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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Suggested citation (APA style, 7th Edition):
Block D: SkilledTradesBC. (2025). *Block D: Drainage systems* (Rev. ed.; adapted by Rod Lidstone, the BC Articulation Curriculum Subcommittee, & TRU Open Press). TRU Open Press. https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/ (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/)

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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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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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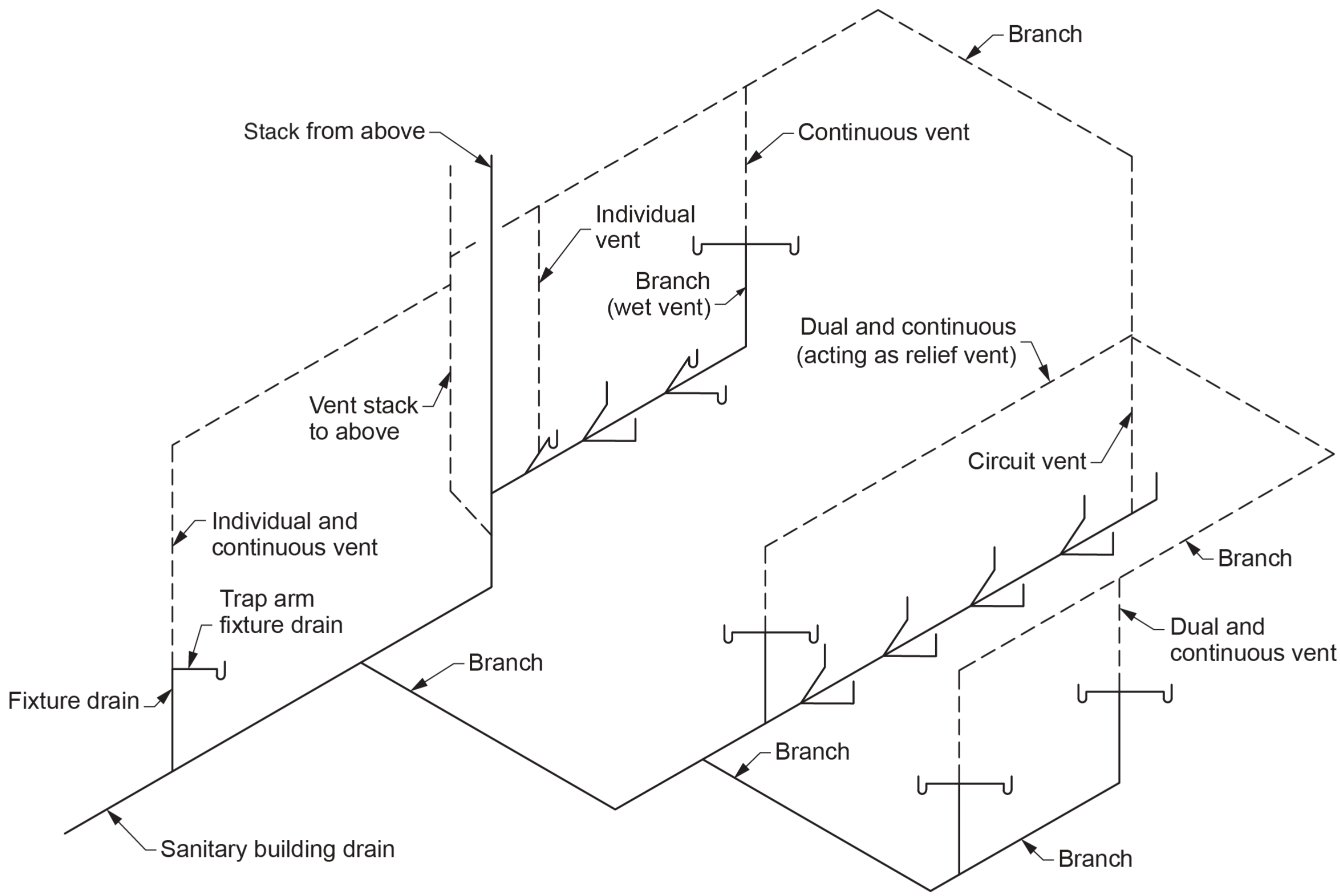
D-1 SANITARY DRAIN, WASTE AND VENT SYSTEMS

Plumber Apprenticeship Program – Level 2



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D-1 Sanitary Drain, Waste, and Vent Systems Introduction

The drain, waste, and vent (DWV) system is perhaps the most important part of the total plumbing system in a building. The sanitary drainage system is a circuit of piping designed to remove the wastewater from the plumbing fixtures in a building and drain the fixtures safely, reliably, and efficiently. Sanitary and storm drainage systems are required to meet the code regulations set out by the British Columbia Plumbing Code.

Learning Objectives

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

- Describe codes, regulations, standards, and agencies related to the plumbing industry.
- Describe terminology and definitions for DWV systems used in the National Plumbing Code.
- Describe functions of pipes used in DWV systems.
- Identify code requirements for drainage piping in DWV systems.
- Identify code requirements for venting piping in DWV systems.
- Identify prohibitions and requirements when installing DWV systems.
- Identify requirements of trade waste 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**.
Please also see the separate NPC Definitions for DWV Systems in Section D-1.2.

- **acrylonitrile-butadiene-styrene (ABS) pipe**: A type of plastic pipe that is lightweight, strong, and resistant to damage. It is often used in homes and buildings for carrying waste and venting air. However, because it can catch fire, it is usually only used in certain types of buildings. (Section D-1.4)
- **Applied Science Technologists and Technicians of BC (ASTTBC):** The association for technology professionals and regulatory body that certifies wastewater professionals in BC. The ASTTBC registers practitioners once they have obtained the proper training. (Section D-1.1)
- **BC Plumbing Code (BCPC):** The plumbing standard for British Columbia, historically based on the National Plumbing Code of Canada. (Section D-1.1)
- **bell trap:** A type of drain used in the past, often in floor drains. Installation is prohibited by the NPC because it can cause problems with draining. (Section D-1.10)
- **certification mark**: A special symbol or label on a product (such as ASME) that shows it has been tested and approved to meet safety and quality standards. It proves that the product is safe to use and works properly. Note about ASME certification marks: the ASME “H” or “U” stamp is used on pressure vessels, boilers, and piping systems to indicate compliance with ASME codes. In plumbing, ASME standards apply to products like pipes, fittings, and fixtures, but the products themselves often carry certification marks from testing organizations like CSA, NSF, or UL, which certify that they meet ASME standards. (Section D-1.1)
- **chemical-dosing neutralization systems:** Systems that use controlled injection of acid or base into a waste stream to neutralize chemicals. The chemicals react to form a salt and water mixture, which is then discharged. (Section D-1.11)
- **cleanout:** An access point installed in drainage and venting systems for cleaning and inspection services. (Section D-1.2; Section D-1.3; Section D-2.3)
- **co-extruded dual-wall pipe:** A pipe that has two layers, with a smooth inside and a stronger outside. The extra layer makes it more durable and better for certain drainage and sewer systems. (Section D-1.4)
- **combustible piping:** Pipes made from materials that can burn, such as ABS and PVC, which have specific installation restrictions. (Section D-1.4)
- **drainage system:** An assembly of pipes, fittings, fixtures, and traps used to convey sewage, clear-water waste, or stormwater to a public sewer or private sewage disposal system. It does not include subsoil drainage pipes. (Section D-1.1)
- **DWV system:** Stands for Drain, Waste, and Vent system, which removes wastewater and vent gases from a building, ensuring proper drainage and pressure balance. (Section D-1.3; Section D-2.3)
- ***Environmental Management Act:*** A law that helps protect the environment by making sure people and businesses follow rules about pollution, waste, and how they use natural resources. It helps keep the air, water, and land clean and safe for everyone. (Section D-1.1)
- **fixture unit load:** A way to measure how much water a plumbing fixture, like a sink or toilet, uses. It helps plumbers figure out how big the pipes need to be to handle the amount of water that flows through them. Each fixture has a specific number of fixture units based on how much water it uses. The higher the

number of fixture units, the more water the fixture needs. (Section D-1.5)

- **flame spread rating (FSR):** A classification that indicates how quickly flames spread along a material's surface, relevant for building code compliance. (Section D-1.4)
- **forcemain:** A pressurized sewer system that transports wastewater using pumps when gravity flow is insufficient. (Section D-1.4)
- **grease interceptor:** A device used to trap fats, oils, or grease from wastewater before it enters the drainage system, often used in kitchens, restaurants, or care facilities. (Section D-1.10)
- **hydraulic load:** The amount of water moving through a system, like pipes or drains, over a certain time. Imagine pouring water into a funnel—if you pour too much too fast, it overflows. In plumbing and wastewater systems, hydraulic load helps us understand how much water a system can handle before it gets too full or backs up. (Section D-1.5)
- **indirect connections:** Plumbing connections where a fixture or device is not directly connected but instead terminates above the flood level rim of a directly connected fixture, forming an air break. This type of connection is designed to prevent backflow. (Section D-1.10)
- **limestone chip neutralization:** A method where acidic waste is neutralized by mixing it with limestone chips (calcium carbonate). The process produces a chemical reaction that neutralizes the acid, and the mixture is then discharged. (Section D-1.11)
- **municipal bylaws**: Rules made by a city or town to help keep things safe and organized, like where buildings can be built and how plumbing systems should be set up. (Section D-1.1)
- **National Plumbing Code (NPC):** A model plumbing code developed by the National Research Council of Canada, updated every five years. (Section D-1.1)
- **non-combustible piping**: Pipes made from materials like cast iron and copper that do not burn and are often required in fire-rated construction. (Section D-1.4)
- **p-trap:** A U-shaped pipe that prevents sewer gases, odors, and pests from entering a building by maintaining a water seal. (Section D-1.3)
- **S-trap:** (Section D-1.10)
- **sanitary building drain:** A building drain that conducts sewage to a building sewer from the most upstream stack, branch, or fixture drain serving a water closet. (Section D-1.2; Section D-1.3)
- **seismic restraint:** The components and systems installed to protect mechanical systems, including piping, from seismic forces, ensuring that the system can withstand the stresses of an earthquake. (Section D-1.10)
- **trap arm:** The portion of a fixture drain between the trap weir and the vent pipe connection. (Section D-1.3)
- **vent hierarchy:** A system that classifies plumbing vents based on their role in the drainage system. As vents connect, their names change, determining their size and function. Smaller vents, like individual and branch vents, combine into larger ones, such as vent stacks and headers. This system ensures proper airflow and prevents sewer gas buildup. (Figure 22, Section D-1.3)

D-1.1 Codes and Standards

Codes and Standards

A standards organization's primary activities are developing technical codes and standards that are intended to address the needs of the industries that adopt them. The main purpose of building codes is to protect public health, safety, and general welfare because building codes relate to the construction and occupancy of buildings and structures. A standard is a document that provides requirements, specifications, guidelines, or characteristics that can be used consistently to ensure that materials, products, processes, and services are fit for their purpose.

Standards used in the construction industry cover a range of topics but are usually in one of the following categories:

- **Test or measurement standards** that provide information on the acceptability (pass/fail) in a performance category, usually under some standard condition (fire separation ratings), or that provide data that can be used to determine acceptability or performance.
- **Procedural standards** that detail how products or systems are to be installed, used, maintained, tested, or operated to be safe, reliable, and fit for their intended use.

National Standards System

The National Standards System is the network of organizations and individuals involved in voluntary standards development, promotion, and implementation in Canada. Under the Standards Council of Canada Act, the Standards Council of Canada (SCC) is mandated with overseeing the National Standards System. The SCC is a federal non-profit Crown corporation responsible for coordinating voluntary standardization in Canada. It is also responsible for Canada's activities in voluntary international standardization.

Canadian Standards

Plumbing codes contain many references to standards published by accredited standards development organizations in Canada. As part of the accreditation requirements, these organizations adhere to the principles of consensus. This generally means substantial majority agreement of a committee — comprising a balance of producer, user, and general-interest members — and the consideration of all negative comments. The organizations also have formal procedures for the second-level review of the technical preparation and balloting of standards prepared under their auspices. The Canadian Commission on Building and Fire Codes (CCBFC) follows these same principles of consensus in the operation of its code development process.

