**Status of Approved Documents**

Approved Documents are prepared by the Building Industry Authority in accordance with section 49 of the Building Act 1991. They are non-mandatory guidance documents offering only one method of compliance with specific performance criteria of the New Zealand Building Code.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Approved Documents and explains alternative methods of achieving compliance.

Classified uses and defined words which are italicised in the text are explained in clauses A1 and A2 of the New Zealand Building Code.

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**Document Status**

The most recent version of this document, as detailed in the Document History, is approved by the Building Industry Authority. It is effective from 25 February 2004 and supercedes all previous versions of this document.

### Clause G12–Water Supplies

#### Objective

G12.1 The objective of this provision is to–

(a) safeguard people from illness caused by contaminated water;
(b) safeguard people from injury caused by hot water system explosion, or from contact with excessively hot water:
(c) safeguard people from loss of amenity arising from–
   (i) a lack of hot water for personal hygiene; or
   (ii) water for human consumption, which is offensive in appearance, odour or taste:
(d) ensure that people with disabilities are able to carry out normal activities and functions within buildings.

#### Functional requirement

G12.2 Buildings provided with water outlets, sanitary fixtures or sanitary appliances must have safe and adequate water supplies.

#### Performance

G12.3.1 Water intended for human consumption, food preparation, utensil washing or oral hygiene must be potable

G12.3.2 A potable water supply system shall be–

(a) protected from contamination; and
(b) installed in a manner which avoids the likelihood of contamination within the system and the water main; and
(c) installed using components that will not contaminate the water.

G12.3.3 A non-potable water supply system used for personal hygiene shall be installed in a manner that avoids the likelihood of illness or injury being caused by the system.

G12.3.4 Water pipes and outlets provided with non-potable water shall be clearly identified.

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### Schedule

#### Schedule

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Clerk of the Executive Council.
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**Building Industry Authority**

25 February 2004
For the purposes of New Zealand Building Code compliance, acceptable reference documents include only the quoted edition and specific amendments as listed below.

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Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Approved Document. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

**Adequate** Adequate to achieve the objectives of the building code.

**Amenity** means an attribute of a building which contributes to the health, physical independence, and well being of the building’s users but which is not associated with disease or a specific illness.

**Air gap** The vertical distance through air between the lowest point of the water supply outlet and the flood level rim of the equipment or the fixture into which the outlet discharges.

**Backflow** The unplanned reversal of flow of water or mixtures of water and contaminants into the water supply system. See back-siphonage and back-pressure.

**Backflow prevention device** A device that prevents backflow.

**Back-pressure** A backflow condition caused by the downstream pressure becoming greater than the supply pressure.

**Back-siphonage** A backflow condition caused by the supply pressure becoming less than the downstream pressure.

**Building** has the meaning ascribed to it by the Building Act 1991.

**Check valve** A valve that permits flow in one direction but prevents a return flow and is part of a backflow prevention device.

**Contaminant** includes any substance (including gases, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat

a) When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water, or

b) When discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.

This is the meaning ascribed to it by the Resource Management Act 1991.

**Cross connection** Any actual or potential connection between a potable water supply and a source of contamination.

**Diameter (or bore)** The nominal internal diameter.

**Fixture** An article intended to remain permanently attached to and form part of a building.

**Flood level rim** The top edge at which water can overflow from equipment or a fixture.

**Free outlet (push through)** In the context of storage water heaters means a water heater with a tap on the cold water inlet so designed that the hot water is discharged through an open outlet.

**Household unit** means any building or group of buildings, or part of any building or group of buildings, used or intended to be used solely or principally for residential purposes and occupied or intended to be occupied exclusively as the home or residence of not more than one household; but does not include a hostel or boardinghouse or other specialised accommodation.

**Network utility operator** means a person who:

a) Undertakes the distribution or transmission by pipeline of natural or manufactured gas, petroleum, or geothermal energy; or

b) Is an electricity operator or electrical distributor as defined by section 2(1) of the Electricity Act 1992 for the purposes of any works defined by that Act; or

c) Undertakes the piped distribution of potable water for supply, or
d) Is the operator of a sewerage system or a stormwater drainage system.

Non-return valve A valve that permits flow in one direction but prevents a return flow and is part of a hot or cold water system.

Open vented storage water heater A water heater incorporating a vent pipe which is permanently open to the atmosphere.

Potable (and potable water) Water that is suitable for human consumption.

Sanitary appliance An appliance which is intended to be used for sanitation and which is not a sanitary fixture. Included are machines for washing dishes and clothes.

Sanitary fixture Any fixture which is intended to be used for sanitation.

Sanitation The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection.

Storage water heater A water tank with an integral water heater for the storage of hot water.

Toxic environment An environment that contains contaminants that can contaminate the water supply in concentrations greater than those included in the New Zealand Drinking Water Standard 1995.

Valve vented storage water heater (Also known as an unvented storage water heater.) A storage water heater in which the required venting to the atmosphere is controlled by a valve.

Vent pipe A pipe which is open to the atmosphere at one end and acts as a pressure limiting device.

Water heater A device for heating water.

Water main A water supply pipe vested in, or is under the control, or maintained by, a network utility operator.

Water supply system Pipes, fittings and tanks used or intended to be used for the storage and reticulation of water from a water main or other water source, to sanitary fixtures, sanitary appliances and fittings within a building.

Water tank (vessel) A covered fixed container for storing hot or cold water.
Verification Method G12/VM1

1.0 Water Supply System

1.0.1 A design method for water supply systems may be verified as satisfying the Performances of NZBC G12 if it complies with:

a) AS/NZS 3500.1.2 Section 3 and Appendix B (note that Appendix B is part of this Verification Method even though it is included in the standard as an “Informative” Appendix), and

b) AS/NZS 3500.4.2.
Acceptable Solution G12/AS1

1.0 Scope
1.0.1 This acceptable solution applies to below ground and above ground piped water supply systems.

2.0 Materials

2.1 Water quality
2.1.1 Components of the water supply system shall not contaminate potable water.
2.1.2 Non-metallic components complying with NZS/BS 6920 or AS 4020 materials complying with Table 1 shall be acceptable.

