and adjacent streets;
 - (ii) the size and location of network utility operator mains and street fire hydrants (dimensioned);

- (iii) any valves and connections with the water supply serving the building or site;
 - (iv) the location and size of on-site fire mains;
 - (v) the length and size used of any PE underground pipework;
 - (vi) the location and capacities of water storage tanks;
 - (vii) the location of pumps;
 - (viii) the location and number of each fire hydrant;
 - (ix) the location of all fire brigade booster assemblies;
 - (x) the location and number of any isolating valve;
 - (xi) the location of any non-return valves;
 - (xii) any connections to other installed fire protection systems;
 - (xiii) the location of the main electrical switchroom and substation;
 - (xiv) the location of LPG tanks and gas supply shutdown valve;
 - (xv) the location of all flammable storage areas;
 - (xvi) the location of any fire indicator panel or fire control centre;
 - (xvii) the location of any sprinkler alarm valve sets; and
 - (xviii) a north point symbol orientated to suit Item (e).
- (h) The block plan shall include the year of installation of the system, any major extensions thereto, any unusual features of the installation and —
- (i) the name of the contractor who installed or modified the system;
 - (ii) the name of the designer of the system;
 - (iii) the name of the contractor who commissioned the system
 - (iv) the required system design and commissioning pressure and flow rate (kPa @ L/s) —
 - (A) at the fire brigade booster connection inlets, when the fire hydrant system is boosted by a fire brigade pumping appliance; and
 - (B) from the discharge side of any on-site pumps, where applicable.
 - (v) the automatic inflow rate to any reduced-capacity tank;
 - (vi) the network utility operator flow and pressure details under 95th percentile demand conditions;
 - (vii) the height of the highest fire hydrant outlet above the lowest booster inlet connection; and
 - (viii) the number of fire hydrants required to flow for each fire compartment, where the fire hydrant system design incorporates differing flow rates.

Where a single block plan cannot represent the size or complexity of the building or site, additional block plans or schematic diagrams shall be provided.

NOTE 1 The block plan should only contain information useful to the operation of the fire hydrant system and risks associated with the building or site.

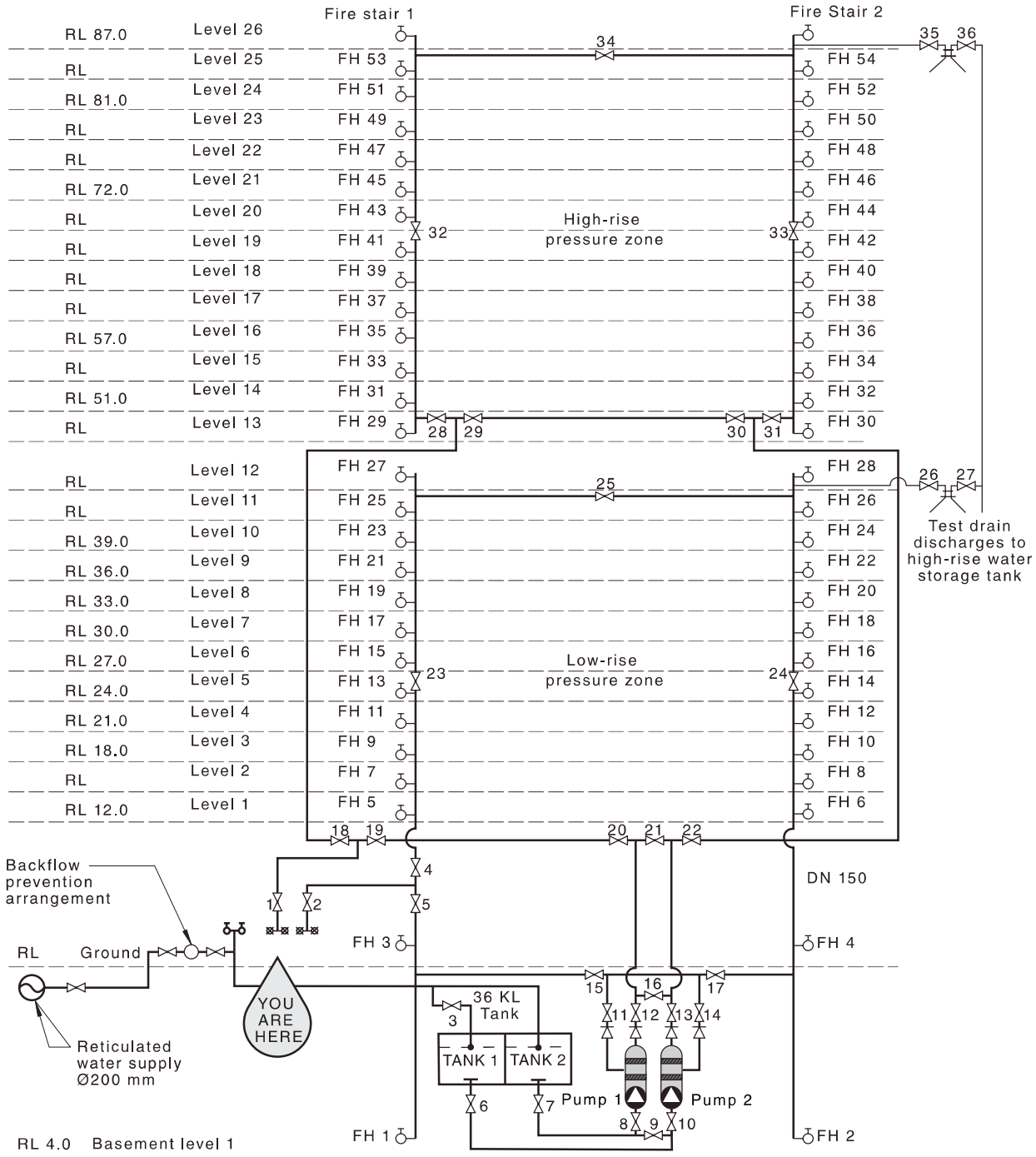
NOTE 2 The block plan provided at each booster location aims to make firefighters using the booster assembly aware of the system in terms of its designed capacity, extent and configuration. This information together with other notices of test and boost pressures should enable firefighters to safely use the system.

NOTE 3 Typical block plans are shown in [Figure 11.5](#).

NOTE 4 The figures shown below are for illustrative purposes only and do not fully detail all Block Plan information required by [Clause 11.5](#).

NOTE 5 Laminated paper is not considered water-, fade- or weather-resistant.

BLOCK PLAN - 90 BERNOULLI ROAD, CLEAR WATER



(a) High-rise block plan (1 of 2)

BLOCK PLAN - 90 BERNOULLI ROAD, CLEAR WATER

System designed by
 System installed by
 System installation date
 System commissioned by

Notes:

1. Reticulated water supply: 95th percentile 300 kPa @ 32 L/s from 200 mm diameter main
2. System design kPa L/s
3. System commissioning kPa L/s
4. Tank inflow rate kPa L/s
5. Height of the highest hydrant above fire brigade booster assembly metres

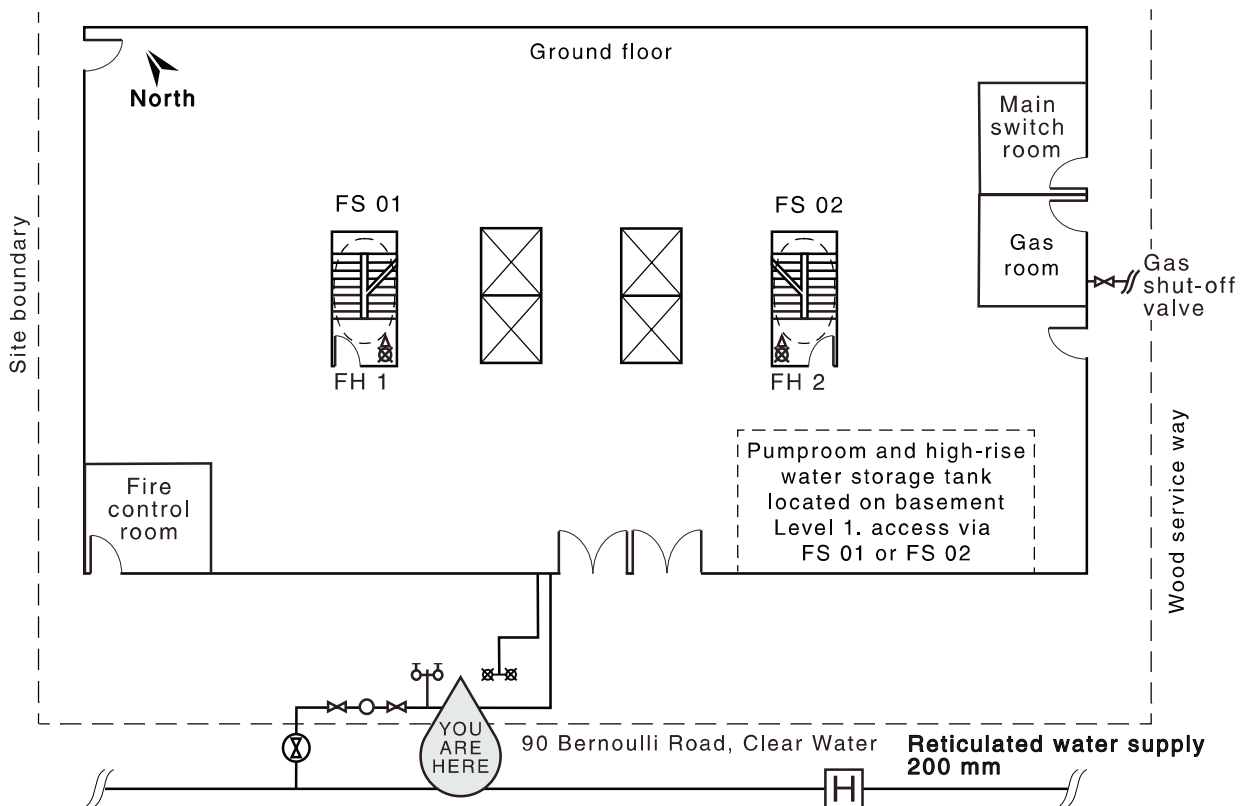
All measurements for Notes 2 and 3 are taken at the most hydraulically disadvantaged hydrant outlet

Pump duty:

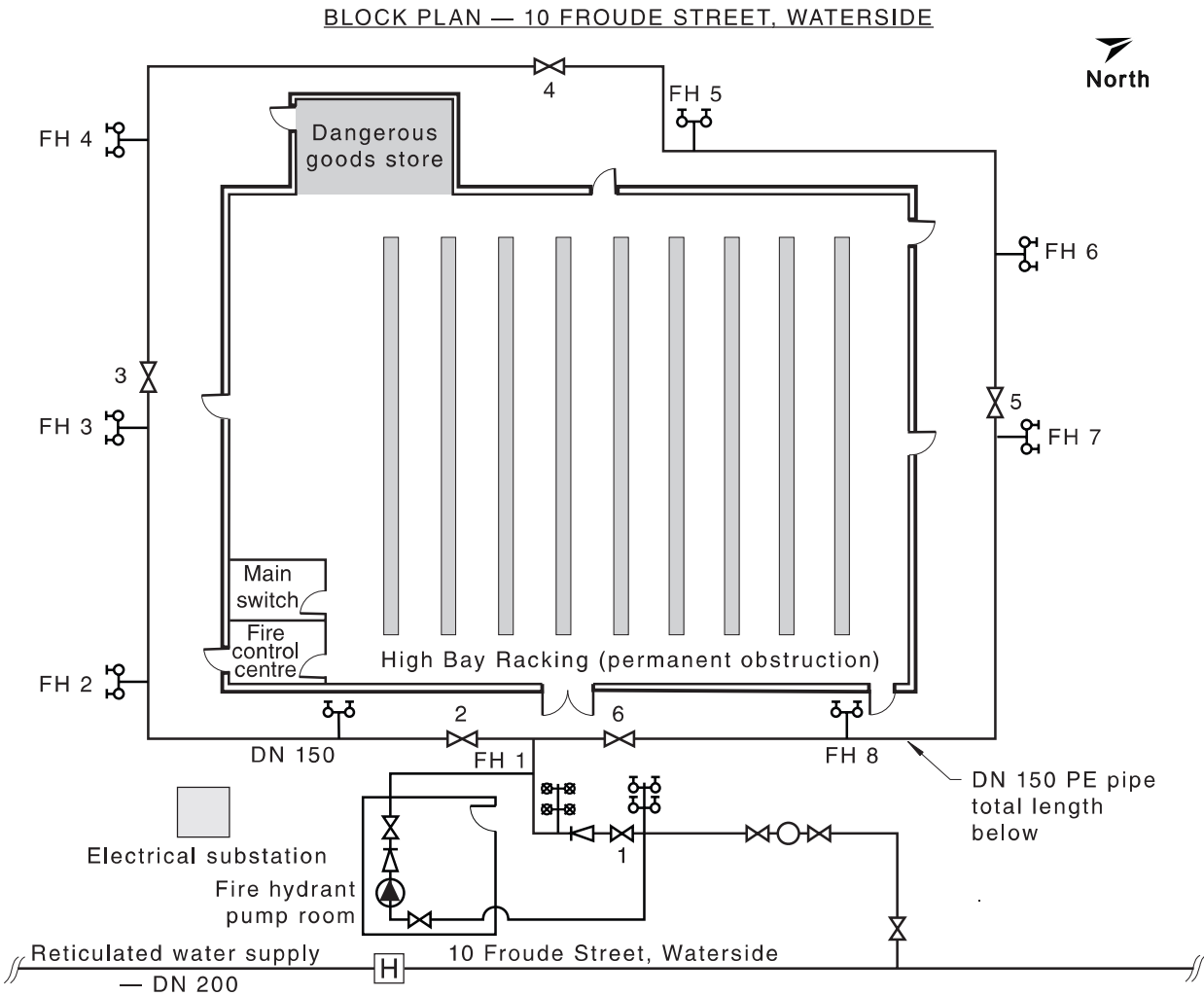
1. Full-duty fire hydrant pump 1 kPa L/s
2. Full-duty fire hydrant pump 2 kPa L/s

Key








- | | | | |
|--|---|--|---|
| | Fire hydrant (elevation) | | Multi-stage full-duty fire hydrant pump |
| | Fire hydrant (plan view) | | Fire brigade booster connection |
| | Isolating valve (normally open) with anti-tamper switch | | Flow test facility |
| | Non-return valve | | Street hydrant |
| | Backflow prevention apparatus | | |



(a) High-rise block plan (2 of 2)



Key

-  Fire hydrant
-  Isolating valve (normally open) with anti-tamper switch
-  Non-return valve
-  Backflow prevention
-  Half-duty fire hydrant pump
-  Fire brigade booster connection
-  Street hydrant

System installed by.....
 System installation date.....
 System designed by.....
 System commissioned by

NOTE:

1. Reticulated water supply: 95th percentile 220 kPa @ 30 L/s from 200 mm diameter
2. System design.....kPa.....L/s
3. System commissioning test.....kPa.....L/s
4. Height of highest hydrant above fire brigade booster assembly.....m

All measurements for Notes 2 and 3 are taken at the hydraulically most disadvantaged hydrant outlet

Pump duty:

1. Fire hydrant pump.....kPa.....L/s

(b) Low-rise block plan

Figure 11.5 — Typical block plans

11.6 Location plan — Additional fire hydrants (baseline data)

Where additional fire hydrants are installed in accordance with [Clauses 3.6.1\(g\)](#) and [3.6.3](#), a plan identifying the location of the additional fire hydrants shall be provided and—

- (a) be titled “Additional fire hydrants — Location Plan”;
- (b) be sized no less than A3;
- (c) be fade- and weather-resistant;
- (d) detail the location of the additional fire hydrants and the other attack fire hydrants serving the floor;
- (e) be permanently affixed adjacent to each internal fire hydrant located in accordance with [Clause 3.6.2](#), serving the storey or level; and
- (f) be oriented in a manner that reflects the aspect of the fire hydrant installation as it is presented to the reader, with reference to the defining features of the storey, such as exits, compartmentation and any risks.

11.7 Location plan — Street fire hydrants (baseline data)

Where street fire hydrants are used to provide fire hydrant coverage to a building or site in accordance with [Clause 3.5.2](#), a plan sized no less than A3 shall —

- (a) be titled “Street fire hydrants — Location Plan”;
- (b) be permanently affixed adjacent to either —
 - (i) the fire indicator panel, where provided;
 - (ii) the main entry point of the building; or
 - (iii) the fire hose reel or fire extinguisher closest to the main entry point to the building;
- (c) be fade- and weather-resistant;
- (d) detail the location of the street hydrants;
- (e) detail the location of any additional on-site feed fire hydrant;
- (f) detail the name of the designer of the system; and
- (g) detail the network utility operator’s pressure and flow under 95th percentile demand conditions.

11.8 Pipework identification

Fire hydrant pipework including pipe risers shall be painted or labelled conforming to AS 1345.

Section 12 Commissioning

12.1 General

Fire hydrant systems designed and installed in accordance with this document shall be commissioned in accordance with the provisions of this section.

The testing shall demonstrate the capability of the system compared to the design criteria under —

- (a) hydrostatic pressure, in accordance with the testing procedures for all metal and plastics pipe in [Appendix S](#); and
- (b) dynamic flow conditions, in accordance with the testing procedures for all metal and plastics pipe in [Appendix T](#).

The tests and inspections shall confirm —

- (i) the integrity of the installed fire hydrant system;
- (ii) the operational performance of the fire hydrant system against the design criteria;
- (iii) the operational performance of any installed pumpsets against the design criteria; and
- (iv) that the fire hydrant system is supported and anchored.

On-site pumpsets shall meet the commissioning requirements of AS 2941.

A document or report shall be issued upon successful completion of the acceptance testing confirming that the installed fire hydrant system conforms to the design criteria of this document.

12.2 Hydrostatic testing — Feed fire hydrant systems

12.2.1 All joints accessible

Where a fire hydrant system incorporates feed fire hydrants only, and all joints are accessible, no evidence of leakage shall be detected when the fire hydrant system is subjected to hydrostatic pressure. Testing shall be in accordance with [Appendix S](#) Test 1.

12.2.2 All joints not accessible

Where a fire hydrant system incorporates feed fire hydrants only, and all of the joints are not accessible, no evidence of leakage shall be detected when the fire hydrant system is subjected to hydrostatic pressure. Testing shall be in accordance with [Appendix S](#) Test 2.

12.3 Hydrostatic testing — Attack fire hydrant systems

12.3.1 Buildings having an effective height not more than 50 m

Where a fire brigade booster assembly is installed and the building has an effective height not more than 50 m, no evidence of leakage shall be detected when the fire hydrant system is subjected to hydrostatic pressure. Testing shall be in accordance with [Appendix S](#) Test 3.

12.3.2 Buildings having an effective height more than 50 m

Where a fire brigade booster assembly is installed and the building has an effective height more than 50 m, no evidence of leakage shall be detected when the fire hydrant system is subjected to hydrostatic pressure. Testing shall be in accordance with [Appendix S](#) Test 4.

12.4 Flow and pressure performance testing

12.4.1 Maximum static pressure

The maximum static pressure recorded at any fire hydrant at no flow, with the fixed on-site pump running, shall not exceed 1 300 kPa. Testing shall be in accordance with [Appendix T](#) Test 2.

12.4.2 Unassisted feed, attack or attack/feed fire hydrants

Where a fire hydrant system is served by a reticulated water supply or an elevated private reservoir and no fixed on-site fire pumpsets are installed, the unassisted pressure and flow recorded at each of the most hydraulically disadvantaged fire hydrant outlets required to flow when operating simultaneously shall be not less than those specified in [Table 2.2.6\(A\) or \(B\)](#), as applicable. Testing shall be in accordance with [Appendix T](#) Test 3.

Where the recorded water supply pressure differs from the design pressure (base line data value), the recorded test pressure results, at the most disadvantaged fire hydrants, shall be adjusted to account for this variation. The adjusted test results shall be checked against the design criteria (baseline data value) to determine conformance.

NOTE 1 The supply source pressure should be monitored and measured at a location corresponding to where the design pressure is derived.

NOTE 2 For information on test result adjustment methods, see [Appendix U](#).

12.4.3 Fire brigade booster assemblies

Where a fire brigade booster assembly is installed, the pressure and flow recorded at each of the most hydraulically disadvantaged fire hydrant outlets required to flow in a pressure zone shall be not less than that specified in [Table 12.4.3](#). The pressure and flow required shall be achieved when a fire brigade pumping appliance or other portable pumping appliance pressurizes the system through the fire brigade booster connection. Testing shall be in accordance with [Appendix T](#) Test 4.

Table 12.4.3 — Fire brigade boost pressure

Height of pressure zone	Flow rate at MHD ^a fire hydrant	Pressure at MHD ^a fire hydrant	Boost pressure range kPa
Not more than 45 m	Specified in Table 2.2.6(F)	Specified in Table 2.2.6(F)	700–1 345
More than 45 m and not more than 90 m	Specified in Table 2.2.6(F)	Specified in Table 2.2.6(F)	1 345–1 790
More than 90 m and not more than 135 m	Specified in Table 2.2.6(F)	Not less than 350 kPa	1 790–1 880

^a MHD = Most hydraulically disadvantaged

NOTE 1 The maximum boost pressure in each boost pressure range includes the maximum friction loss value of 150 kPa, the friction losses permitted across the fire brigade booster assembly, and the fire hydrant valve in accordance with AS 2419.3 and AS 2419.2, respectively.

NOTE 2 9.81 kPa for each 1 m of elevation has been applied.

NOTE 3 The maximum boost pressure in each boost pressure range is that required at the fire brigade booster connection when the MHD fire hydrants are flowing.

NOTE 4 The requirement to provide not less than 350 kPa at the MHD fire hydrants in a pressure zone above 90 m acknowledges the maximum working pressure of 2 100 kPa for Class H (High) layflat firefighting hose conforming to AS 2792.

NOTE 5 See [Clause 9.4](#) for information on the required pressure rating of fire brigade booster connections conforming to AS 2419.3.

12.4.4 Half-duty fire hydrant pumpsets

Where a half-duty fire hydrant pumpset is installed, the pressure and flow recorded at each of the most hydraulically disadvantaged fire hydrants required to flow with the pump running shall be as specified in [Table 2.2.6\(C\)](#). Testing shall be in accordance with [Appendix T](#) Test 5.

Where the recorded water supply input pressure to the pump differs from the design input pressure (baseline data value), the recorded test pressure results at the most disadvantaged fire hydrants shall be adjusted to account for this variation. The adjusted test results shall be checked against the design criteria (baseline data value) to determine conformance.

NOTE For information on test result adjustment methods, see [Appendix U](#).

12.4.5 Full-duty fire hydrant pumpsets

Where a full-duty fire hydrant pumpset is installed, the pressure and flow recorded at each of the most hydraulically disadvantaged fire hydrant outlets required to flow with the pump running, shall be not less than those specified in [Table 2.2.6\(D\)](#). Testing shall be in accordance with [Appendix T](#) Test 5.

Where the recorded water supply input pressure to the pump differs from the design input pressure (baseline data value), the recorded test results, at the most disadvantaged fire hydrants, shall be adjusted to account for this variation. The adjusted test results shall be checked against the design criteria (baseline data value) to determine conformance.

NOTE For information on test result adjustment methods, see [Appendix U](#).

12.4.6 Jockey pumps

Where a jockey pump is installed (i.e. an automatic pressure maintenance pump), testing shall confirm that start up and shut off will occur prior to the operation of any installed fire hydrant pumpset. Testing shall be in accordance with [Appendix T](#) Test 6.

12.4.7 Friction loss

During commissioning, pressure measurements shall be taken during flow testing to verify that the pipework friction losses are less than the maximum allowable losses specified in [Clause 2.3](#).

12.4.8 Multiple firefighting systems

Where an additional firefighting system, other than hose reels (e.g. wall-wetting sprinklers, automatic fire sprinklers), draws from the same water source or uses common pipework simultaneous operation of the systems shall be confirmed by flow testing in accordance with [Appendix T](#) and referral to and comparison with any required documentation.

Where fire hydrant and sprinkler systems are required to flow simultaneously, the fire hydrant requirement shall be measured at the most hydraulically disadvantaged hydrant outlets and the sprinkler requirement shall be measured at an annubar located at the highest point in the system or zone with each system flowing simultaneously.

12.5 Commissioning and acceptance testing requirements

[Table 12.5](#) below details the minimum commissioning and acceptance test requirements for fire hydrant systems designed and installed in accordance with this document.

Table 12.5 — Minimum acceptance test requirements

Fire hydrant system design features	Acceptance tests
Street hydrants	As per Clause 4.2.7.1 and Appendix L
On-site feed fire hydrants with no fire brigade booster installed	Inspection Design criteria tests: Appendix S - Test 1 or Test 2 Appendix T - Test 1 Appendix T - Test 3
On-site fire hydrants with a fire brigade booster installed	Inspection Design criteria tests: Appendix S - Test 3 Appendix T - Test 1 Appendix T - Test 3 Appendix T - Test 4
On-site fire hydrants with a fire brigade booster and fixed on-site pumpsets installed	Inspection Design criteria tests: Appendix S - Test 3 (where applicable) Appendix S - Test 4 (where applicable) Appendix T - Test 2 Appendix T - Test 5 Appendix T - Test 6 (where applicable) Appendix T - Test 7 (where applicable)
Water storage tanks	Inspection Design criteria tests: As per site hydrants with a fire brigade booster installed Where applicable as per on-site hydrants with a fire brigade booster and fixed on-site pumpsets Appendix T - Test 7
Extensions from existing	As above, depending on system configuration
NOTE Measured test results in the test procedures of Appendix T should be adjusted, where applicable, in accordance with the method in Appendix U to confirm that the fire hydrant system conforms to the design requirements.	

12.6 Inspection

Fire hydrant systems shall be inspected to the extent necessary to confirm that pipes, fittings and supports conform to this document.

12.7 Documentation

The document detailing the results of the acceptance testing shall include the following:

- (a) Name of the owner or agent.
- (b) Address.

- (c) Name of the organization performing the tests.
- (d) Identification of the system.
- (e) Results of the tests.
- (f) Signatures of owner or agent and test person.

NOTE 1 This record of commissioning should be available on-site at all times.

NOTE 2 See [Appendix A](#) for guidance on the documentation required to demonstrate conformance to this document.

Appendix A (informative)

Means of demonstrating conformance

A.1 General

This appendix provides guidance on the form of documentation required to demonstrate conformance to this document.

As the long-term performance of a fire hydrant system is critical to protecting life and property, any fire hydrant system design or installation should be accompanied by documentation demonstrating conformance to this document.

NOTE 1 This documentation should be readily available to all relevant parties including regulatory bodies, building project certifiers, the fire brigade and building owners.

NOTE 2 Broad statements of conformance such as “This installation conforms to AS 2419.1” are not considered adequate to demonstrate conformance.

NOTE 3 Manufacturers making a statement of conformance to this document on a product, packaging or promotional material should be able to substantiate conformance.

A.2 Documentation

A.2.1 General

As a minimum, any documentation provided should include the information detailed in [Clauses A.2.2 to A.2.11](#), as applicable:

A.2.2 System performance and design

In relation to system performance and design, the documentation should detail —

- (a) the types of fire hydrants included within the fire hydrant system (e.g. external feed and/or attack/feed and internal attack);
- (b) the number of fire hydrant outlets required to flow simultaneously in the fire hydrant system;
- (c) the minimum pressure and flow achieved at the most hydraulically disadvantaged fire hydrants in each pressure zone and the system conditions under which this occurs;
- (d) the maximum static pressure achieved at the most hydraulically advantaged fire hydrant in each pressure zone, with on-site pumps running, if applicable;
- (e) any other fire system drawing from the same water source or directly from the fire hydrant system water supply (e.g. a fire sprinkler system) and its demand;
- (f) the hydraulic loss associated with any required backflow prevention device, meter or pipes, valves and fittings installed upstream of feed fire hydrants or on-site pumps; and
- (g) the hydraulic loss associated with the pipework between the fire brigade booster connection inlets and the most hydraulically disadvantaged hydrant in each pressure zone.

A.2.3 Fire hydrant coverage

In relation to fire hydrant coverage, the documentation should detail —

- (a) the number of street fire hydrants included in the design, if applicable, their location and the hose coverage distances provided from each;
- (b) the number of external or internal fire hydrants or both in the system, if applicable, their location and the hose coverage distances provided from each;
- (c) the location of any additional internal fire hydrants; and
- (d) the type of protection provided to each external fire hydrant.

A.2.4 Water sources and supply

In relation to water sources and supply, the documentation should detail —

- (a) the water sources used (e.g. lake, reticulated water supply, tank) and the means of delivering water to the site;
- (b) the primary water supply serving the fire hydrant system [e.g. direct from a reticulated water supply, from an on-site tank; from a reticulated water supply with on-site break tank and one pump in accordance with [Clause 4.2.2\(c\)](#)];
- (c) the types of fixed on-site tank incorporated into the design (e.g. full or reduced-capacity water storage tank, break tank);
- (d) the size of any reduced-capacity tank and the inflow rate provided by the secondary water supply to supplement the fire hydrant system design flow rate;
- (e) the water supply pressure used and the method of calculation associated with the design flow [e.g. pressure due to the minimum operating level of a tank; 95th percentile value provided by a network utility operator, adjusted to account for any simultaneous demand from another firefighting system (e.g. sprinklers)];
- (f) the type of backflow prevention device and metering installed; and
- (g) the hydraulic losses associated with any fixed suction connection.

A.2.5 Water storage tanks

Where water storage tanks are installed, the documentation should detail —

- (a) the supplier/brand of the fixed on-site tanks;
- (b) the Standard to which the fixed on-site tanks conform or have been manufactured;
- (c) the size of any fixed on-site tanks;
- (d) suction connection arrangements at the site, including those made for the expected users; and
- (e) the depth of any below-ground water storage tanks, including the lower water level if applicable.

A.2.6 Pumpsets

Where on-site pumpsets are installed, the documentation should detail —

- (a) the supplier/brand of each fixed on-site pump;
- (b) the Standard to which the fixed on-site pumps conform or have been manufactured;

- (c) the duty of each fixed on-site pump and the input values used to determine this duty (e.g. lowest level of static water supply; lowest operating level in tank; 95th percentile values provided by the network utility operator);
- (d) the configuration of each fixed on-site pump with respect to the fire brigade booster assembly (e.g. series or parallel);
- (e) the power supply to each pump and the quantity of fuel provided, in hours;
- (f) the automatic cut-in and cut-out pressures for each pump, see pressure schedule requirements of [Section 11](#); and
- (g) the manual pump start arrangements (e.g. remote within the fire control room).

A.2.7 Fire brigade booster assembly

Where fire brigade booster assemblies are installed, the documentation should detail —

- (a) the type of fire brigade booster assembly provided and its location (e.g. H pattern, separate from building, near front vehicle access; I pattern, in facade of building, adjacent to front pedestrian entrance);
- (b) the supplier/installer of the fire brigade booster assembly;
- (c) the supplier/manufacture of the fire hydrant valves and the Standard to which they conform;
- (d) the supplier/manufacture of the fire brigade booster fittings and the Standard to which they conform;
- (e) the supplier/manufacture/specifications of the hose couplings used at the fire brigade booster assembly and throughout the system;
- (f) the pressure rating of the fire brigade booster connection; and
- (g) the protection provided to the fire brigade booster assembly.

A.2.8 Pipework

In relation to the pipes, valves and fittings used within the fire hydrant system, the documentation should detail —

- (a) the type of piping used, including its pressure rating for specified parts of the fire hydrant system, and the Standard to which it conforms;
- (b) the jointing mechanism applied throughout the system;
- (c) the type and pressure rating of valves and/or fittings installed and the Standard to which they conform;
- (d) the location of all isolating valves;
- (e) the measures taken in the installation to manage flow and pressure between pressure zones;
- (f) the system monitoring devices included in the installation;
- (g) the particulars and location of any on-site welding undertaken; and
- (h) the location and type of corrosion protection applied.

A.2.9 Pipe support

In relation to pipe support used within the fire hydrant system, the documentation should detail —

- (a) the environment in which the piping and support is to be installed (e.g. heavy industrial);
- (b) the manufacturer/supplier of the pipe supports;
- (c) the type of pipe support provided, their load rating, the distance between supports and the type of fixing used; and
- (d) the fire rating or protection provided to the pipe supports to protect them from the effects of fire.

A.2.10 Ancillary equipment and signage

In relation to any ancillary equipment and signage used within the fire hydrant system, the documentation should —

- (a) detail the construction particulars and FRL of the fire brigade booster assembly enclosure or cabinet;
- (b) detail all signage required to be installed;
- (c) detail the type and location of any pressure gauge; and
- (d) confirm that the block plan details the fire hydrant system and associated pressure/flow information for operation of the system.

A.2.11 Commissioning

In relation to commissioning of the fire hydrant system, the documentation should detail —

- (a) all tests undertaken, their results and the adjusted pressure results that account for any difference between the source water supply pressure used in the design of the fire hydrant system (and detailed on the block plan) and the pressure available on the day of the test; and
- (b) any circumstances where the commissioning tests failed and the action taken to rectify any identified problem.

A.2.12 Commissioning documentation

Detailed below is an example of the information that should be included in commissioning documentation provided to the building owner.

A copy of this documentation should be retained on-site and incorporated with all other documentation relating to the building for future reference by the building owner, the fire service on-going maintenance provider and the fire brigade.

Part 1 Abbreviations	
The following abbreviations may be used in this report.	
AA = Authority assessment	MDH = most disadvantaged hydrant
AH = Attack fire hydrant	NC = Non-critical
CA = Corrective action	No.(x) = Number
EH = External hydrant	< = less than
FH = Feed hydrant	> = more than
FT = Fire truck	a/g = above-ground
MAH = most advantaged hydrant	b/g = below-ground

Part 2 Inspection details	
Item	Comment
Fire Service Report Number and Company Name	
Date and time of test and Issue Date	
Inspection, Test and Report compiled by	
Test and inspection report was completed on behalf of	
Site address	
This report is for completed works/staged handover	

Part 3 Building details		
Item	Comment	
Installation date and building regime applicable		
Building approval number		
Building site classifications and use		
Variance of FER/performance solutions from AS 2419.1	Yes / No	
Large isolated building	Yes / No	
Storeys contained below ground and above ground	b/g:	a/g:
Largest fire compartment in square metres	> : m ²	< : m ²
Effective height and, if sprinkler-protected, what type	Effective height > #m	AS 2118• Sprinklers / Nil

Part 4 Baseline data of system infrastructure		
Item	Comment	Conforms Y / N
Water supply diameters (mm) and locations		
System pressurized by pumps, network utility operator, gravity		
No. of pressure zones (Z) installed; height to MDHs (m)	No.: Z 1: m, Z 2: m, Z 3: m	
Nominate: Ring main, trunk main and branches		
Percentage isolation for ring mains and branches		
Pipework materials installed above- and below-ground		
Pipework diameters (mm) below- and above-ground		
Pipe supports and fixing structures including concrete supports		
Type and no. of isolating valves and no. monitored		
Hose reel branch valves for > 25 mm pipe and > 1 No. HR	Valves installed as per Clause 8.11	
System valves secured in operating position and indicated		
Discharge points to suit hydrant demands installed		
Perimeter vehicle access and hard standing areas provided		

Part 4 Baseline data of system infrastructure							
Item				Comment			Conforms Y / N
System and infrastructure installed as designed: Drg No.							
Fire brigade booster connection inlet and FH outlet ratio				Boost and test pressure signs and cabinet indication			
No. external dual outlet hydrants	Attack		Feed/ Attack		Feed		Indicated
No. internal single outlet hydrants	Attack		Public street hydrants				Indicated
No. and type of static storage tanks							Indicated
No. and type of pumps installed				x Jockey, x Electric, x Diesel			Indicated
Block plans as specified in AS 2419							Installed
Fire brigade jurisdiction and compatible connections for large- and small-bore suction connections and hydrants							

Part 5 Demands of equipment installed in accordance with AS 2419.1:2021 Tables 2.2.6(A) to (F)							
Fire brigade booster assembly	Max. _____ kPa delivering: _____ L/s @ 700 kPa to MDH with ≤ 150 kPa friction loss						
Feed fire hydrants serving boosters	FH to FT inlet	_____ L/s@ _____ kPa		EH protected by 90/90/90 FRL, 10 m distance other active/passive measure			Y/N
Hard suction to fire truck	Max. lift (-30) kPa	_____ L/s@ _____ kPa					
The _____ no. MDH outlets to operate simultaneously.	Attack fire hydrant	_____ L/s@ _____ kPa					
	Feed/Attack fire hydrant	_____ L/s@ _____ kPa					
	Feed fire hydrant	_____ L/s@ _____ kPa					
	Public street hydrant	_____ L/s@ _____ kPa					
	Internal AH	_____ L/s@ _____ kPa					
Secondary pumps	_____ L/s@ _____ kPa	Primary pumps		_____ L/s@ _____ kPa			
Multipurpose pumps	_____ L/s@ _____ kPa	Ultrahigh-rise pumps		_____ L/s@ _____ kPa			
Gravity in ultrahigh-rises	_____ L/s@ _____ kPa						
Primary static storage tanks	x Capacity: L	Inflow: L/s		Fill time: h			
Reduced-capacity tanks	x Capacity: L	Inflow: L/s		Fill time: h			
Break tanks	x Capacity: L	Inflow: L/s		Fill time: h			

Part 6 Achieved results of installed equipment with MDHs operating (simultaneously)							
Fire brigade booster assembly equipment used:	Boost pressure - Zone 1	_____ L/s@ _____ kPa		Friction loss: kPa			
	Boost pressure - Zone 2	_____ L/s@ _____ kPa		Friction loss: kPa			
Feed fire hydrants serving boosters	FH to FT inlet	_____ L/s@ _____ kPa		Hydrants located as per AS 2419.1		Y/N	
Hard suction to fire truck	Max. lift (-30) kPa	_____ L/s@ _____ kPa					
<i>Equipment used for:</i> Feed and attack fire hydrant tests				AH:		FH:	
Network utility operator - static pressure	Ground level: kPa	MAH: kPa		MDH: kPa			
Unassisted hydrant locations tested	H1x1 N/W with H2x2	H2x2 Level 2 with H1x1		H3			
Simultaneous flowing pressure	H1: _____ L/s@ _____ kPa	H2: _____ L/s@ _____ kPa		H3: _____ L/s@ _____ kPa			

Part 6 Achieved results of installed equipment with MDHs operating (simultaneously)			
Achieved external dual outlets, internal single outlet hydrant outlets results operating simultaneously. For example, <i>H1 × 1 outlet with H2 × 2 outlets</i>	Attack fire hydrant	_____ L/s@ _____ kPa	External and internal hydrant cover achieved and outlets on 35°
	Feed/Attack fire hydrant	_____ L/s@ _____ kPa	
	Feed fire hydrant	_____ L/s@ _____ kPa	
	Public street hydrant	_____ L/s@ _____ kPa	
	Internal AH	_____ L/s@ _____ kPa	
Secondary pumps	_____ L/s@ _____ kPa	Primary pumps	_____ L/s@ _____ kPa
Multipurpose pumps	_____ L/s@ _____ kPa	Ultrahigh-rise pumps	_____ L/s@ _____ kPa
Gravity fed droppers	_____ L/s@ _____ kPa		
Primary static storage tanks	Inflow rate: L/s	Fill time: h	Total capacity: L
Reduced-capacity tanks	Inflow rate: L/s	Fill time: h	Total capacity: L
Break tanks	Inflow rate: L/s	Fill time: h	Total capacity: L
≥ 4 h of firefighting water available	Y / N		
Required Block Plans installed	Y / N	Demands achieved	PASS / NC / FAIL / CA

Part 7 Pressure Zone: pumps actuation and achieved results levels: to							
Jockey Pump						Pressure-reducing stations	
Location	Cut in at	Cut out at				Inlet	Outlet
At pump location:			PASS / FAIL / CA			kPa	kPa
At hydrant (MDH):			PASS / FAIL / CA			PASS / NC / FAIL / CA	
Electric pump							
The number most hydraulically disadvantaged hydrants (MDHs) operating (simultaneously) <i>Using:</i>							
Located: H1: H2: H3:						Attempting _____ L/s@ _____ kPa	
Location	Cut in at	Churn at	Into pump	Out pump	H1	H2	H3
At pump location							
Hydrants (MDH)							
Pressure at flow achieved			_____ L/s@ _____ kPa				PASS / NC / FAIL / CA
Diesel Pump							
The No. most hydraulically disadvantaged hydrants (MDHs) operating (simultaneously) <i>Using:</i>							
Located: H1: H2: H3:						Attempting _____ L/s@ _____ kPa	
Location	Cut in at	Churn at	Into pump	Out pump	H1	H2	H3
At Pump location							
Hydrants (MDH)							
Pressure at flow achieved			_____ L/s@ _____ kPa				PASS / NC / FAIL / CA
Pressure Limits recorded							
Maximum <i>static</i> pressure tested at the MAH						kPa	
Maximum <i>flowing</i> pressure checked at the MAH while flowing at the MDH						kPa	
While electric and then diesel results were being recorded, the pressures at the MAH						PASS / NC / FAIL / CA	
Differential between installed Pumps							
Jockey pump start and cut out at the MDH						kPa	
Jockey pump start and first pump (usually electric) to cut in at the MDH						kPa	
Electric pump start and second pump (usually diesel) to cut in in at the MDH						kPa	
Differential between pumps is for site information only						INFORMATIVE	

Part 8 Pressure Zones: and hydrostatic pressure tests levels: to and to					
Test duration	Locations tested from	Leak rate	FH	MAH	MDH
minutes	Feed fire hydrant upstream of NRV to booster	L/m	kPa	kPa	kPa
minutes	Feed fire hydrant system without boosters	L/m	kPa	kPa	kPa
			Booster		
minutes	Booster connections Pressure Zone 1	L/m	kPa	kPa	kPa
minutes	Booster connections Pressure Zone 2	L/m	kPa	kPa	kPa
As applicable	Where PE Pipe is incorporated in system, refer to AS/NZS 2033				
The hydrostatic tests required for the systems demonstrated conformance:				PASS / FAIL	

Part 9 Non-conformance and other items	
e.g.	Valve not under booster head, level indicator not in sight from booster, b/g tracing tape on pipework
1	<i>etc...</i>
Inspection and tests conforming to AS 2419.1	
PASS / AA / FAIL	
Gauges used for tests:	

Appendix B (informative)

Fire hydrant system design

B.1 General

This appendix provides guidance on the application of some requirements applicable to a fire hydrant system design for a building having an effective height not more than 25 m.

B.2 Class 2 to 9 buildings having an effective height not more than 25 m

[Figure B.2](#) details a typical fire hydrant system for Class 2 to 9 buildings having an effective height not more than 25 m. [Table B.2](#) lists relevant clauses referred to by number in [Figure B.2](#).

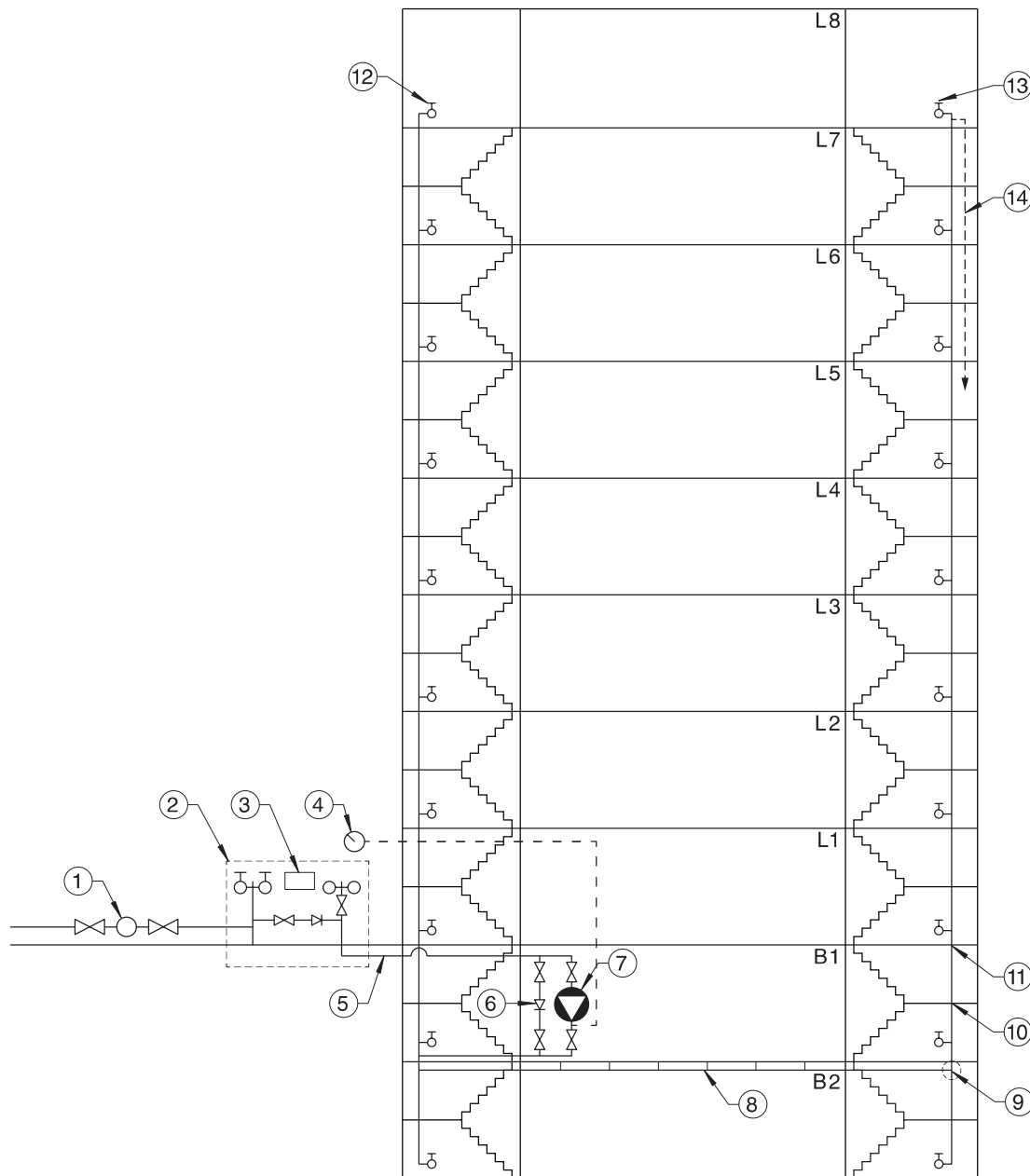


Figure B.2 — Class 2 to 9 buildings having an effective height not more than 25 m

Table B.2 — Supplement to Figure B.2

Number in Figure B.2	Clause / comment
1	See Clause 4.2 Water Supply for information on primary and secondary water supplies.
1	See Clause 4.3.1 Connection to a reticulated water supply and Clause 9.3.4 Backflow prevention devices for information on connecting to a network utility operator’s reticulated water supply network.
2	See Clause 2.2.5 Number of fire hydrant outlets required to flow simultaneously for information on the number of fire hydrant outlets required to flow for different sized fire compartments.
2	See Clause 7.3 Location and Clause 7.6 Protection of fire brigade booster assemblies for information on the location, positioning, and protection requirements for a fire brigade booster assembly.

Table B.2 (continued)

Number in Figure B.2	Clause / comment
2	See Clause 2.2.6 Pressure and flow and Clause 2.2.10 Feed fire hydrants for information on the performance of the feed fire hydrants of a fire brigade booster assembly.
2	See Clause 7.5.1 General, Clause 7.5.2 Number of booster connection inlets required and Clause 7.5.3 H-pattern fire brigade booster assembly for information on the configuration of a fire brigade booster assembly.
2	See Clause 7.1 General for information on the requirements for fire hydrant valves and fire brigade booster connections.
2	See Clause 2.2.6 Pressure and flow and Clause 2.2.11 Attack fire hydrants for information on the boosting of a fire hydrant system by a fire brigade pumping appliance.
2	See Clause 11.4 Pressure gauges for information on pressure gauges being provided at a fire brigade booster connection.
3	See Clause 11.3 Signage and Clause 11.5 Block plan for signage requirements at a fire brigade booster assembly.
4	See Clause 6.8 Fixed on-site pumpsets in series with the fire brigade booster assembly for information on the signage and ancillary equipment that is required at a booster assembly when a fixed on-site pump is installed in series.
5	See Clause 8.3 Fire mains, Clause 9.2.1 Above-ground pipework, Clause 9.2.2 Below-ground pipework, and Clause 10.10 Penetration of pipework through structures for information on the applicable pipe standards, the limitations placed on galvanised steel pipe and the requirements for pipework entering a building or other structure.
6	See Clause 6.8 Fixed on-site pumps in series with the fire brigade booster assembly for the requirements where a fixed on-site fire hydrant pump is installed in series with the fire brigade booster assembly.
7	See Clause 2.2.6 , Pressure and flow, Clause 2.2.11 Attack fire hydrants, Clause 6.1 General, Clause 6.2 When a pumpset is required, and Clause 6.3.1 Half-duty fire hydrant pumpsets for information on the performance and requirements for a fixed on-site half-duty fire hydrant pump.
8	See Clause 8.5 Internal pipework, Clause 10.5 Requirements for pipe-support components, Clause 10.6 Spacing of supports, Clause 10.7 Location of supports, and Clause 10.10 Penetration of pipework through structures for information on internal pipework and its support.
9	See Clause 9.5.2 Roll-grooved fittings and couplings for information on the jointing of steel pipe.
10	See Clause 8.3 Fire mains, Clause 9.2.1 Above-ground pipework and Clause 9.2.3 Additional requirements for steel pipe and fittings for information on minimum pipe size, pipe, and the applicable pipe standards for above ground pipe.
11	See Clause 8.5.1 General for information on the protection of internal pipework.
12	See Clause 3.2.2 Features, accessibility and clearances, Clause 3.6 Internal fire hydrants, and Clause 9.3.1 Fire hydrant valves for information on internal fire hydrants and hose coverage from these hydrants.
13	See Clause 2.2.6 Pressure and flow and Clause 11.4.2 Location of pressure gauges for information on the pressure and flow requirements at the most hydraulically disadvantaged fire hydrants.
14	See Clause 8.10 Test facility for information on the test facility and associated drainage.

Appendix C (informative)

Fire hydrant system design — large isolated buildings with a total volume more than 108 000 m³ and automatic storage and retrieval systems

C.1 Introduction

This appendix provides guidance on those requirements that should be incorporated into a fire hydrant system design, serving a large isolated building (LIB) having a total volume of more than 108 000 m³ or where an Automatic Storage and Retrieval System (ASRS) is installed, and the supporting infrastructure that will enable the attending fire brigade to optimize the use of the fire hydrant system.

The scope now limits the application of this document to buildings having a total volume not more than 108 000 m³. It also indicates that this document does not apply to automatic storage and retrieval systems (ASRS).

With the ever-increasing size of modern LIBs and the physical extent, arrangement, and density of storage in ASRS having the potential for extended duration fires that will challenge the attending fire brigade in a variety of ways, the fire hydrant system cannot be designed in isolation but as part of a coordinated fire safety strategy. For a fire hydrant system to effectively support fire brigade intervention activities, the design should take into account the dimensions (volume and floor area) of the building and the type of storage system installed, the commodities being stored, the height of storage and the type of fire sprinkler installed.

The fire safety strategy developed for the building should aid the movement and wayfinding endeavours of the attending fire brigade by including an access and egress system and a smoke hazard management system with the capacity to effectively clear smoke, particularly in the area of a sprinkler-controlled fire.

NOTE Refer to the NCC for information on performance solutions.

C.2 Large isolated buildings – Fire hydrant system design

C.2.1 General

In developing a fire hydrant system design for a modern Class 7b or Class 8 building having a volume more than 108 000 m³, the design should support and supplement the equipment that will be used by the attending fire brigade. In this regard, the equipment used by the attending fire brigade places limits on the activities that can be practically undertaken by the attending fire brigade. As such, a performance-based building and fire hydrant system design needs to take these limitations into account.

C.2.2 Provision for special hazards

An increase in the volume of material stored in Class 7b or Class 8 buildings having a total volume of more than 108 000 m³ presents firefighters with a variety of challenges and special hazards. These include the possibility of extended duration fires that require additional water supplies, internal wayfinding challenges and difficulties associated with delivering an internal hose stream to the seat of the fire in racked storage. Therefore, any fire hydrant system and associated infrastructure should address the special hazards these buildings present to firefighters.

NOTE Refer to the NCC for requirements relating to special hazards.

C.2.3 Volume and the number of fire hydrants required to flow

As Class 7b or Class 8 buildings having a volume of more than 108 000 m³ are outside the scope of this document, the provisions of [Table 2.2.5\(B\)](#) no longer apply. A first principles analysis should therefore be undertaken to determine the number of fire hydrants required to flow in these buildings. In undertaking this analysis, items for consideration include the floor area and total volume of the building, risks and special hazards associated with the building, the fire safety systems within the building, the water supply, and the fire brigade resources available. Irrespective of the analysis undertaken, not less than three fire hydrants required to flow should be provided in all instances.

C.2.4 Fire brigade booster assemblies and other firefighting infrastructure

The location of a fire brigade booster assembly and other infrastructure such as sprinkler boosters define where the attending fire brigade will be principally operating from at a fire. Therefore, when determining the location of the fire brigade booster assembly and firefighting infrastructure, the design approach applied should aim to locate this infrastructure as remotely as possible from the building and site risks. The application of this approach also aims to ensure that the infrastructure supports and facilitates safe and effective firefighting at the fire brigade's place of work.

When operating at an LIB fire, exclusion zones of not less than 1.5 times the height of the building are established to mitigate the risk to the attending fire brigade from building collapse. When considering the location of the fire brigade booster assembly (and sprinkler booster), the booster assembly should be located not less than 1.5 times the height of the building away from the building. [Figure C.2.9](#) highlights the application of this principle.

C.2.5 Fire hydrant coverage

Fire hydrant coverage should be provided to all parts of the floor area of the building. Additionally, where elevated walkways or platforms are provided in or around the ASRS, coverage should be provided to all parts of the walkway or platform.

Depending on the storage arrangements provided, fire hydrant coverage may also have to be provided to storage areas, elevated walkways or platforms not considered part of the floor area.

C.2.6 Fire hydrant location

Fire hydrants should be located externally to the building in the first instance and as remotely as possible from the risks associated with the building or site so that, if required, firefighters can enter the building under the protection of a charged line of hose.

Where internal fire hydrants are provided, they should be installed at locations that are provided with multiple access (and egress) paths to the hydrant.

C.2.7 Fire hydrant system pipework

Where the ring main serving the building extends into the building, external isolating valves should be provided so that in the event that an internal fire hydrant is damaged, supply to this fire hydrant can be isolated.

C.2.8 Fire hydrant pumps

The installed fire hydrant pumps should be sized to provide 10 L/s for each fire hydrant required to flow. Wherever possible the on-site pumps should be installed in parallel with the fire brigade booster assembly.

C.2.9 Fire hydrant system design

[Figure C.2.9](#) provides an example of the application of the provisions in the clauses above.

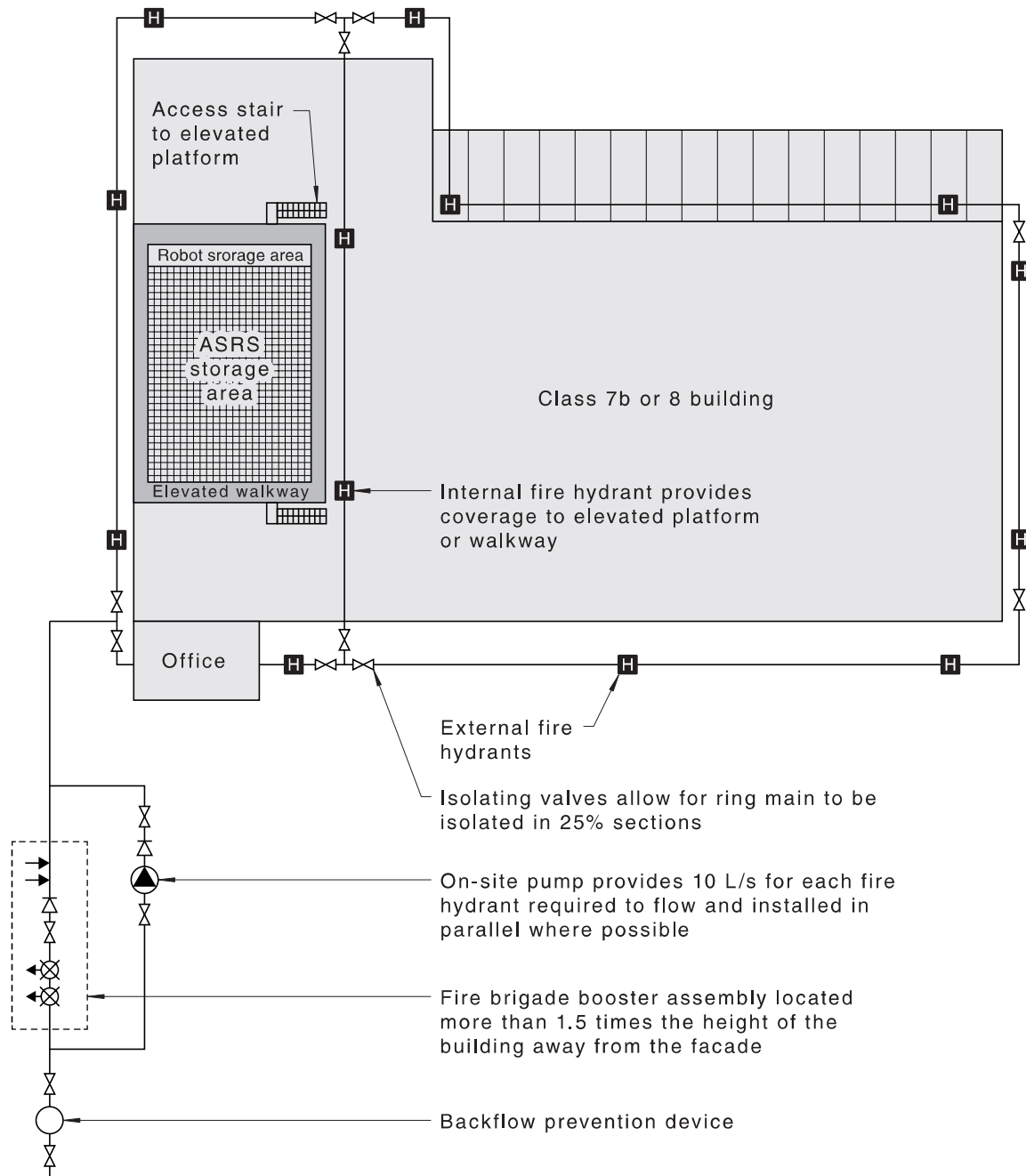


Figure C.2.9 — Fire hydrant system serving an LIB with an ASRS arrangement

C.3 Automatic Storage and Retrieval Systems

C.3.1 General

Despite the large variety of ASRS available, the systems share typical features such as the use of computer-controlled devices to place and retrieve discrete storage units at defined locations in a storage arrangement that is typically more densely packed than traditional manual storage methods. The typical features of mini-load, pallet-style and top-load ASRS are described below.

C.3.1.1 Mini-load ASRS

Mini-load ASRS use trays or small containers/totes that are transported to/from the storage area by stacker cranes travelling in aisles. The angle irons which support the containers divert sprinkler water away from the longitudinal and transverse flues and towards the face of the rack. The rack uprights in mini-load ASRS structures are typically about 450 mm to 600 mm horizontally apart and are about 50 mm to 75 mm in width and depth. The storage height and narrow aisles can make manual fire brigade intervention activities difficult.

C.3.1.2 Pallet-style ASRS

Pallet-style ASRS use stacker cranes travelling in aisles to transport pallet loads to/from open-frame racking. The pallets are typically supported by either horizontal beams that are perpendicular to the loading aisle or by roller-type conveyors. The storage height and narrow aisles can make manual fire brigade intervention activities difficult.

C.3.1.3 Top-load ASRS

Top-load ASRS use automated robots that move on a grid above the storage array and load and unload containers vertically, delivering them to operator stations for product picking/packing. The containers are typically constructed of plastic or metal and can be solid- or mesh-walled. Top-load ASRS systems have no aisles and, depending on container construction and the stored commodity, can result in deep-seated, long-duration fires that make final extinguishment challenging.

C.3.2 Fire hydrant system design considerations

The challenge of achieving final extinguishment of fires in various ASRS arrangements means the requirements for a fire hydrant system should be considered as part of an integrated fire safety strategy during the design phase. Consultation between the attending fire brigade and relevant stakeholders is advised so that the infrastructure is in place for safe and effective firefighting.

NOTE Relevant stakeholders may include the building operator/owner, ASRS provider, fire engineers, fire protection designers or insurer.

A sprinkler-controlled fire in the ASRS should be included as one of the design fires in fire hydrant system design if an appropriate sprinkler system is installed. One of the major challenges in this environment could be a sprinkler-controlled fire in the elevated rack or deep in a top-loading system. Expected delays due to difficulties with access and the delivery of hose stream water to the seat of the fire may require the following to be considered: extending water supply durations, additional access arrangements, modifications to ASRS control systems, and enhanced smoke exhaust systems.

C.3.3 Firefighting infrastructure

C.3.3.1 Fire hydrant system

To deal specifically with the risks associated with a fire in the ASRS, the strategic location of fire hydrants and/or the installation of additional infrastructure should be considered.

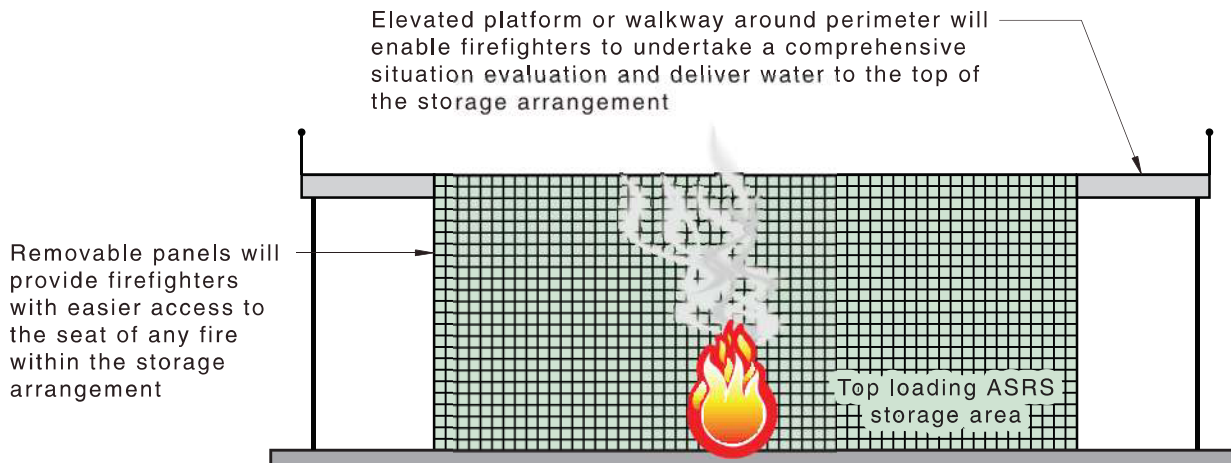
C.3.3.1.1 Mini-load or pallet-style ASRS

Where a mini-load or pallet-style ASRS is installed, consideration should be given to the installation of additional on-floor fire hydrants installed on a ring main and located around the perimeter of the storage array. Multiple paths of travel to the hydrants should be provided.

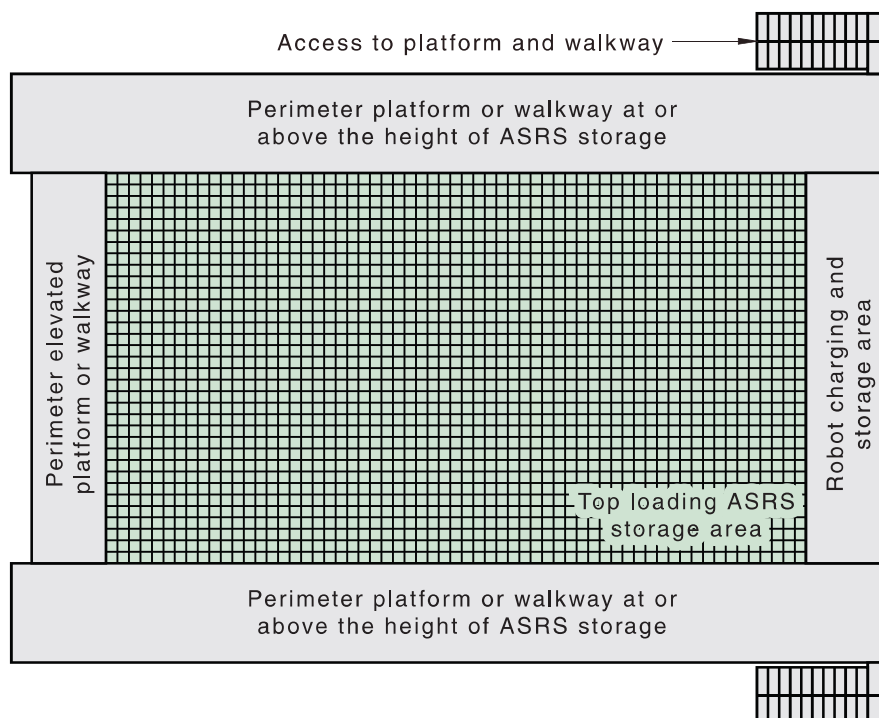
C.3.3.2 Top-loading ASRS

Where a top-loading ASRS using combustible containers or totes is installed, easily removable side panels and an elevated platform or walkway around the ASRS storage array should be provided at or

above the height of the array to allow a comprehensive assessment of the fire to be undertaken and to support fire brigade intervention, see [Figure C.5.1.2\(A\)](#).



(a)



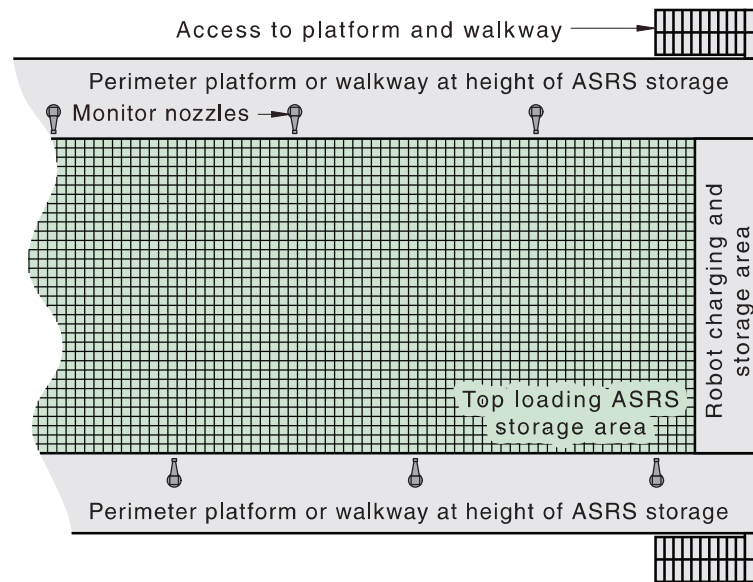
(b)

Figure C.5.1.2(A) — Elevated walkway and removable panels provided to a top loading ASRS array

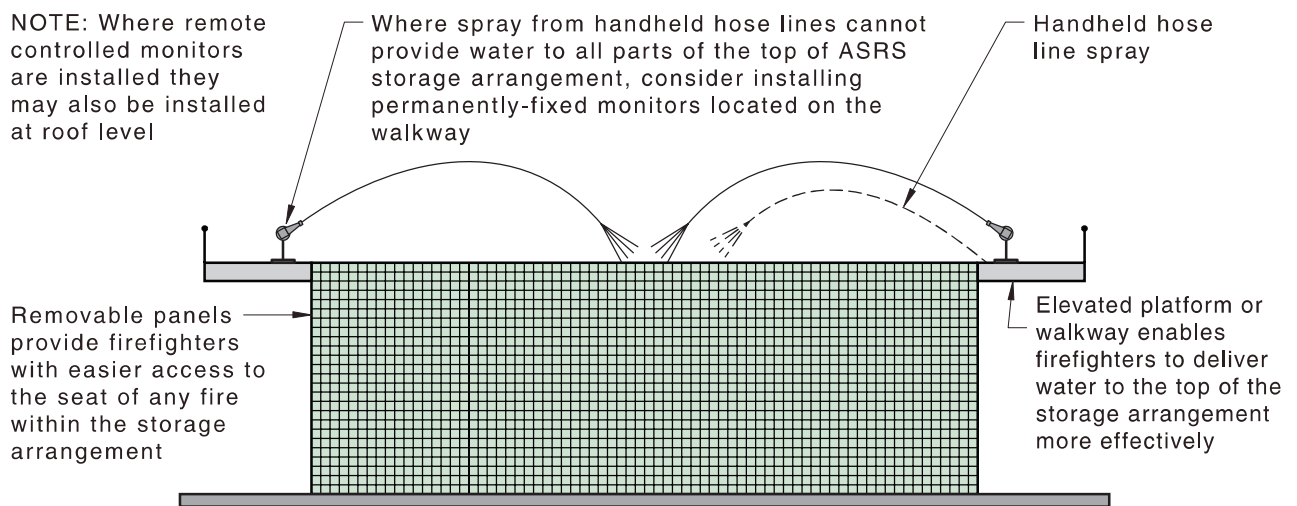
Where the ASRS storage array is of such a size that hand-held hose streams used from the elevated platform are unable to deliver water to all parts of the top of the storage arrangement, additional provisions should be considered, see [Figure C.5.1.2\(B\)](#). These additional provisions may include the installation of —

- (a) fixed-in-place monitor nozzles; or

- (b) remote control monitor nozzles and infrared cameras that are controlled from the FCR; or
- (c) sheet metal vertical barriers that extend from the floor to the underside of the storage grid, with one row on one side of the barrier devoid of storage, so that the storage array is segregated into areas less than the area of the operation of the sprinkler system design, in an endeavour to limit the fire size the sprinkler system has to deal with.