The following organizations are accredited as standards development organizations in Canada:

- American Society for Testing and Materials International (ASTM)
- Bureau de normalisation du Quebec (BNQ)
- Canadian General Standards Board (CGSB)

- Canadian Standards Association (CSA)
- ULC Standards (ULC)
- Underwriters' Laboratories (UL)

Non-Canadian Standards

A number of subject areas for which the Canadian standards development organizations have not developed standards are covered in the National Plumbing Code of Canada. In these cases, the code often references standards developed by organizations in other countries, such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and the National Fire Protection Association (NFPA). These standards are developed using processes that may differ from those used by the Canadian standards development organizations; nevertheless, these standards have been reviewed by the relevant standing committees and were found to be acceptable.

Certifications

Products are considered "listed" or "approved" when they have been tested and certified by an accredited certification organization. They appear in a list of certified products in either an electronic or hard copy directory published by that organization. Testing and certification involves an initial independent, third-party evaluation of a product to determine if the product conforms to applicable standards.

The following certification organizations have been accredited to test/certify plumbing products for Canada: BNQ, IAPMO, ICC, LabTest, NSF, QAI, UL & ULC, and the Water Quality Association (Figure 1). Products that do not bear one of the following marks may not be appropriate for sale and installation in all jurisdictions and, in some cases, may create health and safety issues.

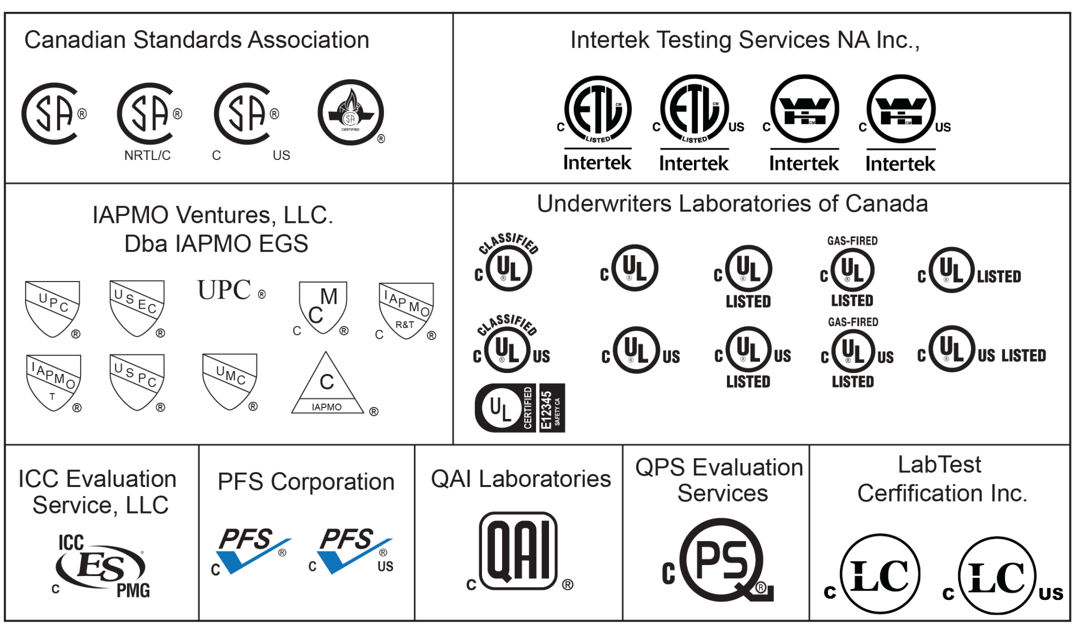

Figure 1 *Certification marks currently accepted in Canada. (CSA, 2020). Used with permission.*

Each organization's scope of accreditation and certification marks can also be accessed at the Standards Council of Canada (SCC) (https://scc-ccn.ca/accreditation).

A certified product is required to bear the certification mark. Some fixture manufacturers acknowledge that customers want an mark-free aesthetic and choose to mark their product with a permanent adhesive label designed to be removed after inspection and that will also self-destruct so that it cannot be placed on another product. If an adhesive label is accidentally removed prior to inspection, the inspector has no choice but to assume that the product is uncertified and request its removal. Therefore, it is important that contractors and consumers maintain proof of the product certification compliance on the product (in addition to the carton, installation instructions, warranty and homeowner's manual, and specification sheet) until after inspection.

Government Roles in Code Enforcement

Provincial and territorial authorities with jurisdiction are responsible for:

- Adopting and enforcing laws and regulations
- Providing interpretation of these laws and regulations
- Providing training and education
- Establishing roles and responsibilities of trades people and professionals

Local Government Systems in BC

BC's local government system is unique in Canada, accommodating diverse local governance structures within a federated model that provides local services and governance to communities throughout BC. One hundred and 62 municipalities and 27 regional districts serve urban and rural communities in virtually all areas of BC.

The first municipalities predate the establishment of British Columbia as a province. Regional districts were created in the mid-1960s. Other local service bodies, such as improvement districts (not local governments), continue to exist in some areas.

Municipalities in BC

Municipalities in BC are responsible for providing local services and governance to approximately 89% of the province's population. There are currently 162 municipalities, ranging in population from just over 100 to over 630,000 people and ranging in size from 63 hectares to over 8,500,000 hectares.

Municipalities can be classified as either a town, village, district, or city, depending on the size and density of their population. An older classification, township, is still referenced in the names of some municipalities; townships are currently classified as districts. Municipalities were first established in BC in the late 1800s. Since then, the roles and responsibilities of municipalities have evolved to become more complex. The BC government sets the legislation that provides municipalities with the authority and flexibility to respond to the varying needs and changing circumstances of each community. Within that framework, the BC government regards municipalities as autonomous, responsible, and accountable governments directed by democratically elected councils.

Most municipalities are incorporated by the BC government through the issuance of a legal document called a letters patent. Each letters patent contains the name of the municipality, describes or represents its boundary, and establishes its classification. Early municipalities were incorporated by the colonial or provincial legislature under legislative acts, although the power to create new municipalities in response to local interest was granted to the Provincial Cabinet in 1910.

The City of Vancouver is an enduring example of a municipality created and operating under a distinct piece of legislation (Vancouver Charter). On rare occasions, a municipality has also been created by special legislation, such as the City of Powell River and the Resort Municipality of Whistler.

Municipal Powers

Core municipal powers and responsibilities are set out in the Local Government Act and Community Charter. For the City of Vancouver, its key powers and responsibilities are set out in the Vancouver Charter. Other legislation may also provide important authorities or requirements for municipalities, including the Motor Vehicle Act, Environmental Management Act, and the Building Act.

Municipalities generally have some of the broadest service authorities in Canada to provide whichever services they consider necessary or desirable for the community. Municipalities may provide services directly or indirectly — for example, through the regional district, with a private partner, or with another government. Municipalities are not responsible for schools, social assistance, or hospitals. These are a provincial responsibility exercised directly or through other bodies.

Municipal Bylaws

Municipal councils and regional district boards may only make decisions by bylaw or resolution. Bylaws are laws that formalize rules made by a council or board. Local governments may use bylaws for various purposes, especially to regulate, prohibit, or impose requirements. Local bylaws will require you to apply for building and plumbing permits, for example.

Bylaws are laws passed by municipal councils and regional district boards to exercise their statutory authority. Bylaws may be used for a variety of different purposes, including:

- Establishing meeting procedures
- Regulating services
- Prohibiting an activity
- Requiring certain actions

Bylaws and the Building Act

The Community Charter of BC states that municipalities are "… subject to any specific conditions and restrictions established under this or another Act" and that "a provision of a municipal bylaw has no effect if it is inconsistent with a Provincial enactment."

The Building Act of BC (enacted 2015) also states that "… a local building requirement … has no effect to the extent that it relates to a matter that is subject to a requirement, in respect of building activities, of a (provincial) building regulation…."

Prior to the Building Act, local governments had the authority to set technical building requirements in their bylaws that differed from those set by the province in the BC Building Code. To bring greater consistency to the technical building requirements in force across BC, the Building Act gives the province sole authority to establish these requirements.

Under Section 5 of the Building Act, if a matter is regulated in a provincial building regulation, any requirements for that matter established in bylaws by local governments will be of no legal force after December 15, 2017.

When a provincial building regulation does not regulate a matter (e.g., requirements relating to fencing or erecting a freestanding sign), local governments may regulate such matters if they determine they have legislative authority to do so.

Basically, this means that local bylaws cannot supersede the requirements of building codes.

Note that the Building Act does not apply to the city of Vancouver. Under the Vancouver Charter, Vancouver has authority to set its own building requirements through bylaw and to determine the qualification requirements for the city's building officials. It also has its own appeal process for building bylaw disputes.

Permits

Depending on the scope of the work you are proposing, you may also need a building permit, development permit, or both.

Building Permits

You will need a building permit if you plan to:

- Construct a new building
- Make any addition to an existing building
- Alter the structure of a building
- Renovate, repair, or add to a building
- Demolish or remove all or a portion of a building
- Change a building's use
- Build a garage, balcony, or deck
- Excavate a basement or construct a foundation

Plumbing Permits

Plumbing permits are required for the construction of all associated systems and must be obtained before construction begins.

A plumbing permit is required if you want to:

- Install, change, or upgrade any part of a plumbing system
- Do repair or replacement work if you have to:
    - Open walls
    - Move pipes
    - Change other plumbing or pipes

If your company is a licensed gas contractor, you will require a gas permit to install or replace a gas-fired appliance, such as a fireplace, hot water tank, boiler, furnace, or kitchen stove. A permit is also required if you are installing or altering the associated gas pipes and appliance vents.

If you are constructing a new dwelling, you will require a building permit prior to being issued a gas or plumbing permit. A plumbing permit is NOT required for clearing stoppages or repairing leaks in pipes, valves, or fixtures.

Plumbing permits are issued by your local municipal building department. Gas permits are typically issued by Technical Safety BC. In some instances, gas installation permits might also be offered by municipal departments.

The permit process is generally the same for all types of projects, but there may be more specific requirements for some commercial construction and industrial projects.

Permit Application

A completed permit application is required prior to beginning the permit-issuing process. Permit applications are available through the authority having jurisdiction (AHJ). Typical required information includes who will perform the work and what, where, and how the work will be completed. Drawings, plans, or other documentation of the proposed work may be required. Permit fees are usually due at the time of application.

Review Process

During the review process, staff determine if the project is in compliance with the applicable codes and other local ordinances and statutes. The length of the review process depends on the type and complexity of the project. Many small residential applications can be processed in one day.

Permit Approval

When compliance with the code and other applicable statutes is determined, the permit application is approved. Once all final permit fees are paid, the permit is issued.

However, if the permit application is not approved or a review has failed, the permit application as submitted will be denied. When a permit application is denied, corrections to the application shall be made and the application is resubmitted for final approval.

Permit Execution

There are various stages involved in executing any building permit.

Construction

During the entire construction phase, the permits must be placed in a prominent place at the project site. A copy of the approved building plan and other related documents must also be maintained at the site.

Inspections

Each major phase of construction must typically be inspected by an inspector or similar authority to ensure that the work conforms to the code, permit, and approved plans. Inspection requests may be made via internet, by phone, or in person. Normally, the response is one business day after the request is made.

Field Changes

Most changes will require a review and approval in the same manner as the original application. Proposed revisions or alterations must be brought to the attention of the permit staff before making changes in the field.

Project Completion

When the project is completed and code compliance is determined, the inspector issues a final inspection. The final inspection marks the completion of the project and grants permission to occupy a building with the knowledge that it has met the minimum safety standards as required by the code.

Plumbing Codes

The **BC Plumbing Code (BCPC)** is the standard for the province of BC and has historically been substantially based on the National Plumbing Code (NPC) of Canada.

The NPC was developed by the National Research Council with collaboration from provinces and territories. The National Codes are updated approximately every five years. The NPC is a model code in the sense that it helps promote consistency among provincial and territorial plumbing codes.

In Canada, provincial and territorial governments have the authority to enact legislation that regulates the design and installation of plumbing systems within their jurisdictions. This legislation may include adopting the NPC without change or with modifications to suit local needs and enacting other laws and regulations regarding plumbing system design and installation, including the requirements for professional involvement. People involved in designing or installing plumbing systems should consult the provincial or territorial government with jurisdiction to find out which plumbing code is applicable

In the past, BC has produced an updated consolidated BCPC to reflect NPC updates and any unique provincial needs. Over time, these two codes have become harmonized to the point that, in 2024, the province of BC announced they would adopt the NPC rather than produce a separate BCPC.

