Block D: Drainage Systems

TRU Open Press

Plumbing Apprenticeship Program Level 2 Series

Block D: Drainage Systems

BC Plumbing Apprenticeship, Level 2

SKILLED TRADES BC

BC PIPING ARTICULATION AND CURRICULUM SUBCOMMITTEE; ROD LIDSTONE; AUDREY CURRAN; AND PAUL SIMPSON

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KAMLOOPS

Contents

In the field, there are many similarities or overlaps with the work of plumbers and gas fitters. Many plumbing and heating contractors employ both plumbers and gas fitters as well as tradespeople with dual certifications.

Upon completion of a Plumbing Apprenticeship, a plumber can receive cross-program credit for a portion of the Gas fitter apprenticeship. As such, training in fuel gas has been incorporated into all levels of the Plumbing Apprenticeship.

Block D of the **Plumbing Apprenticeship Program Level 2 Series** focuses on the fundamentals of sanitary and storm drainage systems, providing apprentices with a comprehensive understanding of installation, maintenance, and repair processes. This section equips apprentices with essential skills to handle the complexities of both sanitary and storm drainage systems, ensuring effective installation and upkeep in various settings.

Plumbing Apprenticeship Program Level 2 Series

The *Plumbing Apprenticeship Program Level 2 Series* offers comprehensive training materials designed to build on foundational skills and knowledge. The series is divided into four main blocks, each focusing on critical areas of plumbing systems and installations.

Block A: Fuel Gas Systems (https://a-fuelgas-bcplumbingapprl2.pressbooks.tru.ca/)

A-1: Gas Fired Appliances
A-2: Gas Codes Regulations and Standards
A-3: Gas Appliance and Building Air Requirements
A-4: Technical Instruments and Testers

Block B: Heating and Cooling Systems (https://b-heating-bcplumbingapprl2.pressbooks.tru.ca/)

B-1: Types of Heating and Cooling Systems
B-2: Hydronic Heating and Cooling Generating Equipment
B-3: Hydronic Heat Transfer Units
B-4: Hydronic Heating Piping and Components

Block C: Install Fixtures and Appliances (https://c-plumbfixappliance-bcplumbingapprl2.pressbooks.tru.ca/)

C-1: Plumbing Fixtures and Trim
C-2: Plumbing Appliances

Block D: Drainage Systems (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/)

D-1: Sanitary Drain, Waste and Vent Systems
D-2: Planning and Installation of DWV Systems
D-3: Storm Drainage Systems
D-4: Test and Drainage Systems
D-5: Drainage System Maintenance and Repairs

Plumbing Apprenticeship Program Overview and Upcoming Resources

- **Plumbing Apprenticeship Program Level 1 Series** is coming soon to TRU Open Press in 2025–2026!
- **Plumbing Apprenticeship Program Level 3 Series (https://collection.bccampus.ca/search/?q=%22pl3%22)** can be found in the BCCampus Open Collection (https://collection.bccampus.ca/).
- **Plumbing Apprenticeship Program Level 4 Series** (https://bccampus.ca/projects/archives/zed-cred-z-degrees/ztc-open-educational-resources-for-trades/) can be found in the BCCampus Open Collection. (https://collection.bccampus.ca/) (Block F: Commission and Service will be available soon.)

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The current Standards and Regulation in BC can be obtained at the WorkSafeBC (http://www.worksafebc.com) website: http://www.worksafebc.com

Please note that it is always the responsibility of any person using these materials to inform themselves about the Occupational Health and Safety Regulation pertaining to their areas of work.

Symbol Legend

Important Information

Potentially Toxic/ Poisonous Situation

Required or Optional Resources

Potentially Flammable Situation

Complete a Self-Test

Possibly Explosive Situation

Use Protective Equipment

Potential Electric Shock

Acknowledgments

The development of the *Piping Trades Learning Guides* was a collaborative effort driven by a commitment to excellence in trades education. These guides were created to support apprentices and journeypersons in mastering the skills and knowledge essential to the piping trades. This achievement would not have been possible without the dedication and expertise of *Skilled Trades BC* and the *Piping Trades Articulation Committee*, whose leadership and guidance have been instrumental in shaping high-quality training resources. We extend our sincere gratitude for their contributions and ongoing stewardship in advancing the piping trades.

The Open Press

The Open Press combines TRU's open platforms and expertise in learning design and open resource development to support the creation and reuse of open educational resources, while encouraging open scholarship and research.

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Resources

Content adapted from:

- Open School BC
- Trades Training BC

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References

Skilled Trades BC. (2021). Book 1: Fuel gas systems, Heating and cooling Systems. Plumber apprenticeship program level 2 book 1 Harmonized. Crown Publications: King's Printer for British Columbia.

SkilledTradesBC. (2022, December 1). Introducing Skilled Trades BC. YouTube. https://www.youtube.com/watch?v=OQgwdP0rNog

Trades Training BC. (2021). A-1: Introduction to gas-fired appliances. In: *Plumber Apprenticeship Program: Level 2*. Industry Training Authority, BC.

