New Zealand Industry Standard

Field testing of backflow prevention devices and verification of air gaps

Master Plumbers Gasfitters Drainlayers

water NEW ZEALAND

COMMITTEE REPRESENTATION

This document was prepared by a committee convened by the New Zealand Water and Wastes Association Inc. (trading as Water New Zealand) and Master Plumbers, Gasfitters and Drainlayers NZ Inc with representatives from plumbing practitioners, plumbing product suppliers, water suppliers and regulatory agencies.

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Published by

Master Plumbers, Gasfitters and Drainlayers NZ Inc
PO Box 6606, Wellington 6141

Water New Zealand
PO Box 1316, Wellington 6140

April 2011	first issued
September 2011	reissued with editorial correction

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REFERENCED DOCUMENTS

Reference is made in this document to the following:

JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

AS/NZS 3500 Plumbing and Drainage

- Part 0: Glossary of terms
- Part 1: Water Supply

AS/NZS 2865 Safe working in a confined space

AUSTRALIAN STANDARDS

AS 2845 Water supply – backflow prevention devices

- Part 2: Registered air gaps and registered break tanks
- Part 3: Field testing and maintenance of testable devices

OTHER PUBLICATIONS

Department of Building and Housing	The New Zealand Building Code Handbook and Compliance Documents

LEGISLATION

Building Act 2004
Health Act 1956
Health and Safety in Employment Act
Plumbers, Gasfitters and Drainlayers Act 2006

LATEST REVISIONS

The users of this document should ensure that their copies of the above-mentioned reference documents are the latest revisions. Amendments to referenced New Zealand and Joint Australian/New Zealand Standards can be found on www.standards.co.nz.

FOREWORD

This industry standard was developed as a replacement for AS 2845 *Water supply – backflow prevention devices*, Part 2 *Registered air gaps and registered break tanks* and Part 3 *Field testing and maintenance of testable devices*. It is more suitable for use in New Zealand as it reflects the regulatory environment and the procedures currently in use.

This document covers the testing of backflow prevention devices and verification of air gaps. In relation to maintenance, repairs should be undertaken immediately a device is known to have failed. During repairs the same level of protection must be maintained or the affected section water supply system shut down.

Repairs to devices that are covered under the Building Act should be carried out only by persons licensed or authorized under the Plumbers, Gasfitters and Drainlayers Act.

Repairs to devices that are covered under the Health Act should be carried out only by persons authorized by the water supply authority.

The procedures in this document for testing backflow prevention devices will help ensure uniformity of practice and reliability of testing and so will provide improved protection of public health from potential contamination of water supplies through cross-connections and backflow.

New Zealand Industry Standard

Field testing of backflow devices and verification of air gaps

1 GENERAL

1.1 Scope

This industry standard specifies requirements for field testing of backflow prevention devices and verification of air gaps following completion of installation and at subsequent intervals demanded by regulatory requirements.

1.2 Application

This standard applies to backflow prevention devices installed to satisfy the requirements of the New Zealand Building Code and the Health Act.

1.3 Interpretation

For the purposes of compliance with this industry standard the word ‘shall’ refers to practices that are mandatory. The word ‘should’ refers to practices that are advised or recommended.

Notes are for information and guidance only.

This standard contains two types of appendices. A ‘normative’ appendix forms an integral part of the standard. An ‘informative’ appendix is for information and guidance only.

1.4 Definitions

For the purposes of this standard, definitions in AS/NZS 3500.0 and the following apply:

Air gap	The unobstructed vertical distance through the free atmosphere between the lowest opening of a water service pipe or fixed outlet supplying water to a fixture or receptacle and the highest possible water level of the fixture or receptacle.
Service Pipe Diameter	The internal diameter of the water service pipe discharging into the fixture or receptacle.
Spill Level	The maximum height to which water will rise, while overflowing the rim level or through channels or openings having a free discharge to the atmosphere under all conditions, when water is flowing into the fixture or receptacle at the maximum rate with all service outlets closed.
Toxic Environment	An environment capable of contaminating the drinking water supply through air-borne contact.
Water supply authority	The network utility operator responsible for drinking water supply, defined as “networked supplier” under the Health Act.

2 AIR GAPS

2.1 Verification Criterion

2.1.1 *Minimum air gap*

Air gap dimensions shall comply with the minimum air gap separation and shall be the greater of 25 mm or twice the service pipe diameter, or shall be as calculated from Appendix B.

2.1.2 *Multiple Inlets*

Where any fixture, tank, or receptacle receives water from two or more water services, the air gap to the lowest inlet shall be the greater of 25 mm or twice the sum of the service pipe diameters, or shall be as required by AS/NZS 3500.1.

2.2 Types of Air Gap

Air gaps shall be one of the following types:

(a) Type A – Unobstructed air gap (Figure 2-1) –The air gap is measured from the spill level to the water service pipe discharge point in accordance with Appendix C.

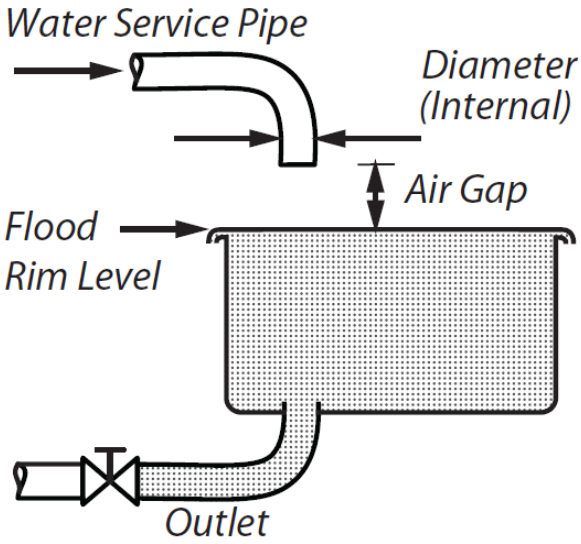


Figure 2-1 Unobstructed Air Gap

(b) Type B – Air gap with overflow (Figure 2-2) – The air gap is measured from the highest point of the tank spill level to the water service pipe discharge point in accordance with Appendix C.

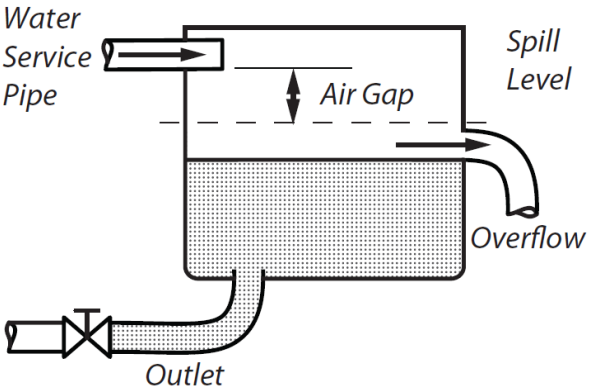


Figure 2-2 Air gap with overflow

3 FIELD TESTING OF MECHANICAL DEVICES

3.1 Field Testing Procedures

Field testing, which includes verification, for the nominated backflow prevention devices, shall be performed in accordance with the applicable test procedures in Table 3.1, with all measurement taken at ambient air temperature.

As Detector Assembly Backflow Prevention Devices have a higher differential pressure across the upstream check valve on the main line device than the device on the bypass line, reference shall be made to the manufacturers' representative for the required differential pressures.

NOTES:

1 Prior to conducting field tests special attention should be given to the safety guidelines in Appendix A particularly notification of the occupier or owner of the premise.

2 Testing should occur after installation and after maintenance or repair, and thereafter should be carried out regularly, at intervals not exceeding 12 months.

3 The line strainer should be cleaned before commencing the test procedure. Cleaning after the test can result in fouling of the check valves which would invalidate test results.

4 Replacement components used for repair should be identical components supplied by the manufacturer of the device.

5 After repairs are completed, entrapped air should be bled off in accordance with manufacturer's instructions.

Table 3.1 TEST REQUIREMENTS

Device	Test procedure
Air gap	Appendix C
Reduced-pressure-zone device	Appendix F
Double check-valves	Appendix G
Pressure vacuum breaker	Appendix H
Spill resistant pressure vacuum breaker	Appendix J
Atmospheric vacuum breaker	Appendix K

3.2 Test Equipment

Test equipment (see Appendix D and Appendix E) used for the field testing of backflow prevention devices shall be calibrated and certified at least annually or after every 200 tests by a laboratory accredited by International Accreditation New Zealand (IANZ) for the testing and calibration of such equipment. Test equipment shall be recalibrated if damaged or the tester suspects the equipment is faulty.