The BC Information Bulletin stated that as of March 8, 2024, "The British Columbia Building Code 2024 Book I (General) (Building Code) adopts the British Columbia Building Code Book II (Plumbing Systems) by reference in Part 7 of Division B, it also effectively states that the British Columbia Building Code 2024 Book II (Plumbing Systems) is the National Plumbing Code of Canada 2020" (NPC 2020).

Plumbing code users will follow the provisions relevant to plumbing systems in the BC Building Code, such as Part 1 of Division A and Part 7 of Division B, together with the NPC. This means that even though provincial documents — and this textbook — may still refer to the relevant plumbing code as the BCPC, the official document is essentially the NPC. The electronic versions of the BC Codes are available on the BC Codes (https://www.bccodes.ca) website.

The NPC sets out technical provisions for designing and installing new plumbing systems. It also applies to the extension, alteration, renewal, and repair of existing plumbing systems. The NPC establishes requirements to address the following four objectives, which are fully described in Division A of the code:

- Safety
- Health
- Protection of buildings and facilities from water and sewage damage
- Environment

The NPC is not a textbook on plumbing system design or installation. The design of a technically sound plumbing system depends upon many factors beyond simple compliance with plumbing regulations. Such factors include the availability of knowledgeable practitioners who have received appropriate education, training, and experience and who have some degree of familiarity with the principles of good plumbing practice and experience using textbooks, reference manuals, and technical guides.

The NCPC provides the minimum requirements for:

- Drainage systems for water-borne wastes and storm water for buildings to the point of connection with public services,
- Venting systems
- Water service pipes
- Water distribution systems

The NPC does not list acceptable proprietary plumbing products. It establishes the criteria that plumbing materials, products, and assemblies must meet. Some of these criteria are explicitly stated in the NPC, while others are incorporated by reference to material or product standards published by standards development organizations.

Numbering System

A consistent numbering system has been used throughout codes in Canada: The first number indicates the part of the code; the second is the section in the part; the third is the subsection; the fourth is the article in the subsection; and so on. The detailed provisions are found at the sentence level (indicated by numbers in brackets), and sentences may be broken down into clauses and subclauses. This structure is illustrated in Table 1.

Table 1: Numbering System for Codes

Number	Category	Example
1st	Part	3.
2nd	Section	3.5.
3rd	Subsection	3.5.2
4th	Article	3.5.2.1.
5th	Sentence	3.5.2.1.(2)
6th	Clause	3.5.2.1.(2)(a)
7th	Subclause	3.5.2.1.(2)(a)(i)

Change Indication

Where a technical change or addition has been made relative to a new edition, a vertical line has been added in the margin next to the affected provision to indicate the approximate location of new or modified content. No change indication is provided for renumbered or deleted content.

Wastewater Treatment and Disposal

Wastewater is approximately 99% water. The remainder is composed of a mix of organic wastes, detergents, cleaning chemicals, and anything else poured or flushed down indoor drains. Wastewater contains chemicals and micro-organisms that can threaten public health and damage the environment.

A building permit cannot be issued unless the building is connected to a public or private onsite sewage system.

Onsite Sewage Systems

Onsite sewage systems are installed in areas that are not served by a public **sanitary sewer** network. Onsite sewage systems are effective at treating household sewage if they are designed and installed properly in appropriate soil and maintained regularly. In typical onsite sewage systems, the wastewater from toilets and other drains flows from your house into a tank that separates the solids and scum from the liquid. Bacteria help break down the solids into sludge. The liquid flows out of the tank into a network of pipes buried in a disposal field of gravel and soil. Holes in the pipes allow the wastewater to be released into the disposal field. These systems can be efficient and cost-effective and can protect health and the environment. However, they must be properly planned, installed, and, above all, properly maintained.

Enacted in 2005, the Sewerage System Regulation (SSR) applies to all smaller systems, including those for houses, small businesses, and even small community systems. Compared to the previous Sewage Disposal Regulation, the SSR includes a significant change in approach. The new approach is performance-based, and responsibility for the proper design and installation of onsite systems has been transferred for the most part from health authorities to "authorized persons," as defined by the SSR.

BC Sewerage System Regulation

The **Sewerage System Regulation** replaced the old **Sewage Disposal Regulation**. This regulation — along with the companion document, the Sewerage System Standard Practice Manual — shifted the focus of managing onsite sewerage systems by using an outcome-based approach to wastewater management to allow for greater flexibility in how the systems are regulated.

An onsite sewerage system is usually located on the land from which sewage originates. This type of system locally treats effluent that is not serviced by a larger municipal or regional sewerage system.

The Sewerage System Regulation, under the Public Health Act, covers holding tanks for sewage effluent or onsite sewerage systems that:

- Process a sewage flow of less than 22,700 L per day
- Serve single-family systems or duplexes
- Serve different buildings on a single parcel of land
- Serve one or more parcels on strata lots or on a shared interest of land

The regional health authorities are responsible for accepting applications and fees for onsite sewerage systems submitted by homeowners or by industry professionals acting on their behalf. Authorized people install, repair, and maintain onsite sewerage systems.

Site investigations of sewerage systems may be initiated in cases where systems are suspected to be negatively affecting a drinking water supply (e.g., as a result of system failure) or causing a health hazard, as per the Public Health Act.

Agencies and Organizations

Wastewater is regulated by two provincial agencies:

- **The Ministry of Environment and Climate Change Strategy:** regulates large community wastewater systems under the Environmental Management Act and the Municipal Wastewater Regulation.
- **The Ministry of Health:** regulates smaller, generally private, domestic sewerage systems, including on-site septic systems, under the Public Health Act and the Sewerage System Regulation.

There are a number of associations that support the wastewater treatment and disposal industry:

- **BC Onsite Sewage Association (BCOSSA) and Western Canada Onsite Wastewater Management Association (WCOWMA):** develop educational programs for onsite wastewater practitioners and provide technical information to industry stakeholders and practitioners.
- **Applied Science Technologists and Technicians of BC (ASTTBC):** the association for technology professionals in British Columbia. The ASTTBC also registers practitioners once they have obtained the proper training.
- **Association of Professional Engineers and Geoscientists of British Columbia (APEGBC):** the licensing body for professional engineers and geoscientists. Only professional engineers and geoscientists are permitted to construct

and/or maintain a Type 3 sewerage system.

- **BC Water and Waste Association (BCWWA):** supports over 3,700 water and wastewater professionals in BC and the Yukon with training, educational opportunities, technology transfer, and networking opportunities.
- **Onsite Wastewater Registration Program (ASTTBC):** provides information for onsite wastewater service providers.

Self-Test D-1.1: Codes and Standards

Complete Self-Test D-1.1 and check your answers.

If you are using a printed copy, please find Self-Test D-1.1 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=5#h5p-1 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=5#h5p-1)

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Media Attribution

- Figure 1 CSA B149.1:20, Natural gas and propane installation code. ©2020 Canadian Standards Association. (Please visit store.csagroup.org (http://store.csagroup.org))

D-1.2 DWV Terminology

Terminology: NPC Definitions for DWV Systems

Standardized terminology is an important communication tool for interpreting code regulations and for on-site communication with co-workers and local inspectors. For professional plumbers, knowing these terms and their applications is essential.

This section defines key terms related to DWV (Drainage, Waste, and Vent) Systems, many of which be used throughout *Block D: Drainage Systems*. The terminology provided here is based on the 2020 *National Plumbing Code* (*NPC*), available online.

additional circuit vent: a vent pipe installed between a circuit vent and a relief vent (Figure 1) to provide additional air circulation.

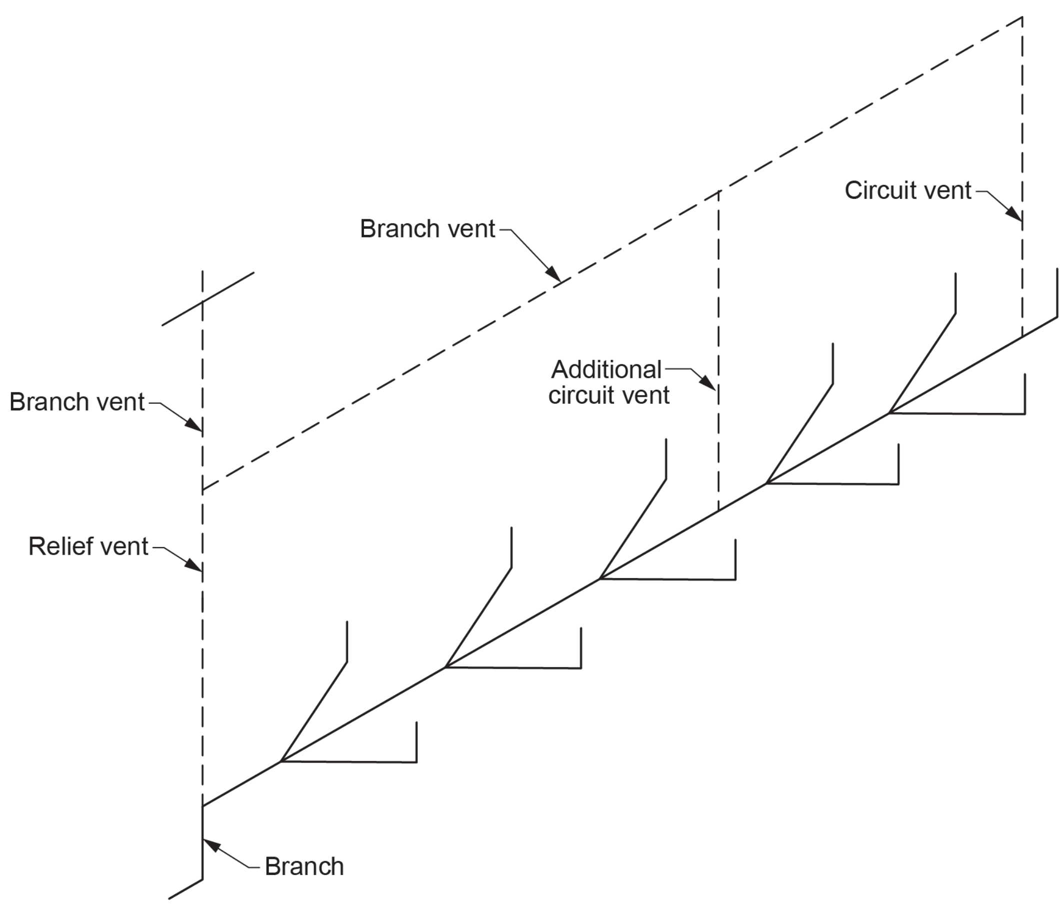

Figure 1 *Additional circuit vent. (Skilled Trades BC, 2021) Used with permission.*

air admittance valves: mechanical valves that simulate vents. They allow air to be drawn into the waste plumbing system under negative pressure to prevent siphoning but prevent any air from escaping the plumbing system under positive pressure. Air admittance valves (Figure 2) should be installed in an accessible, ventilated area. These devices are sometimes an acceptable alternative to conventional venting in applications where installing a conventional vent is not possible.

Figure 2 *Air admittance valve. (Skilled Trades BC, 2021) Used with permission.*

To meet the conditions required by British Columbia Plumbing Code, ensure that your valve conforms to the ASSE 1051 standard.

air break: a method of indirectly connecting a drainage pipe to another drainage pipe. An air break (Figure 3) is created by leaving an unobstructed vertical gap between the discharge of a fixture and the receptacle that receives it. This distance must be at least 25 mm (1 in.) or the size of the upper drain pipe, whichever is greater. This is commonly used to protect fixtures used to store and prepare food, drinking fountains, ice makers, and many other devices that must be protected from contamination due to a direct connection.

