LICENCE

for

AS 2419.1-2005 Fire hydrant installations - System design, installation and commissioning

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AS 2419.1—2005

AS 2419.1—2005

Australian Standard™

Fire hydrant installations

Part 1: System design, installation and commissioning

STANDARDS Australia

This Australian Standard was prepared by Committee FP-009, Fire Hydrant Installations. It was approved on behalf of the Council of Standards Australia on 20 October 2005.
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- Association of Hydraulic Services Consultants Australia
- Australasian Fire Authorities Council
- Australian Building Codes Board
- Certification Interests (Australia)
- Copper Development Centre—Australia
- Department of Defence (Australia)
- Fire Protection Association Australia
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Australian Standard™

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—1994.

The changes to the previous edition of this Standard comprise the following:

(a) A stated objective.

(b) Clarification of intent.

(c) A restructure of the document into more user friendly equipment-specific sections.

(d) Incorporation of all revisions contained in Amendment No. 1, which expanded the requirements for fire hydrant system design, acceptable sources of water supply, water supply capacities and general revisions to account for advances in technology for materials, methods of installation and firefighting requirements.

(e) Inclusion of a commentary to some clauses.

This Standard will be referenced in the Building Code of Australia 2006; thereby superseding AS 2419.1—1994, which will be withdrawn 12 months from the date of publication of this Standard.

Commentary is for information only and does not need to be followed for compliance with the Standard.

Notes to the text contain information and guidance. They are not an integral part of the Standard.

Illustrations in this Standard are purely diagrammatic and are intended to show functional requirements only, not methods of construction.

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

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FOREWORD

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

Although fire hydrants are installed within properties for use by the fire brigade, they may also be used by trained personnel.

An adequate source of water is a fundamental consideration in the design of a fire hydrant installation and may comprise water from more than one source. A source based on a 4 h duration at the flow rates given in this Standard is regarded as the minimum safe quantity to enable fire brigades to commence an initial attack to limit fire spread, protect neighbouring properties and extinguish the fire.

Fire hydrant systems need to be regularly inspected, tested and maintained to ensure continued readiness for use. Where pump sets are installed, regular maintenance is essential.

Fire brigade equipment and firefighting procedures may vary between and within states and should be considered in the fire hydrant system design.

STANDARDS AUSTRALIA

Australian Standard
Fire hydrant installations

Part 1: System design, installation and commissioning

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements for the design, installation, and commissioning of fire hydrant systems to protect properties. It applies to fire hydrant systems installed to protect buildings, structures, storage yards, marinas and associated moored vessels, wharves, and plant. This Standard also applies to street fire hydrants used in lieu of on-site fire hydrants or to supplement the coverage afforded by street fire hydrants.

NOTES:

1 Requirements for maintenance of fire hydrant installations are given in AS 1851 (see Appendix G).

2 Appendix C sets out a flow chart for a fire hydrant system design based on the type and capability of the water supply.

3 Hose couplings and the regions in which they are used in Australia are given in Appendix E.

1.2 OBJECTIVE

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

(a) will augment the efficient extinguishment of fire within the boundaries of the site;

(b) can be utilized to minimize fire spread within or between one property or building and another;

(c) can be used by trained firefighting personnel; and

(d) are compatible with the local fire brigade's firefighting equipment.

1.3 NORMATIVE REFERENCES

The normative documents referenced in this Standard are listed in Appendix A.

NOTE: Documents referenced for informative purposes are listed in Appendix G.

1.4 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 2484.2, AS/NZS 3500.0 and those below apply.

1.4.1 Design pressure

The 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.

1.4.2 Effective height

The height to the floor of the topmost storey (excluding the topmost storey if it contains only heating, ventilating, lift or other equipment, water tanks or similar service units) from the floor of the lowest storey providing direct egress to a road or open space.

1.4.3 Fire brigade booster assembly

A connecting device enabling the fire brigade to pressurize or pump water into a fire hydrant system.

1.4.4 Fire brigade pumping appliance

A fire brigade emergency vehicle that has an inbuilt pump to which firefighting hose may be connected.

1.4.5 Fire compartment

The total space of a building; or any part of a building required by the Building Code of Australia to be separated from the remainder by walls and/or floors each having an FRL not less than that required for a firewall for that type of construction and where all openings in the separating construction are protected in accordance with the Building Code of Australia.

1.4.6 Fire hydrant

An assembly installed on a branch from a water pipeline, which provides a valved outlet to permit a supply of water to be taken from the pipeline for firefighting.

NOTES:

1 Fire hydrants utilized by firefighters are feed fire hydrants and attack fire hydrants.

2 Fire hydrants may be above-ground, with outlets suitable for connection for fire hose; or in-ground, with a connection suitable for attachment of a fire brigade standpipe to which fire hose may be connected.

1.4.7 Fire hydrant, attack

A fire hydrant that is connected to a system incorporating a fire hydrant booster and used for direct attachment of a firefighting hose line to achieve an effective firefighting hose stream.

NOTE: Attack fire hydrants are intended for use by fire brigade to attack a fire or prevent fire spread to adjoining property. They are not intended to supply a fire brigade pumping appliance.

1.4.8 Fire hydrant, external

A fire hydrant installed outside a building or structure.

1.4.9 Fire hydrant, feed

A fire hydrant used to supply water to a fire brigade pumping appliance.

1.4.10 Fire hydrant system

An assembly of pipes and other components that is dedicated for firefighting to permit the fire brigade to access a controlled supply of water.

1.4.11 Fire-resistance level (FRL)

The grading periods, in minutes, determined in accordance with Specification A2.3 of the Building Code of Australia, for—

(a) structural adequacy;

(b) integrity; and

(c) insulation;

and expressed in that order.

NOTE: A dash means that there is no requirement for that criterion. For example, 90/–/– means there is no requirement for an FRL for integrity and insulation.

1.4.12 Hardstand

An identifiable and clearly marked trafficable all-weather pavement providing access and capable of supporting a fire brigade pumping appliance during firefighting operations.

NOTE: Examples of pavements are bituminous concrete, aggregate, concrete or similar surfaces.

1.4.13 Open yard

A designated area greater than 500 m^2, which may be used for storage or processing of combustible material.

NOTE: Refer to AS 1940 (see Appendix G) for areas used for bulk storage of flammable and combustible liquids.

1.4.14 Residual pressure

Water pressure measured at a point within a system at a particular flow rate.

1.4.15 Suction connection

A suction hose connection used to draw water from a static supply.

1.4.16 Water agency

The owner of the water infrastructure or its legally appointed agent.

NOTE: A water agency can be an authority, board, business, corporation, council or local government body with the responsibility of operating and maintaining a water supply system.

1.4.17 Working pressure

The maximum pressure exerted within the system by the fire brigade, the system pumping equipment, or both, when the most hydraulically disadvantaged fire hydrant or fire hydrants are operated at the design flow.

NOTE: 'Operational pressure' for fire brigades is synonymous with 'working pressure'.

1.5 SYMBOLS

The graphical symbols in this Standard comply with those in SA HB 20.

SECTION 2 SYSTEM DESIGN

2.1 DESIGN CONCEPT

2.1.1 General

Fire hydrant systems designed in accordance with this Standard shall be compatible with the equipment employed by the attending fire brigade.

Where possible, all fire hydrants shall be located external to a building, as specified in this Standard. Fire hydrants within a building shall protect those portions not protected by external fire hydrants.

Where street fire hydrants provide coverage, flow rates and residual pressures in accordance with Sections 2, 3 and 4, they may be used to provide total or partial coverage provided a fire brigade booster assembly is not incorporated in the system.

NOTES:

1 Provision should be made for the disposal of water from flow tests (see Section 10).

2 Where seawater is used, adequate provision should be made to flush the system with fresh water to inhibit marine growth.

3 Where non-potable water is used, precautions should be taken to minimize the effects of corrosion on the system.

4 For more information on fire brigade appliances and strategies, see Appendix D.

2.1.2 Fire brigade booster assembly

Where a fire brigade booster assembly is required, it shall comply with the requirements of Section 7.

2.1.3 Hardstand

A hardstand shall be provided where a fire brigade pumping appliance is required to be located adjacent to a tank, hydrant or booster in accordance with Section 3, 5 or 7.

A required hardstand and its vehicular approaches shall remain suitable for use by a fire brigade pumping appliance throughout —

(a) discharge of water during firefighting operations; and

(b) rain periods.

NOTES:

1 Many fire brigade pumping appliances discharge a continuous flow of water while operating.

2 Reference should be made to the fire brigade for detailed requirements for hardstand areas.

2.2 DESIGN PARAMETERS

2.2.1 Hydraulic design

Hydraulic analysis of fire hydrant systems shall be carried out to demonstrate that, when the specified number of fire hydrants are discharging in accordance with Table 2.1 and Table 3.3, the residual pressure at each fire hydrant is within a range suitable for the fire brigade equipment that is to be connected to them.

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

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

NOTES:

1 For the purpose of this Clause, the hydraulic losses through the booster inlet connection and the fire hydrant valve need not be included.

2 When a fire ring main is installed, the hydraulic loss may be calculated with flow through both paths of the ring main (see Figure 8.5.5).

C2.2.1 *The performance of fire hydrant systems specified by this Standard may only suffice initial fire suppression activities. Firefighters may, by using the characteristics of the installed system and their own connected equipment, achieve a greater performance; however, this may be insufficient to extinguish fully developed building fires.*

The nominated 150 kPa hydraulic loss will allow the performance of the system to be enhanced once sufficient fire brigade resources are in attendance. Where a fire brigade booster assembly is provided, up to 2.5 times the design flow may be possible (depending on the characteristics of the water supply and relative elevation of the discharge location) provided the fire brigade pumping appliance is capable of achieving the necessary boost pressure at the increased flow. For systems without a fire brigade booster assembly, drawing water from more feed fire hydrants than adopted in the system design will potentially yield a flow greater than the design flow.

Using the installed system to advantage reduces the time consuming task of laying additional hose from other water sources. Further, limiting hydraulic losses in the installation brings hydrant outlet pressure variations closer to that resulting solely from outlet elevation differences.

Additional supply capacity is usually available in a reticulated water supply system at times when the typical consumer demand is less than that adopted for determination of the residual pressure available 95% of the time (see Clause 2.3.3 and appendix F). Note that the residual pressure, determined for use in the firefighting system design, may not be available 5% of the time on the days of highest consumer demand, and hence reduced supply capacity will be available for firefighting. For fixed storage, any enhanced water supply flow capability is primarily a function of the characteristics of the pipework, any on-site pump and tank suction connections.

2.2.2 Earthquake provisions

Where the installation is to be installed in a seismic area, the design shall comply with this Standard.

NOTE: Earthquake loads should be considered for seismic areas. For more information see AS 1170.4 (see Appendix G).

2.2.3 Mine subsidence provisions

Where the installation is to be installed in a mine subsidence area, the design shall have provision for mine subsidence movement.

2.2.4 Unstable ground provisions

Where in-ground services are to be installed in unstable ground conditions, provision shall be made to adequately support the pipe and cater for the effects of ground movement.

2.3 REQUIRED SYSTEM PERFORMANCE

2.3.1 Flow requirements

2.3.1.1 *General*

The outlet of each fire hydrant, required to flow in accordance with Tables 2.1 and 3.3, shall be capable of discharging not less than the flow rates specified in Table 2.2 and/or Table 2.3. Where a fire brigade booster assembly is provided, hydrants required to flow 5 L/s (unassisted performance or performance using an on-site pump) shall be capable of flowing 10 L/s when a fire brigade pumping appliance is connected to the system.

Where a hydrant system is used to supply water to any other firefighting system other than hose reels, the water supply and system design shall provide the combined system flow requirements.

2.3.1.2 *Buildings*

Where a fire hydrant system is required in a building—

(a) the system shall be designed for the simultaneous operation of the required number of the most hydraulically disadvantaged fire hydrants for each classification and fire compartment area; and

(b) the number of fire hydrants required to flow for any classification and fire compartment area shall be in accordance with Table 2.1.

Where more than one building or fire compartment on a site is protected by a fire hydrant system, the minimum total flow rate for the fire hydrant system shall be not less than that required for the building or fire compartment having the largest demand.

2.3.1.3 *Open yards*

For a protected open yard, the number of fire hydrants required to operate simultaneously shall be as given in Table 3.3.

2.3.2 Operating pressures

With the required number of fire hydrants simultaneously flowing at appropriate flow rate, a water supply to a fire hydrant system shall be capable of maintaining a residual pressure at each of the flowing fire hydrants. The flow rate and residual pressure shall be as given in in Table 2.2.

Where attack hydrants are required and they cannot achieve the performance as set out in Table 2.2, at the required number of most hydraulically disadvantaged hydrant(s) then the flow rate and residual pressure shall be as given in Table 2.3

The maximum operating pressure under flow conditions shall not exceed 1200 kPa, unless agreed by the relevant fire agency.

C2.3.2 *Minimum residual pressures depending on the way the fire hydrant is being used are given in Table 2.2. This assumes a fire hydrant system that utilizes supply pressure and flows without the assistance of on-site pumps.*

Where the water agency supply performance dictates the necessity to install on-site facilities, e.g., tanks, pumps or other systems (excluding reliance on fire brigade pumping appliance) the minimum residual pressures needs to be increased to 700 kPa, as required by Table 2.3. Firefighting nozzles or tips need high pressures to break up the water into fine 'fog' droplets.

A positive pressure of at least 150-200 kPa for a feed fire hydrant is necessary as a safety precaution. Operational firefighting flows can vary greatly as nozzles are opened and closed. A sudden increase in demand can reduce the pressure in the hose feeding the appliance to the extent that it collapses under atmospheric pressure. This collapse will cause the pump to cavitate until suction pressure is restored. The resultant series of pressure surges could seriously damage the fire appliance pump, the fire hydrant system, the attached equipment or cause injury to attending personnel.

2.3.3 Water system supply pressure

Calculations for the fire hydrant system design, to satisfy the required flow for the most hydraulically disadvantaged fire hydrants, shall be based on the residual pressure available to the property from the source of supply at the required flow.

Where the acceptable source of supply is a town main, the residual pressure, for use in design of the fire hydrant system from the point of connection at the main, shall be determined taking into consideration the effect of the required fire flow rate on the water supply system.

The residual pressure adopted shall be the most appropriate that—

(a) the local water agency determines from system modelling and considers that it can be maintained for 95% of the time;

(b) the local water agency advises as a minimum pressure obtained or calculated from its records, (excluding the pressures on the 5% of days having the lowest pressures or 5% of the pressures on the lowest pressure day, as appropriate), adjusted for the effect of fire flows;

(c) is determined from calculations based on adding the required fire flow rate to the 95% availability flow in the water system (see Notes 3 and 4); or

(d) is determined by testing the water supply system using a method approved by the water supply agency.

NOTES:

1 The capability of the water supply system to provide nominated fire flow rates is only acceptable when the residual pressure at the point of connection at the main is not less than a limit as nominated by the water supply agency.

2 Residual pressure from a water supply system 95% of the time is water pressure at a particular flow rate from the point of connection at a water supply system, which the water supply agency determines will be available at least 95% of the time, based on—

  (a) the lowest pressure calculated or measured as occurring in the remaining days of a year excluding the results from the 5% of days having the lowest pressures; or

  (b) the pressure exceeded 95% of the time on the day of the year having the lowest residual pressure results.

3 The results of flow/pressure testing of parts of the water supply system may be used in evaluating the performance capability of the system.

4 Calculations as described in 2.3.3(c) are most likely required where models or records as per Item (a) or (b) are not available or are unreliable. In this case, a method of on-site testing, calculation and evaluation, such as those outlined in Appendix F, may be used.

2.3.4 Maximum static pressure

The maximum static pressure at any fire hydrant at no flow, with the pump running, shall be 1300 kPa.

TABLE 2.1

NUMBER OF FIRE HYDRANT OUTLETS REQUIRED TO DISCHARGE SIMULTANEOUSLY ACCORDING TO BUILDING CLASSIFICATION AND FLOOR AREA

Building classification (see BCA)	Fire compartment floor area m^2	No. of fire hydrant outlets required to flow simultaneously (Note 1)
2, 3, 5 and 9 (1 or 2 storeys contained)	≤1 000	1
2, 3, 5 and 9 (1 or 2 storeys contained)	>1 000 ≤5 000	2
2,3,5 and 9 (3 or more storeys contained)	≤500	1
2,3,5 and 9 (3 or more storeys contained)	>500 ≤5 000	2
6, 7 and 8 (Note 2)	≤500	1
6, 7 and 8	>500 ≤5 000	2
All classes sprinklered	>5 000 ≤10 000	2
All classes sprinklered	>10 000	3
All classes unsprinklered	>5 000 ≤10 000	3
All classes unsprinklered	>10 000	3 plus one additional fire hydrant for each additional 5 000 m^2 or part thereof

NOTES:

1 Where more than one external fire hydrant, each with two valve-controlled outlets is installed and more than one outlet is required to flow, then one outlet on each of the most hydraulically disadvantaged fire hydrants has to achieve the required flow and pressure. If the number of outlets required to flow exceeds the number of fire hydrants installed, then simultaneous flow from each of the two outlets on the most hydraulically disadvantaged fire hydrant will be necessary. Where only one external fire hydrant with two valve-controlled outlets is installed and two outlets are required to flow, then simultaneous flow from each of the two outlets will be necessary. Where an in-ground fire hydrant is required to provide a discharge equal or greater than 20 L/sec, this is acceptable if this flow is achieved from a twin outlet standpipe.

2 One outlet is required to flow for these classifications where the total floor area of the building is greater than 500 m^2, and the building is subdivided into fire compartments of 500 m^2 or less.

TABLE 2.2

MINIMUM FIRE HYDRANT OUTLET FLOW RATES AND PRESSURES

Fire hydrant type	Minimum required flow rate (L/s)	Minimum required residual pressure (kPa)	
		NSW	All other states and territories
Feed fire hydrant, unassisted	10	150	200
Attack fire hydrant, unassisted	10	250	350
Internal and external fire hydrants when boosted by a fire brigade pumping appliance	10	700	700

NOTES:

1 'Unassisted' specifies the system performance characteristics achieved by a water agency's system or other elevated reservoir, before a fire brigade pumping appliance is connected to the system. On-site pumps must not be used to achieve this performance. If pumps are required, then fire hydrants will need to have attack fire hydrant performance and be located in accordance with Clause 3.2.2.2(c).

2 In a system that incorporates a fire brigade booster assembly, external above-ground fire hydrants, accessible by a fire brigade pumping appliance, if located as attack fire hydrants, need only have feed fire hydrant unassisted performance (see Clause 3.2.2.2(d)).

TABLE 2.3

FIRE HYDRANT OUTLET FLOW RATES AND PRESSURES

Fire hydrant type	Minimum required flow rate (L/s)	Minimum required residual pressure (kPa)
Attack fire hydrant performance achieved without the use of a fire brigade pumping appliance	5	700
Internal and external fire hydrants when boosted by a fire brigade pumping appliance	10	700

NOTE: Where the supply from a water agency's reticulated water system does not meet the requirements of this Standard and tanks and pumps are installed, the performance requirements for feed fire hydrants at a booster assembly fed by that water supply may be waived.

SECTION 3 LOCATION AND OTHER PROVISIONS

3.1 GENERAL

This Section provides requirements for the location of fire hydrants and other provisions.

NOTE: For information on fire hydrants in accessways within private properties, see Appendix B.

Fire hydrant valves shall be in accordance with AS 2419.2 and have 65 mm nominal diameter hose connections compatible with local fire brigade equipment.

3.2 LOCATION OF ON-SITE FIRE HYDRANTS

3.2.1 General

The number of fire hydrants required to provide protection to a building shall be determined in accordance with Clauses 3.2.2, 3.2.3, 3.3 and 3.4.

The distance from a fire hydrant to the nominated point relates to hose length. Distance shall be taken as the most direct laid-on-ground or floor route when the storey to be protected provides horizontal access to the fire hydrant. In other cases, the distance shall be measured along the path followed by the stairway or ramp. 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.

The location of internal walls, partitions, doorways, storage racking, and any other fixed obstructions which would restrict normal hose coverage throughout the building or area to be protected shall be considered when determining the number and location of fire hydrants.

NOTE: Fire hydrant locations serving a car park may be determined with all parking spaces empty. The fire brigade may need to employ two hose lengths.

C3.2.1 *The use of external fire hydrants to fight fires in low rise buildings is often operationally more effective than the use of internal fire hydrants. Firefighters may be reluctant to enter a burning building without the protection of a hose stream.*

The provision of external fire hydrants in such cases is likely to be more cost-effective because up to two lengths (total 60 m) of hose may be connected to an external fire hydrant in lieu of a single length within the building as less physical restrictions usually exist outside the building.

3.2.2 External fire hydrants

3.2.2.1 *General*

External on-site fire hydrants, including feed and attack fire hydrants, shall have two valve-controlled outlets and may be used to protect portions of a building up to one level below and levels above the access level subject to the limitation defined in Clause 3.2.1, from the fire hydrant or relevant pumping appliance hardstand location (see Figure 3.2.2.2(g)).

Where vandalism is possible, either an oval spindle in accordance with AS 2419.2 or other locking device shall be provided in lieu of a handwheel. Any such device shall meet the requirements of the local fire brigade.

Street fire hydrants may be considered as external fire hydrants provided they comply with the re0quirements of this Standard for flow, pressure and location, with either a single or double outlet fire hydrant being acceptable in this case.

Street fire hydrants may be used to provide total or partial coverage provided that a fire brigade booster assembly is not incorporated in the system.

When measuring the length of laid hose from a fire brigade pumping appliance, the appliance shall not be located closer than 10 m from the building it is protecting.

NOTE: Where street fire hydrants are used, consideration should be given to enable safe fire brigade access.

C3.2.2.1 *Although street fire hydrants are referred to in this Standard, most water agencies do not design their systems to cater for individual property firefighting flow requirements and, therefore, do not use the criteria contained herein for designing these components. Feed fire hydrants used for boosting are only intended to provide the necessary flow rate to the fire brigade pumping appliance and are not intended to be used to provide direct fire attack. In cases where a single boosted fire hydrant will afford protection to the whole building, it is recommended that discussion with the fire brigade take place regarding what will suffice their operational requirements. It is not intended that a booster be installed to solely serve a fire hydrant adjacent to it.*

3.2.2.2 *Location*

External fire hydrants shall be located as follows:

(a) In a position that provides pedestrian access to the building for the fire brigade.

(b) When installed as a feed fire hydrant [See Figure 3.2.2.2(a), (b), (d) and (e)], within 20 m of a hardstand such that when a fire brigade pumping appliance is connected to it—

  (i) all portions of the building shall be within reach of a 10 m hose stream, issuing from a nozzle at the end of a 60 m length of hose laid on the ground; and

  (ii) a minimum of 1 m of hose shall extend into any room served.

(c) Where installed as an attack fire hydrant [see Figure 3.2.2.2(f)], within 50 m of a hardstand such that when connected directly to the external attack fire hydrant—

  (i) all portions of the building shall be within reach of a 10 m hose stream, issuing from nozzle at the end of a 60 m length of hose laid on the ground; and

  (ii) a minimum of 1 m of hose shall extend into any room served.

(d) Where installed in a system fitted with a fire brigade booster assembly and having feed fire hydrant performance only [see Figure 3.2.2.2(c)], within 20 m of a fire brigade pumping appliance located on a hardstand. All portions of the building shall be within reach of a 10 m hose stream, issuing from a nozzle at the end of 60 m length of hose laid on the ground with a minimum of 1 m of hose extending into any room served—

  (i) where the hose is connected directly to the external fire hydrant; and

  (ii) where the hose is connected to a fire brigade pumping appliance fed from the fire hydrant.

(e) In a position not less than 10 m from the building it is protecting unless safeguarded by construction—

  (i) having a FRL of not less than 90/90/90;

  (ii) extending 2 m each side of the fire hydrant outlet; and

  (iii) extending not less than 3 m above the ground adjacent to the fire hydrant or the height of the building, whichever is the lesser.

(f) In a position not less than 10 m from any high voltage main electrical distribution equipment such as transformers and distribution boards, and from liquefied petroleum gas and other combustible storage.

