

Australian/New Zealand Standard™

National plumbing and drainage

**Part 1.2: Water supply—Acceptable
solutions**



AS/NZS 3500.1.2:1998

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee WS-014, National Plumbing and Drainage Code. It was approved on behalf of the Council of Standards Australia on 14 November 1997 and on behalf of the Council of Standards New Zealand on 5 December 1997. It was published on 5 February 1998.

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Australian/New Zealand Standard™

National plumbing and drainage

Part 1.2: Water supply—Acceptable solutions

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WS/14, National Plumbing and Drainage Code, to supersede AS 3500.1—1992.

This Standard incorporates Amendment 1 (2002). The changes arising from the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure, or part thereof affected.

The object of this revision is to issue it as a Joint Australian/New Zealand Standard with minimum deemed-to-satisfy requirements and incorporate amendments and additions from industry requirements compatible with legislation of authorities who can enforce regulations and authorize products for connection to their systems.

Noise levels have not been included as progress on a unified method of analysis has not been agreed upon and further research is required.

Attention is drawn to the publication of SAA/SNZ Rul PL/1, Rulings to the Joint Australia/New Zealand Plumbing and Drainage Code. Where Rulings of public significance are issued, they will be available from Standards Australia through a subscription service. When rulings are included in an amendment, the specific ruling will be withdrawn at the time of publication of the amendment. Enquiries should be directed to Standards 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.

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FOREWORD

REGULATORY REQUIREMENTS Attention is drawn to the relevant regulatory requirements with respect to—

- (a) the qualifications of persons permitted by law to do plumbing work;
- (b) the administrative procedures to be followed by persons performing plumbing work; and
- (c) the authorization for certain materials, products, fittings, and other components to be connected to water supply systems in accordance with the National Certification of Plumbing and Drainage Products Scheme (NCPDP) in Australia and the Building Industry Authority (BIA) in New Zealand.

RULINGS AND INTERPRETATIONS Enquires concerning the interpretation of specific Clauses contained in AS/NZS 3500.1.2 should be directed initially to the regulatory authority responsible for the locality within which work is, or is to be, conducted. In the event that further clarification is required, the enquiry may be directed to Committee WS/14, which is responsible for the Joint Australian/New Zealand National Plumbing and Drainage Code. The Projects Manager, Committee WS/14, Standards Australia will process enquires and issue replies.

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 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.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

National plumbing and drainage

Part 1.2: Water supply—Acceptable solutions

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard sets out the requirements for the installation of water services from the authority's water main or alternative potable water supplies to the points of discharge. This Standard 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.

Construction of a water supply installation in accordance with this Standard is deemed to satisfy the requirements of AS 3500.1.1 for Australia. This Standard may be used as an alternative acceptable solution to Clause G12 of the New Zealand Building Code but may exceed the performance requirements.

NOTE: The requirements for hot water services are set out in AS/NZS 3500.4.2

1.2 REFERENCED DOCUMENTS A list of the documents referred to in this Standard, is given in Appendix A.

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

1.3.1 Deemed to satisfy—where a provision states that the use of a particular material, component, method of construction or design satisfies a performance requirement of this Standard. An equivalent material, component, method or design may be used if it meets the level of performance prescribed by the provisions concerned.

1.3.2 Registered break tank—a break tank which is recorded by an authority or third party for the purpose of inspection and maintenance to ensure its functional requirements.

1.4 CLASSIFICATION OF SOILS Soils shall be classified in accordance with AS 1726 or NZS 4402.

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 Table 1.1 for Australian requirements or Table 1.2 for New Zealand. As an alternative, Table 1.3 may apply to the selection of tubes for use in either country.

1.6 REQUIREMENTS FOR DISABLED PERSONS Facilities for disabled persons shall comply with the requirements of AS 1428.1 and the Australian Building Code or NZS 4121 and the New Zealand Building Code where applicable.

TABLE 1.1
AUSTRALIAN EQUIVALENT PIPE SIZE GUIDE

Specified nominal size	Acceptable equivalent size							
	Copper	Stainless steel	Galvanized steel	UPVC Nominal size	ABS	PE and PE-X Nominal size	PB Nominal size	PP-R Nominal size
	DN	DN	DN	DN	DN	D _e	D _e	D _e
10	10	10	10	15	10	12	15	12
15	15	15	15	15	10	16	18	16
18	18	18	15	15	15	20	20	20
20	20	20	20	20	20	25	22	25
25	25	25	25	25	25	32	28	32
32	32	32	32	32	32	40	40	40
40	40	40	40	40	40	50	50	50
50	50	50	50	50	50	63	63	63

DN — Nominal size.

De — Nominal size in plastics pipes Standards.

NOTE: Refer to appropriate Standards for pipe Class and equivalent material dimensions.

TABLE 1.2
NEW ZEALAND EQUIVALENT PIPE SIZE GUIDE

Specified nominal size	Acceptable equivalent size					
	Copper	Galvanized steel	UPVC	ABS	PE and PE-X	PB
	DN					
10	10	8	10	10	15	15
15	15	10	15	10	15	15
18	20	15	15	15	20	20
20	20	20	15	20	20	20
25	25	25	20	25	25	28
32	32	32	25	32	32	—
40	40	40	32	40	40	—
50	50	50	50	50	50	—

NOTE: Refer to appropriate Standards for pipe Class and equivalent material dimensions.