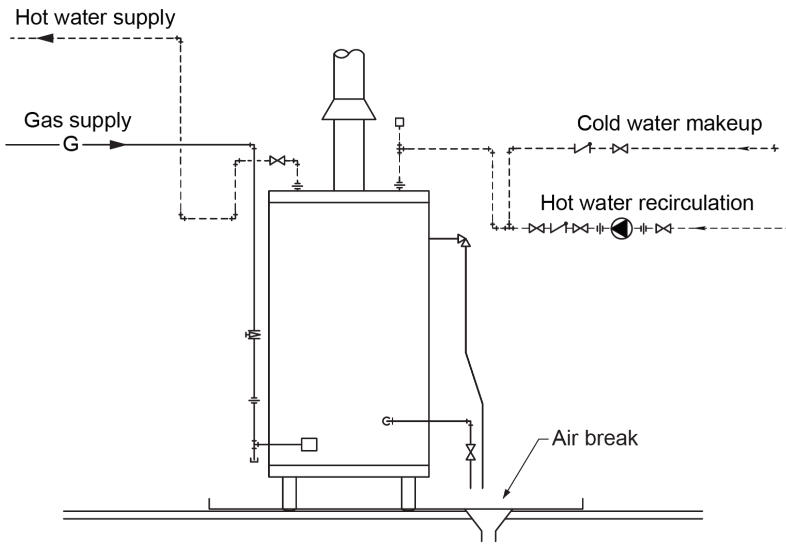

Figure 3 *Air break. (Skilled Trades BC, 2021) Used with permission.*

authority having jurisdiction (AHJ): the governmental body responsible for enforcing any part of the NPC.

backflow: a reversal of the normal direction of the flow.

backwater valve: a one-way flow control valve installed in a drainage system. Backwater valves (Figure 4) are required to protect fixtures and drainage openings installed below grade, such as in a basement, where the possibility exists for the municipal sewage or stormwater systems to become overloaded and force wastewater back through your drains. Backwater valves are also required on any subsoil drainage pipe that connects into the sanitary drain to protect it from sewage backups.

Figure 4 *Backwater valve. (Skilled Trades BC, 2021) Used with permission.*

Under normal conditions, it allows the wastewater to drain out of the system (Figure 5), but if a reversal of flow should occur, the valve is forced closed and protects the interior of the building from sewage backup.

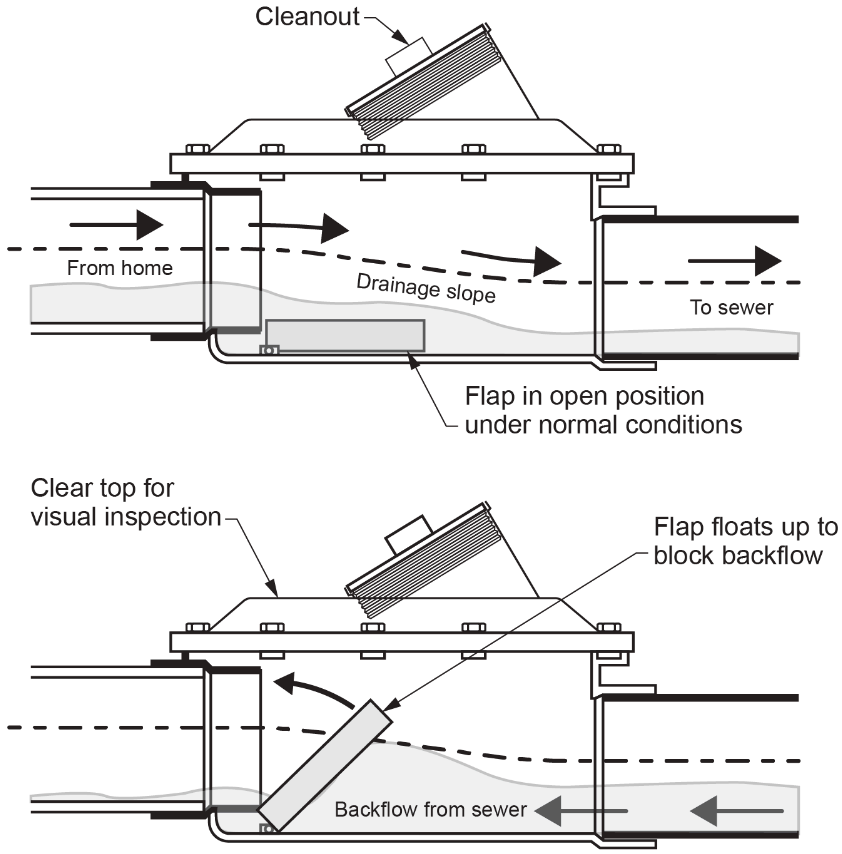

Figure 5 *Backwater valve operation. (Skilled Trades BC, 2021) Used with permission.*

bathroom group: a group of plumbing fixtures installed in the same room, consisting of one domestic lavatory, one water closet, and either one bathtub (with or without a shower) or one single-head shower. The intent is that these three fixtures are located in a room occupied by only one person, so they are not normally in simultaneous use.

branch: a sanitary drainage pipe connected at its upstream end to the junction of two or more sanitary drainage pipes or to a stack and connected at its downstream end to another branch, a sump, a stack, or a building drain (Figure 6).

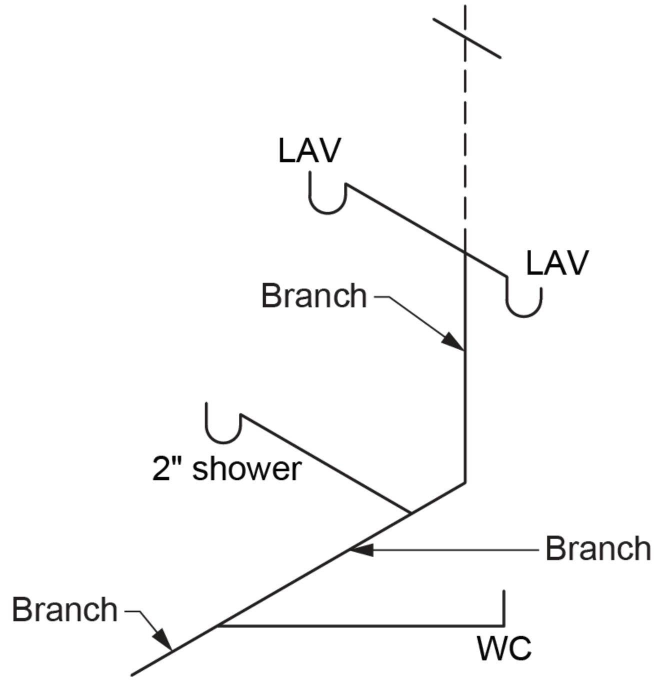

__Figure 6__ Branch. (Skilled Trades BC, 2021) Used with permission.

branch vent: a vent pipe connected at its lower end to the junction of two or more vent pipes. At its upper end, it either terminates in the open air or connects to another branch vent, stack vent, vent stack, or vent header (Figure 7).

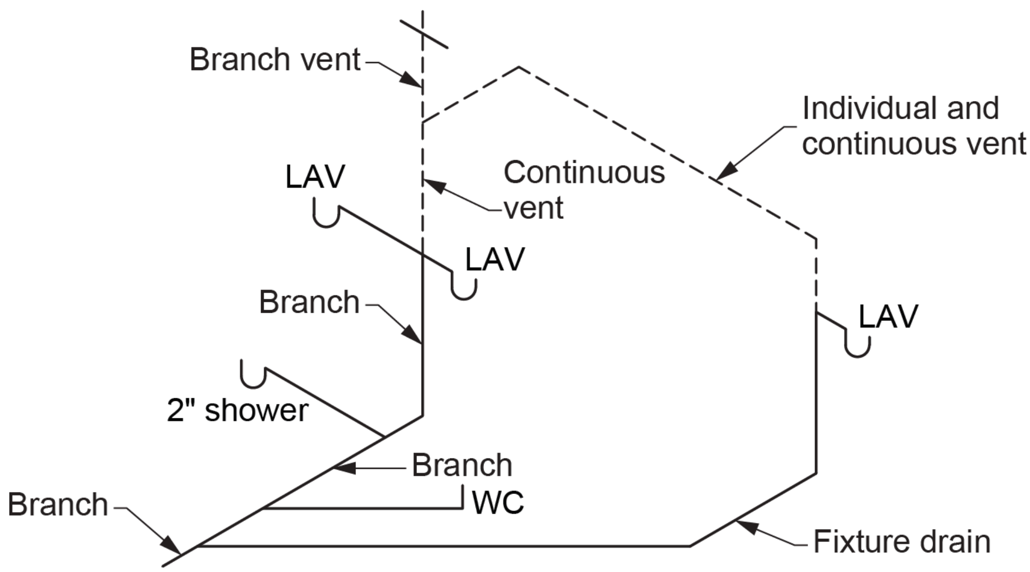

__Figure 7__ Branch vent. (Skilled Trades BC, 2021) Used with permission.

building drain: the lowest horizontal piping, including any vertical offset that conducts sewage, clear-water waste, or stormwater by gravity to a building sewer (Figure 8).

building sewer: a pipe that connects to a building drain 1 m (39 in.) outside the wall of a building and connects to a public sewer or private sewage disposal system (Figure 8).

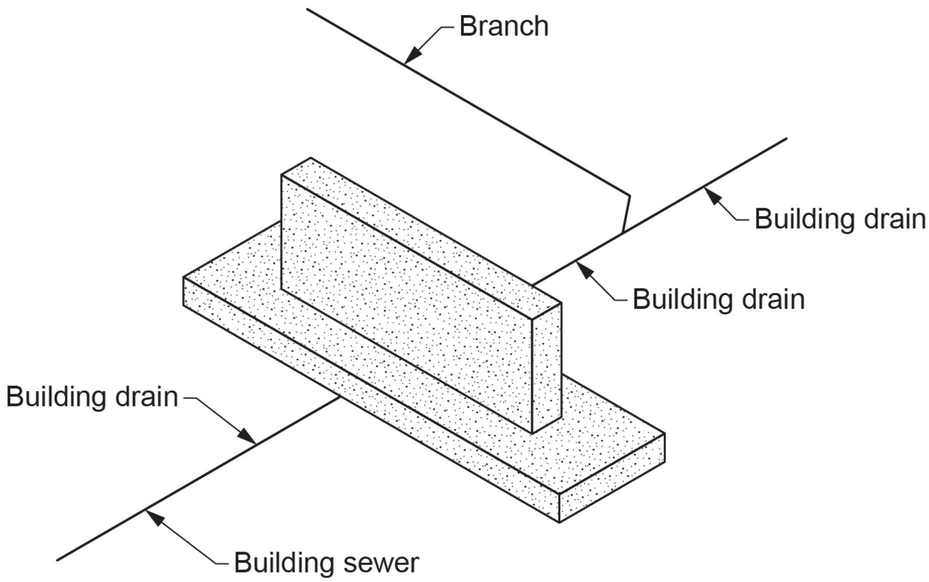

Figure 8 *Building drain and building sewer. (Skilled Trades BC, 2021) Used with permission.*

building trap: a trap installed in a building drain or building sewer to prevent the circulation of air between a drainage system and a public sewer. New buildings do not have building traps installed, but these traps still exist in older homes and buildings (Figure 9).

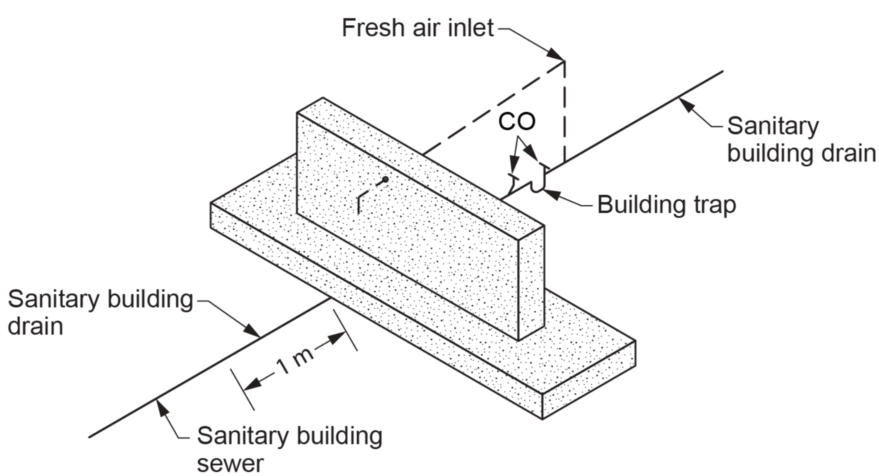

Figure 9 *Building drain and building sewer with building trap. (Skilled Trades BC, 2021) Used with permission.*

cleanout: an access point installed in drainage and venting systems for cleaning and inspection services.

clear-water waste: wastewater with impurity levels not harmful to health. It may include cooling water and condensate drainage from refrigeration and air-conditioning equipment and cooled condensate from steam heating systems, but it does not include stormwater.

combined building drain: a building drain intended to conduct sewage and stormwater (Figure 10).

combined building sewer: a building sewer intended to conduct sewage and stormwater.

combined sewer: a sewer intended to conduct sewage and stormwater.