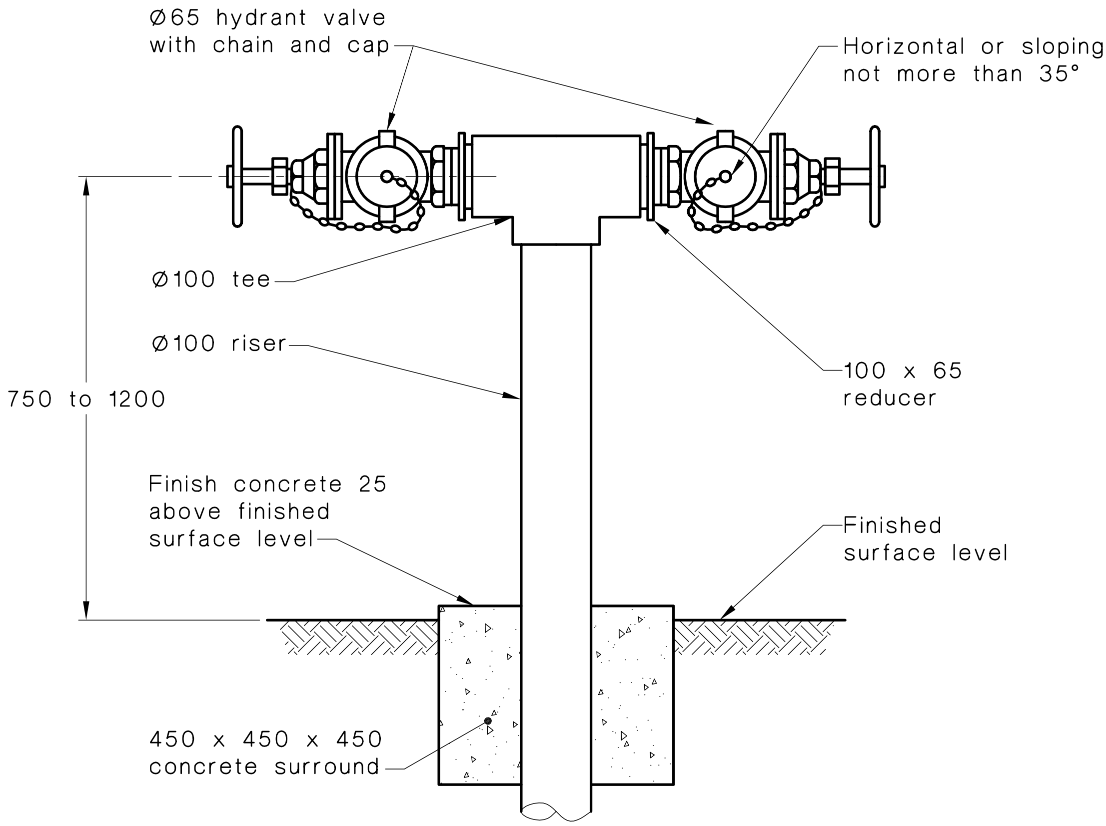
(g) In a position so that the fire hydrant is not obstructed or obscured by obstacles, stored goods, vehicles, vegetation etc.

(h) In a position so that the fire hydrant is protected from possible mechanical damage by vehicles.

C3.2.2.2(d) *This arrangement is typical for low rise industrial buildings and shopping complexes equipped with external fire hydrants and a booster assembly. The first brigade pump appliance to arrive can use the external hydrants as feed fire hydrants and commence fighting the fire using hoses connected to the pumping appliance; however, if the fire escalates, a greater flow demand is required or, if the first pumping appliance is threatened by the fire, a later arriving pumping appliance can connect to the booster assembly. Firefighters will then be able to fight the fire using hoses directly connected to the external hydrants (now boosted to higher pressure) and the threatened fire appliance can be withdrawn to a safer location.*

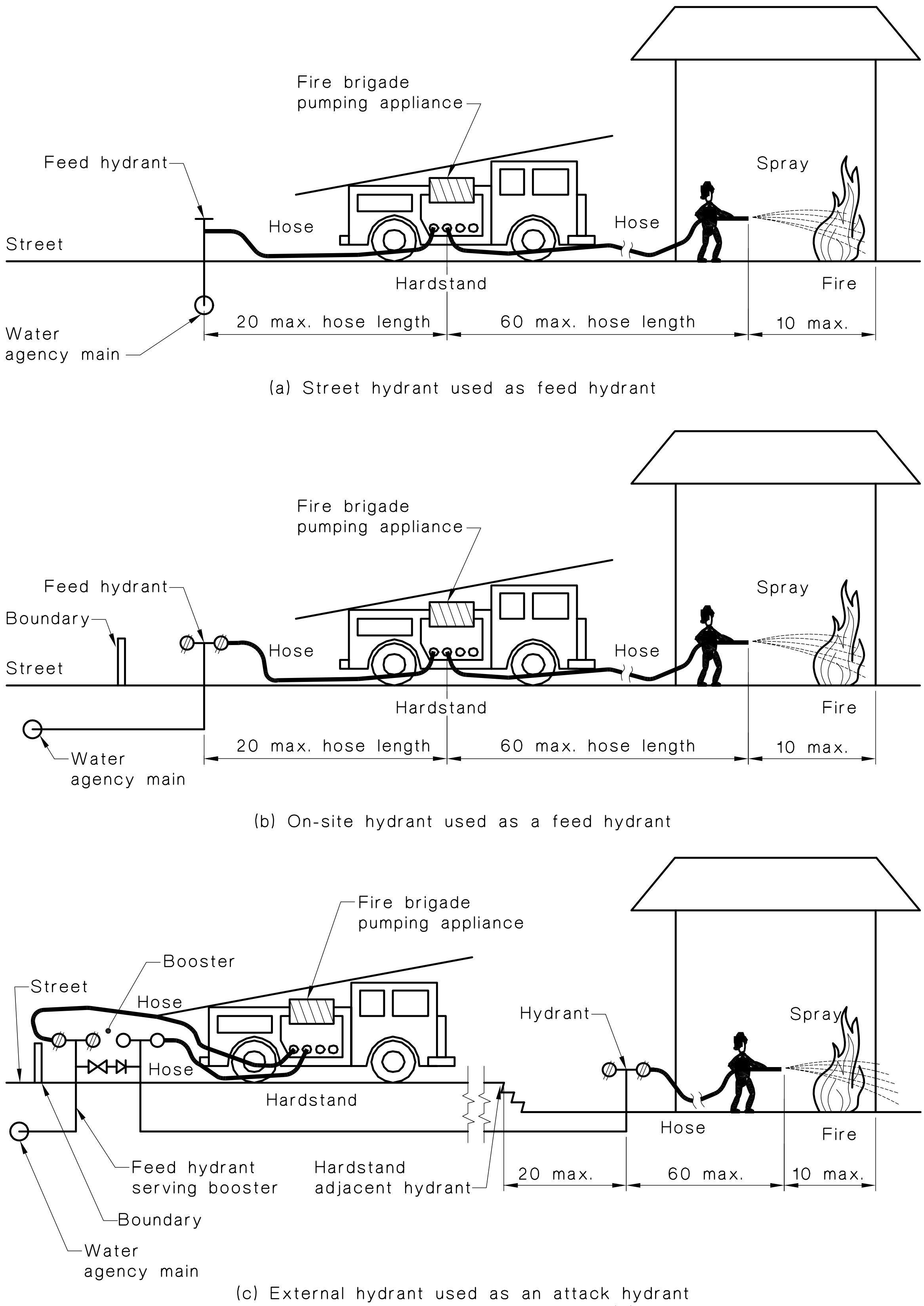
C3.2.2.2(e) *The 10 m clearance distance required from the building is essential to provide access to the fire hydrant under radiant heat from the fire and give a degree of protection in the event of structural collapse due to fire.*

C3.2.2.2(f) *The 10 m clearance distance required from the electrical equipment is essential to avoid a potential electrical hazard.*



DIMENSIONS IN MILLIMETRES

FIGURE 3.2.2.1 EXAMPLE OF AN EXTERNAL FIRE HYDRANT



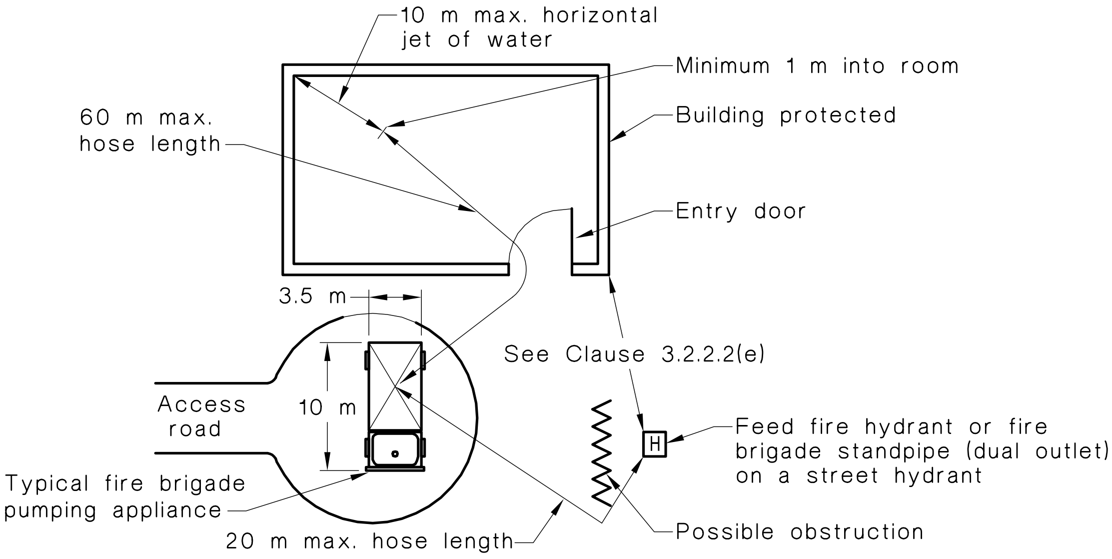
(a) Street hydrant used as feed hydrant

(b) On-site hydrant used as a feed hydrant

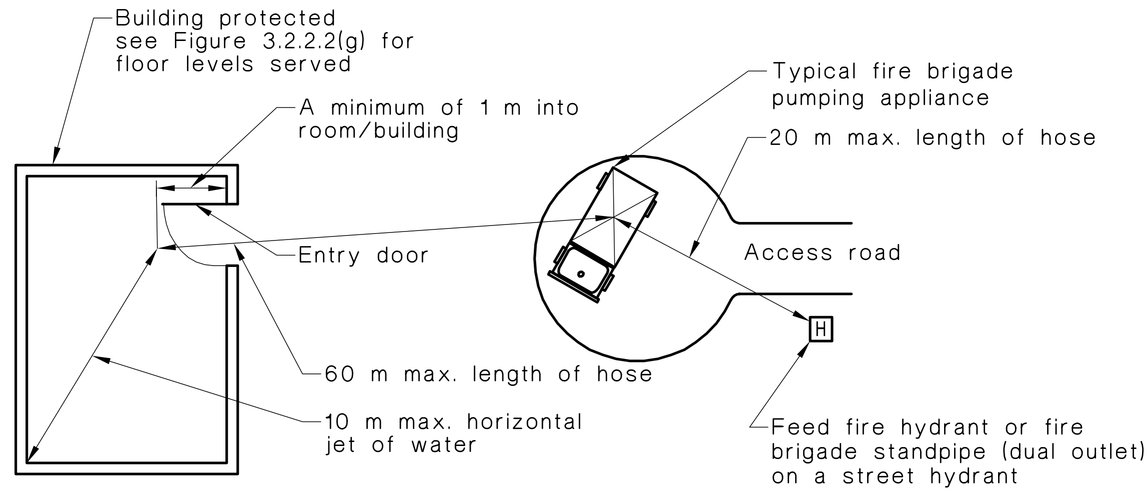
(c) External hydrant used as an attack hydrant in accordance with Clause 3.2.2.2(d)

DIMENSIONS IN METRES

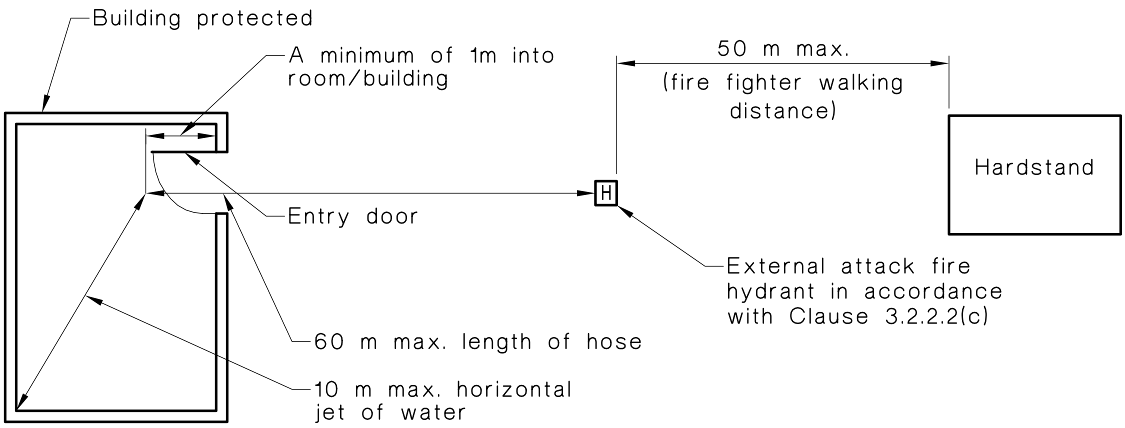
FIGURE 3.2.2.2 (in part) EXTERNAL FIRE HYDRANTS—LOCATION, HARDSTAND AND ACCESS



(d) Feed fire hydrant adjacent to the building

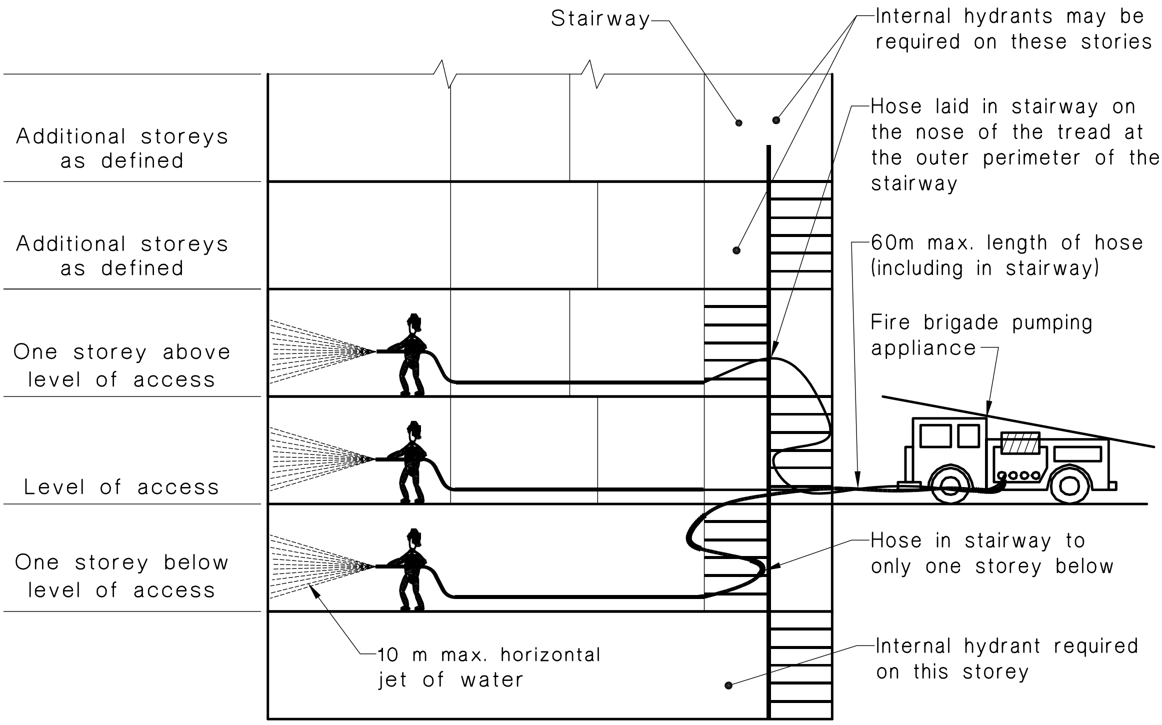


(e) Feed fire hydrant remote from the building



(f) External attack fire hydrant

FIGURE 3.2.2.2 (in part) EXTERNAL FIRE HYDRANTS—LOCATION, HARDSTAND AND ACCESS



(g) Hose coverage from external hydrant (see Clause 3.2.2.1)

NOTE: Due to difficulties associated with fighting building fires, internal fire hydrants are required in fire-isolated stairs for levels more than one floor below ground and one or more levels above ground.

FIGURE 3.2.2.2 (in part) EXTERNAL FIRE HYDRANTS—LOCATION, HARDSTAND AND ACCESS

3.2.3 Internal fire hydrants

3.2.3.1 *General*

Internal fire hydrants shall be provided to protect the whole building or those parts of the building not able to be protected by external fire hydrants. Each internal fire hydrants shall have a single valve-controlled outlet.

Internal fire hydrants shall cover only the level on which they are located.

All points on a floor shall be within reach of a 10 m hose stream issuing from a nozzle at the end of a 30 m length of hose laid on floor connected to the fire hydrant outlet.

The hose shall extend a minimum length of 1 m into the area to which the fire hydrant is providing coverage.

3.2.3.2 *Location*

Internal fire hydrants shall be located as follows:

(a) For fire-isolated exits —

  (i) in each required fire-isolated exit at each storey; or

  (ii) in each required fire-isolated exit at each storey, other than ground level, one level below ground, and one more levels above ground level if coverage is provided by external fire hydrants, regardless of the number of fire hydrants needed to provide coverage (see Figure 3.2.2.2(g)).

(b) For required non-fire-isolated exits —

(i) within 4 m of the required exit;

(ii) at each level or at the lowest level provided coverage of all levels is achieved; and

(iii) fire hydrant outlets need not be located adjacent to each required non fire-isolated exit provided coverage can be achieved by fire hydrants located elsewhere, e.g. within a required fire-isolated exit or external fire hydrants.

3.2.3.3 *Additional fire hydrants*

If floor coverage cannot be achieved in accordance with Clauses 3.2.3.1 and 3.2.3.2, additional provisions shall be made to suit the operational requirements of the fire brigade.

3.2.3.4 *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.

3.2.4 Roof fire hydrants

Enclosed roof top plant rooms (excluding lift machine rooms) greater than 250 m^2 floor area shall be served by fire hydrants in accordance with Clause 3.2.3.

3.3 OPEN YARD PROTECTION

Fire hydrants shall be provided and located so that every part of all storage, production equipment and plant in the protected area is within reach of a 10 m hose stream issuing from a nozzle at the end of a 60 m length of hose connected to a fire hydrant outlet.

Where any part of the fire hydrant pipework is situated above ground and within 150 m of any structure in the protected area, fire hydrants shall be placed not more than 60 m apart along the pipework.

The number of fire hydrant outlets required to discharge simultaneously for protected open yards shall be determined in accordance with Table 3.3 at a flow rate and pressure in accordance with Table 2.2 and Table 2.3.

Suitable additional provisions shall be made where special problems of firefighting could arise because of the nature or quantity of materials stored, displayed or used in a yard.

TABLE 3.3

NUMBER OF FIRE HYDRANT OUTLETS REQUIRED TO DISCHARGE SIMULTANEOUSLY FOR PROTECTED OPEN YARDS

Area of yard m^2	Number of fire hydrant outlets required to flow simultaneously (see Note)
≤3 000	1
>3 000 to ≤9 000	2
>9 000 to ≤27 000	3
>27 000	4

NOTE: Where more than one external fire hydrant, each with two valve-controlled outlets is installed and more than one outlet is required to flow, then one outlet on each of the most hydraulically disadvantaged fire hydrants has to achieve the required flow and pressure.

If the number of outlets required to flow exceed the number of fire hydrants installed, then simultaneous flow from each of the two outlets on the most hydraulically disadvantaged fire hydrant will be necessary.

Where only one external fire hydrant with two valve controlled outlets is installed and 2 outlets are required to flow, then simultaneous flow from each of the two outlets will be necessary.

3.4 MARINAS

Above-ground fire hydrants with dual outlets shall be provided and located so that every part of the marina and main deck of the moored vessels is within reach of a 10 m hose stream issuing from a nozzle at the end of a 60 m length of hose connected to a fire hydrant outlet.

NOTE: For further detail on fire protection of marinas, see AS 3962 (see Appendix G).

3.5 FIRE HYDRANT ACCESSIBILITY AND CLEARANCE

3.5.1 Accessibility

Fire hydrants shall be installed in accordance with the following:

(a) The centre-line of the fire hydrant outlet shall be not less than 750 mm and not more than 1200 mm above the ground, floor or platform.

(b) The valve outlet shall be—

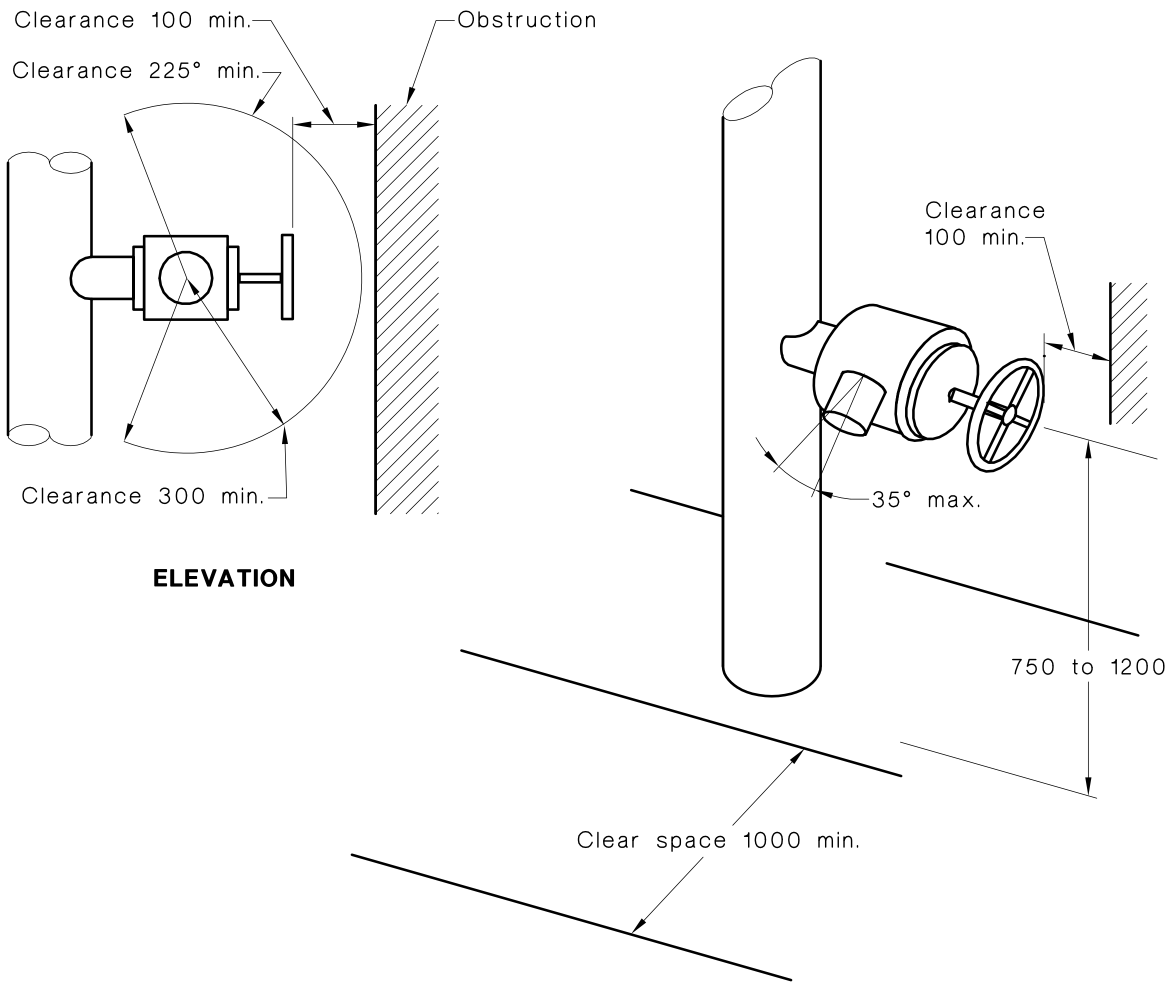
  (i) facing away from the wall immediately behind, if any; and

  (ii) horizontal or sloping not more than 35° below the horizontal (see Figure 3.5.1 (a)).

(c) A clearance of 1000 mm shall be provided directly in front of the fire hydrant outlet for the connection and laying of hose (see Figure 3.5.1(a)).