2.2 Pipe materials
2.2.1 Pipe materials shall comply with Table 1.

2.2.2 All pipes and pipe fittings used for the piping of water shall be:
   a) Suitable for the temperatures and pressures within that system,
   b) Compatible with the water supply and environmental conditions in the particular location, and
   c) Where installed in an exposed situation, resistant to UV light.

Note: Where fire hose reels are served by the above ground cold water supply system the pipe system shall comply with NZS 4503 as referenced in C/AS1 Table 4.1.

<table>
<thead>
<tr>
<th>Material</th>
<th>Relevant Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>NZS 3501</td>
</tr>
<tr>
<td>Galvanised steel</td>
<td>NZS/BS 1387</td>
</tr>
<tr>
<td>Polybutylene</td>
<td>AS/NZS 2642: Parts 1, 2 and 3</td>
</tr>
<tr>
<td>Cold Only</td>
<td></td>
</tr>
<tr>
<td>uPVC</td>
<td>AS/NZS 1477</td>
</tr>
<tr>
<td>Polyethylene</td>
<td>NZS 7601 for pressures up to 0.9 MPa (Type 3)</td>
</tr>
<tr>
<td></td>
<td>NZS 7602 for pressures up to 1.2 MPa (Type 5)</td>
</tr>
<tr>
<td></td>
<td>NZS 7610 for pressures up to 1.2 MPa</td>
</tr>
<tr>
<td></td>
<td>AS 1460: Part 1 Mechanical jointing fittings</td>
</tr>
<tr>
<td></td>
<td>Part 2 Electrofusion fittings</td>
</tr>
<tr>
<td></td>
<td>AS/NZS 4130 for pressures up to 1.5 Mpa</td>
</tr>
</tbody>
</table>
3.0 Protection of Potable Water

3.1 Drawn water not to be returned

3.1.1 Water drawn from the water main shall be prevented from returning to that system by avoiding cross connections or backflow.

3.2 Cross connections prohibited

3.2.1 The water supply system shall be installed so that there is no likelihood of cross connection between:

a) A potable water supply system and a non-potable water supply system,

b) A potable water supply system connected to a water main, and any water from another source including a private water supply,

c) A potable water supply system and any bathing facilities including swimming, spa or paddling pools, and

d) A potable water supply system and pipes, fixtures or equipment (including boilers and pumps) containing chemicals, liquids, gases or other non-potable substances.

3.3 Cross Connection Hazard

3.3.1 High hazard

Any condition, device or practice which, in connection with the potable water supply system, has the potential to cause death.

COMMENT:
High hazard may include but not necessarily be limited to:

a) Autoclaves and sterilisers

b) Systems containing chemicals such as anti-freeze, anti-corrosion, biocides, or fungicides

c) Beauty salon and hairdresser’s sinks

d) Boiler, chiller and cooling tower make-up water

e) Car and factory washing facilities

f) Chemical dispensers

g) Chemical injectors

h) Chlorinators

i) Dental equipment

j) Direct heat exchangers

k) Fire sprinkler systems and fire hydrant systems that use toxic or hazardous water

l) Hose taps associated with High hazard situations like mixing of pesticides

m) Irrigation systems with chemicals

n) Laboratories

o) Mortuaries

p) Pest control equipment

q) Photography and X-ray machines

r) Piers and docks

s) Sewage pumps and sump ejectors

t) Sluice sinks and bed pan washers

u) Livestock water supply with added chemicals

v) Veterinary equipment

Note: The examples given are not an exhaustive list. Where there is doubt comparison must be made to the hazard definitions.

3.3.2 Medium hazard

Any condition, device or practice which, in connection with the potable water supply system, has the potential to injure or endanger health.

COMMENT:
Medium hazard may include but not necessarily be limited to:

a) Appliances, vehicles or equipment

b) Auxiliary water supplies such as pumped and non-pumped fire sprinkler secondary water

c) Deionised water, reverse osmosis units and equipment cooling without chemicals

d) Fire sprinkler systems and building hydrant systems

e) Hose taps and fire hose reels associated with Medium hazard

f) Irrigation systems with underground controllers

g) Irrigation without chemicals

h) Livestock water supply without added chemicals

i) Untreated water storage tanks

j) Water and steam cleaning

k) Water for equipment cooling

l) Drink dispensers with carbonators

m) Swimming pools, spas and fountains

Note: The examples given are not an exhaustive list. Where there is doubt comparison must be made to the hazard definitions.
### 3.3.3 Low hazard

Any condition, device or practice which, in connection with the potable water supply system, would constitute a nuisance, by colour, odour or taste, but not injure or endanger health.

**COMMENT:**
Low hazard may include but not necessarily be limited to:

1. Drink dispensers (except carbonators).

**Note:** The example given is not an exhaustive list. Where there is doubt comparison must be made to the hazard definitions.

### 3.4 Backflow protection

**3.4.1** Backflow protection shall be provided where it is possible for water or contaminants to backflow into the potable water supply system.

**COMMENT:**
The protection of non-potable water used for personal hygiene is contained in Paragraph 4.1.

### 3.4.2 Backflow protection shall be determined by identifying the individual cross connection hazard(s) and backflow protection required.

Water from each hazard shall be regarded as non-potable until an appropriate backflow protection is installed.

**3.4.3** Backflow protection shall be achieved by:

1. An air gap, in accordance with Paragraph 3.5, or
2. A backflow prevention device selected in accordance with Paragraphs 3.4.4 and 3.4.5.