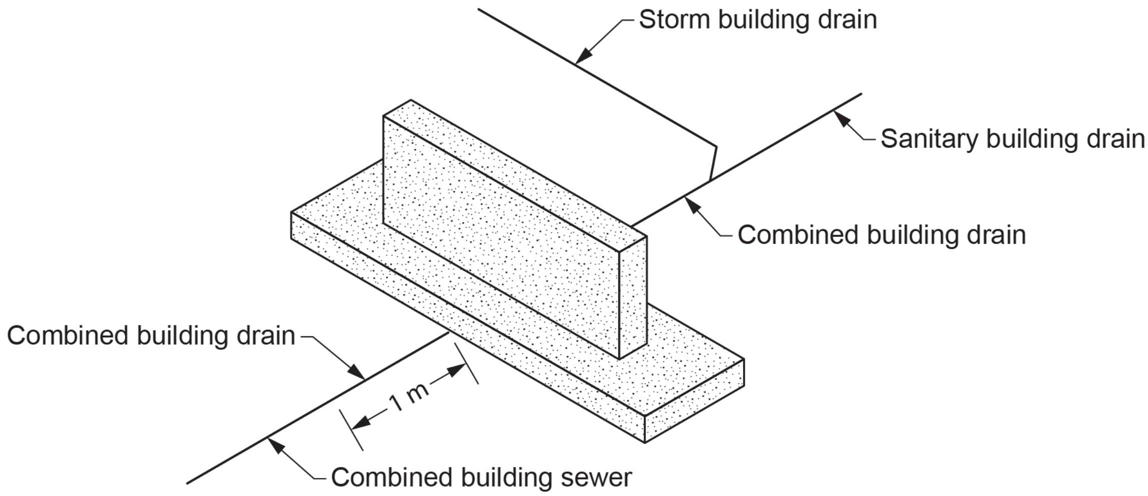

Figure 10 *Combined building drain and combined building sewer. (Skilled Trades BC, 2021) Used with permission.*

continuous vent: a vent pipe that is an extension of a vertical section of a branch or fixture drain.

Figure 11 *Continuous vent. (TRU Open Press). CC-BY-NC-SA (https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en)*

dead end: a pipe that terminates with a capped fitting.

developed length: the length along the centreline of the pipe and fittings (Figure 12).

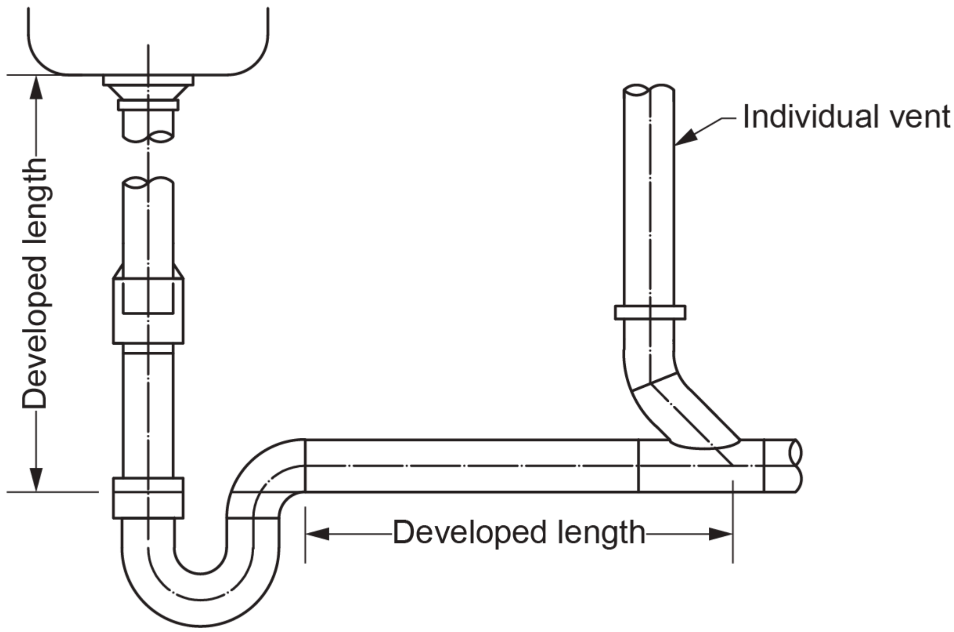

Figure 12 *Developed length of fixture outlet pipe and trap arm. (Skilled Trades BC, 2021) Used with permission.*

directly connected: implies that two pipes are physically connected in such a way that water or gas cannot escape from the connection.

drainage system: an assembly of pipes, fittings, fixtures, and traps used to convey sewage, clear-water waste, or stormwater to a public sewer or private sewage disposal system. It does not include subsoil drainage pipes.

dual vent: a vent pipe that serves two fixtures and connects at the junction of the trap arms (Figure 13).

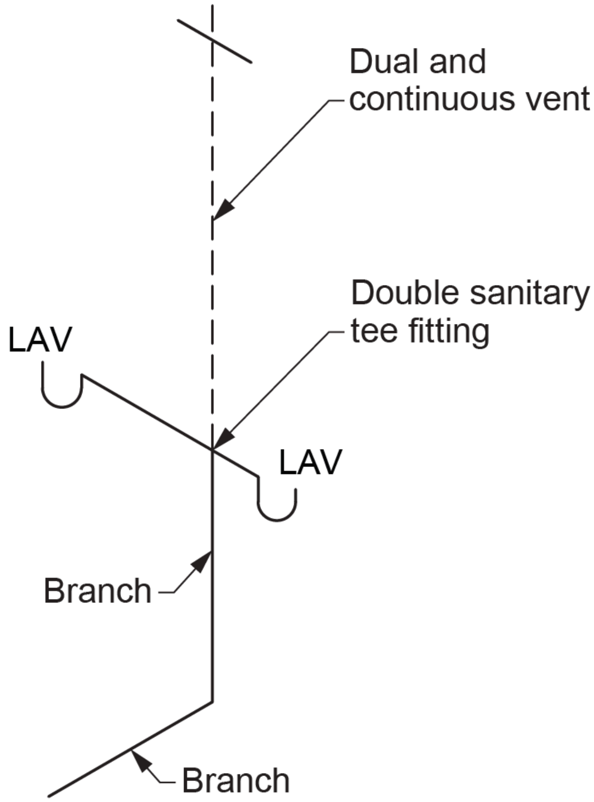

Figure 13 *Dual and continuous vent. (Skilled Trades BC, 2021) Used with permission.*

emergency floor drain: a fixture used for overflow protection that does not receive regular discharge from other fixtures, other than from a trap primer. Any floor drain installed in a washroom is considered an emergency floor drain.

fixture: a receptacle, appliance, apparatus, or other device that discharges sewage or clear-water waste and includes a floor drain.

fixture drain: the pipe that connects a trap serving a fixture to another part of a drainage system (Figure 14).

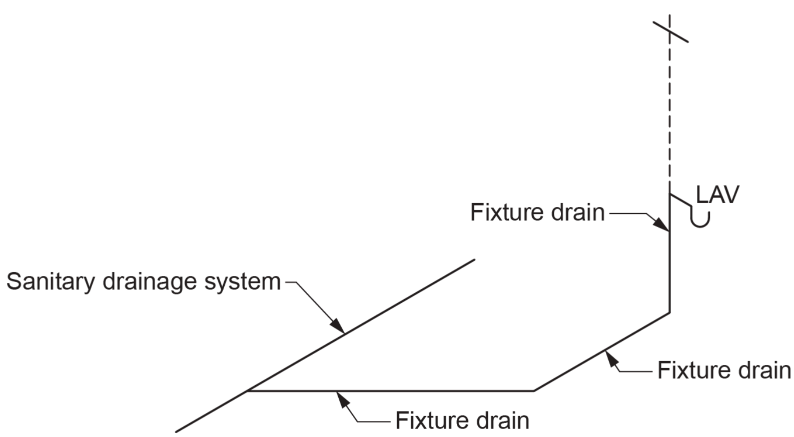

Figure 14 *Fixture drain. (Skilled Trades BC, 2021) Used with permission.*

fixture outlet pipe: a pipe that connects the waste opening of a fixture to the inlet of the trap serving the fixture (Figure 15).

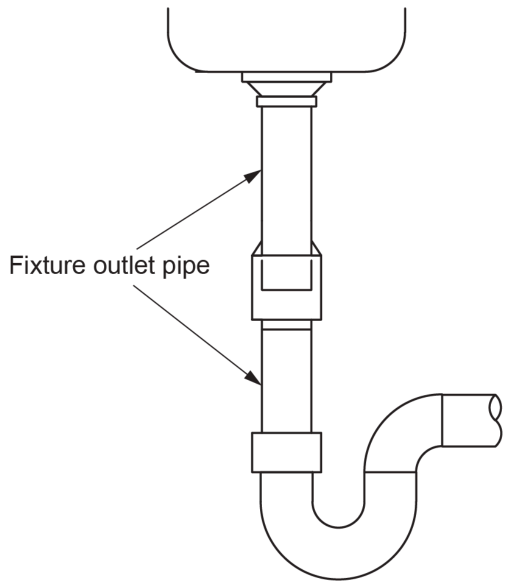

Figure 15 *Fixture outlet pipe. (Skilled Trades BC, 2021) Used with permission.*

fixture unit (DWV): the unit of measure based on the rate of discharge, time of operation, and frequency of use of a fixture that expresses the hydraulic load imposed by that fixture on the drainage system.

flood level rim: the top edge at which water can overflow from a fixture or device (Figure 16).

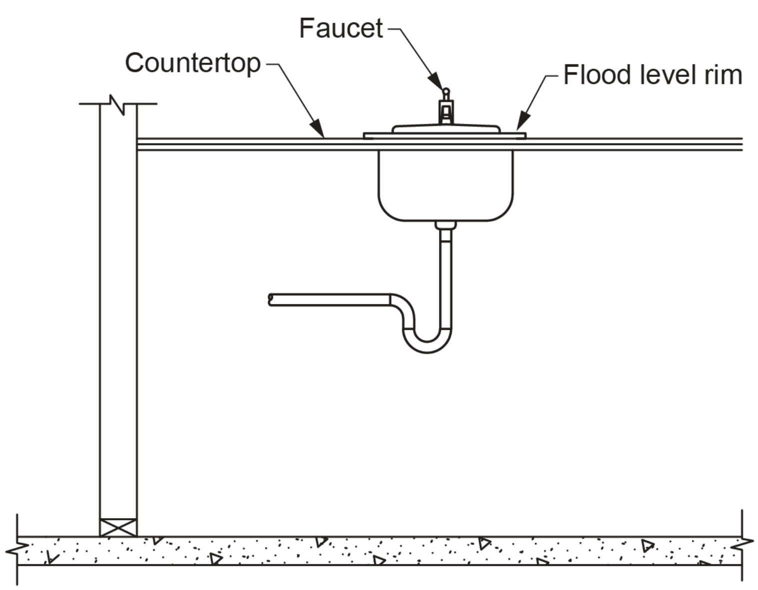

Figure 16 *Cabinet-mounted sink flood level rim. (Skilled Trades BC, 2021) Used with permission.*

fresh air inlet: a vent pipe installed in conjunction with a building trap and that terminates outdoors. It is used to prevent an air lock between the fixture traps and the building trap by allowing air circulation through the DWV system (Figure 17).