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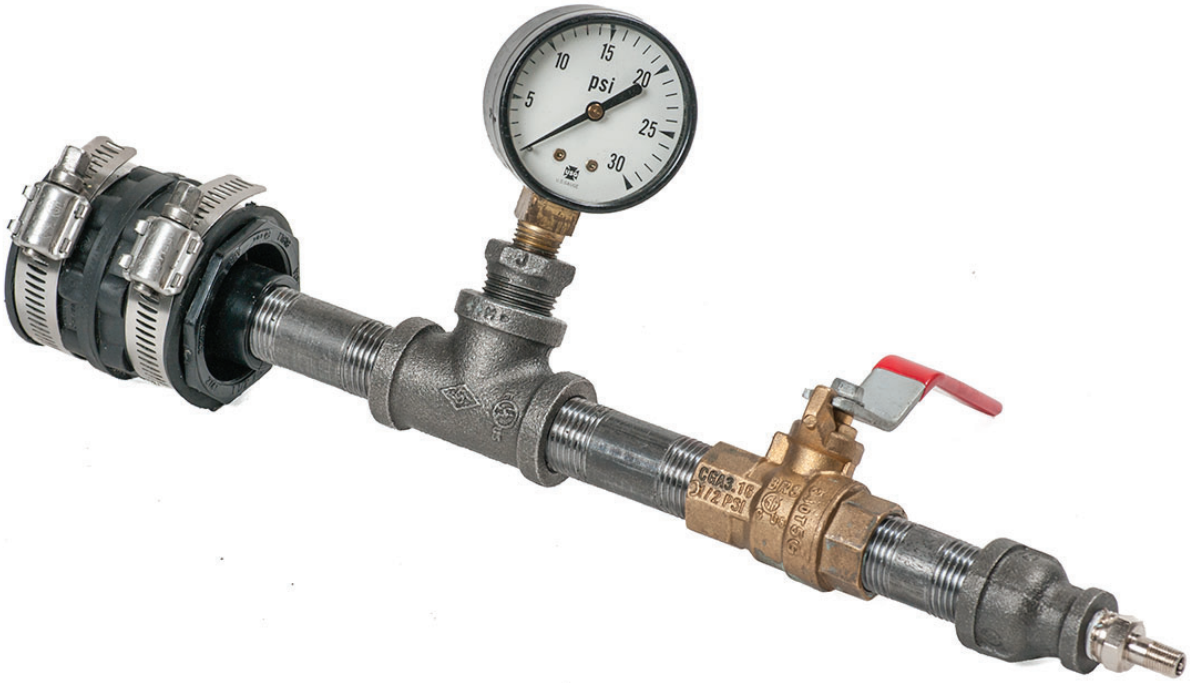
D-4 TEST DRAINAGE SYSTEMS

Plumber Apprenticeship Program – Level 2



D-4 Testing Sanitary and Storm Drainage Systems Introduction

Code requires drain-waste-vent (DWV) pipes to be tested using an acceptable test method. The test must be present on the piping system during inspection. An improperly installed joint in a drainage pipe or vent could allow unsanitary conditions to occur inside a building and allow toxic gases to enter. If an alteration to the system occurs after the test and inspection, the piping system will have to be re-tested and inspected.

Learning Objectives

After completing the chapters in this section, you should be able to:

- Describe code and requirements used to test DWV systems.
- Describe methods used to test DWV systems.

Resources

You will be required to reference the most current National Plumbing Code.

Terminology

The following terms will be used throughout this section. A complete list of terms for this section can be found in the **Glossary**.

- **air pressure test:** A test that checks for leaks by filling pipes with pressurized air and observing if the pressure drops. (Section D-4.1)
- **ball test:** A test that checks for proper slope and obstructions in pipes by rolling a dense ball through the system. (Section D-4.1)
- **final test:** A test performed after fixtures are installed to make sure the whole plumbing system is

working properly and has no leaks. (Section D-4.1)