NOTE: Testers are advised to check equipment more frequently using the test method in Appendix L.

3.3 Preliminary procedures

Prior to testing, the following actions should be taken:

(a) Obtain permission to shut down the water supply from the appropriate personnel.
(b) Determine the type of device.
(c) Determine the direction of flow.
(d) Identify the test cocks.
(e) Fit test adaptors, if required.

4 REPORTING OF TEST RESULTS

The test reports shall contain details of the device, location and ownership together with other pertinent information as shown in the example report form in Appendix M for the relevant device.

Any installation non-conformances shall be identified and detailed in the comments section of the report.

The test report shall be completed and signed by the tester irrespective of the test result.

Copies of the test report shall be retained by the tester and provided to the client.

NOTES:

1 At the request of the client, copies may be forwarded to the following:

(a) the relevant regulatory authority;

(b) the water supply authority, in the case of boundary protection devices.

2 As a duty of care, all failed devices and any non-compliance with installation requirements should be documented on the test report and notified to (a) or (b) above.

Appendix A SAFETY AND OTHER GUIDELINES

(Informative)

These guidelines are not exhaustive and should be read in conjunction with the tester's and client's site specific health and safety requirements.

A1 Hygiene

All tools and equipment used must be specifically for water services work to avoid the potential to contaminate the potable water supply. Always follow strict hygiene practices such as hand washing and sanitation, covering of open sores with waterproof dressings and stand-down periods for illness and infections. If engaged in work on wastewater systems, ensure relevant immunizations are current. Where the water supply authority has a relevant Hygiene Code of Practice this should be followed.

A2 Confined Spaces

Confined space entry is notifiable work under Health and Safety in Employment Act. If you must test a device in a pit or confined space, notify the client and the relevant authority well in advance of your test so that safety personnel can be present. Gas detectors, safety harnesses, battery lights, sump pumps and additional personnel above the pit, may be required. Refer to *AS/NZS 2865-2001 Safe working in a confined space.*

A3 Electrical Hazards

Care should be taken with and around electrical equipment with respect to personal safety. When testing any backflow prevention devices be aware that the water discharged during testing could pass over electrical equipment installed below the device.

A4 Get Permission

Never walk through a facility, on your way to a device location, without first notifying a responsible representative of the company who owns the device. You may be trespassing if you first do not have permission to enter the facility to perform the test.

A5 Testing Supplies to Fire Sprinkler Systems

When testing a device in the water supply to a fire sprinkler system, be aware that alarms may be attached that will activate if not disabled. Notification to the fire service is normally required.

A6 Testing Elevated Devices

If devices are in elevated locations, particularly if they can be hot as in a boiler room, consider requesting the owner have the device moved down to a reasonable height. Remember that testing a device located at a high elevation (and frequently very warm) puts the tester in a precarious position from both a practical and safety viewpoint. Note also OSH requirements regarding working at height.

A7 Other Safety Devices

The testing and venting of backflow prevention devices should not hinder the operation of other system safety devices.

A8 Notify Owner Before Shutting Off Water

The owner of the device or their authorised agent should be notified in advance that the water service will be shut off during the test procedures. Special arrangements may have to be made so that interruptions to services will not create a hardship to the user. If a fire sprinkler service is being shut down, the appropriate people should be notified. Ensure the water is turned back on.

Appendix B CALCULATION OF AIR GAPS

(Normative)

B1 Flow rate through an orifice

The supply rate shall be determined from the following equation:

$$Q = mA\sqrt{2gH} \times 10^3$$

where

Q = supply rate, in litres per second

m = orifice coefficient for thin sharp-edged plate = 0.6

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

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

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

NOTES:

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

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

B2 Rate of outflow from type 1 overflow (piped) horizontal outlet storage tanks

Flow rates shall be determined from the following equations, where *h* and *d* are as in Figure B1:

$$\text{Weir flow, } h \le d, \qquad Q = 4.66 \times 10^{-5} d^{0.7} h^{1.8}$$

$$\text{Orifice flow, } h > d, \qquad Q = 6.60 \times 10^{-5} d^2 \sqrt{h - 0.5d}$$

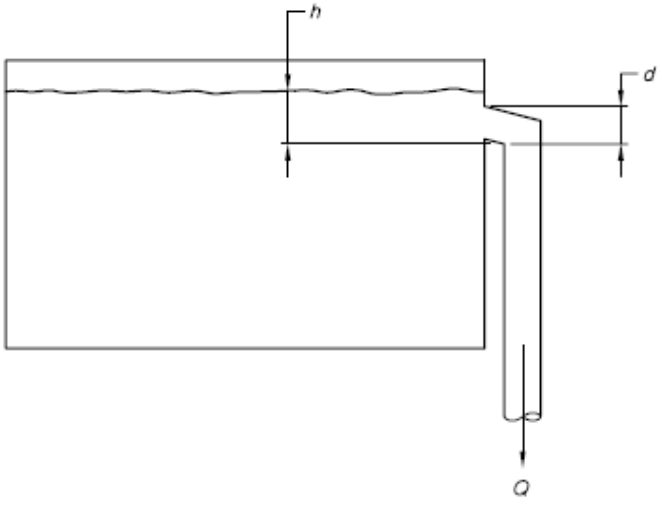


Figure B1 Type 1 overflow

B3 Rate of outflow from type 2 overflow (piped) vertical outlet storage tanks

Flow rates shall be determined from the following equations, where *h* and *d* are as Figure B2:

$$\text{Weir flow, } h \le d/3, \qquad Q = 1.98 \times 10^{-4} dh^{1.5}$$

Orifice flow, $h > d/3$, $\quad Q = 6.60 \times 10^{-5} d^2 \sqrt{h}$

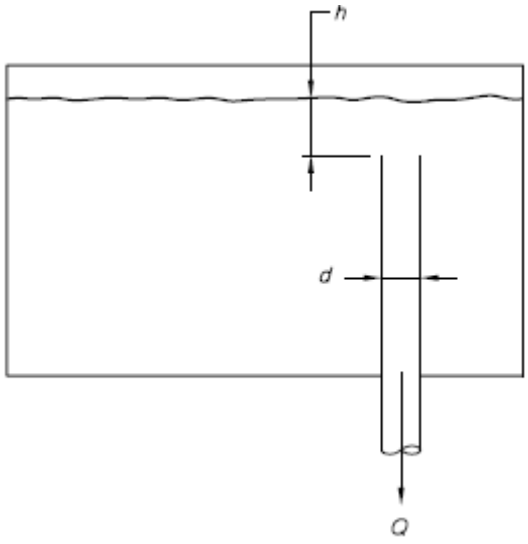


Figure B2 Type 2 overflow

B4 Rate of outflow from type 3 overflow (weir) rectangular storage tanks

Flow rates shall be determined from the following equation, where *h* and *b* are as Figure B3:

Weir flow, $\quad Q = 5.39 \times 10^{-5} bh^{1.5}$

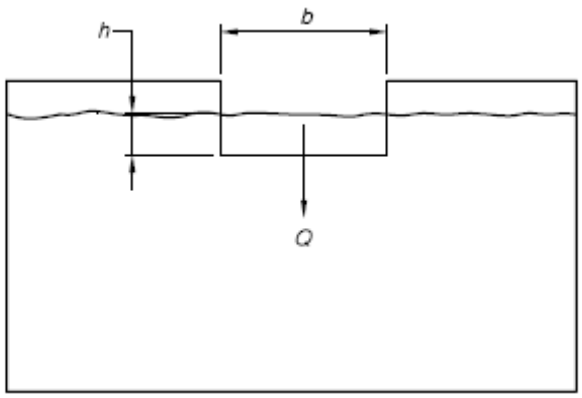


Figure B3 Type 3 overflow

B5 Determination of air gap

The air gap shall be calculated as the distance between the invert or lowest point of the inlet and the height of the water level determine as in B2, B3 or B4 for the relevant style of discharge.

Appendix C VERIFICATION OF AIR GAPS

(Normative)

C1 Scope

This Appendix sets out the method for verifying air gaps.

C2 Procedure

C2.1 *Type A* (Figure 2-1 Unobstructed Air Gap)

The procedure shall be as follows:

(a) Determine the spill level by overflowing the tank and observing, after ensuring the tank outlets are isolated.

(b) Measure and record the distance from the spill level to the discharge point of the lowest water service pipe.

(c) Complete the test sheet, Appendix M.