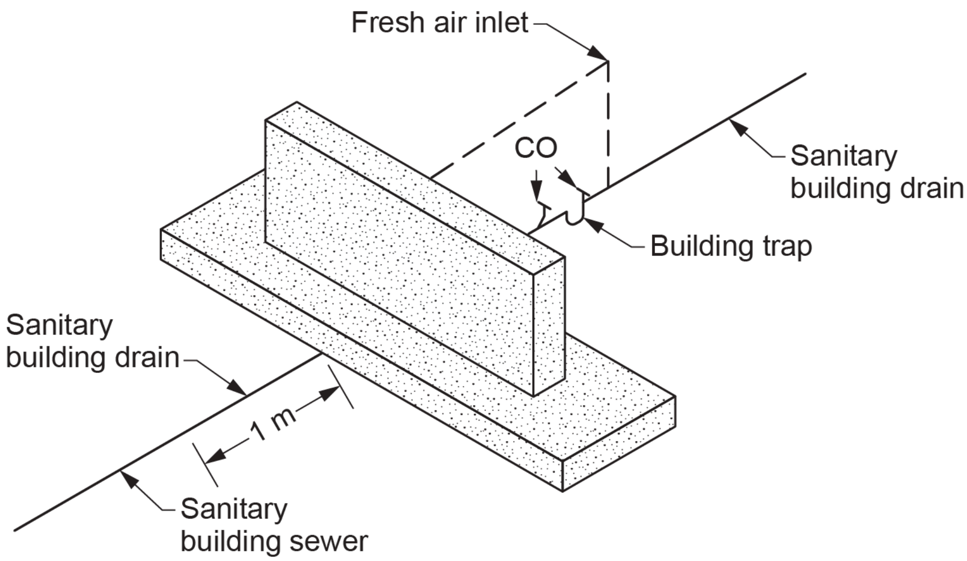

Figure 17 *Fresh air inlet. (Skilled Trades BC, 2021) Used with permission.*

indirectly connected: a pipe that does not connect directly with the drainage system but conveys liquid wastes by discharging into a plumbing fixture, interceptor, or receptacle directly connected to the drainage system. An air break separates the two systems. The air break prevents the possibility of wastes backing up into a compartment or device and contaminating it (Figure 18).

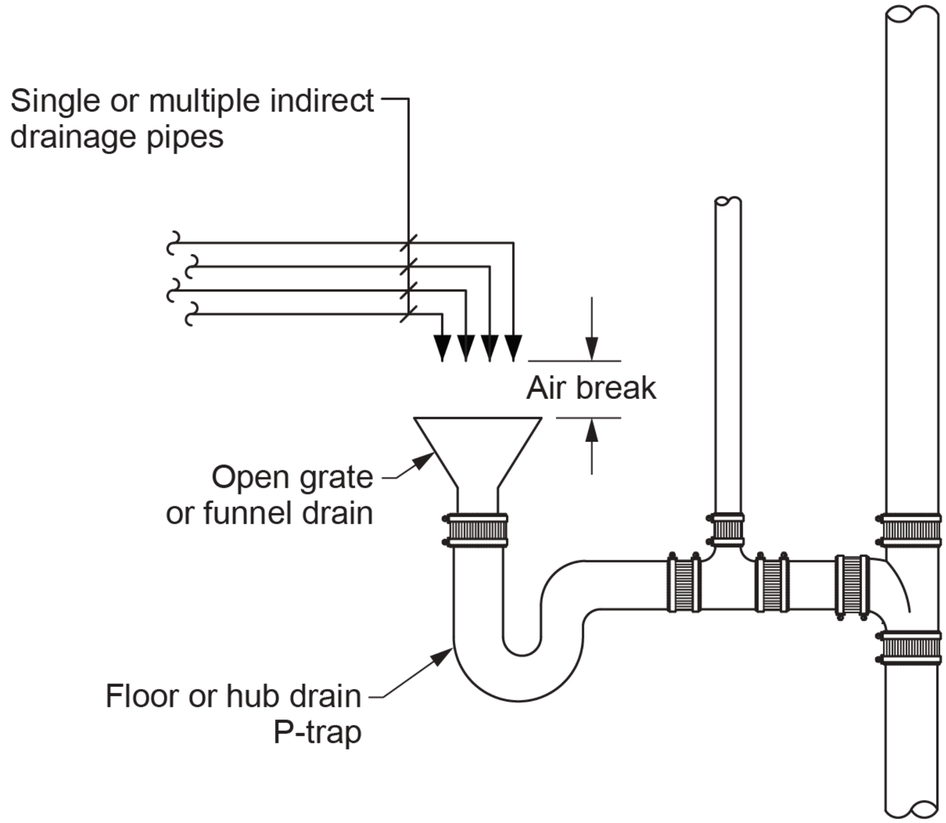

Figure 18 *Indirectly connected waste piping terminating with an air break. (Skilled Trades BC, 2021) Used with permission.*

individual vent: a vent pipe that serves one fixture (Figure 19).

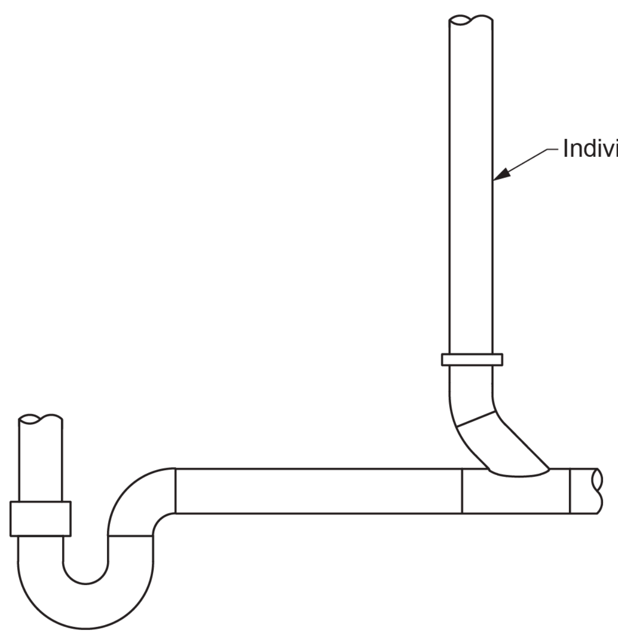

Figure 19 *Individual vent. (Skilled Trades BC, 2021) Used with permission.*

interceptor: a receptacle installed to prevent unwanted materials from passing into a drainage system. There are three main types of interceptors: grease, oil, and solids. Each of them requires different considerations for sizing, operation, and maintenance (Figure 20).

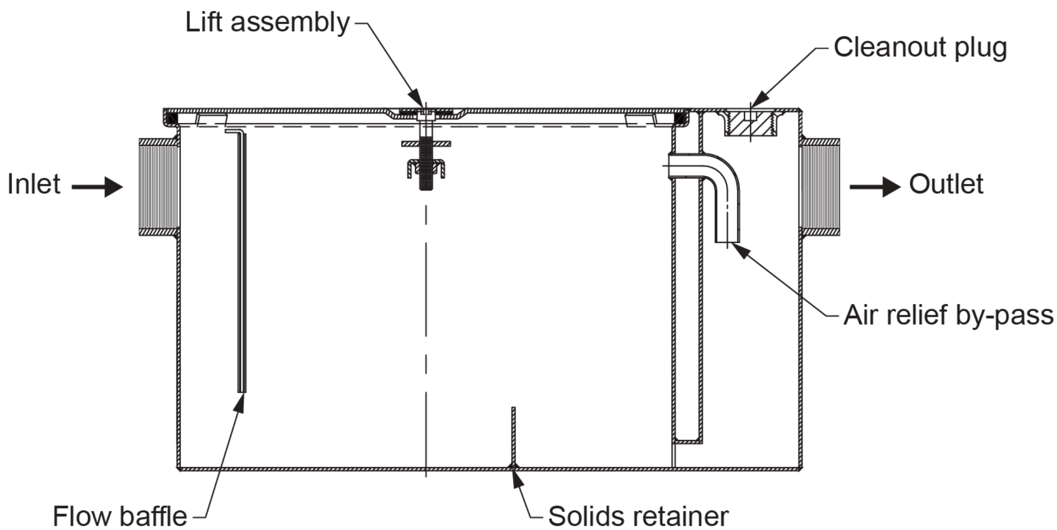

Figure 20 *Commercial-grade grease interceptor. (Skilled Trades BC, 2021) Used with permission.*

nominally horizontal: a DWV piping arrangement installed at an angle of less than 45° with the horizontal.

nominally vertical: a DWV piping arrangement installed at an angle of not more than 45° with the vertical (Figure 21).

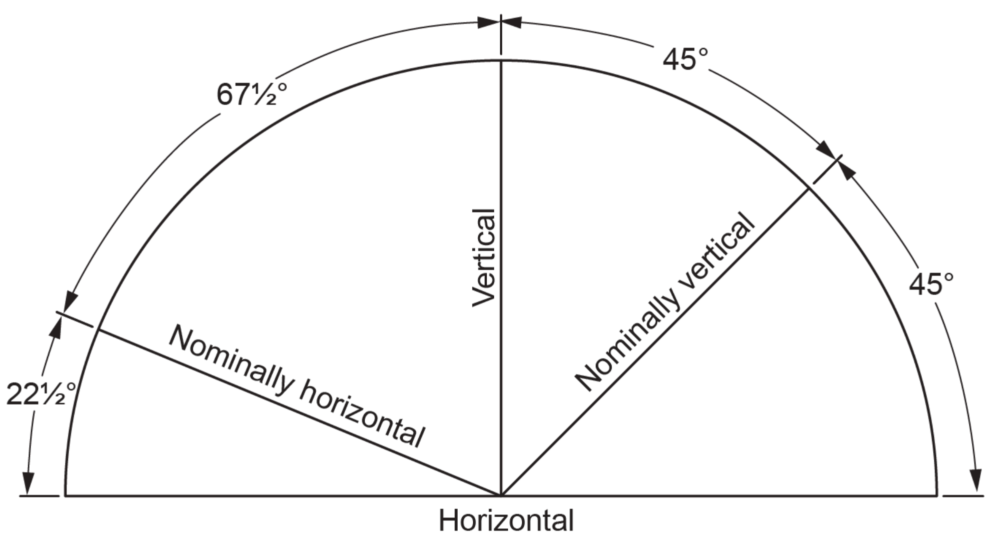

Figure 21 *Nominally horizontal and vertical. (Skilled Trades BC, 2021) Used with permission.*

nominal pipe size (NPS): the nominal diameter by which a pipe, fitting, trap, or other similar item is commercially designated.

offset: the piping that connects the ends of two parallel pipes (Figure 22).

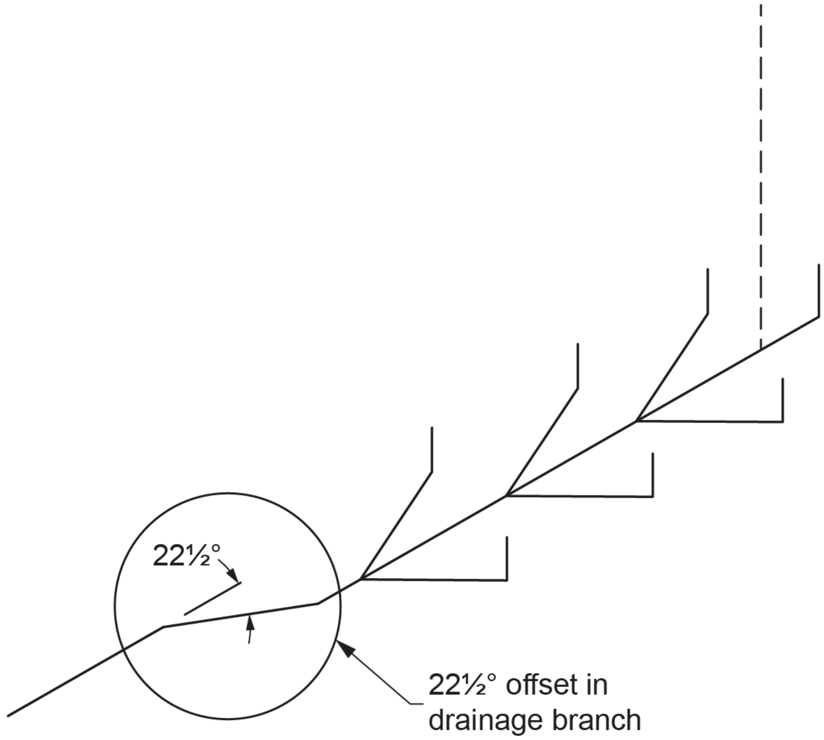

Figure 22 *Offset connecting two parallel drainage pipes. (Skilled Trades BC, 2021) Used with permission.*

offset relief vent: a relief vent that provides additional air circulation upstream and downstream of an offset in a stack (Figure 23).

