

Block D: Drainage Systems



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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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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Safety Advisory

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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Starting December 1, 2022, Industry Training Authority was officially renamed to SkilledTradesBC. Hear more in this video from SkilledTradesBC CEO, Shelley Gray, on what this means for the trades industry and British Columbians. Closed captioning and transcripts are available with this video, Introducing Skilled Trades BC (<https://www.youtube.com/watch?v=OQgwdP0rNog>) (2022) on YouTube.



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References

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D-5 DRAINAGE SYSTEM MAINTENANCE AND REPAIRS

Plumber Apprenticeship Program – Level 2



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D-5 Maintaining and Repairing Sanitary and Storm Drainage Systems Introduction

Household, commercial, and industrial drains are subject to a variety of materials that can cause stoppages in the drainage system. Maintenance and repair of drainage systems is critical to proper flow of waste and rainwater.

Learning Objectives

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

- Explain the use of drain-cleaning equipment.



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**.

- **auger head:** An attachment fitted to the end of a drill rod or casing, designed to bore into the ground and remove soil or sediment during well installation. (Section D-5.1)
- **closet auger:** A special tool, named after the water closet, used to unclog toilets. It has a long, flexible rod with a spiral end that you insert into the toilet drain. When you turn the handle, the spiral helps break up or remove the blockage. (Section D-5.1)
- **combustible gas indicator (CGI):** A tool that helps workers find dangerous gases in the air that could catch fire or explode. It keeps people safe by warning them when gas levels are too high. (Section D-5.1)
- **cross bore:** A cross bore happens when one underground pipe accidentally goes through another pipe.

For example, a new pipe might be drilled through a sewer pipe by mistake. This can be dangerous and cause clogs or leaks, so workers check carefully to make sure pipes don't cross like this. (Section D-5.1)

- **digital pipe locator:**
- **drain auger:**
- **hand auger:** A tool used to dig small holes in the ground. It has a long handle and a sharp, spiral bit at the end that you twist into the soil to make the hole. It's used for tasks like planting trees or installing posts. (Section D-5.1)
- **interface probe:** A portable electronic device used to detect the presence and thickness of non-aqueous phase liquids (NAPLs) such as oil floating on groundwater, by distinguishing between water and other fluids. (Section D-5.1)
- **lockable well cap:** A secure, often tamper-proof cap placed on top of a monitoring well casing to prevent contamination or unauthorized access. (Section D-5.1)
- **multi-parameter sonde:** A multi-sensor probe used for in situ water quality monitoring, capable of simultaneously measuring variables such as temperature, dissolved oxygen, pH, turbidity, and conductivity. (Section D-5.1)
- **piezometer:** A type of well designed specifically to measure groundwater pressure or hydraulic head at a specific depth within an aquifer. (Section D-5.1)
- **power drum auger:** A machine used to clear blockages in sewer pipes. It has a long, flexible metal cable stored in a drum (a round container) that spins to push the cable through the pipe. A cutting tool on the end helps break up clogs. Large diameter augers are used for big pipes, and small diameter augers are used for smaller household pipes. (Section D-5.1)
- **pressure transducer:** A device that converts pressure measurements (such as water level) into electrical signals, commonly used to monitor changes in groundwater elevation over time. (Section D-5.1)
- **radio transmitter:** A device that sends out signals through the air, like a radio station sending music or a walkie-talkie sending messages. It turns electrical signals into radio waves that can travel through the air to other devices, like radios or phones, that can receive and play the signals. (Section D-5.1)
- **riser pipe:** A vertical pipe that extends from the screened section of a well or piezometer to the surface, allowing access for sampling or measurement instruments. (Section D-5.1)
- **screen:** (well screen); A perforated section of a well casing that allows groundwater to enter the well while keeping out sediment. (Section D-5.1)
- **submersible pump:** An electric pump that operates while submerged in groundwater, commonly used to purge wells or collect samples during groundwater monitoring. (Section D-5.1)
- **top cap:** A protective cover placed on the top of a monitoring well casing, often used in addition to a lockable well cap. (Section D-5.1)
- **tubing:** Flexible plastic or rubber piping used to convey water from a well to sampling equipment, available in various diameters and materials depending on chemical compatibility. (Section D-5.1)
- **Waterloo APS:** The Waterloo Advanced Profiling System (APS), a high-resolution system used to collect groundwater samples and measure hydraulic conductivity at multiple depths within a single borehole. (Section D-5.1)
- **well casing:** A rigid pipe, usually made of PVC or stainless steel, that lines the borehole of a well to maintain its structure and isolate screened intervals. (Section D-5.1)
- **well development:** The process of cleaning and stabilizing a newly installed monitoring well by removing fine sediments and ensuring good hydraulic connection between the well screen and surrounding aquifer. (Section D-5.1)

