COMMITTEE WS-014

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Draft for Public Comment Australian/New Zealand Standard

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Plumbing and drainage
Part 1: Water services
(Revision of AS/NZS 3500.1:2015)

Important:
This document comprises Public Comment DR AS/NZS 3500.1:2017 and an additional reference copy that has been prepared using an automated tool to indicate key differences between the current edition of AS/NZS 3500.1:2003 (as amended) and Public Comment DR AS/NZS 3500.1:2017.
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Draft for Public Comment
Australian/New Zealand Standard

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Draft for Public Comment

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Committee WS-014—Plumbing and Drainage

DRAFT

Australian/New Zealand Standard

Plumbing and drainage

Part 1: Water services

(Revision of AS/NZS 3500.1:2015)

(To be AS/NZS 3500.1:201X)

Comment on the draft is invited from people and organizations concerned with this subject. It would be appreciated if those submitting comment would follow the guidelines given on the inside front cover.

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This document is a draft Australian/New Zealand Standard only and is liable to alteration in the light of comment received. It is not to be regarded as an Australian/New Zealand Standard until finally issued as such by Standards Australia/Standards New Zealand.

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WS-014, Plumbing and Drainage, to supersede AS/NZS 3500.1:2015.

The objective of this Standard is to provide installers with solutions to conform to—

(a) the National Construction Code of Australia (NCC), Volume Three, Plumbing Code of Australia (PCA); and

(b) the New Zealand Building Code (Clause G12, Water Supplies).

This Standard is part of a series for plumbing and drainage, as follows:

AS/NZS	
3500	Plumbing and drainage
3500.0	Part 0: Glossary of terms
3500.1	Part 1: Water services (this Standard)
3500.2	Part 2: Sanitary plumbing and drainage
3500.3	Part 3: Stormwater drainage
3500.4	Part 4: Heated water systems

The objective of this revision is to update requirements relating to backflow prevention, plastic pipes in direct sunlight, circulatory heated water, non-drinking water and clarification for jointing methods.

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.

Statements expressed in mandatory terms in notes to figures and tables are deemed to be requirements of this Standard.

Notes used in this Standard are of an advisory nature only and are used to provide explanation or guidance to the user on recommended considerations or technical procedures, or to provide an informative cross-reference to other documents or publications. Notes to clauses in this Standard do not form a mandatory part for compliance with this Standard.

This Standard includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

Some materials and products used in a water service are provided with instructions for installation and use. Whilst not a requirement of this Standard, or acceptable as an alternative to the requirements of this Standard, compliance with these instructions generally ensures that—

(i) the material or product is fit for the application;

(ii) the performance of the system is not degraded;

(iii) the durability of the material or product is not impaired; and

(iv) the manufacturer’s warranty remains valid.

PROVISION FOR REVISION

This Standard necessarily deals with existing conditions, but is not intended to discourage innovation or to exclude materials, equipment and methods that may be developed in future. Revisions will be made from time to time in view of such developments and amendments to this Edition will be made only when absolutely necessary.

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Part 1: Water services

S E C T I O N 1 S C O P E A N D G E N E R A L

1.1 SCOPE

This Standard specifies requirements for the design, installation and commissioning of cold water services from a point of connection to the points of discharge, and non-drinking water from a point of connection to the points of discharge. It applies to new installations as well as alterations, additions and repairs to existing installations.

Illustrations used in this Standard are diagrammatic only and have been chosen without prejudice.

NOTES:

1 The requirements for heated water services are set out in AS/NZS 3500.4.

2 See Figure 1.1 for typical installation of a property service and water service.

1.2 APPLICATION

1.2.1 Australia

This Standard shall be read in conjunction with the Plumbing Code of Australia (PCA) in Australia.

Where alternative Australian or New Zealand standards are referenced (e.g. AS 1345) the Australian Standard shall be used for Australia.

For Australia, this Standard does not preclude the use of any design or method of installation, provided the completed system and installation meet the performance requirements of the PCA or BCA, as appropriate.

1.2.2 New Zealand

This Standard shall be read in conjunction with the New Zealand Building Code in New Zealand. This Standard may be used for compliance with the New Zealand Building Code Paragraph G12, Water Supplies.

Where alternative New Zealand standards are referenced (e.g. NZS 5807) the New Zealand Standard shall be used for New Zealand.

1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

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

AS

1074 Steel tubes and tubulars for ordinary service

1172 Water closets (WCs)

1172.1 Part 1: Pans

1172.2 Part 2: Flushing devices and cistern inlet and outlet valves

1319	Safety signs for the occupational environment
1345	Identification of the contents of pipes, conduits and ducts
1379	Specification and supply of concrete
1397	Continuous hot-dip metallic coated steel sheet and strip—Coatings of zinc and zinc alloyed with aluminium and magnesium
1432	Copper tubes for plumbing, gasfitting and drainage applications
1478	Chemical admixtures for concrete, mortar and grout
1478.1	Part 1: Admixtures for concrete
1604	Specification for preservative treatment
1604.1	Part 1: Sawn and round timber
1646	Elastomeric seals for waterworks purposes
1657	Fixed platforms, walkways, stairways and ladders—Design, construction and installation
2129	Flanges for pipes, valves and fittings
2419	Fire hydrant installations
2419.1	Part 1: System design, installation and commissioning
2700	Colour Standards for general purposes
2845	Water supply—Backflow prevention devices
2845.2	Part 2: Registered air gaps and registered break tanks
2845.3	Part 3: Field testing and maintenance of testable devices
2865	Confined spaces
3600	Concrete structures
3688	Water supply—Metallic fittings and end connectors
3795	Copper alloy tubes for plumbing and drainage applications
4176	Multilayer pipes for pressure applications (series)
4728	Electric resistance welded steel pipe for pressure purposes
4809	Copper pipe and fittings—Installation and commissioning
5082	Polybutylene (PB) plumbing pipe systems—Metric series
5082.1	Part 1: Metric polybutylene (PB) pipes for hot and cold water applications
5082.2	Part 2: Mechanical and fusion jointing systems
5200	Plumbing and drainage products
5200.000	Technical specification for plumbing and drainage products—Procedures for certification of plumbing and drainage products
5200.053	Stainless steel pipes and tubes for pressure applications
AS/NZS	
1167	Welding and brazing—Filler metals
1167.1	Part 1: Filler metal for brazing and braze welding
1167.2	Part 2: Filler metal for welding
1477	PVC pipes and fittings for pressure applications
2032	Installation of PVC pipe systems
2033	Installation of polyethylene pipe systems
2280	Ductile iron pressure pipes and fittings
2492	Cross-linked polyethylene (PE-X) pipes for pressure applications

2537	Mechanical jointing fittings for use with crosslinked polyethylene (PE-X) for pressure applications—Plastics piping systems for hot and cold water installations—Crosslinked polyethylene (PE-X) (series)
2544	Grey iron pressure fittings
2642	Polybutylene (PB) plumbing pipe systems
2642.2	Part 2: Polybutylene (PB) pipe for hot and cold water applications
2642.3	Part 3: Mechanical jointing fittings for use with polybutylene (PB) pipes for hot and cold water application
2648	Underground marking tape
2648.1	Part 1: Non-detectable tape
2845	Water supply—Backflow prevention devices
2845.1	Part 1: Materials, design and performance requirements
2878	Timber—Classification into strength groups
3500	Plumbing and drainage
3500.0	Part 0: Glossary of terms
3500.4	Part 4: Heated water services
3518	Acrylonitrile butadine styrene (ABS) compounds, pipes and fittings for pressure applications
3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
4020	Testing of products for use in contact with drinking water
4087	Metallic flanges for waterworks purposes
4129	Fittings for polyethylene(PE) pipes for pressure applications
4130	Polyethylene (PE) pipes for pressure applications
4331	Metallic flanges
4331.1	Part 1: Steel flanges
4331.2	Part 2: Cast iron flanges
4331.3	Part 3: Copper alloy and composite flanges
4441	Oriented PVC (PVC-O) pipes for pressure applications
4671	Steel reinforcing materials
AS/NZS	
4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
4765	Modified PVC (PVC-M) pipes for pressure applications
4792	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
NZS	
3109	Concrete construction
3124	Specification for concrete construction for minor works
3501	Specification of copper tubes for water, gas and sanitation
3640	Chemical preservation of round and sawn timber
4121	Design for access and mobility: Buildings and associated facilities
5807	Code of practice for industrial identification by colour, wording or other coding
7702	Specification for colours for identification, coding and special purposes
NZS BS	

1387	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads
ISO 15874	Plastics piping systems for hot and cold water installations—Polypropylene (PP) (series)
NCC	Nation Construction Code (series)
ANSI/AWWA C217	Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
C651	Disinfecting water mains
BS EN 10312	Welded stainless steel tubes for the conveyance of water and other aqueous liquids. Technical delivery conditions
D2846	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
F493	Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
NZBC	New Zealand Building Code (G12, Water Supplies)
WSAA WSA 03	Water supply code of Australia

1.4 DEFINITIONS

For the purposes of this Standard, the definitions given in AS/NZS 3500.0 and the definition below apply.

1.4.1 Point of connection

For a water service, the point where the service pipe within the premises connects to the network utility operator's property service or to an alternative water supply system.

1.5 ABBREVIATIONS

The following plastics abbreviations are used in this Standard.

PVC-U	Unplasticized polyvinyl chloride
PVC-M	Modified polyvinyl chloride
PVC-O	Oriented polyvinyl chloride
PE	Polyethylene
PP	Polypropylene
PE-X	Cross-linked polyethylene
ABS	Acrylonitrile butadiene styrene
PB	Polybutylene

1.6 EQUIVALENT PIPE SIZES

Where the nominal size of a pipe is specified in this Standard, an equivalent pipe size, appropriate to the material being used, shall be selected from Appendix A.

1.7 FACILITIES FOR PEOPLE WITH DISABILITIES

The installation of sanitary facilities for people with disabilities shall be in accordance with the following:

(a) Australia ..... the NCC.

(b) New Zealand ..... NZS 4121 and the New Zealand Building Code (NZBC).

1.8 TERMITE MANAGEMENT

This Standard does not cover termite barriers and construction techniques to impede and discourage termite attack in buildings.

C1.8 *Within Australia, termites have a wide geographic distribution and can attack cellulose products, including timber, in service in buildings.*

AS 3660.1 and the NCC contain information on protection of new buildings from subterranean termites.

Where a building has been treated against termite attack, it is essential that care be exercised during installation of plumbing services so that both physical and chemical termite barriers are not compromised.

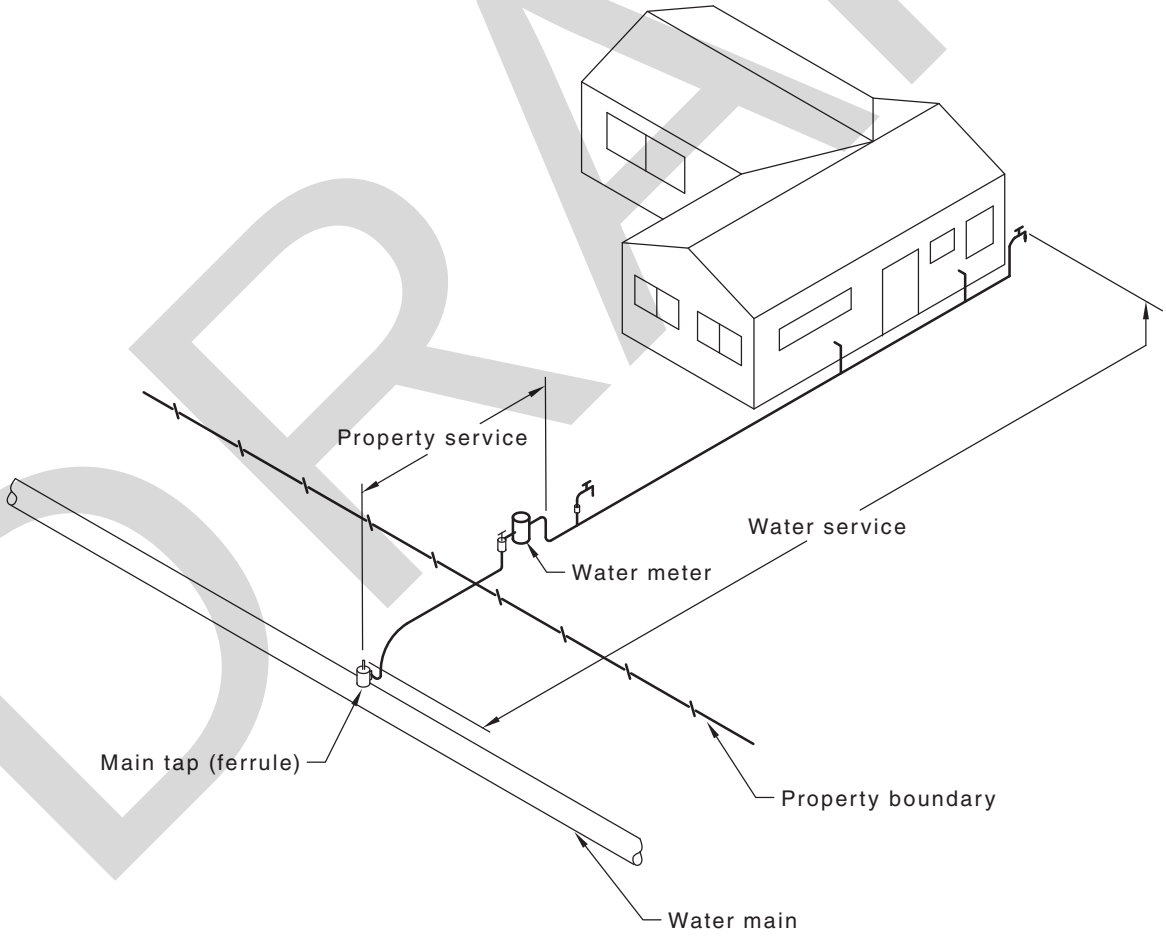


FIGURE 1.1 TYPICAL INSTALLATION OF A PROPERTY SERVICE AND WATER SERVICE WHERE CONNECTED TO THE NETWORK UTILITY OPERATOR'S WATER MAIN

SECTION 2 MATERIALS AND PRODUCTS

2.1 SCOPE OF SECTION

This Section specifies requirements for materials and products used in water services.

2.2 AUTHORIZATION

In Australia, certain materials and products require authorization for use in plumbing and drainage installations in accordance with the Plumbing Code of Australia (PCA). In New Zealand product authorization is not required.

NOTE: A database of authorized products is available from www.abcb.gov.au.

2.3 SELECTION AND USE OF MATERIALS AND PRODUCTS

Materials and products in contact with water that is intended for human consumption, food preparation, utensil washing, personal hygiene or oral hygiene shall conform to AS/NZS 4020. Linings and coatings shall conform to AS/NZS 4020, at a surface area to volume ratio not greater than that applicable to the installation.

Materials and products used in a water service shall be selected to ensure fitness for their intended purpose. Pipes and fittings shall be selected from those listed in Appendix B.

Factors to be taken into account in the selection shall include, but are not limited to, the following:

(a) The type of usage likely to occur.

(b) The nature and temperature of the water to be conveyed and the risk of corrosion, degradation and leaching.

(c) The nature of the environment and the ground and the possibility of chemical attack and permeation therefrom.

(d) The physical and chemical characteristics of the materials and products.

(e) Compatibility of materials and products.

(f) Frost protection in accordance with Clause 5.17.

(g) Accessibility, for inspection, service, repair and replacement.

NOTE: Information on some of the above items may be obtainable from the manufacturer or supplier of the product or materials.

2.4 LIMITATIONS ON USE OF PIPES AND FITTINGS

2.4.1 General limitations

The following limitations shall apply to the use of pipes and fittings for water services:

(a) Pipes and fittings—

  (i) up to and including DN 100, shall have a maximum allowable operating pressure (MAOP) of at least 1.2 MPa at 20°C; and

  (ii) where larger than DN 100, shall be selected to satisfy design criteria for the system.

(b) Bends in pipes shall be free from wrinkling and flattening.

(c) Semi-flexible connectors and braided flexible hoses shall be used only above surface level and in accessible locations.

(d) Pipes and fittings shall be protected from external heat sources that limit the service life of the pipes.

(e) Soft solder jointing shall not be used.

(f) Copper pipes to AS 1432 shall only be of type A, B or C.

NOTE: In many parts of Australia and New Zealand, the maintenance of the property service is the responsibility of the network utility operator. Pipes used in a property service or meter assembly are installed to the network utility operator's specification (see Figure 1.1).

2.4.2 Metallic pipes and fittings

Metallic pipes and fittings shall conform to the following:

(a) Ductile iron pipes and fittings shall be lined and provided with an outer protective coating in accordance with AS/NZS 2280.

(b) Cast iron pipes and fittings shall be lined with cement mortar and provided with an outer protective coating.

(c) Galvanized pipes and fittings shall be used only in non-drinking water systems that are installed above ground. The internal and external galvanizing coating shall be a minimum of 300 g/m^2 hot-dipped galvanizing to AS/NZS 4680 or AS/NZS 4792.

NOTE: The risk of rapid corrosion should be considered when selecting galvanized steel pipes for any application.

Where galvanized steel fire hydrant or booster riser pipes are to be buried below ground in accordance with AS 2419.1, the pipes shall be heavy thickness up to and including DN 80 and not less than medium thickness over DN 80. The maximum length of fire hydrant or booster riser pipe below ground shall be 1.5 m. The buried section of pipe shall be protected against corrosion by continuous wrapping in petrolatum tape to AWWA C217.

(d) Fittings used to join copper and copper alloy pipes shall conform to AS 3688 and be installed in accordance with the installation requirements of AS 4809. Copper pipes shall conform to AS 1432.

(e) Stainless steel (SS) pipes shall be used in conjunction with dezincification resistant (DR) copper alloy fittings or stainless steel fittings conforming to AS 3688.

2.4.3 Plastics pipes and fittings

Plastics pipes and fittings shall conform to the following:

(a) Where plastics pipes and fittings are subject to direct sunlight they shall be installed as follows:

(i) PVC shall be painted with light coloured water-based paints, or be otherwise protected.

(ii) Solid black PE pipes and fittings are not required to be protected. Coloured and jacketed pipes and fittings shall be protected (see Note 1).

(iii) ABS is not required to be protected.

(iv) Solid black PE-X pressure pipe is not required to be protected. Coloured and jacketed PE-X pipes and fittings shall be protected.

(v) Plastics pipes of other materials including PB, PP and multi-layered pipe shall be protected (see Note 2).

(b) Plastics pipes and fittings shall not be used to support valves, meters or associated pipes and fittings (see Note 3).

NOTES:

1 Painting with light coloured water-based paints will minimize the effects of ultraviolet radiation such as loss of impact strength and discolouration of the surface.

2 Examples of protection include sleeving with metal or plastics pipe or conduit, lagging or painting with UV resistant paint.

3 Requirements for the use, handling and transportation of plastics pipes, fittings, solvent cement and priming fluid are specified in AS/NZS 2032 or AS/NZS 2033.

2.5 SAFE-TRAYS AND WASTE PIPES

Safe-trays and waste pipes connected to safe-trays shall be—

(a) fabricated from 0.60 mm thick galvanized steel sheet conforming to AS 1397 and having a minimal nominal zinc coating mass of 275 g/m^2; or

(b) made from other materials with corrosion properties not inferior to Item (a) requirements.

2.6 JOINTS

2.6.1 Flanged joints

Flanged joints shall conform to—

(a) AS/NZS 1477 for PVC-U;

(b) AS/NZS 2280 and AS/NZS 2544 for ductile iron and grey cast iron; or

(c) AS 2129, AS/NZS 4331.1, AS/NZS 4331.2, AS/NZS 4331.3 or AS/NZS 4087 and be appropriate for the test pressure requirements of Section 18.

2.6.2 Elastomeric seals

Materials used for elastomeric seals shall conform to AS 1646.

Where an elastomeric seal gasket is provided in the line or in a fitting, it shall not be replaced with mastic or sealant compounds.

2.6.3 Silver brazing alloy

2.6.3.1 *Copper and copper alloys*

Silver brazing alloys and copper-phosphorus brazing alloys for capillary jointing of copper and copper alloy pipes and fittings shall conform to AS/NZS 1167.1 and contain a minimum of 1.8% silver and a maximum of 0.05% cadmium.

2.6.3.2 *Stainless steels*

Silver brazing alloys for capillary jointing of stainless steel pipes and fittings shall conform to AS/NZS 1167.1 and contain a minimum of 38% silver and a maximum of 0.05% cadmium.

2.6.4 Solvent cement and priming fluid

Solvent cement and priming fluid for jointing PVC-U and PVC-M pipes and fittings shall conform to AS/NZS 3879.

Solvent cement shall be Type P, green colour (Australia) or blue or gold colour (New Zealand). Priming fluid shall be red colour.

Solvent cement shall not be used without priming fluid.

2.6.5 Filler rods for stainless steel joints

Welded joints in stainless steel pipework larger than DN 25 shall be made using filler rods of low carbon stainless steel not greater than 2 mm in diameter and conforming to AS/NZS 1167.2.

2.7 CONCRETE AND MORTAR

2.7.1 Concrete mix

Ready-mixed concrete shall conform to AS 1379 and shall have a minimum characteristic compressive strength of 20 MPa as defined in AS 3600 or NZS 3109 and NZS 3124.

Site-mixed concrete shall consist of cement, fine aggregate and coarse aggregate, all measured by volume with sufficient water added to make the mix workable. Site-mixed concrete shall have a minimum characteristic compressive strength of 20 MPa as defined in AS 3600 or NZS 3109 and NZS 3124.

2.7.2 Cement mortar

Cement mortar shall consist of one part cement and two parts of fine aggregate, all measured by volume and properly mixed with the minimum amount of water necessary to render the mix workable.

NOTE: For bedding pipes, a mixture consisting of one part cement to four parts of fine aggregate may be used.

Cement mortar that has been mixed and left standing for more than 1 h shall not be used.

2.7.3 Chemical admixtures

Chemical admixtures used in concrete shall conform to AS 1478.1.

2.7.4 Water for concrete and mortar

Water used for mixing concrete and cement mortar shall be free from impurities that are harmful to the mixture, the reinforcement, or any other items embedded within the concrete or mortar.

2.7.5 Steel reinforcement

Steel reinforcing materials used in concrete structures shall conform to AS/NZS 4671.

2.8 MISCELLANEOUS MATERIALS

2.8.1 Timber

Timber exposed to the weather shall be of durability Class 2 conforming to AS/NZS 2878 or shall be treated in accordance with AS 1604.1. In New Zealand, exposed timber shall be treated to H3 (CCA) in accordance with NZS 3640.

Timber in contact with the ground shall be durability Class 1 for Australia and H4 (CCA) for New Zealand, and exposed timber shall be treated to a minimum of H3.2 (copper based) in accordance with NZS 3640.

2.8.2 External protective coatings

External coatings used for the protection of pipes and fittings buried in corrosive areas shall—

(a) be impervious to the passage of moisture;

(b) be resistant to the corrosive environment;

(c) be resistant to abrasion by the surrounding fill; and

(d) not contain any material that could cause corrosion to the underlying pipes or fittings.

NOTE: Polyethylene sleeving used to protect underground pipes and fittings may require additional protection if installed in rock or stony ground.

2.9 BACKFLOW PREVENTION DEVICES

Backflow prevention devices shall conform to AS/NZS 2845.1.

SECTION 3 SIZING OF WATER SERVICES

3.1 SCOPE OF SECTION

This Section specifies requirements for the sizing of pipes for water service installations.

3.2 FLOW REQUIREMENTS

3.2.1 Flow rates

The flow rates to fixtures, appliances, taps, valves and cisterns shall be not less than the flow rates specified in Table 3.2.1.

The maximum flow rate from a shower, basin and kitchen sink or laundry trough outlet shall not exceed 9 L/min.

TABLE 3.2.1

FLOW RATES AND LOADING UNITS

Fixture/appliance	Flow rate L/s	Flow rate L/min	Loading units
Water closet cistern	0.10	6	2
Bath	0.30	18	8
Basin (standard outlet)	0.10	6	1
Spray tap	0.03	1.8	0.5
Shower	0.10	6	2
Sink (standard tap)	0.12	7	3
Sink (aerated tap)	0.10	6	2
Laundry trough	0.12	7	3
Washing machine/dishwasher	0.20	12	3
Mains pressure water heater	0.20	12	8
Hose tap (20 nom. size)	0.30	18	8
Hose tap (15 nom. size)	0.20	12	4

NOTES:

1 In the case of valves and appliances where test information indicates that they will function satisfactorily with a flow rate less than that shown in this Table, the tested flow rate may be substituted and the loading units adjusted accordingly.

2 Flow rates and loading units given above are taken with cold water flowing from each individual outlet.

3.2.2 Loading units

Loading units are factors that take into account the flow rate, length of time in use, and frequency of use of the fixture or appliance. Loading units for fixtures/appliances shall be as specified in Table 3.2.1.

3.2.3 Probable simultaneous demand (PSD)

The probable simultaneous demand (PSD) for dwellings shall be not less than that specified in Table 3.2.3.

The minimum flow rates specified in Table 3.2.3 shall be used to estimate the size of the supply pipe for dwellings.

NOTE: A method of sizing supply piping for dwellings is given in Appendix C.

3.2.4 Probable simultaneous flow rate (PSFR)

Conversion of loading units to probable simultaneous flow rates (PSFRs) for branch piping within dwellings is given in Table 3.2.4.

NOTES:

1 A method for sizing of piping within dwellings is given in Appendix D.

2 Flow rates may be used to estimate the minimum size of piping within dwellings.

TABLE 3.2.3
PROBABLE SIMULTANEOUS DEMAND (PSD) FOR DWELLINGS

No. of units or dwellings	Flow rate L/s	No. of units or dwellings	Flow rate L/s	No. of units or dwellings	Flow rate L/s
1	0.48	35	3.74	68	5.79
2	0.70	36	3.81	69	5.85
3	0.88	37	3.88	70	5.91
4	1.03	38	3.95	71	5.96
5	1.17	39	4.01	72	6.02
6	1.30	40	4.08	73	6.08
7	1.41	41	4.14	74	6.13
8	1.53	42	4.21	75	6.19
9	1.64	43	4.27	76	6.25
10	1.74	44	4.34	77	6.30
11	1.84	45	4.40	78	6.36
12	1.94	46	4.47	79	6.41
13	2.03	47	4.53	80	6.47
14	2.12	48	4.49	81	6.53
15	2.21	49	4.66	82	6.58
16	2.30	50	4.72	83	6.64
17	2.39	51	4.78	84	6.69
18	2.47	52	4.84	85	6.75
19	2.55	53	4.90	86	6.80
20	2.64	54	4.96	87	6.86
21	2.72	55	5.02	88	6.91
22	2.79	56	5.09	89	6.96
23	2.87	57	5.15	90	7.02
24	2.95	58	5.21	91	7.07
25	3.03	59	5.27	92	7.12
26	3.10	60	5.32	93	7.18
27	3.17	61	5.38	94	7.23
28	3.25	62	5.44	95	7.29
29	3.32	63	5.50	96	7.34
30	3.39	64	5.56	97	7.39
31	3.46	65	5.62	98	7.44
32	3.53	66	5.68	99	7.50
33	3.60	67	5.73	100	7.55
34	3.67	—	—	—	—

NOTES:

1 The minimum flow rates shown in this Table are based on domestic installations. If it is expected that the dwelling(s) will have a greater demand, then the probable simultaneous flow rate may be estimated using the loading unit method outlined in Appendix D.

2 Determination of PSD for dwellings exceeding the scope of this Table may be estimated using the following equation:

$$Q = 0.03\,n + 0.4554\sqrt{n}$$

where

Q = flow rate, in litres per second

n = number of dwellings

TABLE 3.2.4

PROBABLE SIMULTANEOUS FLOW RATES (PSFRs)

Loading units	PSFR L/s	Loading units	PSFR L/s	Loading units	PSFR L/s
1	0.09	21	0.39	41	0.55
2	0.12	22	0.40	42	0.56
3	0.14	23	0.41	43	0.57
4	0.16	24	0.42	44	0.58
5	0.18	25	0.43	45	0.58
6	0.20	26	0.43	46	0.59
7	0.22	27	0.44	47	0.60
8	0.24	28	0.45	48	0.60
9	0.25	29	0.46	49	0.61
10	0.26	30	0.47	50	0.62
11	0.28	31	0.48	51	0.62
12	0.29	32	0.49	52	0.63
13	0.30	33	0.49	53	0.64
14	0.31	34	0.50	54	0.64
15	0.33	35	0.51	55	0.65
16	0.34	36	0.52	56	0.65
17	0.35	37	0.52	57	0.66
18	0.36	38	0.53	58	0.67
19	0.37	39	0.54	59	0.67
20	0.38	40	0.55	60	0.68

3.3 PRESSURE REQUIREMENTS

3.3.1 Available pressure

Pipe sizing shall be based on the minimum available pressure.

NOTE: The maximum and minimum pressures for the water main serving the property may be obtained from the utility responsible for the supply of water.

3.3.2 Pressure at outlets

The minimum working pressure at the furthermost or most disadvantaged fixture or outlet shall be not less than 50 kPa (5 m head), at the flow rate specified in Table 3.2.1.

NOTES:

1 Storage tanks conforming to Section 8 or booster pumps conforming to Section 13 may be required to achieve the minimum pressure.

2 Some fixtures may require more than 50 kPa supply pressure in order to function.

3.3.3 Pressure losses

Allowance shall be made for pressure losses through pipes, valves, fittings, meters and any other equipment present in the installation.

NOTE: The methods used in Appendices C and D make an allowance of 50% additional pipe length for pressure losses through fittings.

3.3.4 Maximum pressure within buildings

Provision shall be made to ensure that the maximum static pressure at any outlet, other than a fire service outlet, within a building does not exceed 500 kPa.

NOTE: Pressures above 500 kPa can cause damage from water hammer, reduced life of appliances, taps and fittings, and cause excessive noise in the system.

3.3.5 Availability of water supply

Where the available water supply cannot meet the minimum pressure and flow rates of this Section, storage tanks with or without pumps shall be installed to achieve the pressure and flow rate demands in accordance with this Section.

3.4 VELOCITY REQUIREMENTS

The maximum water velocity in piping shall be 3.0 m/s.

The velocity limitation shall not apply to any piping that is exclusively used for fire services, whether independently served by a main or combined with a domestic water supply.

3.5 PIPE SIZE LIMITATIONS

3.5.1 Water service

For a single dwelling, the water service pipe from the property service to branch offtakes shall have an internal diameter of not less than 15.0 mm.

Internal diameter of pipes shall be as specified in Appendix A.

NOTE: Where the installation includes home fire sprinklers or some other specialist systems, a water service of this size will be inadequate and pipe sizes will need to be determined by specific hydraulic design.

C3.5.1 *Minimum internal diameter sizes quoted in this Standard have been derived from copper piping systems.*

3.5.2 Branch offtakes

Branch offtake pipes shall—

(a) be of a length not exceeding those specified in Table 3.5.2; and

(b) supply only one fixture or outlet, except that—

(i) a branch with a minimum internal diameter of 12.5 mm may also supply a flushing device or a supply tank feeding a gravity-fed, domestic-type water heater; and

(ii) a branch with a minimum internal diameter of 10.0 mm may supply a combination bath and shower unit, or a laundry trough and washing machine, or a kitchen sink and dishwasher.

NOTE: For minimum internal diameter of pipes, see Appendix A.

TABLE 3.5.2

BRANCH OFFTAKE PIPE-LENGTH

Internal diameter of offtake pipe, mm	Maximum length, m
12.5	6
10.0	3
7.0	1

SECTION 4 CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION

4.1 SCOPE OF SECTION

This Section specifies requirements and methods for the prevention of contamination of the drinking water within the water service and the water main and provides for the selection and installation of backflow prevention devices.

NOTE: For typical examples of potential cross-connections, see Appendix E.

4.2 PROTECTION OF WATER SUPPLIES

4.2.1 Design

All water supply systems shall be designed, installed, and maintained so as to prevent contaminants from being introduced into the drinking water supply system.

4.2.2 Protection against contaminants

No device or system that may cause contamination of a water supply shall be connected directly or indirectly to any part of a water service without appropriate cross-connection or backflow prevention control suitable for the degree of hazard.

4.2.3 Combined tanks

Combined tanks storing drinking water and water for other purposes shall achieve separation of the two supplies by the internal installation of double partition walls. The space between the partition walls shall be arranged to ensure that any leakage is not able to enter the other compartment of the tank and is drained such that any discharge is external and readily noticed.

4.2.4 Alternative water supplies

Where water supplied from one source is connected to another water source, appropriate backflow prevention shall be provided.

4.2.5 Integral backflow prevention

Where backflow prevention devices are provided as an integral part of a fixture, appliance or apparatus and are appropriate for the cross-connection hazard generated by that fixture, appliance or apparatus, no additional backflow prevention is required upstream of the point of connection to the water supply system.

NOTE: Where a cross-connection is found in the water service at any property or if the water service is installed in a manner that will enable backflow to occur, such cross-connection should be reported to the water utility in Australia and territorial authority in New Zealand.

4.3 CROSS-CONNECTION HAZARD RATING

Cross-connections are rated using three degrees of hazard, as follows:

(a) *High hazard* Any condition, device or practice that, in connection with the water supply system, has the potential to cause death.

(b) *Medium hazard* Any condition, device or practice that, in connection with the water supply system, has the potential to endanger health.

(c) *Low hazard* Any condition, device or practice that, in connection with the water supply system, constitutes a nuisance but does not endanger health or cause injury.

4.4 PROVISION OF BACKFLOW PREVENTION DEVICES

4.4.1 General

The required backflow protection shall be determined by identifying the individual hazard(s) within the premises. Then working upstream from each hazard, the water shall be regarded as non-drinking until a backflow prevention device, suitable for the degree of hazard, is provided.

NOTE: For typical backflow prevention, see Figure 4.4.1.

The drinking water supply shall be protected from the hazard(s) by installing—

(a) individual protection at each hazard with a device listed in Table 4.4.1, depending on the hazard rating;

(b) zone protection with a device listed in Table 4.4.1, depending on the hazard rating, and pipework identified in accordance with Clause 4.4.5;

(c) containment protection for fire service installations with a device listed in Table 4.4.1; or

(d) combinations of Items (a), (b) and (c).

Backflow prevention devices shall conform to AS/NZS 2845.1 and AS 2845.2.

For New Zealand, the field testing of backflow prevention devices and verification of air gaps shall be conducted in accordance with NZBC G12/AS1.

NOTES:

1 In assessing a backflow condition, consideration should be given to the complexity of piping, the probability of piping change, and negligent or incorrect use of equipment resulting in a backflow condition.

2 For typical examples of potential cross-connection, see Appendix E.

C4.4.1 *Backflow prevention may be in the form of—*

(a) individual protection provided at individual fixtures, appliances or apparatus;

(b) zone protection provided at the connection to specific sections of a water supply system within a building or a facility;

(c) containment protection provided at the property boundary to protect the network utility operator's water supply; or

(d) combinations of (a), (b) and (c).

4.4.2 Type of backflow protection

Backflow prevention devices shall be provided in accordance with—

(a) the hazard rating given in Clause 4.3; and

(b) the suitability of the device listed in Table 4.4.1.

NOTE: For examples of backflow devices relative to levels of protection, see Appendix F.

4.4.3 Hose taps

Hose taps within 18 m of a zone-protected area within the same premises shall have a backflow protection device of the same hazard rating as the zone protection adjacent to which they are installed.

4.4.4 Additional backflow protection

Where cross-connections are identified, zone(s) or individual backflow prevention devices appropriate to the hazard shall be installed.

NOTES:

1 For typical examples of potential cross-connections, see Figure 4.4.1 and Appendix E.

2 Additional backflow protection may also be required by the network utility operator.

4.4.5 Water downstream of backflow prevention device

Water downstream of a containment device is considered to be drinking water unless there are unprotected hazards within the premises.

Individual or zone protection against these hazards shall be provided to prevent contamination of the water supply.

The water service downstream of a backflow prevention device shall not be reconnected to the water service upstream of the backflow prevention device without the installation of a backflow prevention device of the same hazard rating.

Piping conveying water downstream of backflow prevention device, installed for high or medium hazard protection, other than backflow prevention devices used for containment, shall be clearly and permanently labelled 'WARNING NOT FOR DRINKING' at every outlet.

NOTE: For requirements for non-drinking water, see Section 9.

In New Zealand, identification of non-drinking water outlets and pipelines shall be in accordance with NZBC G12/AS1 Clauses 4.2 and 4.3.

4.4.6 Commissioning and maintenance

Testable backflow prevention devices shall be commissioned and tested after installation and prior to service. They shall be maintained in working order and tested for operational function at intervals not exceeding 12 months. Reduced pressure zone devices, double check valve assemblies, pressure type vacuum breakers, registered break tanks and registered air gaps shall only be used with a maintenance program for device registration and test certification.

Where there is no such program, these devices shall not be fitted and the standard air gap requirements shall apply.

NOTE: In New Zealand, the testing of automatic backflow protection devices is mandatory for compliance with S44 of the Building Act 1991.

4.4.7 Heated water systems

The requirements of this Section for backflow prevention devices apply equally to heated water supply systems and cold water supply services. The backflow prevention device used in heated water systems shall be suitable for the specific heated water installation.

TABLE 4.4.1
SUITABILITY OF DEVICES

Registered or testable backflow prevention device	Cross-connection hazard rating	Protection against back-pressure	Protection against back-siphonage
(a) Registered testable devices			
Registered break tank (RBT)	High/medium/low	Yes	Yes
Registered air gap (RAG)	High/medium/low	Yes	Yes
Reduced pressure zone device (RPZD)*	High/medium/low	Yes	Yes
Reduced pressure detector assembly (RPDA)*	High/medium/low	Yes	Yes
Double-check valve assembly (DCV)*	Medium/low	Yes	Yes
Double-check detector assembly (DCDA)*	Medium/low	Yes	Yes
Spill resistant pressure type vacuum breaker (SPVB)*†	High/medium/low	No	Yes
Pressure type vacuum breaker (PVB)*	Medium/low	No	Yes
(b) Non-testable devices			
Dual-check valve with atmospheric port (DCAP)‡	Low	Yes	Yes
Dual-check valve (DUAL CV)‡	Low	Yes	Yes
Dual-check valve with intermediate vent (DuCV)‡	Low	Yes	Yes
Air gap (AG)	Low	No	Yes
Break tank (BT)	Low	No	Yes
Atmospheric vacuum breaker (AVB) ‡	Low	No	Yes
Hose connection vacuum breaker (HCVB)‡ (see Note 3)	Low	No	Yes
Beverage dispenser dual-check valve (BDDC)‡	Low	Yes	Yes
Pipe interrupter device (PID)	Low	No	Yes
(c) Fire services only			
Single check valve (testable) (SCVT) *	Low	Yes	Yes
Single check detector assembly (testable) (SCDAT)*	Low	Yes	Yes

* Backflow prevention devices that are provided with test taps for the purposes of testing the operation of the devices, which do not necessarily include isolating valves.

† SPVBs are suitable for high-hazard installation for mains pressure flushing valves only.

‡ Backflow prevention devices that are not provided with test taps for the purposes of testing the operation of the devices.

NOTES:

1 PVBs are designed to vent at 7 kPa or less; however, they may require a significantly higher pressure to reseat and should be installed only in systems that provide pressures sufficient to ensure full closing of the valve and should not be installed close to water outlets where low pressures could be encountered.

2 In areas where water spillage may cause nuisance, tundishes or alternative drainage should be installed to receive the discharge from—

(a) RPZDs;

(b) PVBs;

(c) DCAP; or

(d) AVBs.

3 HCVBs are designed to withstand the small amount of back-pressure that would occur if the end of the hose is higher than the hose tap.

4 PVBs, AVBs, HCVBs and PIDs should only be used to protect against back-siphonage.

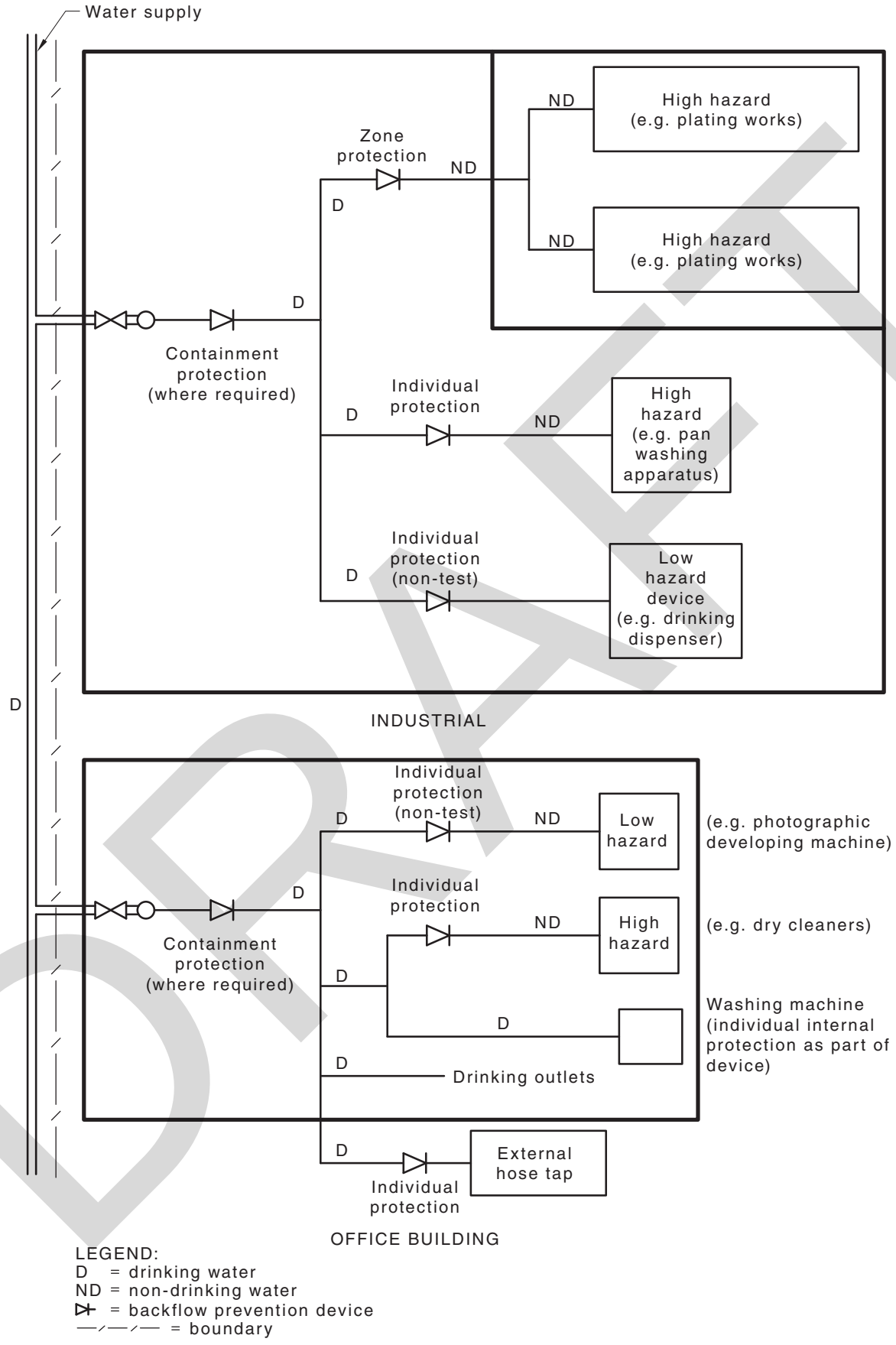


FIGURE 4.4.1 TYPICAL BACKFLOW PREVENTION SCHEMES

4.5 SUITABILITY OF DEVICES FOR HAZARDS

Table 4.4.1 lists devices suitable for each hazard rating and indicates whether protection is provided against back-pressure or back-siphonage.

The type of device selected for each hazard rating shall conform to Table 4.4.1.

4.6 INSTALLATION OF BACKFLOW PREVENTION DEVICES

4.6.1 General installation requirements

The installation of each backflow prevention device shall conform to the following:

(a) Heat shall not be applied to any device during installation.

(b) Installations for pressure type vacuum breakers (PVBs), spill resistant pressure type vacuum breakers (SPVBs), double check valves (DCVs) and (DDCVs) and reduced pressure zone detectors (RPZDs) and detector reduced pressure zone device (DRPZDs) shall be fitted with line strainers in accordance with Item (c), except where used in fire service installations.

(c) Line strainer elements shall be as specified in Table 4.6.1.

(d) For all testable devices, resilient-seated (drop tight when closed) isolating valves shall be installed—

  (i) immediately upstream of the line strainer or immediately upstream of the device in cases where no integral line strainer is fitted [see Item (b)]; and

  (ii) immediately downstream of the device.

(e) Piping shall be flushed before devices are connected.

(f) Unprotected bypasses shall not be installed around backflow prevention devices.

(g) The devices shall be installed in accordance with Clause 4.6.3.

(h) The devices shall be protected from damage, including freezing.

(i) Where continuous water supply is essential, devices shall be installed in parallel to permit shutdown of a device.

(j) In-line devices shall be capable of being removed and replaced.

NOTE: For examples of typical installations, see Appendix F.

TABLE 4.6.1

MAXIMUM ORIFICE DIAMETERS AND MAXIMUM CENTRE DISTANCES OF LINE STRAINER ELEMENT PERFORATIONS

Size DN	Maximum orifice diameter mm	Maximum centre distance mm
20	1.6	2.4
25	1.6	2.4
32, 40, 50	3.25	5.6
80, 100, 150	4.6	5.6
200, 250, 300	4.6	5.6

4.6.2 Location of devices

4.6.2.1 *General*

The location of each backflow prevention device shall conform to the following:

(a) Backflow prevention devices shall not be located in a corrosive or polluted atmosphere where the contaminated air can enter the piping system through the air gap or open vent port, or cause the device to malfunction.

(b) Insulation or any other protection of a backflow prevention device shall not interfere with its operation, testing or maintenance.

(c) Vented testable backflow prevention devices shall not be located in cabinets without drainage or in pits.

(d) Backflow prevention devices shall not be buried in the ground.

(e) All in-line devices shall be installed with connections, to permit the removal and replacement of the device.

(f) Containment devices shall be located as close as practicable to the point of connection and downstream of any water meter. There shall be no branch connection between the meter and device.

NOTE: Where water hammer occurs, it should be rectified by the installation of a surge protector or water hammer arrestor.

4.6.2.2 *Accessibility*

All devices shall be readily accessible for ease of maintenance or testing without the need to work from ladders or scaffolding.

Where the device is fitted with test taps, their location shall ensure the clearance necessary for the performance of the applicable test procedure and maintenance as defined in AS 2845.3.

4.6.2.3 *Drainage and leakage*

Backflow prevention devices shall be positioned so that any leakage from air ports of vacuum breakers and openings on pipe interrupter devices, or discharge from reduced pressure zone devices, and vented double-check valves is readily visible, but does not constitute a hazard or nuisance.

4.6.3 Specific installation requirements for testable and non-testable devices

4.6.3.1 *General*

Backflow prevention devices shall be installed in accordance with Clause 4.6.1 and Clauses 4.6.3.2 and 4.6.3.3.

NOTE: For examples of backflow prevention devices, see Appendix F.

4.6.3.2 *Testable devices*

Testable devices shall be installed as follows:

(a) *Registered break tank (RBT) and registered air gap (RAG)* RBTs shall conform to Section 8 of this Standard and incorporate the following air gap requirements:

(i) The unobstructed vertical distance through the free atmosphere between the lowest opening of a water service pipe or fixed outlet supplying water to an RBT and the highest possible water level of such RBT shall be as given in Table 4.6.3.2.

(ii) Where any break tank receives water from two or more water services of different diameter, the air gap shall be not less than the air gap required for the largest effective opening of the water service outlets as given in Table 4.6.3.2.

(b) *Pressure type vacuum breaker (PVB)* PVBs shall—

(i) be located not less than 300 mm above the highest outlet;

(ii) be ventilated to the atmosphere at all times; and

(iii) not be located in an area that may be subjected to ponding or freezing.

(c) *Double-check valve (DCV) assembly* DCV assemblies shall be located so as not to be subject to freezing.

(d) *Reduced pressure zone device (RPZD)* RPZDs shall—

(i) have free ventilation to the atmosphere for the relief valve outlet, at all times;

(ii) not be located in an area that may be subjected to ponding;

(iii) have the relief drain outlet located not less than 300 mm above the finished surface level; and

(iv) be located so that they are not subject to freezing.

NOTE: For an example of a typical installation, see Figure F7, Appendix F.

(e) *Double-check detector assembly (DCDA)* DCDAs shall be located so that they are not subjected to freezing.

(f) *Reduced pressure detector assembly (RPDA)* RPDAs shall—

(i) have free ventilation to the atmosphere for the relief valve, at all times;

(ii) not be located in an area subject to ponding;

(iii) have the relief drain outlet located not less than 300 mm above the finished surface level;

NOTE: For an example, see Figure F7, Appendix F.

(iv) be located so that they are not subjected to freezing.

(g) *Spill resistant pressure vacuum breaker (SPVB)* SPVBs shall—

(i) be located not less than 300 mm above the highest outlet;

(ii) be ventilated to atmosphere at all times; and

(iii) not be located in areas that may be subjected to ponding.

(h) *Single check valve (testable) (SCVT)* SCVTs shall—

(i) be located so as not to be subjected to freezing;

(ii) have isolating valves installed immediately upstream and downstream of the device;

(iii) be fitted in an accessible position; and

(iv) be used only in fire services.

(i) *Single check detector assembly (testable) (SCDAT)* SCDATs shall—

(i) be located so as not to be subjected to freezing;

(ii) have isolating valves installed immediately upstream and downstream of the device;

(iii) be fitted in an accessible position; and

(iv) be used only in fire services.

TABLE 4.6.3.2

MINIMUM AIR GAP

Diameter of the effective opening of water service outlet	Minimum air gap, mm	
	When not affected by near wall	When affected by near wall
≤9	20	25
>9 ≤12	25	40
>12 ≤20	40	55
>20 ≤25	50	75
>25	2 × effective opening	3 × effective opening

4.6.3.3 *Non-testable devices*

Non-testable devices shall be installed as follows:

(a) *Atmospheric vacuum breaker (AVB)* AVBs shall—

(i) be located not less than 150 mm above the highest outlet;

(ii) have no isolating valves located downstream of the vacuum breaker;

(iii) not, under normal operation, remain continuously pressurized for more than 12 h, as set out in AS/NZS 2845.1;

(iv) be ventilated to the atmosphere, at all times;

(v) not be located in an area that may be subject to ponding; and

(vi) be located in-line and be at least the same size as the supply and discharge piping.

(b) *Hose connection vacuum breaker (HCVB)* HCVBs shall—

(i) be located downstream of the isolating valve;

(ii) not, under normal operation, remain continuously pressurized with water for more than 12 h; and

(iii) be ventilated to the atmosphere at all times.

(c) *Dual-check valve with atmospheric port (DCAP)* DCAPs shall—

(i) not be located in an area that is subject to ponding or freezing; and

(ii) have the vent port located not less than 300 mm above the finished surface level so that the device is freely drained or over a tundish.

NOTES:

1 For an example of atmospheric port location, see Figure F5, Appendix F.

2 For leakage from devices, see Clause 4.6.2.3.

(d) *Dual check valve (DUAL CV)* DUAL CVs shall not be located in an area subject to freezing.

(e) *Dual check valve with intermediate vent (DuCV)* DuCVs shall—

(i) not be located in an area that is subject to ponding; and

(ii) have the vent port located not less than 300 mm above the finished surface level so that the device is freely drained or over a tundish.

NOTES:

1 For an example of the port location, see Figure F5, Appendix F.

2 For leakage from devices, see Clause 4.6.2.3.

(f) *Beverage dispenser dual-check valve (BDDC)* BDDCs shall—

(i) not be located in an area that is subject to freezing; and

(ii) have the vent port located not less than 300 mm above the finished surface level so that the device can drain freely.

NOTE: For leakage from devices, see Clause 4.6.2.3.

(g) *Single-check valve—Spring loaded (Australia only)* Spring-loaded single check valves shall—

(i) have an isolating valve installed upstream and adjacent to the device;

(ii) be fitted in an accessible position; and

(iii) only be used in fire services.

(h) *Pipe interrupter device (PID)* PIDs shall—

(i) not be installed in a continuous pressure system; and

(ii) be located not less than 300 mm above the finished surface level so the device can drain freely.

NOTE: For leakage from devices, see Clause 4.6.2.3.

SECTION 5 INSTALLATION OF COLD WATER SERVICES

5.1 SCOPE OF SECTION

This Section specifies requirements for the installation of pipes, fittings, and apparatus used in cold water services.

NOTE: For installation of heated water services, see AS/NZS 3500.4.

C5.1 *Safety precautions need to be observed when cutting into pipework or disconnecting water meters, fittings and devices on pipework. There have been fatalities and injuries that have been attributed to water services carrying an electrical current.*

Where existing metallic service pipework is to be replaced in part or in its entirety by plastics pipe or other non-metallic fittings or couplings, the work should not commence until the earthing requirements have been checked by an electrical contractor and modified, if necessary.

5.2 PROXIMITY TO OTHER SERVICES

5.2.1 General

Where electrical conduits, wires, cables or consumer gas pipes, drains and other services are in existence, pipes shall be installed in accordance with the requirements of Clauses 5.2.2 to 5.2.10.

5.2.2 Separation from above-ground electrical conduit, wire, cable or consumer gas pipes

A separation of at least 25 mm shall be maintained between any above-ground water service and any of the following services:

(a) Electrical conduits.

(b) Electrical wires or cables.

(c) Consumer gas pipes.

(d) Sanitary plumbing and drainage.

5.2.3 Separation from underground electrical supply cables or consumer gas pipes

5.2.3.1 *Electrical supply cables*

The separation between any underground water service pipe and a high voltage electrical supply cable, exceeding 1000 V a.c or 1500 V d.c (see Note), shall be at least—

(a) 100 mm for a water service pipe not greater than DN 65, provided the electrical supply cable is indicated along its length with orange marker tape conforming to AS/NZS 2648.1 and is mechanically protected;

(b) 300 mm for a water service pipe greater than DN 65, provided the electrical supply cable is indicated along its length with orange marker tape conforming to AS/NZS 2648.1 and is mechanically protected; or

(c) 600 mm where the electrical supply cable is neither indicated nor protected in accordance with Items (a) or (b).

(d) The separation between any underground water service pipe and an extra-low voltage: Not exceeding 50 V a.c. or 120 V ripple-free d.c. (see Note) electrical supply, shall be at least 100 mm.

NOTE: For definition of high voltage cable, see AS/NZS 3000.

5.2.3.2 *Consumer gas pipes*

The separation between any underground water service pipe and consumer gas pipes shall be at least—

(a) 100 mm for a water service pipe not greater than DN 65, provided the consumer gas pipe is indicated along its length with marker tape conforming to the requirements of AS/NZS 2648.1 and laid 150 mm above the installed pipe;

(b) 300 mm for a water service pipe greater than DN 65, provided the consumer gas pipe is indicated along its length with marker tape conforming to AS/NZS 2648.1 and laid 150 mm above the installed pipe; or

(c) 600 mm where the consumer gas pipe is neither indicated nor mechanically protected.

NOTES:

1 Mechanical protection may be provided by concrete slabs, continuous concrete pour, or bricks designed for protecting electrical supply cables.

2 For clearance from a communication cable, see Clause 5.2.5.

5.2.4 Separation from underground electrical earthing electrode

For an electrical supply not exceeding 1000 V, the separation between any underground water service pipe and an electrical earthing electrode shall be at least 500 mm.

NOTE: For an electrical supply exceeding 1000 V, the relevant regulatory authorities should be contacted for a ruling.

5.2.5 Separation from underground communication cable

The separation between any underground water service pipe and a communication cable shall be at least 100 mm.

5.2.6 Separation from underground drains

The following applies:

(a) Water services pipes shall not be laid in or through any drain.

(b) A water service pipe may be laid in the same trench as a drain (see Note), provided the following conditions are observed:

(i) The water service pipe is located on a shelf or ledge, excavated at one side of the trench not less than 50 mm from the continuation of the trench, or on compacted bedding such that the horizontal separation of the two pipes is not less than 100 mm and the required depth of cover is maintained.

(ii) The underside of the water pipe is at least 100 mm above the top of the drain.

NOTE: See Figure 5.2.6 for an example of the laying of water supply piping in the same trench as a drain.

5.2.7 Separation from non-drinking water

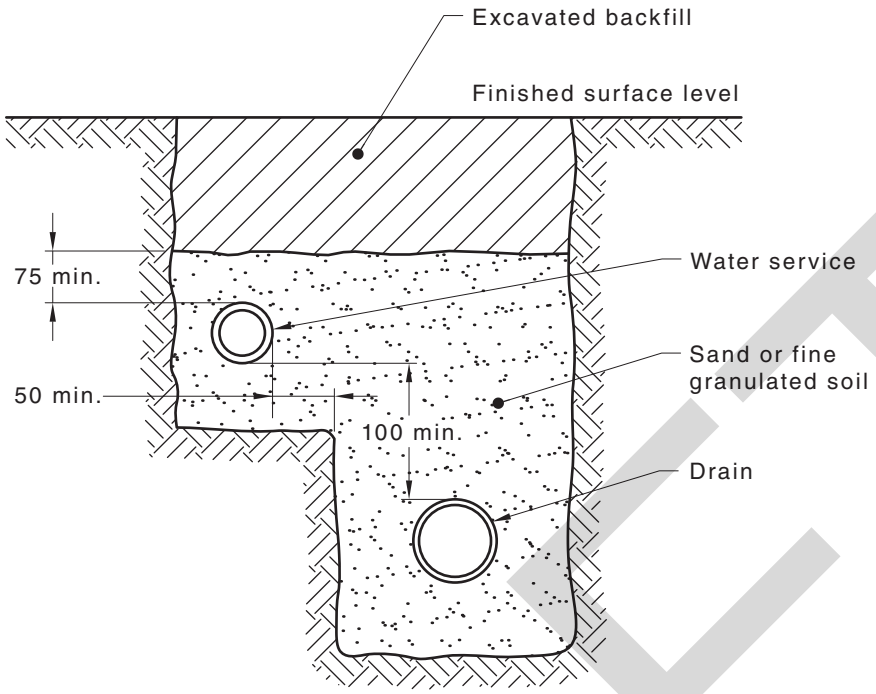
Water services shall be separated from a non-drinking water service in accordance with Clause 9.3.2.

5.2.8 Separation from other underground services

The separation between any underground water service pipe and any other service, other than consumer gas piping and electrical or communication service, shall be at least—

(a) 100 mm for a water service pipe not greater than DN 65; or

(b) 300 mm for a water service pipe greater than DN 65.



DIMENSIONS IN MILLIMETRES

FIGURE 5.2.6 LAYING OF WATER SUPPLY PIPING IN SAME TRENCH AS A DRAIN

5.2.9 Crossover of other underground services

Any underground water service crossing another service or any underground service crossing a water service shall—

(a) cross at an angle of not less than 45°;

(b) have a vertical separation of not less than 100 mm; and

(c) be marked along its length for 1 m either side of the centre-line of the service with marker tape conforming to AS/NZS 2648.1 and laid 150 mm above the installed service.

5.2.10 Clearance from underground obstructions

Water service pipes shall be installed with sufficient clearance to any underground obstruction to protect the service from physical damage and to permit repairs. The clearance shall be at least—

(a) 100 mm for a water service not exceeding DN 65; and

(b) 300 mm for a water service exceeding DN 65.

5.3 ISOLATING VALVES

5.3.1 General

The flow within the water service pipes shall be controlled by means of isolating valves.

5.3.2 Location

Isolating valves shall be installed in the following locations:

(a) At any connection to an alternative water supply.

(b) At the water meter inlet or at the point of connection with the property service if no meter is fitted.

(c) At each flushing cistern.

(d) At each appliance.

(e) At each testable backflow prevention device.

(f) At each thermostatic mixing valve.

(g) At each pressure-limiting or pressure-reduction valve.

(h) At each pumping apparatus.

(i) At each storage tank (inlet).

(j) At each storage tank outlet (where capacity exceeds 50 L).

(k) At each offtake point to an irrigation system.

Where a water meter is fitted outside the property, an additional isolating valve shall be installed.

NOTE: For isolating valves on home fire sprinkler systems, see AS 2118.5 or NZS 4517.

5.3.3 On fire services

On fire services, additional isolating valves shall be installed as follows:

(a) At each water main.

(b) At or near the property boundary.

(c) At each hose reel.

(d) At each pumping apparatus.

NOTES:

1 A stop valve is a valve that can be operated to stop the flow in a pipeline and includes stop taps, ball valves, gate valves.

2 The isolating valve adjacent to the water utilities water meter should meet the requirements of AS/NZS 3718.

5.3.4 Multiple dwellings

An isolating valve shall be installed on each branch serving an individual dwelling and be accessible by the individual dwelling occupier.

5.3.5 Maintenance

Isolating valves within the property shall be installed so that they are accessible.

5.4 LOCATION OF PIPING

5.4.1 Location

The following applies to the installation of water service pipes:

(a) Any water service branch, including valves, shall be located within the dwelling it serves.

(b) Water service pipes shall not be embedded or cast into concrete structures.

NOTES:

1 Care should be taken to ensure that the water service is not damaged during normal building activities.

2 Concealed piping should be maintained under normal water pressure while subsequent building operations, which could cause damage to the pipes, are being carried out.

3 All pipes should be flushed with clean water at regular intervals until the building is occupied.

4 To prevent any unreasonable rise in the temperature of the cold water delivered to fixtures located within a building, pipes and fittings installed above the ground should be protected against the heating effects of solar radiation or other heat sources.

5.4.2 Concealed piping

5.4.2.1 *Walls*

Water services located in timber- or metal-framed walls shall be installed as follows:

(a) *Timber wall framework* Holes or notches made in timber studs and plates in walls shall be in accordance with the following:

(i) The maximum size and spacing of holes or notches in studs shall be in accordance with Figure 5.4.2.1(A) and Table 5.4.2.1.

(ii) Where uninsulated pipes are used, a collar of lagging material or a neutral cure silicone sealant shall be used to fill the annular space.

(b) *Timber beams, bearers and joists* Holes or notches made in timber beams, bearers and joists in floors shall be in accordance with Figure 5.4.2.1(A) and Figure 5.4.2.1(B).

(c) *Metal framework* Holes drilled or formed in metal studs or plates shall be accurately sized to enable suitable grommets, insulation or a short sleeve of oversize pipe firmly secured in the framework to be inserted around the pipe, to ensure no direct contact between the pipe and framework but to allow free longitudinal movement of the pipe through the grommet, lagging or sleeve, as shown in Figures 5.4.2.1(C) and 5.4.2.1(D).

(d) Pipes located in cavities shall be installed so as to prevent the transfer of moisture from the outer wall to the inner wall.

NOTE: Care should be taken to ensure that the air cavity moisture barrier within an external wall of any building is not bridged with pipe or pipe duct penetrations and porous pipe insulation materials. A clear air gap is required between the external wall and the pipe insulation material. For additional details, see Figures 5.4.2.1(C) and 5.4.2.1(D).

TABLE 5.4.2.1
HOLES AND NOTCHES IN STUDS AND PLATES

Symbol	Description	Limits	
		Notched	Not notched
A	Distance between holes and/or notches in stud breadth	Min. 3*D*	Min. 3*D*
H	Hole diameter (studs and plates)	Max. 25 mm (wide face only)	Max. 25 mm (wide face only)
C	Notch into stud breadth	Max. 10 mm	Max. 10 mm
E	Notch into stud depth	Max. 20 mm (for diagonal cut in bracing only) (see Note)	Not permitted (see Note)
F	Distance between notches in stud depth	Min. 12*B*	N/A
F	Trenches in plates	3 mm max.	

NOTE: A horizontal line of notches up to 25 mm may be provided for the installation of baths.