**3.4.4** Backflow protection shall be appropriate to the cross connection hazard contained in Paragraph 3.3.

**3.4.5** The selection of the appropriate backflow protection for the cross connection hazard is given in Table 2.

**COMMENT:**
Table 2 includes air gap separation.

### Table 2: Selection of Backflow Protection

<table>
<thead>
<tr>
<th>Type of backflow protection</th>
<th>CROSS CONNECTION HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIGH back-pressure</td>
</tr>
<tr>
<td>Air gap (see Note 1)</td>
<td>✓</td>
</tr>
<tr>
<td>Reduced pressure zone device</td>
<td>✓</td>
</tr>
<tr>
<td>Double check valve assembly (see Note 2)</td>
<td>✓</td>
</tr>
<tr>
<td>Pressure type vacuum breaker (see Note 3)</td>
<td>✓</td>
</tr>
<tr>
<td>Atmospheric vacuum breaker (see Note 4)</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Note:**
1. Air gaps must not be installed in a toxic environment.
2. Double check valves can be installed in a medium and low hazard toxic environment.
3. Pressure type vacuum breakers are designed to vent at 7 kPa or less. However, they require a significantly higher pressure to reseat and must be installed only in systems which provide pressures sufficient to ensure full closing of the valve.
4. Hose outlet vacuum breakers are a specific type of atmospheric vacuum breaker.
3.4.6 All backflow prevention devices must be testable in service to verify effective performance.

3.5 Air gap

3.5.1 An air gap shall be an unobstructed distance between the lowest opening of a water supply outlet and the highest level of the overflow water. The air gap separation shall be the greater of 25 mm or twice the supply pipe diameter, as shown in Figure 1.

3.5.2 To ensure the air gap distance is maintained the overflow pipe discharge flow rate shall be no less than the inlet pipe flow rate.

COMMENT: AS/NZS 3500.1.2 Appendix F may be used to calculate the size of the overflow.

3.5.3 Air gaps shall not be used in a toxic environment to prevent contaminated air entering the water and piping system through the air gap.

3.5.4 Where any fixture or tank has more than one supply pipe, the air gap separation shall be the greater of 25 mm or twice the sum of the inlet pipe diameters and shall also comply with Paragraph 3.5.2.

3.6 Backflow prevention devices

3.6.1 Location

Backflow prevention devices and air gaps shall be located:

a) As near as practicable to the potential source of contamination, and
b) In an accessible position for maintenance and testing to AS/NZS 2845.3.

3.6.2 Manufacture

Backflow prevention devices shall be manufactured as follows:

a) Reduced pressure zone devices to AS/NZS 2845.1 Section 11 (see Figure 2 (a)),

b) Double check valve devices to AS/NZS 2845.1 Section 10 (see Figure 2 (b)),

c) Pressure type vacuum breakers to AS/NZS 2845.1 Section 9, (see Figure 2 (c)), and

d) Atmospheric vacuum breakers to AS/NZS 2845.1 Section 4 for atmospheric vacuum breakers (see Figure 2 (d)), and Section 5 for hose tap vacuum breakers.

3.6.3 General installation requirements

Backflow prevention devices shall be:

a) Fitted with a line strainer upstream to prevent particles and corrosion products from the pipework rendering the device ineffective,

b) A by-pass may only be fitted where the by-pass contains another backflow prevention device appropriate to the same hazard rating,

c) Protected from the effects of corrosive or toxic environments, and

d) Protected from damage.

COMMENT:

1. The device should be attached only after the pipework has been flushed.

2. Corrosive environments may cause the malfunction of the device. Polluted air from a toxic environment may enter the piping system through the air gap or open port vent thus negating the effective air gap separation.

3. The device should be protected from physical and frost damage and installed without the application of heat.

3.6.4 Specific installation requirements

Backflow prevention devices shall be installed as follows:

a) Reduced pressure zone devices. These devices shall:

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

ii) be located in an area that is not subject to ponding,

iii) have the relief drain outlet located not less than 300 mm above the surrounding surface, and

iv) be installed horizontally with the relief valve discharge facing vertically down, unless different orientations are specifically recommended by the device manufacturer.

b) Double check valve devices. There are no additional requirements to those in Paragraph 3.6.3.

c) Pressure type vacuum breakers. These devices shall:

i) be located not less than 300 mm above the highest outlet, measured from the highest outlet to the lowest part of the valve body,

ii) be installed vertically with the air ports at the top, and

iii) have free ventilation to the air ports at all times.

d) Atmospheric vacuum breakers. These devices shall:

i) be located not less than 150 mm above the highest outlet, measured from the highest outlet to the lowest part of the valve body,

ii) have no valves located downstream of the vacuum breaker,

iii) under normal operation, not remain continuously pressurised for more than 12 hours,

iv) be installed vertically with the air ports at the top, and

v) Have free ventilation to the air ports at all times.
Figure 2: Backflow Prevention Devices
Paragraph 3.6.2

(a) Schematic diagram of a reduced pressure zone device

(b) Schematic diagram of a double check valve

(c) Schematic diagram of a pressure type vacuum breaker

(d) Schematic diagram of an atmospheric vacuum breaker
3.7 Testing

3.7.1 Backflow protection installations shall have the following provisions to enable routine testing of their operational effectiveness:

a) Resilient seated isolating valves shall be located immediately upstream and downstream of a reduced pressure zone device, double check valve assembly, or a pressure vacuum breaker,

b) A resilient seated isolating valve shall be located immediately upstream of an atmospheric vacuum breaker, and

c) Reduced pressure zone devices, double check valve assemblies and pressure vacuum breakers shall have sufficient test points to enable testing of each check valve and relief valve.

COMMENT: Full ported valves will provide the best flow characteristics.

Atmospheric vacuum breakers do not require test points.

3.7.2 Reduced pressure zone devices, double check valves and pressure vacuum breakers shall be tested and verified as meeting the test requirements of AS 2845.3.

3.7.3 Atmospheric vacuum breaker devices shall comply with the following test:

a) Operate the device by turning on the fixture or equipment and observe the operation. The poppet or float must close on increase in pressure, and

b) Operate the device by turning off the fixture or equipment and observe the operation. The poppet or float must open on decrease in pressure.