D-5.1 Drain Cleaning

Safety Precautions When Drain Cleaning

Using drain-cleaning equipment safely and effectively requires service personnel to wear personal protective equipment (PPE) while working on sewer or drain lines. Two important safety items essential to drain cleaning are:

- Safety glasses or goggles with side shields
- Gloves

Eye protection is an important safeguard against flying solid objects or pathogenic liquids, which can become airborne when, for instance, the tension on a cable is suddenly released. Gloves protect a technician's hands from sharp objects and are especially important for the hand that guides the cable into and out of the drain. The sudden release of a stoppage can cause the cable to spin rapidly enough to burn or cut bare hands.



Drains and sewers can carry bacteria and other infectious micro-organisms or materials that can cause death or severe illness. Avoid exposing eyes, nose, mouth, ears, hands, cuts, and abrasions to wastewater or other potentially infectious materials during drain and sewer cleaning operations.

Service personnel also need to be aware of the risks presented by ponding water from backed-up drains. One good safety practice is to stand on boards or a solid pallet to prevent electrical shock from grounding through water. As with any power tool, always check the safety features provided by the manufacturer before taking the equipment to the job site.

Since drain cleaners can suddenly hit blocks or stoppages, you should never force them through the blockage. The best practice is to use short forward and reverse movements of the cable to prevent jamming and breakage.

The cable drum should be cleaned before it is returned to storage because bacteria and pathogens can be transferred during handling, even after the job has been completed.

Cross Bores

To help minimize sidewalk and landscaping damage, new service lines — such as gas, electric, and cable TV — are usually installed by drilling holes horizontally beneath the ground. A “**cross bore**” is when the new pipe or cable accidentally goes through another underground pipe or cable (Figure 1).

A clogged sewer line may result from a cross bore with a gas line. Many explosions and deaths have occurred when a drain auger has ripped through a plastic gas line that has been drilled through a building sewer and caused a blockage.

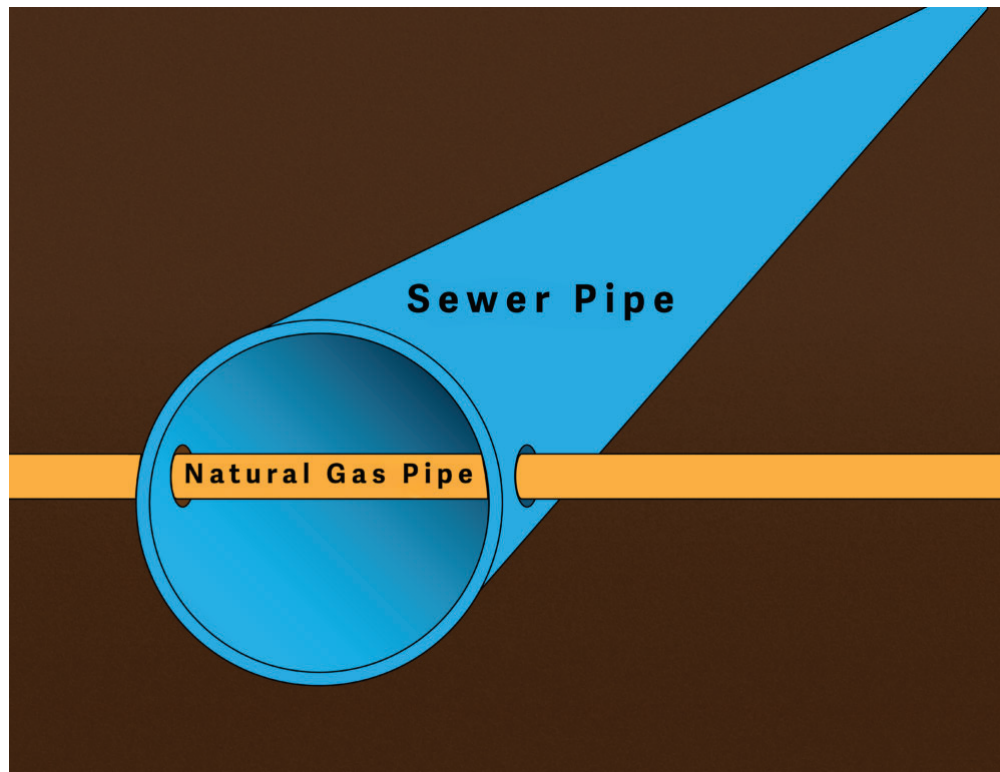


Figure 1 Gas pipeline cross bore. (Skilled Trades BC, 2021) Used with permission.