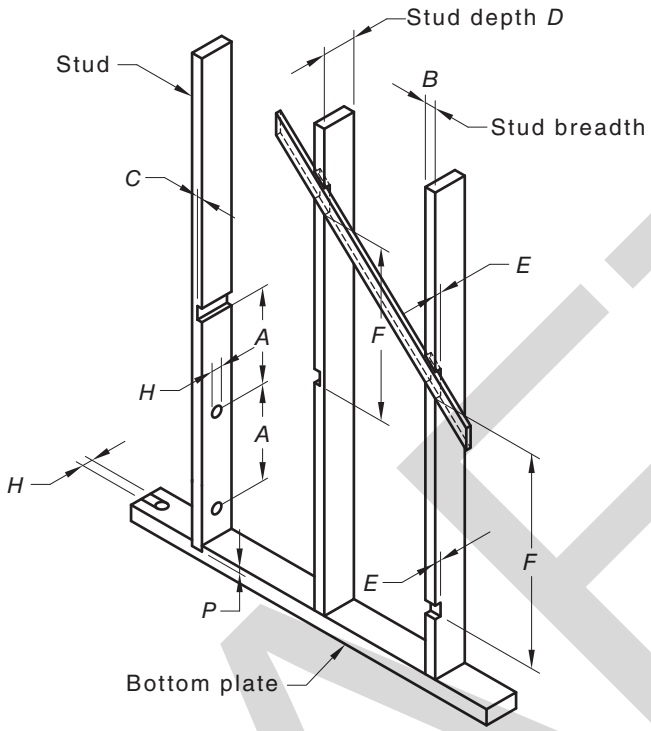


FIGURE 5.4.2.1(A) NOTCHING OF WALL STUDS

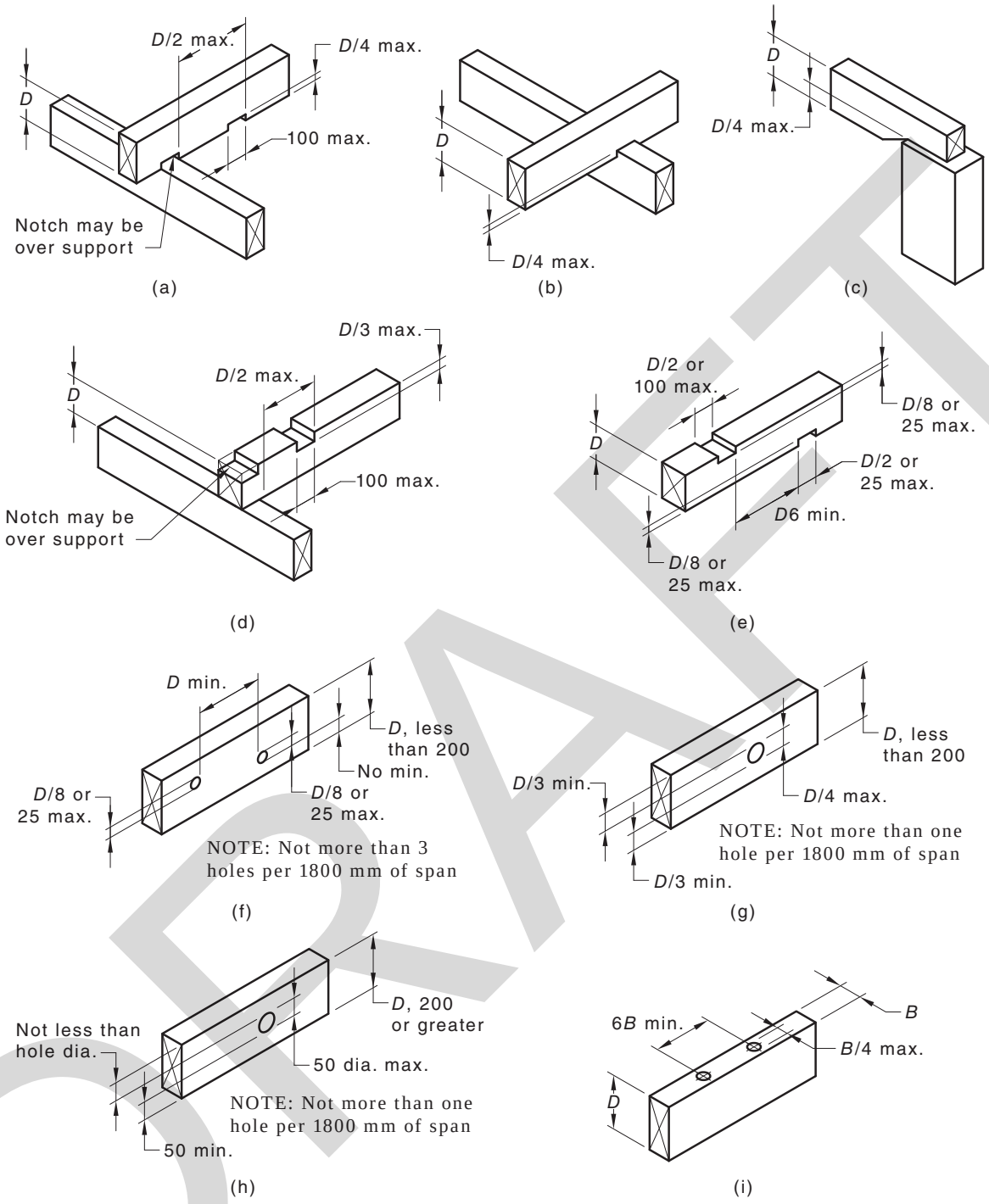


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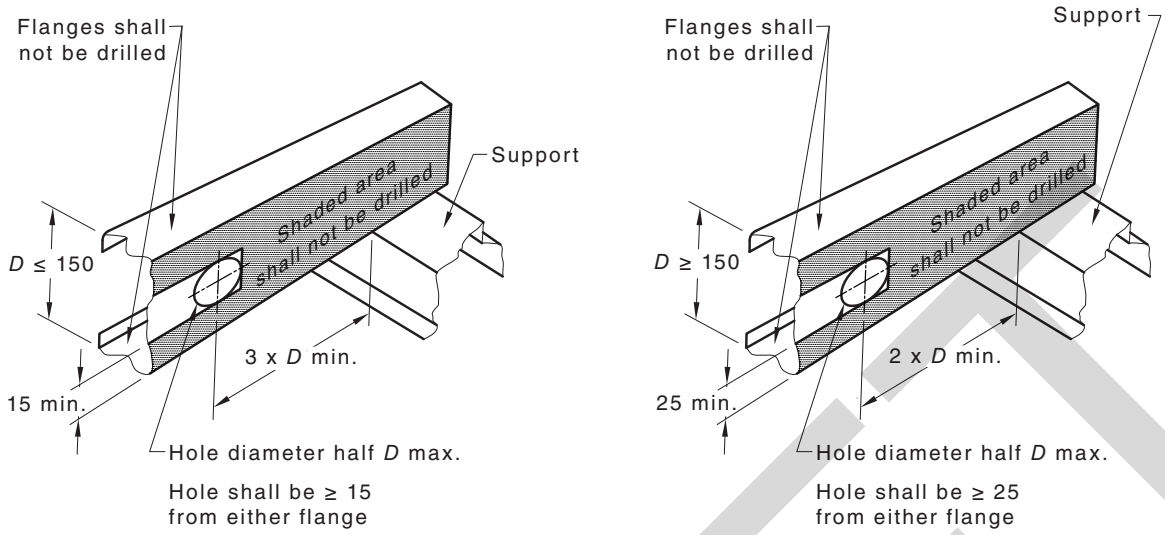
FIGURE 5.4.2.1(B) NOTCHES, CUTS AND HOLES IN BEAMS, BEARERS, JOISTS, RAFTERS



(a) Hole drilling criteria when $D \leq 150$ mm

(b) Hole drilling criteria when $D \geq 150$ mm

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FIGURE 5.4.2.1(C) PENETRATIONS TO STEEL FLOOR JOISTS

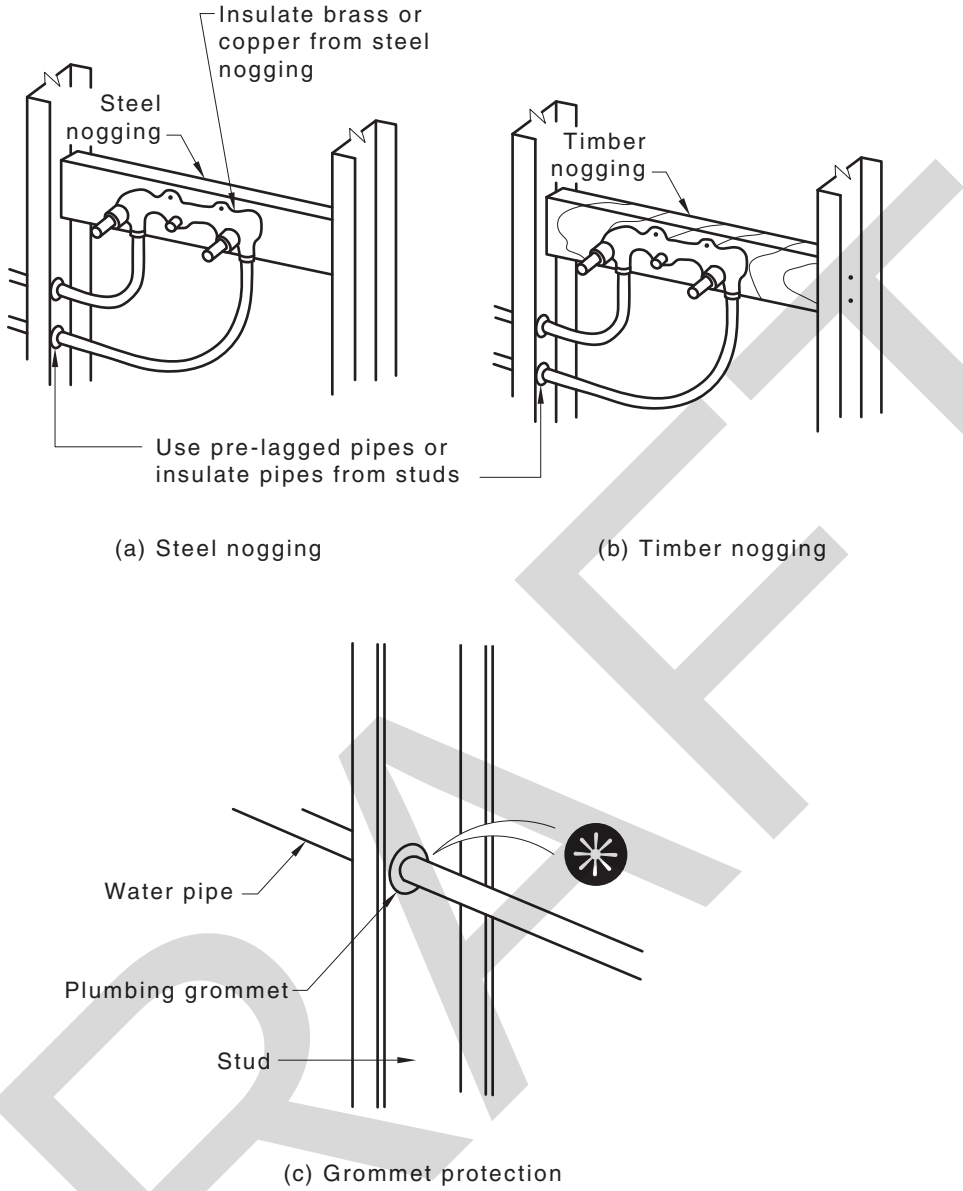


FIGURE 5.4.2.1(D) INSTALLATION AND FIXING OF SERVICES

5.4.3 Chases, ducts or conduits

Pipes located in chases, ducts or conduits within walls or floors of masonry or concrete construction shall be installed in accordance with the following:

(a) Pipes in chases shall be continuously wrapped with an impermeable flexible material.

(b) Ducts shall be fitted with removable covers.

(c) Conduits embedded in walls or floors shall conform to the requirements of the NCC or New Zealand Building Code, as applicable.

5.4.4 Under concrete slabs

Water service pipes located beneath concrete slabs on ground shall conform to the following:

(a) Pipes shall be laid in a narrow trench on a bed of sand or fine-grained soil placed and compacted in a manner that will not damage the piping. There shall be a minimum distance of 75 mm between the top of the pipe and the underside of the slab or slab-stiffening beam.

(b) The ends shall be crimped or capped prior to pouring of the concrete and measures shall be taken to protect the exposed pipe from damage.

(c) Any pipework that penetrates the slab shall be at right angles to the surface of the slab, and shall be lagged for the full depth of the slab penetration with—

(i) an impermeable flexible material of not less than 6 mm thickness; or

(ii) impermeable plastics sleeve or conduit providing equivalent protection.

NOTE: Where termite protection is required, the integrity of the chosen termite protection method should not be compromised.

(d) Metal pipes shall be continuously lagged with an impermeable material.

(e) Soft-soldered joints shall not be used.

(f) The number of joints shall be kept to a minimum.

5.5 METHODS OF JOINTING

5.5.1 General

Jointing of water services shall be in accordance with the following:

(a) *Removal of burr* The burr formed in cutting any pipe shall be removed.

(b) *Joints requiring use of heat* Care shall be taken so that pipes or fittings are not damaged by the application of excessive heat.

(c) *Use of fittings* Where straight sections of pipe of different diameter are to be joined, such increase or reduction in size shall be made by a fitting.

(d) *Crimping* Crimping, shall not be used when joining to reduce a larger diameter pipe to a smaller diameter pipe.

(e) *Jointing of copper or stainless steel pipes* Copper or stainless steel water service pipes of different diameter shall not be joined by filling the annular space using a filler rod.

(f) *Fabricated fittings* Sockets and tees may be fabricated from copper, copper alloy or stainless steel pipes using tools specifically designed for such purposes and shall then be silver brazed.

(g) *Copper tees* Copper tees shall not be fabricated from pipe of thickness less than Type C in accordance with AS 1432.

5.5.2 Threading

Threads shall conform to the relevant Standard for the materials to be jointed and be sealed with a compatible jointing medium.

5.5.3 Bolted gland and gibault type joints

5.5.3.1 *General*

Joints of the bolted gland type or gibault type may be used to join similar or dissimilar pipes and fittings of the same nominal diameter.

5.5.3.2 *Joints below ground*

Bolted gland and gibault type joints used below ground shall be protected against corrosion in accordance with Clause 5.12.

5.5.4 Joining of copper and copper alloy pipes

Fittings used to join copper and copper alloy pipes shall conform to AS 3688 and be installed in accordance with the installation requirements of AS 4809.

5.5.5 Compression joints

Compression joints shall conform to AS 3688 or AS/NZS 4129.

NOTE: Croxed joints without rubber olives may be used in New Zealand.

5.5.6 Flanged joints

Flanges shall be attached to pipe ends by means of—

(a) threads for galvanized steel pipe and fittings;

(b) silver brazing in accordance with Clause 5.5.8.1 or bolting for flanges of copper alloy to copper or copper alloy pipes or fittings;

(c) priming fluid and solvent cement for PVC-U pipes and fittings; and

(d) set screws for cast iron pipes and fittings.

Flange joints below ground shall be protected against corrosion in accordance with Clause 5.12.

5.5.7 Roll-grooved joints

Roll-grooved joints fittings shall conform to AS 3688.

Where used below ground, the joints shall be—

(a) protected against corrosion with each assembled copper or copper alloy joint protected with a petrolatum-based wrapping system; and

(b) external to a building and not under concrete.

5.5.8 Silver brazing

5.5.8.1 *Joints*

A compatible flux shall be used when making joints.

5.5.8.2 *Taps and valves*

Silver brazing shall not be used as a means of joining taps or valves to pipes larger than DN 20. To prevent damage, the tap assembly and jumper valve shall be removed from the body of taps and valves prior to silver brazing.

5.5.9 Soft soldering

A compatible flux shall be used when making joints.

NOTE: The chemical composition of the water in some areas may preclude the use of soft solder joints.

5.5.10 Solvent cement joints

Pipes and fittings of PVC material shall be joined by solvent cementing (using a suitable cleaner/primer) in accordance with AS/NZS 2032.

Solvents cements and priming fluids for PVC-U and PVC-M pipes and fittings shall conform to AS/NZS 3879, except where a gap-filling solvent cement is required. For PVC-C pipes, solvent cement and priming fluids shall conform to ASTM F493.

5.5.11 Jointing of stainless steel pipe and fittings

5.5.11.1 *Jointing of piping, up to and including DN 25*

Joints not larger than DN 25 shall be made by using Type 1 or Type 2 mechanically jointed compression fittings or press-fit end connectors conforming to AS 3688 or using silver-brazed stainless steel capillary joints. Silver brazing alloys shall conform to Clause 2.6.4.

5.5.11.2 *Jointing of piping larger than DN 25*

Joints in stainless steel piping larger than DN 25 shall—

(a) be butt welded using a tungsten inert gas (TIG) argon arc method and—

  (i) have a gap not greater than 0.5 mm between the abutting pipe ends to be joined;

  (ii) have inserted a backup ring 6 mm long, made from the parent pipe, to straddle the joint of pipes with a wall thickness less than 1.2 mm;

  (iii) use a low carbon stainless steel type filler rod not greater than 2 mm in diameter; and

  (iv) be tack welded in not less than four spots around the circumference, prior to welding the entire joint; or

(b) have flanged joints fabricated by rolling or welding to the pipe a stub flange of the same wall thickness as the pipe, having a diameter conforming to dimension 'F' in AS 2129, AS/NZS 4331.1, AS/NZS 4331.2 or AS/NZS 4331.3, with mild steel back up flange conforming to AS 2129, AS/NZS 4331.1, AS/NZS 4331.2 or AS/NZS 4331.3, fitted and a gasket not less than 3 mm thick inserted; or

(c) stainless steel press-fit end connectors conforming to AS 3688.

5.5.12 Jointing of dissimilar metallic pipes and fittings below ground

Where ferrous and non-ferrous pipes or fittings are joined together below ground, protection against galvanic corrosion shall be provided by—

(a) fitting a plastic connector or a short length of plastic pipe between the dissimilar metals, for threaded type joints; or

(b) fitting an insulating gasket between flanges, insulating sleeves along the bolts, and insulating washers under the bolthead and nut, for flanged type joints.

NOTE: For electrical safety precautions, see Clause 5.2.

5.6 SUPPORT AND FIXING ABOVE GROUND

5.6.1 General

Water services installed above ground shall be retained in position by brackets, clips or hangers.

5.6.2 Brackets, clips and hangers

Brackets, clips and hangers shall be—

(a) formed of material compatible with pipe;

(b) securely attached to the building structure and not to any other service;

(c) designed to withstand the applied loads;

(d) where exposed to a corrosive environment, protected against corrosion;

(e) of like material or lined with a non-abrasive, inert material for that section where contact with the piping may occur;

(f) clamped securely to prevent movement, unless designed to allow for thermal movement;

(g) restrained to prevent lateral movement; and

(h) installed so that no movement can occur while a valve is being operated and so that the weight of the valve is not transferred to the pipe.

5.6.3 Limitations of pipe supports

The following applies:

(a) Pipes shall not be supported by brazing or welding short sections of any material to the pipe surface, nor by clamping, brazing or welding to adjacent pipes.

(b) Brackets, clips and hangers incorporating PVC shall not be used in contact with stainless steel pipes.

5.6.4 Spacing

Water services shall be supported and fixed at the intervals specified in Table 5.6.4.

TABLE 5.6.4

SPACING OF BRACKETS AND CLIPS

Nominal pipe size DN	Maximum spacing of brackets and clips, m			
	Copper, copper alloy and stainless steel pipes	Galvanized steel and ductile iron pipes	UPVC, polyethylene, cross-linked polyethylene, polypropylene, polybutylene pipes and CPVC	
			Horizontal or graded pipes	Vertical pipes
10	1.5	—	0.50	1.00
15	1.5	2.0	0.60	1.20
16	—	—	0.60	1.20
18	1.5	—	0.60	1.20
20	1.5	2.0	0.70	1.40
22	—	—	0.70	1.40
25	2.0	2.0	0.75	1.50
32	2.5	2.5	0.85	1.70
40	2.5	2.5	0.90	1.80
50	3.0	3.0	1.05	2.10
63	—	—	1.10	2.20
65	3.0	3.0	1.20	2.40
75	—	—	1.30	2.60
80	3.0	4.0	1.35	2.70
90	3.0	—	1.40	2.80
100	3.0	4.0	1.50	3.00
110	—	—	1.50	3.00
125	3.0	4.0	1.70	3.00
140	—	—	1.70	3.40
150	3.0	4.0	2.00	4.00
160	—	—	2.00	4.00

NOTE: Due to water pressure effects, additional brackets, clips or hangers conforming to Clause 5.6.2 may be required to prevent movement.

5.6.5 Securing of pipes and fittings

Any pipe or fitting that may be subjected to strain or torsion shall be positively fastened against twisting or any other movement.

5.7 STANDPIPES

Standpipes shall not be smaller than DN 15, and shall be connected downstream of the lower outlet bend of the water meter assembly.

All standpipes connected to the water service shall be securely supported by fixing to walls of buildings, or other rigid supports.

Standpipe taps shall be at a height of not less than 450 mm above the finished surface level or the top of a disconnector gully, as applicable.

5.8 ANCHORAGE BELOW GROUND

5.8.1 General

Water services with elastomeric (rubber) ring joints laid below ground shall be restrained by thrust blocks.

5.8.2 Location of thrust blocks

Thrust blocks shall be installed—

(a) at all bends or junctions;

(b) at the termination of piping;

(c) at valves installed in piping;

(d) at the reducing fitting in the direction of the smaller pipe;

(e) at changes of direction in excess of 5°; and

(f) at grades in excess of 1:5.

NOTE: For typical locations of thrust blocks, see Figure 5.8.2.

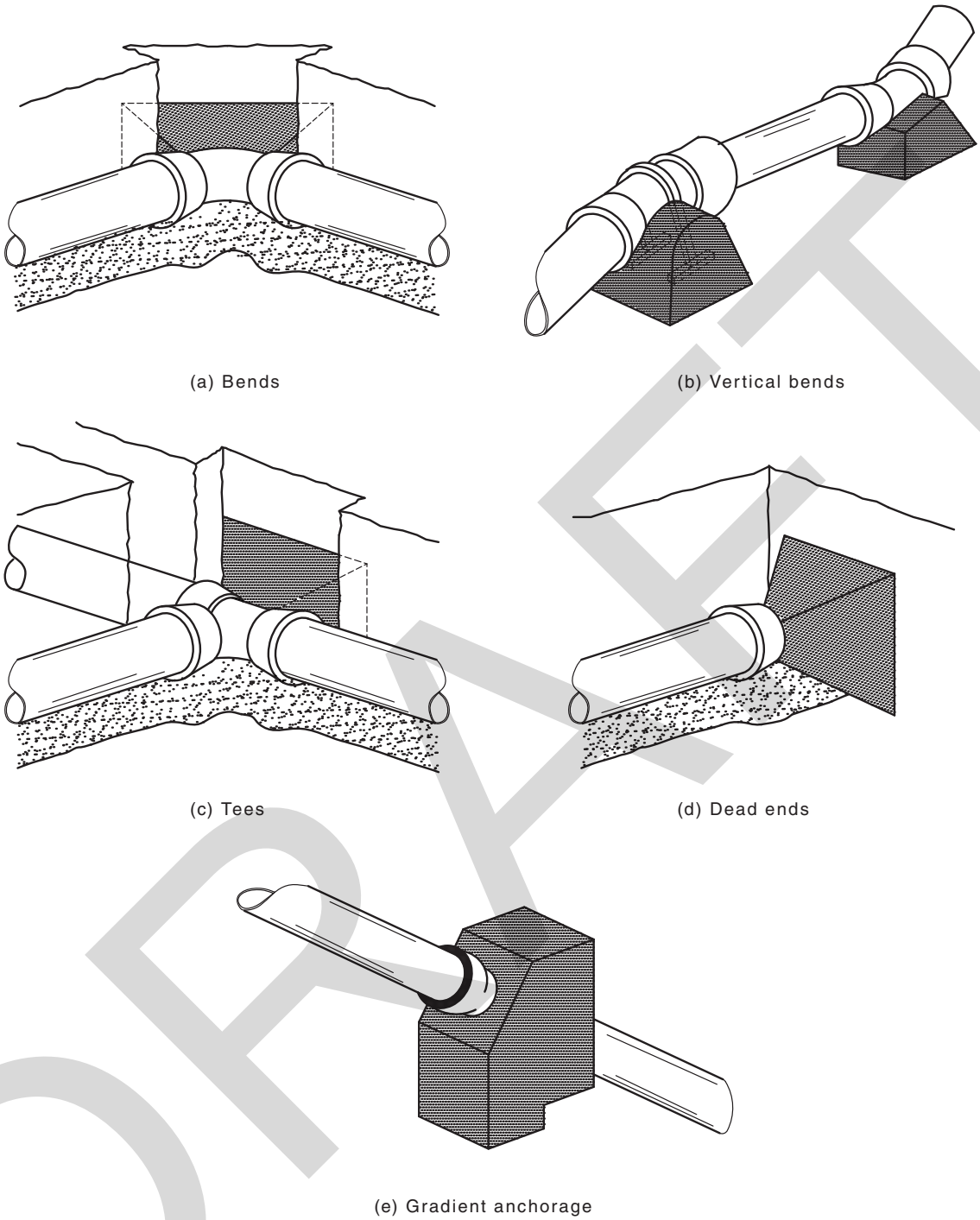


FIGURE 5.8.2 TYPICAL LOCATIONS OF THRUST BLOCKS

5.8.3 Construction of thrust blocks

Thrust blocks shall be—

(a) constructed of concrete with one side bearing against a firm vertical or horizontal face of the excavation, as appropriate; and

(b) designed so that the full hydrostatic forces in the piping are transmitted to the surrounding soil without the maximum bearing pressures of the soil and piping materials being exceeded.

Thrust blocks shall be installed such that thrust will not be transmitted to any other service.

5.9 DEPTH OF COVER

Where water services are installed below ground, the minimum cover shall be as specified in Table 5.9, measured from the proposed finished surface levels.

TABLE 5.9
MINIMUM DEPTH OF COVER FOR BURIED PIPES

Loading conditions	Minimum cover mm
Under slabs and footings (concrete)	75
Not subject to vehicular loading (excluding fire services)	300
Fire services not subject to vehicular loading	600
Subject to vehicular loading:	
(a) no carriageway	450
(b) sealed carriageway	600
(c) unsealed carriageway	750
Pipes in embankments or subject to construction equipment loads	750

NOTE: For minimum cover in bushfire areas, see Clause 5.20.

5.10 BEDDING AND BACKFILL

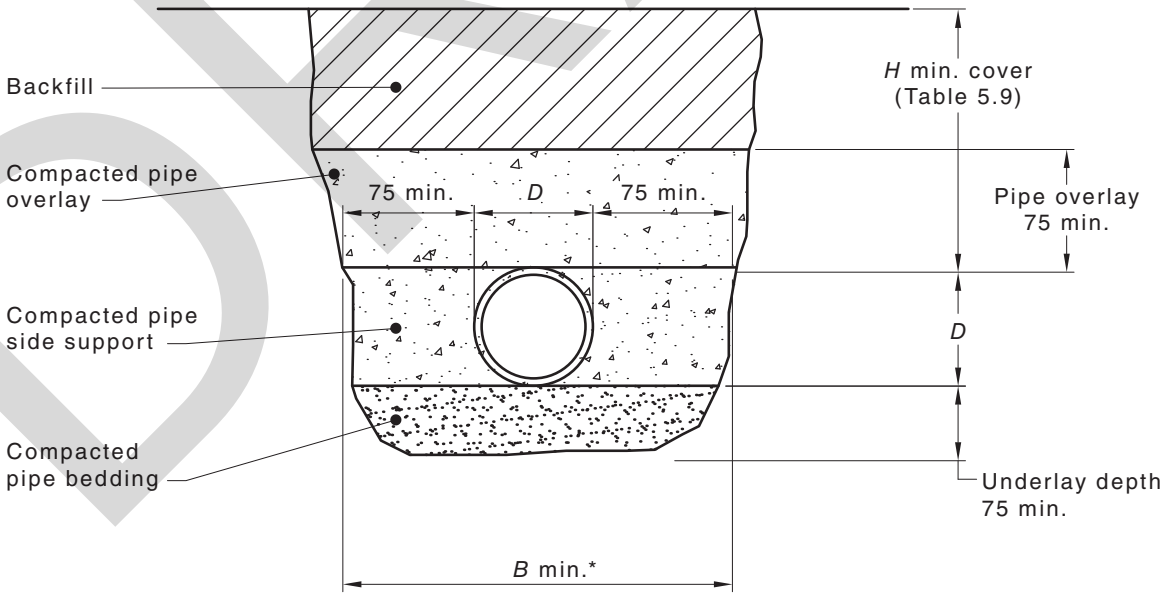
The water services shall be surrounded with not less than 75 mm of compacted sand, or fine-grained soil, with no hard-edged object in contact with or resting against any pipe or fitting.

NOTE: For typical installation, see Figure 5.10.

Material used for final backfill shall be free from rock, hard matter or organic material and be broken up to contain no soil lumps larger than 75 mm.

Unless specified to the contrary, copper and stainless steel pipelines may be installed in soil excavated from the trench in which they are to be installed, provided the soil is compatible with copper and stainless steel and free from rock and rubble.

NOTE: For minimum cover, see Clause 5.9.



*B min. = D + 150

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FIGURE 5.10 TYPICAL INSTALLATION IN A TRENCH

5.11 INSTALLATION IN CONTAMINATED AREAS

The installation of any water service in or through a contaminated area shall be—

(a) laid through a watertight, corrosion-resistant conduit of sufficient length, strength and impermeability to afford adequate protection to the water service; or

(b) fixed not less than 600 mm above the surface of the ground likely to be contaminated.

NOTE: For the purposes of this Standard, contaminated areas are those that are subject to bacterial or chemical pollution. These areas include ash pits, tanks, ponds, manure bins, waste disposal depots, and wastewater treatment works.

5.12 CORROSIVE AREAS

Where metallic pipes, metallic fittings or Type M multilayer pipes are installed in a water service in a corrosive area, they shall be protected externally—

(a) with an impermeable flexible plastic coating;

(b) by placing in a sealed polyethylene sleeve; or

(c) by continuously wrapping in a petrolatum taping material.

NOTE: Corrosive areas are those that contain substances such as any compound consisting of magnesium oxychloride (magnesite) or its equivalent, coal wash, acid sulfate soils, sodium chloride (salt), ammonia or materials that could produce ammonia.

5.13 PIPES IN WATER-CHARGED OR FILLED GROUND

When applied to water services pipes laid in water-charged or filled ground, the solutions provided in this Section are suitable for pipe sizes not greater that DN 40.

NOTE: There is no deemed-to-comply solution for installing water pipes of DN 50 or larger in water-charged or filled ground, so reference should be made to the performance requirements of the Plumbing Code of Australia (PCA).

5.14 OPEN CHANNELS OR WATERCOURSES

Water services crossing any open channel or watercourse shall be installed in accordance with the requirements of the authority controlling the channel or watercourse.

5.15 PRIVATE EASEMENTS

5.15.1 Proximity of water services

Where two or more water services are installed in a private easement, they shall not cross or be closer than 100 mm to each other.

5.15.2 Depth of piping

The depth of the pipes and fittings shall be as specified in Table 5.9.

5.16 DRY SERVICES

Where provided for future connection to a water supply, a dry service shall conform to the following:

(a) The ends of the dry water service shall be kept clean and sealed to prevent the entry of dirt, soil, or other matter.

(b) Before use, the service shall be tested in accordance with Section 18.

5.17 PROTECTION AGAINST FREEZING

5.17.1 General

In areas where the ambient temperature regularly falls below 0°C, care shall be taken to reduce the likelihood of the water service being damaged by water freezing within the pipes.

5.17.2 Piping located outside buildings

All pipes and fittings shall be—

(a) buried to a minimum depth of 300 mm, measured from the proposed finished surface level to the top of the pipe; or

(b) surrounded with waterproof, thermal insulation of minimum thickness, as given in Table 5.17.2(A).

NOTE: Typical examples of insulating materials are given in Table 5.17.2(B).

TABLE 5.17.2(A)

MINIMUM THICKNESSES FOR THERMAL INSULATION

Pipe size	Thermal conductivity of insulating material, W/m.K				
	0.03	0.04	0.05	0.06	0.07
DN	Minimum thickness required, mm				
15	9	14	20	29	40
18	6	9	12	15	20
20	4	6	8	10	12
25	3	4	5	6	8
32	2	3	4	5	6

NOTE: The insulation thicknesses were calculated using the equations given in BS 5422 to just prevent freezing of water initially at 15°C if exposed to an ambient temperature of −5°C for a period of 8 h.

TABLE 5.17.2(B)

TYPICAL EXAMPLES OF INSULATING MATERIALS

Example of material	Thermal conductivity W/m.K
Rockwool or fibreglass section pipe insulation (prefabricated sections)	0.032
Rockwool or fibreglass loose fill or blanket material	0.034–0.040
Flexible polyethylene foam pipe	0.032–0.045
Foamed nitrile rubber	0.040
Loose vermiculite (exfoliated)	0.06–0.07
Flexible foam plastic pre-insulated copper pipe	0.070–0.075

5.17.3 Pipes located on metal roofs

Pipes shall not be installed in direct contact with metal roofs. Where it is necessary to run pipework across a metal roof, it shall be surrounded with waterproof insulation of minimum thickness, as given in Table 5.17.2(A).

NOTE: Consideration should be made for the thermal expansion and contraction of piping and the roof material.

5.17.4 Pipes located inside buildings

5.17.4.1 *General*

Pipes shall be installed so as to avoid those areas of the building that are difficult to keep warm and where temperatures are likely to fall below freezing. These areas include—

(a) unheated roof spaces;

(b) unheated cellars;

(c) locations near windows, ventilators or external doors where cold drafts are likely to occur; and

(d) locations in contact with cold surfaces such as metal roofs, metal framework, or external metal cladding materials.

5.17.4.2 *Pipes in unheated roof spaces*

Pipes in unheated roof spaces shall be located not less than 100 mm away from the roof covering and external walls.

NOTE: Where practicable, pipes should be located under any insulating material laid for restricting heat losses through the ceilings.

5.17.4.3 *Pipes adjacent to external walls*

Pipes adjacent to external walls shall be positioned not less than 20 mm away from the external surface.

NOTE: Where practicable, pipes should be located on the heated side of any wall insulation present.

5.17.5 Insulation of piping

Where it is necessary to install piping in any of the areas listed in Clause 5.17.4.1, the pipes and fittings shall be surrounded by an appropriate thickness of insulation as specified in Table 5.17.2(A).

NOTES:

1 If conditions are particularly severe over an extended time, additional thicknesses of insulation may be necessary to prevent water freezing.

2 In situations where the building, or part of the building, is not in use over the winter months, and no interior heating of the inside areas is maintained, it may be necessary to drain the pipes to prevent damage by water freezing. For effective drainage to occur, it is essential for air to freely enter the pipes, and for all draw-off taps and float valves to be left open when draining is being carried out.

3 For typical examples of insulating materials, see Table 5.17.2(B).

5.18 IDENTIFICATION OF PIPING

In other than domestic or residential buildings (Class 3 to Class 9 buildings), accessible pipework shall be permanently marked so as to be readily identifiable as part of the water service.

Identification markings shall conform to AS 1345 in Australia or NZS 5807 in New Zealand, and be placed—

(a) at spacings not exceeding 8 m; and

(b) adjacent to branches, junctions, valves, and wall and floor penetrations.

5.19 TEMPERATURE CONTROL DEVICES

Temperature control devices shall be installed in accordance with AS/NZS 3500.4.

5.20 BUSHFIRE ZONES

In Australia, in areas designated as bushfire-prone areas by an authority having jurisdiction, all exposed piping shall be metal. Pipes of other materials shall be buried with a minimum depth of cover of 300 mm, measured from the proposed finished surface level to the top of the pipe.

NOTE: The NCC includes requirements for water supply piping in bushfire zones.

SECTION 6 FIRE SERVICES

6.1 SCOPE OF SECTION

This Section specifies requirements for the installation of fire hydrants, fire hose reels, fire sprinkler services and independent wall drencher systems downstream of the backflow prevention device, fitted, where required, to a water supply system.

NOTES:

1 For direction as to when a fire service is required, see the NCC or the New Zealand Building Code.

2 Backflow prevention devices are generally installed at the property boundary and may also be located inside the property.

6.2 MATERIALS AND PRODUCTS

Materials and products used in fire service installations shall be subject to the limits on the use of the material or product specified in Section 2 and the relevant Standard covering the fire service.

NOTES:

1 For examples of devices for backflow prevention at the connection to specified sections of a water supply system within a building or facility, see Table F2, Appendix F.

2 Some authorities have additional limitations on the use of certain materials.

6.3 INSTALLATION

Fire service piping shall be installed in accordance with Section 5 and the relevant fire system Standard.

Backflow prevention shall be installed in accordance with Section 4.

NOTES:

1 For examples of devices for backflow prevention at the connection to specified sections of a water supply system within a building or facility, see Table G2, Appendix G.

2 For further information refer to the following Standards:

(a) AS 2118.1.
(b) AS 2118.2
(c) AS 2118.3
(d) AS 2118.4
(e) AS 2118.6
(f) AS 2419.1.
(g) AS 2441.
(h) AS 2941.
(i) NZS 4510.
(j) NZS 4515.
(k) NZS 4541.
(l) AS 2118.5 or NZS 4517.

Where fire hose reels are provided in a high hazard area, backflow prevention commensurate with the hazard level shall be provided.

6.4 WATER STORAGE TANKS

Water storage tanks shall be installed in accordance with Section 8. Where a tank provides a reservoir of water in case of a fire, the tank shall not be bypassed unless a backflow prevention device appropriate to the cross-connection hazard rating is installed in the bypass piping.

NOTE: The minimum water storage for fire services should conform to the requirements of the appropriate regulatory authority.

6.5 IDENTIFICATION

Fire service pipelines shall be identified in accordance with AS 1345 or NZS 5807, as appropriate.

SECTION 7 IRRIGATION AND LAWN WATERING SYSTEMS

7.1 SCOPE OF SECTION

This Section sets out requirements for and defines the types of irrigation systems for the purposes of backflow prevention.

7.2 SYSTEM TYPES

Irrigation systems including hose tap connected systems shall be categorized as one of the following types:

(a) *Type A systems* All permanently open outlets and piping more than 150 mm above finished ground level, not subject to ponding or back-pressure and not involving injection systems. No backflow prevention required [see Figure 7.2(A)].

(b) *Type B systems* Irrigation systems in domestic or residential buildings with piping or outlets installed less than 150 mm above finished surface level and not involving injection systems [see Figures 7.2(B) and 7.2(C)].

(c) *Type C systems* Irrigation systems in other than domestic or residential buildings with piping or outlets less than 150 mm above finished surface level and not involving injection systems [see Figures 7.2(D) and 7.2(E)].

(d) *Type D systems* Irrigation system where fertilizers, herbicides, nematicides or the like are injected or siphoned into the system [see Figures 7.2(F) and 7.2(G)].

7.3 BACKFLOW PROTECTION REQUIREMENTS

Type B, Type C and Type D irrigation systems shall be protected against backflow.

NOTE: For examples, see Tables F1, F2 and F3, Appendix F, and Figures 7.2(A) to 7.2(G), as applicable.

7.4 MATERIALS

All materials, valves and fittings on the upstream side of, and including the last pressurized valve on each line, shall be as specified in Section 2.

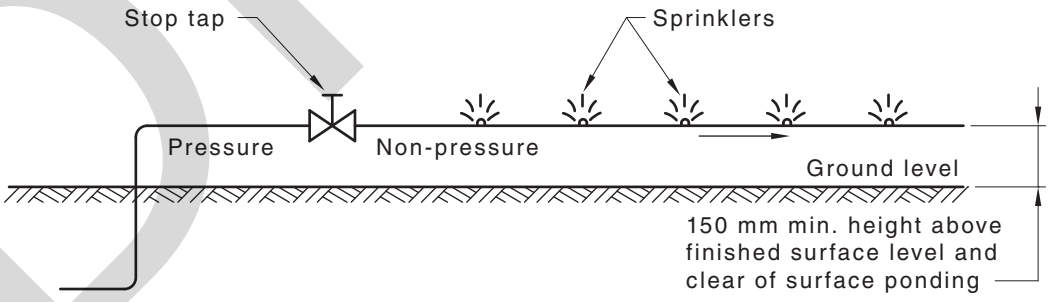
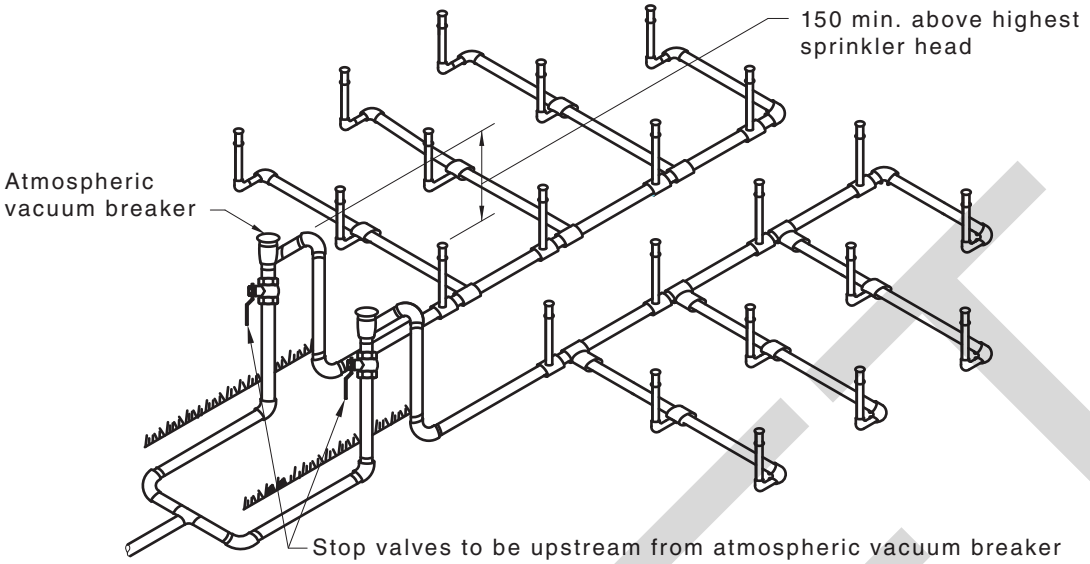
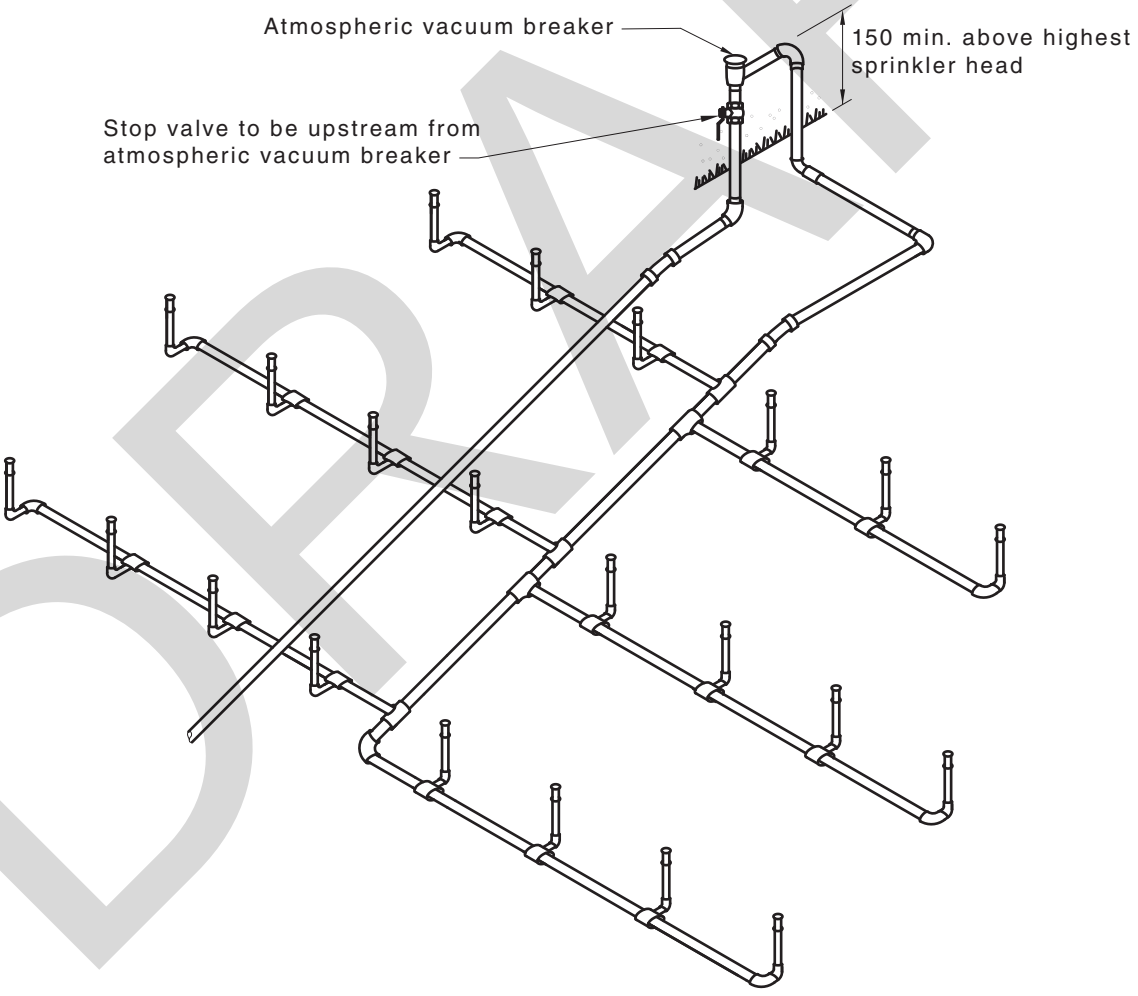


FIGURE 7.2(A) TYPE A SYSTEM—NO BACKFLOW PREVENTION REQUIRED



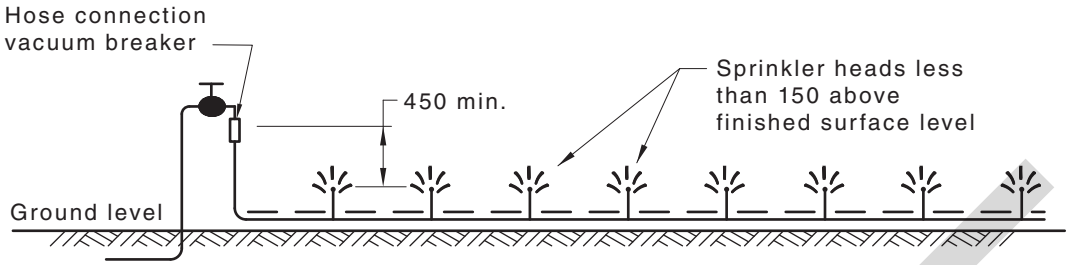
(i) Level terrain—Multi-zone system using atmospheric vacuum breaker



(ii) Hillside system using atmospheric vacuum breaker

DIMENSIONS IN MILLIMETRES

FIGURE 7.2(B) (in part) TYPE B SYSTEM—NON-TESTABLE DEVICES—
NO BACK-PRESSURE



(iii) System using hose connection vacuum breaker

DIMENSIONS IN MILLIMETRES

FIGURE 7.2(B) (in part) TYPE B SYSTEM—NON-TESTABLE DEVICES—NO BACK-PRESSURE

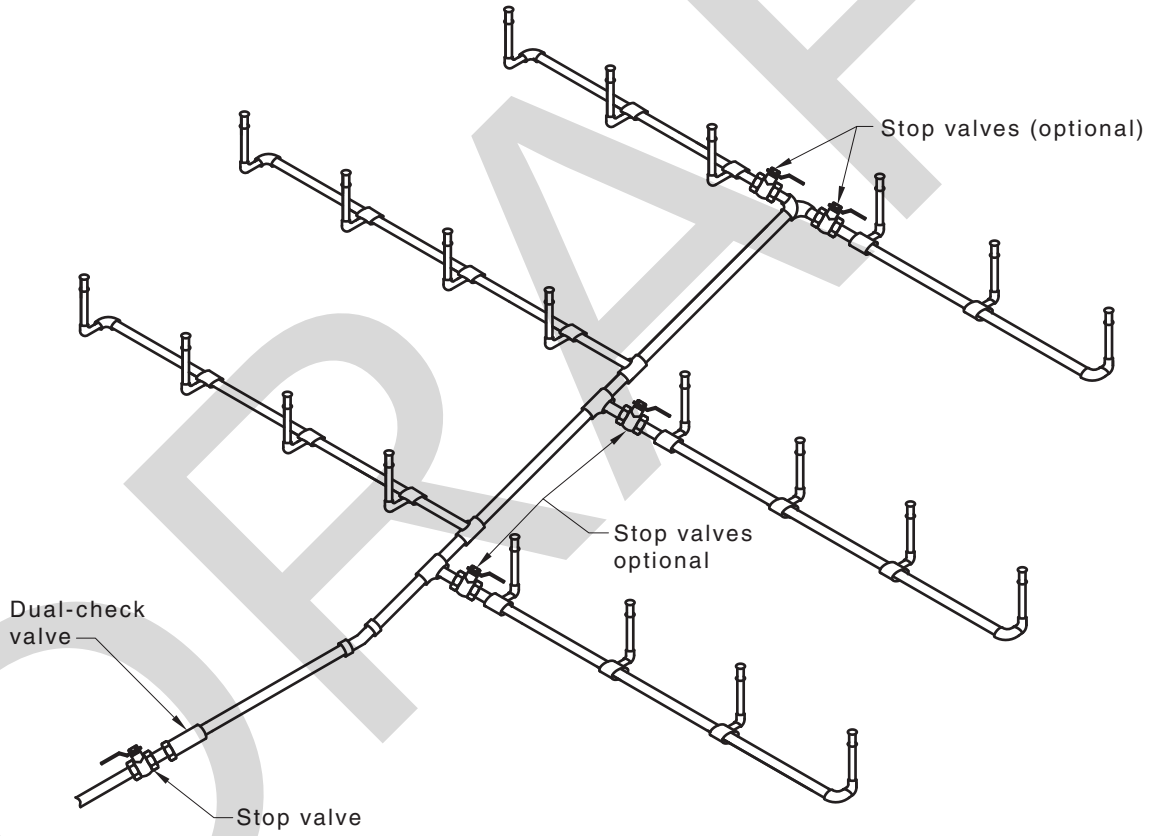
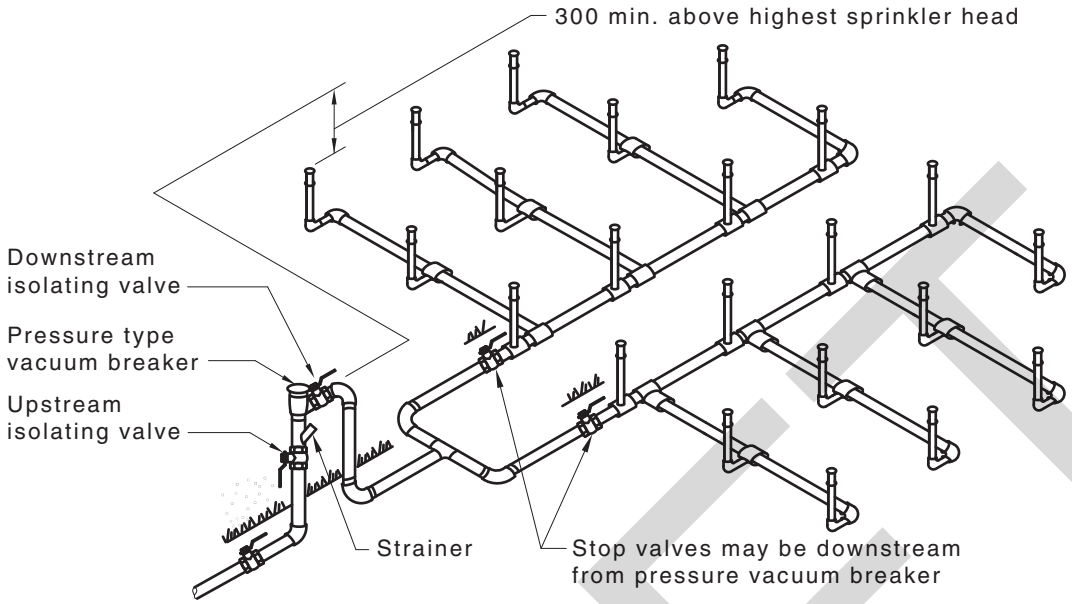
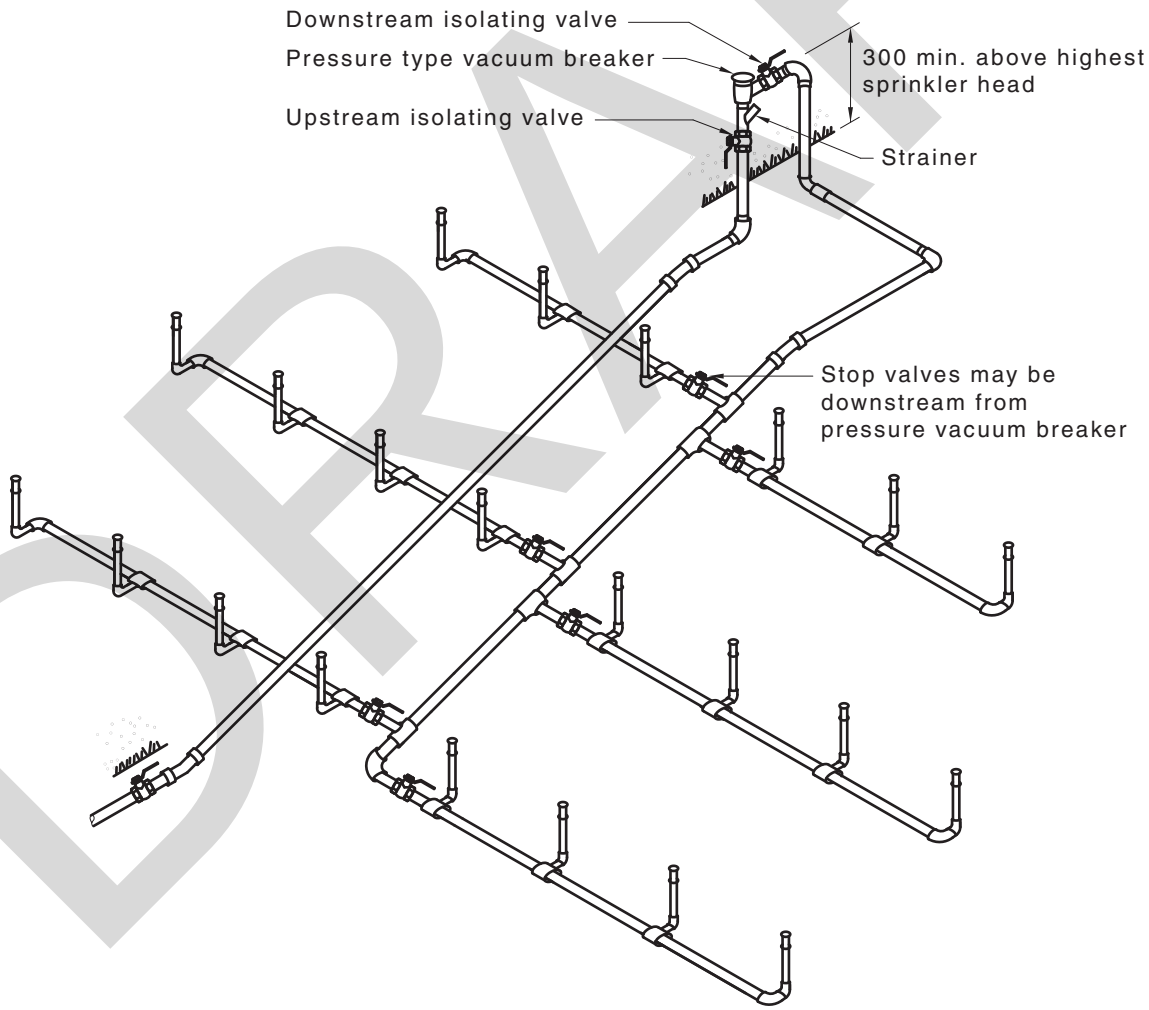


FIGURE 7.2(C) TYPE B SYSTEM—NON-TESTABLE DEVICES—SUITABLE FOR BACK-PRESSURE



(i) Level terrain—Multi-zone system using pressure type vacuum breaker



(ii) Hillside system using pressure type vacuum breaker

DIMENSIONS IN MILLIMETRES

FIGURE 7.2(D) TYPE C SYSTEM—TESTABLE DEVICES—NO BACK-PRESSURE

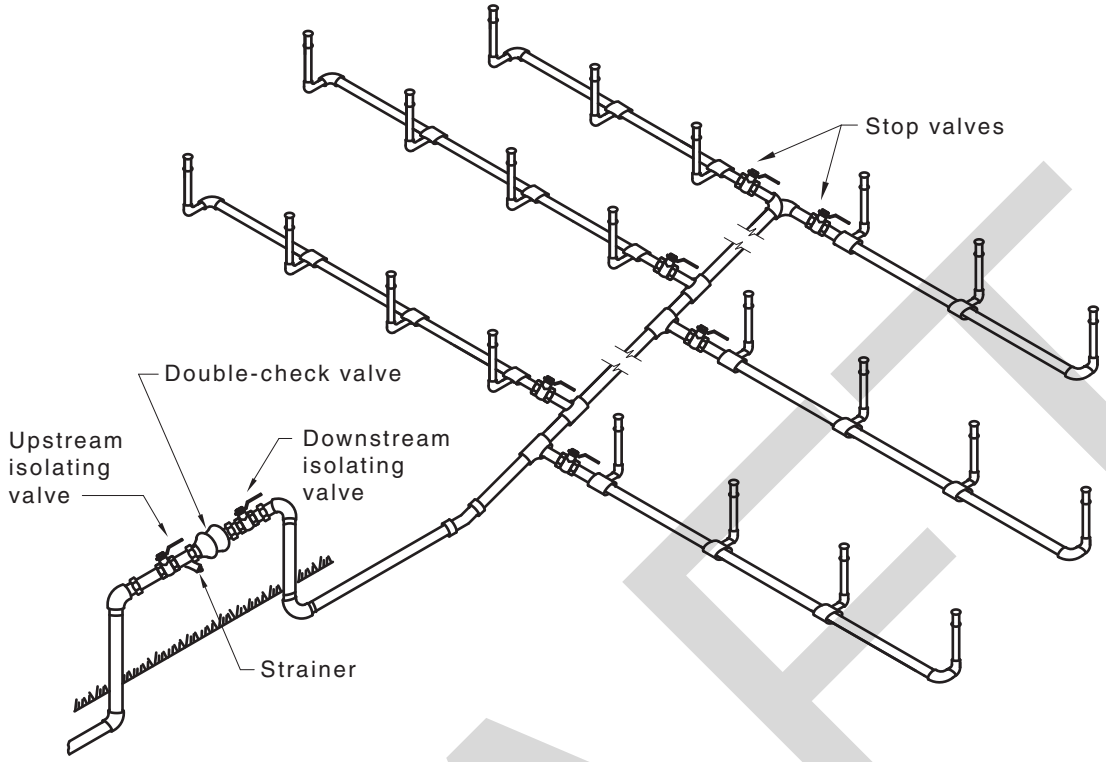


FIGURE 7.2(E) TYPE C SYSTEM—TESTABLE DEVICES SUBJECT TO BACK-PRESSURE OR NO BACK-PRESSURE FOR HILLSIDE OR MULTI-ZONE SYSTEM—DOUBLE CHECK VALVE ASSEMBLY

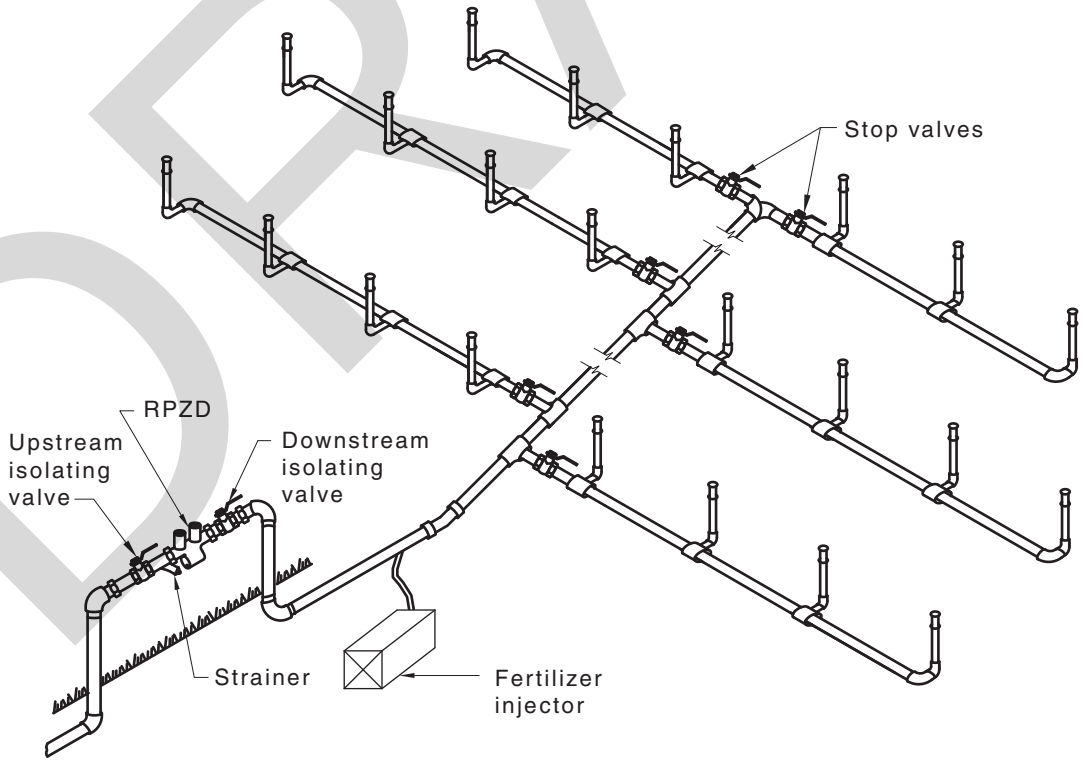


FIGURE 7.2(F) TYPE D SYSTEM—TESTABLE DEVICES SUBJECT TO BACK-PRESSURE OR NO BACK-PRESSURE FOR APPLICATIONS WITH CHEMICAL ADDITIVES—REDUCED PRESSURE ZONE DEVICE

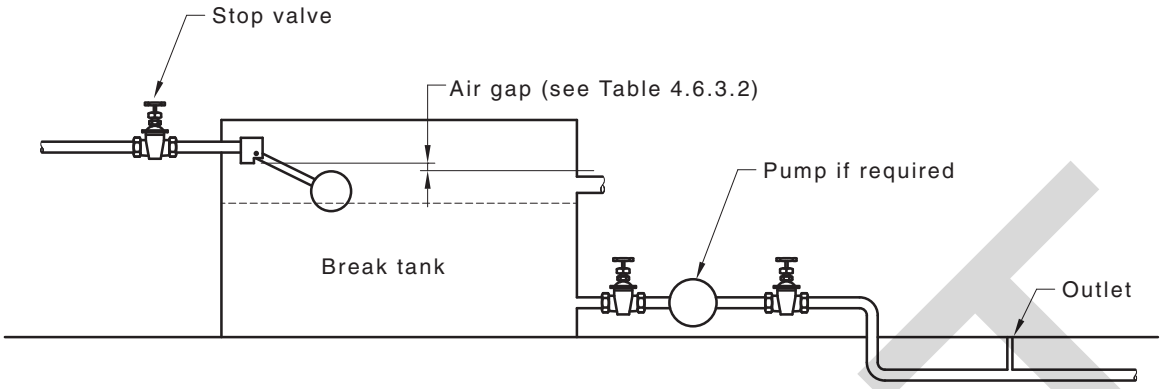


FIGURE 7.2(G) TYPE D SYSTEM—TYPICAL IRRIGATION SUPPLY THROUGH A REGISTERED BREAK TANK

SECTION 8 WATER STORAGE TANKS

8.1 SCOPE OF SECTION

This Section specifies requirements for water storage tanks.

NOTE: For connections of rainwater tanks, see Section 16.

8.2 PURPOSE OF TANKS

8.2.1 General

This Section applies to tanks provided for the storage of water for the following purposes:

(a) Sanitary flushing.

(b) Drinking water supply.

(c) Firefighting.

(d) Air-conditioning.

(e) Refrigeration.

(f) Ablutions.

(g) Prevention of cross-connections.

(h) Make-up water.

(i) Contingency reserve.

8.2.2 Limitations on use

A tank that is intended for the storage of drinking water shall not be used to supply directly any water closet pan, bidet, flush valve, slop hopper pan or other similar fixture or fitting used, or intended to be used, for sanitary flushing, except as provided for in Clause 11.9.

8.3 DESIGN AND INSTALLATION REQUIREMENTS

8.3.1 General

The installation of tanks shall be as follows:

(a) Materials used to construct tanks shall be as specified in Section 2.

(b) All tanks shall be installed on bases, plinths or supports designed to adequately support the weight of any such tank and its contents when filled to maximum capacity.

(c) All metallic tanks, or such other tanks as may be directed, shall be installed with a membrane of non-corrosive insulating material between the support and the underside of the tank.

(d) Every tank shall be supported in such a manner that no load is transmitted to any of the attached pipes.

(e) All tanks shall be accessible for inspection, repairs, maintenance and replacement.

(f) Every tank shall be provided with a cover that is designed to prevent the entry of dust, roof water, surface water, groundwater, and bird or animal life.

(g) For New Zealand, see acceptable solution NZBC G12/AS1.

8.3.2 Capacity of storage tanks—Measurement

The storage capacity of any tank shall be taken to be the volume of water above the invert of the outlet pipe when the water surface is 20 mm below overflow level.

8.3.3 Access

Access to tanks shall be provided in accordance with the following:

(a) Headroom and side access shall be provided for every tank to enable inspection, cleaning and maintenance procedures to be carried out to the interior and exterior of the tank.

(b) The requirements of AS 2865 shall be taken into account in the design, manufacture and installation of a water tank.

Where the interior depth of any storage tank exceeds 2 m, access ladders of standard design and dimensions conforming to AS 1657 shall be installed.

8.3.4 Placement of tank

8.3.4.1 *Safe-tray*

Where required, tanks shall be placed in safe-trays in accordance with Clause 8.8.

8.3.4.2 *Limitations on location of drinking water tanks*

Tanks storing drinking water shall not be located directly beneath any sanitary plumbing or any other pipes conveying non-drinking water.

8.4 TANK DESIGN

8.4.1 General

Water storage tanks shall be designed and connected in accordance with Figure 8.4.1. Tanks with dual water supply shall maintain the air gap in accordance with Clause 4.6.3.2(a). Where the capacity exceeds 500 L, provision shall be made at the base for removal of sludge.

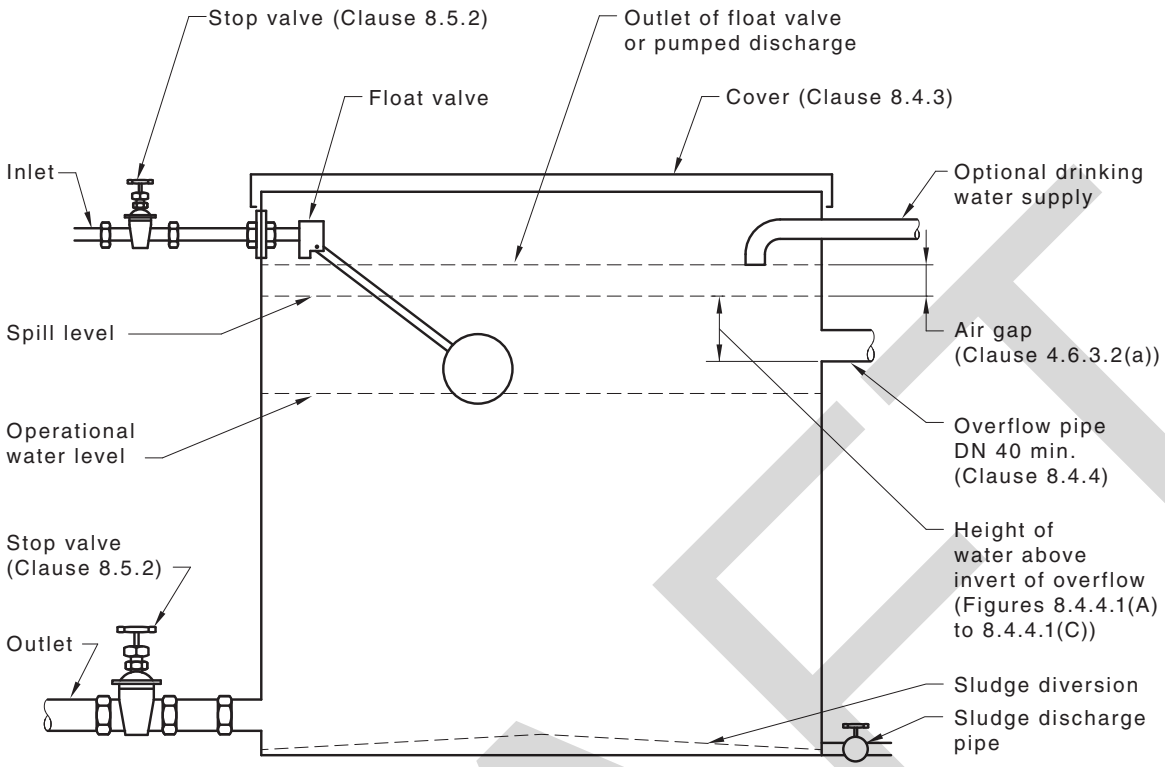


FIGURE 8.4.1 COLD WATER STORAGE TANK

8.4.2 Internal corrosion protection

Where required for corrosion protection, the internal surfaces of tanks shall be coated with a protective coating.

8.4.3 Tank cover

Any tank that supplies drinking water shall be provided with a cover that is—

(a) close fitting; and

(b) secured in position if the tank is located externally.

Where the whole cover is not removable, the tank shall be provided with a covered access opening not smaller than 0.5 m^2.

8.4.4 Tank overflow

8.4.4.1 *General*

Overflow pipes from tanks shall be—

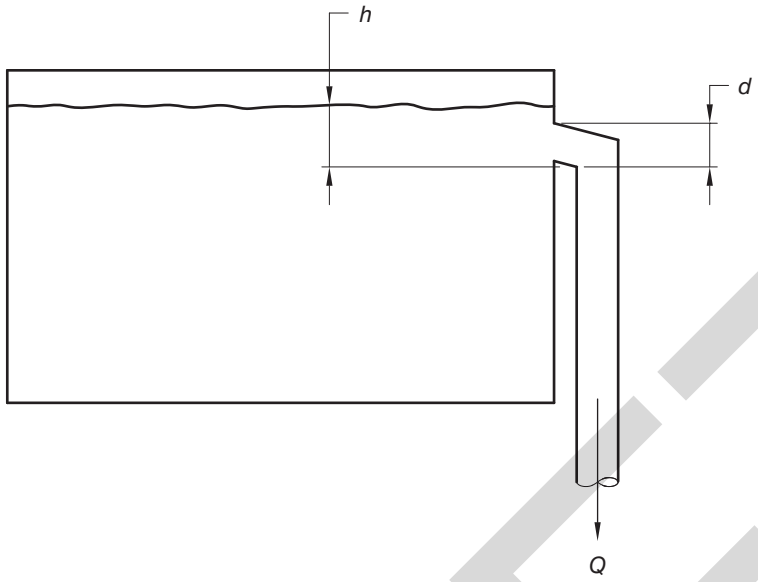
(a) not smaller than DN 40; and

(b) capable of discharging the inflow rates given in Table 8.4.4.1 and the outflow rates specified in Figures 8.4.4.1(A), 8.4.4.1(B) and 8.4.4.1(C) or hydraulically calculated, taking into account the maximum head available in the main (but not less than 500 kPa), friction losses, elevation of the tank, size of the orifice and type of overflow outlet.

TABLE 8.4.4.1
RATE OF INFLOW TO STORAGE TANKS

Diameter of float valve inlet orifice mm	Inflow at 500 kPa L/s
6	0.54
8	0.95
10	1.49
15	3.4
20	6.0
25	9.3
32	15.3
40	23.8
50	37.2*
65	63.0
80	95.4
100	149.0
125	232.8
150	335.2

* Figures 8.4.4.1(A), 8.4.4.1(B) and 8.4.4.1(C) only cover up to this inflow.