3.7.4 Backflow prevention devices shall be tested after installation or repair. Before testing the strainer shall be cleaned, the pipework flushed and the system commissioned.

COMMENT: Testing is also required annually in accordance with Compliance Schedule CS 7, except for devices installed in single residential dwellings.

4.0 Non-potable Supply

4.1 Protection of non-potable water supplies

4.1.1 Where non-potable water supplies are used for personal hygiene they shall be protected from High and Medium hazards (see Paragraph 3.3). Where backflow protection is required it shall be in accordance with Paragraphs 3.1 to 3.7 of this Acceptable Solution.

4.2 Outlet identification

4.2.1 NZBC F8 requires signs to be provided to all potential hazards. Outlets for non-potable water shall be identified non-potable, by displaying the safety sign shown in Figure 3.

4.3 Pipeline identification

4.3.1 Where a non-potable water supply is reticulated around the building, the potable and non-potable pipelines shall be identified in accordance with NZS 5807: Part 2.
5.0 Water Supply

5.1 Water tanks

5.1.1 To ensure the health and safety of people in the event of the water main supply being interrupted, buildings having the classification of Community Care (e.g. hospitals, old people’s homes, prisons) shall be provided with cold water storage of no less than 50 litres per person.

COMMENT:
1. Cold water storage is required only to maintain adequate personal hygiene within buildings where the principal users are legally or physically confined.
2. Refer to the NZBC A1 for classification of buildings.
3. Network utility operators cannot guarantee a continuous supply of water. Building owners may therefore wish to provide water storage to buildings having a classification other than Community Care, to enable continuation of a business, service, industrial process or other reason.
4. The “litres per person” is based on a daily use of 20 litres WC, 25 litres washing, 5 litres drinking.

5.2 Water tank installation

5.2.1 Location
Water tanks in roof spaces shall be located and supported as detailed in Figure 4.

5.2.2 Overflow pipes
Water tanks shall have an overflow pipe to discharge any overflow to a visible place within the same property that does not create a nuisance or damage to building elements. The overflow pipe shall be sized so that the discharge capacity is no less than the maximum inlet flow. The outlet of the overflow pipe shall not permit the entry of birds or vermin. Overflow from a WC cistern may discharge internally into a WC pan.

5.2.3 Safe trays
Performance E3.3.2 requires water to be prevented from penetrating another household unit within the same building. An acceptable method of preventing water damage is to locate a safe tray below the water tank (see Figure 4). The safe tray shall incorporate an overflow pipe with a minimum diameter of 40 mm. Where the tank overflow discharges into the safe tray the diameter of the drain shall be greater than the overflow pipe from the tank and comply with Paragraph 5.2.2.

5.2.4 Covers
Covers shall be provided to:

a) Potable water tanks to prevent contamination and the entry of vermin, and

b) All tanks located in roof spaces to prevent condensation damaging building elements.

5.2.5 Access
Covers to water tanks shall be removable or shall contain a covered opening to allow access for inspection and maintenance. A minimum height clearance of 350 mm above the opening is necessary for easy access.

5.2.6 Supporting structure
The supporting structure for water tanks shall be protected from damage due to condensation where durability of the supports could be compromised by moisture. A material such as H3 treated timber shall be installed under the water tank.

5.3 Water pipe size

5.3.1 Pipe sizing
Pipes shall be sized:

a) To achieve the flow rates given in Table 3, or

b) Using the sizes given in Table 4.

COMMENT:
Manufacturers’ literature must be referenced for pressure and flow information on tempering valves and tapware. Outlets (e.g. shower mixers and showerheads) must be appropriate for the available flow and pressure. Note the limitations on lengths and pipe sizes given in Table 3.
5.3.2 Where a pressure reducing or pressure limiting valve is installed, the available head shall be taken as the outlet pressure of the valve plus or minus the pressure to the outlet or valve.

Figure 5 illustrates how to determine available head to the outlet or valve.
### Table 3: Acceptable Flow Rates to Sanitary Fixtures

<table>
<thead>
<tr>
<th>Sanitary fixture</th>
<th>Flow rate and temperature</th>
<th>How measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bath</td>
<td>0.3 l/s at 45°C</td>
<td>Mix hot and cold water to achieve 45°C</td>
</tr>
<tr>
<td>Sink</td>
<td>0.2 l/s at 60°C* (hot) and 0.2 l/s (cold)</td>
<td>Flow rates required at both hot and cold taps but not simultaneously</td>
</tr>
<tr>
<td>Laundry tub</td>
<td>0.2 l/s at 60°C* (hot) and 0.2 l/s (cold)</td>
<td>Flow rates required at both hot and cold taps but not simultaneously</td>
</tr>
<tr>
<td>Basin</td>
<td>0.1 l/s at 45°C</td>
<td>Mix hot and cold water to achieve 45°C</td>
</tr>
<tr>
<td>Shower</td>
<td>0.1 l/s at 42°C</td>
<td>Mix hot and cold water to achieve 42°C</td>
</tr>
</tbody>
</table>

* The temperatures in this table relate to the temperature of the water used by people in the daily use of the fixture.

Note:
The flow rates required by Table 3 shall be capable of being delivered simultaneously to the kitchen sink and one other fixture.