3.5.2 Clearance

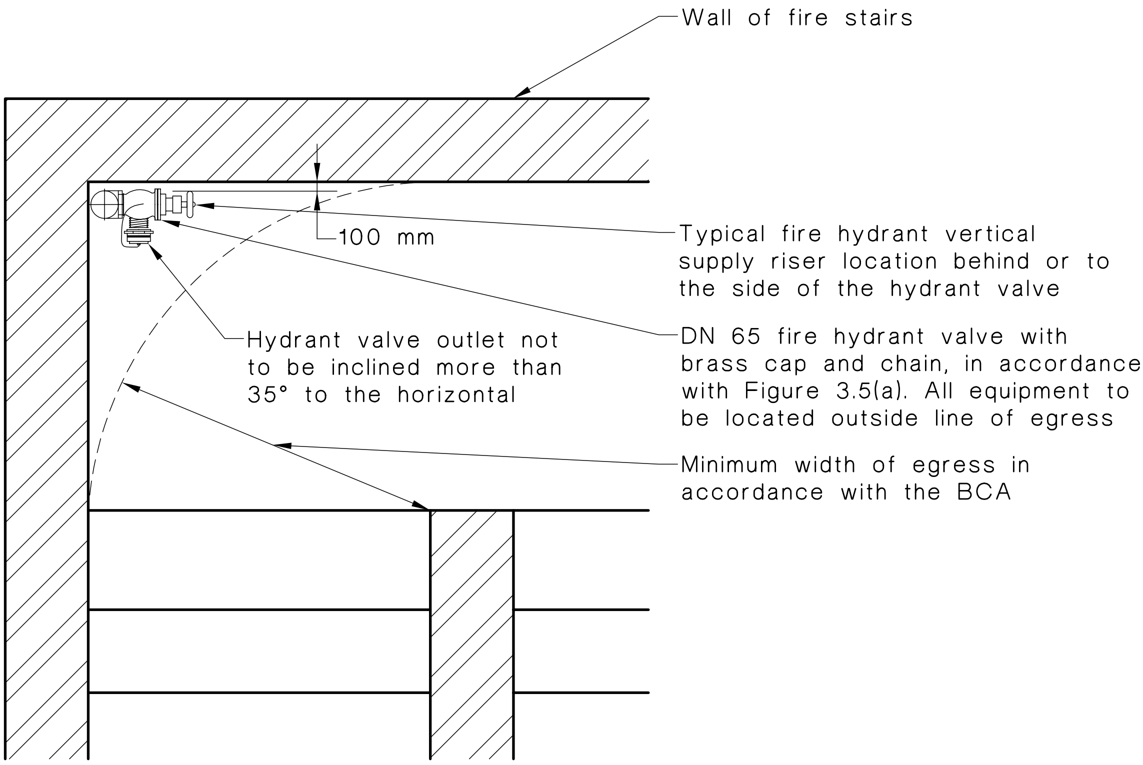
For a fully open fire hydrant valve, there shall be not less than 100 mm clearance around the valve handwheel. Fire hydrant valves shall be installed with a clearance around the outlet of not less than 300 mm through an arc of 225° to facilitate hose coupling (see Figure 3.5.1 (a)).



(a) Typical fire hydrant location and clearances

DIMENSIONS IN MILLIMETRES

FIGURE 3.5.1 (in part) FIRE HYDRANT ACCESSIBILITY AND CLEARANCE



DIMENSIONS IN MILLIMETRES

FIGURE 3.5.1 (in part) FIRE HYDRANT ACCESSIBILITY AND CLEARANCE

3.6 FIRE HYDRANT CABINETS, ENCLOSURES OR RECESSES

3.6.1 General

Where cabinets, enclosures or recesses are supplied, they shall —

(a) be of sufficient size to house all equipment;

(b) be of a design that facilitates access to and handling of equipment;

(c) have any doors fitted so that when open they do not encroach on exits or inhibit access to firefighting equipment;

(d) be used to contain firefighting pipework and equipment only; and

(e) if external, be of weatherproof design and fitted with hinges of stainless steel or copper alloy.

NOTE: Where fire hose reels complying with AS/NZS 1221 (see Appendix G) are installed in conjunction with a fire hydrant, they may be enclosed in the same cabinet, where practicable.

3.6.2 Cabinet enclosure and recess identification

The words 'FIRE HYDRANT' in letters of a contrasting colour to that of the background, shall be marked on each cabinet, enclosure and recess. Where a fire hose reel is enclosed in the same cabinet, the words 'FIRE HYDRANT—HOSE REEL' shall be used. The lettering height shall be —

(a) for external fire hydrants, 75 mm; or

(b) for internal fire hydrants, 50 mm.

SECTION 4 WATER SUPPLIES

4.1 ACCEPTABLE SOURCES OF WATER SUPPLY

4.1.1 General

The following sources of water supply for a fire hydrant system shall be selected either individually from, or any combination of the following:

(a) Town main.

(b) Reservoirs or tanks.

(c) Rivers, lakes, dams, bores, or seawater.

4.1.2 Metering of water supply

Where the metering of the water supply for firefighting purposes is required by the water agency, in-line meters shall not be installed.

NOTE: The preferred method is a metered bypass across a non-return valve.

4.2 MINIMUM WATER SUPPLY QUANTITY

The minimum capacity of the source of water supply for fire hydrant installations shall be not less than that necessary to satisfy the minimum flow rates specified in Clause 2.3.1 or 3.3, as appropriate, for a duration of not less than 4 hours.

If water is available elsewhere off-site but is not connected to the site then an on-site supply having a capacity for the time required by the fire brigade to set up equipment to pump water to the site shall be provided. The off-site source shall have the capacity to supply the required flow rate continuously for the remaining period to make up a total of 4 h water supply.

Where the town main is capable of providing make-up supply to the on-site storage, the capacity of the on-site storage shall be such that a 4 h supply is available based on the difference in flow rates between the fire hydrant system required flow rate and the make-up flow rate.

C4.2 *This Standard recognizes that interruptions to water supplies can occur when supply is recovering from an abnormally excessive demand or from temporary valve closures for short periods of time to facilitate emergency repairs or new system connections. Interruptions can and will affect the required 4 h duration; however, it would be expected that precautionary action by the owner or owner's agent would include notification of the local fire brigade.*

4.3 ON-SITE WATER STORAGE

4.3.1 When required

On-site water storage shall be provided where—

(a) the off-site source has insufficient capacity or is unable to achieve the required flow rates;

(b) the building has an effective height in excess of 25 m; or

(c) the water agency requires the installation of a break tank.

Where on site storage is provided the system shall, with or without onsite pumps, achieve the performance requirements of Clause 2.3.2 (without assistance from fire brigade pumping appliance or fire brigade relay pumps).

4.3.2 Capacity

Where on-site storage is provided to satisfy Clause 4.3.1(a), it shall have a capacity appropriate to the circumstances.

Where on-site storage is provided to only satisfy Clause 4.3.1(b) or (c), or both, it shall be—

(a) if located at a roof top in a sprinkler protected building, not less than 25 000 L; or

(b) in any other case, the lesser of—

  (i) 25 000 L; or

  (ii) that necessary to satisfy the minimum number of hydrants required to flow in accordance with Table 2.1, at a flow rate of not less than 10 L/s each.

4.3.3 Maintenance

On-site storage shall be arranged so that during any maintenance, at least 50% of the required volume remains available for use.

SECTION 5 WATER STORAGE

5.1 GENERAL

On site storage tanks shall comply with the requirements of this Section, the specific requirements of the water agency and AS/NZS 3500.1.

Tanks shall be constructed from concrete, steel, fibreglass or other suitable material. Any liner shall be attached to the tank to prevent blockage of suction inlet(s).

C5.1 *Tanks containing water for firefighting may be internal or external to the building. If external, the tank should be located a minimum distance of 10 m from any building to ensure access and protection from radiant heat and additional distance may be necessary depending on the building structure. Such tanks are used as pump suction tanks for on-site pump sets where installed and for connection to attending fire brigade pumping appliances. The use of in-ground storage tanks requires special consideration.*

5.2 WATER SUPPLIES TO STORAGE TANKS

5.2.1 Make-up water

To make up for losses due to evaporation, minor leakage and water extracted for test purposes, there shall be a water supply to the tank controlled by a valve to maintain the required water level. The make-up supply pipe, stop valve and float or pilot-operated valve shall be not less than DN 25.

5.2.2 Automatic inflow

Where the effective tank storage capacity has allowed for automatic inflow to reduce the size of the tank, provision shall be made to measure the rate of inflow.

The automatic inflow shall be controlled by a diaphragm or pilot-operated valve actuated by a direct-acting float-operated valve of not less than DN 25

5.2.3 Manual quick fill

Where the effective tank storage capacity has not been reduced in accordance with Clause 5.2.2 and towns main reticulated water is available, a manual quick fill facility shall be provided.

NOTE: See Figure 5.2.3 for typical quick-fill arrangements.

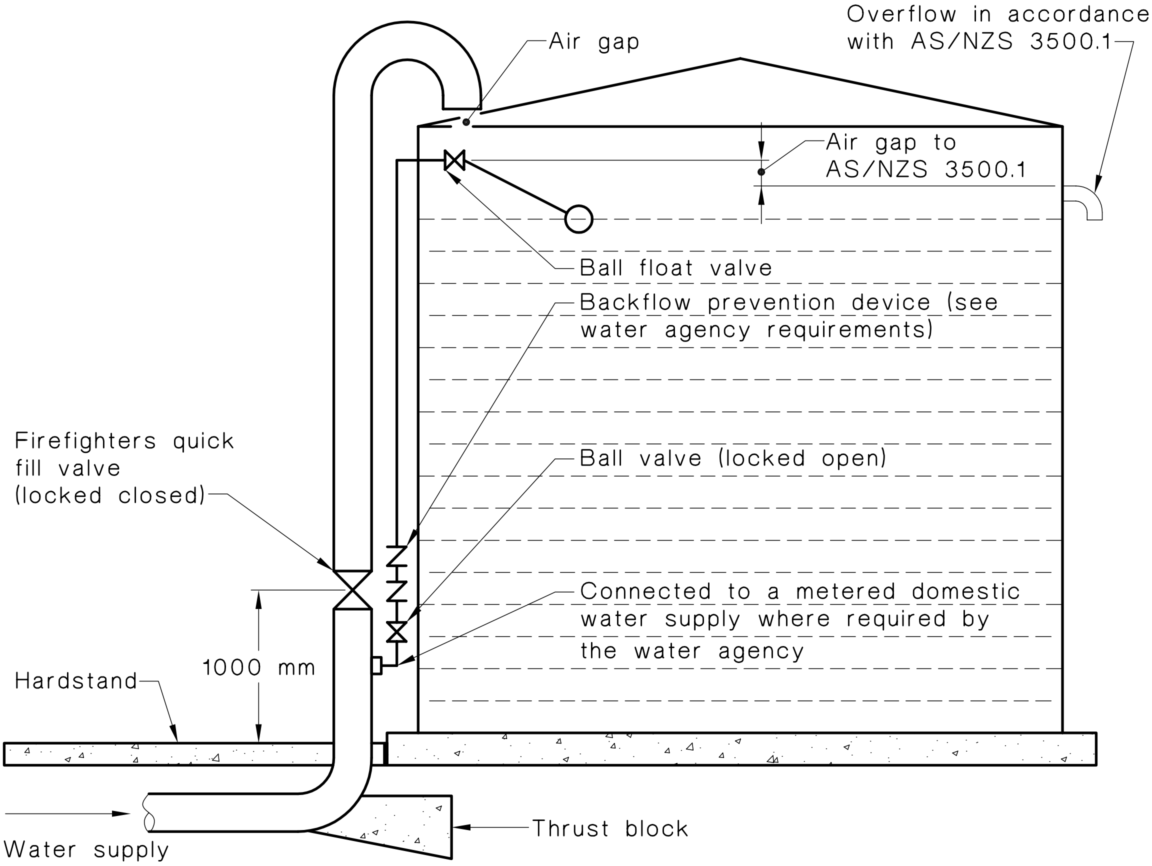
5.2.4 Tank fill time

Water supplied to fire hydrant system storage tanks shall be capable of refilling 50% of the required tank storage capacity in less than 24 h.

Where storage tanks are also used as a supply to an automatic sprinkler system, the water supply to the tank shall be capable of completely refilling the tank in accordance with AS 2118.1.

5.2.5 Overflows and air gaps

Overflow pipe sizes and air gaps between float-operated valves and automatic infill outlets and the maximum tank water level shall be designed in accordance with AS/NZS 3500.1.



NOTE: Materials and construction are to comply with the requirements of AS/NZS 3500.1.2.

FIGURE 5.2.3 TYPICAL SECTIONAL ELEVATION OF AN ABOVE-GROUND EXTERNAL STORAGE TANK SHOWING FILL AND QUICK-FILL ARRANGEMENTS

5.3 EFFECTIVE CAPACITY

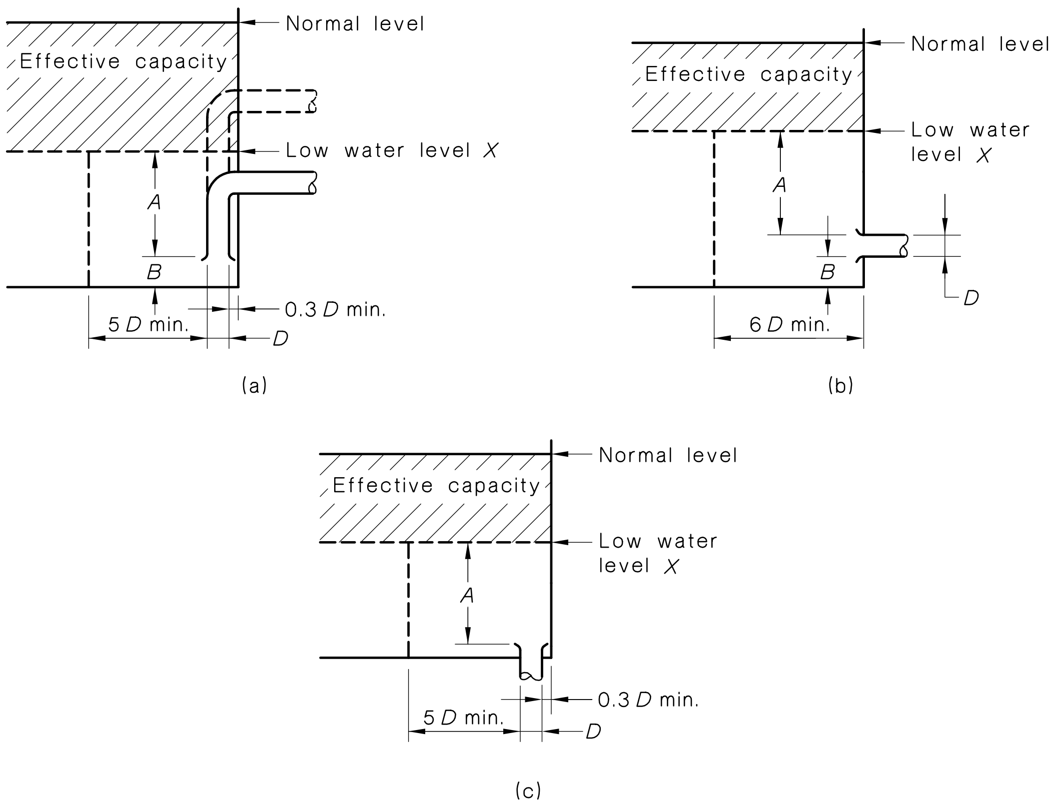
5.3.1 General

When calculating the effective capacity of a storage tank, the depth shall be taken as the measurement between the normal water level in the tank and the low water level *X* shown in Figure 5.3.1 in accordance with AS 3500.1. Low water level *X* is calculated to be the lowest level before a vortex is created causing the pump to draw air (see Note to Figure 5.3.1).

Where the suction pipe is taken from the side of the tank, as shown in Figure 5.3.1, the clearance between the base of the tank and the lowest level of the pump suction pipe shall be not less than dimension *B*.

Where a sump is formed in the base of a suction tank from which the suction pipe draws water, the sump shall be not smaller than indicated in Figure 5.3.1 in which the position of the sump is shown with broken lines. In addition, the sump width shall be not less than 3.6 *d*, where *d* is the nominal diameter of the suction pipe. The point of entry of water to the suction pipe shall be located centrally across the width of the sump.

The entry to the suction pipe shall be enlarged so that at the maximum design flow rate the velocity entering the enlarged portion does not exceed 1.25 m/s.



Nominal diameter of suction pipe	Dimension *A* mm	Dimension *B* mm
65	250	80
80	310	80
100	370	100
150	500	100
200	620	150
250	750	150
300	900	200
350	1050	250
400	1200	300

NOTE: Where a vortex inhibitor is installed the following may be applied:

(a) Dimension *A* may be disregarded and low water level *X* may be taken as the level at which vortex commences.

(b) Dimension *B* may be taken from the base of the tank to the level at which vortex commences in the case of Example (a). Example (b) is unlikely to be appropriate to arrangements employing a vortex inhibitor.

FIGURE 5.3.1 EFFECTIVE CAPACITY OF PUMP SUCTION TANKS

5.3.2 Vortex inhibitors

Where a flat circular plate vortex inhibitor is used at the suction inlet of a fire hydrant pump, it shall be designed in accordance with Figure 5.3.2 using the following formulae:

(a) Minimum clearance (H_m) under the vortex plate:

$$H_m = 0.5d, \text{ if } d > \text{DN } 150 \qquad \ldots 5.3.2(1)$$

$$H_m = 0.75d, \text{ if } d \leq \text{DN } 150 \qquad \ldots 5.3.2(2)$$

where

H_m = H_a

H_m = minimum clearance under plate in millimetres

H_a = actual clearance under plate in millimetres

(b) Minimum diameter (D) of vortex plate:

$$D = \frac{Q \times 17.68 \times 60}{H_a} \qquad \ldots 5.3.2(3)$$

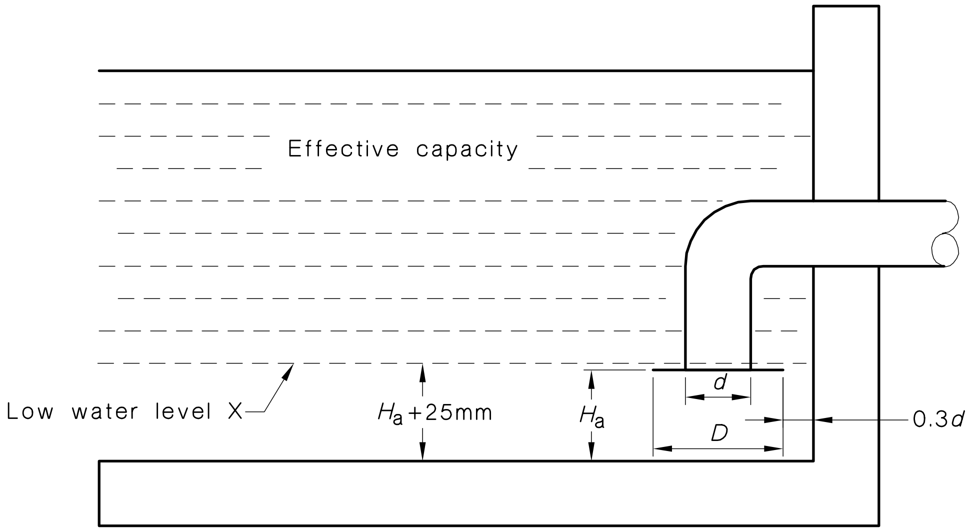
where

D = minimum diameter of vortex plate in millimetres

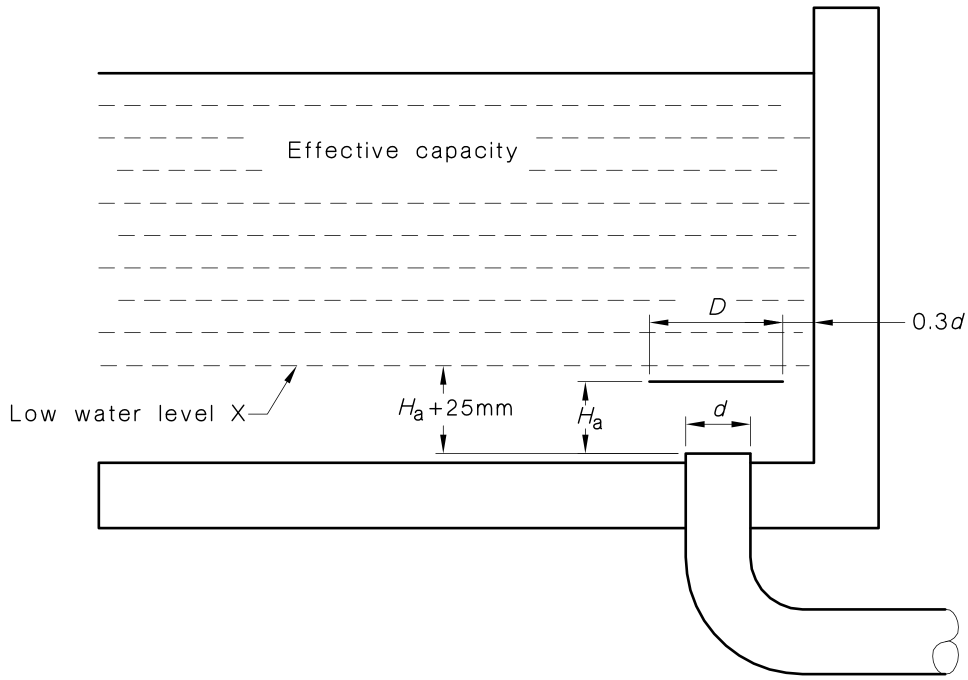
Q = maximum required flow rate L/s (see Section 2)

The plate shall be not less than 10 mm thick and shall be effectively protected from corrosion.

NOTE: Vortex inhibitors are not suitable for use in sumps.



(a) Side entry



(b) Bottom entry

FIGURE 5.3.2 VORTEX PLATE SIZE AND LOCATION

5.4 STORAGE TANK CONNECTIONS, VALVES AND ACCESSORIES

5.4.1 General

Storage tanks shall be capable of providing water by suction to fire brigade pumping equipment. Such suction points shall be compatible with the equipment of the fire brigades operating in the particular area.

Elevated and below-ground tanks in multistorey buildings may not require a suction connection. Connections to tanks shall be compatible with the operational requirements of the fire brigade.

Suction points for external storage tanks are of two types as defined in Clauses 5.4.2 and 5.4.3.

Suction connections shall be located in a position such that a fire brigade pumping appliance can be positioned on a hardstand facing and not more than 4.5 m from each suction connection.

5.4.2 Large bore suction connection

Each water storage installation shall be fitted with at least one large bore suction point for use by the fire brigade, comprising a large bore hose connection complete with a metal cap and captive chain.

The suction connection shall be fed by a pipe internal to the tank of not less than DN 150, complete with a flat plate vortex inhibitor of not less than 400 mm having a clearance beneath it of not less than 100 mm, in accordance with Figure 5.4.2 (see Note 2).

The centre-line of the large bore suction connection shall be between 450 mm and 600 mm above the hardstand. An isolation valve, in accordance with Clause 8.5.8, shall be installed upstream of the suction connection, except that—

(a) it shall be secured in the closed position; and

(b) an identification tag is not required.

5.4.3 Small bore suction connection

Where a large bore suction connection is to be installed, each tank shall be also fitted with a minimum of two small bore connections (DN 65) 400 mm above the large bore connection, each comprising a lever-operated ball or butterfly valve or a gate valve, and each with a DN 65 hose connection with blank cap and chain (see Note 1). The use of valves with loose jumpers shall not be permitted for this purpose.

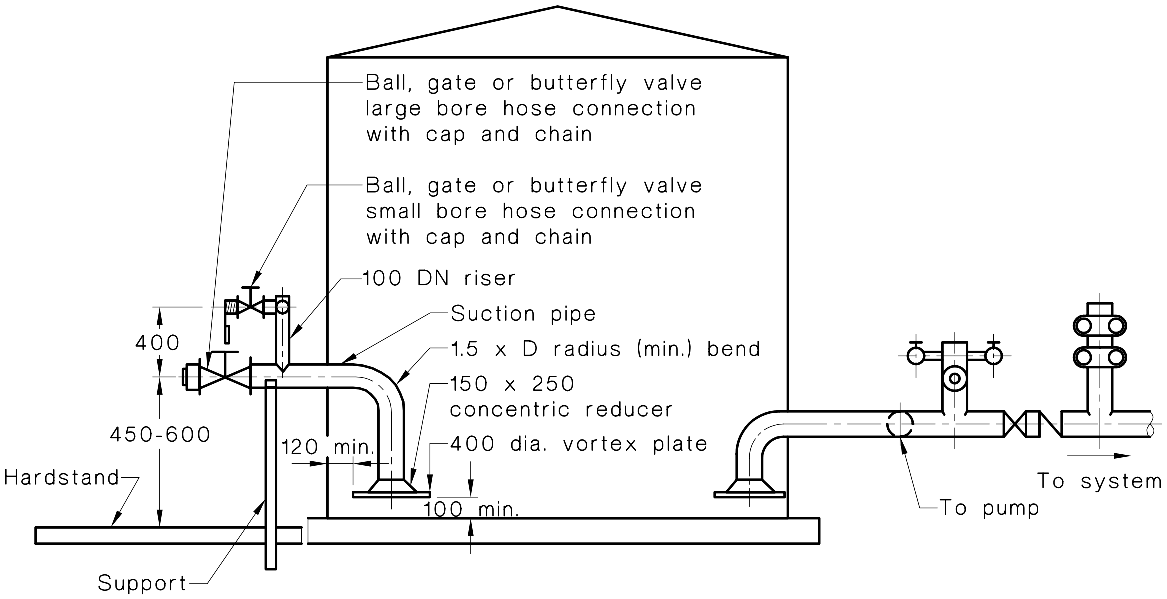
Where a tank is not located in a secure area, all valves shall be locked in the closed position with a padlock key suitable to the needs of the local fire brigade.