  (i) If the air gap complies with the minimum air gap (clause 2.1.1 or 2.1.2 as applicable), record as compliant,

  (ii) If the water supply pipe is not secure or the air gap cannot be measured, record as non-compliant on the test sheet,

  (iii) If the air gap is in a toxic environment, record as non-compliant.

B3.2 *Type B* (Figure 2-2 Air gap with overflow)

The procedure shall be as follows:

(a) Ensure the tank outlets are isolated.

(b) Check that the tank has an overflow below the level of the inlet.

(c) Inspect overflow entry for any obstructions.

(d) Measure and record the service pipe diameter and overflow pipe diameter.

(e) Determine the spill level either –

  (i) by checking the overflow function under full flow conditions for at least 60 seconds or until steady state is achieved by fully discharging the inlet service pipe, until the water rises to the spill level (the maximum water level achieved in the tank), or

  (ii) by calculation in accordance with Appendix B or AS/NZS 3500.1.

  NOTE: Check that there is no bridging device between the discharge point of the service pipe and the spill level.

(f) Measure and record the air gap.

(g) Complete the test sheet, Appendix M.

  (i) If the air gap complies with the minimum air gap (clause 2.1.1 or 2.1.2 as applicable), record as compliant,

(ii) If the air gap cannot be measured, record as non-compliant on the test sheet,

(iii) If the air gap is in a toxic environment, record as non-compliant.

(h) Return the inlet service pipe to pre-test status.

(i) Return the outlet pipe to pre-test status.

C3 Test Report

The information as set out in Appendix M shall be reported. All dimensional measurements shall be made and recorded in millimetres. Any reason for non-compliance shall be noted.

Appendix D THREE VALVE TEST KIT

(Informative)

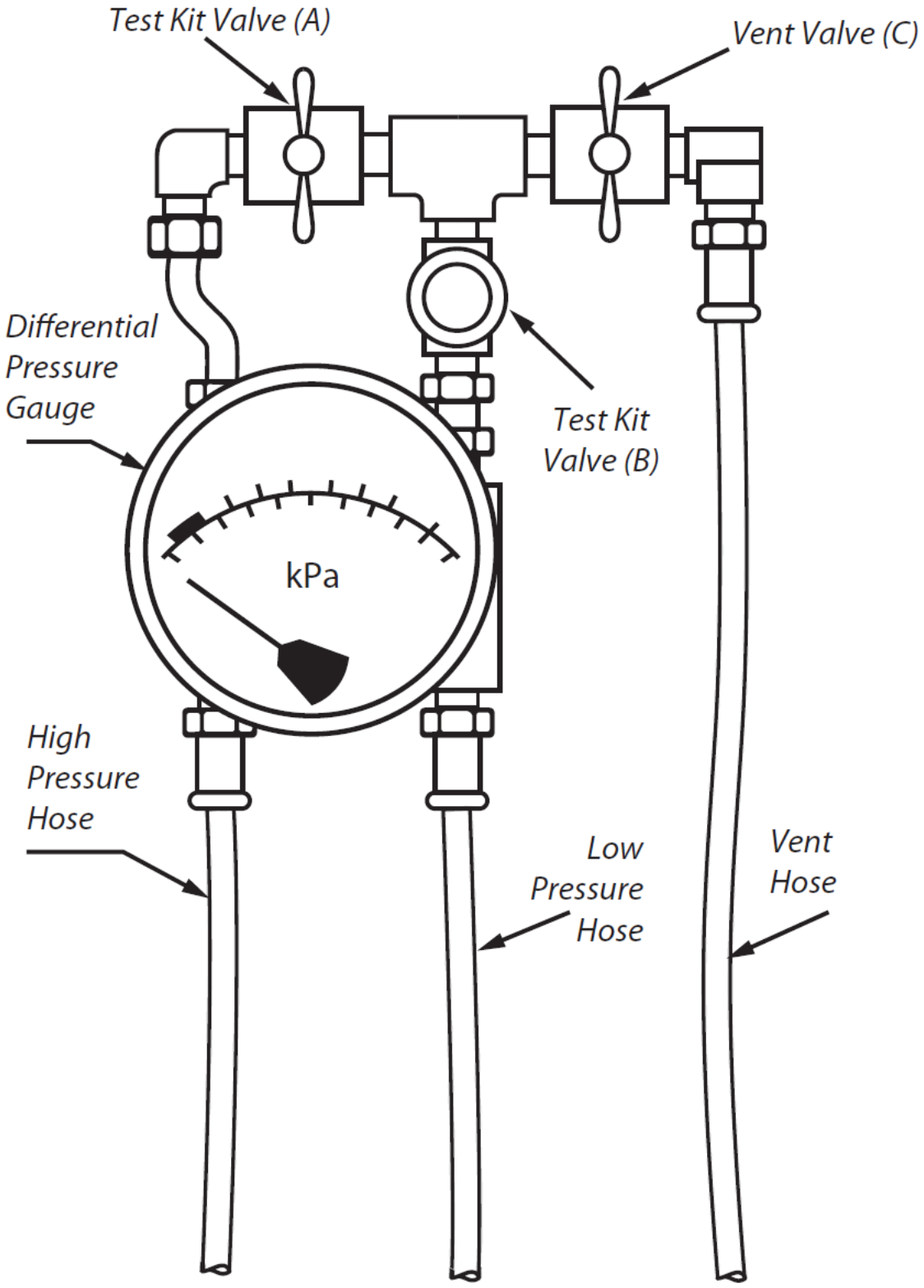


Figure D1 Typical Arrangement of 3 Valve Test Kit

Appendix E FIVE VALVE TEST KIT

(Informative)

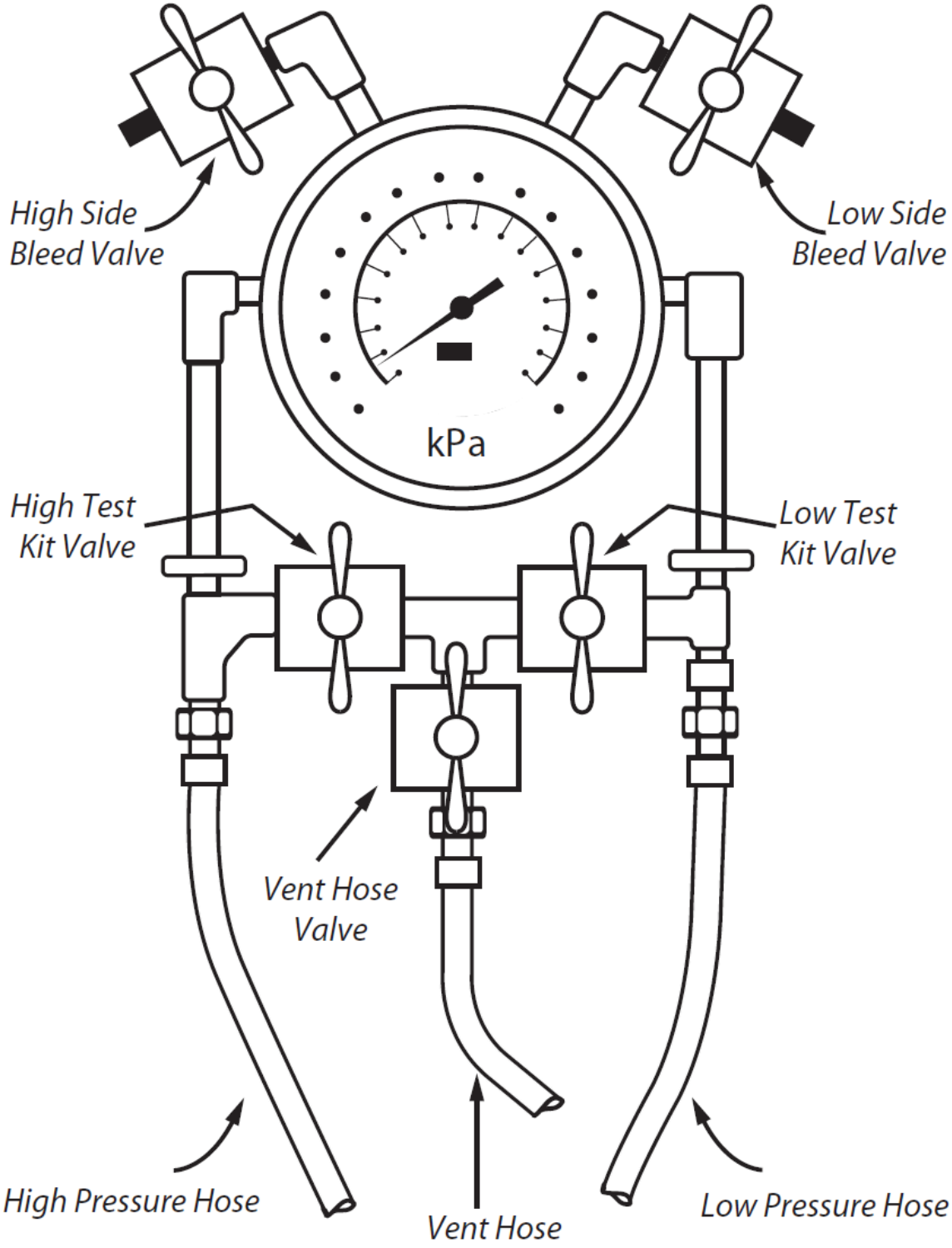


Figure E1 Typical Arrangement of 5 Valve Test Kit

Appendix F FIELD TESTING OF REDUCED-PRESSURE-ZONE BACKFLOW PREVENTION DEVICES

(Normative)

F1 Scope

This Appendix sets out the method for field testing reduced-pressure-zone backflow prevention devices.