### Table 4: Tempering Valve and Nominal Pipe Diameters

<table>
<thead>
<tr>
<th>Pressure of water at tempering valve (kPa)</th>
<th>Low pressure (i.e. header tank supply or low pressure)</th>
<th>Low and medium pressure unvented (valve vented) and open vented</th>
<th>Mains pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 – 30</td>
<td>30 – 120</td>
<td>over 30</td>
<td></td>
</tr>
<tr>
<td>2 – 3</td>
<td>&gt;3 – 12</td>
<td>over 30</td>
<td></td>
</tr>
<tr>
<td>25 mm</td>
<td>20 mm</td>
<td>20 mm (15 mm optional) (see Note 1)</td>
<td></td>
</tr>
<tr>
<td>Pipes to tempering valve (see Note 3)</td>
<td>20 mm</td>
<td>15 mm</td>
<td></td>
</tr>
<tr>
<td>Pipes to shower (see Note 4)</td>
<td>20 mm</td>
<td>15 mm</td>
<td></td>
</tr>
<tr>
<td>Pipes to sink/laundry (see Note 2)</td>
<td>20 mm</td>
<td>10 mm</td>
<td></td>
</tr>
<tr>
<td>Pipes to bath (see Note 2)</td>
<td>20 mm</td>
<td>10 mm</td>
<td></td>
</tr>
<tr>
<td>Pipes to basins (see Note 2)</td>
<td>15 mm</td>
<td>10 mm</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. If supplied by separate pipe from storage water heater to a single outlet.
2. This table is based on maximum pipe lengths of 20 metres.
3. 2 m maximum length from water heater outlet to tempering valve.
4. 15 mm if dedicated line to shower.
5. 10 mm if dedicated line to shower.
6. Table 3 pipe sizes have been calculated to deliver water simultaneously to the kitchen sink and one other fixture.

### 5.4 Maintenance facilities

#### 5.4.1 The water supply system shall be provided with an isolating valve where a supply pipe enters the building or at each Dwelling unit within a Multi-unit dwelling.

#### 5.4.2 Where the water supply pipe serves a Detached dwelling, the isolating valve required by Paragraph 5.4.1 may be located at the property boundary.

**COMMENT:**
Additional isolating valves may be provided for the maintenance of storage water heaters, valves and components.

#### 5.4.3 Provision shall be made for draining storage water heaters in accordance with Figure 7.
6.0 Hot Water Supply System

6.1 Water heaters
6.1.1 Water heaters shall comply with Table 5.
6.1.2 Hot water supply systems are given in Figures 6 to 11. (Note: Pipe insulation is not shown for clarity.)

6.2 Water supply to storage water heaters
6.2.1 Storage water heaters shall be supplied with cold water at a pressure not exceeding their working pressure by means of a:
   a) Water tank,
   b) Pressure reducing valve,
   c) Pressure limiting valve, or
   d) Mains pressure supply.

Table 5: Water Heaters

<table>
<thead>
<tr>
<th>Water heater type</th>
<th>Standard/Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric low pressure copper storage water heater</td>
<td>NZS 4602</td>
</tr>
<tr>
<td>Electric storage water heater</td>
<td>NZS 4606: Parts 1, 2 and 3</td>
</tr>
<tr>
<td>Electric instantaneous water heater</td>
<td>AS 1056: Part 1</td>
</tr>
<tr>
<td>Gas storage water heater</td>
<td>NZS 6335</td>
</tr>
<tr>
<td>Gas instantaneous water heater</td>
<td>Gas Regulations</td>
</tr>
<tr>
<td>Solar storage water heater</td>
<td>NZS 4613</td>
</tr>
<tr>
<td></td>
<td>AS 2712</td>
</tr>
</tbody>
</table>
6.2.2 Storage water heaters supplied by other than a water tank shall include a non-return valve as shown in Figures 7, 8, 9 and 10 to prevent the storage water heater emptying and hot water flowing into the cold water supply and thence from the cold water taps.

6.2.3 Filters or strainers shall be installed upstream of any valves that could be damaged or malfunction due to solids in the water supply.

6.3 Operating devices

6.3.1 Electric and gas storage water heaters shall have their temperature controlled by a thermostat on each heating unit.

6.3.2 Open vented storage water heaters shall have a vent pipe complying with Paragraph 6.8.

6.3.3 Valve vented (unvented) systems shall have:
   a) An expansion control valve
   b) A vacuum relief valve to prevent collapse of the storage water heater where it is not designed to withstand a full vacuum, and
   c) Valves complying with Table 6.

Figure 6: Open Vented Storage Water Heater System – Water Tank Supply

Paragraphs 6.1.2, 6.8.2
Acceptable Solution G12/AS1

Open Vented Storage Water Heater System – Pressure Reducing Valve
Paragraphs 5.4.3, 6.1.2, 6.2.1 b), 6.8.2 d)

Figure 7: Open Vented Storage Water Heater System – Pressure Reducing Valve
Paragraphs 5.4.3, 6.1.2, 6.2.1 b), 6.8.2 d)

Note:
Standing water level no greater than maximum head rating of water heater.
**Figure 8: Mains Pressure Storage Water Heater System (unvented)
Paragraphs 6.1.2 and 6.2.1 b)**

- Cold water supply
- Strainer
- Isolating valve (boundary)
- Pressure limiting valve (as required by water heater manufacturer)
- Non-return valve
- Alternative equal pressure cold water delivery
- Expansion control valve
- Drain
- Storage water heater
- Temperature and pressure relief valve and drain
- Air gap in accordance with Fig. 12
- Drain pipe with cap. Cap only if drain piped to outside

**Figure 9: Low Pressure Valve – Vented Water Heater System – Temperature and Pressure Relief Valve
Paragraphs 6.1.2 and 6.2.1 b)**

- Cold water supply
- Strainer
- Pressure reducing valve
- Alternative equal pressure cold water delivery
- Isolating valve (See figure 7)
- Drain
- Storage water heater
- Temperature and pressure relief valve and drain
- Air gap in accordance with Fig. 12
- Drain pipe with cap. Cap only if drain piped to outside.
Figure 10: Low Pressure Valve – Vented Storage Water Heater System – Pressure Relief Valve
Paragraphs 6.1.2 and 6.2.1 b)

Figure 11: Free Outlet System (push through)
Paragraph 6.1.2

Note: Only free outlets to be used for hot water, i.e. outlets that are not restricted and cannot be shut off.
6.4 Safety devices
6.4.1 Valve vented (unvented) systems shall have in addition to Paragraph 6.3.3 the following safety devices:
   a) Combined temperature/pressure relief valve for systems with a working pressure greater than 120 kPa,
   b) Combined temperature/pressure relief valve or a pressure relief valve for systems with a working pressure less than 120 kPa,
   c) An energy cut-off for each heating unit on gas and electric systems, and
   d) Valves complying with Table 6.