TABLE 1.3
MINIMUM BORE OF PIPES
(AUSTRALIA/NEW ZEALAND)

Size DN	Minimum bore mm
10	7.0
15	10.0
18	12.5
20	15.0
25	20.5
32	26.5
40	32.5
50	44.5

SECTION 2 MATERIALS AND PRODUCTS

2.1 SCOPE OF SECTION This Section specifies material and product requirements. Alternative materials or methods may be used if proven to be equal to or better than those specifically referred to herein.

2.2 AUTHORIZATION Materials and products used in the installation shall comply with the relevant statutory requirements for authorization, if any, and with this Standard.

NOTE: In Australia refer to SAA MP52, whereas in New Zealand there is no mandatory system for authorization of products.

2.3 SELECTION AND USE OF MATERIALS The materials and products used shall be selected to ensure satisfactory service for the life of the installation within the property (see Figure 2.1). Factors to be taken into account include —

- (a) the type of usage likely to occur and the nature of the water to be conveyed;
- (b) the nature of the ground and the possibility of chemical attack therefrom;
- (c) the physical and chemical characteristics of the materials and products;
- (d) frost protection in accordance with Clause 5.19; and
- (e) other environmental factors.

2.4 LIMITS ON USE OF PIPES AND FITTINGS

2.4.1 Acrylonitrile butadiene styrene (ABS) The following limitations shall apply to the use of ABS pipes and fittings:

- (a) Pipes shall not be less than Class 12;
- (b) Moulded fittings shall not be less than Class 15;
- (c) Pipes and fittings shall not be used for a property service;
- (d) Pipes and fittings shall not be used as part of a water meter assembly, as a vertical riser off the meter assembly, as an external standpipe or within 1 m either side of a riser or standpipe;
- (e) Pipes and fittings shall not be used within 2 m of the inlet to a water heater;
- (f) Pipes and fittings shall not be used within buildings where not accessible;
- (g) Pipes and fittings shall not be used where subject to freezing;
- (h) Pipes and fittings shall not be used where subject to direct sunlight; and
- (i) Pipes and fittings shall not be used in areas subject to contamination by petroleum products.

NOTE: For Class 12 and Class 15 pipes and fittings at a material temperature of 20°C, the maximum working pressures should be 1.2 and 1.5 MPa respectively. An allowance for temperature derating should be made. Pipe working pressures should be de-rated where temperatures exceed 20°C.

2.4.2 Black steel pipes and fittings These pipes and fittings shall be limited to above ground fire hydrant and sprinkler systems (see AS 1074).

2.4.3 Cast iron fittings (grey cast iron) The following limitations shall apply to the use of cast iron fittings. Fittings shall be—

- (a) lined with cement mortar or other alternative authorized material;
- (b) provided with a protective coating; and

- (c) provided with corrosion protection in accordance with Clauses 2.8.3 and 5.14, where installed below ground.

NOTE: Lining may not be required for fire services.

2.4.4 Copper The following limitations shall apply to the use of copper fittings and pipes:

- (a) Where installed below ground in corrosive areas, pipes shall be protected in accordance with Clauses 2.8.3 and 5.14.
- (b) In concealed locations the provisions on Clause 5.5.2 shall be observed.
- (c) Bends shall be of uniform radius and free from wrinkling and flattening.
- (d) Copper pipes and fittings complying with AS 1432 shall—
 - (i) not be used in a property service or as part of a meter assembly if of Type C and Type D.
 - (ii) be used only in the hard drawn condition if of Type D, except that local annealing incidental to the making of joints is permitted.
 - (iii) not be bent nor used to form compression joints if of Type D.

2.4.5 Copper alloy The following limitations shall apply to the use of copper alloy pipes and fittings:

- (a) Pipes shall not be used in a property service nor as part of a meter assembly.
- (b) Pipes shall not be bent nor used to form compression joints.
- (c) Pipes shall be protected in accordance with Clauses 2.8.3 and 5.14 where installed below ground in corrosive areas.
- (d) In concealed locations the provisions of Clause 5.5.2 shall be observed.

2.4.6 Ductile iron The following limitations shall apply to the use of ductile iron pipes and fittings. Pipes and fittings shall be—

- (a) lined with cement mortar or other alternative authorized material;
- (b) provided with a protective coating; and
- (c) provided with corrosion protection in accordance with Clauses 2.8.3 and 5.14, where installed below ground.

NOTE: Lining may not be required for fire services.

2.4.7 Galvanized steel The following limitations shall apply to the use of galvanized steel pipes and fittings. Pipes and fittings shall—

- (a) be heavy thickness for sizes up to and including DN 80 and not less than medium thickness for sizes above DN 80;
- (b) not be used in a property service;
- (c) not be used in concealed locations except where installed in a fire service;
- (d) have bends in sizes up to and including DN 50, made using bending machines or tools and have a minimum radius of five times the nominal size of the pipe;
- (e) have welded fabricated fittings hot-dipped galvanized after fabrication; and
- (f) be provided with corrosion protection in accordance with Clauses 2.8.3 and 5.14, where installed below ground.