A drain auger — when sent down the sewer to clear a blockage often thought to have been caused by root penetration — will easily tear through the HDPE line, causing high-pressure gas to exit the sewer downstream of that point as well as upstream toward the auger's operator. Fires and explosions are the most common result, with property damage being the least of the outcomes.

Before clearing and underground drains, you should:

- Look for trees or landscaping that could possibly be causing an obstruction.
- Ask the resident if there has been any recent utility work in the area.
- Use an in-line video inspection device to better assess the blockage.

During the cleaning, you should:

- Clear without a cutting tool. Use minimally invasive equipment, such as a plumbing snake or water jet, to attempt to clear the blockage.
- Feel for obstructions that do not seem to resemble tree roots or other common obstructions as the tool moves through the sewer line.

After you finish, you should:

- Check the blades for yellow or orange plastic when it is withdrawn from the sewer line. Natural gas utility lines are typically made of these colours of plastic.

- Watch for bubbles caused by natural gas escaping from the toilet or other entry point of the cutting equipment. If bubbles or gas are found to be escaping from the entry point of the cutting equipment, IMMEDIATELY exit the structure. In such cases, warn all inhabitants as well.
- Inspect the area with a **Combustible Gas Indicator (CGI)** or other gas-detection equipment, if available.

Video Inspection Equipment

Video inspection equipment uses a remote video camera to inspect underground sewers and drains. If a stoppage is due to a suspected cross bore, video inspection should be attempted first; however, the video image is rarely of good quality when viewing through the sludge at a blockage. If determined to be safe to do so, the drain is typically cleared first using a cleaning auger before being visually inspected.

A video inspection provides an excellent way to detect and locate obstructions or damage that impedes or stops the flow of drainage lines. Video inspections can detect common problems such as:

- Root-bound drainage lines
- Pipe collapse and cracks
- Running inline traps
- Negative grade sloping
- Pipe sagging
- Offset joints
- Sludge buildup

The video camera equipped with LED lighting is “pushed” down the drain or sewer line from a reel on the surface that is connected to a recording monitor (Figure 2). The plumber receives the closed-circuit live picture and views it on a monitor as the video records to a flash drive or DVD archive for future reference.

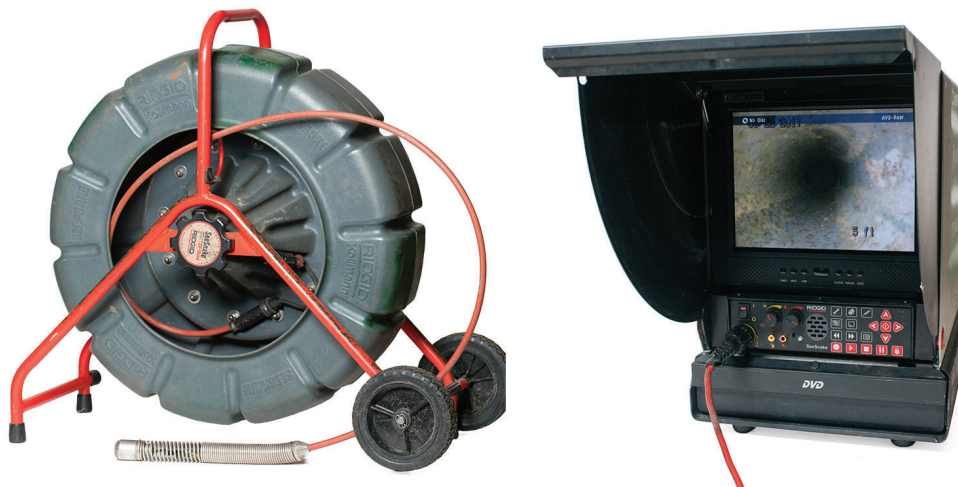


Figure 2 Left: Digital recording camera reel; Right: Digital recording monitor. (Skilled Trades BC, 2021) Used with permission.

Pipe Locators

On some models of video inspection equipment, the camera is equipped with a **radio transmitter** (Figure 3). The camera/transmitter assembly sends a signal to a receiver on the ground surface indicating the camera location and depth of burial. This information can be vital if the line has to be excavated and repaired.