- **one-time-only test caps:** Disposable caps used to seal pipe openings during leak testing. they are designed for single-use applications and are typically removed and discarded after testing is complete. (Section D-4.2)
- **open centre test plug:** A type of test plug that is used to seal pipes during testing. It has a hole in the middle, so tools can be used to adjust or measure the pressure inside the pipe without taking the plug off. (Section D-4.2)
- **prefabricated system:** A plumbing system or part of a system that is built somewhere else (not at the building site) and then brought in and put into place. (Section D-4.1)
- **propeller-style blower:** A type of fan that blows air to test pipes or systems. The fan blades are connected directly to the motor, and it helps push air through the system to check for leaks. (Section D-4.2)
- **smoke testing:** A method used to detect leaks in a drainage system using thick smoke. The smoke is blown into the pipes, and if it escapes from any area other than the designated openings, it means there's a leak. (Section D-4.2)
- **smoke candle:** A small device that creates smoke when lit. It's used in smoke testing to help find leaks in pipes. When the candle is lit, the smoke is blown into the pipes to see if it escapes anywhere. (Section D-4.2)
- **smoke fluid system:** A machine that creates smoke by turning a special fluid into smoke. This is used in smoke testing to check for leaks in pipes, just like the smoke candle. (Section D-4.2)
- **squirrel-cage blower:** A type of blower that has a round fan inside it, kind of like a hamster wheel, to push air through a system. It can move a lot of air and is good for testing large pipes or systems.
- **test plug:** A device used to seal pipe openings during leak testing. Test plugs come in different types, including inflatable and expansion plugs, and help keep air or water sealed inside the system. (Section D-4.2)
- **water pressure test:** A test that checks for leaks by filling pipes with water and keeping them pressurized for a set amount of time. (Section D-4.1)
- **wye fitting:** A plumbing fitting shaped like a "y" that allows one pipe to join another at a 45-degree angle. it is commonly used to connect branch lines to a main drain line, helping to maintain smooth water flow and reduce clogs. (Section D-4.2)

D-4.1 Drainage System Testing Code Requirements

The regulations set out in the **National Plumbing Code (NPC)** are intended to ensure the quality and functionality of plumbing installations, protect the health of the occupants and the general public, and protect the building structure from damage caused by improper piping installation. As a result of this intent, drainage and venting pipes are required by code to be pressure-tested after the installation of each phase of the project.

The term "**authority having jurisdiction,**" commonly referred to as AHJ, covers a variety of regulating organizations. In the plumbing trade, the most common application is referencing the building official responsible for plumbing code and regulation enforcement.

For the building official, the limits may be the building and plumbing codes adopted by the jurisdiction. Quite often, local AHJ may require a DWV installation to meet bylaws or regulations that address local conditions before they will give approval. Some examples of local regulations could include using piping materials suitable for local soil conditions or burying piping at a certain depth to prevent freezing.

National Plumbing Code Testing Requirements

The NPC has certain requirements for testing DWV systems to ensure uniformity throughout its jurisdiction. Once the piping rough-in has been completed (ground work or above grade), the piping is required to be under a test while being inspected to confirm that there are no leaks as well as to confirm conformance with all other code requirements. The installer is required to notify the plumbing inspector or the administrative authority having jurisdiction over plumbing work before the test is applied.

Concealed work should remain uncovered until the required tests have been done and the work has been inspected. When testing, the system should be properly restrained at all bends, changes of direction, and the end of runs to prevent system failure due to applied test pressures. Follow proper safety procedures and use protective equipment during all testing procedures. Installers should always consider local conditions, codes, manufacturer installation instructions, and architect/engineer instructions in any installation.

The following are required by the NPC.

Testing Drainage Systems

- Except in the case of an external leader, after a section of a drainage system or a venting system has been roughed in, and before any fixture is installed or piping is covered, a water or air pressure test or air pressure test shall be conducted.
- After every fixture is installed and before any part of the drainage system or venting system is placed in operation, a final test shall be carried out when requested.
- Where a **prefabricated system** is assembled off the building site in such a manner that it cannot be inspected and tested on site, off-site inspections and tests shall be conducted.
- Where a prefabricated system is installed as part of a drainage or venting system, all other plumbing work shall be tested and inspected and a final test shall be carried out on the complete system when requested.

- When requested, a ball test shall be made to any pipe in a drainage system.
- Every pipe in a drainage system, except an external leader or fixture outlet pipe, shall be capable of withstanding without leakage a water pressure test, air pressure test, and final test.
- Every pipe in a drainage system shall be capable of meeting a ball test.

Testing Venting Systems

Every venting system shall be capable of withstanding without leakage a water pressure test, air pressure test, and final test.

DWV Tests Types

Testing of pipes in a DWV system is usually done after the rough-in phase by sealing off all trap arms and the building drain using plugs or inflatable balls. Four main tests may be performed on a DWV system:

- Water pressure tests
- Air pressure tests
- Final tests
- Ball tests

Water Pressure Tests

A **water pressure test** consists of applying a water column of at least 3 m (10 ft) to all joints. In making a water pressure test, every opening except the highest shall be tightly closed with a testing plug or screw cap, and the system or section shall be kept filled with water for at least 15 minutes.

Air Pressure Tests

Air pressure tests shall be conducted in accordance with the manufacturer's instructions for each piping material. Air shall be forced into the system until a pressure of 35 kPa (5 psig) is created, and this pressure shall be maintained for at least 15 minutes without a drop in pressure.

Final Tests

Where a **final test** is requested and made, every trap shall be filled with water, and the bottom of the system being tested shall terminate at a building trap, test plug, or cap. Smoke from smoke-generating machines shall be forced into the system, and when the smoke appears from all roof terminals, they shall be closed. A pressure equivalent to a 25 mm (1 in.) water column shall be maintained for 15 minutes without the addition of more smoke.