Flow rates shall be determined from the following equations:

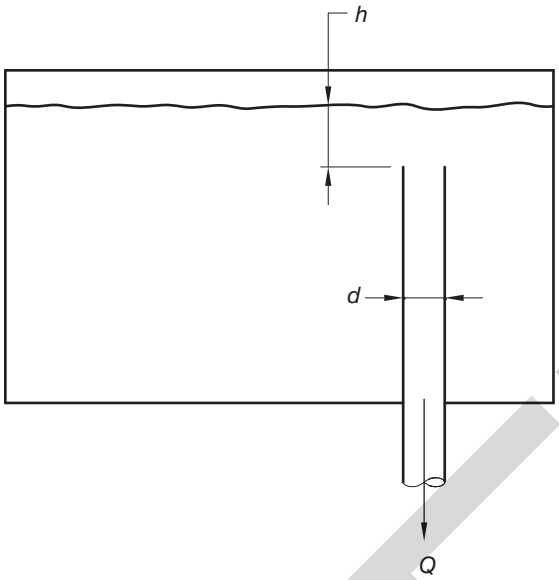
Weir flow, $h \leq d$ $Q = 6.6 \times 10^{-5} \times d^{0.7} \times h^{1.8}$ . . . 8.4.4.1(1)

Orifice flow, $h > d$ $Q = 6.6 \times 10^{-5} \times d^{2} \times \sqrt{\left(h - \frac{d}{2}\right)}$ . . . 8.4.4.1(2)

Internal diameter of overflow pipe (*d*)	Discharge through overflow (*Q*), L/s									
	Height of water above invert of overflow (*h*), mm									
mm	20	30	40	50	75	100	125	150	175	200
40	0.14	0.28	0.47	0.58	0.78	0.94	1.08	1.20	1.31	1.42
50	0.16	0.33	0.55	0.83	1.17	1.43	1.65	1.84	2.02	2.18
75	0.21	0.44	0.73	1.09	2.27	2.93	3.47	3.94	4.35	4.73
100	0.26	0.53	0.90	1.34	2.78	4.67	5.72	6.60	7.38	8.08
125	0.30	0.62	1.05	1.56	3.25	5.45	8.15	9.65	10.94	12.09
150	0.34	0.71	1.19	1.78	3.69	6.19	9.25	12.86	14.85	16.60
175	0.38	0.79	1.33	1.98	4.11	6.89	10.30	14.30	18.91	21.44
200	0.42	0.87	1.45	2.17	4.51	7.57	11.31	15.71	20.73	26.40

NOTE: The orifice coefficient $m = 0.6$ applies to the orifice flow conditions. Water heights are measured from the pipe invert or crest. This allows for overflows that are not flowing full. The capacity of those overflows is determined from the minimum specific energy of flow over a weir. No allowance is given in the Table for belling of the overflow, nor for an increase in effective head due to siphonage through the overflow pipe. These factors may substantially increase the discharge capacity of the overflow pipe.

FIGURE 8.4.4.1(A) RATE OF OUTFLOW FROM TYPE 1 OVERFLOW (PIPED) HORIZONTAL OUTLET STORAGE TANKS



Flow rates shall be determined from the following equations:

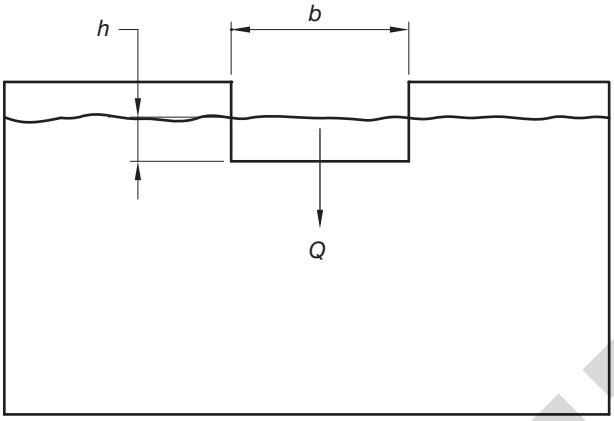
Weir flow, $h \leq \frac{d}{3}$ $Q = 1.98 \times 10^{-4} \times d \times h^{1.5}$ . . . 8.4.4.1(3)

Orifice flow, $h > \frac{d}{3}$ $Q = 6.60 \times 10^{-5} \times d^2 \times \sqrt{h}$ . . . 8.4.4.1(4)

Internal diameter of overflow pipe (*d*)	Discharge through overflow (*Q*), L/s									
	Height of water above invert of overflow (*h*), mm									
mm	20	30	40	50	75	100	125	150	175	200
40	0.47	0.58	0.67	0.75	0.91	1.06	1.18	1.29	1.40	1.49
50	0.74	0.90	1.04	1.17	1.43	1.65	1.84	2.02	2.18	2.33
75	1.33	2.03	2.35	2.63	3.22	3.71	4.14	4.55	4.91	5.25
100	1.77	3.25	4.17	4.67	5.72	6.60	7.38	8.08	8.73	9.33
125	2.21	4.07	6.26	7.29	8.93	10.31	11.53	12.63	13.64	14.58
150	2.66	4.88	7.51	10.50	12.86	15.84	16.60	18.19	19.64	21.00
175	3.10	5.69	8.77	12.25	17.50	20.21	22.60	24.76	26.74	28.58
200	3.54	6.51	10.02	14.00	22.86	26.40	29.52	32.33	34.92	37.34

NOTE: The orifice coefficient $m = 0.6$ applies to the orifice flow conditions. Water heights are measured from the pipe invert or crest. This allows for overflows that are not flowing full. The capacity of those overflows is determined from the minimum specific energy of flow over a weir. No allowance is given in the Table for belling of the overflow, nor for an increase in effective head due to siphonage through the overflow pipe. These factors may substantially increase the discharge capacity of the overflow pipe.

FIGURE 8.4.4.1(B) RATE OF OUTFLOW FROM TYPE 2 OVERFLOW (PIPED) VERTICAL OUTLET STORAGE TANKS



Flow rates shall be determined from the following equation:

Weir flow $Q = 5.39 \times 10^{-5} \times b \times h^{1.5}$ . . . 8.4.4.1(5)

Width of weir (*b*)	Discharge overflow (*Q*), L/s									
	Height of water above crest of weir (*h*), mm									
mm	20	30	40	50	75	100	125	150	175	200
25	0.12	0.22	0.34	0.48	0.88	1.35	1.88	2.48	3.12	3.81
30	0.14	0.27	0.41	0.57	1.05	1.62	2.26	2.97	3.74	4.57
75	0.36	0.66	1.02	1.43	2.63	4.04	5.65	7.43	9.36	11.43
100	0.48	0.89	1.36	1.91	3.50	5.39	7.53	9.90	12.48	15.25
125	0.60	1.11	1.70	2.38	4.38	6.74	9.42	12.38	15.60	19.06
150	0.72	1.33	2.05	2.86	5.25	8.08	11.30	14.85	18.72	22.87
175	0.84	1.55	2.39	3.33	6.13	9.43	13.18	17.33	21.84	26.68
200	0.96	1.77	2.73	3.81	7.00	10.78	15.07	19.80	24.96	30.49

NOTE: The orifice coefficient $m = 0.6$ applies to the orifice flow conditions. Water heights are measured from the pipe invert or crest. This allows for overflows that are not flowing full. The capacity of those overflows is determined from the minimum specific energy of flow over a weir. No allowance is given in the Table for belling of the overflow, nor for an increase in effective head due to siphonage through the overflow pipe. These factors may substantially increase the discharge capacity of the overflow pipe.

FIGURE 8.4.4.1(C) RATE OF OUTFLOW FROM TYPE 3 OVERFLOW (WEIR) RECTANGULAR STORAGE TANKS

8.4.4.2 *Discharge of overflow*

In order not to cause damage or nuisance, the tank overflow shall discharge where it is readily visible—

(a) into the safe-tray, directly over the safe-tray overflow outlet;

(b) directly into the safe-tray overflow;

(c) onto an impervious graded floor, in such manner that the entire discharge drains freely and harmlessly to a floor waste outlet; or

(d) outside the building, clear of doors, windows or other opening, and within the property boundaries.

The supply rate shall be determined from the following equation:

$$Q = m \times A \times \sqrt{(2gH)} \times 10^3 \quad \text{. . . 8.4.4.2}$$

where

Q = supply rate, in litres per second

m = orifice coefficient for thin sharp-edged plate

= 0.6

A = cross-sectional area of orifice, in square metres

g = acceleration due to gravity (9.8 m/s^2)

H = head of water on inlet of orifice, in metres

NOTES:

1 The diameter of the float valve inlet orifice is not necessarily related to the nominal size of the fitting.

2 As a guide, the orifice size is normally half the nominal size, except in the case of full way valves.

3 For an example of calculation of overflow rate, see Appendix G.

8.4.4.3 *Discharge not readily visible*

Where the tank overflow pipe does not discharge to a readily visible position, a telltale pipe not smaller than DN 20 shall be connected to the invert of the overflow pipe and discharge as required by Clause 8.4.4.2.

8.4.4.4 *Size of air gap*

An air gap conforming to Clause 4.6.3.2(a) shall be maintained between the spill level of the tank and the outlet of the water service.

8.5 INLET PIPING

8.5.1 Connections

Union couplings or flanges shall be used to connect the water service to the inlet of the storage tank.

8.5.2 Stop valve

Where a float valve is fitted, an isolating valve shall be installed in an accessible position to allow maintenance of the float valve.

8.6 OUTLET PIPING

8.6.1 Connections

The outlet piping shall be connected to the storage tank by means of union couplings or flanges and shall be a minimum of one pipe diameter from the bottom of the tank.

8.6.2 Service outlets

For tanks of more than 50 L capacity, each service outlet shall be fitted with an isolating valve installed in an accessible location.

8.7 SLUDGE VALVES

A sludge valve shall be fitted when the capacity of the tank exceeds 500 L. The minimum size of the valve shall be not less than half the outlet pipe size nor less than DN 40.

8.8 SAFE-TRAY

8.8.1 General

A safe-tray shall be provided under every storage tank, except where the tank is external to the building or located on an impervious floor graded to an outlet, the safe-tray shall—

(a) have no portion of the tank closer than 75 mm to a vertical line from the edge of the safe-tray and no portion of an attached auxiliary part closer than 25 mm to such vertical line; and

(b) have placed, between the tank and the safe-tray, durable supports not less than 12 mm thick and of an area not less than 0.5*A* nor more than 0.6*A*, (where *A* is the area of the base of the tank), and the support shall project beyond the sides and walls of the tank but not closer than 20 mm to the sides of the safe-tray.

8.8.2 Safe-tray construction

Safe-trays shall be fabricated from materials as specified in Clause 2.5. The sides of trays shall be not less than 50 mm in height and all joints shall be made watertight.

8.8.3 Overflow

The safe-tray shall be fitted with an overflow that effectively drains the safe-tray. The overflow drain shall have—

(a) an internal diameter greater than the diameter of the tank overflow, but not less than DN 50 in Australia and DN 40 in New Zealand;

(b) a continuous fall to its discharge point in accordance with Clause 8.4.4.2;

(c) all seams in sheet metal pipe uppermost;

(d) all joints in sheet metal pipe lapped in the direction of the flow;

(e) all circumferential joints made watertight; and

(f) support in the vicinity of the tray and at intervals not greater than 1 m horizontally and 2.4 m vertically.

8.9 MARKING OF TANKS

Except if installed in domestic or residential buildings, all tanks shall have their intended use identified with not less than two permanent notices attached to each tank in visible positions, one on the front of the tank and one on the cover. Notices shall—

(a) be not less than 450 mm × 250 mm in size;

(b) have a red background;

(c) have the text in white, capital letters of not less than 25 mm in height; and

(d) have an identification in accordance with AS 2865 where applicable.

Tanks holding drinking water shall carry the following warning:

WARNING: DRINKING WATER

SECTION 9 NON-DRINKING WATER SERVICES

9.1 SCOPE OF SECTION

This Section specifies the design, installation and maintenance requirements for non-drinking water services, including recycled and reclaimed water from the point of connection to the point of discharge.

NOTES:

1 For a typical layout of a non-drinking water installation, see Figure 9.1.

2 Non-drinking water is any water that is not fit for human consumption, as determined by the health authority or authority having jurisdiction.

3 NCC Volume Three outlines the limitations for the use of non-drinking water.

9.2 MATERIALS AND PRODUCTS

9.2.1 General

Pipework and products used in the installation of non-drinking water services shall be as specified in Section 2.

Colours for pipework and products shall be as specified in—

(a) AS 2700 in Australia; or

(b) NZS 7702 in New Zealand.

9.2.2 Water meters

Water meters shall be—

(a) permanently coloured purple, being no darker than Jacaranda P24 or Purple P12 and no lighter than Lilac P23; and

(b) installed in an accessible position.

NOTE: The meter inlet and outlet threads may be different to prevent interchange with the drinking water meter.

9.3 INSTALLATION REQUIREMENTS

9.3.1 Installation

Installation shall be in accordance with the requirements for drinking water.

9.3.2 Proximity to other services

9.3.2.1 *Above ground installations*

An above ground non-drinking water services shall be installed—

(a) a minimum of 100 mm from any parallel drinking water service; and

(b) in a duct or structurally separated.

9.3.2.2 *Below ground installations*

A below ground non-drinking water services shall be installed—

(a) a minimum of 100 mm from any parallel drinking water service; and

(b) a minimum of 300 mm from any other non-drinking water service.

NOTE: Below ground installation refers to non-drinking water services buried in the ground.

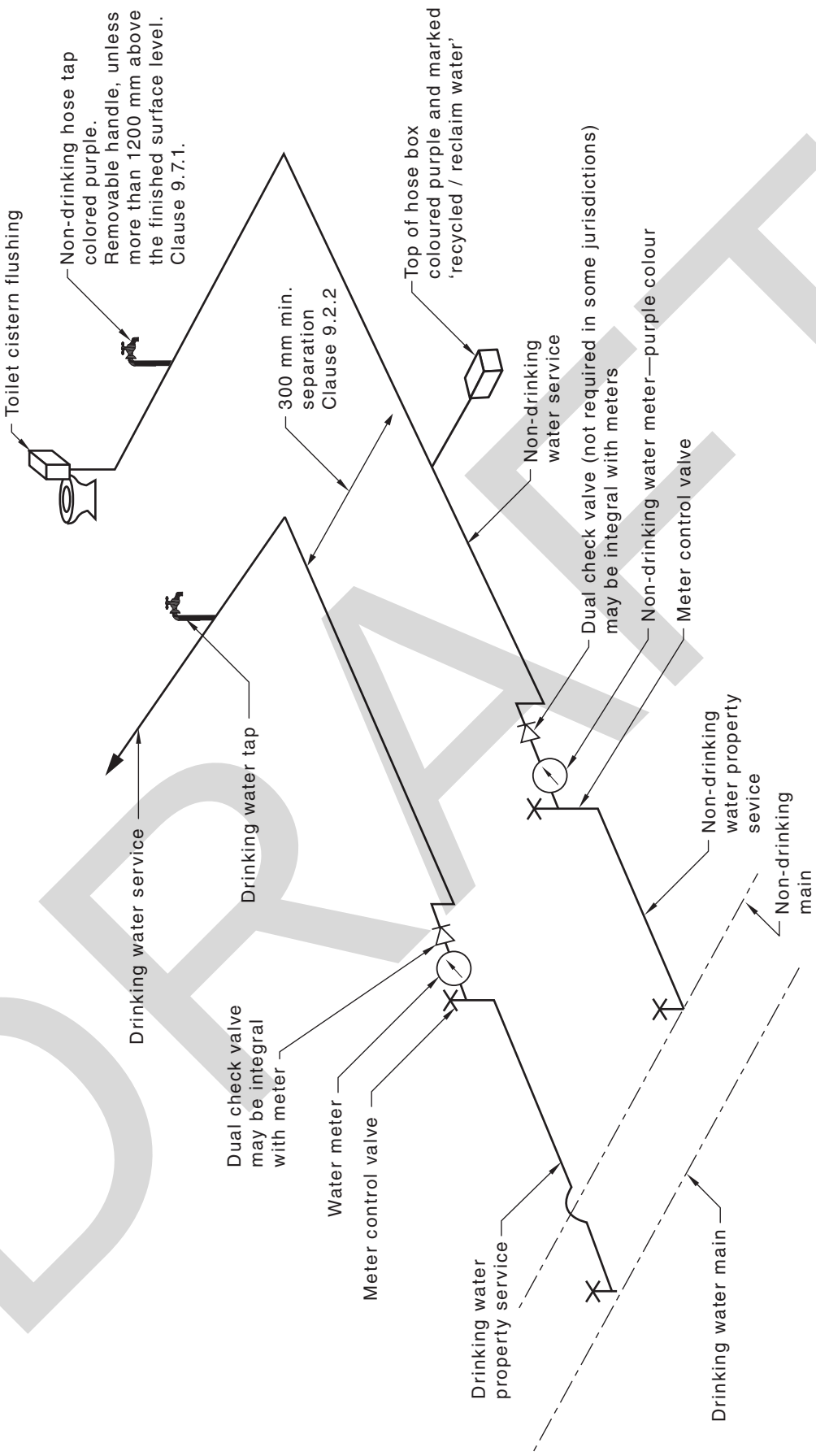


FIGURE 9.1 TYPICAL NON-DRINKING WATER INSTALLATION FROM A RETICULATED RECYCLED WATER SYSTEM

9.4 Cross-connection control

There shall be no cross-connection between any drinking or non-drinking water services.

9.5 Temporary bypass

During construction of a property that is intended to have a non-drinking water service, however a non-drinking water supply has not yet been provided, a bypass line can be temporally installed.

The bypass shall—

(a) be temporary during construction of the building;

(b) be located at the meter or property boundary;

(c) incorporate an insolation valve at the connection to the drinking water service; and

(d) be in an accessible location.

NOTE: A typical temporary bypass is shown in Figure 9.5.

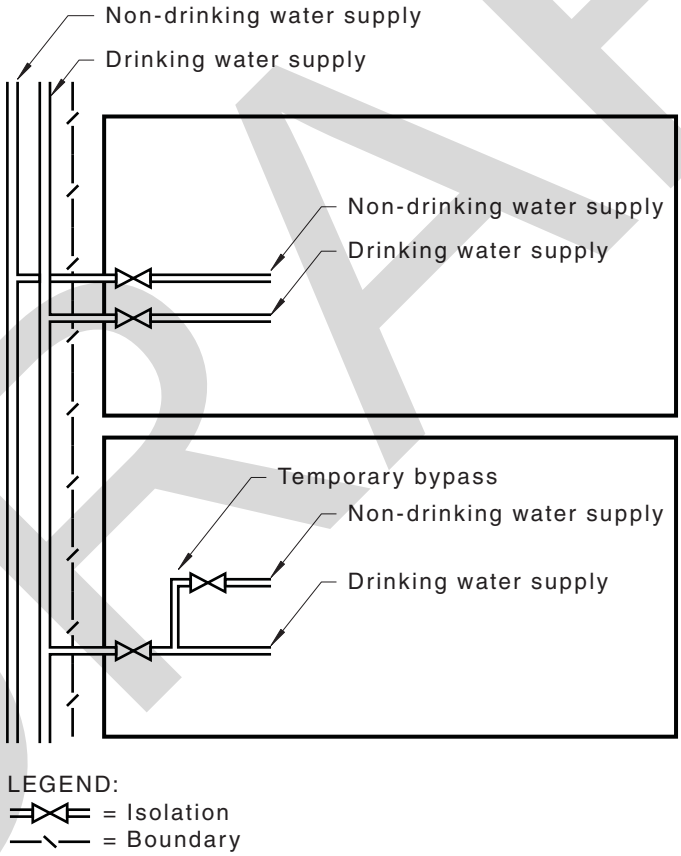


FIGURE 9.5 TYPICAL EXAMPLE OF A TEMPORARY NON-DRINKING WATER BYPASS

9.6 Identification of non-drinking water services

9.6.1 Colour of non-drinking water pipework

Non-drinking water service pipework shall be a purple colour being no darker than P24 Jacaranda or P12 Purple, and no lighter than P23 Lilac.

Where pipes are not coloured purple, identification can be achieved by means of close-fitting durable purple-coloured sleeving, netting or spirally wrapped tape.

NOTE: It is not necessary to use purple coloured fittings.

9.6.2 Marking of non-drinking water pipework

In other than domestic or residential buildings (Class 3 to Class 9 buildings) accessible pipework shall be permanently marked as a non-drinking water service.

Identification markings shall be placed—

(a) at spacing's not exceeding 8 m;

(b) adjacent to branches, junctions, valves and penetrations; and

(c) markings shall be specified with—

  (i) AS 1345 in Australia; or

  (ii) NZS 5807 in New Zealand

9.6.3 Identification of buried non-drinking water services

Buried pipes shall be identified with purple coloured underground marking tape.

The contents of pipes shall identified in accordance with—

(a) AS 1345 in Australia; or

(b) NZBC G12/AS1 in New Zealand.

9.6.4 Installation of underground marking tape

Underground marking tape shall—

(a) conform to AS/NZS 2648.1; and

(b) be installed on top of the pipe, running longitudinally, fastened to the pipe at not more than 3 m intervals and state the following:

  RECYCLED OR RECLAIMED WATER—DO NOT DRINK

Non-drinking water for irrigation; be installed above the service and be marked with the following:

  THE PIPE BELOW IS NON-DRINKING WATER

9.7 Identification of outlets

9.7.1 External non-drinking hose tap outlets

External non-drinking water hose tap outlets shall—

(a) have a removable handle, except where the outlet is installed 1200 mm or more above the finished surface level;

(b) be permanently coloured purple, being no darker than Jacaranda P24 or Purple P12 and no lighter than Lilac P23; and

(c) have standard threads on the inlet and outlet.

9.7.2 All non-drinking water outlets

All non-drinking water outlets shall be clearly and permanently marked with a—

(a) warning sign in accordance with Figure 9.7.2(A); or

(b) prohibition sign in accordance with—

  (i) AS 1319 in Australia; or

(ii) NZBC G12/AS1 in New Zealand.

NOTE: A typical example of a prohibition sign is shown in Figure 9.7.2(B).

FIGURE 9.7.2(A) TYPICAL EXAMPLE OF A WARNING SIGN

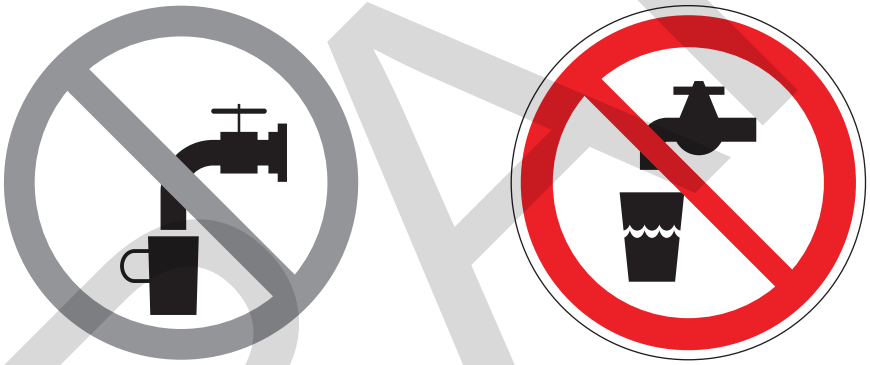


FIGURE 9.7.2(B) TYPICAL EXAMPLES OF PROHIBITION SIGNS

9.8 TESTING AND COMMISSIONING A NON-DRINKING WATER SERVICE

9.8.1 Flushing and testing

Prior to use, the non-drinking water service shall be—

(a) flushed in accordance with Clause 18.2; and

(b) hydrostatically tested in accordance with Clause 18.3.

9.8.2 Commissioning a non-drinking water service

A non-drinking water service shall be commissioned as follows:

(a) Turn on the drinking water supply at the meter or isolation valve.

(b) Turn off the non-drinking water supply at the meter or isolation valve.

(c) Turn on all tapware (both heated and cold) and appliances one by one. Water should flow from all tapware and appliances.

(d) Flush all toilets. The toilets shall not refill (provided they are connected to the non-drinking water service).

(e) Turn on all external hose tap outlets. Water shall flow continuously from the drinking water hose tap outlets with the non-drinking water running dry.

(f) Turn the non-drinking water meter tap back on slowly so that all air will be purged from the pipeline while it is being recharged.

NOTE: The commissioning process may be repeated for the drinking water supply. This process is as follows:

(a) Turn off the drinking water supply at the meter or isolation valve.

(b) Turn on the non-drinking water supply at the meter of isolation valve.

(c) Turn on all heated and cold tapware, including appliances one by one.

(d) Ensure all tap outlets and appliances have run dry.

(e) Flush all toilets. Check that the toilet cisterns have refilled after flushing.

(f) Turn on all external hose taps.

(g) Check that the drinking water taps have run dry.

(h) Check that the non-drinking water taps are flowing continuously.

(i) Turn the drinking water supply back on slowly so that all air will be purged from the pipeline while it is being recharged.

(j) Turn the drinking water supply back on again.

SECTION 10 TREATED GREYWATER SERVICES

10.1 SCOPE OF SECTION

This Section specifies requirements for the installation of services for the supply of greywater, which has been treated, from a greywater treatment system to the point of re-use.

This Section does not cover direct diversion greywater systems.

NOTE: For direct diversion greywater systems, see AS/NZS 3500.2.

C10.1 *There are a number of authorities that should be consulted where treated greywater use is being considered. These authorities include the following:*

(a) The network utility operator(s) responsible for water supply and sewerage or both.

(b) The health authority.

(c) The environment protection authority.

(d) Local council.

(e) State or territory plumbing standards setting authority.

The relevant authority will—

(i) determine the quality levels for the treated greywater; and

(ii) the acceptable internal and external use.

10.2 MATERIALS AND PRODUCTS

Materials and products used in the installation of greywater water services shall be as specified in Section 2.

10.3 CROSS-CONNECTION CONTROL

Greywater installations shall be designed, installed and maintained to prevent a cross-connection with drinking water supply. Where a property is served by a greywater supply, the following shall apply:

(a) A backflow prevention device for the degree of hazard shall be fitted at the meter (or at the boundary when a meter is not installed) on the drinking water supply.

(b) Each external tap on the drinking water service shall be fitted with a low hazard backflow prevention device, such as a hose connection vacuum breaker (see Section 4).

(c) Cross-connection protection from any greywater service shall meet the requirements of Section 4.

10.4 INSTALLATION

Installation of a water supply system from a greywater treatment unit shall be as specified in Section 9.

SECTION 11 WATER FOR SANITARY FLUSHING

11.1 SCOPE OF SECTION

This Section specifies requirements for water services used for sanitary flushing purposes.

11.2 GENERAL

Sanitary fixtures that are cleansed by the action of a flush shall have water supplied by one of the following:

(a) A cistern.

(b) A flush valve supplied by a separate break tank in accordance with Clause 11.6.

(c) A flush valve connected to the drinking water supply service in accordance with Clause 11.9.

(d) A flush valve supplied through an anti-back-siphonage device.

NOTE: Flushing devices may be used on the following fixtures:

(a) Water closet pan.
(b) Urinal.
(c) Slop hopper pan.
(d) Combination pan room sink and flush bowl.
(e) Bedpan washer.
(f) Floor waste with flushing rim.

11.3 WATER CLOSET

Compatibility of a pan and water closet cistern or flushing device shall be determined in accordance with AS 1172.1 and AS 1172.2.

NOTE: AS 1172.1 and AS 1172.2 require that product labelling indicate matching set model identification where not supplied as close coupled.

11.4 URINALS

Flush valves that connect to urinals shall be installed so that the operating mechanism is not more than 2 m above the floor level. Flush valves shall be accessible and installed above the level of the sparge pipe by not less than—

(a) 300 mm for wall-hung urinals; and

(b) 450 mm for continuous wall urinals.

11.5 INSTALLATION OF CISTERNS

11.5.1 General

Cisterns shall be installed so they are capable of being maintained and serviced.

11.5.2 Urinal type cisterns

Cisterns that connect to urinals shall be installed at a height of not less than 300 mm for wall-hung type urinals and 450 mm for continuous wall urinals, above the level of the sparge pipe or spreader of the urinal stall, measured to the underside of the cistern.

11.5.3 Manually operated cisterns

Manually operated cisterns shall be installed so that the cistern’s operating control is positioned at a height of not more than 2 m, measured from the floor level.

11.5.4 Water closet pan and slop hopper pan type cisterns

Cisterns that connect to a water closet pan or slop hopper pan shall conform to AS 1172.2.

11.6 FLUSH VALVES SUPPLIED FROM BREAK TANKS

11.6.1 General

Break tanks shall be installed in accordance with the requirements of Section 8. Break tanks shall not be used to supply water for drinking purposes.

11.6.2 Capacity

The water storage to be provided for flush valves serving water closets shall not be less than 45 L for each flush valve served, and 30 L for each flush valve serving urinals.

11.6.3 Operating head

The operating water pressure supplied to any flush valve shall not exceed 300 kPa.

11.6.4 Pipe size guide

NOTE: Guidance on the size of service pipes from break tanks to flush valves is given in Table 11.6.4.

TABLE 11.6.4

SERVICE PIPE SIZES—BREAK TANKS TO FLUSH VALVES

Available head of water at highest flush valve m	Maximum number of flush valves served downstream on the same floor and at lower levels	Nominal size of service pipes DN
>3 ≤6	1 to 2 3 to 15 16 to 50 51 to 150	40 50 65 80
>6 ≤9	1 to 3 4 to 30 31 to 150 151 to 200	40 50 65 80
>9 ≤12	1 to 4 5 to 50 51 to 200	40 50 65
>12	1 to 6 7 to 100 101 to 250	40 50 65

11.6.5 Urinal flush valves

Each urinal flush valve shall supply water to not more than three separate urinal stalls, or a continuous urinal wall not more than 1.8 m in length. Only urinal stalls that are located adjacent to each other may be supplied from a common flush valve.

11.7 FLUSH PIPES AND WATER FLOW DISTRIBUTION

Cisterns and flush valves shall supply water to a fixture through a flush pipe or, in the case of a urinal, through a flush pipe or a distribution system in accordance with Table 11.7.

TABLE 11.7

FLUSHING WATER FLOW DISTRIBUTION

Volume of water discharged by the cistern or flushing valve L	Maximum length of urinal wall served per cistern or flushing valve mm	Minimum number of spreaders for the urinal	Nominal size of flush pipe DN	Nominal size of spreader DN
2.5	450*	1	20	—
2.5	600	1	25	20
5.0	1 200	3	32	25
7.5	1 800	4	40	25
10.0	2 400	5	50	25

* Wall-hung unit

11.8 PRESSURE RATIO VALVES

11.8.1 General

Pressure ratio valves shall be—

(a) installed in the service piping in duplicate and in parallel, and each valve shall be separately sized to cater for the total simultaneous demand;

NOTE: For a typical valve installation involving a pressure ratio valve, see Figure 11.8.1.

(b) controlled by means of stop valves, installed at both the inlet and outlet of each ratio valve, which under normal operating conditions shall be fully opened;

(c) installed in an accessible position where they will not be subject to interference;

(d) readily removable by means of flanged or union type joints; and

(e) not less than the nominal size of the section of pipeline in which they are installed.

11.8.2 Requirement for pressure gauges

Pressure gauges that are calibrated to read higher than the available working head in the particular installation shall be installed on the inlet and outlet of each ratio valve assembly.

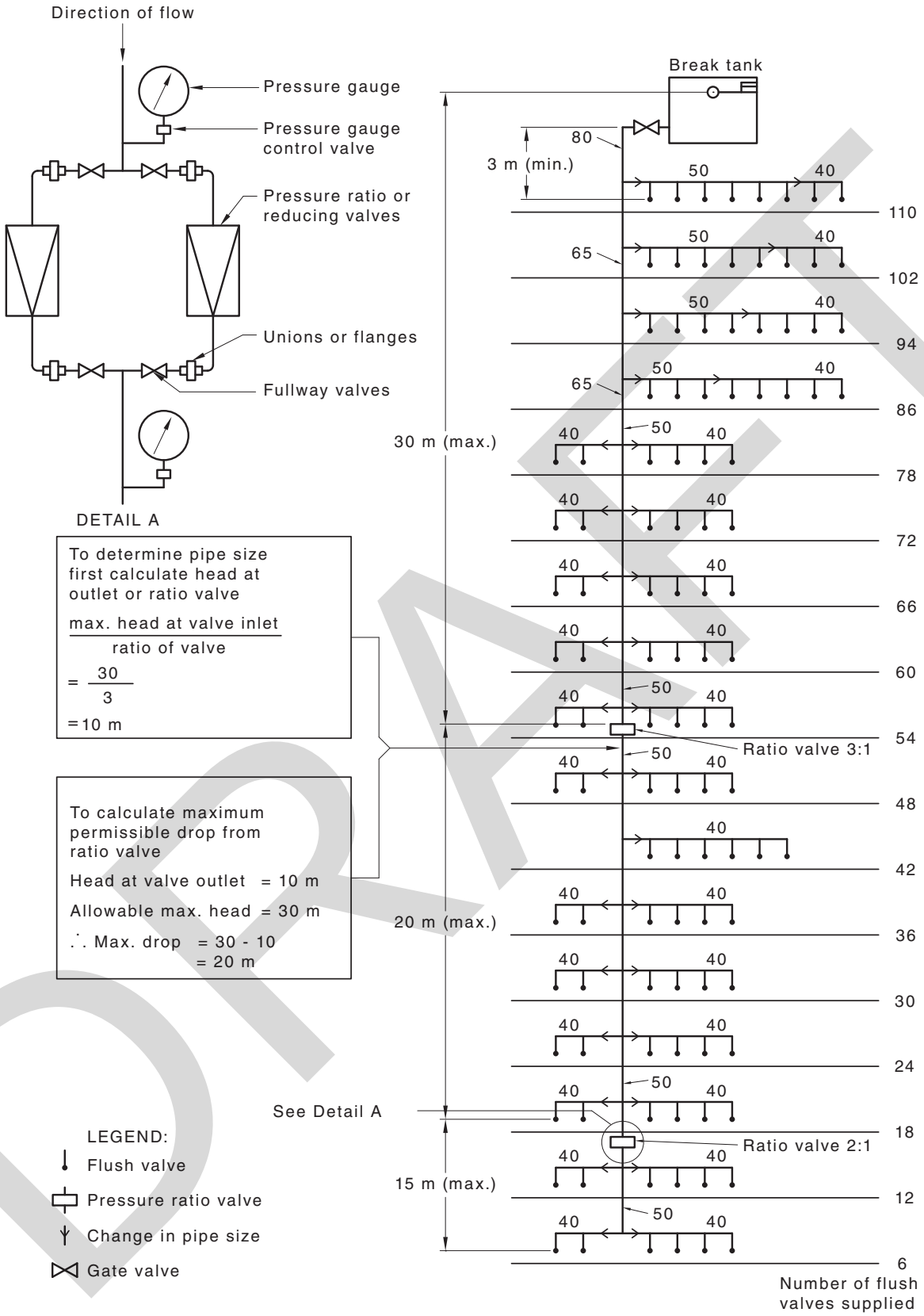


FIGURE 11.8.1 TYPICAL FLUSH VALVE INSTALLATION INCORPORATING PRESSURE RATIO VALVES

11.9 FLUSH VALVES CONNECTED TO THE DRINKING WATER SERVICE

11.9.1 General

Flush valves for connection either to the water service or to a storage tank supplying other fixtures shall incorporate within the valves a back-siphonage prevention device, and shall be installed in accordance with Clauses 11.9.2 to 11.9.7.

11.9.2 Compatibility

The flush valve shall be compatible with the fixture to which it is connected.

11.9.3 Pipe size

The minimum pipe size serving the flush valve shall be DN 25. The sizes of all pipework to the valve shall be hydraulically calculated.

11.9.4 Protection

The back-siphonage prevention device incorporated in the flush valve shall be protected against interference and possible blockage.

11.9.5 Location

The flush valve shall be installed such as to place the outlet at a minimum of 450 mm above the rim of the pan.

11.9.6 Pressure and velocity limitations

Flushing valves shall only be installed where the pressure and flow is sufficiently high to effectively operate the valve and not interfere with the operation of any other appliances dependent on the pressure from the water supply.

11.9.7 Branch service pipe

For maintenance purposes, the branch service pipe to each flush valve or group of flush valves shall be provided with a stop valve.

SECTION 12 INSTALLATION OF WATER SUPPLY TO SPECIFIED FIXTURES

12.1 SCOPE OF SECTION

This Section specifies installation requirements for the connection of water supply to specified fixtures.

12.2 BIDET, BIDETTE AND TOILET SEAT DOUCHE

12.2.1 Bidets

A bidet shall be installed with a registered break tank or a testable device conforming to AS/NZS 2845.1 or AS 2845.2.

12.2.2 Bidette

A bidette shall be installed with a non-testable device or a 25 mm air gap.

12.2.3 Toilet seat douches

Where the douche outlet, in all positions, is at least 25 mm above the overflow level of the pan, backflow prevention is not required.

Where the douche outlet, in any position, is less than 25 mm above the overflow of the pan, a high-hazard backflow prevention device, conforming to AS/NZS 2845.1 or AS 2845.2, shall be installed. This device shall be either part of the douche or installed separately.

SECTION 13 PUMPS

13.1 SCOPE OF SECTION

This Section specifies requirements for the installation of pumps used in water services for buildings.

13.2 GENERAL

Where the available water supply cannot meet the minimum pressure and flow rates of Section 3, storage tanks and/or pumps shall be installed to achieve the pressure and flow rate demands in accordance with Section 3.

NOTE: Pumping directly from the water main is not permitted by some network utility operators.

13.3 CONTROL OF PUMPS

Pumps shall be controlled to limit the number of starts per hour to within the capacity of the pump.

13.4 INSTALLATION OF PUMPS

Pumps shall—

(a) have vibration eliminators at the base of the pump, on the suction side and the delivery side of the pump, so as to minimize the transmission of noise into the building structure and along the piping system and to prevent undue stress being placed on the pump;

(b) have isolation valves on the delivery side and suction side of the pump;

(c) have a non-return valve on the delivery side of the pump before the isolation valve;

(d) have pressure gauges on the inlet and outlet of the pump; and

(e) have unions or flanges to enable the pump's removal.

NOTES:

1 A restrictive device may be installed between the flanges at the outlet of the pump, or a suction storage tank may be provided.

2 Where it is intended to install a stand-by pump arrangement, the pumps should be electrically coupled in such a manner that each pump can operate individually but can be changed over for stand-by or alternative duty.

13.5 BOOSTER PUMPS

Booster pumps shall be wired electrically so that the operation of the pump is controlled by float switches or other devices located at the storage tank or pressure vessel. Booster pumps and their appurtenances shall be installed in such a manner as to be readily accessible.

SECTION 14 WATER REQUIREMENTS FOR HAEMODIALYSIS MACHINES

14.1 SCOPE OF SECTION

This Section specifies requirements for water services installed to supply haemodialysis machines.

NOTES:

1 Where it is intended to carry out any work in connection with water supply, water analysis samples should be obtained prior to installation in relation to the degree of hardness or amount of chlorine residual.

2 The network utility operator should be notified prior to connection of the machine to enable records to be kept and metallic notification disks to be fitted on all water main valves in the vicinity of the machine, to prevent or minimize disruption of the supply.

14.2 CONNECTION TO THE WATER SERVICE

A stop valve, strainer and backflow prevention device in accordance with Section 4 shall be installed at the connection of the water supply to the haemodialysis machine.

NOTE: For hazard rating of backflow prevention devices, see Table F1, Appendix F.

14.3 MAINTENANCE OF FLOW RATE

The water service to the haemodialysis machine shall be capable of maintaining the flow rate specified by the manufacturer of the haemodialysis machine during periods of peak demand.

14.4 WATER METERS

Where a water meter is installed, it shall be blue in colour denoting that a haemodialysis machine is connected to the water supply.

SECTION 15 PROPERTY WATER METERS

15.1 SCOPE OF SECTION

This Section specifies general requirements for the location, installation, electrical safety precautions and protection of property water meters.

NOTES:

1 Installation of a network utility operator's water meters should be undertaken in accordance with the network utility operator's requirements.

2 For electrical safety precaution and earthing, see Commentary C5.1 of Clause 5.1.

15.2 LOCATION OF WATER METERS

Water meters shall be—

(a) located so as to be accessible for reading, maintenance and removal;

(b) located in areas not susceptible to ponding;

(c) orientated horizontally, unless designed to operate otherwise; and

(d) positioned immediately downstream of the meter-isolating valve.

15.3 INSTALLATION INSIDE BUILDINGS

Where a water meter is installed inside a building and where water damage may result from the removal of the meter, an additional isolating valve shall be fitted adjacent to the meter outlet.

15.4 INSTALLATION BELOW GROUND

Water meters installed below ground shall be located in a meter box that has—

(a) a cover that can be removed; and

(b) a base that enables drainage.

15.5 PROTECTION FROM MECHANICAL DAMAGE

Where likely to be subject to mechanical damage, water meters shall be protected.

15.6 FROST PROTECTION

Water meters and meter assemblies located in frost-prone areas shall be protected against damage caused by freezing of water.

NOTE: Possible solutions include in-ground installation, or installation in an insulated enclosure.

SECTION 16 INSTALLATION OF WATER SUPPLY SYSTEM FROM RAINWATER TANKS

16.1 SCOPE OF SECTION

This Section specifies minimum requirements for the installation of a water supply system from a rainwater tank, where the tank is collecting water from roof catchments and is installed in an area where water from a network utility operator is provided to the property.

C16.1 *There are a number of authorities that should be consulted, particularly when the services are to be interconnected or where the water is to serve common fittings within the property. These authorities include the following:*

(a) The water supplier (network utility operator), which may determine the conditions to be met to allow connection of the rainwater system to their water supply (i.e. the minimum containment protection).

(b) The health authority, which determines water quality standards, and may set guidelines on the use of water from rainwater tanks. The health authority may also recommend against the use of rainwater tanks in certain areas due to pollution. Guidelines on the use of rainwater tanks have been developed by enHealth.

16.2 PIPES, VALVES AND FITTINGS

All pipes, valves and fittings within a water supply system from a rainwater tank shall be as specified in Section 2.

16.3 INSTALLATION

16.3.1 General

The water supply system from a rainwater tank shall be as specified in Section 5.

Backflow prevention shall be as specified in Section 4 or Clause 16.3.3.

NOTE: The network utility operator may require containment protection at the property boundary.

16.3.2 Additional marking and signage of pipework and outlets

16.3.2.1 *Pipework*

Pipework from a rainwater tank shall be clearly marked with the word ‘RAINWATER’ at intervals not exceeding 500 mm where concealed in walls, or 1 m where exposed or buried.

Marking shall be in accordance with AS 1345, and be—

(a) around the circumference at the above intervals; or

(b) longitudinally at the above intervals along the pipe.

NOTE: Labels or stickers marked to AS 1345 may be fixed to the pipe.

16.3.2.2 *Water outlets*

Water outlets shall be identified as ‘RAINWATER’ or, in the case of a rainwater tap, identified by a green coloured indicator with the letters ‘RW’.

NOTE: A typical sign is shown in Figure 16.3.2.2.

FIGURE 16.3.2.2 TYPICAL SIGN FOR RAINWATER OUTLETS

16.3.3 Connection between service pipes

Where a water supply system from a rainwater tank is connected with the water service from a network utility operator's water supply, the following applies:

(a) Backflow prevention shall be provided to protect the network utility operator's water supply.

(b) Where the rainwater is being used as a supply to a flushing device, either a low hazard backflow prevention device as shown in Figure 16.3.3 or a dual inlet cistern shall be provided.

(c) A device shall be provided on the pipeline from the rainwater tank to prevent water from the network utility operator's water supply flowing into the rainwater tank.

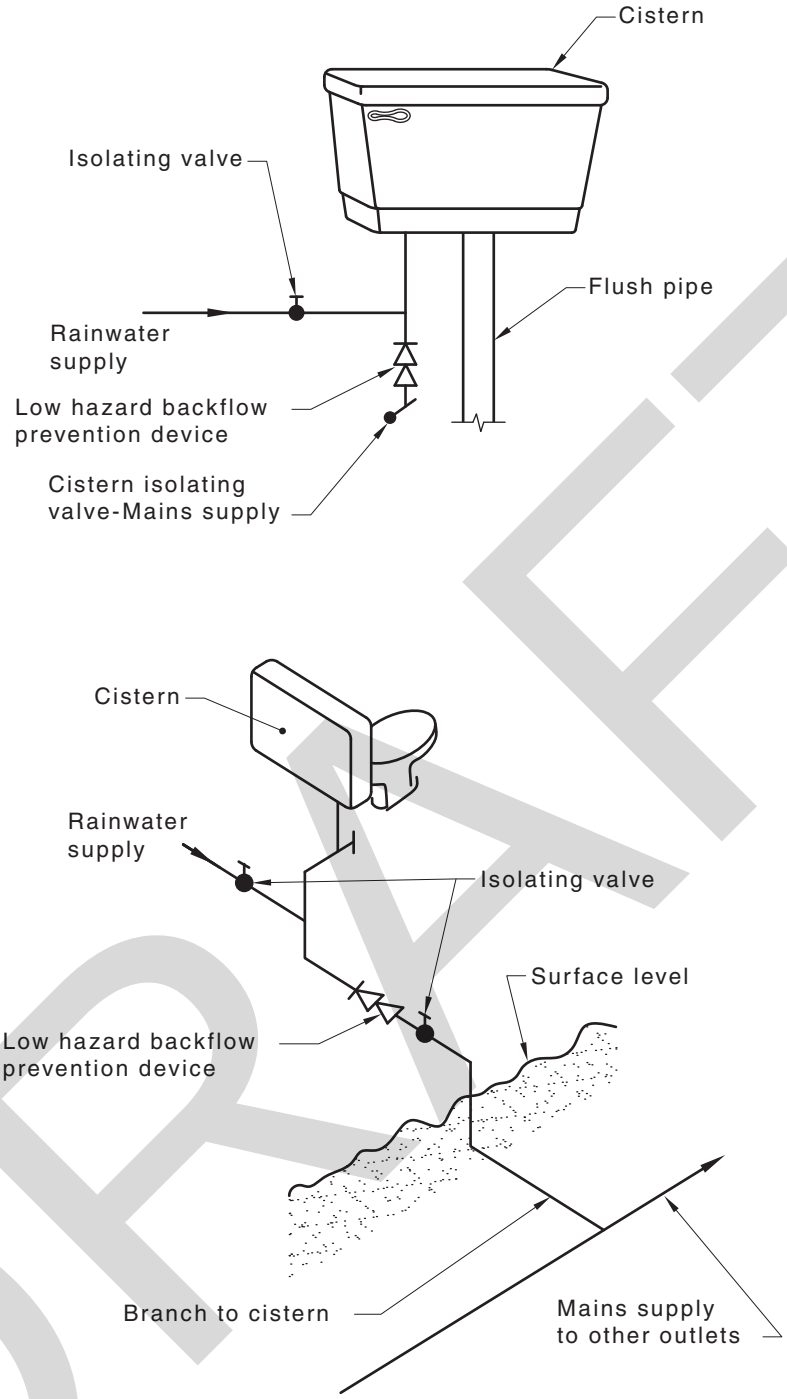


FIGURE 16.3.3 CONNECTION OF SERVICE PIPES AT CISTERNS

16.4 PROTECTION OF OTHER WATER SUPPLIES FROM RAINWATER

Where provision is made for augmentation of the rainwater supply by either top-up of the rainwater tank with water from another supply or by connection of another supply to any point downstream of the rainwater tank outlet, the installation shall include backflow protection in accordance with Section 4 and Table 16.4, to protect the other supply system.

NOTE: The other supply may be a drinking water supply or an alternative water supply.

TABLE 16.4

BACKFLOW PREVENTION—MINIMUM REQUIREMENTS FOR ZONE PROTECTION

Rainwater tank location	Protection on the supply pipe before tank for provision of top-up	Protection on the supply pipe before connection to tank outlet line	No top-up or connection
Buried	Testable device	Testable device	No backflow prevention device required
Partly buried	Non-testable device	Testable device	No backflow prevention device required
Above ground	Non-testable device	Non-testable device	No backflow prevention device required

NOTES:

1 A rainwater tank without an overflow conforming to Section 8 shall have a testable device.

2 The selection of the backflow prevention device should be determined based on the level of hazard in the immediate environment (see Table 4.4.1).

16.5 TESTING AND COMMISSIONING A RAINWATER SYSTEM

16.5.1 Flushing and testing

Prior to use, the rainwater service shall be—:

(a) flushed in accordance with Clause 18.2; and

(b) hydrostatically tested in accordance with Clause 18.3.

16.5.2 Commissioning a rainwater system

Rainwater system shall be commissioned, as follows:

(a) Turn on the drinking water supply and rainwater water supply (if installed) at the meter or isolation valve.

(b) Turn off the rainwater water supply at the meter or isolation valve.

(c) Turn on all tapware (*both heated and cold*) and appliances one by one. Ensure water is flowing from all tapware and appliances.

(d) Flush all toilets. The toilets shall not refill (provided they are connected to the rainwater system).

(e) Turn on all external hose tap outlets. Water shall flow continuously from the drinking water hose tap outlets with the rainwater service running dry.

(f) Turn the rainwater system tap back on slowly so that all air will be purged from the pipeline while it is being recharged.

NOTE:The commissioning process may be repeated for the drinking water supply. This process is as follows:

(a) Turn off the drinking water supply at the meter or isolation valve.

(b) Turn on the rainwater water supply at the meter of isolation valve.

(c) Turn on all heated and cold tapware, including appliances one by one.

(d) Check that tap outlets and appliances have run dry.

(e) Flush all toilets. Check that the toilet cisterns have refilled after flushing.

(f) Turn on all external hose taps.

(g) Check that the drinking water taps have run dry.

(h) Check that the rainwater water taps are flowing continuously.

(i) Turn the drinking water supply back on slowly so that all air will be purged from the pipeline while it is being recharged.

SECTION 17 MULTI-UNIT DEVELOPMENTS

17.1 SCOPE OF SECTION

This Section specifies minimum requirements for main lines of water services located within common property of a multi-unit development of 20 or more residential buildings up to three storeys in height.

17.2 METHODS OF DESIGN AND INSTALLATION

Design and installation of the main lines of the water service shall conform to—

(a) WSA 03, *Water Supply Code of Australia*; or

(b) this Standard including Clauses 17.3 to 17.5.

17.3 DIVISION OF DEVELOPMENT

The development shall be divided into zones where the number of allotments within a zone affected by any shut-off at the main lines of the water service shall not exceed 40. The dividing or isolation valves that are fitted to the main line itself shall be at intervals not exceeding 300 m.

17.4 RING MAINS AND FLUSHING POINTS

To maintain circulation of water, the main lines of the water service shall form a ring main or be provided, at surface level, with flushing points at any dead end of the main line of the water service.

17.5 FIRE SERVICES

External fire hydrants shall be located in accordance with AS 2419.1.

SECTION 18 TESTING AND COMMISSIONING

18.1 SCOPE OF SECTION

This Section specifies requirements for testing and commissioning a water service.

18.2 FLUSHING

At the completion of the water service installation and prior to hydrostatic testing, the system shall be thoroughly flushed to remove any foreign matter. The flushing shall be undertaken in accordance with Paragraph I3, Appendix I, and continue until the flushed water runs completely clear. The system shall then be pressure-tested in accordance with Clause 18.3.1.

The water service used to supply drinking water shall be protected against contamination in accordance with Appendix H and Appendix I.

NOTE: For testing and commissioning non-drinking water services, see also Section 9.

18.3 TESTING

18.3.1 Hydrostatic test

Water services shall not show any leakage when subjected to a hydrostatic pressure of 1500 kPa for a period of not less than 30 min.

The test shall be performed on installed piping prior to burial or concealment. In the case of pipe systems with elastomeric seals, the piping shall be backfilled leaving the joints exposed until completion of the test.

NOTES:

1 When a pressure test is carried out, it may be necessary to disconnect and cap the water service to isolate it from the water main, fixtures and appliances, which may be damaged by the test pressure applied.

2 Fire services are subject to individual testing by some network utility operators at a higher pressure and for varied periods of time.

18.3.2 Storage tanks (except rainwater tanks)

Storage tanks (except rainwater tanks) shall be filled until they overflow for a period of not less than 1 min. The overflow shall discharge in accordance with Clause 8.4.4.2.

Conformance to the air gap criteria shall be verified [see Clause 4.6.3.2(a)].

18.4 CLEANING AND DISINFECTION OF DRINKING WATER STORAGE TANKS

The disinfection of drinking water storage tanks shall be carried out in accordance with Appendix H.

18.5 DISINFECTION OF WATER SERVICES

The disinfection of water services shall be carried out in accordance with Appendix I.

18.6 COMMISSIONING

At the completion and testing of the water service, the operation of all valves, cisterns, taps, pressure-relief valves and other components shall be checked to confirm their correct performance.

APPENDIX A

EQUIVALENT PIPE SIZES

(Normative)

This Appendix provides tables for selecting the appropriate pipe nominal diameter (DN), based on internal diameter for different pipe materials and types, standard dimension ratios (SDRs) or pressure classes, as marked on the pipe. The equivalent pipe DN for different materials shall be determined using Tables A1, A2, A3, A4 and A5.

Multilayer pipes and ABS pipes are not covered by this Appendix.

For multilayer pipes, and ABS pipes, the equivalent pipe DN shall be selected on the basis of the internal diameters specified by the pipe supplier.

NOTES:

1 Standard dimension ratio (SDR)—Plastic pipes may be categorized by their SDR value. It is the ratio of the nominal outside diameter of the pipe to its nominal wall thickness, SDR = DN/T. SDR values are printed onto pipes and can be obtained from the pipe manufacturer.

2 Values in the tables were calculated from the values for maximum outside diameter and minimum wall thickness as specified in the respective pipe product Standards as follows:

(a)	AS 1432	Copper (Australia)
(b)	NZS 3501	Copper (New Zealand)
(c)	AS/NZS 2492	PE-X
(d)	AS 5082.1	PB (metric series)
(e)	AS/NZS 2642.2	PB (imperial series)
(f)	AS/NZS 4130	PE
(g)	AS/NZS 1477	PVC-U
(h)	AS/NZS 4765	PVC-M
(i)	AS/NZS 4441	PVC-O
(j)	ISO 15874.2	PP-R
(k)	AS 5200.053	Stainless steel

3 For pipes made to Standards not listed in Note 2, see the relevant Standards listed in AS 5200.000.

TABLE A1

INTERNAL DIAMETERS FOR COPPER PIPES AND TUBES

DN	Copper (Australia)			Copper (New Zealand)
	Type A	Type B	Type C	
	mm	mm	mm	mm
10	7.5	7.7	8.1	9.5
15	10.7	10.9	11.3	12.7
18	13.4	13.8	14.1	—
20	16.2	17.0	17.2	19.0
25	22.1	23.0	23.6	25.4
32	28.5	29.3	—	31.8
40	34.8	35.7	—	38.1
50	47.5	48.4	—	50.8
65	60.2	61.1	—	63.5
80	72.1	72.9	—	76.2
90	85.8	85.6	—	88.9
100	97.5	98.3	—	101.6
125	122.9	123.7	—	127.0
150	147.1	148.3	—	152.4
200	197.9	199.1	—	188.5

TABLE A2

INTERNAL DIAMETERS FOR STAINLESS STEEL PIPES AND TUBES

DN	Stainless Steel Pipes as per ASME B36.19M		Stainless Steel Tubes as per EN 10312
	Schedule 5S	Schedule 10S	Series 2
	mm	mm	mm
15	18.0	17.1	13.0
18	—	—	16.0
20	23.4	22.5	19.6
25	30.1	27.9	25.6
32	38.9	36.6	32.0
40	45.0	42.7	39.0
50	57.0	54.8	51.0
65	68.8	66.9	72.1
80	84.7	82.8	84.9
100	110.1	108.2	104.0
125	135.8	134.5	—
150	162.8	161.5	—
200	213.6	211.6	—

TABLE A3
INTERNAL DIAMETERS FOR POLYOLEFIN PIPES

PE, PE-X, PP, R, PB (metric)			
DN	SDR 11	SDR 9	SDR 7.4
	mm	mm	mm
16	13.1	12.3	11.9
20	16.5	15.7	14.7
25	20.7	19.7	18.3
32	26.5	25.1	23.5
40	33.0	31.4	29.4
50	41.2	39.3	36.7
63	52.0	49.4	46.4
75	62.1	58.6	55.1
90	74.5	70.7	66.3
110	91.0	86.4	80.8
125	103.4	98.2	92.0
140	115.9	109.9	102.9
160	132.3	125.7	117.1
180	148.9	141.5	132.5
200	165.4	157.0	147.2

TABLE A4
INTERNAL DIAMETERS FOR PVC-U PIPES

	PVC-U		
DN	PN12	PN15	PN18
	mm	mm	mm
10	—	—	14.5
15	—	18.7	18.3
20	24.1	23.5	22.9
25	30.3	29.5	28.7
32	38.0	37.0	36.0
40	43.4	42.2	41.2
50	54.3	52.9	51.3

TABLE A5
INTERNAL DIAMETERS FOR IMPERIAL PB PIPES

PB (imperial)	
Nominal outside diameter	Internal diameter for Class 16 pipe
mm	mm
15	9.6
18	12.8
22	18.1
28	22.8

APPENDIX B

ACCEPTABLE PIPES AND FITTINGS

(Normative)

The following pipes and fittings are acceptable solutions subject to the limitations of Clause 2.4:

(a) Acrylonitrile butylene styrene (ABS) in accordance with AS/NZS 3518.

(b) Cast iron fittings (grey cast iron) in accordance with AS/NZS 2544.

(c) Copper pipes and fittings in accordance with AS 1432 (A, B or C) or NZS 3501 (water pipes).

(d) Copper alloy pipes in accordance with AS 3795.

(e) Copper and copper alloy fittings in accordance with AS 3688.

(f) Ductile iron pipes and fittings in accordance with AS/NZS 2280.

(g) Galvanized steel pipes and fittings in accordance with AS 1074, or NZS BS 1387, or AS 4728 and AS/NZS 4792 HDG300.

(h) Polybutylene (PB) pipes and fittings in accordance with AS/NZS 2642.2, AS/NZS 2642.3, AS 5082.1 and AS 5082.2.

(i) Polyethylene (PE) pipes and fittings in accordance with AS/NZS 4130 and AS/NZS 4129.

(j) Cross-linked polyethylene (PE-X) pipes and fittings in accordance with AS/NZS 2492 and AS/NZS 2537 (series).

(k) Multilayer pipes in accordance with AS 4176 (series).

(l) Unplasticized polyvinyl chloride (PVC-U) pipes and fittings in accordance with AS/NZS 1477.

(m) Modified polyvinyl chloride (PVC-M) pipes and fittings in accordance with AS/NZS 4765.

(n) Oriented polyvinyl chloride (PVC-O) pipes and fittings in accordance with AS/NZS 4441.

(o) Chlorinated polyvinyl chloride (PVC-C) pipes and fittings in accordance with ASTM D2846. (The use of PVC-C in Australia is currently restricted to use in fire services).

(p) Stainless steel (SS) pipes and fittings in accordance with AS 5200.053.

(q) Polypropylene (PP) pipes and fittings in accordance with ISO 15874 (series).

NOTE: See also Clause 2.2.

APPENDIX C

SIZING METHOD FOR SUPPLY PIPING FOR DWELLINGS

(Informative)

C1 GENERAL

The sizing method given in this Appendix may be used as an alternative to a full hydraulic calculation for the rapid sizing of piping, using the probable simultaneous demand (PSD) values given in Table 3.2.3.

The probable simultaneous flow rates given in Table C1 have been calculated from the following equations:

$$Q = 3.637 \times 10^{-5} \ H^{0.555} \ D^{2.667} \quad \ldots \text{C1}$$

where

Q = flow rate, in litres per second (see Note)

D = pipe internal diameter, in millimetres

H = head loss gradient, in metres per 100 m

$$= \frac{h \times 100}{L \times 1.5}$$

where

h = head loss, in metres head

L = index length, in metres

1.5 is a factor to allow for the additional head loss through fittings

Conversion factors: 1 kPa = 0.102 m head, 1 m head = 9.8 kPa

NOTE: Where velocity would have exceeded the design maximum of 3.0 m/s (see Clause 3.4), the flow rates in Table C1 have been reduced to limit the velocity to 3.0 m/s.

C2 PROCEDURE

The procedure is as follows:

Step 1 Draw a sketch of the installation (see Figure C1).

Step 2 Determine the index length. This is the distance, in metres, from the point where the minimum available pressure head is known (e.g. at main tapping or at meter location) to the most distant fixture outlet in the building. This is the only pipe length used for sizing each pipe section.

Step 3 Determine the pressure drop, in metres head, along the index length using the following equation:

$$\text{Pressure drop} = H_m - H_s - H_x \quad \ldots \text{C2}$$

where

H_m = minimum head available, in metres head

H_s = height of highest fixture outlet (static head loss), in metres

H_x = minimum head required at any fixture outlet, in metres head

NOTE: Clause 3.3.2 requires a minimum value of 5 m head; however, some special appliances may require a larger value for satisfactory operation.

Step 4 Draw up a table with the following headings:

Pipe section	Probable simultaneous demand	Nominal pipe size
	L/s	DN

Step 5 For each pipe section find the appropriate probable simultaneous demand (PSD) value from Table 3.2.3 and enter the value on Figure C1 (e.g. three dwellings require 0.88 L/s).

Step 6 Enter each pipe section to be sized into the table (see Step 4) with the appropriate probable simultaneous demand (PSD) value for this pipe section.

Step 7 Select the appropriate sizing table corresponding to the pressure drop calculated in Step 3. If the pressure drop falls between two tables use the table for the lower pressure drop. If the pressure drop calculated in Step 3 is greater than 35 m, use the 35 m table.

Step 8 Select the index length column that is equal to or greater than the index length calculated in Step 2.

Step 9 Follow down this column until a probable simultaneous flow rate (PSFR) equal to or greater than the value required for each pipe section is reached. The size of the pipe required is found by reading across this line to the first column marked ‘DN’.

NOTE: Flow rates in these tables have been adjusted, where required, to limit water velocity to a maximum of 3.0 m/s.

Step 10 Enter the size of pipe in the table (Step 4) and continue through Steps 9 and 10 for each pipe section.

C3 WORKED EXAMPLE

Sizing of the external piping for a group of 12 villa-style home units arranged in three buildings each containing four units on a steeply sloping site.

The minimum available pressure at the main tapping is 30 m head, and the furthest fixture outlet is 13 m above the main. The length of internal piping to this most remote outlet in Unit 12 is 11 m.

Step 1 Sketch of installation

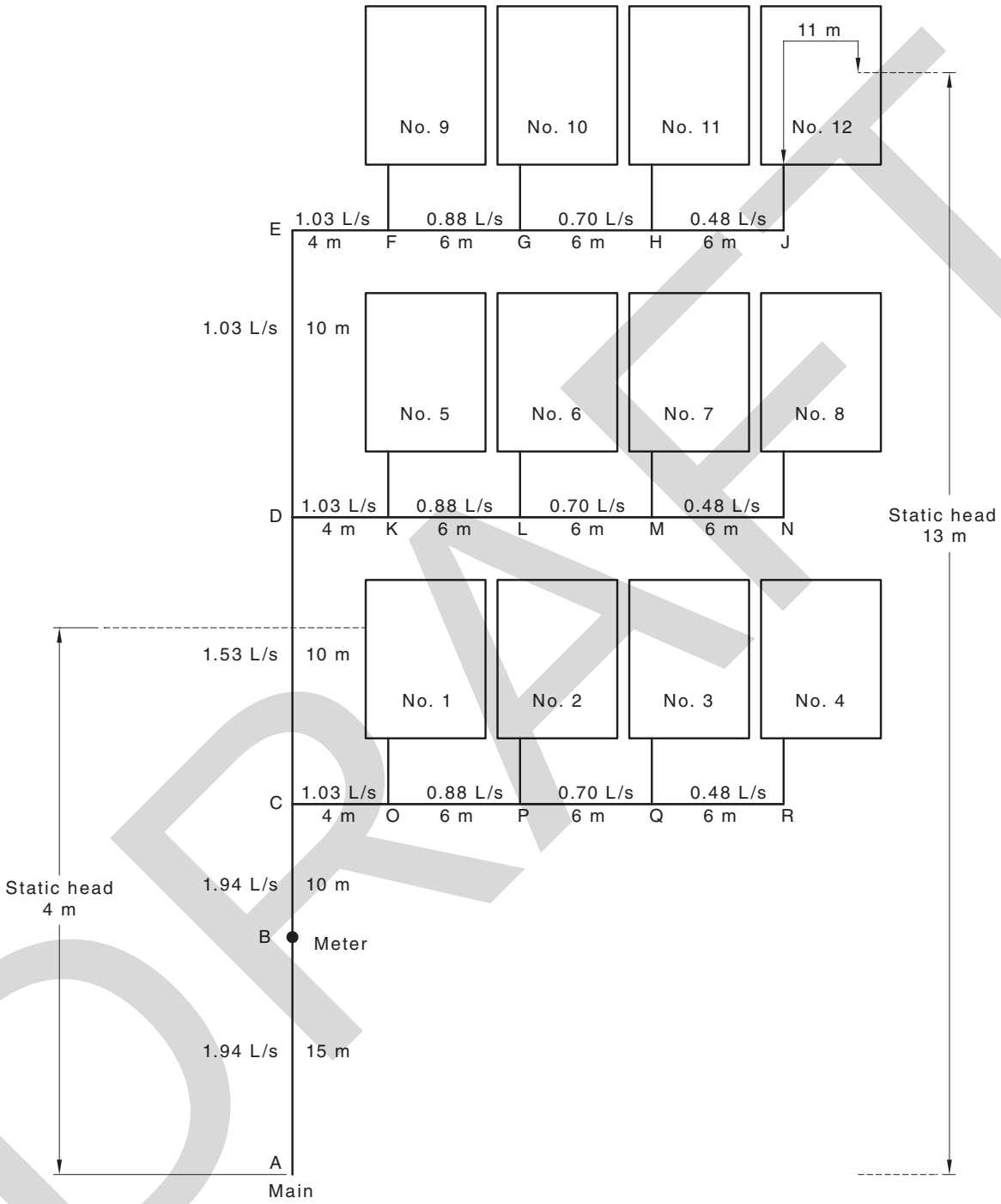


FIGURE C1 SKETCH OF INSTALLATION

Step 2 Index length = AB + BC + CD + DE + EF + FG + GH + HJ + (distance from point J to the most remote fixture)

= 15 + 10 + 10 + 10 + 4 + 6 + 6 + 6 + 11

= 78 m

Step 3 The minimum head available at the main is 30 m head. The height of the highest fixture outlet in Unit 12 is 13 m above the main therefore:

Pressure drop = $H_m - H_s - H_x$

= 30 – 13 – 5

= 12 m head

Step 4

	Pipe section	Probable simultaneous demand (PSD) (see Table 3.2.3)	Nominal pipe size
		L/s	DN
Steps 5 and 6	JH, NM, RQ	0.48	25 Step 10
	HG, ML, QP	0.70	32
	GF, LK, PO	0.88	32
	FE, KD, OC	1.03	40
	ED	1.03	40
	DC	1.53	40
	CB	1.94	50
	BA	1.94	50

Step 7 The pressure drop of 12 m head falls between the 10 m and 15 m head pressure drop tables. Therefore, use 10 m head table.

Step 8 Index length = 78 m, so use 80 m column.

Step 9 For pipe sections JH, NM and RQ the required probable simultaneous flow rate (PSFR) value is 0.48 L/s. The next largest value in the 80 m column is 0.50 L/s and this corresponds to pipe size DN 25 (see Table C1).

Step 10 Enter value of DN 25 in table above and using the same values of pressure drop and index length, proceed to size each other pipe section and enter size in the table.