Figure 3 Digital pipe locator used with a video inspection system. (Skilled Trades BC, 2021) Used with permission.

Drain Augers

A drain auger is typically a long, flexible metal cable that rotates in a circular motion and is powered by an electric motor or by hand. On some models, the tool that attaches to the end can be changed to meet specific job requirements. The drain auger is inserted into a drain and rotated until it reaches the obstruction. The auger then breaks through and retrieves or reduces the obstruction so the drain can flow freely.

There are several different types of drain augers for home and commercial use:

- Hand auger
- Closet auger
- Power drum auger for small-diameter piping
- Power drum auger for large-diameter piping

Hand Auger

The **hand auger** uses a drum to contain the cable and keep it from tangling and kinking while being rotated by hand (Figure 4). These tools are useful for clearing small-diameter sink and bathtub drains (up to 2 in. NPS) when the obstruction has yet to solidify. Do not attempt to send this auger through toilet bowls because the exposed wire cable might damage the porcelain finish. Also, due to the large bowl passageway and the cable's small diameter, the cable can become tangled when rotated.

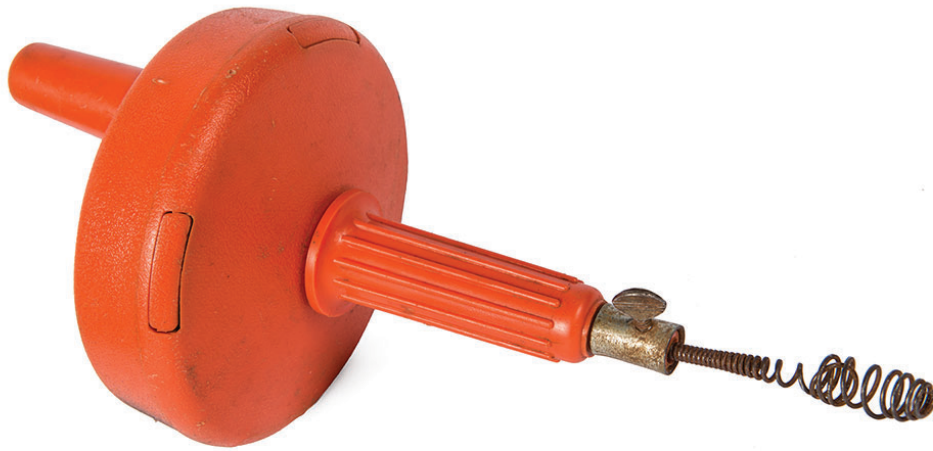


Figure 4 Hand-operated drain auger. (Skilled Trades BC, 2021) Used with permission.

Some hand augers can be attached to an electric drill, giving it more power to force it through the clog while also making it easier for the operator to use (Figure 5).



Figure 5 Drain auger powered by an electric drill. (Skilled Trades BC, 2021) Used with permission.

Closet Auger

The **closet auger**, named after the water closet, feeds a relatively short cable through a hook-shaped length of metal tubing (Figure 6). The hook shape makes it easier to feed the cable into a toilet. A plastic boot on the end of the cable protects the finish of the visible porcelain. Since most toilet clogs occur in the integral trap, the short cable is sufficient to break up or retrieve most clogs.

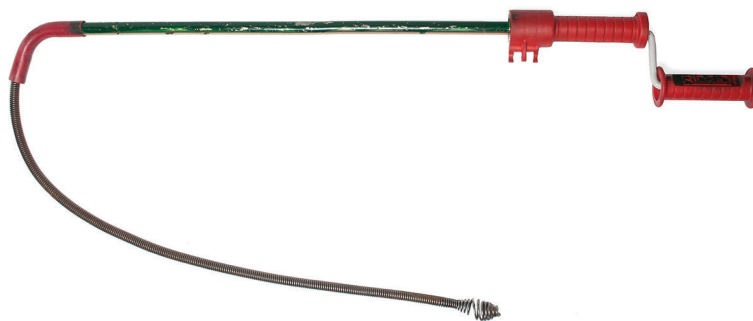


Figure 6 Water closet drain auger. (Skilled Trades BC, 2021) Used with permission.