NOTES:

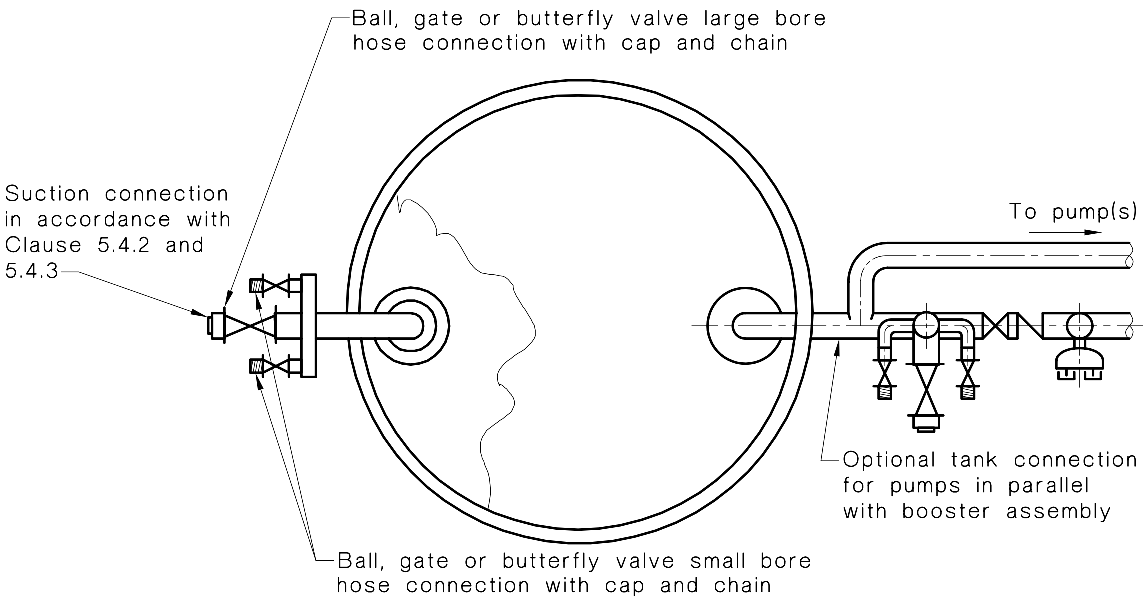
1 For a typical arrangement, see Figure 5.4.2.

2 Multiple water storage tanks may be interconnected using a manifold with a valve at each tank.

C5.4.2, C5.4.3 *Generally, metropolitan fire brigades use large bore suction connections and rural fire brigades use small suction connections while mutual response areas use both. Because many rural fire brigades in Australia also have fire brigade pumping appliances capable of using large diameter suction hose, it is important to liaise with the local fire brigade as to the details of any large size tank connection.*



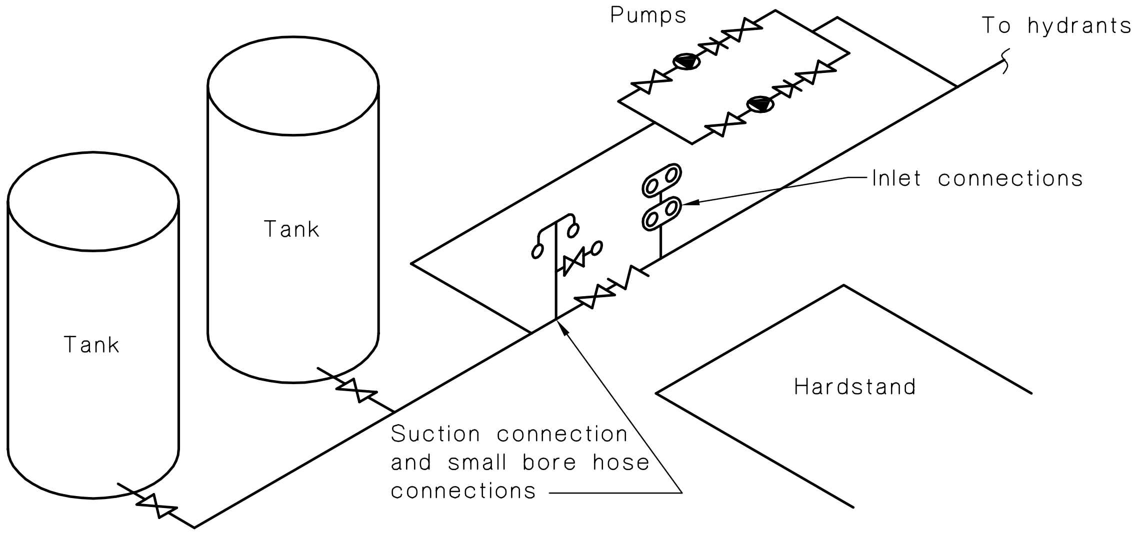
(a) Sectional elevation



(b) Part plan

DIMENSIONS IN MILLIMETRES

FIGURE 5.4.2 (in part) TYPICAL ARRANGEMENT OF FIRE BRIGADE CONNECTION TO AN ABOVE-GROUND EXTERNAL STORAGE TANK (UP TO 40 L/s)



(c) Example of tank-fed pumped system

DIMENSIONS IN MILLIMETRES

FIGURE 5.4.2 (in part) TYPICAL ARRANGEMENT OF FIRE BRIGADE CONNECTION TO AN ABOVE-GROUND EXTERNAL STORAGE TANK (UP TO 40 L/S)

5.4.4 Tank contents indicator

5.4.4.1 *General*

Each tank shall be fitted with an external indicator to show the tank water level.

NOTE: Example of tank contents indicators is given in Figure 5.4.3.

The indicator shall display the contents of the tank as follows:

F (full), ½ (half full) and E (empty)

The indicator shall be—

(a) located on the side of the tank in a prominent position adjacent to the suction connection;

(b) marked in upper case lettering not less than 100 mm in height; and

(c) in lettering in a colour contrasting with that of the background.

5.4.4.2 *Materials for indicator assembly*

Components of a water level indicator (see Figure 5.4.3) that are installed inside the tank shall be constructed of the following materials:

(a) Copper or PVC for the weighted float.

(b) Flexible stainless steel for the cable.

(c) Bronze, stainless steel or dezincification resistant brass for the corner pulley(s) and housing(s).

(d) Stainless steel for any cable conduit.

(e) Stainless steel for any bolts, nuts, cable clamps, or the like.

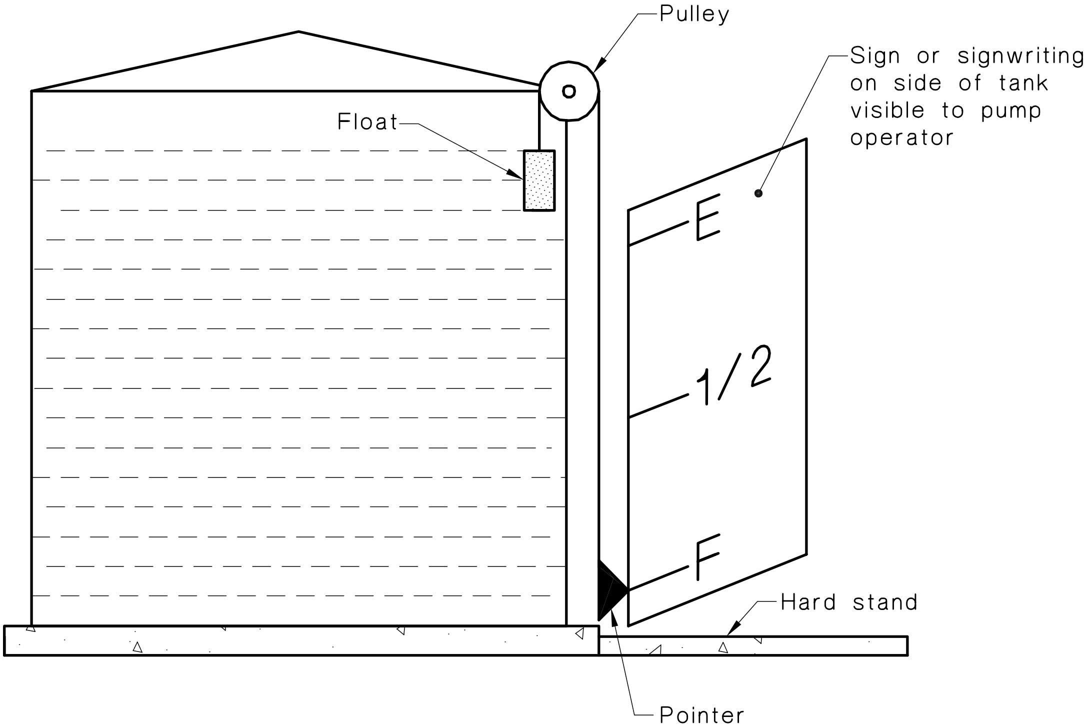
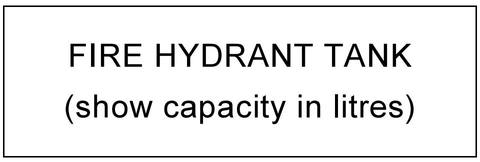


FIGURE 5.4.3 EXAMPLE OF TANK CONTENTS INDICATORS

5.4.5 Fire hydrant tank signs

Fire hydrant tanks shall have the following sign:



The sign shall be—

(a) marked on the side of the tank and repeated to ensure visibility from all approach directions;

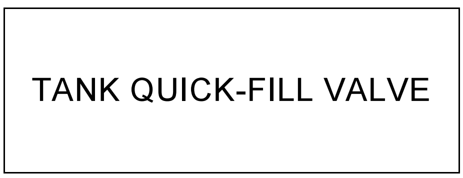
(b) marked in upper case lettering not less than 100 mm in height; and

(c) in fade-resistant lettering in a colour contrasting with that of the background.

NOTE: The main hydrant tank sign may be appropriately amended if other systems are fed from this source.

5.4.6 Fire Hydrant tank quick-fill valve

Quick fill valves shall have the following sign:



The sign shall be—

(a) engraved or other fade-resistant method;

(b) in upper case lettering not less than 50 mm in height; and

(c) in fade-resistant lettering in a colour contrasting with that of the background.

5.4.7 Access openings and ladders

Covered access openings shall be provided in all tank roofs for access to the tank and its equipment. Internal and external access ladders shall be provided to facilitate periodic inspection and cleaning of the tank in accordance with AS/NZS 3500.1. Confined space signs shall be fixed adjacent to the access openings.

SECTION 6 PUMPSETS

6.1 GENERAL

Pumpsets shall be installed to meet the hydrant flow and pressure requirements of this Standard and shall comply with AS 2941.

6.2 PUMPSET CONFIGURATIONS

On-site pumpsets provided to achieve the hydrant flow and pressure requirements of this Standard shall comprise —

(a) two pumps with at least one driven by a compression ignition engine or an electric motor supplied from an emergency power generator;

(b) three pumps driven by compression ignition engines, any two of which will meet the duty requirements; or

(c) two pumps driven by electric motors connected to completely independent power sources;

(d) if connected to a reticulated water supply and installed in a building not greater than 25 m in effective height, one pump driven by —

  (i) a compression ignition engine;

  (ii) an electric motor supplied from an emergency power generator; or

  (iii) an electric motor connected to two completely independent power sources through an automatic changeover facility;

6.3 ELECTRIC DRIVER ISOLATING SWITCHES

Switches in circuits supplying the driver shall be locked 'ON' and clearly labelled '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 (see Appendix G) .

6.4 PUMPROOM

6.4.1 General

Pumprooms containing fixed on-site pumpsets and associated equipment shall be weatherproof and be—

(a) secure to prevent the entry of unauthorized persons;

(b) adequately ventilated for the aspiration and cooling of pump drivers;

(c) heated, where necessary, to prevent freezing and facilitate the cold start of compression ignition drivers;

(d) identified by appropriate signs and other visual and audible aids, so that the room and its entrance can be readily located by the attending fire brigade; and

(e) constructed with a minimum 2.1 m high internal clearance with adequate space for pump maintenance and replacement.

6.4.2 Internal pumprooms

Pumprooms located within a building shall have—

(a) a door opening to a road or open space, or a door opening to fire-isolated passage or stair which leads to a road or open space; and

(b) except where the building is sprinklered in accordance with AS 2118.1, enclosing walls with an FRL not less than that prescribed by the BCA for a firewall for the particular building classification served by the fire hydrant system.

6.4.3 External Pumprooms

Pumprooms and enclosures, located external to and within 6 m of any building they are protecting, shall have enclosing walls with an FRL not less than that prescribed by the BCA for a firewall for the particular building classification served by the fire hydrant system.

Hardstand shall be provided within 20 m of the access door to the pumproom.

SECTION 7 FIRE BRIGADE BOOSTER ASSEMBLY

7.1 GENERAL

Fire brigade booster assemblies shall comply with the requirements of this Section.

Fire brigade booster assemblies fitted to fire hydrant systems shall conform to the requirements of AS 2419.3 and the hose couplings shall be compatible with those used by the fire brigade serving the area.

Where the assembly is located in a cabinet, it shall be weatherproof.

7.2 WHEN A BOOSTER ASSEMBLY IS REQUIRED

A fire brigade booster assembly shall be fitted to each 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 6 external on-site above ground fire hydrants are installed;

(d) a pumpset is installed;

(e) on-site storage tanks are installed; or

(f) more than one external on site fire hydrant is required to serve a building where the floor area of any fire compartment is greater than 2000 m^2 .

7.3 LOCATION

Fire brigade booster assemblies shall be located so that they meet the following requirements:

(a) They are readily accessible to firefighters.

(b) They are operable by fire brigade pumping appliances located within 8 m.

(c) If within, or affixed to, the external wall of the building, the booster shall be—

  (i) within sight of the main entrance to the building; and

  (ii) separated from the building by a construction with a fire resistance rating of not less than FRL 90/90/90 for a distance of not less than 2 m each side of and 3 m above the upper hose connections in the booster assembly

  NOTE: An example of a booster assembly within the external wall of a building is shown in Figure 7.3.1.

(d) If remote from the building, the booster shall be—

  (i) at the boundary of the site or within sight of the main entrance of the building;

  (ii) adjacent to the principal vehicular access to the site; and

  (iii) located not less than 10 m from the external wall of any building served

  NOTE: An example of a booster assembly remote from a building is shown in Figure 7.3.2..

(e) The booster enclosure shall only contain firefighting pipework and equipment.

(f) In a position not less than 10 m from any high voltage main electrical distribution equipment such as transformers and distribution boards, and from liquefied petroleum gas and other combustible storage.

(g) In a position so that the booster assembly is not obstructed or obscured by obstacles, stored goods, vehicles, vegetation, etc.

C7.3 *The location of the fire brigade booster assembly should be chosen so as to afford maximum accessibly for and protection of firefighting personnel.*

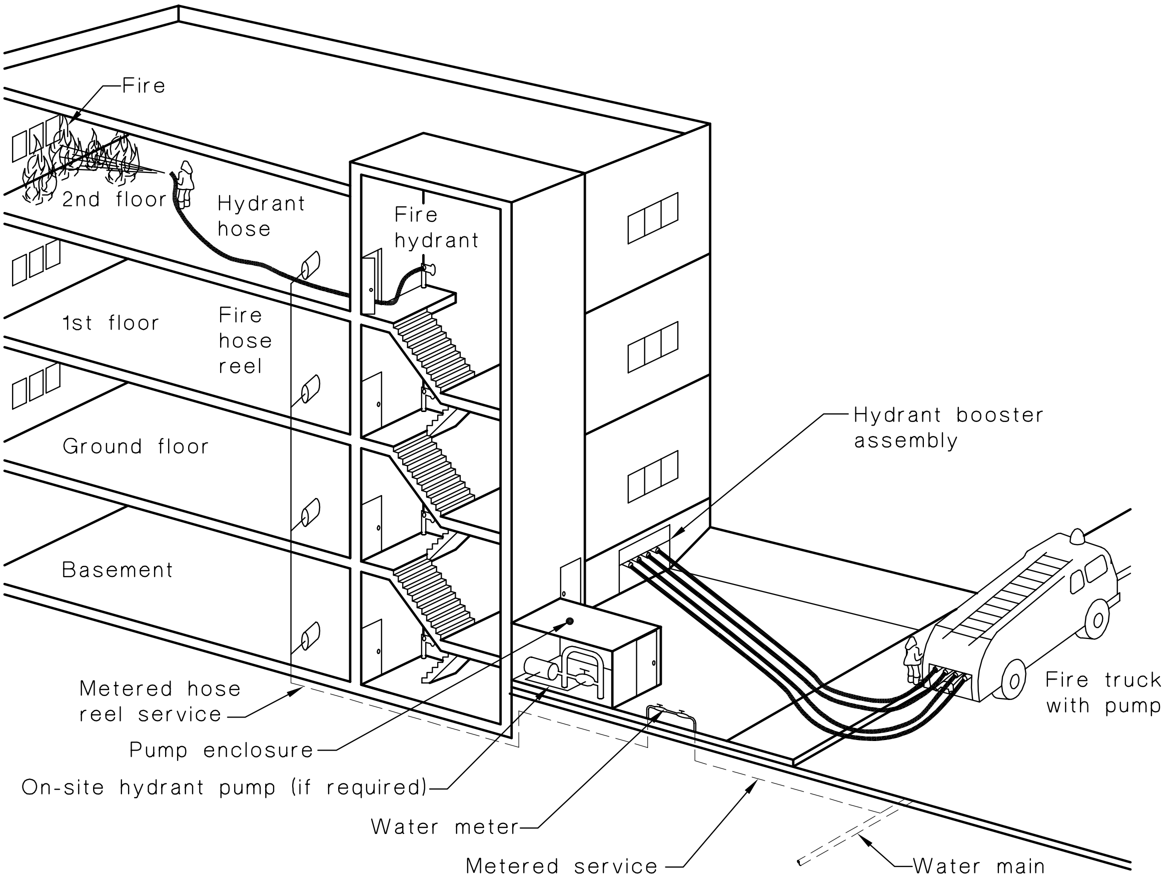


FIGURE 7.3.1 EXAMPLE OF BOOSTER ASSEMBLY WITHIN EXTERNAL WALL OF A BUILDING

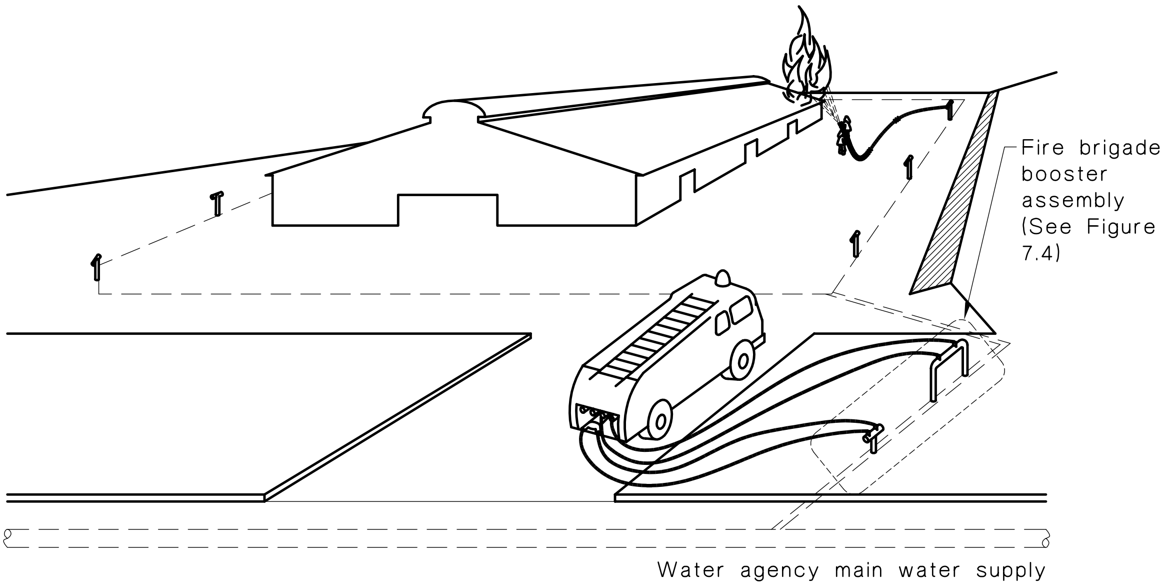


FIGURE 7.3.2 EXAMPLE OF BOOSTER ASSEMBLY REMOTE FROM BUILDING

7.4 FIRE BRIGADE BOOSTER ASSEMBLY ARRANGEMENT

Feed fire hydrants shall be installed on-site adjacent to booster inlet connections within the following limitations:

(a) The centre distance between any feed fire hydrant and the closest fire brigade booster inlet shall be not less than 450 mm and not more than 5 m.

NOTE: Typical booster arrangements are shown in Figure 7.4.

(b) The position of feed fire hydrant and fire brigade booster inlet connections shall be such that, when all inlets and outlets have hoses connected, one hose shall not cause interference with another hose (see Figure 7.4).

(c) The height of the feed fire hydrant outlets and the fire brigade booster inlet connections shall be not less than 750 mm or more than 1200 mm above the floor or standing surface in front of the fire brigade booster assembly

Where external water storage facilities at ground level are provided, suction points may be provided in lieu of the feed fire hydrants, in accordance with Clause 5.4, where the make-up flow rate to the tank is insufficient for firefighting purposes. The suction points shall be within 10 m of the booster inlet connection(s).

Where boosters or feed fire hydrants are installed in a cabinet or recess, the front face of all connections shall be within 150 mm of the front face of the cabinet or recess.

The number of booster inlet connections required shall be calculated for a maximum rate of 10 L/s each to meet the system design requirements subject to a minimum of 2 inlets. Where hydrant systems are combined with any other system, additional fire hydrants and inlets shall be provided to accommodate the additional flow requirements.

The number of installed feed fire hydrant outlets for the fire brigade booster assembly shall be equal to the number of fire brigade booster assembly inlets.

Where more than 8 fire brigade booster assembly inlets are required for a system, additional fire hydrant booster facilities shall be provided to suit.

Where more than one fire brigade booster assembly is installed, or more than four booster inlets are provided, the booster assembly shall be so arranged to allow multiple fire brigade pumping appliance access.

Booster assemblies shall permit a fire main to be pressurized without recourse to the manual operation of isolating valves and shall be arranged generally in accordance with Figure 7.4.

NOTE: Where a backflow prevention device is required by the water agency, the booster arrangement may be modified in accordance with Figure 9.4.

Where the head of water present at the booster inlets, due to the system configuration or additional water supplies, can at any time be greater than 50 kPa, additional valves shall be installed to isolate the booster inlets.

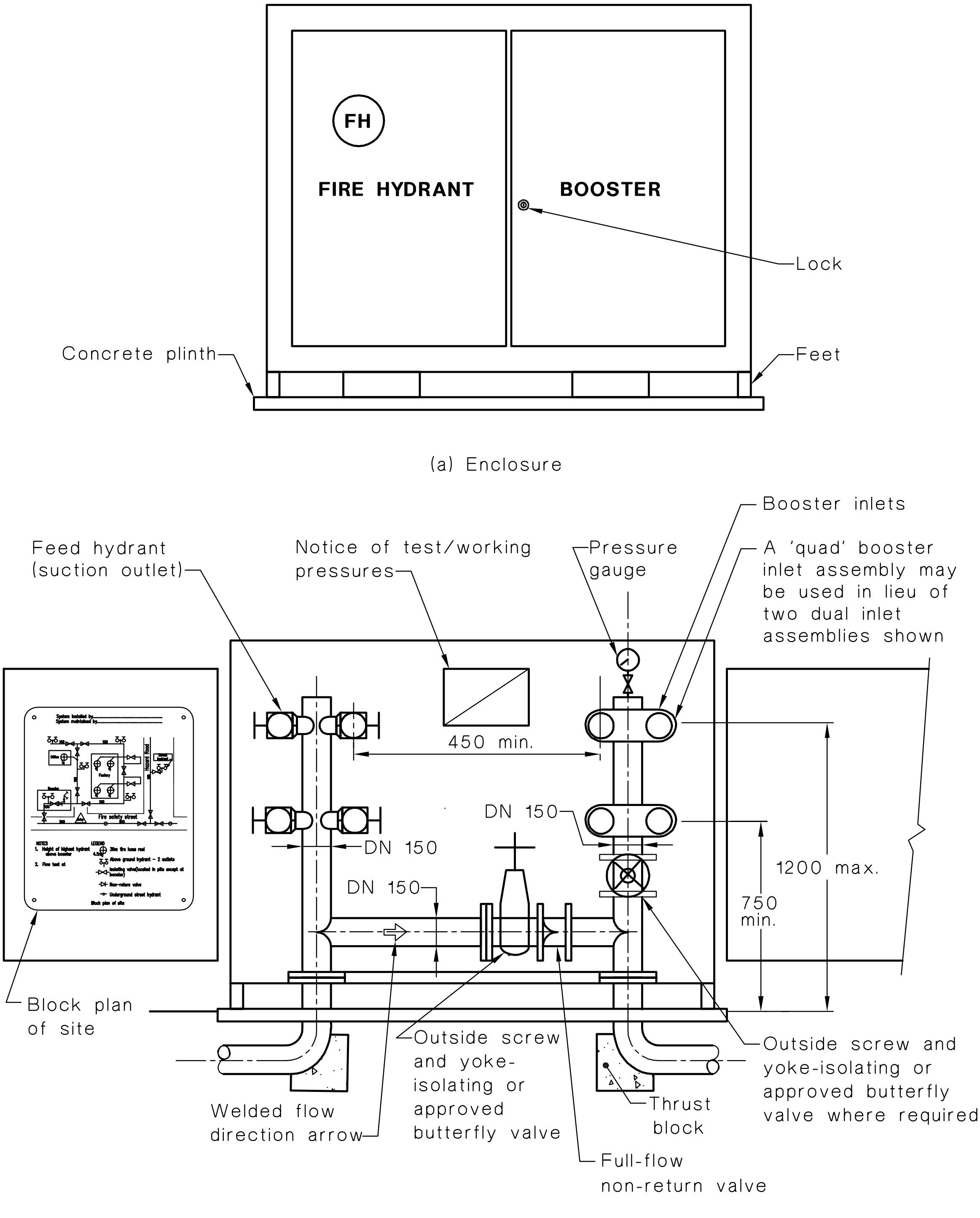
Where there is a town main supply to the fire hydrant system, there shall be a full flow non-return valve and an isolating valve installed above ground on the supply. The isolating valve shall be on the inlet, before the non-return valve.