F2 Apparatus

A test kit as shown in Figure D1 or Figure E1 is required, with the kit level with or above the device being tested.

F3 Procedure using 3-valve test kit

With reference to Figures D1 and F1, the procedure shall be as follows:

(a) Verify the inlet isolating valve (8) is open, and then close the outlet isolating valve (4). If there is no leakage from the relief port (7), it is assumed that the upstream check valve (5) is tight.

(b) In sequence, open and close test cocks (1), (2) and (3) to flush out any impurities.

To test the upstream check valve:

(c) Close test kit valves (A) and (B).

(d) Open test kit valve (C).

(e) Connect –

  (i) the high-pressure hose of the test kit to test cock (1); and

  (ii) the low-pressure hose of the test kit to test cock (2).

(f) Open test cocks (1) and (2).

(g) Slowly open test kit valve (A) and bleed water through the vent hose.

(h) Close test kit valve (A).

(i) Slowly open test kit valve (B) and bleed water through the vent hose to eliminate air from the system.

(j) Slowly close test kit valve (B).

(k) Record the reading on the differential pressure gauge, the pressure drop across the inlet check valve (5).

NOTE A reading below 35 kPa indicates that the inlet check valve (5) is faulty and should be repaired. The test should then be repeated.

To test the downstream check valve:

(l) Connect the vent hose to test cock (3).

(m) Open test cock (3) and test kit valve (A).

(n) Observe the relief port (7).

(o) Record whether there is any discharge.

NOTE A discharge from the relief port indicates the downstream check valve (6) is leaking and should be repaired. The test should then be repeated.

(p) Close test cock (1).

(q) Observe the differential gauge.

NOTE If the pressure differential decreases (approaches zero) this indicates the outlet isolating valve (8) is leaking and should be repaired. Leakage invalidates the results of the earlier tests. These must be repeated after the isolating valve is repaired.

To test the relief valve:

(r) Open test cock (1) and slowly open test kit valve (B), observing both the differential gauge and the relief port (7).

(s) Record the reading on the differential gauge when the relief port (7) commences discharging.

NOTE The reading must be no less than 14 kPa.

To test the outlet isolating valve:

(t) Close test cock (1) to stop the supply of high pressure water downstream of the downstream check valve (6).

NOTE If the differential pressure gauge remains steady the outlet isolating valve is tight. If the differential pressure gauge reading drops, the valve is leaking and must be repaired or replaced.

(u) Shut all test cocks.

(v) Disconnect the test kit, draining the kit and hoses.

(w) Open the outlet isolating valve to restore the system to operating condition.

F4 Procedure using 5-valve test kit

With reference to Figures E1 and F1, the procedure shall be as follows:

(a) Verify the inlet isolating valve (8) is open, and close the outlet isolating valve (5). If there is no leakage from the relief port (7), it is assumed that the upstream check valve is tight.

(b) In sequence, open and close test cocks (1), (2) and (3) to flush out any impurities.

To test the upstream check valve:

(c) Close the high-side (A) and low-side (B) test kit valves. Leave the vent hose valve (C) open.

(d) Connect the high-pressure hose to test cock (1).

(e) Connect the low-pressure hose to test cock (2).

(f) Open test cocks (1) and (2) slowly.

(g) Open the high-side bleed valve to bleed air from the high-pressure hose and then close the high-side bleed valve.

(h) Open the low-side bleed valve to bleed air from the low-pressure hose and then close the low-side bleed valve.

(i) Record the differential pressure gauge reading.

NOTE It must be a minimum of 35 kPa.

To test the downstream check valve:

(j) Connect the vent hose to test cock (3).

(k) Open test cock (3), the high-side test kit valve (A) and vent hose valve (C).

NOTE This supplies high pressure water downstream of the downstream check valve. If the differential pressure gauge falls off and water comes out the relief valve, the downstream check valve is recorded as leaking. If the differential pressure gauge remains steady and no water comes out the relief valve, the downstream check valve is considered tight.

To test the outlet isolating valve:

(l) Close test cock (1) to stop the supply of high pressure water downstream of the downstream check valve.

NOTE If the differential pressure gauge remains steady the outlet isolating valve is tight. If the differential pressure gauge reading drops, the outlet isolating valve is leaking and must be repaired or replaced.

To check the relief opening point:

(m) Open test cock (1).

(n) Slowly open the low-side test kit valve (B) and record the differential pressure gauge reading when the water starts to drip from the relief valve opening.

NOTE The reading must be no less than 14 kPa.

(o) Shut all test cocks.

(p) Disconnect the test kit draining the kit and hoses.

(q) Open the outlet isolating valve (4).

F5 Test Report

The following shall be reported:

(a) The readings at steps F3 (k) and (s) for the 3-valve test kit or steps F4 (i) and (n) for the 5-valve test.

(b) The presence or absence of any discharge at step F3 (o) or F4 (k).

(c) Whether the outlet isolating valve is tight.

(d) Reference to this test method, i.e. NZ backflow testing standard 2011, Appendix F

F6 Criteria for Acceptance

The following shall be the criteria for acceptance:

(a) The reading at step F3 (k) for the 3-valve test kit or step F4 (i) for the 5-valve test shall be not less than 35 kPa.

(b) There shall be no discharge from the relief port at step F3 (o) or F4 (k).

(c) The reading at step F3 (s) for the 3-valve test kit or steps F4 (n) shall be not less than 14 kPa.

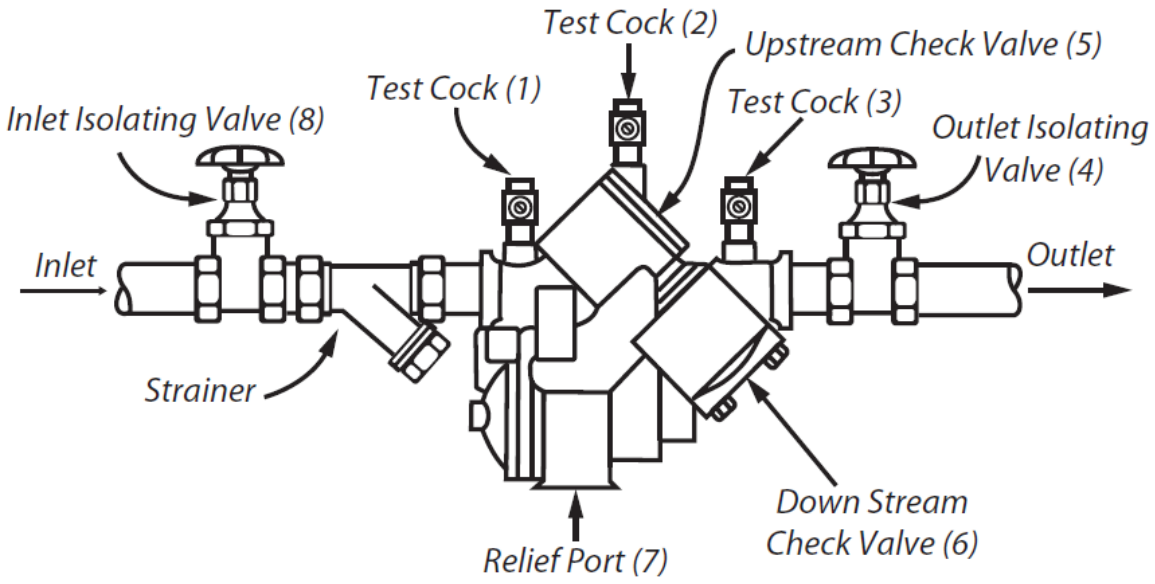


Figure F1 Typical test arrangement for reduced pressure zone backflow prevention device

Appendix G FIELD TESTING OF DOUBLE CHECK-VALVE BACKFLOW PREVENTION DEVICES

(Normative)

G1 Scope

This Appendix sets out the method for field testing double check-valve backflow prevention devices.