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

2.4.8 Polybutylene (PB) The following limitations shall apply to the use of polybutylene pipes and fittings:

- (a) Pipes and fittings shall not be less than PN 16.
- (b) Pipes and fittings shall not be used as part of a water meter assembly or vertical riser.
- (c) Pipes and fittings shall not be used within 1 m of the inlet to a water heater.
- (d) In concealed locations, the provisions of Clause 5.5.2 shall be observed.
- (e) Pipes and fittings shall not be used where subject to direct sunlight.
- (f) Pipes and fittings shall not be used in areas subject to contamination by petroleum products.
- (g) Pipes and fittings shall not be used in continuously circulating hot water plumbing loops. (Branch lines off the loop may be polybutylene after the first 1 m of branch line length).

NOTE: Classes and temperature ratings for different working pressures are given in AS/NZS 2642.2.

2.4.9 Polyethylene (PE) The following limitations shall apply to the use of polyethylene pipes and fittings:

- (a) Pipes and fittings shall not be less than PN 12.5.
- (b) Pipes and fittings shall not be used as part of a water meter assembly or vertical riser.
- (c) Pipes and fittings shall not be used within 1 m of the inlet to a water heater.
- (d) In concealed locations, the provisions of Clause 5.5.2 shall be observed.
- (e) Pipes and fittings shall not be used where subject to direct sunlight.
- (f) Pipes and fittings shall not be used in areas subject to contamination by petroleum products.

NOTE: For PN 12, PN 12.5 and PN 16 pipes, at a pipe material temperature of 20°C, the maximum allowable working pressures should be 1.2 MPa, 1.25 MPa and 1.6 MPa respectively. For other classes of pipe reference should be made to AS 2033.

2.4.10 Cross-linked polyethylene (PE-X) The following limitations shall apply to the use of cross-linked polyethylene pipes and fittings:

- (a) Pipes and fittings shall not be less than PN 16.
- (b) Pipes and fittings shall not be used as part of a water meter assembly or vertical riser.
- (c) Pipes and fittings shall not be used within 1 m of the inlet to a water heater.
- (d) Pipes and fittings shall not be used where subject to direct sunlight.
- (e) In concealed locations, the provisions of Clause 5.5.2 shall be observed.
- (f) Pipes and fittings shall not be used in areas subject to contamination by petroleum products.

NOTE: PN and temperature ratings for different working pressures are given in AS 2492.

2.4.11 Polypropylene (PP-R) The following limitations shall apply to the use of polypropylene pipes and fittings:

- (a) Pipes and fittings shall not be less than PN 16;
- (b) Pipes and fittings shall not be used as part of a water meter assembly or vertical riser;

- (c) Pipes and fittings shall not be used within 1 m of the inlet to a water heater;
- (d) In concealed locations, the provisions of Clause 5.5.2 shall be observed;
- (e) Pipes and fittings shall not be used where subject to direct sunlight; and
- (f) Pipes and fittings shall not be used in areas subject to contamination by petroleum products.

NOTE: PN and temperature ratings for different working pressures are given in DIN 8077 and DIN 8078.

2.4.12 Unplasticized polyvinyl chloride (UPVC) The following limitations shall apply to the use of unplasticized polyvinyl chloride pipes and fittings:

- (a) Pipes shall not be less than PN 12;
- (b) Moulded fittings shall not be less than PN 18;
- (c) Pipes and fittings shall not be used for a property service;
- (d) Pipes and fittings shall not be used within 2 m of the inlet to a water heater;
- (e) Pipes and fittings shall not be used as part of a water meter assembly, vertical riser or standpipe;
- (f) Pipes and fittings shall not be used within buildings where not accessible, (Australia only);
- (g) Pipes and fittings shall not be used where subject to direct sunlight;
- (h) Pipes and fittings shall not be used where subject to freezing; and
- (i) Pipes and fittings shall not be used in areas subject to contamination by petroleum products.

NOTE: For PN 12, 15 and 18 pipes, at a material temperature of 20°C, the maximum working pressures should be 1.2, 1.5, and 1.8 MPa respectively. For working pressures of other classes of pipes and other temperatures, reference should be made to Table 2.1 in AS 2032—1977.

2.4.13 Chlorinated polyvinyl chloride (CPVC) The following limitations shall apply to the use of chlorinated polyvinyl chloride pipes and fittings:

- (a) Pipes shall not be less than PN 12 and PN 18 for moulded fittings.
- (b) Pipes and fittings shall not be used as part of a water meter assembly or vertical riser.
- (c) Pipes and fittings shall not be used within 2 m of the inlet to a water heater.
- (d) In concealed locations, the provisions of Clause 5.5.2 shall be observed.
- (e) Pipes and fittings shall not be used where subject to direct sunlight.
- (f) Pipes and fittings shall not be used in areas subject to contamination by petroleum products.

NOTES:

- 1 For information on (CPVC) see ASTM D2846.
- 2 In Australia for fire services only.

2.4.14 Stainless steel The following limitations shall apply to the use of stainless steel pipe and fittings:

- (a) Fittings shall be either—
 - (i) copper alloy compression type and be dezincification resistant (DR); or
 - (ii) stainless steel capillary type manufactured from alloy 304 or 316 complying with AS 1449.
- (b) All bends to be of uniform radius and free from wrinkling and flattening.

- (c) Bends in sizes up to and including DN 20 to be made using bending machines or tools and have a minimum radius of five times the nominal size of the pipe.
- (d) Bends in sizes above DN 20 to be made only with machines incorporating internal plug support.
- (e) In concealed locations the provisions of Clause 5.5.2 are to be observed.
- (f) Where installed below ground in corrosive areas, pipes and fittings are to be protected in accordance with Clauses 2.8.3 and 5.14.
- (g) Braided flexible connections shall be installed only in accessible positions.