An arrow showing the direction of flow shall be welded or cast to the pipework adjacent to the booster (see Figure 7.4(b)).

Caps, chains, bleed valves and ancillary fittings shall be as specified in AS 2419.3.

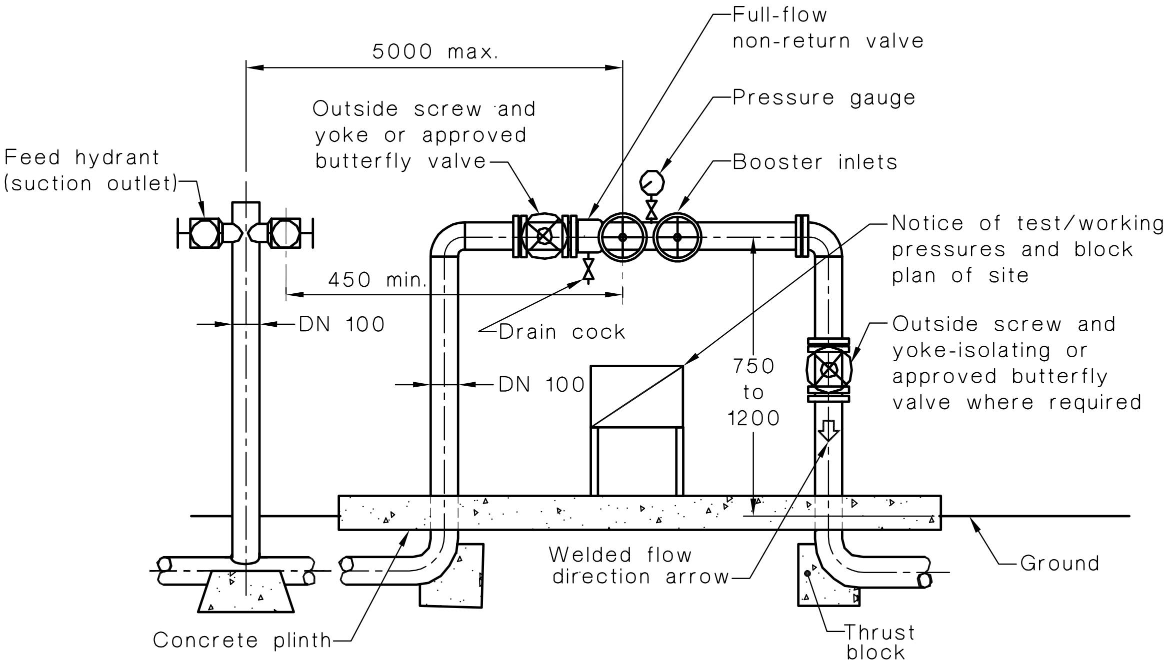
C7.4 *Designers should liaise closely with the authorities when locating a fire brigade booster assembly. They should be aware of the weight of fire appliances, their height, turning circles and other space requirements and their likely direction of approach to the booster assembly with respect to width restrictions, traffic hazards, and the like.*

If boosting is on the suction side of a pump, care should be taken in specifying maximum pressure on pump casing and seals.

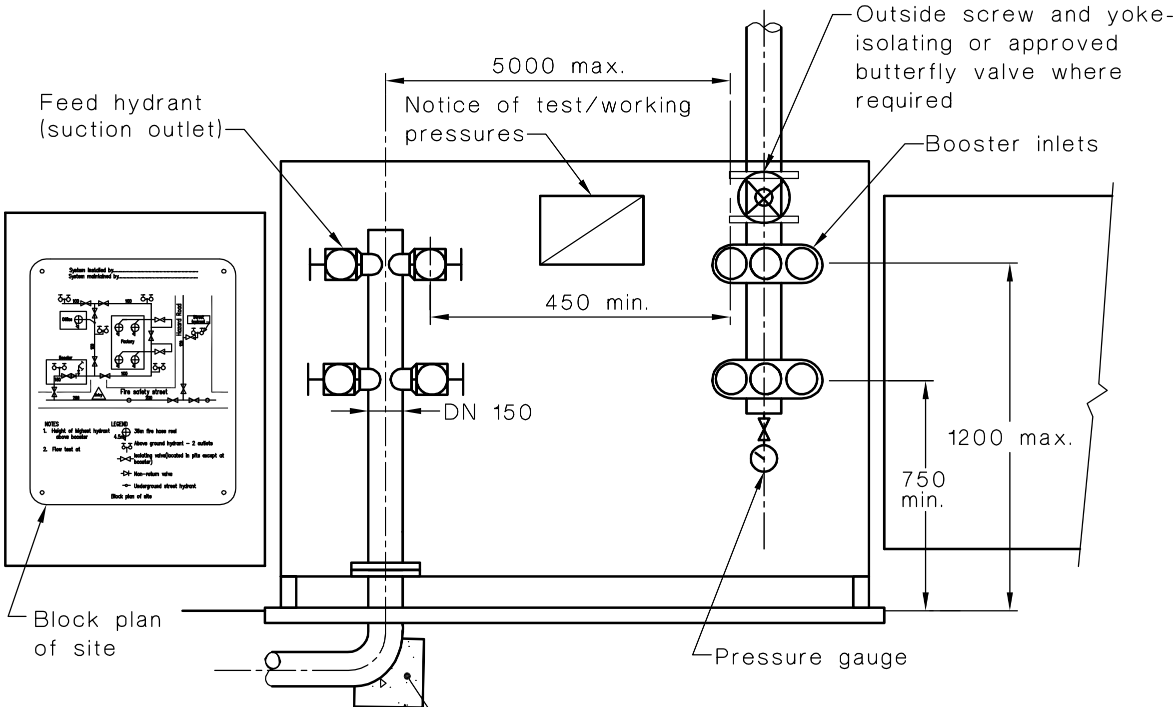


DIMENSIONS IN MILLIMETRES

FIGURE 7.4 (in part) TYPICAL BOOSTERS ARRANGEMENT (>50 kPA PRESSURE AT BOOSTER INLET)



(c) Typical arrangements without closure



(d) Typical arrangement for a high rise tank fed system

DIMENSIONS IN MILLIMETRES

FIGURE 7.4 (in part) TYPICAL HIGH RISE TANK FED BOOSTER ARRANGEMENT (>50 kPA PRESSURE AT BOOSTER INLET)

7.5 BOOSTER IN PARALLEL WITH PUMPS

Where a booster is connected in parallel with the fixed on-site fire pumps, the booster feed fire hydrants shall be installed on the suction side of the fixed onsite fire pumps and the booster inlets shall be installed after the branch connection of the discharge pipework from the fixed onsite fire pumps.

NOTE: A general arrangement is shown in Figure 7.5.

C7.5 *This arrangement is preferred to the series (relay) arrangement because the maximum pressure and flow under boost conditions will not be affected by the fixed on-site pumps pressure relief valves (see fig. 7.5).*

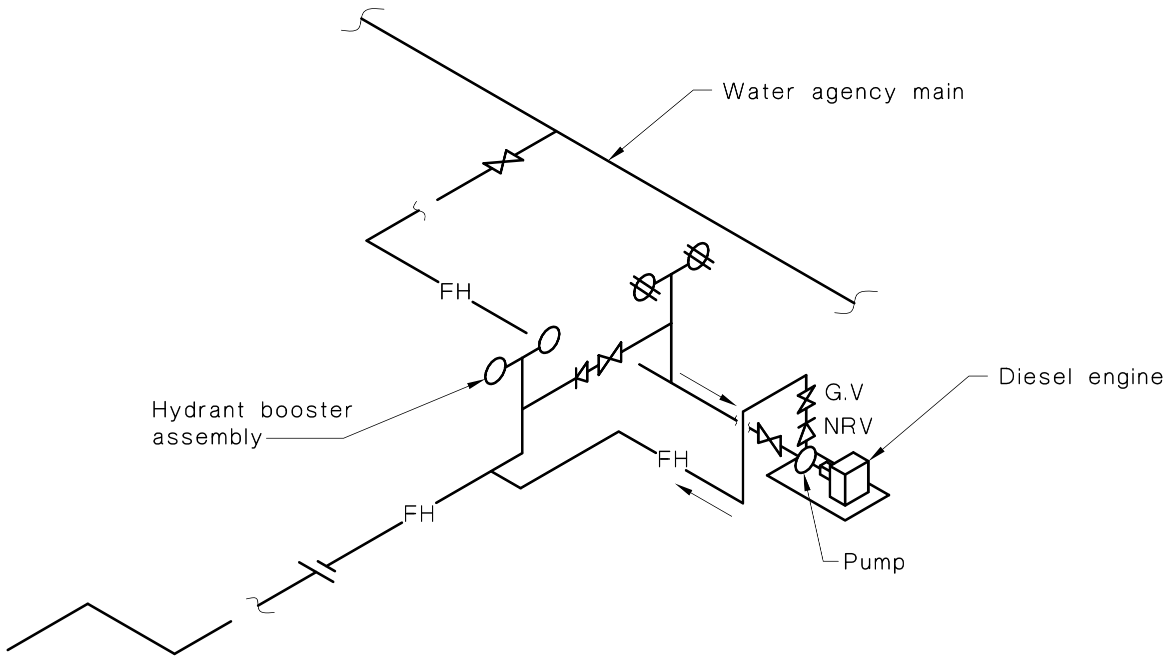


FIGURE 7.5 GENERAL ARRANGEMENT OF BOOSTER ASSEMBLY IN PARALLEL WITH PUMPS

7.6 BOOSTERS IN SERIES (RELAY) WITH PUMPS

Where the booster is connected in series with the fixed on-site fire pumps, the following additional provisions shall be made:

(a) 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 (see Figures 7.6.1).

NOTE: A schematic of booster is shown in Figure 7.6.1.

(b) A 150 mm diameter liquid-filled pressure gauge, which will indicate the pressure at the pump discharge pipe/manifold, shall be located at the booster.

(c) An engraved warning sign shall be affixed adjacent to the pressure gauge consisting of the wording given in Figure 7.6.2 and in accordance with the following—

(i) fixed in a prominent position;

(ii) marked in upper case lettering not less than 25 mm in height; and

(iii) in lettering in a colour contrasting with that of the background.

C7.6 In series pumping arrangement may create operational problems for the attending fire brigade unless the required AS 2941 pressure relief valve and hydraulic characteristics of the system permit adequate performance to be achieved prior to over pressure operation of the relief valve. Advisory signs to manually isolate the pump may be necessary where hydrant flows and pressures beyond the requirements of this Standard are desired.

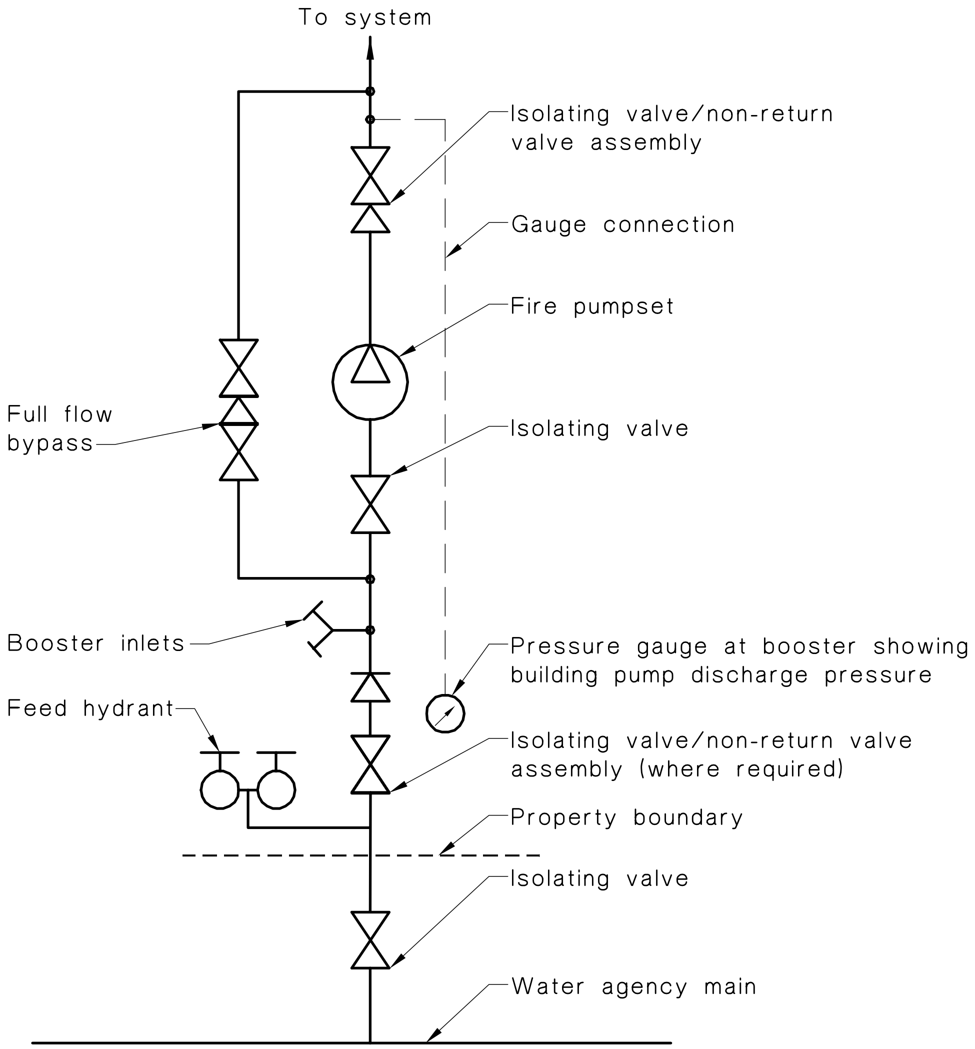


FIGURE 7.6.1 SCHEMATIC OF BOOSTER ASSEMBLY IN SERIES (RELAY) WITH PUMPS

WARNING

THIS BOOSTER IS CONNECTED IN SERIES (RELAY) WITH THE FIXED ON-SITE FIRE PUMPS WHICH MAY BE RUNNING

THIS GAUGE SHOWS THE TRUE BOOST PRESSURE AT THE FIXED ON-SITE PUMP DISCHARGE

FIGURE 7.6.2 WARNING LABEL

7.7 FIRE BRIGADE RELAY PUMPS

In buildings having an effective height greater than 50 m, fire brigade relay pumps shall be installed in the system as follows:

(a) A pumpset shall be provided to enable relay boosting of each 50 m pressure stage.

(b) Each pumpset shall comprise one pump driven by—

  (i) a compression ignition engine; or

  (ii) an electric motor supplied from an emergency power generator.

(c) A full flow by-pass shall be installed around the pump.

(d) Each pump location shall be clearly indicated with a fade-resistant sign—

  (i) with the lettering 'FIRE BRIGADE RELAY PUMP'; and

  (ii) in letters not less than 75 mm high and in a colour contrasting with that of the background.

(e) Location of fire brigade relay pumps shall be in accordance with Clause 6.4.

NOTE: Location and performance of any fire brigade relay pump is dependent upon the available resources of the attending fire brigade. Consultations should take place to determine the parameters required to achieve a satisfactory level of performance.

7.8 FIRE BRIGADE BOOSTER ASSEMBLY ENCLOSURE

Where a booster assembly is installed in an enclosure, recess or cabinet (see Figure 7.4) it shall—

(a) be of sufficient size to contain all necessary equipment;

(b) permit ease of operation of the equipment;

(c) have a block plan of the system (see Clause 7.11); and

(d) provide a means for water to drain.

Metal cabinets remote from the building shall be mounted on legs to provide not less than 50 mm space between the bottom edge of the cabinet and the finished surface level.

All other cabinets, enclosures or recesses shall have a sloping floor of not less than 40 mm from the rear of the cabinet, enclosure or recess to weep holes (where provided) at the front.

7.9 FIRE BRIGADE BOOSTER ASSEMBLY CABINET OR ENCLOSURE DOORS

7.9.1 General

Doors of cabinets and enclosures shall be fitted so that when open they do not encroach on exits or inhibit access to other firefighting equipment. The door (or doors) shall be fitted with—

(a) a lever-type handle;

(b) a lock compatible with fire brigade operational procedures; and

(c) signage affixed to or painted on the door (or doors) complying with the requirements of Clause 7.10.

7.9.2 Doors

The doors shall be —

(a) side-hung swing door(s) with each door fitted with hinges of stainless steel or copper alloy and a device capable of securing the door in not less than a 90° open position; or

(b) a lift-off panel no larger than 1500 mm high by 1200 mm wide, weighing not more than 23 kg and fitted with not less than two D-handles near the top of the panel.

7.10 SIGNAGE

7.10.1 Notice of pressure

A fade-resistant or engraved sign indicating boost pressure and test pressure (in kilopascals) shall be—

(a) fixed in a prominent position adjacent to the fire brigade booster assembly or within the cabinet or recess; and

(b) marked in upper case lettering not less than 25 mm in height; and

in lettering in a colour contrasting with that of the background.

NOTE: Examples are shown in Figure 7.10.

BOOST PRESSURE ……. kPa

TEST PRESSURE ……. kPa

FIGURE 7.10 EXAMPLES OF BOOST AND TEST PRESSURE SIGNS

7.10.2 Location identification

Doors on fire brigade booster assembly cabinets, recesses and enclosures shall be clearly identified with fade-resistant signs as follows—

(a) with the lettering 'FIRE HYDRANT BOOSTER', 'FIRE HYDRANT AND SPRINKLER BOOSTER' or 'COMBINED FIRE HYDRANT AND SPRINKLER BOOSTER', as appropriate;

(b) in letters not less than 50 mm high and in a colour contrasting with that of the background; and

(c) if a feed fire hydrant is enclosed in the cabinet, the symbol 'FH' marked within a circular line of inside diameter 100 mm, of the same thickness and colour as the lettering (see Figure 7.4 (a)).

7.11 BLOCK PLAN

A block plan, A3 minimum size, shall be fixed within the booster cabinet, enclosure, recess, fire control room and pump room where it can be readily seen.

NOTE: Typical block plans are shown in Figures 7.4 and 7.11.

The block plan shall be water- and fade-resistant and display the following:

(a) A diagrammatic layout of the protected buildings or open yards and adjacent streets.

(b) A diagram showing—

  (i) size and location of water supply authorities mains and street fire hydrants (dimensioned);

  (ii) valves and connections for non-industrial purposes;

  (iii) location and size of on-site fire mains;

  (iv) location and capacities of water storage tanks;

  (v) location of pumps;

  (vi) location and total number of fire hydrants;

  (vii) location of all fire brigade booster assemblies;

  (viii) location of isolating and non-return valves;

  (ix) any connections to other installed fire protection systems;

  (x) pressure and flow rating of pumps (kPa and L/s);

  (xi) location of main electrical switchroom;

  (xii) location of LPG tanks and gas supply shutdown valve; and

  (xiii) location of all flammable storage areas.

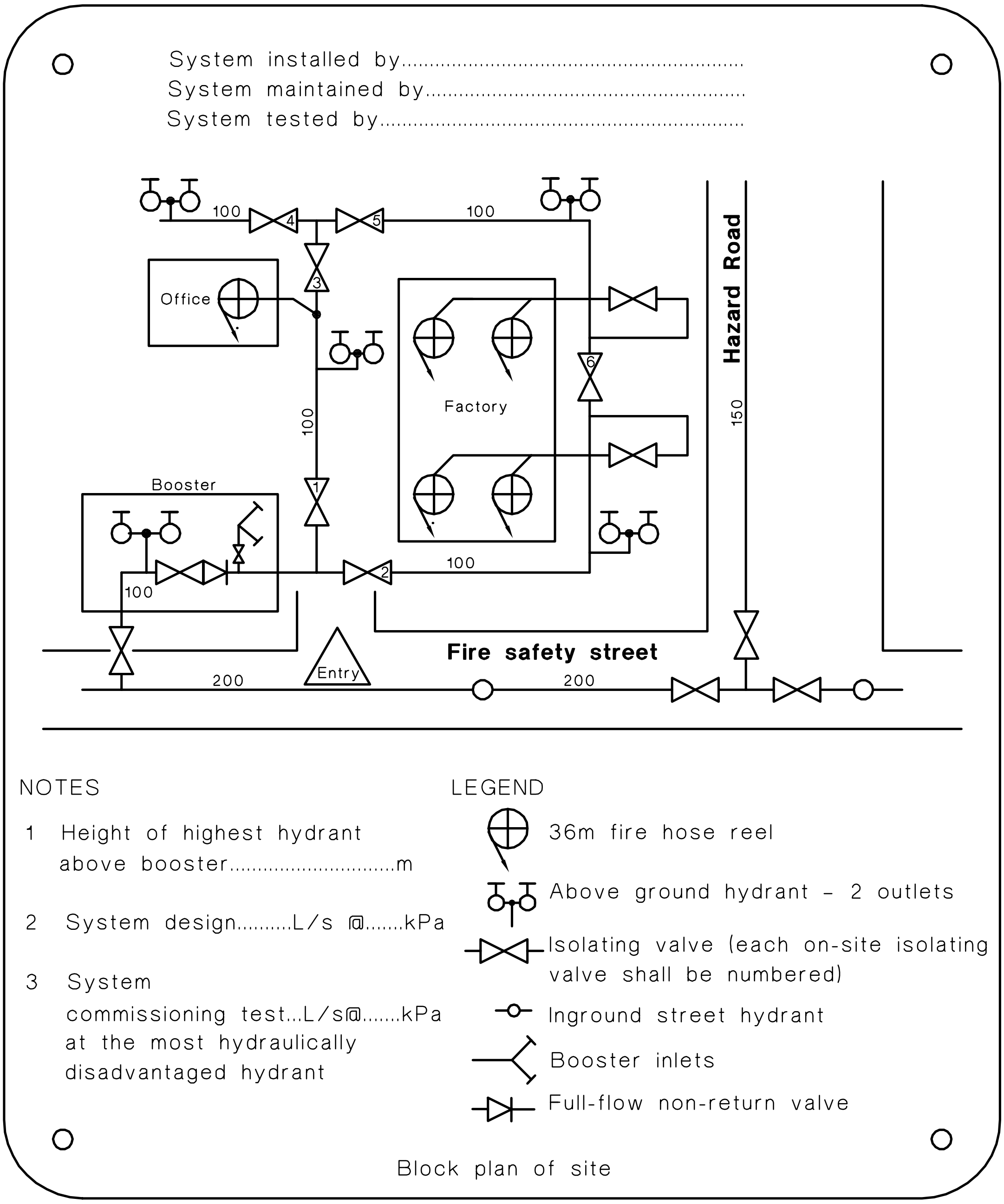
(c) The year of installation of the system, any major extensions thereto, and any unusual features of the installation, and—

  (i) the name of the contractor who installed or modified the system;

  (ii) the system design and commissioning pressure and flow rate; and

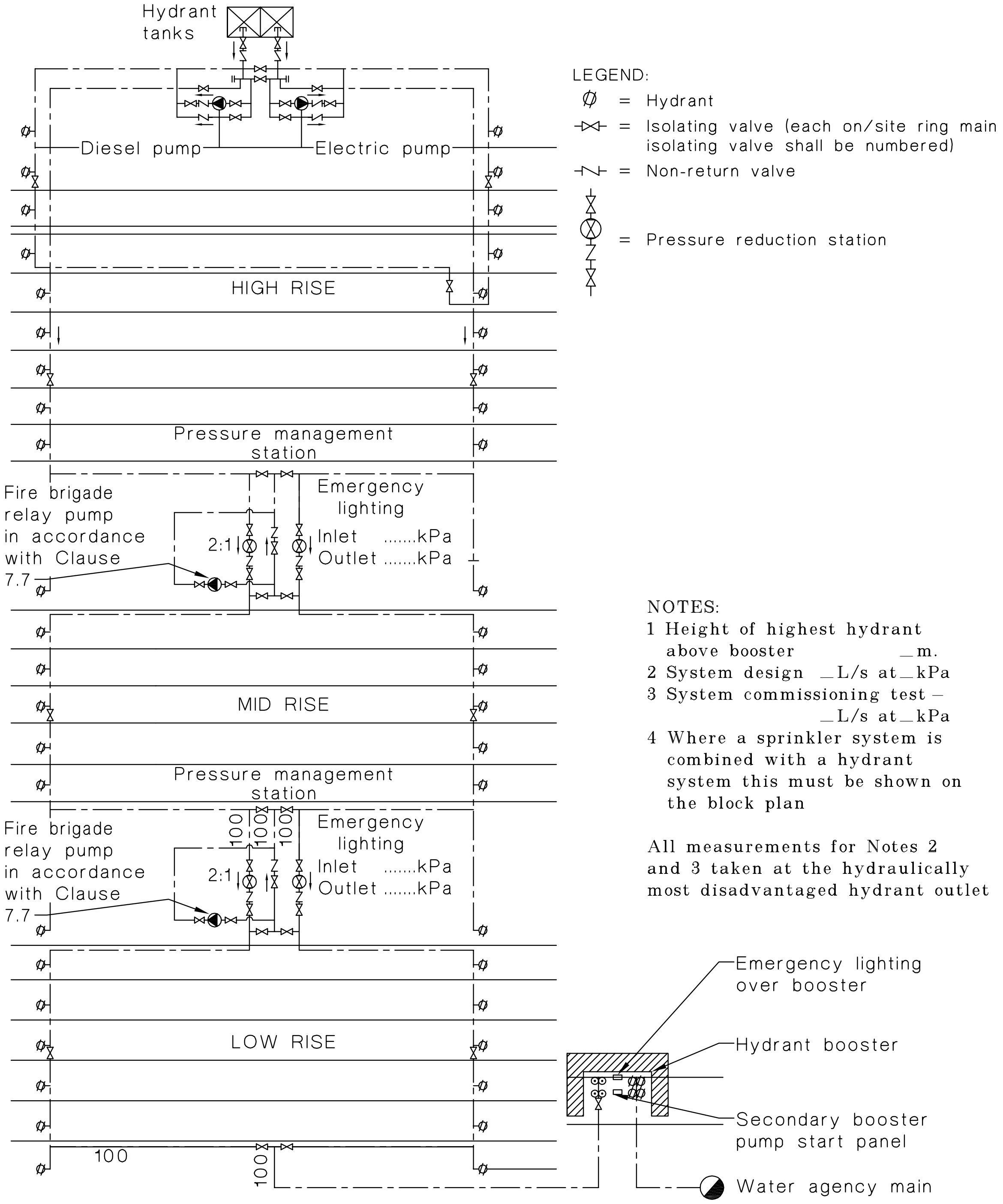
  (iii) the height of the highest fire hydrant outlet above the lowest booster inlet connection.