G2 Apparatus

A test kit as shown in Figure D1 or Figure E1 is required, with the kit level with or above the device being tested.

G3 Procedure using 3-valve test kit

With reference to Figures D1 and G1, the procedure shall be as follows:

(a) Ensure the inlet isolating valve (7) is open.

(b) Close the outlet isolating valve (4).

(c) In sequence, open and close test cocks (1), (2) and (3) to flush out any impurities.

To test the upstream check valve:

(d) Close test kit valves (A) and (B) and open test kit valve (C).

(e) Connect –

  (i) the high-pressure hose of the test kit to test cock (1); and

  (ii) the low-pressure hose of the test kit to test cock (2).

(f) Open test cocks (1) and (2).

(g) Open test kit valve (A) and bleed water through the vent valve (C).

(h) Close test kit valve (A).

(i) Slowly open test kit valve (B) and bleed water through the vent valve (C).

(j) Slowly close test kit valve (B) and observe and record the reading on the differential pressure gauge.

  NOTE: A reading below 7 kPa indicates a faulty check valve.

(k) Close test cocks (1) and (2) and open test kit valves (A) and (B) to drain the test kit.

(l) Disconnect the test kit hoses from test cocks (1) and (2).

(m) Close test kit valves (A) and (B).

To test the downstream check valve:

(n) Connect the low-pressure hose to test cock (3).

(o) Connect the high-pressure hose to test cock (2).

(p) Open test cocks (2) and (3).

(q) Open test kit valve (A) and bleed water through the vent valve (C).

(r) Close test kit valve (A).

(s) Slowly open test kit valve (B) and bleed water through the vent valve (C).

(t) Slowly close test kit valve (B) and observe and record the reading on the differential pressure gauge.

NOTE: A reading below 7 kPa indicates a faulty check valve.

(u) Close test cocks (2) and (3), open test kit valves (A) and (B) to drain the test kit.

To test the outlet isolating valve:

(v) Disconnect the test kit hoses from test cock (2) and (3).

(w) Close test kit valves (A) and (B) and open test kit valve (C).

(x) Connect –

(i) the high-pressure hose of the test kit to test cock (1); and

(ii) the low-pressure hose of the test kit to test cock (2).

(y) Open test cocks (1) and (2).

(z) Open test kit valve (A) and bleed water through the vent valve (C).

(aa) Close test kit valve (A).

(bb) Slowly open test kit valve (B) and bleed water through the vent valve (C).

(cc) Slowly close test kit valve (B) and observe and record the reading on the differential pressure gauge.

NOTE: A reading below 7 kPa indicates a faulty check valve.

(dd) Connect the vent hose of the test kit to test cock (3).

(ee) Slowly open test cock (3).

(ff) Open test kit valve (A).

(gg) Close test cock (1) and observe the differential gauge.

NOTE: If the pressure differential reduces approaching zero the outlet isolating valve (5) is leaking. The valve must be repaired or replaced and a new test performed as leakage invalidates test results.

(hh) Close all test cocks, disconnect the test kit and open outlet isolating valve (5) to restore the device to operating condition.

G4 Procedure using 5-valve test kit

With reference to Figures E1 and G1, the procedure shall be as follows:

To test upstream check valve

(a) Verify the inlet isolating valve (7) is open and then close the outlet isolating valve (4).

(b) In sequence, open and close test cocks (1), (2) and (3) to flush out any impurities.

(c) Close the high-side (A) and low-side test (B) kit valves, leaving the vent hose valve (C) open.

(d) Connect the high-pressure hose to test cock (1).

(e) Connect the low-pressure hose to test cock (2).

(f) Open test cocks (1) and (2) slowly.

(g) Open the high-side bleed valve to bleed air from the high-pressure hose and then close the high-side bleed valve.

(h) Open the low-side bleed valve to bleed air from the low-side pressure hose and then close the low-side bleed valve.

(i) Record the differential pressure gauge reading.

NOTE: A reading below 7 kPa indicates a faulty check valve.

(j) Close test cocks (1) and 2.

(k) Disconnect the test kit and drain the hoses.

To test downstream check valve:

(l) Connect the high-pressure hose to test cock (2).

(m) Connect the low-pressure hose to test cock (3).

(n) Open test cocks (2) and (3) slowly.

(o) Open the high-side bleed valve to bleed air from the high-pressure hose and then close the high bleed valve.

(p) Open the low-side bleed valve to bleed air from the low-pressure hose and then close the low-side bleed valve.

(q) Record the differential pressure gauge reading

NOTE: A reading below 7 kPa indicates a faulty check valve.

(r) Close test cocks (2) and (3).

(s) Disconnect the test kit and drain the hoses.

To test the outlet isolating valve:

(t) Connect the high-pressure hose to test cock (1).

(u) Connect the low-pressure hose to test cock (2).

(v) Connect the vent hose to test cock (3).

(w) Open test cocks (1), (2) and (3) slowly.

(x) Open the high-side bleed valve to bleed air from the high-pressure hose and then close the high-side bleed valve.

(y) Open the low-side bleed valve to bleed air from the low-pressure hose and then close the low-side bleed valve.

(z) Record the differential pressure gauge reading.

NOTE: A reading below 7 kPa indicates a faulty valve.

(aa) Open the high-side (A) test kit valve and the vent hose (C) test kit valve to supply high pressure water downstream of the downstream check valve (6).

(bb) Close test cock (1) to stop the supply of high pressure water downstream of the downstream check valve (6).

(cc) If the differential pressure gauge reading drops the outlet isolating valve (4) is leaking. If the gauge remains steady the outlet isolating valve is recorded as being tight.

(dd) Turn off all test cocks.

(ee) Disconnect the test kit and drain the hoses.

(ff) Open the outlet isolating valve to restore the device to operating condition.

G5 Test report

The following shall be reported:

(a) The readings at steps G3 (j), (t) and (cc) for the 3-valve test kit or steps G4 (i), (q) and (z) for the 5-valve test.

(b) Whether the outlet isolating isolation valve (4) is tight.

(c) Reference to this test method, i.e. NZ backflow testing standard 2011, Appendix G.

G6 Criteria for acceptance

The readings at steps G3 (j), (t) and (cc) for the 3-valve test kit and steps G4 (i), (q) and (z) for the 5-valve test shall be not less than 7 kPa.

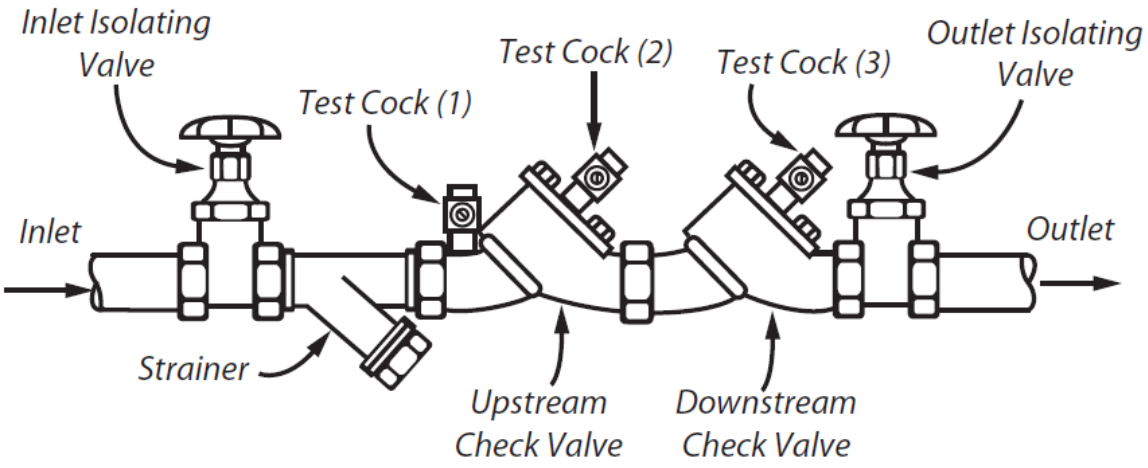


Figure G1 Typical test arrangement for double check valve backflow prevention device

Appendix H FIELD TESTING OF PRESSURE VACUUM-BREAKERS

(Normative)

H1 Scope

This Appendix sets out the method for field testing pressure vacuum-breaker backflow prevention devices.