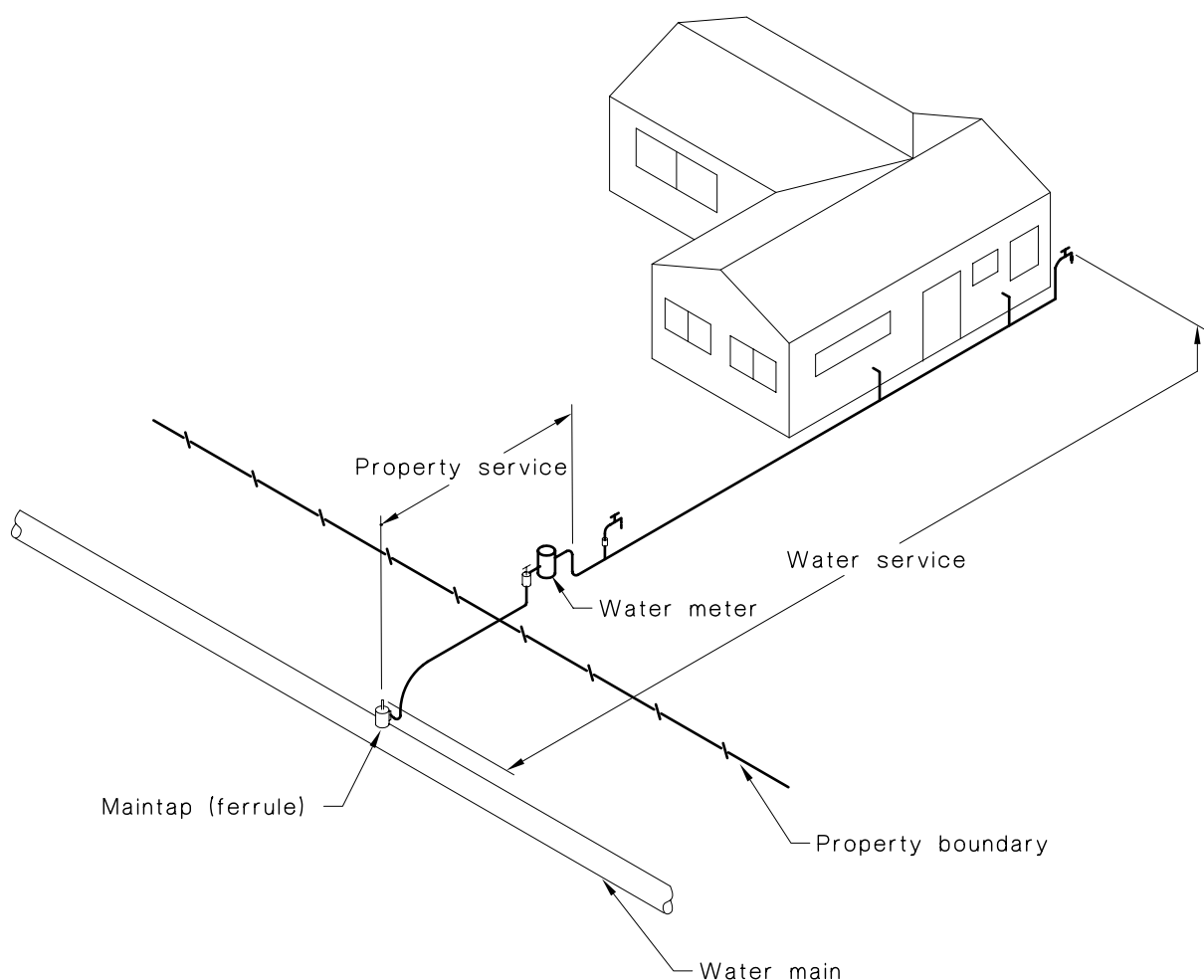


FIGURE 2.1 IDENTIFICATION OF PROPERTY SERVICE AND WATER SERVICE

2.5 STORAGE TANK MATERIALS Materials shall comply to a relevant Australian or New Zealand Standard and be suitable for storing potable water and comply with AS 3855.

2.6 JOINTING

2.6.1 Elastomeric rings Elastomeric rings shall be of dimensions, composition and hardness appropriate to the materials being joined and for the particular application.

2.6.2 Elastomeric gaskets Elastomeric gasket materials shall comply with AS 1646 or NZS/BS 2494, as appropriate.

2.6.3 Silver brazing alloy

2.6.3.1 Copper and copper alloys Silver brazing alloys for capillary jointing of copper and copper alloy pipes and fittings shall comply with Table 1 or Table 2 of AS 1167.1—1993 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 comply with Table 1 of AS 1167.1—1993 and contain a minimum of 38% silver and a maximum of 0.05% cadmium.

2.6.4 Soft solders The following limitations apply to the use of soft solder which 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.

A1 | **2.6.5 Rolled grooved joints** Rolled grooved Joints shall comply with the specification relevant to the pipe material being used.

2.7 CONCRETE AND MORTAR

2.7.1 Cement Cement shall be portland cement complying with AS 3972 or NZS 3122.

2.7.2 Fine aggregate (sand) Fine aggregate shall comply with AS 2758.1.

2.7.3 Coarse aggregate (metal) Coarse aggregate shall comply with AS 2758.1 or NZS 3121 and shall not exceed 20 mm nominal size.