TABLE C1
PIPE SIZING FOR MAXIMUM VELOCITY OF 3 m/s

PRESSURE DROP = 4 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.08	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
15	0.19	0.13	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
18	0.36	0.25	0.20	0.17	0.15	0.14	0.12	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.05
20	0.63	0.43	0.34	0.29	0.26	0.23	0.22	0.20	0.19	0.18	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.10	0.09
25	1.24	0.96	0.77	0.65	0.58	0.52	0.48	0.44	0.42	0.39	0.35	0.33	0.30	0.28	0.27	0.25	0.24	0.23	0.22	0.21	0.21
32	2.02	1.84	1.47	1.25	1.11	1.00	0.92	0.85	0.80	0.75	0.68	0.62	0.58	0.54	0.51	0.49	0.46	0.44	0.43	0.41	0.39
40	3.00	3.00	2.47	2.11	1.87	1.69	1.55	1.44	1.35	1.27	1.15	1.05	0.98	0.92	0.86	0.82	0.78	0.75	0.72	0.69	0.67
50	5.51	5.51	5.51	4.77	4.21	3.80	3.49	3.24	3.03	2.86	2.59	2.37	2.21	2.07	1.95	1.85	1.76	1.68	1.62	1.56	1.50
65	8.78	8.78	8.78	8.78	7.85	7.05	6.50	6.03	5.65	5.33	4.82	4.42	4.11	3.85	3.63	3.44	3.28	3.14	3.01	2.90	2.80
80	12.54	12.54	12.54	12.54	12.54	11.34	10.44	9.69	9.08	8.57	7.74	7.11	6.60	6.18	5.83	5.53	5.27	5.04	4.84	4.66	4.49
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	21.50	20.16	19.00	17.17	15.77	14.64	13.71	12.94	12.27	11.69	11.18	10.73	10.33	9.97

PRESSURE DROP = 6 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.10	0.07	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
15	0.24	0.16	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04
18	0.45	0.31	0.25	0.21	0.19	0.17	0.16	0.14	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.07
20	0.68	0.54	0.43	0.37	0.32	0.29	0.27	0.25	0.23	0.22	0.20	0.18	0.17	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.12
25	1.24	1.20	0.96	0.82	0.72	0.65	0.60	0.56	0.52	0.49	0.44	0.41	0.38	0.35	0.33	0.32	0.30	0.29	0.28	0.27	0.26
32	2.02	2.02	1.83	1.57	1.39	1.25	1.15	1.07	1.00	0.94	0.85	0.78	0.73	0.68	0.64	0.61	0.58	0.55	0.53	0.51	0.49
40	3.00	3.00	3.00	2.65	2.34	2.11	1.94	1.80	1.69	1.59	1.44	1.32	1.23	1.15	1.08	1.03	0.98	0.94	0.90	0.86	0.83
50	5.51	5.51	5.51	5.51	5.28	4.74	4.37	4.06	3.80	3.58	3.24	2.97	2.76	2.59	2.44	2.31	2.21	2.11	2.02	1.95	1.88
65	8.78	8.78	8.78	8.78	8.78	8.78	8.13	7.55	7.08	6.68	6.03	5.54	5.14	4.82	4.54	4.31	4.11	3.93	3.77	3.63	3.50
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.13	11.38	10.72	9.69	8.90	8.26	7.74	7.30	6.93	6.60	6.31	6.06	5.83	5.63
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	21.50	19.74	18.34	17.17	16.20	15.36	14.64	14.00	13.44	12.94	12.48

(*continued*)

TABLE C1 (*continued*)

PRESSURE DROP = 8 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate (L/s)**																				
10	0.11	0.08	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
15	0.28	0.19	0.15	0.13	0.12	0.10	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04
18	0.45	0.36	0.29	0.25	0.22	0.20	0.18	0.17	0.16	0.15	0.14	0.12	0.12	0.11	0.10	0.09	0.09	0.09	0.08	0.08	0.08
20	0.68	0.63	0.51	0.43	0.38	0.34	0.32	0.29	0.27	0.26	0.23	0.22	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14
25	1.24	1.24	1.12	0.96	0.85	0.77	0.70	0.65	0.61	0.58	0.52	0.48	0.44	0.42	0.39	0.37	0.35	0.34	0.33	0.31	0.30
32	2.02	2.02	2.02	1.84	1.62	1.47	1.35	1.25	1.17	1.11	1.00	0.92	0.85	0.80	0.75	0.71	0.68	0.65	0.62	0.60	0.58
40	3.00	3.00	3.00	3.00	2.74	2.40	2.27	2.11	1.98	1.87	1.69	1.55	1.44	1.35	1.27	1.20	1.15	1.10	1.05	1.01	0.98
50	5.51	5.51	5.51	5.51	5.51	5.51	5.12	4.75	4.41	4.21	3.80	3.49	3.24	3.03	2.86	2.72	2.59	2.47	2.37	2.29	2.21
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.31	7.82	7.07	6.45	6.03	5.65	5.33	5.06	4.82	4.61	4.42	4.26	4.11
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	11.36	10.43	9.69	9.08	8.57	8.12	7.74	7.40	7.11	6.84	6.60
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	21.50	20.15	19.00	18.02	17.17	16.43	15.77	15.17	14.64

PRESSURE DROP = 10 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.13	0.09	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
15	0.28	0.22	0.17	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05
18	0.45	0.42	0.33	0.28	0.25	0.22	0.21	0.19	0.18	0.17	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.10	0.10	0.09	0.09
20	0.68	0.68	0.57	0.49	0.43	0.39	0.36	0.33	0.31	0.29	0.27	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.17	0.16	0.15
25	1.24	1.24	1.24	1.09	0.96	0.87	0.80	0.74	0.69	0.65	0.59	0.54	0.50	0.47	0.44	0.42	0.40	0.38	0.37	0.35	0.34
32	2.02	2.02	2.02	2.02	1.84	1.66	1.53	1.42	1.33	1.25	1.13	1.04	0.96	0.90	0.85	0.81	0.77	0.74	0.71	0.68	0.66
40	3.00	3.00	3.00	3.00	3.00	2.80	2.57	2.39	2.24	2.11	1.91	1.75	1.63	1.52	1.44	1.36	1.30	1.24	1.19	1.15	1.11
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	5.05	4.75	4.30	3.95	3.67	3.44	3.24	3.07	2.93	2.80	2.60	2.59	2.50
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.01	7.35	6.83	6.40	6.03	5.72	5.45	5.22	5.01	4.82	4.65
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	11.82	10.98	10.28	9.70	9.20	8.76	8.38	8.04	7.74	7.47
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	21.50	20.40	19.45	18.60	17.85	17.17	16.47

(*continued*)

TABLE C1 (*continued*)

PRESSURE DROP = 15 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.11	0.09	0.07	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02
15	0.28	0.27	0.22	0.19	0.16	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06
18	0.45	0.45	0.41	0.35	0.31	0.28	0.26	0.24	0.22	0.21	0.19	0.18	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.12	0.11
20	0.68	0.68	0.68	0.61	0.54	0.49	0.45	0.42	0.39	0.37	0.33	0.30	0.28	0.27	0.25	0.24	0.23	0.22	0.21	0.20	0.19
25	1.24	1.24	1.24	1.24	1.20	1.08	0.99	0.93	0.87	0.82	0.74	0.68	0.63	0.59	0.56	0.53	0.50	0.48	0.46	0.44	0.43
32	2.02	2.02	2.02	2.02	2.02	2.02	1.91	1.77	1.65	1.57	1.42	1.30	1.21	1.13	1.07	1.01	0.96	0.92	0.89	0.85	0.82
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.81	2.64	2.39	2.19	2.04	1.91	1.80	1.71	1.63	1.56	1.49	1.44	1.39
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	4.91	4.59	4.30	4.06	3.85	3.67	3.51	3.37	3.24	3.13
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.56	8.01	7.55	7.16	6.83	6.53	6.27	6.03	5.82
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.14	11.51	11.00	10.50	10.07	9.69	9.35
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.35	21.52	20.75

PRESSURE DROP = 20 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.13	0.10	0.09	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
15	0.28	0.28	0.25	0.22	0.19	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07
18	0.45	0.45	0.45	0.41	0.36	0.33	0.30	0.28	0.26	0.25	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14	0.13
20	0.68	0.68	0.68	0.68	0.63	0.57	0.53	0.49	0.46	0.43	0.39	0.36	0.33	0.31	0.29	0.28	0.27	0.25	0.24	0.23	0.23
25	1.24	1.24	1.24	1.24	1.24	1.24	1.17	1.08	1.00	0.96	0.87	0.80	0.74	0.69	0.65	0.62	0.59	0.56	0.54	0.52	0.50
32	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	1.94	1.84	1.66	1.53	1.42	1.33	1.25	1.19	1.13	1.08	1.04	1.00	0.96
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.80	2.56	2.39	2.24	2.11	2.00	1.91	1.83	1.75	1.69	1.63
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	5.04	4.76	4.51	4.30	4.12	3.95	3.80	3.67
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.40	8.01	7.66	7.35	7.08	6.83
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.31	11.82	11.38	10.97
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78

(*continued*)

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TABLE C1 (*continued*)

PRESSURE DROP = 25 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.14	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
15	0.28	0.28	0.28	0.25	0.22	0.20	0.18	0.17	0.16	0.15	0.13	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08	0.08
18	0.45	0.45	0.45	0.45	0.41	0.37	0.34	0.32	0.30	0.28	0.25	0.23	0.22	0.20	0.19	0.18	0.17	0.17	0.16	0.15	0.15
20	0.68	0.68	0.68	0.68	0.68	0.64	0.59	0.55	0.52	0.49	0.44	0.40	0.38	0.35	0.33	0.31	0.30	0.29	0.28	0.27	0.26
25	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.23	1.15	1.08	0.98	0.90	0.84	0.78	0.74	0.70	0.67	0.64	0.61	0.59	0.57
32	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	1.88	1.71	1.60	1.50	1.42	1.34	1.28	1.23	1.18	1.13	1.09
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.90	2.70	2.53	2.40	2.27	2.16	2.07	1.98	1.91	1.84
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	5.11	4.87	4.65	4.47	4.30	4.15
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.67	8.32	8.00	7.73
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.42
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78

PRESSURE DROP = 30 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.14	0.13	0.11	0.10	0.09	0.08	0.07	0.07	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03
15	0.28	0.28	0.28	0.27	0.24	0.22	0.20	0.19	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.09
18	0.45	0.45	0.45	0.45	0.45	0.41	0.38	0.35	0.33	0.31	0.28	0.26	0.24	0.22	0.21	0.20	0.19	0.18	0.18	0.17	0.16
20	0.68	0.68	0.68	0.68	0.68	0.68	0.66	0.61	0.56	0.54	0.49	0.45	0.42	0.39	0.37	0.35	0.33	0.32	0.30	0.29	0.28
25	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.20	1.08	0.99	0.93	0.87	0.82	0.78	0.74	0.71	0.68	0.65	0.63
32	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	1.90	1.77	1.66	1.57	1.49	1.42	1.36	1.30	1.25	1.21
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.80	2.64	2.51	2.39	2.29	2.19	2.11	2.04
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.39	5.15	4.94	4.76	4.59
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.55
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78

(*continued*)

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TABLE C1 (*continued*)

PRESSURE DROP = 35 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.14	0.14	0.12	0.10	0.09	0.09	0.08	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04
15	0.28	0.28	0.28	0.28	0.26	0.24	0.23	0.20	0.19	0.18	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.09
18	0.45	0.45	0.45	0.45	0.45	0.45	0.41	0.38	0.36	0.34	0.31	0.28	0.26	0.24	0.23	0.22	0.21	0.20	0.19	0.18	0.18
20	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.66	0.62	0.58	0.53	0.49	0.45	0.42	0.40	0.38	0.36	0.35	0.33	0.32	0.31
25	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.18	1.09	1.01	0.94	0.89	0.84	0.80	0.77	0.74	0.71	0.69
32	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	1.93	1.81	1.70	1.62	1.54	1.48	1.42	1.36	1.32
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.88	2.73	2.60	2.49	2.39	2.30	2.22
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	5.18	5.00
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78

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APPENDIX D

SIZING OF PIPING FOR DWELLINGS

(Informative)

D1 GENERAL

This Appendix provides a method for sizing of piping for the supply of water to single or multiple dwellings and uses the probable simultaneous demand (PSD) values provided in Table 3.2.3.

The method given in this Appendix may also be used to size the piping within the dwelling using the concept of loading units. Each branch pipe within the dwelling is assigned a number of loading units, depending on the number and type of fixture outlets it serves. Loading units corresponding to fixtures and appliances are given in column 4 of Table 3.2.1. A table for converting loading units (LU) to probable simultaneous flow rate (PSFR) is given in Table 3.2.4.

D2 PROCEDURE

The procedure is as follows:

Step 1 Draw a sketch of the internal piping (see Figure D1) showing the location of each fixture or appliance together with its appropriate loading units.

Step 2 Determine the index length. This is the distance, in metres, from the point in the supply line where the minimum available pressure head is known (e.g. main tapping or meter position) to the most distant outlet within the dwelling.

Step 3 Determine the pressure drop, in metres head, across this index length using the following equation:

$$\text{Pressure drop} = H_m - H_s - H_x$$

where

H_m = minimum available head, in metres head

H_s = height of the highest outlet within the dwelling, in metres

H_x = minimum head required at any fixture outlet, in metres head

NOTE: In the case of multistorey residential dwellings, the index length and pressure drop may be different for each dwelling; however, it may not be necessary to individually size each dwelling where the index lengths and pressure drops are similar for a group of dwellings.

Step 4 Draw up a table with the following headings:

Pipe section	Loading units	Probable simultaneous flow rate (PSFR)	Nominal pipe size
		L/s	DN

Step 5 For each pipe section within the dwelling determine the PSFR for that section using the following rules:

(a) If it supplies only one fixture outlet, the PSFR is the minimum flow rate for that fixture or appliance given in column 2 of Table 3.2.1.

(b) If it supplies more than one fixture outlet, sum the loading units served by this pipe section and then read off the PSFR corresponding to the total loading units carried from Table 3.2.4.

Step 6 Enter each pipe section to be sized in your table (see Step 4) with the appropriate loading units and PSFR values. Once the estimated PSFR value is obtained, the pipe size for each section is obtained from Table C1, Appendix C, using Steps 7 to 10 of Paragraph C2, Appendix C.

NOTE: The flow rates in Table C1, Appendix C, have been adjusted, where necessary, to limit the velocity to a maximum of 3.0 m/s.

D3 WORKED EXAMPLE

A worked example for the sizing of the internal pipework within Units 1 and 12 of the installation used in the example given in Appendix C is shown below.

Step 1

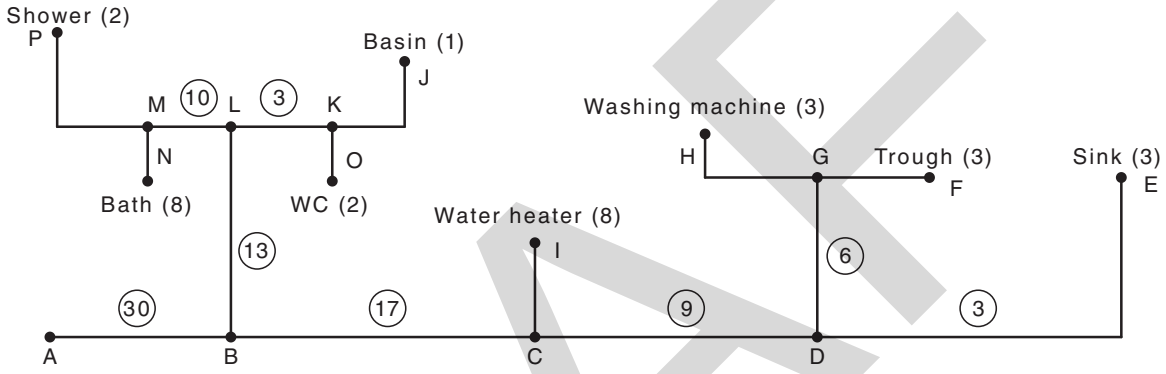


FIGURE D1 SKETCH OF INSTALLATION

	UNIT 1	UNIT 12
Step 2	Index length	Index length
	= 15 + 10 + 4 + 11	= 15 + 10 + 10 + 10 + 4 + 6 + 6 + 6 + 11
	= 40 m	= 78 m
Step 3	The height of the highest outlet in Unit 1 is found to be 4 m above the main. Therefore, the static head loss (H_s) is 4 m head	
	Pressure drop	*Pressure drop*
	$= H_m - H_s - H_x$	$= H_m - H_s - H_x$
	= 30 – 4 – 5	= 30 – 13 – 5
	= 21 m head	= 12 m head

Step 4

Pipe section		Loading units	PSFR, L/s	Nominal pipe size, DN	
Section		Units	(L/s)	Unit 1	Unit 12

Step 5 Pipe section ED serves one outlet (sink with standard tap). Hence PSFR is 0.12 L/s as per Table 3.2.1, column 2. Pipe section GD serves both washing machine and tub (H,F). Hence total loading units are 6 (3 + 3) and PSFR corresponding to 6 loading units is 0.20 L/s as per Table 3.2.4, column 2. Each pipe section is dealt with in turn, proceeding in the opposite direction to the water flow.

Step 6 Completed table is shown at the end of this example (Step 10).

	UNIT 1	**UNIT 12**
Step 7	Pressure drop is 21 m head, so use the 20 m head table.	Pressure drop is 12 m head, so use the 10 m head table.
Step 8	Use 40 m column	Use 80 m column.
Step 9	For section ED, the PSFR is 0.12 L/s and this corresponds to a pipe size of at least DN 15.	For Section ED, the PSFR is 0.12 L/s, and this corresponds to a pipe size of at least DN 18.

Step 10

Pipe section	**Loading units (see Table 3.2.4)**	**PSFR, L/s (see Tables 3.2.1 and 3.2.4)**	**Nominal pipe size, DN**	
			Unit 1	**Unit 12**
ED	*	0.12	15	18
FG	*	0.12	15	18
HG	*	0.20	18	20
GD	6	0.20	18	20
DC	9	0.25	18	25
IC	*	0.20	18	20
CB	17	0.35	20	25
JK	*	0.10	15	18
OK	*	0.10	15	18
KL	3	0.14	15	20
PM	*	0.10	15	18
NM	*	0.30	20	25
ML	10	0.26	18	25
LB	13	0.30	20	25
BA	30	0.47	20	25

* One outlet only

NOTES:

1 If the pipe supplies only one fixture outlet, the PSFR is the minimum flow rate for that fixture or appliance given in column 2 of Table 3.2.1.

2 If the pipe supplies more than one fixture outlet, sum the loading units served by this pipe section and then read off the PSFR corresponding to the total loading units carried from Table 3.2.4.

APPENDIX E

EXAMPLES OF POTENTIAL CROSS-CONNECTIONS

(Informative)

E1 SCOPE

This Appendix provides some examples of installations in which cross-connections are likely to be encountered.

The methods of cross-connection control are given in Section 4.

E2 POTENTIAL CROSS-CONNECTIONS

Some examples of installations in which cross-connections are likely to occur are as follows:

(a) *Agricultural and horticultural properties* Market gardens, poultry farms, and dairy farms, the interconnection between water service and dam water, drinking nipples, fogging sprays, irrigation pipes, antibiotic injectors, cleansing injectors, vertical sprays for vehicle washing, or any submerged outlet or hose at tanks or feed troughs.

(b) *Catering and allied trade installations* Commercial kitchens, hotels, and clubs, the interconnection between the water service and water-cooled refrigerant units containing methylchloride gas, or any submerged outlets or hoses that connect to glass washers dishwashers, bain-maries, food waste disposal units, garbage can washers, ice-making machines, refrigerators, hoses when supplying water to sinks or other receptacles.

(c) *Domestic installation* Interconnection of the water service to a haemodialysis machine, bidet, water-operated venturi type ejectors attached to garden hoses where used to empty or clean out sullage pits, septic tanks, gullies, stormwater sumps, domestic grease traps, or any submerged outlets, or discharge point of the water service in sanitary flushing cisterns, garden hoses supplying water to swimming pools, ornamental ponds, fish ponds, hose taps below the flood level rim of any fixture, or located below the finished surface level.

(d) *Health and sanitary services installations* These installations include the following:

  (i) *Council sanitary depots* Interconnection between the water service and sanitary pan washers, truck washers, and pan-dumping machines.

  (ii) *Dental surgeries* Any submerged water service outlets connected to chair bowls and venturi type water aspirators.

  (iii) *Funeral parlours* In embalming areas, the interconnection between the water service outlet and water-operated aspirator pumps.

  (iv) *Hospitals and nursing homes* Submerged outlets of the water service at bed pan washers, bed bottle washers, sterilizers, steam autoclaves, instrument washers, and any interconnection between the water service and steam pipes, steam boilers, or steam calorifiers.

  (v) *Mortuaries* Post-mortem areas, submerged water service outlets at autopsy tables, flushing rim floor gullies, specimen tables, and instrument washing sinks.

(e) *Industrial and commercial installations* These installations include the following:

(i) *Tanks* Any submerged discharge point of hoses or pipes that supply water to rinse tanks, process tanks and other tanks.

(ii) *Abattoirs* Interconnection between the water service and steam pipes, steam boilers, or steam calorifiers, and the washing sprays in contact with animal carcases.

(iii) *Bleaching works* Interconnection between the water service and steam pipes, steam boilers, steam calorifiers, or any submerged outlets at revolving drum washers, or any pipes conveying non-drinking water.

(iv) *Breweries, cordial and soft drink plants* Interconnection between water service and the contents of gas cylinders, steam pipes, steam boilers, or steam calorifiers, or any submerged water service outlets at drum or bottle washers, process tanks.

(v) *Butchers' shops* Interconnection between the water service and any water-cooled refrigerant units containing methyl-chloride gas, or water-powered food processing machines.

(vi) *Chemical plants* Interconnection between the water service and chemical pipelines, or the submerged water service pipe outlets at drum washer and process tanks.

(vii) *Dry cleaners* Interconnection between the water service and solvent stills.

(viii) *Dyeing works* Interconnection between the water service pipes and steam pipes, foul water inlet sprays in process tanks, and any submerged water service pipe outlets at vats, tanks, and colanders.

(ix) *Engineering works* Interconnection between the water service and any steam boilers, diesel oil recirculating systems, recirculated cooling water for machines, testing pressure vessels, oil cooling coils, pump priming, compressed air pipelines, and venturi type ejectors in vehicle maintenance pits.

(x) *Laboratories* Interconnection between the water service and any aspirator pumps, fume cupboards, stills, centrifuges, blood testing machines, air scrubbers, test-tube washing machines, animal feeding troughs, and high-pressure gas cylinders.

(xi) *Laundries* Interconnection between the water service and any clothes washing machines, starch tanks, soap mixing vats, and recirculated heated water tanks.

(xii) *Milk processing plants* Interconnection between the water service and any steam pipes, steam boilers, steam calorifiers, or any submerged outlets at bottle washing machines, milk can washing machines, and process chilling tanks.

(xiii) *Oil storage depots* Interconnection between the water service and foam firefighting equipment.

(xiv) *Poultry processing plants* Interconnection between the water service and any steam pipes, steam boilers, steam calorifiers, or any submerged outlets at feather-plucking machines, carcass-washing machines, offal boilers, and process tanks.

(xv) *Photographic developers* Interconnection between the water service and X-ray equipment, or any submerged outlets at tanks and rinse machines.

(xvi) *Plating workings* Interconnection between the water service and solvent, acid or alkaline tanks, cooling coils, steam pipes, or any submerged outlets at tanks and rinse machines.

(xvii) *Tanneries* Interconnection between the water service and vats, drum process tanks, or steam pipes.

(xviii) *Wool processors* Interconnection between the water service and lanolin centrifuges and head recycling coils, or any submerged outlets or hoses at vats, drums, and tanks.

APPENDIX F

TYPES OF BACKFLOW PROTECTION

(Informative)

This Appendix provides examples in Tables F1 to F3 for individual zone and containment protection together with hazard ratings and device selection. It is recommended these procedures be adopted to contain the risk levels required for backflow protection.

Figures F1 to F7 give typical installation examples for testable and non-testable backflow prevention devices.

TABLE F1

INDIVIDUAL PROTECTION—HAZARD RATINGS AND A SELECTION OF BACKFLOW PREVENTION—DEVICES FOR BACKFLOW PREVENTION AT INDIVIDUAL FIXTURES, APPLIANCES OR APPARATUS

Form of cross-connection	Hazard rating	Backflow prevention device
AGRICULTURAL AND HORTICULTURAL		
Antibiotic injectors	High	RBT or RPZD
Fertilizers, herbicides, nematicides, insecticides and weedicides injected into an irrigator (see Section 7, Type D)	High	RBT or RPZD
Fogging and cleaning sprays with chemical injection	High	RBT or RPZD
INDUSTRIAL AND COMMERCIAL		
Fogging and cleaning spray equipment with chemical injection or additives	High	RBT or RPZD
Pan washing apparatus	High	RBT or RPZD
Chemical dispensers (high toxicity)	High	RAG, RBT or RPZD
Weed and pest spraying and water cartage tanks	High	RAG or RPZD (see Figure G1)
Mixing of chemicals	High	RAG or RPZD
Portable and mobile tankers	High	RAG or RPZD (see Figure G1)
Chemical dispensers (low toxicity)	Medium	Testable device
Coils and jackets in heat exchangers—unsealed and toxic environment	Medium	DCV only
Coils and jackets in heat exchangers—sealed and non-toxic environments	Low	Non-testable device
Photographic processing machines (no developer mixing)	Low	Non-testable device
HOSPITALS/MEDICAL		
Equipment used for handling, mixing, measuring and processing chemical and microbiological substances	High	RAG or RPZD
Photographic developers		
(a) Developer mixing facilities	High	RAG or RPZD
(b) Water supplying rinse tanks	Low	Non-testable device
Dental console		
(a) Australia	Low	DCAP
(b) New Zealand	High	RAG or RPZD

(*continued*)

TABLE F1 (*continued*)

Form of cross-connection	Hazard rating	Backflow prevention device
Haemodialysis machines		
(a) Australia	Low	Non-testable device
(b) New Zealand	High	RAG or RPZD
NOTE: Veterinary equipment is rated as for Hospital/Medical		
FIXTURES AND APPLIANCES		
Bidets	High	RBT or RPZD
Food preparation or food storage tanks, vats and vessels with clean-in-place systems	High	RAG or RPZD
Fixtures used for food preparation, e.g. sinks	Low	AG
Fixtures used for ablutions, e.g. baths, bidettes, basins, showers	Low	AG
Laundry troughs	Low	AG
Hair salons basins or troughs	Low	Non-testable device
Carbonated drink dispensing machines	Low	Stainless steel dual CV (intermediate) vent
Drink-dispensing equipment, vending machines, coffee machines	Low	Non-testable device
Food preparation or food storage tanks, vats and vessels	Low	AG/non-testable device
HOSE ATTACHMENT OUTLETS		
(a) External hose taps	Low	Non-testable device
(b) Flexible connections over domestic fixtures	Low	Non-testable device
(c) Hose taps located within an area provided with zone protection		
(i) flexible connections over commercial, industrial or hospital fixtures	Low	Non-testable device
(ii) laboratory outlets	Low	Non-testable device
(d) Hose taps located within 18 m of a Type C irrigation system	Low	Non-testable device
WATER SUPPLY SYSTEMS PERMANENTLY ATTACHED		
Steam boilers	Low	BT
Cooling towers (see Note)	High	RAG or RPZD
Steam calorifier	Medium	Testable device
WATER TREATMENT SYSTEMS		
Demineralizing equipment using ion-exchange resins with acid and alkali regeneration	High	RBT or RPZD
Plants with auxiliary non-drinking water supplies	High	RBT or RPZD
Drinking water in reclaimed water plants	Low	Non-testable device
Chlorinators	Medium	Testable device
In-line water softeners and filters	Low	Non-testable device

LEGEND:
AG = air gap
BT = break tank
DCAP = dual check valve with atmospheric port
DCV = double-check valve
RAG = registered air gap
RBT = registered break tank
RPZD = reduced pressure zone device
NOTE: Cooling tower air gap should be measured from the rim of the cooling tower basin.

TABLE F2

ZONE PROTECTION—HAZARD RATINGS AND A SELECTION OF BACKFLOW PREVENTION—DEVICES FOR BACKFLOW PREVENTION AT THE CONNECTION TO SPECIFIED SECTIONS OF A WATER SUPPLY SYSTEM WITHIN A BUILDING OR FACILITY

Form of cross-connection	Hazard rating	Backflow prevention device
AGRICULTURAL, HORTICULTURAL AND IRRIGATION SYSTEMS		
Irrigation systems injected with fertilizers, herbicides, nematicides and insecticides (see Section 7, Type D)	High	RBT or RPZD
Drinking nipples and troughs	High	RAG or RBT or RPZD
Irrigation systems (see Section 7, Type C)	Medium	Testable device
Irrigation systems (see Section 7, Type B)	Low	Non-testable device
INDUSTRIAL AND COMMERCIAL		
Electroplating, degreasing, descaling, stripping, pickling, dipping, etc., tanks, vats and vessels	High	RBT or RPZD
Commercial laundries	High	RAG or RPZD
Cooling or heating systems with recirculating water	High	RAG or RPZD
Clean-in-place systems (i.e. internal chemical cleaning takes place without dismantling equipment)	High	RAG or RPZD
Dockside facilities	High	RAG or RPZD
Industrial process water that has been recirculated	High	RAG or RPZD
Industrial and teaching laboratories	High	RAG or RPZD
Aircraft facilities	Medium	Testable device
Secondary school laboratories (including fume cupboards)	Medium	Testable device
Water filtration equipment	Low	Non-testable device
Photographic laboratories	Low	
FIRE SERVICES		
Fire hose reels located in areas of hazard have to have a backflow prevention device in line with the hazard ratings of the areas within reach of the fire hose	Medium	DCV
Home fire sprinklers systems (see AS 2118.5)	Low	DCV or Dual CV
Bushfire water spray systems (see AS 5414)	Low	Non-testable device or AG

(*continued*)

TABLE F2 (*continued*)

Form of cross-connection	Hazard rating	Backflow prevention device
HOSPITALS/MEDICAL LABORATORIES, NURSING HOMES		
Dissecting rooms in hospitals and medical buildings	High	RBT or RPZD
Mortuary equipment used in funeral parlours, mortuaries, autopsy areas	High	RBT or RPZD
Utility rooms, where other than handbasins are installed	High	RBT or RPZD
Operating theatres in hospitals and medical buildings	High	RBT or RPZD
Dental and medical surgeries		
(a) Australia	Low	Non-testable device
(b) New Zealand	High	RAG or RPZD
FIXTURES AND APPLIANCES		
Sanitary dump points	High	RAG or RPZD
Food storage tanks, vats and vessels with clean-in-place systems	High	RAG or RPZD
Food storage tanks, vats and vessels	Low	Non-testable device
Hair salons, basins or troughs	Low	Non-testable device

TABLE F3

CONTAINMENT PROTECTION—HAZARD RATINGS AND A SELECTION OF BACKFLOW PREVENTION DEVICES—BACKFLOW PREVENTION PROVIDED AT THE PROPERTY BOUNDARY TO PROTECT THE NETWORK UTILITY'S OR MAINS WATER SUPPLY FROM CONTAMINATION

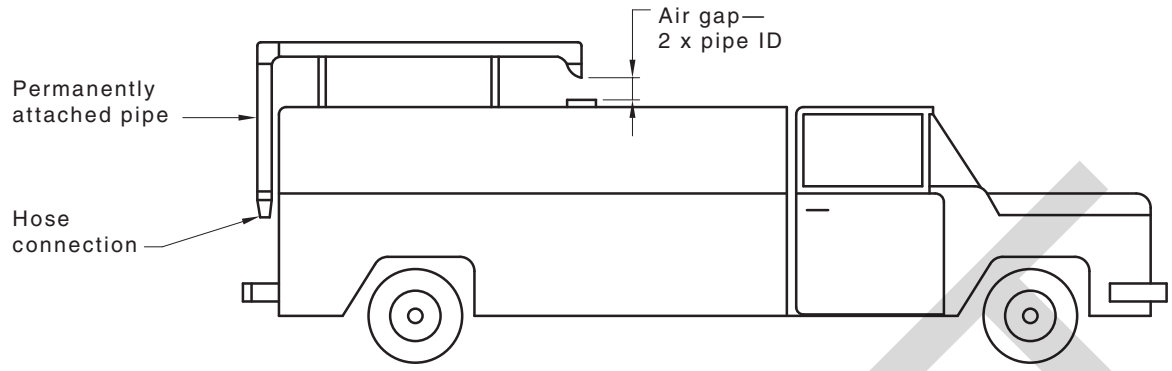
Form of cross-connection	Hazard rating	Backflow prevention device
TYPE OF PREMISES		
Premises with an alternative water supply excluding rainwater tanks	High	RBT or RPZD
Premises where inspection is restricted	High	RBT or RPZD
Hospitals, mortuaries, clinics and the like	High	RBT or RPZD
Piers, docks and other waterfront facilities	High	RBT or RPZD
Sewage treatment plants and sewage lift stations	High	RBT or RPZD
Chemical plants	High	RBT or RPZD
Metal finishing plants	High	RBT or RPZD
Petroleum processing or storage plants	High	RBT or RPZD
Radioactive material processing plants or nuclear reactors	High	RBT or RPZD
Car and plant washing facilities	High	RBT or RPZD
Abattoirs	High	RBT or RPZD
Factories using processing or manufacturing toxic chemicals	High	RBT or RPZD
Chemical laboratories	High	RBT or RPZD
Pathology laboratories	High	RBT or RPZD
Sanitary depots	High	RBT or RPZD
Universities	High	RBT or RPZD
Food and beverage processing plants	Medium	Testable device
Caravan parks	Medium	Testable device
Marinas	Medium	Testable device
Premises with greywater re-use systems	Medium	Testable device
Public swimming pools	Medium	Testable device
Premises with reticulated and disinfected reclaimed water systems	Medium	Testable device
Premises with rainwater tanks (see Clause 16.4)	Low	Non-testable device
Premises with reticulated recycled water system	Low	Non-testable device
All premises – Containment requirement for fire services	Low	SCVT or SCDAT
	Medium	DCV or DCDA
	High	RBT or RPZD or RPDA

LEGEND:
AG = air gap
AVB = atmospheric vacuum breaker
DCV = double check valve
RAG = registered air gap
RBT = registered break tank
RPZD = reduced pressure zone device

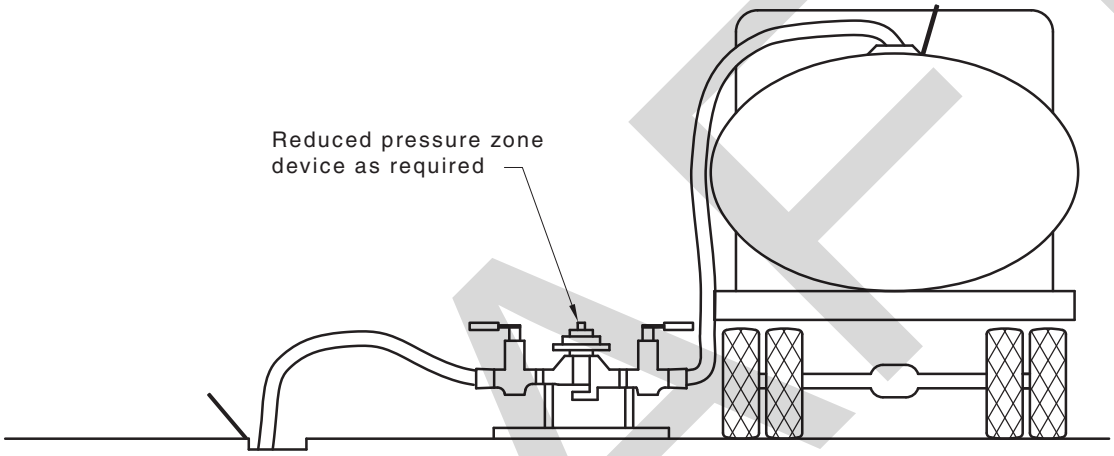
NOTES:

1 For requirements for alternative water supply, see Clause 4.2.4.

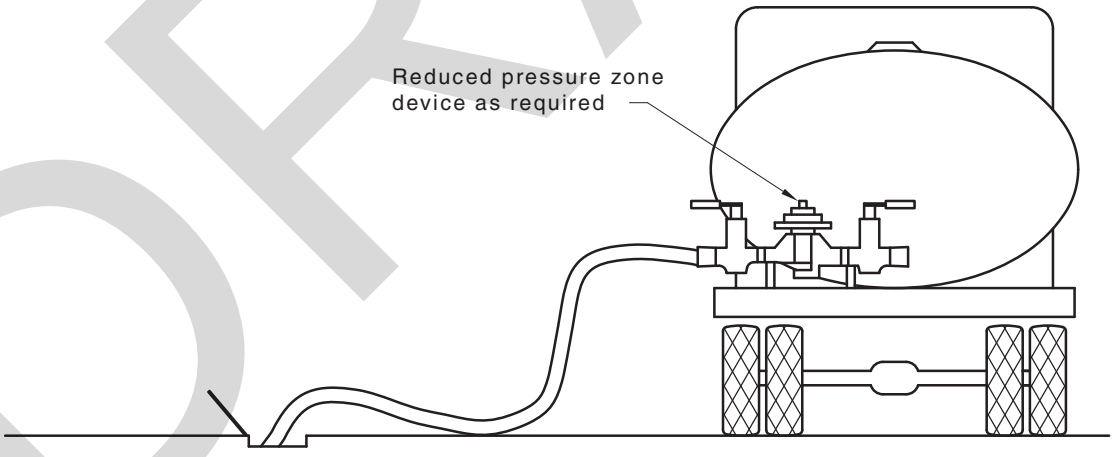
2 Air gaps should not be used in toxic environments.



(a) With air gap



(b) With portable assembly



(c) With truck-mounted assembly

FIGURE F1 TYPICAL MINIMUM PROTECTION FOR FILLING TANKER TRUCKS

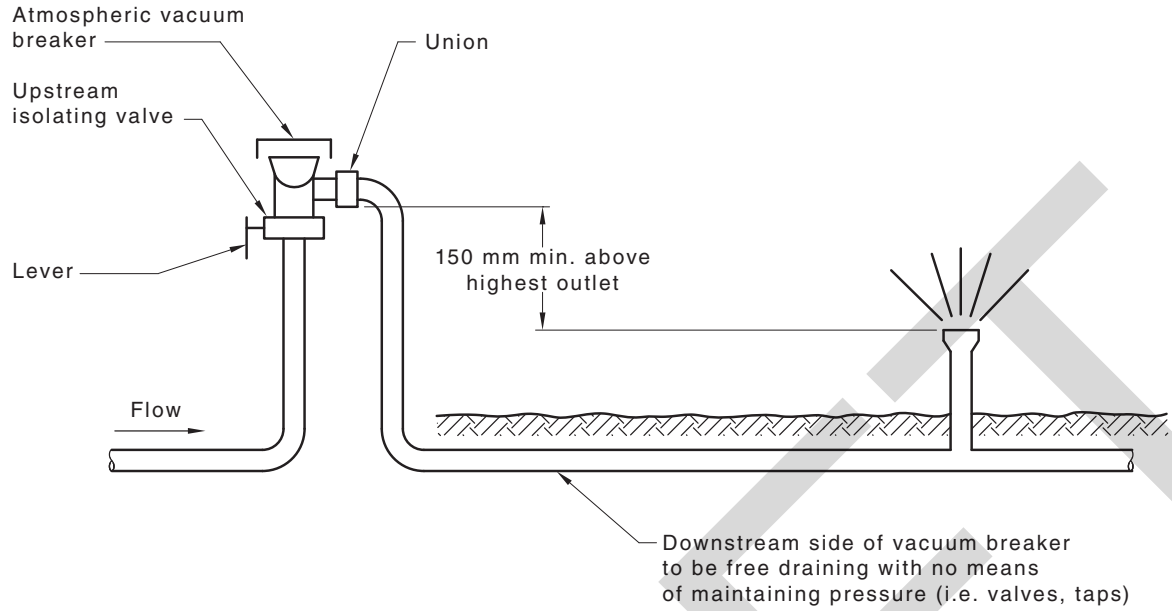


FIGURE F2 TYPICAL INSTALLATION OF AN ATMOSPHERIC VACUUM BREAKER

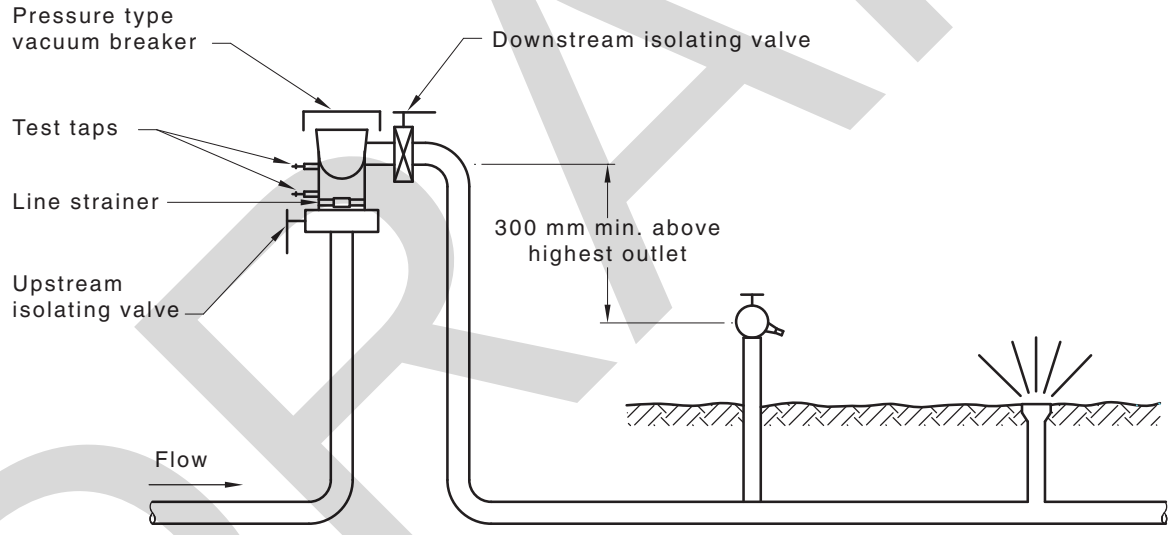


FIGURE F3 TYPICAL INSTALLATION OF A PRESSURE TYPE VACUUM BREAKER

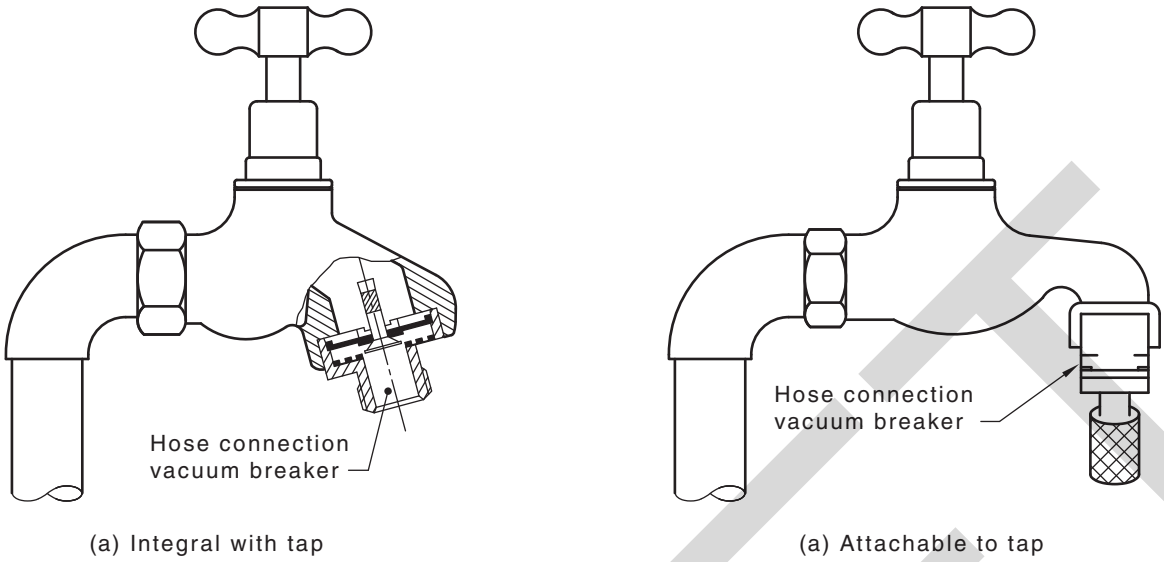


FIGURE F4 TYPICAL INSTALLATIONS OF EXTERNAL HOSE CONNECTION VACUUM BREAKERS

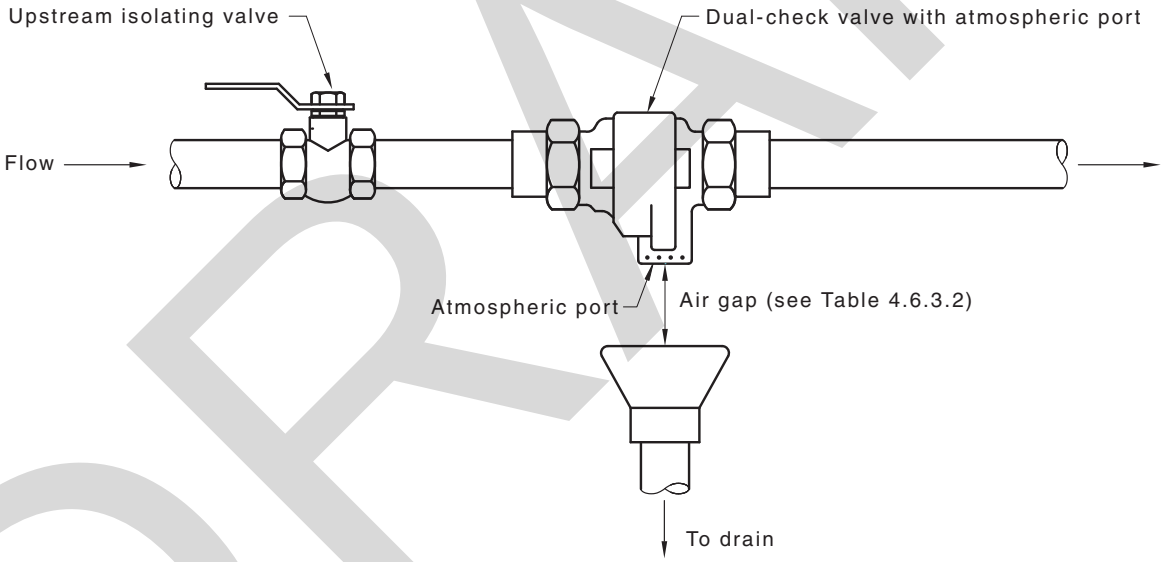


FIGURE F5 TYPICAL INSTALLATION OF A DUAL CHECK VALVE WITH ATMOSPHERIC PORT

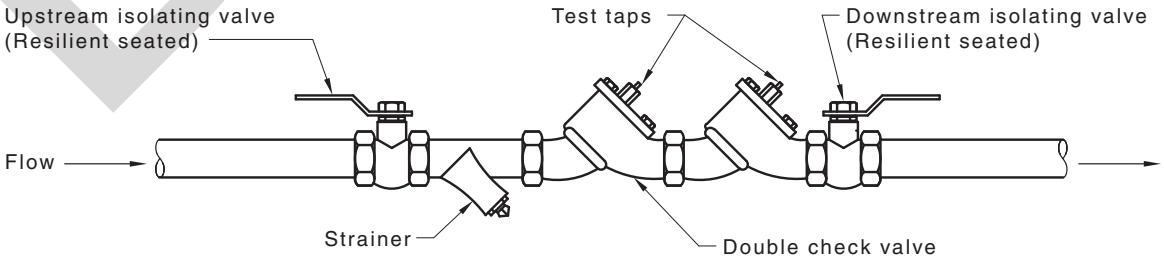


FIGURE F6 TYPICAL INSTALLATION OF A DOUBLE CHECK VALVE

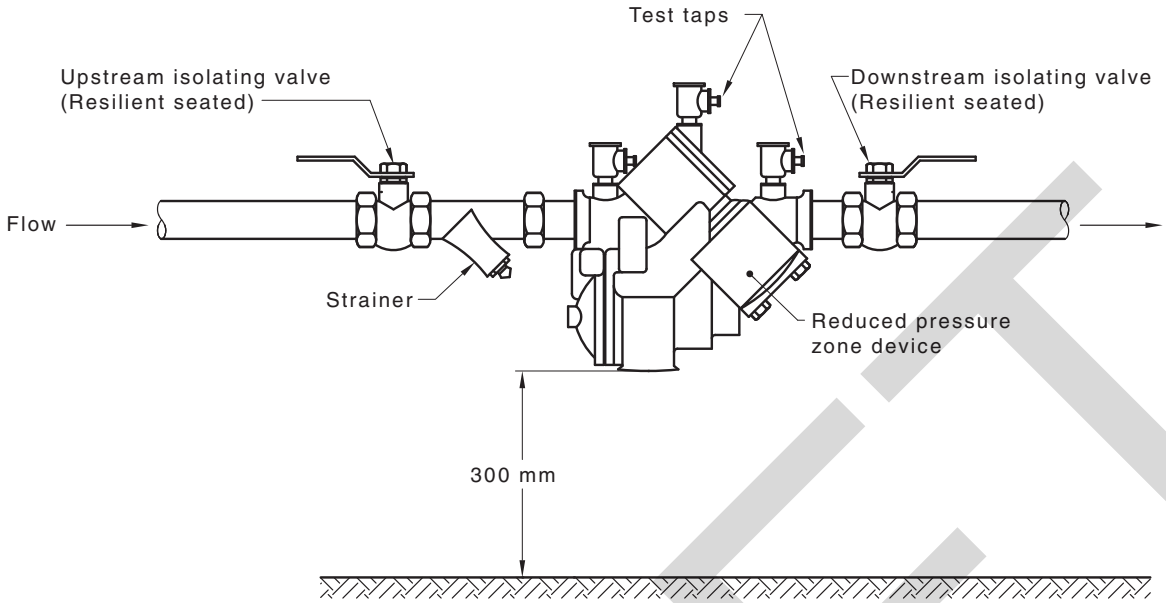


FIGURE F7 TYPICAL INSTALLATION OF A REDUCED PRESSURE ZONE DEVICE

APPENDIX G

STORAGE TANKS—INFLOW AND OVERFLOW

(Informative)

G1 GENERAL

This Appendix contains an example of the calculations for inflow rate, overflow size, spill level air gap and height of inlet above invert of overflow for storage tanks.

G2 INFLOW RATE

Inflow rates may be determined from Table 8.4.4.1. As an example, the inflow rate from a 20 mm orifice with an inlet pressure of 500 kPa would be 6.0 L/s.

G3 OVERFLOW SIZE AND SPILLING LEVEL

With reference to Figure 8.4.1 and 8.4.4.1(A), 8.4.4.1(B) or 8.4.4.1(C), depending on the type of overflow, determine the size of overflow and spill level required from the alternative available.

For this example, Figure 8.4.4.1(A) is used. Using the inflow rate determined from Paragraph G2 (i.e. 6.0 L/s) select combination required. The available alternatives are given in Table G1.

TABLE G1

SPILL LEVELS

Internal diameter of overflow pipe mm	Spill level (height of water above invert of overflow) mm
100	150
125	125
150	100

G4 AIR GAP

With reference to Table 4.6.3.2, the minimum air gap for a 20 mm orifice, when not affected by a near wall, is 40 mm (see Figure G1).

G5 HEIGHT OF INLET ABOVE INVERT LEVEL OF OVERFLOW

The height of the float control valve outlet above the invert of the overflow is determined by the addition of the spill level (Paragraph G3) and the air gap (Paragraph G4).

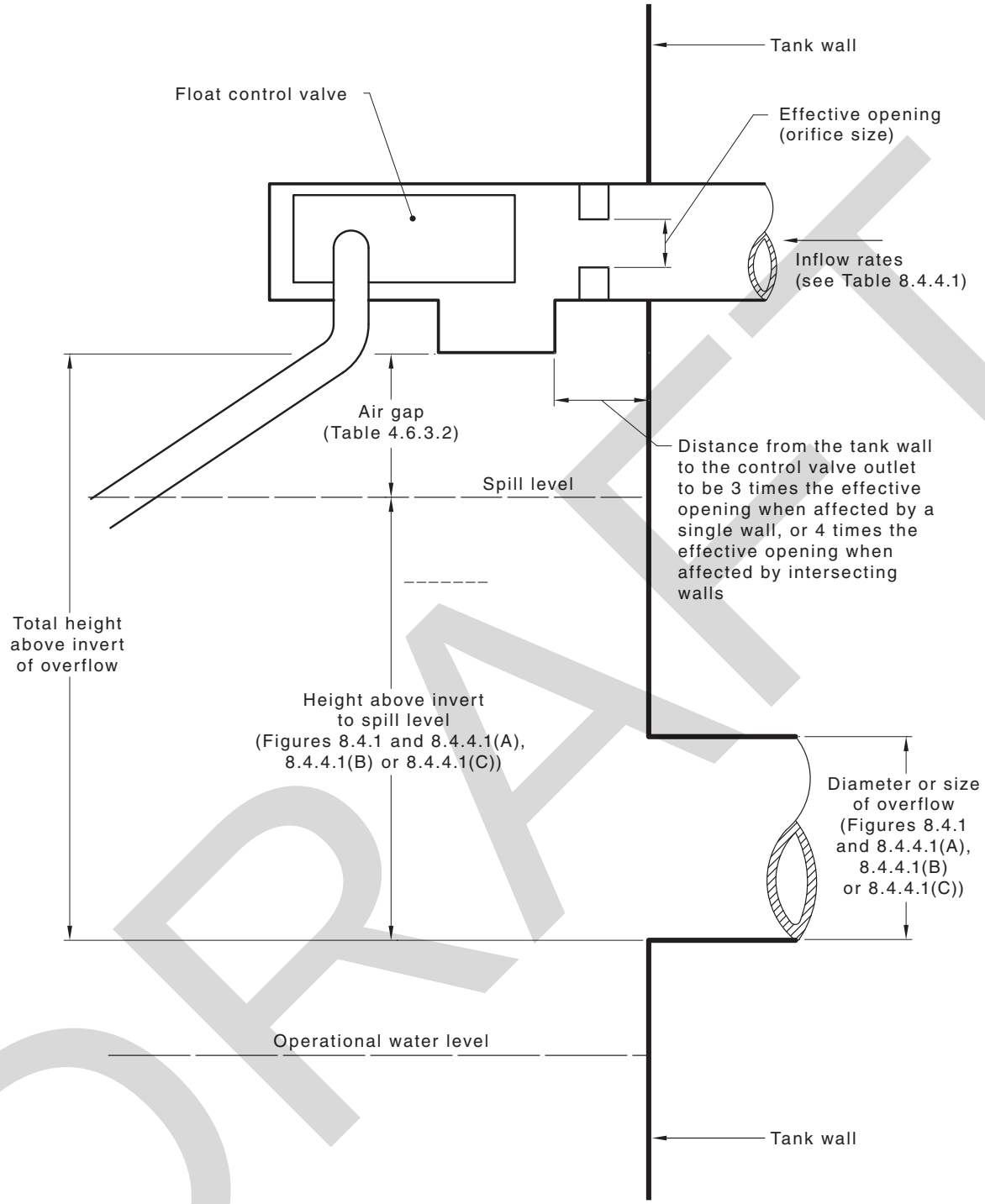


FIGURE G1 DISTANCES RELATED TO OVERFLOW SIZE, SPILL LEVEL AND AIR GAP

APPENDIX H

CLEANING AND DISINFECTION OF STORAGE TANKS

(Normative)

H1 GENERAL

All water storage tanks for drinking water shall be cleaned and disinfected—

(a) prior to initial use; and

(b) whenever the tank is taken out of service for inspection, repairs, painting or other activity that might lead to contamination of water.

H2 CLEANING

The tank shall be drained and all debris and sludge removed. The surfaces of walls, floor and operating facilities shall be thoroughly cleaned using a high-pressure water jet, sweeping, scrubbing or other similar effective means. All water, dirt, and other material accumulated in this cleaning process shall be flushed or otherwise removed from the tank.

H3 DISINFECTION

After cleaning, the tank shall be disinfected by one of the following means:

(a) Filling the tank to overflow level with drinking water to which enough chlorine is added to provide a free chlorine residual, in the whole tank, of not less than 10 mg/L, at the end of the retention time (see Note 1).

The retention time shall be not less than 6 h, when the water entering the tank has been chlorinated uniformly by gas-fed equipment or chemical pump, or not less than 24 h, when the storage tank has been filled with water that has been mixed with sodium hypochlorite or calcium hypochlorite within the storage facility.

The tank shall be drained after disinfection and flushed out with drinking water prior to being put back into service.

(b) Application of 200 mg/L available chlorine directly to all surfaces of the storage tank.

The disinfection solution shall remain in contact with the surface for at least 30 min. The tank surfaces shall then be hosed down and flushed with drinking water prior to being put back into service.

NOTES:

1 The amount of chlorine to be added to obtain 10 mg/L residual after the retention period will depend on the amount of organic material present and the chemical composition of the water. As a guide, an initial chlorine dose of 50 mg/L is recommended.

2 Amounts of common chlorine, including agents required per 1 000 L should be as follows:

Chlorine dose	12.5% Sodium hypochlorite solution	70% Calcium hypochlorite
mg/L	mL	g
50	400	70
200	1 600	280

3 Authorities may require chlorinated water to be neutralized before discharging to the environment.

4 Authorities may require collection and disposal of sludge and silts separately.

5 ANSI/AWWA C652 contains details of disinfection methods that may be used together with an appendix on neutralization of chlorinated water.

6 Choice of the method of disinfection used should include consideration of the size of the tank to be disinfected, the availability of materials and disinfection equipment, training of personnel, safety of operation and disposal of chlorinated water.

APPENDIX I

DISINFECTION OF WATER SERVICES

(Normative)

I1 GENERAL

Water services that are used to supply drinking water shall be protected against contamination during storage, construction and repairs, and flushed and chlorinated before being placed in service and after any repairs that might lead to contamination of water.

I2 PRECAUTIONS AGAINST CONTAMINATION

Precautions shall be taken to protect the interior of pipes fittings and valves against contamination during storage, construction and repairs.

NOTE: See Note 1 of Paragraph I5.

I3 FLUSHING OF WATER SERVICES

On completion of installation or repairs, water services shall be flushed at each discharge point to remove any dirty water or debris from the service. The flushing velocity in any section of the service shall be not less than 0.75 m/s.

I4 CHLORINATION

After flushing, water services from storage tanks shall be chlorinated, before being placed in service, as follows:

(a) Water services from storage tanks shall be disinfected by drawing chlorinated water from the storage tank into the service, such that after a retention period of 6 h, a free chlorine residual of not less than 10 mg/L is obtained throughout the services.

NOTE: See Note 2 of Paragraph I5.

(b) Water services DN 80 or larger, shall be disinfected as for water services from storage tank or in accordance with ANSI/AWWA C651.

I5 FINAL FLUSHING

After the applicable retention period, heavily chlorinated water shall not be allowed to remain in prolonged contact with service piping. In order to prevent damage to pipe lining or corrosion to pipe itself, the heavily chlorinated water shall be flushed from the service until chlorine measurements show that the concentration in the water leaving the service is no higher than that generally prevailing in the authority's distribution system.

NOTES:

1 During construction, all openings in pipelines should be covered and, when laid in a trench, sealed with watertight plugs during interruption to installation to prevent contamination from water in the trench.

2 Water services that are supplied from storage tanks should be disinfected at the same time as that of the disinfection of the storage tank. The water service to the tank should be closed. The discharge points on the service from the tank then be opened, working progressively away from the storage tank until chlorinated water (as detected by odour) is delivered from each discharge point, which should then be closed. The storage tanks should then be topped up with chlorinated water.

BIBLIOGRAPHY

AS	
2118	Automatic fire sprinkler systems
2118.1	Part 1: General systems
2118.2	Part 2: Drencher systems
2118.3	Part 3: Deluge systems
2118.4	Part 4: Sprinkler protection for accommodation buildings not exceeding four storeys in height
2118.5	Part 5: Home fire sprinkler systems
2118.6	Part 6: Combined sprinkler and hydrant systems in multistorey buildings
2441	Installation of fire hose reels
2941	Fixed fire protections installations—Pumpset systems
3660	Termite management
3660.1	Part 1: New building work
5414	Bushfire water spray systems
AS/NZS	
3500	Plumbing and drainage
3500.2	Part 2: Sanitary plumbing and drainage
3718	Water supply—Tap ware
NZS	
4510	Fire hydrant systems for buildings
4515	Fire sprinkler systems for life safety in sleeping occupancies (up to 2000 square metres)
4517	Fire sprinkler systems for houses
4541	Automatic fire sprinkler systems
ANSI/AWWA	
C652	Disinfection of Water-Storage Facilities
enHealth	Guidance on the use of rainwater tanks
BS	
5422	Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range –40°C to +700°C

*** END OF DRAFT ***

REFERENCE COPY ONLY

Draft for Public Comment

Australian/New Zealand Standard

This following part of Public Comment DR 3500.1:2017 is for reference only.

This reference copy has been prepared using an automated tool to indicate key differences between the current edition of AS/NZS 3500.1:2015 (as amended) and Public Comment DR 3500.1:2017.

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Public Comment DR 3500.1:2017 in the first part of this PDF document without changes indicated is the official version for comment.

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WS-014, Plumbing and Drainage, to supersede AS/NZS ~~3500.1:2003~~3500.1:2015.

The objective of this Standard is to provide installers with solutions to ~~comply with~~ conform to—

(a) the National Construction Code of Australia (NCC), Volume Three, Plumbing Code of Australia (PCA); and

(b) the New Zealand Building Code (Clause G12, Water Supplies).

This Standard is part of a series for plumbing and drainage, as follows:

AS/NZS		
3500	Plumbing and drainage	
3500.0	Part 0:	Glossary of terms
3500.1	Part 1:	Water services (this Standard)
3500.2	Part 2:	Sanitary plumbing and drainage
3500.3	Part 3:	Stormwater drainage
3500.4	Part 4:	Heated water systems
~~3500.5~~	~~Part 5:~~	~~Housing installations~~

The objective of this revision is to update requirements relating to backflow prevention, plastic pipes in direct sunlight, circulatory heated water, non-drinking water and clarification for jointing methods.

~~This revision include changes aligning the requirements with the Plumbing Code of Australia.~~

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.

Statements expressed in mandatory terms in notes to figures and tables are deemed to be requirements of this Standard.

Notes used in this Standard are of an advisory nature only and are used to ~~give~~ provide explanation or guidance to the user on recommended considerations or technical procedures, or to provide an informative cross-reference to other documents or publications. Notes to clauses in this Standard do not form a mandatory part for compliance with this Standard.

This Standard includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

Some materials and products used in a water service are provided with instructions for installation and use. Whilst not a requirement of this Standard, or acceptable as an alternative to the requirements of this Standard, compliance with these instructions generally ensures that—

(i) the material or product is fit for the application;

(ii) the performance of the system is not degraded;

(iii) the durability of the material or product is not impaired; and

(iv) the manufacturer’s warranty remains valid.

PROVISION FOR REVISION

This Standard necessarily deals with existing conditions, but is not intended to discourage innovation or to exclude materials, equipment and methods~~, which~~ that may be developed in future. Revisions will be made from time to time in view of such developments and amendments to this ~~edition~~ Edition will be made only when absolutely necessary.

CONTENTS

Page

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Plumbing and drainage

Part 1: Water services

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for the design, installation and commissioning of cold water services from a point of connection to the points of discharge, and non-drinking water from a point of connection to the points of discharge. It applies to new installations as well as alterations, additions and repairs to existing installations.

Illustrations used in this Standard are diagrammatic only and have been chosen without prejudice.

NOTES:

1 The requirements for heated water services are set out in AS/NZS 3500.4.

2 See Figure 1.1 for typical installation of a property service and water service.

1.2 APPLICATION

1.2.1 Australia

This Standard ~~is to~~ shall be read in conjunction with the Plumbing Code of Australia (PCA) in Australia.

Where alternative Australian or New Zealand standards are referenced (e.g. AS 1345) the Australian Standard shall be used for Australia.

For Australia, this Standard does not preclude the use of any design or method of installation, provided the completed system and installation meet the performance requirements of the PCA or BCA, as appropriate.

1.2.2 New Zealand

This Standard ~~is to~~ shall be read in conjunction with the New Zealand Building Code in New Zealand. This Standard may be used for compliance with the New Zealand Building Code Paragraph G12, Water Supplies.

Where alternative New Zealand standards are referenced (e.g. NZS 5807) the New Zealand Standard shall be used for New Zealand.

1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard ~~are listed in Appendix A.~~:

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

~~—~~AS 1074	Steel tubes and tubulars for ordinary service
1172	Water closets (WCs)
1172.1	Part 1: Pans

1172.2	Part 2: Flushing devices and cistern inlet and outlet valves
1319	Safety signs for the occupational environment
1345	Identification of the contents of pipes, conduits and ducts
1379	Specification and supply of concrete
1397	Continuous hot-dip metallic coated steel sheet and strip—Coatings of zinc and zinc alloyed with aluminium and magnesium
1432	Copper tubes for plumbing, gasfitting and drainage applications
1478	Chemical admixtures for concrete, mortar and grout
1478.1	Part 1: Admixtures for concrete
1604	Specification for preservative treatment
1604.1	Part 1: Sawn and round timber
1646	Elastomeric seals for waterworks purposes
1657	Fixed platforms, walkways, stairways and ladders—Design, construction and installation
2129	Flanges for pipes, valves and fittings
2419	Fire hydrant installations
2419.1	Part 1: System design, installation and commissioning
2700	Colour Standards for general purposes
2845	Water supply—Backflow prevention devices
2845.2	Part 2: Registered air gaps and registered break tanks
2845.3	Part 3: Field testing and maintenance of testable devices
2865	Confined spaces
3600	Concrete structures
3688	Water supply—Metallic fittings and end connectors
3795	Copper alloy tubes for plumbing and drainage applications
4176	Multilayer pipes for pressure applications (series)
4728	Electric resistance welded steel pipe for pressure purposes
4809	Copper pipe and fittings—Installation and commissioning
5082	Polybutylene (PB) plumbing pipe systems—Metric series
5082.1	Part 1: Metric polybutylene (PB) pipes for hot and cold water applications
5082.2	Part 2: Mechanical and fusion jointing systems
5200	Plumbing and drainage products
5200.000	Technical specification for plumbing and drainage products—Procedures for certification of plumbing and drainage products
5200.053	Stainless steel pipes and tubes for pressure applications
AS/NZS	
1167	Welding and brazing—Filler metals
1167.1	Part 1: Filler metal for brazing and braze welding
1167.2	Part 2: Filler metal for welding
1477	PVC pipes and fittings for pressure applications
2032	Installation of PVC pipe systems
2033	Installation of polyethylene pipe systems
2280	Ductile iron pressure pipes and fittings
2492	Cross-linked polyethylene (PE-X) pipes for pressure applications

2537	Mechanical jointing fittings for use with crosslinked polyethylene (PE-X) for pressure applications—Plastics piping systems for hot and cold water installations—Crosslinked polyethylene (PE-X) (series)
2544	Grey iron pressure fittings
2642	Polybutylene (PB) plumbing pipe systems
2642.2	Part 2: Polybutylene (PB) pipe for hot and cold water applications
2642.3	Part 3: Mechanical jointing fittings for use with polybutylene (PB) pipes for hot and cold water application
2648	Underground marking tape
2648.1	Part 1: Non-detectable tape
2845	Water supply—Backflow prevention devices
2845.1	Part 1: Materials, design and performance requirements
2878	Timber—Classification into strength groups
3500	Plumbing and drainage
3500.0	Part 0: Glossary of terms
3500.4	Part 4: Heated water services
3518	Acrylonitrile butadine styrene (ABS) compounds, pipes and fittings for pressure applications
3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
4020	Testing of products for use in contact with drinking water
4087	Metallic flanges for waterworks purposes
4129	Fittings for polyethylene(PE) pipes for pressure applications
4130	Polyethylene (PE) pipes for pressure applications
4331	Metallic flanges
4331.1	Part 1: Steel flanges
4331.2	Part 2: Cast iron flanges
4331.3	Part 3: Copper alloy and composite flanges
4441	Oriented PVC (PVC-O) pipes for pressure applications
4671	Steel reinforcing materials
AS/NZS	
4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
4765	Modified PVC (PVC-M) pipes for pressure applications
4792	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
NZS	
3109	Concrete construction
3124	Specification for concrete construction for minor works
3501	Specification of copper tubes for water, gas and sanitation
3640	Chemical preservation of round and sawn timber
4121	Design for access and mobility: Buildings and associated facilities
5807	Code of practice for industrial identification by colour, wording or other coding
7702	Specification for colours for identification, coding and special purposes
NZS BS	

1387	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads
ISO 15874	Plastics piping systems for hot and cold water installations—Polypropylene (PP) (series)
NCC	Nation Construction Code (series)
ANSI/AWWA C217	Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
C651	Disinfecting water mains
BS EN 10312	Welded stainless steel tubes for the conveyance of water and other aqueous liquids. Technical delivery conditions
D2846	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
F493	Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
NZBC	New Zealand Building Code (G12, Water Supplies)
WSAA WSA 03	Water supply code of Australia

1.4 DEFINITIONS

For the ~~purpose~~ purposes of this Standard~~-~~, the definitions given in AS/NZS 3500.0 and the definition below apply.

1.4.1 Point of connection

For a water service, the point where the service pipe within the premises connects to the network utility operator's property service or to an alternative water supply system.

1.5 ABBREVIATIONS

The following plastics abbreviations are used in this Standard.

PVC-U	Unplasticized polyvinyl chloride
PVC-M	Modified polyvinyl chloride
PVC-O	Oriented polyvinyl chloride
PE	Polyethylene
PP	Polypropylene
PE-X	Cross-linked polyethylene
ABS	Acrylonitrile butadiene styrene
PB	Polybutylene

1.6~~1.5~~ EQUIVALENT PIPE SIZES

Where the nominal size of a pipe is specified in this Standard, an equivalent pipe size, appropriate to the material being used, shall be selected from Appendix ~~B~~A.

1.7~~1.6~~ FACILITIES FOR PEOPLE WITH DISABILITIES

The installation of sanitary facilities for people with disabilities shall ~~comply~~ be in accordance with the following:

(a) Australia ..... the NCC.

(b) New Zealand ..... NZS 4121 and the New Zealand Building Code (NZBC).