The smoke may be omitted, provided that the roof terminals are closed and the system is subjected to an air pressure equivalent to a 25 mm water column maintained for 15 minutes without the addition of more air.

Ball Tests

Where a **ball test** is conducted, a hard ball dense enough not to float shall be rolled through the pipe. The diameter of the ball shall be not less than 50 mm (2 in.) where the size of the pipe is 75 mm (3 in.) or more or 25 mm where the size of the pipe is less than 75 mm.

Self-Test D-4.1: Drainage System Testing Code Requirements

Complete Self-Test D-4.1 and check your answers.

If you are using a printed copy, please find Self-Test D-4.1 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=87#h5p-32 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=87#h5p-32)

References

Skilled Trades BC. (2021). *Book 2: Install fixtures and appliances, install sanitary and storm drainage systems.* Plumber apprenticeship program level 2 book 2 (Harmonized). Crown Publications: King's Printer for British Columbia.

Trades Training BC. (2021). D-4: Test sanitary and storm drainage systems. In: *Plumber Apprenticeship Program: Level 2.* Industry Training Authority, BC.

D-4.2 Testing Methods

Safety is of paramount importance when conducting leak tests. Even at relatively low internal pressures, leak testing can generate very high forces that can be dangerous if suddenly released by the failure of a joint, system component, or testing component. Air testing is inherently more dangerous than water testing, since air is highly compressible and expands quickly when pressure is released. If high air pressure is used, this expansion can be violent.

Always take safety precautions, such as the following, when conducting leak tests:

- Install all test plugs in a manner that prevents blowouts. Restrain pipe, components, and test equipment from moving in the event of a failure.
- Ensure that all air pressurizing equipment used for testing includes a regulator or relief valve set no higher than 63 kPa (9 psi) to avoid over-pressurizing.
- Keep people not involved in testing a safe distance away while testing.
- General safety instructions for inflatable test plug usage:
    - Read and understand the safety instruction sheet before using a test plug.
    - Always wear PPE.
    - Do not enter the safety zone when test plugs are under pressure.
    - Measure the pipe diameter accurately before selecting a test plug.
    - Never use a test plug in a pipe size different from the recommended usage range.
    - Always inflate the test plug to the recommended pressure shown on the plug.

Test Equipment

Different test equipment will be required depending on the type of DWV test that will be performed.

Test Plugs

Whether the test is by water, air, or smoke, all openings in the test section must be sealed. **Test plugs** are often used in the industry because they may be used repeatedly and are, therefore, cheaper than **one-time-only test caps**. Test plugs are available in a number of configurations, such as inflatable for use in a line cleanout or inflatable for use in a **wye fitting** (Figure 1).

Figure 1 *Left: Inflatable test plug for use in a line cleanout; Right: Inflatable test plug for use in wye cleanouts. (Skilled Trades BC, 2021) Used with permission.*

When sealing open pipe and fitting hubs for testing, you may use an expansion plug. These devices are not inflatable but use the expansion of a rubber sleeve to provide a seal. The expansion plug is inserted in the opening and tightened by hand or a smooth-faced wrench (Figure 2).

Figure 2 *Hand-tightened expansion-type test plug. (Skilled Trades BC, 2021) Used with permission.*

Water Pressure Tester

A **water pressure tester** allows you to introduce and measure the water pressure in a plumbing system. Used in conjunction with **open centre test plugs**, it allows access to the DWV system without cutting lines or creating leaky threaded joints (Figure 3).

Figure 3 *Open centre test plug. (Skilled Trades BC, 2021) Used with permission.*

Air Pressure Test Equipment

Another acceptable method for testing drainage and venting is an **air pressure test**. This is recommended if testing must be done in sub-zero temperatures or over water-sensitive areas, such as computer labs, hospital operating theatres, and rooms containing archives. Although these situations are rare to most installers, air tests have been employed when testing DWV systems in similar environments. As with a water test, the entire system or section you are testing must be completely sealed with airtight test plugs. The air pressure may be introduced into the system with a compressor, provided that a properly calibrated regulator is installed.

The air pressure may be introduced and recorded through a pressure gauge and Schrader valve combination (Figure 4).

A shop-built pressure testing assembly can be added to the drainage system. Pressure is applied through the Schrader valve, then the ball valve is closed. The system should hold pressure for 15 minutes at 5 psig when tested.