6.4.2 Free outlet (push through) water heaters shall have a relief valve. No relief valve drain is required.

6.5 Temperature control devices
6.5.1 Electric thermostats shall comply with NZS 6214 or AS 1308.
6.5.2 Energy cut-off devices shall be designed to:
   a) Be reset manually, and
   b) Disconnect the energy supply before the water temperature exceeds 95°C.

6.6 Relief valves
6.6.1 All valves shall have flow rates, pressure and diameter compatible with the system they serve.
6.6.2 Pressure relief valves and expansion control valves shall have:
   a) A flow rate capacity of no less than the rate of cold water supply, and
   b) A maximum pressure rating of no more than the working pressure of the hot water storage vessel.

COMMENT:
The provision of cold water expansion valves satisfies two objectives of the New Zealand Building Code:
1. Safety: Protects the pressure relief or combined temperature/pressure relief valve from blockage due to calcium and other similar deposits where hard water is frequently discharged through the valve.
2. Energy Efficiency (NZBC H1): Cold water instead of hot water is discharged to waste during the frequent warm up cycles.

6.6.3 Expansion control valves shall have a pressure rating of no less than that of the water supply pressure to the storage water heater, but less than the pressure rating of the relief valve.

<table>
<thead>
<tr>
<th>Valve type</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold water expansion valves</td>
<td>NZS 4608, BS 6283: Part 1, AS 1357: Part 1</td>
</tr>
<tr>
<td>Temperature/pressure relief valve</td>
<td>NZS 4608, BS 6283: Part 3, AS 1357: Part 1</td>
</tr>
<tr>
<td>Non-return valves</td>
<td>NZS 4608, AS 1357: Part 1</td>
</tr>
<tr>
<td>Vacuum relief valves</td>
<td>NZS 4608, AS 1357: Part 2</td>
</tr>
<tr>
<td>Pressure reducing valves and pressure limiting valves</td>
<td>NZS 4608, BS 6283: Part 4, AS 1357: Part 2</td>
</tr>
<tr>
<td>Pressure relief valves</td>
<td>NZS 4608</td>
</tr>
</tbody>
</table>
6.6.4 The following valves shall have an energy rating greater than that of the energy sources heating the water:

a) Temperature/pressure relief valve, and
b) Pressure relief valve.

6.6.5 Valve installation

a) Temperature/pressure relief valves shall be located with their probe within the top 20% of the water capacity and no more than 150 mm from the top of the container,
b) Pressure relief valves shall be located no further than 1 metre from the storage water heater, and
c) Valves shall be installed in a manner which provides for easy access for replacement, servicing or maintenance of devices.

6.6.6 There shall be no valve or restriction between the relief valve and the storage water heater.

6.7 Relief valve drains

6.7.1 Relief valve drains (see Figures 12 and 13) shall be fitted to:

a) Temperature/pressure relief valves,
b) Pressure relief valves, and
c) Expansion control valves.

6.7.2 Relief valve drains shall:

a) Be of copper pipe,
b) Have no restrictions or valves,
c) Have a continuous fall from the relief valve to the outlet,
d) Discharge in a visible position which does not present a hazard or damage to other building elements (except when used in association with free outlet storage water heaters),
e) Have a minimum diameter of the same size as the valve outlet,
f) Have the number of changes in direction plus the length of the relief drain (in metres) not exceeding 12.

g) Be connected to a relief valve in accordance with the valve manufacturer’s specification,
h) Comply with Paragraph 6.7.3 when relief valve drains are combined, and
i) Comply with Paragraphs 6.7.4 and 6.7.5 when freezing is likely.

6.7.3 Combined relief valve drains

When relief valve drains are combined the combined drain shall (see Figure 13):

a) Receive discharges from one temperature/pressure relief valve or the pressure relief valve and one expansion control valve,
b) Discharge via a minimum air break of 25 mm, and
c) Have a minimum size of 20 mm diameter and be one size larger than the largest relief valve outlet.

COMMENT: The drain from the storage water heater may also be connected into the combined relief valve drain.

6.7.4 Water heaters located where freezing is likely

Additional requirements for relief valve drains are (see Figure 12):

a) Relieve one valve only, and
b) Comply with Paragraph 6.7.5 when freezing of the drain is likely.

COMMENT: This paragraph applies to water heaters that are installed outside the building’s thermal envelope in cold climates.

6.7.5 Relief drains located where freezing is likely

Additional requirements for relief drains located where freezing is likely (see Figure 12) are that:

a) Relief valve drain pipes shall discharge over a tundish with a 25 mm air break before the drain pipe enters a zone where freezing is likely, and
b) Relief valve drains from a tundish shall be one size larger than the outlet diameter of the relief valve.
6.8 Vent pipes

6.8.1 Vent pipes for open vented storage water heaters shall comply with the provisions of Paragraphs 6.8.2 and 6.8.3.

6.8.2 Installation

a) Materials: The pipe material shall be copper complying with Table 1,
b) Diameter: The diameter of the vent pipe shall be no less than that of the hot water outlet fitting on the storage water heater and no less than 20 mm where the energy input rating is greater than 3 Kw,
c) Termination: The vent pipe (see Figure 6) shall terminate either:
   i) outside the building, or
   ii) over a water tank supplying the storage water heater, and

d) Height: The vent pipe height, measured in metres from the base of the storage water heater, shall not exceed the height (in metres) that equates to the maximum pressure rating of the storage water heater, and

e) Water level: The normal standing water level in the vent pipe shall be a minimum of 3.0 metres above the highest outlet. The height of the vent pipe shall be:
   i) 300 mm above the standing water level of the vent pipe, for tank fed systems, and
   ii) 1.0 m above the standing water level, for pressure reducing valve fed systems.