~~1.7 ABBREVIATIONS~~

~~The following plastics abbreviations are used in this Standard.~~

~~PVC-U~~	~~Unplasticized polyvinyl chloride~~
~~PVC-M~~	~~Modified polyvinyl chloride~~
~~PVC-O~~	~~Oriented polyvinyl chloride~~
~~PE~~	~~Polyethylene~~
~~PP~~	~~Polypropylene~~
~~PE-X~~	~~Cross-linked polyethylene~~
~~ABS~~	~~Acrylonitrile butadiene styrene~~
~~PB~~	~~Polybutylene~~

1.8 TERMITE MANAGEMENT

This Standard does not cover termite barriers and construction techniques to impede and discourage termite attack in buildings.

C1.8 *Within Australia, termites have a wide geographic distribution and can attack cellulose products, including timber, in service in buildings.*

AS 3660.1 and the NCC contain information on protection of new buildings from subterranean termites.

Where a building has been treated against termite attack, it is essential that care be exercised during installation of plumbing services so that both physical and chemical termite barriers are not compromised.

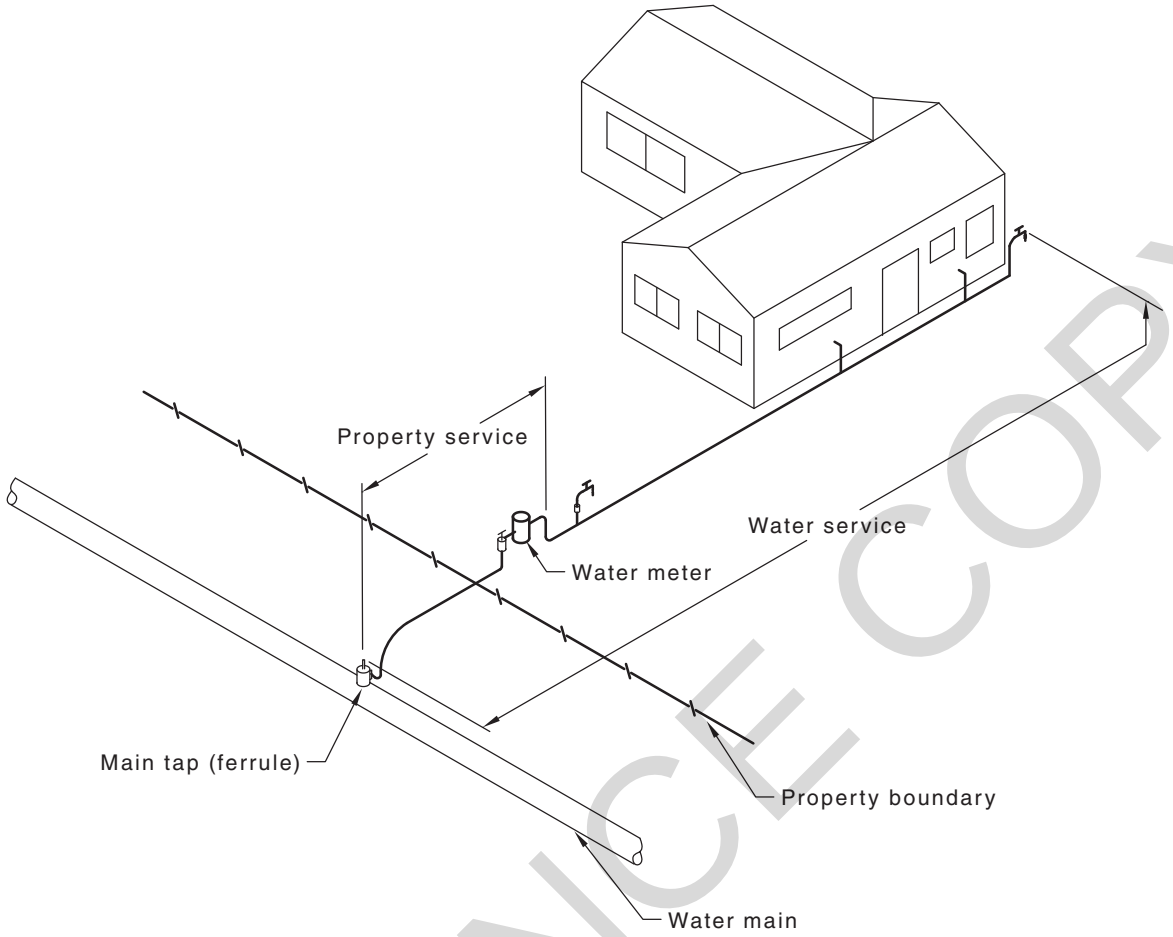


FIGURE 1.1 TYPICAL INSTALLATION OF A PROPERTY SERVICE AND WATER SERVICE WHERE CONNECTED TO THE NETWORK UTILITY OPERATOR'S WATER MAIN

SECTION 2 MATERIALS AND PRODUCTS

2.1 SCOPE OF SECTION

This Section specifies requirements for materials and products used in water services.

2.2 AUTHORIZATION

In Australia, certain materials and products require authorization for use in plumbing and drainage installations in accordance with the Plumbing Code of Australia (PCA). In New Zealand product authorization is not required.

NOTE: A database of authorized products is available from www.abcb.gov.au.

2.3 SELECTION AND USE OF MATERIALS AND PRODUCTS

Materials and products in contact with water that is intended for human consumption, food preparation, utensil washing, personal hygiene or oral hygiene shall ~~comply with~~ conform to AS/NZS 4020. Linings and coatings shall ~~comply with~~ conform to AS/NZS 4020, at a surface area to volume ratio not greater than that applicable to the installation.

Materials and products used in a water service shall be selected to ensure fitness for their intended purpose. Pipes and fittings shall be selected from those listed in Appendix ~~C~~B.

Factors to be taken into account in the selection shall include, but are not limited to, the following:

(a) The type of usage likely to occur.

(b) The nature and temperature of the water to be conveyed and the risk of corrosion, degradation and leaching.

(c) The nature of the environment and the ground and the possibility of chemical attack and permeation therefrom.

(d) The physical and chemical characteristics of the materials and products.

(e) Compatibility of materials and products.

(f) Frost protection in accordance with Clause 5.17.

(g) Accessibility, for inspection, service, repair and replacement.

NOTE: Information on some of the above items may be obtainable from the manufacturer or supplier of the product or materials.

2.4 LIMITATIONS ON USE OF PIPES AND FITTINGS

2.4.1 General limitations

The following limitations shall apply to the use of pipes and fittings for water services:

(a) Pipes and fittings—

(i) up to and including DN 100, shall have a maximum allowable operating pressure (MAOP) of at least 1.2 MPa at 20°C; and

(ii) where larger than DN 100, shall be selected to satisfy design criteria for the system.

(b) Bends in pipes shall be free from wrinkling and flattening.

(c) Semi-flexible connectors and braided flexible hoses shall be used only above surface level and in accessible locations.

(d) Pipes and fittings shall be protected from external heat sources that limit the service life of the pipes.

(e) Soft solder jointing shall not be used.

(f) Copper pipes to AS 1432 shall only be of type A, B or C.

NOTE: In many parts of Australia and New Zealand, the maintenance of the property service is the responsibility of the network utility operator. Pipes used in a property service or meter assembly are installed to the network utility operator's specification (see Figure 1.1).

2.4.2 Metallic pipes and fittings

Metallic pipes and fittings shall ~~comply with~~ conform to the following ~~requirements~~:

(a) Ductile iron pipes and fittings shall be lined and provided with an outer protective coating in accordance with AS/NZS 2280.

(b) Cast iron pipes and fittings shall be lined with cement mortar and provided with an outer protective coating.

(c) Galvanized pipes and fittings shall be used only in non-drinking water systems that are installed above ground. The internal and external galvanizing coating shall be a minimum of 300 g/m^2 hot-dipped galvanizing to AS/NZS 4680 or AS/NZS 4792.

NOTE: The risk of rapid corrosion should be considered when selecting galvanized steel pipes for any application.

Where galvanized steel fire hydrant or booster riser pipes are to be buried below ground in accordance with AS 2419.1, the pipes shall be heavy thickness up to and including DN 80 and not less than medium thickness over DN 80. The maximum length of fire hydrant or booster riser pipe below ground shall be 1.5 m. The buried section of pipe shall be protected against corrosion by continuous wrapping in petrolatum tape to AWWA C217.

(d) ~~Copper~~ Fittings used to join copper and copper alloy pipes ~~and fittings~~ shall conform to AS 3688 and be installed in accordance with the installation requirements of AS 4809. Copper pipes shall conform to AS 1432.

(e) Stainless steel (SS) pipes shall be used in conjunction with dezincification resistant (DR) copper alloy fittings or stainless steel fittings conforming to AS 3688.

2.4.3 Plastics pipes and fittings

Plastics pipes and fittings shall ~~comply with~~ conform to the following ~~requirements~~:

(a) Where plastics pipes and fittings are subject to direct sunlight~~,~~ they shall be installed ~~in accordance with the specific product installation Standard for that pipe material.~~as follows:

(i) PVC shall be painted with light coloured water-based paints, or be otherwise protected.

(ii) Solid black PE pipes and fittings are not required to be protected. Coloured and jacketed pipes and fittings shall be protected (see Note 1).

(iii) ABS is not required to be protected.

(iv) Solid black PE-X pressure pipe is not required to be protected. Coloured and jacketed PE-X pipes and fittings shall be protected.

(v) Plastics pipes of other materials including PB, PP and multi-layered pipe shall be protected (see Note 2).

(b) Plastics pipes and fittings shall not be used to support valves, meters or associated pipes and fittings~~.~~ (see Note 3).

NOTES:

1 Painting with light coloured water-based paints will minimize the effects of ultraviolet radiation such as loss of impact strength and discolouration of the surface.

2 Examples of protection include sleeving with metal or plastics pipe or conduit, lagging or painting with UV resistant paint.

3 ~~NOTE:~~Requirements for the use, handling and transportation of plastics pipes, fittings, solvent cement and priming fluid are specified in AS/NZS 2032 or AS/NZS 2033.

2.5 SAFE-TRAYS AND WASTE PIPES

Safe-trays and waste pipes connected to safe-trays shall be—

(a) fabricated from 0.60 mm thick galvanized steel sheet ~~complying with~~ conforming to AS 1397 and having a minimal nominal zinc coating mass of 275 g/m^2; or

(b) made from other materials with corrosion properties not inferior to Item (a) requirements.

2.6 JOINTS

2.6.1 Flanged joints

Flanged joints shall ~~comply with~~ conform to—

(a) AS/NZS 1477 for PVC-U;

(b) AS/NZS 2280 and AS/NZS 2544 for ductile iron and grey cast iron; or

(c) AS 2129, AS/NZS 4331.1, AS/NZS 4331.2, AS/NZS 4331.3 or AS/NZS 4087 and be appropriate for the test pressure requirements of Section 18.

2.6.2 Elastomeric seals

Materials used for elastomeric seals shall ~~comply with~~ conform to AS 1646.

Where an elastomeric seal gasket is provided in the line or in a fitting, it shall not be replaced with mastic or sealant compounds.

2.6.3~~2.6.4~~

~~**2.6.3 Shouldered or grooved joints**~~

~~Shouldered or grooved joints shall comply with AS 3688.~~**Silver brazing alloy**

2.6.3.1~~2.6.4.1~~ *Copper and copper alloys*

Silver brazing alloys and copper-phosphorus brazing alloys for capillary jointing of copper and copper alloy pipes and fittings shall ~~comply with~~ conform to AS/NZS 1167.1 and contain a minimum of 1.8% silver and a maximum of 0.05% cadmium.

2.6.3.2~~2.6.4.2~~ *Stainless steels*

Silver brazing alloys for capillary jointing of stainless steel pipes and fittings shall ~~comply with~~ conform to AS/NZS 1167.1 and contain a minimum of 38% silver and a maximum of 0.05% cadmium.

2.6.4~~2.6.6~~

~~**2.6.5 Soft solders**~~

~~Soft solder shall—~~

~~(a) not contain more than 0.1% lead by weight;~~

~~(b) only be used for jointing copper or copper alloy pipes to capillary fittings of the long engagement type complying with AS 3688; and~~

~~(c) not be used with coiled annealed pipes.~~

~~NOTE: The chemical composition of water in some areas may preclude the use of soft solder joints.~~**Solvent cement and priming fluid**

Solvent cement and priming fluid for jointing PVC-U and PVC-M pipes and fittings shall ~~comply with~~ conform to AS/NZS 3879.

Solvent cement shall be Type P, green colour (Australia) or blue or gold colour (New Zealand). Priming fluid shall be red colour.

Solvent cement shall not be used without priming fluid.

2.6.5~~2.6.7~~ Filler rods for stainless steel joints

Welded joints in stainless steel pipework larger than DN 25 shall be made using filler rods of low carbon stainless steel not greater than 2 mm in diameter and ~~complying with~~ conforming to AS/NZS 1167.2.

2.7 CONCRETE AND MORTAR

2.7.1 Concrete mix

Ready-mixed concrete shall ~~comply with~~ conform to AS 1379 and shall have a minimum characteristic compressive strength of 20 MPa as defined in AS 3600 or NZS 3109 and NZS 3124.

Site-mixed concrete shall consist of cement, fine aggregate and coarse aggregate, all measured by volume with sufficient water added to make the mix workable. Site-mixed concrete shall have a minimum characteristic compressive strength of 20 MPa as defined in AS 3600 or NZS 3109 and NZS 3124.

2.7.2 Cement mortar

Cement mortar shall consist of one part cement and two parts of fine aggregate, all measured by volume and properly mixed with the minimum amount of water necessary to render the mix workable.

NOTE: For bedding pipes, a mixture consisting of one part cement to four parts of fine aggregate may be used.

Cement mortar that has been mixed and left standing for more than 1 h shall not be used.

2.7.3 Chemical admixtures

Chemical admixtures used in concrete shall ~~comply with~~ conform to AS 1478.1.

2.7.4 Water for concrete and mortar

Water used for mixing concrete and cement mortar shall be free from impurities that are harmful to the mixture, the reinforcement, or any other items embedded within the concrete or mortar.

2.7.5 Steel reinforcement

Steel reinforcing materials used in concrete structures shall ~~comply with~~ conform to AS/NZS 4671.

2.8 MISCELLANEOUS MATERIALS

2.8.1 Timber

Timber exposed to the weather shall be of durability Class 2 ~~complying with~~ conforming to AS/NZS 2878 or shall be treated in accordance with AS 1604.1. In New Zealand, exposed timber shall be treated to H3 (CCA) in accordance with NZS 3640.

Timber in contact with the ground shall be durability Class 1 for Australia and H4 (CCA) for New Zealand, and exposed timber shall be treated to a minimum of H3.2 (copper based) in accordance with NZS 3640.

2.8.2 External protective coatings

External coatings used for the protection of pipes and fittings buried in corrosive areas shall—

(a) be impervious to the passage of moisture;

(b) be resistant to the corrosive environment;

(c) be resistant to abrasion by the surrounding fill; and

(d) not contain any material that could cause corrosion to the underlying pipes or fittings.

NOTE: Polyethylene sleeving used to protect underground pipes and fittings may require additional protection if installed in rock or stony ground.

2.9 BACKFLOW PREVENTION DEVICES

Backflow prevention devices shall ~~comply with~~ conform to AS/NZS 2845.1.

SECTION 3 SIZING OF WATER SERVICES

3.1 SCOPE OF SECTION

This Section specifies requirements for the sizing of pipes for water service installations.

3.2 FLOW REQUIREMENTS

3.2.1 Flow rates

The flow rates to fixtures, appliances, taps, valves and cisterns shall be not less than the flow rates specified in Table 3.2.1.

The maximum flow rate from a shower, basin and kitchen sink or laundry trough outlet shall not exceed 9 L/min.

TABLE 3.2.1

FLOW RATES AND LOADING UNITS

Fixture/appliance	Flow rate L/s	Flow rate L/min	Loading units
Water closet cistern	0.10	6	2
Bath	0.30	18	8
Basin (standard outlet)	0.10	6	1
Spray tap	0.03	1.8	0.5
Shower	0.10	6	2
Sink (standard tap)	0.12	7	3
Sink (aerated tap)	0.10	6	2
Laundry trough	0.12	7	3
Washing machine/dishwasher	0.20	12	3
Mains pressure water heater	0.20	12	8
Hose tap (20 nom. size)	0.30	18	8
Hose tap (15 nom. size)	0.20	12	4

NOTES:

1 In the case of valves and appliances where test information indicates that they will function satisfactorily with a flow rate less than that shown in this Table, the tested flow rate may be substituted and the loading units adjusted accordingly.

2 Flow rates and loading units given above are taken with cold water flowing from each individual outlet.

3.2.2 Loading units

Loading units are factors that take into account the flow rate, length of time in use, and frequency of use of the fixture or appliance. Loading units for fixtures/appliances shall be as ~~given~~ specified in Table 3.2.1.

3.2.3 Probable simultaneous demand (PSD)

The probable simultaneous demand (PSD) for dwellings shall be not less than that specified in Table 3.2.3.

The minimum flow rates specified in Table 3.2.3 shall be used to estimate the size of the supply pipe for dwellings.

NOTE: A method of sizing supply piping for dwellings is given in Appendix ~~D~~C.

3.2.4 Probable simultaneous flow rate (PSFR)

Conversion of loading units to probable simultaneous flow rates (PSFRs) for branch piping within dwellings is given in Table 3.2.4.~~These flow rates may be used to estimate the minimum size of piping within dwellings.~~

~~NOTE: A method for sizing of piping within dwellings is given in Appendix E.~~

NOTES:

1 A method for sizing of piping within dwellings is given in Appendix D.

2 Flow rates may be used to estimate the minimum size of piping within dwellings.

TABLE 3.2.3
PROBABLE SIMULTANEOUS DEMAND (PSD) FOR DWELLINGS

No. of units or dwellings	Flow rate L/s	No. of units or dwellings	Flow rate L/s	No. of units or dwellings	Flow rate L/s
1	0.48	35	3.74	68	5.79
2	0.70	36	3.81	69	5.85
3	0.88	37	3.88	70	5.91
4	1.03	38	3.95	71	5.96
5	1.17	39	4.01	72	6.02
6	1.30	40	4.08	73	6.08
7	1.41	41	4.14	74	6.13
8	1.53	42	4.21	75	6.19
9	1.64	43	4.27	76	6.25
10	1.74	44	4.34	77	6.30
11	1.84	45	4.40	78	6.36
12	1.94	46	4.47	79	6.41
13	2.03	47	4.53	80	6.47
14	2.12	48	4.49	81	6.53
15	2.21	49	4.66	82	6.58
16	2.30	50	4.72	83	6.64
17	2.39	51	4.78	84	6.69
18	2.47	52	4.84	85	6.75
19	2.55	53	4.90	86	6.80
20	2.64	54	4.96	87	6.86
21	2.72	55	5.02	88	6.91
22	2.79	56	5.09	89	6.96
23	2.87	57	5.15	90	7.02
24	2.95	58	5.21	91	7.07
25	3.03	59	5.27	92	7.12
26	3.10	60	5.32	93	7.18
27	3.17	61	5.38	94	7.23
28	3.25	62	5.44	95	7.29
29	3.32	63	5.50	96	7.34
30	3.39	64	5.56	97	7.39
31	3.46	65	5.62	98	7.44
32	3.53	66	5.68	99	7.50
33	3.60	67	5.73	100	7.55
34	3.67	—	—	—	—

NOTES:

1 The minimum flow rates shown in this Table are based on domestic installations. If it is expected that the dwelling(s) will have a ~~larger~~ greater demand, then the probable simultaneous flow rate may be estimated using the loading unit method outlined in Appendix ~~E~~D.

2 Determination of PSD for dwellings exceeding the scope of this Table may be estimated using the following equation:

$$Q = 0.03\,n + 0.4554\sqrt{n}$$

where

Q = flow rate, in litres per second

n = number of dwellings

TABLE 3.2.4

PROBABLE SIMULTANEOUS FLOW RATES (PSFRs)

Loading units	PSFR L/s	Loading units	PSFR L/s	Loading units	PSFR L/s
1	0.09	21	0.39	41	0.55
2	0.12	22	0.40	42	0.56
3	0.14	23	0.41	43	0.57
4	0.16	24	0.42	44	0.58
5	0.18	25	0.43	45	0.58
6	0.20	26	0.43	46	0.59
7	0.22	27	0.44	47	0.60
8	0.24	28	0.45	48	0.60
9	0.25	29	0.46	49	0.61
10	0.26	30	0.47	50	0.62
11	0.28	31	0.48	51	0.62
12	0.29	32	0.49	52	0.63
13	0.30	33	0.49	53	0.64
14	0.31	34	0.50	54	0.64
15	0.33	35	0.51	55	0.65
16	0.34	36	0.52	56	0.65
17	0.35	37	0.52	57	0.66
18	0.36	38	0.53	58	0.67
19	0.37	39	0.54	59	0.67
20	0.38	40	0.55	60	0.68

3.3 PRESSURE REQUIREMENTS

3.3.1 Available pressure

Pipe sizing shall be based on the minimum available pressure.

NOTE: The maximum and minimum pressures for the water main serving the property may be obtained from the utility responsible for the supply of water.

3.3.2 Pressure at outlets

The minimum working pressure at the furthermost or most disadvantaged fixture or outlet shall be not less than 50 kPa (5 m head), at the flow rate specified in Table 3.2.1.

NOTES:

1 Storage tanks ~~complying with~~ conforming to Section 8 or booster pumps ~~complying with~~ conforming to Section 13 may be required to achieve the minimum pressure.

2 Some fixtures may require more than 50 kPa supply pressure in order to function.

3.3.3 Pressure losses

Allowance shall be made for pressure losses through pipes, valves, fittings, meters and any other equipment present in the installation.

NOTE: The methods used in Appendices ~~D~~ C and ~~E~~ D make an allowance of 50% additional pipe length for pressure losses through fittings.

3.3.4 Maximum pressure within buildings

Provision shall be made to ensure that the maximum static pressure at any outlet, other than a fire service outlet, within a building does not exceed 500 kPa.

NOTE: Pressures above 500 kPa can cause damage from water hammer, reduced life of appliances, taps and fittings, and cause excessive noise in the system.

3.3.5 Availability of water supply

Where the available water supply cannot meet the minimum pressure and flow rates of this Section, storage tanks with or without pumps shall be installed to achieve the pressure and flow rate demands in accordance with this Section.

3.4 VELOCITY REQUIREMENTS

The maximum water velocity in piping shall be 3.0 m/s.

The velocity limitation shall not apply to any piping that is exclusively used for fire services, whether independently served by a main or combined with a domestic water supply.

3.5 PIPE SIZE LIMITATIONS

3.5.1 Water service

For a single dwelling, the water service pipe from the property service to branch offtakes shall have an internal diameter of not less than 15.0 mm.

Internal diameter of pipes shall be ~~in accordance with~~ as specified in Appendix ~~B~~A.

NOTE: Where the installation includes home fire sprinklers or some other specialist systems, a water service of this size will be inadequate and pipe sizes will need to be determined by specific hydraulic design.

C3.5.1 *Minimum internal diameter sizes quoted in this Standard have been derived from copper piping systems.*

3.5.2 Branch offtakes

Branch offtake pipes shall—

(a) be of a length not exceeding those specified in Table 3.5.2; and

(b) supply only one fixture or outlet, except that—

(i) a branch with a minimum internal diameter of 12.5 mm may also supply a flushing device or a supply tank feeding a gravity-fed, domestic-type water heater; and

(ii) a branch with a minimum internal diameter of 10.0 mm may supply a combination bath and shower unit, or a laundry trough and washing machine, or a kitchen sink and dishwasher.

NOTE: For minimum internal diameter of pipes, see Appendix ~~B~~A.

TABLE 3.5.2

BRANCH OFFTAKE PIPE-LENGTH

Internal diameter of offtake pipe, mm	Maximum length, m
12.5	6
10.0	3
7.0	1

SECTION 4 CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION

4.1 SCOPE OF SECTION

This Section specifies requirements and methods for the prevention of contamination of the drinking water within the water service and the water main and provides for the selection and installation of backflow prevention devices.

NOTE: For typical examples of potential cross-connections, see Appendix ~~F~~E.

4.2 PROTECTION OF WATER SUPPLIES

4.2.1 Design

All water supply systems shall be designed, installed, and maintained so as to prevent contaminants from being introduced into the drinking water supply system.

4.2.2 Protection against contaminants

No device or system that may cause contamination of a water supply shall be connected directly or indirectly to any part of a water service without appropriate cross-connection or backflow prevention control suitable for the degree of hazard.

4.2.3 Combined tanks

Combined tanks storing drinking water and water for other purposes shall achieve separation of the two supplies by the internal installation of double partition walls. The space between the partition walls shall be arranged to ensure that any leakage is not able to enter the other compartment of the tank and is drained such that any discharge is external and readily noticed.

4.2.4 Alternative water supplies

~~Alternative water supplies shall comply with the following requirements:~~

~~(a)~~Where water supplied from one source is connected to another water source, appropriate backflow prevention shall be provided.

~~NOTE: In New Zealand, a building consent is required.~~

~~(b) Where an alternative supply is non-drinking water, piping shall be clearly and permanently identified in accordance with Clause 9.3.2.~~

~~(c) Where the non-drinking alternative supply is installed below ground, the service shall have a continuous marker tape, installed in the trench above the service, which shall state the following:~~

~~THE PIPE BELOW IS NON-DRINKING WATER~~

~~(d)Piping conveying water for non-drinking water applications downstream of a backflow prevention device installed for high or medium hazard protection, other than used for containment, shall be clearly and permanently labelled in accordance with Clause 9.3.2.~~

4.2.5 Integral backflow prevention

Where backflow prevention devices are provided as an integral part of a fixture, appliance or apparatus and are appropriate ~~to~~ for the cross-connection hazard generated by that fixture, appliance or apparatus, no additional backflow prevention is required upstream of the point of connection to the water supply system.

NOTE: Where a cross-connection is found in the water service at any property or if the water service is installed in a manner that will enable backflow to occur, such cross-connection should be reported to the water utility in Australia and territorial authority in New Zealand.

4.3 CROSS-CONNECTION HAZARD RATING

Cross-connections are rated using three degrees of hazard, as follows:

(a) *High hazard* Any condition, device or practice that, in connection with the water supply system, has the potential to cause death.

(b) *Medium hazard* Any condition, device or practice that, in connection with the water supply system, has the potential to endanger health.

(c) *Low hazard* Any condition, device or practice that, in connection with the water supply system, constitutes a nuisance but does not endanger health or cause injury.

4.4 PROVISION OF BACKFLOW PREVENTION DEVICES

4.4.1 General

The required backflow protection shall be determined by identifying the individual hazard(s) within the premises. Then working upstream from each hazard, the water shall be regarded as non-drinking until a backflow prevention device, suitable ~~to~~ for the degree of hazard, is provided.

NOTE: For typical backflow prevention, see Figure 4.4.1.

The drinking water supply shall be protected from the hazard(s) by installing—

(a) individual protection at each hazard with a device listed in Table 4.4.1, depending on the hazard rating;

(b) zone protection with a device listed in Table 4.4.1, depending on the hazard rating, and pipework identified in accordance with Clause 4.4.5;~~or~~

(c) containment protection for fire service installations with a device listed in Table 4.4.1; or

(d) ~~(c)combination~~ combinations of Items (a), (b) and (~~b~~c).

Backflow prevention devices shall ~~comply with~~ conform to AS/NZS 2845.1 and AS 2845.2.

For New Zealand, the field testing of backflow prevention devices and verification of air gaps shall be conducted in accordance with NZBC G12/AS1.

NOTES:

1 In assessing a backflow condition, consideration should be given to the complexity of piping, the probability of piping change, and negligent or incorrect use of equipment resulting in a backflow condition.

2 For typical examples of potential cross-connection, see Appendix ~~F~~E.

C4.4.1 *Backflow prevention may be in the form of—*

(a) individual protection provided at individual fixtures, appliances or apparatus;

(b) zone protection provided at the connection to specific sections of a water supply system within a building or a facility;

(c) containment protection provided at the property boundary to protect the network utility operator's water supply; or

(d) combinations of (a), (b) and (c).

4.4.2 Type of backflow protection

Backflow prevention devices shall be provided in accordance with—

(a) the hazard rating given in Clause 4.3; and

(b) the suitability of the device listed in Table 4.4.1.

NOTE: For examples of backflow devices relative to levels of protection, see Appendix ~~G~~F.

4.4.3 Hose taps

Hose taps within 18 m of a zone-protected area within the same premises shall have a backflow protection device of the same hazard rating as the zone protection adjacent to which they are installed.

4.4.4 Additional backflow protection

Where cross-connections are identified, zone(s) or individual backflow prevention devices appropriate to the hazard shall be installed.

NOTES:

1 For typical examples of potential cross-connections, see Figure 4.4.1 and Appendix ~~F~~E.

2 Additional backflow protection may also be required by the network utility operator.

4.4.5 Water downstream of backflow prevention device

~~The water service downstream of a backflow prevention device shall not be reconnected to the water service upstream of the backflow prevention device without the installation of a backflow prevention device of the same hazard rating.~~

Water downstream of a containment device is considered to be drinking water unless there are unprotected hazards within the premises.

Individual or zone protection against these hazards shall be provided to prevent contamination of the water supply.

The water service downstream of a backflow prevention device shall not be reconnected to the water service upstream of the backflow prevention device without the installation of a backflow prevention device of the same hazard rating.

Piping conveying water downstream of backflow prevention device, installed for high or medium hazard protection, other than backflow prevention devices used for containment, shall be clearly and permanently labelled 'WARNING NOT FOR DRINKING' at every outlet.

NOTE: For requirements for non-drinking water, see Section 9.

In New Zealand, identification of non-drinking water outlets and pipelines shall be in accordance with NZBC G12/AS1 Clauses 4.2 and 4.3.

4.4.6 Commissioning and maintenance

Testable backflow prevention devices shall be commissioned and tested after installation and prior to service. They shall be maintained in working order and tested for operational function at intervals not exceeding 12 months. Reduced pressure zone devices, double check valve assemblies, pressure type vacuum breakers, registered break tanks and registered air gaps shall only be used with a maintenance program for device registration and test certification.

Where there is no such program, these devices shall not be fitted and the standard air gap requirements shall apply.

NOTE: In New Zealand, the testing of automatic backflow protection devices is mandatory for compliance with S44 of the Building Act 1991.

4.4.7 Heated water systems

The requirements of this Section for backflow prevention devices apply equally to heated water supply systems and cold water supply services. The backflow prevention device used in heated water systems shall be suitable for the specific heated water installation.

~~4.5 SUITABILITY OF DEVICES FOR HAZARDS~~

~~Table 4.4.1 lists devices suitable for each hazard rating and indicates whether protection is provided against back-pressure or back-siphonage.~~

~~The type of device selected for each hazard rating shall comply with Table 4.4.1.~~

TABLE 4.4.1
SUITABILITY OF DEVICES

Registered or testable backflow prevention device	Cross-connection hazard rating	Protection against back-pressure	Protection against back-siphonage
(a) Registered testable devices			
Registered break tank (RBT)	High/medium/low	Yes	Yes
Registered air gap (RAG)	High/medium/low	Yes	Yes
Reduced pressure zone device (RPZD)*	High/medium/low	Yes	Yes
Reduced pressure detector assembly (RPDA)*	High/medium/low	Yes	Yes
Double-check valve assembly (DCV)*	Medium/low	Yes	Yes
Double-check detector assembly (DCDA)*	Medium/low	Yes	Yes
Spill resistant pressure type vacuum breaker (SPVB)*†	High/medium/low	No	Yes
Pressure type vacuum breaker (PVB)*	Medium/low	No	Yes
(b) Non-testable devices			
Dual-check valve with atmospheric port (DCAP)‡	Low	Yes	Yes
Dual-check valve (DUAL CV)‡	Low	Yes	Yes
Dual-check valve with intermediate vent (DuCV)‡	Low	Yes	Yes
Air gap (AG)	Low	No	Yes
Break tank (BT)	Low	No	Yes
Atmospheric vacuum breaker (AVB) ‡	Low	No	Yes
Hose connection vacuum breaker (HCVB)‡ (see Note 3)	Low	No	Yes
Beverage dispenser dual-check valve (BDDC)‡	Low	Yes	Yes
Pipe interrupter device (PID)	Low	No	Yes
(c) Fire services only			
Single check valve (testable) (SCVT) *	L~~Low~~ow	Y~~Yes~~es	Yes
Single check detector assembly (testable) (SCDAT)*~~Single check valve non-testable (in Australia only)~~	Low	Yes	~~Yes~~s

* Backflow prevention devices that are provided with test taps for the purposes of testing the operation of the devices, which do not necessarily include isolating valves.

† SPVBs are suitable for high-hazard installation for mains pressure flushing valves only.

‡ Backflow prevention devices that are not provided with test taps for the purposes of testing the operation of the devices.

NOTES:

1 PVBs are designed to vent at 7 kPa or less; however, they may require a significantly higher pressure to reseat and should be installed only in systems that provide pressures sufficient to ensure full closing of the valve and should not be installed close to water outlets where low pressures could be encountered.

2 In areas where water spillage may cause nuisance, tundishes or alternative drainage should be installed to receive the discharge from—

(a) RPZDs;

(b) PVBs;

(c) DCAP; or

(d) AVBs.

3 HCVBs are designed to withstand the small amount of back-pressure that would occur if the end of the hose is higher than the hose tap.

4 PVBs, AVBs, HCVBs and PIDs should only be used to protect against back-siphonage.

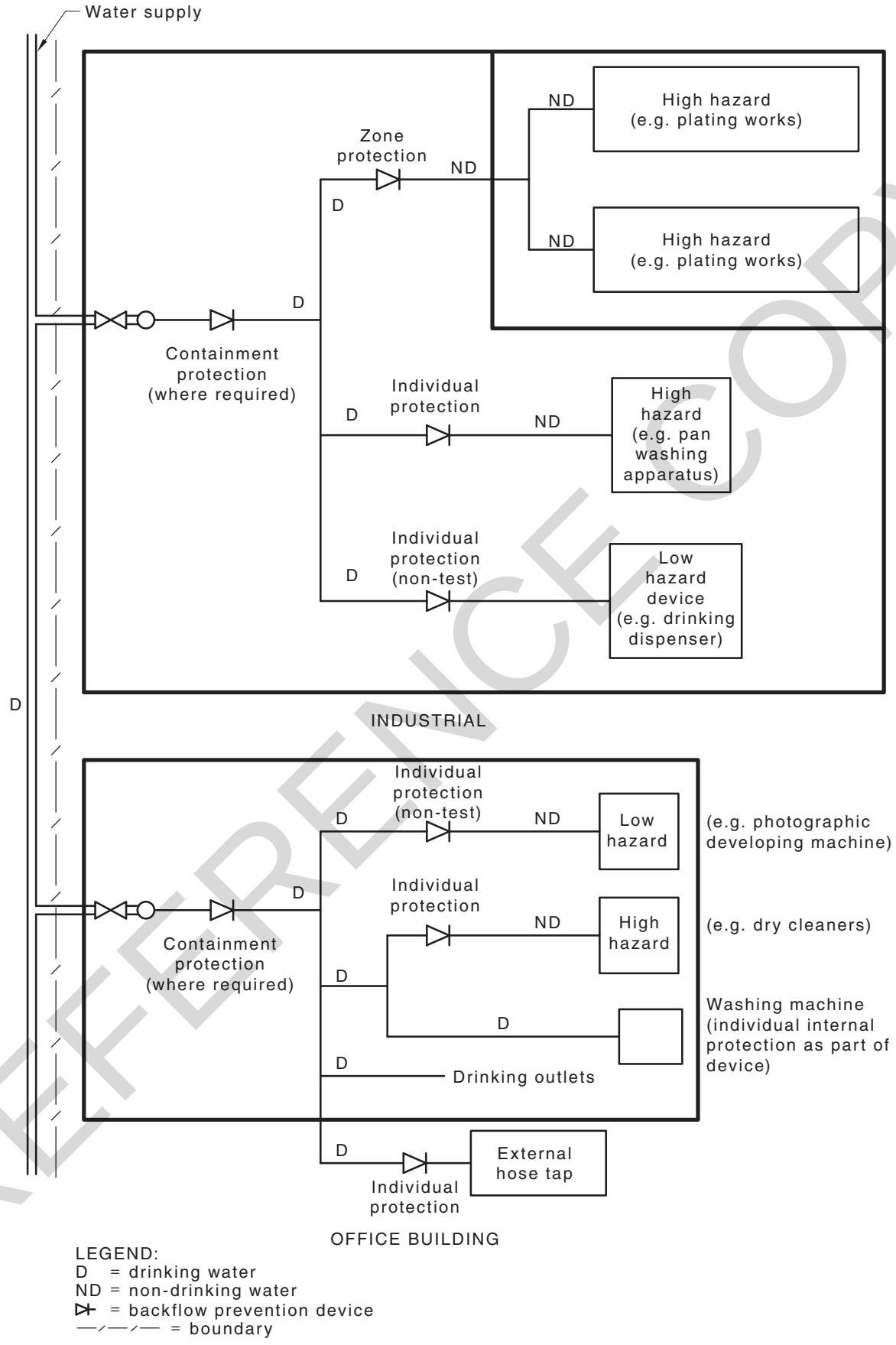


FIGURE 4.4.1 TYPICAL BACKFLOW PREVENTION SCHEMES

4.5 SUITABILITY OF DEVICES FOR HAZARDS

Table 4.4.1 lists devices suitable for each hazard rating and indicates whether protection is provided against back-pressure or back-siphonage.

The type of device selected for each hazard rating shall conform to Table 4.4.1.

4.6 INSTALLATION OF BACKFLOW PREVENTION DEVICES

4.6.1 General installation requirements

The installation of each backflow prevention device shall ~~comply with~~ conform to the following ~~requirements~~:

(a) Heat shall not be applied to any device during installation.

(b) Installations for pressure type vacuum breakers (PVBs), spill resistant pressure type vacuum breakers (SPVBs), double check valves (DCVs) and (DDCVs) and reduced pressure zone detectors (RPZDs) and detector reduced pressure zone device (DRPZDs) shall be fitted with line strainers in accordance with Item (c), except where used in fire service installations.

(c) Line strainer elements shall ~~comply with the requirements of~~ be as specified in Table 4.6.1.

(d) For all testable devices, resilient-seated (drop tight when closed) isolating valves shall be installed—

(i) immediately upstream of the line strainer or immediately upstream of the device in cases where no integral line strainer is fitted [see Item (b)]; and

(ii) immediately downstream of the device.

(e) Piping shall be flushed before devices are connected.

(f) Unprotected bypasses shall not be installed around backflow prevention devices.

(g) The devices shall be installed in accordance with Clause 4.6.3.

(h) The devices shall be protected from damage, including freezing.

(i) Where continuous water supply is essential, devices shall be installed in parallel to permit shutdown of a device.

(j) In-line devices shall be capable of being removed and replaced.

NOTE: For examples of typical installations, see Appendix ~~G~~F.

TABLE 4.6.1

MAXIMUM ORIFICE DIAMETERS AND MAXIMUM CENTRE DISTANCES OF LINE STRAINER ELEMENT PERFORATIONS

Size DN	Maximum orifice diameter mm	Maximum centre distance mm
20	1.6	2.4
25	1.6	2.4
32, 40, 50	3.25	5.6
80, 100, 150	4.6	5.6
200, 250, 300	4.6	5.6

4.6.2 Location of devices

4.6.2.1 *General*

The location of each backflow prevention device shall ~~comply with~~ conform to the following:

(a) Backflow prevention devices shall not be located in a corrosive or polluted atmosphere~~,~~ where the contaminated air can enter the piping system through the air gap or open vent port, or cause the device to malfunction.

(b) Insulation or any other protection of a backflow prevention device shall not interfere with its operation, testing or maintenance.

(c) Vented testable backflow prevention devices shall not be located in cabinets without drainage or in pits.

(d) Backflow prevention devices shall not be buried in the ground.

~~(e) Where water hammer occurs, it should be rectified by the installation of a surge protector or water hammer arrestor.~~

(e) ~~(f)~~All in-line devices shall be installed with connections, to permit the removal and replacement of the device.

(f) ~~(g)~~Containment devices shall be located as close as practicable to the point of connection and downstream of any water meter. There shall be no branch connection between the meter and device.

NOTE: Where water hammer occurs, it should be rectified by the installation of a surge protector or water hammer arrestor.

4.6.2.2 *Accessibility*

All devices shall be readily accessible for ease of maintenance or testing without the need to work from ladders or scaffolding.

Where the device is fitted with test taps, their location shall ensure the clearance necessary for the performance of the applicable test procedure and maintenance as defined in AS 2845.3.

4.6.2.3 *Drainage and leakage*

Backflow prevention devices shall be positioned so that any leakage from air ports of vacuum breakers and openings on pipe interrupter devices, or discharge from reduced pressure zone devices, and vented double-check valves is readily visible, but does not constitute a hazard or nuisance.

4.6.3 Specific installation requirements for testable and non-testable devices

4.6.3.1 *General*

Backflow prevention devices shall be installed in accordance with Clause 4.6.1 and ~~the requirement of~~ Clauses 4.6.3.2 and 4.6.3.3.

NOTE: For examples of backflow prevention devices, see Appendix ~~G~~F.

4.6.3.2 *Testable devices*

Testable devices shall be installed as follows:

(a) *Registered break tank (RBT) and registered air gap (RAG)* RBTs shall ~~comply with~~ conform to Section 8 of this Standard and incorporate the following air gap requirements:

(i) The unobstructed vertical distance through the free atmosphere between the lowest opening of a water service pipe or fixed outlet supplying water to an RBT

and the highest possible water level of such RBT shall be as given in Table 4.6.3.2.

(ii) Where any break tank receives water from two or more water services of different diameter, the air gap shall be not less than the air gap required for the largest effective opening of the water service outlets as given in Table 4.6.3.2.

(b) *Pressure type vacuum breaker (PVB)* PVBs shall—

(i) be located not less than 300 mm above the highest outlet;

(ii) be ventilated to the atmosphere at all times; and

(iii) not be located in an area that may be ~~subject~~ subjected to ponding or freezing.

(c) *Double-check valve (DCV) assembly* DCV assemblies shall be located so as not to be subject to freezing.

(d) *Reduced pressure zone device (RPZD)* RPZDs shall—

(i) have free ventilation to the atmosphere for the relief valve outlet, at all times;

(ii) not be located in an area that may be ~~subject~~ subjected to ponding;

(iii) have the relief drain outlet located not less than 300 mm above the finished surface level; and

(iv) be located so that they are not subject to freezing.

NOTE: For an example of a typical installation, see Figure ~~G7~~F7, Appendix ~~G~~F.

~~(iv) be located so that it is not subject to freezing.~~

(e) *Double-check detector assembly (DCDA)* DCDAs shall be located so that they are not ~~subject~~ subjected to freezing.

(f) *Reduced pressure detector assembly (RPDA)* RPDAs shall—

(i) have free ventilation to the atmosphere for the relief valve, at all times;

(ii) not be located in an area subject to ponding;

(iii) have the relief drain outlet located not less than 300 mm above the finished surface level;

NOTE: For an example, see Figure ~~G7~~F7, Appendix ~~G~~F.

(iv) be located so that they are not ~~subject~~ subjected to freezing.

(g) *Spill resistant pressure vacuum breaker (SPVB)* SPVBs shall—

(i) be located not less than 300 mm above the highest outlet;

(ii) be ventilated to atmosphere at all times; and

(iii) not be located in areas that may be ~~subject~~ subjected to ponding.

(h) *Single check valve (testable) (SCVT)* SCVTs shall—

(i) be located so as not to be subjected to freezing;

(ii) have isolating valves installed immediately upstream and downstream of the device;

(iii) be fitted in an accessible position; and

(iv) be used only in fire services.

(i) *Single check detector assembly (testable) (SCDAT)* SCDATs shall—

(i) be located so as not to be subjected to freezing;

(ii) have isolating valves installed immediately upstream and downstream of the device;

(iii) be fitted in an accessible position; and

(iv) be used only in fire services.

TABLE 4.6.3.2

MINIMUM AIR GAP

Diameter of the effective opening of water service outlet	Minimum air gap, mm	
	When not affected by near wall	When affected by near wall
≤9	20	25
>9 ≤12	25	40
>12 ≤20	40	55
>20 ≤25	50	75
>25	2 × effective opening	3 × effective opening

4.6.3.3 *Non-testable devices*

Non-testable devices shall be installed as follows:

(a) *Atmospheric vacuum breaker (AVB)* AVBs shall—

(i) be located not less than 150 mm above the highest outlet;

(ii) have no isolating valves located downstream of the vacuum breaker;

(iii) not, under normal operation, remain continuously pressurized for more than 12 h ~~(see~~ , as set out in AS/NZS 2845.1~~)~~;

(iv) be ventilated to the atmosphere, at all times;

(v) not be located in an area that may be subject to ponding; and

(vi) be located in-line and be at least the same size as the supply and discharge piping.

(b) *Hose connection vacuum breaker (HCVB)* HCVBs shall—

(i) be located downstream of the isolating valve;

(ii) not, under normal operation, remain continuously pressurized with water for more than 12 h; and

(iii) be ventilated to the atmosphere at all times.

(c) *Dual-check valve with atmospheric port (DCAP)* DCAPs shall—

(i) not be located in an area that is subject to ponding or freezing; and

(ii) have the vent port located not less than 300 mm above the finished surface level so that the device is freely drained or over a tundish.

NOTES:

1 For an example of atmospheric port location, see Figure ~~G5~~F5, Appendix ~~G~~F.

2 For leakage from devices, see Clause 4.6.2.3.

(d) *Dual check valve (DUAL CV)* DUAL CVs shall not be located in an area subject to freezing.

(e) *Dual check valve with intermediate vent (DuCV)* DuCVs shall—

(i) not be located in an area that is subject to ponding; and

(ii) have the vent port located not less than 300 mm above the finished surface level so that the device is freely drained or over a tundish.

NOTES:

1 For an example of the port location, see Figure ~~G5~~F5, Appendix ~~G~~F.

2 For leakage from devices, see Clause 4.6.2.3.

(f) *Beverage dispenser dual-check valve (BDDC)* BDDCs shall—

(i) not be located in an area that is subject to freezing; and

(ii) have the vent port located not less than 300 mm above the finished surface level so that the device can drain freely.

NOTE: For leakage from devices, see Clause 4.6.2.3.

(g) *Single-check valve—Spring loaded (Australia only)* Spring-loaded single check valves shall—

(i) have an isolating valve installed upstream and adjacent to the device;

(ii) be fitted in an accessible position; and

(iii) only be used in fire services.

(h) *Pipe interrupter device (PID)* PIDs shall—

(i) not be installed in a continuous pressure system; and

(ii) be located not less than 300 mm above the finished surface level so the device can drain freely.

NOTE: For leakage from devices, see Clause 4.6.2.3.

SECTION 5 INSTALLATION OF COLD WATER SERVICES

5.1 SCOPE OF SECTION

This Section specifies requirements for the installation of pipes, fittings, and apparatus used in cold water services.

NOTE: For installation of heated water services, see AS/NZS 3500.4.

C5.1 *Safety precautions need to be observed when cutting into pipework or disconnecting water meters, fittings and devices on pipework. There have been fatalities and injuries that have been attributed to water services carrying an electrical current.*

Where existing metallic service pipework is to be replaced in part or in its entirety by plastics pipe or other non-metallic fittings or couplings, the work should not commence until the earthing requirements have been checked by an electrical contractor and modified, if necessary.

5.2 PROXIMITY TO OTHER SERVICES

5.2.1 General

Where electrical conduits, wires, cables or consumer gas pipes, drains and other services are in existence, pipes shall be installed in accordance with the requirements of Clauses 5.2.2 to 5.2.10.

5.2.2 Separation from above-ground electrical conduit, wire, cable or consumer gas pipes

A separation of at least 25 mm shall be maintained between any above-ground water service and any of the following services:

(a) Electrical conduits.

(b) Electrical wires or cables.

(c) Consumer gas pipes.

(d) Sanitary plumbing and drainage.

5.2.3 Separation from underground electrical supply cables or consumer gas pipes

5.2.3.1 *Electrical supply cables*

The separation between any underground water service pipe and ~~an~~ a high voltage electrical supply cable~~,~~ , exceeding 1000 V a.c or 1500 V d.c (see Note), shall be at least—

(a) 100 mm for a water service pipe not greater than DN 65, provided the electrical supply cable is indicated along its length with orange marker tape ~~complying with~~ conforming to AS/NZS 2648.1 and is mechanically protected;

(b) 300 mm for a water service pipe greater than DN 65, provided the electrical supply cable is indicated along its length with orange marker tape ~~complying with~~ conforming to AS/NZS 2648.1 and is mechanically protected; or

(c) 600 mm where the electrical supply cable is neither indicated nor protected in accordance with Items (a) or (b).

(d) The separation between any underground water service pipe and an extra-low voltage: Not exceeding 50 V a.c. or 120 V ripple-free d.c. (see Note) electrical supply, shall be at least 100 mm.

NOTE: For definition of high voltage cable, see AS/NZS 3000.

5.2.3.2 *Consumer gas pipes*

The separation between any underground water service pipe and consumer gas pipes shall be at least—

(a) 100 mm for a water service pipe not greater than DN 65, provided the consumer gas pipe is indicated along its length with marker tape ~~complying with~~ conforming to the requirements of AS/NZS 2648.1 and laid 150 mm above the installed pipe;

(b) 300 mm for a water service pipe greater than DN 65, provided the consumer gas pipe is indicated along its length with marker tape ~~complying with~~ conforming to AS/NZS 2648.1 and laid 150 mm above the installed pipe; or

(c) 600 mm where the consumer gas pipe is neither indicated nor mechanically protected.

NOTES:

1 Mechanical protection may be provided by concrete slabs, continuous concrete pour, or bricks designed for protecting electrical supply cables.

2 For clearance from a communication cable, see Clause 5.2.5.

5.2.4 Separation from underground electrical earthing electrode

For an electrical supply not exceeding 1000 V, the separation between any underground water service pipe and an electrical earthing electrode shall be at least 500 mm.

NOTE: For an electrical supply exceeding 1000 V, the relevant regulatory authorities should be contacted for a ruling.

5.2.5 Separation from underground communication cable

The separation between any underground water service pipe and a communication cable shall be at least 100 mm.

5.2.6 Separation from underground drains

The following applies:

(a) Water services pipes shall not be laid in or through any drain.

(b) A water service pipe may be laid in the same trench as a drain (see ~~Figure 5.2.6~~Note), provided the following conditions are observed:

(i) The water service pipe is located on a shelf or ledge, excavated at one side of the trench not less than 50 mm from the continuation of the trench, or on compacted bedding such that the horizontal separation of the two pipes is not less than 100 mm and the required depth of cover is maintained.

(ii) The underside of the water pipe is at least 100 mm above the top of the drain.

NOTE: See Figure 5.2.6 for an example of the laying of water supply piping in the same trench as a drain.

5.2.7 Separation from non-drinking water

~~The following applies:~~

~~(a)Above-ground installations of~~ Water services shall be separated from a non-drinking water ~~services shall not be installed within 100 mm of any parallel drinking water supply.~~service in accordance with Clause 9.3.2.

5.2.8

~~(b) Below-ground installations of non-drinking water services shall not be installed within 300 mm of any parallel drinking water supply.~~

~~NOTE: See also Clause 9.3.3.~~**Separation from other underground services**

The separation between any underground water service pipe and any other service, other than consumer gas piping and electrical or communication service, shall be at least—

(a) 100 mm for a water service pipe not greater than DN 65; or

(b) 300 mm for a water service pipe greater than DN 65.

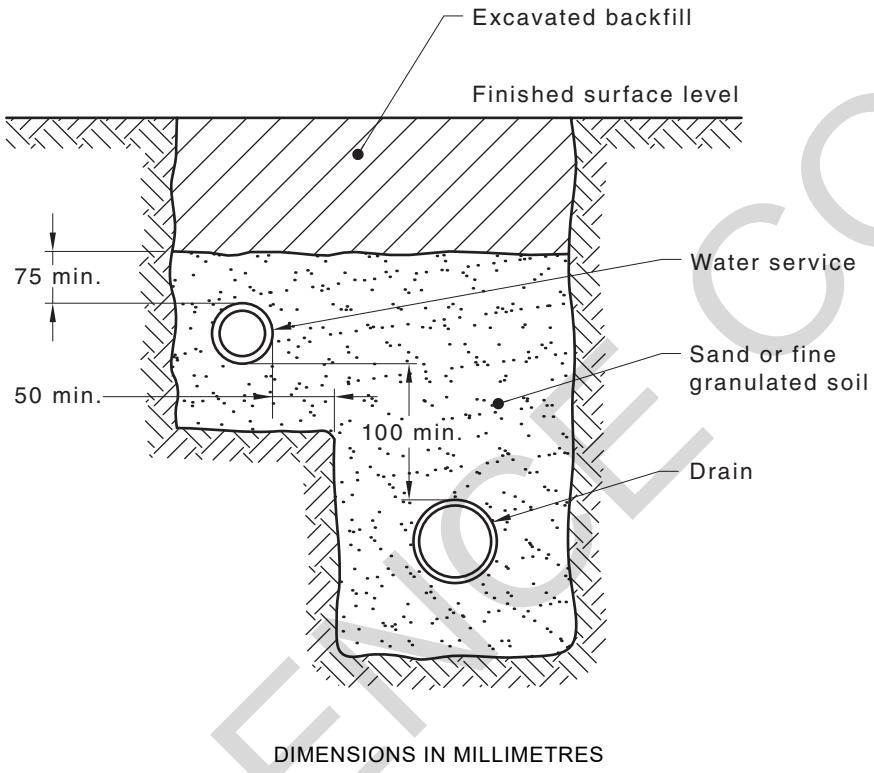


FIGURE 5.2.6 LAYING OF WATER SUPPLY PIPING IN SAME TRENCH AS A DRAIN

5.2.9 Crossover of other underground services

Any underground water service crossing another service or any underground service crossing a water service shall—

(a) cross at an angle of not less than 45°;

(b) have a vertical separation of not less than 100 mm; and

(c) be marked along its length for 1 m either side of the centre-line of the service with marker tape ~~complying with~~ conforming to AS/NZS 2648.1 and laid 150 mm above the installed service.

5.2.10 Clearance from underground obstructions

Water service pipes shall be installed with sufficient clearance to any underground obstruction to protect the service from physical damage and to permit repairs. The clearance shall be at least—

(a) 100 mm for a water service not exceeding DN 65; and

(b) 300 mm for a water service exceeding DN 65.

5.3 ISOLATING VALVES

5.3.1 General

The flow within the water service pipes shall be controlled by means of isolating valves.

5.3.2 Location

Isolating valves shall be installed in the following locations:

(a) At ~~the water main (at either a tapping or tee insertion) and~~ any connection to an alternative water supply.

(b) At the water meter inlet or at the point of connection with the property service if no meter is fitted.

(c) At each flushing cistern.

(d) At each appliance.

(e) At each testable backflow prevention device.

(f) At each thermostatic mixing valve.

(g) At each pressure-limiting or pressure-reduction valve.

(h) At each pumping apparatus.

(i) At each storage tank (inlet).

(j) At each storage tank outlet (where capacity exceeds 50 L).

(k) At each offtake point to an irrigation system.

Where a water meter is fitted outside the property, an additional isolating valve shall be installed.

NOTE: For isolating valves on home fire sprinkler systems, see AS 2118.5 or NZS 4517.

5.3.3 On fire services

On fire services, additional isolating valves shall be installed as follows:

(a) At each water main.

(b) At or near the property boundary.

(c) At each hose reel.

(d) At each pumping apparatus.

NOTES:

1 A stop valve is a valve that can be operated to stop the flow in a pipeline and includes stop taps, ball valves, gate valves.

2 The isolating valve adjacent to the water utilities water meter should meet the requirements of AS/NZS 3718.

5.3.4 Multiple dwellings

An isolating valve shall be installed on each branch serving an individual dwelling and be accessible by the individual dwelling occupier.

5.3.5 Maintenance

Isolating valves within the property shall be installed so that they are accessible.

5.4 LOCATION OF PIPING

5.4.1 Location

The following applies to the installation of water service pipes:

(a) Any water service branch, including valves, shall be located within the dwelling it serves.

(b) Water service pipes shall not be embedded or cast into concrete structures.

NOTES:

1 Care should be taken to ensure that the water service is not damaged during normal building activities.

2 Concealed piping should be maintained under normal water pressure while subsequent building operations, which could cause damage to the pipes, are being carried out.

3 All pipes should be flushed with clean water at regular intervals until the building is occupied.

4 To prevent any unreasonable rise in the temperature of the cold water delivered to fixtures located within a building, pipes and fittings installed above the ground should be protected against the heating effects of solar radiation or other heat sources.

5.4.2 Concealed piping

5.4.2.1 *Walls*

Water services located in timber- or metal-framed walls shall be installed as follows:

(a) *Timber wall framework* Holes or notches made in timber studs and plates in walls shall be in accordance with the following:

(i) The maximum size and spacing of holes or notches in studs shall be in accordance with Figure 5.4.2.1(A) and Table 5.4.2.1.

(ii) Where uninsulated pipes are used, a collar of lagging material or a neutral cure silicone sealant shall be used to fill the annular space.

(b) *Timber beams, bearers and joists* Holes or notches made in timber beams, bearers and joists in floors shall be in accordance with Figure 5.4.2.1(A) and Figure 5.4.2.1(B).

(c) *Metal framework* Holes drilled or formed in metal studs or plates shall be accurately sized to enable suitable grommets, insulation or a short sleeve of oversize pipe firmly secured in the framework to be inserted around the pipe, to ensure no direct contact between the pipe and framework but to allow free longitudinal movement of the pipe through the grommet, lagging or sleeve, as shown in Figures 5.4.2.1(C) and 5.4.2.1(D).

(d) Pipes located in cavities shall be installed so as to prevent the transfer of moisture from the outer wall to the inner wall.

NOTE: Care should be taken to ensure that the air cavity moisture barrier within an external wall of any building is not bridged with pipe or pipe duct penetrations and porous pipe insulation materials. A clear air gap is required between the external wall and the pipe insulation material. For additional details, see Figures 5.4.2.1(C) and 5.4.2.1(D).

TABLE 5.4.2.1
HOLES AND NOTCHES IN STUDS AND PLATES

Symbol	Description	Limits	
		Notched	Not notched
A	Distance between holes and/or notches in stud breadth	Min. 3*D*	Min. 3*D*
H	Hole diameter (studs and plates)	Max. 25 mm (wide face only)	Max. 25 mm (wide face only)
C	Notch into stud breadth	Max. 10 mm	Max. 10 mm
E	Notch into stud depth	Max. 20 mm (for diagonal cut in bracing only) (see Note)	Not permitted (see Note)
F	Distance between notches in stud depth	Min. 12*B*	N/A
F	Trenches in plates	3 mm max.	

NOTE: A horizontal line of notches up to 25 mm may be provided for the installation of baths.

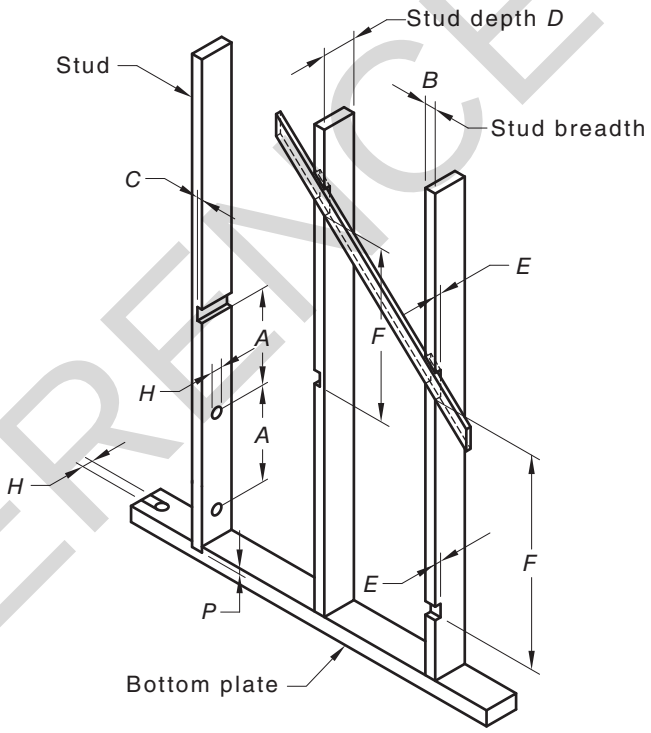
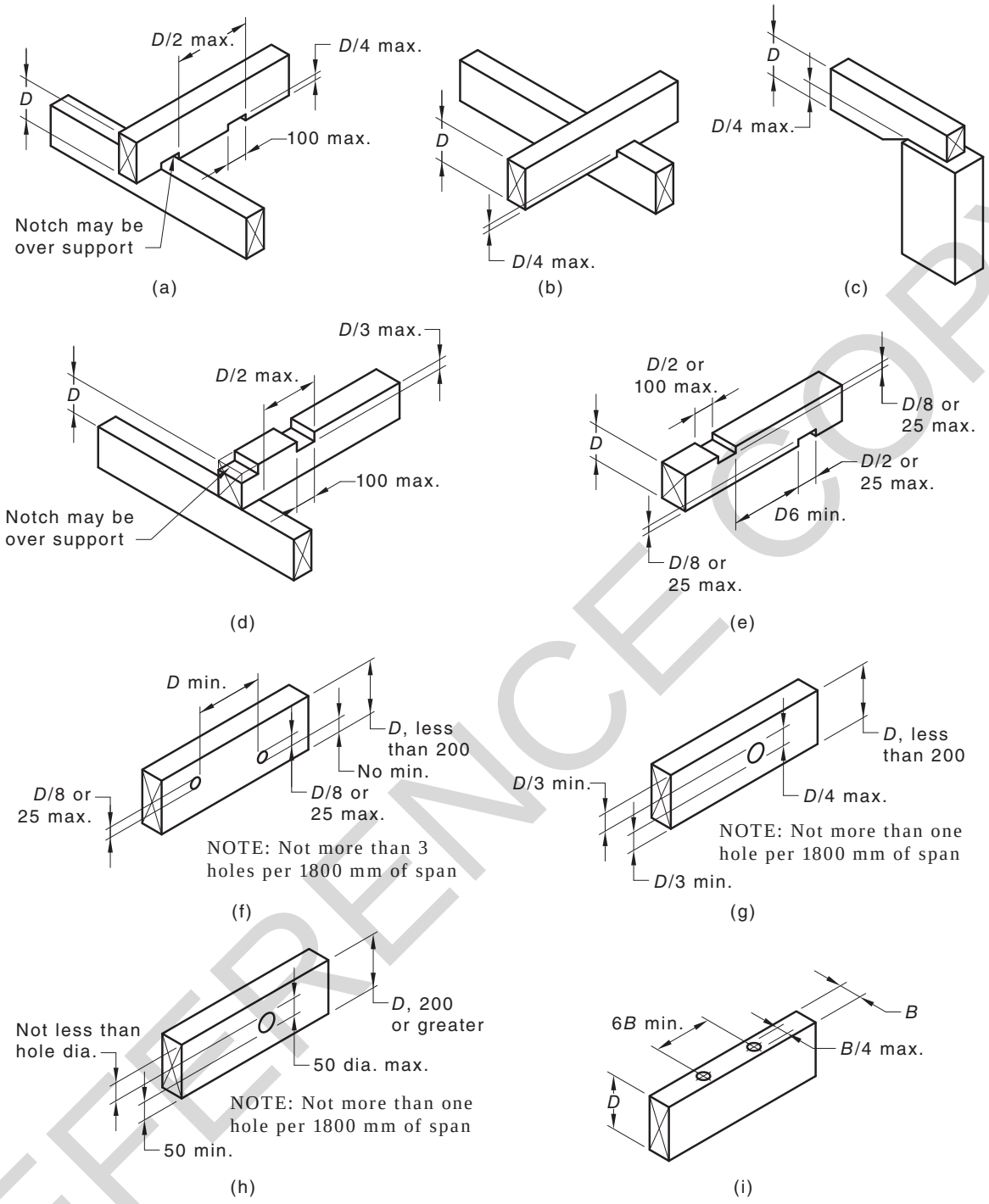
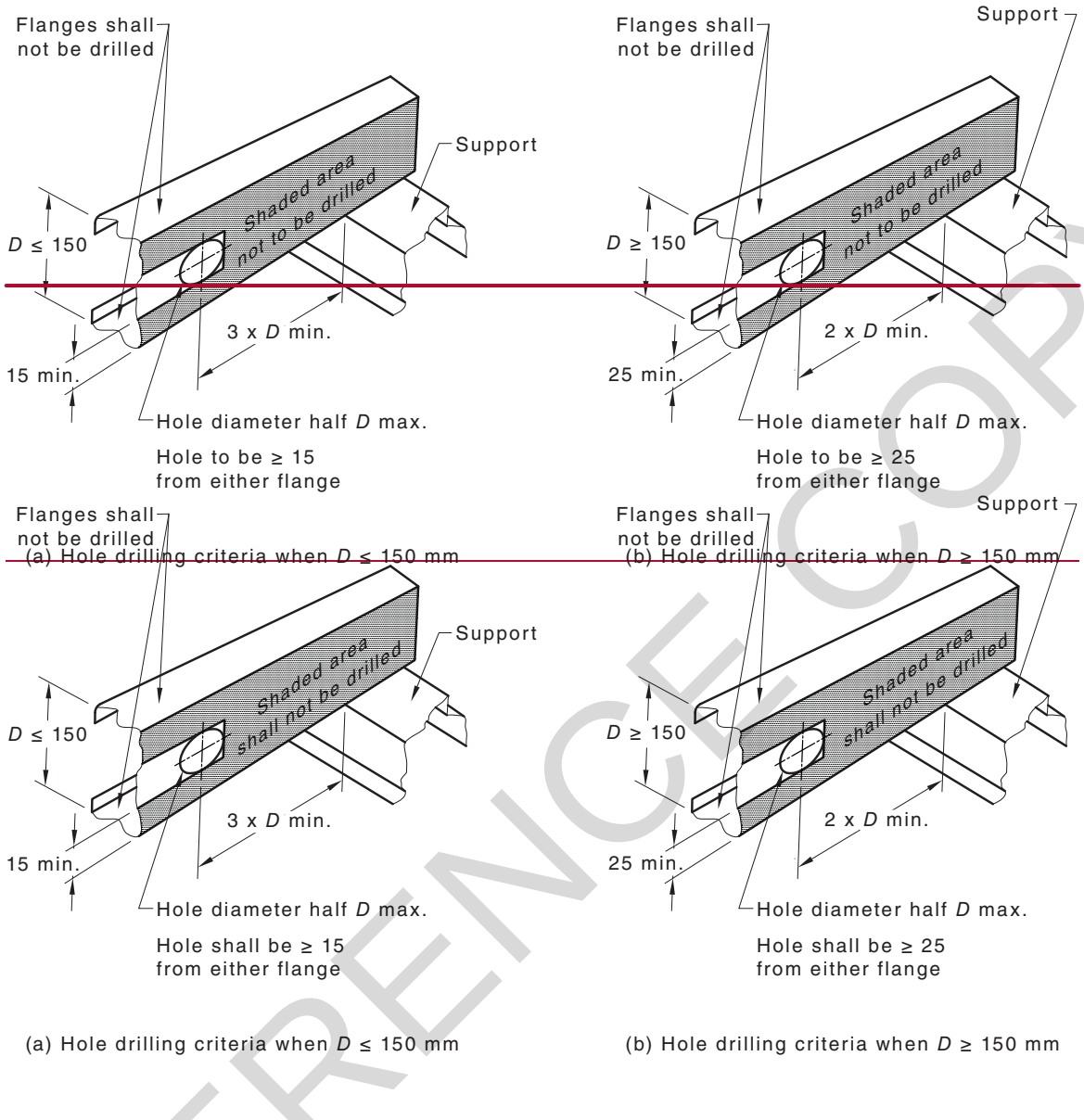


FIGURE 5.4.2.1(A) NOTCHING OF WALL STUDS



DIMENSIONS IN MILLIMETRES

FIGURE 5.4.2.1(B) NOTCHES, CUTS AND HOLES IN BEAMS, BEARERS, JOISTS, RAFTERS



DIMENSIONS IN MILLIMETRES

FIGURE 5.4.2.1(C) PENETRATIONS TO STEEL FLOOR JOISTS

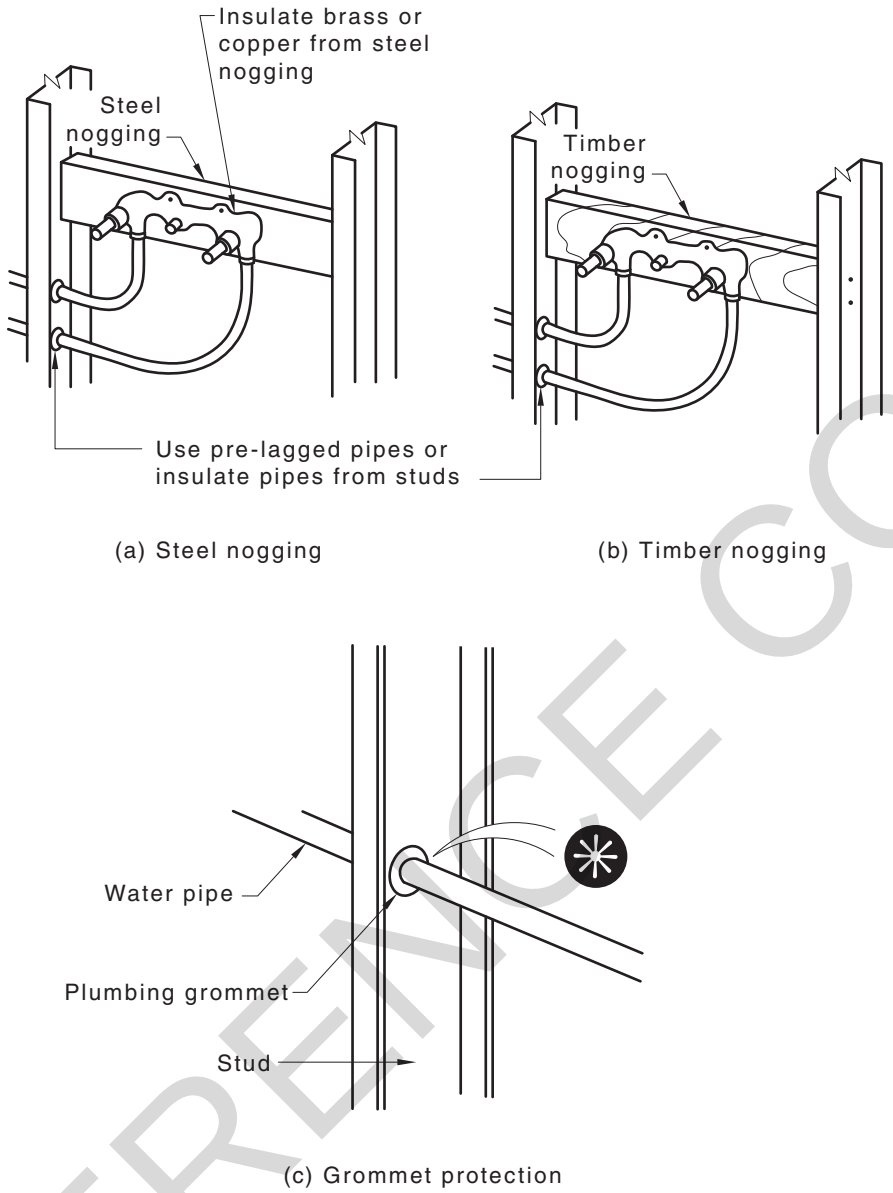


FIGURE 5.4.2.1(D) INSTALLATION AND FIXING OF SERVICES

5.4.3 Chases, ducts or conduits

Pipes located in chases, ducts or conduits within walls or floors of masonry or concrete construction shall be installed in accordance with the following:

(a) Pipes in chases shall be continuously wrapped with an impermeable flexible material.