2.7.4 Concrete mix Ready-mixed concrete shall comply with AS 1379 and shall have a minimum characteristic compressive strength of 20 MPa f'_c as defined in AS 3600 or NZS 3109 and NZS 3124.

Site mixed concrete shall consist of cement, fine aggregate, coarse aggregate all measured by volume, and sufficient water added to make the mix workable and shall have a minimum f'_c of 20 MPa.

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

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

Cement mortar which has been mixed and left standing for more than one hour shall not be used.

2.7.6 Chemical admixtures Chemical admixtures used in concrete shall comply with AS 1478.

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

2.7.8 Steel reinforcement Steel reinforcing bars used in concrete structures shall comply with AS 1302 or NZS 3402.

Steel welded mesh reinforcing fabric used in concrete structures shall comply with AS 1304 or NZS 3422.

2.8 MISCELLANEOUS MATERIALS

2.8.1 Timber Timber exposed to the weather shall be of durability Class 2 complying with AS 2878, NZS 3631 or shall be treated in accordance with AS 1604 or NZS 3640.

2.8.2 Thermal insulation Thermal insulation for the protection of pipework against freezing shall comply with BS 5422.

NOTE: In selecting insulating materials, consideration should be given to maintaining the fire resistance level (FRL Australia only) of any affected building components and potential smoke and fume release.

2.8.3 External protective coatings External coatings used for the protection against corrosion of pipelines buried in corrosive areas shall—

- (a) be impervious to the passage of moisture;
- (b) be resistant to the external corrosive environment;
- (c) be resistant to abrasion by the surrounding fill; and
- (d) not contain any material which could cause corrosion to the underlying pipes or fittings.

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

2.9 SAFE TRAY AND SAFE WASTE MATERIALS

2.9.1 Safe tray Safe trays shall be fabricated from materials not inferior, under the condition of use, to 0.60 mm thick galvanized steel sheet complying with AS 1397 and having a minimal nominal zinc coating mass of 275 g/m².

2.9.2 Safe wastes Safe waste pipes from safe trays shall be fabricated from material complying with the following:

- (a) AS/NZS 1260 or NZS 7641, NZS 7642 and NZS 7649 for UPVC.
- (b) AS 1074 or NZS/BS 3601 for galvanized steel pipe.
- (c) AS 1432 or NZS 3501 for seamless copper pipe (min. 0.9 mm thickness).
- (d) AS 1397 for sheet steel (min. 0.6 mm thickness).

2.10 BACKFLOW PREVENTION DEVICES Backflow prevention devices shall comply with AS/NZS 2845.1.

SECTION 3 SIZING OF WATER SERVICES

3.1 SCOPE OF SECTION This Section sets out the requirements for the sizing of pipes for water service installations.

3.2 FLOW REQUIREMENTS

3.2.1 Water flow rates at outlets The flow rates to taps, valves and cisterns shall be not less than as shown in Table 3.1.

3.2.2 Loading units Loading units for fixtures/appliances when installed in a domestic situation are given in Table 3.1. Loading units are factors which take into account the flow rate, length of time in use, and frequency of use of the fixture or appliance.

TABLE 3.1
FLOW RATES AND LOADING UNITS

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

NOTE: 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 Table 3.1, the tested flow rate may be substituted and the loading units adjusted accordingly.

3.2.3 Probable simultaneous demand The probable simultaneous demand for multiple dwellings shall be not less than that shown in Table 3.2. These minimum flow rates are used to estimate the size of the supply piping for these dwellings.

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

3.2.4 Probable simultaneous flow rate Loading units are converted to probable simultaneous flow rates for branch piping within dwellings in accordance with Table 3.3. 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 C.

3.3 PRESSURE REQUIREMENTS

3.3.1 Available pressure The maximum and minimum pressures, for the water main serving the property, can be obtained from the utility responsible for the supply of water. Pipe sizing shall be based on the minimum available head.

3.3.2 Pressure at outlets The minimum working head at the furthestmost or most disadvantaged fixture or outlet shall not be less than 50 kPa (5 m head), at the flow rate specified in Table 3.1.

Where 50 kPa of water cannot be obtained, either storage tanks complying with Section 8, or booster pumps complying with Section 10 shall be installed to achieve the required pressure.

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

NOTES:

- 1 The maximum static pressure should not exceed 500 kPa (50 m head) at any outlet.
- 2 Where quick acting valves are fitted, as in the case of clothes and dishwashing machines, water hammer suppression devices should be installed at the time of installation of the appliance.
- 3 The method used in Appendices B and C makes an allowance of 50% additional pipe length for head losses through fittings.

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 which 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 The size of the water service to branch offtakes to a single dwelling shall not be less than DN 20 in Australia and DN 15 in New Zealand.

3.5.2 Branch offtakes Branch offtake pipes extended from any water service, shall comply with the following:

- (a) DN 18 branches shall not exceed 6 m in length and may supply one fixture or outlet and, in addition, any make up tank supplying a gravity-fed, domestic type water heater, a flush valve or a bidet.
- (b) DN 15 branches shall not exceed 3 m in length and may only supply one fixture or outlet, including a combination bath and shower unit.
- (c) DN 10 branches shall not exceed 1 m in length, be installed in a reasonably straight run, and may supply a hot and cold water mixing tap.