Power Drum Augers (Small-Diameter Piping)

This power auger consists of a drum containing a length of cable (15 m/50 ft of $\frac{1}{4}$ in. or $\frac{5}{16}$ in. or 10 m/35 ft of $\frac{3}{8}$ in.) that is generally mounted on the end of a variable-speed electric drill. This hand-held drain cleaner can clear clogs in lines from 32 mm to 75 mm ($1\frac{1}{4}$ in.–3 in.) in diameter in awkward and tight spaces. The motor also has a quick-reversing switch to help release the cable should it get caught in a drain line.

The rotation of the drill unspools and drives the cable down a pipe. The cable is gripped by a chuck that must be loosened by hand for the cable to be loosened and manually fed into the drain and must again be hand-tightened to lock the cable in place. When the cable reaches the clog, the tip begins digging into and loosening the material.

This is where an electric power drum auger offers many benefits over a manual version. Using a hand auger, you are limited to the power you can generate and maintain with your hands alone. With a power auger, you can slowly ease up the pressure you are applying to a clogged drain in order to more effectively get rid of the obstruction.

Power Drum Augers (Large-Diameter Piping)

This power tool consists of a cable 30 m (100 ft) — or sometimes 15 m (50 ft) — long wrapped inside a metal drum or cage-like spool, which is turned by a reversible electric motor (Figure 7). Long lengths of cable contained within a cage or drum are not the only variety of cable available. Some models of drain augers use 8 ft (2.4 m) sections of cable in straight lengths that are fed through the machine and coupled using male and female ends before feeding again.

These tools are incredibly powerful, using low internal gear ratios to move slowly but with enough force to break apart or cut tough material. These machines are too heavy for one person to carry, so they are typically equipped with a frame with two wheels, allowing it to be rolled around like a dolly.



Figure 7 Large-diameter power drum auger. (Skilled Trades BC, 2021)
Used with permission.

To use this type of tool, position the auger a few feet away from the cleanout and plug its power cord into a nearby grounded electrical outlet. Most augers have a foot pedal that allows the motor to be controlled hands-free. Set this down in a convenient location. Pull out the cable and feed it into the pipe a few feet, then press the pedal to start spinning the cable (and cutter head) in the normal (clockwise) rotation. While the auger is spinning, pull the cable off the spool and feed it into the drain a foot or so at a time. In addition to powering the cutting action, the rotation helps the cable work its way through bends in the drain pipe.

If the cable meets resistance, it could be an offset or obstruction. In either case, do not try to force the cable forward. Back off the cutter head by retracting the cable a bit, then feed it in again.

When the cutter encounters an obstruction, it may grab the material and stop turning while the cable keeps spinning. The cable is actually a tightly wound torsion spring, so you can let it wind up for a few rotations, but going too far can break it. Let the energy build up a little bit, then pull the cable back to free the cutter blade; the cable will instantly spin back to its normal position.

If the cutter gets stuck and you cannot get the cable unwound, stop the auger rotation, hit the reverse switch on the motor, and rotate the auger backward. Then, pull the cutter free before resuming in the clockwise rotation.

Once the cable returns to the normal position, start feeding it in again. Repeat the process until the drain is clear. Often, it is necessary to pull the cable all the way back out to check the cutter head for roots and other debris.

Advantages of electric drain cleaners include the ability to clean long sections of sewer drain and the ability to remove solid objects, such as tree roots. Machines using flexible attachments can easily negotiate multiple 90° bends while maintaining their effectiveness and without damaging the pipe.

Safety considerations for electric drain cleaners include the following:

- Wear work gloves and eye protection.
- Carefully control the cable during operation to avoid over-stressing it.
- Use appropriate caution when working around rotating machinery.
- Use properly grounded electrical outlets.

Auger Heads

Large-diameter machines typically have interchangeable heads that can be attached to the cable, each suited to a specific task. The most common types of **auger heads** are:

- Drop head auger
- Straight auger
- Funnel auger
- Hook auger
- Retrieving auger
- Spade cutter
- Four-blade sawtooth cutter
- Grease cutter
- Spiral sawtooth cutter
- Sawtooth cutter
- Spiral bar cutter
- Sharktooth cutter
- Grease C cutter
- Expanding finish cutter
- Chain knocker

Drop head auger: for cleaning the trap arms of fixtures mounted back-to-back (e.g., sinks where cable needs to be led into downpipe) (Figure 8).



Figure 8 Drop head auger attachment. (RIDGID, n.d.). Used with permission.

Straight auger: for use in exploring and breaking up stoppages or returning samples to the surface to determine the correct tool to use (Figure 9).



Figure 9 Straight auger attachment.
(RIDGID, n.d.). Used with permission.