C7.11 *The block plan provided at each booster location is to ensure that firefighters using the booster assembly are aware of the system in terms of its designed capacity, extent and configuration. This information together with other notices of test and working pressures should provide firefighters with sufficient detail to safely boost the system.*



(a) For low-rise installations

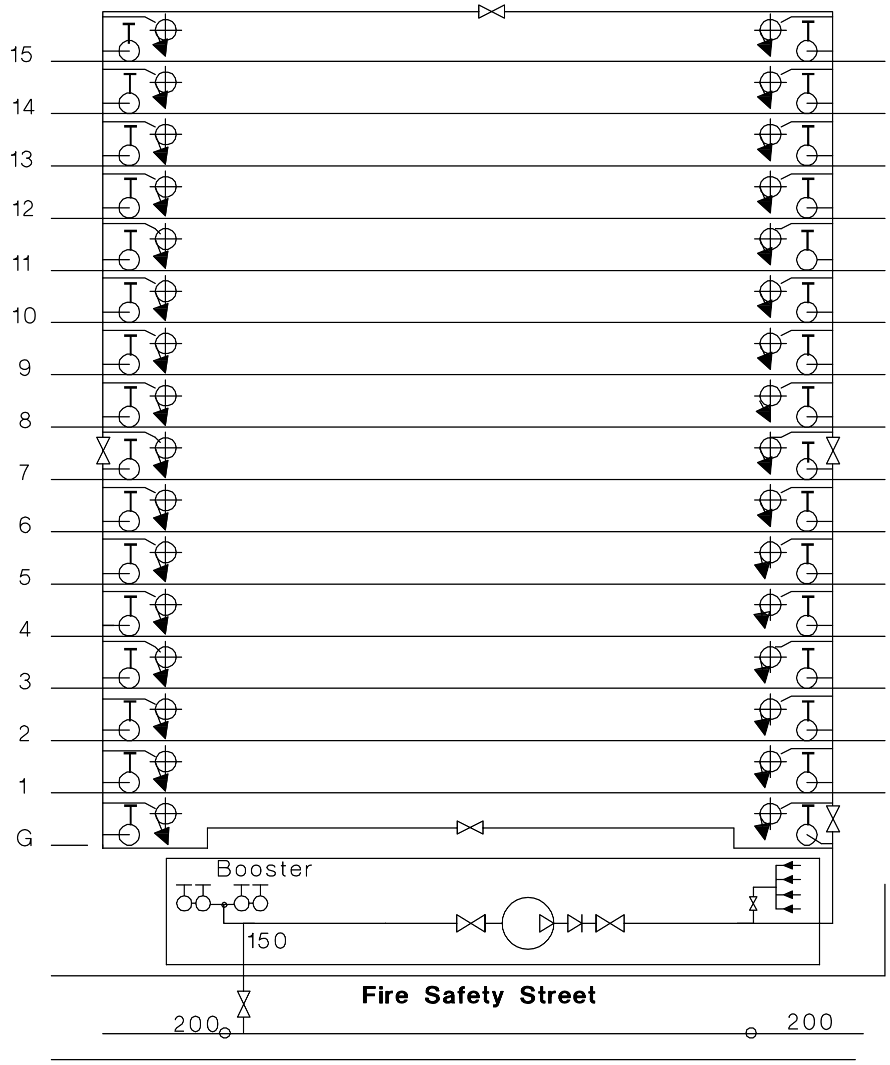
FIGURE 7.11 (in part) TYPICAL BLOCK PLAN



BLOCK PLAN OF SITE

(b) For high-rise installations Example 1

FIGURE 7.11 (in part) TYPICAL BLOCK PLAN



LEGEND

NOTES
1 Height of highest hydrant above booster.........................m
2 System design..........L/s @.....kPa
3 System commissioning test................................L/s @.....kPa

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

- 36 m fire hose reel
- On-site hydrant
- Isolating valve (each on-site hydrant isolating valve shall be numbered)
- Non-return valve
- Underground street hydrant
- Fire brigade booster inlets
- Pumpset where installed

Block plan of site

(c) For high-rise installations—Example 2

FIGURE 7.11 (in part) TYPICAL BLOCK PLAN

SECTION 8 PIPEWORK AND VALVES

8.1 PIPES AND PIPE SETTINGS

All pipes and fittings in a fire hydrant system shall be new and comply with the requirements of Clause 8.2.

Fire hydrant systems shall accommodate fluctuations in pressure created by a system pump start and any other operating characteristic envisaged, e.g. stopping a hydrant flow of 10 L/s within a period of 3 s (achieved by firefighters closing down the flow at the firefighting tip).

NOTES:

1 Where copper pipe is installed, the regulatory authority may marginally upgrade its working pressure limitations, if the installation is normally maintained at a pressure below the rated working pressure of the pipe.

2 This dispensation may be given on the grounds that the working pressure for copper pipe is based upon a satisfactory operating performance for many decades, whereas its use for firefighting at elevated pressures will be limited to a matter of hours.

3 A similar dispensation may also be given for pipe thread connections.

8.2 PIPE AND PIPE FITTING SPECIFICATIONS

8.2.1 Above-ground pipes

Pipes and pipe fittings used in above-ground fire hydrant installations shall comply with the following:

(a) Plastic pipes and pipe fittings shall not be used.

(b) Steel pipes and fittings shall be galvanized.

(c) They shall be installed in accordance with the provisions of AS/NZS 3500.1.

(d) They shall comply with the appropriate Standards as follows:

  (i) Steel tube and pipes—AS 1074, AS 1579, AS 1769 and ASTM A135.

  (ii) Ductile iron pipes—AS 2280.

  (iii) Cast iron fittings—AS/NZS 2544.

  (iv) Copper tubes—AS 1432, AS 1572 and AS 4809. The wall thickness of copper tubes shall not be less than the sizes stated in AS 1432 for type B material.

  (v) Wrought steel fittings—AS 3672.

  (vi) Systems designed for pressure piping application—AS 4041.

Light steel pipe shall be installed in accordance with Clause 8.2.4.

8.2.2 Below-ground pipes

Pipes and pipe fittings used below ground in fire hydrant installations shall comply with the following:

(a) They shall be installed in accordance with the provisions of AS/NZS 3500.1 and protected in accordance with Clauses 8.3 and 8.6.

(b) They shall comply with the appropriate Standards, as follows:

  (i) Ductile iron pipes—AS 2280.

  (ii) Cast iron fittings—AS 2544.

(iii) Copper tubes—AS 1432, AS 1572 and AS 4809. The wall thickness of copper tubes shall be not less than the sizes stated in AS 1432 for type B material.

(iv) Plastics pipe and pipe fittings—AS 1477, AS/NZS 4129 and AS/NZS 4130, AS 4441(Int) and AS 4765(Int).

NOTE: Ductile and cast iron pipes and fittings may need to be coated and cement mortar lined in accordance with AS 1281 and AS/NZS 1516 (see Appendix G) where required by the local water agency.

Polyvinyl chloride (PVC-U, O and M) and polyethylene pipe (PE) shall be not less than PN16.

Steel pipes shall be installed in accordance with Clauses 8.2.3 and 8.2.4.

Galvanized steel pipes, fittings and couplings shall only be used below ground for individual hydrant risers or short connection pieces not exceeding 1.5 m in length, the entire length containing the fitting or coupling shall be double wrapped with a petrolatum tape in accordance with Clause 8.6.5.3. Where galvanized pipes are used below ground, they shall be heavy duty for sizes up to and including DN 80 and not less than medium thickness for sizes greater than DN 80.

Black steel pipes shall not be used underground.

NOTE: Some water supply agencies may not approve in some circumstances the use of plastic pipes and certain steel pipes for use below-ground.

C8.2.2 *Advice supplied by major steel pipe manufacturers suggests that steel pipe, including various wall thickness galvanized pipe, is unsuitable for use below ground on the basis of corrosion induced by soil and potential mechanical damage.*

8.2.3 Steel pipe in hydrant systems

Steel pipe, including light steel pipe, where specified in hydrant systems, shall only be used down-stream of a non-return valve or backflow prevention device in the service from the water agency main.

Where steel pipe is used in hydrant systems, it shall be galvanised. This includes all pipe reticulation from the water source to each hydrant valve and up to the connection point of any other fire protection system.

Steel pipe in accordance with AS 1074 shall be—

(a) heavy pipe in sizes up to and including DN 80;

(b) medium pipe in sizes above DN 80;

Light steel pipe shall be in accordance with Clause 8.2.4.

8.2.4 Light steel pipe

8.2.4.1 *Description*

Light steel pipe shall be in accordance with AS 1074 or ASTM 135 and shall have —

(a) a minimum wall thickness of 3.04 mm for pipe diameters up to and including DN 100 mm; and

(b) a minimum wall thickness of 3.4 mm for pipe diameters greater than 100 mm and up to DN 150 mm.

8.2.4.2 *General requirements*

Light steel pipe shall comply with the following:

(a) The pipe shall be joined with compatible pipe fittings and methods in accordance with Clause 8.3.

(b) Pipe and pipe fittings shall be new hot-dip galvanized and comply with the relevant Standards.

(c) On-site welding of fittings or modifications is not permitted.

(d) Any disturbance of protective coating by cutting, roll-grooving or handling shall be repaired with a zinc-rich primer or equivalent in accordance with AS/NZS 4792.

8.2.4.3 *Deemed to satisfy*

Light steel pipes and pipe systems that have been tested and certified for hydrant systems by an internationally recognized fire protection test and certification body shall be deemed to have met the listing requirements of this Standard.

NOTE: Examples of recognized testing and certification bodies are JAS-ANZ Registered Certification Bodies, CSIRO's ActivFire Scheme, Factory Mutual (FM), Loss Prevention Certification Board (LPCB), Underwriters Laboratories (UL) and Verband der Schandenverhutung (VdS).

C8.2.4.3 *Light steel pipe is permitted for use in designated fire hydrant systems provided the pipe is contained in a recognized listing such as FM, UL and the CSIRO's ActivFire Scheme Register of Fire Protection Equipment. Should there be any doubt concerning the listing, the approval body should be contacted for assistance. The requirements for light steel pipe contained in Standards, such as AS 1074, need to be followed in addition to local and state regulations on the use of the material.*

8.2.4.4 *Limitations*

The following requirements shall apply to the use of light steel pipes in hydrants systems:

(a) Pipes shall comply with an Australian Standard or a recognised international Standard as listed in Appendix A.

(b) Where pipe systems are designed and manufactured to AS 4041, the commissioning, testing and reporting provisions of that Standard shall apply.

(c) Pipes are to be certified or listed by a recognised body as being fit for purpose in hydrant systems in accordance with Clause 8.2.4.3.

(d) Pipes are to comply with the impact protection requirements of this Standard.

8.2.5 Pipework for other purposes

Hydrant installations are for fire-fighting purposes only. A separate system complying with AS/NZS 3500.1 shall be provided for any other use.

NOTE: This does not preclude a single tapping from a water agency main being used for other purposes.

8.3 METAL PIPE JOINTS

8.3.1 General

Pipes, valves and fittings used in fire hydrant systems shall be joined by screwed, grooved, shouldered or flanged ends, welding or brazing. Joints shall comply with the requirements of AS 3500.1 and this Section.

Where grooved couplings comprising an approved combination of coupling segments, gaskets and grooves are used, the grooves shall not be cut in pipes and rolled grooves shall be dimensionally compatible with the couplings.

Steel pipe fittings should be dimensionally compatible with the pipe in accordance with AS 1074 and ASTM A135.

8.3.2 Roll-grooved fittings and couplings

Where roll-grooved fittings and couplings are used, they shall be hot-dip galvanized for steel pipework and copper-treated ductile iron for copper tube.

8.3.3 Shouldered fittings and couplings

Where shouldered fittings and couplings are used, shoulder rings shall be welded to the pipes and fittings prior to hot-dip galvanizing.

8.3.4 Compression type couplings

Where compression type couplings are used, they shall be hot dip galvanized or fusion-bonded epoxy coated and comply with Clause 8.6.5.4.

8.3.5 Fitting and couplings below ground.

Where fittings and couplings in steel pipe are used below ground for individual hydrant risers or short connection pieces not exceeding 1.5 m in length, the entire joint containing the fitting or coupling shall be double wrapped with a petrolatum type tape system in accordance with Clause 8.6.5.3.

8.3.6 Gasket seals

All rubber gasket seals used in roll-grooved or compression-type couplings shall be Grade 'E' EPDM-70 moulded synthetic rubber, tested to UL 213 or similar and suitable for water temperature in the range of −34°C to 110°C. Gasket seals shall be fully enclosed within the housing of the coupling.

8.3.7 Brazed joints in copper pipework

Brazed joints 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 1167.1.

On-site brazing shall be carried out in accordance with AS 1674.

Soft solder shall not be used in joining copper pipe or fittings.

8.4 HYDROSTATIC PRESSURE TEST

All new pipework shall be capable of being pressure-tested to at least 1700 kPa or 1.5 times the design pressure, whichever is the greater.

NOTE: The maximum working and test pressures of the piping should be checked for conformance to the requirements of this Clause.

8.5 PIPEWORK DESIGN

8.5.1 Fire mains

The nominal size of a fire main shall comply with the requirements for pressure, flow and velocity as further specified in Section 2 and shall have nominal diameters of not less than—

(a) DN 100; and

(b) DN 80 for any pipe, not exceeding 10 m hydraulic equivalent length, connecting a single fire hydrant outlet to a fire main.

NOTE: It is permissible to reduce the pipe size at the valve connection where it connects to the reducer; however, it is not permissible to have any pipe exceeding 50 mm in length between the reducer and the fire hydrant valve.

8.5.2 External pipework

External pipework shall be located below ground as far as is practicable. Where it is not possible to install pipework below ground, provision shall be made to protect the pipework, if necessary, from freezing.

Provision shall be made to protect the pipework and any supporting structure from damage by fire.

8.5.3 Internal pipework

Where internal above-ground pipework is installed, it shall be protected from the effects of fire by the following methods:

(a) An automatic fire sprinkler system which shall comply with AS 2118.1.

(b) Fire rating the pipe supports in accordance with Clause 8.7.4; or installing in a fire-isolated stair or fire-resisting shaft; or protecting with barriers suitable to resist the effects of fire for a period not less than 60 min.

Where the pipework is of copper and may be exposed to fire in a building that is not protected by sprinklers, the pipework shall be protected using materials that will provide a FRL of not less than –/60/60/; or installed in a fire isolated-stair or fire-resisting shaft; or located above a ceiling system that achieves a resistance to the incipient spread of fire for a period of not less than 60 min.

Where appropriate, exposed internal pipework shall also be protected from mechanical damage.

8.5.4 Ring main

Fire hydrants shall be connected to a ring main where any of the following conditions apply:

(a) There are large isolated buildings in accordance with Specification C2.3 of the BCA.

(b) The building(s) has an effective height in excess of 25 m.

C8.5.4 *The reliability of a fire hydrant system is increased by the installation of a ring main.*

8.5.5 Ring main design criteria

Where a ring main is installed, it shall comply with the following:

(a) Each ring or pressure zone shall be able to be isolated in 25% increments, whilst maintaining not less than 50% of the fire hydrants required to protect each fire compartment (see Figure 8.5.5).

(b) Risers shall be installed in fire-isolated stairs or fire-isolated shafts.

(c) In buildings exceeding 25 m effective height, the interconnection of the ring main risers shall be located at not more than 50 m intervals and be within the physical limits of the pressure zone they serve (see Figure 7.11(b)).

(d) In buildings exceeding 25 m effective height, risers feeding the same zone of protection shall not be located in the same shaft. This does not apply to fire stairs that cross over each other, i.e., scissor stairs.

(e) Hydraulic losses may be calculated with flow through both paths of the ring main.

(f) Flow shall be taken in one direction only for velocity calculations and shall not exceed 4 m/s.

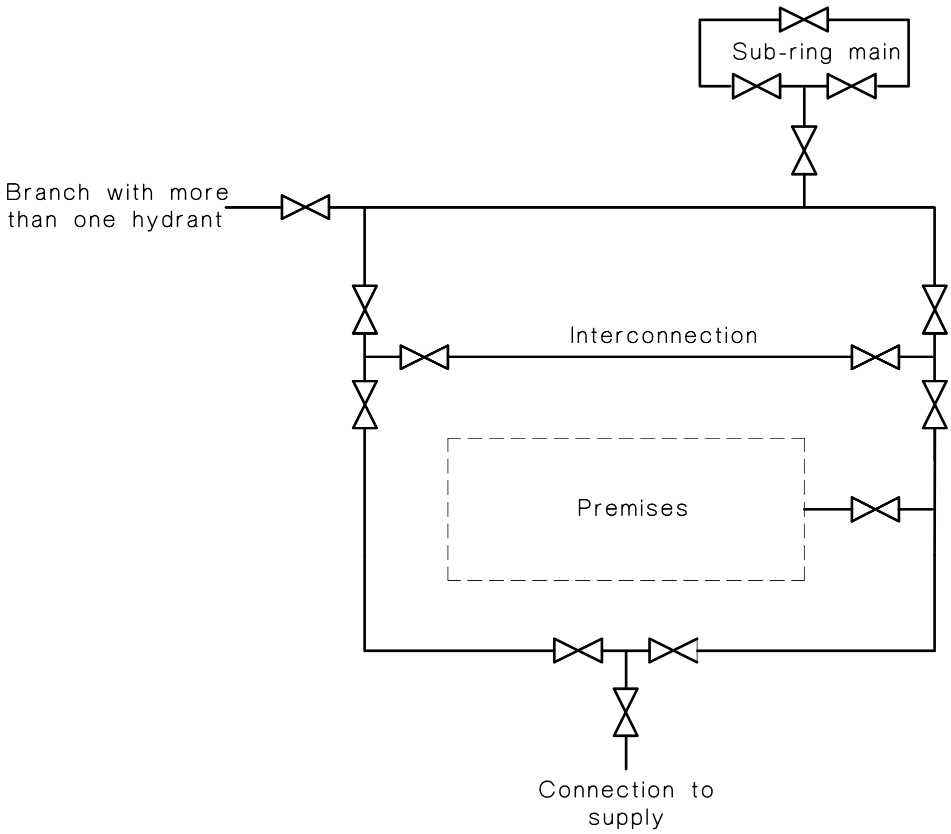


FIGURE 8.5.5 TYPICAL LOCATION OF ISOLATING VALVES ON RING MAIN

8.5.6 Isolating valves

A fire main incorporating fire hydrants shall include isolating valves located as follows:

NOTE: See Figures 8.55 and 7.11(b).

(a) On each arm of the ring main, adjacent to the connection with the supply pipe.

(b) On branches into buildings, adjacent to the tapping in the ring main, in a position considered to be accessible under fire conditions.

(c) On branches supplying more than one fire hydrant, adjacent to the tapping in the ring main.

(d) On branches supplying a sub-ring main, adjacent to the tapping in the ring main.

(e) On the ring main, remote from the source of supply.

(f) 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.

All ring main isolating valves shall be so located as to permit ready access by fire brigade personnel.

On ring mains supplied by separate sources, isolating valves shall be located at the point of connection with each source.

8.5.7 Cross-connections

There shall be no cross-connections between a potable water supply and a non-potable water supply. Any other cross-connections between different water sources shall be in accordance with AS 3500.1.

NOTE: For the definition of cross-connection see AS/NZS 3500.0.

8.5.8 Above-ground isolating valves

Above-ground installed isolating valves shall be full-flow outside screw and yoke wheel gate valves of the indicating type, complying with AS 3579, or low torque wheel-operated multi-turn post indicator ball or butterfly valves with all metal actuating mechanisms, closed by rotating the wheel clockwise and shall—

(a) be secured or locked in the open position; and

(b) have affixed to the valve body or strap, a plate inscribed with the words 'FIRE MAIN VALVE –SECURE OPEN' in uppercase letters not less than 8 mm high;

except within a plant, tank or pump room isolation valves within a building shall be located in fire-isolated exits.

All isolating valves shall be clearly identified with a tag showing the valve number on the block plan in accordance with Figure 8.5.8.

VALVE nn*
FIRE MAIN VALVE — SECURE OPEN

FIGURE 8.5.8 FIRE MAIN VALVE—SECURE OPEN

NOTES:

1 Where the building has an effective height in excess of 25 m, isolating valves should be continuously monitored.

2 Where the building has an effective height not greater than 25 mm, isolating valves other than in-ground sluice valves should be either continuously monitored or be of the indicating type.

3 Monitoring should consist of a supervisory circuit connected to an alarm panel.

8.5.9 Below-ground isolating valves

Isolating valves installed below ground shall be suitably tagged or marked by either post, reflective marker or reflective paint (to access covers) in 25 mm high text, and shall—

(a) conform with Clause 8.5.8 and be located in a fully drained pit; or

(b) be key-operated sluice valves complying with AS 2638 (see Figure 8.5.9) and be clearly identified with a permanent ground marking showing the valve number on the block plan.

8.5.10 Test facility

Provision shall be made for the purpose of flow testing as required in Section 10. If such a provision cannot readily be accomplished from fire hydrant outlets, a permanent test connection shall be provided, together with a suitable means for disposing of test water.

NOTE: Where practicable, a closed loop flow testing arrangement, incorporating a permanent or temporary on site tank, should be provided.

8.5.11 Valves

8.5.11.1 *Fire hydrant valves*

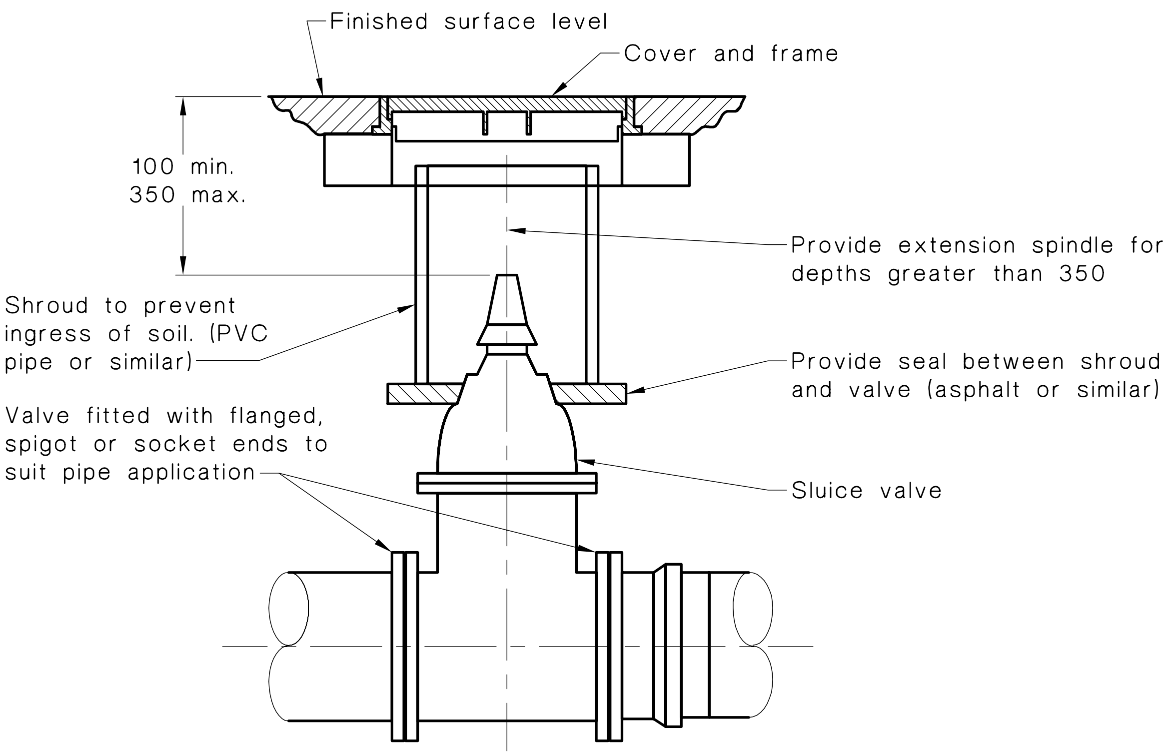
Above-ground fire hydrant valves shall—

(a) be DN 65;

(b) have their outlets fitted with hose connections compatible with the local fire brigade;

(c) be equipped with protective caps and retaining chains; and

(d) comply with AS 2419.2.