TABLE 3.2
PROBABLE SIMULTANEOUS DEMAND (PSD) FOR MULTIPLE 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:

- The minimum flow rates shown in this Table are based on normal domestic installations. If it is expected that the dwelling(s) will have a larger demand, then the probable simultaneous flow rate may be estimated using the loading unit method outlined in Appendix C.
- The probable simultaneous demand for larger multiple dwellings may be estimated using the following equation:

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

where

n = number of dwellings

Q = flow rate (L/s)

TABLE 3.3
PROBABLE SIMULTANEOUS FLOW RATES (PSFR)

Loading units	PSFR L/s	Loading units	PSFR L/s	Loading units	PSFR L/s
1	0.08	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	0.39	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

SECTION 4 CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION

4.1 SCOPE OF SECTION This Section sets out the requirements and the methods used to prevent contamination of the potable water within the water service and the water main and provides for the selection and installation of backflow prevention devices.

NOTES:

- 1 This Section applies to Australia only.
- 2 In New Zealand, reference may be made to the New Zealand Building Code Approved Document G12, *Water Supplies*, for alternative information on cross connection control and backflow prevention.
- 3 Examples of potential cross-connections are given in Appendix D.

4.2 PROTECTION OF POTABLE 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 potable water supply system.

4.2.2 Quality of water supply Only potable water shall be supplied to plumbing fixtures or outlets for human consumption, bathing, food preparation, utensil washing or clothes washing.

4.2.3 Introduction of contaminants No device or system that may permit the introduction of any foreign substance into the water service, shall be connected directly or indirectly to any part of the water supply system (including fire protection, garden-watering and irrigation systems) or to any temporary attachment to the water service without cross-connection or backflow prevention control authorized by the regulatory authority.

4.2.4 Combined tanks serving flush valves (other than directly connected) Combined tanks storing potable water and water for other purposes shall achieve separation of the two supplies by a double partition wall installed internally. The space between the partition walls shall be arranged to ensure that any leakage shall not be able to enter the other compartment of the tank and it shall be drained so that any discharge is external and readily noticed.

4.2.5 Alternative water supplies Alternative water supplies shall conform with the following:

- (a) Where water supplied from one source is connected to another water source—
 - (i) an appropriate backflow prevention device shall be fitted; and
 - (ii) the installation shall be authorized by the responsible regulatory authority.
- (b) Where the alternative supply is a non-potable water supply, it shall be clearly and permanently labelled 'CAUTION NOT FOR DRINKING' at every outlet.
- (c) Where the alternative supply is a non-potable water supply, clear and permanent labels in accordance with AS 1345 for the distribution pipes and AS 1319 for the outlets are required. Where the non-potable alternative supply is installed below ground the service shall have a continuous marker tape, stating the pipe below is non-potable, installed in the trench above the service.
- (d) Piping conveying water downstream of a high or medium hazard backflow prevention device other than which is used for containment shall be clearly and permanently labelled 'CAUTION NOT FOR DRINKING' at every outlet. The caution sign shall comply with AS 1319 and the distribution pipes shall be clearly marked in accordance with AS 1345.

4.2.6 Authorized fixtures, appliances or apparatus Where backflow prevention devices are provided as an integral part of an authorized fixture, appliance or apparatus, and are appropriate to 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 shall be reported to the water utility.

4.3 CROSS-CONNECTION HAZARD RATING Cross-connections are rated using three degrees of hazard which are as follows:

- (a) *High hazard* Any condition, device or practice which in connection with the potable water supply system has the potential to cause death.
- (b) *Medium hazard* Any condition, device or practice which in connection with the potable water supply system has the potential to endanger health.
- (c) *Low hazard* Any condition, device or practice which in connection with the potable water supply system would constitute a nuisance but not endanger health or cause injury.

4.4 PROVISION OF BACKFLOW PREVENTION DEVICES

4.4.1 General The backflow protection required shall be determined by first identifying the individual hazard(s) within the premises. Then working upstream from each hazard, the water shall be regarded as non-potable until a backflow prevention device is provided suitable to the degree of hazard (see Figure 4.1). Backflow prevention devices shall comply with AS 2845.1.

NOTES:

- 1 In assessing a potential backflow condition, consideration must 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 Typical potential cross-connection examples are given in Appendix D.

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;
- (b) the suitability of the device shown in Table 4.1.

NOTE: See Appendix E for examples of devices relative to levels of protection.

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 near which they are installed.

NOTE: An example of backflow prevention is given in Table E2.

4.4.4 Additional backflow protection In water supply installations where there is potential for unprotected cross-connections, additional backflow protection shall be provided if required by the water utility or by the installation of supplementary containment zone or individual backflow prevention devices.

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 an additional backflow prevention device of the same hazard rating.

Water downstream of a containment device is considered to be potable unless there are unprotected hazards within the premises. Individual or zone protection against these hazards shall be provided to preserve the portability of the internal water supply.

Piping downstream of the zone protection device shall be identified as not potable.

4.4.6 Inspection and maintenance Testable backflow prevention devices shall be inspected and tested after installation and prior to service. They shall be maintained in working order and inspected for operational function at intervals not exceeding 12 months. Reduced pressure zone devices, double-check valves, 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.