Funnel auger: for use as a second tool in line. It breaks up the stoppage remains left by a straight auger (Figure 10).



Figure 10 Funnel auger attachment. (RIDGID, n.d.).
Used with permission.

Hook auger: for heavy and dense root stoppages in pipes that require hooking into and breaking up (Figure 11).



Figure 11 Hook auger attachment. (RIDGID, n.d.). Used with permission.

Retrieving auger: used for searching for cable that is broken or lost in a drain line (Figure 12).



Figure 12 Retrieving auger attachment. (RIDGID, n.d.). Used with permission.

Spade cutter: for following up after augers have been used and to open up floor drains (Figure 13).



Figure 13 Spade cutter attachment. (RIDGID, n.d.). Used with permission.

Four-blade sawtooth cutter: for blockages caused by hardened, glazed material, such as chemical deposits (Figure 14).



Figure 14 Four-blade sawtooth cutter attachment. (RIDGID, n.d.). Used with permission.

Grease cutter: for lines that have become badly clogged with grease or detergents and have to be opened (Figure 15).



Figure 15 Grease cutter attachment. (RIDGID, n.d.). Used with permission.

Spiral sawtooth cutter: for clearing any stoppage caused by roots, rags, sticks, etc. (Figure 16).



Figure 16 Spiral sawtooth cutter attachment. (RIDGID, n.d.). Used with permission.

Sawtooth cutter: for cleaning lines blocked heavily with roots. Its unique design permits the cutter to be removed from damaged pipe without locking (Figure 17).



Figure 17 Sawtooth cutter attachment. (RIDGID, n.d.). Used with permission.

Spiral bar cutter: for main sewers blocked by roots, leaf debris, sticks, sawdust, cloth, or sack material (Figure 18).



Figure 18 Spiral bar cutter attachment. (RIDGID, n.d.). Used with permission.

Sharktooth cutter: for use in cleaning pipes of general material clinging to pipe walls (Figure 19).



Figure 19 Sharktooth cutter attachment. (RIDGID, n.d.). Used with permission.

Grease C cutter: For grease blockages in lines leading from garbage disposal units or waste pipes (Figure 20).



Figure 20 Grease C cutter attachment. (RIDGID, n.d.). Used with permission.

Expanding finish cutters: for final removal of material adhering to walls and certain roots of fibrous nature (Figure 21).



Figure 21 Expanding finish cutter attachment. (RIDGID, n.d.). Used with permission.

Chain knocker: for use when vigorous action is required to clean scale in pipes and boiler tubes (Figure 22).



Figure 22 Chain knocker attachment. (RIDGID, n.d.). Used with permission.

Water jetting is a method of cleaning or unclogging drains and sewers using high-pressure water to remove debris. High-pressure water jetters usually operate with water pressures up to 28,000 kPa (4,000 psig), with flow rates of 9 to 113 L (2 to 25 gal.) of water per minute.

The pressure of the water jet propels a highly flexible hose through lines measuring 32 to 100 mm ($1\frac{1}{4}$ in. to 4 in.),

blasting through sludge, soap, and grease blockages. As you pull the hose back, it power-scrubs the line, flushing debris away and restoring drain lines to their free-flowing capacity. By introducing water into an already plugged line, the drainage pipe is ideally cleaned from the downstream end of the pipe, and the hose propels itself upstream.

When it is impossible to clean from the lower end of the pipe, the pipe must be water jetted several times to remove all the debris.

Water jetters can be truck-mounted and may carry up to 6,800 L (1,500 gal.) of water for large sewer cleaning jobs, or they can be mounted on a trailer and pulled by a large van or small truck. Smaller water jetters can be mounted on a cart for residential and light commercial applications (Figure 23).

When using this type of tool for a residential job, be aware of any cross-contamination issues. If a direct connection from the building's houseline is used, there must be an approved backflow preventer in the form of an RPBA (reduced pressure backflow assembly) installed between the houseline and the jetter.



Figure 23 Water jetter machine. (RIDGID, n.d.). Used with permission.

Air Blasters

Air blaster drain cleaners use accelerated carbon dioxide, air, or other gas to rupture the obstruction membrane. Accelerated gas creates a force on standing water that can dislodge clogs that accumulate close to drain openings but are too far away from the drain opening to be removed with a plunger. Unlike drain augers, air blasters do not pose any risk of scratching the surfaces of ceramic sinks, bathtubs, and toilets.