(b) Ducts shall be fitted with removable covers.

(c) Conduits embedded in walls or floors shall ~~comply with~~ conform to the requirements of the NCC or New Zealand Building Code, as applicable.

5.4.4 Under concrete slabs

Water service pipes located beneath concrete slabs on ground shall ~~comply with~~ conform to the following:

(a) Pipes shall be laid in a narrow trench on a bed of sand or fine-grained soil placed and compacted in a manner that will not damage the piping. There shall be a minimum distance of 75 mm between the top of the pipe and the underside of the slab or slab-stiffening beam.

(b) The ends shall be crimped or capped prior to pouring of the concrete and measures shall be taken to protect the exposed pipe from damage.

(c) Any pipework that penetrates the slab shall be at right angles to the surface of the slab, and shall be lagged for the full depth of the slab penetration with—

(i) an impermeable flexible material of not less than 6 mm thickness; or

(ii) impermeable plastics sleeve or conduit providing equivalent protection.

NOTE: Where termite protection is required, the integrity of the chosen termite protection method should not be compromised.

(d) Metal pipes shall be continuously lagged with an impermeable material.

(e) Soft-soldered joints shall not be used.

(f) The number of joints shall be kept to a minimum.

5.5 METHODS OF JOINTING

5.5.1 General

Jointing of water services shall be in accordance with the following:

(a) *Removal of burr* The burr formed in cutting any pipe shall be removed.

(b) *Joints requiring use of heat* Care shall be taken so that pipes or fittings are not damaged by the application of excessive heat.

(c) *Use of fittings* Where straight sections of pipe of different diameter are to be joined, such increase or reduction in size shall be made by a fitting.

(d) *Crimping* Crimping, shall not be used when joining to reduce a larger diameter pipe to a smaller diameter pipe.

(e) *Jointing of copper or stainless steel pipes* Copper or stainless steel water service pipes of different diameter shall not be joined by filling the annular space using a filler rod.

(f) *Fabricated fittings* Sockets and tees may be fabricated from copper, copper alloy or stainless steel pipes using tools specifically designed for such purposes and shall then be silver brazed.

(g) *Copper tees* Copper tees shall not be fabricated from pipe of thickness less than Type C in accordance with AS 1432.

5.5.2 Threading

Threads shall ~~comply with~~ conform to the relevant Standard for the materials to be ~~joined~~ jointed and be sealed with a compatible jointing medium.

5.5.3 Bolted gland and gibault type joints

5.5.3.1 *General*

Joints of the bolted gland type or gibault type may be used to join similar or dissimilar pipes and fittings of the same nominal diameter.

5.5.3.2 *Joints below ground*

Bolted gland and gibault type joints used below ground shall be protected against corrosion in accordance with Clause 5.12.

5.5.4

~~5.5.4 Capillary fitting~~

~~Capillary fittings used to join~~ Joining of **copper and copper alloy pipes** ~~shall comply with AS 3688.~~

Fittings used to join copper and copper alloy pipes shall conform to AS 3688 and be installed in accordance with the installation requirements of AS 4809.

5.5.5 Compression joints

Compression joints shall ~~comply with~~ conform to AS 3688 or AS/NZS 4129.

NOTE: Croxed joints without rubber olives may be used in New Zealand.

5.5.6 Flanged joints

Flanges shall be attached to ~~the~~ pipe ends by means of—

(a) threads for galvanized steel pipe and fittings;

(b) silver brazing in accordance with Clause 5.5.8.1 or bolting for flanges of copper alloy to copper or copper alloy pipes or fittings;

(c) priming fluid and solvent cement for PVC-U pipes and fittings; and

(d) set screws for cast iron pipes and fittings.

Flange joints below ground shall be protected against corrosion in accordance with Clause 5.12.

5.5.7 Roll-grooved joints

Roll-grooved joints fittings shall ~~comply with~~ conform to AS 3688.

Where used below ground, the joints shall be—

(a) protected against corrosion with each assembled copper or copper alloy joint protected with a petrolatum-based wrapping system; and

(b) external to a building and not under concrete.

5.5.8 Silver brazing

5.5.8.1 *Joints*

A compatible flux shall be used when making joints.

5.5.8.2 *Taps and valves*

Silver brazing shall not be used as a means of ~~jointing~~ joining taps or valves to pipes larger than DN 20. To prevent damage, the tap assembly and jumper valve shall be removed from the body of taps and valves prior to silver brazing.

5.5.9 Soft soldering

A compatible flux shall be used when making joints.

NOTE: The chemical composition of the water in some areas may preclude the use of soft solder joints.

5.5.10 Solvent cement joints

Pipes and fittings of PVC material shall be joined by solvent cementing (using a suitable cleaner/primer) in accordance with AS/NZS 2032.

Solvents cements and priming fluids for PVC-U and PVC-M pipes and fittings shall ~~comply with~~ conform to AS/NZS 3879, except where a gap-filling solvent cement is required. For PVC-C pipes, solvent cement and priming fluids shall ~~comply with~~ conform to ASTM F493.

5.5.11 Jointing of stainless steel pipe and fittings

5.5.11.1 *Jointing of piping, up to and including DN 25*

Joints not larger than DN 25 shall be made by using Type 1 or Type 2 mechanically jointed compression fittings ~~complying with~~ or press-fit end connectors conforming to AS 3688 or using silver-brazed stainless steel capillary joints. Silver brazing alloys shall ~~comply with~~ conform to Clause 2.6.4.

5.5.11.2 *Jointing of piping larger than DN 25*

Joints in stainless steel piping larger than DN 25 ~~shall either~~ shall—

(a) be butt welded using a tungsten inert gas (TIG) argon arc method and—

(i) have a gap not greater than 0.5 mm between the abutting pipe ends to be joined;

(ii) have inserted a backup ring 6 mm long, made from the parent pipe, to straddle the joint of pipes with a wall thickness less than 1.2 mm;

(iii) use a low carbon stainless steel type filler rod not greater than 2 mm in diameter; and

(iv) be tack welded in not less than four spots around the circumference, prior to welding the entire joint; or

(b) have flanged joints~~,~~ fabricated by rolling or welding to the pipe~~,~~ a stub flange of the same wall thickness as the pipe, having a diameter conforming to dimension 'F' in AS 2129, AS/NZS 4331.1, AS/NZS 4331.2 or AS/NZS 4331.3, with mild steel back up flange ~~complying with~~ conforming to AS 2129, AS/NZS 4331.1, AS/NZS 4331.2 or AS/NZS 4331.3, fitted and a gasket not less than 3 mm thick inserted~~.~~; or

(c) stainless steel press-fit end connectors conforming to AS 3688.

5.5.12 Jointing of dissimilar metallic pipes and fittings below ground

Where ferrous and non-ferrous pipes or fittings are joined together below ground, protection against galvanic corrosion shall be provided by—

(a) fitting a plastic connector or a short length of plastic pipe between the dissimilar metals, for threaded type joints; or

(b) fitting an insulating gasket between flanges, insulating sleeves along the bolts, and insulating washers under the bolthead and nut, for flanged type joints.

NOTE: For electrical safety precautions, see Clause 5.2.

5.6 SUPPORT AND FIXING ABOVE GROUND

5.6.1 General

Water services installed above ground shall be retained in position by brackets, clips or hangers.

5.6.2 Brackets, clips and hangers

Brackets, clips and hangers shall be—

(a) formed of material compatible with pipe;

(b) securely attached to the building structure and not to any other service;

(c) designed to withstand the applied loads;

(d) where exposed to a corrosive environment, protected against corrosion;

(e) of like material or lined with a non-abrasive, inert material for that section where contact with the piping may occur;

(f) clamped securely to prevent movement, unless designed to allow for thermal movement;

(g) restrained to prevent lateral movement; and

(h) installed so that no movement can occur while a valve is being operated and so that the weight of the valve is not transferred to the pipe.

5.6.3 Limitations of pipe supports

The following applies:

(a) Pipes shall not be supported by brazing or welding short sections of any material to the pipe surface, nor by clamping, brazing or welding to adjacent pipes.

(b) Brackets, clips and hangers incorporating PVC shall not be used in contact with stainless steel pipes.

5.6.4 Spacing

Water services shall be supported and fixed at the intervals specified in Table 5.6.4.

TABLE 5.6.4

SPACING OF BRACKETS AND CLIPS

Nominal pipe size DN	Maximum spacing of brackets and clips, m			
	Copper, copper alloy and stainless steel pipes	Galvanized steel and ductile iron pipes	UPVC, polyethylene, cross-linked polyethylene, polypropylene, polybutylene pipes and CPVC	
			Horizontal or graded pipes	Vertical pipes
10	1.5	—	0.50	1.00
15	1.5	2.0	0.60	1.20
16	—	—	0.60	1.20
18	1.5	—	0.60	1.20
20	1.5	2.0	0.70	1.40
22	—	—	0.70	1.40
25	2.0	2.0	0.75	1.50
32	2.5	2.5	0.85	1.70
40	2.5	2.5	0.90	1.80
50	3.0	3.0	1.05	2.10
63	—	—	1.10	2.20
65	3.0	3.0	1.20	2.40
75	—	—	1.30	2.60
80	3.0	4.0	1.35	2.70
90	3.0	—	1.40	2.80
100	3.0	4.0	1.50	3.00
110	—	—	1.50	3.00
125	3.0	4.0	1.70	3.00
140	—	—	1.70	3.40
150	3.0	4.0	2.00	4.00
160	—	—	2.00	4.00

NOTE: Due to water pressure effects, additional brackets, clips or hangers ~~complying with~~ conforming to Clause 5.6.2 may be required to prevent movement.

5.6.5 Securing of pipes and fittings

Any pipe or fitting that may be subjected to strain or torsion shall be positively fastened against twisting or any other movement.

5.7 STANDPIPES

Standpipes shall not be smaller than DN 15, and shall be connected downstream of the lower outlet bend of the water meter assembly.

All standpipes connected to the water service shall be securely supported by fixing to walls of buildings, or other rigid supports.

Standpipe taps shall be at a height of not less than 450 mm above the finished surface level or the top of a disconnector gully, as applicable.

5.8 ANCHORAGE BELOW GROUND

5.8.1 General

Water services with elastomeric (rubber) ring joints laid below ground shall be restrained by thrust blocks.

5.8.2 Location of thrust blocks

Thrust blocks shall be installed—

(a) at all bends or junctions;

(b) at the termination of piping;

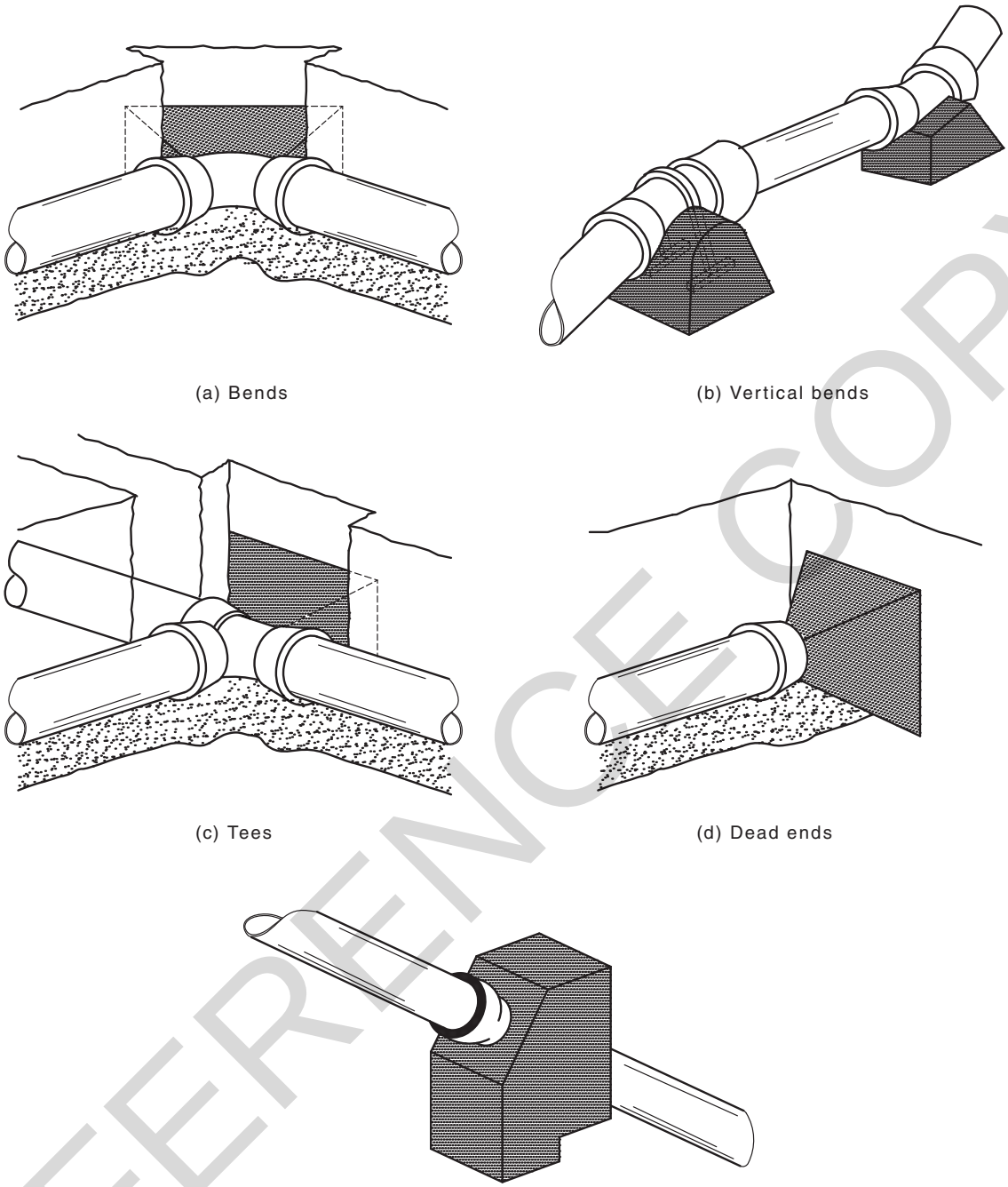
(c) at valves installed in piping;

(d) at the reducing fitting in the direction of the smaller pipe;

(e) at changes of direction in excess of 5°; and

(f) at grades in excess of 1:5.

NOTE: For typical locations of thrust blocks, see Figure 5.8.2.



(a) Bends

(b) Vertical bends

(c) Tees

(d) Dead ends

(e) Gradient anchorage

FIGURE 5.8.2 TYPICAL LOCATIONS OF THRUST BLOCKS

5.8.3 Construction of thrust blocks

Thrust blocks shall be—

(a) constructed of concrete with one side bearing against a firm vertical or horizontal face of the excavation, as appropriate; and

(b) designed so that the full hydrostatic forces in the piping are transmitted to the surrounding soil without the maximum bearing pressures of the soil and piping materials being exceeded.

Thrust blocks shall be installed such that thrust will not be transmitted to any other service.

5.9 DEPTH OF COVER

Where water services are installed below ground, the minimum cover shall ~~comply with~~ be as specified in Table 5.9, measured from the proposed finished surface levels.

TABLE 5.9
MINIMUM DEPTH OF COVER FOR BURIED PIPES

Loading conditions	Minimum cover mm
Under slabs and footings (concrete)	75
Not subject to vehicular loading (excluding fire services)	300
Fire services not subject to vehicular loading	600
Subject to vehicular loading:	
(a) no carriageway	450
(b) sealed carriageway	600
(c) unsealed carriageway	750
Pipes in embankments or subject to construction equipment loads	750

NOTE: For minimum cover in bushfire areas, see Clause 5.20.

5.10 BEDDING AND BACKFILL

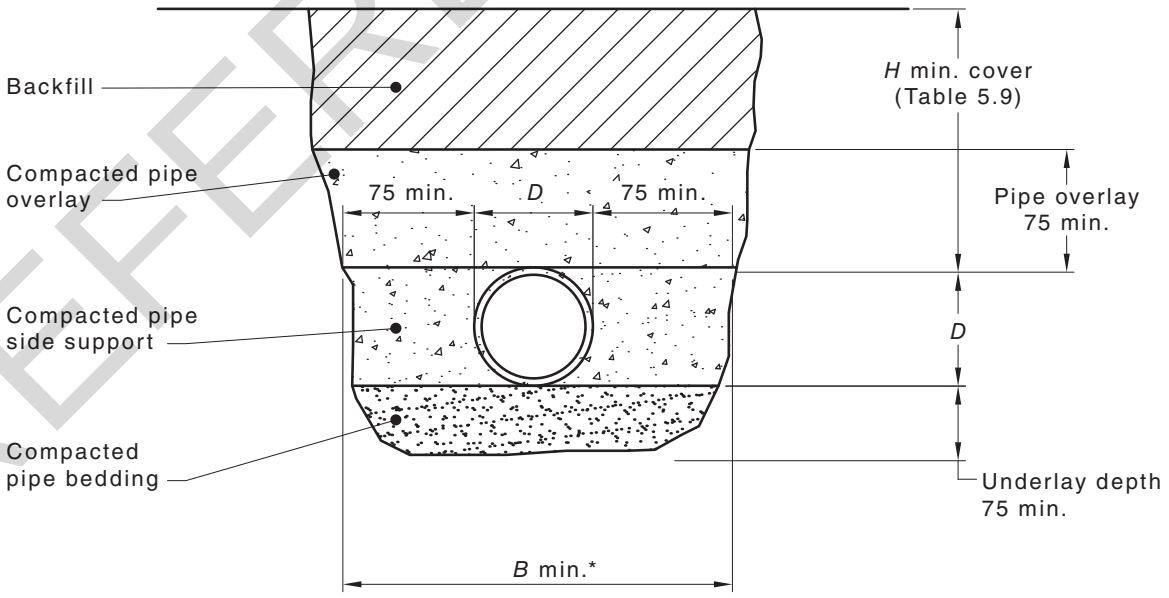
The water services shall be surrounded with not less than 75 mm of compacted sand, or fine-grained soil, with no hard-edged object in contact with or resting against any pipe or fitting.

NOTE: For typical installation, see Figure 5.10.

Material used for final backfill shall be free from rock, hard matter or organic material and be broken up to contain no soil lumps larger than 75 mm.

Unless specified to the contrary, copper and stainless steel pipelines may be installed in soil excavated from the trench in which they are to be installed, provided the soil is compatible with copper and stainless steel and free from rock and rubble.

NOTE: For minimum cover, see Clause 5.9.



*B min. = D + 150

DIMENSIONS IN MILLIMETRES

FIGURE 5.10 TYPICAL INSTALLATION IN A TRENCH

5.11 INSTALLATION IN CONTAMINATED AREAS

The installation of any water service in or through a contaminated area shall be—

(a) laid through a watertight, corrosion-resistant conduit of sufficient length, strength and impermeability to afford adequate protection to the water service; or

(b) fixed not less than 600 mm above the surface of the ground likely to be contaminated.

NOTE: For the purposes of this Standard, contaminated areas are those that are subject to bacterial or chemical pollution. These areas include ash pits, tanks, ponds, manure bins, waste disposal depots, and wastewater treatment works.

5.12 CORROSIVE AREAS

Where metallic pipes, metallic fittings or Type M multilayer pipes are installed in a water service in a corrosive area, they shall be protected externally—

(a) with an impermeable flexible plastic coating;

(b) by placing in a sealed polyethylene sleeve; or

(c) by continuously wrapping in a petrolatum taping material.

NOTE: Corrosive areas are those that contain substances such as any compound consisting of magnesium oxychloride (magnesite) or its equivalent, coal wash, acid sulfate soils, sodium chloride (salt), ammonia or materials that could produce ammonia.

5.13 PIPES IN WATER-CHARGED OR FILLED GROUND

When applied to water services pipes laid in water-charged or filled ground, the solutions provided in this Section are suitable for pipe sizes ~~of~~ not greater that DN 40.

NOTE: There is no deemed-to-comply solution for installing water pipes of DN 50 or larger in water-charged or filled ground~~.~~ , so reference should be made to the performance requirements of the Plumbing Code of Australia (PCA).

5.14 OPEN CHANNELS OR WATERCOURSES

Water services crossing any open channel or watercourse shall be installed in accordance with the requirements of the authority controlling the channel or watercourse.

5.15 PRIVATE EASEMENTS

5.15.1 Proximity of water services

Where two or more water services are installed in a private easement, they shall not cross or be closer than 100 mm to each other.

5.15.2 Depth of piping

The depth of the pipes and fittings shall ~~comply with~~ be as specified in Table 5.9.

5.16 DRY SERVICES

Where provided for future connection to a water supply, a dry service shall ~~comply with~~ conform to the following ~~requirements~~:

(a) The ends of the dry water service shall be kept clean and sealed to prevent the entry of dirt, soil, or other matter.

(b) Before use, the service shall be tested in accordance with Section 18.

5.17 PROTECTION AGAINST FREEZING

5.17.1 General

In areas where the ambient temperature regularly falls below 0°C, care shall be taken to reduce the likelihood of the water service being damaged by water freezing within the pipes.

5.17.2 Piping located outside buildings

All pipes and fittings shall be—

(a) buried to a minimum depth of 300 mm, measured from the proposed finished surface level to the top of the pipe; or

(b) surrounded with waterproof, thermal insulation of minimum thickness, as given in Table 5.17.2(A).

NOTE: Typical examples of insulating materials are given in Table 5.17.2(B).

TABLE 5.17.2(A)

MINIMUM THICKNESSES FOR THERMAL INSULATION

Pipe size	Thermal conductivity of insulating material, W/m.K				
	0.03	0.04	0.05	0.06	0.07
DN	Minimum thickness required, mm				
15	9	14	20	29	40
18	6	9	12	15	20
20	4	6	8	10	12
25	3	4	5	6	8
32	2	3	4	5	6

NOTE: The insulation thicknesses were calculated using the equations given in BS 5422 to just prevent freezing of water initially at 15°C if exposed to an ambient temperature of −5°C for a period of 8 h.

TABLE 5.17.2(B)

TYPICAL EXAMPLES OF INSULATING MATERIALS

Example of material	Thermal conductivity W/m.K
Rockwool or fibreglass section pipe insulation (prefabricated sections)	0.032
Rockwool or fibreglass loose fill or blanket material	0.034–0.040
Flexible polyethylene foam pipe	0.032–0.045
Foamed nitrile rubber	0.040
Loose vermiculite (exfoliated)	0.06–0.07
Flexible foam plastic pre-insulated copper pipe	0.070–0.075

5.17.3 Pipes located on metal roofs

Pipes shall not be installed in direct contact with metal roofs. Where it is necessary to run pipework across a metal roof, it shall be surrounded with waterproof insulation of minimum thickness, as given in Table 5.17.2(A).

NOTE: Consideration should be made for the thermal expansion and contraction of piping and the roof material.

5.17.4 Pipes located inside buildings

5.17.4.1 *General*

Pipes shall be installed so as to avoid those areas of the building that are difficult to keep warm and where temperatures are likely to fall below freezing. These areas include—

(a) unheated roof spaces;

(b) unheated cellars;

(c) locations near windows, ventilators or external doors where cold drafts are likely to occur; and

(d) locations in contact with cold surfaces such as metal roofs, metal framework, or external metal cladding materials.

5.17.4.2 *Pipes in unheated roof spaces*

Pipes in unheated roof spaces shall be located not less than 100 mm away from the roof covering and external walls.

NOTE: Where practicable, pipes should be located under any insulating material laid for restricting heat losses through the ceilings.

5.17.4.3 *Pipes adjacent to external walls*

Pipes ~~in~~ adjacent to external walls shall be positioned not less than 20 mm away from the external surface.

NOTE: Where practicable, pipes should be located on the heated side of any wall insulation present.

5.17.5 Insulation of piping

Where it is necessary to install piping in any of the areas listed in Clause 5.17.4.1, the pipes and fittings shall be surrounded by an appropriate thickness of insulation as ~~given in Tables~~ specified in Table 5.17.2(A).

NOTES:

1 If conditions are particularly severe over an extended time, additional thicknesses of insulation may be necessary to prevent water freezing.

2 In situations where the building, or part of the building, is not in use over the winter months, and no interior heating of the inside areas is maintained, it may be necessary to drain the pipes to prevent damage by water freezing. For effective drainage to occur, it is essential for air to freely enter the pipes, and for all draw-off taps and float valves to be left open when draining is being carried out.

3 For typical examples of insulating materials, see Table 5.17.2(B).

5.18 IDENTIFICATION OF PIPING

In other than domestic or residential buildings (Class 3 to Class 9 buildings), accessible pipework shall be permanently marked so as to be readily identifiable as part of the water service. ~~Pipes installed for non-drinking systems shall be marked accordingly.~~

Identification markings shall ~~comply with~~ conform to AS 1345 in Australia or NZS 5807~~, as appropriate~~ in New Zealand, and be placed—

(a) at spacings not exceeding 8 m; and

(b) adjacent to branches, junctions, valves, and wall and floor penetrations.

5.19 TEMPERATURE CONTROL DEVICES

Temperature control devices shall be installed in accordance with AS/NZS 3500.4.

5.20 BUSHFIRE ZONES

In Australia, in areas designated as bushfire-prone areas by an authority having jurisdiction, all exposed piping shall be metal. Pipes of other materials shall be buried with a minimum depth of cover of 300 mm, measured from the proposed finished surface level to the top of the pipe.

NOTE: The NCC includes requirements for water supply piping in bushfire zones.

SECTION 6 FIRE SERVICES

6.1 SCOPE OF SECTION

This Section specifies requirements for the installation of fire hydrants, fire hose reels, fire sprinkler services and independent wall drencher systems downstream of the backflow prevention device, fitted, where required, to a water supply system.

NOTES:

1 For direction as to when a fire service is required, see the NCC or the New Zealand Building Code.

2 Backflow prevention devices are generally installed at the property boundary and may also be located inside the property.

6.2 MATERIALS AND PRODUCTS

Materials and products used in fire service installations shall be subject to the limits on the use of the material or product specified in Section 2 and the relevant Standard covering the fire service.

NOTES:

1 For examples of devices for backflow prevention at the connection to specified sections of a water supply system within a building or facility, see Table ~~G2~~F2, Appendix ~~G~~F.

2 Some authorities have additional limitations on the use of certain materials.

6.3 INSTALLATION

Fire service piping shall be installed in accordance with Section 5 and the relevant fire system Standard.

Backflow prevention shall be installed in accordance with Section 4.

NOTES:

1 For examples of devices for backflow prevention at the connection to specified sections of a water supply system within a building or facility, see Table G2, Appendix G.

2 For further information refer to the following Standards:

(a) AS 2118.1.
(b) AS 2118.2
(c) AS 2118.3
(d) AS 2118.4
(e) AS 2118.6
(f) AS 2419.1.
(g) AS 2441.
(h) AS 2941.
(i) NZS 4510.
(j) NZS 4515.
(k) NZS 4541.
(l) AS 2118.5 or NZS 4517.

Where fire hose reels are provided in a high hazard area, backflow prevention commensurate with the hazard level shall be provided.

6.4 WATER STORAGE TANKS

Water storage tanks shall be installed in accordance with Section 8. Where a tank provides a reservoir of water in case of a fire, the tank shall not be bypassed unless a backflow prevention device appropriate to the cross-connection hazard rating is installed in the bypass piping.

NOTE: The minimum water storage for fire services should ~~comply with~~ conform to the requirements of the appropriate regulatory authority.

6.5 IDENTIFICATION

Fire service pipelines shall be identified in accordance with AS 1345 or NZS 5807, as appropriate.

SECTION 7 IRRIGATION AND LAWN WATERING SYSTEMS

7.1 SCOPE OF SECTION

This Section sets out requirements for and defines the types of irrigation systems for the purposes of backflow prevention.

7.2 SYSTEM TYPES

Irrigation systems including hose tap connected systems shall be categorized as one of the following types:

(a) *Type A systems* All permanently open outlets and piping more than 150 mm above finished ground level, not subject to ponding or back-pressure and not involving injection systems. No backflow prevention required [see Figure 7.2(A)].

(b) *Type B systems* Irrigation systems in domestic or residential buildings with piping or outlets installed less than 150 mm above finished surface level and not involving injection systems [see Figures 7.2(B) and 7.2(C)].

(c) *Type C systems* Irrigation systems in other than domestic or residential buildings with piping or outlets less than 150 mm above finished surface level and not involving injection systems [see Figures 7.2(D) and 7.2(E)].

(d) *Type D systems* Irrigation system where fertilizers, herbicides, nematicides or the like are injected or siphoned into the system [see Figures 7.2(F) and 7.2(G)].

7.3 BACKFLOW PROTECTION REQUIREMENTS

Type B, Type C and Type D irrigation systems shall be protected against backflow.

NOTE: For examples, see Tables ~~G1~~F1, ~~G2~~ F2 and ~~G3~~F3, Appendix ~~G~~F, and Figures 7.2(A) to 7.2(G), as applicable.

7.4 MATERIALS

All materials, valves and fittings on the upstream side of, and including the last pressurized valve on each line, shall ~~comply with~~ be as specified in Section 2.

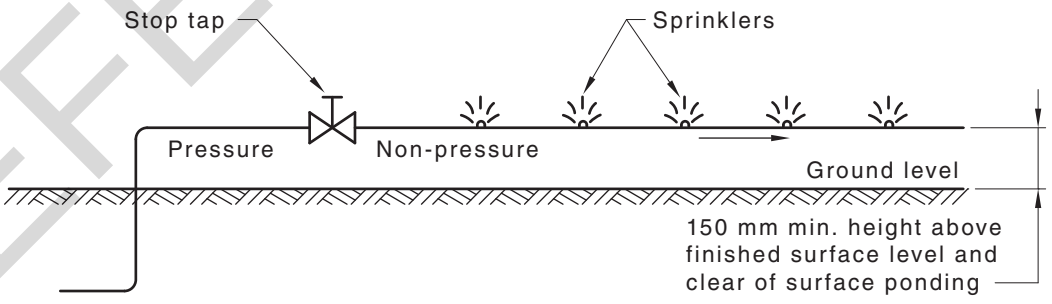
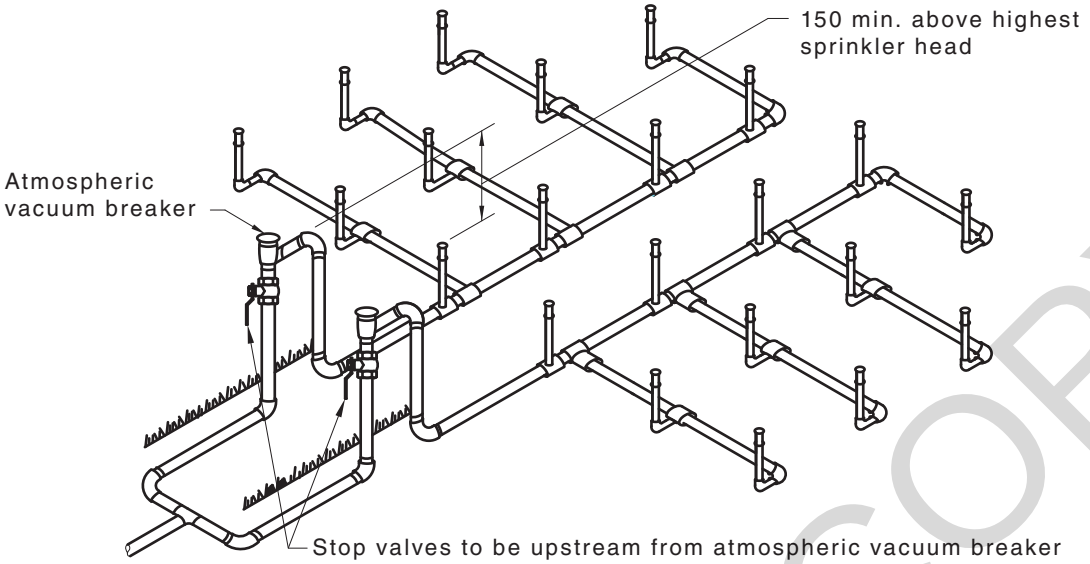
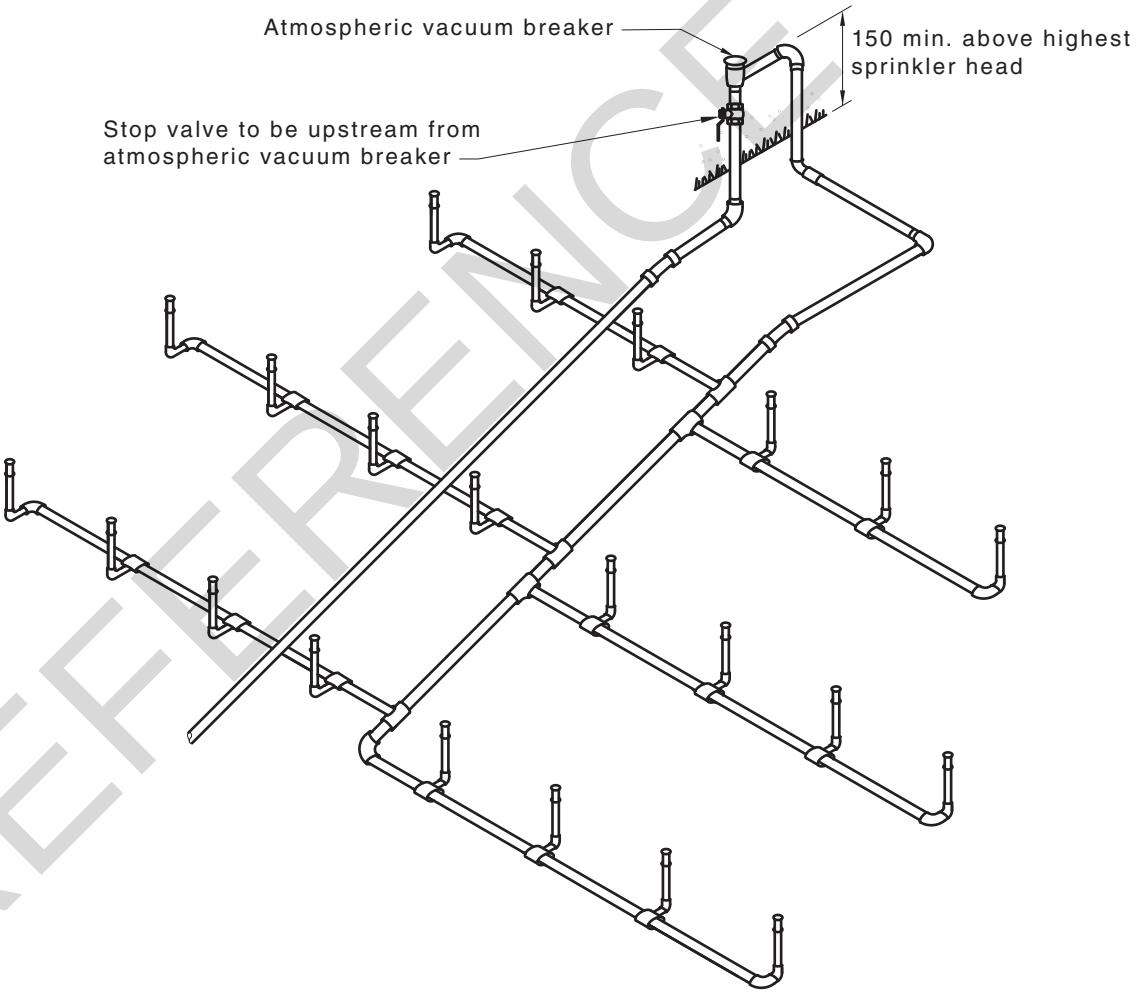


FIGURE 7.2(A) TYPE A SYSTEM—NO BACKFLOW PREVENTION REQUIRED



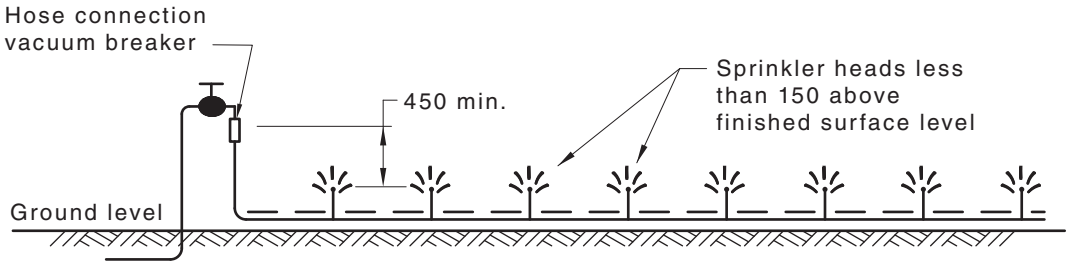
(i) Level terrain—Multi-zone system using atmospheric vacuum breaker



(ii) Hillside system using atmospheric vacuum breaker

DIMENSIONS IN MILLIMETRES

FIGURE 7.2(B) (in part) TYPE B SYSTEM—NON-TESTABLE DEVICES—
NO BACK-PRESSURE



(iii) System using hose connection vacuum breaker

DIMENSIONS IN MILLIMETRES

FIGURE 7.2(B) (in part) TYPE B SYSTEM—NON-TESTABLE DEVICES—
NO BACK-PRESSURE

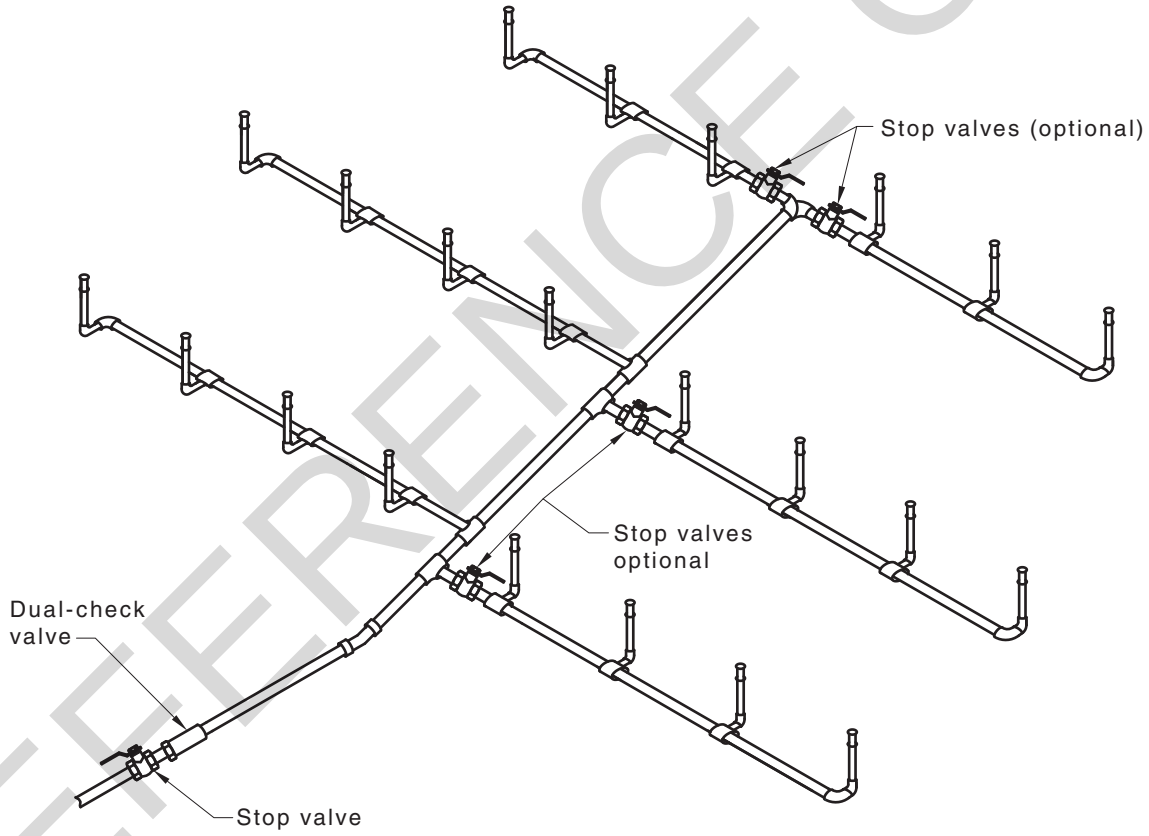
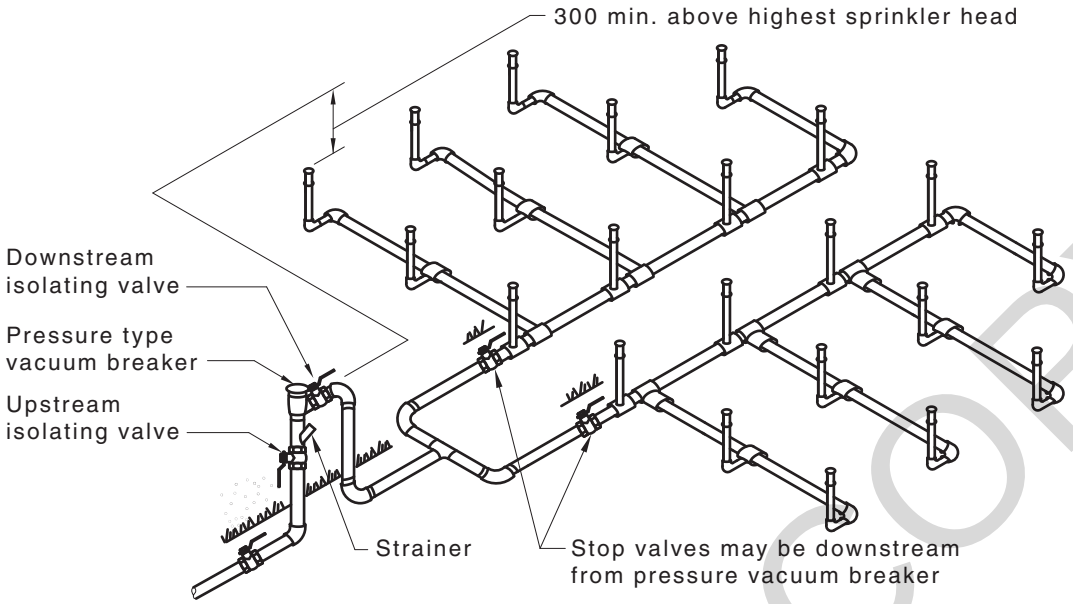
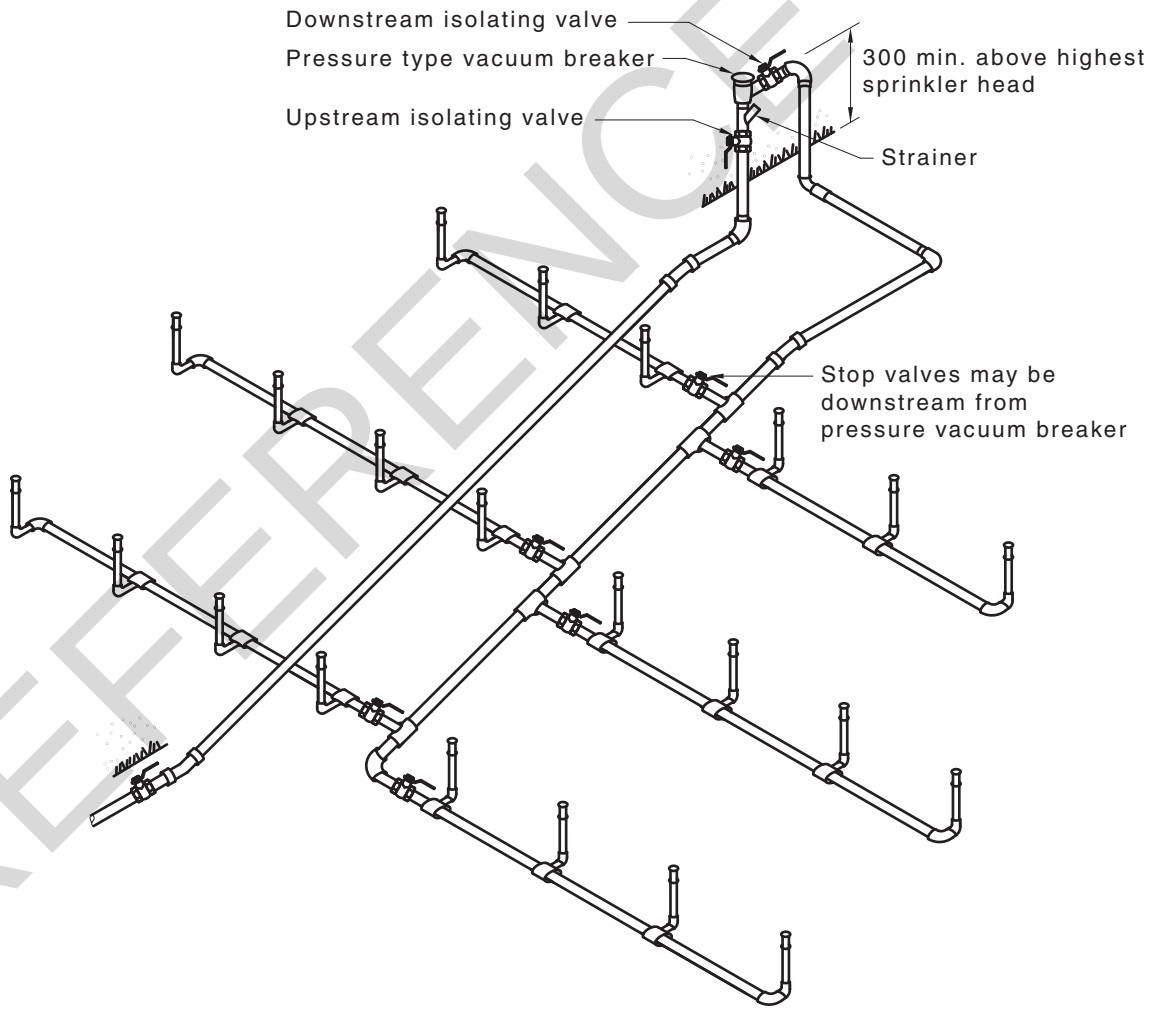


FIGURE 7.2(C) TYPE B SYSTEM—NON-TESTABLE DEVICES—
SUITABLE FOR BACK-PRESSURE



(i) Level terrain—Multi-zone system using pressure type vacuum breaker



(ii) Hillside system using pressure type vacuum breaker

DIMENSIONS IN MILLIMETRES

FIGURE 7.2(D) TYPE C SYSTEM—TESTABLE DEVICES—NO BACK-PRESSURE

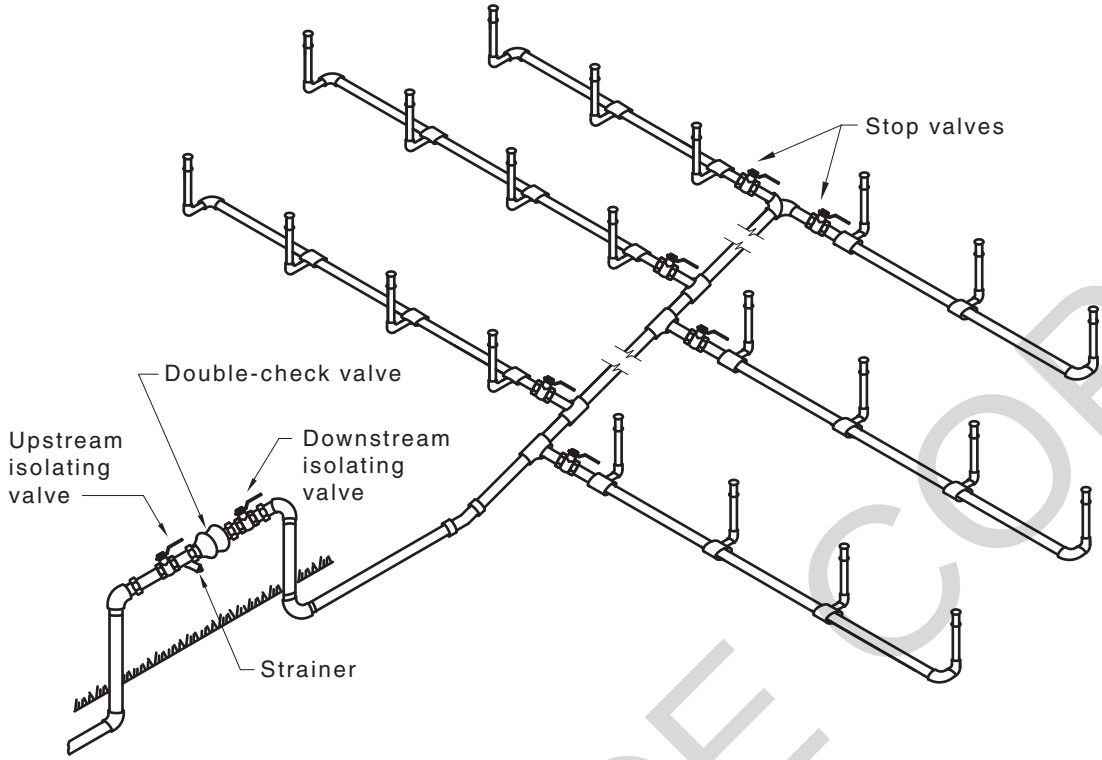


FIGURE 7.2(E) TYPE C SYSTEM—TESTABLE DEVICES SUBJECT TO BACK-PRESSURE OR NO BACK-PRESSURE FOR HILLSIDE OR MULTI-ZONE SYSTEM—DOUBLE CHECK VALVE ASSEMBLY

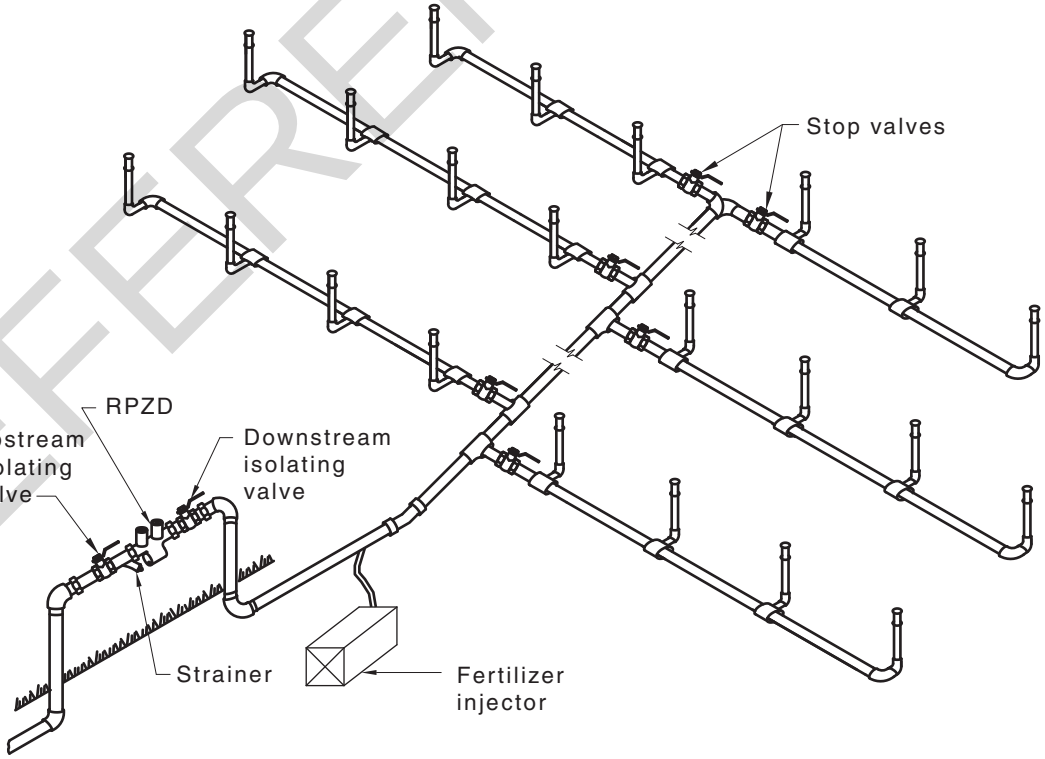


FIGURE 7.2(F) TYPE D SYSTEM—TESTABLE DEVICES SUBJECT TO BACK-PRESSURE OR NO BACK-PRESSURE FOR APPLICATIONS WITH CHEMICAL ADDITIVES—REDUCED PRESSURE ZONE DEVICE

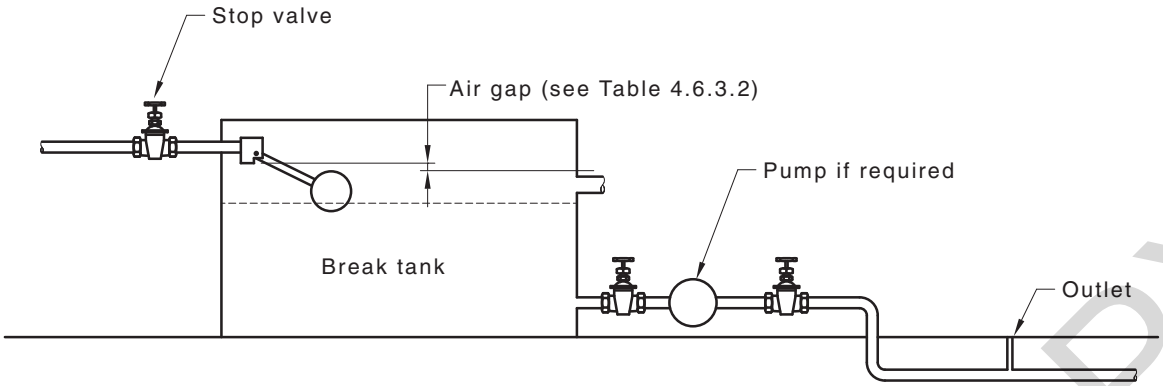


FIGURE 7.2(G) TYPE D SYSTEM—TYPICAL IRRIGATION SUPPLY THROUGH A REGISTERED BREAK TANK

SECTION 8 WATER STORAGE TANKS

8.1 SCOPE OF SECTION

This Section specifies requirements for water storage tanks.

NOTE: For connections of rainwater tanks, see Section 16.

8.2 PURPOSE OF TANKS

8.2.1 General

This Section applies to tanks provided for the storage of water for the following purposes:

(a) Sanitary flushing.

(b) Drinking water supply.

(c) Firefighting.

(d) Air-conditioning.

(e) Refrigeration.

(f) Ablutions.

(g) Prevention of cross-connections.

(h) Make-up water.

(i) Contingency reserve.

8.2.2 Limitations on use

A tank that is intended for the storage of drinking water shall not be used to supply directly any water closet pan, bidet, flush valve, slop hopper pan or other similar fixture or fitting used, or intended to be used, for sanitary flushing, except as provided for in Clause 11.9.

8.3 DESIGN AND INSTALLATION REQUIREMENTS

8.3.1 General

The installation of tanks shall be as follows:

(a) Materials used to construct tanks shall ~~comply with~~ be as specified in Section 2.

(b) All tanks shall be installed on bases, plinths or supports designed to adequately support the weight of any such tank and its contents when filled to maximum capacity.

(c) All metallic tanks, or such other tanks as may be directed, shall be installed with a membrane of non-corrosive insulating material between the support and the underside of the tank.

(d) Every tank shall be supported in such a manner that no load is transmitted to any of the attached pipes.

(e) All tanks shall be accessible for inspection, repairs, maintenance and replacement.

(f) Every tank shall be provided with a cover that is designed to prevent the entry of dust,

(g) For New Zealand, see acceptable solution NZBC G12/AS1.

8.3.2 Capacity of storage tanks—Measurement

The storage capacity of any tank shall be taken to be the volume of water above the invert of the outlet pipe when the water surface is 20 mm below overflow level.

8.3.3 Access

Access to tanks shall be provided in accordance with the following:

(a) Headroom and side access shall be provided for every tank to enable inspection, cleaning and maintenance procedures to be carried out to the interior and exterior of the tank.

(b) The requirements of AS 2865 shall be taken into account in the design, manufacture and installation of a water tank.

Where the interior depth of any storage tank exceeds 2 m, access ladders of standard design and dimensions ~~complying with~~ conforming to AS 1657 shall be installed.

8.3.4 Placement of tank

8.3.4.1 *Safe-tray*

Where required, tanks shall be placed in safe-trays in accordance with Clause 8.8.

8.3.4.2 *Limitations on location of drinking water tanks*

Tanks storing drinking water shall not be located directly beneath any sanitary plumbing or any other pipes conveying non-drinking water.

8.4 TANK DESIGN

8.4.1 General

Water storage tanks shall be designed and connected in accordance with Figure 8.4.1. Tanks with dual water supply shall maintain the air gap in accordance with Clause 4.6.3.2(a). Where the capacity exceeds 500 L, provision shall be made at the base for removal of sludge.

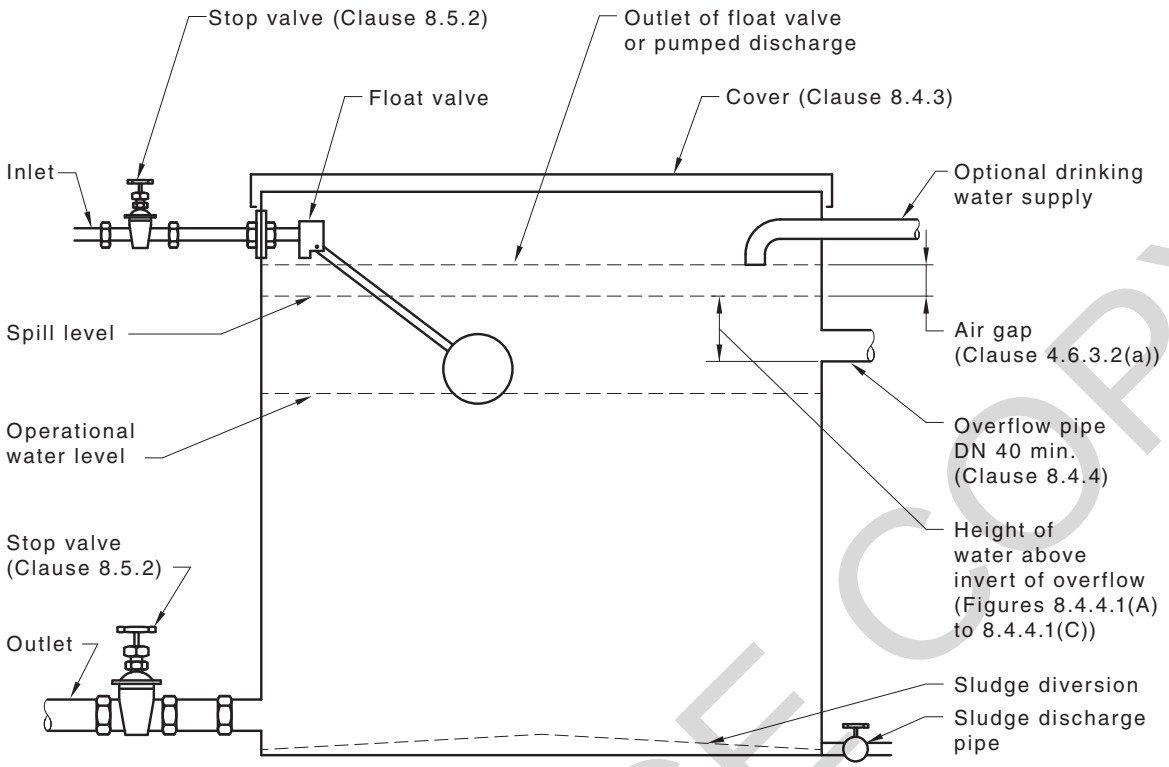


FIGURE 8.4.1 COLD WATER STORAGE TANK

8.4.2 Internal corrosion protection

Where required for corrosion protection, the internal surfaces of tanks shall be coated with a protective coating.

8.4.3 Tank cover

Any tank that supplies drinking water shall be provided with a cover that is—

(a) close fitting; and

(b) secured in position if the tank is located externally.

Where the whole cover is not removable, the tank shall be provided with a covered access opening not smaller than 0.5 m^2.

8.4.4 Tank overflow

8.4.4.1 *General*

Overflow pipes from tanks shall be—

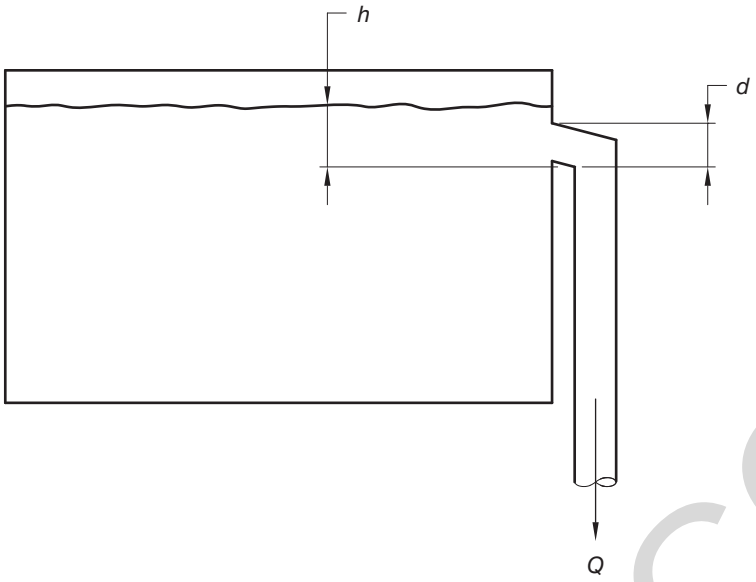
(a) not smaller than DN 40; and

(b) capable of discharging the inflow rates given in Table 8.4.4.1 and the outflow rates specified in Figures 8.4.4.1(A), 8.4.4.1(B) and 8.4.4.1(C) or hydraulically calculated, taking into account the maximum head available in the main (but not less than 500 kPa), friction losses, elevation of the tank, size of the orifice and type of overflow outlet.

TABLE 8.4.4.1
RATE OF INFLOW TO STORAGE TANKS

Diameter of float valve inlet orifice mm	Inflow at 500 kPa L/s
6	0.54
8	0.95
10	1.49
15	3.4
20	6.0
25	9.3
32	15.3
40	23.8
50	37.2*
65	63.0
80	95.4
100	149.0
125	232.8
150	335.2

* Figures 8.4.4.1(A), 8.4.4.1(B) and 8.4.4.1(C) only cover up to this inflow.



Flow rates shall be determined from the following equations:

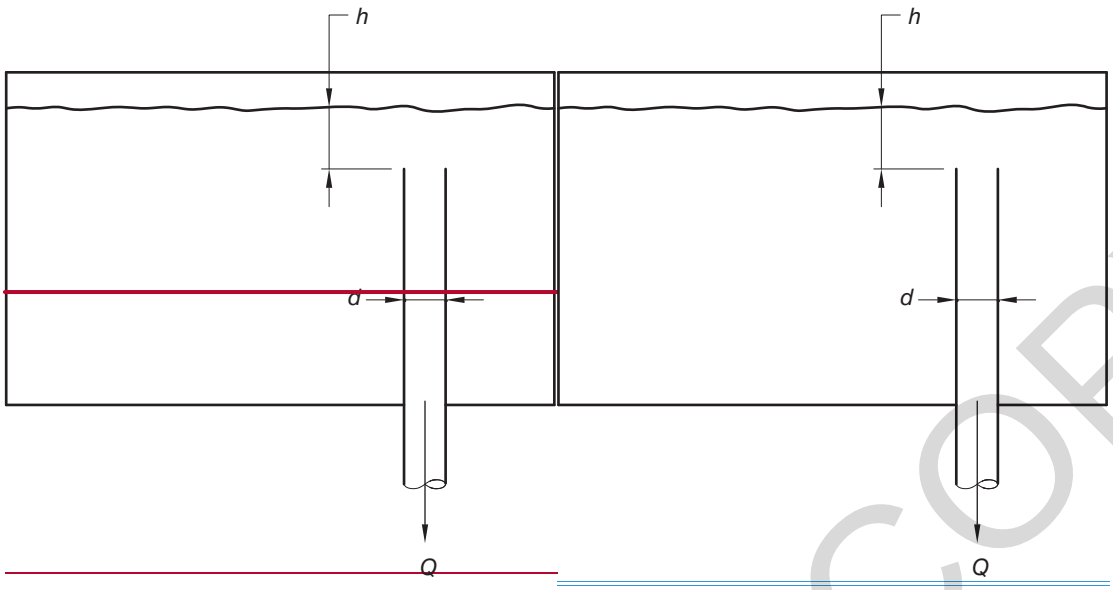
Weir flow, $h \leq d$ $Q = 6.6 \times 10^{-5} \times d^{0.7} \times h^{1.8}$ . . . 8.4.4.1(1)

Orifice flow, $h > d$ $Q = 6.6 \times 10^{-5} \times d^{2} \times \sqrt{\left(h - \frac{d}{2}\right)}$ . . . 8.4.4.1(2)

Internal diameter of overflow pipe (*d*)	Discharge through overflow (*Q*), L/s									
	Height of water above invert of overflow (*h*), mm									
mm	20	30	40	50	75	100	125	150	175	200
40	0.14	0.28	0.47	0.58	0.78	0.94	1.08	1.20	1.31	1.42
50	0.16	0.33	0.55	0.83	1.17	1.43	1.65	1.84	2.02	2.18
75	0.21	0.44	0.73	1.09	2.27	2.93	3.47	3.94	4.35	4.73
100	0.26	0.53	0.90	1.34	2.78	4.67	5.72	6.60	7.38	8.08
125	0.30	0.62	1.05	1.56	3.25	5.45	8.15	9.65	10.94	12.09
150	0.34	0.71	1.19	1.78	3.69	6.19	9.25	12.86	14.85	16.60
175	0.38	0.79	1.33	1.98	4.11	6.89	10.30	14.30	18.91	21.44
200	0.42	0.87	1.45	2.17	4.51	7.57	11.31	15.71	20.73	26.40

NOTE: The orifice coefficient $m = 0.6$ applies to the orifice flow conditions. Water heights are measured from the pipe invert or crest. This allows for overflows that are not flowing full. The capacity of those overflows is determined from the minimum specific energy of flow over a weir. No allowance is given in the Table for belling of the overflow, nor for an increase in effective head due to siphonage through the overflow pipe. These factors may substantially increase the discharge capacity of the overflow pipe.