4.4.7 Hot water systems Backflow prevention devices shall be installed in hot water supply systems in the same way as cold water supply systems. The backflow prevention device used shall be suitable for the specific hot water installation.

4.5 SUITABILITY OF DEVICES FOR HAZARDS Table 4.1 shows devices suitable for each hazard rating and indicates whether protection is provided against back-pressure.

The actual device selected for each hazard rating shall comply with Table 4.1 and be subject to the approval of the regulatory authority.

TABLE 4.1
SUITABILITY OF DEVICES
(a) Registered testable devices

Registered or testable backflow prevention device	Cross-connection hazard rating	Protection against back-pressure	Protection against backsiphonage
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
Anti-spill pressure type vacuum breakers (APVB)*	Medium/low†	No	Yes
Pressure type vacuum breaker (PVB)*	High/medium/low	No	Yes

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

† Anti-spill vacuum breakers are suitable for high hazard installation for mains pressure flushing valves only.

(b) Non-testable devices

Non-testable backflow prevention device	Cross-connection hazard rating	Protection against back-pressure	Protection against backsiphonage
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	Yes	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
Vacuum break-check valve (VBCV)	Low	No	Yes
Single-check valve	Fire services only in accordance with Appendix E		

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

NOTES:

- Pressure type vacuum breakers are designed to vent at 7 kPa or less. However, they may require a significantly higher pressure to reseal and should only be installed in systems which 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.
- In areas where water spillage may cause nuisance, tundishes or alternative drainage should be installed to receive the discharge from —
 - reduced pressure zone devices;
 - pressure type vacuum breakers;
 - dual check with atmospheric port; or
 - atmospheric vacuum breakers.
- Hose connection vacuum breakers 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.
- Pressure type vacuum breakers, atmospheric vacuum breakers and hose connection vacuum breakers, should only be used to protect against back siphonage.
- A single-check valve is not considered a backflow prevention device in accordance with AS/NZS 2845.1.

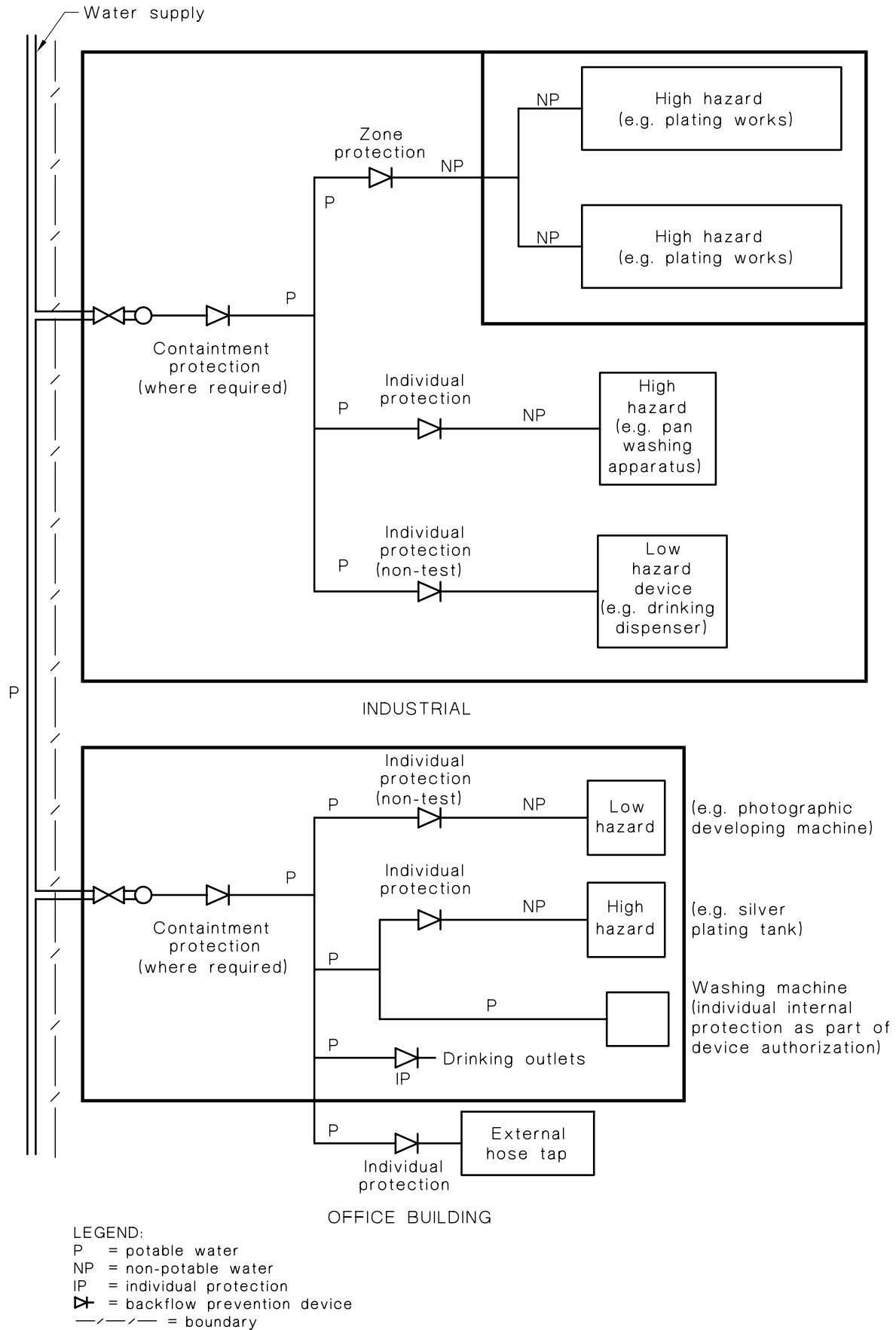


FIGURE 4.1 TYPICAL BACKFLOW PREVENTION SCHEMES

4.6 INSTALLATION OF BACKFLOW PREVENTION DEVICES

4.6.1 General installation requirements The installation of each backflow prevention device shall comply with the following:

- (a) No heat shall be applied to any device during installation.
- (b) Line strainers:
 - (i) Installations for pressure type vacuum breakers (PVB), anti-spill pressure type vacuum breakers (APVB), double check valves (DCV) and (DDCV) and reduced pressure zone devices (RZPD) and (DRZPD) shall be fitted with line strainers in accordance with Clause 4.6.1(c), and except where used in fire service installations.
 - (ii) Line strainer elements shall comply with the requirements of Table 4.2.

TABLE 4.2
MAXIMUM ORIFICE DIAMETERS AND
MAXIMUM CENTRE DISTANCE OF
LINE STRAINER ELEMENT PERFORATIONS

Size DN	Max. orifice diameter mm	Max. 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

- (c) For all testable devices, resilient seated (drop tight when closed) isolating valves shall be installed in the following position:
 - (i) immediately upstream of the line strainer or immediately upstream of the device in the cases where no integral line strainer is fitted (refer Item 4.6.1(b)); and
 - (ii) immediately downstream of the device.
- (d) Piping shall be flushed before devices are connected.
- (e) Unprotected bypasses shall not be installed around backflow prevention devices.
- (f) The devices shall be installed in accordance with Clause 4.6.3 and the manufacturer's written instructions.
- (g) The devices shall be protected from damage including freezing.
- (h) Where continuous water supply is essential, devices shall be installed in parallel to permit shut down of a device.
- (i) In-line devices should have a capability for easy removal and replacement.

NOTE: For typical installations see Appendix E.

4.6.2 Location of devices

4.6.2.1 General The location of each backflow prevention device shall conform to the following specific requirements:

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

4.6.2.2 Accessibility All devices shall be readily accessible for ease of maintenance or testing without the need to climb ladders or scaffolding.

Where the device is fitted with test taps, their location shall ensure the accessibility 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 the air ports of vacuum breakers, or drainage from reduced pressure zone devices and vented double-check valves shall be readily visible, but 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 following requirements.

NOTE: For examples of backflow prevention devices see Appendix E.

4.6.3.2 Testable devices Testable devices shall be installed as follows:

- (a) *Registered break tanks (RBT) and registered air gaps (RAG)* Registered break tanks shall comply with Section 8 of this Standard and incorporate the following air gap requirements.

The unobstructed vertical distance through the free atmosphere between the lowest opening of a water service pipe or fixed outlet supplying water to a (RBT), and the highest possible water level of such (RBT), shall be as given in Table 4.3. 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 4.3.

TABLE 4.3
MINIMUM AIR GAP

Diameter of the effective opening of water service outlet	Minimum air gap	
	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

- (b) *Pressure type vacuum breakers (PVB)* These 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 to ponding or freezing.
- (c) *Double-check valves (DCV)* These shall be located so as not to be subject to freezing.
- (d) *Reduced pressure zone devices (RPZD)* These 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 to ponding;
 - (iii) have the relief drain outlet located not less than 300 mm above the surrounding surface; and
 - (iv) be located so that they are not subject to freezing.
- (e) *Double-check detector assemblies (DCDA)* These shall be located so as they are not subject to freezing.
- (f) *Reduced pressure detector assemblies (RPDA)* These 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 surrounding surface; and
 - (iv) be located so that they are not subject to freezing.
- (g) *Anti-spill pressure vacuum breaker (APVB)* These 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 area that may be subject to ponding.

4.6.3.3 Non-testable devices Although non-testable devices are not subject to verification for on-going effective operation. They should be checked (at least every two years). Non-testable devices shall be installed as follows:

- (a) *Atmospheric vacuum breakers (AVB)* These 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/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 breakers (HCVB)* These 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 valves with atmospheric port (DCAP)* These 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 surrounding surface so that the device is freely drained.
- (d) *Dual-check valves (DUAL CV)* These shall be located in an area not subject to freezing.
- (e) *Dual-check valves with intermediate vent (DU CV)* These shall—
 - (i) not be located in an area that is subject to ponding; and
 - (ii) have the vent port located in accordance with Figure E5.

NOTE: See Clause 4.6.2.3 regarding leakage from devices.
- (f) *Beverage dispenser dual-check valve (BDDC)* These shall—
 - (i) not be located in an area subject to freezing; and
 - (ii) have the vent port located not less than 300 mm above the surrounding surface so as the device can drain freely.
- (g) *Vacuum breaker check valve (VBCV)* These shall—
 - (i) be located in an area not subject to freezing; and
 - (ii) have the vent port located not less than 300 mm above the surrounding surface so as the device can drain freely.
- (h) *Single-check valves (spring loaded)* These shall—
 - (i) have an isolating valve installed upstream and adjacent to the device; and
 - (ii) be fitted in an accessible position; and
 - (iii) only be used in fire services.