Disadvantages of air blaster drain cleaners include a limited cleaning range in pipes that do not contain standing water

and, in general, ineffectiveness for unclogging blocked main sewer drains. Air blasters can also force air and water back through the overflow of a basin if used improperly.

Safety considerations for air blaster drain cleaners include a requirement to wear eye protection and, when using an air-burst cleaner that uses compressed gas cartridges, careful handling of unused cartridges.

Steam Cleaning

Unlike air- and water jet systems, steam cleaning is an entirely different process. The steam cleaner (Figure 24) uses steam's expansion to accelerate water droplets, at the boiling point, to a high velocity. The closer the steam cleaner's nozzle is to the surface to be cleaned, the higher the temperature and velocity of the water/steam mixture, and the more rapid the cleaning action. The temperature of the water/steam mixture drops quickly as the distance between the nozzle and the surface to be cleaned increases.

Consequently, for drain-cleaning applications, the nozzle should be held close to the inner surfaces to achieve the best results.



Figure 24 Steam-powered drain cleaner. (SIOUX Corporation, n.d.). Used with permission.

Shop Vacuum

Most “shop vacs” have an output blower mode that should be powerful enough to clear small drain obstructions. Place the end of the vacuum hose firmly over the drain and seal the edges to maintain output pressure. Make sure any other drain openings are closed or tightly plugged.

In blower mode, quickly turn the power on and off repeatedly until you dislodge the clog from the drain. Continuously running the blower for a long period of time can damage your pipes (or the vacuum, if its air flow is restricted).



Self-Test D-5.1: Drain Cleaning

Complete Self-Test D-5.1 and check your answers.

If you are using a printed copy, please find Self-Test D-5.1 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=91#h5p-31> (<https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=91#h5p-31>)

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- **Figures 8-23** are from RIDGID/Emerson Electric Co. 's Sectional cable tools (<https://www.ridgid.com/ca/en/sectional-cable-tools>) webpage and they are used with permission.
- **Figure 24** Steam-powered drain cleaner (<https://sioux.com/e-series-pressure-washers>) [H4D2750 high pressure hot water washer] is from SIOUX Corporation and is used with permission.

Self-Test D-5.1 Drain Cleaning

Complete Self-Test D-5.1 and check your answers.

- Using Table 1, match the following drain-cleaning applications with the appropriate drum cable attachment

Table 1

Question	Answer	Application	Attachment
1		Used in drain lines for final removal of material and roots adhering to pipe walls	A. Sharktooth cutter
2		Used on drain lines that have become badly greased with detergents and have to be opened	B. Four-blade sawtooth cutter
3		Used in drain lines leading from garbage disposal units and associated waste lines	C. Retrieving auger
4		Used on drain lines to recover a lost or broken drum cable	D. Funnel auger
5		Used in drain lines after a straight auger to break up remaining obstructions	E. Straight auger
6		Used in drain lines that are coated with hardened material such as chemical deposits	F. Spiral sawtooth cutter
7		Used for easier entrance into drain lines from back-to-back fixtures	G. Drop head auger
8		Used in drain lines where heavy and dense roots require hooking to break them up	H. Grease C cutter
9		Used in drain lines to follow up after an auger has cleared a floor drain	I. Spiral bar cutter
10		Used in main sewers blocked by roots, leaf debris, sticks, sawdust, cloth, or sacking	J. Chain knocker
11		Used in drain lines blocked heavily with roots; has a feature that allows it to be removed from damaged pipe without locking	K. Spade cutter
12		Used in drain lines that require scale removal or even boiler tubes during service	L. Expanding finish cutter
13		Used in drain lines to clear general material that may be attached to the pipe walls	M. Hook auger
14		Used to retrieve a drain blockage sample that determines proper attachment	N. Grease cutter
15		Used in drain lines to clear multiple obstructions such as roots, rags, and sticks	O. Sawtooth cutter

- What two pieces of PPE are essential when undertaking a drain-cleaning procedure?
 - Hard hat and safety glasses
 - Rubber safety shoes and safety glasses with side shields
 - Rubber safety shoes and gloves
 - Gloves and safety glasses with side shields
- What is the proper procedure to follow when sending a cutter attachment into a drain line and a blockage stops the cutter?
 - Allow the cable to twist until the stoppage is cleared.
 - Use short forward and reverse movements and allow the machine to work on the blockage.
 - Force the attachment forward to break up the obstruction.
 - Return the cable to the surface and attach a larger attachment.
- What is the best tool to use when a building sewer is draining slowly and you suspect it has collapsed?