DIMENSION IN MILLIMETRES

FIGURE 8.5.9 TYPICAL KEY-OPERATED SLUICE VALVE (IN-GROUND)

8.5.11.2 *Pressure-reducing valve station*

Where pressure-reducing valves are used to achieve the required pressure limits, the valves shall be duplicated at each location to facilitate removal of either valve for servicing.

Pressure-reducing valves shall be of the type in which the controlling mechanism is operated in conjunction with water flow through the valve from—

(a) the low pressure side; or

(b) the differential pressure across the valve.

A full-flow non-return valve shall be installed on a by-pass at pressure-reducing stations, to allow reverse flow under boosting conditions.

Isolating valves shall be installed on either side of each pressuring-reducing valve and non-return valve (see Figure 8.5.12).

Facilities shall be provided for testing the pressure-reducing valve.

C8.5.11.2 *Pressure-reducing valves are installed in fire hydrant systems primarily to prevent excessive pressures, which could cause injury to firefighters when using the fire hydrants and to ensure that the working pressure is not exceeded.*

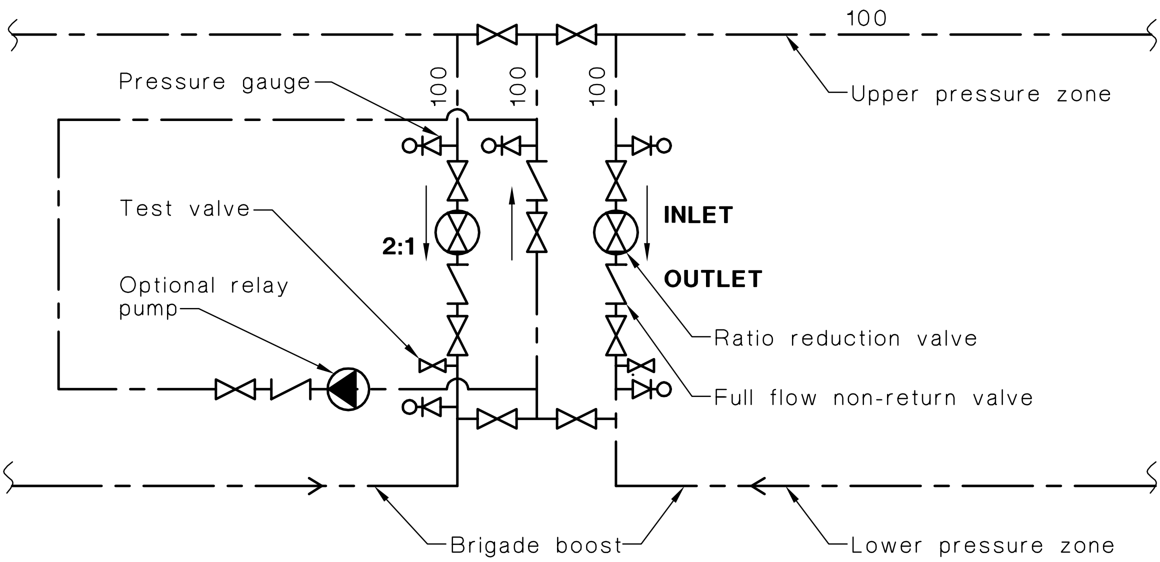


FIGURE 8.5.11.2 PRESSURE-REDUCING VALVE STATION

8.5.11.3 *Fire hose reel main isolation valves*

Where a fire hose reel main serves two or more fire hose reels and is connected to a fire hydrant system it shall have an isolating valve fitted at the point of connection in accordance with the requirements of the BCA.

Each fire hose reel main 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 with the following instruction in upper case lettering of not less than 8 mm high as follows:

FIRE SERVICE VALVE CLOSE ONLY TO SERVICE FIRE HOSE REELS

8.6 SYSTEM PROTECTION AND IDENTIFICATION

8.6.1 Physical protection

Fire hydrant pipework shall be protected from mechanical and physical damage, for example from vehicular traffic, soil movements, and the like.

8.6.2 Corrosion protection

Fire hydrant pipework shall be protected against corrosion (see AS 2312 and AS 2832.2).

8.6.3 Pipework identification

Fire hydrant pipework shall be identified in accordance with AS 1345.

8.6.4 Pipe marking

Each straight length of pipe shall be marked permanently throughout its length with the information given in Method A or B below at intervals not exceeding 1 m, and a minimum height of lettering of 10 mm, as follows:

(a) *Method A*

CHARACTERISTIC:			
MANUFACTURER	WALL	THICKNESS	GRADE
Example:			
XYZ STEEL MILLS	DN 100	MEDIUM or ACTUAL	AS 1074 or SCH 10

(b) *Method B*

Characteristic:

Fire pipe Specification	Approval status	Working Pressure	Thickness Series	Galvanizing Specification	End Finish	Manufacturer's Name
Example:						
AS 1074	CSIRO or UL or FM or Water Mark	1400 kPa	Light or 3.05 mm	AS/NZS 4680	ROLL GROOVED	XYZ STEEL MILLS

8.6.5 Corrosion protection

8.6.5.1 *General*

All steel pipes shall be galvanized internally, externally and at their ends in accordance with AS/NZS 4792. The galvanized coating shall have a minimum zinc coated mass of 300 g/m^2.

All pipe fittings, fasteners and hangers shall be galvanized internally, externally and at their ends in accordance with AS/NZS 4680.

Any cutting that exposes the base metal or damages the galvanized protective coating shall be repaired in accordance with Clause 6.2.4.2.processes—

8.6.5.2 *Polyethylene extruded plastic coating and tape*

For in-ground hydrant lines that are polyethylene coated, the extruded sleeve or tape shall be of high-density polyethylene plastic, 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.

NOTE: Loose polyethylene sleeving should not be used as in-ground corrosion protection.

8.6.5.3 *Petrolatum tape coating*

For in-ground hydrant lines (galvanised steel risers in all soil conditions and all copper pipe in aggressive soils) that are to be petrolatum tape coated, shall be double-wrapped. The second wrapping shall be wrapped in the opposite direction and be overlapped by 50%. The coating shall then be overwrapped with a self-adhesive polyethylene tape.

8.6.5.4 *Fusion-bonded epoxy coating*

Fusion-bonded epoxy-coated steel or ductile iron pipe, couplings or fittings shall have a minimum film thickness of 200 μm, applied in accordance with AS/NZS 3862 or AS/NZS 4158.

8.7 SUPPORT OF FIRE HYDRANT PIPEWORK

8.7.1 General

Pipe supports for a fire hydrant system shall address—

(a) stresses and loads that may be imposed on the support system from all external causes, including differential movement of the building structure under normal and fire conditions, and all internal causes, including pressure reactions;

(b) transmission of vibration; and

(c) the effects of corrosion.

8.7.2 Pipe support design

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

(a) a pipe support system, the individual components of which comply with the requirements of Clause 8.7.5; or

(b) pipe supports and fasteners that are capable of supporting two times the mass of the pipework filled with water plus a mass of 115 kg at each point of support.

In addition to providing support for the pipework, pipe-support systems shall be designed to prevent sway in the pipework.

NOTE: Verification by test may be used to confirm the structural adequacy of the design.

8.7.3 Materials for pipework support

Pipework supports and components shall be of ferrous material.

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

Pipe supports shall be protected from direct contact with copper pipe or pipe fittings.

8.7.4 Fire rating of pipework supports

Where pipework is likely to be exposed to fire in a building that is not protected by sprinklers, then the pipe supports shall have a FRL not less than 60/–/–, while maintaining a pipe-support temperature of not less than 500°C when tested in accordance with AS 1530.4; or other measures shall be taken to prevent its early collapse when exposed to fire.

8.7.5 Requirements for pipe-support components

8.7.5.1 *U-bolts used for clamping down*

U-bolts used for clamping down shall conform to the dimensions given in Table 8.7.5.1.

TABLE 8.7.5.1

U-BOLTS USED FOR CLAMPING DOWN

Pipe size DN	Minimum nominal diameter of material mm
80	10
100	10
150	10
200	12
250	12
300	16

8.7.5.2 *Rods and U-bolts used for clamping up*

U-bolts used for clamping up and rods supporting pipework shall conform to the dimensions given in Table 8.7.5.2.

TABLE 8.7.5.2

RODS AND U-BOLTS USED FOR CLAMPING UP

Pipe size DN	Minimum nominal diameter of material mm
80	12
100	12
150	12
200	16
250	16
300	20

8.7.5.3 *U-hangers (clips)*

U-hangers shall conform to the dimensions given in Table 8.7.5.3.

TABLE 8.7.5.3

U-HANGERS (CLIPS)

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

8.7.5.4 *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.

8.7.5.5 *Pipe bands*

Pipe bands shall be fabricated from materials complying with the following requirements:

(a) For non-corrosive atmospheres, in accordance with Table 8.7.5.5.

(b) For corrosive atmospheres, not less than 3 mm thick.

TABLE 8.7.5.5

PIPE BANDS

Pipe size DN	Minimum material thickness mm
80	1
100	1
150	3

8.7.5.6 *Pipe support beams (trapeze bar)*

Pipe support beams shall either—

(a) be fabricated from ferrous material with section modulus equal to or greater than those calculated from the material sections detailed below; or

(b) conform to the dimensions in Table 8.7.5.6.

TABLE 8.7.5.6

PIPE SUPPORT BEAMS

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

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

8.7.6 Fixing of pipe supports

8.7.6.1 *General*

Fire hydrant pipework may be supported from a building structure provided that the structure is capable of supporting the loads specified in Clause 8.7.2. Fire hydrant pipework shall be supported independently of ceiling sheathing and any associated suspension system (see Clause 8.7.8).

8.7.6.2 *Fixing to concrete or masonry*

Explosive-powered fasteners, wooden plugs, or plugs of plastic 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 8.7.2.

8.7.6.3 *Fixing to timber*

Fire hydrant pipework may be fixed to timber. Acceptable methods for fixing to timber are coach screws, coach bolts and explosive-powered fasteners.

NOTE: For more information, see AS/NZS 1873 (see Appendix G).

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

The following requirements shall apply:

(a) The fixing method shall be capable of supporting the design load specified in Clause 8.7.2

(b) Coach bolts and coach screws shall conform to the dimensions in Table 8.7.6.3.

TABLE 8.7.6.3

TIMBER FIXING

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

8.7.6.4 *Fixing to steel*

Explosive-powered fasteners may be used for fixing pipe supports to steel provided that the steel is not less than 5 m thick. The fixing shall be capable of supporting the design load specified in Clause 8.7.2.

8.7.7 Spacing of supports

The distance between supports for horizontal and vertical steel fire hydrant pipework shall not exceed those specified in Table 8.7.7.

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

TABLE 8.7.7

SPACING OF SUPPORTS

Pipe size DN	Maximum spacing m
80	5
100	5
>100	6

8.7.8 Location of supports

8.7.8.1 *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.

8.7.8.2 *Vertical pipework*

Main vertical pipes rising (or dropping) from the fire hydrant valves, or linking the pipework between levels, shall be supported directly from the structure, or by supports on horizontal branches leaving the vertical pipework and not more than 300 mm from it.

8.8 THRUST BLOCKS AND ANCHORS

Thrust blocks and anchors shall be installed in systems with unrestrained joints. They shall be designed to provide adequate reaction to the forces imposed by the maximum pressures generated, including system water pressures, water hammer, ground pressures and soil conditions.

NOTE: For unrestrained joints, see AS/NZS 3500.1.

SECTION 9 ANCILLARY EQUIPMENT

9.1 GENERAL

All equipment installed in a fire hydrant system shall be protected from the weather and shall comply with the requirements of this Section.

9.2 FIRE HOSE

Where fire hose is supplied, provision shall be made for it to be stored adjacent to the fire hydrant in an approved manner, e.g., on bollard boards or in cradles, and in a suitable cabinet depending on location, e.g., in a weatherproof enclosure for external locations.

All layflat fire hoses in fire hydrant installations shall comply with AS 2792. Fire hose fittings shall be compatible with that used by the local fire brigade.

9.3 PRESSURE GAUGES

9.3.1 General

Fire hydrant system pressure gauges shall—

(a) comply with 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 cock to permit removal, servicing or testing of the gauge;

(d) have a dial face of not less than 65 mm diameter unless otherwise specified in this Standard; and

(e) have a window made of glass.

9.3.2 Location of pressure gauges

Pressure gauges shall be installed on a fire hydrant system as follows:

(a) For all installations—

    (i) on the suction and delivery side of any booster pump;

    (ii) adjacent to any fire brigade booster assembly inlet connection [see Figure 7.4(a), (b) or (c)];

    (iii) on the delivery side of any pressure maintenance pump; and

    (iv) at each pressure switch.

(b) For buildings with an effective height of not more than 25 m, at the hydraulically most disadvantaged fire hydrant in any installation with more than six fire hydrants.

(c) For buildings with an effective height greater than 25 m—

    (i) at the hydraulically most disadvantaged fire hydrant in any pressure zone; and

    (ii) immediately upstream and downstream of any pressure-reducing valve.

Where the water supply contains foreign matter of sufficient size to impede or restrict the effective operation of the system, strainers shall be fitted.

The area of each hole in the strainer shall be less than the area of the smallest orifice between the strainer and the hose nozzle, and each hole shall be not larger than 12 mm diameter. The aggregate area of the holes in the strainer shall be such that when 50% of the holes are blocked, the pressure and flow requirements of the installation are met.

9.4 BACKFLOW PREVENTION

Where the water agency requires a backflow prevention device to be installed in a mains feed system it shall be located within the property near the boundary, upstream of any hydrant or booster assembly in accordance with Figure 9.4.1. Where a fire brigade booster assembly can be sited in the same location as a required backflow prevention device, subject to agreement by the water agency, it shall be incorporated into the booster assembly in accordance with Figure 9.4.2. Backflow prevention devices shall comply with the requirements of AS 2845.1.

NOTES:

1 Location of the backflow prevention device between the feed fire hydrants and booster inlet connections of a booster assembly are preferred because—

(a) the hydraulic losses of the device do not restrict the water available to the fire brigade pumping appliance; and

(b) feed fire hydrants and booster inlet connections will remain operational during service or repair of the backflow prevention device.

2 The water agency may require a backflow prevention to be incorporated in a check detector assembly provided to monitor for unauthorized water usage. This is usually required upstream of any outlets on the fire service.

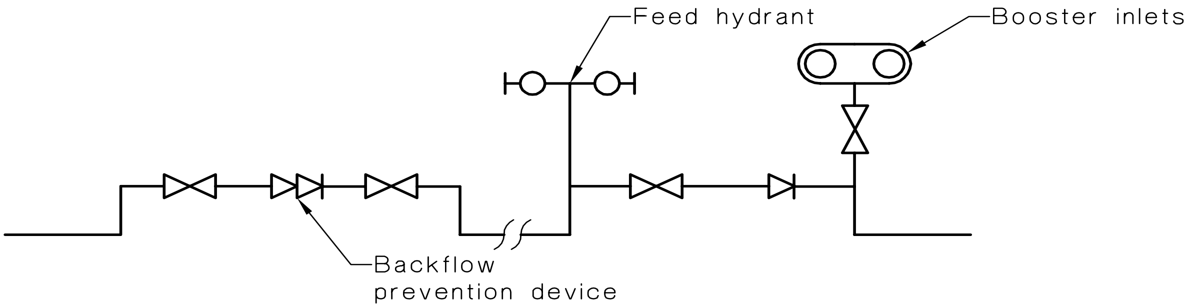


FIGURE 9.4.1 SCHEMATIC—TYPICAL BACKFLOW PREVENTION DEVICE

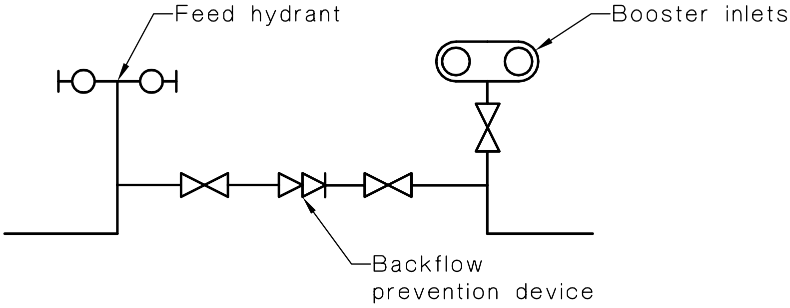


FIGURE 9.4.2 SCHEMATIC—BACKFLOW PROTECTION DEVICE IN THE BOOSTER ASSEMBLY

SECTION 10 COMMISSIONING

10.1 GENERAL

This Section specifies test for verifying that the performance of the fire hydrant system is in accordance with the design approval. These tests shall be conducted at time of system commissioning, and thereafter where required by the regulatory authority. Where a system fails to comply with the requirements of this Section, any faults shall be investigated, rectified and the system retested.

NOTE: For guidelines on commissioning of fire hydrants, see SA HB 93 *Commissioning of fire hydrant systems*.

10.2 HYDROSTATIC TESTS

10.2.1 Pre-test preparation of the system

Upon completion of the installation, all trapped air within the system shall be removed and the system flushed to remove any debris that may have accumulated within it.

10.2.2 Hydrostatic test

The system shall be pressurized, at the elevation of the highest hydrant outlet to not less than 1.5 times the highest operating pressure at that location, or 1700 kPa, whichever is the greater.

The test shall be applied for a duration of not less than 2 h.

Where hydrant pipework is underground, or may be otherwise rendered inaccessible, the hydrostatic test shall be made before covering or concealment of pipe joints takes place.

In multistorey buildings, each pressure zone shall be tested separately by applying a pressure not less than 1.5 times the operating pressure required at the highest elevation in each pressure zone.

10.3 COMMISSIONING TESTS

Every hydrant within the system shall be opened, and the presence of water proved at each point. The following procedures shall then be performed to ensure the flow rates and pressures required in Tables 2.1, 2.2, 2.3 and 3.3 are achieved and the requirements of this Standard are met:

(a) Simultaneously discharge the required number of the most hydraulically disadvantaged hydrants, each at not less than the required outlet pressure. Where the minimum system design flows are less than flows supplied by a pumping appliance, each condition shall be tested.

(b) Test at any installed pump to measure the flow entering the system, supported by the relevant calculations.

(c) Investigate and measure the pressure in water agency mains, supported by relevant calculations.

NOTE: Any significant water hammer found during commissioning tests should be investigated and remedial action taken..

For each system pump or group of pumps operating, the hydrant with the greatest hydraulic head in each zone shall also be tested at the required minimum hydrant flow rate prescribed in Tables 2.2, 2.3 and at zero flow. The pressures achieved at these conditions shall be recorded and shall not exceed those prescribed in Clauses 2.3.2 and 2.3.4.

NOTE: Within reason, every endeavor should be made to minimize water wastage when testing a fire hydrant system. This may be achieved by recirculating water through storage tanks or limiting the duration of flow to waste. The disposal of water to waste should be carried out without damage to property or the environment.

10.4 SYSTEMS THAT INCORPORATE A BOOSTER

10.4.1 Boosters including those connected in parallel with building pumps

When a pumping appliance is boosting the system, the required flow rate shall be achieved at the required number of most hydraulically disadvantaged hydrants in accordance with Table 2.3. The required pressure at the booster inlet to achieve this performance shall not exceed the designed working pressure of the system as displayed at the booster. This test shall be performed with all building pumps shut down.

10.4.2 Boosters connected in series (relay) with building pumps

Where the booster effectively connects the fire brigade pumping appliance in series with the inlet connection of a building pump(s), an additional test shall be carried out. For each fixed pump or group of pumps operating, the most hydraulically disadvantaged hydrant in each pressure zone shall discharge water at the required outlet pressure and the resultant flow rate recorded. While maintaining this recorded flow rate, the system shall be boosted to achieve an additional pressure of 300 kPa at the hydrant outlet. At this point, the pressure indicated on the gauge of the booster assembly inlet and that indicated on the building pump discharge pressure gauge (also located within the booster cabinet) shall be recorded. The pressure indicated on the building pump discharge pressure gauge, at this condition shall not exceed the system design operating pressure as displayed at the booster.

NOTE: The additional 300 kPa is a safety margin necessary to compensate for over-pressurization likely to occur due to variations in flow rate experienced during firefighting operations.

10.5 SYSTEMS THAT INCORPORATE A PUMP

When each required pump or pump group is separately operated, the required number of most hydraulically disadvantaged hydrants shall discharge at the required outlet pressure, and flow rate. The pressure and flow rate at each hydrant outlet shall be recorded for each pump or pump group operating.

10.6 SYSTEMS THAT INCORPORATE A TANK

Where a tank is incorporated within a system and it has connections for a fire brigade pumping appliance, then a pumping appliance shall be connected to the tank and the system boosted to achieve the required flow rate and outlet pressure at the required number of the most hydraulically disadvantaged hydrants. The pressure and flow rate at each hydrant outlet shall be recorded.

10.7 RECORDING OF COMMISSIONING (VERIFICATION) TESTS

A record shall be made of the results of all tests nominated in this Section and shall include the following:

(a) Name of owner or agent and the reporting location.

(b) Name of the organization performing the test(s).

(c) Identification of system.

(d) Results of test(s).

(e) Signatures of owner or agent and test person.

The record of system commissioning tests shall be available on the property at all times.

NOTE: Where a logbook is provided to record the commissioning tests it can then be used for any future maintenance requirements. In such cases it should be substantially bound (not in loose leaf format) and have numbered pages in triplicate. Such a logbook should include the signature of the owner or agent, and service person and have a required distribution of copies printed on each page, e.g., *Original*—owner/occupier/agent; *Duplicate*—service person; *Triplicate*—retain in book. A required maintenance record system may also be in the form of a computer-based record or other appropriate permanent record system.

APPENDIX A
NORMATIVE REFERENCES
(Normative)

The following referenced documents are indispensable for the application of this Document. The latest edition of the referenced document (including any amendments) applies.

AS	
1074	Steel tubes and tubulars for ordinary service
1167	Welding and brazing—Filler metals
1167.1	Part 1: Filler metal for brazing and braze welding
1345	Identification of the contents of pipes, conduits and ducts
1349	Bourdon tube pressure and vacuum gauges
1432	Copper tubes for plumbing, gasfitting and drainage applications
1477	PVC pipes and fittings for pressure applications
1572	Copper and copper alloys—Seamless tubes for engineering purposes
1579	Arc-welded steel pipes and fittings for water and wastewater
1674	Safety in welding and allied processes—Fire precautions
1769	Welded stainless steel tubes for plumbing applications
2118	Automatic fire sprinkler systems
2118.1	Part 1: General requirements
2312	Guide to the protection of iron and steel against atmospheric corrosion by the use of protective coatings
2419	Fire hydrant installations
2419.2	Part 2: Fire hydrant valves
2419.3	Part 3: Fire brigade booster connections
2484	Fire—Glossary of terms
2484.2	Part 2: Fire protection and firefighting equipment
2638	Sluice valves for waterworks purposes (all parts)
2792	Fire hose—Delivery layflat
2832	Cathodic protection of metals
2832.2	Part 2: Compact buried structures
2941	Fixed fire protection installations—Pumpset systems
3579	Cast iron wedge gate valves for general purposes
3672	Wrought steel threaded pipe fittings
4041	Pressure piping
4441 (Int)	Oriented PVC (PVC-O) pipes for pressures applications
4809	Copper and pipe fittings—Installation and commissioning
AS/NZS	
1518	External extruded high-density polyethylene coating system for pipes
2280	Ductile iron pressure pipes and fittings

2544	Grey iron pressure fittings
2845	Water supply—Backflow prevention devices
2845.1	Part 1: Materials, design and performance requirements
3500	Plumbing and drainage
3500.0	Part 0: Glossary of terms
3500.1	Part 1: Water services
3862	External fusion-bonded epoxy coating for steel pipes
4129	Fittings for polyethylene (PE) pipes for pressure applications
4130	Polyethylene (PE) pipes for pressure applications
4158	Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
4765 (Int)	Modified PVC (PVC-M) pipes for pressures applications
4792	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
ASTM	
A135	Standard specification for Electric-resistance-welded Steel pipe
SA	
HB 20	Graphical symbols for fire protection drawings
UL	
213	Rubber gasketed fittings for fire-protection service
ABCB	
BCA	Building Code of Australia

APPENDIX B

FIRE HYDRANTS IN ACCESSWAYS WITHIN A PRIVATE DEVELOPMENT

(Informative)

B1 GENERAL

Property developments incorporating streets or common accessways within a common private title should incorporate water mains of DN 100 or more together with fire hydrants.