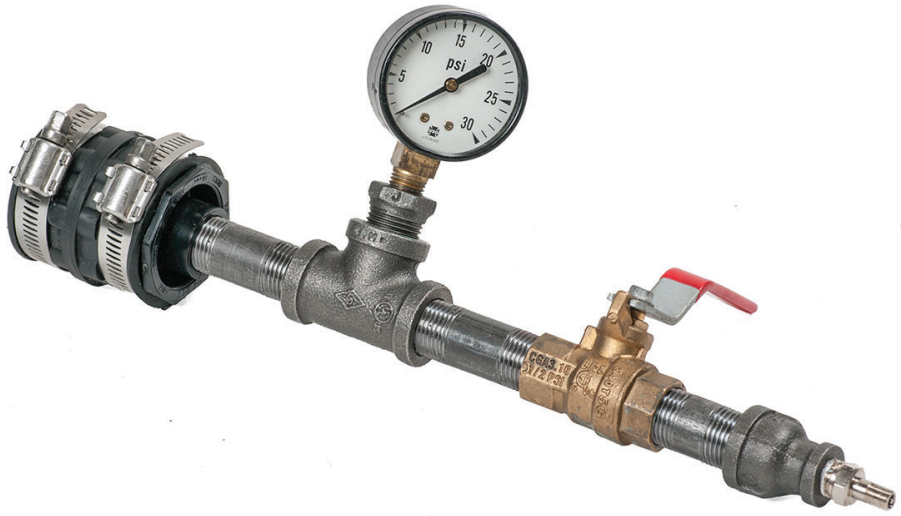


Figure 4 *Pressure testing assembly for DWV pipe. (Skilled Trades BC, 2021) Used with permission.*

Smoke Test Equipment

Smoke testing requires the use of a blower and a controlled smoke source.

Blowers

The NPC requirements for smoke testing identify a static pressure of a 25 mm (1 in.) water column. This requires the use of a blower capable of producing the test pressure. Two types of blowers are available for smoke testing DWV systems:

- Squirrel cage
- Direct-drive propeller

Squirrel-cage blowers are generally larger and can provide more static pressure in relation to CFM output. The output of the squirrel-cage type is usually adjustable by alternating pulleys and belts to meet the demands of the job.

Propeller-style blowers are usually more compact, and the output is not adjustable since the fan blade is attached directly to the engine shaft.

Smoke Sources

Two types of smoke sources are currently offered for smoke testing DWV systems:

- Smoke candles
- Smoke fluids

To use a **smoke candle**, simply place one on the fresh air intake side of the blower. Once the candle has been ignited, the exiting smoke is drawn in with the fresh air and blown down into the system. This type of smoke is formed by a chemical reaction and has a high atmospheric moisture content. It is very visible even at low concentrations and extremely effective at finding leaks.

A **smoke fluid system** involves injecting a smoke fluid (usually a petroleum-based product) into a heating chamber, such as the engine exhaust muffler of a portable blower engine (Figure 5). The smoke is then exhausted into the fresh air intake side of the blower. Smoke fluids do not consistently provide the same quality of smoke because as fluid is injected into the heating chamber, it immediately begins to cool the heating surface. The heating chamber will eventually reach a point where it is not hot enough to completely convert all the fluid to smoke, and it will then produce thin, wet smoke that is difficult to see. This can happen quickly, depending on the rate of fluid flow. Some manufacturers have taken steps to address this issue and now offer insulated heating chambers to help maintain necessary temperatures.

Figure 5 *Smoke testing machine for DWV pipe using liquefied smoke. (Kingscote Chemicals, n.d.). Used with permission.*

DWV Test Procedures

Test procedures vary with the type of test needed for the installation.

Water Test

A water or hydrostatic test is the most common test used to inspect a DWV installation. This is the recommended test in most plumbing codes, weather permitting. Before starting the test, all bends, changes of direction, and ends of runs should be properly restrained. Cap or plug all openings in the lower part of the section to be tested. Fill the system to be

tested with water at the highest point, if available. If this is not possible due to job-site conditions, use an open centre test plug.

Filling the system slowly should allow any air in the system to escape as the water rises in the vertical pipe. All air entrapped in the system should be expelled prior to beginning the test. Failure to remove entrapped air may give faulty test results. Once the piping has been filled to 3 m (10 ft) of head, the section being tested should be visually inspected for leaks. If leaks are found, drain the system, disassemble the joints, and check for proper installation. Once you have successfully tested the system, drain it and prepare the next section for testing.

In single-family houses, an adapter with a hose bib is commonly attached to a trap arm. Water is fed through a hose connected to the bibb, and the system is filled until water spills from the roof vent. This method eliminates the need to get a hose into the open vent on the roof, which would have created issues with fall arrest procedures.

Air Test

Prior to performing the air test, all threaded openings shall be sealed with a manufacturer's recommended sealant. All additional openings should be sealed using test plugs recommended for use in performing air testing. It is important to note that manufacturers of cast-iron soil pipe and fittings joined with rubber compression joints or MJ couplings expect to have a reduction in air pressure during a 15-minute test. This drop in air pressure does not indicate a failure of the system or that the system will leak water. The reduction occurs because air molecules are much smaller than water molecules and can escape through microscopic perforations in the pipe wall formed during the casting process.

However, a reduction of more than 7 kPa (1 psi) during the test period indicates a failure of the test. The system shall be pressurized to 35 kPa (5 psig) using a gauge graduated preferably to not more than three times the test pressure. Upon completion of the test, depressurize the system and remove the test plugs.