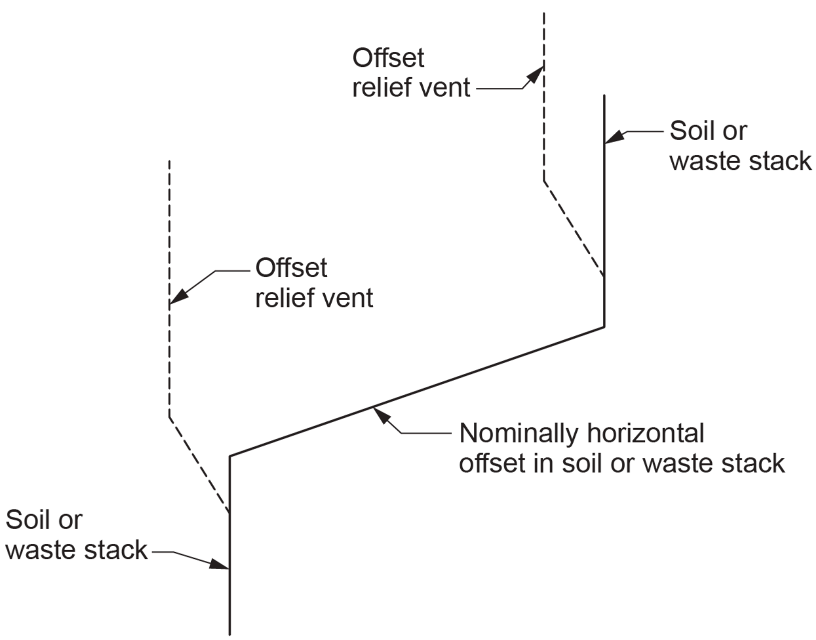

Figure 23 *Offset relief vents. (Skilled Trades BC, 2021) Used with permission.*

private sewage disposal system: a privately owned plant for treating and disposing of sewage (e.g., a septic tank with an absorption field).

private use (plumbing fixtures): fixtures in residences, apartments, or in private bathrooms of hotels or other buildings intended for use by one family or an individual.

public use (plumbing fixtures): fixtures that may be used by multiple users in a public setting, such as washrooms in schools, gymnasiums, hotels, bars, public comfort stations, and other installations where fixtures are installed so that their use is unrestricted.

relief vent: a vent pipe used in conjunction with a circuit vent to provide additional air circulation within a circuit-vented system (Figure 24).

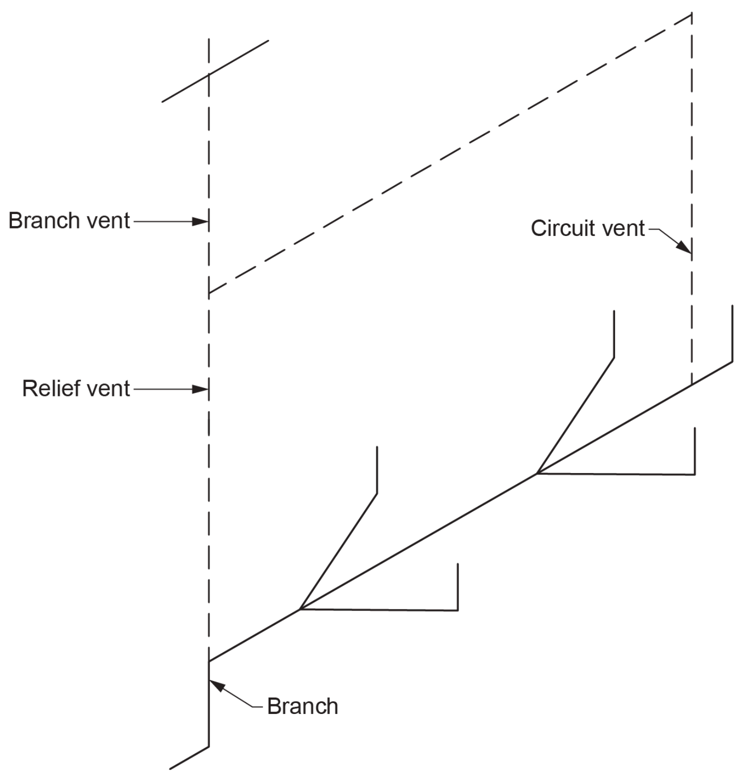

Figure 24 *Relief vent. (Skilled Trades BC, 2021) Used with permission.*

sanitary building drain: a building drain that conducts sewage to a building sewer from the most upstream stack, branch, or fixture drain serving a water closet.

sanitary building sewer: a building sewer that conducts sewage (Figure 25).

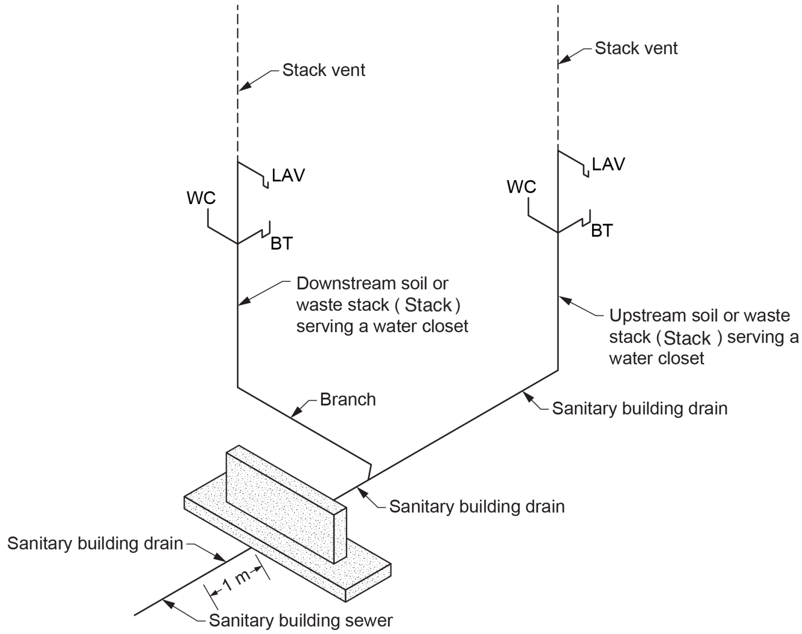

Figure 25 *Sanitary building drain and building sewer locations. (Skilled Trades BC, 2021) Used with permission.*

sanitary drainage pipe: a pipe in a sanitary drainage system.

sanitary drainage system: a drainage system that conducts sewage.

sanitary sewer: a sewer that conducts sewage.

sewage: any liquid waste other than clear-water waste or stormwater.

stack: a vertical sanitary drainage pipe that passes through one or more storeys and includes any offset in the stack. Previously referred to as a soil-or-waste stack or SOWS.

stack vent: a vent pipe that connects the top of a stack to a vent header or terminates to outside air (Figure 26).

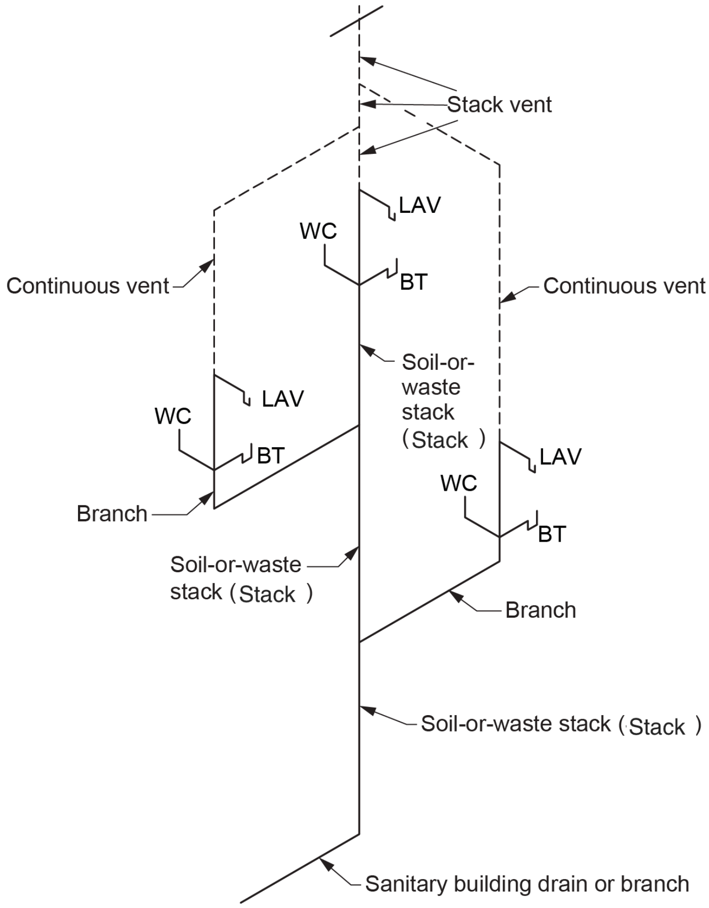

Figure 26 *Stack and stack vent locations. (Skilled Trades BC, 2021) Used with permission.*

storey (as applied to plumbing): the interval between two successive floor levels, including mezzanine floors that contain plumbing fixtures, or between a floor level and roof.

subsoil drainage pipe (drain tile/weeping tile): a pipe installed underground to intercept and convey subsurface water.

trap: a fitting or device designed to hold a liquid seal that prevents the passage of gas while allowing the flow of liquid to continue without significant obstruction.

trap arm: the portion of a fixture drain between the trap weir and the vent pipe connection.

trap dip: the lowest part of the upper interior surface of a trap.

trap seal depth: the vertical distance between the trap dip and the trap weir.

trap weir: the highest part of the lower interior surface of a trap (Figure 27).

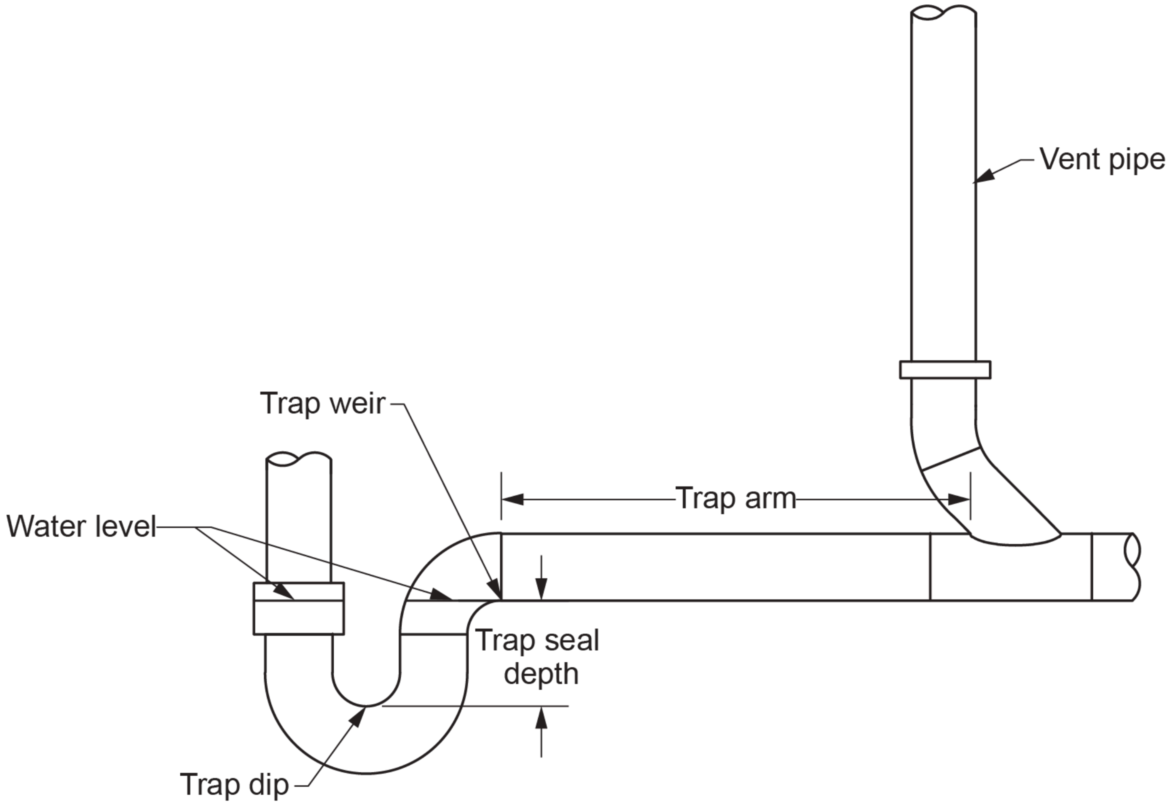

Figure 27 *P-trap terminology. (Skilled Trades BC, 2021) Used with permission.*

trap standard: a trap for a fixture that is integral to the support for the fixture (Figure 28).