FIGURE 8.4.4.1(A) RATE OF OUTFLOW FROM TYPE 1 OVERFLOW (PIPED) HORIZONTAL OUTLET STORAGE TANKS



Flow rates shall be determined from the following equations:

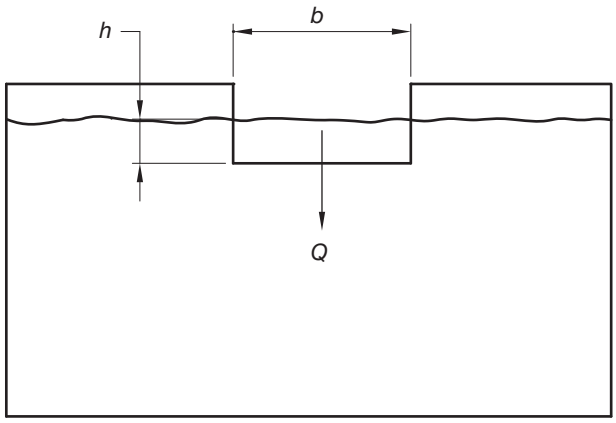
Weir flow, $h \leq \frac{d}{3}$ $Q = 1.98 \times 10^{-4} \times d \times h^{1.5}$ . . . 8.4.4.1(3)

Orifice flow, $h > \frac{d}{3}$ $Q = 6.60 \times 10^{-5} \times d^2 \times \sqrt{h}$ . . . 8.4.4.1(4)

Internal diameter of overflow pipe (d)	Discharge through overflow (Q), L/s									
	Height of water above invert of overflow (h), mm									
mm	20	30	40	50	75	100	125	150	175	200
40	0.47	0.58	0.67	0.75	0.91	1.06	1.18	1.29	1.40	1.49
50	0.74	0.90	1.04	1.17	1.43	1.65	1.84	2.02	2.18	2.33
75	1.33	2.03	2.35	2.63	3.22	3.71	4.14	4.55	4.91	5.25
100	1.77	3.25	4.17	4.67	5.72	6.60	7.38	8.08	8.73	9.33
125	2.21	4.07	6.26	7.29	8.93	10.31	11.53	12.63	13.64	14.58
150	2.66	4.88	7.51	10.50	12.86	15.84	16.60	18.19	19.64	21.00
175	3.10	5.69	8.77	12.25	17.50	20.21	22.60	24.76	26.74	28.58
200	3.54	6.51	10.02	14.00	22.86	26.40	29.52	32.33	34.92	37.34

NOTE: The orifice coefficient $m = 0.6$ applies to the orifice flow conditions. Water heights are measured from the pipe invert or crest. This allows for overflows that are not flowing full. The capacity of those overflows is determined from the minimum specific energy of flow over a weir. No allowance is given in the Table for belling of the overflow, nor for an increase in effective head due to siphonage through the overflow pipe. These factors may substantially increase the discharge capacity of the overflow pipe.

FIGURE 8.4.4.1(B) RATE OF OUTFLOW FROM TYPE 2 OVERFLOW (PIPED) VERTICAL OUTLET STORAGE TANKS



Flow rates shall be determined from the following ~~equations~~equation:

Weir flow $Q = 5.39 \times 10^{-5} \times b \times h^{1.5}$ . . . 8.4.4.1(5)

Width of weir (b)	Discharge overflow (Q), L/s									
	Height of water above crest of weir (h), mm									
mm	20	30	40	50	75	100	125	150	175	200
25	0.12	0.22	0.34	0.48	0.88	1.35	1.88	2.48	3.12	3.81
30	0.14	0.27	0.41	0.57	1.05	1.62	2.26	2.97	3.74	4.57
75	0.36	0.66	1.02	1.43	2.63	4.04	5.65	7.43	9.36	11.43
100	0.48	0.89	1.36	1.91	3.50	5.39	7.53	9.90	12.48	15.25
125	0.60	1.11	1.70	2.38	4.38	6.74	9.42	12.38	15.60	19.06
150	0.72	1.33	2.05	2.86	5.25	8.08	11.30	14.85	18.72	22.87
175	0.84	1.55	2.39	3.33	6.13	9.43	13.18	17.33	21.84	26.68
200	0.96	1.77	2.73	3.81	7.00	10.78	15.07	19.80	24.96	30.49

NOTE: The orifice coefficient $m = 0.6$ applies to the orifice flow conditions. Water heights are measured from the pipe invert or crest. This allows for overflows that are not flowing full. The capacity of those overflows is determined from the minimum specific energy of flow over a weir. No allowance is given in the Table for belling of the overflow, nor for an increase in effective head due to siphonage through the overflow pipe. These factors may substantially increase the discharge capacity of the overflow pipe.

FIGURE 8.4.4.1(C) RATE OF OUTFLOW FROM TYPE 3 OVERFLOW (WEIR) RECTANGULAR STORAGE TANKS

8.4.4.2 *Discharge of overflow*

In order not to cause damage or nuisance, the tank overflow shall discharge where it is readily visible—

(a) into the safe-tray, directly over the safe-tray overflow outlet;

(b) directly into the safe-tray overflow;

(c) onto an impervious graded floor, in such manner that the entire discharge drains freely and harmlessly to a floor waste outlet; or

(d) outside the building, clear of doors, windows or other opening, and within the property boundaries.

The supply rate shall be determined from the following equation:

$$Q = m \times A \times \sqrt{(2gH)} \times 10^3 \quad \text{. . . 8.4.4.2}$$

where

Q = supply rate, in litres per second

m = orifice coefficient for thin sharp-edged plate

= 0.6

A = cross-sectional area of orifice, in square metres

g = acceleration due to gravity (9.8 m/s^2)

H = head of water on inlet of orifice, in metres

NOTES:

1 The diameter of the float valve inlet orifice is not necessarily related to the nominal size of the fitting.

2 As a guide, the orifice size is normally half the nominal size, except in the case of full way valves.

3 ~~For additional information, see Figure H1,~~ For an example of calculation of overflow rate, see Appendix ~~H~~G.

8.4.4.3 *Discharge not readily visible*

Where the tank overflow pipe does not discharge to a readily visible position, a telltale pipe not smaller than DN 20 shall be connected to the invert of the overflow pipe and discharge as required by Clause 8.4.4.2.

8.4.4.4 *Size of air gap*

An air gap ~~complying with~~ conforming to Clause 4.6.3.2(a) shall be maintained between the spill level of the tank and the outlet of the water service.

8.5 INLET PIPING

8.5.1 Connections

Union couplings or flanges shall be used to connect the water service to the inlet of the storage tank.

8.5.2 Stop valve

Where a float valve is fitted, an isolating valve shall be installed in an accessible position to allow maintenance of the float valve.

8.6 OUTLET PIPING

8.6.1 Connections

The outlet piping shall be connected to the storage tank by means of union couplings or flanges and shall be a minimum of one pipe diameter from the bottom of the tank.

8.6.2 Service outlets

For tanks of more than 50 L capacity, each service outlet shall be fitted with an isolating valve installed in an accessible location.

8.7 SLUDGE VALVES

A sludge valve shall be fitted when the capacity of the tank exceeds 500 L. The minimum size of the valve shall be not less than half the outlet pipe size nor less than DN 40.

8.8 SAFE-TRAY

8.8.1 General

A safe-tray shall be provided under every storage tank, except where the tank is external to the building or located on an impervious floor graded to an outlet, the safe-tray shall—

(a) have no portion of the tank closer than 75 mm to a vertical line from the edge of the safe-tray and no portion of an attached auxiliary part closer than 25 mm to such vertical line; and

(b) have placed, between the tank and the safe-tray, durable supports not less than 12 mm thick and of an area not less than 0.5*A* nor more than 0.6*A*, (where *A* is the area of the base of the tank), and the support shall project beyond the sides and walls of the tank but not closer than 20 mm to the sides of the safe-tray.

8.8.2 Safe-tray construction

Safe-trays shall be fabricated from materials ~~that comply with~~ as specified in Clause 2.5. The sides of trays shall be not less than 50 mm in height and all joints shall be made watertight.

8.8.3 Overflow

The safe-tray shall be fitted with an overflow that effectively drains the safe-tray. The overflow drain shall have—

(a) an internal diameter greater than the diameter of the tank overflow, but not less than DN 50 in Australia and DN 40 in New Zealand;

(b) a continuous fall to its discharge point in accordance with Clause 8.4.4.2;

(c) all seams in sheet metal pipe uppermost;

(d) all joints in sheet metal pipe lapped in the direction of the flow;

(e) all circumferential joints made watertight; and

(f) support in the vicinity of the tray and at intervals not greater than 1 m horizontally and 2.4 m vertically.

8.9 MARKING OF TANKS

Except if installed in domestic or residential buildings, all tanks shall have their intended use identified with not less than two permanent notices attached to each tank in visible positions, one on the front of the tank and one on the cover. Notices shall—

(a) be not less than 450 mm × 250 mm in size;

(b) have a red background;

(c) have the text in white, capital letters of not less than 25 mm in height; and

(d) have an identification in accordance with AS 2865 where applicable.

Tanks holding drinking water shall carry the following warning:

WARNING: DRINKING WATER

SECTION 9 NON-DRINKING WATER SERVICES

9.1 SCOPE OF SECTION

This Section specifies the design, installation and maintenance requirements for non-drinking water services, including recycled and reclaimed water from the point of ~~supply~~ connection to the point of discharge.

NOTES:

1 For a typical layout of a non-drinking water installation, see Figure 9.1.

2 Non-drinking water is any water that is not fit for human consumption, as determined by the health authority or authority having jurisdiction.

~~3 For water services from rainwater tanks, see Section 16.~~

3 ~~C9.1 Before commencing any work on any non-drinking water service, reference should be made to the local supplier, the health authority and the environmental protection authority for the requirements determining the permitted~~ NCC Volume Three outlines the limitations for the use of non-drinking water.

9.2 MATERIALS AND PRODUCTS

9.2.1 General

Pipework and products used in the installation of non-drinking water services shall ~~comply with~~ be as specified in Section 2.

Colours for pipework and products shall be as specified in—

(a) AS 2700 in Australia; or

(b) NZS 7702 in New Zealand.

9.2.2 Water meters

Water meters shall be—

(a) permanently coloured purple, being no darker than Jacaranda P24 or Purple P12 and no lighter than Lilac P23; and

(b) installed in an accessible position.

NOTE: The meter inlet and outlet threads may be different to prevent interchange with the drinking water meter.

9.3 INSTALLATION REQUIREMENTS

9.3.1 Installation

Installation shall be in accordance with the requirements for drinking water.

~~NOTE: See Section 3 and Section 5.~~

9.3.2 Proximity to other services

9.3.2.1 *Above ground installations*

An above ground non-drinking water services shall be installed—

(a) a minimum of 100 mm from any parallel drinking water service; and

(b) in a duct or structurally separated.

9.3.2.2 *Below ground installations*

~~9.3.2 Non-drinking~~ A below ground non-drinking water services ~~and outlets~~ shall be installed—

(a) a minimum of 100 mm from any parallel drinking water service; and

(b) a minimum of 300 mm from any other non-drinking water service.

NOTE: Below ground installation refers to non-drinking water services buried in the ground.

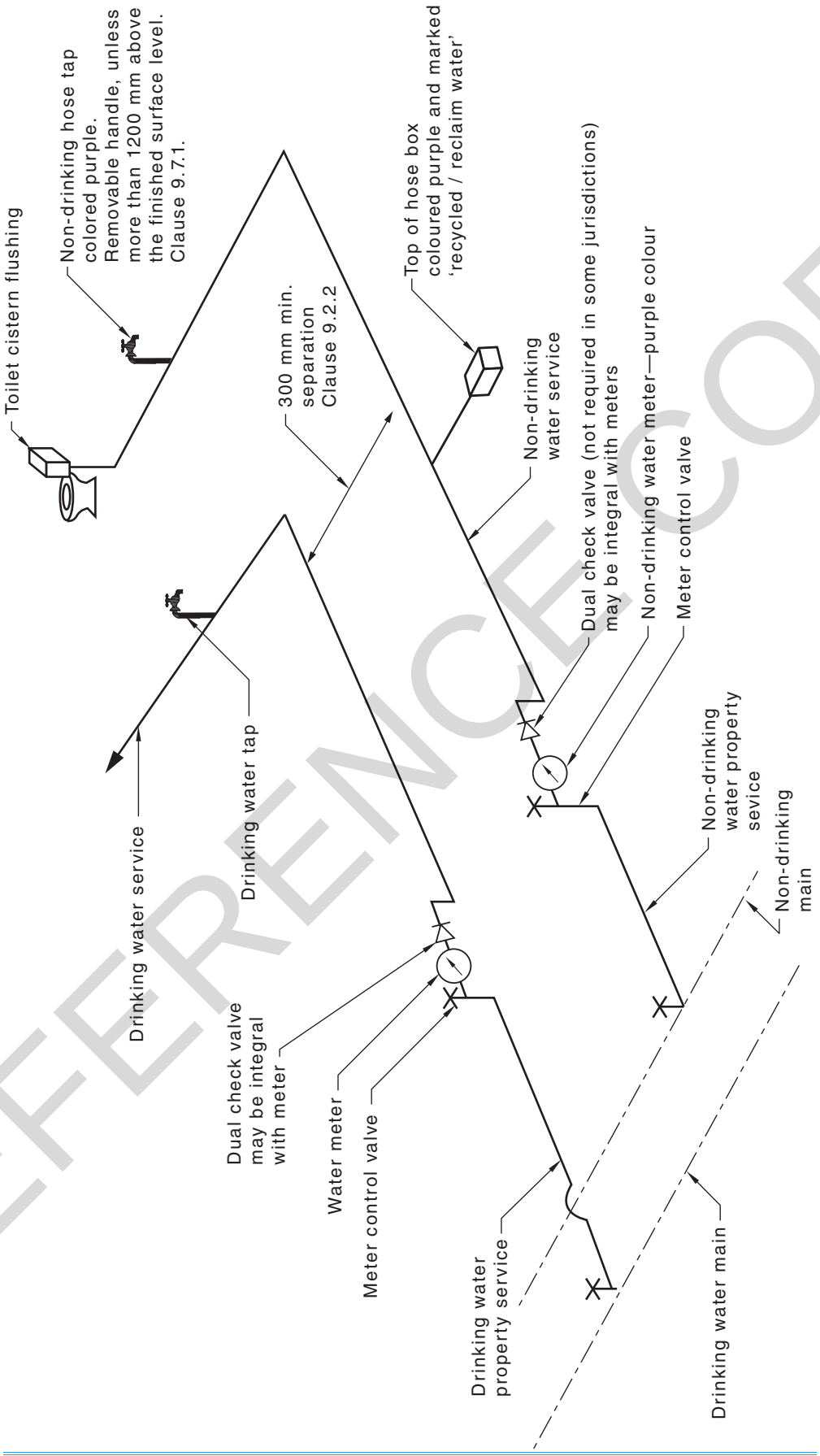


FIGURE 9.1 TYPICAL NON-DRINKING WATER INSTALLATION FROM A RETICULATED RECYCLED WATER SYSTEM

9.4 Cross-connection control

There shall be no cross-connection between any drinking or non-drinking water services.

9.5 Temporary bypass

During construction of a property that is intended to have a non-drinking water service, however a non-drinking water supply has not yet been provided, a bypass line can be temporally installed.

The bypass shall—

(a) be temporary during construction of the building;

(b) be located at the meter or property boundary;

(c) incorporate an insolation valve at the connection to the drinking water service; and

(d) be in an accessible location.

NOTE: A typical temporary bypass is shown in Figure 9.5.

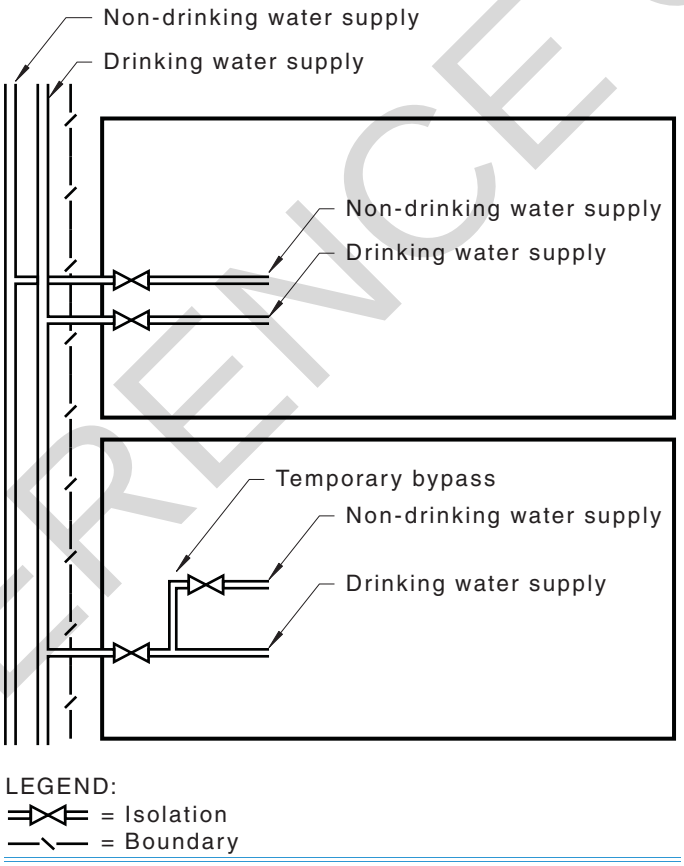


FIGURE 9.5 TYPICAL EXAMPLE OF A TEMPORARY NON-DRINKING WATER BYPASS

9.6 Identification of non-drinking water services

9.6.1 Colour of non-drinking water pipework

~~**9.3.2.1** *Service pipes*~~

~~All pipes shall be identified by~~ Non-drinking water service pipework shall be a purple colour ~~in accordance with AS 2700 (NZS 7702)~~ being no darker than P24 Jacaranda or P12 Purple, and no lighter than P23 Lilac.

Where pipes are not ~~integrally~~ coloured purple, identification ~~may~~ can be achieved by means of close-fitting durable purple-coloured sleeving, netting or spirally wrapped tape.

~~All buried pipes shall have an identification tape complying with AS/NZS 2648.1 and marked with the following:~~

NOTE: It is not necessary to use purple coloured fittings.

9.6.2 Marking of non-drinking water pipework

In other than domestic or residential buildings (Class 3 to Class 9 buildings) accessible pipework shall be permanently marked as a non-drinking water service.

Identification markings shall be placed—

(a) at spacing's not exceeding 8 m;

(b) adjacent to branches, junctions, valves and penetrations; and

(c) markings shall be specified with—

(i) AS 1345 in Australia; or

(ii) NZS 5807 in New Zealand

9.6.3 Identification of buried non-drinking water services

Buried pipes shall be identified with purple coloured underground marking tape.

The contents of pipes shall identified in accordance with—

(a) AS 1345 in Australia; or

(b) NZBC G12/AS1 in New Zealand.

9.6.4 Installation of underground marking tape

Underground marking tape shall—

(a) conform to AS/NZS 2648.1; and

(b) ~~(a)Contrasting purple lettering~~ be installed on top of the pipe, running longitudinally, ~~and~~ fastened to the pipe at not more than 3 m intervals~~.~~ and state the following:

~~(b) The following statement in accordance with AS 1345:~~

RECYCLED OR RECLAIMED WATER—DO NOT DRINK

~~In New Zealand, markings shall be~~ Non-drinking water for irrigation; be installed above the service and be marked with the following:

~~*in accordance with NZBC G12/AS1.*~~ ~~**9.3.2.2 Service fittings**~~

~~Fittings may be coloured purple in accordance with the colours specified in Clause 9.3.2.1.~~

~~NOTE:It is not necessary to use purple coloured fittings for service fittings.~~

THE PIPE BELOW IS NON-DRINKING WATER

9.7 Identification of outlets

9.7.1~~9.3.2.3~~ External non-drinking hose tap outlets~~other than those installed as part of a fire service~~

External non-drinking water hose tap outlets~~, other than those installed as part of a fire service, shall comply with the following:~~ shall—

~~(a) They shall be clearly marked with either a 'warning sign' in accordance with Figure 9.3.2.3 or 'prohibition sign' in accordance to AS 1319; or in New Zealand, in accordance with NZBC G12/AS1. The prohibition sign shall conform with sign number 404 of AS 1319.~~

(a) ~~(b)They shall be of a type that has~~ have a removable handle, except where the outlet is installed 1200 mm or more above the finished surface level~~.~~;

(b) be permanently coloured purple, being no darker than Jacaranda P24 or Purple P12 and no lighter than Lilac P23; and

~~(c) They shall be colour-coated purple permanently in accordance with Clause 9.3.2.1.~~

(c) ~~(d)They shall~~ have standard threads on the inlet and outlet~~, except where the~~ .

9.7.2 All non-drinking water outlets

All non-drinking water outlets

~~authority having jurisdiction requires either a (i) standard inlet connecting thread and non-standard hose connection outlet (left-hand thread); or~~

~~(ii) non-standard inlet connecting thread (e.g. left-hand thread) and a standard hose connection outlet.~~

~~NOTE: The requirement for either a 'Warning' or 'Prohibition' sign in Item (a) and tap connection in Item (b) may differ between regulatory authorities.~~

~~NOTE: The signs shall be in accordance with AS 1319.~~

shall be clearly and permanently marked with a—

(a) warning sign in accordance with Figure 9.7.2(A); or

(b) prohibition sign in accordance with—

(i) AS 1319 in Australia; or

(ii) NZBC G12/AS1 in New Zealand.

NOTE: A typical example of a prohibition sign is shown in Figure 9.7.2(B).

~~FIGURE 9.3.2.3~~ FIGURE 9.7.2(A) TYPICAL EXAMPLE OF A WARNING SIGN

~~AND~~ FIGURE 9.7.2(B) TYPICAL EXAMPLES OF PROHIBITION ~~SIGN~~SIGNS

~~**9.3.2.4 *Other outlets, including fire service outlets***~~

~~All other outlets shall be clearly marked with either a 'warning sign' in accordance with Figure 9.3.2.3 or 'prohibition sign' in accordance to AS 1319; or in New Zealand, in accordance with NZBC G12/AS1. The 'prohibition sign' shall conform with sign number 404 of AS 1319.~~

~~**9.3.3 Proximity to other services**~~

~~The following applies:~~

~~(a) Above-ground installations of non-drinking water services shall not be installed within 100 mm of any parallel drinking water service, except when installed in pipe duct or structurally separated.~~

~~(b) Below-ground installations of non-drinking water services shall not be installed within 300 mm of any parallel drinking water supply.~~

~~**9.3.4 Water meters**~~

~~Water meters shall be coloured purple in accordance with the colours specified in Clause 9.3.2.1. The meter shall be fitted above ground in an accessible position.~~

~~NOTE: The meter inlet and outlet threads are different to prevent interchange with the normal drinking water meter.~~

9.8~~9.4~~ TESTING AND COMMISSIONING A NON-DRINKING WATER SERVICE

9.8.1 Flushing and testing

~~The~~ Prior to use, the non-drinking water service shall ~~be flushed and tested in accordance with Section 18. It shall also be tested for cross-connection, prior to commissioning, as follows:~~be—

(a) flushed in accordance with Clause 18.2; and

(b) hydrostatically tested in accordance with Clause 18.3.

9.8.2 Commissioning a non-drinking water service

A non-drinking water service shall be commissioned as follows:

(a) Turn ~~off~~ on the drinking water supply ~~to the property~~ at the meter ~~(*drinking water meter and non-drinking water meter will be different colours*). The non-drinking water supply to remain on.~~or isolation valve.

(b) Turn off the non-drinking water supply at the meter or isolation valve.

(c) ~~(b)~~Turn on all ~~sink, laundry trough, bath and shower taps~~ tapware (both heated and cold) and appliances one by one. ~~All taps should run dry after a short period of time~~Water should flow from all tapware and appliances.

(d) ~~(c)After taps have run dry, flush~~ Flush all toilets. The toilets ~~should~~ shall not refill ~~as normal,~~ (provided they are connected to ~~the non-drinking water service.~~the non-drinking water service).

(e) Turn on all external hose tap outlets. Water shall flow continuously from the drinking water hose tap outlets with the non-drinking water running dry.

~~(d) Turn on all outside taps. The external drinking water tap should run dry. Taps that continue to run are connected to the non-drinking water service; they shall be clearly identified with warning signs.~~

~~(e) To check appliances, turn off the non-drinking water service and turn the drinking supply back on. Run the non-drinking water service dry via the outside taps or by toilet flushing.~~

~~(f) Turn on the internal appliances. If the appliances do not fill, they are connected to the incorrect supply.~~

~~(g) Turn on the tap connected to the non-drinking water service that is located furthest away from the non-drinking meter.~~

(f) ~~(h)~~Turn the non-drinking water meter tap back on slowly so that all air will be purged from the pipeline while it is being recharged.

~~9.5 CROSS-CONNECTION CONTROL~~

NOTE: The commissioning process may be repeated for the drinking water supply. This process is as follows:

~~Non-drinking water installations shall be designed installed and maintained to prevent a cross-connection with drinking water supply. Where a property is served by a non-drinking water supply, the following shall apply:~~

(a) ~~A backflow prevention device for the degree of hazard, and sized to suit the water service, shall be fitted at the meter (or at the boundary when a meter is not installed) on~~ Turn off the drinking water supply at the meter or isolation valve.

~~(b) There shall be no cross-connection between any drinking or non-drinking water service.~~

~~(c) All external tap outlets on the drinking water service shall be fitted with a low hazard backflow prevention device.~~

~~NOTE: See Clauses 4.4.2 and 4.6.3.3(b).~~

~~(d) Cross-connection protection for non-drinking water service shall meet the requirements of Section 4.~~

(b) Turn on the non-drinking water supply at the meter of isolation valve.

(c) Turn on all heated and cold tapware, including appliances one by one.

(d) Ensure all tap outlets and appliances have run dry.

(e) Flush all toilets. Check that the toilet cisterns have refilled after flushing.

(f) Turn on all external hose taps.

(g) Check that the drinking water taps have run dry.

(h) Check that the non-drinking water taps are flowing continuously.

(i) Turn the drinking water supply back on slowly so that all air will be purged from the pipeline while it is being recharged.

(j) Turn the drinking water supply back on again.

SECTION 10 TREATED GREYWATER SERVICES

10.1 SCOPE OF SECTION

This Section specifies requirements for the installation of services for the supply of greywater, which has been treated, from a greywater treatment system to the point of re-use.

This Section does not cover direct diversion greywater systems.

NOTE: For direct diversion greywater systems, see AS/NZS 3500.2.

C10.1 *There are a number of authorities that should be consulted where treated greywater use is being considered. These authorities include the following:*

(a) The network utility operator(s) responsible for water supply and sewerage or both.

(b) The health authority.

(c) The environment protection authority.

(d) Local council.

(e) State or territory plumbing standards setting authority.

The relevant authority will—

(i) determine the quality levels for the treated greywater; and

(ii) the acceptable internal and external use.

10.2 MATERIALS AND PRODUCTS

Materials and products used in the installation of greywater water services shall ~~comply with~~ be as specified in Section 2.

10.3 CROSS-CONNECTION CONTROL

Greywater installations shall be designed, installed and maintained to prevent a cross-connection with drinking water supply. Where a property is served by a greywater supply, the following shall apply:

(a) A backflow prevention device for the degree of hazard shall be fitted at the meter (or at the boundary when a meter is not installed) on the drinking water supply.

(b) Each external tap on the drinking water service shall be fitted with a low hazard backflow prevention device, such as a hose connection vacuum breaker (see Section 4).

(c) Cross-connection protection from any greywater service shall meet the requirements of Section 4.

10.4 INSTALLATION

Installation of a water supply system from a greywater treatment unit shall ~~comply with~~ be as specified in Section 9.

SECTION 11 WATER FOR SANITARY FLUSHING

11.1 SCOPE OF SECTION

This Section specifies requirements for water services used for sanitary flushing purposes.

11.2 GENERAL

Sanitary fixtures that are cleansed by the action of a flush shall have water supplied by one of the following:

(a) A cistern.

(b) A flush valve supplied by a separate break tank in accordance with Clause 11.6.

(c) A flush valve connected to the drinking water supply service in accordance with Clause 11.9.

(d) A flush valve supplied through an anti-back-siphonage device.

NOTE: Flushing devices may be used on the following fixtures:

(a) Water closet pan.
(b) Urinal.
(c) Slop hopper pan.
(d) Combination pan room sink and flush bowl.
(e) Bedpan washer.
(f) Floor waste with flushing rim.

11.3 WATER CLOSET

Compatibility of a pan and water closet cistern or flushing device shall be determined in accordance with AS 1172.1 and AS 1172.2.

NOTE: AS 1172.1 and AS 1172.2 require that product labelling indicate matching set model identification where not supplied as close coupled.

11.4 URINALS

Flush valves that connect to urinals shall be installed so that the operating mechanism is not more than 2 m above the floor level. Flush valves shall be accessible and installed above the level of the sparge pipe by not less than—

(a) 300 mm for wall-hung urinals; and

(b) 450 mm for continuous wall urinals.

11.5 INSTALLATION OF CISTERNS

11.5.1 General

Cisterns shall be installed so they are capable of being maintained and serviced.

11.5.2 Urinal type cisterns

Cisterns that connect to urinals shall be installed at a height of not less than 300 mm for wall-hung type urinals and 450 mm for continuous wall urinals, above the level of the sparge pipe or spreader of the urinal stall, measured to the underside of the cistern.

11.5.3 Manually operated cisterns

Manually operated cisterns shall be installed so that the cistern’s operating control is positioned at a height of not more than 2 m, measured from the floor level.

11.5.4 Water closet pan and slop hopper pan type cisterns

Cisterns that connect to a water closet pan or slop hopper pan shall ~~comply with~~ conform to AS 1172.2.

11.6 FLUSH VALVES SUPPLIED FROM BREAK TANKS

11.6.1 General

Break tanks shall be installed in accordance with the requirements of Section 8. Break tanks shall not be used to supply water for drinking purposes.

11.6.2 Capacity

The ~~minimum~~ water storage to be provided for flush valves serving water closets shall not be less than 45 L for each flush valve served, and 30 L for each flush valve serving urinals.

11.6.3 Operating head

The operating water pressure supplied to any flush valve shall not exceed 300 kPa.

11.6.4 Pipe size guide

NOTE: Guidance on the size of service pipes from break tanks to flush valves is given in Table 11.6.4.

TABLE 11.6.4

SERVICE PIPE SIZES—BREAK TANKS TO FLUSH VALVES

Available head of water at highest flush valve m	Maximum number of flush valves served downstream on the same floor and at lower levels	Nominal size of service pipes DN
>3 ≤6	1 to 2 3 to 15 16 to 50 51 to 150	40 50 65 80
>6 ≤9	1 to 3 4 to 30 31 to 150 151 to 200	40 50 65 80
>9 ≤12	1 to 4 5 to 50 51 to 200	40 50 65
>12	1 to 6 7 to 100 101 to 250	40 50 65

11.6.5 Urinal flush valves

Each urinal flush valve shall supply water to not more than three separate urinal stalls, or a continuous urinal wall~~,~~ not more than 1.8 m in length. Only urinal stalls that are located adjacent to each other may be supplied from a common flush valve.

11.7 FLUSH PIPES AND WATER FLOW DISTRIBUTION

Cisterns and flush valves shall supply water to a fixture through a flush pipe or, in the case of a urinal, through a flush pipe or a distribution system in accordance with Table 11.7.

TABLE 11.7

FLUSHING WATER FLOW DISTRIBUTION

Volume of water discharged by the cistern or flushing valve L	Maximum length of urinal wall served per cistern or flushing valve mm	Minimum number of spreaders for the urinal	Nominal size of flush pipe DN	Nominal size of spreader DN
2.5	450*	1	20	—
2.5	600	1	25	20
5.0	1 200	3	32	25
7.5	1 800	4	40	25
10.0	2 400	5	50	25

* Wall-hung unit

11.8 PRESSURE RATIO VALVES

11.8.1 General

Pressure ratio valves shall be—

(a) installed in the service piping in duplicate and in parallel, and each valve shall be separately sized to cater for the total simultaneous demand;

NOTE: For a typical valve installation involving a pressure ratio valve, see Figure 11.8.1.

(b) controlled by means of stop valves, installed at both the inlet and outlet of each ratio valve, which under normal operating conditions shall be fully opened;

(c) installed in an accessible position where they will not be subject to interference;

(d) readily removable by means of flanged or union type joints; and

(e) not less than the nominal size of the section of pipeline in which they are installed.

11.8.2 Requirement for pressure gauges

Pressure gauges that are calibrated to read higher than the available working head in the particular installation shall be installed on the inlet and outlet of each ratio valve assembly.

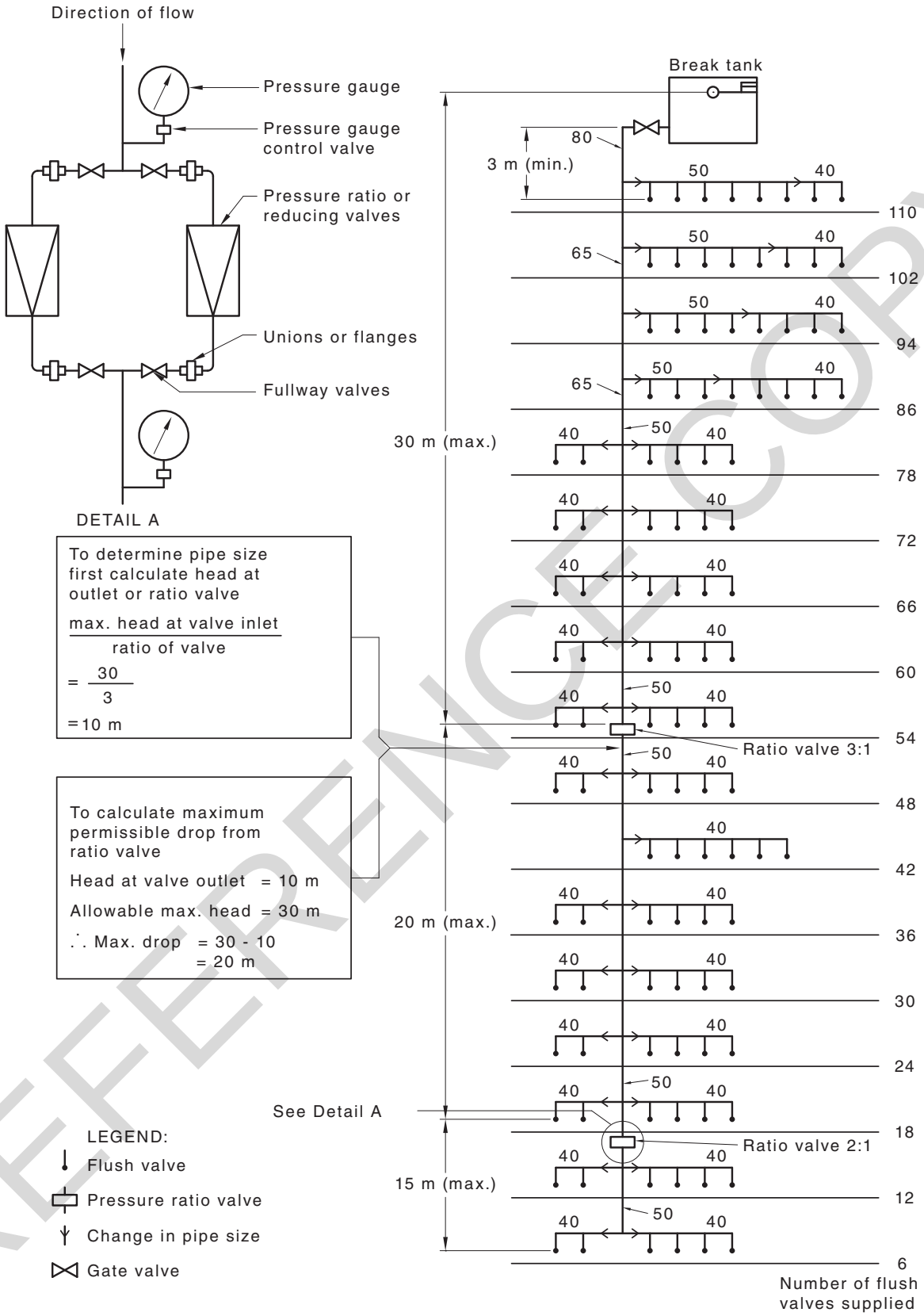


FIGURE 11.8.1 TYPICAL FLUSH VALVE INSTALLATION INCORPORATING PRESSURE RATIO VALVES

11.9 FLUSH VALVES CONNECTED TO THE DRINKING WATER SERVICE

11.9.1 General

Flush valves for connection either to the water service or to a storage tank supplying other fixtures shall incorporate within the valves a back-siphonage prevention device, and shall be installed in accordance with Clauses 11.9.2 to 11.9.7.

11.9.2 Compatibility

The flush valve shall be compatible with the fixture to which it is connected.

11.9.3 Pipe size

The minimum pipe size serving the flush valve shall be DN 25. The sizes of all pipework to the valve shall be hydraulically calculated.

11.9.4 Protection

The back-siphonage prevention device incorporated in the flush valve shall be protected against interference and possible blockage.

11.9.5 Location

The flush valve shall be installed such as to place the outlet at a minimum of 450 mm above the rim of the pan.

11.9.6 Pressure and velocity limitations

Flushing valves shall only be installed where the pressure and flow is sufficiently high to effectively operate the valve and not interfere with the operation of any other appliances dependent on the pressure from the water supply.

11.9.7 Branch service pipe

For maintenance purposes, the branch service pipe to each flush valve or group of flush valves shall be provided with a stop valve.

SECTION 12 INSTALLATION OF WATER SUPPLY TO SPECIFIED FIXTURES

12.1 SCOPE OF SECTION

This Section specifies installation requirements for the connection of water supply to specified fixtures.

12.2 BIDET, BIDETTE AND TOILET SEAT DOUCHE

12.2.1 Bidets

A bidet shall be installed with a registered break tank or a testable device ~~complying with~~ conforming to AS/NZS 2845.1 or AS 2845.2.

12.2.2 Bidette

A bidette shall be installed with a non-testable device or a 25 mm air gap.

12.2.3 Toilet seat douches

Where the douche outlet, in all positions, is at least 25 mm above the overflow level of the pan, backflow prevention is not required.

Where the douche outlet, in any position, is less than 25 mm above the overflow of the pan, a high-hazard backflow prevention device, ~~complying with~~ conforming to AS/NZS 2845.1 or AS 2845.2, shall be installed. This device shall be either part of the douche or installed separately.

SECTION 13 PUMPS

13.1 SCOPE OF SECTION

This Section specifies requirements for the installation of pumps used in water services for buildings.

13.2 GENERAL

Where the available water supply cannot meet the minimum pressure and flow rates of Section 3, storage tanks and/or pumps shall be installed to achieve the pressure and flow rate demands in accordance with Section 3.

NOTE: Pumping directly from the water main is not permitted by some network utility operators.

13.3 CONTROL OF PUMPS

Pumps shall be controlled to limit the number of starts per hour to within the capacity of the pump.

13.4 INSTALLATION OF PUMPS

Pumps shall—

(a) have vibration eliminators at the base of the pump, on the suction side and the delivery side of the pump, so as to minimize the transmission of noise into the building structure and along the piping system and to prevent undue stress being placed on the pump;

(b) have isolation valves on the delivery side and suction side of the pump;

(c) have a non-return valve on the delivery side of the pump before the isolation valve;

(d) have pressure gauges on the inlet and outlet of the pump; and

(e) have unions or flanges to enable the pump's removal.

NOTES:

1 A restrictive device may be installed between the flanges at the outlet of the pump, or a suction storage tank may be provided.

2 Where it is intended to install a stand-by pump arrangement, the pumps should be electrically coupled in such a manner that each pump can operate individually but can be changed over for stand-by or alternative duty.

13.5 BOOSTER PUMPS

Booster pumps shall be wired electrically so that the operation of the pump is controlled by float switches or other devices located at the storage tank or pressure vessel. Booster pumps and their appurtenances shall be installed in such a manner as to be readily accessible.

SECTION 14 WATER REQUIREMENTS FOR HAEMODIALYSIS MACHINES

14.1 SCOPE OF SECTION

This Section specifies requirements for water services installed to supply haemodialysis machines.

NOTES:

1 Where it is intended to carry out any work in connection with water supply, water analysis samples should be obtained prior to installation in relation to the degree of hardness or amount of chlorine residual.

2 The network utility operator should be notified prior to connection of the machine to enable records to be kept and metallic notification disks to be fitted on all water main valves in the vicinity of the machine, to prevent or minimize disruption of the supply.

14.2 CONNECTION TO THE WATER SERVICE

A stop valve, strainer and backflow prevention device in accordance with Section 4 shall be installed at the connection of the water supply to the haemodialysis machine.

NOTE: For hazard rating of backflow prevention devices, see Table ~~G1~~F1, Appendix ~~G~~F.

14.3 MAINTENANCE OF FLOW RATE

The water service to the haemodialysis machine shall be capable of maintaining the flow rate specified by the manufacturer of the haemodialysis machine during periods of peak demand.

14.4 WATER METERS

Where a water meter is installed, it shall be blue in colour denoting that a haemodialysis machine is connected to the water supply.

SECTION 15 PROPERTY WATER METERS

15.1 SCOPE OF SECTION

This Section specifies general requirements for the location, installation, electrical safety precautions and protection of property water meters.

NOTES:

1 Installation of a network utility operator's water meters should be undertaken in accordance with the network utility operator's requirements.

2 For electrical safety precaution and earthing, see Commentary C5.1 of Clause 5.1.

15.2 LOCATION OF WATER METERS

Water meters shall be—

(a) located so as to be accessible for reading, maintenance and removal;

(b) located in areas not susceptible to ponding;

(c) orientated horizontally, unless designed to operate otherwise; and

(d) positioned immediately downstream of the meter-isolating valve.

15.3 INSTALLATION INSIDE BUILDINGS

Where a water meter is installed inside a building and where water damage may result from the removal of the meter, an additional isolating valve shall be fitted adjacent to the meter outlet.

15.4 INSTALLATION BELOW GROUND

Water meters installed below ground shall be located in a meter box that has—

(a) a cover that can be removed; and

(b) a base that enables drainage.

15.5 PROTECTION FROM MECHANICAL DAMAGE

Where likely to be subject to mechanical damage, water meters shall be protected.

15.6 FROST PROTECTION

Water meters and meter assemblies located in frost-prone areas shall be protected against damage caused by freezing of water.

NOTE: Possible solutions include in-ground installation, or installation in an insulated enclosure.

SECTION 16 INSTALLATION OF WATER SUPPLY SYSTEM FROM RAINWATER TANKS

16.1 SCOPE OF SECTION

This Section specifies minimum requirements for the installation of a water supply system from a rainwater tank, where the tank is collecting water from roof catchments and is installed in an area where water from a network utility operator is provided to the property.

C16.1 *There are a number of authorities that should be consulted, particularly when the services are to be interconnected or where the water is to serve common fittings within the property. These authorities include the following:*

(a) The water supplier (network utility operator), which may determine the conditions to be met to allow connection of the rainwater system to their water supply (i.e. the minimum containment protection).

(b) The health authority, which determines water quality standards, and may set guidelines on the use of water from rainwater tanks. The health authority may also recommend against the use of rainwater tanks in certain areas due to pollution. Guidelines on the use of rainwater tanks have been developed by enHealth.

16.2 PIPES, VALVES AND FITTINGS

All pipes, valves and fittings within a water supply system from a rainwater tank shall ~~comply with~~ be as specified in Section 2.

16.3 INSTALLATION

16.3.1 General

The water supply system from a rainwater tank shall ~~comply with~~ be as specified in Section 5.

Backflow prevention shall ~~comply with~~ be as specified in Section 4 or Clause 16.3.3.

NOTE: The network utility operator may require containment protection at the property boundary.

16.3.2 Additional marking and signage of pipework and outlets

16.3.2.1 *Pipework*

Pipework from a rainwater tank shall be clearly marked with the word 'RAINWATER' at intervals not exceeding 500 mm where concealed in walls, or 1 m where exposed or buried.

Marking shall be in accordance with AS 1345, and be—

(a) around the circumference at the above intervals; or

(b) longitudinally at the above intervals along the pipe.

NOTE: Labels or stickers marked to AS 1345 may be fixed to the pipe.

16.3.2.2 *Water outlets*

Water outlets shall be identified as 'RAINWATER' or, in the case of a rainwater tap, identified by a green coloured indicator with the letters 'RW'.

NOTE: A typical sign is shown in Figure 16.3.2.2.

FIGURE 16.3.2.2 TYPICAL SIGN FOR RAINWATER OUTLETS

16.3.3 Connection between service pipes

Where a water supply system from a rainwater tank is connected with the water service from a network utility operator's water supply, the following applies:

(a) Backflow prevention shall be provided to protect the network utility operator's water supply.

(b) Where the rainwater is being used as a supply to a flushing device, either a low hazard backflow prevention device as shown in Figure 16.3.3 or a dual inlet cistern shall be provided.

(c) A device shall be provided on the pipeline from the rainwater tank to prevent water from the network utility operator's water supply flowing into the rainwater tank.

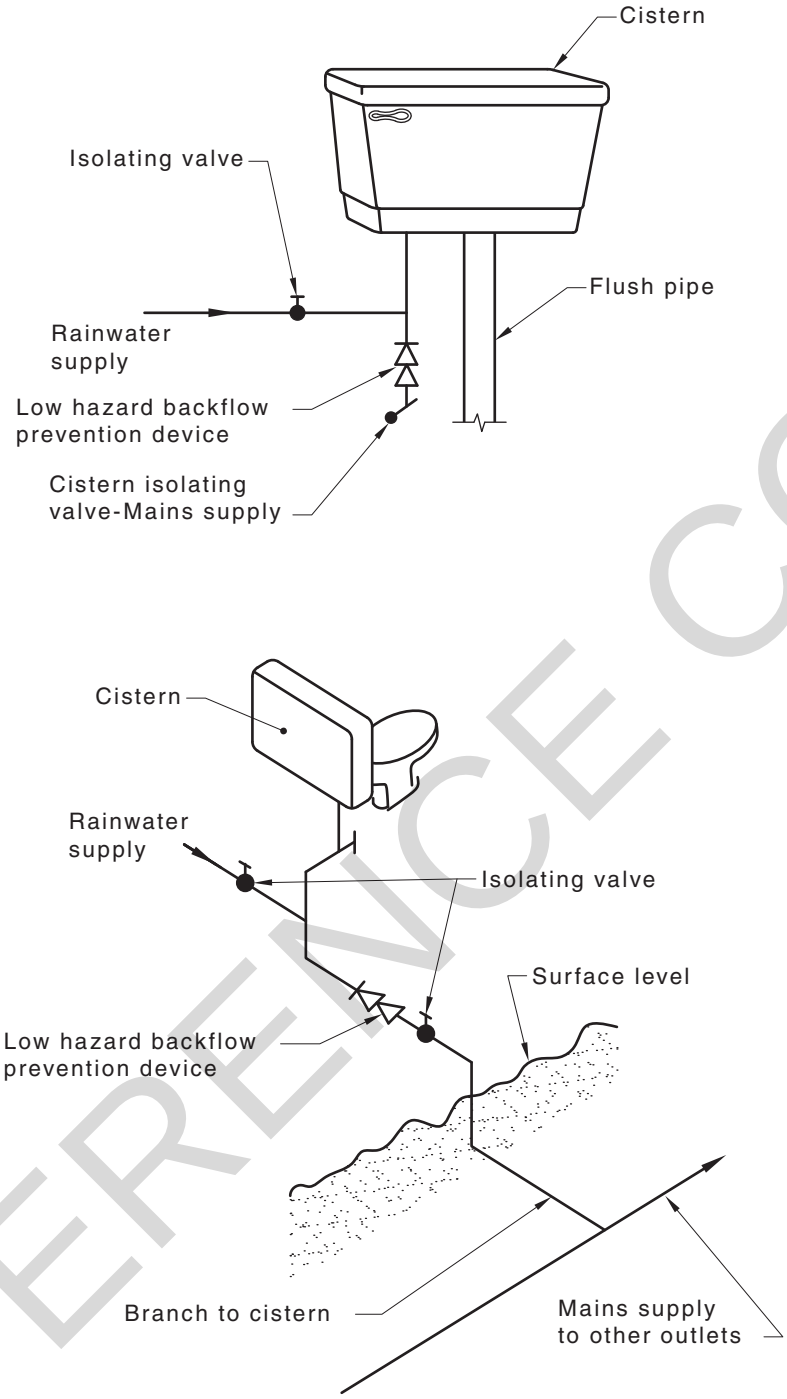


FIGURE 16.3.3 CONNECTION OF SERVICE PIPES AT CISTERNS

16.4 PROTECTION OF OTHER WATER SUPPLIES FROM RAINWATER

Where provision is made for augmentation of the rainwater supply by either top-up of the rainwater tank with water from another supply or by connection of another supply to any point downstream of the rainwater tank outlet, the installation shall include backflow protection in accordance with Section 4 and Table 16.4, to protect the other supply system.

NOTE: The other supply may be a drinking water supply or an alternative water supply.

TABLE 16.4

BACKFLOW PREVENTION—MINIMUM REQUIREMENTS FOR ZONE PROTECTION

Rainwater tank location	Protection on the supply pipe before tank for provision of top-up	Protection on the supply pipe before connection to tank outlet line	No top-up or connection
Buried	Testable device	Testable device	No backflow prevention device required
Partly buried	Non-testable device	Testable device	No backflow prevention device required
Above ground	Non-testable device	Non-testable device	No backflow prevention device required

NOTES:

1 A rainwater tank without an overflow ~~complying with~~ conforming to Section 8 shall have a testable device.

2 The selection of the backflow prevention device should be determined based on the level of hazard in the immediate environment (see Table 4.4.1).

16.5 TESTING AND COMMISSIONING A RAINWATER SYSTEM

16.5.1 Flushing and testing

Prior to use, the rainwater service shall be—:

(a) flushed in accordance with Clause 18.2; and

(b) hydrostatically tested in accordance with Clause 18.3.

16.5.2 Commissioning a rainwater system

Rainwater system shall be commissioned, as follows:

(a) Turn on the drinking water supply and rainwater water supply (if installed) at the meter or isolation valve.

(b) Turn off the rainwater water supply at the meter or isolation valve.

(c) Turn on all tapware (*both heated and cold*) and appliances one by one. Ensure water is flowing from all tapware and appliances.

(d) Flush all toilets. The toilets shall not refill (provided they are connected to the rainwater system).

(e) Turn on all external hose tap outlets. Water shall flow continuously from the drinking water hose tap outlets with the rainwater service running dry.

(f) Turn the rainwater system tap back on slowly so that all air will be purged from the pipeline while it is being recharged.

NOTE:The commissioning process may be repeated for the drinking water supply. This process is as follows:

(a) Turn off the drinking water supply at the meter or isolation valve.

(b) Turn on the rainwater water supply at the meter of isolation valve.

(c) Turn on all heated and cold tapware, including appliances one by one.

(d) Check that tap outlets and appliances have run dry.

(e) Flush all toilets. Check that the toilet cisterns have refilled after flushing.

(f) Turn on all external hose taps.

(g) Check that the drinking water taps have run dry.

(h) Check that the rainwater water taps are flowing continuously.

(i) Turn the drinking water supply back on slowly so that all air will be purged from the pipeline while it is being recharged.

SECTION 17 MULTI-UNIT DEVELOPMENTS

17.1 SCOPE OF SECTION

This Section specifies minimum requirements for main lines of water services located within common property of a multi-unit development of 20 or more residential buildings up to three storeys in height.

17.2 METHODS OF DESIGN AND INSTALLATION

Design and installation of the main lines of the water service shall ~~comply with~~ conform to—

(a) ~~the~~ WSA 03, *Water Supply Code of Australia*; or

(b) this Standard including Clauses 17.3 to 17.5.

17.3 DIVISION OF DEVELOPMENT

The development shall be divided into zones where the number of allotments within a zone affected by any shut-off at the main lines of the water service shall not exceed 40. The dividing or isolation valves that are fitted to the main line itself shall be at intervals not exceeding 300 m.

17.4 RING MAINS AND FLUSHING POINTS

To maintain circulation of water, the main lines of the water service shall form a ring main or be provided, at surface level, with flushing points at any dead end of the main line of the water service.

17.5 FIRE SERVICES

External fire hydrants shall be located in accordance with AS 2419.1.

SECTION 18 TESTING AND COMMISSIONING

18.1 SCOPE OF SECTION

This Section specifies requirements for testing and commissioning a water service.

18.2 FLUSHING

At the completion of the water service installation and prior to hydrostatic testing, the system shall be thoroughly flushed to remove any foreign matter. The flushing shall be undertaken in accordance with Paragraph ~~J3~~I3, Appendix ~~J~~I, and continue until the flushed water runs completely clear. The system shall then be pressure-tested in accordance with Clause 18.3.1.

The water service used to supply drinking water shall be protected against contamination in accordance with Appendix ~~J~~H and Appendix ~~J~~I.

NOTE: For testing and commissioning non-drinking water services, see also Section 9.

18.3 TESTING

18.3.1 Hydrostatic test

Water services shall not show any leakage when subjected to a hydrostatic pressure of 1500 kPa for a period of not less than 30 min.

The test shall be performed on installed piping prior to burial or concealment. In the case of pipe systems with elastomeric seals, the piping shall be backfilled leaving the joints exposed until completion of the test.

NOTES:

1 When a pressure test is carried out, it may be necessary to disconnect and cap the water service to isolate it from the water main, fixtures and appliances, which may be damaged by the test pressure applied.

2 Fire services are subject to individual testing by some network utility operators at a higher pressure and for varied periods of time.

18.3.2 Storage tanks (except rainwater tanks)

Storage tanks (except rainwater tanks) shall be filled until they overflow for a period of not less than 1 min. The overflow shall discharge in accordance with Clause 8.4.4.2.

~~Compliance with~~ Conformance to the air gap criteria shall be verified [see Clause 4.6.3.2(a)].

18.4 CLEANING AND DISINFECTION OF DRINKING WATER STORAGE TANKS

The disinfection of drinking water storage tanks shall be carried out in accordance with Appendix ~~J~~H.

18.5 DISINFECTION OF WATER SERVICES

The disinfection of water services shall be carried out in accordance with Appendix ~~J~~I.

18.6 COMMISSIONING

At the completion and testing of the water service, the operation of all valves, cisterns, taps, pressure-relief valves and other components shall be checked to confirm their correct performance.

APPENDIX A

NORMATIVE REFERENCES

(Normative)

AS	
1074	Steel tubes and tubulars for ordinary service
1172	Water closets (WCs)
1172.1	Part 1: Pans
1172.2	Part 2: Flushing devices and cistern inlet and outlet valves
1319	Safety signs for the occupational environment
1345	Identification of the contents of pipes, conduits and ducts
1379	Specification and supply of concrete
1397	Continuous hot-dip metallic coated steel sheet and strip – Coatings of zinc and zinc alloyed with aluminium and magnesium
1432	Copper tubes for plumbing, gasfitting and drainage applications
1478	Chemical admixtures for concrete, mortar and grout
1478.1	Part 1: Admixtures for concrete
1604	Specification for preservative treatment
1604.1	Part 1: Sawn and round timber
1646	Elastomeric seals for waterworks purposes
1657	Fixed platforms, walkways, stairways and ladders – Design, construction and installation
2129	Flanges for pipes, valves and fittings
2419	Fire hydrant installations
2419.1	Part 1: System design, installation and commissioning
2700	Colour Standards for general purposes
2845	Water supply – Backflow prevention devices
2845.2	Part 2: Registered air gaps and registered break tanks
2845.3	Part 3: Field testing and maintenance of testable devices
2865	Confined spaces
3600	Concrete structures
3688	Water supply – Metallic fittings and end connectors
3795	Copper alloy tubes for plumbing and drainage applications
4176	Multilayer pipes for pressure applications (series)
4728	Electric resistance welded steel pipe for pressure purposes
4809	Copper pipe and fittings – Installation and commissioning
5082	Polybutylene (PB) plumbing pipe systems – Metric series
5082.1	Part 1: Metric polybutylene (PB) pipes for hot and cold water applications
5082.2	Part 2: Mechanical and fusion jointing systems

AS		
5200	Plumbing and drainage products	
5200.000	Technical specification for plumbing and drainage products—Procedures for certification of plumbing and drainage products	
5200.053	Stainless steel pipes and tubes for pressure applications	
AS/NZS		
1167	Welding and brazing—Filler metals	
1167.1	Part 1:	Filler metal for brazing and braze welding
1167.2	Part 2:	Filler metal for welding
1477	PVC pipes and fittings for pressure applications	
2032	Installation of PVC pipe systems	
2033	Installation of polyethylene pipe systems	
2280	Ductile iron pressure pipes and fittings	
2492	Cross-linked polyethylene (PE-X) pipes for pressure applications	
2537	Mechanical jointing fittings for use with crosslinked polyethylene (PE-X) for pressure applications—Plastics piping systems for hot and cold water installations—Crosslinked polyethylene (PE-X) (series)	
2544	Grey iron pressure fittings	
2642	Polybutylene (PB) plumbing pipe systems	
2642.2	Part 2:	Polybutylene (PB) pipe for hot and cold water applications
2642.3	Part 3:	Mechanical jointing fittings for use with polybutylene (PB) pipes for hot and cold water application
2648	Underground marking tape	
2648.1	Part 1:	Non-detectable tape
2845	Water supply—Backflow prevention devices	
2845.1	Part 1:	Materials, design and performance requirements
2878	Timber—Classification into strength groups	
3500	Plumbing and drainage	
3500.0	Part 0:	Glossary of terms
3500.4	Part 4:	Heated water services
3518	Acrylonitrile butadine styrene (ABS) compounds, pipes and fittings for pressure applications	
3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings	
4020	Testing of products for use in contact with drinking water	
4087	Metallic flanges for waterworks purposes	
4129	Fittings for polyethylene(PE) pipes for pressure applications	
4130	Polyethylene (PE) pipes for pressure applications	
4331	Metallic flanges	
4331.1	Part 1:	Steel flanges
4331.2	Part 2:	Cast iron flanges
4331.3	Part 3:	Copper alloy and composite flanges
4441	Oriented PVC (PVC-O) pipes for pressure applications	
4671	Steel reinforcing materials	

AS/NZS	
4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
4765	Modified PVC (PVC-M) pipes for pressure applications
4792	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
NZS	
3109	Concrete construction
3124	Specification for concrete construction for minor works
3501	Specification of copper tubes for water, gas and sanitation
3640	Chemical preservation of round and sawn timber
4121	Design for access and mobility: Buildings and associated facilities
5807	Code of practice for industrial identification by colour, wording or other coding
7702	Specification for colours for identification, coding and special purposes
NZS BS	
1387	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads
ISO	
15874	Plastics piping systems for hot and cold water installations – Polypropylene (PP) (series)
NCC	Nation Construction Code (series)
ANSI/AWWA	
C217	Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
C651	Disinfecting water mains
BS EN	
10312	Welded stainless steel tubes for the conveyance of water and other aqueous liquids. Technical delivery conditions
ASTM	
A269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
D2846	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
F493	Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
NZBC	New Zealand Building Code (G12, Water Supplies)
WSAA	
WSA 03	Water supply code of Australia

EQUIVALENT PIPE SIZES

(Normative)

This Appendix provides tables for selecting the appropriate pipe nominal diameter (DN), based on internal diameter for different pipe materials and types, standard dimension ratios

(SDRs) or pressure classes, as marked on the pipe. The equivalent pipe DN for different materials shall be determined using Tables ~~B1~~A1, ~~B2~~A2, ~~B3~~ A3, A4 and ~~B4~~A5.

Multilayer pipes and ABS pipes are not covered by this Appendix.

For multilayer pipes, and ABS pipes, the equivalent pipe DN shall be selected on the basis of the internal diameters specified by the pipe supplier.

NOTES:

1 Standard dimension ratio (SDR)—Plastic pipes may be categorized by their SDR value. It is the ratio of the nominal outside diameter of the pipe to its nominal wall thickness, SDR = DN/T. SDR values are printed onto pipes and can be obtained from the pipe manufacturer.

2 Values in the tables were calculated from the values for maximum outside diameter and minimum wall thickness as specified in the respective pipe product Standards as follows:

(a) AS 1432 Copper (Australia)
(b) NZS 3501 Copper (New Zealand)
(c) AS/NZS 2492 PE-X
(d) AS 5082.1 PB (metric series)
(e) AS/NZS 2642.2 PB (imperial series)
(f) AS/NZS 4130 PE
(g) AS/NZS 1477 PVC-U
(h) AS/NZS 4765 PVC-M
(i) AS/NZS 4441 PVC-O
(j) ISO 15874.2 PP-R
(k) AS 5200.053 Stainless steel

3 For pipes made to Standards not listed in Note 2, see the relevant Standards listed in AS 5200.000.

TABLE ~~B1~~A1

INTERNAL DIAMETERS FOR COPPER PIPES AND TUBES

DN	Copper (Australia)			Copper (New Zealand)
	Type A	Type B	Type C	
	mm	mm	mm	mm
10	7.5	7.7	8.1	9.5
15	10.7	10.9	11.3	12.7
18	13.4	13.8	14.1	—
20	16.2	17.0	17.2	19.0
25	22.1	23.0	23.6	25.4
32	28.5	29.3	—	31.8
40	34.8	35.7	—	38.1
50	47.5	48.4	—	50.8
65	60.2	61.1	—	63.5
80	72.1	72.9	—	76.2
90	85.8	85.6	—	88.9
100	97.5	98.3	—	101.6
125	122.9	123.7	—	127.0
150	147.1	148.3	—	152.4
200	197.9	199.1	—	188.5

TABLE ~~B2~~A2

INTERNAL DIAMETERS FOR STAINLESS STEEL PIPES AND TUBES

DN	Stainless Steel Pipes as per ASME B36.19M		Stainless Steel Tubes as per EN 10312
	Schedule 5S mm	Schedule 10S mm	Series 2 mm
15	18.0	17.1	13.0
18	—	—	16.0
20	23.4	22.5	19.6
25	30.1	27.9	25.6
32	38.9	36.6	32.0
40	45.0	42.7	39.0
50	57.0	54.8	51.0
65	68.8	66.9	72.1
80	84.7	82.8	84.9
100	110.1	108.2	104.0
125	135.8	134.5	—
150	162.8	161.5	—
200	213.6	211.6	—

TABLE A3

INTERNAL DIAMETERS FOR POLYOLEFIN PIPES

PE, PE-X, ~~PP,~~PP, R, PB (metric)			
DN	SDR 11 mm	SDR 9 mm	SDR 7.4 mm
16	13.1	12.3	11.9
20	16.5	15.7	14.7
25	20.7	19.7	18.3
32	26.5	25.1	23.5
40	33.0	31.4	29.4
50	41.2	39.3	36.7
63	52.0	49.4	46.4
75	62.1	58.6	55.1
90	74.5	70.7	66.3
110	91.0	86.4	80.8
125	103.4	98.2	92.0
140	115.9	109.9	102.9
160	132.3	125.7	117.1
180	148.9	141.5	132.5
200	165.4	157.0	147.2

TABLE ~~B3~~A4

INTERNAL DIAMETERS FOR PVC-U PIPES

DN	PVC-U		
	PN12	PN15	PN18
	mm	mm	mm
10	—	—	14.5
15	—	18.7	18.3
20	24.1	23.5	22.9
25	30.3	29.5	28.7
32	38.0	37.0	36.0
40	43.4	42.2	41.2
50	54.3	52.9	51.3

TABLE ~~B4~~A5

INTERNAL DIAMETERS FOR IMPERIAL PB PIPES

PB (imperial)	
Nominal outside diameter	Internal diameter for Class 16 pipe
mm	mm
15	9.6
18	12.8
22	18.1
28	22.8

APPENDIX B~~NOTES:~~

~~1 Standard dimension ratio (SDR) Plastic pipes may be categorized by their SDR value. It is the ratio of the nominal outside diameter of the pipe to its nominal wall thickness, SDR = DN/T. SDR values are printed onto pipes and can be obtained from the pipe manufacturer.~~

~~2 Values were calculated from the values for maximum outside diameter and minimum wall thickness as specified in the respective pipe product Standards as follows:~~

~~(a) AS 1432 Copper (Australia)~~

~~(b) NZS 3501Copper (New Zealand)~~

~~(c) AS/NZS 2492 PE X~~

~~(d) AS 5082.1 PB (metric series)~~

~~(e) AS/NZS 2642.2 PB (imperial series)~~

~~(f) AS/NZS 4130 PE~~

~~(g) AS/NZS 1477 PVC U~~

~~(h) AS/NZS 4765 PVC M~~

~~(i) AS/NZS 4441 PVC O~~

~~3For pipes made to Standards not listed above, see the relevant Standards listed in AS 5200.000.~~

ACCEPTABLE PIPES AND FITTINGS

(Normative)

The following pipes and fittings are acceptable solutions subject to the limitations of Clause 2.4:

(a) Acrylonitrile butylene styrene (ABS) in accordance with AS/NZS 3518.

(b) Cast iron fittings (grey cast iron) in accordance with AS/NZS 2544.

(c) Copper pipes and fittings in accordance with AS 1432 (A, B or C) or NZS 3501 (water pipes).

(d) Copper alloy pipes in accordance with AS 3795.

(e) Copper and copper alloy fittings in accordance with AS 3688.

(f) Ductile iron pipes and fittings in accordance with AS/NZS 2280.

(g) Galvanized steel pipes and fittings in accordance with AS 1074, or NZS BS 1387, or AS 4728 and AS/NZS 4792 HDG300.

(h) Polybutylene (PB) pipes and fittings in accordance with AS/NZS 2642.2, AS/NZS 2642.3, AS 5082.1 and AS 5082.2.

(i) Polyethylene (PE) pipes and fittings in accordance with AS/NZS 4130 and AS/NZS 4129.

(j) Cross-linked polyethylene (PE-X) pipes and fittings in accordance with AS/NZS 2492 and AS/NZS 2537 (series).

(k) Multilayer pipes in accordance with AS 4176 (series).

(l) Unplasticized polyvinyl chloride (PVC-U) pipes and fittings in accordance with AS/NZS 1477.

(m) Modified polyvinyl chloride (PVC-M) pipes and fittings in accordance with AS/NZS 4765.

(n) Oriented polyvinyl chloride (PVC-O) pipes and fittings in accordance with AS/NZS 4441.

(o) Chlorinated polyvinyl chloride (PVC-C) pipes and fittings in accordance with ASTM D2846. (The use of PVC-C in Australia is currently restricted to use in fire services).

(p) Stainless steel (SS) pipes and fittings in accordance with AS 5200.053.

(q) Polypropylene (PP) pipes and fittings in accordance with ISO 15874 (series).

NOTE: See also Clause 2.2.

APPENDIX C~~APPENDIX D~~

SIZING METHOD FOR SUPPLY PIPING FOR DWELLINGS

(Informative)

C1~~D1~~ GENERAL

The sizing method given in this Appendix may be used as an alternative to a full hydraulic calculation for the rapid sizing of piping, using the probable simultaneous demand (PSD) values given in Table 3.2.3.

The probable simultaneous flow rates given in Table ~~D1~~ C1 have been calculated from the following equations:

$$Q = 3.637 \times 10^{-5} \; H^{0.555} \; D^{2.667} \qquad \ldots \; \text{~~D1~~ C1}$$

where

Q = flow rate, in litres per second (see Note)

D = pipe internal diameter, in millimetres

H = head loss gradient, in metres per 100 m

$$= \frac{h \times 100}{L \times 1.5}$$

where

h ~~h~~ = head loss, in metres head

L ~~L~~ = index length, in metres

1.5 is a factor to allow for the additional head loss through fittings ~~1.5 is a factor to allow for the additional head loss through fittings~~

Conversion factors: 1 kPa = 0.102 m head, 1 m head = 9.8 kPa

NOTE: Where velocity would have exceeded the design maximum of 3.0 m/s (see Clause 3.4), the flow rates in Table ~~D1~~ C1 have been reduced to limit the velocity to 3.0 m/s.

C2~~D2~~ PROCEDURE

The procedure is as follows:

Step 1 Draw a sketch of the installation (see Figure ~~D1~~C1).

Step 2 Determine the index length. This is the distance, in metres, from the point where the minimum available pressure head is known (e.g. at main tapping or at meter location) to the most distant fixture outlet in the building. This is the only pipe length used for sizing each pipe section.

Step 3 Determine the pressure drop, in metres head, along the index length using the following equation:

$$\text{Pressure drop} = H_m - H_s - H_x \quad \ldots (D2C2)$$

where

H_m = minimum head available, in metres head

H_s = height of highest fixture outlet (static head loss), in metres

H_x = minimum head required at any fixture outlet, in metres head

NOTE: Clause 3.3.2 requires a minimum value of 5 m head; however, some special appliances may require a larger value for satisfactory operation.