(a)



(b)

Figure C.5.1.2(B) — Fixed monitor protection to a top loading ASRS array

C.3.4 Fire sprinkler system infrastructure

The automatic sprinkler system protecting the ASRS should be designed in accordance with AS 2118.1 with due consideration for the storage arrangement and commodity hazards involved. Where AS 2118.1 does not provide guidance for the type of ASRS installed, the automatic sprinkler system should be designed using international Standards that are based on large-scale fire tests for the system under consideration.

The sprinkler system should be provided with an appropriate level of redundancy so that there is no single point of failure between the on-site water storage tanks and all sprinkler alarm valves. Additionally, to allow the fire brigade to supplement or extend the operation of the sprinkler system or both, eight sprinkler boost inlets should be provided. The corresponding number of feed fire hydrants, however, would not be required.

C.3.5 Water storage capacity and duration

The difficulty associated with manual response and access to a sprinkler-controlled fire in any ASRS means consideration should be given to extending the duration of the water supply for both sprinklers and hydrants. For top-loading ASRS the water supply should be capable of providing the combined sprinkler system and hydrant demands for four hours.

C.3.6 Additional provisions

Due to the unique nature of fires in ASRS, for the attending fire brigade to undertake safe and effective firefighting the following should be considered:

- (a) Provision to isolate electrical supply to crane aisles and robot/carrier charging stations without affecting supply to lighting systems above and/or within the storage system.
- (b) Provision of a very-early warning fire detection system (such as multi-point aspirating smoke detectors) above the storage area arranged to shutdown material handling systems.
- (c) Where robots are used, they should be programmed to proceed to a designated holding area void of storage below on operation of the very early warning fire detection system.
- (d) Provision for the fire brigade to command stacker cranes or aisle carriers to move to the aisle ends.
- (e) Access doors positioned such that the ends of the aisles are readily accessible.

C.4 Building Features

C.4.1 Smoke hazard management, lighting, and fire brigade wayfinding

While wayfinding for firefighters in these buildings will be dependent on many factors, smoke being the primary one, appropriate lighting and the capacity of the installed smoke hazard management system to remove smoke, particularly in and around a sprinkler-controlled fire, are considered to be critical to safe and effective firefighting.

C.4.2 Provisions for special hazards

To safely extinguish a sprinkler-controlled fire, smoke around the area of the fire should be removed.

NOTE Refer to the NCC for requirements relating to special hazards and the installation of additional smoke hazard management provisions.

C.4.3 Lighting

Lighting systems on independent circuits supplied from redundant power sources should be provided to enable the fire brigade to control the lighting in the fire-affected area.

C.4.4 Provision of exits, travel distance and SCBA

The most fundamental limitation of the self-contained breathing apparatus (SCBA), worn by all firefighters, is that it does not provide an inexhaustible supply of air. The SCBA cylinders can and will run out of air. Firefighters wearing SCBA cannot travel endless distances within a building, undertake firefighting operations and return to a place of safety without the inclusion of appropriate building

infrastructure. As such, for a Class 7b or Class 8 LIB, travel distances to an exit should not exceed 90 m from any point on the floor. Where this distance is exceeded, additional exits around and from within the building should be provided, see [Figure C.4.4](#).

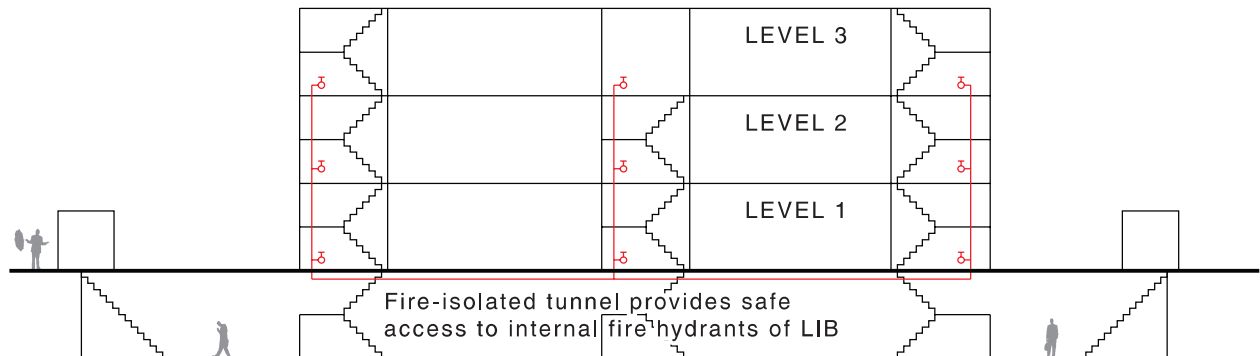


Figure C.4.4 — Internal fire-isolated stair and tunnel service interior of an LIB

C.5 Pre-planning

A detailed pre-fire plan should be developed to enhance the response of the attending fire brigade. In developing the plan, the following items should be considered:

- (a) Recognition that maintaining an operational sprinkler system is critical to a successful outcome
- (b) Methods to extend duration of water supplies through fire water tank and fuel top-ups.
- (c) Power isolation for cranes/carriers and charging stations
- (d) Access keys for gates/barriers that prevent access to aisles, storage grids, and the like.
- (e) Operation of manual smoke exhaust.
- (f) Fire brigade strategies and tactics for a fire involving the ASRS (e.g. deep-seated fire or an elevated fire as applicable).
- (g) Roles and responsibilities for the fire brigade and key facility personnel.
- (h) Fire brigade access to put cranes into fire mode and move cranes easily to an end of aisle.
- (i) Dismantling consideration.

To develop an effective pre-fire plan, all relevant stakeholders should be consulted.

NOTE Relevant stakeholders may include the fire brigade, design team consultants and insurers.

The plan should be documented and include tailored drawings showing items such as storage features, fire protection system details, hydrant locations, building layout and construction, access doorways, control system instructions, etc. The plan should be annually reviewed by way of an on-site walk through with the responding fire brigade.

Appendix D (informative)

Fire hydrant system design — Class 2 to 9 buildings having an effective height more than 135 m

D.1 General

The scope now limits the application of this document to buildings having an effective height not more than 135 m.

While the primary aim of this appendix is to provide guidance on the provisions that should be incorporated into a fire hydrant system design serving a building having an effective height more than 135 m, the principle themes discussed in this appendix though are considered applicable to fire hydrant system design in all high-rise buildings.

D.2 Background

Any review of tall building or super-tall building literature will speak to and endeavour to address the risks and unique challenges these buildings present. The common themes typically discussed in this literature include egress and evacuation challenges, access for emergency services, the importance of effective communication and situation awareness, fire resistance and the resilience and reliability of the active fire protection systems and any water supply that serves them.

When considering the requirements for a fire hydrant system in these buildings, the design of the fire hydrant system cannot be considered in isolation. As such, this appendix will touch briefly on some of the items that will support fire brigade intervention activities including the use of the fire hydrant system and the protection of building occupants more broadly.

D.3 The three “r’s”

Redundancy, robustness, and reliability. In terms of fire hydrant system design, these terms can be considered to represent the following concepts:

- (a) *Redundancy* — in a high-rise building there should be no single point of failure within the fire hydrant system that has the potential to compromise the operation and function of the system. As a minimum, an N +1 design philosophy should be applied throughout the design. In assessing the redundancy proposed to be provided to the fire hydrant system design, the consequences of a component part failing and being offline for an extended period should be evaluated. Where an extended time for replacement is identified, further levels of redundancy should be considered.
- (b) *Robustness* — this term speaks directly to the quality of the component parts of the system. All component parts installed within the fire hydrant system (and all other fire safety systems) in a high-rise building should be recognized for their quality, their durability, their longevity, and their serviceability.
- (c) *Reliability (or maintainability)* — A fire hydrant system design based only upon redundancy and robustness is likely to offer neither if provisions are not made for all components of the system to be easily maintained. Ready access to all component parts and the provision of test facilities are considered to be non-negotiable if a fire hydrant system is to support safe and effective firefighting and provide protection to building occupants for the life of the building.

The fire hydrant system design discussed in this appendix aims to highlight the concept of redundancy and reliability.

D.4 Supporting fire brigade intervention

When considering the fire safety strategy for a high-rise building, the design of a fire hydrant system cannot be considered in isolation. A fire hydrant system designed around the three “R’s” but without the provision of appropriate supporting infrastructure may result in fire brigade intervention activities being interrupted. Some of the infrastructure items needed would include:

- (a) *Communication* — For the attending fire brigade to operate a fire hydrant system effectively at a high-rise building fire, good communication is critical. Depending on the height, form of construction and the building design, the hand-held radios used to transmit fireground messages may not operate effectively. As such, consideration should be given to the installation of a radio signal amplification system.
- (b) *Access* — At a high-rise building fire, accessing any fire hydrant on any level is going to impact on any building evacuation currently being undertaken. Actions such as, creating a counter flow in the fire stair to that of descending building occupants, or the laying of firefighting hose for the commencement of firefighting operations will either delay or halt the evacuation being undertaken in that stair. When considering the size of stair landings and fire stairs more broadly, any building design should therefore consider the impacts of fire brigade intervention on these features.

With regard to the number of fire stairs provided, the more the better, particularly when it is considered that the connection to an internal fire hydrant, the laying of fire hose in that stair and access to the fire floor from that stair, will require the attending fire brigade to take control of this attack fire stair which may prevent further use of the stair by building occupants, while firefighting operations are being undertaken. Where only two stairs are provided, all floors above the fire floor may now only be served by a single fire stair. In this case, the single stair may also have to be controlled and monitored by the attending fire brigade for the safety of building occupants, further delaying the evacuation of building occupants.

In relation to stair landings, to ensure enough room is provided for the installation of internal fire hydrants, appropriate test facilities and possibly an AS 2118.6 alarm valve set, if a combined fire sprinkler and fire hydrant system is installed, a landing depth of not less than 1.4 m should be provided. This depth would enable the minimum egress width to be maintained, while providing sufficient space for the installation of critical fire safety infrastructure.

- (c) *The Fire Control Room* — Typically, the control of a high-rise building’s mechanical and electrical equipment will be done by a Building Management system (BMS). Where the BMS is not located within the Fire Control Room (FCR), provision should be made for the information from the BMS to be duplicated within the FCR. The availability of this information would support items such as fire brigade operational decision making, the use of the installed fire hydrant system, and undertaking safe and effective firefighting.

D.5 Improving redundancy and reliability

As buildings increase in height, building occupant safety and fire brigade intervention activities become more and more dependent on the continued operation of the installed fire safety systems, irrespective of the circumstance. When it is considered that a typical egress strategy for building occupants in a high-rise building is a staged approach, without the ongoing operation of the installed fire safety systems, it is highly likely that the egress strategy would diminish in effectiveness over time. Enhancing the redundancy and reliability of the fire hydrant, the fire sprinkler system, and all other fire safety systems should therefore be a priority.

With regard to fire hydrant system design and fire sprinkler design, two approaches are currently available: a bottom up approach and a cascade system (or top down approach). When comparing these approaches in terms of redundancy and reliability, each system is dependent on the performance and operation of installed fire pumps. The defining difference in the two design approaches is the additional redundancy an elevated on-site tank offers to wet fire services. Should on-site pumps fail, in a cascade design approach the roof top or upper level water storage tank can still support the continuing operation of the fire hydrant system (as distance from the tank increases) due to the influence of gravity and the operation of fire sprinklers. [Figure D.5](#) shows a five-pressure zone building where a roof top tank provides gravity supply to the three upper-most pressure zones. [Table D.5](#) should be read in conjunction with [Figure D.5](#) and explains the different aspects of the design approach in terms of redundancy and reliability.

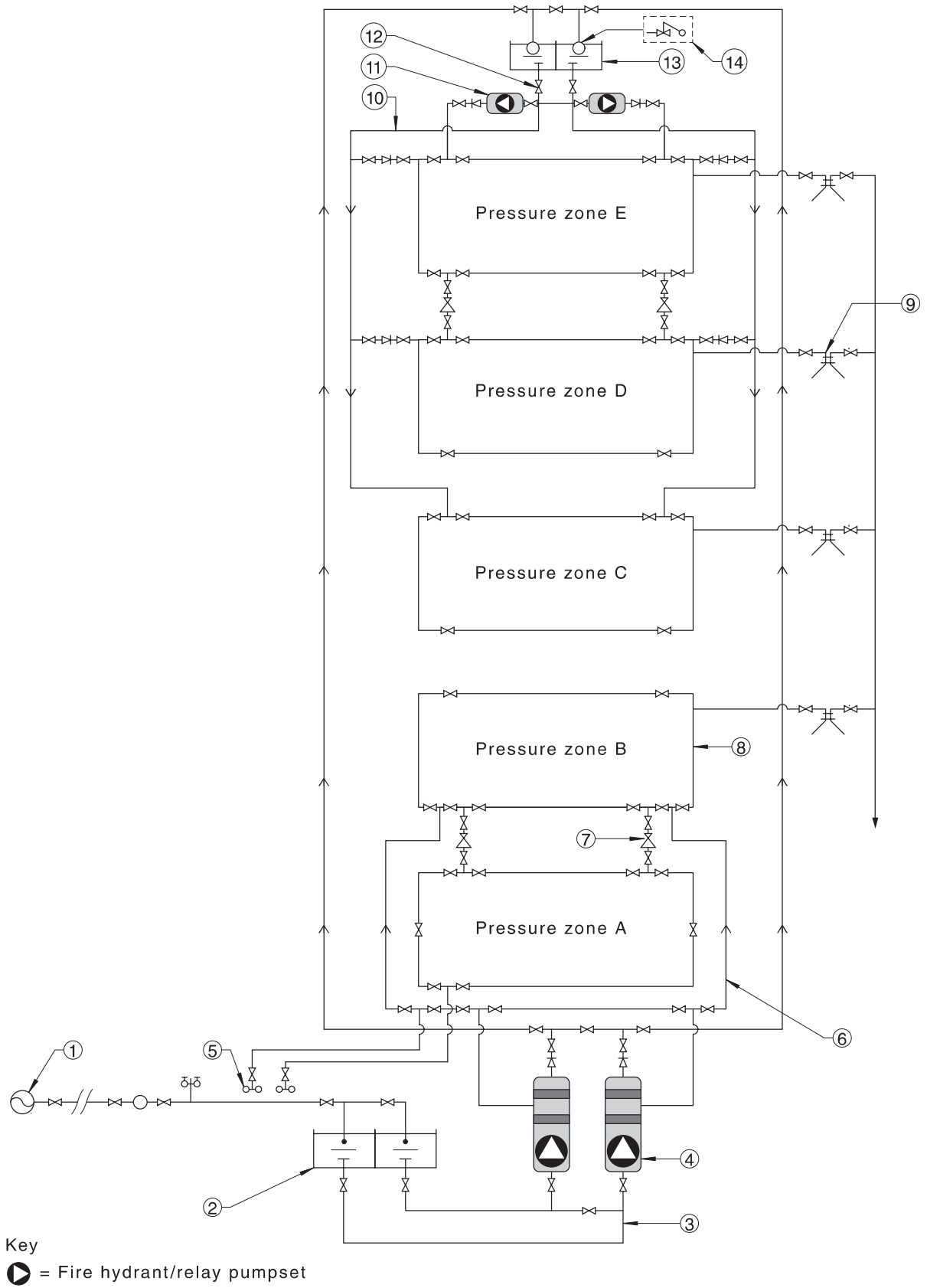


Figure D.5 — Cascade fire hydrant system design — Class 2 to 9 buildings having an effective height more than 135 m

Table D.5 — Supplement to Figure D.5

Item no. in Figure D.5	Comment
1	A single reticulated water supply is shown providing automatic inflow to the lower-level reduced-capacity water storage tank. In this circumstance, to improve the redundancy of the system, consideration should be given to providing an additional reticulated water supply to the lower-level tank or increasing the volume of the tank. Increasing the volume brings the added benefit of increasing the duration of the water supply to the upper-level tank should the reticulated water supply fail.
2, 3 and 4	The provision of a compartmented water storage tank (or two tanks), the pipe manifold and two automatic starting full-duty fire hydrant pumps aligns with an N + 1 redundancy approach.
5	In the event of the on-site pumps failing, the fire brigade booster assembly provides an additional level of redundancy to the lower levels of the building.
6, 7 and 8	<p>Two water supplies are provided from the full-duty fire hydrant pumps to Pressure Zone B and the upper level water storage tank. The redundant pathways provided by the installation of ring mains and the duplication of the pressure-reducing valves continues the N + 1 design approach.</p> <p>All rising pipe, carrying pressures above those required by the internal fire hydrants should be located outside the fire stair, as failure of high-pressure piping during a building evacuation would have significant consequences for any building occupants within the stair and fire brigade intervention activities.</p>
9	Designated test facilities within each pressure zone support the long-term reliability of the fire hydrant system.
10	The upper level tanks provide a duplicate gravity supply to three upper pressure zones of the building. Therefore, the gravity supply provided adds an additional level of redundancy to the fire hydrant system in the event of the on-site pumps failing.
11, 12 and 13	As with Items 2, 3 and 4, the provision of a compartmented water storage tank (or two tanks), the pipe manifold and two automatic starting full-duty fire hydrant pumps align with an N + 1 redundancy approach.
14	<p>The simple failure of a float valve modulating flow into an on-site water storage could have significant consequences for the continuing operation of the fire pumps drawing from the tank. To address this issue and to ensure an N + 1 design approach is applied, two hydraulic float valves arranged in series should be installed. Similar analysis should be applied to all component parts.</p> <p>An additional benefit to the duplication of float valves is that it also offers a level of protection from localized flooding should a valve fail.</p>

Appendix E (informative)

Special hazard areas

E.1 General

Where special hazards are identified within a building, open yard, or industrial site, the requirements of this document may not appropriately address the risks associated with these hazards, particularly flow rates and the fire hydrant locations. This appendix provides limited, general guidance only on some of the processes, commodities, storage configurations and structures associated with special hazards, some of the standards and codes applicable to this specific area of risk and some considerations for providing a fire hydrant system for the special hazard identified within the building or site.

NOTE Refer to the NCC for requirements relating to special hazards and the installation of additional smoke hazard management provisions.

E.2 Hazards

For the purpose of this document, special hazards are characterized by their ease of ignition, explosive tendencies, high fire load, and difficulty of access.

The following examples highlight particularly hazardous processes, commodities, configurations and geometry:

- (a) Processes —
 - (i) chemical plants;
 - (ii) oil refineries; and
 - (iii) explosives factories.
- (b) Commodities —
 - (i) flammable gases such as, acetylene, hydrogen, liquefied petroleum gas (LPG), liquefied natural gas (LNG);
 - (ii) flammable and combustible liquids such as, alcohols (e.g. ethanol and methanol), diesel, petrol, thinners, turps;
 - (iii) flammable solids such as, aluminium phosphide, calcium carbide, magnesium, potassium, sodium, sulfur, and nitrocellulose;
 - (iv) oxidising agents such as ammonium nitrate, sodium nitrite;
 - (v) miscellaneous dangerous goods such as lithium batteries, ammonium nitrate fertiliser; and
 - (vi) expanded and unexpanded plastics, foam plastics.
- (c) Configuration of storage —
 - (i) high piles;
 - (ii) stacked timber;

- (iii) coal heaps;
 - (iv) grain and sugar silos; and
 - (v) storage tanks or pressure vessels.
- (d) Geometry of structures —
- (i) process towers;
 - (ii) cooling towers;
 - (iii) conveyors; and
 - (iv) wharves.

E.3 Factors to be considered

Where a fire hydrant system is being designed for a special hazard area, consideration should be given to the following:

- (a) Pressure, flow rates, and duration of water supply required to address the specific hazard.
- (b) Possible use of supplementary water from sources such as cooling water basins.
- (c) Protection of pipework and equipment from possible explosion.
- (d) Protection of pipework against corrosion.
- (e) Access of firefighters to the fire risk.
- (f) Availability of hardstand for firefighting appliances.
- (g) Provision of equipment such as monitors, water spray systems, fog systems and foam systems.
- (h) Automatic and/or remote control of installed monitors, water spray systems, or the like.
- (i) Location of isolating valves.
- (j) Location of hydrants.

NOTE For special hazards located in designated open areas, the regulatory authority may require an increase in separation distances.

E.4 Hazard analysis and additional considerations

When analysing the hazards associated with a special hazard area, consideration should be given to the following:

- (a) The provisions of the NCC.
- (b) Undertaking a risk assessment of the potential fire scenarios in accordance with the processes detailed in ISO 31000.
- (c) Consulting with the relevant regulatory authority.
- (d) Consulting with the relevant fire service or fire brigade.
- (e) Referring to the applicable Australian Standard (e.g. AS 1940, AS/NZS 1596, AS/NZS 2022, AS/NZS 3833 or AS 3846).

NOTE Refer to the relevant state or territory authority for legislation on work health and safety.

Appendix F (informative)

Fire brigade operations and equipment — Design considerations for fire hydrant systems

F.1 Scope

This appendix provides information and guidance on fire brigades, fire brigade pumping appliances, fire brigade operations and firefighting strategies used when controlling or extinguishing fires in buildings. An understanding of these aspects is considered fundamental to designing a fire hydrant system that meets the operational needs of the attending fire brigade and the design requirements of this document.

F.2 Introduction

F.2.1 Firefighters

In Australia, depending on which fire service has jurisdiction in an area, a fire station may be staffed by full-time firefighters, part-time or retained firefighters, volunteers, or a combination of these.

Fire stations staffed with full-time firefighters are found in all major metropolitan areas and in selected large regional cities and towns across Australia.

Fire stations staffed by part-time or retained firefighters or volunteers are typically found in regional cities and towns.

F.2.2 Response capability

The number and type of fire brigade pumping appliances and the number of firefighters available to respond to a fire incident will depend on the fire service that has jurisdiction and the location of the fire in its area of jurisdiction.

Typically, if a fire incident occurs in a metropolitan area, a large and comprehensive response incorporating multiple fire brigade pumping appliances and numerous firefighters is available if required. In regional centres and towns, a similar response is not possible due to the limited resources available. In some regional centres and towns, additional resources (i.e. fire brigade pumping appliances and firefighters) may be sourced from neighbouring towns and areas.

F.2.3 Equipment

To undertake firefighting operations, the attending firefighters carry a range of equipment. This equipment and their approximate weights are detailed in [Table F.1](#).

Table F.1 — Typical equipment used by fire brigade

Equipment	Weight
Firefighting uniform	9.5 kg
Self-contained breathing apparatus	12.0 kg
One length of 70 mm hose (non-percolating)	16.5 kg
One length of 38 mm hose (non-percolating)	7.8 kg
One 70 mm firefighting branch	4.4 kg
One 38 mm firefighting branch	2.1 kg
One standpipe	8.3 kg

F.2.4 Implications for design

The design of a fire hydrant system should take into account the fire brigade within that area (i.e. metropolitan, country, or rural), the staffing provided (i.e. full-time, part-time or volunteer) and the response capability available (i.e. number and type of pumping appliances available within the area).

NOTE Refer to the NCC for further information on the provision of a fire hydrant system appropriate to the needs of the attending fire brigade.

Due to the weight of equipment required to be carried wherever possible, the distance from an external fire hydrant to a hardstand should be minimised.

In regional towns and centres where resources are typically limited, consideration should be given to the number of fire brigade pumping appliances and firefighters available to respond to a fire incident. For example, in a regional centre provided with only two fire brigade pumping appliances, the provision of a fire brigade booster assembly will enable the attending fire brigade to use the limited resources available more effectively.

F.3 Fire brigade operations

F.3.1 General

Figure F.3.1 below provides a simplified representation of how fire brigade operations are conducted at a fire incident.

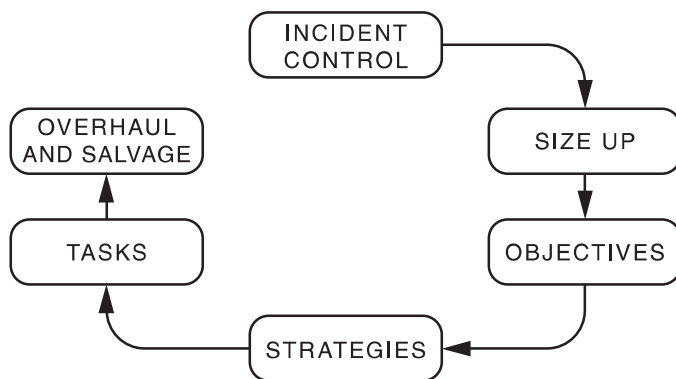


Figure F.3.1 — Incident control cycle

F.3.2 Incident control

Unless lives are at risk, the first priority at a fire incident is to establish an incident command point. The incident command point may be either internal or external to the building depending on the type

of building, the fire safety systems installed within the building, and the location and size of the fire. When established, other priorities of the fire brigade incident command include:

- (a) Taking control of the incident, evaluating the situation, identifying risks, and developing an action plan to bring the incident to its conclusion.
- (b) Tactically deploying the available firefighters and resources.
- (c) Continually gathering and monitoring information from the fire ground to enable fire ground strategies and tactics to be evaluated and modified as required.
- (d) Providing support to firefighters (e.g. additional resources, food, or fuel).

Depending on the size and complexity of the fire incident, control of the fire incident can be expanded to include multiple levels involving other members of the fire brigade or contracted as required.

F.3.3 Size up

F.3.3.1 General

Upon establishment of an incident command point, an initial size up of the incident is conducted. Some factors to be considered include:

- (a) The characteristics of the building.
- (b) The exposure(s) threatened by the fire.
- (c) The location of the fire.
- (d) The best means of extinguishing the fire.
- (e) The assistance required.

As part of this initial size up, the risks associated with the fire incident are identified and strategies to mitigate these risks are developed. For example, a risk typical to all building fires is the presence of electricity, so a typical mitigation strategy would be to isolate the electrical supply or part of the power supply if safe to do so.

F.3.3.2 Building

In the size up of the building, some factors to be considered include:

- (a) Whether all building occupants are accounted for.
- (b) The type of building occupancy and its characteristics (e.g. type of construction, compartmentation within the building, location of access and entry points, and available fire safety systems).
- (c) Any hazards associated with the building (e.g. gas or LPG supplies and storage).
- (d) The potential for structural collapse.

F.3.3.3 Exposures

In the size up of risks to exposures, some factors to be considered include:

- (a) Internal exposures — protection of the internal parts of the building threatened by the growing fire.
- (b) External exposures — protection of other occupancies, adjacent to or adjoining the building that are threatened by the growing fire.

- (c) The risk of air and water pollution due to the products of combustion released at all fires.

F.3.3.4 Location

In the size up of the fire, some factors to be considered include:

- (a) The location of the fire.
- (b) The most appropriate means of accessing the fire.
- (c) The characteristics of the fire (i.e. how rapidly it is growing, whether it is growing vertically or horizontally, and the amount of smoke and heat being produced).
- (d) The personnel protective equipment (PPE) required by firefighters.
- (e) The likely means of fire spread (e.g. radiant heat, convection, conduction, flying embers and direct flame impingement).
- (f) The effect of the fire and fire suppression techniques on the building structure.
- (g) The most effective cut-off points and means of extinguishing the fire.

F.3.3.5 Extinguishment

In the size up of the fire some factors to be considered include:

- (a) The type of fuel burning.
- (b) The most appropriate extinguishing agent.
- (c) The adequacy of the water supply serving the building or site.
- (d) How to most effectively use the fire hydrant system provided
- (e) The most appropriate means of ventilating the fire.
- (f) Any special hazards associated with the fuel that is burning.

F.3.3.6 Assistance

In the size up to effectively resource the fire, some factors to be considered include:

- (a) The need for additional firefighters.
- (b) The need for additional fire brigade pumping appliances.
- (c) The need for specialist fire brigade pumping appliances (e.g. aerial appliances, foam appliances or CO₂ appliances).
- (d) The need for specialist advice (e.g. electrical or network utility operator).

F.3.4 Objectives

On all fire grounds the primary objectives of the attending fire brigade are:

- (a) To save saveable lives.
- (b) To save saveable property.
- (c) To protect the environment.

In all instances, the primary objective of any fire brigade intervention activity is to locate and rescue any reported building occupants.

F.3.5 Strategies

The following firefighting strategies are available to achieve the stated objectives:

- (a) *Offensive* — An offensive firefighting strategy aims to contain the fire to the area of origin within the building. The decision to undertake this choice of strategy and commit firefighters to an internal fire attack is determined by the internal fire conditions. Should the prevailing internal conditions be identified as tenable to firefighters wearing personal protective equipment (PPE) during the initial size-up, an offensive firefighting strategy will be adopted.

Where an offensive firefighting strategy is adopted, the hose lines attached to a fire brigade pumping appliance will be pressurized by the pumping appliance to provide a pressure of 700 kPa at the nozzle of any firefighting hose branch. Internal firefighting is typically conducted using smaller diameter fire hoses (e.g. 38 mm).

- (b) *Defensive* — A defensive firefighting strategy typically aims to contain the fire to the building of origin (i.e. the efforts of the attending fire brigade are aimed at protecting adjoining or adjacent buildings). The decision to undertake this choice of strategy and not commit firefighters to an offensive internal fire attack is determined by the internal fire conditions. Should the prevailing internal conditions be identified as untenable to firefighters wearing PPE during the initial size-up and the risks involved in an offensive strategy are too high, a defensive firefighting strategy will be adopted.

Where a defensive firefighting strategy is adopted, lower pressures are normally provided at the nozzle of any firefighting branch; however, significantly higher flow rates are also provided and larger diameter fire hoses are typically used (e.g. 65 mm or 70 mm).

F.3.6 Tactics

To achieve the stated objectives, the following firefighting tactics will be prioritized:

- (a) *Rescue* — save and protect people's lives, including those of firefighters.
- (b) *Exposure* — confine the fire to the compartment or building of origin.
- (c) *Containment* — stop the spread of fire.
- (d) *Extinguish the fire* — deploy resources to overwhelm the fire.
- (e) *Overhaul* — totally extinguish all pockets of fire.
- (f) *Ventilation* — planned and systematic removal of heat and fire gases.
- (g) *Salvage* — commence damage control operations as soon as possible during fire attack.

These tactics represent a hierarchical framework for decision making where resources are assigned to deal with each tactical priority before committing resources to the next. Where resources are available and circumstances permit, firefighters may be assigned to more than one tactical priority at the same time.

F.3.7 Tasks

F.3.7.1 General

Once the strategic and tactical priorities for the fire incident have been established, some of the tasks to be undertaken include:

- (a) Door entry — forcible entry into the building;
- (b) Breathing apparatus operations;

- (c) Operation of the fire brigade booster assembly; and
- (d) Deployment of fire hose lines.

F.3.7.2 Fire ground sectoring

Each side or floor of the building will be allocated a sector name to facilitate fire brigade intervention and control of resources.

For low-rise buildings, each side of the building is allocated a sector name. Typically, the front of the building is designated as Sector A, with other sides named Sector B, Sector C, respectively in a clockwise direction. A diagrammatic example of fire brigade operations using sectoring is shown in [Figure F.3.7.2](#). Each sector is then assigned a “Sector Commander A, B, C”, as applicable.

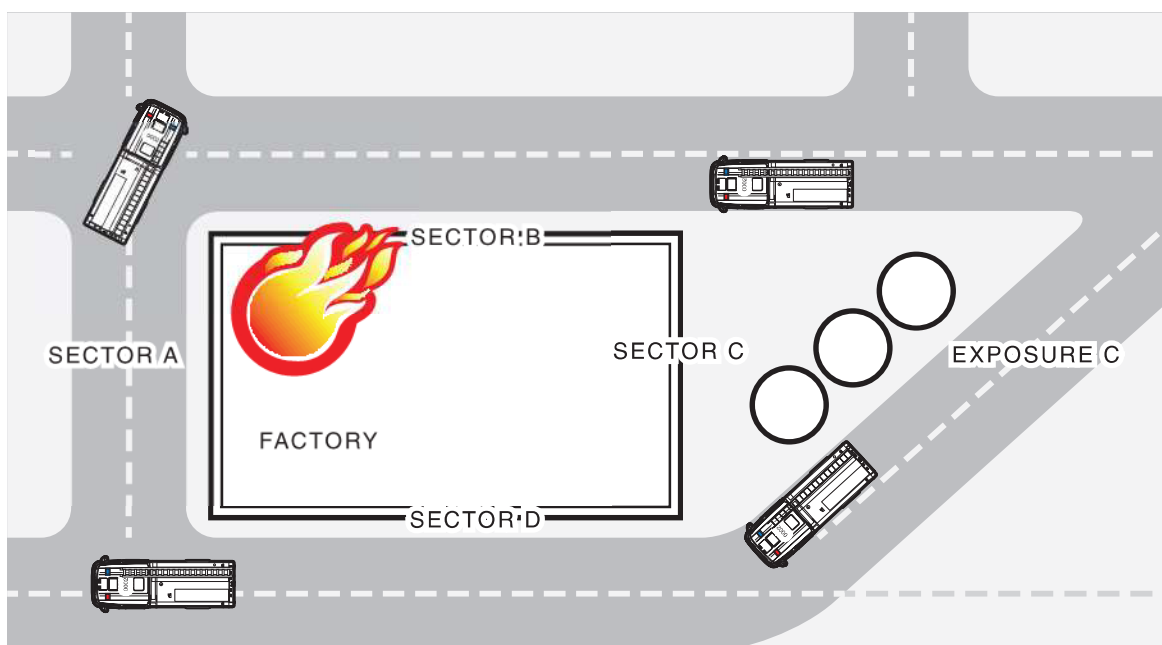


Figure F.3.7.2 — Sectoring during fire brigade operations

For multi-level buildings, the building’s floor numbering or naming system will be used to sectorise the building and identify the locations where firefighters are operating. Each floor level involved in the control of the fire is then assigned a “Sector Commander floor level 1, 2, 3”, as applicable.

Fire brigade activities undertaken in each of the building’s sectors and the fire conditions at those locations are regularly communicated to the incident command point.

F.3.7.3 Firefighting operations — Low-rise buildings

After an initial size-up of the fire incident has been conducted, a determination of whether additional resources are required will be made. The number of firefighters and resources required will reflect the size and complexity of the fire scenario confronted.

Where a small fire is identified, this may be extinguished by the first arriving appliance in attendance using either an on-board high-pressure hose or a small-bore (38 mm) layflat hose that is pressurized by the on-board appliance pump with water supplied from an on-board tank.

Where internal firefighting is required in a low-rise building, layflat firefighting hose connected to either an external attack fire hydrant, an internal attack fire hydrant or a fire brigade pumping appliance will be used. Supply to a fire brigade pumping appliance will typically be from either a street hydrant or feed fire hydrant. To facilitate safe and effective firefighting of a fire internally, a pressure of

not less than 700 kPa would be provided at the firefighting branch by either the fixed on-site pump or by the fire brigade pumping appliance.

Where a larger fire is identified, additional resources may be required for strategic deployment around/throughout the building to control the spread of fire and to protect any exposures under threat by fire.

At a large fire, multiple hose streams using larger diameter hoses (up to 70 mm) and aerial appliances using high discharge monitors are likely to be deployed. In such operations, large volumes of water are needed. If water is not available on site or immediately adjacent to the site, it will be obtained from sources further afield, such as street fire hydrants in other locations or reservoirs and, if necessary, relayed through additional pumping appliances and layflat hose to the fire location.

The organizing, command, and control of the fire incident and the resources available will be undertaken by a single fire brigade officer or through the establishment of a hierarchical structure using multiple fire brigade officers, depending on the size of the fire.

F.3.7.4 Firefighting operations — High-rise buildings

Fires in high-rise buildings often pose special challenges to the attending fire brigade because of the time taken to get firefighters and resources to the fire floor. Typically, the attending fire brigade travel to the level below the fire floor, often by taking control of the firefighter lift within the building. The first arriving firefighters, carrying small diameter layflat hose and forced entry equipment, then travel to the fire floor by the fire stair, connect the hose to the internal fire hydrant on the floor and then enter the fire floor under the protection of a charged line of hose and possibly a firefighting hose stream. To facilitate safe and effective firefighting of a fire internally, a pressure of not less than 700 kPa is provided at the firefighting branch by either the fixed on-site pump or by the fire brigade pumping appliance.

F.3.8 Overhaul and salvage

At the conclusion of a fire incident or when the fire is under control, activities aimed at ending the fire incident are initiated. Some of the tasks undertaken include —

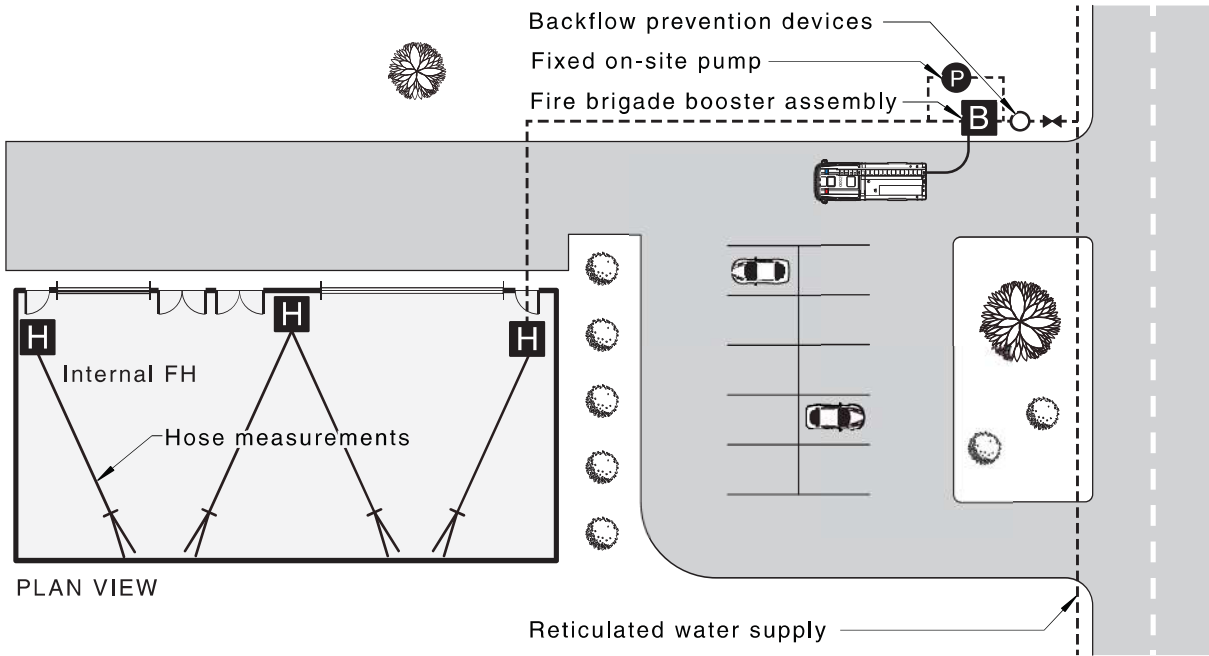
- (a) removal of water from the building;
- (b) reduction of water damage;
- (c) extinguishment of spot fires; and
- (d) protection of stock.

F.3.9 Implications for design

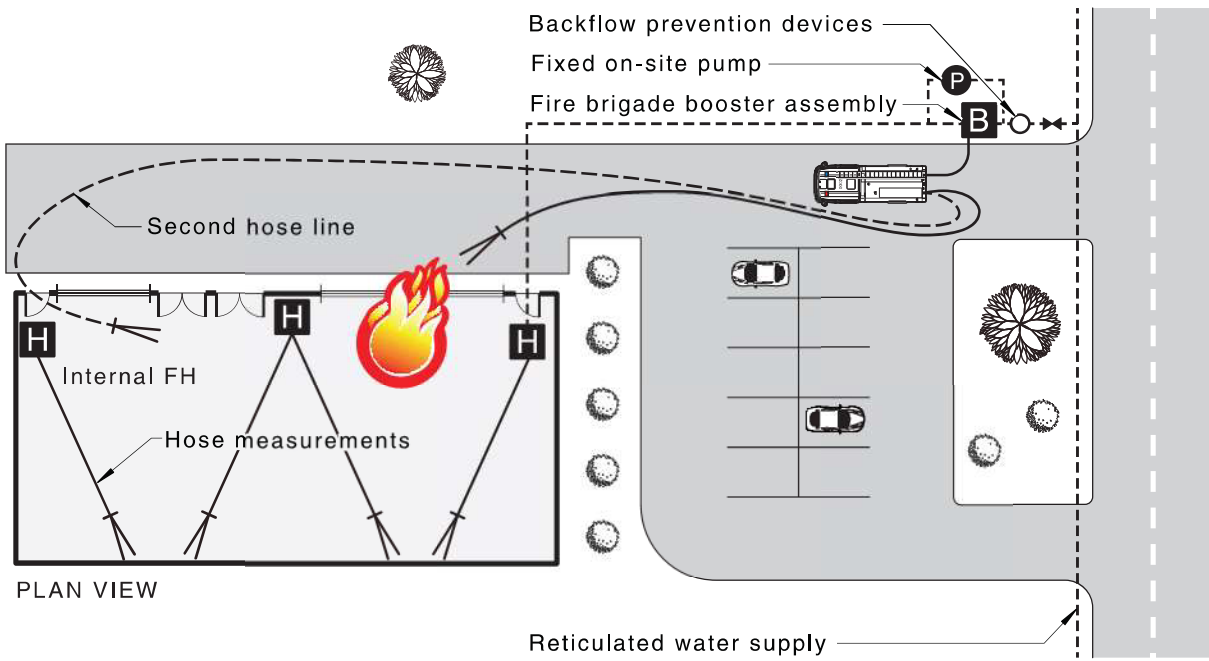
In reviewing a fire hydrant system design, some questions to be asked include:

- (a) Does the fire hydrant layout allow for offensive and defensive firefighting operations to be undertaken?
- (b) Does the fire hydrant layout provide attending fire brigade personnel with ready access to a fire hydrant as they approach and progressively move through or around a building?
- (c) Does the fire hydrant layout locate the first feed fire hydrant or fire brigade booster assembly in a position that may be readily seen by the attending fire brigade upon approach to the building?
- (d) Are the fire hydrants in the design located as far as practicable from the risks associated with the building?

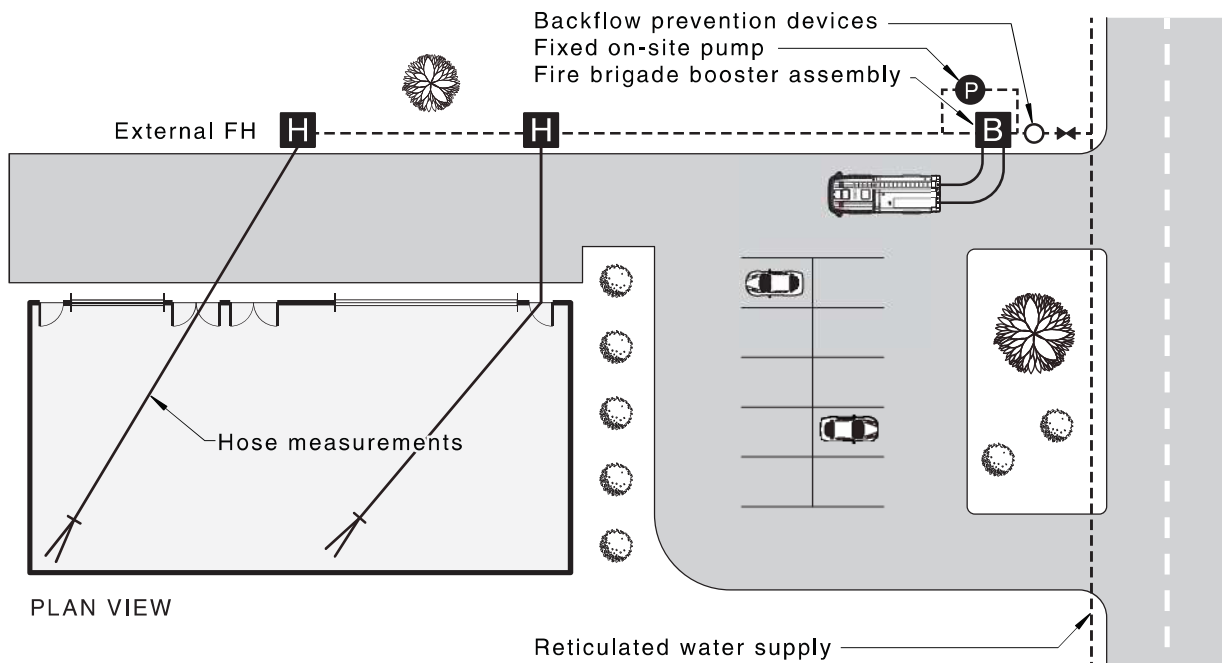
[Figure F.3.9](#) and the following text provide a discussion on fire hydrant system designs and fire brigade operations.



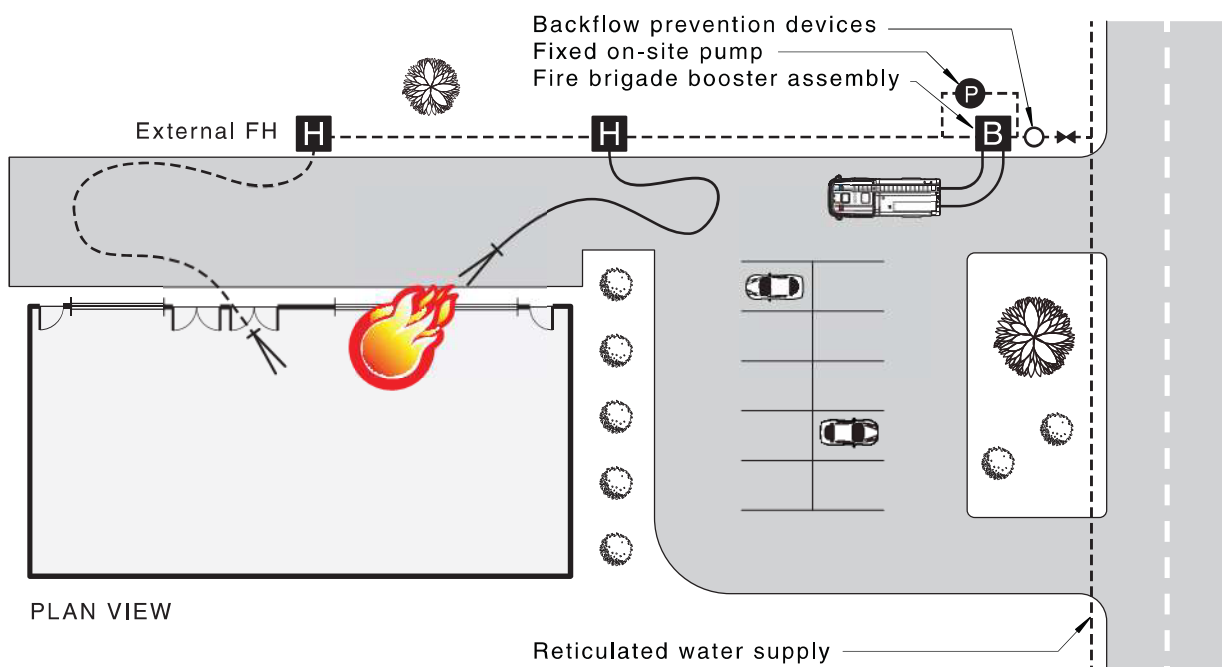
(a) Low-rise building internal fire hydrant system design



(b) Low-rise building internal fire hydrant system design — Operational impact



(c) Low-rise building external fire hydrant system design



(d) Low-rise building external fire hydrant system design — Operational impact

Figure F.3.9 — Fire hydrant system design and operational impact

In [Figure F.3.9\(a\)](#), to provide fire hydrant coverage to all parts of this low-rise building, fire hydrants have been located internally not more than 4 m from the exits. In [Figure F.3.9\(b\)](#), the problem of this design approach is highlighted, with the fire in the building compromising access to the internal fire hydrants and, therefore, compromising the effectiveness of the fire hydrant system. In the example shown, the attending fire brigade are unable to access the internal fire hydrants and are required to lay all hose from the fire brigade pumping appliance, which may result in extended hose lays and a delay in fire brigade intervention.

In [Figure F.3.9\(c\)](#), to provide fire hydrant coverage to all parts of this low-rise building, fire hydrants have been located externally from the building. In [Figure F.3.9\(d\)](#), the benefits of this design approach are highlighted, with the fire in the building not compromising access to the external fire hydrants. As such, through the application of this design approach, the attending fire brigade can commence operations in an environment free from heat and smoke thus allowing the brigade to rapidly deploy hose lines.

In summary, when developing a fire hydrant system design, the design should consider not only how the attending fire brigade will approach and move through and around the building as they endeavour to extinguish a fire in any location within the protected building but also the risks associated with the building. For low-rise buildings in particular where space is available around the building, external fire hydrants should always be installed.

F.4 Fire brigade pumping appliances

F.4.1 General

Fire brigade pumping appliances are equipped with an on-board pump, which is used to increase the pressure of the water supplied to it.

Fire brigade pumping appliances may be used for the direct connection of fire hoses to attack a fire, to boost the performance of an installed fire hydrant system or to supply water to an aerial appliance.

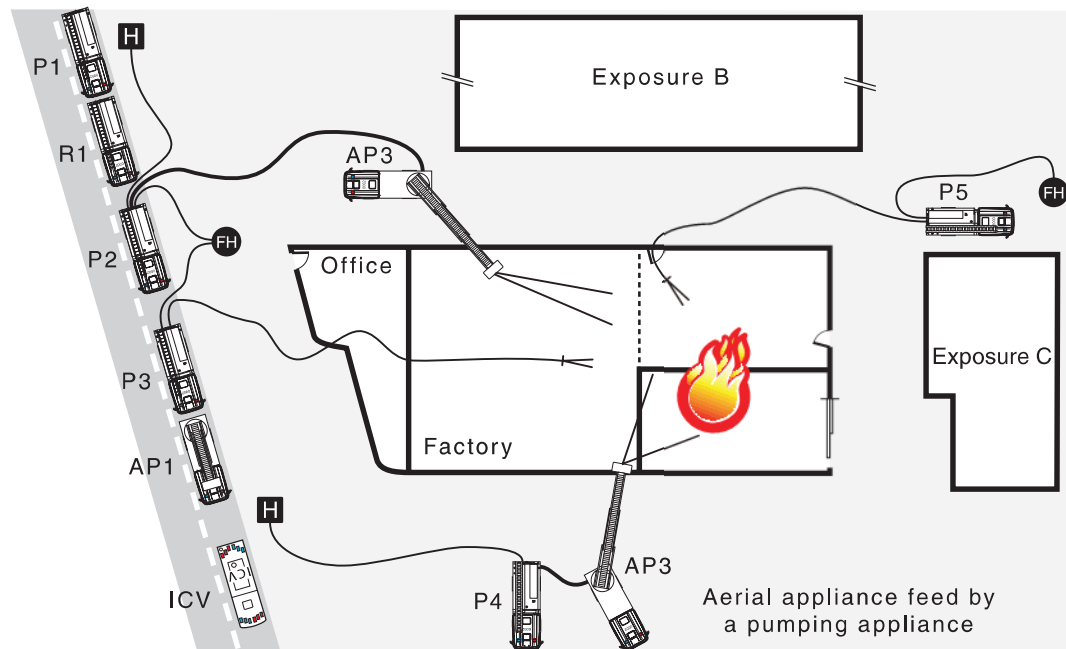
F.4.2 Fire brigade aerial appliances

Aerial appliances have on-board hydraulically operated extending ladders, elevating platforms or extending booms, with firefighting nozzles fixed to the elevating part of the appliance. These are used principally to direct large capacity hose streams down onto a fire or onto adjacent exposures, to prevent fire from spreading.

Aerial appliances are fitted with outriggers for stability; however, where excessive ground gradients are present, despite the provision of outriggers, aerial appliances may not be able to be used. As such, where a hardstand is required, the gradient of the hardstand should not exceed 1 in 8. The hardstand and approaches with gradients less than 1 in 8 will also enable all other fire brigade vehicles to manoeuvre more effectively around a site.

Aerial appliances may or may not be fitted with a pump.

[Figure F.4.2](#) provides a typical example of deployment of fire brigade pumping and aerial appliances at a large fire.



Key

P	=	pumping appliance
R	=	rescue appliance
AP	=	aerial appliance
ICV	=	incident control vehicle
H	=	street hydrant
FH	=	on-site feed fire hydrant

Figure F.4.2 — Deployment of pumping and aerial appliances

F.4.3 Pumping operations

Where a reticulated water supply is available, layflat (soft canvas) hose conforming to AS 2792 is used to connect a feed fire hydrant to the pump suction of the fire brigade pumping appliance. A minimum pressure at the feed fire hydrant is required to overcome the frictional losses associated with the layflat hoses at appropriate flow rates. At low feed pressures, the hose will begin to collapse and restrict supply. AS 2792 provides information on friction loss in layflat firefighting hose.

The type and capability of fire brigade pumping appliances available to attend a fire incident will, in most instances, vary between State and Territory and rural and metropolitan fire brigades. In major metropolitan areas and some regional centres, pumping appliances with a capacity of 1 000 kPa at 40 L/s or more are commonly available.

F.4.4 Draughting operations

Where a static water supply (e.g. reservoirs, open water or a ground level tank) is available, rigid wall fire hose (suction hose) is used to connect the water supply to the pump suction of the fire brigade pumping appliance. A characteristic of this suction hose is that it has been designed to withstand external pressures; as such, it has a pressure limitation of 200 kPa.

The successful draughting of water from a static water supply is dependent on the air in the suction hose being removed by the fire brigade pumping appliance. An on-board primer is used to remove the air from the suction hose and, as such, vertical and horizontal lift limitations are placed on the fire brigade pumping appliances draughting from a static water supply. For example, the maximum number of rigid wall suction hoses carried by a typical metropolitan fire brigade pumping appliance is three.

Apart from the vertical and horizontal lift limitations, appliance pump performance is compromised when operating with a negative suction pressure. [Figure F.4.4\(A\)](#) details some typical pump performance losses associated with draughting from a below-ground static supply.

The pump suction of a fire brigade pumping appliance may be located at the rear of the appliance as shown in [Figure F.4.4\(A\)](#) or mid-mounted as shown in [Figure F.4.4\(B\)](#). [Figure F.4.4\(B\)](#) details a typical example of a fire brigade pumping appliance with a mid-mounted large-bore suction connection draughting from an on-site tank.

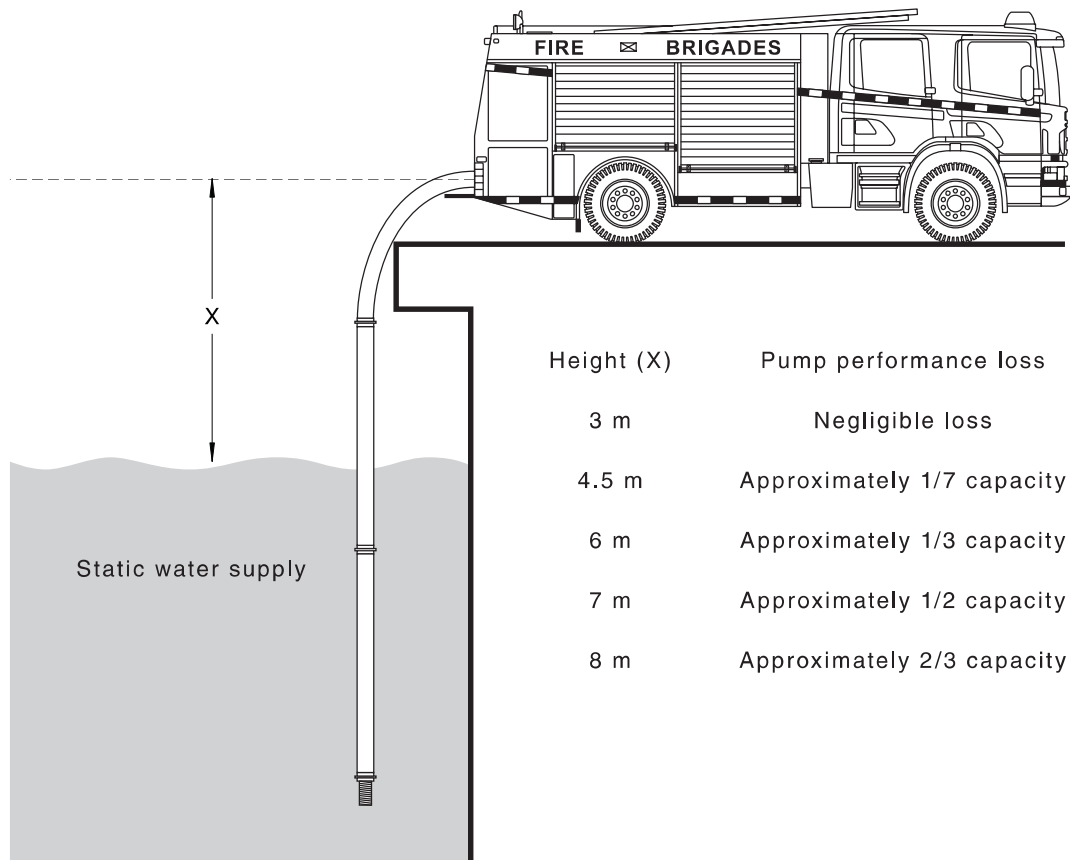


Figure F.4.4(A) — Rear-mounted pump, draughting from static water supply

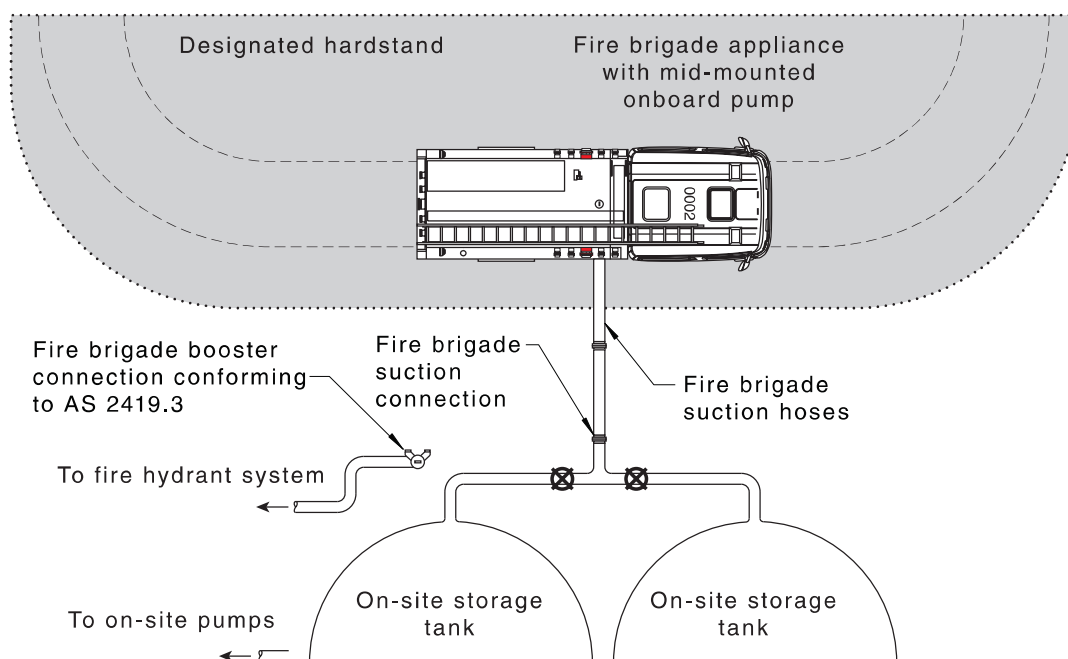


Figure F.4.4(B) — Mid-mounted pump, draughting from on-site storage tank

F.4.5 Implications for design

In developing a fire hydrant system design, an understanding of the fire brigade pumping appliances likely to respond to the location where the fire hydrant system is to be installed is essential. In this regard, it is particularly important to understand the capability of the fire brigade pumping appliance where an on-site tank is to be installed.

Where an on-site tank provides the primary water supply for the site, it is recommended that the tank is not installed below ground. Where site or building constraints require the tank to be installed below ground, consultation with the fire brigade is recommended.

Where a river, lake, dam or the sea provides the primary water supply for the site, the fire hydrant system must be designed so that the vertical lift required by a fire brigade pumping appliance does not exceed 3 m from the low water mark. Additionally, where fixed piping is provided, the volume of pipe should be limited so that the fire brigade can successfully draught from this source. See [Clause 4.4](#) for the volume limitations applied to fixed on-site piping.

Where the fire hydrant system design requires the fire brigade to use hard suction hose, the size of the hardstand provided should consider whether the pumping appliances that will respond to the building have a rear or mid-mounted pump suction. Pumping appliances with a mid-mounted pump suction will typically require a far greater area to manoeuvre than an appliance with a rear-mounted pump suction. The hardstand should also be sized to allow firefighters to circulate around the fire brigade pumping appliance, remove equipment and connect the hoses. [Figure F.4.5](#) depicts the dimensions of a typical metropolitan fire brigade pumping appliance and the minimum clearances required around the appliance.

Due to the draughting limitations associated with fire brigade pumping appliances where negative suction conditions are associated with a static water supply, it is recommended that consultation with the attending fire brigade is undertaken to determine if the design supports fire brigade intervention activities.

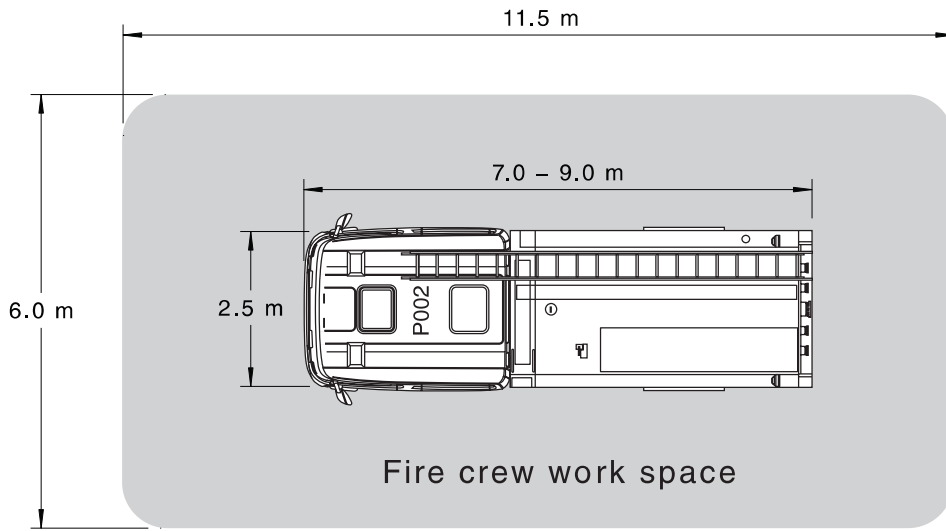


Figure F.4.5 — Dimensions of a typical metropolitan fire brigade pumping appliance

Appendix G (informative)

Guidance on system performance and design

G.1 Scope

This appendix provides guidance on the application of the design criteria specified in [Sections 1](#) and [2](#).

G.2 General

The scope of this document is now limited to buildings having an effective height not more than 135 m, Class 7b or Class 8 buildings having a total volume not more than 108 000 m³, buildings not having automatic storage and retrieval systems (ASRS) installed, and buildings or sites that do not have special hazards. Where this document does not apply, a performance solution should be developed in consultation with all key stakeholders.

In developing a performance solution for a fire hydrant system, the provisions listed in this document may be used as a basis for its design. In applying these provisions to a performance solution, the following factors should be considered:

- (a) Whether the flow rate proposed is appropriate for the performance solution as this document only provides a rudimentary assessment of the risk and fuel loading within a building through the application of floor area alone. Where this document does not apply, a more comprehensive assessment of fuel loading and risk should be undertaken so that the flow rate provided is appropriate to the risk and more effectively supports the extended duration fire brigade operations that are likely in these occupancies.
- (b) Whether the number, location and access to fire hydrants provided is appropriate for the performance solution particularly where large volume Class 7b or 8 buildings give rise to extended travel distances that make wayfinding for firefighters wearing self-contained breathing apparatus (SCBA) challenging and dangerous due to the limited supply of air available from an SCBA.
- (c) The redundancies incorporated into the design, particularly in high-rise buildings where the failure of system components could limit or halt fire brigade intervention activities due to a loss of water.

The design requirements of this document are intended to address a fire at a single location.

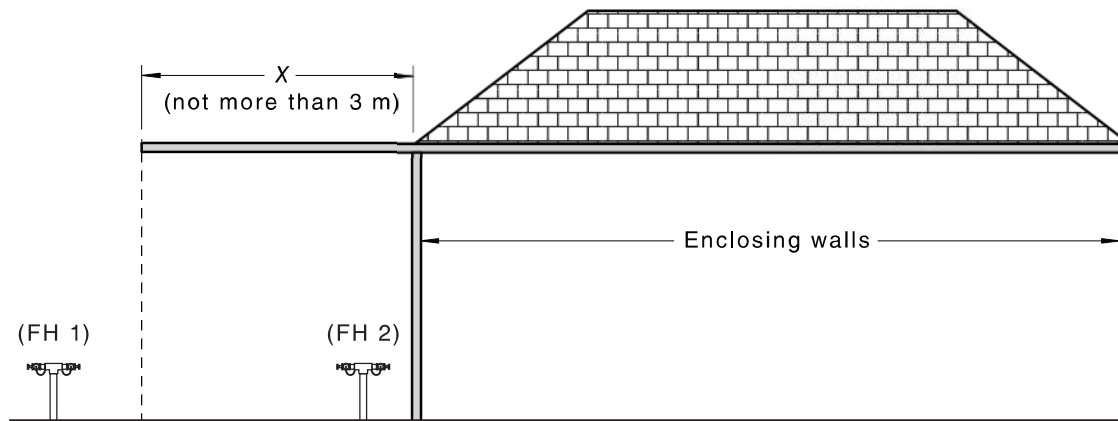
NOTE Refer to the NCC for more information on special hazards.

G.3 Classification of fire hydrants

G.3.1 External fire hydrants

[Clause 2.2.2](#) details the criteria for the classification of an external fire hydrant. Any fire hydrant conforming to [Clause 2.2.2](#) should be classified as an external fire hydrant. This classification can then be used to determine the pressure, flow and coverage applicable to the fire hydrant.

[Figure G.3.1\(A\)](#) shows the application of the design principles specified in [Clauses 2.2.2\(a\) and \(d\)](#).



Key

- X = Awning, roof, overhang or similar projection is less than 3 m in depth
 FH = External fire hydrant

NOTE 1 Where a fire hydrant is located as shown by FH1, the hydrant is classified as an external fire hydrant because the hydrant is located outside the enclosing walls of the building. The external fire hydrant's subsequent classification (attack, attack/feed or feed fire hydrant) and distance from a hardstand will then determine the flow and pressure requirements to be met and the fire hydrant coverage that may be applied.

NOTE 2 Where an external fire hydrant is located as shown by FH2, the hydrant may be classified as an external fire hydrant provided the awning roof, overhang or the like is less than 3 m in depth and the area under the awning roof overhang or similar does not contribute to the fire load of the building. The external fire hydrant's subsequent classification (attack, attack/feed or feed fire hydrant) and distance from a hardstand will then determine the flow and pressure requirements to be met and the fire hydrant coverage that may be applied.