Smoke Test

When a system has been completely installed with some sections obscured from view, a smoke test may be required by engineers, architects, or plumbing codes to find leaks in the piping. The test is applied to all the parts of the drainage and venting system after all fixtures have been permanently connected and all traps have been filled with water. A thick, penetrating smoke produced by one or more smoke machines is introduced into the bottom of the system through a suitable opening. As the smoke appears at the stack opening on the roof, the opening is closed off and the introduction of smoke is continued until a pressure equal to 25 mm (1 in.) of water is built up and maintained for 15 minutes without the addition of more smoke. Under this pressure, smoke should not be visible at any point, connection, or fixture. To eliminate drafts, all windows in the building should be closed until the test has been completed.

Ball Test

A ball test does not check for leaks but instead ensures the drainage pipes have a proper grade. The local plumbing inspector may exercise discretion and insert a ball into a fitting to check for an adequate grade; if all is well, the ball will make it to the bottom point, which is normally a cleanout.

Duration

A DWV system undergoing pressure testing using an approved method and procedure shall withstand the test pressure for 15 minutes while the plumbing inspector is present.

Inspection

Upon completion of the roughed-in piping installation, the piping of plumbing drainage and venting systems shall be tested by water or air to prove it is watertight. The inspector's job is to make sure that the testing of the DWV system follows the plumbing code requirements. The inspector may require the removal of any cleanout plugs to determine if the pressure has reached all parts of the system.

During the construction of any project, large or small, the DWV test will be witnessed and signed off by the AHJ upon satisfactory completion of each phase. The plumbing contractor should record and maintain detailed inspection and testing data showing the date, time, and names of people participating in the inspection and testing.

Documentation

It is safe to say that the DWV system is an important part of the building design and function, which is why the final plumbing installation must be inspected before calling for the final building inspection. Once the plumbing and other individual disciplines have substantially completed their work, a certificate of occupancy may be issued.

A certificate of occupancy is a document issued by a local government agency or building department certifying a building's compliance with applicable building codes and other laws and indicating that it is in a condition suitable for occupancy. The procedure and requirements for the certificate vary widely from jurisdiction to jurisdiction and with the type of structure. Some projects may require certification from the installer that the plumbing system functions according to the approved design.

Self-Test D-4.2: Testing Methods

Complete Self-Test D-4.2 and check your answers.

If you are using a printed copy, please find Self-Test D-4.2 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=89#h5p-33 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=89#h5p-33)

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Skilled Trades BC. (2021). *Book 2: Install fixtures and appliances, install sanitary and storm drainage systems.* Plumber apprenticeship program level 2 book 2 (Harmonized). Crown Publications: King's Printer for British Columbia.

Trades Training BC. (2021). D-4: Test sanitary and storm drainage systems. In: *Plumber Apprenticeship Program: Level 2.* Industry Training Authority, BC.

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- **Figure 5** M-45 Plumbing Kit from ©Kingscote Chemicals [A division of Kingscote Industries] (n.d.) is used with permission.

Self-Test D-4.1 Drainage System Testing Code Requirements

Complete Self-Test D-4.1 and check your answers.

1. For what period of time shall a drainage or venting system hold a water test before it is passed by the inspector?
    a. 15 min
    b. 20 min
    c. 25 min
    d. 30 min

2. What pressure shall drainage or venting systems hold during an air test?
    a. 15 kPa (2 psig)
    b. 21 kPa (3 psig)
    c. 35 kPa (5 psig)
    d. 56 kPa (8 psig)

3. During a ball test, what size ball shall a 3 in. drain be able to pass before the inspector accepts the installation?
    a. 75 mm
    b. 50 mm
    c. 38 mm
    d. 62 mm

4. The final test of a plumbing system is performed after all of the fixtures are installed and put into operation.
    a. True
    b. False

5. When testing drainage and venting installation for leaks with water (water pressure test), the pipe must be fitted with a standpipe for the introduction and observation of test water. What is the minimum height requirement for such a standpipe?
    a. 1.5 m
    b. 2 m
    c. 3 m
    d. 4 m

6. In certain instances, a code official may require a final test on the DWV system. The substance used will be either smoke or 25 mm air pressure.
    a. True
    b. False

Answer Key: Self-Test D-4.1 (#chapter-answer-key-self-test-d-4-1) is on the next page.

Answer Key: Self-Test D-4.1

1. a. 15 min
2. c. 35 kPa (5 psig)
3. b. 50 mm
4. b. False
5. c. 3 m
6. a. True

Self-Test D-4.2 Testing Methods

Complete Self-Test D-4.2 and check your answers.