H2 Apparatus

A test kit as shown in Figure D1 or in Figure E1 is required, with the kit level with or above the device being tested.

H3 Procedure using 3-valve test kit

With reference to Figures D1 and H1, the procedure shall be as follows.

To test the check valve:

(a) Remove the air port shield (3).

(b) Open the inlet isolating valve (4).

(c) Close the outlet isolating valve (5).

(d) Open and close test cocks (1) and (2) to flush out any impurities.

(e) Connect –

  (i) The high-pressure hose of the test kit to test cock (1); and

  (ii) The low-pressure hose of the test kit to test cock (2).

(f) Close test kit valves (A) and (B).

(g) Open test kit valve (C).

(h) Slowly open test cocks (1) and (2).

(i) Open test kit valve (A) to bleed water through the vent valve (C).

(j) Close test kit valve (A).

(k) Slowly open test kit valve (B) to bleed water through the vent valve (C).

(l) Slowly close test kit valve (B).

(m) Record the reading on the differential pressure gauge.

  NOTE: A reading below 7 kPa indicates the check valve is faulty and the test has failed.

(n) Close test cocks (1) and (2), open test kit valves (A) and (B) and disconnect the test kit.

(o) Close test kit valves (A) and (B).

To test the air inlet valve:

(p) Connect the high-pressure hose to test cock (2) and open test kit valve (A).

(q) Bleed the high-pressure hose by opening test cock (2).

(r) In sequence close –

(i) test kit valve (C); and

(ii) inlet isolating valve (4).

(s) Slowly open test kit valve (B).

(t) Record the reading on the differential pressure gauge when the air inlet valve opens.

NOTES:

1 A reading below 7 kPa indicates the air inlet valve is faulty and the test has failed.

2 If the pressure on the gauge is rising, the inlet isolating valve (4) is leaking.

3 If the pressure on the gauge is dropping (approaching zero), the outlet isolating valve is leaking.

4 The faulty valves must be repaired, or replaced, and a new test performed, as leakage invalidates the test results.

(u) Close test cock (2).

(v) Remove the test kit, replace the air port shield (3) and open isolating valves (4) and (5), to restore the device to operating condition.

H4 Procedure using 5-valve test kit

With reference to Figures E1 and H1, the procedure shall be as follows:

To test the check valve:

(a) Remove the air port shield (3).

(b) Open the inlet isolating valve (4).

(c) Close the outlet isolating valve (5).

(d) Open and close test cocks (1) and (2) to flush out any impurities.

(e) Connect the high-pressure hose to test cock (1).

(f) Connect the low-pressure hose to test cock (2).

(g) Close test kit high-side and low-side bleed valves and the vent hose valve (C).

(h) Open test cocks (1) and (2) slowly.

(i) Open the high-side bleed valve to bleed air from the high-pressure hose and then close the high-side bleed valve.

(j) Open the low-side bleed valve to bleed air from the low-pressure hose and then close the low-side bleed valve.

(k) Record the differential pressure gauge reading.

NOTE: A reading below 7 kPa indicates the check valve is faulty and the test has failed.

(l) Close test cocks (1) and (2).

(m) Disconnect the hoses, draining the test kit by opening valves (A), (B) and (C).

To test the air inlet valve:

(n) Connect the high-pressure hose to test cock (2).

(o) Close test kit high-side (A), low-side (B) and vent hose (C) valves.

(p) Open test cock (2) slowly.

(q) Slowly open the high-side bleed valve, and then close it, observing the differential pressure on the test kit.

(r) Close the inlet isolating valve (4)

(s) Slowly open the high-side bleed valve.

(t) Record the differential pressure gauge reading when the air inlet valve opens.

NOTES:

1 A reading below 7 kPa indicates the air inlet valve is faulty and the test has failed.

2 If the pressure on the gauge is rising, the inlet isolating valve (4) is leaking.

3 If the pressure on the gauge is dropping (approaching zero), the outlet isolating valve is leaking.

4 The faulty valves must be repaired, or replaced, and a new test performed, as leakage invalidates the test results.

(u) Turn off test cock (2).

(v) Disconnect the test kit, draining the hoses by opening valves (A), (B) and (C).

(w) Open both the isolating valves, (4) and (5), and replace the air port shield (3) to restore the device to operating condition.

H5 Test report

The following shall be reported:

(a) The readings obtained at steps H3 (m) and (t) for the 3-valve test kit, or steps H4 (k) and (t) for the 5-valve test kit.

(b) Whether the outlet isolating valve is tight.

(c) Reference to this test method, i.e. NZ backflow testing standard 2011, Appendix H.

H6 Criteria for acceptance

The readings at steps H3 (m) and (t), or steps H4 (k) and (t) shall be not less than 7 kPa, and the outlet isolating valve shall be tight.

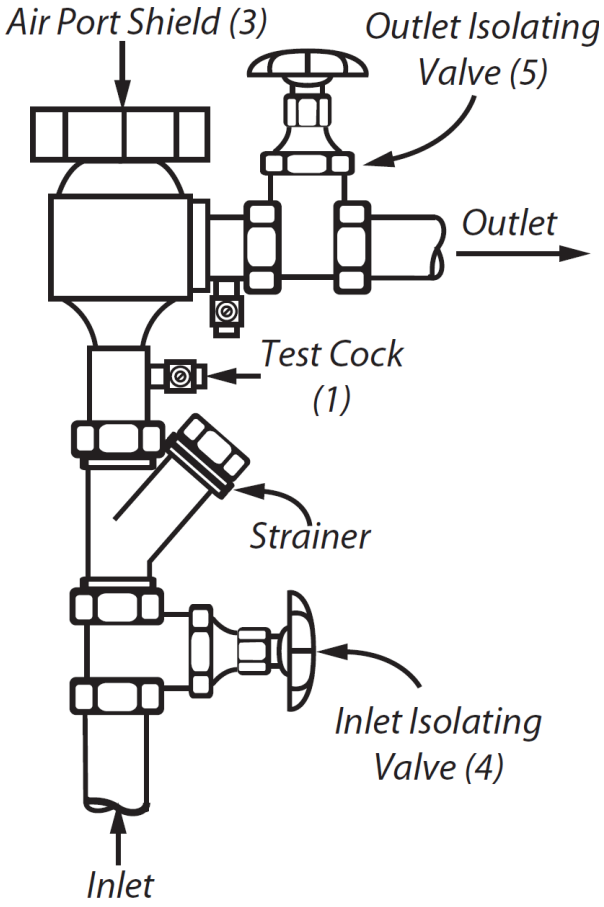


Figure H1 Typical Pressure Vacuum Breaker

Appendix J FIELD TESTING OF SPILL-RESISTANT VACUUM BREAKERS

(Normative)

J1 Scope

This Appendix sets out the method for field testing spill-resistant vacuum-breakers.

J2 Apparatus

A test kit as shown in Figure D1 or Figure E1 is required, with the kit level with or above the device being tested.

J3 Procedure using 3-valve test kit

With reference to Figures D1 and J1, the procedure shall be as follows:

To test the check valve:

(a) Open the inlet isolating valve (4).

(b) Close the outlet isolating valve (5).

(c) Remove the air port shield (2).

(d) Flush out test cock (1) and the bleed screw (3).

(e) Connect the high-pressure hose to the test cock (1).

(f) Open test cock (1) and test kit valve (A) and bleed water through vent valve (C).

(g) Close the vent valve (C).

(h) Close the inlet isolating valve (4).

(i) Open the bleed screw, observing test kit differential, and record the value when steady.

NOTE: A reading below 7 kPa indicates the outlet isolating valve is not closed.

To test the air inlet valve:

(j) Open the test kit valve (B), check that the air inlet valve on top of the device drops open.

(k) Close the test kit valve (B) and the bleed screw (3)

(l) Remove the test kit and drain its hoses.

(m) Refit the air port shield (2).

(n) Open the inlet isolating valve (4) and slowly open the outlet isolating valve (5) to return the device to service.

J4 Procedure using 5-valve test kit

With reference to Figures E1 and J1, the procedure shall be as follows:

To test the check valve:

(a) Open the inlet isolating valve (4).

(b) Close the outlet isolating valve (5).

(c) Remove the air port shield (2).

(d) Flush out test cock (1) and the bleed screw (3).

(e) Connect the high-pressure hose to the test cock (1).

(f) Open the test cock slowly.

(g) Open the high-side bleed valve to bleed air from the high-pressure hose and then close the high-side bleed valve.

(h) Close the inlet isolating valve (4).