- a. Drum auger with a retrieving attachment
 - b. Video inspection machine
 - c. Water jetter machine
 - d. Drum auger with a chain knocker attachment
5. What device does an on-surface pipe locator communicate with inside a drain line?
- a. Drain-cleaning attachment on the end of a cleaning cable
 - b. Ball with an internal magnet
 - c. Tracer wire
 - d. Camera/transmitter on the end of the video inspection cable
6. Other than the location of a problem area inside a drain line, what other information is available to the operator at ground level when using a pipe locator?
- a. Depth of burial of the drain line
 - b. Condition of the drain pipe
 - c. Type of pipe material
 - d. Drain pipe's proximity to the property line
7. Why is a hand-powered drum auger not meant to be sent down a toilet bowl to clear an obstruction?
- a. The cabling is too short and fragile and will snap inside the bowl.
 - b. Toilets require more force than can be obtained from a hand-operated machine.
 - c. The cable will mark the porcelain finish on the bowl surface.
 - d. The cable is not flexible enough to navigate through the integral trap found in toilet bowls.
8. What feature does a closet auger have to help protect the finish on the inside of a closet bowl?
- a. Plastic cable
 - b. Plastic boot on the hooked foot of the tool
 - c. Re-usable rubber bowl liner
9. What loosens and tightens the chuck onto the cable when using a small pipe diameter power drum auger?
- a. A hex wrench
 - b. The chuck is hand-tightened and loosened.
 - c. The tool's motor automatically tightens and loosens the chuck.
 - d. The cable is not tightened or loosened at the chuck.
10. What rotation direction is the normal forward feed position when using a large pipe diameter drum auger?
- a. Clockwise
 - b. Counter-clockwise
11. If you are using a large pipe diameter drum auger and you encounter an obstruction that stops the rotation of the cutting attachment, what is the proper procedure to avoid snapping the cable?

- a. Continue in the forward direction.
 - b. Continue in the forward direction, pull hard on the cable, and allow it to spin backward once released.
 - c. Place the machine in reverse to relax the tension on the cable.
 - d. Stop the machine and hand-feed the cable through the blockage.
12. What is typically the maximum water pressure used with drain-cleaning water jetter machines?
- a. 7,000 kPa (1,000 psig)
 - b. 14,000 kPa (2,000 psig)
 - c. 21,000 kPa (3,000 psig)
 - d. 28,000 kPa (4,000 psig)
13. Which pipe location is best to introduce a water jetter hose into a clogged line?
- a. Closest upstream cleanout above the obstruction
 - b. Closest downstream cleanout below the obstruction
 - c. Furthest upstream cleanout above the obstruction
 - d. Furthest downstream cleanout below the obstruction
14. What is the best tool to use when you suspect that a building sewer is frozen because it is not buried deep enough?
- a. Drum auger with a root-cutting attachment
 - b. Steam cleaning machine
 - c. Water jetter machine
 - d. Drum auger with a chain knocker attachment

Answer Key: Self-Test D-5.1 (#chapter-answer-key-self-test-d-5-1) is on the next page.

Answer Key: Self-Test D-5.1

1. Table 1 Answers

1. L. Expanding finish cutter
 2. N. Grease cutter
 3. H. Grease C cutter
 4. C. Retrieving auger
 5. D. Funnel auger
 6. B. Four-blade sawtooth cutter
 7. G. Drop head auger
 8. M. Hook auger
 9. K. Spade cutter
 10. I. Spital bar cutter
 11. O. Sawtooth cutter
 12. J. Chain knocker
 13. A. Sharktooth cutter
 14. E. Straight auger
 15. F. Spiral sawtooth cutter
2. d. Gloves and safety glasses with side shields
 3. b. Use short forward and reverse movements and allow the machine to work on the blockage.
 4. b. Video inspection machine
 5. d. Camera/transmitter on the end of the video inspection cable
 6. a. Depth of burial of the drain line
 7. c. The cable will mark the porcelain finish on the bowl surface.
 8. b. Plastic boot on the hooked foot of the tool
 9. b. The chuck is hand-tightened and loosened.
 10. a. Clockwise
 11. c. Place the machine in reverse to relax the tension on the cable.
 12. d. 28,000 kPa (4,000 psig)
 13. b. Closest downstream cleanout below the obstruction
 14. b. Stream cleaning machine

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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If you identify an error in this resource, please report it using the TRU Open Education Resource Error ([#back-matter-tru-open-education-resource-error-form](#))Form.

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)