COMMENT:

a) The 1.0 m height has been found to prevent hot water loss due to the pressure reducing valve creeping.
b) The 3.0 m height is measured from the highest fitting in order to ensure sufficient working head to that fitting.
c) 9.81 kPa = 1 metre in head = 1 metre in height.

COMMENT:

This paragraph applies to storage water heaters located inside the building’s thermal envelope with relief valve drains discharging where freezing of the drain is likely.

6.7.6 Closed cell foam polymer insulation or fibre glass insulation which is preformed to the shape of the pipe and not less than 13 mm thick, is acceptable material for preventing pipes less than or equal to 40 mm diameter from freezing. Any insulation material that absorbs moisture shall be protected in a waterproof membrane.
6.8.3 Insulation

a) Where the vent pipe is likely to be subjected to freezing, it shall be insulated between the top of the storage water heater, and a point no less than 300 mm above the normal standing water level in the vent pipe.

b) Insulation material is to comply with Paragraph 6.7.6.

6.9 Alternative acceptable solutions for the installation of open vented storage water heaters

6.9.1 NZS 4603 is an acceptable solution for open vented low pressure storage water heaters, but may exceed the performance criteria of NZBC G12.

6.10 Alternative acceptable solutions for the installation of unvented (valve vented) storage water heaters.

6.10.1 NZS 4607 is an acceptable solution for unvented (valve vented) storage water heaters, but may exceed the performance criteria of NZBC G12.

6.11 Water heater installation

6.11.1 Water heaters shall be installed in accordance with the manufacturer’s instructions.

6.11.2 Where heating units, sacrificial anodes, thermostats, pipework connections, valves, or other accessories being components of a storage water heater are installed, they shall be accessible for inspection, maintenance and removal.

6.11.3 Storage water heaters shall have:

a) Safe trays complying with Paragraph 5.2.3 where water could penetrate another household unit within the same building.

b) Connections compatible with the pipe material used, and

c) Drain pipes (for every storage water heater of more than 45 litres capacity) which:

i) have a conveniently located isolating valve, and terminate with a cap or plug.
suitably located to easily empty the vessel for maintenance, or
ii) terminate outside the building with a cap only.

6.11.4 Structural Support

NZBC B1.3.2 requires building elements (including storage water heaters) to be adequately supported including support against earthquake forces. The method illustrated in Figure 14 is acceptable for water heaters up to 360 litre capacity. Where fittings and pipework are attached to the water heater through the supporting platform or floor a 50 mm minimum clearance shall be provided between the fitting and the support structure.

6.11.5 An alternative acceptable solution for securing storage water heaters against seismic forces is given in Section 203 of NZS 4603.

6.12 Hot water pipe sizes

6.12.1 The diameter of hot water supply pipes from storage water heaters and to sanitary fixtures shall be no less than those required by Table 4.

6.13 Wet-back water heaters

6.13.1 Wet-back water heaters shall be:

a) Connected only to open vented storage water heaters, or a water storage vessel (see Figure 15), and

b) Made of copper.

6.13.2 Copper pipework shall be used between the wet-back and the water tank.
6.14 Safe water temperatures

6.14.1 Maximum temperatures

The delivered hot water temperature at any sanitary fixture used for personal hygiene shall not exceed:

a) 45°C for early childhood centres, schools, old people’s homes, institutions for people with psychiatric or physical disabilities, hospitals, and

b) 55°C for all other buildings.

COMMENT:
1. At greatest risk from scalding are children, the elderly, and people with physical or intellectual disabilities, particularly those in institutional care.

2. Sanitary fixtures used for personal hygiene includes showers, baths, hand basins and bidets.

6.14.2 Hot water delivered from storage water heaters

a) An acceptable method of limiting hot water temperature delivered from storage water heaters is to install a mixing device between the outlet of the water heater and the sanitary fixture (see Figure 16).

b) Tempering valves shall comply with NZS 4617 or AS 1357.2.

6.14.3 Legionella bacteria

Irrespective of whether a mixing device is installed, the storage water heater control thermostat shall be capable of being set at a temperature of not less than 60°C to prevent the growth of Legionella bacteria.
6.14.4 The water temperatures within flow and return circulating systems shall be maintained at not less than 60°C.

**COMMENT:**
Alternative methods of controlling Legionella within hot water circulating or warm water systems may include chlorine disinfection, UV sterilisation, high temperature pasteurisation combined with system flushing as part of a documented maintenance programme.

### 6.15 Solar water heaters

6.15.1 AS/NZS 3500.4.2 Section 5 provides an acceptable solution for the installation of solar water heaters providing the solar water heating system maintains an average daily temperature of 60°C.

### 7.0 Installation Methods

7.0.1 *Water supply systems* shall be installed to comply with the durability requirements of NZBC B2.

#### 7.1 Pipe supports

7.1.1 Pipes and their supports shall be electrochemically compatible.

7.1.2 Except where anchor points are necessary, the pipes shall be installed and supported in a manner which permits thermal movement.

#### 7.1.3 Support spacing

Above ground water supply pipework shall be securely supported at centres of no greater than those given in Table 7.

#### 7.1.4 Anchor points

Anchor points shall be provided where:

a) Seal ring joints are used, and

b) The joint is not able to resist the thrust imposed by the water pressure.

#### 7.2 Protection from freezing

7.2.1 Where there is the likelihood of freezing, hot and cold *water supply systems* shall be protected in the following manner:

a) Piping outside of the *building* thermal envelope shall be insulated,

b) Piping buried in the ground shall be insulated or installed below a level affected by freezing, and

c) *Storage water heater vent pipes* shall be insulated (see Figure 17).

7.2.2 In climates where freezing temperatures are likely for a period of greater than 24 hours an expansion control valve is required in addition to *vent pipe* insulation (see Figure 17).