1. Which of the following test methods for DWV piping is potentially more dangerous to the personnel conducting the test in the event of component failure?
    a. Air test
    b. Water test
    c. Smoke test
    d. Ball test

2. When conducting a 35 kPa (5 psig) air test on a DWV system, what is the maximum setpoint of the pressure regulator used to control test pressure?
    a. 35 kPa (5 psig)
    b. 49 kPa (7 psig)
    c. 63 kPa (9 psig)
    d. 77 kPa (11 psig)

3. What is the main advantage of using test plugs as opposed to glue- or solder-in-place test caps?
    a. The test plugs are less expensive.
    b. The test plugs can be used repeatedly.
    c. A single test plug will fit any size pipe.
    d. Test plugs will never leak once in place.

4. What is the most important test component that must be employed when conducting a DWV air test using compressed gas?
    a. Reliable hand pump as a backup
    b. Properly calibrated regulator
    c. High-pressure-rated test plugs
    d. Inert gas

5. Which testing component is typically employed when conducting a water test on a section of DWV piping where there is not an opening provided on the top of the system to introduce the water?
    a. Saddle fitting
    b. Test hub
    c. Open centre test plug
    d. Test spigot

6. When the AHJ requires a smoke test to be performed, how is the smoke introduced into the DWV system?
    a. Blower
    b. Compressed smoke cylinder

c. Gravity
d. Smoke bomb placed in the main sewer cleanout

7. In which of the two available styles of smoke test blowers is it easier to adjust the output in order to meet job conditions?
   a. Squirrel cage
   b. Direct-drive propeller

8. Where is a smoke candle placed in relation to the test blower when introducing the smoke into the system under test?
   a. At the blower exhaust
   b. At the blower intake
   c. Inside the blower housing
   d. In the piping cleanout

9. Which of the two types of smoke supplies used in DWV testing is more effective in producing a visible indicator of a system leak?
   a. Smoke candle
   b. Smoke fluid

10. Why do cast-iron soil pipe systems sometimes experience a drop in pressure when under an air test but do not show leakage when under a water test?
    a. MJ clamps are not meant to hold against static pressure above 1 in. wc.
    b. Water molecules bind together and seal pipe perforations.
    c. Air molecules are smaller than water molecules and sometimes escape through pipe perforations.
    d. Air molecules are lighter than water molecules and sometimes escape through the top of the system.

11. What is the maximum drop in air pressure expected by manufacturers of cast-iron soil pipe before they consider the piping system faulty?
    a. 7 kPa (1 psig)
    b. 14 kPa (2 psig)
    c. 21 kPa (3 psig)
    d. 28 kPa (4 psig)

12. What is the maximum preferred gauge scale for use when air testing a DWV system?
    a. Equal to test pressure
    b. Twice the test pressure
    c. Triple the test pressure
    d. Quadruple the test pressure

13. When performing a smoke test on a DWV system, what must the system traps be?

a. Not installed
b. Installed and inlets plugged
c. Installed and filled with water
d. Installed and inlets vented to atmosphere to verify the presence of test smoke

14. What does a ball test verify?

a. Pipe alignment
b. Pipe grade
c. That no concentric reducing fittings are used downstream
d. That no eccentric reducing fittings are used downstream

15. Which certificate does the local building department issue to indicate that a building is safe to inhabit?

a. Plumbing final inspection report
b. Electrical final inspection report
c. All trade disciplines' final inspection reports
d. Certificate of occupancy

Answer Key: Self-Test D-4.2 (#chapter-answer-key-self-test-d-4-2) is on the next page.

Answer Key: Self-Test D-4.2

1. a. Air test
2. c. 63 kPa (9 psig)
3. b. The test plugs can be used repeatedly.
4. b. Properly calibrated regulator
5. c. Open-centre test plug
6. a. Blower
7. a. Squirrel cage
8. b. At the blower intake
9. a. Smoke candle
10. c. Air molecules are smaller than water molecules and sometimes escape through pipe perforations.
11. a. 7 kPa (1 psig)
12. c. Triple the test pressure
13. c. Installed and filled with water.
14. b. Pipe grade
15. d. a certificate of occupancy

Plumbing Apprenticeship & Trade Resources in BC

A successful career in plumbing requires a strong foundation of skills, knowledge, and workplace safety awareness. Below are key resources to support plumbing apprentices in BC, including educational pathways, trade certifications, workplace safety guidelines, and mental health and wellness support.

Plumbing Apprenticeship & Certification Resources

- **SkilledTradesBC – Plumbing Apprenticeship (https://skilledtradesbc.ca/plumber)** — Overview of plumbing training, certification requirements, and apprenticeship pathways in British Columbia.
- **Red Seal Program – Plumber (https://www.red-seal.ca/eng/trades/plumbers/overview.shtml)** — National certification program with exam prep guides and trade mobility information.
- **BC Building Codes & Standards (https://www.bccodes.ca/)** — Official building and plumbing codes for British Columbia.