(i) Slowly unscrew the bleed screw (3) until the dripping of water stops and the reading on the gauge is steady.

(j) Record the differential pressure gauge reading

NOTE: A reading below 7 kPa indicates the outlet isolating valve is not closed.

To test the air inlet valve:

(k) Slowly open the vent hose valve (C) until the gauge reading is 7 kPa and then close the vent hose valve (C).

(l) Inspect that the air inlet valve is slightly open.

(m) Open vent hose valve (C) fully until the dripping of water completely stops.

(n) Visually inspect that the air inlet valve is fully open.

(o) Close the test cock (1) and the vent hose valve (C).

(p) Disconnect the test kit and drain the hose.

(q) Slowly open both the inlet and outlet isolating valves, (4) and (5).

(r) Replace the air port shield (2).

J5 Test report

The following shall be reported:

(a) The readings obtained at steps J3 (i) for the 3-valve test kit and steps J4 (j) for the 5-valve test kit.

(b) Whether the air inlet poppet valve opened fully.

(c) Reference to this test method, i.e. NZ backflow testing standard 2011, Appendix J.

J6 Criteria for acceptance

The readings at steps J3 (i) for the 3-valve test kit and steps J4 (j) for the 5-valve test kit shall be not less than 7 kPa and the poppet shall open fully.

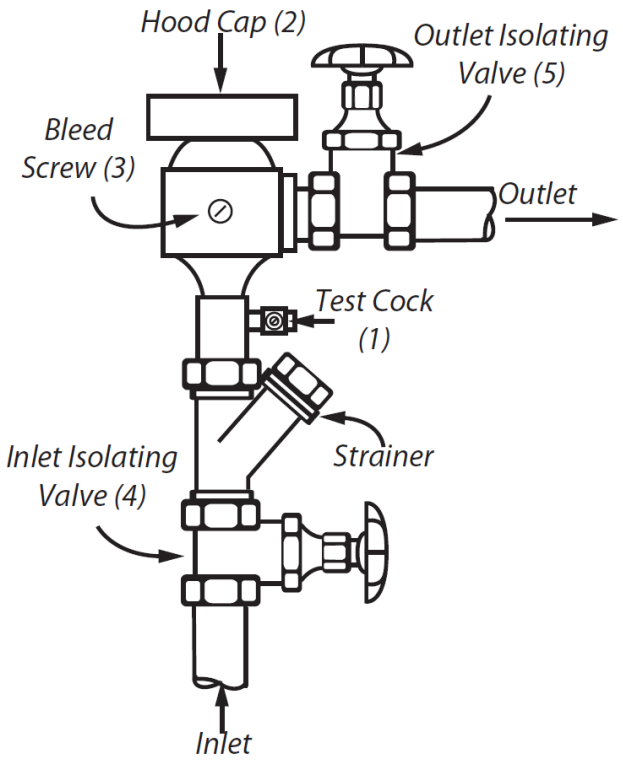


Figure J1 Typical spill-resistant vacuum-breaker

Appendix K FIELD VERIFICATION OF ATMOSPHERIC VACUUM BREAKERS

(Normative)

K1 Scope

This Appendix sets out the method for verifying the operation of atmospheric vacuum-breaker backflow prevention devices.

K2 Procedure

With reference to Figure K1, the procedure shall be as follows:

(a) Operate the device by turning on the fixture or equipment and observe that the poppet or float closes on increase in pressure, and

(b) Operate the device by turning off the fixture or equipment and observe that the poppet or float opens on decrease in pressure.

K3 Test Report

The following shall be reported:

(a) The observations obtained at steps (a) and (b).

(b) Reference to this test method, i.e. NZ backflow testing standard 2011, Appendix K.

K4 Criteria for Acceptance

The poppet or float shall be observed to be moving freely.

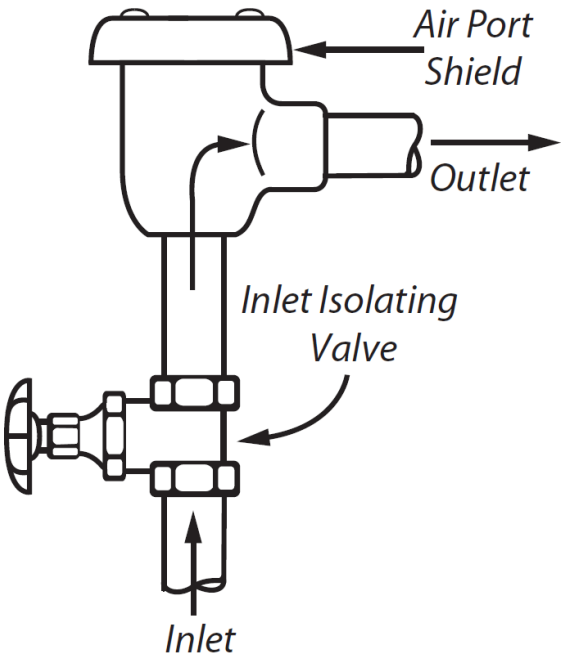


Figure K1 Typical Atmospheric Vacuum-Breaker

Appendix L DIFFERENTIAL GAUGE TEST EQUIPMENT CALIBRATION CHECK

(Informative)

L1 Scope

This Appendix sets out a method for testers to check the calibration of test equipment using a water column.

NOTE: The use of this method does not negate the requirement for all gauges to be calibrated by an IANZ certified laboratory at least annually or after every 200 tests.

L2 Apparatus

The following apparatus is required:

(a) Two transparent tubes (approx. 20 mm diameter), minimum length 1.5 m.

(b) Adaptors from transparent tube to gauge hoses: rubber stoppers, nipples, elbows.

L3 Procedure for the 3-valve test kit

With reference to Figures D1 and L1, the procedure is as follows:

(a) Attach high-pressure hose to the base of one transparent tube.

(b) Attach low-pressure hose to the base of second transparent tube.

(c) Fill the transparent tubes with water.

(d) Bleed air from the gauge by opening test kit valves (A) and (C), then close valve (A), then open the valve (B) and close again.

(e) Fill or drain transparent tubes to desired heights (h).

(f) Compare the gauge reading to the pressure generated by the water column height (h); if the two values are not equal the gauge must be recalibrated.

(g) If the gauge requires adjustment, contact the gauge manufacturer or a qualified gauge repairer.

L4 Procedure for the 5-valve test kit

With reference to Figures E1 and L1, the procedure is as follows:

(a) Attach high-side hose to the base of one transparent tube.

(b) Attach low-side hose to the base of second transparent tube.

(c) Fill the transparent tubes with water.

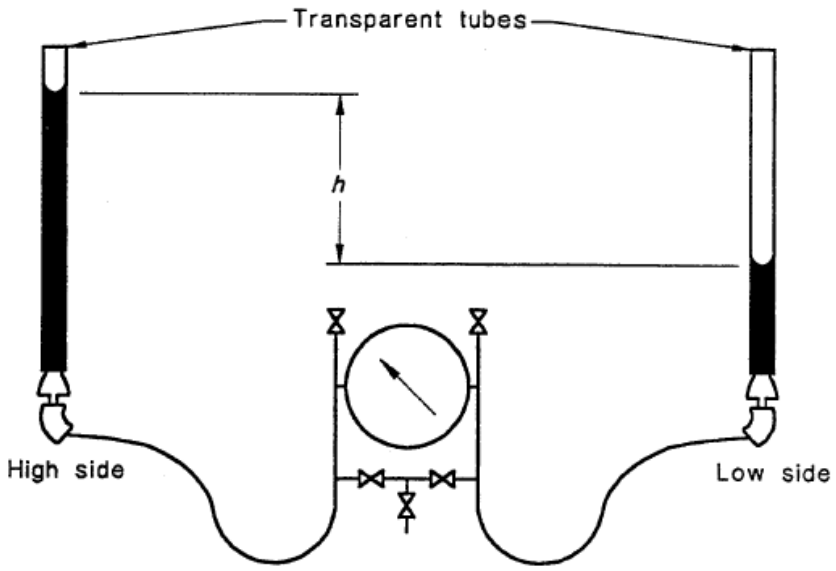
(d) Bleed air from the gauge by opening the high-side bleed valve, then close, then open the low-side bleed valve and close again.

(e) Fill or drain transparent tubes to desired heights (h).

NOTE: 1 m water = 10 kPa.

(f) Compare the gauge reading to the pressure generated by the water column height (h); if the two values are not equal the gauge must be recalibrated.

(g) If the gauge requires adjustment, contact the gauge manufacturer or a qualified gauge repairer.