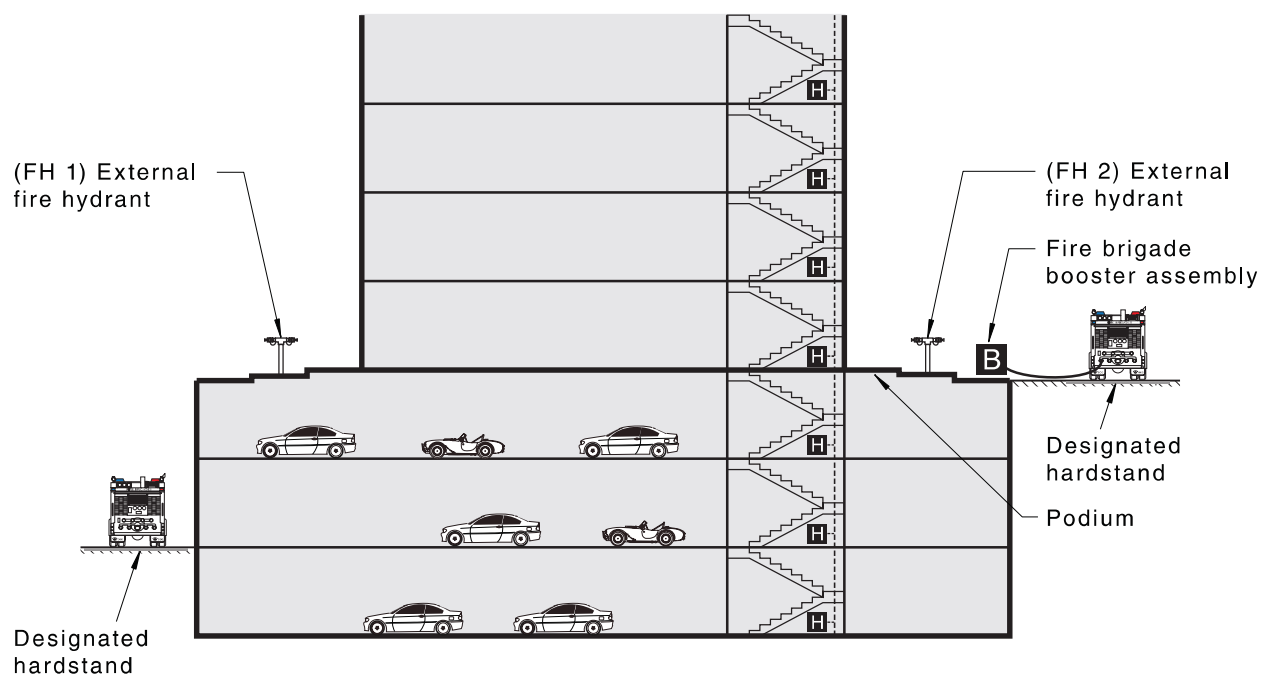
NOTE 3 See [Clauses 2.2.6](#) and [2.2.10](#) for the flow and pressure requirements of feed fire hydrants, [Clauses 2.2.6](#) and [2.2.11.3](#) for the flow and pressure requirements of attack/feed fire hydrants, and [Clauses 2.2.6](#) and [2.2.11.1](#) for the flow and pressure requirements of external attack hydrants.

NOTE 4 See [Clause 3.5](#) for location, fire hydrant coverage and protection requirements for an external fire hydrant.

Figure G.3.1(A) — External fire hydrants

The determination of whether the area under an awning, roof overhang or similar projection contributes to the fire load of the building should be made by the relevant authority.

[Figure G.3.1\(B\)](#) shows the application of the design principles specified in [Clause 2.2.2\(b\)](#) pertaining to a fire hydrant located on a podium.



Key

FH = External feed hydrant

NOTE 1 Where a fire hydrant is located on a podium as shown by FH1 and FH2 and direct pedestrian access is provided to the fire hydrant from road or open space, the hydrant may be classified as an external fire hydrant. If classified as an attack/feed fire hydrant or a feed fire hydrant, a designated hardstand should be not more than 20 m from the external fire hydrant. If classified as an attack fire hydrant, a designated hardstand should be not more than 50 m from the external fire hydrant if the building is not sprinkler-protected throughout and 100 m if the building is sprinkler-protected throughout.

NOTE 2 See [Clause 3.5](#) for location, fire hydrant coverage and protection requirements.

Figure G.3.1(B) — External fire hydrants located on a podium

G.3.2 Internal fire hydrants

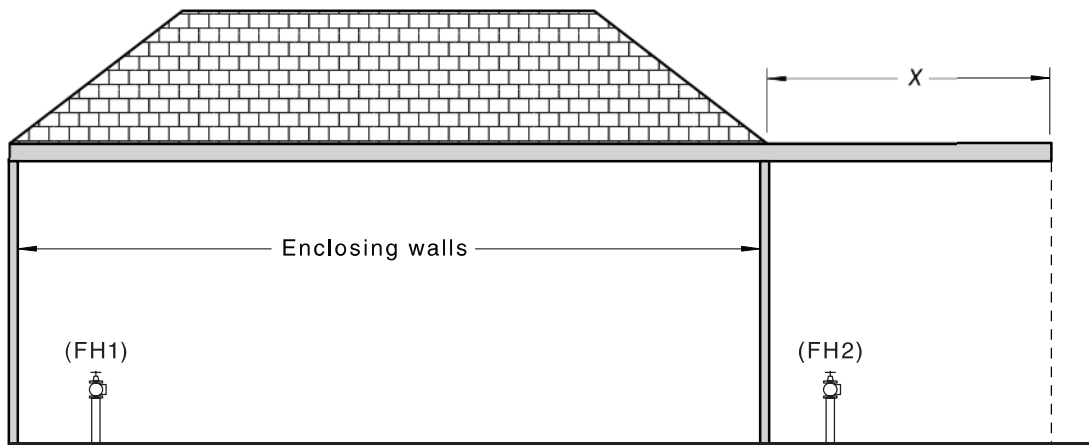
[Clause 2.2.3](#) details the criteria for the classification of an internal fire hydrant.

Any fire hydrant conforming to [Clause 2.2.3](#) should be classified as an internal fire hydrant. This classification can then be used to determine the pressure, flow and coverage applicable to the fire hydrant.

[Figure G.3.2](#) shows the application of the design principles of [Clause 2.2.3\(a\), \(c\) and \(d\)](#).

In relation to Item (c), where an awning, roof overhang or similar projection has a depth more than the 3 m detailed in [Clause 2.2.3](#) and the area under the awning does not contribute to the fire load of a building, a fire hydrant located under the awning, roof overhang or similar projection is considered to be an internal fire hydrant for the purpose of determining hose lay coverage.

In relation to Item (d), where an awning, roof overhang or similar projection having a depth less than 3m and the area under the awning contribute to the fire load of a building, a fire hydrant located under the awning, roof overhang or similar projection is considered to be an internal fire hydrant for the purpose of determining hose lay coverage.



Key

- X Awning, roof overhang or similar projection of any depth
 FH Internal fire hydrant

NOTE 1 Where a fire hydrant is located as shown by FH1, the hydrant is classified as an internal fire hydrant because it is located in an area within the enclosing walls of the building

NOTE 2 Where a fire hydrant is located as shown by FH2, the hydrant is classified as an internal fire hydrant because either the area under the awning, roof overhang or similar projection contributes to the fire load of the building or "X" is more than 3 m.

NOTE 3 See [Clause 3.6](#) for information on location and fire hydrant coverage from an internal fire hydrant.

Figure G.3.2 — Internal fire hydrants

The determination of whether the area under an awning, roof overhang or similar projection contributes to the fire load of the building should be made by the relevant authority.

[Clause 2.2.3\(e\)](#) requires a fire hydrant located under a balcony, horizontal floor projection or similar projection to be classified as an internal fire hydrant. This is in recognition of the unknown nature and quantity of materials that may be located on, stored on, or occupy a balcony space or other horizontal floor projection, and the increased risk the storage of these items may bring to attending fire brigade or trained firefighting personnel.

G.3.3 Feed, attack and attack/feed fire hydrants

G.3.3.1 Feed fire hydrants

[Clause 2.2.4\(a\)](#) details the criteria for the classification of a feed fire hydrant.

Any fire hydrant conforming to [Clause 2.2.4\(a\)](#) should be classified as a feed fire hydrant.

[Figure G.3.3.1](#) highlights some of the design principles applicable to the classification of a fire hydrant as a feed fire hydrant. In particular, it highlights that for an external fire hydrant to be classified as a feed fire hydrant, the external fire hydrant should be located not more than 20 m from a hardstand and not downstream of the fire brigade booster connection of a fire brigade booster assembly.

Other design principles that apply to the classification of a feed fire hydrant include —

- the requirement for a feed fire hydrant to deliver pressure and flow as specified in [Table 2.2.6\(A\)](#);
- the location and fire hydrant coverage requirements specified in [Clause 3.5.3.1](#); and
- the protection requirements specified in [Clauses 3.5.5.1](#) and [3.5.5.2](#), as applicable.

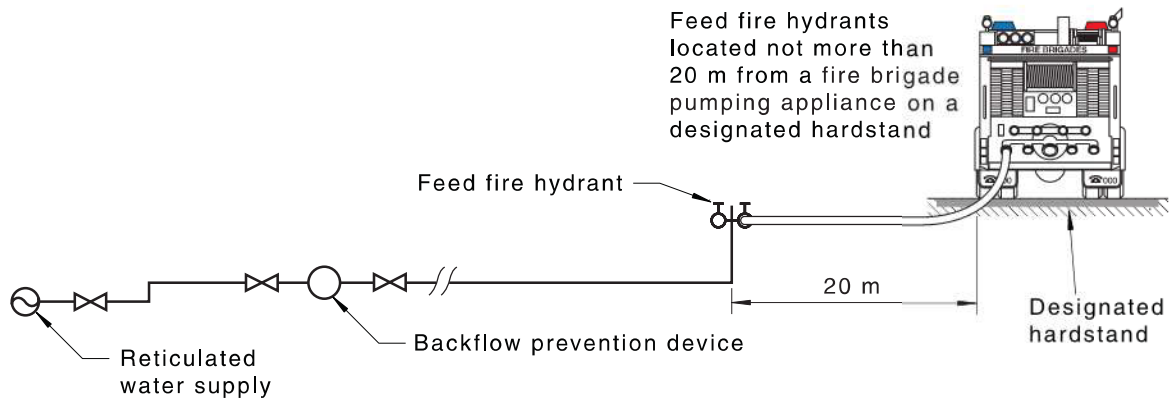


Figure G.3.3.1 — Feed fire hydrants

G.3.3.2 Attack fire hydrants

[Clause 2.2.4\(b\)](#) details the criteria for the classification of an external attack fire hydrant.

Any fire hydrant conforming to [Clause 2.2.4\(b\)](#) should be classified as an external attack fire hydrant.

[Figure G.3.3.2](#) highlights some of the design principles applicable to the classification of a fire hydrant as an external attack fire hydrant. In particular, it highlights that for an external fire hydrant to be classified as an attack fire hydrant, the hydrant is located downstream of a fire brigade booster assembly and not more than 50 m from a hardstand, where a building is not sprinkler-protected, and not more than 100 m from a hardstand where [Clause 3.5.3.3](#) applies.

Other design principles applicable to the classification of a fire hydrant as an attack fire hydrant include —

- the requirement for an attack fire hydrant to deliver pressure and flow as specified in [Table 2.2.6\(B\)](#) where an on-site pump is not installed, [Tables 2.2.6\(B\)](#) and (C) where a fixed on-site fire hydrant pump is installed, or [Tables 2.2.6\(B\) and \(D\)](#) where a full-duty fire hydrant pump is installed, as applicable;
- the requirement to deliver the pressure and flow specified in [Table 2.2.6\(F\)](#) when boosted by a fire brigade pumping appliance; and
- the location and fire hydrant coverage requirements specified in [Clause 3.6.2](#).

Attack fire hydrant located not more than 100 m from a fire brigade pumping appliance on a designated hardstand for selected sprinkler-protected buildings

Attack fire hydrant located not more than 50 m from a fire brigade pumping appliance on a designated hardstand

Feed fire hydrant of fire brigade booster assembly

Backflow prevention device

Reticulated water supply

Designated hardstand

50 m

100 m

Figure G.3.3.2 — Attack fire hydrants

G.3.3.3 Attack/feed fire hydrants

[Clause 2.2.4\(c\)](#) details the criteria for the classification of an attack/feed fire hydrant. Any attack fire hydrant conforming to [Clause 2.2.4\(a\)](#) may be classified as an attack/ feed fire hydrant.

[Figure G.3.3.3](#) highlights some of the design principles applicable to the classification of a fire hydrant system as an attack/feed fire hydrant. In particular, it highlights that an attack/feed fire hydrant should be located not more than 20 m from a hardstand. Other design principles that are applicable to the classification of an attack/feed fire hydrants include—

- the requirement for an attack/feed fire hydrant to provide the pressure and flow specified in [Table 2.2.6\(A\)](#);
- the requirement for an attack/feed fire hydrant to be capable of delivering the pressure and flow specified in [Table 2.2.6\(F\)](#) when boosted by a fire brigade pumping appliance;
- the location requirements specified in [Clause 3.5.3.1](#); and
- the protection requirements specified in [Clauses 3.5.5.1](#) and [3.5.5.2](#), as applicable.

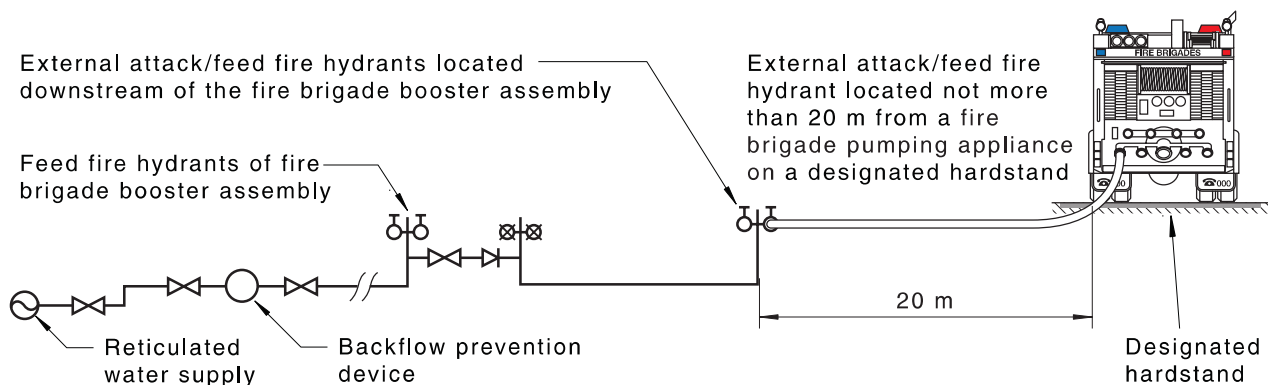


Figure G.3.3.3 — Attack/feed fire hydrants

G.4 System performance

G.4.1 Number of fire hydrant outlets required to flow

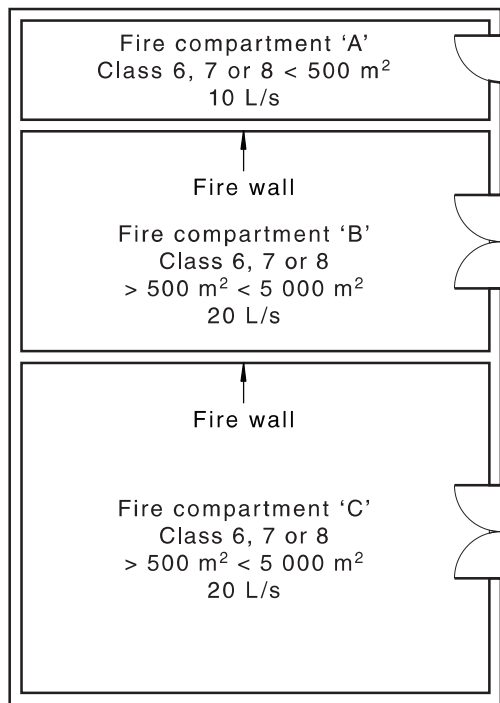
[Clause 2.2.5](#) establishes the minimum number of fire hydrant outlets required to flow to protect a fire compartment.

Where a fire hydrant system is installed to protect a building, the system is designed for the simultaneous operation of the required number of most hydraulically disadvantaged fire hydrants for the building classification and fire compartment floor area that the fire hydrants are protecting.

When determining the number of fire hydrant outlets required to flow within a building, the classification and size of the fire compartments should be confirmed with the relevant authority

When designing a fire hydrant system, the flow requirements in a building or building complex may vary to satisfy the firefighting requirements in a specific location, part of the building or building complex. See [Figure G.4.1\(A\)](#) for examples of flow variation in a low-rise building and [Figure G.4.1\(B\)](#) for an example of flow variation in a high-rise building.

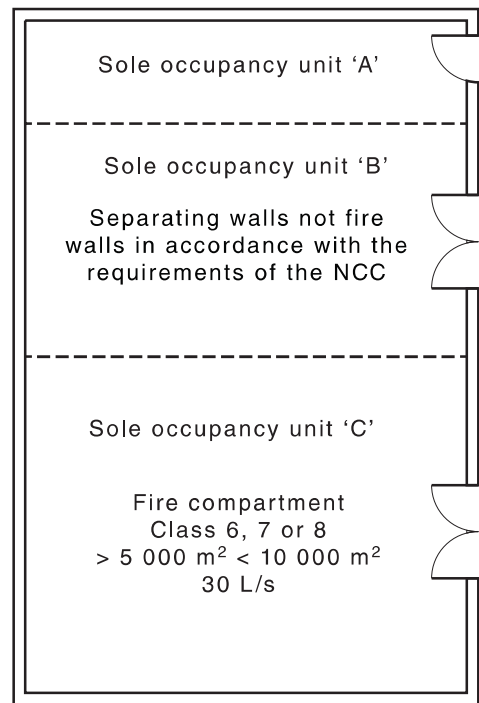
PLAN VIEW



Non-sprinkler-protected Class 6, 7 or 8 building with fire compartments of variable size.

(a)

PLAN VIEW



Non-sprinkler-protected Class 6, 7 or 8 building with a single fire compartment. Total floor area of building greater than 5 000 m² and less than 10 000 m²

(b)

Figure G.4.1(A) — Flow variation in a low-rise building

ELEVATION



6	Fire compartment	H	Non-sprinkler-protected Class 2, 3, 5 or 9 fire compartment greater than 500 m ² ; less than 5 000 m ² ; 20 L/s required to flow
5	Fire compartment	H	
4	Fire compartment	H	
3	Fire compartment	H	
2	Fire compartment	H	
1	Fire compartment	H	
G	Class 2, 3, 5 or 9 > 500 m ² < 5 000 m ²	H	
<hr/>			
B1	Fire compartment	H	Sprinkler-protected Class 7a fire compartment greater than 10 000 m ² ; 30 L/s required flow
B2	Class 7a > 10 000 m ²	H	
B3		H	
B4		H	

Figure G.4.1(B) — Flow variation in a high-rise building

In relation to the size of the fire compartment in [Tables 2.2.5\(B\), \(C\) and \(D\)](#) that are used to determine the number of fire hydrant outlets required to flow, the NCC details different requirements for fire walls or floors bounding a fire compartment, or both, and the bounding construction of an SOU. As such, where an SOU in a Class 2 or 3 building has bounding construction, the floor area of the SOU may not be used to determine the number of fire hydrants required to flow.

NOTE Refer to the NCC for more information on fire compartments and bounding construction.

G.4.2 Pressure and flow

[Clause 2.2.6](#) establishes the minimum flow and pressure required by the fire hydrant system where feed, attack or attack/feed fire hydrants are installed. [Clause 2.2.6](#) also establishes the minimum pressure and flow to be achieved when a half-duty fire hydrant pump is installed, a full-duty fire hydrant pump is installed, and the pressures and flow that should be delivered when a fire brigade pumping appliance is boosting the fire hydrant system.

The important point to note here is that depending on the fire hydrant system design, more than one of the performance tables listed in [Clause 2.2.6](#) could apply.

G.4.3 Multiple firefighting systems

[Clause 2.2.7](#) defines the simultaneous water supply requirements for a building where a fire hydrant system and other firefighting systems (e.g. a sprinkler system or wall-wetting sprinklers) are installed.

When a fire brigade attends a fire incident involving an operating sprinkler or wall-wetting sprinkler system, in all instances the systems will not be turned off until either the fire is extinguished or under control. Consequently, where a sprinkler system or wall-wetting sprinkler system, or both, are installed in a building, the water supply should allow for the simultaneous operation of the installed systems.

Examples of multiple firefighting systems are shown in [Figure G.4.3](#).

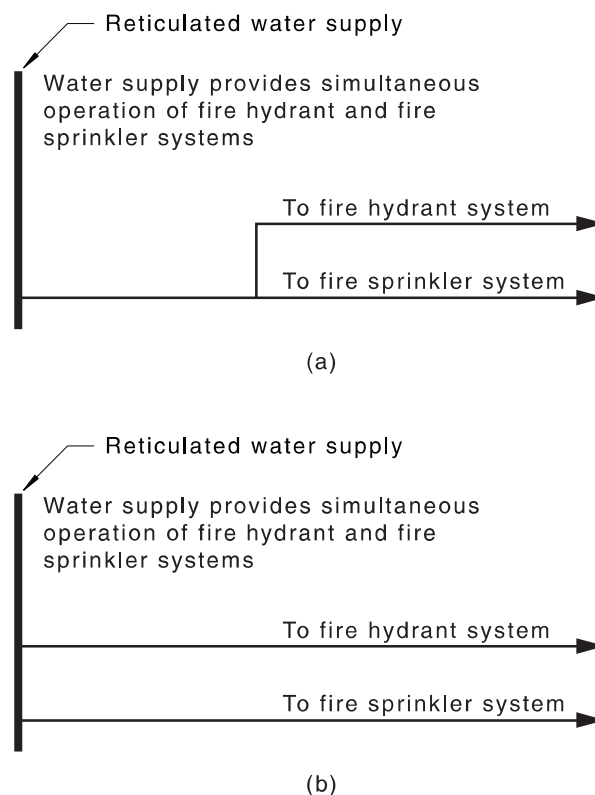


Figure G.4.3 — Multiple firefighting systems

G.4.4 Class 7a car parks — Multiple firefighting systems

[Clause 2.2.8](#) details the circumstances under which the simultaneous flow requirement of [Clause 2.2.7](#) does not apply.

Where a Class 7a car park is sprinkler-protected throughout and a car stacker within the carpark does not stack more than two cars vertically, the simultaneous flow requirements do not have to be applied.

G.4.5 Feed fire hydrants

[Clause 2.2.10](#) establishes the minimum design criteria for a fire hydrant system that incorporates feed fire hydrants only or where street fire hydrants are used as feed fire hydrants.

The minimum unassisted pressure and flow requirements for feed fire hydrants are specified in [Table 2.2.6\(A\)](#). An example of a fire hydrant system incorporating feed fire hydrants only is shown in [Figure G.4.5\(A\)](#).

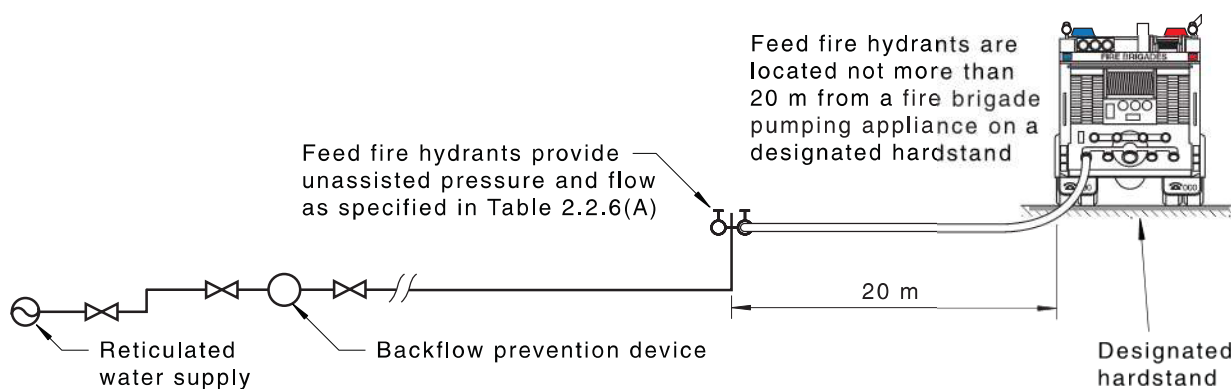


Figure G.4.5(A) — Feed fire hydrants

In developing a fire hydrant system that incorporates feed fire hydrants, the fundamental design expectation is that fire brigade pumping appliances will be positioned not more than 20 m from a feed fire hydrant and firefighting operations will be commenced from the fire brigade pumping appliance. In most instances, unless threatened by fire conditions, the fire brigade pumping appliance will be kept at this location for the duration of the fire incident. Consequently, the design approach should assign as much flow as possible to each feed fire hydrant to allow the attending fire brigade to carry out its operations as effectively as possible from a single location. As such, when determining the flow requirements of the system designed to achieve feed fire hydrant performance, each outlet of the most hydraulically disadvantaged feed fire hydrant should be used before assigning flow to the next most hydraulically disadvantaged fire hydrant in the system.

An example of 30 L/s feed fire hydrant system is shown in [Figure G.4.5\(B\)](#).

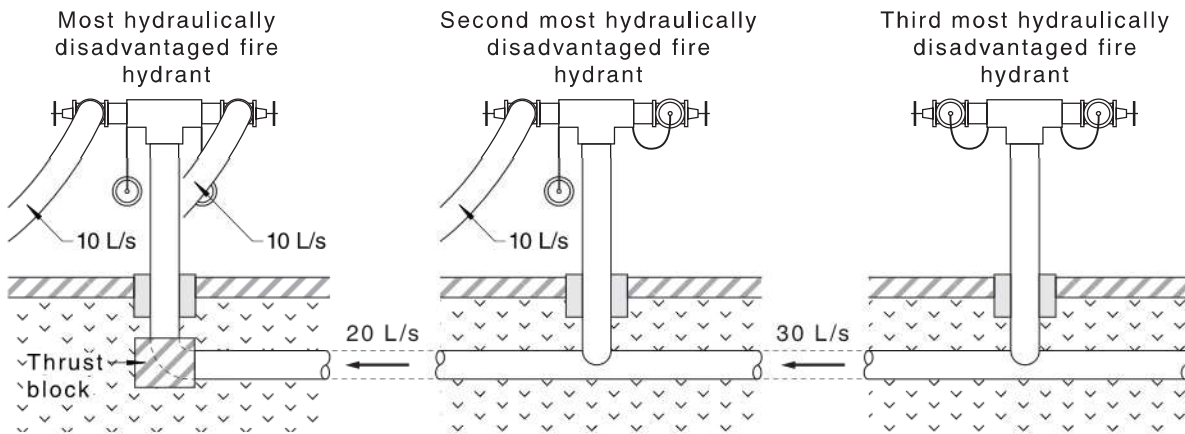


Figure G.4.5(B) — 30 L/s feed fire hydrant system

The requirement to provide a positive pressure of at least 150 kPa to 200 kPa (depending on the State or Territory) for a feed fire hydrant is necessary so the design flow can be delivered via layflat hoses connected to the fire brigade pumping appliance. When conducting firefighting operations, firefighting flows can vary greatly as nozzles are opened and closed. Excessive pump speed when attempting to meet increases in demand and the consequent increased flow can reduce the pressure in the hose feeding the appliance to the extent that it collapses under atmospheric pressure. This collapse can cause the pump to cavitate until suction pressure is restored or the pump speed is reduced. The resultant series of pressure surges could seriously damage the fire brigade pumping appliance, the fire hydrant system and the attached equipment or cause injury to the attending fire brigade or trained firefighting personnel.

G.4.6 Street fire hydrants

[Clause 2.2.10](#) establishes the minimum criteria (i.e. location and hydraulic performance) applicable to street fire hydrants when used to provide total or partial hydrant coverage to a building.

The criteria detailed in [Clause 2.2.10](#) include meeting the requirements of [Clause 3.5.2](#) and delivering the pressure and flow specified in [Table 2.2.6\(A\)](#). The requirements of [Clause 3.5.2](#) indicate that for a street hydrant to be used, its performance and location should be comparable with that of a feed fire hydrant. Where a flow more than 10 L/s is required from a street fire hydrant, it may be assumed the attending fire brigade will use a twin outlet standpipe. In these instances, the flow capacity of the street hydrant should be determined by flow test and calculation to adjust the test results to reflect the design supply conditions.

The primary intention for providing a location plan is to identify the location of the street hydrant providing fire hydrant coverage for regulatory and compliance issues.

G.4.7 Unassisted attack fire hydrants – External and Internal

[Clauses 2.2.11.1\(a\), \(b\)\(i\) and \(c\)](#) and [Clauses 2.2.11.2\(a\), \(b\)\(i\) and \(c\)](#) establish the minimum design criteria for a fire hydrant system incorporating unassisted attack fire hydrants. The minimum unassisted pressure and flow requirements for an attack fire hydrant are specified in [Table 2.2.6\(B\)](#).

An example of a fire hydrant system incorporating external attack fire hydrants providing the minimum unassisted pressure and flow is shown in [Figure G.4.7 \(a\)](#).

An example of a fire hydrant system incorporating internal attack fire hydrants providing the minimum unassisted pressure and flow is shown in [Figure G.4.7 \(b\)](#).

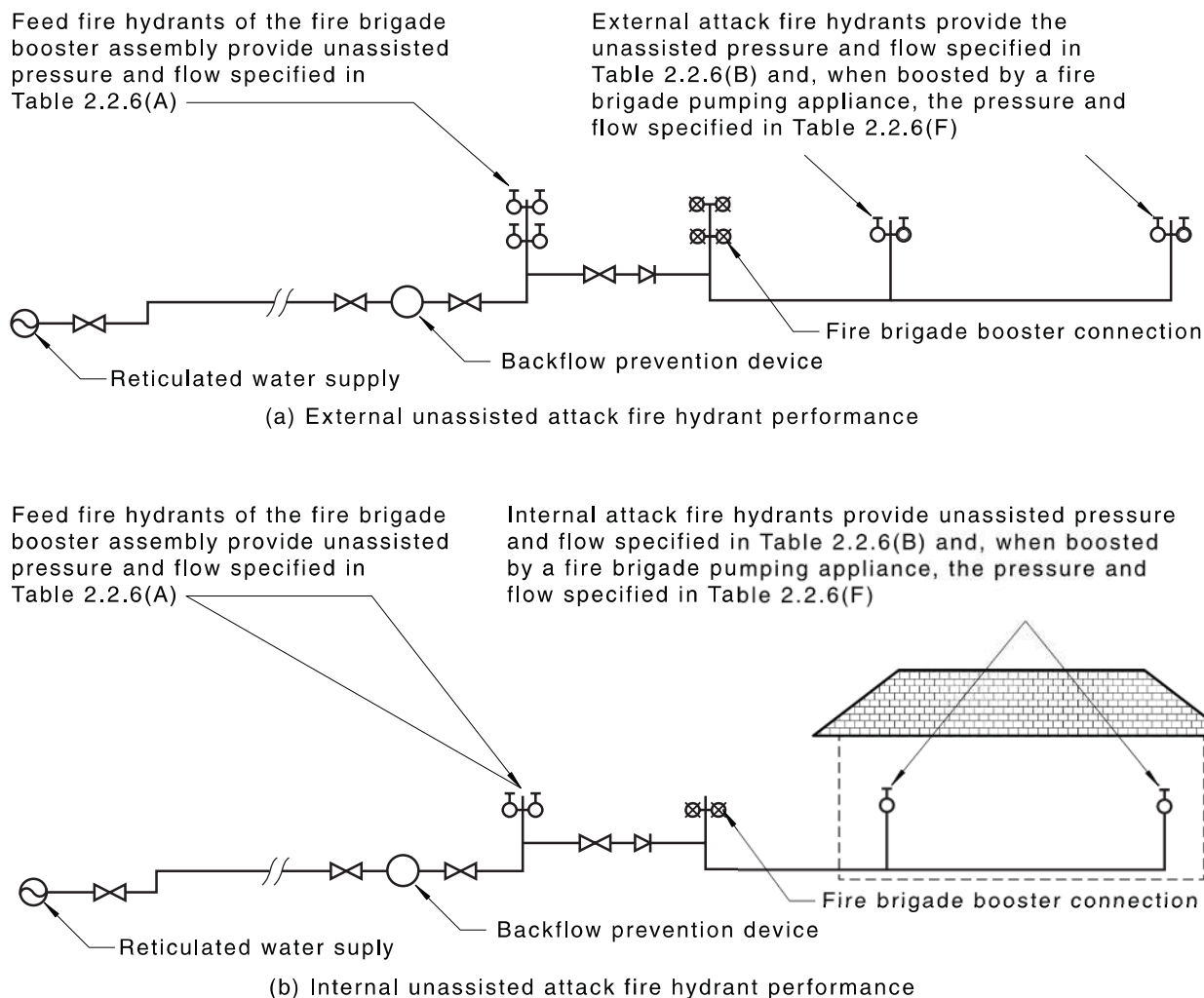


Figure G.4.7 — Fire hydrant systems incorporating unassisted attack fire hydrants

The provision of the unassisted pressure and flow specified in [Table 2.2.6\(B\)](#) at the attack fire hydrants allows the attending fire brigade or trained firefighting personnel, depending on fire conditions, to possibly commence attack firefighting operations with a hose connected directly to the attack fire hydrant prior to the operation of the fire brigade booster assembly.

When a fire brigade pumping appliance connects to the fire brigade booster assembly and then pressurises (boosts) the system, the attack fire hydrants should be capable of delivering the pressure and flow specified in [Table 2.2.6\(F\)](#).

G.4.8 Assisted attack fire hydrants — External and internal

[Clauses 2.2.11.1\(a\), 2.2.11.1\(b\)\(ii\), 2.2.11.1\(c\)](#) and [Clauses 2.2.11.2\(a\), 2.2.11.2\(b\)\(ii\) and \(iii\)](#), and [2.2.11.2\(c\)](#) establish the minimum design criteria for a fire hydrant system incorporating on-site pumps.

Where the primary water supply serving the fire hydrant system is able to provide the unassisted pressure and flow at the feed fire hydrants of a fire brigade booster assembly but is unable to provide the unassisted pressure specified in [Table 2.2.6\(B\)](#) to the most hydraulically disadvantaged attack fire hydrant outlets required to flow, on-site fire pumps are installed so the attack fire hydrants can deliver the pressure and flow specified in [Table 2.2.6\(C\) or \(D\)](#), as applicable.

For buildings having an effective height not more than 50 m, one or more half-duty fire hydrant pumpsets are required. For buildings having an effective height more than 50 m, not less than two full-duty fire hydrant pumps are required.

An example of a fire hydrant system incorporating a single on-site half-duty fire hydrant pump is shown in [Figure G.4.8\(A\)](#).

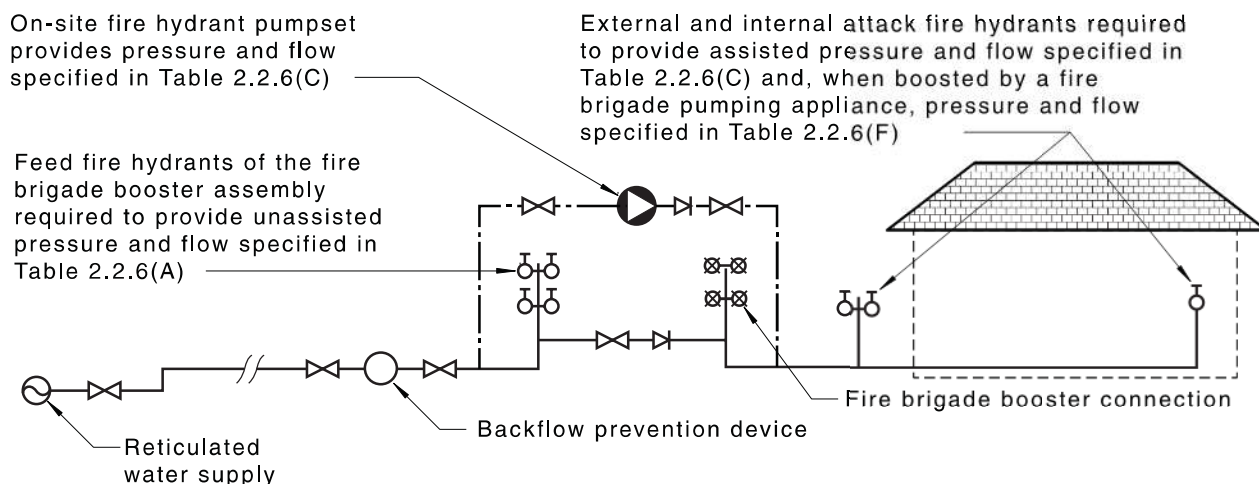


Figure G.4.8(A) — Fire hydrant system incorporating assisted attack fire hydrants through provision of an on-site pump

Where the primary supply serving the fire hydrant system is unable to deliver the unassisted flow specified in [Table 2.2.6\(A\)](#) for the number of fire hydrant outlets required to flow at the building or site, additional on-site water storage and not less than two half-duty fire hydrant pumps should be installed.

An example of a fire hydrant system incorporating an on-site tank and two half-duty fire hydrant pumps is shown in [Figure G.4.8\(B\)](#).

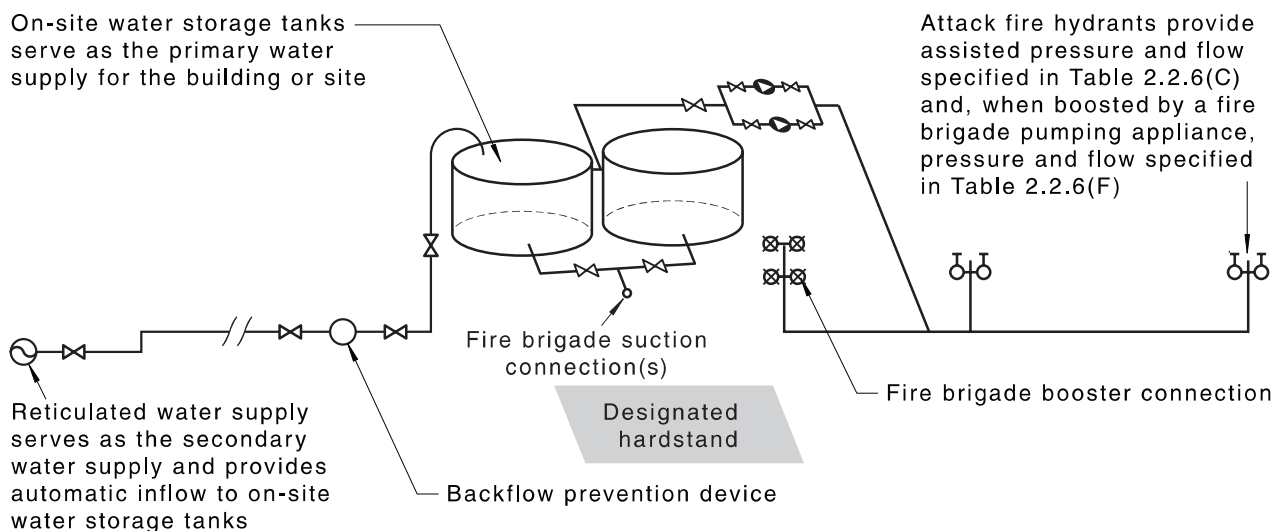


Figure G.4.8(B) — Fire hydrant system incorporating an on-site tank and pumps

In relation to the pressures required by a half-duty fire hydrant pump [see [Table 2.2.6\(C\)](#)], a full-duty fire hydrant pump [see [Table 2.2.6\(D\)](#)] and gravity tanks [see [Table 2.2.6\(E\)](#)], fire brigades across Australia employ internal firefighting techniques based upon a pressure of 700 kPa. At this pressure the firefighting nozzles are able to break a hose stream into fine water droplets. The creation of these droplets significantly increases the surface area of the hose stream, maximizing the cooling and suppression effects of the hose stream. This allows firefighters to control more effectively the fire environment and reduce the fire-associated risks.

In developing a fire hydrant system design consisting of attack fire hydrants, one of the fundamental design expectations is that a fire brigade pumping appliance will connect to the fire brigade booster assembly and a hose line with firefighting branch will be attached to the attack fire hydrant and that firefighting operations will be commenced from the attack fire hydrant. Using this approach where multiple attack fire hydrants are installed, multiple hose lines can be operated simultaneously. Additionally, when boosted, if required, the fire brigade pumping appliance may have the capacity to provide additional flow and pressure into the system. Consequently, for an attack fire hydrant system the design should aim to provide not less than 10 L/s at each fire hydrant.

Where a fire hydrant system is designed to achieve attack fire hydrant performance, when determining the flow requirements of the system, a single outlet of the most hydraulically disadvantaged attack fire hydrant should be used before assigning flow to the next most hydraulically disadvantaged fire hydrant in the system.

An example of 30 L/s attack fire hydrant system is shown in [Figure G.4.8\(C\)](#).

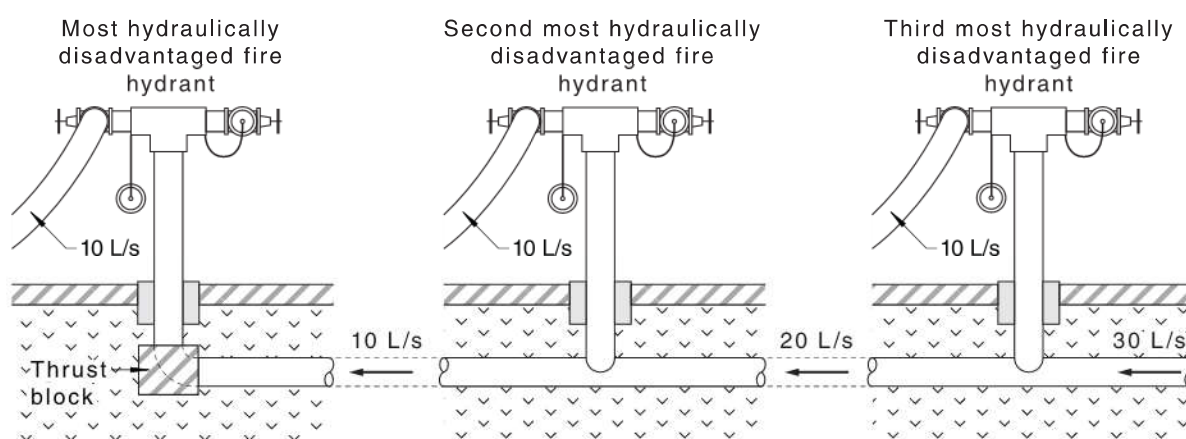


Figure G.4.8(C) — 30 L/s attack fire hydrant system

G.4.9 Attack/Feed fire hydrants

[Clause 2.2.11.3](#) establishes the minimum design criteria for attack fire hydrants that have been classified to serve as both attack and feed fire hydrants (attack/feed fire hydrant). The attack/feed fire hydrant classification allows for variation from the unassisted pressure requirements for attack fire hydrants specified in [Table 2.2.6\(B\)](#).

In [Clause 2.2.11.3](#), external attack fire hydrants located not more than 20 m from a hardstand do not have to deliver the unassisted pressure and flow specified in [Table 2.2.6\(B\)](#) if the primary water supply serving the fire hydrant system is capable of providing the unassisted pressure and flow for a feed fire hydrant specified in [Table 2.2.6\(A\)](#) to the external fire hydrants classified as attack/fire hydrants.

The requirement to provide the pressure and flow specified in [Table 2.2.6\(A\)](#) at the attack/feed fire hydrant allows the attending fire brigade to use this fire hydrant as a feed fire hydrant.

Additionally, in fire hydrant systems incorporating attack/feed fire hydrants, these systems should be capable of providing the pressure and flows specified in [Table 2.2.6\(F\)](#) when boosted by a fire brigade pumping appliance.

An example of a fire hydrant system incorporating attack/feed fire hydrants is shown in [Figure G.4.9](#).

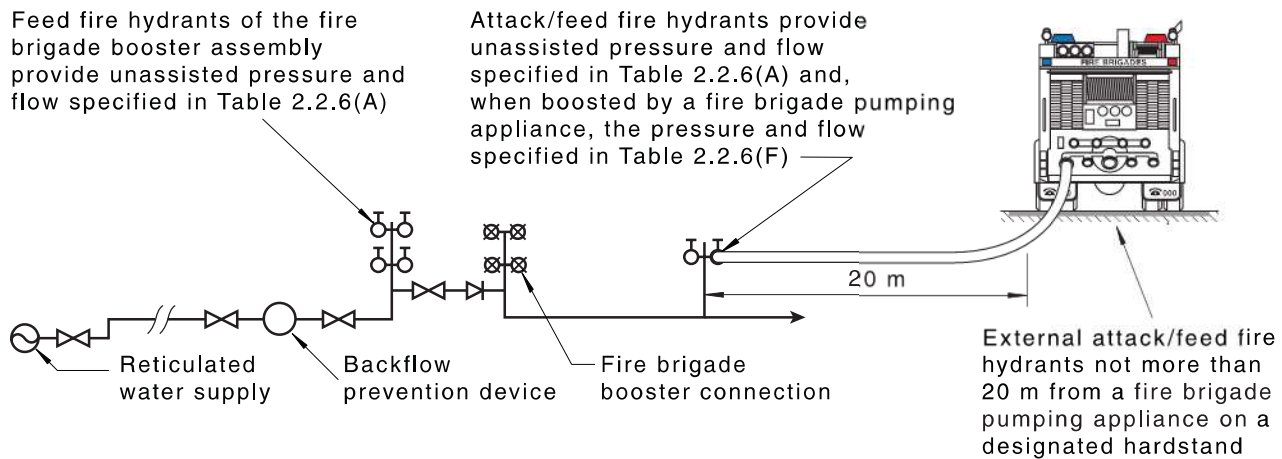


Figure G.4.9 — Fire hydrant system incorporating attack/feed fire hydrants

G.4.10 On-site pumps

[Clause 2.2.12](#) details the design scenarios where on-site half-duty fire hydrant pumpsets are required to be installed when the primary water supply is unable to provide the required unassisted pressure or flow.

In relation to [Clause 2.2.12\(a\)](#), where the primary water supply is unable to deliver the unassisted pressure and flow specified in [Table 2.2.6\(A\)](#) to the most hydraulically disadvantaged feed fire hydrant outlets required to flow, a fixed on-site half-duty fire hydrant pumpset and fire brigade booster assembly are required in a building having an effective height not more than 25 m. In this case though it should be noted that the preceding sentence indicates that the primary water supply can provide the unassisted pressure and flow specified in [Table 2.2.6\(A\)](#) to the number of most hydraulically advantaged feed fire hydrant outlets required to flow.

In this design scenario, the fixed on-site half-duty fire hydrant pump is required to deliver the pressure and flow specified in [Table 2.2.6\(C\)](#) to the attack fire hydrant outlets required to flow. [Figure G.4.10\(A\)](#) highlights the application of this design principle.

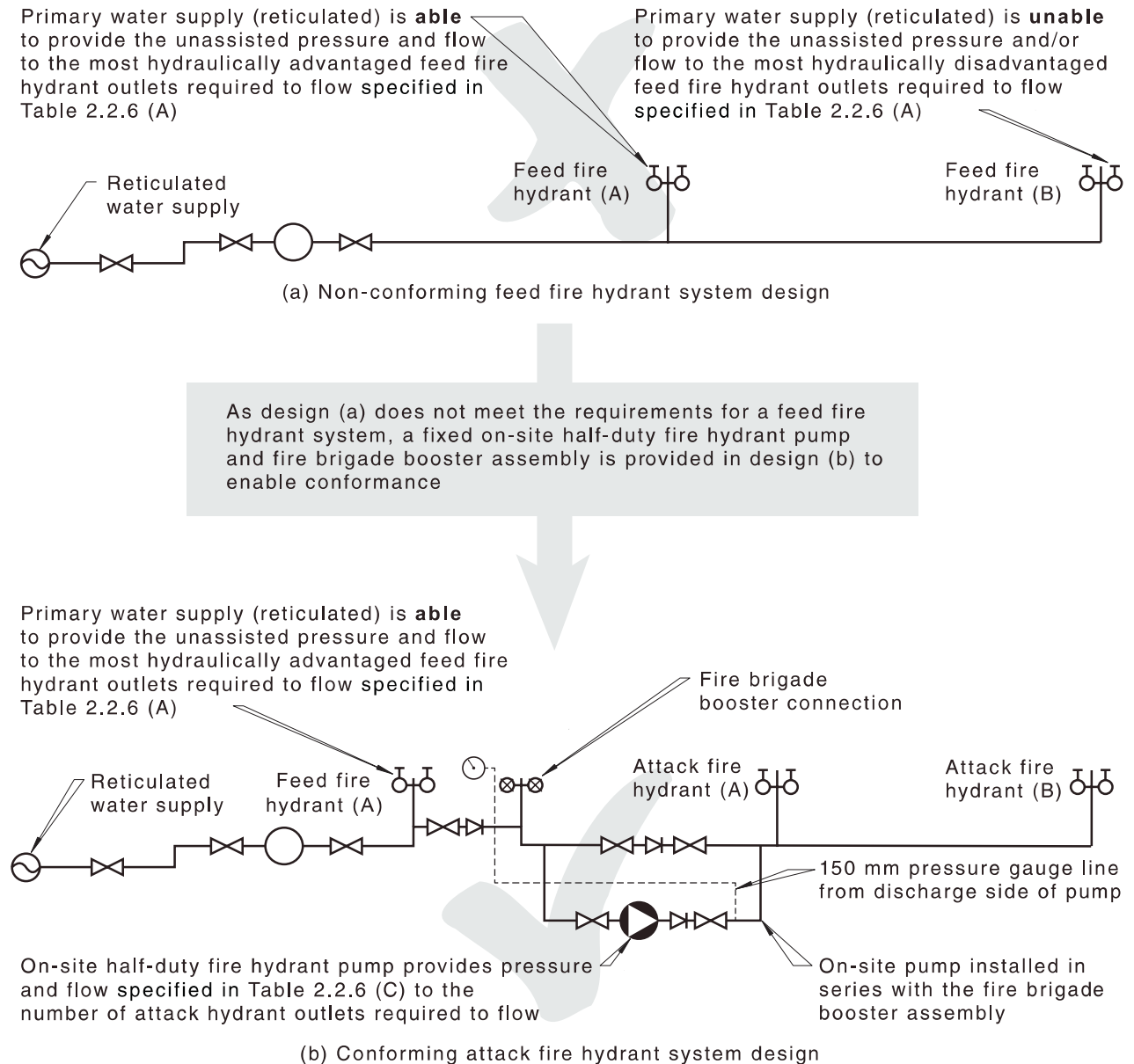


Figure G.4.10(A) — Non-conforming feed fire hydrant systems and the requirement for on-site pumps

In relation to [Clause 2.2.12\(b\)](#), where the primary water is unable to provide the unassisted pressure and flow specified in [Table 2.2.6\(B\)](#) to the most hydraulically disadvantaged attack fire hydrant outlets required to flow, a fixed on-site half-duty fire hydrant pumpset is required in a building having an effective height not more than 25 m. In this case, it should be noted that the preceding sentence indicates that the primary water supply can provide the unassisted pressure and flow specified in [Table 2.2.6\(A\)](#) to the number of feed fire hydrant outlets required to flow of the fire brigade booster assembly.

In this design scenario, the fixed on-site pump is required to deliver the pressure and flow specified in [Table 2.2.6\(C\)](#) to the fire hydrant outlets required to flow. [Figure G.4.10\(B\)](#) highlights the application of this design principle.

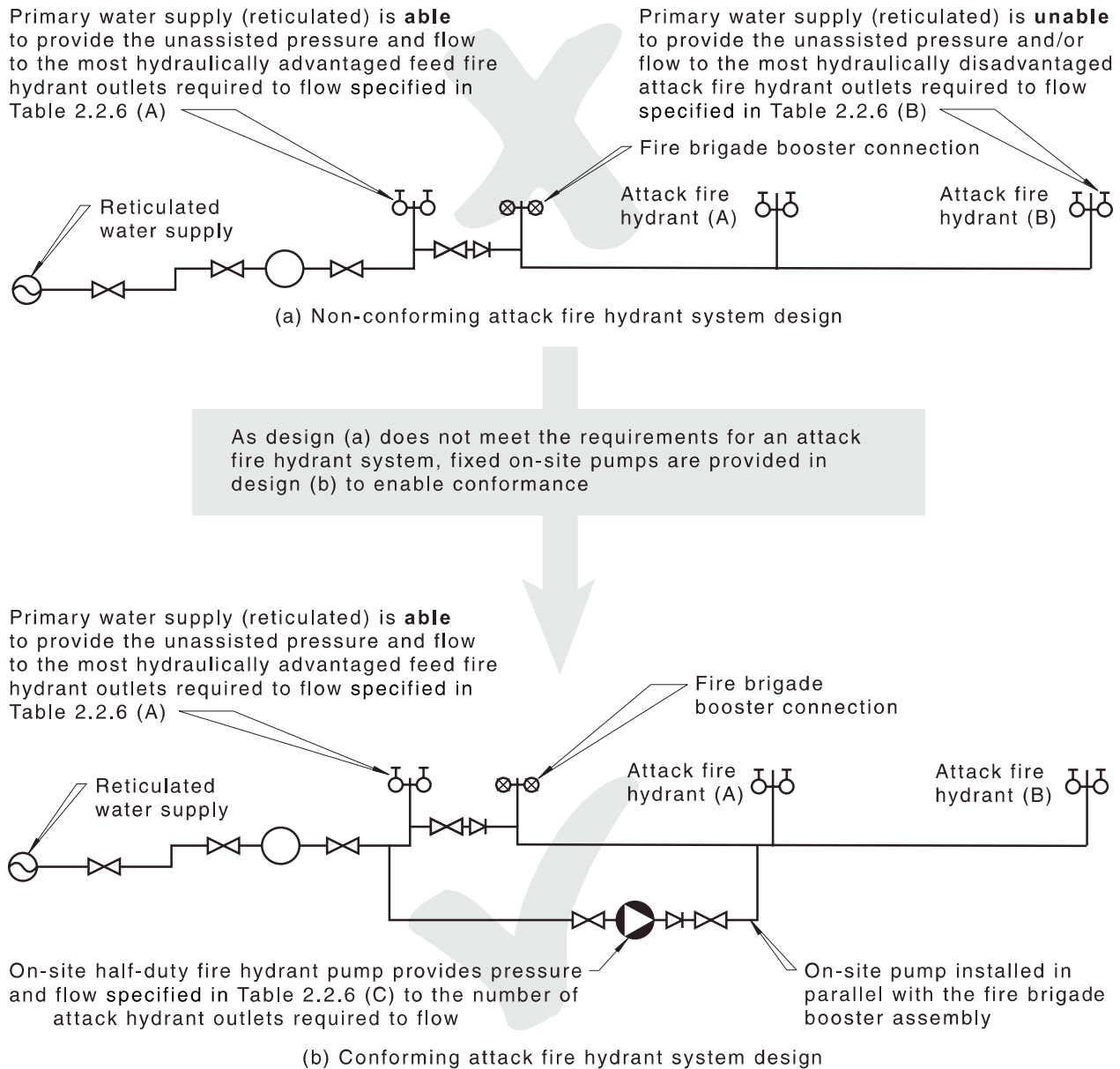


Figure G.4.10(B) — Non-conforming attack fire hydrant systems and the requirement for on-site pumps

Where a building has an effective height more than 25 m and not more than 50 m, and the above design scenario applies, then not less than two fixed on-site half-duty fire hydrant pumps are required.

Where a building has an effective height more than 50 m and not more than 135 m, the requirements of [Clause 6.5](#) apply.

G.4.11 On-site tanks and pumps

[Clause 2.2.13](#) details the design scenarios where an on-site tank and not less than two on-site half-duty fire hydrant pumpsets or full duty pumps are required to be installed when the primary water supply is unable to provide the required unassisted pressure or flow.

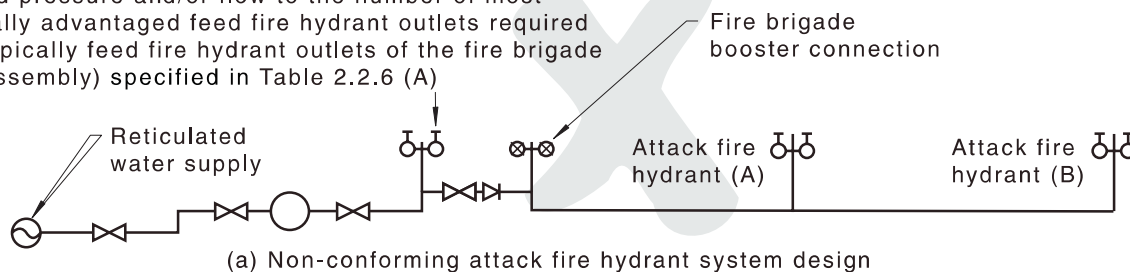
In relation to [Clause 2.2.13](#), where the primary water supply is unable to provide the unassisted pressure and flow as specified in [Table 2.2.6\(A\)](#) to the most hydraulically advantaged feed fire hydrant outlets required to flow (typically those of the fire brigade booster assembly), a fixed on-site tank, tank suction booster assembly and not less than two half-duty fire hydrant pumpsets are required in

a building having an effective height not more than 50 m. In cases, where the building has an effective height of more than 50 m, not less than two full duty pumps are required.

In these design scenarios, the fixed on-site tank is required to deliver not less than four hours of water and each fixed on-site pump is required to deliver the pressure and flow specified in [Table 2.2.6\(C\) or \(D\)](#), as applicable, to the number of fire hydrant outlets required to flow. [Figure G.4.11](#) highlights the application of this design principle.

Where a building has an effective height more than 50 m and not more than 135 m, the requirements of [Clause 6.5](#) also apply.

Primary water supply (reticulated) is **unable** to provide the unassisted pressure and/or flow to the number of most hydraulically advantaged feed fire hydrant outlets required to flow (typically feed fire hydrant outlets of the fire brigade booster assembly) specified in [Table 2.2.6 \(A\)](#)



As design (a) does not meet the requirements for an attack fire hydrant system, an on-site tank, tank suction booster assembly and not less than two half-duty fixed on-site pumps are provided in design (b) to enable conformance

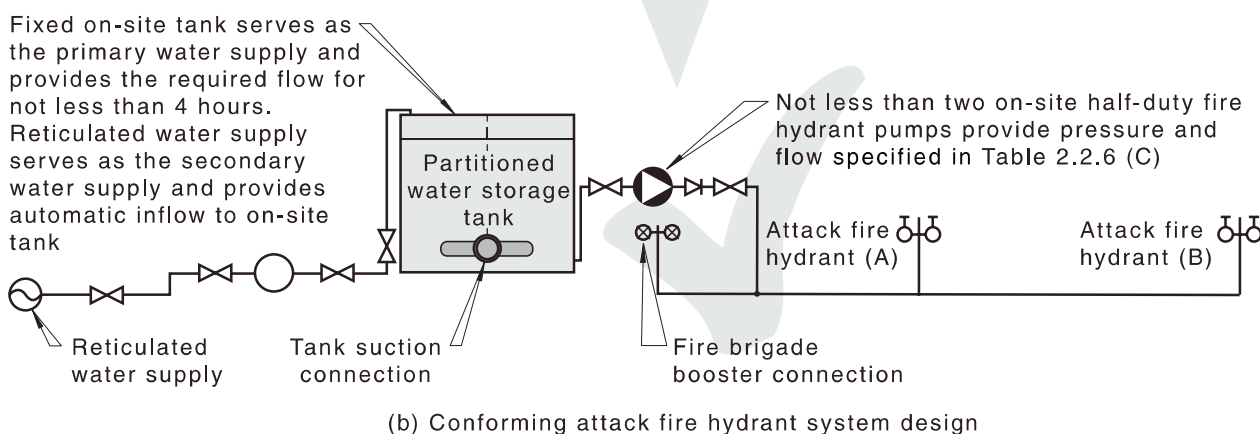


Figure G.4.11 — Non-conforming feed fire hydrants and the requirement for on-site tanks and pumps

G.4.12 Fire brigade booster assembly

[Clause 2.2.14.1](#) defines the minimum pressure and flow required at the feed fire hydrant outlets of an H-pattern, I-pattern, tank model or in-line fire brigade booster assembly and the applicable location requirements.

[Clause 2.2.14.2](#) defines the requirements for the large- and small-bore suction connections provided to a static water supply (water storage tank, dam, lake sea, river) that provides the primary water supply for the building or site.

[Clause 2.2.14.3](#) defines the parameters upon which the minimum number of boost inlet connections required at the fire brigade booster assembly are based.

An example of a fire brigade pumping appliance connected to an H-pattern fire brigade booster assembly is shown in [Figure G.4.12](#).

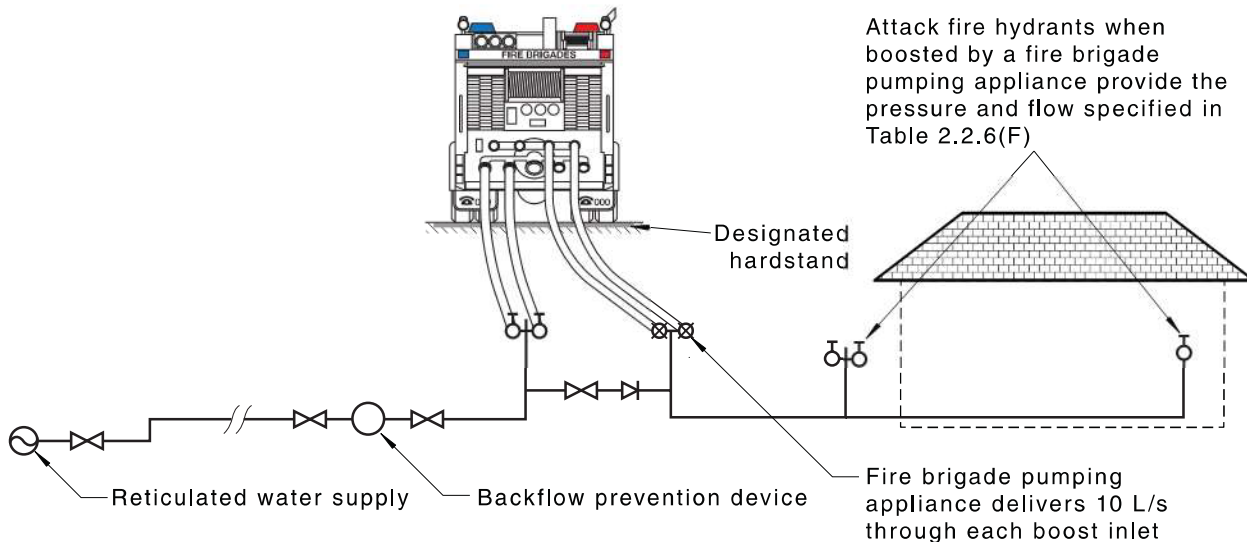


Figure G.4.12 — Fire brigade pumping appliance connected to a fire brigade booster assembly

G.4.13 Pumps

[Clauses 2.2.15](#) and [2.2.16](#) specify the minimum pressure and flow requirements for a half-duty fire hydrant pump and a full-duty fire hydrant pump, respectively.

In relation to the performance of a half-duty fire hydrant pump, the pump is required to deliver not less than 700 kPa at 5 L/s to each fire hydrant outlet required to flow as specified in [Tables 2.2.5\(B\), \(C\) and \(D\)](#), as applicable. Half-duty fire hydrant pumps are required to be installed in buildings having an effective height not more than 50 m, where required.

In relation to the performance of a full-duty fire hydrant pump, the pump is required to deliver not less than 700 kPa at 10 L/s to each fire hydrant outlet required to flow as specified in [Tables 2.2.5\(B\), \(C\) and \(D\)](#), as applicable. Full-duty fire hydrant pumps are required in buildings having an effective height more than 50 m. The increase in flow to 10 L/s for full-duty fire hydrant pumps is because this flow rate was previously assigned to relay pumps in buildings having an effective height more than 50 m. These full-duty fire hydrant pumps now serve the function previously required from the relay pump.

G.5 Hydraulic design parameters

[Clause 2.3](#) specifies the hydraulic parameters to be met when designing and installing the fire hydrant system.

In determining the design parameters of friction loss, velocity, flow and pressure, the hydraulic calculations are based on the residual pressure available to the building or site from the source of supply at the required flow rate (i.e. the pressure available for design should be determined when the minimum number of fire hydrant outlets required to flow are discharging at the required flow rate).

Where a reticulated water supply provides the primary water supply, the total hydraulic loss associated with the system should include the losses across the service connection and fittings, metering assembly, the backflow prevention device and between the reticulated water supply and the fire brigade booster assembly. Losses associated through the fire brigade booster connection and the most hydraulically disadvantaged fire hydrant valve need not be included.

Where an on-site tank or river, lake or dam (i.e. is a seasonally affected water supply) provides the primary water supply for the site, the total hydraulic loss associated with the system should include the losses between the primary water supply and the large- or small-bore suction connections, or both.

As the design criteria specified in this document may only be sufficient for initial firefighting activities, the requirement to limit the hydraulic loss to 150 kPa may allow the actual performance of the system to be enhanced by up to twice the design flow. This increase in performance will be dependent on the primary water supply being capable of providing for increased flows and fire brigade resources being available.

Appendix H (informative)

Guidance on fire hydrant location and related provisions

H.1 Scope

This appendix provides guidance on the application of the location, coverage and related provisions specified in [Section 3](#).

H.2 General

[Clause 3.1](#) introduces the concept of fire hydrant coverage and the areas required to be protected.

The requirement to provide fire hydrant coverage to all parts of the building that are considered to be part of the floor area of the building as defined by the NCC seeks to provide the attending fire brigade with a fire hydrant system design suitable for the commencement of firefighting activities. In developing the fire hydrant system design layout, the fire hydrant locations selected should be —

- (a) readily accessible to the attending fire brigade;
- (b) remote from the risks and special hazards associated with the building;
- (c) considerate of the access provisions provided; and
- (d) considerate of the type and size of fire that could reasonably be expected within the building.

A key requirement of the design principles specified in [Section 3](#) is that access to the available primary water supply by way of accessible street hydrants, on-site feed or attack fire hydrants or on-site large- and small-bore suction connections, will be provided at the front of the building or site. The ready access to the primary water supply will then enable the attending fire brigade to approach the fire in the building or site under the protection of a charged line of layflat firefighting hose, if required.

Fire hydrant coverage to parts of a building/storey above the reach of a standard hose stream, such as a gantry or the upper parts of storage racks (i.e. areas not considered to be part of the floor area of the building by the NCC), is not addressed by this document. Where the relevant authority is of the opinion that structures or items, such as those detailed above, require protection by a fire hydrant system, these structures or items should be addressed in compliance with the special hazard provisions of the NCC and [Appendix E](#) of this document.

NOTE Refer to the NCC for more information on the floor area of a building.

In Australia, depending on location, fire hydrants systems may be used by either a metropolitan or rural fire brigade or fire service, or both, by way of a mutual response agreement. Consequently, the fire hydrant system design should be suitable for use by the attending fire brigade or fire service, either metropolitan or rural, and considerate of the response capability of the attending fire brigade or fire service.

H.3 Fire hydrant features, accessibility, and clearances

[Clause 3.2.2](#) specifies the general requirements, minimum clearances and design criteria for external and internal fire hydrants.

[Figure H.3\(A\)](#) highlights the application of the design principles and minimum clearances required in and around external fire hydrants, including minimum and maximum heights for these fire hydrants. Additionally, [Figure H.3\(A\)](#) highlights that an external above-ground on-site fire hydrant is required to have two outlets.

NOTE In some circumstances, the authority having jurisdiction may require external fire hydrants to be installed below ground.

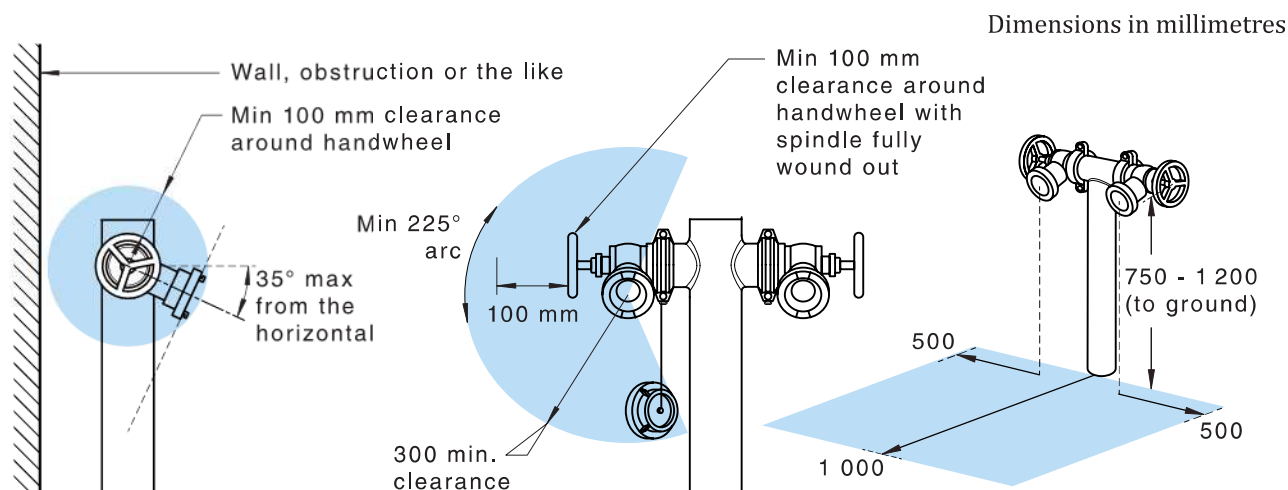


Figure H.3(A) — External fire hydrant clearances

[Figure H.3\(B\)](#) highlights the application of the design principles and minimum clearances required in and around internal fire hydrants, including minimum and maximum heights for these fire hydrants. Additionally, [Figure H.3\(B\)](#) highlights that an internal above-ground on-site fire hydrant is required to have one valve-controlled outlet, except where the requirements of [Clause 3.2.2.5\(b\) and \(c\)](#) apply.