Where the water mains are to be owned and operated by the local water agency, fire hydrants should be provided in accordance with the water agency requirements, including their location being appropriately marked. These fire hydrants should generally be of the in-ground type, spaced as for the remainder of the water agency's system.

Where privately owned water mains are to be 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.

In the absence of alternate requirements from the water agency and/or fire authority, the recommendations given in Paragraphs B2 and B3 should be met.

For each of the cases above, additional fire hydrants may need to be provided on site to meet the fire hydrant system requirements for protecting properties and/or building complexes.

B2 RESIDENTIAL STREETS AND ACCESSWAYS

Above- or below-ground fire hydrants should be provided at not more than 120 m intervals along residential streets and at each street intersection. Above-ground fire hydrants may be single outlet.

B3 COMMERCIAL AND INDUSTRIAL STREETS AND ACCESSWAYS

Within streets serving commercial properties such as factories, warehouses and offices, above or below ground fire hydrants should be provided at not more than 90 m intervals and at each street intersection. Above-ground fire hydrants should have dual valved 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 can be initially employed 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, can be more than for a commercial property.

APPENDIX C

FIRE HYDRANT INSTALLATION WATER SUPPLY FLOW CHART

(Informative)

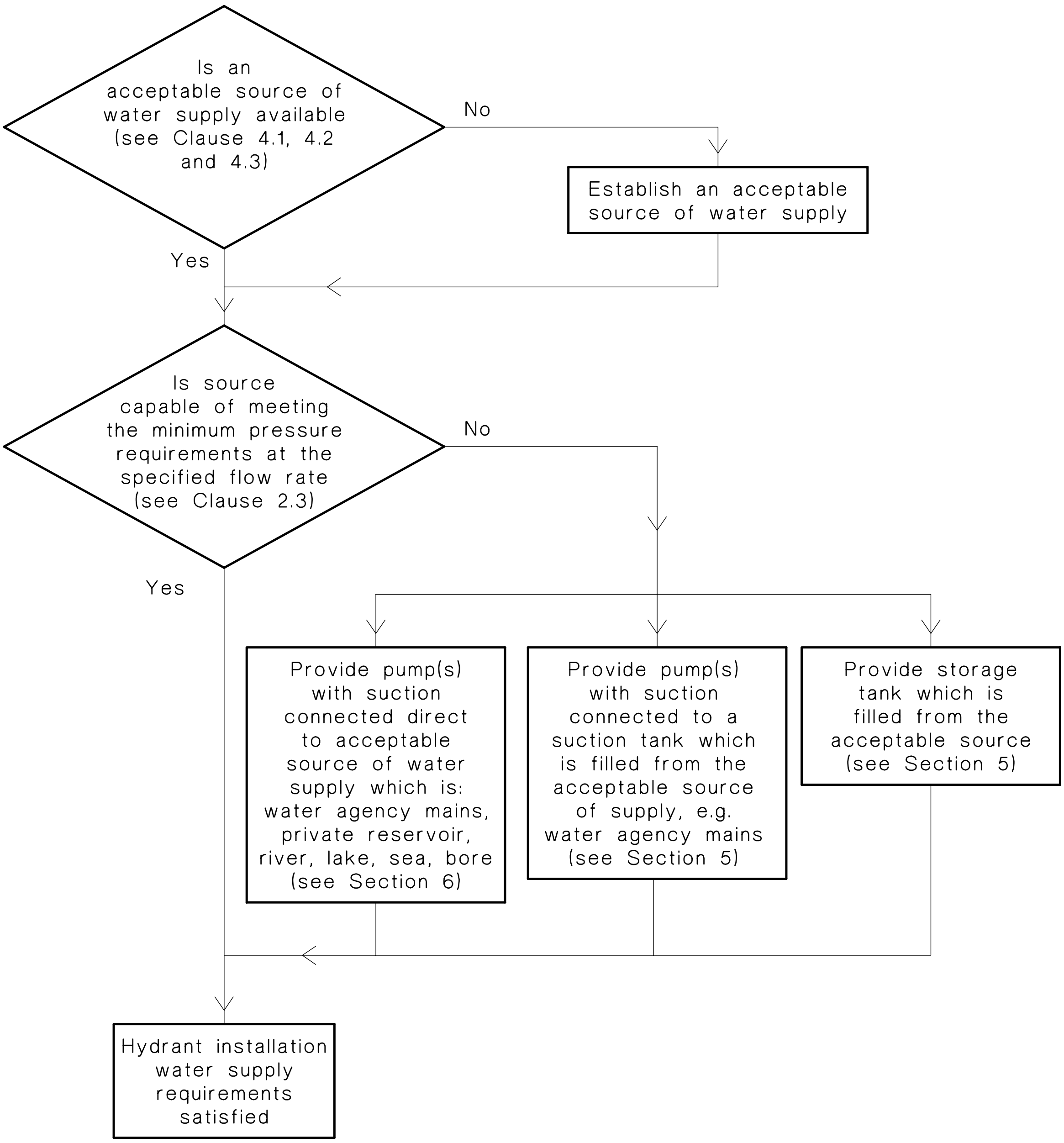


FIGURE C1 FIRE HYDRANT INSTALLATION WATER SUPPLY

APPENDIX D
FIRE BRIGADE APPLIANCES AND STRATEGIES
(Informative)

D1 GENERAL

This Appendix provides information on appliances and firefighting strategies used by fire brigades when controlling or extinguishing fires in buildings or properties by the use of fire hydrant systems.

D2 TYPES OF APPLIANCES

Fire brigades principally employ two types of equipment to fight fires, which generally use layflat (soft canvas) hose to reticulate water to the fire area, as follows:

(a) *Fire brigade pumping appliance* Fire brigade pumping appliances are equipped with an on board pump which is used to increase the pressure of the water supplied to it. The flow performance of the pump is determined by the water supply characteristics. Layflat (soft canvas) hose is connected between a feed fire hydrant and the pump suction and it is the pressure available at the feed fire hydrant to overcome the frictional loss in the hose, which determines the available flow at the pump suction. The characteristics of the appliance pump will then determine the pressure increase available. Typically, 1000 kPa or more can be achieved at 20 L/s with zero pressure at the pump suction.

    Rigid wall fire hose (suction hose) may also be carried on an appliance. These hoses are used when water supply pressures are low and are typically employed to draw water from reservoirs, open water or from a suction connection on a ground level tank. They are not permitted for use when drawing water from street water supplies.

    Appliance pump performance is compromised when operating with a negative suction pressure.

    Fire brigade pumping appliances can 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.

    Apart from carrying the necessary breathing apparatus and other firefighting equipment many fire brigade pumping appliances have an onboard, high-pressure hose reel system, for the rapid attack of relatively small fires, which utilizes an onboard water supply typically of the order of 1000 to 1500 L.

(b) *Pumping appliance (aerial appliance)* Aerial appliances have onboard 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 properties, to prevent fire from spreading.

    Aerial appliances may or may not be fitted with a pump.

D3 ACTION ON ARRIVAL

The actions taken by a fire brigade on its arrival at the scene of a fire depend on many aspects, such as the following:

(a) Is there an immediate threat to life?

(b) The size of the fire.

(c) The firefighting equipment already at hand.

(d) Additional equipment being despatched and its estimated time of arrival.

(e) The amount of water available for firefighting purposes.

The primary consideration will always be 'life safety' of the building occupants and firefighters affecting their rescue. The first firefighters to arrive at a structure fire generally need to quickly enter the fire area with a protective fire hose stream and search for missing building occupants. Where practicable, a building will need to have installed equipment that is capable of providing necessary hydrant flows and pressure so that firefighters can 'get to work' without delay. Subsequent arrivals of fire brigade pumping appliances may be directed for connection to a booster assembly to provide improved 'operational hydrant water flows and pressure', depending upon time of arrival, size of fire and number of personnel needed to complete the search.

If the fire is of limited heat output (typically a house fire) it may only be necessary to use the onboard high-pressure hose reel or a small bore (38 mm) layflat hose with water supplied from an on board tank or a street fire hydrant.

Fires of greater intensity and size will of necessity require the use of an increased amount of equipment such as multiple hose streams, larger diameter hoses (up to 70 mm) and the use of high discharge monitors on aerial appliances, requiring an even larger amount of water to be available.

If sufficient 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, if and necessary, relayed through additional pump appliances and layflat hose.

High-rise fires pose a special problem because it takes time to set up water supplies at the fire level that is at the top of the building. Initially fire crews will access the level beneath the fire floor, often by using a special firefighter lift. The first firefighters carrying small diameter layflat hose and forced entry equipment will access the fire floor by the fire stair, connect the hose to the in-stair fire hydrant and enter the fire floor under the protection of a firefighting stream. Because of the rapidity of entry, in-built systems are required to ensure that the fire hydrant in the stair is immediately available at a performance compatible with the first attack equipment used, which generally operates at pressures of 700 kPa or more. Whilst this operation is under way, other firefighters arriving with other appliances will 'set in' to the booster so that additional water supplies, if required, can be achieved by the fire brigade pumping appliances supplementing the building system.

It must be remembered that actual fires have revealed problems caused by falling debris, which rupture fire hoses and interrupt water supplies to firefighters within a building. In such cases the building system should be relied on to provide the necessary water supply for protection and safety.

Building complexes are somewhat similar operationally to a high-rise fire where firefighters may be working at a considerable distance from their pumping appliances. Furthermore, if one part of a complex is burning, adjoining parts or buildings may need to be protected to prevent fire spreading to these parts. Therefore, in building complexes, adequate access for fire brigade vehicles is often a critical issue.

Firefighters at a fire scene are constantly watching for points of potential fire extension. Fire may spread from one floor or part of a building to another by flame impingement, burning brands, conduction of heat through walls and other building elements, convective heat build-up into hot layers that will radiate heat down to other combustible surfaces pre-warming them, thus accelerating the rate of fire growth, or by direct radiation heating up and causing adjacent surfaces to either burst into flame or be ignited by sparks and flying brands. These are collectively referred to as exposure hazards and are usually protected by the application of cooling water to the surfaces or volumes under exposure.

At an industrial fire in a factory or warehouse, very high levels of radiant heat are often produced by high temperature flames. In such instances it is not uncommon to see aerial appliance and other fixed large volume monitors pouring large quantities of cooling water onto adjoining buildings in order to prevent them bursting into flames.

APPENDIX E

DETAILS OF EQUIPMENT CONNECTED TO A FIRE HYDRANT

(Informative)

E1 HOSE COUPLINGS USED TO CONNECT FIRE HOSE, FIRE HYDRANTS AND BOOSTERS

The types of fire hose couplings used in Australia are listed in Table E1.

TABLE E1

TYPES OF FIRE HOSE COUPLINGS

Type	Description
1	British instantaneous to BS 336
2	Storz hermaphrodite
3	64 mm × 4.88 mm pitch (2½ × $5^{1}/_{5}$ TPI)
4	64 mm × 5.08 mm pitch (2½ × 5 TPI) Whitworth form
5	63 mm × 8.47 mm pitch (2½ × 3 TPI)
6	Queensland round thread
7	SA round thread

NOTE: Other types may be in use in some areas of Australia. Except for hermaphrodite couplings, and large diameter rigid feed hose used for draughting water or connection to tanks, all hose couplings have external/internal threaded connections with fire hydrant outlets being external and booster inlets being internal. On the fire-ground this means external threaded end to the fire (i.e., in the direction of water flow).

E2 COUPLING TYPES USED IN DIFFERENT PARTS OF AUSTRALIA

The locations where the different types of fire hose couplings are used in Australia are listed in Table E2.

TABLE E2
USE OF VARIOUS TYPES OF FIRE HOSE COUPLINGS

Type	Authority
1	Australian Defence Forces (all states)
	British Petroleum Co. of Australia
	Broken Hill Proprietary Ltd, Broken Hill, N.S.W.
	Civil Aviation Authority
	Northern Territory Fire and Rescue Service
	Western Australian Fire Brigades Board
2	ACT Fire Brigade
	NSW Fire Brigades
	Metropolitan Fire Brigades Board (Vic.)
	WA Fire Brigade
3	NSW Fire Brigades
4	Country Fire Authority (Vic.)
	Metropolitan Fire Brigades Board (Vic.)
	Tasmanian Fire Brigade
5	Country Fire Authority (Vic.)
6	Queensland Fire Service
7	South Australia Fire Services

APPENDIX F

DETERMINATION OF WATER SYSTEM SUPPLY PRESSURE

(Informative)

F1 SCOPE

This Appendix sets out methods for determining residual pressures in a water supply system for use in the design of a fire hydrant system for a property. Methods are appropriate where the water agency can supply only limited information on the system pressure performance in water mains serving the property.

F2 WATER SUPPLY SYSTEM CHARACTERISTICS

Both the residual pressure and the available flow in a water supply system can vary considerably. It is therefore important, when obtaining information to be used in fire hydrant system design, to use appropriate methods to determine results that are representative of the actual system pressure performance in the locality.

The local water agency is usually in the best position to provide system pressure and flow information by use of a computer model of the system or other records of pressure performance; however, there are some circumstances where this information may not be available or reliable. These circumstances may include where models only include the principal mains, records only exist for a presently under-utilized system or parts of the system have friction characteristics that may radically affect calculations.

F3 RECOMMENDED TESTING AND CALCULATION METHODS

A combination of flow testing and calculation may be used to determine the pressure and flow performance of a water supply system in the vicinity of the property.

Where only a portion of the water system is included for calculation purposes (rather than the complete network from a reservoir), a main shall be selected as the starting point for calculations. The main should, where possible, be close to the location of the property. The pressure performance at this point should be obtained from a model that can be used to determine residual pressures with the fire flow added to the base flow in the mains.

Where a computer model is not available it is recommended that the capacity of the selected main should be at least 5 times the required fire flow rate. This is so that calculations can be performed with the fire flow having little effect on upstream head losses in the water supply system. The designed max hour capacity of general distribution mains is typically a flow that results in a head loss rate of 3 m/km for DN 200 and larger sizes, and 5 m/km for DN 100/DN 150. Therefore, the main at the calculation starting point should preferably be at least DN 300 for 10 L/s, DN 375 for 20 L/s and DN 450 for 30 L/s or 40 L/s fire flow rates.

The residual pressure in the main at the selected calculation starting point may be calculated (or measured with appropriate adjustment being made for the system operating conditions at the time) to ensure adoption of a pressure available at least 95% of the time (as per Clause 2.3.3).

Either a flow test should be performed or calculations used to determine head losses through the pipe network, from the selected main to the property. The objective is to determine the pressure performance with the required fire flow rate added to not less than 2/3 of the max hour flow rate for each pipe. (With a 2/3 flow reduction factor, this approximately equates to the 95% availability flow rate for residential demands. A higher fraction, as required, should be adopted for industrial/ commercial demands; it is advisable to not apply a flow reduction factor to these demands). If necessary, testing may be performed to determine the friction characteristics of parts of the water supply network, for use in calculations.

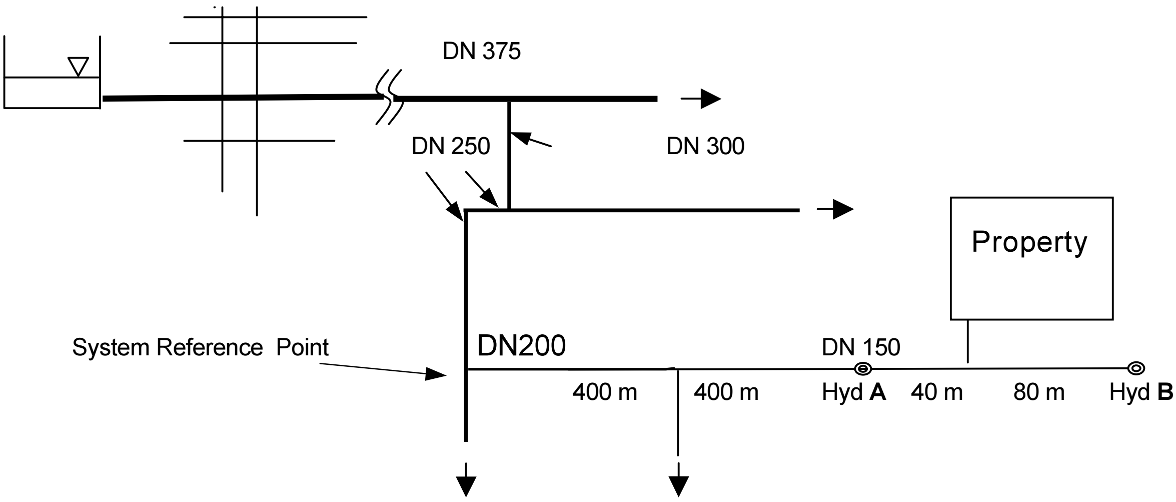
The residual pressure for the property at the point of connection at the main shall be the residual pressure at the calculation starting point less head losses and adjustment for ground levels.

Suitable methods using these principles are outlined in Paragraphs F3.1 and F3.2.

NOTE: Pressures and head losses are shown in metres head. (1 metre head is approximately 9.8 kPa (say 10 kPa)).

F3.1 Flow measurement method

F3.1.1 *Procedure*



The procedure is as follows:

(a) Select a system reference point (SRP), in the water supply network, that is included in the water agency's model of its system.

(b) Obtain the residual pressures expected at this point under peak flow conditions (including having flows up to the required fire flow added to the base peak flow in the network). This will usually be the pressure that the water agency considers can be maintained 95% of the time, adjusted to include the effect of the fire flow.

(c) Perform a flow test involving street hydrants in the vicinity of the property. Varying discharges should be initiated at a hydrant/s beyond the property service location (at hydrant B in diagram) with residual pressures being measured at a hydrant near the property service (at hydrant A in diagram). At the same time measure the pressures at the SRP.

(d) Calculate the difference in the pressures at the SRP, provided by the water agency, and the pressure measured during testing, for the appropriate fire flow rate near the property.

(e) Subtract this pressure difference from the pressure measured near the property (at hydrant A). The resulting pressure(s) may be taken as indicative of that available to the property (at hydrant A) under fire flow conditions.

(f) For greater accuracy, the pressure(s) obtained may be adjusted by—

(i) considering the total head loss in the water main to the property service location rather than only that to the pressure measurement point (hydrant A), and adjusting for the difference in ground level; and

(ii) reducing the measured discharge rates (that are an indication of the fire flow rate) by the amount the base flow in the local water main, at the time of testing, is estimated to be below the expected flow under peak (usually 95% availability) conditions.

NOTE: The water agency may apply a limit to the rate of discharge permitted during testing and/or the minimum residual pressure to which the System may be drawn down.

F3.1.2 *Example*

(based on arrangement as per diagram):

Item	2	3	4	3	3	5	6(a)	6(b)	6
Fire flow (L/s)	**Pressure at SRP (Calc'd by water agency) (m head)**	**Pressure at SRP (during test) (m head)**	**Difference (m head)**	**Hyd B flow (L/s)**	**Hyd A Press (at gauge m head)**	**Adjsuted residual pressure at hyd A (m head)**	**Pressure adjusted for location (m head)**	**Flow rates adjusted for low base flow (L/s)**	**Combined effect of adjustments (m head L/s)**
0	37	46	9	0	56.1	47.1	47.3	(-2)	46.3@0
5	35.5	44.5	9	5	53.1	44.1@5	44.2	3	42.5@5
10	33	42.5	9.5	10	49.1	39.6@10	39.6	8	37.1@10
15	29	39	10	15	42.3	32.3@15	32.0	13	28.7@15
20	23.5	34.5	11	20	34.6	23.6@20	23.0	18	18.8@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)	46.7 m (AHD)		

Assumptions in the example calculations:

(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 (2/3 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 Item 6, should be used in preference to results generated from basic testing and adjustment (Item 5).

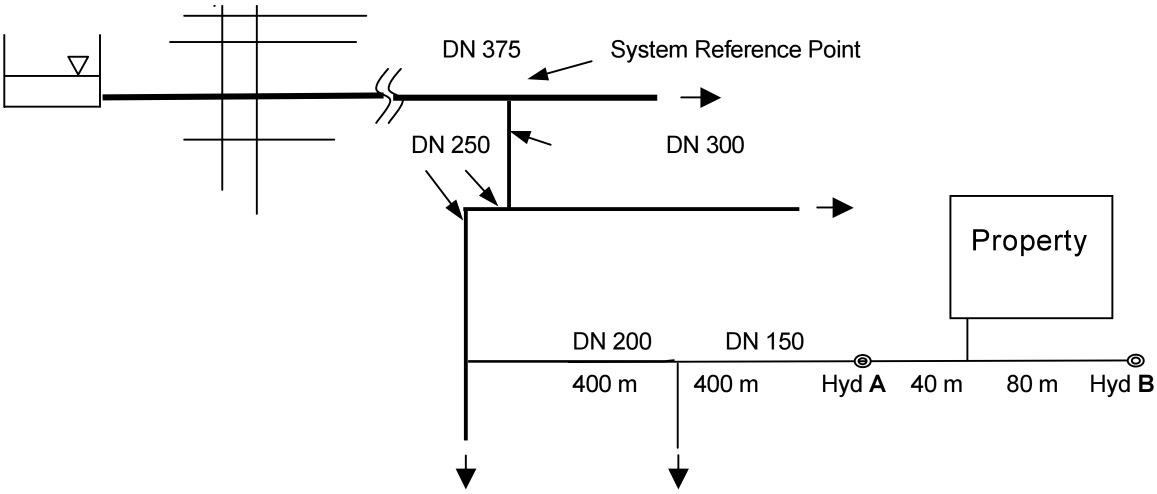
F3.2 Head loss calculation method

F3.2.1 *Procedure*

The procedure is as follows:

(a) 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.

(b) 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.



(c) Determine the base (peak) flows in the mains between the SRP and the property service location. For the 95% availability case, a flow rate of 2/3 of the max hour flow rate (for mains serving residential areas) and a higher fraction, as required, for mains serving industrial/commercial areas should be adopted.

(d) Add the required fire flow rate to the base (peak) flow in each of the mains between the SRP and the property.

(e) Calculate the head losses in the mains for the combined flows.

(f) Calculate the residual pressure at the property by subtracting the head losses from the pressure at the SRP, and adjusting for the difference in ground level at the two locations.

(g) For greater accuracy, the pressure(s) obtained may be adjusted by—

(i) measuring 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; and

(ii) if necessary, testing may be performed to determine the friction characteristics of parts of the water supply network (particularly local water mains), for use in the calculations.

F3.2.2 *Example*

(based on arrangement as per diagram)

Item		2	3	4	5	5	6	7(b)	
Mains		Pressure at SRP (Calc'd by water agency) (m head)	Base (peak flows (L/s)	Base flow plus fire flows (L/s)	Head Loss rates (m/km)	Head Losses rates (m head)	Residual head at property (m head	(Higher measured friction in DN 200/DN 150) Head losses	Residual head at property (adjusted) (m head)
Fire flow (L/s)	Length (m)								
		47							
File 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@5L/s	16.9/7.4	40.3@5L/s
File flow rate = 10 L/s									
DN 300	180		48.8	53.8	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		11.4/4.4	
DN 150	440		10.4	20.4	12.5	5.5	42.8@10L/s	27/11.9	34.0@10L/s
File 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@15L/s	42/18.5	25.4@15L/s
File flow rate = 20 L/s									
DN 300	180		48.8	68.8	3.7	0.7			
DN 250	450		29.6	44.6	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@20L/s	56/24.6	16.8@20L/s
	Ground level	52m (AHD)					46.7m (AHD)		46.7m (AHD)

Assumptions in the 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 (2/3 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 7(b)) Friction factor in DN 200 and DN 150 mains, obtained from testing, is 50% higher than the assumed friction factor for the initial (Item 6) calculation. (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 into account the best available information, such as those from Item 7, should be used in preference to results generated from basic assumptions (Item 6).

APPENDIX G
BIBLIOGRAPHY
(Informative)

AS

1170 Minimum design loads on structures
1170.4 Part 4: Earthquake loads

1281 Cement mortar lining of steel pipes and fittings

1851 Maintenance of fire protection systems and equipment

1940 The storage and handling of flammable and combustible liquids

3962 Guidelines for design of marinas

AS/NZS
1221 Fire hose reels

1873 Powder-actuated (PA) hand-held fastening tools (all parts)

1516 The cement mortar lining of pipelines in situ

3000 Electrical installations (known as the Australian/New Zealand Wiring rules)

NOTES

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