NOTES:

1 Readings of h are taken from the bottom of the meniscus in each column.

2 1 m water = 10 kPa.

3 The set-up for a 3-valve test is equivalent to that shown in the figure for the 5-valve kit.

Figure L1 Typical Differential Gauge Calibration Check Apparatus

Appendix M TEST REPORTS

(Informative)

M1 Air gaps

BACKFLOW PREVENTION DEVICE TEST CERTIFICATE

AIR GAP

Building Details:		**Owner:**	
Building name:		*Name:	
Block / level / unit no.:		Contact person:	
*Street address:		*Address:	
Suburb:			
Compliance Schedule. No.:		Phone number:	
Water meter no.:			

Occupier:			
Business name:		Type of business:	
*Contact person		*Phone number:	

Device Details:

Protection:	Individual source ☐	Zone ☐	Boundary ☐
Location:			
Supply pipe diameter:	mm	Required air gap:	mm
Air gap unobstructed:	Yes ☐ No ☐	Measured air gap:	mm
Overflow type[+]:	1 ☐ 2 ☐ 3 ☐		
Air gap determined:	by observation of spill ☐	by calculation ☐	
Comments:			

Test Result: **Compliant** ☐ **Non – compliant** ☐

Tester Details:			
Name of tester:		Company name:	
IQP No:		Company address:	
Signature:			
Date of test:			

NOTE: This test report only constitutes an assessment of existing devices and does not mean ALL cross connections on the site have been addressed. Neither does it mean the existing devices are appropriate for the hazard. This must be addressed by an IQP (Survey). Cross connections are a major PUBLIC HEALTH RISK and are the owner's responsibility to ensure they are addressed.

* required entry

[+] see NZ backflow testing standard 2011 for definition of overflow types

M2 Reduced pressure zone device

BACKFLOW PREVENTION DEVICE TEST CERTIFICATE

REDUCED PRESSURE ZONE DEVICE (RPZD)

Building Details:

Building name:	
Block / level / unit no.:	
*Street address:	
Suburb:	
Compliance Schedule. No.:	
Water meter no.:	

Owner:

*Name:	
Contact person:	
*Address:	
Phone number:	

Occupier:

Business name:		Type of business:	
*Contact person		*Phone number:	

Device Details:

Protection:	Individual source ☐	Zone ☐	Boundary ☐
Location:			
Manufacturer:		Serial no.:	
Model:		Nominal Size:	mm
Installation correct:	Yes ☐ No ☐	Strainer installed:	Yes ☐ No ☐
Comments on installation:			

Test Details:

Test kit serial no.:			Calibration date:	
	1st check valve	2nd check valve	relief valve opening pressure	downstream isolating valve
Initial test:	tight ☐ leaked ☐	tight ☐ leaked ☐	kPa	tight ☐ leaked ☐
Pressure reading:	kPa	kPa		
Test after repairs:	tight ☐ leaked ☐	tight ☐ leaked ☐	kPa	tight ☐ leaked ☐
Pressure reading:	kPa	kPa		
Repairs and materials used (if applicable):				
Comments:				

Test Result: **Pass** ☐ **Fail** ☐ Test method:

Tester Details:

Name of tester:		Company name:	
IQP No:		Company address:	
Signature:			
Date of test:			

NOTE: This test report only constitutes an assessment of existing devices and does not mean ALL cross connections on the site have been addressed. Neither does it mean the existing devices are appropriate for the hazard. This must be addressed by an IQP (Survey). Cross connections are a major PUBLIC HEALTH RISK and are the owner's responsibility to ensure they are addressed.

* required entry

M3 Double check valve

BACKFLOW PREVENTION DEVICE TEST CERTIFICATE

DOUBLE CHECK VALVE (DCV)

Building Details:

Building name:	
Block / level / unit no.:	
*Street address:	
Suburb:	
Compliance Schedule. No.:	
Water meter no.:	

Owner:

*Name:	
Contact person:	
*Address:	
Phone number:	

Occupier:

Business name:		Type of business:	
*Contact person		*Phone number:	

Device Details:

Protection:	Individual source ☐	Zone ☐	Boundary ☐
Location:			
Manufacturer:		Serial no.:	
Model:		Nominal Size:	mm
Installation correct:	Yes ☐ No ☐	Strainer installed:	Yes ☐ No ☐
Comments on installation:			

Test Details:

Test kit serial no.:		Calibration date:	

	1st check valve	2nd check valve	downstream isolating valve
Initial test:	tight ☐ leaked ☐	tight ☐ leaked ☐	tight ☐ leaked ☐
Pressure reading:	kPa	kPa	
Test after repairs:	tight ☐ leaked ☐	tight ☐ leaked ☐	tight ☐ leaked ☐
Pressure reading:	kPa	kPa	

Repairs and materials used (if applicable):	
Comments:	

Test Result: **Pass** ☐ **Fail** ☐ Test method:

Tester Details:

Name of tester:		Company name:	
IQP No:		Company address:	
Signature:			
Date of test:			

NOTE: This test report only constitutes an assessment of existing devices and does not mean ALL cross connections on the site have been addressed. Neither does it mean the existing devices are appropriate for the hazard. This must be addressed by an IQP (Survey). Cross connections are a major PUBLIC HEALTH RISK and are the owner's responsibility to ensure they are addressed.

* required entry

M4 Pressure vacuum breaker

BACKFLOW PREVENTION DEVICE TEST CERTIFICATE

PRESSURE VACUUM BREAKER (PVB)

Building Details:		**Owner:**	
Building name:		*Name:	
Block / level / unit no.:		Contact person:	
*Street address:		*Address:	
Suburb:			
Compliance Schedule. No.:		Phone number:	
Water meter no.:			

Occupier:			
Business name:		Type of business:	
*Contact person		*Phone number:	

Device Details:

Protection:	Individual source ☐	Zone ☐	Boundary ☐
Location:			
Manufacturer:		Serial no.:	
Model:		Nominal Size:	mm
Installation correct:	Yes ☐ No ☐	Strainer installed:	Yes ☐ No ☐
Comments on installation:			

Test Details:

Test kit serial no.:		Calibration date:	

	Check valve	Air inlet valve	downstream isolating valve
Initial test:	opened ☐ did not open ☐	opened ☐ did not open ☐	tight ☐ leaked ☐
Pressure reading:	kPa	kPa	
Test after repairs:	opened ☐ did not open ☐	opened ☐ did not open ☐	tight ☐ leaked ☐
Pressure reading:	kPa	kPa	

Repairs and materials used (if applicable):	
Comments:	

Test Result: **Pass** ☐ **Fail** ☐ Test method:

Tester Details:

Name of tester:		Company name:	
IQP No:		Company address:	
Signature:			
Date of test:			

NOTE: This test report only constitutes an assessment of existing devices and does not mean ALL cross connections on the site have been addressed. Neither does it mean the existing devices are appropriate for the hazard. This must be addressed by an IQP (Survey). Cross connections are a major PUBLIC HEALTH RISK and are the owner's responsibility to ensure they are addressed.

* required entry

M5 Atmospheric vacuum breaker

BACKFLOW PREVENTION DEVICE TEST CERTIFICATE

ATMOSPHERIC VACUUM BREAKER (AVB)

Building Details:		**Owner:**	
Building name:		*Name:	
Block / level / unit no.:		Contact person:	
*Street address:		*Address:	
Suburb:			
Compliance Schedule. No.:		Phone number:	
Water meter no.:			

Occupier:			
Business name:		Type of business:	
*Contact person		*Phone number:	

Device Details:

Protection:	Individual source ☐	Zone ☐	Boundary ☐
Location:			
Manufacturer:		Serial no.:	
Model:		Nominal Size:	mm
Installation correct:	Yes ☐ No ☐	Strainer installed:	Yes ☐ No ☐
Comments on installation:			

Test Details:

	Poppet closed when pressure increased	Poppet opened when pressure decreased
Initial test:	Yes ☐ No ☐	Yes ☐ No ☐
Test after repairs:	Yes ☐ No ☐	Yes ☐ No ☐
Repairs and materials used (if applicable):		
Comments:		

Test Result: **Pass** ☐ **Fail** ☐ Test method:

Tester Details:

Name of tester:		Company name:	
IQP No:		Company address:	
Signature:			
Date of test:			

NOTE: This test report only constitutes an assessment of existing devices and does not mean ALL cross connections on the site have been addressed. Neither does it mean the existing devices are appropriate for the hazard. This must be addressed by an IQP (Survey). Cross connections are a major PUBLIC HEALTH RISK and are the owner's responsibility to ensure they are addressed.

* required entry

NOTES

NOTES