Step 4 Draw up a table with the following headings:

Pipe section	Probable simultaneous demand	Nominal pipe size
	L/s	DN

Step 5 For each pipe section find the appropriate probable simultaneous demand (PSD) value from Table 3.2.3 and enter the value on Figure ~~D1~~ C1 (e.g. three dwellings require 0.88 L/s).

Step 6 Enter each pipe section to be sized into the table (see Step 4) with the appropriate probable simultaneous demand (PSD) value for this pipe section.

Step 7 Select the appropriate sizing table corresponding to the pressure drop calculated in Step 3. If the pressure drop falls between two tables use the table for the lower pressure drop. If the pressure drop calculated in Step 3 is greater than 35 m, use the 35 m table.

Step 8 Select the index length column that is equal to or greater than the index length calculated in Step 2.

Step 9 Follow down this column until a probable simultaneous flow rate (PSFR) equal to or greater than the value required for each pipe section is reached. The size of the pipe required is found by reading across this line to the first column marked 'DN'.

NOTE: Flow rates in these tables have been adjusted, where required, to limit water velocity to a maximum of 3.0 m/s.

Step 10 Enter the size of pipe in the table (Step 4) and continue through Steps 9 and 10 for each pipe section.

C3~~D3~~ WORKED EXAMPLE

Sizing of the external piping for a group of 12 villa-style home units arranged in three buildings each containing four units on a steeply sloping site.

The minimum available pressure at the main tapping is 30 m head, and the furthest fixture outlet is 13 m above the main. The length of internal piping to this most remote outlet in Unit 12 is 11 m.

Step 1 Sketch of installation

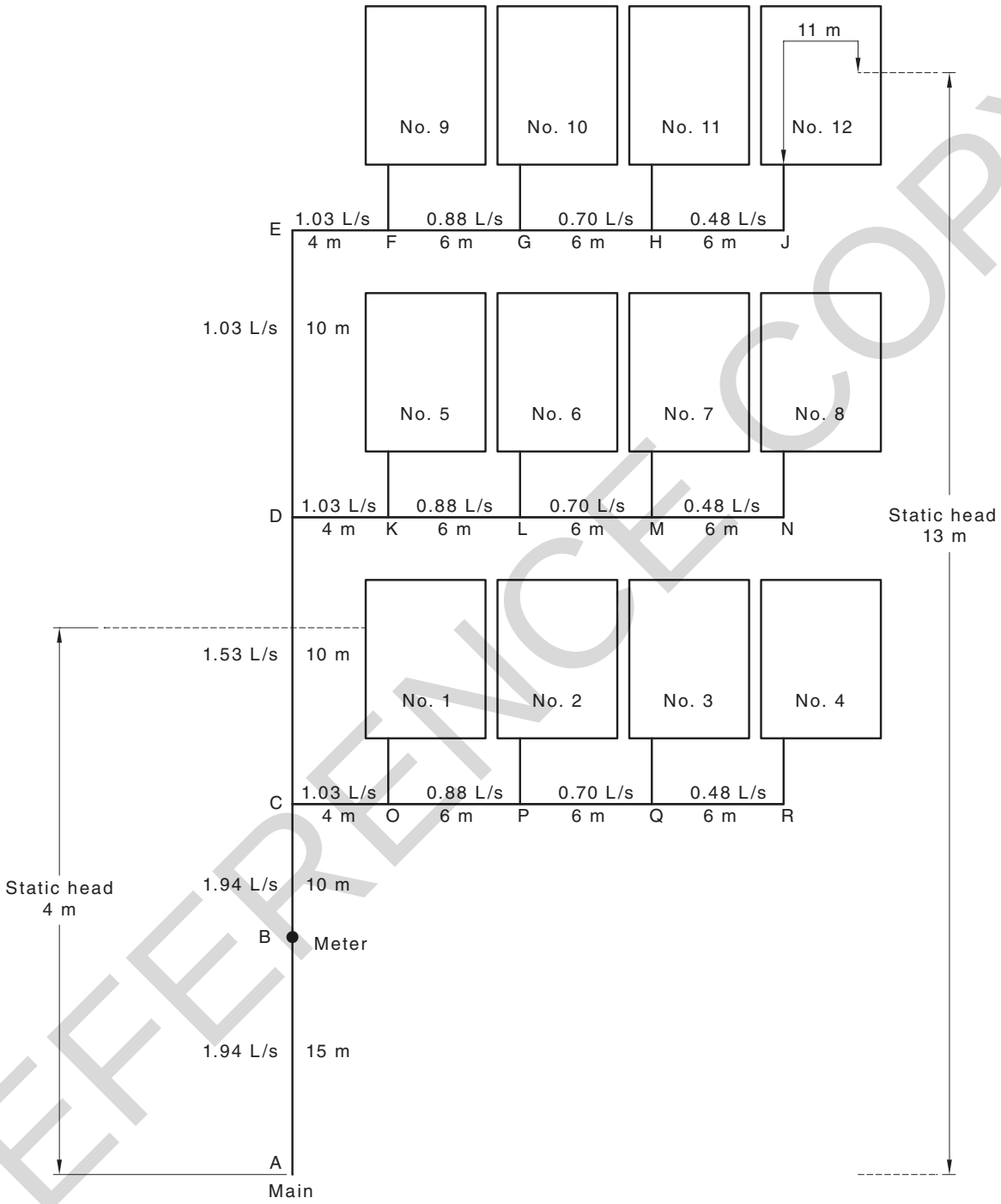


FIGURE ~~D1~~ C1 SKETCH OF INSTALLATION

Step 2 Index length = AB + BC + CD + DE + EF + FG + GH + HJ + (distance from point J to the most remote fixture)

= 15 + 10 + 10 + 10 + 4 + 6 + 6 + 6 + 11

= 78 m

Step 3 The minimum head available at the main is 30 m head. The height of the highest fixture outlet in Unit 12 is 13 m above the main therefore:

Pressure drop = $H_m - H_s - H_x$

= 30 – 13 – 5

= 12 m head

Step 4

	Pipe section	Probable simultaneous demand (PSD) (see Table 3.2.3)	Nominal pipe size
		L/s	DN
Steps 5 and 6	JH, NM, RQ	0.48	25 Step 10
	HG, ML, QP	0.70	32
	GF, LK, PO	0.88	32
	FE, KD, OC	1.03	40
	ED	1.03	40
	DC	1.53	40
	CB	1.94	50
	BA	1.94	50

Step 7 The pressure drop of 12 m head falls between the 10 m and 15 m head pressure drop tables. Therefore, use 10 m head table.

Step 8 Index length = 78 m, so use 80 m column.

Step 9 For pipe sections JH, NM and RQ the required probable simultaneous flow rate (PSFR) value is 0.48 L/s. The next largest value in the 80 m column is 0.50 L/s and this corresponds to pipe size DN 25 (see Table ~~D1~~C1).

Step 10 Enter value of DN 25 in table above and using the same values of pressure drop and index length, proceed to size each other pipe section and enter size in the table.

TABLE ~~D1~~C1
PIPE SIZING FOR MAXIMUM VELOCITY OF 3 m/s

PRESSURE DROP = 4 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.08	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
15	0.19	0.13	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
18	0.36	0.25	0.20	0.17	0.15	0.14	0.12	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.05
20	0.63	0.43	0.34	0.29	0.26	0.23	0.22	0.20	0.19	0.18	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.10	0.09
25	1.24	0.96	0.77	0.65	0.58	0.52	0.48	0.44	0.42	0.39	0.35	0.33	0.30	0.28	0.27	0.25	0.24	0.23	0.22	0.21	0.21
32	2.02	1.84	1.47	1.25	1.11	1.00	0.92	0.85	0.80	0.75	0.68	0.62	0.58	0.54	0.51	0.49	0.46	0.44	0.43	0.41	0.39
40	3.00	3.00	2.47	2.11	1.87	1.69	1.55	1.44	1.35	1.27	1.15	1.05	0.98	0.92	0.86	0.82	0.78	0.75	0.72	0.69	0.67
50	5.51	5.51	5.51	4.77	4.21	3.80	3.49	3.24	3.03	2.86	2.59	2.37	2.21	2.07	1.95	1.85	1.76	1.68	1.62	1.56	1.50
65	8.78	8.78	8.78	8.78	7.85	7.05	6.50	6.03	5.65	5.33	4.82	4.42	4.11	3.85	3.63	3.44	3.28	3.14	3.01	2.90	2.80
80	12.54	12.54	12.54	12.54	12.54	11.34	10.44	9.69	9.08	8.57	7.74	7.11	6.60	6.18	5.83	5.53	5.27	5.04	4.84	4.66	4.49
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	21.50	20.16	19.00	17.17	15.77	14.64	13.71	12.94	12.27	11.69	11.18	10.73	10.33	9.97

PRESSURE DROP = 6 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.10	0.07	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
15	0.24	0.16	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04
18	0.45	0.31	0.25	0.21	0.19	0.17	0.16	0.14	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.07
20	0.68	0.54	0.43	0.37	0.32	0.29	0.27	0.25	0.23	0.22	0.20	0.18	0.17	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.12
25	1.24	1.20	0.96	0.82	0.72	0.65	0.60	0.56	0.52	0.49	0.44	0.41	0.38	0.35	0.33	0.32	0.30	0.29	0.28	0.27	0.26
32	2.02	2.02	1.83	1.57	1.39	1.25	1.15	1.07	1.00	0.94	0.85	0.78	0.73	0.68	0.64	0.61	0.58	0.55	0.53	0.51	0.49
40	3.00	3.00	3.00	2.65	2.34	2.11	1.94	1.80	1.69	1.59	1.44	1.32	1.23	1.15	1.08	1.03	0.98	0.94	0.90	0.86	0.83
50	5.51	5.51	5.51	5.51	5.28	4.74	4.37	4.06	3.80	3.58	3.24	2.97	2.76	2.59	2.44	2.31	2.21	2.11	2.02	1.95	1.88
65	8.78	8.78	8.78	8.78	8.78	8.78	8.13	7.55	7.08	6.68	6.03	5.54	5.14	4.82	4.54	4.31	4.11	3.93	3.77	3.63	3.50
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.13	11.38	10.72	9.69	8.90	8.26	7.74	7.30	6.93	6.60	6.31	6.06	5.83	5.63
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	21.50	19.74	18.34	17.17	16.20	15.36	14.64	14.00	13.44	12.94	12.48

(*continued*)

TABLE ~~D1~~ C1 (*continued*)

PRESSURE DROP = 8 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate (L/s)**																				
10	0.11	0.08	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
15	0.28	0.19	0.15	0.13	0.12	0.10	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04
18	0.45	0.36	0.29	0.25	0.22	0.20	0.18	0.17	0.16	0.15	0.14	0.12	0.12	0.11	0.10	0.09	0.09	0.09	0.08	0.08	0.08
20	0.68	0.63	0.51	0.43	0.38	0.34	0.32	0.29	0.27	0.26	0.23	0.22	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14
25	1.24	1.24	1.12	0.96	0.85	0.77	0.70	0.65	0.61	0.58	0.52	0.48	0.44	0.42	0.39	0.37	0.35	0.34	0.33	0.31	0.30
32	2.02	2.02	2.02	1.84	1.62	1.47	1.35	1.25	1.17	1.11	1.00	0.92	0.85	0.80	0.75	0.71	0.68	0.65	0.62	0.60	0.58
40	3.00	3.00	3.00	3.00	2.74	2.40	2.27	2.11	1.98	1.87	1.69	1.55	1.44	1.35	1.27	1.20	1.15	1.10	1.05	1.01	0.98
50	5.51	5.51	5.51	5.51	5.51	5.51	5.12	4.75	4.41	4.21	3.80	3.49	3.24	3.03	2.86	2.72	2.59	2.47	2.37	2.29	2.21
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.31	7.82	7.07	6.45	6.03	5.65	5.33	5.06	4.82	4.61	4.42	4.26	4.11
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	11.36	10.43	9.69	9.08	8.57	8.12	7.74	7.40	7.11	6.84	6.60
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	21.50	20.15	19.00	18.02	17.17	16.43	15.77	15.17	14.64

PRESSURE DROP = 10 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.13	0.09	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
15	0.28	0.22	0.17	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05
18	0.45	0.42	0.33	0.28	0.25	0.22	0.21	0.19	0.18	0.17	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.10	0.10	0.09	0.09
20	0.68	0.68	0.57	0.49	0.43	0.39	0.36	0.33	0.31	0.29	0.27	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.17	0.16	0.15
25	1.24	1.24	1.24	1.09	0.96	0.87	0.80	0.74	0.69	0.65	0.59	0.54	0.50	0.47	0.44	0.42	0.40	0.38	0.37	0.35	0.34
32	2.02	2.02	2.02	2.02	1.84	1.66	1.53	1.42	1.33	1.25	1.13	1.04	0.96	0.90	0.85	0.81	0.77	0.74	0.71	0.68	0.66
40	3.00	3.00	3.00	3.00	3.00	2.80	2.57	2.39	2.24	2.11	1.91	1.75	1.63	1.52	1.44	1.36	1.30	1.24	1.19	1.15	1.11
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	5.05	4.75	4.30	3.95	3.67	3.44	3.24	3.07	2.93	2.80	2.60	2.59	2.50
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.01	7.35	6.83	6.40	6.03	5.72	5.45	5.22	5.01	4.82	4.65
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	11.82	10.98	10.28	9.70	9.20	8.76	8.38	8.04	7.74	7.47
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	21.50	20.40	19.45	18.60	17.85	17.17	16.47

(*continued*)

TABLE ~~D1~~ C1 (*continued*)

PRESSURE DROP = 15 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.11	0.09	0.07	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02
15	0.28	0.27	0.22	0.19	0.16	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06
18	0.45	0.45	0.41	0.35	0.31	0.28	0.26	0.24	0.22	0.21	0.19	0.18	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.12	0.11
20	0.68	0.68	0.68	0.61	0.54	0.49	0.45	0.42	0.39	0.37	0.33	0.30	0.28	0.27	0.25	0.24	0.23	0.22	0.21	0.20	0.19
25	1.24	1.24	1.24	1.24	1.20	1.08	0.99	0.93	0.87	0.82	0.74	0.68	0.63	0.59	0.56	0.53	0.50	0.48	0.46	0.44	0.43
32	2.02	2.02	2.02	2.02	2.02	2.02	1.91	1.77	1.65	1.57	1.42	1.30	1.21	1.13	1.07	1.01	0.96	0.92	0.89	0.85	0.82
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.81	2.64	2.39	2.19	2.04	1.91	1.80	1.71	1.63	1.56	1.49	1.44	1.39
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	4.91	4.59	4.30	4.06	3.85	3.67	3.51	3.37	3.24	3.13
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.56	8.01	7.55	7.16	6.83	6.53	6.27	6.03	5.82
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.14	11.51	11.00	10.50	10.07	9.69	9.35
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.35	21.52	20.75

PRESSURE DROP = 20 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.13	0.10	0.09	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
15	0.28	0.28	0.25	0.22	0.19	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07
18	0.45	0.45	0.45	0.41	0.36	0.33	0.30	0.28	0.26	0.25	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14	0.13
20	0.68	0.68	0.68	0.68	0.63	0.57	0.53	0.49	0.46	0.43	0.39	0.36	0.33	0.31	0.29	0.28	0.27	0.25	0.24	0.23	0.23
25	1.24	1.24	1.24	1.24	1.24	1.24	1.17	1.08	1.00	0.96	0.87	0.80	0.74	0.69	0.65	0.62	0.59	0.56	0.54	0.52	0.50
32	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	1.94	1.84	1.66	1.53	1.42	1.33	1.25	1.19	1.13	1.08	1.04	1.00	0.96
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.80	2.56	2.39	2.24	2.11	2.00	1.91	1.83	1.75	1.69	1.63
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	5.04	4.76	4.51	4.30	4.12	3.95	3.80	3.67
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.40	8.01	7.66	7.35	7.08	6.83
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.31	11.82	11.38	10.97
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78

(*continued*)

TABLE C1 (*continued*)

PRESSURE DROP = 25 m HEAD

~~(*continued*)~~

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.14	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
15	0.28	0.28	0.28	0.25	0.22	0.20	0.18	0.17	0.16	0.15	0.13	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08	0.08
18	0.45	0.45	0.45	0.45	0.41	0.37	0.34	0.32	0.30	0.28	0.25	0.23	0.22	0.20	0.19	0.18	0.17	0.17	0.16	0.15	0.15
20	0.68	0.68	0.68	0.68	0.68	0.64	0.59	0.55	0.52	0.49	0.44	0.40	0.38	0.35	0.33	0.31	0.30	0.29	0.28	0.27	0.26
25	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.23	1.15	1.08	0.98	0.90	0.84	0.78	0.74	0.70	0.67	0.64	0.61	0.59	0.57
32	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	1.88	1.71	1.60	1.50	1.42	1.34	1.28	1.23	1.18	1.13	1.09
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.90	2.70	2.53	2.40	2.27	2.16	2.07	1.98	1.91	1.84
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	5.11	4.87	4.65	4.47	4.30	4.15
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.67	8.32	8.00	7.73
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.42
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78

PRESSURE DROP = 30 m HEAD

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.14	0.13	0.11	0.10	0.09	0.08	0.07	0.07	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03
15	0.28	0.28	0.28	0.27	0.24	0.22	0.20	0.19	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.09
18	0.45	0.45	0.45	0.45	0.45	0.41	0.38	0.35	0.33	0.31	0.28	0.26	0.24	0.22	0.21	0.20	0.19	0.18	0.18	0.17	0.16
20	0.68	0.68	0.68	0.68	0.68	0.68	0.66	0.61	0.56	0.54	0.49	0.45	0.42	0.39	0.37	0.35	0.33	0.32	0.30	0.29	0.28
25	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.20	1.08	0.99	0.93	0.87	0.82	0.78	0.74	0.71	0.68	0.65	0.63
32	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	1.90	1.77	1.66	1.57	1.49	1.42	1.36	1.30	1.25	1.21

TABLE C1 (*continued*)

40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.80	2.64	2.51	2.39	2.29	2.19	2.11	2.04
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.39	5.15	4.94	4.76	4.59
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.55
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78

(*continued*)

PRESSURE DROP = 35 m HEAD

~~(*continued*)~~

	INDEX LENGTH, m																				
	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160
DN	**Probable simultaneous flow rate, L/s**																				
10	0.14	0.14	0.14	0.12	0.10	0.09	0.09	0.08	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04
15	0.28	0.28	0.28	0.28	0.26	0.24	0.23	0.20	0.19	0.18	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.09
18	0.45	0.45	0.45	0.45	0.45	0.45	0.41	0.38	0.36	0.34	0.31	0.28	0.26	0.24	0.23	0.22	0.21	0.20	0.19	0.18	0.18
20	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.66	0.62	0.58	0.53	0.49	0.45	0.42	0.40	0.38	0.36	0.35	0.33	0.32	0.31
25	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.18	1.09	1.01	0.94	0.89	0.84	0.80	0.77	0.74	0.71	0.69
32	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	1.93	1.81	1.70	1.62	1.54	1.48	1.42	1.36	1.32
40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.88	2.73	2.60	2.49	2.39	2.30	2.22
50	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.38	5.18	5.00
65	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78
80	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54
100	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78	22.78

DRAFT ONLY

APPENDIX D~~APPENDIX E~~

SIZING OF PIPING FOR DWELLINGS

(Informative)

D1~~E1~~ GENERAL

This Appendix ~~D~~ provides a method for sizing of piping for the supply of water to single or multiple dwellings and uses the probable simultaneous demand (PSD) values provided in Table 3.2.3.

The method given in this Appendix may also be used to size the piping within the dwelling using the concept of loading units. Each branch pipe within the dwelling is assigned a number of loading units, depending on the number and type of fixture outlets it serves. Loading units corresponding to fixtures and appliances are given in column 4 of Table 3.2.1. A table for converting loading units (LU) to probable simultaneous flow rate (PSFR) is given in Table 3.2.4.

D2~~E2~~ PROCEDURE

The procedure is as follows:

Step 1 Draw a sketch of the internal piping (see Figure ~~E1~~D1) showing the location of each fixture or appliance together with its appropriate loading units.

Step 2 Determine the index length. This is the distance, in metres, from the point in the supply line where the minimum available pressure head is known (e.g. main tapping or meter position) to the most distant outlet within the dwelling.

Step 3 Determine the pressure drop, in metres head, across this index length using the following equation:

$$\text{Pressure drop} = H_m - H_s - H_x$$

where

H_m = ~~H_m =~~ minimum available head, in metres head

H_s = ~~H_s =~~ height of the highest outlet within the dwelling, in metres

H_x = ~~H_x =~~ minimum head required at any fixture outlet, in metres head

NOTE: In the case of multistorey residential dwellings, the index length and pressure drop may be different for each dwelling; however, it may not be necessary to individually size each dwelling where the index lengths and pressure drops are similar for a group of dwellings.

Step 4 Draw up a table with the following headings:

Pipe section	Loading units	Probable simultaneous flow rate (PSFR)	Nominal pipe size
		L/s	DN

Step 5 For each pipe section within the dwelling determine the PSFR for that section using the following rules:

(a) If it supplies only one fixture outlet, the PSFR is the minimum flow rate for that fixture or appliance given in column 2 of Table 3.2.1.

(b) If it supplies more than one fixture outlet, sum the loading units served by this pipe section and then read off the PSFR corresponding to the total loading units carried from Table 3.2.4.

Step 6 Enter each pipe section to be sized in your table (see Step 4) with the appropriate loading units and PSFR values. Once the estimated PSFR value is obtained, the pipe size for each section is obtained from Table ~~D1~~C1, Appendix ~~D~~C, using Steps 7 to 10 of Paragraph ~~D2 of~~ C2, Appendix ~~D~~C.

NOTE: The flow rates in Table ~~D1~~C1, Appendix ~~D~~C, have been adjusted, where necessary, to limit the velocity to a maximum of 3.0 m/s.

D3~~E3~~ WORKED EXAMPLE

A worked example for the sizing of the internal pipework within Units 1 and 12 of the installation used in the example given in Appendix ~~D~~ C is shown below.

Step 1

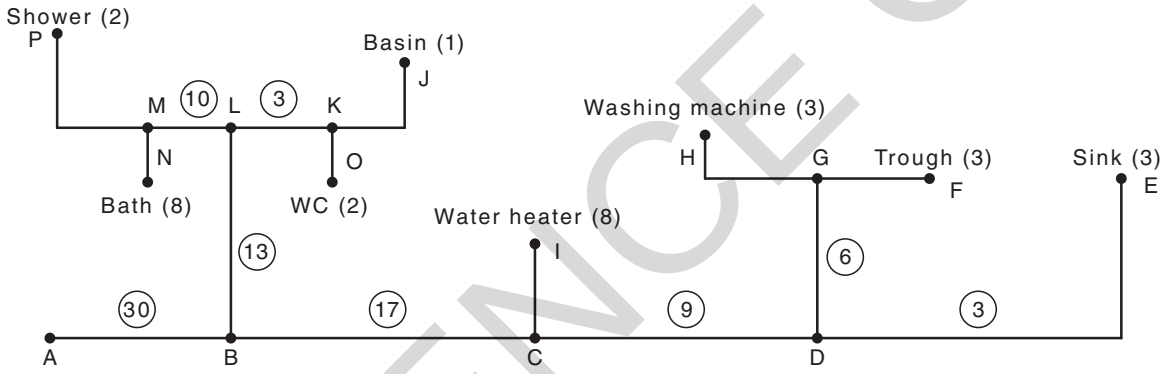


FIGURE ~~E1~~ D1 SKETCH OF INSTALLATION

	UNIT 1	UNIT 12
Step 2	Index length	Index length
	= 15 + 10 + 4 + 11	= 15 + 10 + 10 + 10 + 4 + 6 + 6 + 6 + 11
	= 40 m	= 78 m

Step 3 The height of the highest outlet in Unit 1 is found to be 4 m above the main. Therefore, the static head loss (H_s) is 4 m head

	Pressure drop	*Pressure drop*
	$= H_m - H_s - H_x$	$= H_m - H_s - H_x$
	= 30 – 4 – 5	= 30 – 13 – 5
	= 21 m head	= 12 m head

Step 4

Pipe section	Loading units	PSFR, L/s	Nominal pipe size, DN	
Section	Units	(L/s)	Unit 1	Unit 12

Step 5 Pipe section ED serves one outlet (sink with standard tap). Hence PSFR is 0.12 L/s as per Table 3.2.1, column 2. Pipe section GD serves both washing machine and tub (H,F). Hence total loading units are 6 (3 + 3) and PSFR corresponding to 6 loading units is 0.20 L/s as per Table 3.2.4, column 2. Each pipe section is dealt with in turn, proceeding in the opposite direction to the water flow.

Step 6 Completed table is shown at the end of this example (Step 10).

	UNIT 1	**UNIT 12**
Step 7	Pressure drop is 21 m head, so use the 20 m head table.	Pressure drop is 12 m head, so use the 10 m head table.
Step 8	Use 40 m column	Use 80 m column.
Step 9	For section ED, the PSFR is 0.12 L/s and this corresponds to a pipe size of at least DN 15.	For Section ED, the PSFR is 0.12 L/s, and this corresponds to a pipe size of at least DN 18.

Step 10

Pipe section	**Loading units (see Table 3.2.4)**	**PSFR, L/s (see Tables 3.2.1 and 3.2.4)**	**Nominal pipe size, DN**	
			Unit 1	**Unit 12**
ED	*	0.12	15	18
FG	*	0.12	15	18
HG	*	0.20	18	20
GD	6	0.20	18	20
DC	9	0.25	18	25
IC	*	0.20	18	20
CB	17	0.35	20	25
JK	*	0.10	15	18
OK	*	0.10	15	18
KL	3	0.14	15	20
PM	*	0.10	15	18
NM	*	0.30	20	25
ML	10	0.26	18	25
LB	13	0.30	20	25
BA	30	0.47	20	25

* One outlet only

NOTES:

1 If the pipe supplies only one fixture outlet, the PSFR is the minimum flow rate for that fixture or appliance given in column 2 of Table 3.2.1.

2 If the pipe supplies more than one fixture outlet, sum the loading units served by this pipe section and then read off the PSFR corresponding to the total loading units carried from Table 3.2.4.

APPENDIX E~~APPENDIX F~~

EXAMPLES OF POTENTIAL CROSS-CONNECTIONS

(Informative)

E1~~F1~~ SCOPE

This Appendix provides some examples of installations in which cross-connections are likely to be encountered.

The methods of cross-connection control are given in Section 4.

E2~~F2~~ POTENTIAL CROSS-CONNECTIONS

Some examples of installations in which cross-connections are likely to occur are as follows:

(a) *Agricultural and horticultural properties* Market gardens, poultry farms, and dairy farms, the interconnection between water service and dam water, drinking nipples, fogging sprays, irrigation pipes, antibiotic injectors, cleansing injectors, vertical sprays for vehicle washing, or any submerged outlet or hose at tanks or feed troughs.

(b) *Catering and allied trade installations* Commercial kitchens, hotels, and clubs, the interconnection between the water service and water-cooled refrigerant units containing methylchloride gas, or any submerged outlets or hoses that connect to glass washers dishwashers, bain-maries, food waste disposal units, garbage can washers, ice-making machines, refrigerators, hoses when supplying water to sinks or other receptacles.

(c) *Domestic installation* Interconnection of the water service to a haemodialysis machine, bidet, water-operated venturi type ejectors attached to garden hoses where used to empty or clean out sullage pits, septic tanks, gullies, stormwater sumps, domestic grease traps, or any submerged outlets, or discharge point of the water service in sanitary flushing cisterns, garden hoses supplying water to swimming pools, ornamental ponds, fish ponds, hose taps below the flood level rim of any fixture, or located below the finished surface level.

(d) *Health and sanitary services installations* These installations include the following:

(i) *Council sanitary depots* Interconnection between the water service and sanitary pan washers, truck washers, and pan-dumping machines.

(ii) *Dental surgeries* Any submerged water service outlets connected to chair bowls and venturi type water aspirators.

(iii) *Funeral parlours* In embalming areas, the interconnection between the water service outlet and water-operated aspirator pumps.

(iv) *Hospitals and nursing homes* Submerged outlets of the water service at bed pan washers, bed bottle washers, sterilizers, steam autoclaves, instrument washers, and any interconnection between the water service and steam pipes, steam boilers, or steam calorifiers.

(v) *Mortuaries* Post-mortem areas, submerged water service outlets at autopsy tables, flushing rim floor gullies, specimen tables, and instrument washing sinks.

(e) *Industrial and commercial installations* These installations include the following:

(i) *Tanks* Any submerged discharge point of hoses or pipes that supply water to rinse tanks, process tanks and other tanks.

(ii) *Abattoirs* Interconnection between the water service and steam pipes, steam boilers, or steam calorifiers, and the washing sprays in contact with animal carcases.

(iii) *Bleaching works* Interconnection between the water service and steam pipes, steam boilers, steam calorifiers, or any submerged outlets at revolving drum washers, or any pipes conveying non-drinking water.

(iv) *Breweries, cordial and soft drink plants* Interconnection between water service and the contents of gas cylinders, steam pipes, steam boilers, or steam calorifiers, or any submerged water service outlets at drum or bottle washers, process tanks.

(v) *Butchers' shops* Interconnection between the water service and any water-cooled refrigerant units containing methyl-chloride gas, or water-powered food processing machines.

(vi) *Chemical plants* Interconnection between the water service and chemical pipelines, or the submerged water service pipe outlets at drum washer and process tanks.

(vii) *Dry cleaners* Interconnection between the water service and solvent stills.

(viii) *Dyeing works* Interconnection between the water service pipes and steam pipes, foul water inlet sprays in process tanks, and any submerged water service pipe outlets at vats, tanks, and colanders.

(ix) *Engineering works* Interconnection between the water service and any steam boilers, diesel oil recirculating systems, recirculated cooling water for machines, testing pressure vessels, oil cooling coils, pump priming, compressed air pipelines, and venturi type ejectors in vehicle maintenance pits.

(x) *Laboratories* Interconnection between the water service and any aspirator pumps, fume cupboards, stills, centrifuges, blood testing machines, air scrubbers, test-tube washing machines, animal feeding troughs, and high-pressure gas cylinders.

(xi) *Laundries* Interconnection between the water service and any clothes washing machines, starch tanks, soap mixing vats, and recirculated heated water tanks.

(xii) *Milk processing plants* Interconnection between the water service and any steam pipes, steam boilers, steam calorifiers, or any submerged outlets at bottle washing machines, milk can washing machines, and process chilling tanks.

(xiii) *Oil storage depots* Interconnection between the water service and foam firefighting equipment.

(xiv) *Poultry processing plants* Interconnection between the water service and any steam pipes, steam boilers, steam calorifiers, or any submerged outlets at feather-plucking machines, carcass-washing machines, offal boilers, and process tanks.

(xv) *Photographic developers* Interconnection between the water service and X-ray equipment, or any submerged outlets at tanks and rinse machines.

(xvi) *Plating workings* Interconnection between the water service and solvent, acid or alkaline tanks, cooling coils, steam pipes, or any submerged outlets at tanks and rinse machines.

(xvii) *Tanneries* Interconnection between the water service and vats, drum process tanks, or steam pipes.

(xviii) *Wool processors* Interconnection between the water service and lanolin centrifuges and head recycling coils, or any submerged outlets or hoses at vats, drums, and tanks.

APPENDIX F~~APPENDIX G~~

TYPES OF BACKFLOW PROTECTION

(Informative)

This Appendix provides examples in Tables ~~G1 to G3~~ F1 to F3 for individual zone and containment protection together with hazard ratings and device selection. It is recommended these procedures be adopted to contain the risk levels required for backflow protection.

Figures ~~G1 to G7~~ F1 to F7 give typical installation examples for testable and non-testable backflow prevention devices.

TABLE ~~G1~~F1

INDIVIDUAL PROTECTION—HAZARD RATINGS AND A SELECTION OF BACKFLOW PREVENTION—DEVICES FOR BACKFLOW PREVENTION AT INDIVIDUAL FIXTURES, APPLIANCES OR APPARATUS

Form of cross-connection	Hazard rating	Backflow prevention device
AGRICULTURAL AND HORTICULTURAL		
Antibiotic injectors	High	RBT or RPZD
Fertilizers, herbicides, nematicides, insecticides and weedicides injected into an irrigator (see Section 7, Type D)	High	RBT or RPZD
Fogging and cleaning sprays with chemical injection	High	RBT or RPZD
INDUSTRIAL AND COMMERCIAL		
Fogging and cleaning spray equipment with chemical injection or additives	High	RBT or RPZD
Pan washing apparatus	High	RBT or RPZD
Chemical dispensers (high toxicity)	High	RAG, RBT or RPZD
Weed and pest spraying and water cartage tanks	High	RAG or RPZD (see Figure G1)
Mixing of chemicals	High	RAG or RPZD
Portable and mobile tankers	High	RAG or RPZD (see Figure G1)
Chemical dispensers (low toxicity)	Medium	Testable device
Coils and jackets in heat exchangers—unsealed and toxic environment	Medium	DCV only
Coils and jackets in heat exchangers—sealed and non-toxic environments	Low	Non-testable device
Photographic processing machines (no developer mixing)	Low	Non-testable device
HOSPITALS/MEDICAL		
Equipment used for handling, mixing, measuring and processing chemical and microbiological substances	High	RAG or RPZD
Photographic developers		
(a) Developer mixing facilities	High	RAG or RPZD
(b) Water supplying rinse tanks	Low	Non-testable device

Form of cross-connection	Hazard rating	Backflow prevention device
Dental console		
(a) Australia	Low	DCAP
(b) New Zealand	High	RAG or RPZD
		(*continued*)
Haemodialysis machines		
(a) Australia	Low	Non-testable device
(b) New Zealand	High	RAG or RPZD
NOTE: Veterinary equipment is rated as for Hospital/Medical		
FIXTURES AND APPLIANCES		
Bidets	High	RBT or RPZD
Food preparation or food storage tanks, vats and vessels with clean-in-place systems	High	RAG or RPZD
Fixtures used for food preparation, e.g. sinks	Low	AG
Fixtures used for ablutions, e.g. baths, bidettes, basins, showers	Low	AG
Laundry troughs	Low	AG
Hair salons basins or troughs	Low	Non-testable device
Carbonated drink dispensing machines	Low	Stainless steel dual CV (intermediate) vent
Drink-dispensing equipment, vending machines, coffee machines	Low	Non-testable device
Food preparation or food storage tanks, vats and vessels	Low	AG/non-testable device
HOSE ATTACHMENT OUTLETS		
(a) External hose taps	Low	Non-testable device
(b) Flexible connections over domestic fixtures	Low	Non-testable device
(c) Hose taps located within an area provided with zone protection		
(i) flexible connections over commercial, industrial or hospital	Low	Non-testable device
(ii) fixtures laboratory outlets	Low	Non-testable device
(d) Hose taps located within 18 m of a Type C irrigation system	Low	Non-testable device
WATER SUPPLY SYSTEMS PERMANENTLY ATTACHED		
Steam boilers	Low	BT
Cooling towers~~*~~ (see Note)	High	RAG or RPZD
Steam calorifier	Medium	Testable device
WATER TREATMENT SYSTEMS		
Demineralizing equipment using ion-exchange resins with acid and alkali regeneration	High	RBT or RPZD
Plants with auxiliary non-drinking water supplies	High	RBT or RPZD
Drinking water in reclaimed water plants	Low	Non-testable device
Chlorinators	Medium	Testable device
In-line water softeners and filters	Low	Non-testable device

LEGEND: ~~*~~

~~Cooling tower air gap should be measured from~~

TABLE F1 *(continued)*

Form of cross-connection	Hazard rating	Backflow prevention device
		~~the rim of the cooling tower basin.~~

~~LEGEND:~~

AG = air gap
BT = break tank
DCAP = dual check valve with atmospheric port
DCV = double-check valve
RAG = registered air gap
RBT = registered break tank
RPZD = reduced pressure zone device

NOTE: Cooling tower air gap should be measured from the rim of the cooling tower basin.

TABLE ~~G2~~F2

ZONE PROTECTION—HAZARD RATINGS AND A SELECTION OF BACKFLOW PREVENTION—DEVICES FOR BACKFLOW PREVENTION AT THE CONNECTION TO SPECIFIED SECTIONS OF A WATER SUPPLY SYSTEM WITHIN A BUILDING OR FACILITY

Form of cross-connection	Hazard rating	Backflow prevention device
AGRICULTURAL, HORTICULTURAL AND IRRIGATION SYSTEMS		
Irrigation systems injected with fertilizers, herbicides, nematicides and insecticides (see Section 7, Type D)	High	RBT or RPZD
Drinking nipples and troughs	High	RAG or RBT or RPZD
Irrigation systems (see Section 7, Type C)	Medium	Testable device
Irrigation systems (see Section 7, Type B)	Low	Non-testable device
INDUSTRIAL AND COMMERCIAL		
Electroplating, degreasing, descaling, stripping, pickling, dipping, etc., tanks, vats and vessels	High	RBT or RPZD
Commercial laundries	High	RAG or RPZD
Cooling or heating systems with recirculating water	High	RAG or RPZD
Clean-in-place systems (i.e. internal chemical cleaning takes place without dismantling equipment)	High	RAG or RPZD
Dockside facilities	High	RAG or RPZD
Industrial process water that has been recirculated	High	RAG or RPZD
Industrial and teaching laboratories	High	RAG or RPZD
Aircraft facilities	Medium	Testable device
Secondary school laboratories (including fume cupboards)	Medium	Testable device
Water filtration equipment	Low	Non-testable device
Photographic laboratories	Low	

TABLE F2 (*continued*)

Form of cross-connection	Hazard rating	Backflow prevention device
FIRE SERVICES		
~~Direct connection to public water supply (Australia only) No tanks, reservoir, connection to other water supply, antifreeze or other additives or auxiliary supply, e.g. pond or lake within 180 m of fire brigade booster connection~~	~~See Table 4.1~~	~~Single check valve (testable) [see Clause 4.6.3.2(h)(iv)], single check detector assembly (testable) [see Clause 4.6.3.2(i)(iv)], or single check valve [see Clause 4.6.3.3(h)(iii)]~~
Fire hose reels located in areas of hazard have to have a backflow prevention device in line with the hazard ratings of the areas within reach of the fire hose	Medium	DCV
Home fire sprinklers systems (see AS 2118.5)	Low	DCV or Dual CV
~~All other fire services~~	~~Medium~~	~~DCV~~
~~Fire storage tank~~Bushfire water spray systems (see AS 5414)	Low	Non-testable device or AG

(*continued*)

HOSPITALS/MEDICAL LABORATORIES, NURSING HOMES		
Dissecting rooms in hospitals and medical buildings	High	RBT or RPZD
Mortuary equipment used in funeral parlours, mortuaries, autopsy areas	High	RBT or RPZD
Utility rooms, where other than handbasins are installed	High	RBT or RPZD
Operating theatres in hospitals and medical buildings	High	RBT or RPZD
~~TABLE G2 (*continue*~~		
Dental and medical surgeries		
(a) Australia	Low	Non-testable device
(b) New Zealand	High	RAG or RPZD
FIXTURES AND APPLIANCES		
Sanitary dump points	High	RAG or RPZD
Food storage tanks, vats and vessels with clean-in-place systems	High	RAG or RPZD
Food storage tanks, vats and vessels	Low	Non-testable device
Hair salons, basins or troughs	Low	Non-testable device

TABLE ~~G3~~F3

CONTAINMENT PROTECTION—HAZARD RATINGS AND A SELECTION OF BACKFLOW PREVENTION DEVICES—BACKFLOW PREVENTION PROVIDED AT THE PROPERTY BOUNDARY TO PROTECT THE NETWORK UTILITY'S OR MAINS WATER SUPPLY FROM CONTAMINATION

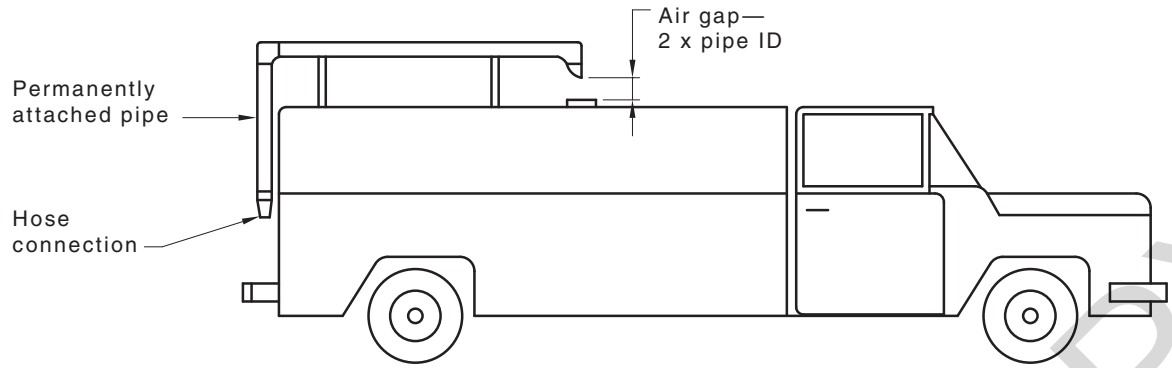
Form of cross-connection	Hazard rating	Backflow prevention device
TYPE OF PREMISES		
Premises with an alternative water supply excluding rainwater tanks	High	RBT or RPZD
Premises where inspection is restricted	High	RBT or RPZD
Hospitals, mortuaries, clinics and the like	High	RBT or RPZD
Piers, docks and other waterfront facilities	High	RBT or RPZD
Sewage treatment plants and sewage lift stations	High	RBT or RPZD
Chemical plants	High	RBT or RPZD
Metal finishing plants	High	RBT or RPZD
Petroleum processing or storage plants	High	RBT or RPZD
Radioactive material processing plants or nuclear reactors	High	RBT or RPZD
Car and plant washing facilities	High	RBT or RPZD
Abattoirs	High	RBT or RPZD
Factories using processing or manufacturing toxic chemicals	High	RBT or RPZD
Chemical laboratories	High	RBT or RPZD
Pathology laboratories	High	RBT or RPZD
Sanitary depots	High	RBT or RPZD
Universities	High	RBT or RPZD
Food and beverage processing plants	Medium	Testable device
Caravan parks	Medium	Testable device
Marinas	Medium	Testable device
Premises with greywater re-use systems	Medium	Testable device
Public swimming pools	Medium	Testable device
Premises with reticulated and disinfected reclaimed water systems	Medium	Testable device
Premises with rainwater tanks (see Clause 16.4)	Low	Non-testable device
Premises with reticulated recycled water system	Low	Non-testable device
All premises – Containment requirement for fire services ~~LEGEND:~~	Low	SCVT or SCDAT
	Medium	DCV or DCDA
	High	RBT or RPZD or RPDA

LEGEND:
AG = air gap
AVB = atmospheric vacuum breaker
DCV = double check valve
RAG = registered air gap
RBT = registered break tank
RPZD = reduced pressure zone device

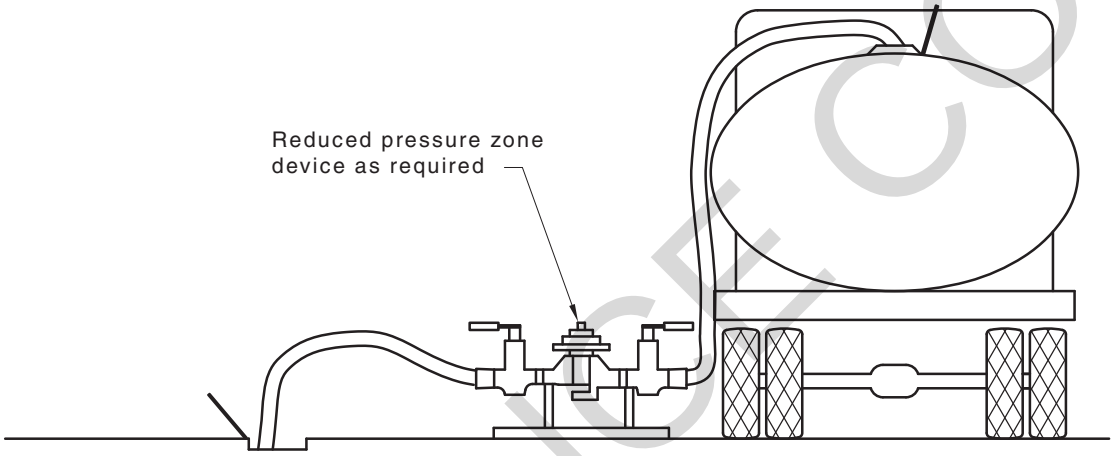
NOTES:

1 For requirements for alternative water supply, see Clause 4.2.4.

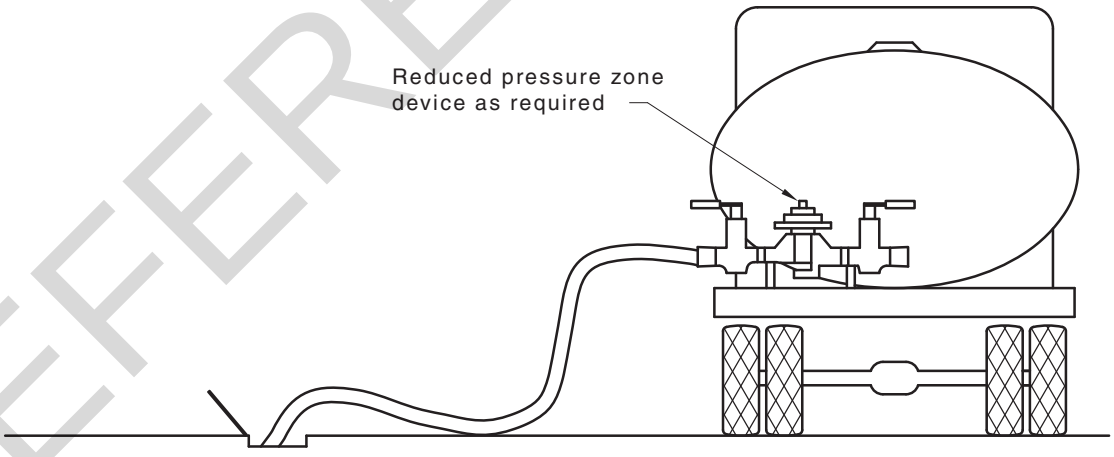
2 Air gaps should not be used in toxic environments.



(a) With air gap



(b) With portable assembly



(c) With truck-mounted assembly

FIGURE ~~G1~~ F1 TYPICAL MINIMUM PROTECTION FOR FILLING TANKER TRUCKS

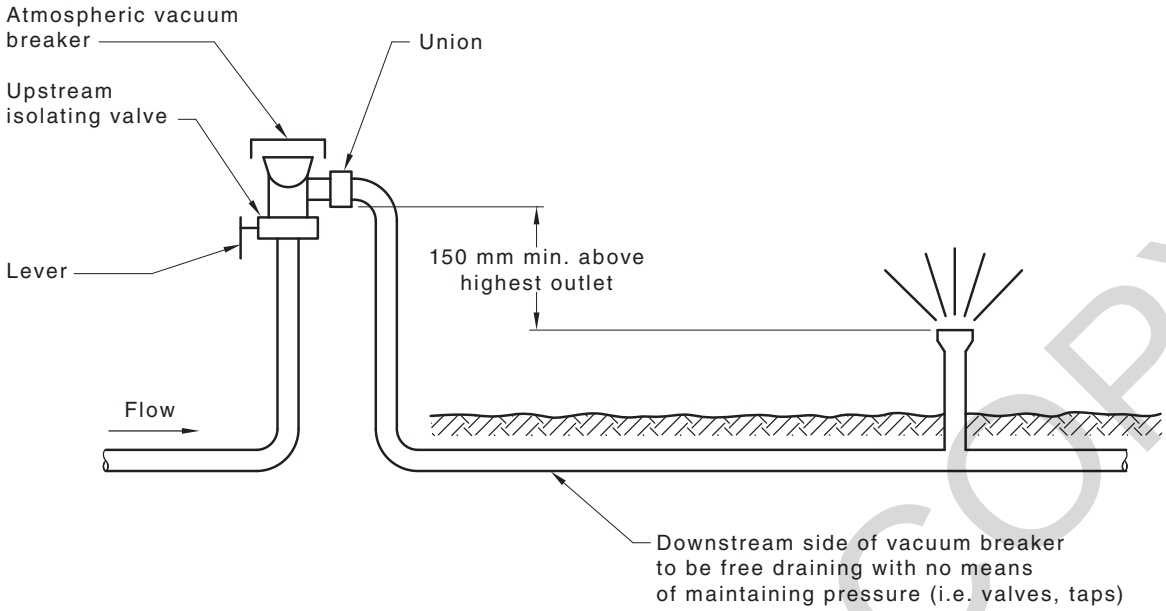


FIGURE ~~G2~~ F2 TYPICAL INSTALLATION OF AN ATMOSPHERIC VACUUM BREAKER

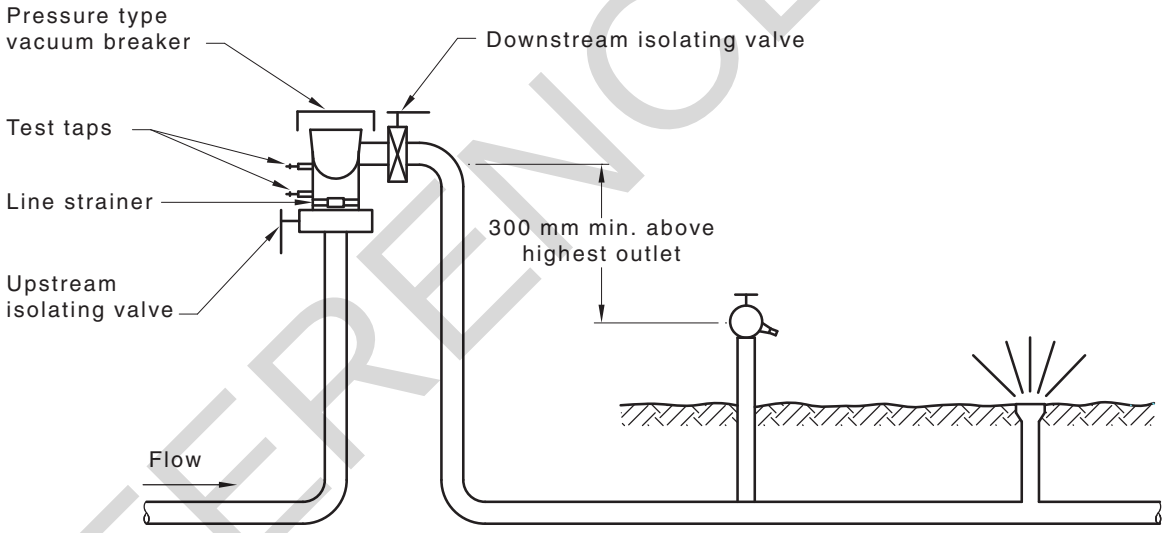


FIGURE ~~G3~~ F3 TYPICAL INSTALLATION OF A PRESSURE TYPE VACUUM BREAKER

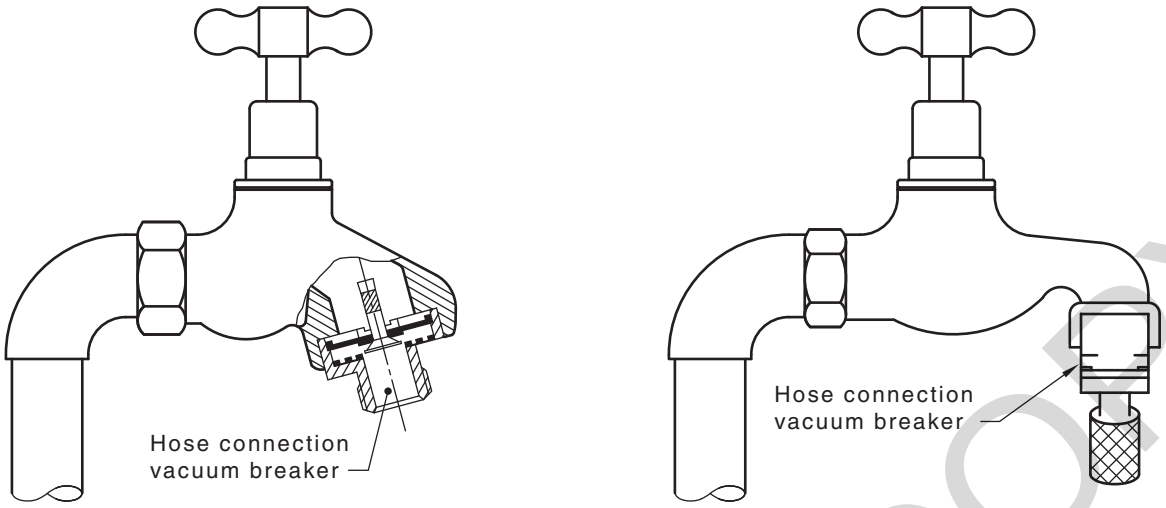


FIGURE ~~G4~~ F4 TYPICAL INSTALLATIONS OF EXTERNAL HOSE CONNECTION VACUUM BREAKERS

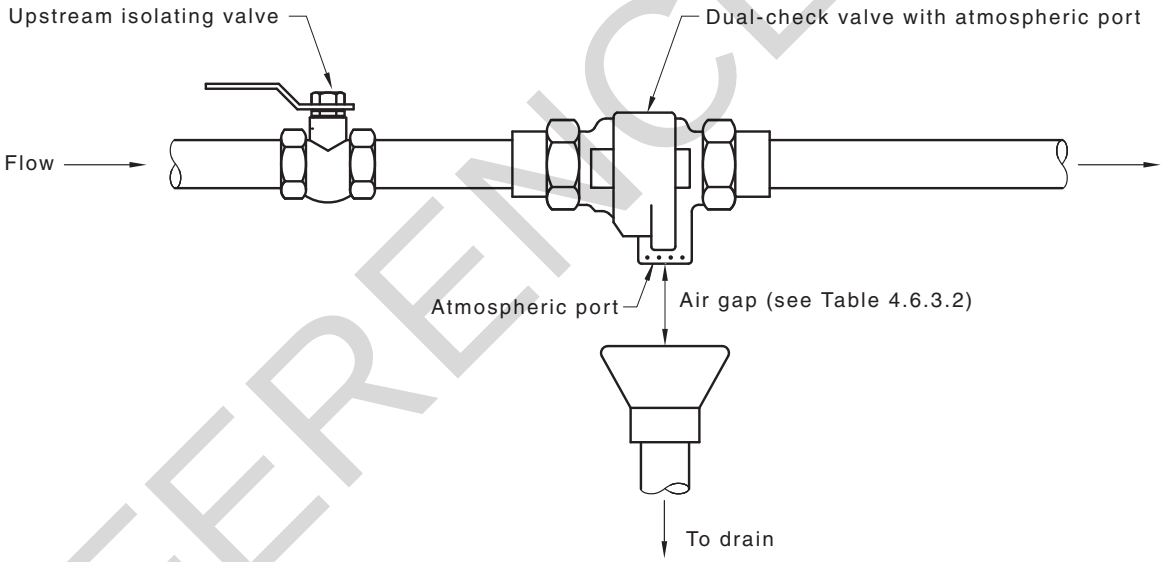


FIGURE ~~G5~~ F5 TYPICAL INSTALLATION OF A DUAL CHECK VALVE WITH ATMOSPHERIC PORT

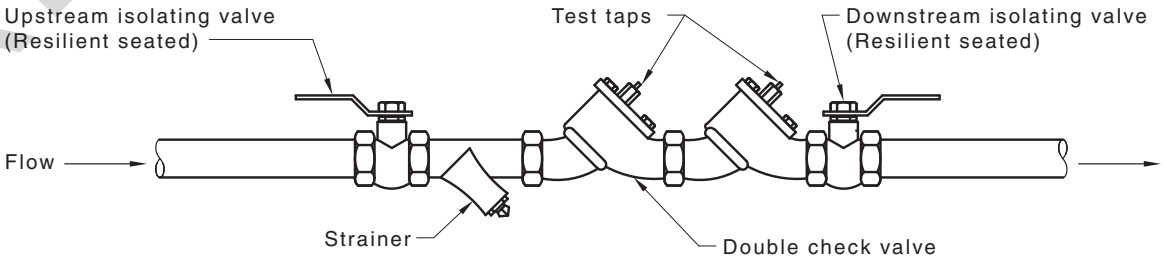


FIGURE ~~G6~~ F6 TYPICAL INSTALLATION OF A DOUBLE CHECK VALVE

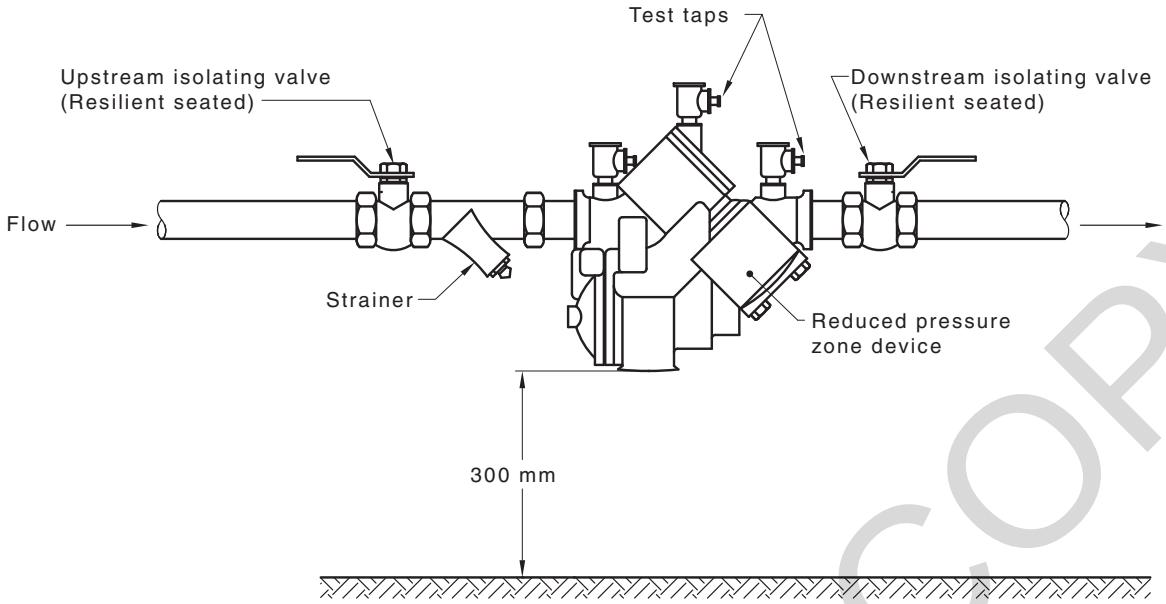


FIGURE ~~G7~~ F7 TYPICAL INSTALLATION OF A REDUCED PRESSURE ZONE DEVICE

APPENDIX G~~APPENDIX H~~

STORAGE TANKS—INFLOW AND OVERFLOW

(Informative)

G1~~H1~~ GENERAL

This Appendix contains an example of the calculations for inflow rate, overflow size, spill level air gap and height of inlet above invert of overflow for storage tanks.

G2~~H2~~ INFLOW RATE

Inflow rates may be determined from Table 8.4.4.1. As an example, the inflow rate from a 20 mm orifice with an inlet pressure of 500 kPa would be 6.0 L/s.

G3~~H3~~ OVERFLOW SIZE AND SPILLING LEVEL

With reference to Figure 8.4.1 and 8.4.4.1(A), 8.4.4.1(B) or 8.4.4.1(C), depending on the type of overflow, determine the size of overflow and spill level required from the alternative available.

For this example, Figure 8.4.4.1(A) is used. Using the inflow rate determined from Paragraph ~~H2~~ G2 (i.e. 6.0 L/s) select combination required. The available alternatives are given in Table ~~H1~~G1.

TABLE ~~H1~~G1

SPILL LEVELS

Internal diameter of overflow pipe	Spill level (height of water above invert of overflow)
mm	mm
100	150
125	125
150	100

G4~~H4~~ AIR GAP

With reference to Table 4.6.3.2, the minimum air gap for a 20 mm orifice, when not affected by a near wall, is 40 mm (see Figure ~~H1~~G1).

G5~~H5~~ —HEIGHT OF INLET ABOVE INVERT LEVEL OF OVERFLOW

The height of the float control valve outlet above the invert of the overflow is determined by the addition of the spill level (Paragraph ~~H3~~G3) and the air gap (Paragraph ~~H4~~G4).

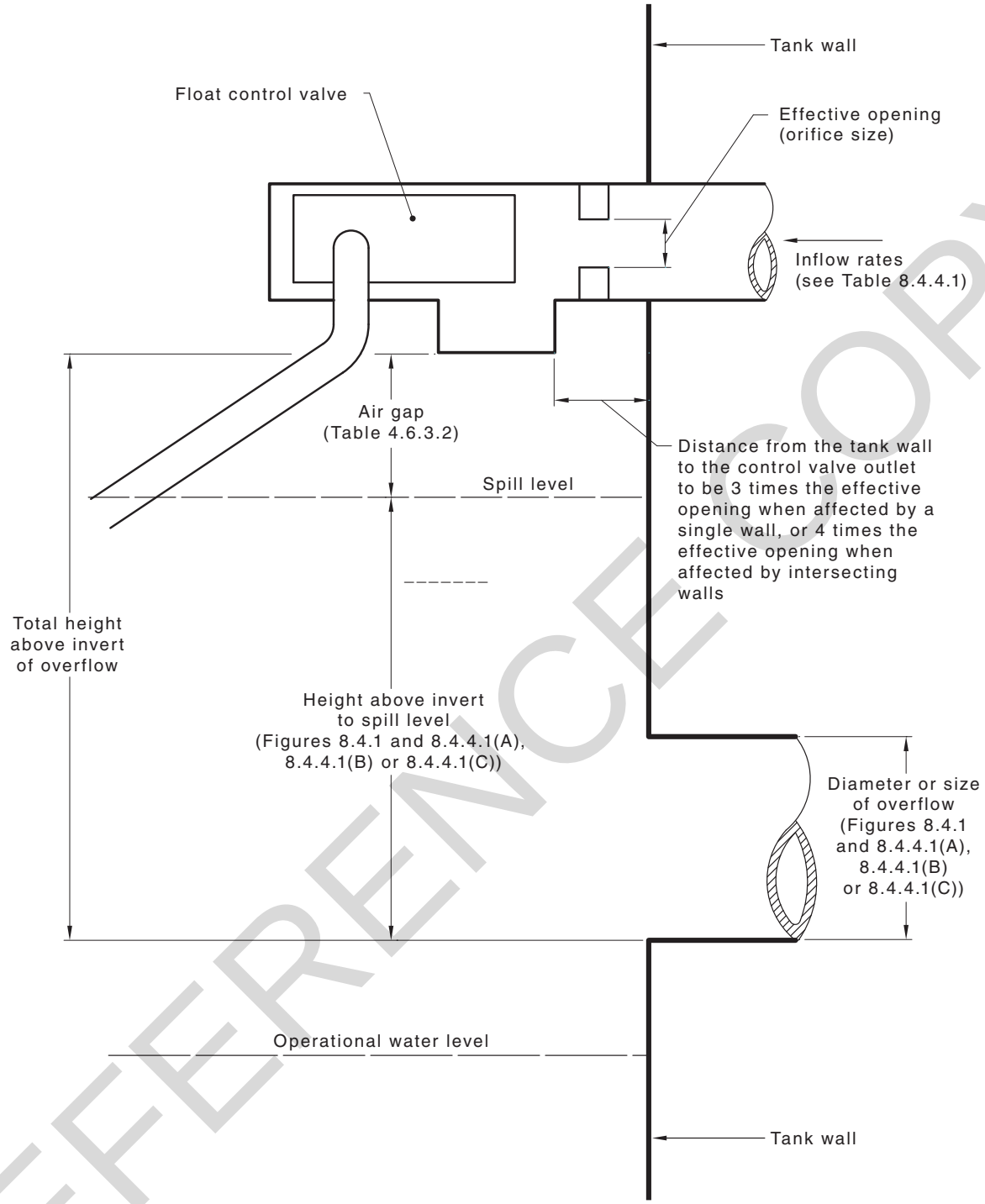


FIGURE ~~H1~~ G1 DISTANCES RELATED TO OVERFLOW SIZE, SPILL LEVEL AND AIR GAP

APPENDIX H~~APPENDIX I~~

CLEANING AND DISINFECTION OF STORAGE TANKS

(Normative)

H1~~I1~~ GENERAL

All water storage tanks for drinking water shall be cleaned and disinfected—

(a) prior to initial use; and

(b) whenever the tank is taken out of service for inspection, repairs, painting or other activity that might lead to contamination of water.

H2~~I2~~ CLEANING

The tank shall be drained and all debris and sludge removed. The surfaces of walls, floor and operating facilities shall be thoroughly cleaned using a high-pressure water jet, sweeping, scrubbing or other similar effective means. All water, dirt, and other material accumulated in this cleaning process shall be flushed or otherwise removed from the tank.

H3~~I3~~ DISINFECTION

After cleaning, the tank shall be disinfected by one of the following means:

(a) Filling the tank to overflow level with drinking water to which enough chlorine is added to provide a free chlorine residual, in the whole tank, of not less than 10 mg/L, at the end of the retention time (see Note 1).

The retention time shall be not less than 6 h, when the water entering the tank has been chlorinated uniformly by gas-fed equipment or chemical pump, or not less than 24 h, when the storage tank has been filled with water that has been mixed with sodium hypochlorite or calcium hypochlorite within the storage facility.

The tank shall be drained after disinfection and flushed out with drinking water prior to being put back into service.

(b) Application of 200 mg/L available chlorine directly to all surfaces of the storage tank.

The disinfection solution shall remain in contact with the surface for at least 30 min. The tank surfaces shall then be hosed down and flushed with drinking water prior to being put back into service.

NOTES:

1 The amount of chlorine to be added to obtain 10 mg/L residual after the retention period will depend on the amount of organic material present and the chemical composition of the water. As a guide, an initial chlorine dose of 50 mg/L is recommended.

2 Amounts of common chlorine, including agents required per 1 000 L should be as follows:

Chlorine dose mg/L	12.5% Sodium hypochlorite solution mL	70% Calcium hypochlorite g
50	400	70
200	1 600	280

3 Authorities may require chlorinated water to be neutralized before discharging to the environment.

4 Authorities may require collection and disposal of sludge and silts separately.

5 ANSI/AWWA C652 contains details of disinfection methods that may be used together with an appendix on neutralization of chlorinated water.

6 Choice of the method of disinfection used should include consideration of the size of the tank to be disinfected, the availability of materials and disinfection equipment, training of personnel, safety of operation and disposal of chlorinated water.

APPENDIX I~~APPENDIX J~~

DISINFECTION OF WATER SERVICES

(Normative)

I1~~J1~~ GENERAL

Water services that are used to supply drinking water shall be protected against contamination during storage, construction and repairs, and flushed and chlorinated before being placed in service and after any repairs that might lead to contamination of water.

I2~~J2~~ PRECAUTIONS AGAINST CONTAMINATION

Precautions shall be taken to protect the interior of pipes fittings and valves against contamination during storage, construction and repairs.

NOTE: See Note 1 of Paragraph ~~J5~~I5.

I3~~J3~~ ~~—~~FLUSHING OF WATER SERVICES

On completion of installation or repairs, water services shall be flushed at each discharge point to remove any dirty water or debris from the service. The flushing velocity in any section of the service shall be not less than 0.75 m/s.

I4~~J4~~ CHLORINATION

After flushing, water services from storage tanks shall be chlorinated, before being placed in service, as follows:

(a) Water services from storage tanks shall be disinfected by drawing chlorinated water from the storage tank into the service, such that after a retention period of 6 h, a free chlorine residual of not less than 10 mg/L is obtained throughout the services.

NOTE: See Note 2 of Paragraph ~~J5~~I5.

(b) Water services DN 80 or larger, shall be disinfected as for water services from storage tank or in accordance with ANSI/AWWA C651.

I5~~J5~~ FINAL FLUSHING

After the applicable retention period, heavily chlorinated water shall not be allowed to remain in prolonged contact with service piping. In order to prevent damage to pipe lining or corrosion to pipe itself, the heavily chlorinated water shall be flushed from the service until chlorine measurements show that the concentration in the water leaving the service is no higher than that generally prevailing in the authority's distribution system.

NOTES:

1 During construction, all openings in pipelines should be covered and, when laid in a trench, sealed with watertight plugs during interruption to installation to prevent contamination from water in the trench.

2 Water services that are supplied from storage tanks should be disinfected at the same time as that of the disinfection of the storage tank. The water service to the tank should be closed. The discharge points on the service from the tank then be opened, working progressively away from the storage tank until chlorinated water (as detected by odour) is delivered from each discharge point, which should then be closed. The storage tanks should then be topped up with chlorinated water.

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