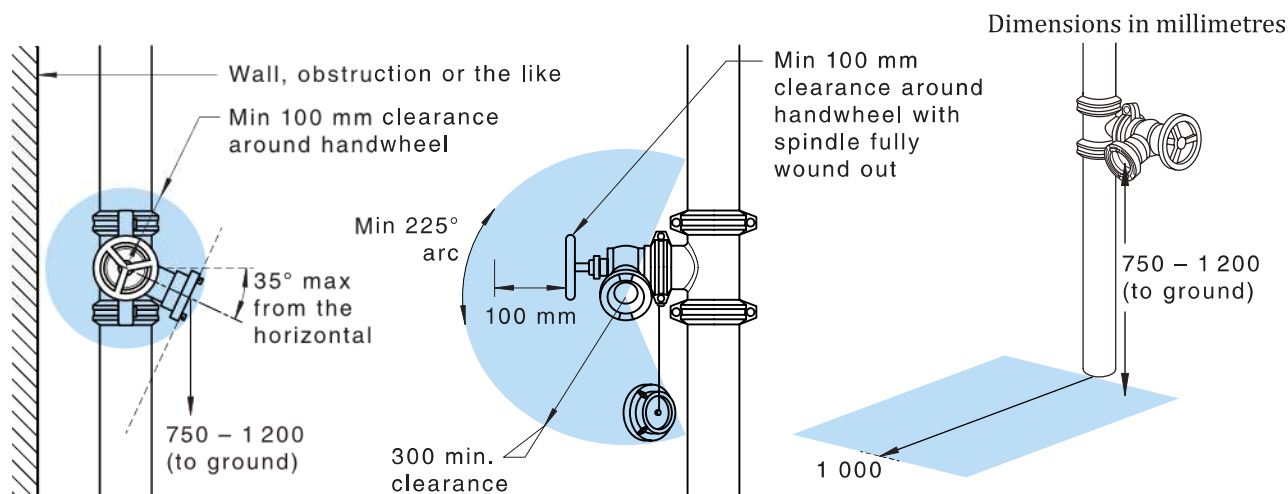


Figure H.3(B) — Internal fire hydrant clearances

[Figure H.3\(C\)](#) highlights the application of the design principles applicable to the clearances required where an internal fire hydrant outlet is located within a fire-isolated stair.

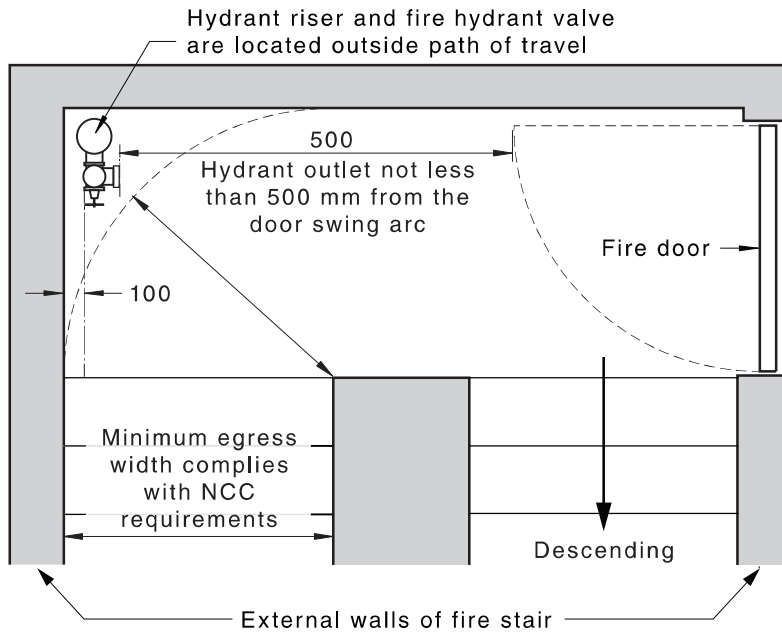


Figure H.3(C) — Internal fire hydrant clearances required within a fire isolated stair

Figure H.3(D) highlights the application of the design principles relating to the orientation of an internal fire hydrant outlet within a fire isolated stair. The requirement for the fire hydrant outlet to face or point towards the descending fire stair allows for the fire hose that has been rolled down the stairs to be easily connected to the fire hydrant outlet and then taken through the door.

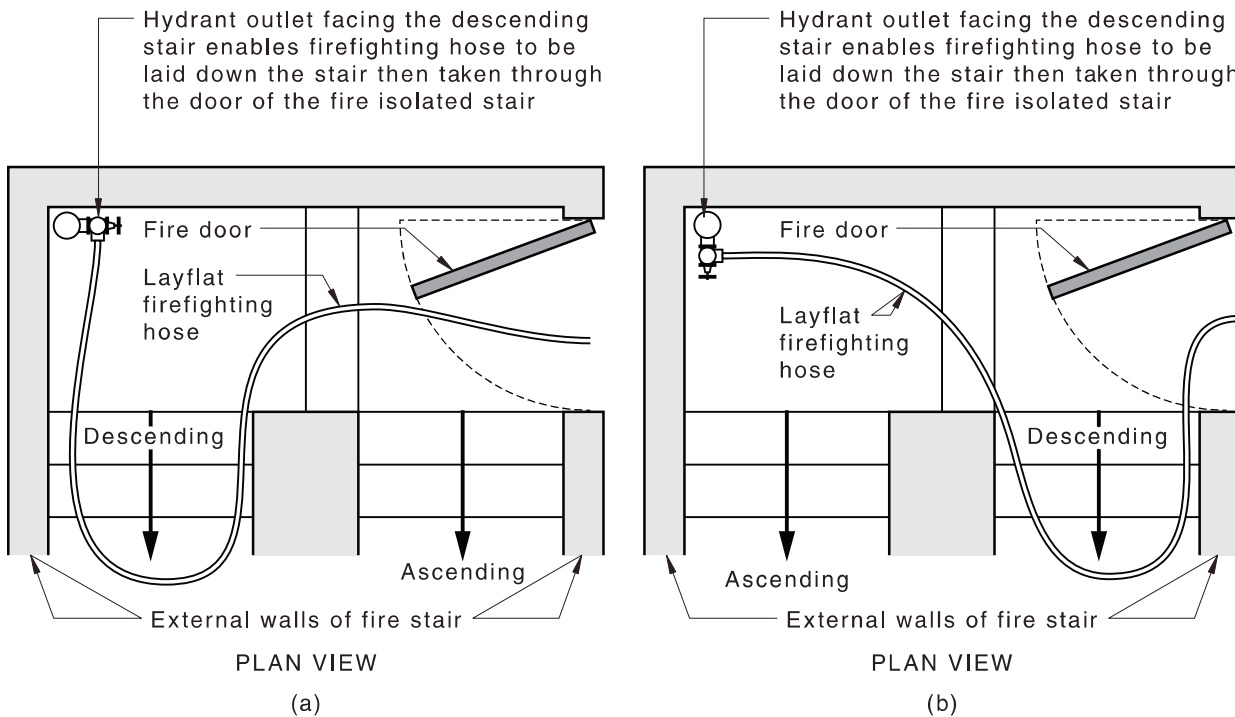


Figure H.3(D) — Orientation of fire hydrant outlets in fire-isolated stairs

Where the internal fire hydrant is located at the bottom of a descending stair, the hydrant outlet should in this instance be orientated to face the ascending stair.

H.4 Hardstands

[Clause 3.3](#) details the requirements for hardstands.

NOTE For additional information on hardstands, see [Appendix F](#).

H.5 Location of fire hydrants

[Clause 3.4](#) indicates that fire hydrants may be located externally or internally to provide fire hydrant coverage to all parts of the floor area of a building.

In considering the application of these provisions, wherever possible, fire hydrants should be located externally before considering locating them internally. When locating an external fire hydrant, the position chosen should be remote or protected from the risk associated with the building.

The application of this design principle allows the attending fire brigade to access the primary water supply in the safest possible environment (i.e. remote from heat and smoke or the specific dangers associated with the building or open yard) before commencing firefighting operations.

H.6 External fire hydrants

H.6.1 General

H.6.1.1 Application

[Clause 3.5.1](#) specifies the use and limitations of use of external fire hydrants.

H.6.1.2 Fire hydrant coverage limitations — Fire brigade pumping appliances

[Clause 3.5.1\(a\)](#) specifies the use and limitation of fire hydrant coverage from a fire brigade pumping appliance.

[Figure H.6.1.2\(A\)](#) highlights the application of the design principles of [Clause 3.5.1\(a\)](#). In particular, it shows that fire hydrant coverage from a fire brigade pumping appliance located not less than 10 m from the building and supplied from an external feed fire hydrant may only provide coverage to the lowest four storeys included in the calculation of rise in storeys for a building and the storey immediately below the lowest storey used in this calculation, provided coverage is achieved to all parts of each storey of the protected building. Where a building has a rise in storeys of more than 4, fire hydrant coverage is provided by internal fire hydrants conforming to [Clause 3.6.2](#) and the application of the provisions of [Clause 3.5.1\(c\)](#), if applicable.

The limitation applied to fire hydrant coverage from a fire brigade pumping appliance enables firefighters using fire hoses connected to fire brigade pumping appliances to enter a building in the knowledge that all parts of the floor are not more than 70 m from the fire brigade pumping appliances supplying their layflat firefighting hose.

Coverage to all parts of the building may be achieved by locating one or more fire brigade pumping appliances around the building, provided a suitably located feed fire hydrant is available.

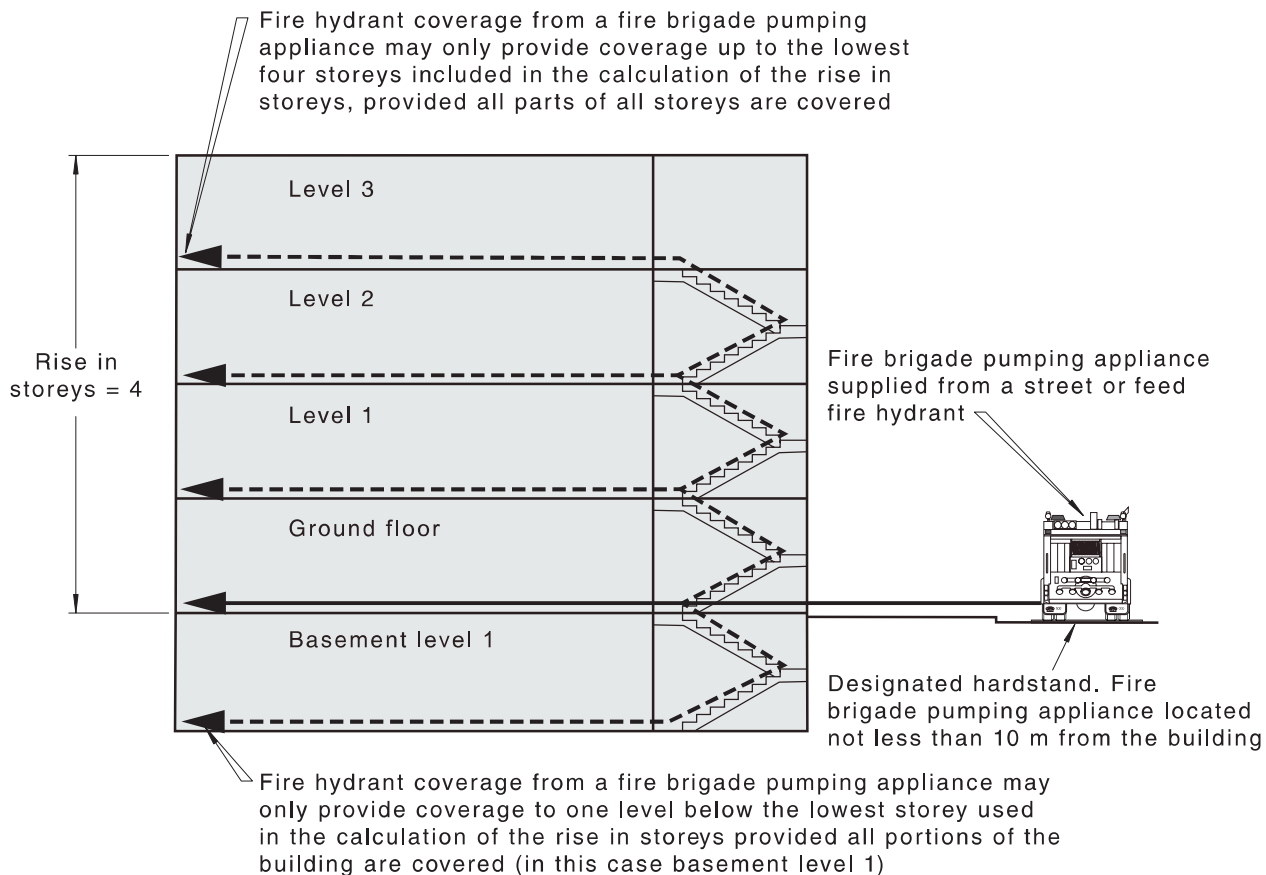


Figure H.6.1.2(A) — Coverage from a fire brigade pumping appliance

Where fire hydrant coverage to all parts of the building cannot be achieved by applying the provisions of [Clause 3.5.1\(a\)](#), the fire hydrant coverage requirements specified in [Clause 3.5.1\(c\)](#) apply.

The requirement to locate a fire brigade pumping appliance not less than 10 m from a building when determining fire hydrant coverage ensures that it reflects how and where a fire brigade pumping appliance may be positioned in the event of a fire.

The use of the phrase “rise in storeys” has been included to align the requirements of [Clause 3.5.1](#) with the terminology used in the NCC and to eliminate any ambiguity about the storeys that can be protected from a fire brigade pumping appliance.

[Figure H.6.1.2\(B\)](#) provides an example of the fire hydrant coverage requirements of [Clause 3.5.1\(a\)](#) from a fire brigade pumping appliance where the building has a rise in storeys of two and is located on a sloping site.

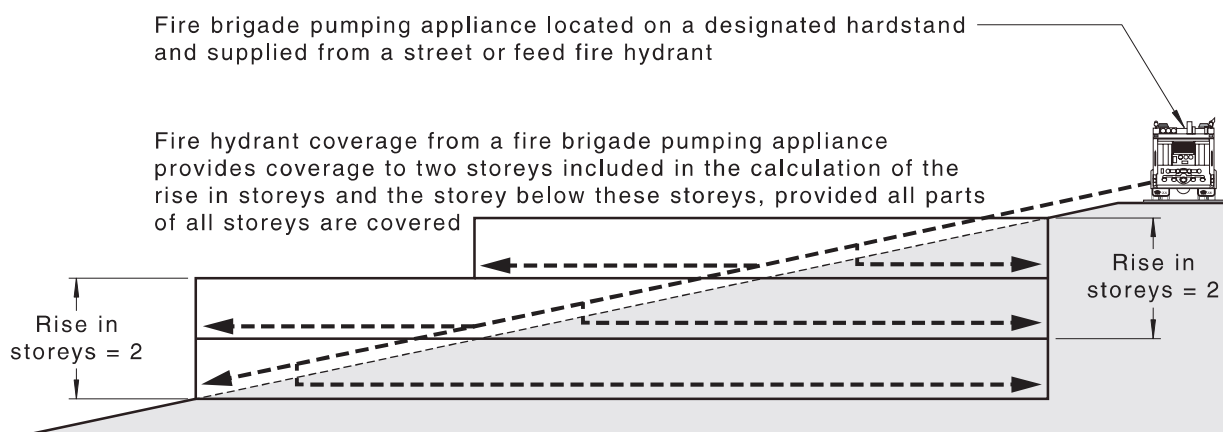


Figure H.6.1.2(B) — Coverage from a fire brigade pumping appliance where building is located on a sloping site

H.6.1.3 Fire hydrant coverage limitation — External attack fire hydrant

[Clause 3.5.1\(b\)](#) specifies the use and limitation of fire hydrant coverage from an external attack fire hydrant.

[Figure H.6.1.3](#) highlights the application of the design principles specified in [Clause 3.5.1\(b\)](#). In particular, [Figure H.6.1.3](#) shows that fire hydrant coverage from an external attack fire hydrant may only provide coverage to the lowest four storeys included in the calculation of rise in storeys for a building and the storey immediately below the lowest storey used in this calculation, provided coverage is achieved to all parts of each storey of the building protected.

The use of the phrase “rise in storeys” has been included to align the requirements of [Clause 3.5.1](#) with the terminology used in the NCC and to eliminate any ambiguity about the storeys that can be protected from an external fire hydrant.

This limitation ensures that firefighters using external fire hydrants can enter a building in the knowledge that all parts of the floor protected by the external fire hydrants are not more than 70 m.

Coverage to all of the building may be achieved from one or more external attack fire hydrants.

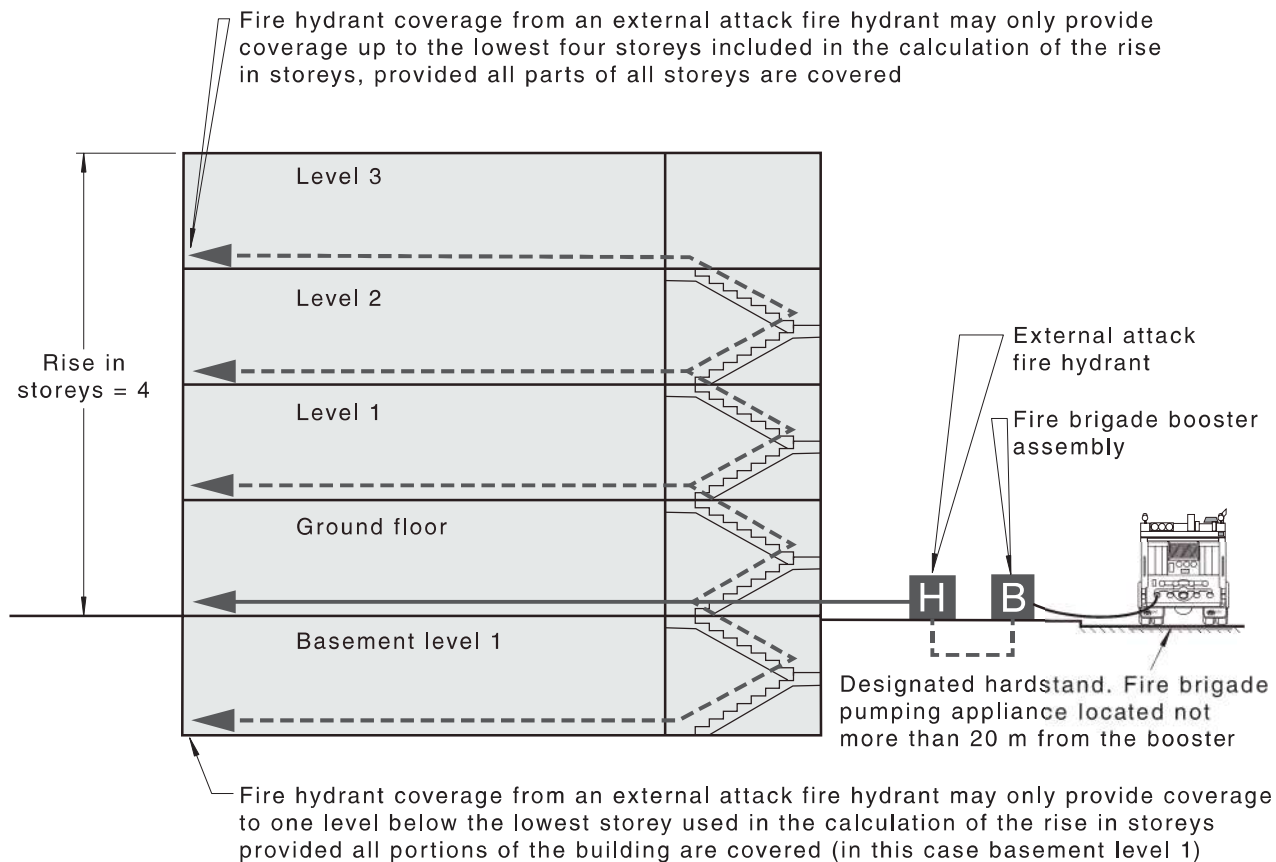


Figure H.6.1.3 — External attack fire hydrant coverage

Where fire hydrant coverage to all parts of the building cannot be achieved by applying the provisions of [Clause 3.5.1\(b\)](#), the fire hydrant coverage specified in [Clause 3.5.1\(c\)](#) applies.

H.6.1.4 External fire hydrant coverage limitations

[Clause 3.5.1\(c\)](#) specifies the use and limitation of fire hydrant coverage from a fire brigade pumping appliance or an external attack fire hydrant when fire hydrant coverage cannot be achieved through the application of [Clause 3.5.1\(a\)](#) and [\(b\)](#).

[Figure H.6.1.4](#) highlights the application of the design principles of [Clause 3.5.1\(c\)](#). In particular, where fire hydrant coverage cannot be provided in accordance with [Clause 3.5.1\(a\)](#) or [\(b\)](#), coverage from a fire brigade pumping appliance or an external fire hydrant is then limited to all parts of the ground floor, any associated storey or mezzanine within the ground floor fire compartment, and the storey immediately below ground.

Coverage to all parts of the ground floor and any associated storey or mezzanine as well as the storey immediately below-ground may be achieved through the use of one or more fire brigade pumping appliances or external attack fire hydrants.

This limitation ensures that firefighters using a fire brigade pumping appliance, or an external fire hydrant can enter a building in the knowledge that all parts of the floor protected by the fire brigade pumping appliance or external attack fire hydrants are within 70 m.

Where the provisions of [Clause 3.5.1\(c\)](#) are applied to provide fire hydrant coverage to part of a building, coverage to the remainder of the building is to be provided through the installation of internal attack fire hydrants at each storey not covered from external fire hydrants.

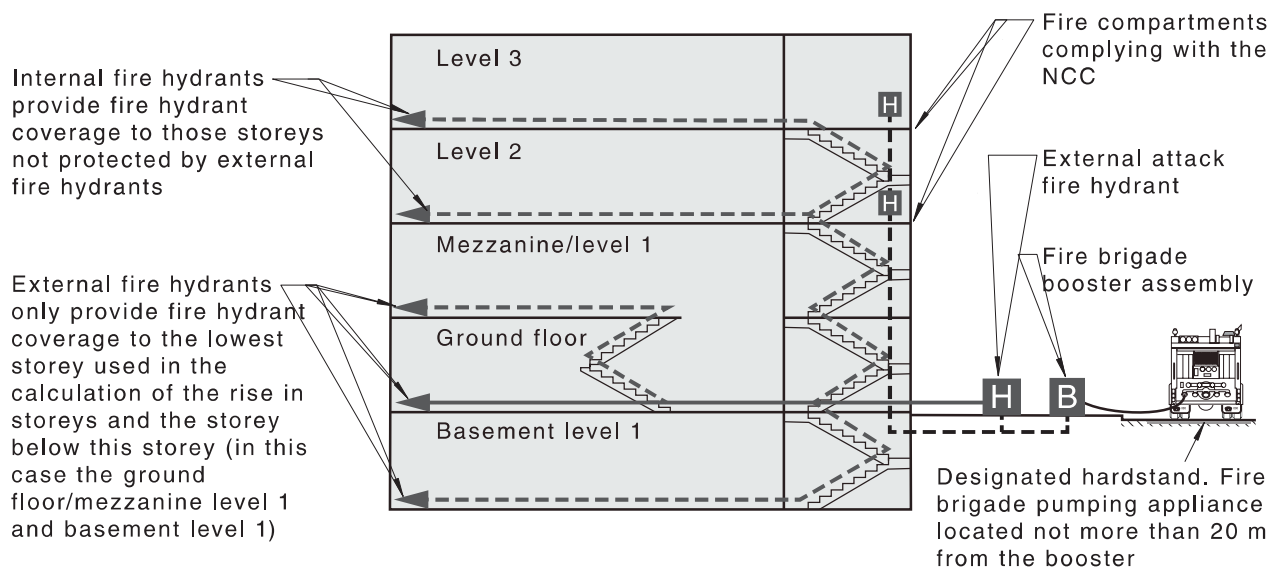


Figure H.6.1.4 — External fire hydrant coverage

While the fire hydrant coverage requirements of [Clause 3.5.1\(c\)](#) specify how the ground floor fire compartment and the storey immediately below are to be protected, where a multi-level building also requires the installation of internal fire hydrants above and below the protected storeys, fire brigade intervention activities would be further supported through the installation of internal fire hydrants on all levels or storeys of the building.

H.6.2 Street fire hydrants

[Clause 3.5.2](#) specifies the requirements for the use of street fire hydrants.

[Figure H.6.2](#) shows the application of the design principles detailed in [Clause 3.5.2](#). In particular, it illustrates the minimum requirements for a street fire hydrant to be used including —

- (a) the hydrant delivering the minimum pressure and flow specified in [Table 2.2.6\(A\)](#);
- (b) the fire brigade pumping appliance being located not less than 10 m from the building and not more than 20 m from the street hydrant when determining fire hydrant coverage;
- (c) the fire brigade pumping appliance being located not more than 20 m from the street hydrant when determining fire hydrant coverage;
- (d) the street fire hydrant being located not less than 10 m from the building or being protected; and
- (e) the maximum fire hydrant coverage of 70 m that may be applied from a fire brigade pumping appliance located on a hardstand and supplied by the street fire hydrant.

The requirement to include not more than two street fire hydrants in a fire hydrant system design is in recognition of the following:

- (i) Street fire hydrants are often more difficult to locate than on-site fire hydrants.
- (ii) Street fire hydrants can be obstructed by the normal activities in the street.
- (iii) Street fire hydrants may be moved by the owner of the infrastructure.
- (iv) The building owner is not responsible for the maintenance of the street fire hydrants providing fire hydrant coverage to their building.

In relation to the use of street fire hydrants, prior to incorporating street fire hydrants into a design, consideration should also be given to the possible factors that could limit fire brigade access to the hydrant. In this regard, it is considered unacceptable and not in keeping with the design principles of this document to incorporate street hydrants that could not be reasonably accessed by the attending fire brigade (e.g. a street fire hydrant located across train or tram tracks or on the other side of main roads).

Where street fire hydrants are used to provide fire hydrant coverage in lieu of on-site feed fire hydrants under the provisions of [Clause 3.5.2\(d\)](#), a permanently affixed location plan is required. Among other items, this plan is required to indicate the location of the street fire hydrants and the pressure and flow available at the street fire hydrant under 95th percentile demand conditions.

NOTE For more information on the location plan requirements, see [Clause 11.7](#).

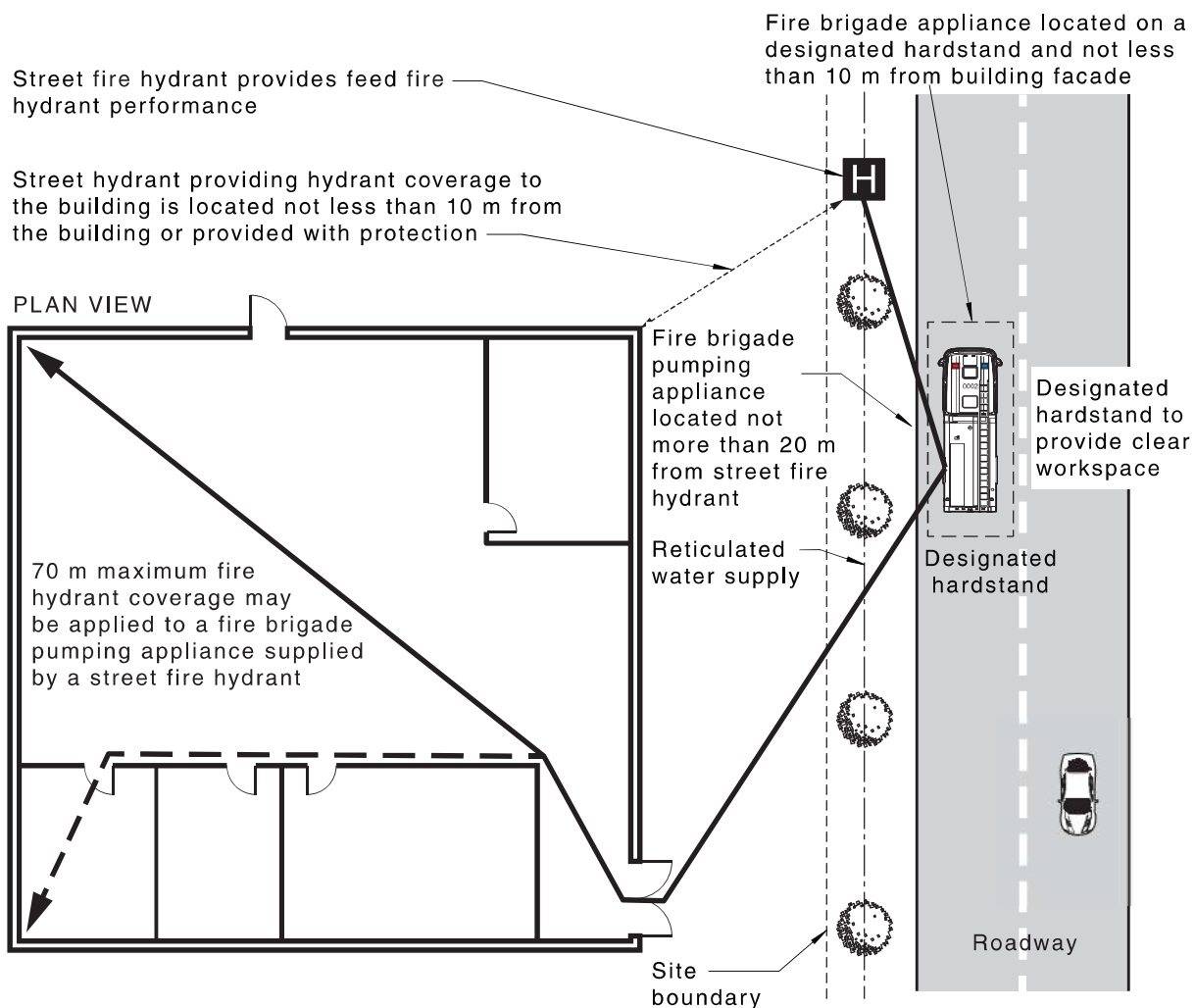


Figure H.6.2 — Street fire hydrant coverage

H.6.3 Location of external fire hydrants

H.6.3.1 General

[Clause 3.5.3.1](#) details the general requirements regarding access to and from an external fire hydrant and, unless protected in accordance with [Clause 3.5.5](#), the minimum distance an external fire hydrant should be located from typical risks such as electricity supply equipment. Minimum clearances are also defined.

In relation to [Clause 3.5.3.1\(b\)\(i\)](#) to (v), the 10 m distance specified is considered to represent the minimum distance a fire hydrant should be located from a building to mitigate the effects of radiant heat (and other fire related hazards) on firefighters that attempt to use the fire hydrant. Where atypical risks or special hazards are present within the building, distances more than 10 m should be provided.

In relation to [Clause 3.5.3.1\(b\)\(vi\)](#), the 3 m distance specified is considered to represent the minimum distance the vent terminal of any gas assembly or gas measurement system should be located from an external fire hydrant.

In relation to [Clause 3.5.3.1\(c\)](#), the clearances specified in front of, and to each side of the external hydrant, enable the fire hydrant to be accessed by the attending fire brigade and for layflat firefighting hose to be laid and connected to the hydrant. Additionally, the external locations selected should allow the attending fire brigade to enter and move around the building under the protection of a charged hose line.

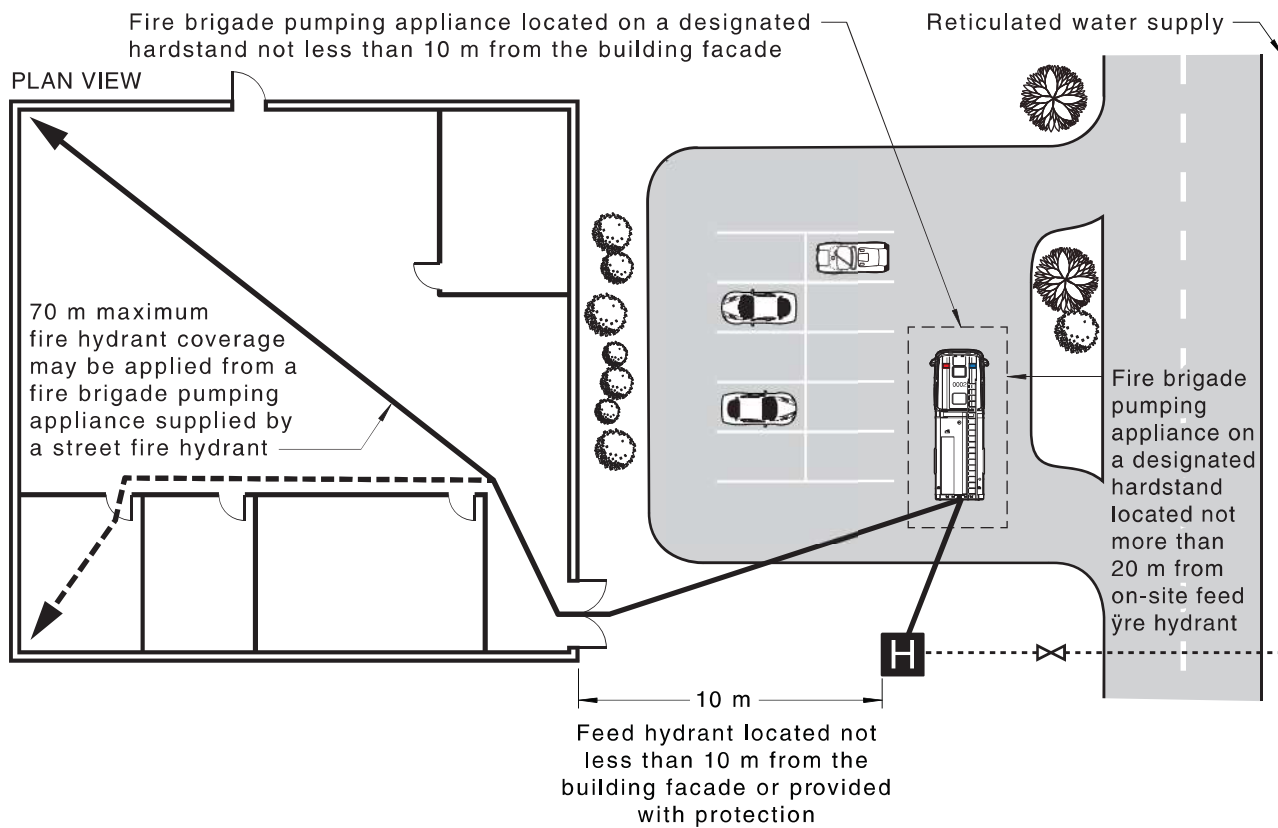
In relation to [Clause 3.5.3.1\(d\)](#), where mechanical damage is likely due to vehicle movement or other activities, it is recommended that damage to the fire hydrant is prevented by the installation of bollards or other protection devices.

While the provisions of [Clause 3.5.3.1](#) provide direction on the location of external fire hydrants, they will not be appropriate in all instances. As such, the location of any external fire hydrant should be considerate to the specific risks associated with the building or site and how these risks may impact the attending fire brigade or trained firefighting personnel endeavouring to access the external fire hydrant.

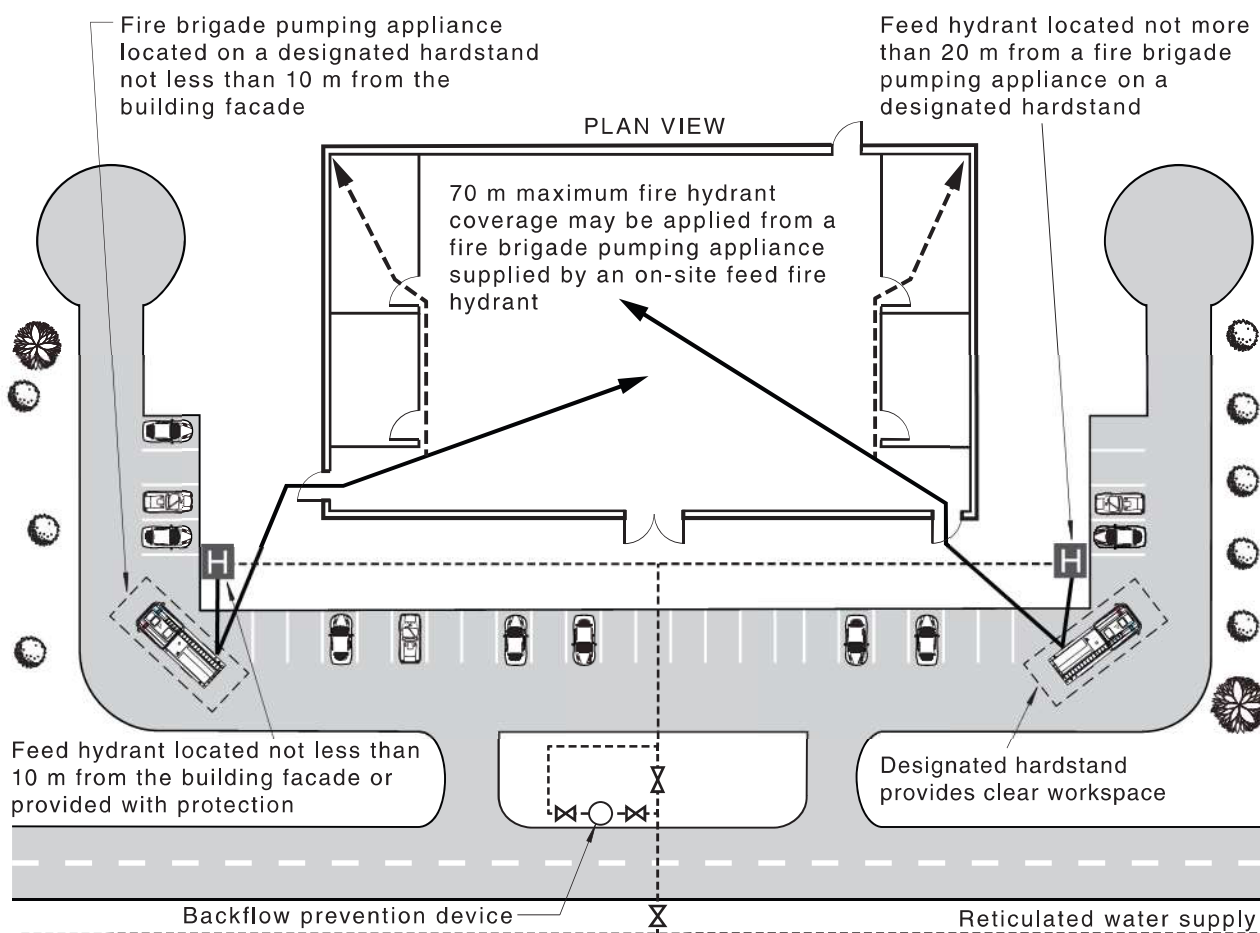
H.6.3.2 External feed fire hydrants

[Clause 3.5.3.2](#) specifies the location and fire hydrant coverage requirements that may be applied from external feed fire hydrants.

[Figure H.6.3.2](#) highlights the application of the design principles of [Clause 3.5.3.2](#). In particular, it shows that in determining fire hose coverage, a maximum of 70 m of fire hydrant coverage may be applied from a fire brigade pumping appliance supplied by an external fire hydrant that is located not more than 20 m from a hardstand.



(a) Coverage using one on-site feed fire hydrant



(b) Coverage using two on-site feed fire hydrants

Figure H.6.3.2 — External feed fire hydrant coverage to all parts of a building's floor area

H.6.3.3 External attack fire hydrants

[Clause 3.5.3.3](#) specifies location and fire hydrant coverage requirements that may be applied from external attack fire hydrants.

[Clause 3.5.3.3\(a\)](#) requires an external attack fire hydrant to be located not more than 50 m from a hardstand except where the provisions of [Clause 3.5.3.3\(a\)\(ii\)\(A\)](#), (B) and (C) can be applied.

The concession provided by [Clause 3.5.3.3\(a\)\(ii\)](#) acknowledges that, although firefighters may be required to travel further than 50 m thereby increasing the time taken before fire brigade intervention can commence, the risks of significant fire spread are likely to be reduced either by the operation of the installed sprinkler system or the features of the building. Additionally, the extra travel distance from a hardstand enables these fire hydrants to be located externally from the building.

The concession provided by [Clause 3.5.3.3\(a\)\(i\)](#), (ii) and (iii) acknowledges that, although firefighters may be required to travel further than 50 m thereby increasing the time taken before fire brigade intervention can commence, the risks of significant fire spread are likely to be reduced either by the operation of the installed sprinkler system or the features of the building. Additionally, the extra travel distance from a hardstand allows for these fire hydrants to be located externally from the building.

In relation to [Clause 3.5.3.3\(b\)](#), where an external attack fire hydrant is located not more than 50 m from a hardstand, a maximum of 70 m fire hydrant coverage may be applied from the external attack fire hydrant.

In relation to [Clause 3.5.3.3\(c\)](#), where an external attack fire hydrant is located more than 50 m but not more than 100 m from a hardstand in accordance with [Clause 3.5.3.3\(a\)](#), a maximum of 40 m fire hydrant coverage may be applied from the external attack fire hydrant.

[Figure H.6.3.3](#) highlights the application of the design principles detailed in [Clause 3.5.3.3\(b\)](#).

Attack fire hydrant located not more than 50 m from a fire brigade pumping appliance on a designated hardstand

Attack fire hydrant located not more than 50 m from a fire brigade pumping appliance on a designated hardstand

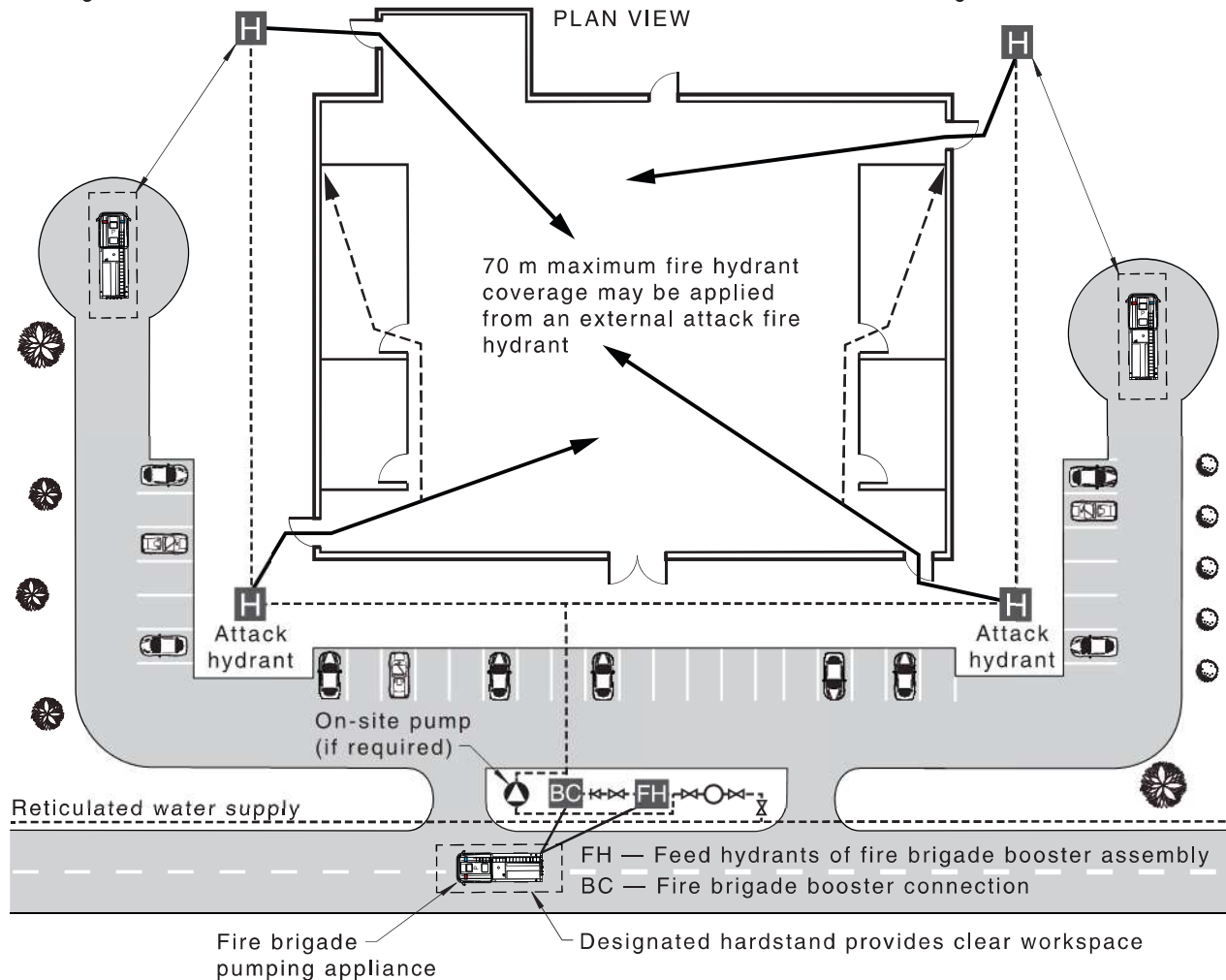


Figure H.6.3.3 — External attack fire hydrant coverage

H.6.3.4 External attack/feed fire hydrants

[Clause 3.5.3.4](#) specifies the location and fire hydrant coverage requirements that may be applied to external attack/feed fire hydrants.

[Clause 3.5.3.4\(a\)](#) requires that for an external attack fire hydrant to be classified as an external attack/feed fire hydrant, it should be located not more than 20 m from a hardstand.

[Clause 3.5.3.4\(b\)](#) requires that an external attack fire hydrant classified as an attack/feed fire hydrant is to be in a location that enables the attending fire brigade to use it as either an attack fire hydrant or as a feed fire hydrant, as required.

In relation to [Clause 3.5.3.4\(c\)](#), these requirements indicate that when determining fire hydrant coverage from an external attack fire hydrant that has been classified as an attack/feed fire hydrant,

the fire hydrant coverage measured is determined when used as an attack fire hydrant and when used as a feed fire hydrant supplying a fire brigade pumping appliance located not less than 10 m from a building. The fire hydrant coverage applied will be the most onerous.

In relation to [Clause 3.5.3.4\(d\)](#), these provisions indicate that when determining fire hydrant coverage from an attack/feed fire hydrant, a maximum of 70 m fire hydrant coverage may be applied and that the fire hose coverage is to be determined when the attack/feed fire hydrant is used as a feed hydrant and as an attack fire hydrant (that is all parts of the floor should be protected in both circumstances).

Where an external fire hydrant is classified as an attack/feed fire hydrant, although the design expectation is that the attack fire hydrant will serve as a feed fire hydrant and supply a fire brigade pumping appliance, it is equally likely that it will serve as an attack fire hydrant and supply hose lines pressurized by a fire brigade pumping appliance connected to the booster assembly. As such, the fire hydrant coverage requirements specified in [Clause 3.5.3.4](#) are measured from both the attack fire hydrant and from the fire brigade pumping appliance.

[Figure H.6.3.4](#) highlights the application of the design principles detailed in [Clause 3.5.3.4](#).

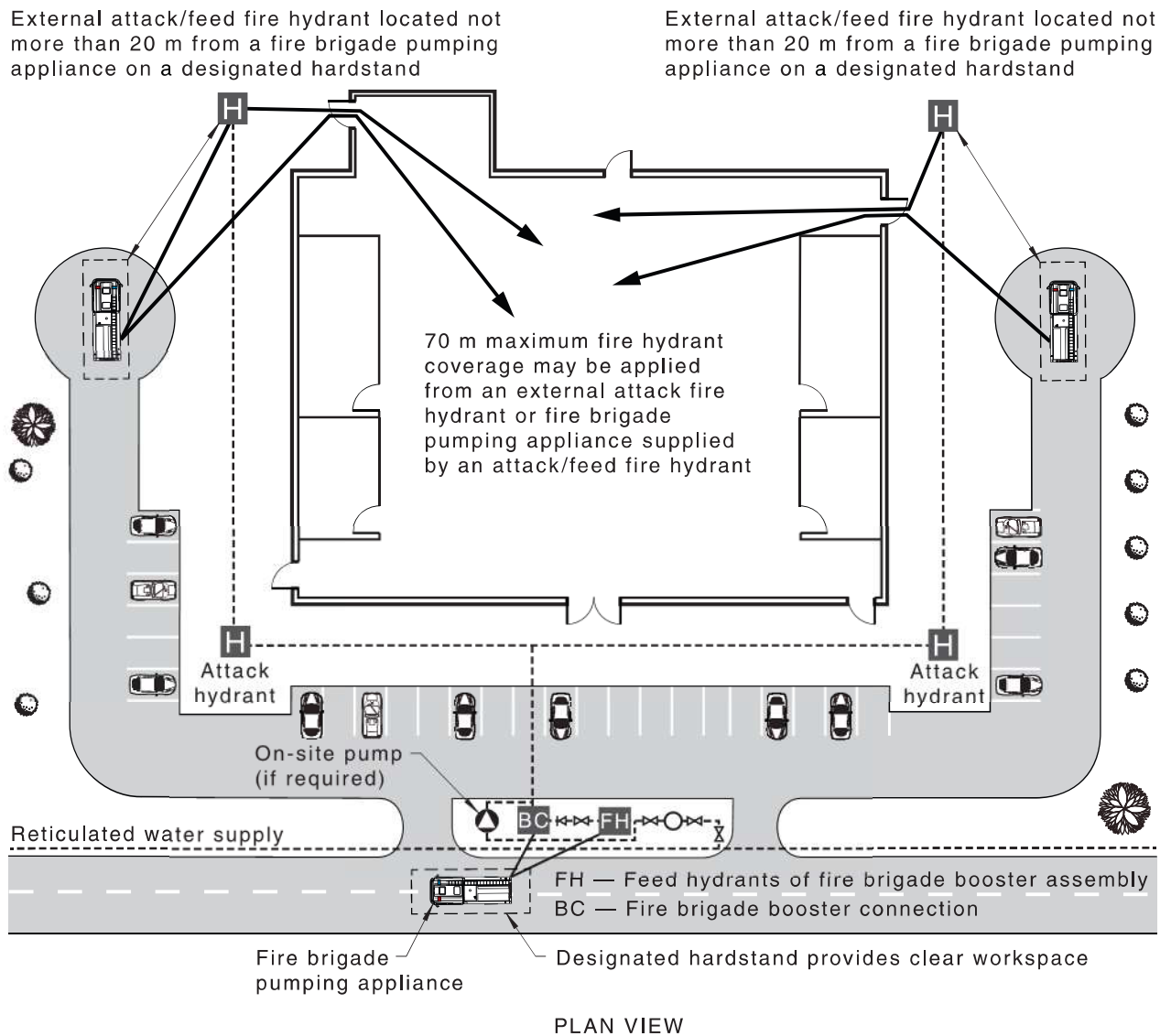


Figure H.6.3.4 — External attack/feed fire hydrant coverage

H.6.4 Fire brigade booster assembly — Feed fire hydrants

[Clause 3.5.4](#) specifies the fire hydrant coverage requirements and limitations that may be applied from the feed fire hydrants of a fire brigade booster assembly.

In relation to [Clause 3.5.4\(a\) to \(d\)](#), these provisions indicate that the feed fire hydrants of a fire brigade booster assembly may be used to provide fire hydrant coverage to the following areas of a building, provided all parts of the area is protected:

- The lowest storey included in the calculation of rise in storeys (typically the ground floor).
- A mezzanine or mezzanines of the lowest storey included in the calculation of rise in storeys provided the mezzanines are within the same fire compartment as the lowest storey referred to in Item (a).
- A storey immediately below the lowest storey included in the calculation of rise in storeys (typically the ground floor).
- A storey immediately above the lowest storey included in the calculation of rise in storeys (typically the ground floor) provided the storey is within the same fire compartment as the lowest storey referred to in Item (a).

Where all parts of the above areas are unable to be protected by a fire brigade pumping appliance supplied from the feed fire hydrants of the fire brigade booster assembly, the feed fire hydrants cannot be used to supply a fire brigade pumping appliance to provide fire hydrant coverage to the above mentioned areas. The applicable provisions of [Clause 3.5](#) for external fire hydrants and [Clause 3.6](#) for internal fire hydrants apply.

The limitation ensures that firefighters can enter a building safely in the knowledge that all parts of the floor protected by the fire brigade pumping appliance are within 70 m.

[Figure H.6.4](#) highlights the application of the design principles detailed in [Clause 6.3.4](#).

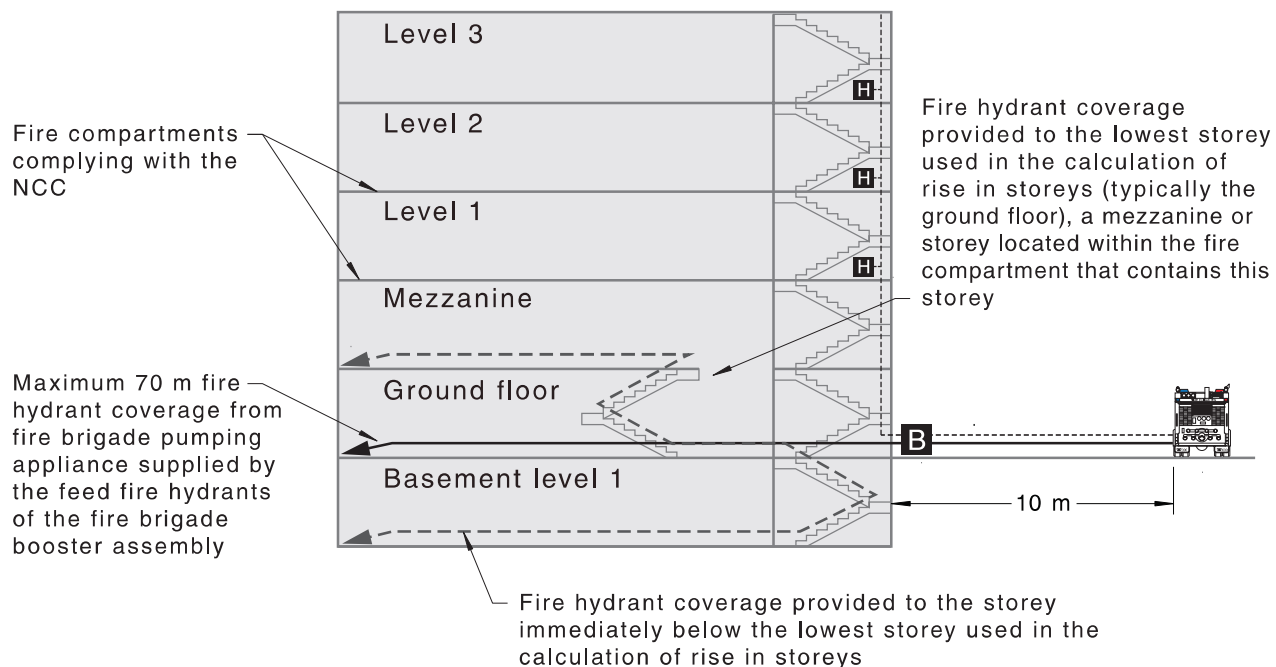


Figure H.6.4 — Feed fire hydrant coverage from a fire brigade booster assembly

H.6.5 Protection of external fire hydrants — Sprinkler-protected buildings

[Clause 3.5.5.1](#) specifies the protection requirements for external fire hydrants serving a sprinkler-protected building.

Where a building is sprinkler-protected throughout by an AS 2118.1, AS 2118.4, AS 2118.6, FPAA101D or FPAA101H sprinkler system, the protection requirements of [Clause 3.5.5.2](#) do not apply to external fire hydrants. This concession is in recognition of the benefits a sprinkler system provides to building occupants and the attending fire brigade or trained firefighting personnel through the control of a growing fire.

H.6.6 Protection of external fire hydrants — Non-sprinkler-protected buildings

[Clause 3.5.5.2](#) specifies the protection requirements for external fire hydrants serving a non-sprinkler-protected building.

In relation to [Clause 3.5.5.2\(a\)](#), where a fire hydrant is within or affixed to the external wall of a building, the protection for the external fire hydrant may be provided by the intrinsic characteristics of the building or by the provision of a freestanding wall. In each case, the protection is to provide the required FRL and dimensions detailed.

In relation to [Clause 3.5.5.2\(b\)](#), where a fire hydrant is located not more than 3.5 m from the external wall of the building, the protection provided for the external fire hydrant may be provided from the external wall of the building or from a freestanding wall. In each case, the protection should provide the required FRL and dimensions.

In relation to [Clause 3.5.5.2\(c\)](#), where a fire hydrant is located more than 3.5 m and not more than 10 m from the external wall of the building, the fire hydrant is to be protected by a freestanding wall having the required FRL and dimensions.

Where external fire hydrants are unable to be protected in accordance with [Clause 3.5.5.2](#), the fire brigade should be consulted to determine if the protection proposed for the fire hydrant system design meets their operational needs.

[Figure H.6.6](#) highlights the application of the design principles of [Clause 3.5.5.2\(a\) to \(c\)](#). In particular, it highlights that the protection requirements reduce once a fire hydrant is located more than 3.5 m from the facade or external wall of the building.

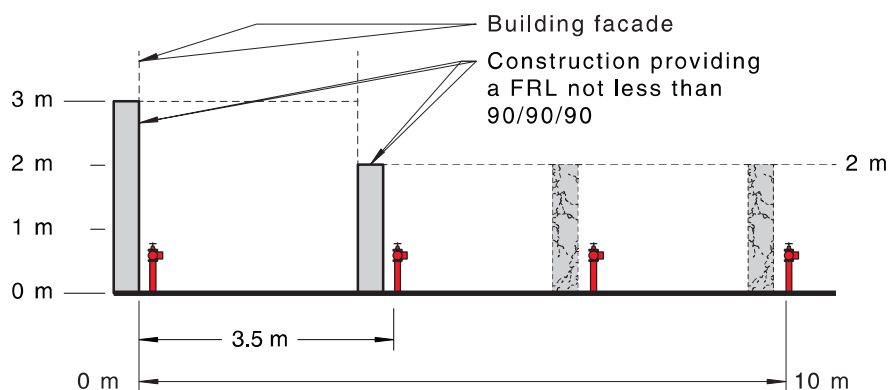


Figure H.6.6 — Protection of external fire hydrants

H.7 Internal fire hydrants

H.7.1 General

[Clause 3.6.1](#) specifies the use, and limitations of use, of internal fire hydrants.

The provisions of [Clause 3.6.1\(a\) and \(b\)](#) indicate that internal fire hydrants are installed to protect all parts of a building not protected by external fire hydrants conforming to [Clause 3.5](#) or the feed fire hydrants of a fire brigade booster assembly.

[Clause 3.6.1\(c\)](#) allows internal fire hydrants to only provide fire hydrant coverage to the storey on which they are installed, except where [Clause 3.6.1\(d\)](#) has been applied.

[Clause 3.6.1\(d\)](#) allows internal fire hydrants, if installed in accordance with [Clause 3.6.2\(c\)](#), to still only serve the storey it is dedicated to protect, except where permitted by the NCC.

In relation to [Clause 3.6.1\(e\)](#), a maximum of 40 m fire hydrant coverage may be applied from an internal fire hydrant.

In relation to [Clause 3.6.1\(f\)](#), where travel distances throughout the building are in compliance with the Deemed-to-Satisfy provisions of the NCC, a maximum of 45 m fire hydrant coverage may be applied from an internal fire hydrant that is located in accordance with [Clause 3.6.2](#).

In relation to [Clause 3.6.1\(g\)](#), where fire hydrant coverage is not achieved in all parts of an SOU in a Class 2, 3 or 4 building by the application of [Clause 3.6.1\(e\)](#) and the building is sprinkler-protected, an additional fire hydrant may be installed. The requirements applicable to an additional fire hydrant are specified in [Clause 3.6.3](#). The limiting of additional fire hydrants to Class 2, 3 and 4 buildings that are sprinkler-protected is in recognition of the benefits a sprinkler system provides to building occupants and the attending fire brigade or trained firefighting personnel through the control of a growing fire.

H.7.2 Location

[Clause 3.6.2](#) specifies where an internal fire hydrant is to be installed.

[Clause 3.6.2\(a\)](#) details the location requirements for internal fire hydrants where the building is provided with fire-isolated stairs and external stairs or ramps used in lieu of fire isolated stairs.

[Clause 3.6.2\(b\)](#) details the location requirements for an internal fire hydrant where the building is provided with non-fire-isolated stairs.

[Figure H.7.2\(A\)](#) highlights the application of some of the design principles of [Clauses 3.6.1](#) and [3.6.2](#) where an internal fire hydrant is installed in a fire isolated stair and the building has travel distances in compliance with the Deemed-to-Satisfy provisions of the NCC.

(PLAN VIEW)

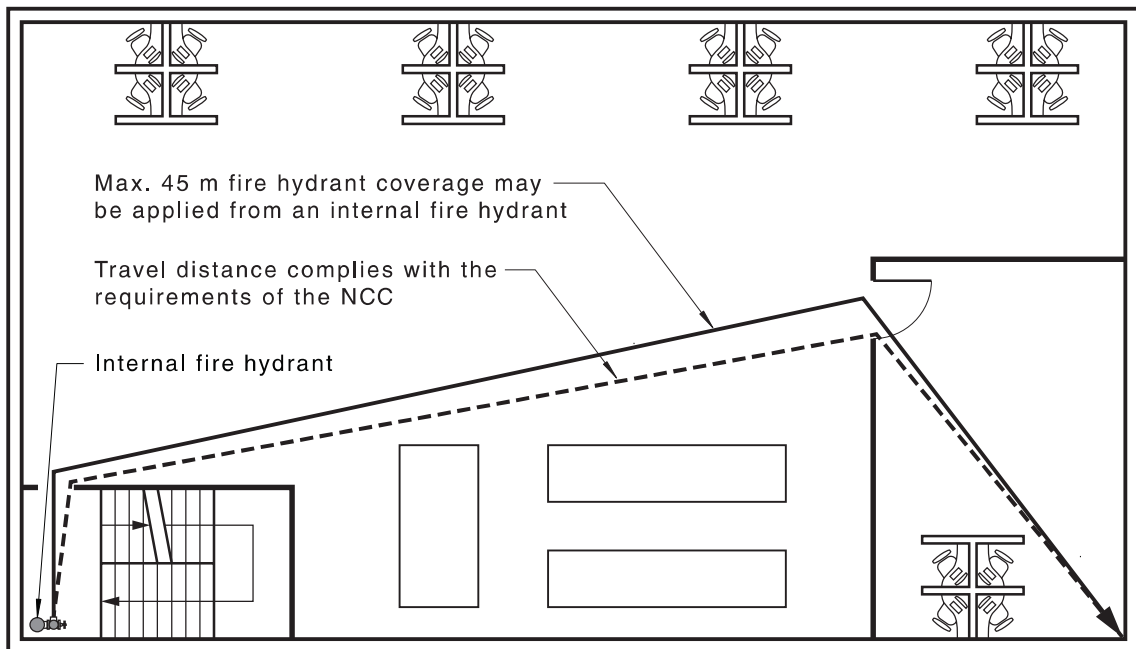
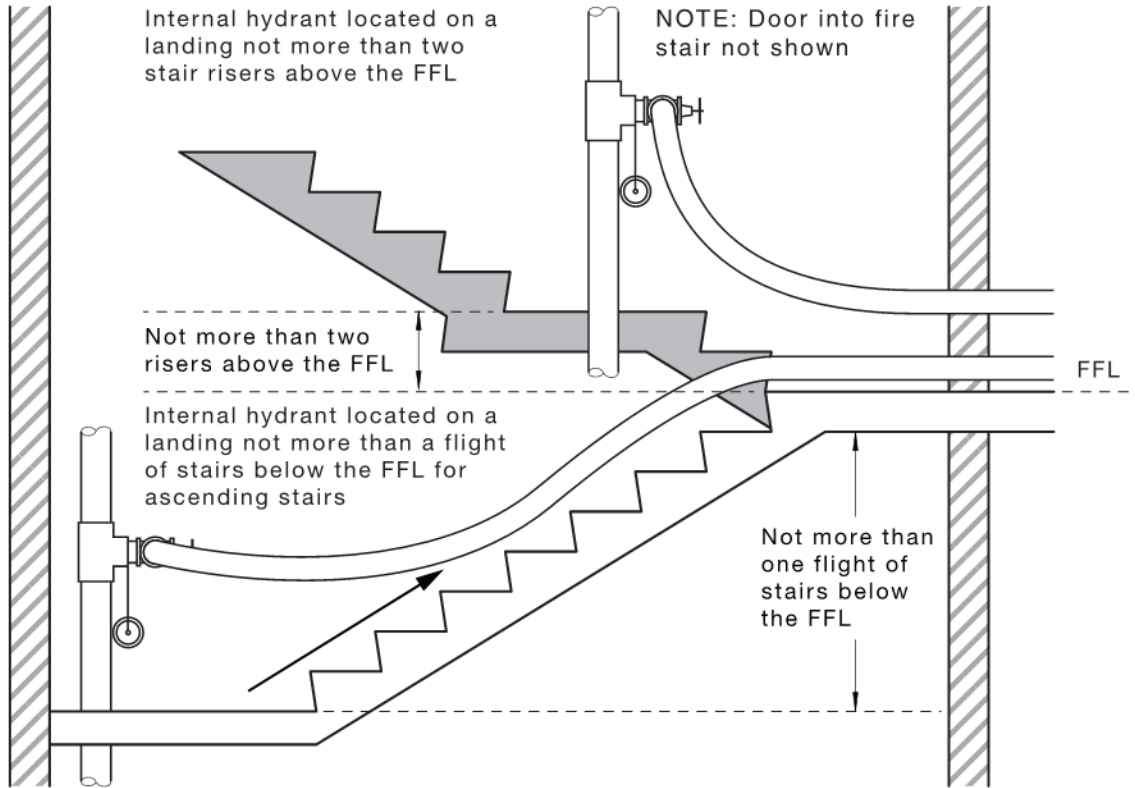


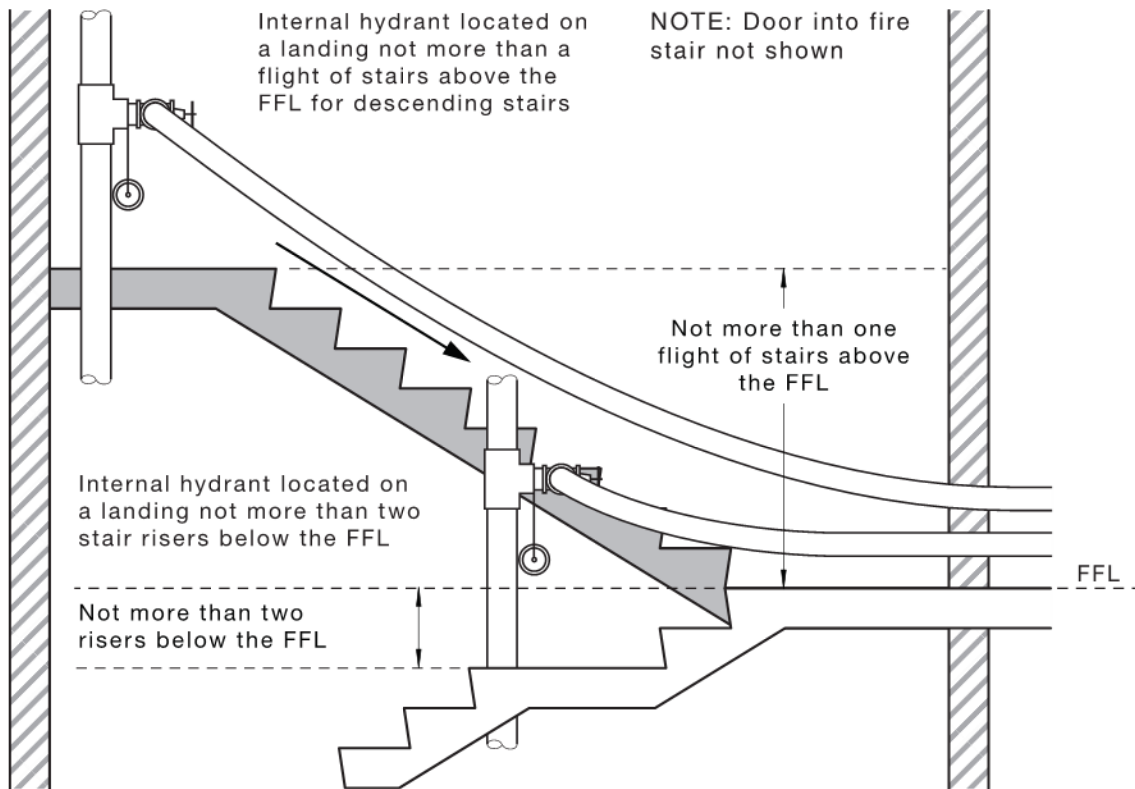
Figure H.7.2(A) — Internal fire hydrant coverage

[Clause 3.6.2\(c\)](#) allows for internal fire hydrants to be installed in locations that vary from the finished floor level (FFL) of the storey or floor. The limitations placed upon these variations in location of internal fire hydrants from the FFL aim to ensure that the attending fire brigade does not have to pass by a storey or building level that is on fire to access the internal fire hydrant designated to protect that storey or level.