Workplace Safety & Regulations

- **WorkSafeBC (https://www.worksafebc.com/en)** — Essential safety resources for plumbers, including:
  - Health & Safety – WorkSafeBC (https://www.worksafebc.com/en/health-safety)
  - Report Unsafe Working Conditions (https://www.worksafebc.com/en/contact-us/departments-and-services/health-safety-prevention)
  - Report a Workplace Injury or Disease (https://www.worksafebc.com/en/claims/report-workplace-injury-illness)
  - Submit a Notice of Project Form (https://www.worksafebc.com/en/for-employers/just-for-you/submit-notice-project)
  - Get Health and Safety Resources (Videos, Posters, Publications, and More) (https://www.worksafebc.com/en/resources-health-safety)
  - Search the OHS Regulations (and Related Materials) (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation)
  - Conduct an Incident Investigation (https://www.worksafebc.com/en/health-safety/create-manage/incident-investigations/conducting-employer-investigation)
- **CCOHS: OHS Answers Fact Sheets – Plumber (https://www.ccohs.ca/oshanswers/occup_workplace/plumber.html)** — Safety guidelines and best practices for plumbers in various work environments.

Financial Supports

- **Financial Support (SkilledTradesBC)** (https://skilledtradesbc.ca/financial-support) — Information about grants, tax credits, Canada apprentice loans, employment insurance, and the Indigenous Skills and Employment Training

(ISET) program.
- **StudentAidBC (https://studentaidbc.ca/)** — Complete post-secondary education through student loans, grants, and scholarships. There is also programs that help with loan repayment.
- **WorkBC (Government of BC)** (https://www.workbc.ca/find-loans-and-grants/students-and-adult-learners/services-apprentices-and-employers) — Services for apprentices and employers.

Mental Health & Wellness Support

- **HealthLink BC – Mental Health and Substance Use** (https://www.healthlinkbc.ca/mental-health-and-substance-use) — HealthLink BC resources for mental health and wellness support.
- **Here2Talk** (https://here2talk.ca/) — Free and confidential counseling services available to all post-secondary students registered at a BC school.
- **Help Starts Here** (https://helpstartshere.gov.bc.ca/) — A database with over 2,500 listings of services related to mental health and substance use supports.
- **Hope for Wellness Helpline** (https://www.hopeforwellness.ca/) — 24/7 online chat and phone line with experienced and culturally competent counselors available to all Indigenous people in Canada.
    - First Nations Health Authority Mental Health Supports Info Sheet [PDF] (https://www.fnha.ca/Documents/FNHA-mental-health-and-wellness-supports-for-indigenous-people.pdf) by First Nations health Authority — List of culturally safe services for Indigenous people.
- **HeretoHelp – BC** (https://www.heretohelp.bc.ca/) — Mental health resources, including videos, articles, and support services in BC.
- **BC Construction Industry Rehabilitation Plan** (https://www.constructionrehabplan.com/) — Mental health and substance use services for CLRA and BCBT members and their families.
- **Virtual Mental Health Supports (Government of BC)** (https://www2.gov.bc.ca/gov/content/health/managing-your-health/mental-health-substance-use/virtual-mental-health-supports) — Virtual services are available for British Columbians who are experiencing anxiety, depression, or other mental health challenges.

Crisis Support

- **Interior Crisis Line Network** — Call 1-888-353-2273 (tel:+1-888-353-2273) for 24/7 emotional support, crisis intervention, and community resource information.
- **Talk Suicide Chat Service** (https://talksuicide.ca/) — An alternative if calling is difficult; available for crisis intervention.
- **310Mental Health Support** — Call 250-310-6789 (tel:+1-250-310-6789) for emotional support, information, and resources specific to mental health.
- **1-800-SUICIDE** — Call 1-800-784-2433 (tel:+1-800-784-2433) if you are experiencing feelings of distress or despair, including thoughts of suicide.
- **Opioid Treatment Access Line** — Call 1-833-804-8111 (tel:+1-833-804-8111) between 9 am and 4 pm to connect with a doctor, nurse, or healthcare worker who can prescribe opioid treatment medication that same day.
- **KUU-US Crisis Response Service** — Call 1-800-588-8717 (tel:+1-800-588-8717) for culturally-aware crisis support for Indigenous peoples in BC.
- **Alcohol and Drug Information and Referral Service** — Call 1-800-663-1441 (tel:+1-800-663-1441) to find resources and support.

Emergency Services — For life-threatening situations, call 911 or visit your nearest emergency department.

Version History

This page provides a record of changes made to this learning resource, Plumbing Apprenticeship Level 2, Block D (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/). Each update increases the version number by 0.1. The most recent version is reflected in the exported files for this resource.

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Version	Date	Change	Details
1.0	September, 2025	Plumbing Apprenticeship Level 2 Block D learning resource from STBC content converted to open and freely accessible digital platform and published at TRU.	Published in September 2025; and released October 2025 by TRU Open Press.
1.01	November 24, 2025	Updates to Figures in D-1.10 and Figures and Answer key for Self-test D-1.8.	Figure 20 (D-1.10) – measurements removed; Figures 2P-28 and 2P-35 (Self-test D-1.8) – measurement and labels changed, Table 8 Answers key adjusted for H and I (Self-test D-1.8)