---

**Table 7: Water Supply Pipework Support Spacing**

<table>
<thead>
<tr>
<th>Pipe material</th>
<th>Pipe diameter (mm)</th>
<th>Maximum distance between supports (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Vertical pipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Graded and horizontal pipe</td>
</tr>
<tr>
<td>Copper</td>
<td>10 – 15</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>20 – 25</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>15 – 20</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>Galvanised steel</td>
<td>15 – 20</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>uPVC</td>
<td>15 – 20</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>Polyethylene and polybutylene (cold water supply)</td>
<td>15 – 20</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9</td>
</tr>
<tr>
<td>Polybutylene (hot water supply)</td>
<td>15 – 18</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>20 – 22</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.7</td>
</tr>
</tbody>
</table>

**Note:** The spacing for these pipe materials is based on the pipes being located within the *building* structure.
7.3 Protection from damage

7.3.1 Water supply pipes shall be protected from the likelihood of damage.

7.3.2 Pipes below ground level
An acceptable method of protecting water supply pipes is to provide the minimum covers given below:

**Cover** | **Location**
--- | ---
600 mm | Residential driveways and similar areas subjected to occasional heavy traffic
450 mm | Gardens, lawns or other areas not subjected to traffic

7.3.3 Movement in concrete or masonry
Pipes penetrating concrete or masonry elements shall be either wrapped with a flexible material, or passed through a sleeve or duct, to permit free movement for expansion and contraction.

Pipework in or under a concrete slab must be installed in a manner to achieve a 50 year durability.

7.4 Installation of uPVC Pipes

7.4.1 An acceptable method of installing uPVC pipe is given in NZS 7643.
7.5 Watertightness

7.5.1 The water supply system shall be tested to ensure watertightness. An acceptable testing method is to:

a) Subject the hot and cold system to a pressure of 1500 kPa for a period of not less than 15 minutes, and

b) Inspect the system to ensure that there are no leaks.

COMMENT:
1. Testing should be carried out before concealing pipework behind interior linings, flooring or within concrete, or before backfilling trenches.
2. All fixtures, appliances, water tanks, storage water heaters and other equipment, which may be damaged during pressure testing, should be isolated before testing.

7.5.2 An alternative solution for testing uPVC water piping systems is given in Section 9 of NZS 7643.

8.0 Usable Facilities for People with Disabilities

8.0.1 Where taps are likely to be used for personal hygiene or the washing of utensils by people with disabilities, they shall have (see Figure 18):

a) Lever or capstan handles,

b) 50 mm clearances to wall surfaces, and

c) The hot tap located to the left of the cold tap.

COMMENT:
This requirement does not apply to Housing, Outbuildings, Ancillary buildings, and Industrial buildings employing fewer than 10 people.

9.0 Equipotential Bonding

9.1 General

9.1.1 NZBC G9 requires any electrical installation within a building to be constructed to protect users from the dangers of contact with parts of the building that may become live during fault conditions.

9.1.2 Equipotential bonding is required where all of the following conditions are likely to exist:
9.2 Installation of equipotential bonding conductors

9.2.1 Water supply pipe

a) Metallic water supply pipe shall be bonded to the earth electrode with an equipotential bonding conductor, as shown in Figure 19. The connection to the water pipe shall be as close as practicable to the point where the pipe leaves the ground, and

b) Metallic hot and cold water supply pipes shall be bonded together.

9.2.2 Metallic sanitary fixtures

a) Metallic sanitary fixtures shall be bonded to the metallic water supply pipe with an equipotential bonding conductor, as shown in Figure 20.

b) The bonding conductor shall be connected directly to the sanitary fixture. The bonding conductor may connect to the waste pipe where a metallic waste pipe is connected to the sanitary fixture and a continuous metallic link is formed between the waste pipe and the fixture.

9.3 Earth bonding conductors

9.3.1 Earth bonding conductors shall be:

a) Made of copper and have a cross-sectional area no less than 4.0 mm²;

b) Sheathed with insulating material coloured green, and

c) Fixed at intervals of no greater than 300 mm with aluminium cable fixings.

9.3.2 Earth bonding conductors shall comply with NZS 6401 or AS 3147.
Index G12/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by VM or AS respectively.

Alternative acceptable solutions
- open vented storage water heaters .................. AS1 6.9.1
- storage water heaters
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  - reduced pressure zone devices .............. AS1 3.6.2, 3.6.4, 3.7.2, Table 2
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Cold water expansion valves (expansion control valves) ................ AS1 6.3.3, 6.6.2, 6.6.3,
- installation ..................................... AS1 6.6.5
- relief valve drains ................................ AS1 6.7, Figures 8 to 10, and 13

Cross connections .............................. AS1 3.1, 3.2
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- earth bonding conductors .................... AS1 9.3
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  - metallic sanitary fixtures .............. AS1 9.2.2, Figure 20
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Hot water supply ................................ AS1 6.0
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  usable water taps ............................................. AS1 Figure 18

Potable water supply ........................................... AS1 3.0, 4.0

Pressure limiting valves ................................. AS1 5.3.3, 6.2.1, Figure 8, Table 6

Pressure reducing valves .............................. AS1 5.3.2, 6.2.1, Figures 7 and 9, Table 6

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  installation ..................................................... AS1 6.6.5
  relief valve drains ........................................... AS1 6.7, Figures 12 and 13

Relief valve drains ............................................. see Cold water expansion valves,
  Temperature relief valves and
  Temperature/pressure relief valves

Safe trays ........................................................ AS1 5.2.3, 6.11.3

Safe water temperatures ...................................... AS1 6.14

Safety device ..................................................... 6.4

Sanitary appliances ........................................... AS1 8.0.1, Table 1

Sanitary fixtures ................................................ AS1 6.12.1, 6.14.2, Figure 20, Tables 1 and 3
  safe water temperatures ..................................... AS1 6.14.1, 6.14.2

Storage water heaters ........................................ AS1 6.2, 6.3.1, 6.6.3, 6.6.5,
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  valve vented .................................................. AS1 6.3 to 6.7, Figure 8

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- solar water heaters: \( AS1 \) 4.14
- storage water heaters: see Storage water heaters
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