[Figure H.7.2\(B\)](#) highlights the application of the design principles of [Clause 3.6.2\(c\)](#).



(a) Above-ground storey — Ascending stairs



(b) Below-ground storey — Descending stairs

Figure H.7.2(B) — Internal fire hydrant locations

H.7.3 Additional fire hydrants

[Clause 3.6.3](#) specifies where an additional internal fire hydrant may be installed.

In a Class 2, 3 or 4 building that is sprinkler protected throughout, an additional fire hydrant may be installed in a path of travel leading to a sole occupancy unit (SOU) to protect those parts of the SOU that are not able to be protected by internal fire hydrants located within a fire-isolated stair or not more than 4 m from a non-fire-isolated exit.

The requirement to install the additional fire hydrant in a path of travel leading to an exit enables this hydrant to be readily accessed by the attending fire brigade and for it to be accessed under the protection of a charged fire hose.

H.8 Marinas

For information and guidance on fire hydrant protection of marinas, see [Appendix J](#).

H.9 Method of measurement and hose lay limitations

H.9.1 General

[Clause 3.11.1](#) specifies how fire hydrant coverage is to be measured so that the fire hydrant system designs reflect how and where a fire brigade or fire service would lay hose when fighting a fire.

[Clause 3.11.1\(a\)](#) indicates that fire hose coverage may be measured in straight lines.

[Clause 3.11.1\(b\)](#) indicates that when measuring hose lay distances between a hardstand and an external fire hydrant, a fire brigade pumping appliance and the protected building, an external fire hydrant and the protected building, or a fire brigade pumping appliance and the protected building, the distance to be measured is along a path of travel that a firefighter would be expected to be able to walk in full protective clothing.

[Clause 3.11.1\(c\)](#) indicates that within the protected building when determining fire hydrant coverage, it must be measured along a path of travel that meets the Deemed-to-Satisfy provisions of the NCC. As such, hose lay measurements within a building are measured around permanently fixed and immovable objects within a building.

[Clause 3.11.1\(d\)](#) indicates that when fire hose coverage requires the ascending or descending of a stair or ramp, coverage should be measured from the outer perimeter of the stair or ramp. The requirement to measure from the outer perimeter of the stair or ramp is because when a fire hose is laid in a stair or ramp, the fire hose will be forced to the outer perimeter when pressurized. For consistency of measurement on a stair landing, an arc equal to the width of the stair shown in [Figure H.9.1\(A\)](#) may be used to determine fire hose coverage.

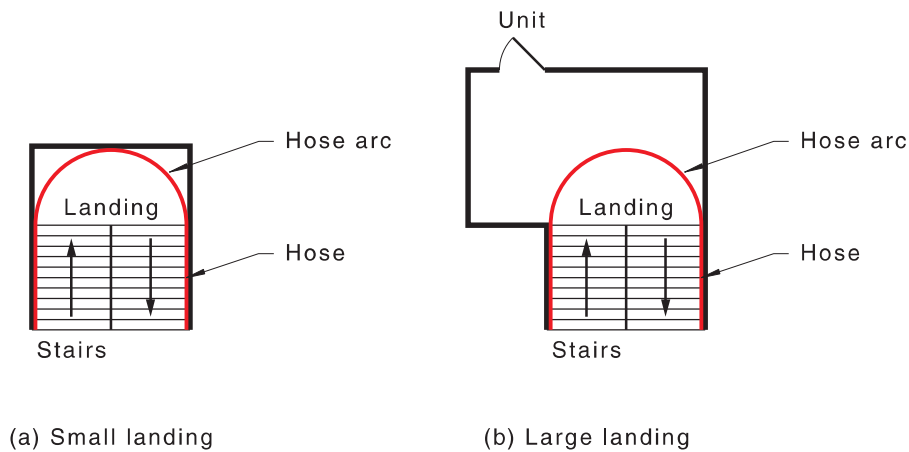
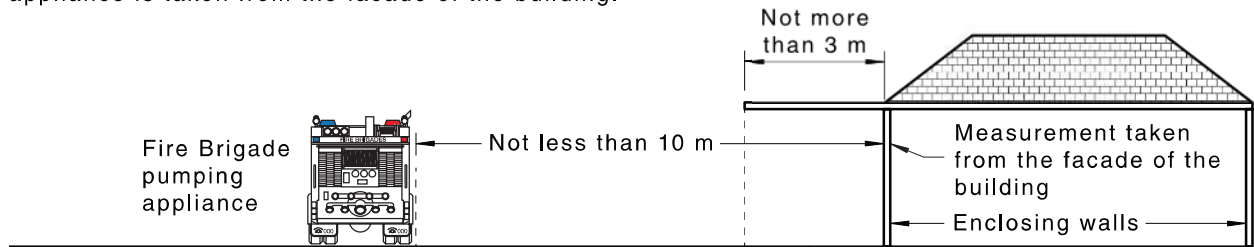


Figure H.9.1(A) — Stair landing — Hose lay measurement

[Clause 3.11.1\(e\)\(i\)](#) to (iii) indicate how measurement from an external fire hydrant, fire brigade booster assembly or fire brigade pumping appliance is to be undertaken.

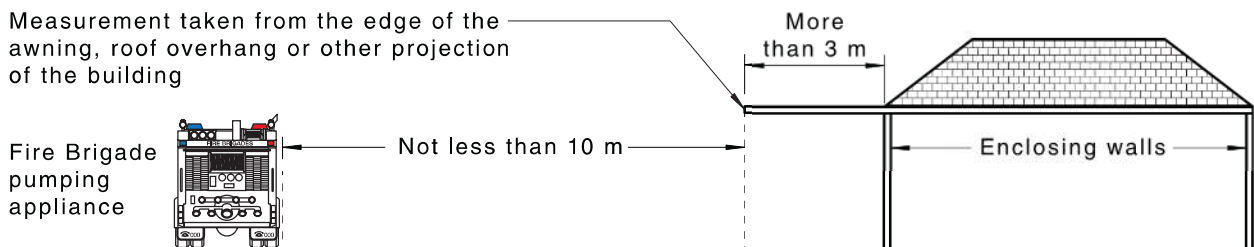
[Figure H.9.1\(B\)](#) highlights the application of the design principles used when measuring from a fire brigade pumping appliance to a building with an awning.

Any measurement relating to the location of an external fire hydrant or a fire brigade pumping appliance is taken from the facade of the building.



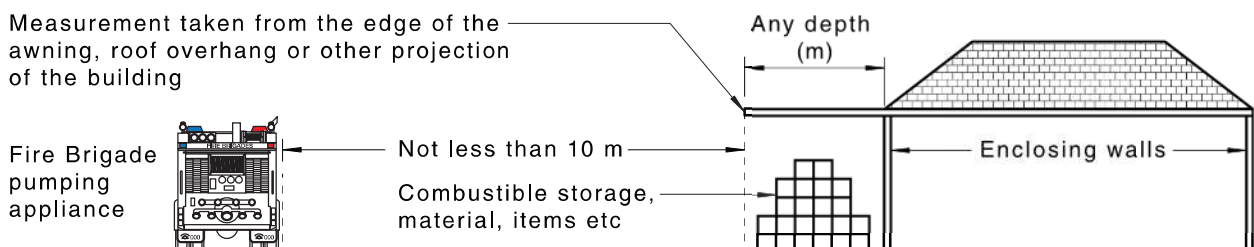
(a) Awning, roof overhang or similar projection not more than 3 m in depth

Any measurement relating to the location of an external fire hydrant or a fire brigade pumping appliance is taken from the edge of the awning or roof overhang.



(b) Awning, roof overhang or similar projection more than 3 m in depth

Any measurement relating to the location of an external fire hydrant or a fire brigade pumping appliance is taken from the edge of the awning or roof overhang.



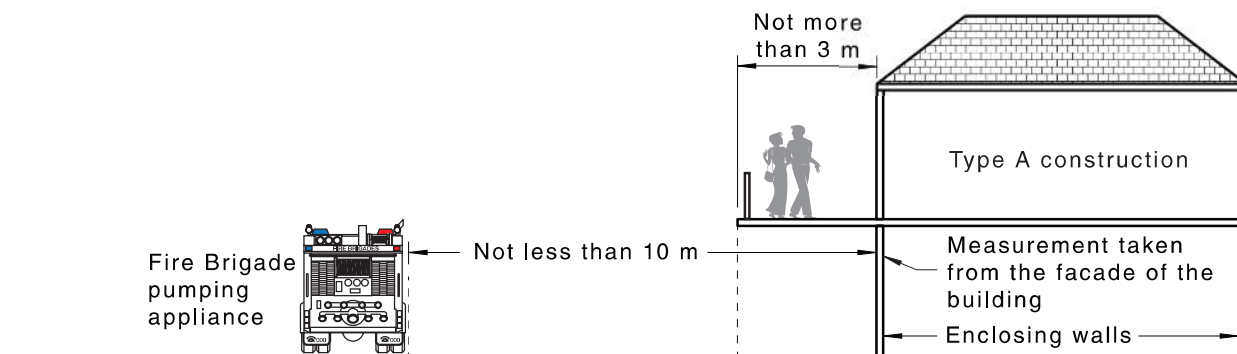
(c) Awning, roof overhang or similar projection of any depth where the floor area contributes to the fire load of the building

Figure H.9.1(B) — Measurement from awning, roof overhang or similar projection

[Clause 3.11.1\(e\)\(v\)](#) details how measurement from a fire brigade pumping appliance to a building with a balcony or similar projection is to be undertaken.

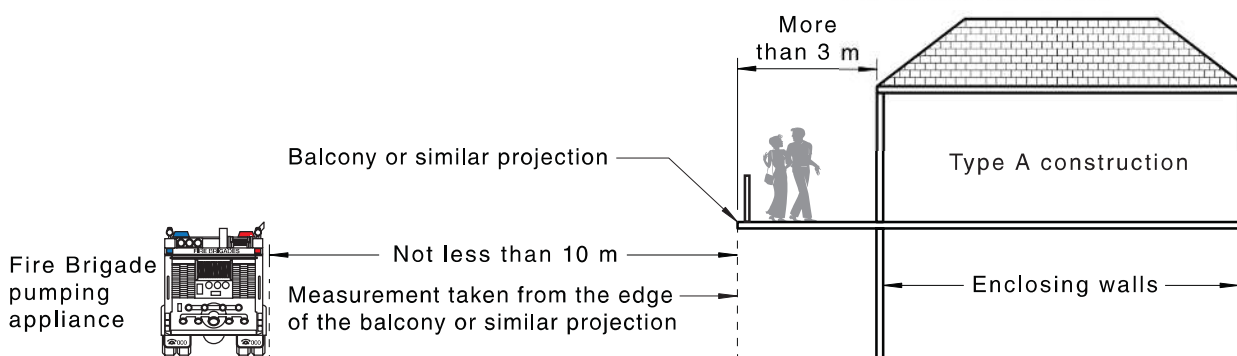
[Figure H.9.1\(C\)](#) highlights the application of the design principles used when measuring from a fire brigade pumping appliance to a building with a balcony.

Any measurement relating to the location of an external fire hydrant or a fire brigade pumping appliance is taken from the facade of the building.



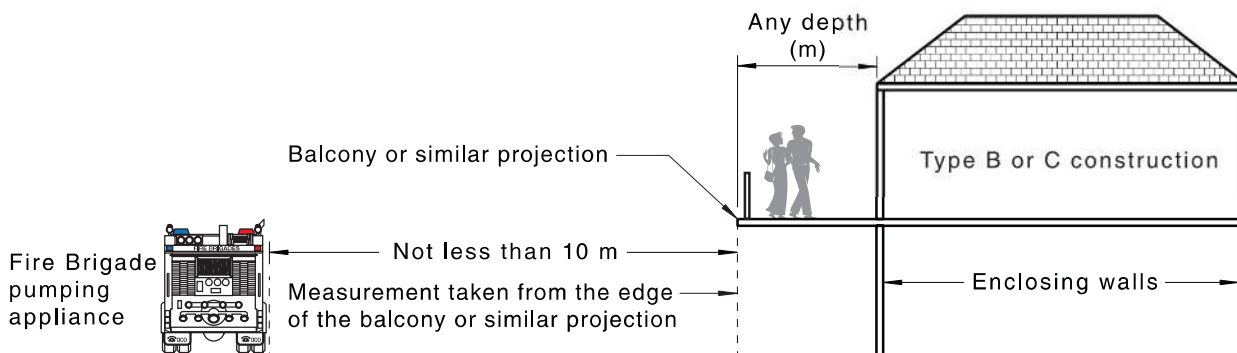
(a) Type A Construction — Balcony of not more than 3 m in depth

Any measurement relating to the location of an external fire hydrant or a fire brigade pumping appliance is taken from the edge of the balcony, horizontal projection or similar projection.



(b) Type A Construction — Balcony of more than 3 m in depth

Any measurement relating to the location of an external fire hydrant or a fire brigade pumping appliance is taken from the edge of the balcony, horizontal projection or similar projection.



(c) Type B or C Construction — Balcony of any depth

Figure H.9.1(C) — Measurement from balconies, horizontal projections or similar projections

Clause 3.11.1(g) requires fire hose measurements to be taken through a centrally located point positioned 1 m from the face of a door so that the method of measurement is more representative of the actual fire hoselay undertaken.

Figure H.9.1(D) highlights the application of this design principle where fire hydrant coverage is measured through an external door.

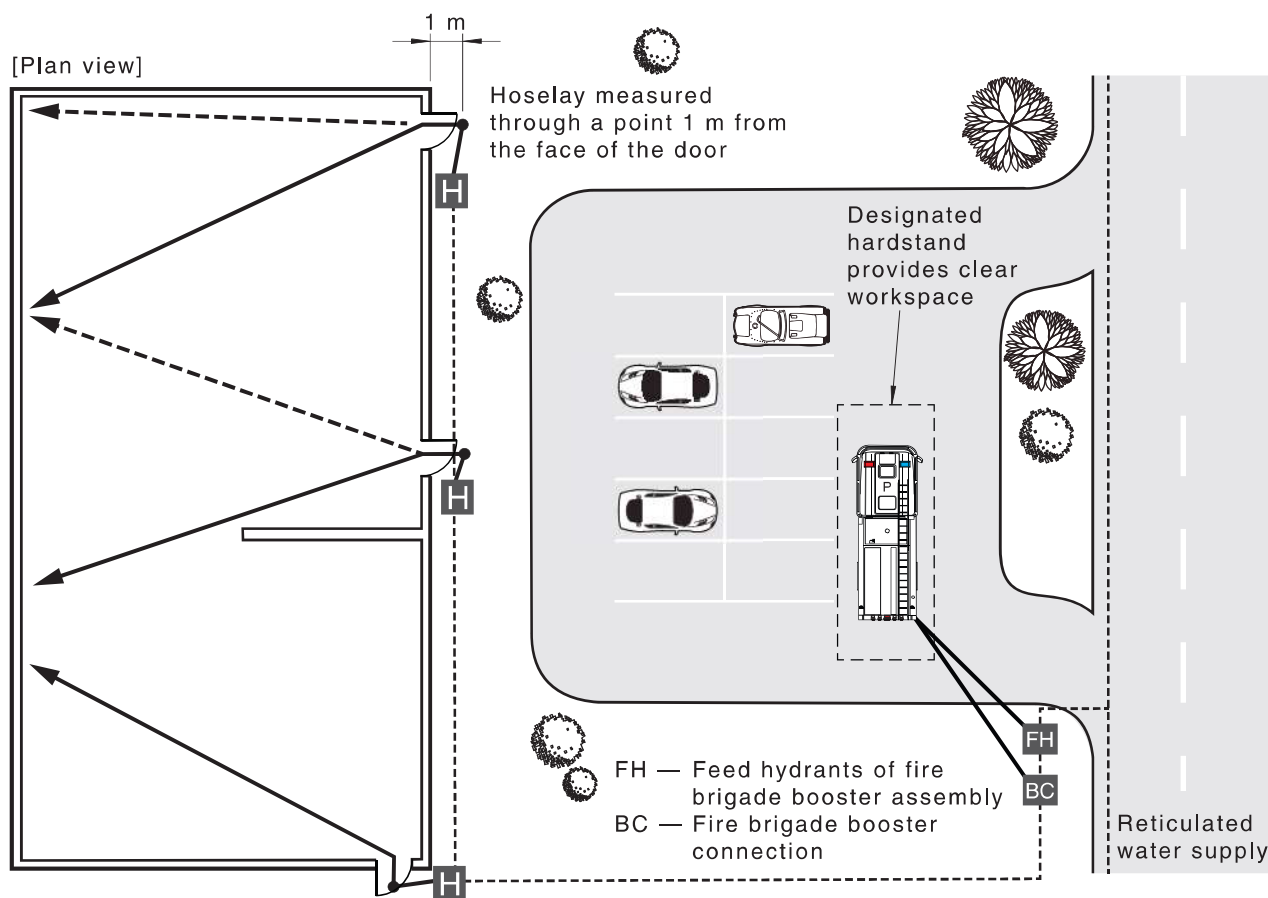


Figure H.9.1(D) — Example of measurement through doorways

H.9.2 Doorways

[Clause 3.11.2](#) ensures that hose lay measurements are only taken through appropriate doorways.

The requirement to measure through pedestrian entries and points to exclude roller shutter doors (except where these are permitted by the NCC) and any revolving door, is so that hose lay measurements reflect the hose lay that will be undertaken by a firefighter using the fire hydrant.

H.9.3 Obstructions

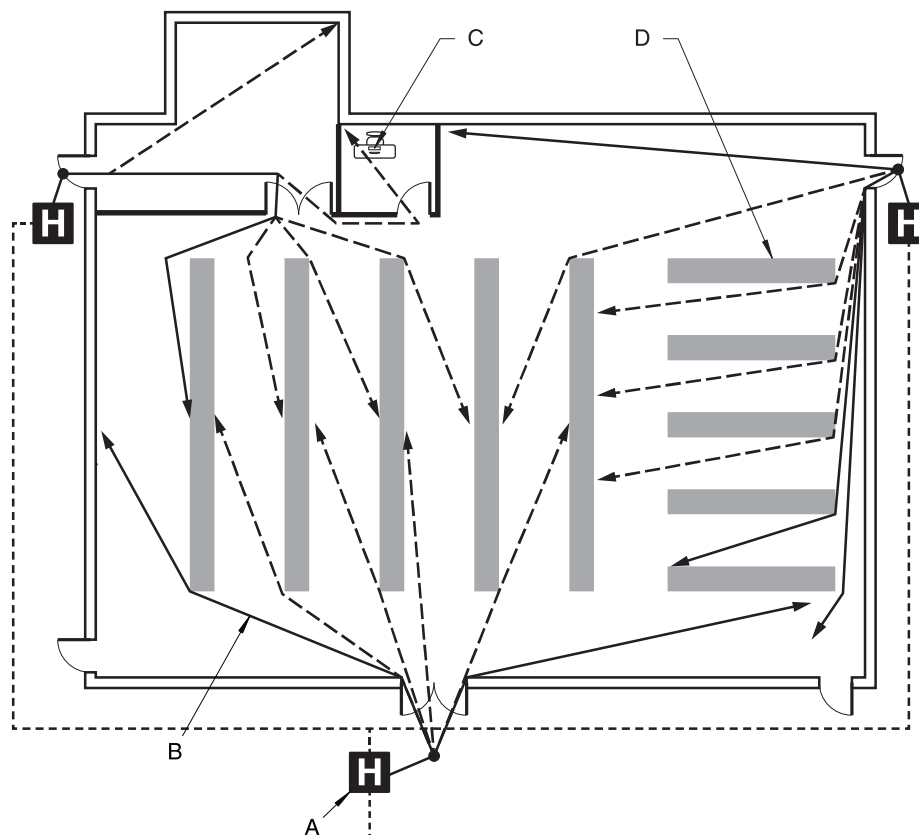
[Clause 3.11.3](#) ensures that hose lay measurements are taken around fixed obstructions.

The requirement to measure around all fixed obstructions aims to ensure that the hose lay measurements taken reflect the actual hose lay by firefighters using the fire hydrant. When determining fire hose lay coverage, demountable internal walls are considered to be a fixed obstruction.

Except where the provisions of [Clause 3.6.3](#) apply, if the layout of the tenancy is unknown and the hose lay measurements cannot be applied, the local fire brigade or fire service should be consulted.

The adoption of this design approach will assist the fire hydrant system to meet the performance requirements of the NCC and support fire brigade or fire service intervention activities when the fit-out of the tenancy is undertaken.

[Figure H.9.3](#) highlights the application of some of the design principles of [Clause 3.11](#).



Key

- A = External fire hydrant
- B = Hose lay measurement
- C = Moveable obstruction
- D = Immoveable obstruction

NOTE 1 When determining hydrant coverage from an external fire hydrant, a maximum of 70 m may be applied.

NOTE 2 When determining hydrant coverage, immoveable objects are to be measured around.

NOTE 3 When determining hydrant coverage, moveable objects may be measured through.

Figure H.9.3 — Example of measurement around obstructions

H.9.4 Measurements from a fire brigade pumping appliance

[Clause 3.11.4](#) ensures that fire brigade pumping appliances are appropriately located when determining hose lay coverage from a fire brigade pumping appliance.

[Clause 3.11.4\(a\)](#) requires fire brigade pumping appliances to be located on a hardstand because they would typically be located on such a surface during firefighting operations. The need to locate fire brigade pumping appliances on an all-weather surface is because during pumping operations the pumping appliances may at times discharge significant quantities of water around the appliances.

[Clause 3.11.4\(b\) to \(e\)](#) requires that the location of the fire brigade pumping appliance and any measurement taken from a fire brigade pumping appliance reflect the operations of a fire brigade attending the building or site.

[Clause 3.11.4\(f\)](#) requires hose lay coverage to be determined from a single location when measuring from a fire brigade pumping appliance because when a fire brigade pumping appliance has been positioned by the attending fire brigade or fire service at a fire and an initial hose lay has been made,

in almost all instances the fire brigade pumping appliance is unlikely to be moved unless threatened by fire. The application of this principle aims to ensure that hose lay measurements taken from a fire brigade pumping appliance reflect operations on the fireground.

Appendix I (informative)

Privately owned street fire hydrants

I.1 General

Property developments incorporating streets or common accessways within a common private title should incorporate water mains of DN 100 or greater together with fire hydrants.

Where the water mains are owned and operated by the local network utility operator, fire hydrants should be provided in accordance with the network utility operator, including appropriate marking of their location. These fire hydrants should generally be of the in-ground type, spaced as for the remainder of the network utility operator's system.

Where privately owned water mains are provided, fire hydrants should be in accordance with the fire brigade's operational requirements. Above-ground fire hydrants are preferred for ease of identification and access under fire conditions and to differentiate fire hydrants on privately owned water mains to those owned and operated by a network utility operator.

In the absence of alternate requirements from the network utility operator or fire authority, the recommendations given in [Clauses I.2](#) and [I.3](#) should be met.

For each of the cases above, additional fire hydrants may be needed on-site to meet the fire hydrant system requirements for protecting properties and building complexes.

I.2 Residential streets and accessways

Fire hydrants should be provided at intervals of not more than 120 m along residential streets and at each street intersection. Above-ground fire hydrants may be single outlet.

I.3 Commercial and industrial streets and accessways

Within streets serving commercial properties such as factories, warehouses and offices, fire hydrants should be provided at intervals of not more than 90 m at each street intersection. Above-ground fire hydrants should have dual-valve outlets.

NOTE Domestic properties are of a smaller floor area and generally contain less combustibles than commercial properties, resulting in the firefighting water flow rate for residential buildings being lower than for commercial properties. As tank supplies from a fire brigade pumping appliance may be employed initially to fight a residential fire, the distance between fire hydrants and, therefore, the length of hose to be laid and the time taken to lay the hose, may be more than that specified for a commercial property.

Appendix J (informative)

Design guidance — Marinas

J.1 Scope

This appendix provides design guidance for fire hydrant installations used to protect marinas and the associated moored vessels.

J.2 General

In developing a fire hydrant system design to protect the walkways of berths in a marina and associated moored vessels, the design goals should be to —

- (a) restrict the fire to the berth of origin;
- (b) prevent the spread of fire to adjoining berths; and
- (c) support fire brigade intervention activities.

Consultation with the fire brigade is recommended to determine the type and availability of resources as these may significantly influence the fire hydrant system design.

J.3 Flow

A minimum flow rate of 10 L/s should be assigned to a fire hydrant outlet. For berth lengths up to 50 m, flow rates should be in accordance with [Table J.3](#). For berth lengths more than 50 m, an analysis of the risks and potential heat release rates of any vessel likely to be moored at the marina should be undertaken to determine the flow demands for the fire hydrant system.

Table J.3 — Fire hydrant system flow rates

Berth length	Minimum flow rate
$0 \leq 20$ m	10 L/s
$20 \leq 30$ m	15 L/s
$30 \leq 50$ m	20 L/s

J.4 Pressure

Feed fire hydrants, attack fire hydrants and any fixed on-site pumpsets should provide the minimum pressures detailed in [Section 2](#).

J.5 Fire hydrant coverage

J.5.1 Feed fire hydrant coverage

Where a fire brigade pumping appliance provides fire hydrant coverage to a marina, all parts of the gangways, walkways and fingers should be not more than 60 m from the fire brigade pumping appliance. In determining coverage, the pumping appliance is to be located on a hardstand not more than 20 m from a street hydrant, an external feed fire hydrant or an attack/feed fire hydrant.

Figure J.5.1 provides an example of fire hydrant coverage to a marina where a fire brigade pumping appliance is supplied by a feed fire hydrant.

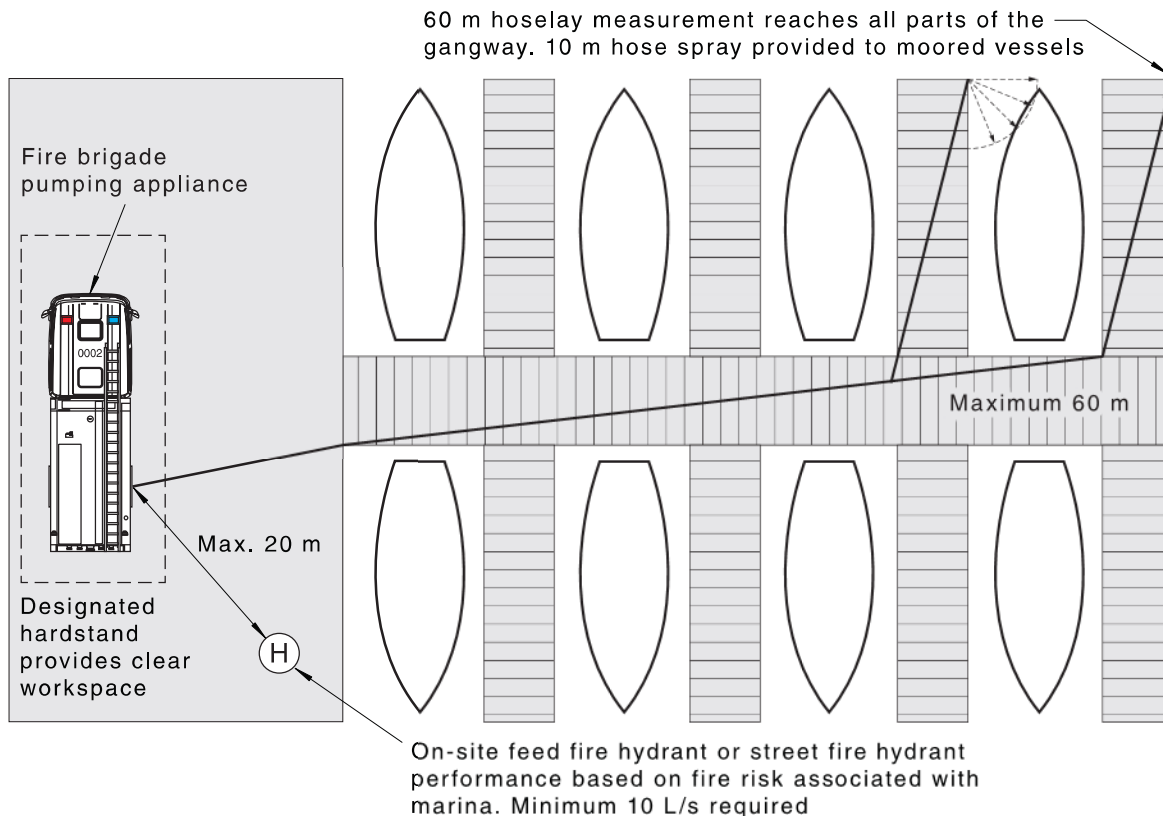


Figure J.5.1 — Example of feed fire hydrant hose lay coverage

J.5.2 Attack fire hydrant coverage

Where fire hydrant coverage cannot be provided as recommended in Clause J.5.1, a fire brigade booster assembly should be provided and located in accordance with Section 7. Fire hydrant coverage to all parts of the marina should be provided from suitably located attack fire hydrants.

Where attack fire hydrants are to provide fire hydrant coverage to a marina, an attack fire hydrant should be located at the entrance to each marina walkway and attack fire hydrants should be located at 30 m intervals along the marina walkway so that all parts of the marina are not more than 30 m from an attack fire hydrant.

Figure J.5.2 provides an example of fire hydrant coverage to a marina where attack fire hydrants are installed.

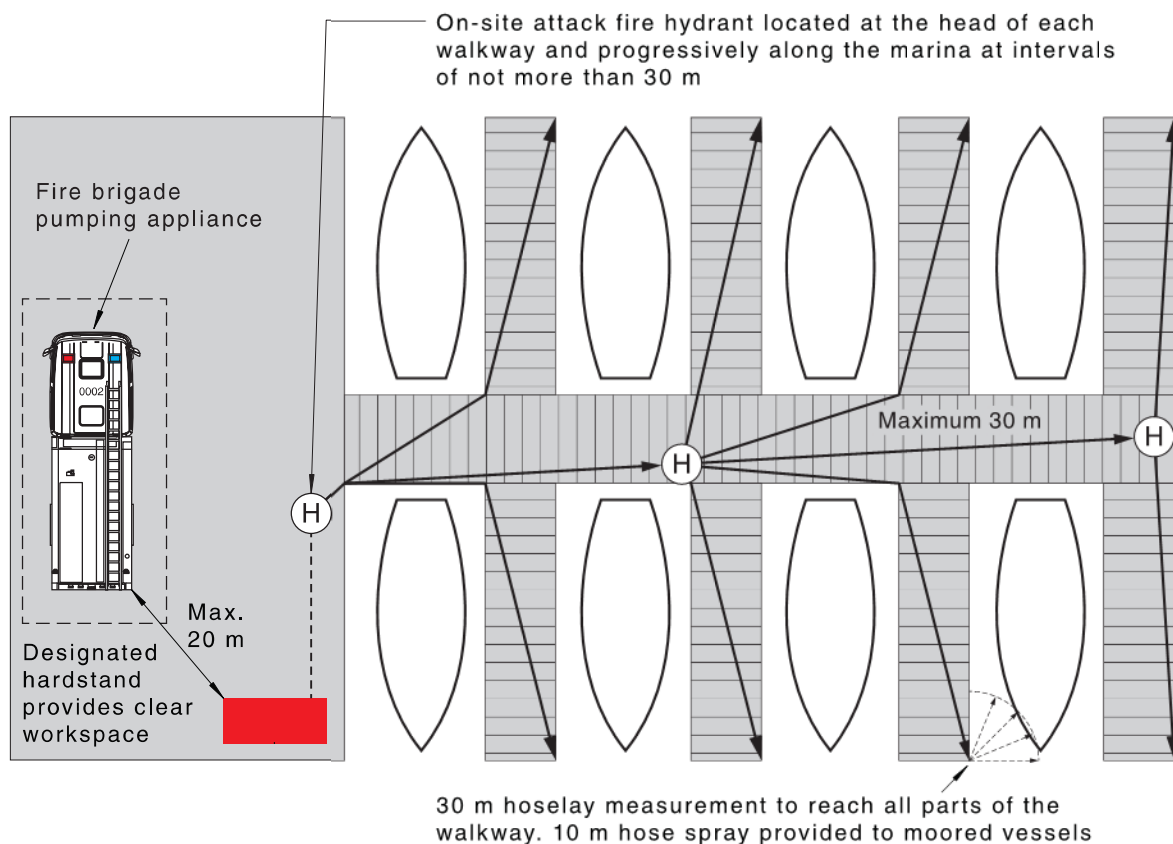


Figure J.5.2 — Example of attack fire hydrant hose lay coverage

J.6 Pipe work design and materials

J.6.1 Isolating valves

Where attack fire hydrants are installed, isolating valves should be located at the head of each marina walkway. Where more than one attack fire hydrant is installed and where a hydrant branch line extends for a distance of more than 150 m along a walkway, additional isolating valves should be located at 120 m intervals.

J.6.2 Pipework

Pipes, valves, and fittings selected for use in a fire hydrant system protecting a marina should be appropriate for the environmental conditions and the design of the marina. In selecting the material for use some of the items for consideration would include, the corrosion effects on the pipework and whether the marina is fixed or floating.

NOTE For further information on suitable pipework materials, refer to NFPA 14.

Appendix K (informative)

Guidance on water sources and water supply

K.1 Scope

This appendix provides guidance on the application of the design principles in [Section 4](#).

K.2 Water sources

K.2.1 General

[Clause 4.1.1](#) defines those sources of water that are considered acceptable for use in a fire hydrant system.

In relation to the use of a reticulated water supply, water agencies typically do not plan, design or maintain their reticulated water supply system to provide the minimum flows and pressures required by this document. As such, when considering the use of a reticulated water supply as the primary water supply, its use as the primary supply is subject to it being capable of providing the required flow and pressure at the feed hydrants of a fire brigade booster assembly or, where a fire brigade booster assembly is not required, at the most hydraulically disadvantaged feed fire hydrants. Where a reticulated water supply does not meet the primary water supply requirements for a fire hydrant system, it can however be used as a secondary water supply delivering automatic inflow to an on-site water storage tank that serves as the primary water supply.

Water sources that are not listed or cannot readily be grouped into the list detailed in [Clause 4.1](#), such as a public pool, are not considered suitable for use as a water source for a fire hydrant system.

NOTE Network utility operators typically do not include a specified water supply capability for building firefighting systems in customer service agreements/contracts. While the network utility operator may permit reticulated water supply fire service connections or the use of street hydrants, the building or site owner is responsible for the firefighting system achieving the minimum performance requirements in this document, over the life of the system.

K.2.2 Adequacy of water sources

[Clause 4.1.2](#) establishes the parameters to be considered when determining the suitability of a natural water source for use in a fire hydrant system design.

Where a natural water source is used in a fire hydrant system, [Clause 4.1.2](#) specifies that evidence is required to confirm the suitability of the natural water source selected for use as the primary or secondary water supply.

K.2.3 Water quality

[Clause 4.1.3](#) specifies the requirements for water quality to ensure the long-term use of the fire hydrant system. At almost all fires, the attending firefighters will come into contact with the water used in the fire hydrant system. For this reason, the supporting notes to [Clause 4.1.3](#) indicate that any water used should be suitable for human contact.

The need to ensure that the quality of water used in a fire hydrant system is fit for human contact cannot be understated because at almost all fires during the course of firefighting operations the attending firefighters will come in contact with the water they are using.

Examples of water not suitable for use in a fire hydrant system include the following:

- (a) Treated process water (e.g. water used for boiler feed and condensate due to the aggressive chemical treatment or process water).
- (b) Untreated rainwater (e.g. all solids, such as leaves, not removed).
- (c) Grey and black water.
- (d) Artesian water (with a high salt concentration).
- (e) Water from a dam, river or lake with high content of dissolved or suspended solids (specific gravity more than 1.0).

K.3 Water supply

K.3.1 General

[Clause 4.2.1](#) specifies the minimum required flow rate, pressure, and duration for a primary water supply serving a fire hydrant system.

Depending on the design, the minimum required flow rate of the primary water supply may be either the fire hydrant system flow rate or, where multiple fire systems draw from the primary water supply, the simultaneous flow rate of the fire systems drawing from the water supply.

NOTE See [Clause 2.2.7](#) for more information on the simultaneous operation of multiple firefighting systems drawing from the primary water supply and the requirement for the flow rate of fire hose reels to be excluded from the calculation of total flow rate.

The minimum flow rate for the primary water supply is determined by applying the following:

- (a) [Clause 2.2.1](#) to determine the classification of the fire hydrants within the fire hydrant system.
- (b) [Tables 2.2.5\(A\) to \(D\)](#) to determine the number of fire hydrants required to flow.
- (c) [Tables 2.2.6\(A\) to \(F\)](#) to determine the minimum flow rate for each fire hydrant required to flow.
- (d) [Clause 2.2.7](#) to determine the simultaneous flow requirements.

The minimum pressure for the primary water supply is determined by applying [Tables 2.2.6\(A\) to \(F\)](#), as applicable.

K.3.2 Primary water supply

[Clause 4.2.2](#) specifies the water supply configurations that may be used to provide the primary water supply for a fire hydrant system.

[Figure K.3.2\(A\)](#) highlights the application of the primary water supply design principle. It shows that the primary water supply serving a fire hydrant system will be connected to by the attending fire brigade.

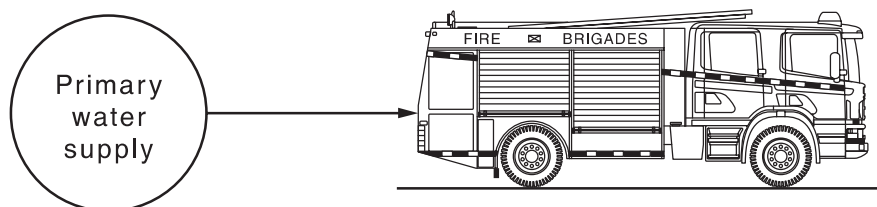


Figure K.3.2(A) — Primary water supply

A primary water supply enables the attending fire brigade to deliver the required firefighting pressure and flow for not less than four hours.

Figure K.3.2(B) provides an example of a reticulated water supply providing the primary water supply for the building or site where the primary water is capable of providing the unassisted pressure and flow required at the feed fire hydrants of the fire brigade booster assembly as specified in Table 2.2.6(A) and at the most hydraulically disadvantaged attack fire hydrants as specified in Table 2.2.6(B) for the number of fire hydrants required to flow. When boosted by a fire brigade pumping appliance, the most hydraulically disadvantaged fire hydrant outlets are also required to deliver the pressure and flow specified in Table 2.2.6(F).

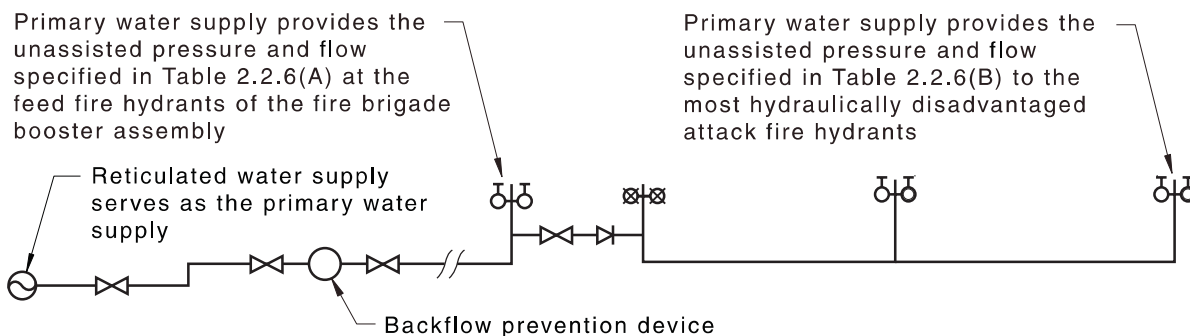


Figure K.3.2(B) — Attack fire hydrants provided with unassisted pressure and flow by the primary water supply

Figure K.3.2(C) provides an example of a reticulated water supply providing the primary water supply for a building or site. In this figure, the reticulated water supply is able to provide the required unassisted pressure and flow at the feed fire hydrants of the booster assembly as specified in Table 2.2.6(A) but is unable to provide the required unassisted pressure and flow to the attack fire hydrants of the fire hydrant system. Therefore, a fixed on-site pump is installed to provide the required assisted pressure and flow specified in Table 2.2.6(C) or (D), as applicable. Additionally, when boosted by a fire brigade pumping appliance, the most hydraulically disadvantaged fire hydrant outlets are also required to deliver the pressure and flow specified in Table 2.2.6(F).

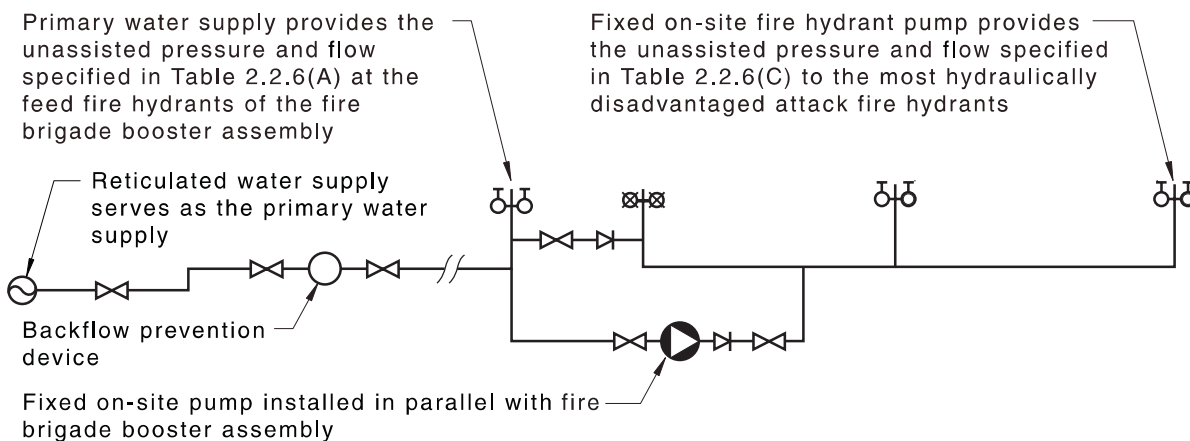


Figure K.3.2(C) — Feed fire hydrants provided with unassisted pressure and flow by the primary water supply

In relation to Clause 4.2.2(f), (g), (i) and (j), the requirement to provide either one partitioned tank or two tanks, where either of the partitioned parts or each separate tank has a capability to provide not less than 50 % of the required water supply quantity, ensures that during periods of essential maintenance the fire hydrant system will have water available for use.

In relation to [Clause 4.2.3](#), where multiple firefighting systems, excluding fire hose reels, draw from the same primary water supply, the supply is to be capable of providing for the simultaneous demand of the systems operating.

In relation to [Clause 4.2.4](#), wherever possible provisions should be made for any commissioning and maintenance testing water to be recycled.

K.3.3 Secondary water supply requirements

[Clause 4.2.5](#) specifies the requirements for a secondary water supply that provides automatic inflow to the primary water supply of the fire hydrant system.

[Figure K.3.3\(A\)](#) details the application of this design principle where the primary water supply is supplemented by automatic inflow from the secondary water supply.

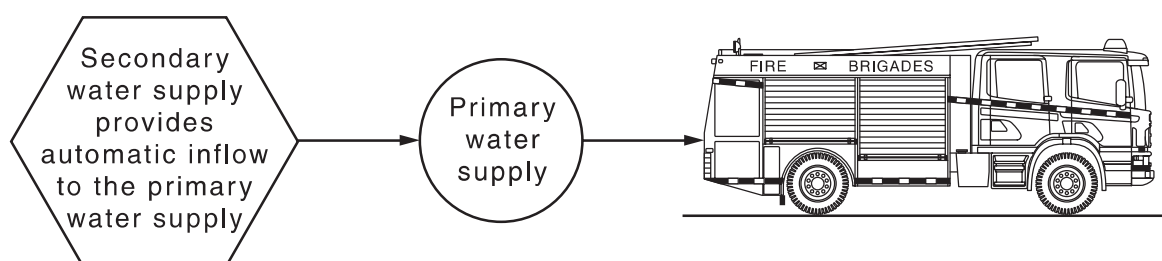


Figure K.3.3(A) — Secondary water supply providing automatic inflow to the primary water supply

A primary water supply, supplemented by a secondary water supply, enables the attending fire brigade to deliver the required firefighting pressure and flow for not less than four hours.

[Figure K.3.3\(B\)](#) provides an example of a reticulated water supply, serving as the secondary water supply, providing automatic inflow to a reduced-capacity on-site water storage tank that serves as the primary water supply for the building or site. In this example, as the reticulated water supply is unable to provide the unassisted pressure and flow at the feed fire hydrants of the fire brigade booster assembly, it is unable to serve as the primary water supply for the fire hydrant system. It can, though, serve as a secondary water supply providing automatic inflow to the primary water supply. Typically, in these circumstances, a reduced-capacity tank with large-bore suction connections, small-bore suction connections (if required), and two fixed on-site pumps is provided. In these designs when the fixed on-site pumps are operating, the most hydraulically disadvantaged fire hydrants deliver the pressure and flow specified in [Tables 2.2.6\(C\) or \(D\)](#), as applicable. When boosted by a fire brigade pumping appliance, the most hydraulically disadvantaged fire hydrant outlets deliver the pressure and flow specified in [Table 2.2.6\(F\)](#).

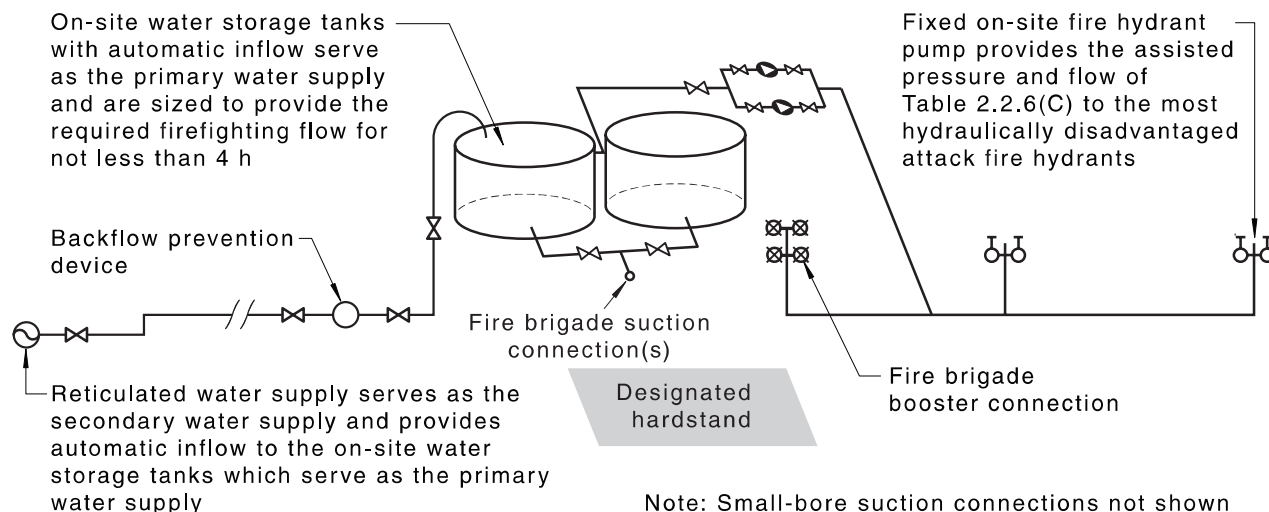


Figure K.3.3(B) — Primary water supply provided with automatic inflow from a reticulated water supply

K.3.4 On-site water storage tanks

K.3.4.1 General

[Clause 4.2.6.1](#) introduces the types of on-site water storage tanks that may be incorporated into a fire hydrant system design and, depending on their role, the requirements relating to that tank.

K.3.4.2 When an on-site water storage tank is required

[Clause 4.2.6.2](#) details the circumstances where an on-site water storage tank is installed.

On-site water storage tanks are installed in a fire hydrant system for one of two reasons:

- (a) The nearest available water supply (reticulated water supply, river, lake, dam, etc.) is unable to serve as the primary water supply and provide the required unassisted pressure or flow to the fire hydrants of the on-site fire hydrant system; or
- (b) The building has an effective height more than 50 m.

K.3.4.3 Full-capacity tanks

This clause applies to [Clause 4.2.6.3](#).

The size of a full-capacity tank is based upon the number of fire hydrant outlets required to flow in accordance with [Tables 2.2.5\(B\) and \(C\)](#) for buildings and [Table 2.2.5\(D\)](#) for open yards at the required flow rate specified in [Table 2.2.6\(A\) or \(B\)](#), as applicable, for not less than four hours.

[Table K.3.4.3](#) details the total volumes required for full-capacity water storage tanks that provide flow rates up to 30 L/s.

Table K.3.4.3 — Full-capacity tank volumes

Number of fire hydrants required to flow	Flow rate L/s	Duration hours	Total volume L
1	10	4	144 000
2	10	4	288 000
3	10	4	432 000

K.3.4.4 Reduced-capacity tanks

[Clause 4.2.6.4](#) details the requirements of a reduced-capacity on-site tank serving as the primary water supply for the building or site.

The size of a reduced-capacity on-site tank is based upon the difference in flow rates between the required flow rate drawn from the primary water supply and the automatic inflow flow rate provided by the secondary water supply.

Under the provisions of [Clause 4.2.6.4\(a\)](#), the size of the reduced-capacity tank and the inflow rate should provide for the number of fire hydrant outlets required to flow in accordance with [Tables 2.2.5\(B\) and \(C\)](#) for buildings and [Table 2.2.5\(D\)](#) for open yards at the required flow rate specified in [Table 2.2.6\(A\) or \(B\)](#), as applicable, for a duration of not less four hours.

[Figure K.3.4.4](#) highlights the relationship between the volume of the on-site reduced-capacity water storage tank (primary water supply) and the automatic inflow rate provided by the secondary water supply, where the design flow rate for a fire hydrant system is 20 L/s.

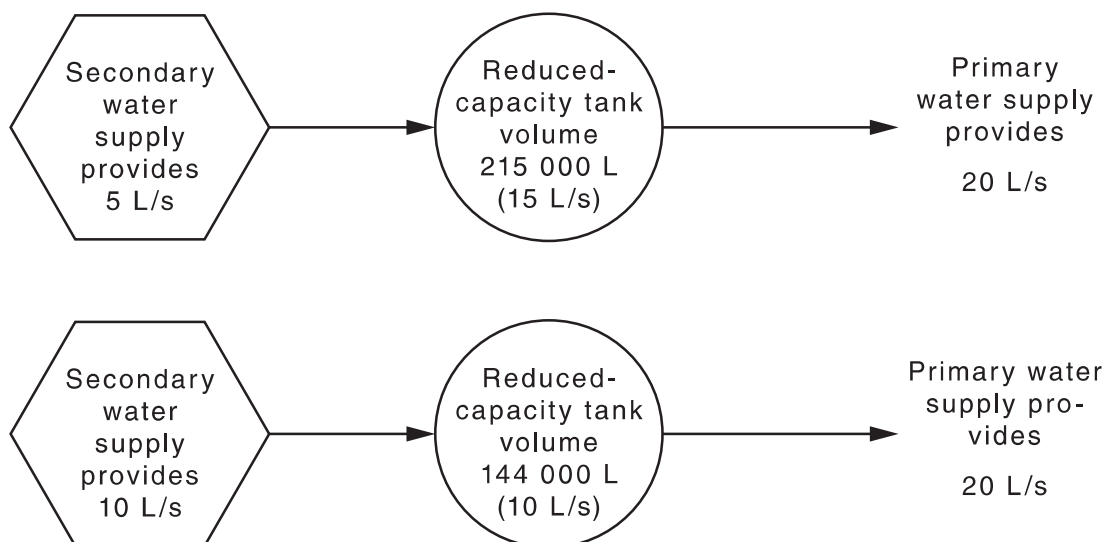


Figure K.3.4.4 — Varying secondary water supply automatic inflow rates on water storage tank volumes

Under the provisions of [Clause 4.2.6.4\(b\)](#), a reduced-capacity tank serving as part of the primary water supply is to have a minimum capacity of not less than 24 000 L which is equivalent to 40 min supply with two hydrants flowing at not less than 5 L/s. Where the number of fire hydrant outlets required to flow is more than two, for each additional fire hydrant required to flow the size of the reduced-capacity tank should be increased.

[Figures K.3.3\(A\)](#) and [K.3.3\(B\)](#) also highlight the key design principles and features of a fire hydrant system that incorporates a reduced-capacity tank serving as the primary water supply for the building or site.

K.3.4.5 Break tanks

Break tanks are typically installed for one of two reasons: to control the pressure at the pump suction inlet or as a condition of connection to a network utility operator's reticulated water supply. In relation to the latter, the requirement to install a break tank by a network utility operator aims to ensure that the surge effect (water hammer) created by the starting and stopping of any on-site pump is not transmitted to the reticulated water supply.

[Clause 4.2.6.5](#) details the requirements for the use of a break tank in a fire hydrant system. Under the provisions of [Clause 4.2.6.5](#), the size of a break tank is based on the number of fire hydrant outlets

required to flow as specified in [Table 2.2.5\(B\)](#) for buildings, [Table 2.2.5\(C\)](#) for open deck car parks, or [Table 2.2.5\(D\)](#) for open yards, at the required flow rate specified in [Table 2.2.6\(B\)](#), for not less than 20 min.

[Figure K.3.4.5](#) highlights the key design features of a fire hydrant system that incorporates a break tank which has been installed as a requirement of connection by the network utility operator that owns and operates the reticulated water supply.

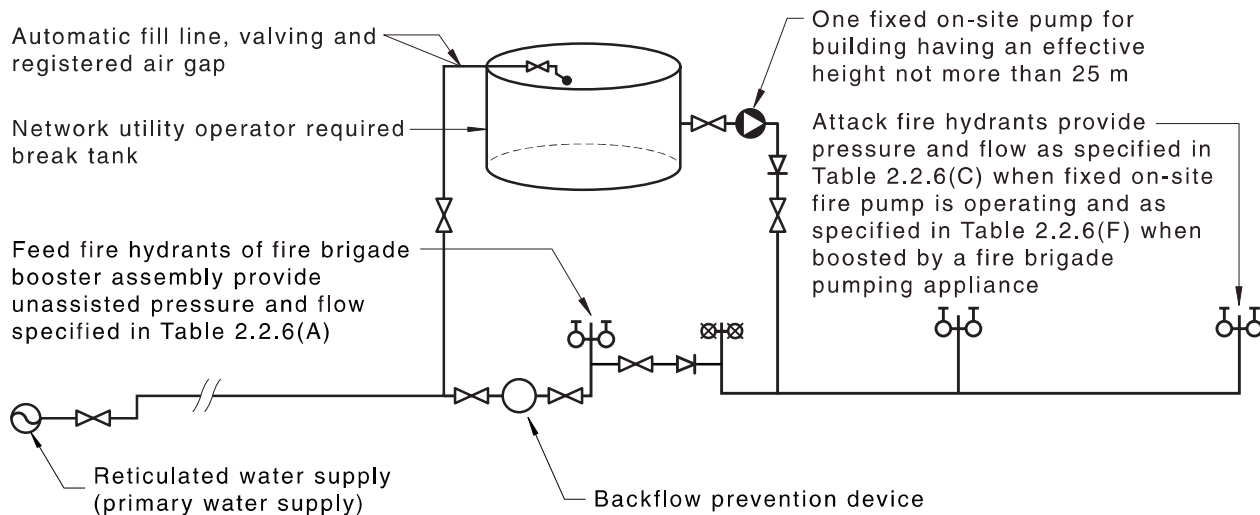


Figure K.3.4.5 — Design incorporating a break tank required by the network utility operator

K.3.4.6 High-rise water storage tanks

[Clause 4.2.6.6](#) details the minimum volume (capacity) for a fixed on-site high-rise water storage tank to be installed in a building having an effective height more than 50 m.

[Clause 4.2.6.6\(a\)](#) indicates that the high-rise water storage tank is to serve as the primary water supply for the full-duty fire hydrant pumps required to be installed as specified in [Clause 6.2.2](#). As such, with automatic inflow, the high-rise water storage tank is to provide the required firefighting flow rate for not less than four hours.

The requirement to provide a high-rise water storage tank for a building having an effective height more than 50 m acknowledges that increased building height is associated with increased risk. The provision of an on-site tank therefore provides a level of redundancy to the water supply serving the fire hydrant system.

Under the provisions of [Clause 4.2.6.6\(b\)](#), a high-rise water storage tank is to have a minimum capacity of not less than 36 000 L, which is equivalent to a 30 min supply with two hydrants flowing at not less than 10 L/s. Where more than two fire hydrants are required to flow, a proportionate increase in the capacity of the high-rise water storage tank is required.

For more information on high-rise water storage tanks and full-duty fire hydrant pumps, see [Appendix N](#).

K.3.4.7 Gravity break tanks

[Clause 4.2.6.7](#) details the minimum requirements for a gravity break tank installed in a high-rise building to control pressure within the building. In this regard, [Clause 4.2.6.7](#) defines the minimum capacity for a gravity break tank in terms of time (not less than 20 min), flow, pressure, and duration of supply (not less than four hours). As such, a gravity tank with automatic inflow serves as the primary water supply for the part of the fire hydrant system it supplies.

K.3.5 Water supply pressure

[Clause 4.2.7](#) clarifies the pressure available for design from the available water sources and supplies.

[Clauses 4.2.7.1, 4.2.7.2](#) and [4.2.7.3](#) illustrate a common design theme in that the most appropriate conservative pressure value is taken for the purpose of design. Where a fixed on-site tank is installed, the minimum operating level (low water level of the tank) should be used to define the water supply pressure. Where a river, lake, dam or sea is used, the average low-tide mark or river level is used to define the water supply pressure. Where a reticulated supply is used, the 95th percentile value as determined by the network utility operator specified in [Clause 4.2.7.1.2\(a\)](#) or another approach specified in [Clause 4.2.7.1.2\(b\), \(c\) or \(d\)](#) is used to define the water supply pressure.

For further information on determining the residual pressure from a reticulated water supply, see [Appendix L](#).

For further information on the determination of the pressure available for design from a fixed on-site tank based on the low water level, refer to AS 2304.

K.3.6 Arrangement of water supplies

[Clause 4.2.8](#) specifies the water supply arrangements suitable for providing the primary water supply for a fire hydrant system. In relation to the water supply arrangements detailed in [Tables 4.2.8\(A\) and \(B\)](#), the acceptable water sources detailed in [Clause 4.1.1](#) allow for differing arrangements to be developed.

K.4 Connections to water sources and supplies

K.4.1 Connection to a reticulated water supply

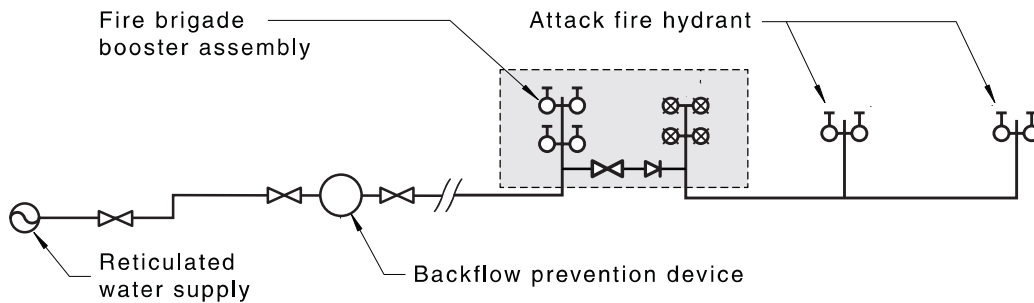
[Clauses 4.3.1.1](#) and [4.3.1.2](#) highlight the requirement for backflow prevention to be provided where a fire hydrant system is proposed to connect to a reticulated water supply system.

The National Construction Code Volume 3 requires that a backflow prevention device conforming to AS/NZS 3500.1 is provided wherever it is possible to contaminate the drinking water supply.

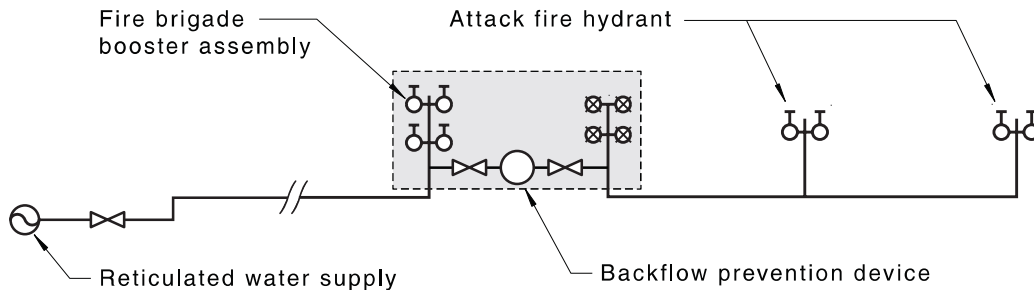
Where a fire hydrant system is to be connected to a reticulated water supply controlled by a network utility operator, separate water supply network connection standards, contractual obligations and approval requirements may also exist covering backflow prevention, pipework, metering requirements and valving for isolation purposes. Consultation with the relevant network utility operator is recommended to determine requirements of the operator and the suitability of the water main to serve a fire hydrant system.

[Figure K.4.1 \(a\)](#) depicts the typical location for a backflow prevention device where a fire hydrant system is to be connected to a Network Utility Operator's reticulated water supply network.

[Figure K.4.1 \(b\)](#) depicts a backflow prevention device located between the feed fire hydrant valves and fire brigade booster connections of a fire brigade booster assembly that may be permitted by some network utility operators. Where this design approach is approved by the network utility operator, all materials upstream of the backflow prevention device should be watermarked.



(a) Backflow prevention device located upstream of the fire brigade booster assembly



(b) Backflow prevention device located within the fire brigade booster assembly

Figure K.4.1 — Typical backflow prevention device locations relative to the fire brigade booster assembly

K.4.2 Connection to on-site private water supply

[Clause 4.3.2](#) clarifies the requirements for an on-site private water supply system that serves a fire hydrant system.

To be considered as a private water supply system suitable for supplying a fire hydrant system and any number of other systems or services, the private water supply system under the control and responsibility of the building or site owner should be fed from a water source of at least twice the capacity of that required to meet the demands of all firefighting and other services drawing from the supply. The requirement for a private water source to have such a capacity ensures that to some degree a private water supply system will have capacity similar to that of a reticulated water supply.

[Figure K.4.2](#) provides a schematic representation of a private water supply system.

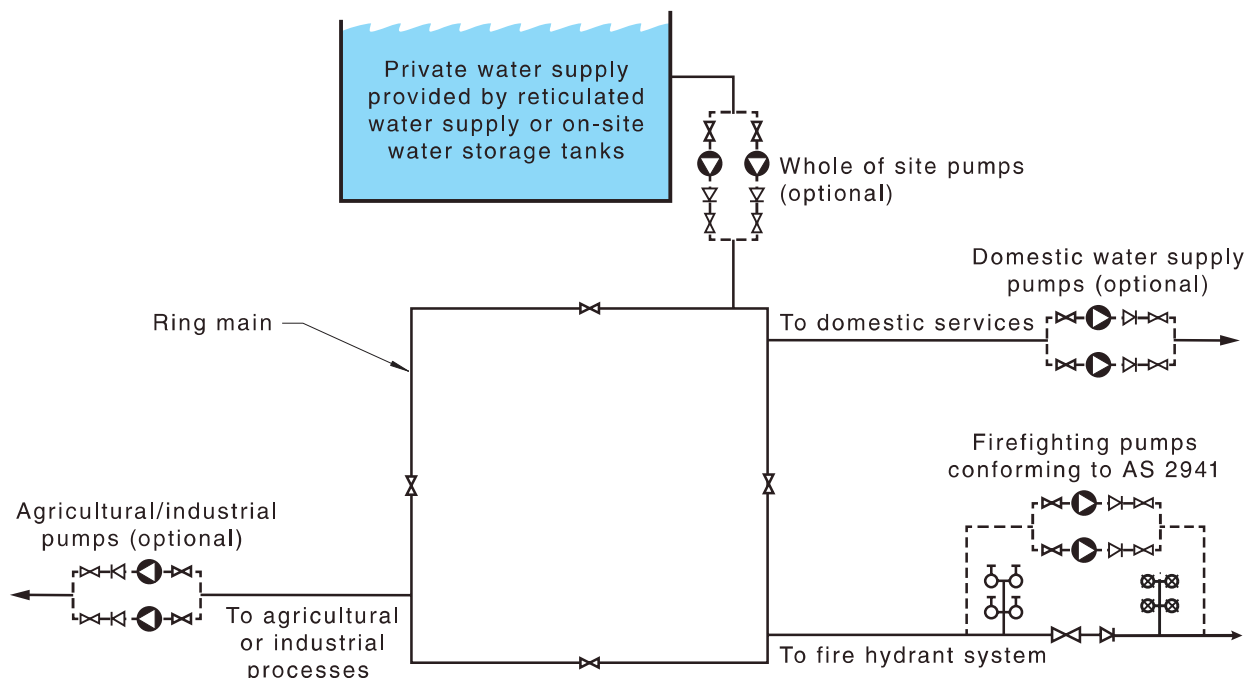


Figure K.4.2 — Schematic representation of a private water supply system

K.4.3 Connection to an on-site water storage tank

[Clause 4.3.3](#) clarifies the connection requirements applicable to a fixed on-site tank that serves as the primary water supply.

[Figure K.4.3](#) highlights the application of the design principle in [Clause 4.3.3\(a\)](#). In particular, it highlights the application of the limiting friction loss value of 20 kPa to the design.

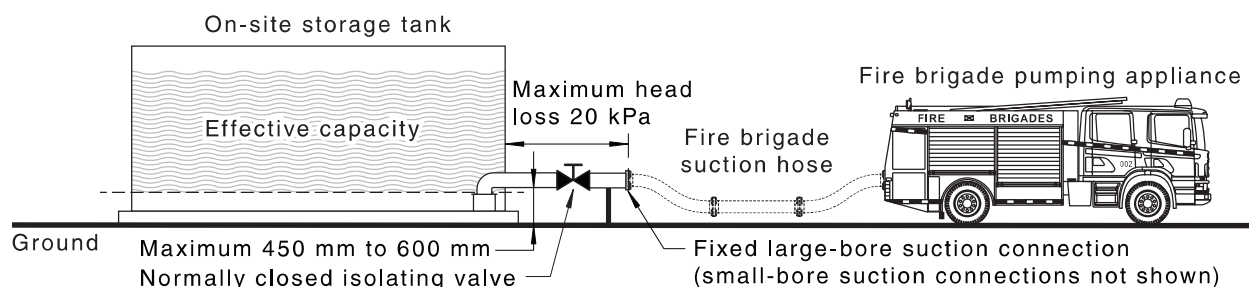


Figure K.4.3 — Fire brigade suction connection

In relation to [Clause 4.3.3\(b\)](#), see [Clause K.5](#) for information pertaining to suction connections serving partially or wholly below-ground on-site tanks.

Where an elevated on-site water storage tank is able to provide pressure and flow as specified in [Table 2.2.6\(A\)](#) at the outlet of a large- or small-bore suction connection, the pressure available at this outlet may exceed the pressure rating of fire brigade suction hoses. Therefore, suction connections should not be provided. They should be replaced with feed fire hydrant outlet valves conforming to AS 2419.2.

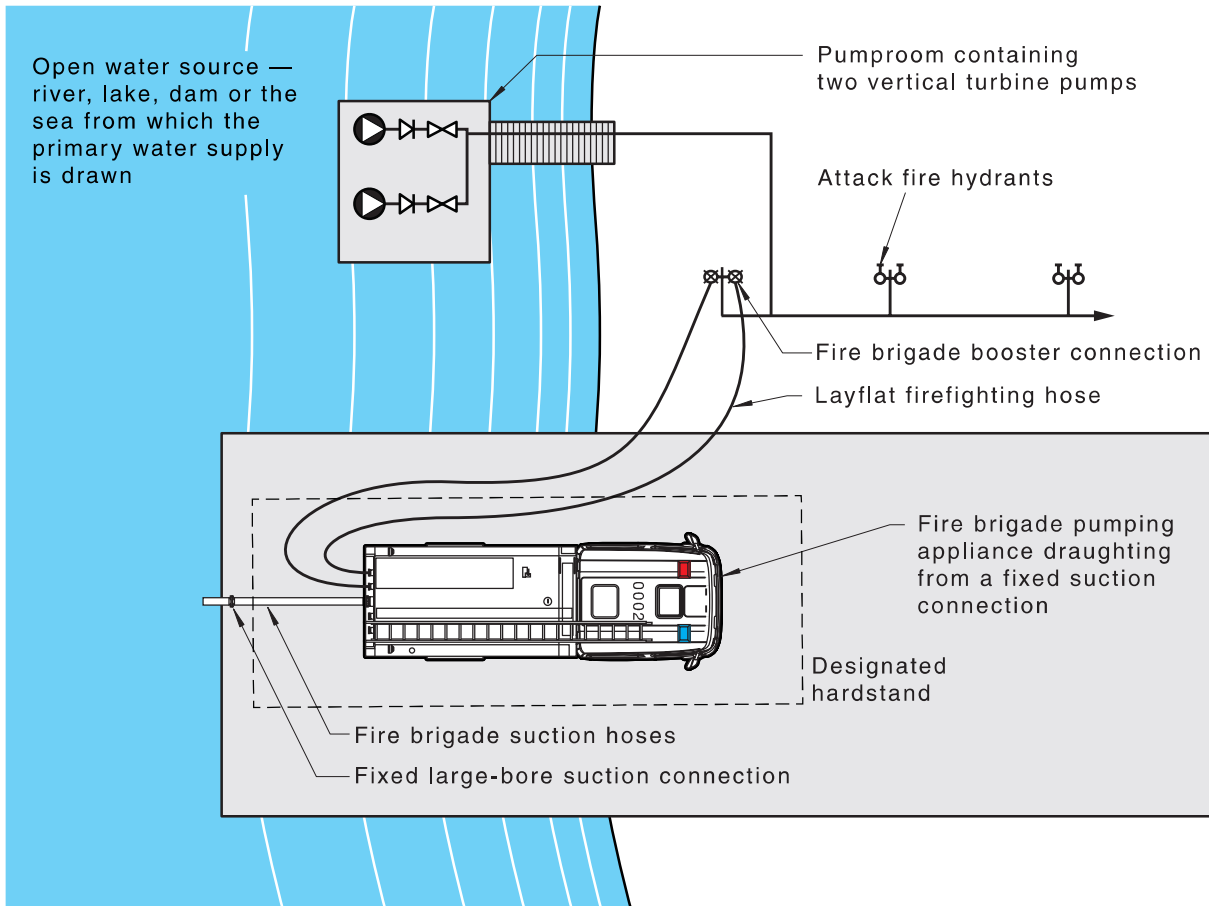
K.4.4 River, lake, dam or seawater

[Clause 4.3.4](#) specifies the connection requirements applicable to a river, lake, dam or body of seawater that serves as the primary water source.

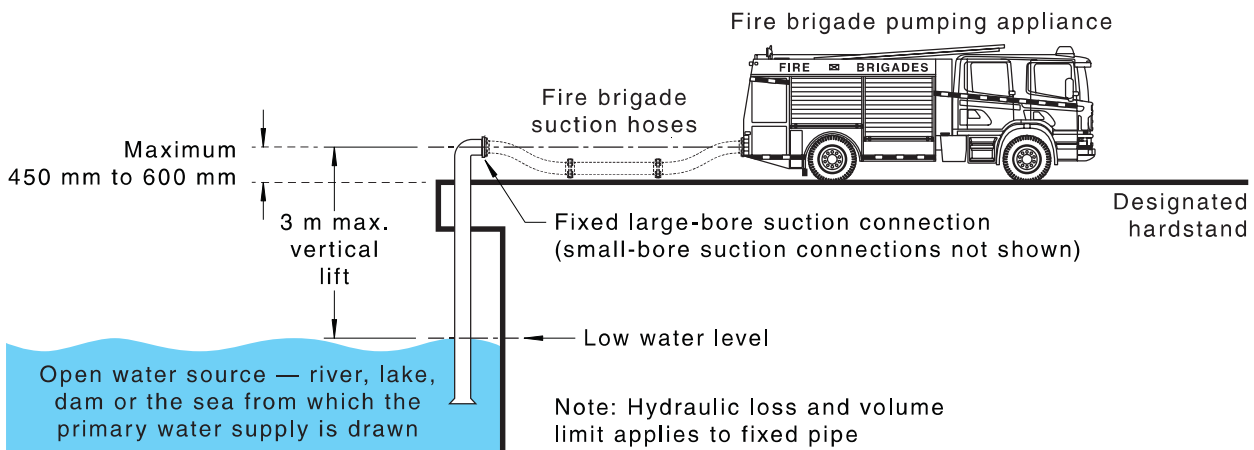
Figure K.4.4 highlights the application of the design principle detailed in Clauses 4.3.4 and 4.4.

The hydraulic loss and volume limits in Clause 4.4 apply to the installed fixed pipe and the large-bore and/or small-bore suction connections provided.

NOTE For signage purposes the suction connection outlets are titled “draughting point”.



(a) Plan view — Fire brigade pumping appliance draughting from an open water source



(b) Elevation — Fire brigade pumping appliance draughting from an open water source

Figure K.4.4 — Fire brigade suction lift from a natural water source

K.5 Fixed suction connection

[Clause 4.4](#) specifies the fixed suction connection requirements for use by fire brigade pumping appliances, where a below-ground static water source is proposed to be used in a fire hydrant system. A below-ground static water source includes any water storage tank that is either fully or partially below ground level and any open water source, such as a river, lake, dam or sea.

[Figure K.5\(A\)](#) highlights the application of the design principle in [Clause 4.4\(a\)](#) where the maximum friction from the outlet of a large-bore suction connection to the low water level of the below-ground static water supply is not to exceed 20 kPa, at the required flow rate.

The hydraulic loss and volume limits in [Clause 4.4](#) apply to the installed fixed pipe and the large- and small-bore suction connections provided.

NOTE For signage purposes the suction connection outlets are titled “draughting point”.

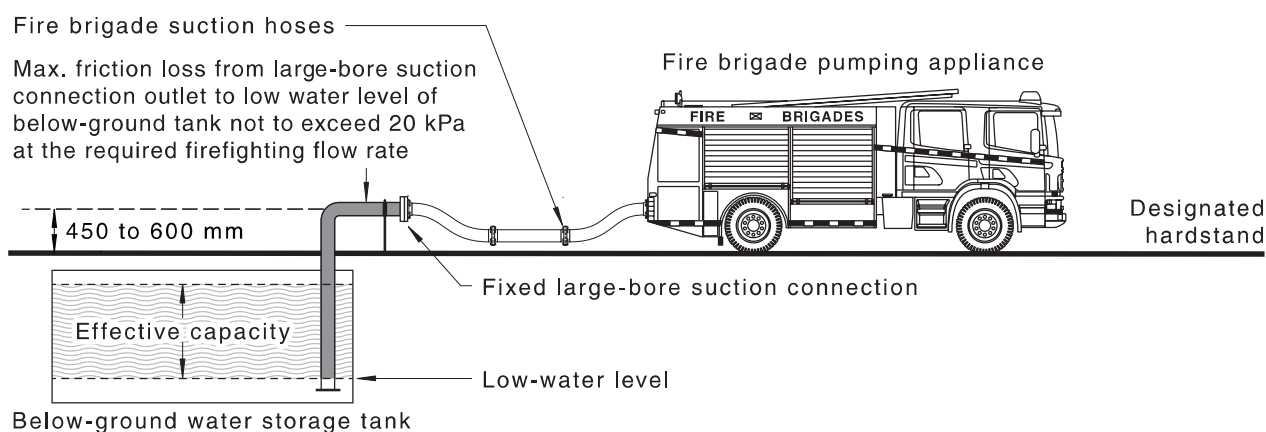


Figure K.5(A) — Maximum friction loss across suction pipework to a below ground water storage tank

[Figure K.5\(B\)](#) highlights the application of the design principle in [Clause 4.4\(b\)](#) where the maximum vertical lift from the low water level of the below-ground static water supply to the outlet of a large-bore suction connection is to be less than 3 m.

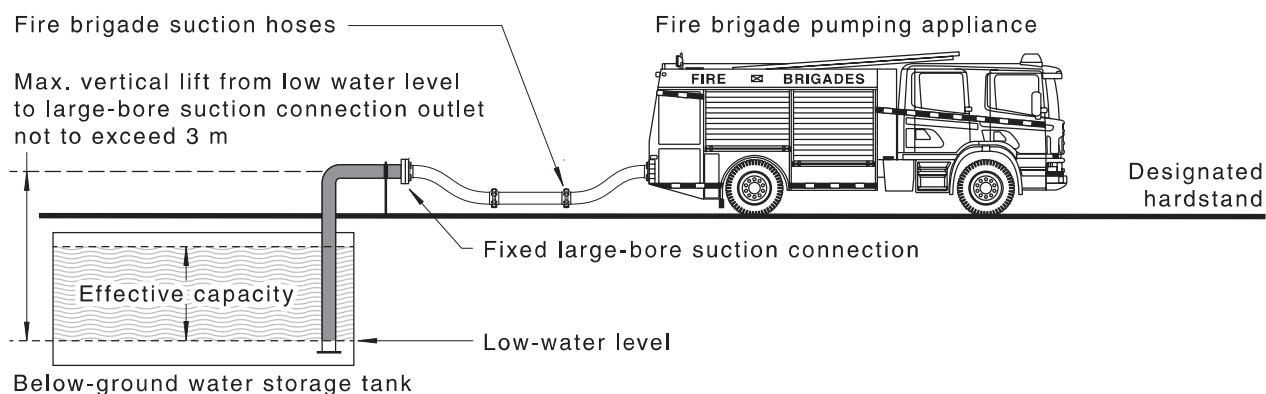


Figure K.5(B) — Maximum vertical lift from a below ground water storage

[Figures K.5\(C\) and \(D\)](#) highlight the application of the design principle in [Clause 4.4\(c\)](#) where the maximum volume of permanently fixed on-site dry pipe from the outlet of a large-bore suction connection to the low water level of the below-ground static water supply is to be not more than 0.07 m³. The volume of dry pipe specified in [Clause 4.4](#) is equivalent to 3.4 m of DN 150 dry-pipe (i.e. a maximum of 0.4 m of horizontal dry-pipe length if the design incorporates the maximum vertical lift of 3 m to the low water level).

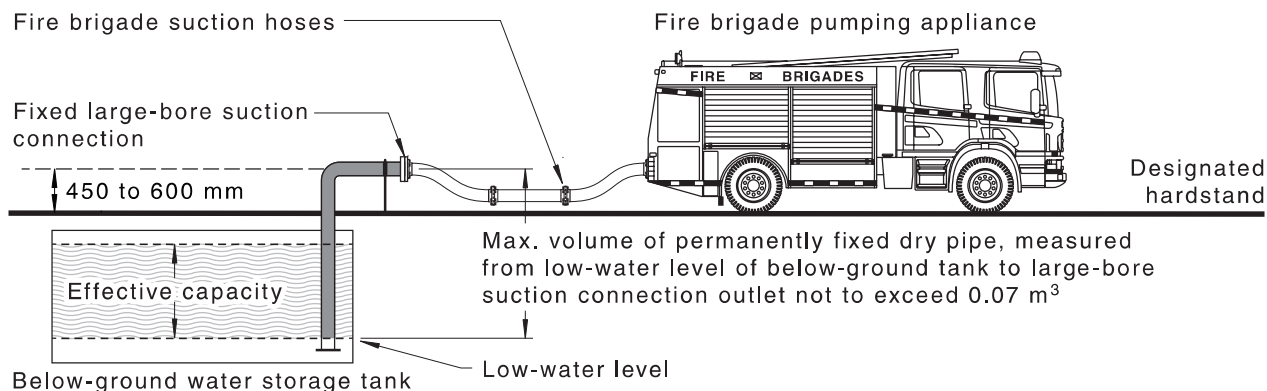


Figure K.5(C) — Maximum volume of fixed on-site dry pipe from a below-ground water storage

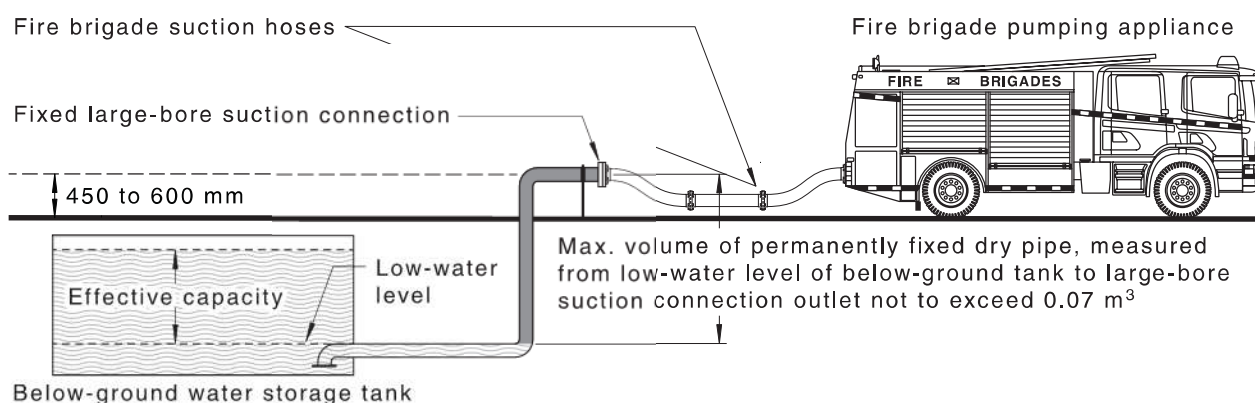


Figure K.5(D) — Maximum volume of fixed on-site dry pipe from a below-ground water storage

Where a water storage tank is partially below ground and a positive pressure is available at the large-bore suction connection when the water storage tank is full, an isolating valve is to be provided before the large-bore suction connection as specified in [Clause 8.7.1](#).

To draught from an open water source such as a river, lake or dam, not provided with a large-bore suction connection, a metropolitan fire brigade will connect a maximum of three lengths of semi-rigid suction hose to their pumping appliance. To commence draughting, an on-board priming pump removes air from within the pump casing lowering the pressure within the pump. Atmospheric pressure acting on the surface of the static water supply then forces water into the eye of the impeller of the on-board pump. When all the air has been removed from these lengths of hose, the fire brigade pumping appliance is considered to be primed and pumping operations can commence.

To draught from a fixed on-site tank located wholly or partially below ground, the attending fire brigade pumping appliance will remove all air from any fixed piping together with the air in the hard suction hose, as stated above, before it can commence draughting from the on-site tank. The requirements of [Clause 4.4](#) place clear limits on the length of on-site dry piping to ensure that the on-board priming pump can successfully prime the on-board pump. As such, the hydraulic parameters in [Clause 4.4](#) should not be exceeded.

In developing a fire hydrant system design incorporating a wholly or partially below-ground tank, it is recommended that the number of joints be minimized in the fixed piping and that appropriate seals are used. This approach will reduce the risk of any air leakage into or from the fixed pipe length possibly jeopardising the fire brigade's ability to draught from the water source.

The hydraulic parameters in [Clause 4.4](#) are representative of a single length of hard suction hose carried on a typical metropolitan fire brigade pumping appliance. As fire brigades across Australia use different-sized hard suction hose and pumping appliances with different capabilities, it is recommended

that the attending fire brigade is consulted prior to installing an on-site tank wholly or partially below ground or provision is to be made to draught from an open water source.

Appendix L (informative)

Determination of water system supply pressure

L.1 Scope

This appendix sets out methods for determining residual pressures in a water source, such as a reticulated water supply system for use in the design of a fire hydrant system.

L.2 Water supply system characteristics

The residual pressure and the available flow in a reticulated water supply system can vary considerably. Water supply networks and their hydraulic characteristics change over time as assets are built, taken in-and-out of service, or reconfigured into different arrangements. Daily network operations frequently temporarily isolate portions of the network to carry out works, often with alternate, temporary water supply arrangements in place. Reservoirs, tanks, control valves and pumps operate at different times, at variable settings as part of a network control system. Background water demands vary with time, due to time-of-day, day-of-week, weather and seasonal factors, and from development that alters the type and number of water supply connections over several years.

These factors combine to cause the available pressures and flows to vary with time. It is therefore important when obtaining information for fire hydrant system design to use appropriate methods to determine building and site design pressures. For a reticulated water supply system, the local network utility operator is usually in the best position to advise system pressure and flow information or to advise design pressure determination methodologies suitable for an individual building or site.

L.3 Source water supply pressure

L.3.1 Reticulated water supply

The requirements of this document require the determination of the “95th percentile” available minimum flows and pressures. The intended performance outcome for the fire hydrant system’s water supply design is to provide the required minimum hydrant outlet pressures and flows, for both system commissioning testing and ongoing maintenance verification testing. Therefore, a conservative design approach to minimum available flow and pressure calculation is specified.

It is generally recommended that assessment methods, similar to how the local network utility operator performs available fire capacity network analyses, be used as the basis for determining water supply system pressures. These methods are conservative and aim for highly reliable outcomes in line with the 95th percentile intent of this document.

Use of single point-in-time field test results as a sole source of design pressure information produce variable and unreliable results and are not a recommended design approach. They do not adequately correct for network and background water demand variables. In addition, testing carried out prior to on-site works frequently do not have sufficient flow metering and pressure gauging points to accurately represent the performance at the proposed network connection point.

It is important to note that while this document prescribes methods for the design of the fire system, local laws and regulations typically do not require the local network utility operator to follow those prescribed methods for the provision of pressure and flow design advice. The relevant clauses intend to provide flexibility to network utility operators to determine their own, most appropriate, design advice and network analysis methods. This is in recognition of the significant variation across water supply

networks in the available information, the capabilities and resources of the relevant network utility operators, the local commercial and regulatory frameworks for provision of water services, and what is locally considered “best practice”.

Key elements to consider before calculating minimum available design pressures and flows include the background water demand, water levels in reservoirs and tanks, status and settings of pumps and control valves, and planned network changes. Ideally, the calculated pressures should cover the anticipated number of years the fire system is required to operate and inform the anticipated future performance.

The residual pressure to be adopted for use in the fire hydrant system design should be determined by one of the following methods (listed in descending order of likely accuracy):

- (a) The calculated pressures from a network utility operator’s water supply network hydraulic model that has been calibrated for fire flow friction losses, background network demands and local network boundary conditions.
- (b) The calculated pressures from a network utility operator’s uncalibrated water supply network hydraulic model, supported by field tests able to verify and adjust the hydraulic model’s reticulation mains fire flow friction losses to the connection point of the fire hydrant system at the reticulated water supply.
- (c) The calculated pressures from a network utility operator’s water supply network hydraulic model, or equivalent network hydraulic calculation, that can accurately calculate the available reticulated water supply residual pressures to a nearby system reference point, such as a large diameter distribution main offtake, local service reservoir outlet, pressure pump or pressure regulation valve outlet, for the total firefighting flows. The additional hydraulic losses from the system reference point to the connection point of the fire hydrant system at the reticulated water supply should be determined by field tests and any required supporting hydraulic calculations to derive the design residual pressure.
- (d) A reticulated water supply residual pressure calculation method assessed or recommended by the network utility operator as being appropriate for the site. For methods incorporating field verification testing, it is anticipated that raw field test pressure measurements will be higher than the 95th percentile design pressures to be used as a basis for fire system design. Field test pressure correction methodologies are recommended to be used with methods described in [Appendix U](#). In addition to verifying minimum available flows and pressures, a key measure to compare between field test results and desktop calculations is the measured hydraulic losses from the network pressure sources to the fire system connection point. This provides insights into the accuracy and validity of the desktop calculation methodology or previously unknown network latent conditions or both.

Network utility operators may set limits on the demands a fire system may place on a network, due to either operational or customer service considerations. Typical constraints include limiting the impact of fire system maintenance flow tests on surrounding pressures, maintaining network domestic supply pressure stability, limiting mains scouring dirty water events, ensuring sufficient capacity for future development, limiting pressure transients such as water hammer. This may be reflected in advice provided in the fire system design or separately in development and connection approval documents provided to others. It is recommended this be checked as an appropriate design due diligence step.

Any known limitations to the accuracy or usage of the design advice should be clearly stated in the fire system design.

L.3.2 Tanks

The residual pressure to be used in the design of the fire hydrant system is that resulting from the required fire flow rate being drawn from the tank with the water level at the level of the bottom of a four hour supply. The pressure is that available at the point of connection of the outlet pipework at the tank.

L.3.3 Seasonally affected water sources

Where the source of water is a river, lake, dam or sea, the residual pressure to be used in the design of the fire hydrant system is to be determined considering the variation of the source during the design life of the fire hydrant system. The water level used to determine the residual pressure is to be assessed as that reliably available, such as average low tide or river level at the point of connection to the source.

L.4 Pressures for multiple firefighting systems

Where an additional firefighting system (other than hose reels) is on-site and draws from the same water supply as the fire hydrant system or uses common pipework on the site, [Clause 2.2.7](#) specifies that the system be designed for the operation of each system either separately or simultaneously, under combined firefighting water demand. The available flow and pressure determination methodologies used are recommended to be adjusted to accommodate combined fire system demands.

[Clauses 2.2.7](#) and [4.2.3](#) require that the source pressure for use in design of each firefighting system be determined based on simultaneous operation of the systems. Each system will have a supply being drawn from a source that might be common to the systems and, in some cases, from a supplementary source. It is the likely combination of these supplies being used simultaneously that should be assessed to determine the water source pressure.

The applicable calculated pressure is then used as the water supply base pressure for the design of each of the firefighting systems and for any combined parts of the systems. In each case, the full required system flow is included in the design of the pipework.

L.5 Calculation methods using field test results

L.5.1 General

The methodologies in [Clauses L.5.2](#) and [L.5.3](#) may be employed where field testing is used to determine the hydraulic losses from a system reference point to the point of connection of a fire system. This will typically be where desktop computer modelling results are unavailable or of limited accuracy.

The residual pressure in the reticulated water supply at the selected system reference point may be calculated (or measured with appropriate adjustment being made for the system operating conditions at the time) to ensure adoption of design pressures met or exceeded at least 95 % of the time.

For greater accuracy, field test results may be adjusted to account for background demands during field testing not corresponding with design background demands. Typical network analysis methodologies assume a certain proportion of peak residential and peak industrial/commercial demands occurring simultaneously during a fire flow.

Suitable methods using these principles are outlined in [Clauses L.5.2](#) and [L.5.3](#). Further adjustment may be required to address differences in the relative levels of test gauges to be used for field testing and system commissioning, and the additional hydraulic losses occurring through pipework in the design flow path that could not be tested due to either not yet being built or having no available downstream flow and pressure test points.

NOTE Pressures and head losses are shown in metres head. 1 m head is approximately 9.8 kPa.

L.5.2.2 Calculations

Based on the arrangement given in [Figure L.5.2.1](#), example calculations are given in [Table L.5.2.1](#).

Table L.5.2.1 — Example 1 — Calculations

Step	2	3	4	3	3	5	6(a)	6(b)	6
Fire flow	Pressure at SRP ^a	Pressure at SRP (during test)	Difference	Hyd. B flow	Hyd. A pressure at gauge	Adjusted residual pressure at Hyd. A	Pressure adjusted for location	Flow rates adjusted for low base flow	Combined effect of adjustments
L/s	m head	m head	m head	L/s	m head	m head at L/s	m head	L/s	m head at L/s
0	37	46	9	0	56.1	47.1	47.3	(-2)	46.3 at 0
5	35.5	44.5	9	5	53.1	44.1 at 5	44.2	3	42.5 at 5
10	33	42.5	9.5	10	49.1	39.6 at 10	39.6	8	37.1 at 10
15	29	39	10	15	42.3	32.3 at 15	32.0	13	28.7 at 15
20	23.5	34.5	11	20	34.6	23.6 at 20	23.0	18	18.8 at 20
25	14						Adjusted for head loss and elevation	Adjusted by 8.5 – 6.5 = 2 L/s	
Ground level	58 m (AHD)			46 m (AHD)	47 m (AHD)	47 m (AHD)		46.7 m (AHD)	
^a Calculated by the network utility operator.									

The following assumptions are used in [Table L.5.2.1](#):

- (a) Base flows estimated to be occurring during the test, in DN 200 = 10 L/s, DN 150 = 6.5 L/s.
- (b) Flows at relevant head loss rate of 3 or 5/1000 are DN 200 = 20 L/s, DN 150 = 13 L/s.
- (c) Therefore, 95 % availability flows (67 % of above) are DN 200 = 13.5 L/s, DN 150 = 8.5 L/s.
- (d) Ground level slope is uniform between A and B.

NOTE Results that take into account the best available information, such as those from [Clause L.5.2.1](#) Step 6, should be used in preference to results generated from basic testing and adjustment ([Clause L.5.2.1](#) Step 5).

L.5.3 Head loss calculation method

L.5.3.1 Procedure

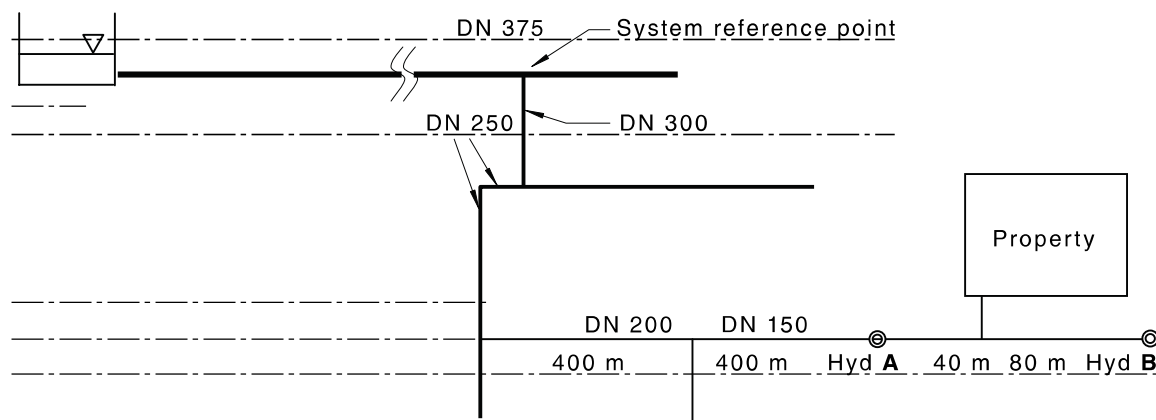


Figure L.5.3.1 — Example 2 — Network utility operator's reticulated water supply system

- Step 1: Select a point in the water supply network at a water main large enough so that addition of the required fire flow rate to the base flow rate in the main will have little effect on upstream head losses.
- Step 2: Obtain the residual pressure expected at this system reference point (SRP) under peak flow conditions. This will be determined either by calculation or by measurement (with appropriate adjustment being made for the system operating conditions at the time). The usual condition adopted is that providing a pressure that will be available 95 % of the time.
- Step 3: Determine the base (peak) flows in the mains between the SRP and the service location. For the 95 % availability case, a flow rate of two thirds of the maximum hourly flow rate (for mains serving residential areas) and a higher fraction, as required, for mains serving industrial/commercial areas should be adopted.
- Step 4: Add the required fire flow rate to the base (peak) flow in each of the mains between the SRP and the building or site.
- Step 5: Calculate the head losses in the mains for the combined flows.
- Step 6: Calculate the residual pressure at the building or site by subtracting the head losses from the pressure at the SRP, and adjusting for the difference in ground level at the two locations.
- Step 7: For greater accuracy, the pressures obtained may be adjusted as follows:

- (a) Measure the pressure at locations such as the SRP under known flow conditions and adjusting the starting pressure (for calculation) or the base flow head loss rate, as appropriate.
- (b) If necessary, perform a suitable test to determine the friction characteristics of parts of the water supply network (particularly local water mains), for use in the calculations.

L.5.3.2 Calculations

Based on the arrangement given in [Figure L.5.3.1](#), example calculations are given in [Table L.5.3.2](#).

Table L.5.3.2 — Example 2 — Calculations

Step	2		3	4	3	3	5	6(a)	6(b)
	Pressure at SRP ^a	m head							
Mains	Length	Base peak flows	Base flow plus fire flows	Head loss rates	Head loss	Residual head at building or site	Residual head at building or site (adjusted)		
Fire flow	L/s	L/s	L/s	m/km	m head	m head	m head	Loss rate/loss	m head
		47							
Fire flow rate = 5 L/s									
DN 300	180	48.8	53.8	2.5	0.4				
DN 250	450	29.6	34.6	2.6	1.2				
DN 200	400	16.0	21.0	3.4	1.4		7.4/3.0		
DN 150	440	10.4	15.4	7.3	3.2	46.1 at 5 L/s	16.9/7.4	40.3 at 5 L/s	
Fire flow rate = 10 L/s									
DN 300	180	48.8	58.8	2.7	0.5				
DN 250	450	29.6	39.6	3.3	1.5				
DN 200	400	16.0	26.0	5.1	2.0		11/4.4		
DN 150	440	10.4	20.4	12.5	5.5	42.8 at 10 L/s	27/11.9	34.0 at 10 L/s	
Fire flow rate = 15 L/s									
DN 300	180	48.8	63.8	3.4	0.6				
DN 250	450	29.6	44.6	4.4	2.0				
DN 200	400	16.0	31.0	6.8	2.7		14.5/5.8		
DN 150	440	10.4	25.4	19	8.4	38.6 at 15 L/s	42/18.5	25.4 at 5 L/s	
Fire flow rate = 20 L/s									
DN 300	180	48.8	68.8	3.7	0.7				
DN 250	450	29.6	49.6	5.1	2.3				
DN 200	400	16.0	36.0	9.2	3.7		19.8/7.9		
DN 150	440	10.4	30.4	26	11.4	34.2 at 20 L/s	56/24.6	16.8 at 20 L/s	
Ground level		52 m (AHD)				46.7 m (AHD)		46.7 m (AHD)	
^a Calculated by the network utility operator									

The following assumptions are used in [Table L.5.3.2](#) example calculations:

- (a) Flows at head loss rate of 3/1000 are DN 300 = 61 L/s, DN 250 = 37 L/s, DN 200 = 20 L/s.
- (b) Flow at head loss rate of 5/1000 is: DN 150 = 13 L/s.
- (c) A flow reduction factor of 1 (i.e. no reduction) used for 95 % availability for industrial/commercial flows.
- (d) Flows for industrial/commercial assumed as 40 % of total peak flow.
- (e) 95 % availability flows (67 % of residential component and all of industrial/commercial component of above flows) are DN 300 = 48.8 L/s, DN 250 = 29.6 L/s, DN 200 = 16.0 L/s, DN 150 = 10.4 L/s.
- (f) For Step 7(b), the friction factor in DN 200 and DN 150 mains, obtained from testing, is 50 % higher than the assumed friction factor for the initial calculation (Step 6). (This example calculation has not made direct allowance for a possible reduced pipe internal diameter. Allowance has been assumed to be included in the friction factor.)
- (g) Ground level slope is uniform between A and B.

NOTE Results from adjusted calculations, which take into account the best available information, such as those from [Clause L.5.3.1](#) Step 7, should be used in preference to results generated from basic assumptions ([Clause L.5.3.1](#) Step 6).

Appendix M (informative)

Water storage tanks

M.1 Scope

This appendix provides guidance on the design principles detailed in [Section 5](#).

M.2 General

[Clause 5.1](#) highlights the major design considerations regarding the construction and capacity of an on-site water storage tank.

To ensure an appropriate level of redundancy is provided to the water supply serving the fire hydrant system, [Clause 5.1\(b\)](#) specifies that an on-site water storage tank forming part of the primary water supply should be compartmented into 50 % sections by volume.

NOTE The redundancy requirement of this clause may also be met through the provision of two separate tanks with each tank able to provide not less than 50 % of the flow requirement for the fire hydrant system.

[Figure M.2](#) depicts many of these design considerations.

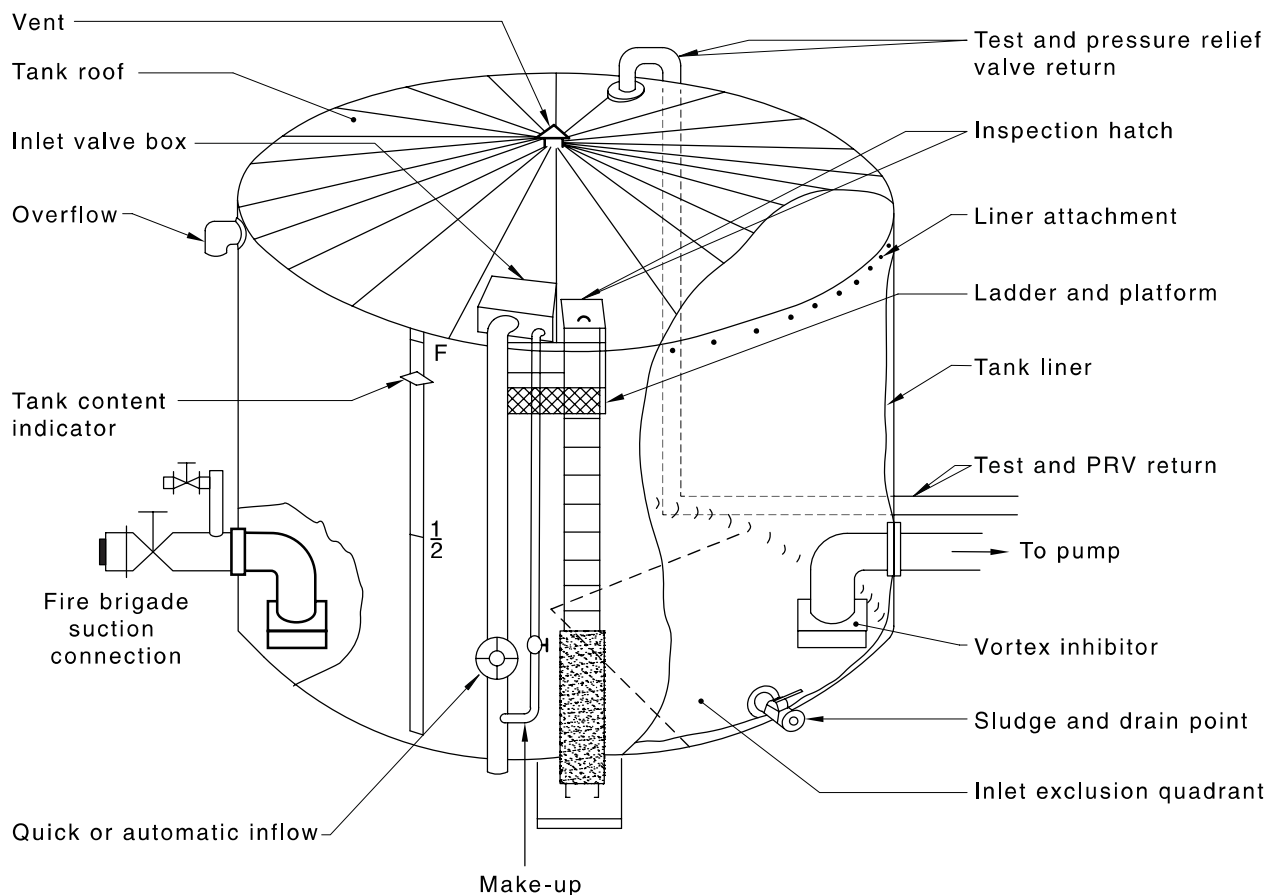


Figure M.2 — Typical cylindrical water storage tank — Major design considerations

M.3 Tank accessories — Fire brigade suction connections

[Clause 5.3.1](#) clarifies the fire brigade suction connection requirements for an on-site water storage tank that serves as the primary water supply for the building or site.

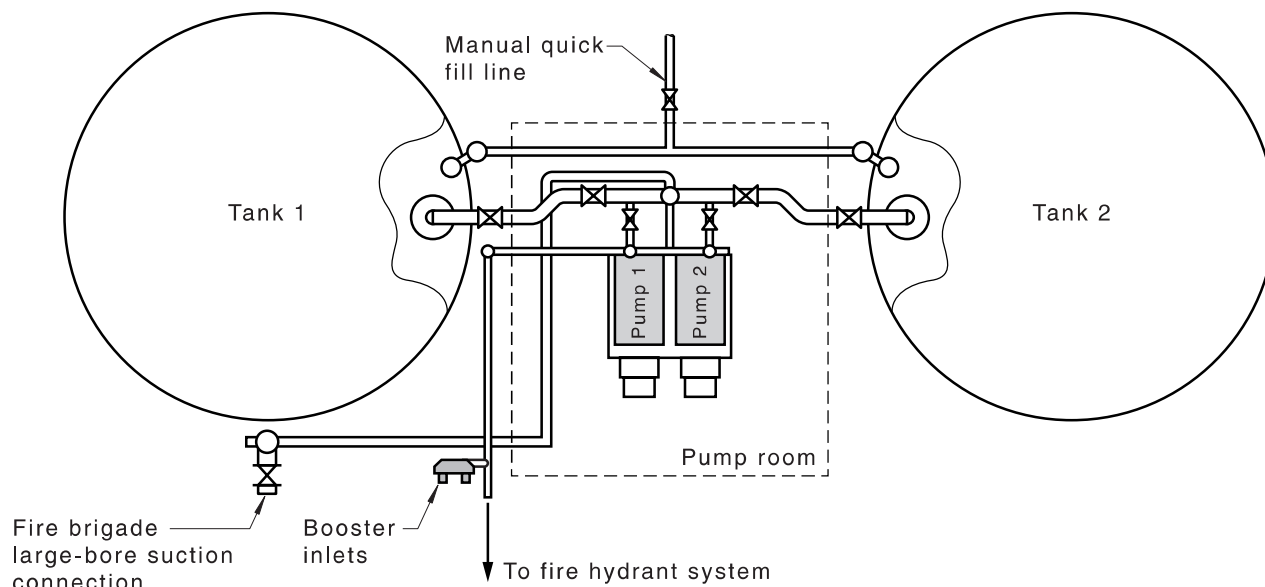
Where a water storage tank serves as the primary water supply for the building or site to allow the attending fire brigades to connect to and draught from this supply, [Clause 5.3.1](#) specifies the installation of large- and small-bore suction connections to the storage tank. The fire brigade connections required will depend on the fire brigade having jurisdiction (metropolitan or rural) and the type of fire brigade pumping appliance likely to be used at the building or site.

Where the building or site is in an area where a metropolitan fire brigade has jurisdiction, a water storage tank with a large-bore suction connection is required by [Clause 5.3.1.2](#).

Where the building or site is located in an area where a joint response involving both a metropolitan brigade and a rural or country fire authority will occur, a water storage tank with both large- and small-bore suction connections may be required by [Clause 5.3.1.3](#).

Where the building or site is located in an area where a rural or country fire authority has jurisdiction, it is recommended that consultation with the attending fire brigade be undertaken because in some instances, the rural or country fire authority will require a large-bore suction connection, while in other circumstances the small-bore suction connections (DN 65) may suffice.

[Figure M.3\(A\)](#) depicts some typical configurations of large- and small-bore suction connections.



(a) Part plan — Dual tanks

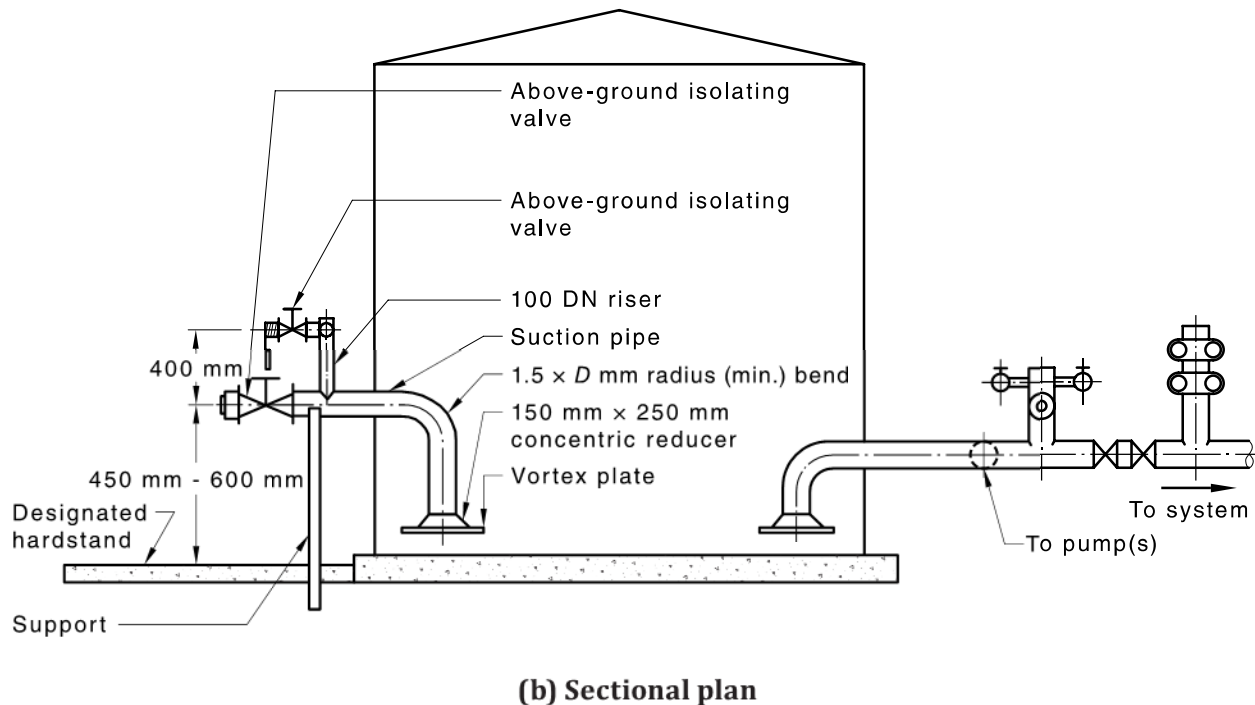


Figure M.3(A) — Typical configurations of fire brigade suction connections

In designing a fire hydrant system where a water storage tank serves as the primary water supply for the building or site, the hardstand and associated circulation areas provided should be appropriate for the type of fire brigade pumping appliance that is likely to respond to the building or site. As such, it is essential to understand whether the fire brigade pumping appliances that will attend the building or site have rear- or mid-mounted pump suction. Pumping appliances with mid-mounted pump suction are likely to require a far greater area to manoeuvre than an appliance with rear-mounted pump suction. The hardstand provided also should be sized to allow firefighters to circulate around the fire brigade pumping appliance, remove equipment, and connect hose.

[Figure M.3\(B\)](#) shows a rear-mounted fire brigade pumping appliance draughting from an on-site water storage tank.

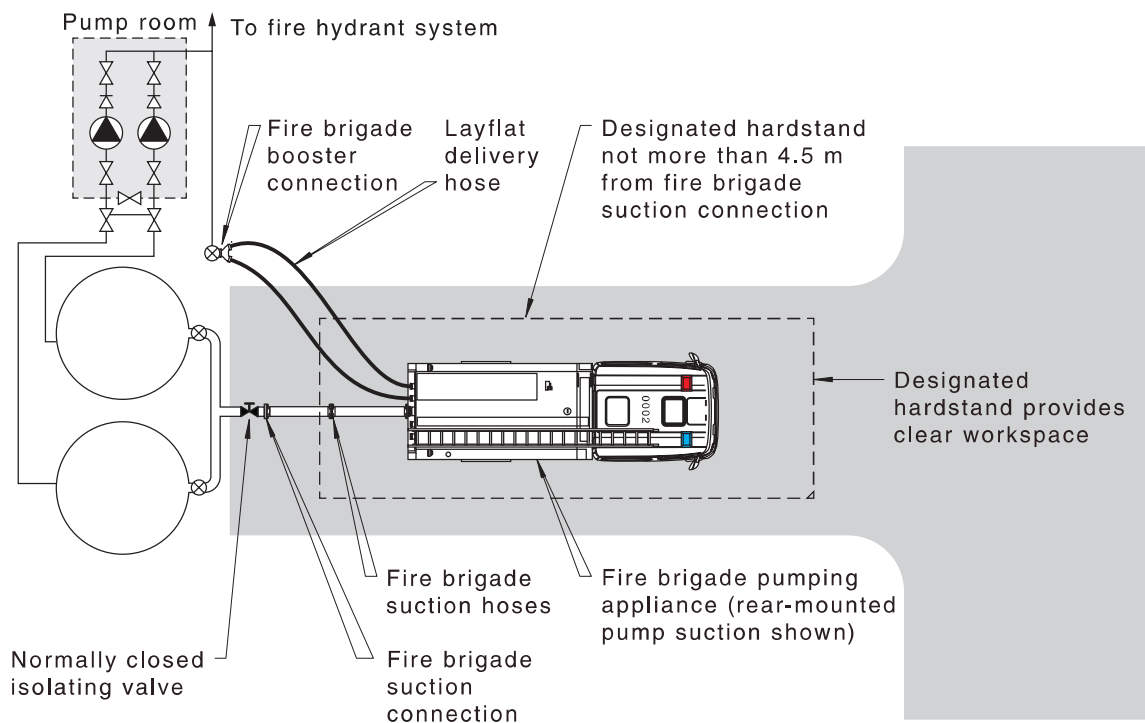


Figure M.3(B) — Rear-mounted fire brigade pumping appliance draughting from an on-site water storage tank

[Figure M.3\(C\)](#) shows a mid-mounted fire brigade pumping appliance draughting from an on-site water storage tank.

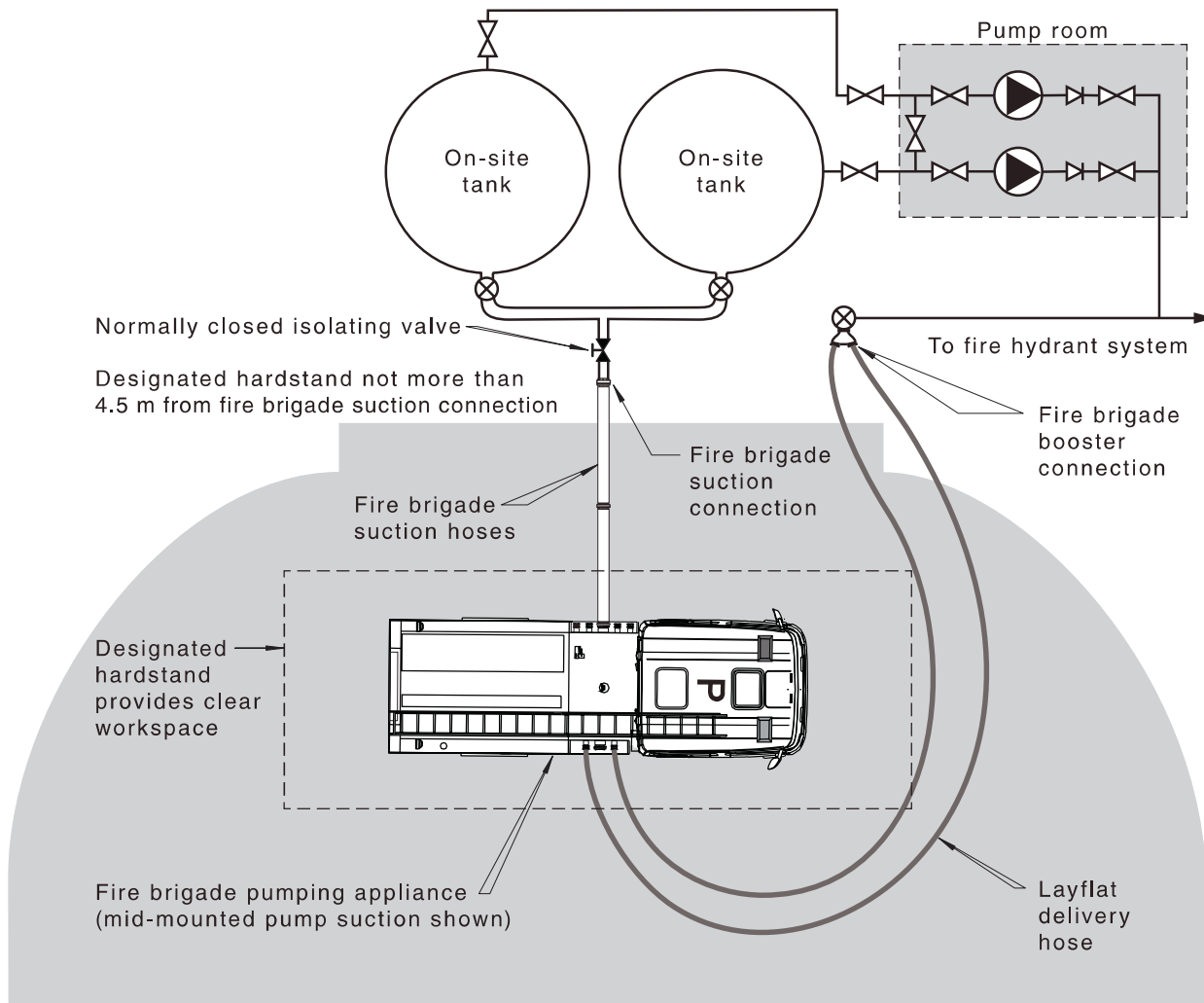


Figure M.3(C) — Mid-mounted fire brigade pumping appliance draughting from an on-site water storage tank

Under the provisions of [Clause 5.3.1.2](#) where a water storage tank serves as the primary water supply for the building or site, a single large-bore suction connection will be required for each 40 L/s demand or part thereof. This requirement is necessitated because a metropolitan fire brigade pumping appliance has four outlets for the connection of firefighting hose that may be pressurized by the on-board pump. For flows up to 80 L/s, two large-bore suction connections are required by [Clause 5.3.1.2](#).

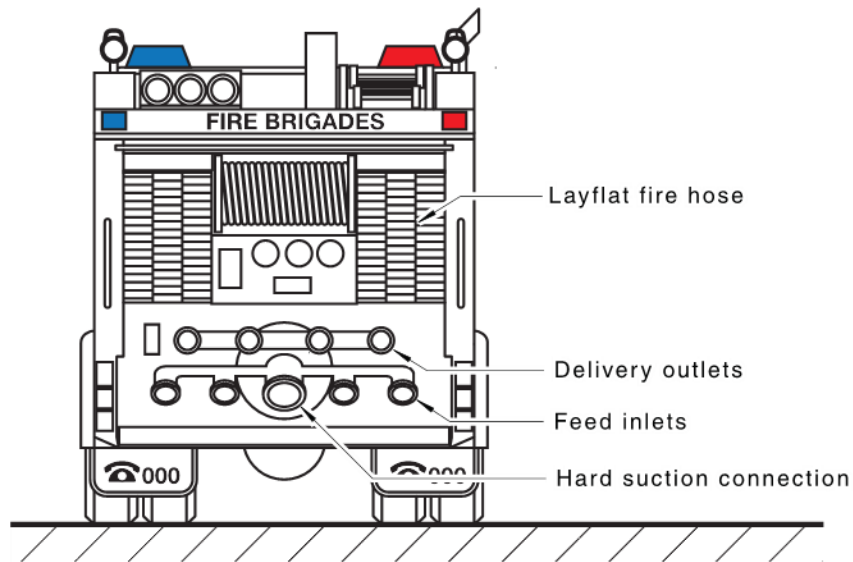


Figure M.3(D) — Typical rear-mounted fire brigade pumping appliance

[Figure M.3\(D\)](#) shows a typical rear-mounted pump configuration with a single large-bore suction connection, four feed fire hydrant inlet connections and four delivery outlets.

Where the demand for the system exceeds 80 L/s, it is recommended that consultation with the attending fire brigade is undertaken, as there are significant operational implications for the fire brigade when the design flow exceeds 80 L/s such as resource availability. Where large- or small- bore suction connections are provided, the hardstand should be large enough to allow —

- (a) the fire brigade pumping appliances to manoeuvre into position;
- (b) the movement of firefighters around the appliances;
- (c) the removal of equipment from the appliances; and
- (d) the laying of fire hoses, both canvas hose and hard suction hose.

In relation to Item (d) the hardstand should be sized to accommodate the laying of the required number of fire hoses to match the number of suction connections and booster connection outlets, as well as attack hoses, as required.

Appendix N (informative)

Guidance on pumpset and pipework design

N.1 General

This appendix provides guidance on the application of selected requirements in [Sections 6](#) and [8](#).

In relation to the type of fixed on-site pumps provided in a fire hydrant system —

- (a) where a building has an effective height not more than 50 m, half-duty fire hydrant pumpsets may be required to be installed to deliver the initial pressure and flow specified in [Table 2.2.6\(C\)](#);
- (b) where a building has an effective height more than 50 m, not less than two full-duty fire hydrant pumps and an on-site high-rise water storage tank are required to be installed to deliver firefighting pressure and flow specified in [Table 2.2.6\(D\)](#).

N.2 When a pumpset is required

[Clause 6.2](#) specifies when a pumpset is required to be installed and the types of pumpset that may be required in a fire hydrant system.

In relation to [Clause 6.2.1\(a\)](#), half-duty pumps are required where the primary water supply is able to deliver the required pressure and flow to the most hydraulically advantaged feed fire hydrants but not to the most hydraulically disadvantaged feed fire hydrants. In this design scenario, the requirement to install half-duty fire hydrant pumps will also result in the installation of a fire brigade booster assembly. Where the building has an effective height not more than 25 m, one half-duty fire hydrant pump is required. Where the building has an effective height more than 25 m but not more than 50 m, not less than two half-duty fire hydrant pumps are required.

In relation to [Clause 6.2.1\(b\)](#), half-duty pumps are required where the primary water supply is able to provide the required pressure and flow to the feed fire hydrants of the fire brigade booster assembly but not to the hydraulically disadvantaged attack fire hydrants. In this design scenario, where the building has an effective height not more than 25 m, one half-duty fire hydrant pump is required. However, where the building has an effective height more than 25 m and not more than 50 m, not less than two half-duty fire hydrant pumps are required.

In relation to [Clause 6.2.1\(c\)](#), where a building has an effective height not more than 50 m and an on-site water storage tank forms part of the fire hydrant system design, not less than two half-duty fire hydrant pumps are required.

In relation to [Clause 6.2.2](#), where a building has an effective height more than 50 m, not less than two full-duty fire hydrant pumps are required.

In summary, the number and type of pumpsets will be determined by the fire hydrant system design, building characteristics, and features of the primary water supply provided. Consequently, a fire hydrant system may require one or more of the pump types specified in [Clause 6.2](#).

N.3 Pumpset design criteria

N.3.1 Half-duty fire hydrant pumpsets

[Clause 6.3.1](#) clarifies the performance characteristics of a half-duty fire hydrant pumpset installed in a fire hydrant system.

Where a half-duty fire hydrant pump is required, under the provisions of [Table 2.2.6\(C\)](#) a pressure of not less than 700 kPa is required at the most hydraulically disadvantaged fire hydrant at a flow rate of not less than 5 L/s for each fire hydrant outlet required to flow.

For example, a Class 6, 7 or 8 building having a fire compartment of more than 500 m² and not more than 5 000 m² requires two fire hydrants to flow simultaneously as specified in [Table 2.2.5\(B\)](#). For this building, if a half-duty fire hydrant pumpset were required, [Table 2.2.6\(C\)](#) specifies the pumpset provided to deliver not less than 700 kPa at not less than 10 L/s (i.e. 2 L/s × 5 L/s) at the most hydraulically disadvantaged fire hydrants.

N.3.2 Full-duty fire hydrant pumpsets

[Clause 6.3.2](#) clarifies the performance characteristics of a full-duty fire hydrant pumpset installed in a fire hydrant system.

Where a full-duty fire hydrant pumpset is required, [Table 2.2.6\(D\)](#) specifies a pressure of not less than 700 kPa at the most hydraulically disadvantaged fire hydrant at a flow rate of not less than 10 L/s for each fire hydrant outlet required to flow.

For example, a Class 2, 3, 5 or 9 building having a fire compartment more than 500 m² and not more than 5 000 m² requires two fire hydrants to flow simultaneously as specified in [Table 2.2.5\(B\)](#). For this building, if a full-duty fire hydrant pumpset were required, [Table 2.2.6\(C\)](#) specifies the pumpset to deliver not less than 700 kPa at not less than 10 L/s (i.e. 2 × 10 L/s) at the most hydraulically disadvantaged fire hydrants.

N.3.3 Secondary water supply pumpsets

[Clause 6.3.4](#) specifies the performance characteristics of a pumpset that provides automatic inflow to a reduced-capacity water storage tank that forms part of the primary water supply.

[Figures N.3.3\(A\), \(B\) and \(C\)](#) show the design principle detailed in [Clause 6.3.4](#) relating to secondary water supply pumps providing automatic inflow. In the examples shown, the secondary water supply pumps provide automatic inflow to reduced-capacity tanks that provide the primary water supply for the fire hydrant system. The capacity of the reduced-capacity tank will, therefore, be dependent on the size and capacity of the automatic inflow water supply pumps selected.

The capacity provided in the tank is that which will supplement the automatic inflow to provide the required water supply. For example, if a fire hydrant system had a demand of 20 L/s and the automatic inflow was capable of providing 15 L/s, an additional 5 L/s would be required from the reduced-capacity tank.

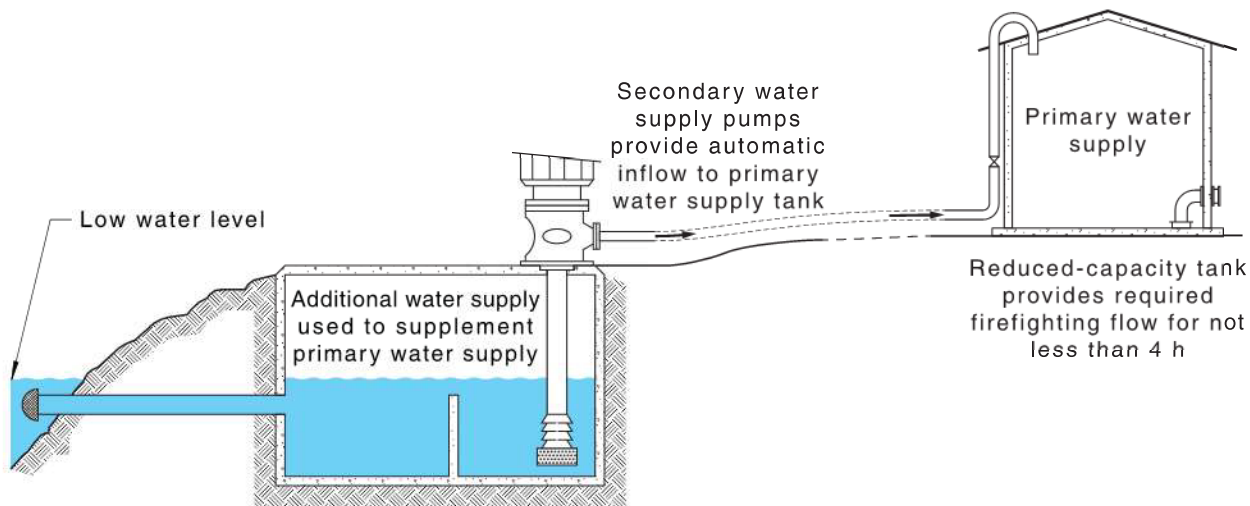


Figure N.3.3(A) — Conduit or pipe feed to inflow water supply pumps

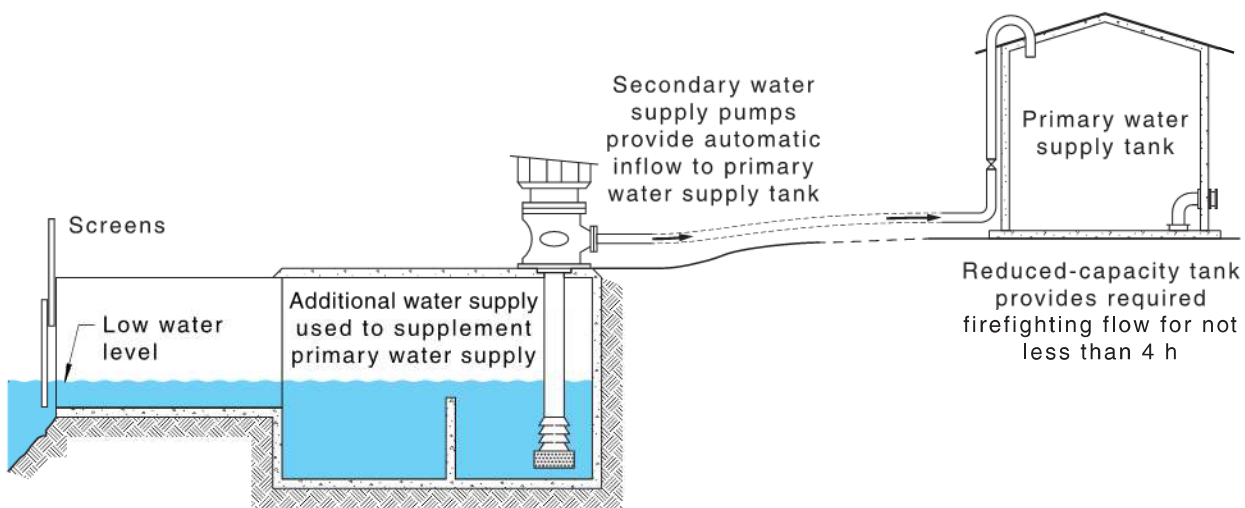


Figure N.3.3(B) — Open-top channel feed to inflow water supply pumps

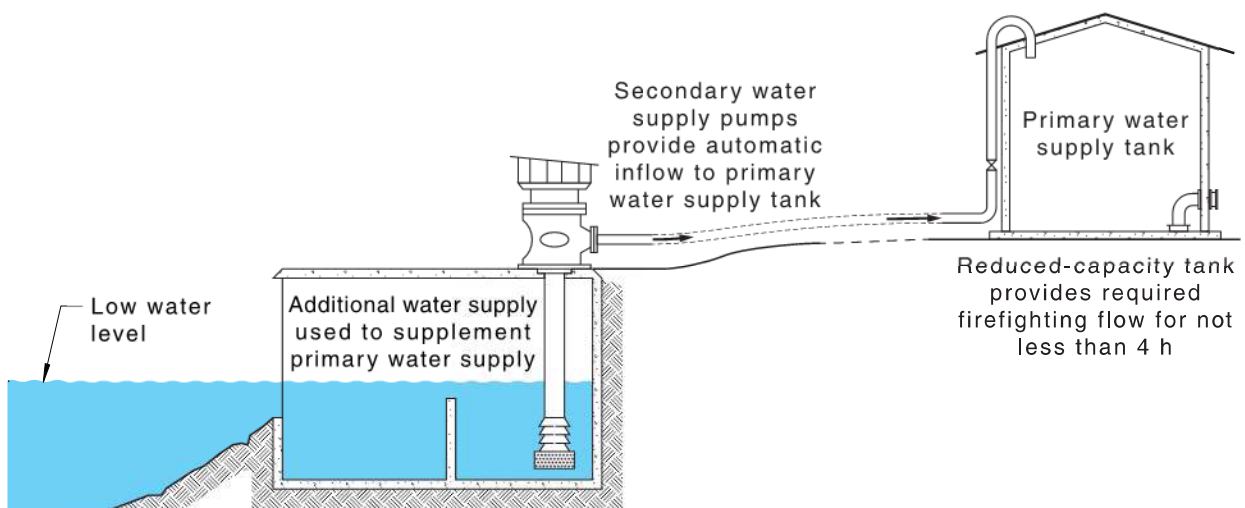


Figure N.3.3(C) — Weir feed to inflow water supply pumps

N.4 Fire hydrant pumpsets

N.4.1 Pumpset configurations

[Clause 6.4.1](#) specifies the number and type of fire hydrant pumps (diesel or electric) to be installed in a fire hydrant system.

Unless otherwise permitted by [Clause 6.4.2](#), not less than two fire hydrant pumpsets are required if the fire hydrant system design necessitates their installation. The provision of not less than two fire hydrant pumps ensures an appropriate level of redundancy is provided to the fire hydrant system. This design approach ensures that in circumstances where one of the fire hydrant pumps is taken offline for maintenance purposes or fails during fire brigade operations, the other available fire hydrant pumps remain operational and can pressurize the fire hydrant system if required.

N.4.2 Fire hydrant pumpset - One pump

[Clause 6.4.2](#) clarifies the circumstance where one half-duty fire hydrant pumpset may be installed in a fire hydrant system.

In relation to Item (a) and (b) of [Clause 6.4.2](#), a single fire hydrant pump may be installed where the building has an effective height not more than 25 m and the reticulated water supply has the capacity to serve as the primary water supply for the building or site and deliver the required pressure and flow at the feed fire hydrants of the fire brigade booster assembly.

[Clause 6.4.2](#) also indicates that connection of the single pump to the reticulated water supply may be done either directly or via a break tank. Where a break tank is installed, the pipework supplying the H-pattern fire brigade booster assembly or other booster assembly effectively bypasses the break tank. Hence the use of the term full-flow bypass in the clause.

Where a water agency requires the installation of a break tank as a condition of connection to their reticulated water supply network, and the reticulated water supply has the capacity to provide the required pressure and flow at the feed fire hydrants of the fire brigade booster assembly, a large-bore suction connection is not required. This concession recognizes that the attending fire brigade are able to use layflat firefighting hose to access the required flows from the feed fire hydrants of the fire brigade booster assembly.

The provision of one pump is an acknowledgement of the benefits a reticulated water supply brings to fire brigade operations.

[Figure N.4.2](#) shows a break tank where the pipework incorporating the fire brigade booster assembly bypasses the break tank.

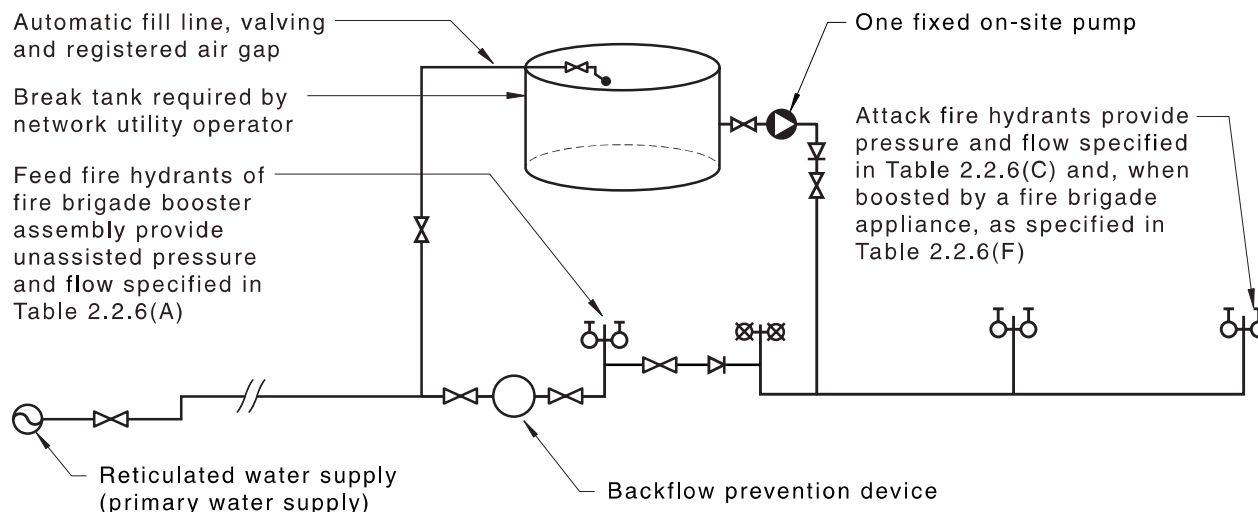


Figure N.4.2 — Fire brigade booster assembly installed on a full-capacity bypass around a break tank

N.5 Full-duty fire hydrant pumps — High-rise fire hydrant system configurations

[Clause 6.5](#) details the minimum provisions required when full-duty fire hydrant pumps are installed within a building having an effective height more than 50 m. In relation to [Clause 6.5\(a\) to \(h\)](#), the provisions listed are intended to ensure that no single point of failure will compromise the continuing operation of the full-duty fire hydrant pumps. To achieve this an N + 1 design approach has been applied.

In relation to the fire hydrant system design, apart from the requirements listed in [Clause 6.5](#) pertaining to full-duty fire hydrant pumps, this document now includes other provisions specifically aimed at improving fire hydrant system design in high-rise buildings including —

- (a) limiting the maximum pressure at any point in the system to less than 2 400 kPa, see [Clause 2.3.2](#).
- (b) requiring the installation of high-rise water supply tanks capable of providing not less than four hours water supply to the full-duty fire hydrant pumps, see [Clause 4.2.6.6](#).
- (c) requiring each pressure zone to be served by two supply pipe risers, see [Clause 8.13.1](#).
- (d) limiting the number of pressure zones that can be linked in cascade design to three, see [Clause 8.13.3](#).
- (e) limiting the number of pilot controlled PRV that can be connected in series in a descending leg of a cascade system design to one, see [Clause 8.13.3](#).

As fire brigade pumping appliance ability to add redundancy to a fire hydrant system design decreases as building heights extend beyond 50 m, in assessing the redundancy proposed to be provided to any fire hydrant system design installed in a building having an effective height more than 50 m and not more than 135 m, the consequences of a component part failing and being offline for an extended period should be evaluated. Where an extended time for replacement is identified, further levels of redundancy should be considered.

[Figures N.5\(A\)](#) and [N.5\(B\)](#) illustrate a bottom-up fire hydrant system design approach. [Figures N.5\(C\)](#) and [N.5\(D\)](#) illustrate a cascade fire hydrant system design approach. Each of the figures show the application of the requirements detailed in [Clause 6.5](#). While all designs show the full-duty fire hydrant pumps at the base of the building, in [Figures N.5\(C\)](#) and [N.5\(D\)](#) the pipework from the pumps bypasses the lower pressure zones before delivering supply to the base of the upper most pressure zone. Supply to the previously bypassed lower pressure zones is then delivered via pressure-reduction

valves which results in the water cascading to lower levels. These design approaches are identified as a cascade design.

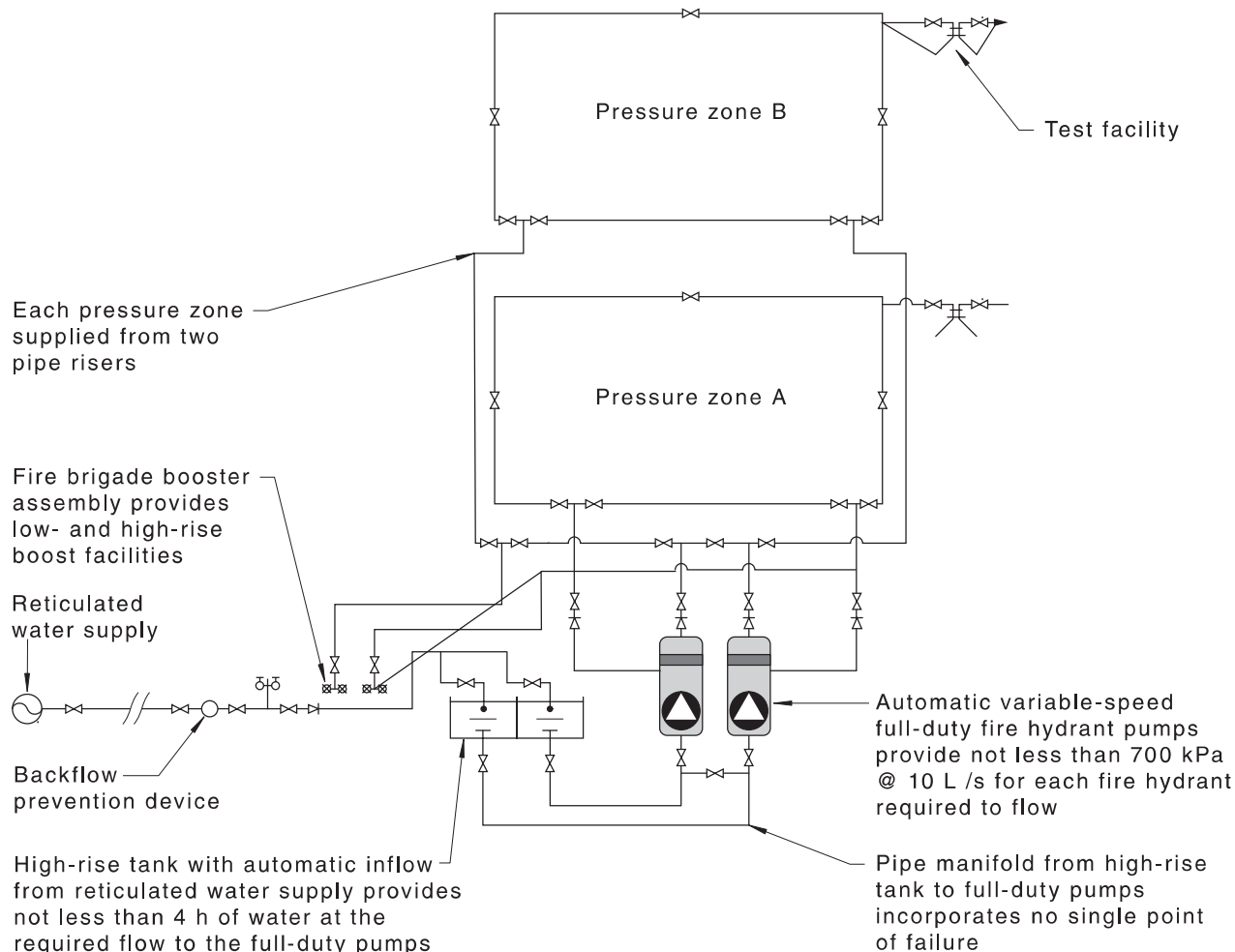


Figure N.5(A) — Full-duty fire hydrant pumps used in a bottom-up high-rise design for a building incorporating two pressure zones

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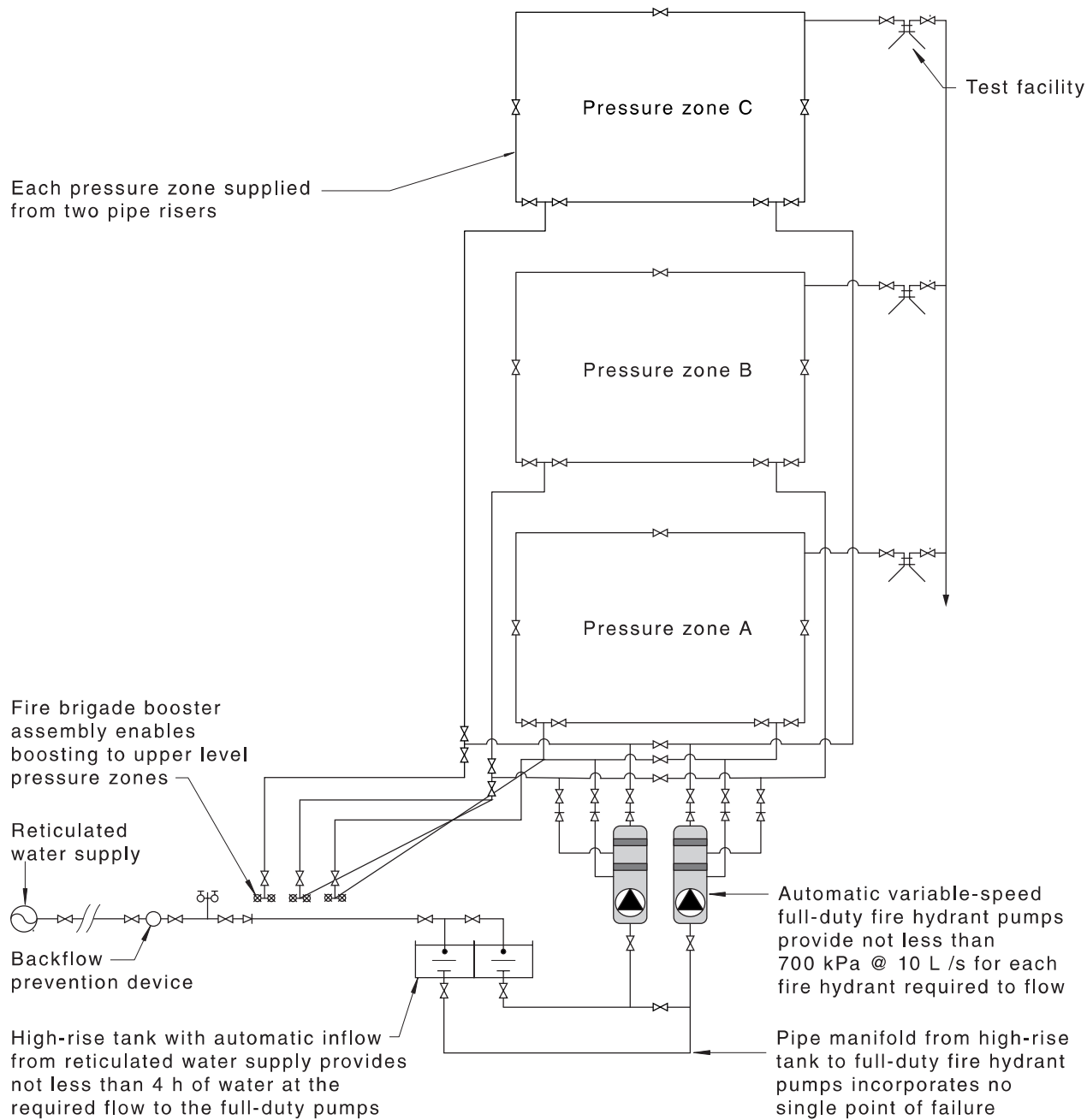


Figure N.5(B) — Full-duty fire hydrant pumps used in a bottom up high-rise design for a building incorporating three pressure zones

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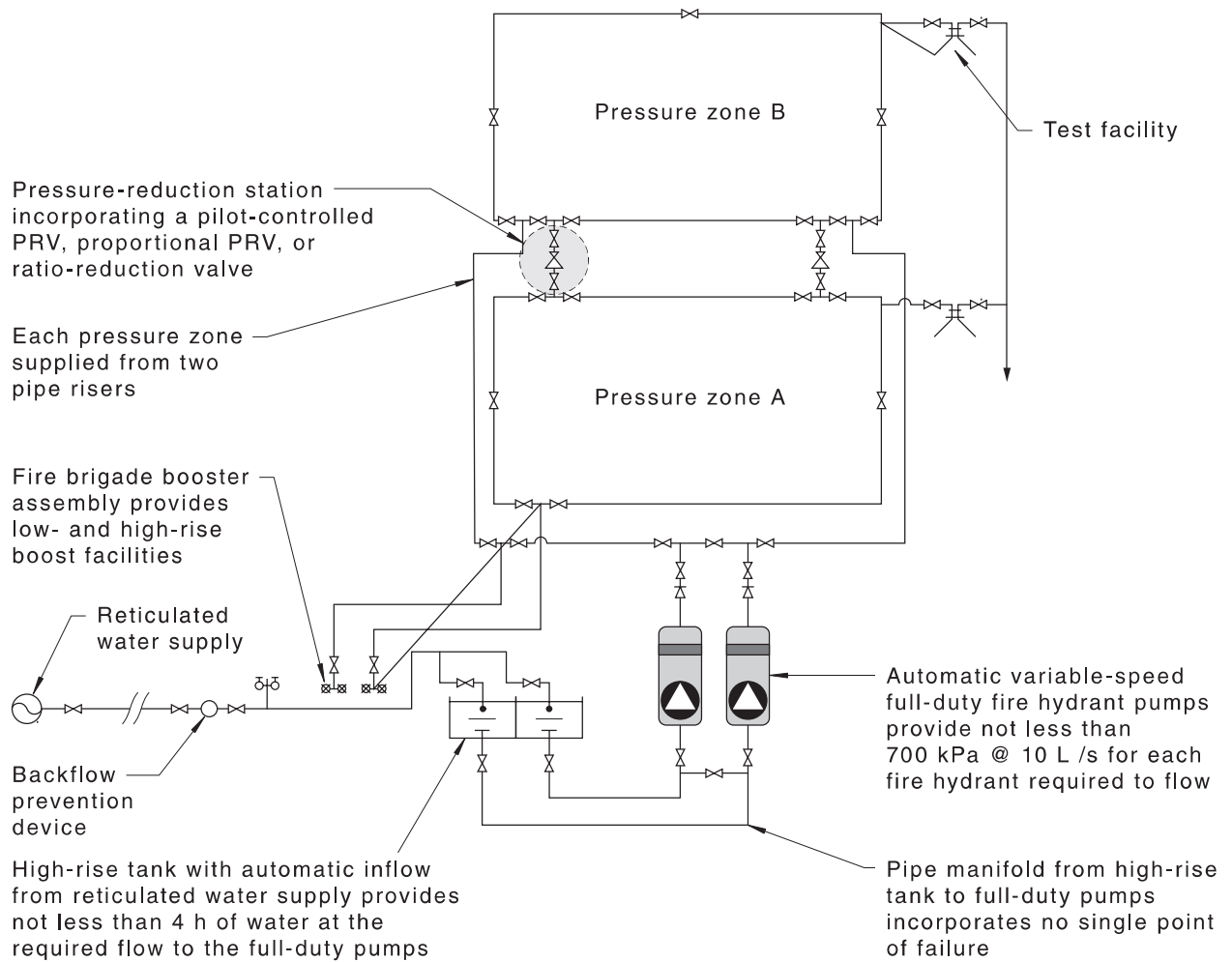


Figure N.5(C) — Full-duty fire hydrant pumps used in a cascade high-rise design for a building incorporating two pressure zones

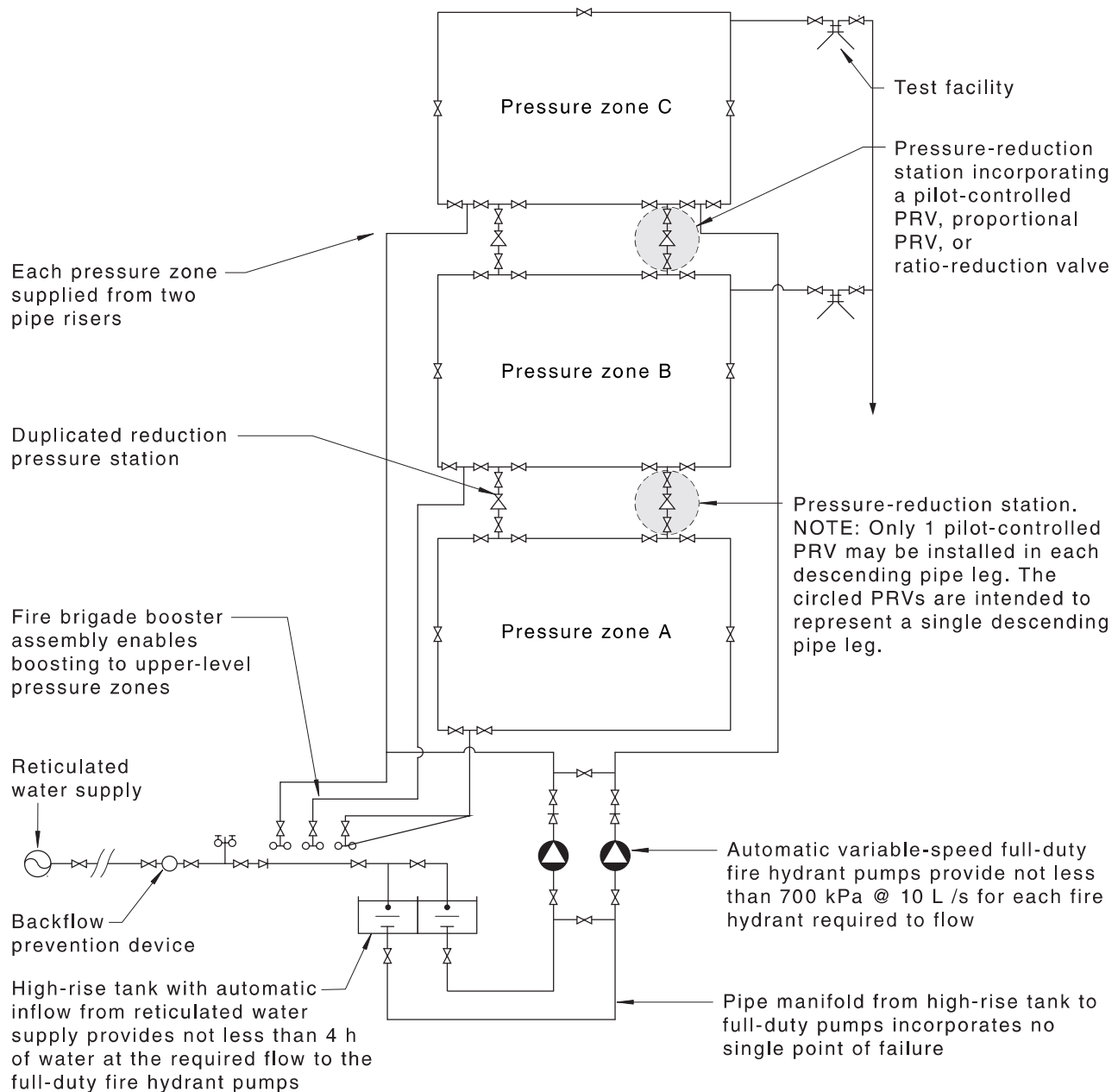


Figure N.5(D) — Full-duty fire hydrant pumps used in a cascade high-rise design for a building incorporating three pressure zones

N.6 Fixed on-site pumpsets in parallel with the fire brigade booster assembly

[Clause 6.7](#) specifies the installation requirements for on-site pumps installed in parallel with a fire brigade booster assembly.

[Figure N.6](#) shows the application of the design principles of [Clause 6.7](#). In particular, it highlights that —

- the suction side of the fixed on-site pump connects directly to the fire hydrant pipework supplying the feed fire hydrants of the fire brigade booster assembly; and
- the discharge side of the fixed on-site pumpset connects directly to fire hydrant system pipework at a point downstream of the fire brigade boost connections.

Where possible, when an on-site pump is required to be installed, it is recommended that the pump be connected in parallel with the fire brigade booster assembly, as this configuration provides the attending fire brigade with the most operationally simple design to use. The installation of the on-site pump in parallel with the fire brigade booster assembly to some degree eliminates the need to coordinate the boosting of the fire hydrant system by the attending fire brigade and the isolation of the fixed on-site pump, if required.

Installation of a pump in parallel with the fire brigade booster assembly also aims to ensure that the fire hydrant system and associated attack fire hydrants will not unintentionally be over-pressurized as a consequence of the fire brigade boosting the fire hydrant system.

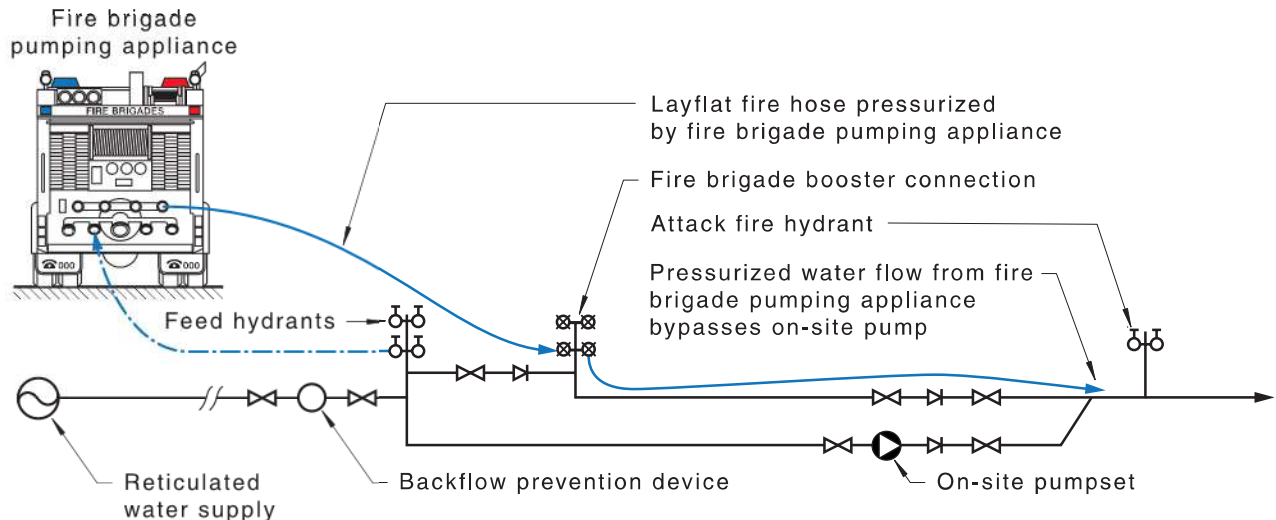


Figure N.6 — Fire hydrant pump in parallel with fire brigade booster assembly

N.7 Fixed on-site pumpsets in series with the fire brigade booster assembly

[Clause 6.8](#) specifies the installation requirements for on-site pumps installed in series with a fire brigade booster assembly.

[Figure N.7](#) shows the application of the design principles of [Clause 6.8](#). In particular, it highlights that —

- (a) the suction side of the fixed on-site pump connects directly to the fire hydrant pipework downstream of the boost inlets of the fire brigade booster assembly;
- (b) the discharge side of the fixed on-site pumpset connects directly to fire hydrant system pipework at a point downstream of the connection from the suction side of the fixed on-site pump; and
- (c) the fire brigade pumping appliances can add pressure to the inlet (or suction side) of the pump when boosting the fire hydrant system.

In relation to Item (a), with the suction side of the fixed on-site pump being located downstream of the boost inlets whenever a fire brigade pumping appliance boosts the system, the pressure available on the inlet side of the fixed on-site pump will increase. As such, where a pump is installed in series with a fire brigade booster assembly to ensure that an attack fire hydrant is not unintentionally over-pressurized, a 150mm diameter pressure gauge is to be provided at the fire brigade booster assembly. The provision of the pressure gauge allows the pressure within the fire hydrant system to be monitored by the attending fire brigade and ensure that not less than 700 kPa is provided at the most hydraulically disadvantaged fire hydrant. A warning sign is also required to be provided to warn the attending fire brigade of this design arrangement.

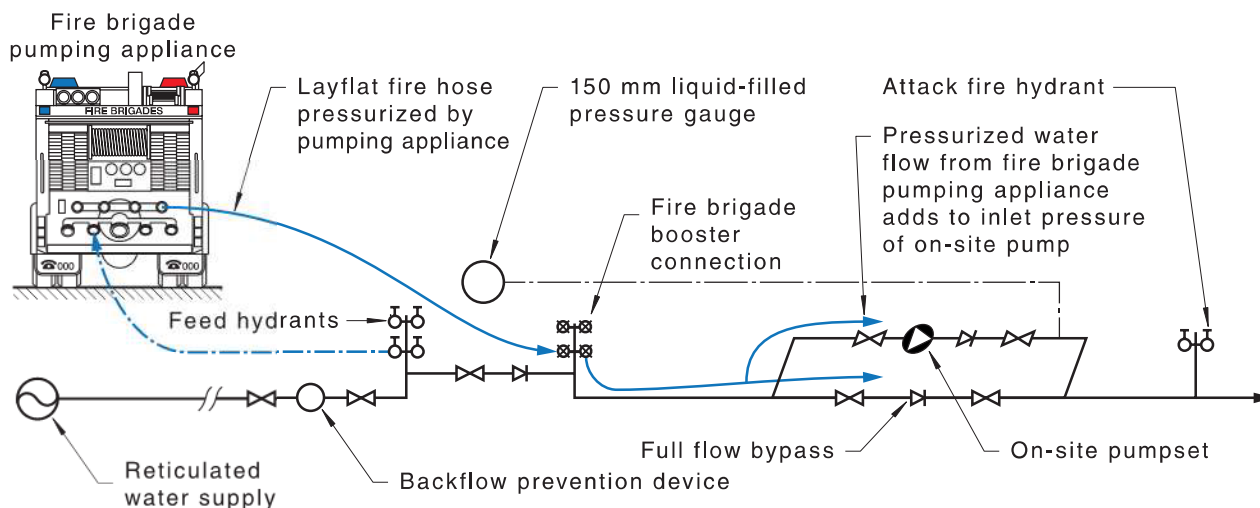


Figure N.7 — Fire hydrant pump in series with fire brigade booster assembly

N.8 Ring main design

N.8.1 Application

[Clause 8.6](#) specifies the types of buildings where the fire hydrant system is required to incorporate ring mains.

[Clause 8.7](#) details the locations where an isolating valve is required to be installed. The locations listed include where a ring main, a pressure-reducing valve station, an on-site tank, or a fire brigade booster assembly is installed.

While the provisions of [Clauses 8.6](#) and [8.7](#) detail the buildings that require a ring main to be installed, where a building other than those detailed in [Clauses 8.6](#) and [8.7](#) is identified as having an increased risk profile, consideration should be given to the inclusion of a ring main. The provision of a ring main in a fire hydrant system design provides an additional layer of redundancy to the system design.

N.8.2 Buildings more than 25 m and multi-tower developments

[Figure N.8.2](#) shows a ring main serving a multi-tower development. This figure highlights that the horizontal and vertical ring mains are interconnected to meet the requirements of [Clause 8.6.1](#). For a development such as this, a horizontal ring main provides supply to all towers of the development while the vertical ring mains extend this supply to all towers of the development having an effective height more than 25 m. It is also recommended that in these types of development a ring main is provided to serve in any other tower where two or more fire isolated stairs are provided.

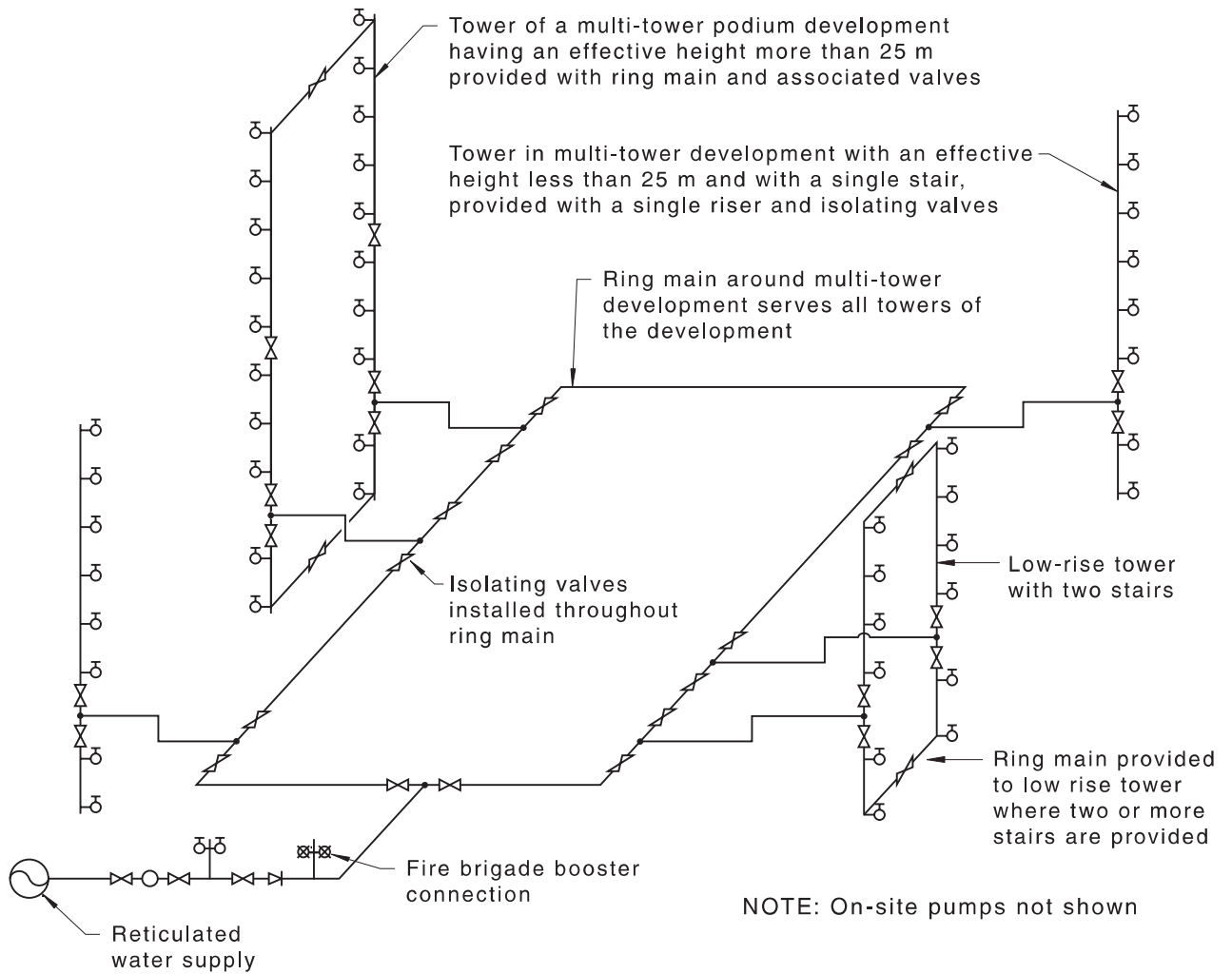


Figure N.8.2 — Ring main valving in a multi-tower development

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N.8.3 Large isolated buildings

[Figure N.8.3\(A\)](#) provides an example of a ring main serving a large isolated building in accordance with the isolating valve requirements.

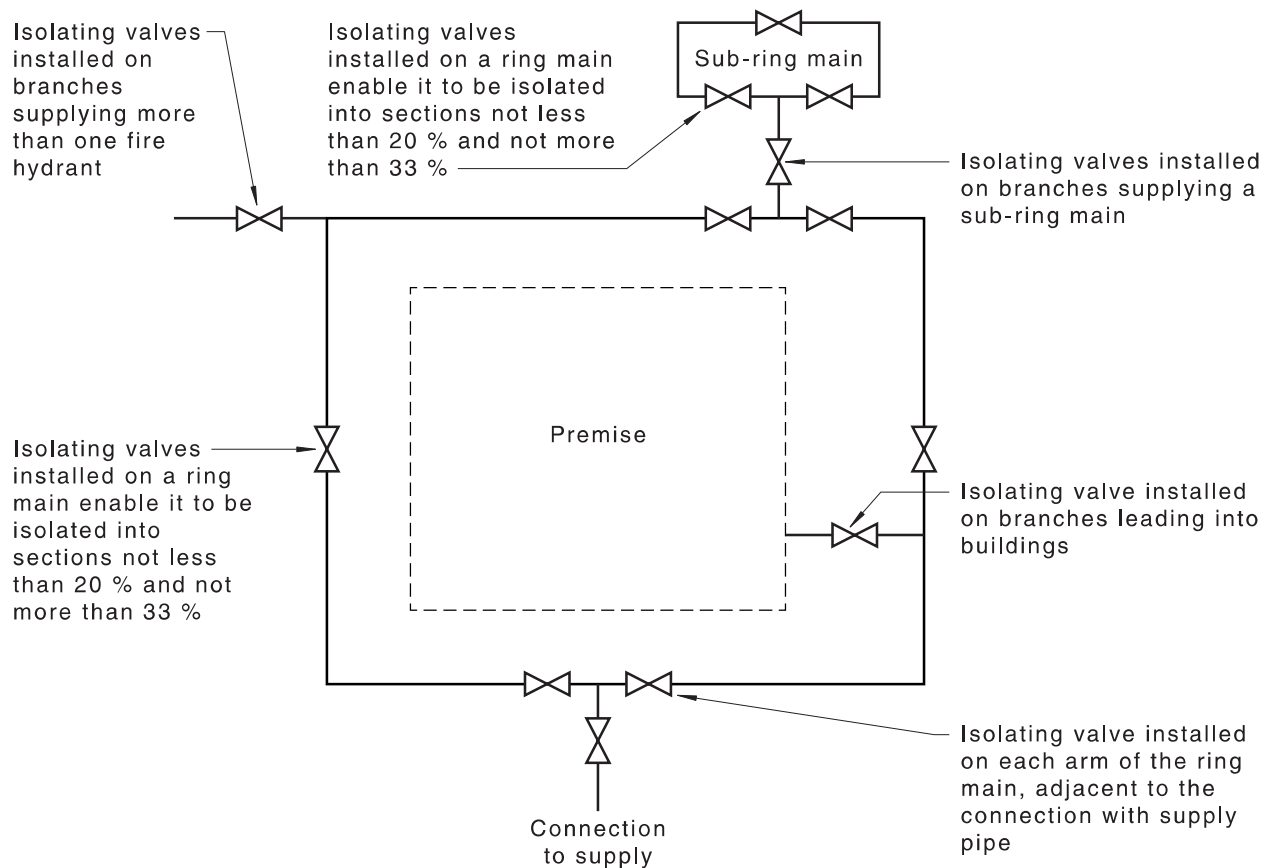


Figure N.8.3(A) — Ring main valving around a large isolated building

Where a ring main is installed around a large isolated building, it is recommended that the ring main be installed below ground to protect it from structural damage. Where this design approach is adopted, a key-operated sluice valve, such as that shown in [Figure N.8.3\(B\)](#), would typically be installed. For more information on sluice valves, see [Clause 9.3.2.2](#).

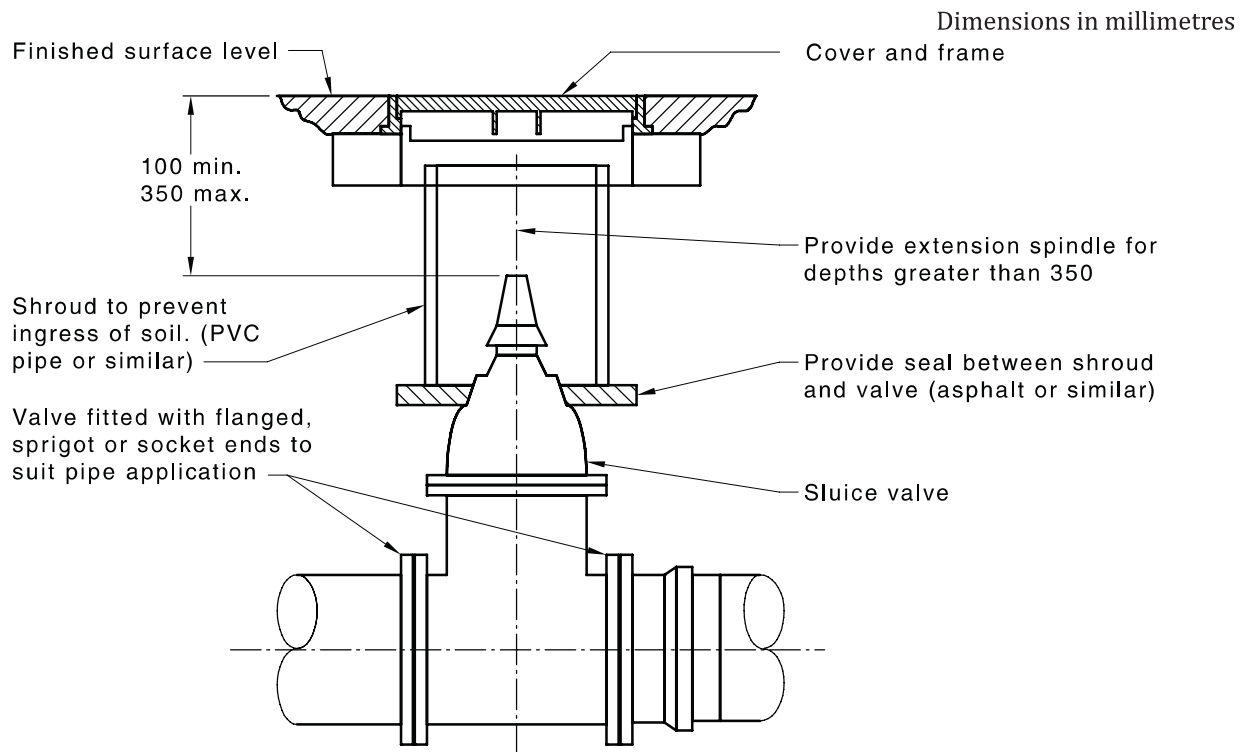


Figure N.8.3(B) — Typical key-operated sluice valve (in-ground)

N.9 Test facility

N.9.1 General

[Clause 8.10.1](#) clarifies when a permanent test facility is required. The clause indicates that where a low rise building has a rise of storeys less than two, a permanent test facility is not required provided testing can be undertaken safely and all test water can be disposed of into the building's drainage system. In all other cases, a permanent test facility and associated drainage is required.

Requirements for flow capacity and scissor stairs are also detailed.

In relation to flow capacity, [Clause 8.10.1](#) indicates that the test facility provided is to be capable of flowing and draining not less than 130 % of the required firefighting flow. For example, where a fire hydrant system design has a design flow rate of 30 L/s, the test facility should be capable of flowing and draining not less than 39 L/s.

In relation to the location of the test facility, [Clause 8.10.1](#) indicates that where multiple stairs are provided the test facility and drainage need only be provided in the stair in which the most hydraulically disadvantaged fire hydrant is located. This will mean that if the fire hydrant system demand exceeds 10 L/s, additional hose connections will be required on lower floors. Where a scissor stair is provided, the descending pipework serving the test facility is permitted to alternate between stairs as it descends, see [Figure N.9.1](#).

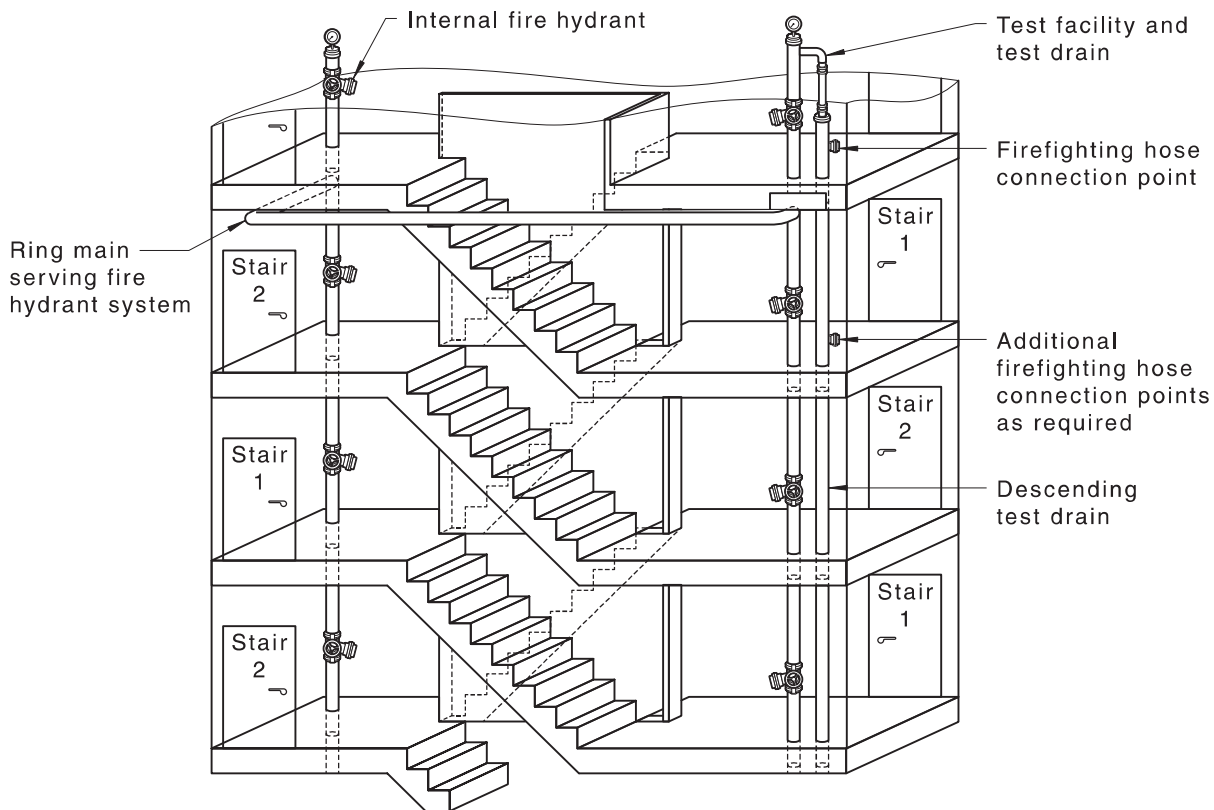


Figure N.9.1 — Typical test facility located within a scissor stair

N.9.2 General

[Clause 8.10.2](#) specifies the items that are to be provided at a test facility.

[Figure N.9.2](#) provides an example of a typical test facility. Items shown include:

- (a) A flow test tube (or annubar) that allows for a differential flow sensing element to be fitted.
- (b) Valving to allow for the isolation of the flow test tube and the connection, disconnection and operation of test gauges and flow sensing elements.
- (c) A permanent test drain.
- (d) Permanently connected hose fittings in the test drain that allow for the fire hydrant valve to be directly connected to this fitting through the use of firefighting hose.

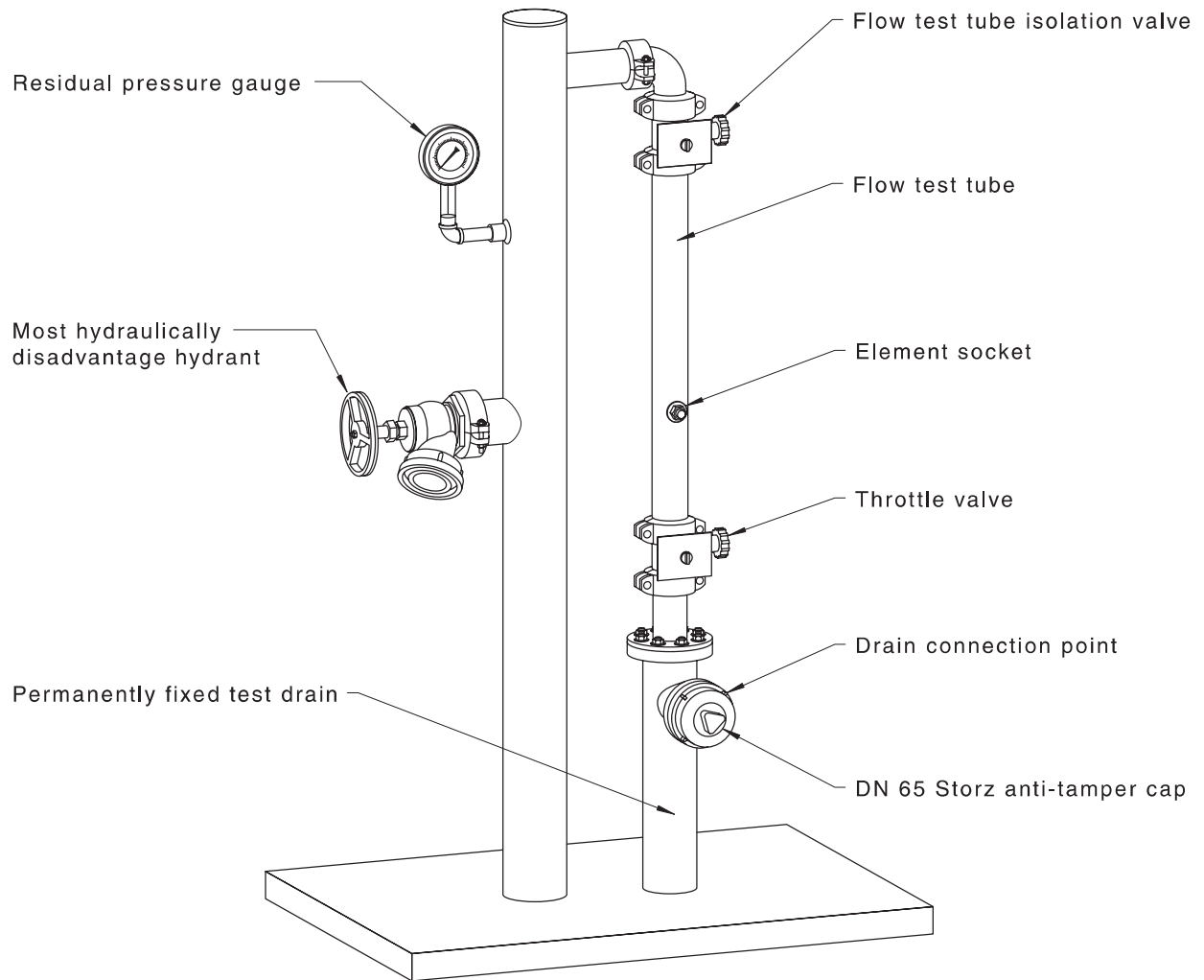


Figure N.9.2 — Typical Flow Test Facility

N.9.2.1 Flow test tube

The flow test tube diameter should be chosen to ensure that commonly available flow test elements can be used to measure the 130 % flow duty within the accurate range of the differential pressure gauge. At a 130 % flow duty the differential pressure should be not less than 3 inches of mercury (approximately 10 kPa).

Differential flow elements can measure flow very accurately but in order to do so, consistent laminar non turbulent flow conditions are necessary. In order to maximize consistent laminar flow past the flow sensing element, the flow test tube should —

- (a) be fabricated from a single-piece AS 1074 steel pipe without any fittings, changes of direction or significant internal flow disturbances other than pipe weld seams or roll grooving features. The internal pipe diameter should be in accordance with flow sensing element data sheets and flow charts.
- (b) have a DN 15 BSP steel socket welded not less than 9 internal pipe diameters downstream of the pipe inlet and 4 internal pipe diameters upstream of the pipe outlet, see [Figure N.9.2.1](#).
- (c) for flow test tube diameters of DN 100 or larger, have a second DN 15 BSP socket welded on the immediately opposing side of the pipe such that longer supported style elements can be used, see [Figure N.9.2.1](#).

- (d) have the hole for the element socket drilled to the full internal diameter of the DN 15 welded socket to ensure the element can be properly inserted without obstruction.

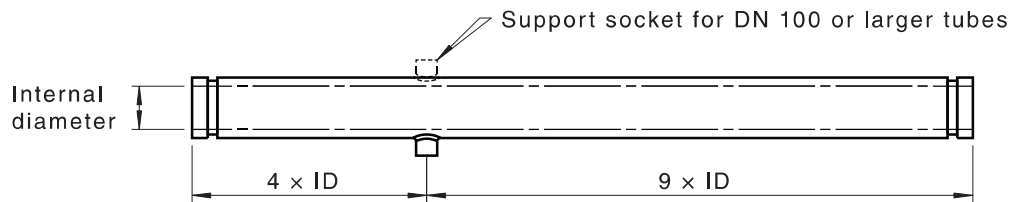


Figure N.9.2.1 — Flow test tube dimensions

N.9.2.2 Permanently connected hose fittings

A maximum flow rate of 12.5 L/s may be assigned to each hose fitting. For flow rates more than 12.5 L/s, additional hose fittings should be provided to the test drain on subsequent lower levels.

N.9.3 Permanent test facility drainage

[Clause 8.10.3](#) specifies the drainage requirements for a permanent test facility. As the drainage provided will in almost all instances have to accommodate flow volumes of 10 L/s, 20 L/s or 30 L/s at a pressure of not less than 700 kPa, the drainage pipework provided should be fit for purpose and capable of accommodating the flow and pressure. The inappropriate selection of material or pipe size may result in pipe failure or overflow resulting in water damage to the building. In relation to the pipes used for the test drain, the requirements of [Section 9](#) apply.

The flow and pressure from the permanent test facility drainage should be coordinated with the building services responsible for disposing of wastewater at the discharge location.

N.9.4 Reduced-capacity tanks test facility

[Clause 8.10.4](#) specifies the items that must be provided where a reduced-capacity tank has been installed so that the automatic inflow rate can be measured.

A typical flow test facility arrangement is shown in [Figure N.9.4](#).

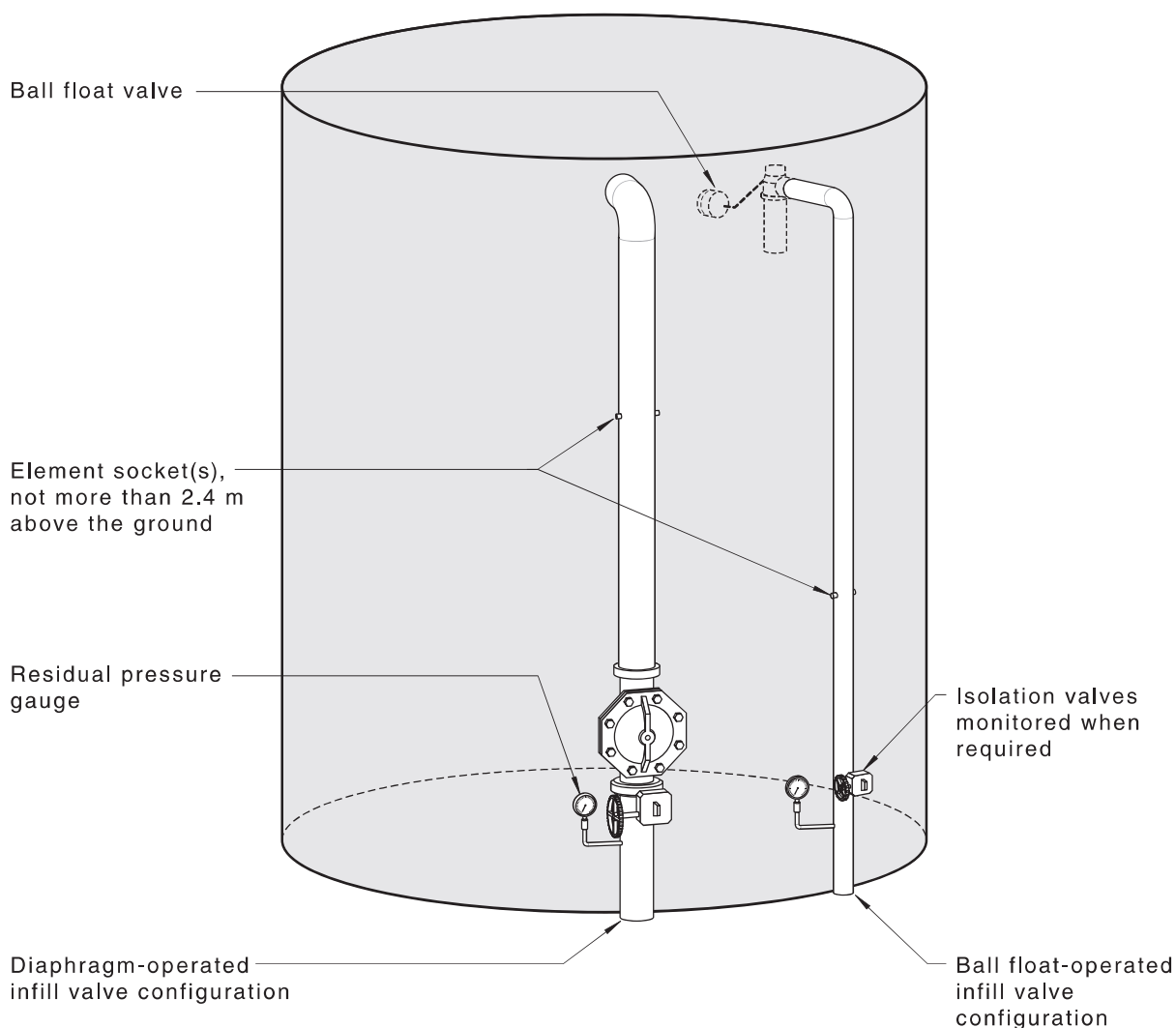


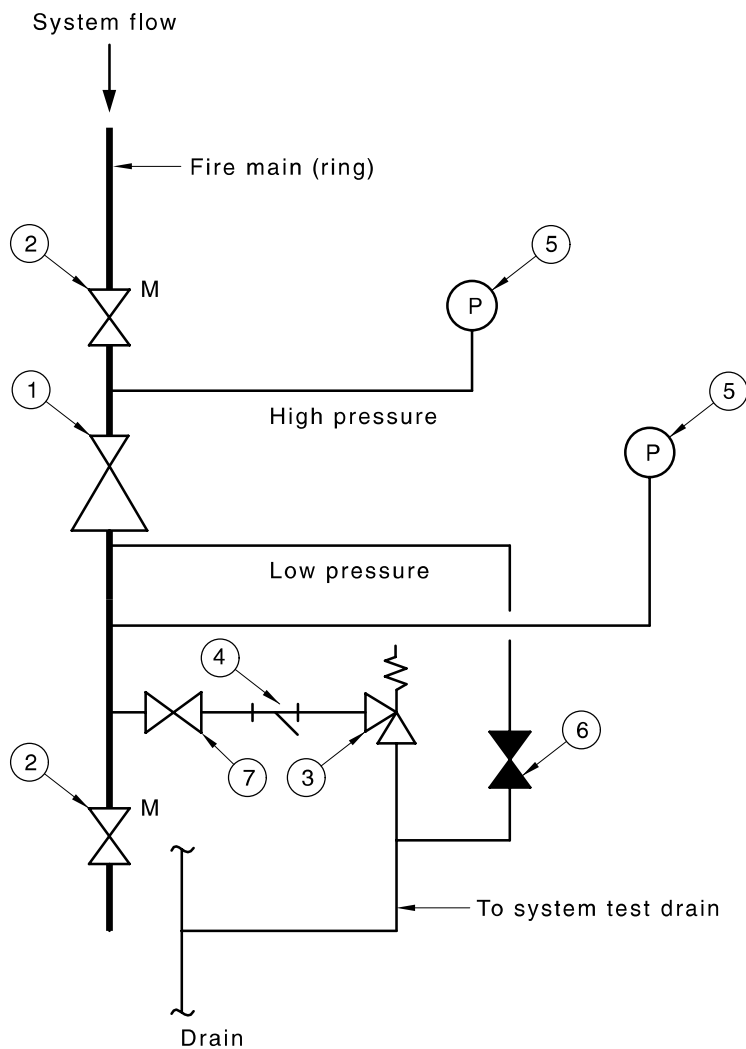
Figure N.9.4 — Reduced-capacity tank test flow test facility

N.10 Pressure-reducing valve station

[Clauses 8.13.2](#) and [8.13.4](#) specify the installation requirements for the use of a pressure-reducing valve station in a building using a bottom-up fire hydrant system design.

[Clauses 8.13.3](#) and [8.13.4](#) specify the installation requirements for the use of a pressure-reducing valve station in a building that uses a cascading fire hydrant system design.

[Figure N.10](#) shows a typical pressure-reduction station used in a cascade design.



Key

- 1 = Pressure-reducing valve (PRV)
- 2 = Monitored fire main isolation valves
- 3 = Pressure-relief valve (set above the operating pressure of the PRV)
- 4 = 'Y' type strainer
- 5 = Pressure gauge
- 6 = Test/drain valve — normally closed
- 7 = Isolation valve — normally open

Figure N.10 — Typical pressure-reducing valve station for use in a cascading fire hydrant system design

Appendix O (informative)

Facilities for testing on-site fire hydrant pumps

0.1 General

This appendix provides general guidance on the facilities required for testing fixed on-site fire pumps.

0.2 Facilities for testing

To reduce the applied pressure to each pressure sensor, appropriate facilities should be provided to simulate the condition of automatic starting at the required pressure.

A separate hydraulic circuit should be provided to each starting device. The separate hydraulic circuit may 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 should be fitted with an orifice plate to reduce the rate of pressure drop.

To facilitate testing and servicing —

- (a) each on-site fire pump should be permanently connected to a water supply with, preferably, the capability to be recirculated to an on-site storage or, if necessary, discharged to a drainage system;
- (b) an isolating valve should be fitted on the hydraulic connection;
- (c) a bypass and non-return valve, allowing flow towards the main, should be provided to ensure pump starting is not disabled if the isolating valve is inadvertently left closed; and
- (d) a pressure gauge, to indicate the pressure at which the pump starts, should be located between the isolating and drain valves so that it can be read during the pump starting test.

NOTE For additional information, refer to AS 2941.

Appendix P (informative)

Design guidance — Fire brigade booster assembly

P.1 Scope

This appendix provides guidance on the design principles of [Section 7](#).

P.2 General

[Clause 7.1](#) introduces some of the general design considerations applicable to a fire brigade booster assembly.

P.3 When a fire brigade booster assembly is required

[Clause 7.2](#) specifies when a fire brigade booster assembly is required in a fire hydrant system.

Each of the circumstances detailed represents a scenario where the inclusion of a fire brigade booster assembly in a fire hydrant system will increase the effectiveness of the attending fire brigade and will enhance the safety of firefighters and building occupants.

The requirement to provide a fire brigade booster assembly where more than two on-site fire hydrants, two street fire hydrants or a combination of these are required, is so that fire brigade resources can be more appropriately used during an incident. This requirement takes on special significance in regional and country areas where fire brigade resources are limited (e.g. only one or two pumping appliances are available) as it will enable these rural and country brigades to maximize the use of these limited resources

P.4 Location

P.4.1 Position

[Clause 7.3.1](#) specifies the locations for a fire brigade booster assembly.

The provisions of [Clause 7.3.1\(a\)](#) require a fire brigade booster assembly within or affixed to the facade of the building to be not more than 20 m from the principal pedestrian entrance. The inclusion of the limiting distance—

- (i) removes the previous ambiguity associated with the fire brigade booster assembly being located within sight of the main entrance to the building; and
- (ii) allows for the fire brigade booster assembly to be located adjacent to or nearby the principal pedestrian entrance for the building, if this is determined to be the most appropriate location to facilitate and support safe and effective fire brigade intervention activities.

In applying this provision, the location of the fire brigade booster assembly is linked to the facade of the building that includes the main (principal) pedestrian entrance for the building.

The provisions of [Clause 7.3.1\(b\)](#) allow for the fire brigade booster assembly to be located within the facade of the building but further than 20 m from the principal pedestrian entrance of the building provided the location of the fire brigade booster assembly is identified by a visual alarm device (i.e. red strobe). Where this design approach is applied, the fire brigade booster assembly should be located as

close as practicable to the corner of the building, as the corner is a readily identifiable building feature. Additionally, as the corner of the building represents a more structurally stable building feature than a wall, by locating the fire brigade booster assembly near the corner of a building, the risks to firefighters required to use the booster may be mitigated by positioning the fire brigade pumping appliance remote from the front facade of the building, see [Figure P.4.1\(A\)](#).

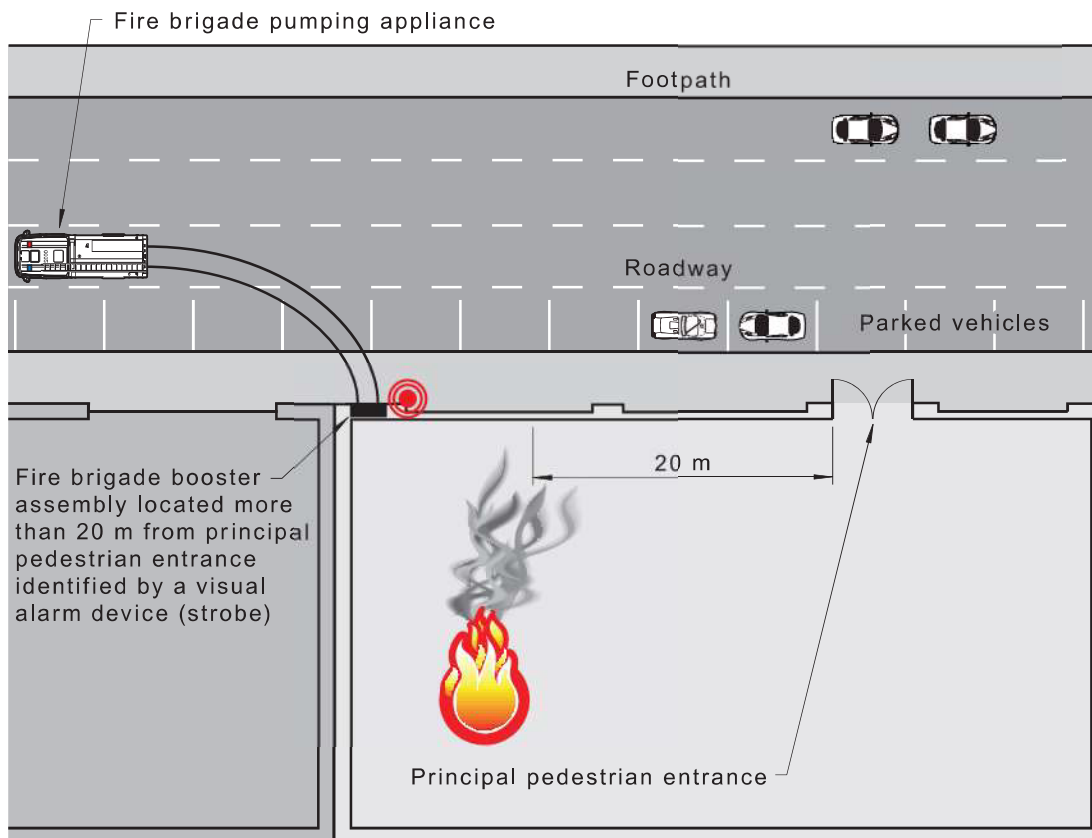


Figure P.4.1(A) — Fire brigade booster assembly location being identified by visual alarm device

The provisions of [Clause 7.3.1\(c\)\(i\)](#) allow for the fire brigade booster assembly to be located at the site boundary adjacent to the principal vehicle entrance. The principal vehicle entrance is the entrance that would lead the attending fire brigade to the principal pedestrian entrance for the building, see [Figure P.4.1\(B\)](#).

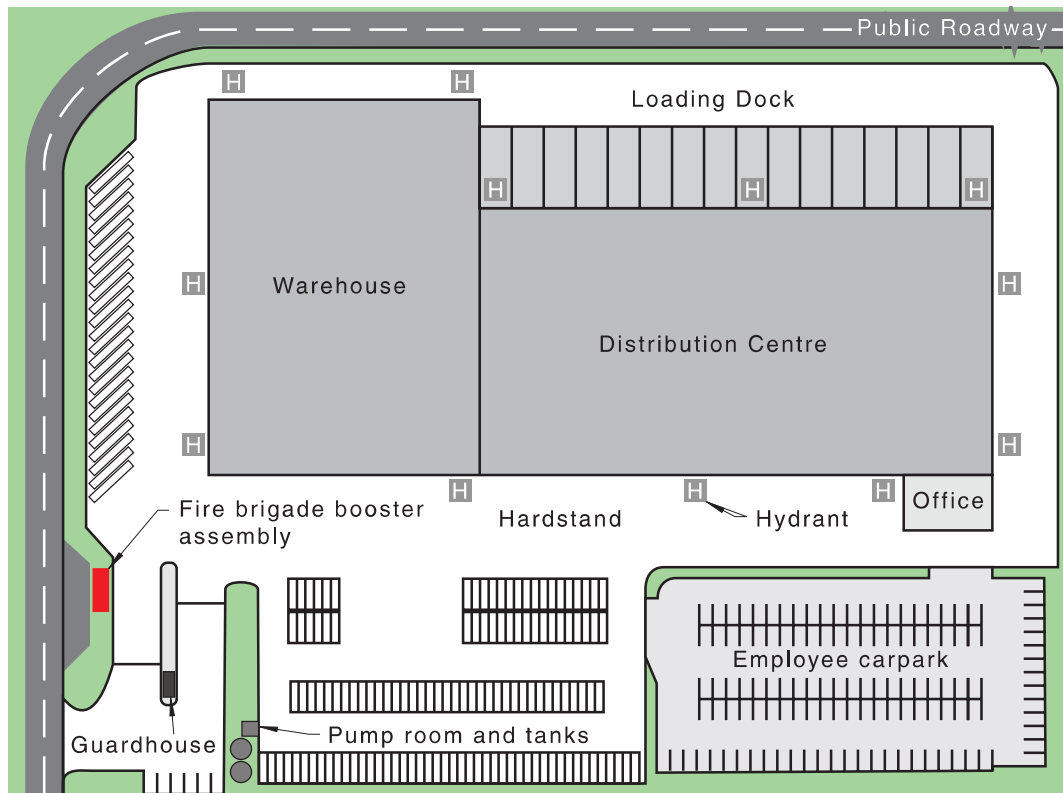


Figure P.4.1(B) — Fire brigade booster assembly location adjacent to the main vehicular entrance

Where the front of the building is served by a public road that leads to the front of the building and rear or side vehicle entrances are provided to a building's carpark or loading dock, the public road is considered to be the principal vehicle entrance because from this point the attending fire brigade can gain access to the principal pedestrian entrance. As such, a fire brigade booster assembly proposed to be located at either the side or rear vehicular accesses to the building does not conform to this clause. [Clause 7.3.1\(c\)\(ii\)](#) allows for the fire brigade booster assembly to be located less than 20 m from the facade of the building containing the principal pedestrian entrance and less than 20 m from this entrance, see [Figure P.4.1\(C\)](#).

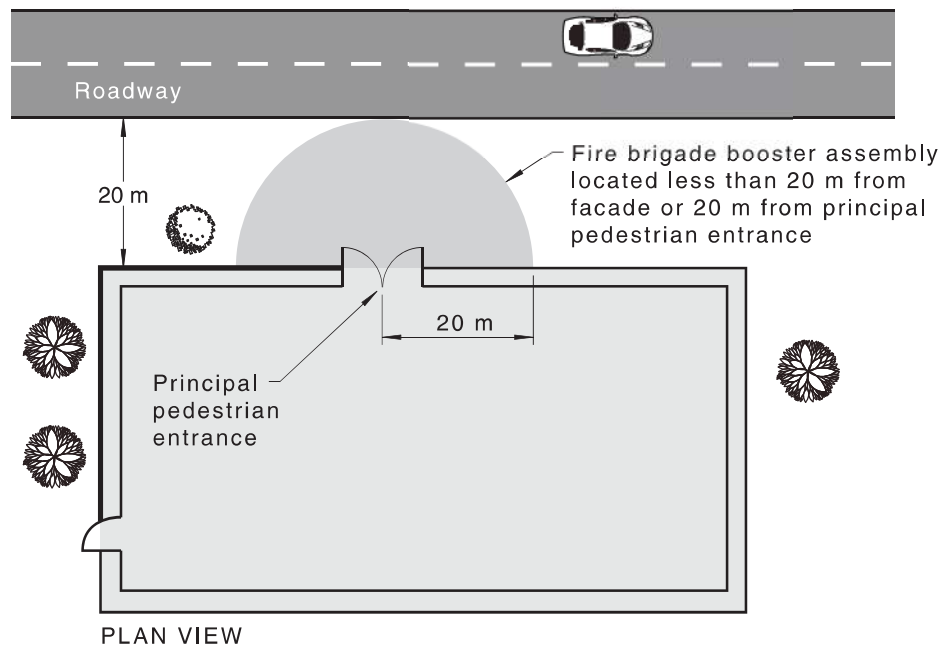


Figure P.4.1(C) — Fire brigade booster assembly located not more than 20 m from the main pedestrian entrance

P.4.2 Fire brigade booster assembly location considerations

While [Clause 7.3.1](#) provides four options for the position of a fire brigade booster assembly, the options are not all equally suited for the range of buildings and circumstances found within the built environment. Safe Work Australia suggests that the five principles of safe design are as follows:

- (a) Principle 1: Persons with control—those who make decisions affecting the design of products, facilities or processes are able to promote health and safety at the source.
- (b) Principle 2: Product lifecycle—safe design applies to every stage in the lifecycle from conception through to disposal. It involves eliminating hazards or minimising risks as early in the lifecycle as possible.
- (c) Principle 3: Systematic risk management—apply hazard identification, risk assessment and risk control processes to achieve safe design.
- (d) Principle 4: Safe design knowledge and capability—should be either demonstrated or acquired by those who control design.
- (e) Principle 5: Information transfer—effective communication and documentation of design and risk control information amongst everyone involved in the phases of the lifecycle is essential for the safe design approach.

NOTE Safe Work Australia is an Australian statutory body chartered with the development of policy relating to work health and safety.

As the location of a fire brigade booster assembly (and other infrastructure such as sprinkler boosters and the Fire Control Room (FCR)) define where the attending fire brigade will be operating from at a fire, the placement of a fire brigade booster assembly in an inappropriate location has the potential to place attending fire brigade crews in areas of unnecessary risk.

On a fireground, the fire brigade's incident command is chartered with identifying all the risks present and to develop strategies to mitigate those risks. along with the risks that a fire brings — heat, smoke, and flame — the major concerns typically for the incident command are structural collapse, electricity,

and the presence of dangerous goods, such as LPG and natural gas. To address these risks the typical risk mitigation strategies are distance (separation), isolation, and cooling.

Where structural collapse is possible, exclusion zones of not less than 1.5 times the height of the building are established. For example, when considering this risk at a fire involving a large isolated building having a height of 16 m, an exclusion zone of not less than 24 m would be established.

Where electricity is present, isolation of the whole or part of the building will be sought, if circumstances allow for this to be undertaken. For example, at a high-rise building fire the isolation of the electrical supply to the whole building is unlikely to be practical. Isolation of that section of the building involved in fire though will be considered.

Where dangerous goods are present, isolation of the goods and the use of cooling hose streams are generally the approach taken.

In determining the location of a fire brigade booster assembly (and other fire brigade infrastructure such as a sprinkler booster or FCR), to facilitate safe and effective firefighting, a comprehensive risk assessment of the building and its contents, not dissimilar to that applied by a fire brigade incident command, should be undertaken. Where risks of structural collapse (or things falling on fire fighters), electricity or dangerous goods are identified, the booster assembly should be located as remotely as practicable from these risks. Where separation distances more than 10 m are possible, they should be applied when considering the location of a fire brigade booster assembly.

The other key point in selecting a fire brigade booster assembly location is that it should be able to be readily identified and found by the attending fire brigade. Locating the fire brigade booster assembly adjacent to a path of travel or vehicular roadway that leads to the principal entry point to the building, identifying the location with a strobe, painting the fire brigade booster assembly signal red or ensuring it is clear of obstructions and vegetation all contribute to the booster assembly being able to be readily located by the attending fire brigade.

The examples in [Clause P.4.2.1](#) and [P.4.2.2](#) are intended to highlight the application of some of the provisions of [Clause 7.3.1](#).

P.4.2.1 Large isolated buildings

Where a large isolated building is provided with an area of free space for the circulation of vehicles, the parking of vehicles and/or the storage of goods, the fire brigade booster assembly should be located in accordance with [Clause 7.3.1\(c\)\(i\)](#). In this regard, the location should be more than 1.5 times the height of the building away from the building structure. As a general design rule, no booster assembly serving an LIB should be located within the likely collapse zone.

The fire brigade booster assembly should also be located as remotely as possible from the typical risks associated with the site. See [Figure P.4.2.1](#) for an example of this design approach.

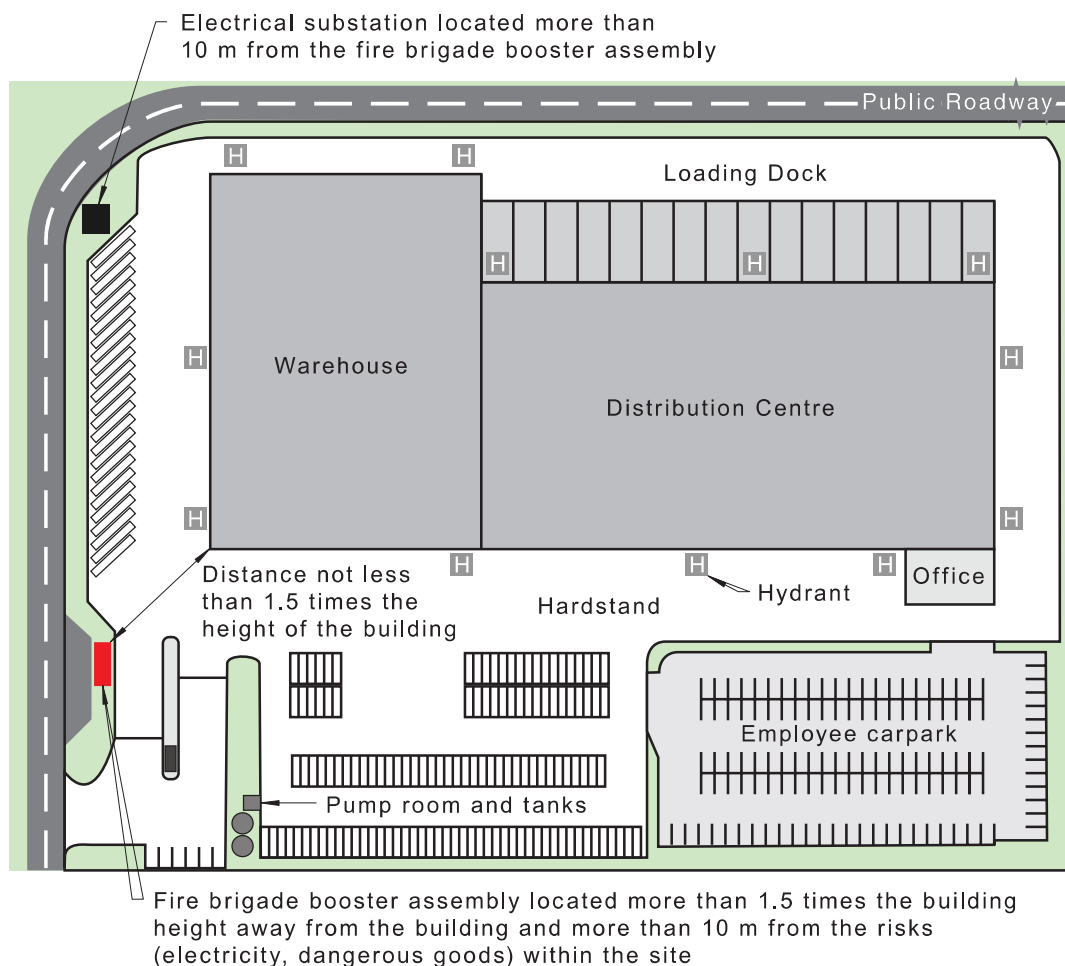


Figure P.4.2.1 — Fire brigade booster assembly serving a large isolated building

P.4.2.2 High-rise buildings in metropolitan areas

At a high-rise building in a metropolitan area in a street of high-rise buildings, the fire brigade booster assembly should be located in accordance with [Clause 7.3.1\(b\)](#). In determining the location within the facade of the building, it should be located as closely as possible to the corner of the building and as remotely as possible from any risks identified on the ground floor. As high-rise buildings bring with them the risk of things falling from above (e.g. windows, facade materials), a booster assembly located at the corner of the building allows for the fire brigade pumping appliance to be positioned as remotely as possible from the facade of the building. Depending on the streetscape, the adjoining buildings may also provide protection from things falling from above. See [Figure P.4.2.2](#) for an example of this design approach.

Before locating a fire brigade pumping appliance at a fire (see [Figure P.4.2.2](#)), a comprehensive risk assessment will have been carried out by the fire brigade's incident command.

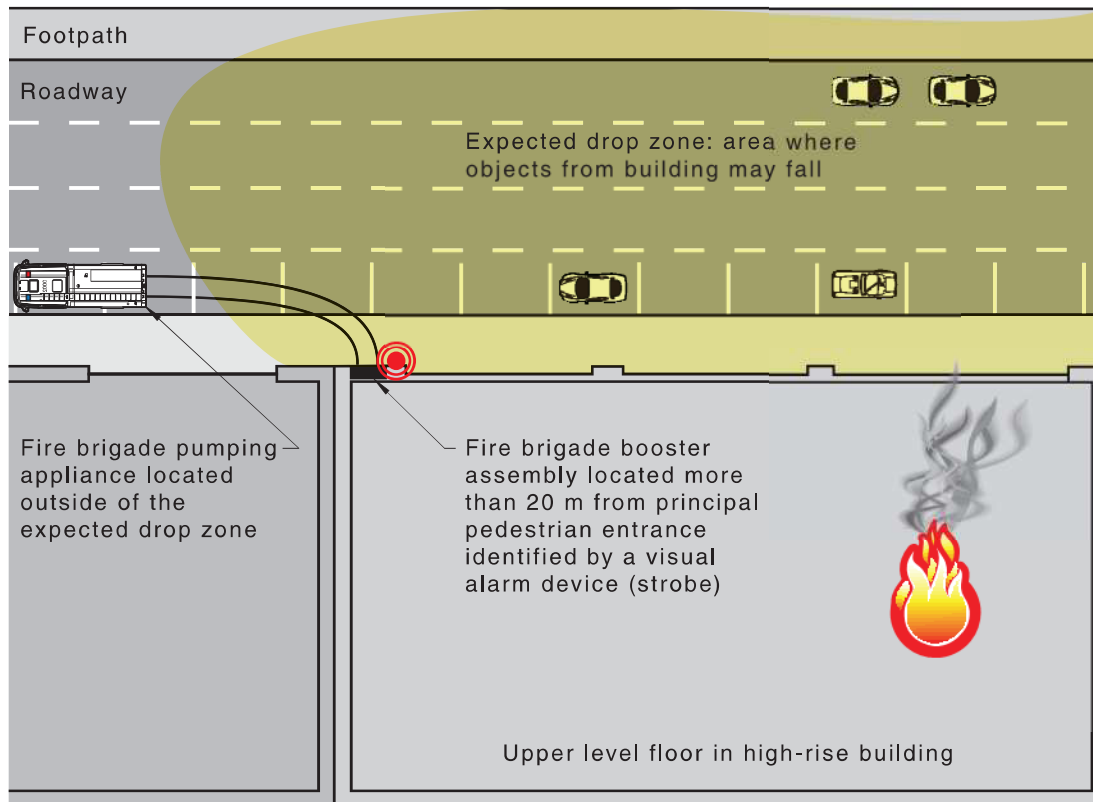


Figure P.4.2.2 — Fire brigade booster assembly serving a high-rise building

P.4.2.3 Summary — Fire brigade booster assembly position and location

Although this appendix is unable to detail the application of the provisions of [Clause 7.3.1](#) for all buildings and circumstances, the examples and preceding text are intended to highlight the following —

- (a) The location of a fire brigade booster assembly and other fire brigade infrastructure items such as fire control rooms, control and indicating equipment have a direct impact on the safety of firefighters attending a fire in the building. Safety in design principles should therefore always be applied when considering the location of the fire brigade booster assembly.
- (b) The location of any fire brigade booster assembly should consider all the risks within the building and be as remote as possible from the risks associated with the building or site.
- (c) The fire brigade booster assembly should be able to be viewed upon approach to the main pedestrian entry of the building

P.4.3 Visual alarm device

[Clause 7.3.2](#) specifies the requirements for the use of a visual alarm device (VAD) (red strobe) when a fire brigade booster assembly is located within or affixed to the facade of the building and more than 20 m from the principal pedestrian entrance.

The key requirement for the use of a VAD is that the building is protected throughout by a smoke detection and alarm system, a sprinkler system, or a combination of both. Where these active systems are not installed throughout the building, the fire brigade booster assembly should be located in accordance with [Clause 7.3.1\(a\) or \(c\)](#).

P.4.4 Accessibility, clearance and protection

[Clause 7.3.3](#) ensures the fire brigade booster assembly is located in a position remote from risk and is provided with clearances that will allow the attending fire brigade to access and use the booster.

[Clause 7.3.3\(a\) to \(h\)](#) detail the minimum access, separation, and protection requirements that may be applied to address the typical risks associated with a building when locating a fire brigade booster assembly. The provisions should not be considered to be the maximum distance a fire brigade booster assembly can be located from a risk or that they safely address all risks in all instances.

Where a building or site is characterized by a risk not detailed in the prescribed list, the design approach should be to locate the fire brigade booster assembly as far as possible from the risk or to protect it.

NOTE: For more information on the protection of risks, see [Clause 7.6](#).

P.4.5 Multiple buildings located on a site

[Clause 7.3.4](#) provides two possible design solutions where multiple buildings are located on a site. These are as follows:

- (a) Locate multiple fire brigade boosters throughout the site where required by [Clause 7.2](#); or
- (b) Locate a single fire brigade booster adjacent to the principal vehicular access point for the site that the attending fire brigade would use in making their way to the main pedestrian entrance to the building.

In developing a fire hydrant system design, the nature of the buildings on the site and the activities undertaken should be considered. For example, at a large hazardous materials complex where a major conflagration is a possibility, a single or multiple fire brigade booster assemblies located at the main entrance to the site would most likely be the most appropriate design solution. This location would in most instances appropriately separate the fire brigade booster assembly or assemblies from the risk associated with the site.

On the other hand, at a large hospital site with multiple buildings all carrying significant life risk, a fire brigade booster assembly at each of the hospital buildings, required by [Clause 7.2](#) to have a booster assembly, would most likely be the most appropriate design solution. Other developments considered appropriate to this design approach would include university campuses or residential precincts.

Notwithstanding this information, where multiple buildings are located on a single site, the attending fire brigade should be consulted to determine the design solution most appropriate for the fire brigade and the resources it has available.

P.5 Fire hydrant booster design and arrangement

P.5.1 General

[Clause 7.5.1](#) specifies the general design requirements applicable to the fire brigade booster assembly configurations detailed in [Section 7](#).

The requirements detailed are intended to ensure that the most appropriate fire brigade booster configuration will be provided and that the attending fire brigade can safely and efficiently connect to and operate the fire brigade booster assembly.

P.5.2 I-pattern fire brigade booster assemblies

[Clause 7.5.5](#) specifies the design requirements for an I pattern fire brigade booster assembly.

In relation to [Clause 7.5.5\(a\)](#), the I-pattern fire brigade booster assembly has been developed for situations where the booster assembly is to be located within or affixed to the facade of the building and the facade is of limited width or limited space is available. Where space is not limited and the building

design allows for the use of an H-pattern fire brigade booster assembly or “tank model” fire brigade booster assembly, either of these configurations should be installed.

The limiting of an I-pattern fire brigade booster assembly to locations within or affixed to the external wall of the building ensures that where a fire brigade booster assembly is installed remote from the external wall of a building, the preferred design option of either an H-pattern or “in-line” fire brigade booster assembly is used.

P.6 Protection of fire brigade booster assemblies

P.6.1 Sprinkler protected buildings

Under the provisions of [Clause 7.6.1](#), where a sprinkler system is installed throughout a building in accordance with AS 2118.1, AS 2118.4 AS 2118.6, FPAA101D or FPAA101H, [Clauses 7.6.2](#) or [7.6.3](#) do not apply to the fire brigade booster assembly.

The concession provided by [Clause 7.6.1](#) that allows for the fire brigade booster assembly to not be protected by a wall having an FRL recognizes the life safety benefits a sprinkler system provides to building occupants and the attending fire brigade.

P.6.2 Non-sprinkler-protected buildings — Passive protection requirements

[Clause 7.6.2](#) specifies the level of protection required for a fire brigade booster assembly where a sprinkler system is not installed throughout the building.

In relation to [Clause 7.6.2\(a\)](#), where a fire brigade booster assembly is within or affixed to the external wall of a building, the protection provided to the booster assembly may be provided by the intrinsic characteristics of the building or by the provision of a freestanding wall that has the required FRL and dimensions, see [Figure P.6.2\(A\)](#).

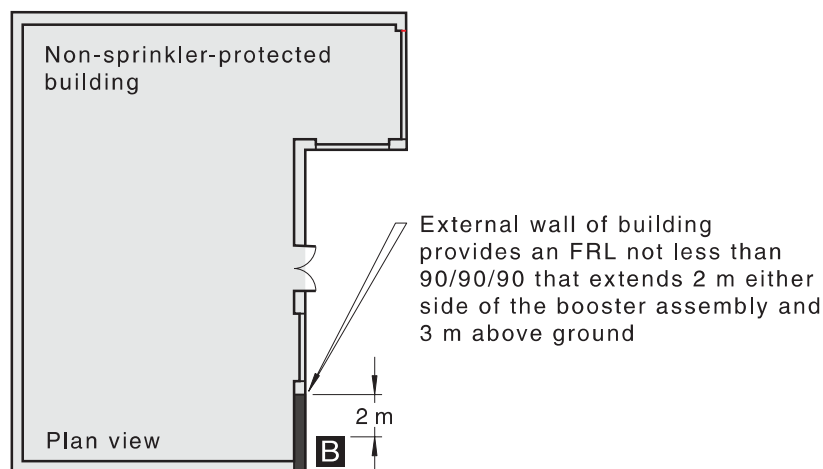


Figure P.6.2(A) — Fire brigade booster assembly provided protection by the external wall of the building

In relation to [Clause 7.6.2\(b\)](#), where a fire brigade booster assembly is not more than 3.5 m from the external wall of a building, the booster assembly may be protected by the intrinsic characteristics of the building or by the provision of a freestanding wall that has the required FRL and dimensions, see [Figure P.6.2\(B\)](#).

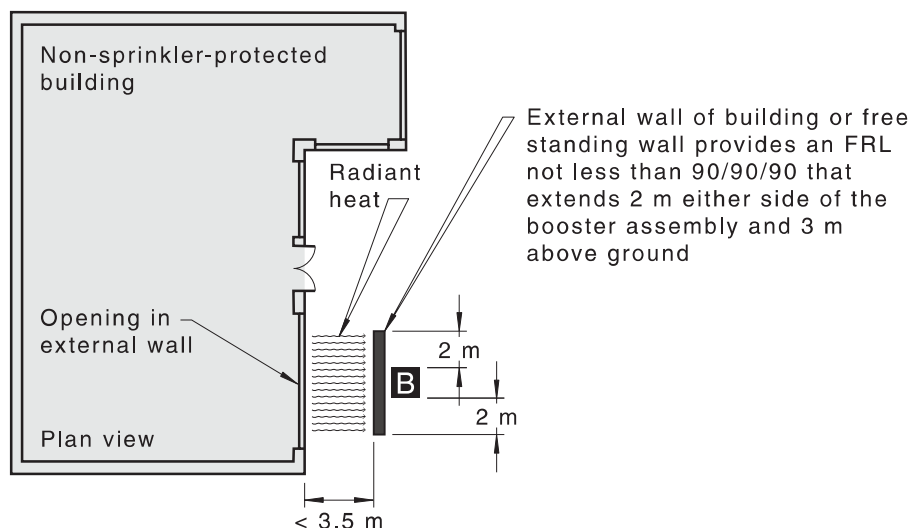


Figure P.6.2(B) — Fire brigade booster assembly provided protection by a free-standing wall located less than 3.5 m from the external wall of the building

In relation to [Clause 7.6.2\(c\)](#), where a fire brigade booster assembly is located between 3.5 m and 10 m from the external wall of the building, a freestanding wall of the prescribed dimensions and FRL is required immediately behind the booster assembly, see [Figure P.6.2\(C\)](#).

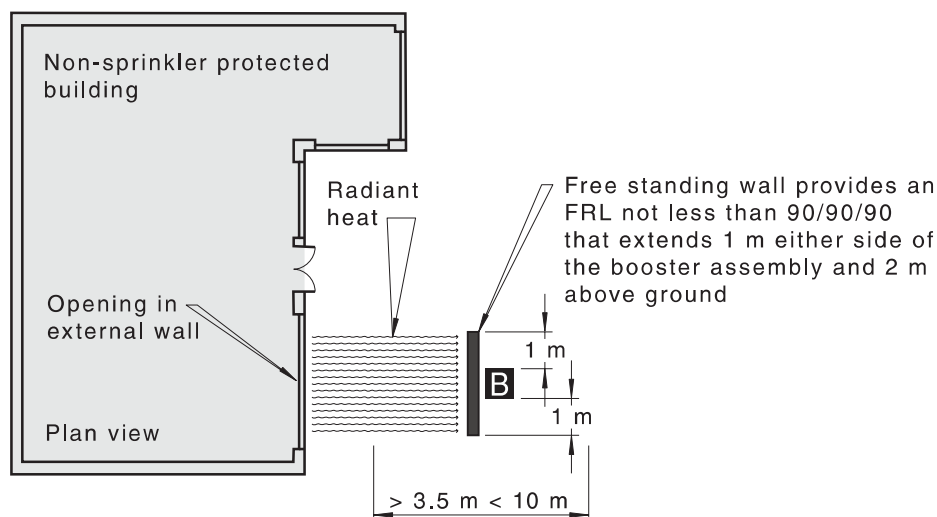


Figure P.6.2(C) — Fire brigade booster assembly provided protection by a freestanding wall located more than 3.5 m and less than 10 m from the building

The requirement to provide the protecting wall immediately behind the fire brigade booster ensures that both the fire brigade booster assembly and the attending fire brigade are protected from, among other things, the effects of radiant heat. [Figure P.6.2\(D\)](#) shows the decreasing height of protection to a fire brigade booster assembly detailed in this clause.

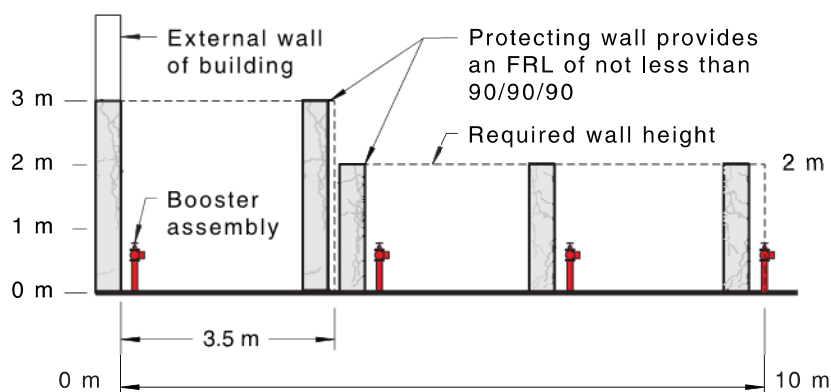


Figure P.6.2(D) — Heights of fire brigade booster assembly protection in a building not sprinkler-protected throughout

In relation to the protection requirements of [Clause 7.6.2](#), where a fire brigade booster assembly is installed in a cabinet, the cabinet may provide part or all of the protection required, if it has the required dimensions and FRL.

P.6.3 Non-sprinkler-protected buildings — Passive and active protection requirements

[Clause 7.6.3](#) specifies an alternative approach to the protection of a fire brigade booster assembly serving a non-sprinkler protected building from those detailed in [Clause 7.6.2](#).

For a non-sprinkler-protected building, the provisions of [Clause 7.6.2](#) need not be applied if all requirements of [Clause 7.6.3](#) are adopted.

In relation to the normative provisions detailed, the requirement to limit the size of the fire compartment to 500 m² is aimed at limiting the size of fire that may occur immediately adjacent to the fire brigade booster assembly. The requirement to protect any opening in the facade of this fire compartment is intended to ensure that the required FRL of $-/60/60$ is maintained and to limit the effects of radiant heat on the fire brigade booster assembly should a fire occur within the fire compartment.

NOTE Refer to the NCC for more information on the FRL requirements of a fire wall.

The design intent of this set of provisions was to provide a design option that could be applied to non-sprinkler protected buildings having a limited street frontage. To facilitate fire brigade intervention activities though architects, builders and hydraulic consultants considering using this approach as part of a fire hydrant system design should endeavour to make the fire compartment protecting the fire brigade booster assembly as small as possible as this will limit the fuel load within this space. Through limiting the fuel load the risks to the attending fire brigade are reduced.

[Figure P.6.3](#) depicts the application of the design principles detailed in [Clause 7.6.3](#). In particular, it highlights that —

- the fire compartment is bounded by fire walls constructed to comply with the requirements of the NCC;
- the fire compartment has a total floor area less than 500 m²;
- the facade of the fire compartment has an FRL not less than $-/60/60$;
- the fire brigade booster assembly is located not less than 2m from the nearest adjoining fire compartment.

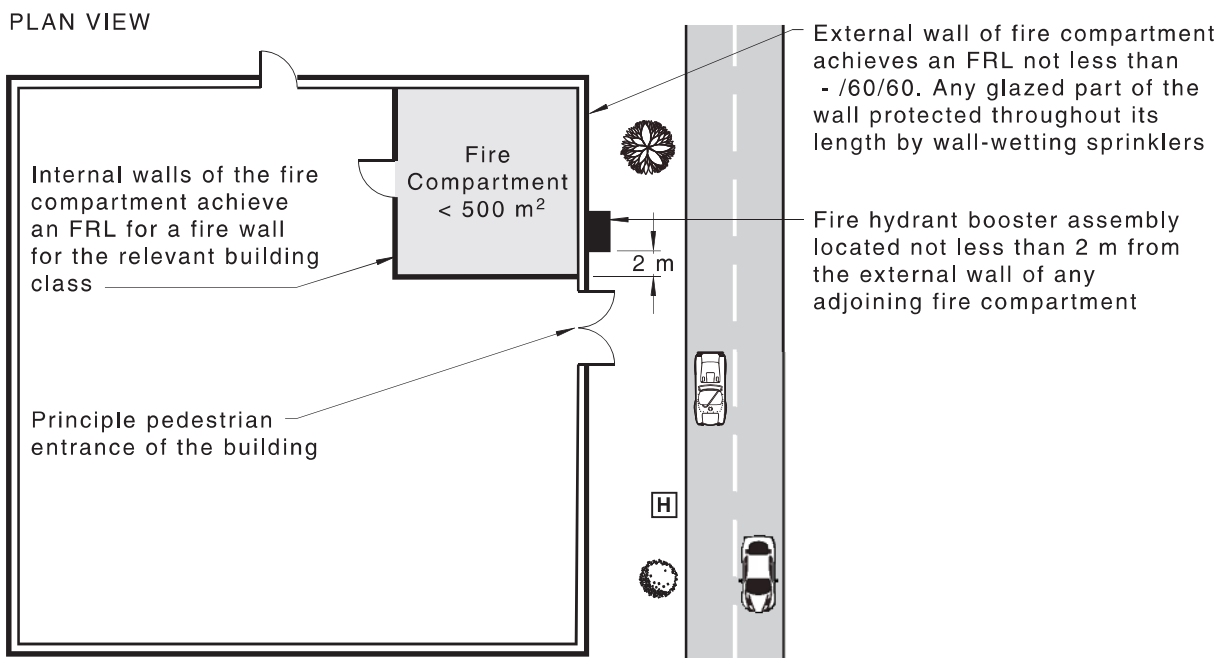


Figure P.6.3 — Fire brigade booster assembly protected by a fire compartment

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Appendix Q (informative)

Fire hose couplings used in Australia

Q.1 Scope

This appendix provides information on the types of fire hose couplings used by fire brigades throughout Australia. Fittings installed to fire hydrant valve outlets, fire brigade booster connection inlets, and large- and small-bore suction connections on a fire hydrant system should be compatible with the fire hose couplings used by each fire brigade.

Q.2 Fire hose couplings

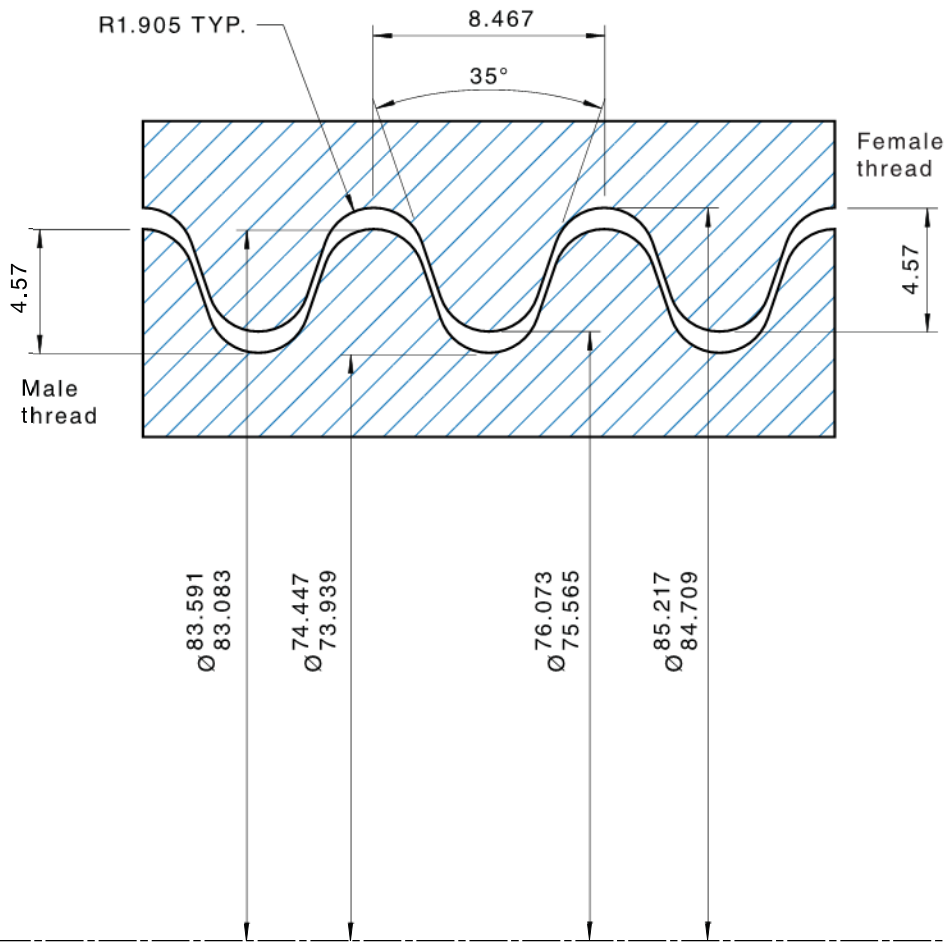
The following hose coupling types are in use in Australia:

Area	Fire brigade	Description
ACT	Australian Capital Territory Fire and Rescue	Storz hermaphrodite to AS 2419.4 (STORZ)
NT	Northern Territory Fire and Rescue Service	British instantaneous to BS 336 (BIC)
NSW	Fire and Rescue New South Wales	Storz hermaphrodite to AS 2419.4 (STORZ)
NSW	NSW Rural Fire Service	Storz hermaphrodite to AS 2419.4 (STORZ)
Qld	Queensland Fire and Emergency Service	Queensland Round Thread (QRT)
SA	South Australian Country Fire Service	Storz hermaphrodite to AS 2419.4 (STORZ)
SA	South Australian Metropolitan Fire Service	South Australian Round Thread (SART)
Tas.	Tasmania Fire Service	Storz hermaphrodite to AS 2419.4 (STORZ)
Vic.	Fire Rescue Victoria	Storz hermaphrodite to AS 2419.4 (STORZ)
Vic.	Country Fire Authority	63 mm × 8.47 mm pitch (CFA)
WA	Western Australia Department of Fire and Emergency Services	British instantaneous to BS 336 (BIC)

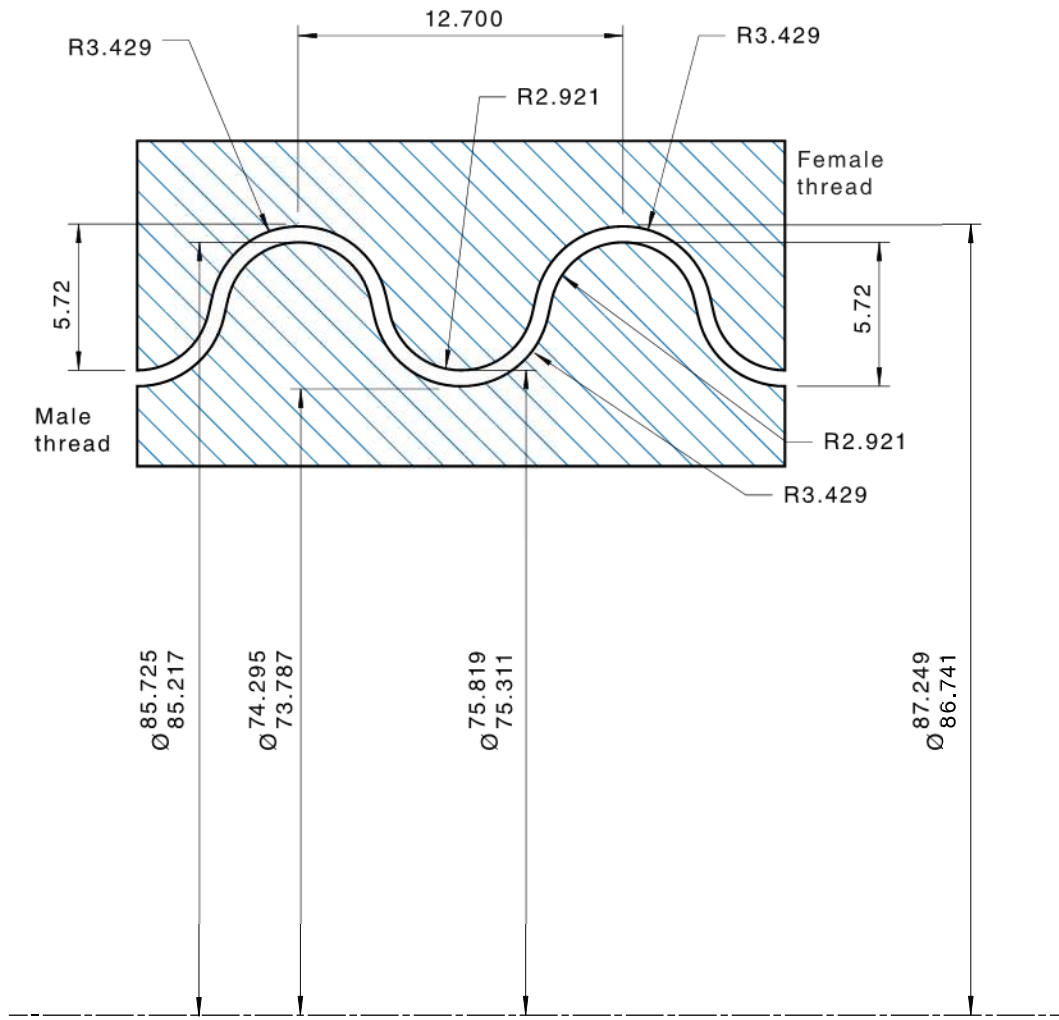
NOTE For more information, refer to AS 2419.3.

Q.3 Fire hose coupling threads

Dimensional details for fire hose coupling threads are shown in [Figures Q.3](#) (a), and (b).



(a) CFA 63 × 8.47 pitch



(b) Queensland round thread

Figure Q.3 — Dimension of typical coupling thread

Appendix R (informative)

Corrosion protection

Fire hydrant systems operate in a range of environments. Externally, the system can be exposed to environments ranging from normal atmospheric conditions to extreme ones, for example, pipework located in highly corrosive enclosed industrial environments or buried in aggressive soils. Internally, the systems are exposed to water that can have a variety of chemistries and microbiological conditions. Exposed systems above ground and inside buildings are generally based on metallic pipe systems, while buried sections, such as ring mains, may use metallic or plastics pipe systems.

In terms of corrosion, in the context of this document, plastics pipe systems are not subject to damage from corrosion from either the effects of the water internally or, where buried, the impact of corrosive soil.

The commonly used metallic pipe systems vary considerably in terms of their corrosion resistance, and therefore this appendix has been included to broadly address the corrosion issue. The commonly used metallic pipe systems include galvanized steel, copper, stainless steel and ductile iron. All of these materials will respond differently to specific internal and external environmental conditions. These pipe systems rely on quite different mechanisms to protect against corrosion. In the case of copper and stainless steel, it is the oxide that forms on the surface of the material; for galvanized steel, it is the sacrificial zinc-based layer that protects the steel; and for ductile iron, a variety of coating systems are employed (paint systems, polyethylene coating and/or internal cement mortar lining).

[Tables R.1](#), [R.2](#) and [R.3](#) provide a general guide to the types of external environments and water chemistries that are acceptable and of concern for commonly used pipe systems. Where known corrosive environments exist, expert advice should be sought on protective measures to be employed. In some cases, additional corrosion protection, such as a suitable coating system or cathodic protection, may allow the pipe system to be installed in a corrosive environment.

Table R.1 — Pipe external environments — Buried

Material	Non-corrosive buried environments	Corrosive buried environments
Ductile iron — Cement lined, externally protected with polyethylene sleeving or polymeric coating	Well-drained and well-aerated soils	Installations below the groundwater table Intertidal zones Anaerobic soils Soils high in chlorides (e.g. beach sands or desert soils) Soils with low resistivity Soils with low pH
Galvanized steel	Only for very well-drained and well-aerated soils such as river sands	Clays or clayey soils Installations below the groundwater table Intertidal zones Anaerobic soils Soils high in chlorides (e.g. beach sands or desert soils) Soils with low resistivity Soils with low pH

Table R.1 (continued)

Material	Non-corrosive buried environments	Corrosive buried environments
Stainless steel	Well-drained and well-aerated soils	Anaerobic soils Dependent on the grade of the stainless, soils high in chlorides may be of concern
Copper	Well-drained and well-aerated soils	Anaerobic soils Soils or backfills containing high sulfur contents (e.g. fly ash) Soils with low pH
Plastics	Practically all soils	Soils heavily contaminated with hydrocarbons or solvents

Table R.2 — Pipe external environments — Above-ground or inside buildings

Material	Non-corrosive external environments	Corrosive external environments
Ductile iron — Externally coated		Dependent on coating system and coating condition
Galvanized steel		Marine environments exposed to salt spray Corrosive industrial atmospheres (e.g. with low pH condensate)
Stainless steel		Dependent on the grade of the stainless steel, environments high in chlorides may be of concern
Copper		Corrosive industrial atmospheres (e.g. with low pH condensate)

Table R.3 — Pipe internal water chemistries

Material	Non-corrosive water chemistries	Corrosive internal water chemistries
Ductile iron cement mortar lined	Drinking and Class A recycled water	Chemically “soft” water Low pH water Waters containing high CO ₂ levels (e.g. some bore waters)
Galvanized steel	Drinking and Class A recycled water	Waters with high levels of specific microbiological activity Seawater or water high in chlorides Water with low pH
Stainless steel	Most water chemistries including drinking and Class A recycled, bore and seawater	Dependent on the grade of stainless steel elevated chloride content may be of concern
Copper	Most water chemistries including drinking and Class A recycled, bore and sea water	Waters with high levels of specific microbiological activity Waters with low pH
Plastics	All water chemistries	—

NOTE Where a reticulated water supply serves as the primary water supply for a fire hydrant system, the Plumbing Code of Australia requires a fire service to be isolated from a drinking water supply by an appropriate backflow prevention device to mitigate cross-connection hazards. The selection of pipe material as per this table therefore not only ensures the longevity of the fire hydrant system but also reduces the potential for cross-connection risks.

Appendix S (normative)

Commissioning — Hydrostatic test procedures

S.1 General

This appendix details the hydrostatic pressure tests required to substantiate the integrity of the installed fire hydrant system in accordance with the provisions of this document.

Where polyethylene (PE) pipe has been installed in a fire hydrant system, hydrostatic testing shall conform to the general test procedure in AS/NZS 2033.

The hydrostatic pressures detailed in this section shall only be applied to pipework downstream of the network utility operators required backflow prevention arrangement.

Pipework upstream of the network utility operators' required backflow prevention device should be hydrostatically tested in accordance with AS/NZS 3500.1. The pressure test shall be conducted using two calibrated pressure gauges, minimum diameter of 100 mm with a range of 0–2 500 kPa, or less than twice the test pressure if the test pressure exceeds 2 500 kPa.

All test gauges shall have a current calibration certificate (not older than 12 months). They shall read within $\pm 1\%$ of the full-scale range of the gauge.

If any test fails, the cause is to be detected, rectified, retested, and repeated, if necessary, until all test criteria are met.:

Any visible or detectable leak shall be rectified.

NOTE 1 Pressure testing should not commence before the curing time for the concrete thrust blocks has elapsed.

NOTE 2 Joints in a buried pipeline may be left exposed for inspection during testing, provided backfilling has been placed over the pipe to prevent pipe movement when subjected to the required test pressure.

NOTE 3 The required test pressure should be monitored at the lowest part of the pipework or, if that is not possible, at another convenient point and the test pressure adjusted to take account of the elevation difference between the lowest part of the pipework and the test rig. The adjustment should be made by subtracting 10 kPa for every metre that the test rig is elevated above the lowest part of the fire main or pipeline.

NOTE 4 The test procedures in this appendix are suitable for all metal and plastic pipes and fittings.

S.2 Preparation

Before commencing any pressure test, the following preparations shall be undertaken:

- (a) Ensure the system is fully charged.
- (b) Ensure all trapped air is bled from the system and the system flushed to remove debris.
- (c) Ensure all fire hydrant valves are closed.
- (d) Ensure all isolating valves are open within the fire hydrant system or pressure zone.
- (e) Ensure that all fire hose reel stop valves are closed, in cases where the fire hose reels are connected to the fire hydrant system.

NOTE The requirement to close the fire hose reel stop valve is to ensure the fire hose reel does not become pressurized during the hydrostatic test.

S.3 Procedure

The procedure shall be as follows:

- (a) Pressurize the fire hydrant system to 100 kPa above the system’s normal static pressure.
- (b) While maintaining the pressure, check for leaks and the functionality of the non-return valves or backflow prevention device.
- (c) Pressurize the fire hydrant system to the required test pressure and perform the appropriate test according to this Appendix. During this period, check for leaks and any unacceptable movement of the system supports (e.g. any pipe support or thrust block movement).
- (d) On completion of the test, the fire hydrant system shall be returned to the normal static pressure and valves opened as appropriate.

NOTE The application of initial pressure [Item (a)], then the application of the full pressure [Item (c)] is to limit the effects of water escape should early failure of the pipework and/or its supports occur.

S.4 Fire hydrant systems incorporating feed fire hydrants only

S.4.1 Test 1 — All joints are accessible for inspection for the duration of the test

S.4.1.1 General

This test shall be applied where a fire hydrant system incorporates feed fire hydrants only.

S.4.1.2 Acceptance criteria

No evidence of leakage shall be detected when the fire hydrant system is pressurized to 1 700 kPa at the elevation of the highest fire hydrant for a period of not less than 30 min.

S.4.1.3 Preparation and procedure

The preparation and procedure for this test shall be in accordance with [Clauses S.2](#) and [S.3](#), respectively.

S.4.1.4 Reporting or results

The following results shall be reported for Test 1:

Tests parameters	Result
Duration of testminutes
Hydrostatic test pressurekPa
Evidence of leakage
Pass/Fail

S.4.2 Test 2 — All joints are not accessible for inspection

S.4.2.1 General

This test shall be applied where a fire hydrant system incorporates feed fire hydrants only.

S.4.2.2 Acceptance criteria

No evidence of leakage shall be detected when the fire hydrant system is pressurized to 1 700 kPa at the elevation of the highest fire hydrant for a period of not less than 2 h.

S.4.2.3 Preparation and procedure

The preparation and procedure for this test shall be in accordance with [Clauses S.2](#) and [S.3](#) respectively.

S.4.2.4 Reporting of results

The maximum allowable make-up water usage during the test shall be in accordance with [Clause S.6](#).

NOTE Every 15 min, the make-up water required to restore the test pressure should be measured and recorded. Additionally, during this period, checks for leaks and the integrity of the system supports (e.g. any pipe or thrust block movement) should be undertaken.

The reporting of results shall be in accordance with [Clause S.7](#).

S.5 Fire hydrant systems incorporating attack fire hydrants

S.5.1 Test 3 — Buildings less than 50 m in height

S.5.1.1 General

This test shall be applied where a fire hydrant system is installed in a building having an effective height less than 50 m.

S.5.1.2 Acceptance criteria

No evidence of leakage shall be detected when the fire hydrant system is subjected, for a period of not less than 2 h, to a hydrostatic test pressure that results in not less than 1 700 kPa at the fire brigade booster assembly, or 1 300 kPa at the most hydraulically disadvantaged fire hydrant in the system. The test pressure selected shall be that which results in the highest test pressure at the fire brigade booster assembly or within the system.

S.5.1.3 Preparation and procedure

The preparation and procedure for this test shall be in accordance with [Clauses S.2](#) and [S.3](#) respectively.

S.5.1.4 Reporting of results

The maximum allowable make-up water usage during the test shall be in accordance with [Clause S.6](#).

NOTE Every 15 min, the make-up water required to restore the test pressure should be measured and recorded. Additionally, during this period, checks for leaks and the integrity of the system supports (e.g. any pipe or thrust block movement) should be undertaken.

The reporting of results shall be in accordance with [Clause S.7](#).

S.5.2 Test 4 — Buildings more than 50 m in height

S.5.2.1 General

This test shall be applied where a fire hydrant system is installed in a building having an effective height more than 50 m.

S.5.2.2 Acceptance criteria

No evidence of leakage shall be detected when the fire hydrant system is subjected, for a period of not less than 2 h, to a hydrostatic test pressure that results in not less than 1 300 kPa at the hydraulically most disadvantaged fire hydrant in the pressure zone, or subjects the system to 1.25 times the maximum static pressure in the pressure zone and/or any associated rising pipework. The test pressure selected shall be that which results in the higher test pressure at the fire brigade booster assembly or within the system.

S.5.2.3 Preparation and procedure

The preparation and procedure for this test shall be in accordance with [Clause S.2](#) and [S.3](#) respectively.

S.5.2.4 Reporting of results

The maximum allowable make-up water usage during the test shall be in accordance with [Clause S.6](#).

NOTE Every 15 min., the make-up water required to restore the test pressure should be measured and recorded. Additionally, during this period, checks for leaks and the integrity of the system supports (e.g. any pipe or thrust block movement) should be undertaken.

The reporting of results shall be in accordance with [Clause S.7](#).

S.6 Allowable make-up water usage during testing

The maximum allowable make-up water that may be used during hydrostatic testing to maintain the pressures in Tests 2, 3 or 4 shall be determined in accordance with the following equation:

$$Q \leq 0.14 \times L \times D \times H \quad \text{S.6}$$

where

Q = maximum allowable make-up water, in litres per hour

L = length of the test section, in kilometres

D = nominal diameter of the test section, in metres

H = average test head over the length of the test section, in metres

NOTE The allowable make-up water is not a leakage allowance but an allowance to cover the effects of the test head forcing small quantities of entrapped air into solution and/or expansion of pipework or fitting.

S.7 Reporting of results

The results in [Table S.7](#) shall be reported for Tests 2, 3 and 4.

Table S.7 — Sample hydrostatic test report

Tests parameters	Result		
Effective height of building		m	
Effective height of the pressure zone		m	
Fire hydrant booster assembly installed		Yes/No	
Test procedure in accordance with Clauses S.4.1, S.4.2, S.5.1 or S.5.2 , as appropriate			
Make-up water usage and hydrostatic pressure at the location of the test rig	15 min	kPa	L
NOTE: To be recorded at 15 min intervals.	30 min	kPa	L
	45 min	kPa	L
	60 min	kPa	L
	75 min	kPa	L
	90 min	kPa	L
	105 min	kPa	L
	120 min	kPa	L
Hydrostatic pressure at the location of the most hydraulically disadvantaged fire hydrant outlet	15 min	kPa	
NB: To be recorded at 15 min intervals.	30 min	kPa	
	45 min	kPa	
	60 min	kPa	
	75 min	kPa	
	90 min	kPa	
	105 min	kPa	
	120 min	kPa	
Make-up water usage for the test period		L	
Duration of the test		min/h	
		L	
Calculate allowable make-up water in accordance with Q(Calculated)			
Pass / Fail: Q(Allowable) is more than Q(Actual)			
Test is in accordance with Clauses S.4.1, S.4.2, S.5.1 or S.5.2 , as appropriate		Yes/No	

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Appendix T (normative)

Commissioning — Flow and pressure performance testing

T.1 General

This appendix sets out the flow and pressure performance testing requirements for fire hydrant systems incorporating feed fire hydrants only and fire hydrant systems incorporating a fire brigade booster assembly and feed/attack fire hydrants or attack fire hydrants.

The preparation requirements are applicable to all flow and pressure performance testing procedures.

T.2 Purpose

The purpose of the pressure and flow performance tests detailed is to confirm —

- (a) the presence of water throughout the installed fire hydrant system;
- (b) that the installed fire hydrant system performs as designed with respect to the hydraulic parameters of [Section 2](#) including flow, pressure, and friction loss;
- (c) the performance of any installed on-site hydrant pumpsets, with respect to the requirements of [Section 2](#) including flow and pressure; and
- (d) the performance of any installed automatic pressure maintenance pump (i.e. jockey pump).

T.3 Preparation

Before commencing any of the performance tests, the following preparations shall be undertaken:

- (a) Ensure the system is fully charged.
- (b) Ensure all trapped air is bled from the system and the system flushed to remove debris.
- (c) Ensure all fire hydrant valves are closed.
- (d) Ensure all isolating valves are open within the fire hydrant system or pressure zone.
- (e) Ensure appropriate provision has been made for the disposal or recycling of water during testing.

T.4 Test 1 — Presence of water

T.4.1 Procedure

Every fire hydrant of the fire hydrant system shall be individually opened, and the presence of water confirmed.

T.4.2 Reporting of results

The presence of water shall be reported, as follows:

- (a) FH 1 — (Yes/No).

- (b) FH 2 — (Yes/No).
- (c) FH “X” — (Yes/No).

T.5 Test 2 — Static pressure — Attack fire hydrants

T.5.1 Acceptance criteria

Where an on-site pump is installed, the static pressure recorded at any fire hydrant at no flow with the fixed on-site pump running shall not exceed 1 300 kPa in accordance with [Clause 2.3.2](#).

T.5.2 Procedure

Where an on-site pump is installed, the following static test procedure shall apply:

- (a) At the connection point of the fire hydrant system to a reticulated water supply or an on-site tank, determine the maximum available supply residual pressure at no flow in the fire hydrant system.
- (b) At street level, use the available water supply or establish a separate water supply, connect an appropriate test apparatus, and record the static pressure with no flow at this point.

NOTE The separate water supply is to provide the expected maximum pressure the system will be subjected to upstream of the on-site fire hydrant pump.
- (c) At the most hydraulically advantaged fire hydrant, located downstream of the non-return valves of pumps serving each pressure zone, connect an appropriate test apparatus and record the static pressure with no flow at this point for a period of not less than 30 s.
- (d) Add the difference between the pressures in Item (a) and Item (b) to the pressure measured in Item (c). Compare to the pressure limit of 1 300 kPa.

T.5.3 Reporting of results

The following results shall be reported:

Test parameter	Result, kPa
Maximum supply residual pressure	
Static pressure recorded at reticulated water supply or tank	
Static pressure recorded at the most hydraulically advantaged fire hydrant	
Adjusted maximum test pressure [Item (c) + Item (a) - Item (b)]	

T.6 Test 3 — Unassisted feed or attack fire hydrant flow and pressure performance

T.6.1 Acceptance criteria

Where a reticulated water supply, an elevated water storage tank, or private reservoir serves as the primary water supply and provides the unassisted pressure and flow to the feed fire hydrants, attack/feed fire hydrants or attack fire hydrants for a fire hydrant system, the fire hydrants required to flow shall each deliver the minimum pressure and flow specified in [Table 2.2.6\(A\)](#) for feed fire hydrants and attack/feed fire hydrants and [Table 2.2.6\(B\)](#) for attack fire hydrants. The number of fire hydrants required to flow shall be as specified in [Table 2.2.5\(B\)](#) for buildings, [Table 2.2.5\(C\)](#) for open deck carparks or [Table 2.2.5\(D\)](#) for open yards.

T.6.2 Procedure

Where the feed, attack/feed or attack fire hydrants of a fire hydrant system are required to deliver the unassisted pressure and flow specified in [Table 2.2.6\(A\) or \(B\)](#), the following steps in the test procedure shall apply:

- (a) At the connection point of the fire hydrant system to a reticulated water supply or a high-level on-site tank, determine the minimum available supply residual pressure.
- (b) Connect an appropriate test apparatus at or near the connection point of the fire hydrant system pipework to the supply source and to the most hydraulically disadvantaged fire hydrants or test facility for each zone.
- (c) Discharge the required number of most hydraulically disadvantaged fire hydrant outlets or the equivalent simultaneous flow for the number of hydrants operating through the test facility.
- (d) Record the pressure at or near the connection point.
- (e) Record the pressure (kPa) and flow (L/s) at the most hydraulically disadvantaged fire hydrant outlets.
- (f) Compare the results obtained, or adjusted results as applicable, with the requirements specified in [Tables 2.2.6\(A\) and \(B\)](#).

T.6.3 Reporting of results

Where the recorded supply pressure is higher than the original design pressure, the recorded pressures shall be adjusted as specified in [Clause 12.4.2](#). The adjusted pressure shall be compared against minimum pressure requirements specified in [Table 2.2.6\(A\)](#) for feed and attack/feed fire hydrants and in [Table 2.2.6\(B\)](#) for attack fire hydrants.

The following results shall be reported:

Test parameter	Result
Number of fire hydrant outlets required to flow	
Feed fire hydrants pressure and flow	kPa L/s
Attack/feed fire hydrants pressure and flow	kPa L/s
Attack fire hydrants pressure and flow	kPa L/s
NOTE The pressure results, as applicable, should be adjusted in accordance with Appendix S .	

T.7 Test 4 — Fire brigade booster assembly

T.7.1 Acceptance criteria

Where a fire hydrant system incorporates a fire brigade booster assembly, the pressure and flow recorded at the required number of the most hydraulically disadvantaged fire hydrants, when boosted by a fire brigade pumping appliance or other suitable off-site pumping appliance, shall be as specified in [Table 12.4.3](#) for the duration of the test period.

T.7.2 Procedure

Where a fire hydrant system incorporates a fire brigade booster assembly, the following test procedure shall apply:

- (a) Isolate any on-site fire hydrant pumpsets.

- (b) Connect a fire brigade pumping appliance or other suitable off-site pumping appliance to the feed fire hydrants of the fire brigade booster assembly, or the suction outlet of the on-site tank, or make provision to draw from a static water supply.
- (c) Connect the fire brigade pumping appliance or other suitable off-site pumpset to the fire brigade booster connection inlets of the fire brigade booster assembly.
- (d) Connect an appropriate test apparatus to the most hydraulically disadvantaged fire hydrants or test facilities for each zone.
- (e) Discharge the required number of most hydraulically disadvantaged fire hydrants or the equivalent simultaneous flow for the number of hydrants operating through the test facilities in the zones served directly from the booster connection pipework.
- (f) Increase pressure in the fire hydrant system so that the required pressure at the most hydraulically disadvantaged fire hydrants is achieved.
- (g) With the required number of most hydraulically disadvantaged fire hydrants flowing fully, determine and record the following:
 - (i) The pressure on the inlet side of the fire brigade pumping appliance or other suitable off-site pumpset.
 - (ii) The pressure leaving the outlet side of the fire brigade pumping appliance or other suitable off-site pumpset.
 - (iii) The pressure entering the fire brigade booster connection inlets.
 - (iv) The pressure and flow at the most hydraulically disadvantaged fire hydrants.
 - (v) The total friction loss throughout the fire hydrant system.
- (h) Compare the results obtained with the requirements of [Section 2](#).

T.7.3 Reporting of results

The following results shall be reported:

Test parameter	Result
Pressure on the inlet side of pumping appliance	kPa
Pressure on the outlet side of pumping appliance	kPa
The boost pressure at the inlet of the fire brigade booster connection	kPa
Pressure and flow at the most hydraulically disadvantaged fire hydrants	kPa
Friction loss	kPa

T.8 Test 5 — Fixed on-site or full-duty fire hydrant pumpsets

T.8.1 Acceptance criteria

Where a fixed on-site half-duty fire hydrant pumpset is installed —

- (a) the pressure and flow recorded at the required number of most hydraulically disadvantaged fire hydrants in each pressure zone shall meet the minimum requirements as specified in [Table 2.2.6\(C\)](#), for the duration of the test period; and
- (b) the pump and driver shall operate at full flow for not less than 30 min.

Where a fixed on-site full-duty fire hydrant pumpset is installed —

- (i) the pressure and flow recorded at the required number of most hydraulically disadvantaged fire hydrants in each pressure zone shall meet the minimum requirements specified in [Table 2.2.6\(D\)](#), for the duration of the test period; and
- (ii) the pump and driver shall operate at full flow for not less than four hours through the recirculation of water into the high-rise water storage tank.

T.8.2 Procedure

The following steps in the test procedure shall apply:

- (a) Connect a test apparatus to the most hydraulically disadvantaged fire hydrants or test facilities for each zone.
- (b) Discharge the most hydraulically disadvantaged fire hydrant in each pressure zone until the first designated on-site pumpset operates.

NOTE 1 The pressure differential between pump activation and the required flowing pressure at the most hydraulically disadvantaged fire hydrant should not exceed 100 kPa.
- (c) Simultaneously record the pressure the on-site pumpset starts at and the pressure at the most hydraulically disadvantaged fire hydrant.
- (d) Close the most hydraulically disadvantaged fire hydrant.
- (e) Simultaneously record the static pressure on the discharge side of the on-site pumpset and at the most hydraulically disadvantaged fire hydrant.
- (f) Discharge the required number of most hydraulically disadvantaged fire hydrants or the equivalent simultaneous flow for the number of hydrants operating through the test facilities.
- (g) Record the flow and pressure at the most hydraulically disadvantaged fire hydrants or test facility.
- (h) Record the pressure on the suction side of the on-site pumpset (that is the water agency pressure available to the on-site pumpset) and the discharge side of the on-site pumpset.
- (i) Compare the results obtained with the requirements of [Section 2](#).

Where the fixed on-site pumpset is located in series with the fire brigade booster assembly, for each step, record —

- (i) the pressures at the 150 mm diameter pressure gauge located at the fire brigade booster assembly; and
- (ii) the pressures at the pressure gauge located at the fire brigade booster assembly.

Where duplicate or additional pumpsets are provided, the following test procedure shall apply:

- (A) Isolate the on-site hydrant pumpsets previously tested.
- (B) Repeat Steps (a) to (i) above.

NOTE The pressure differential between pump activation of any additional on-site pumpset or combination of pumpsets and the required flowing pressure recorded at the most hydraulically disadvantaged fire hydrant should not exceed 200 kPa.

T.8.3 Reporting of results

The following results shall be reported:

Test parameter	Result
Starting pressure of on-site pumpset	kPa
Pressure at most hydraulically disadvantaged fire hydrant when on-site pumpset starts	kPa
Static pressure on the discharge side of the pump upon closure of most hydraulically disadvantaged fire hydrant	kPa
Static pressure at most hydraulically disadvantaged fire hydrant upon closure of most hydraulically disadvantaged fire hydrant	kPa
Pressure on suction side of on-site pumpset while operating at full flow	L/s kPa
Pressure on discharge side of on-site pumpset while operating at full flow	L/s kPa
Flow and pressure at the most hydraulically disadvantaged fire hydrants when the on-site pumpset is operating at full flow	L/s kPa

T.9 Test 6 — Jockey pumps

T.9.1 Acceptance criteria

Testing shall confirm that start-up and shut-off will occur prior to the operation of any installed electric motor pumpset or the compression-ignition engine-driven pumpset and that a stable pressure is maintained within the fire hydrant installation.

NOTE For more information, refer to AS 2941.

T.9.2 Procedure

Where a fire hydrant system incorporates an on-site jockey pump to maintain a uniform or high pressure within the fire hydrant system, the testing procedure shall be as follows:

- (a) Discharge water from the most hydraulically disadvantaged fire hydrant at a flow rate that initiates the starting of the installed jockey pump only.

NOTE 1 For more information on normal leakage rate and maximum flow rate requirements, refer to AS 2941.

NOTE 2 For the purpose of this test, the flow from the most hydraulically disadvantaged fire hydrant should simulate a small leak in the fire hydrant system, which results in the starting of the jockey pump (that is, the pressure maintenance pump) only.

- (b) Simultaneously record the pressure at which the jockey pump starts and the pressure at the most hydraulically disadvantaged fire hydrant.
- (c) Decrease the flow at the most hydraulically disadvantaged fire hydrant until the jockey pump shuts off.
- (d) Simultaneously record the pressure at which the jockey pump shuts off and the pressure at the most hydraulically disadvantaged fire hydrant.
- (e) Compare the starting pressure of the jockey pump with the starting pressure of any fixed on-site pumpset to ensure that the pressure differential determined is in accordance with [Section 6](#).

T.9.3 Reporting of results

The following results shall be reported:

Test parameter	Result
Starting pressure of jockey pump	kPa
Pressure at most hydraulically disadvantaged fire hydrant when jockey pump starts	kPa
Shut-off pressure of jockey pump	kPa
Pressure at most hydraulically disadvantaged fire hydrants when jockey pump shuts-off	kPa
Pressure differential between operation of jockey pump and fixed on-site pumpsets	kPa

T.10 Test 8 — On-site tank and tank suction fire brigade booster assembly

T.10.1 Acceptance criteria

Where a fire hydrant system incorporating a tank suction fire brigade booster assembly is installed and an on-site tank provides the primary water supply, the pressure and flow recorded at the required number of most hydraulically disadvantaged fire hydrants when boosted by a fire brigade pumping appliance shall meet the minimum requirements specified in [Table 2.2.6\(F\)](#) for the duration of the test period.

T.10.2 Procedure

The test procedure shall be as follows:

- Connect the suction outlets of the static water supply to a fire brigade pumping appliance or other suitable off-site pumpset.
- Perform Steps (c) to (h) in [Clause T.7.2](#).
- Where a reduced-capacity tank is installed, determine the rate of inflow based on the design pressure at the source of supply. Record the inflow rate.
- Compare the required four-hour supply minus the inflow rate to the capacity of the storage tank to verify the adequacy of its capacity.

T.10.3 Reporting of results

Where applicable, the following shall be reported:

Test parameter	Result
Pressure on the inlet side of the pumping appliance	kPa
Pressure in the pipework at the fire brigade booster connection	kPa
Flow and pressure at the most hydraulically disadvantaged fire hydrants	L/s kPa
Friction loss	kPa
Capacity of site storage	L
Rate of inflow	L/s

Appendix U (informative)

Adjustment for water supply pressure variation

U.1 General

Differences in the pressure from the primary water supply at the time of testing compared to the pressure used in the design (for example, fluctuation in reticulated water supply pressure due to variations in consumer demand or the level of water in an on-site tank) can cause variation in the results of any commissioning test undertaken. Where this occurs, the commissioning tests and/or results should be adjusted in accordance with the procedure detailed in this Appendix. Adjustment of the commissioning results will then allow for a comparative assessment with the design parameters for pressure and flow to be undertaken which would enable the results obtained to confirm that the fire hydrant system can perform as designed.

At the time of commissioning, where the pressure provided by the water supply equals or exceeds the pressure used to design the fire hydrant system, testing can proceed with the required number of hydrants flowed at 10 L/s.

Where the pressure provided by the available water supply exceeds the original design pressure, the results of any commissioning test should be suitably adjusted to account for this pressure variation.

Where the pressure at the water supply source is less than the design pressure, the circumstances should be investigated and, if possible, the cause rectified.

U.2 Supply pressure variation

As a consequence of both daily and seasonal variation in consumer demand, the pressure available to a fire hydrant system from a reticulated water supply, will vary throughout the day and the year. For those undertaking the commissioning of fire hydrant systems connected to a reticulated water supply, any results obtained should confirm that the fire hydrant system will perform across the range of pressures available, in particular, the design pressure due to 95th percentile supply conditions.

In a similar way, the pressure supplied from a tank should be adjusted to take into account the difference in storage level at the time of testing and that included in the hydrant system design, typically the minimum operating level.

U.3 Verification of system performance

[Figure U.3\(A\)](#) provides a simple schematic drawing of a fire hydrant system design and the design parameters applied to this system.

In this instance, where the reticulated water supply provides the pressures to the fire hydrant system, the pressure used for design from the point of connection at the main would typically be that resulting from the required fire flow rate being drawn from the water supply system while it is simultaneously subject to 95th percentile demand conditions (that is, the lowest acceptable pressure the water agency can provide or exceed 95 % of the time, while providing the required firefighting flows).

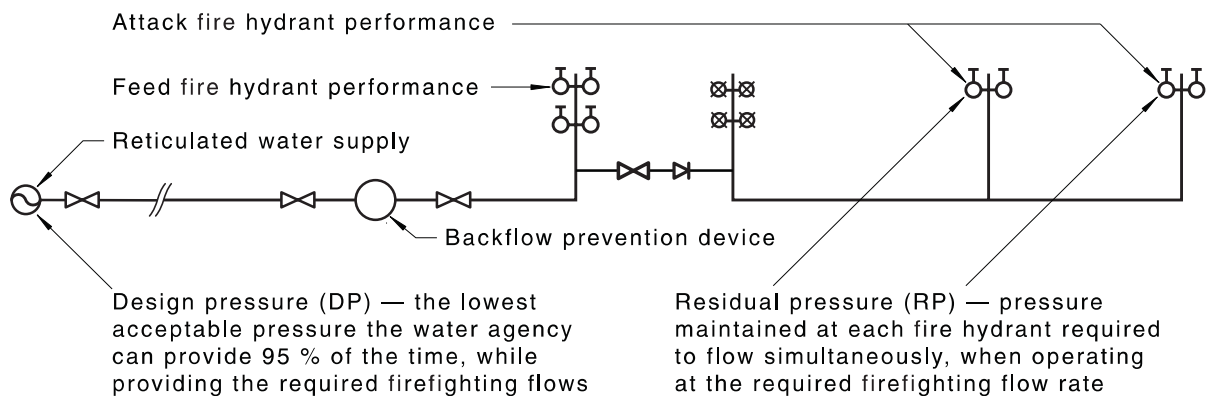


Figure U.3(A) — Fire hydrant system design — design parameters applied

Figure U.3(B) provides the same simple schematic drawing of the fire hydrant system design; however, in this instance it indicates the pressure available at the time of commissioning.

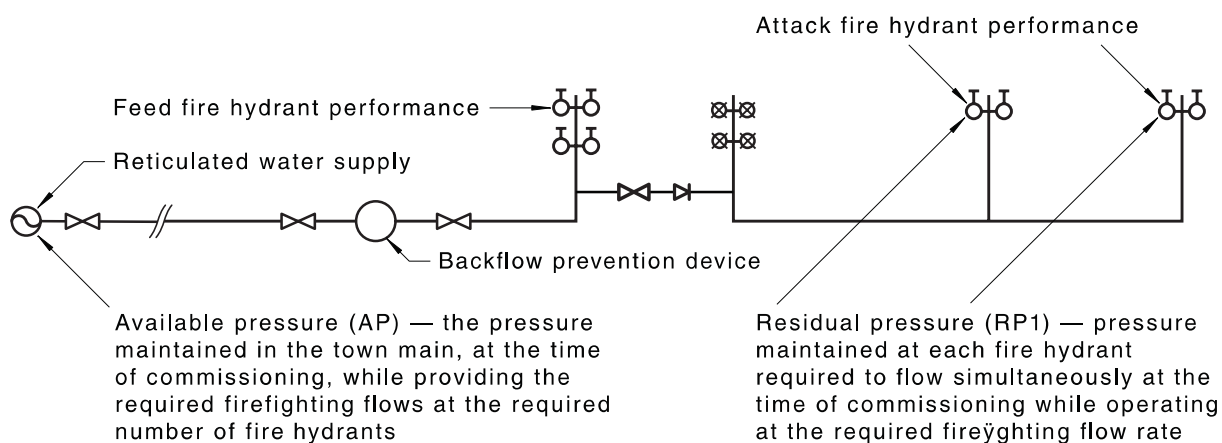


Figure U.3(B) — Fire hydrant system design — pressure available at time of commissioning

Where the available pressure (AP) at the time of commissioning exceeds the design pressure (DP), the results of those commissioning tests that are dependent on the pressure from the primary water supply should be adjusted by applying the following procedure:

- (a) Record values of DP, RP, AP and RP1 in [Table U.3](#).
- (b) Determine design pressure adjustment value (DPAV) by subtracting design pressure from available pressure, as follows:

$$AP - DP = \text{DPAV} \quad \text{U.3(A)}$$

NOTE DPAV represents the pressure difference between the pressure used to design the fire hydrant system and that available at the time the commissioning test was undertaken.

- (c) Determine the adjusted residual pressure (ARP) by subtracting DPAV from RP1, as follows:

$$RP1 - \text{DPAV} = \text{ARP} \quad \text{U.3(B)}$$

NOTE ARP represents a value that can be immediately compared with the pressure used to design the system.

- (d) The fire hydrant system will perform as designed across all acceptable pressures available from the water source by ensuring that the ARP is greater than or equal to the RP value used for design, as follows:

$ARP \geq RP = \text{Pass}$

$ARP < RP = \text{Fail}$

Where the ARP is less than the required RP, the fire hydrant system should be investigated to determine the cause of this pressure loss.

Table U.3 — Confirmation of system performance

Parameter	Pressure	Definition	Recorded value
Design pressure	(DP)	Pressure used to design the fire hydrant system (typically the 95th percentile value provided by a water agency)	
Residual pressure	(RP)	The residual pressure required to be maintained by Section 2 at each of the required number of most hydraulically disadvantaged fire hydrants, when flowing at the required flow rate	
Available pressure	(AP)	Pressure maintained in the water supply source at the time of commissioning, typically a reticulated water supply, when the required number of most hydraulically disadvantaged fire hydrants are flowing at the required flow rate	
Residual pressure 1	(RP1)	Pressure maintained at each of the required number of most hydraulically disadvantaged fire hydrants at the time of commissioning, when flowing at the required flow rate	
Design pressure adjustment value	(DPAV)	The difference in pressure between the pressure available at the time of test (AP) and the system design pressure (DP), see Equation U.3(A)	
Adjusted residual pressure	(ARP)	The test pressure adjusted to be representative of design conditions that can be compared against design requirements, see Equation U.3(B)	

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- AS 1940, *The storage and handling of flammable and combustible liquids*
- AS 2419.4, *Fire hydrant installations, Part 4: Storz fittings for firefighting purposes*
- AS 2832.2, *Cathodic protection of metals, Part 2: Compact buried structures*
- AS 3846, *The handling and transport of dangerous cargoes in port areas*
- AS/NZS 1221, *Fire hose reels*
- AS/NZS 1596, *The storage and handling of LP Gas*
- AS/NZS 2022, *Anhydrous ammonia—Storage and handling*
- AS/NZS 2566.2, *Buried flexible pipelines, Part 2: Installation*
- AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring rules)*
- AS/NZS 3833, *The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers*
- AS/NZS 5601.1, *Gas installations, Part 1: General installations*
- BS 336, *Specification for fire hose couplings and ancillary equipment*
- ISO 31000, *Risk management — Guidelines*
- NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*
- NEN 3374, *Fire Fighting Equipment — Fire Hose Couplings And Ancillary Equipment*
- ABCB, *National Construction Code (NCC)*

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