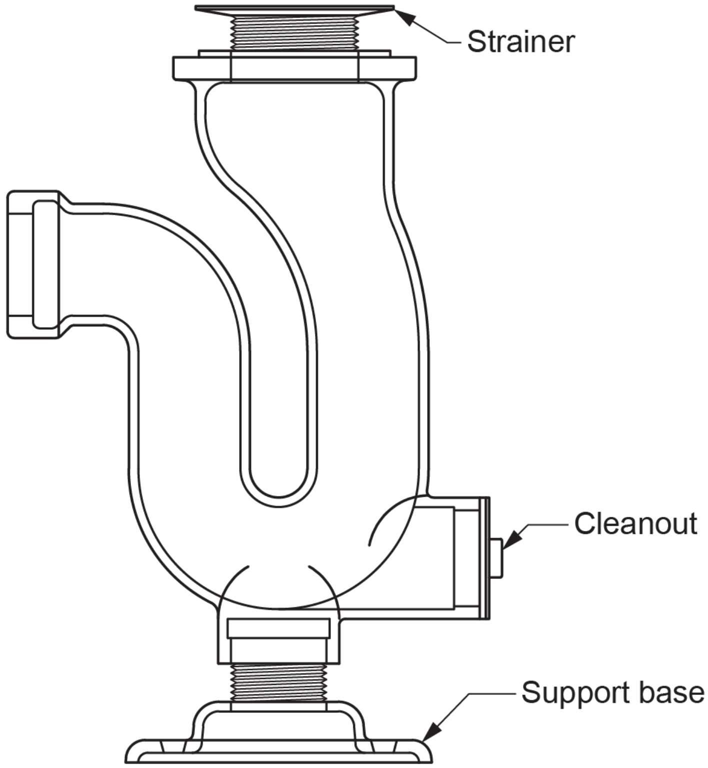

Figure 28 *P-trap standard. (Skilled Trades BC, 2021) Used with permission.*

vent header: a vent pipe that connects any combination of stack vents or vent stacks and terminates to outside air (Figure 29).

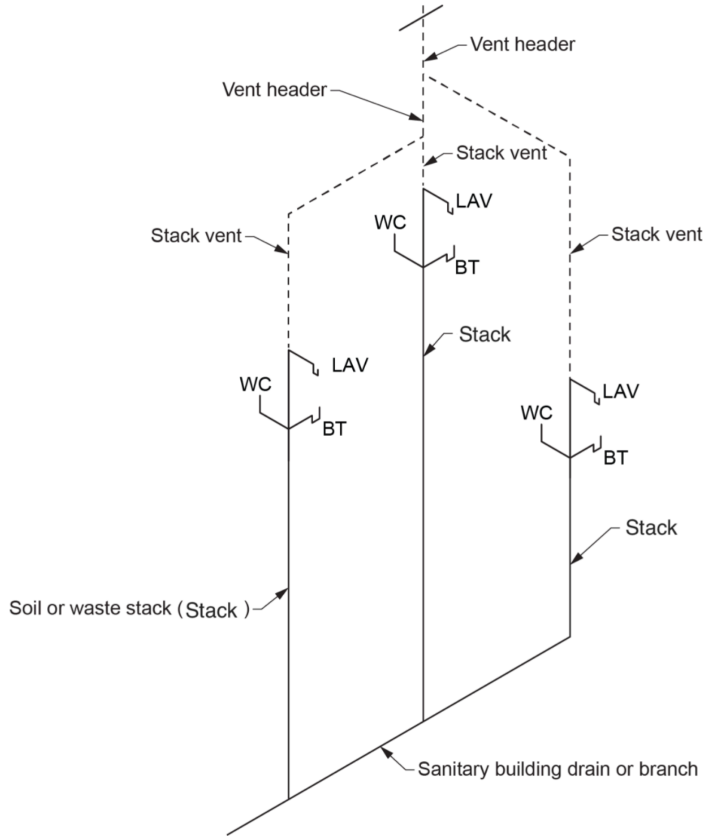

Figure 29 *Vent header. (Skilled Trades BC, 2021) Used with permission.*

vent pipe: a pipe that is part of a venting system.

vent stack: a vent pipe that is connected at its upper end to a vent header or that terminates to outside air. It connects at its lower end to the stack at or below the lowest sanitary drainage pipe connection (Figure 30).

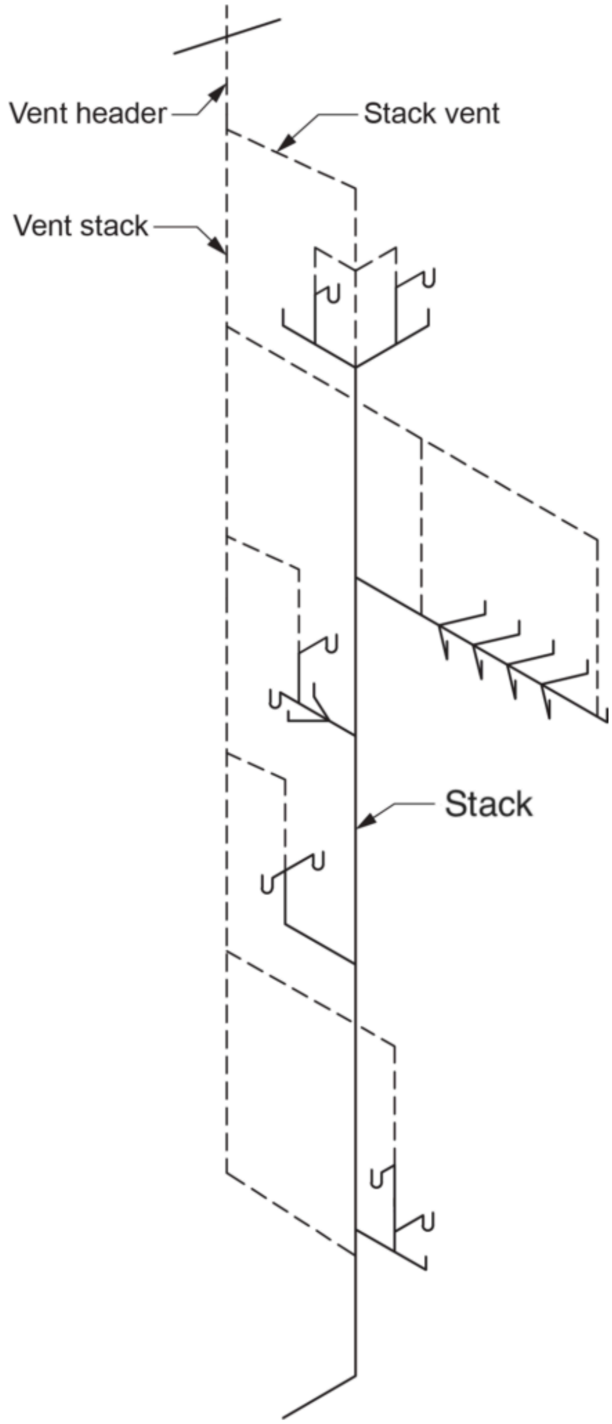

Figure 30 *Vent stack connected to a stack and becoming a vent header. (Skilled Trades BC, 2021) Used with permission.*

venting system: an assembly of pipes and fittings that connects a drainage system with outside air to circulate air and protect trap seals in the drainage system.

wet vent: a sanitary drainage pipe that also serves as a vent pipe and extends from the most downstream wet-vent fixture connection to the most upstream fixture dry-vent connection (Figure 31). A wet vent is a function of a branch, fixture drain, or stack and should be identified as a BR/WV, FD/WV, or a Stack/WV.

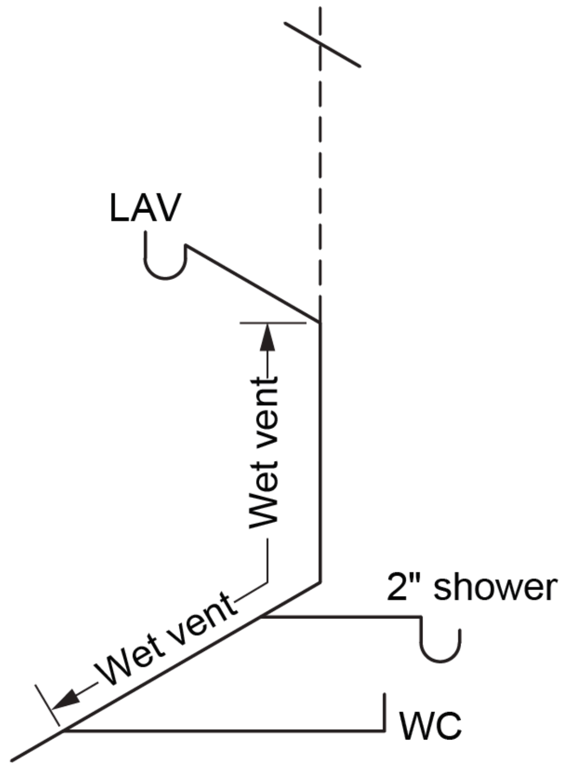

__Figure 31__ Wet vent serving a bathroom group. (Skilled Trades BC, 2021) Used with permission.

yoke vent: a vent pipe connected at its lower end to a stack and at its upper end to a vent stack or to a branch vent connected to a vent stack. A yoke vent is required when serving a stack receiving discharge from more than 11 storeys (Figure 32). A yoke vent provides extra air circulation for the operation of the stack.

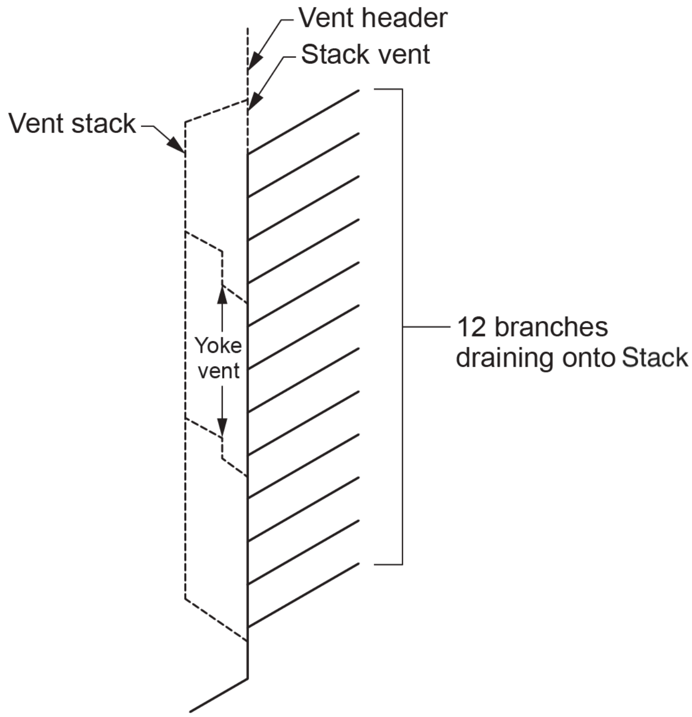

Figure 32 *Yoke vent. (Skilled Trades BC, 2021) Used with permission.*

Self-Test D-1.2: DWV Terminology

Complete Self-Test D-1.2 and check your answers.

If you are using a printed copy, please find Self-Test D-1.2 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=39#h5p-2 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=39#h5p-2)

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- **Figure 11** Continuous vent is by TRU Open Press and can be used under the CC-BY-NC-SA (https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en) license.

D-1.3 Functions of Different Pipes in a DWV System

Each DWV pipe has a specific name and function. Plumbers must thoroughly understand these terms to ensure the design and installation comply with code. Building drainage and venting systems must be appropriately sized based on the fixture unit load imposed on them by the fixtures and conform with other code clauses. Plumbers must also understand the mechanics of fluid flow in pipes to understand certain code regulations and their intent.

The DWV system is perhaps the most important part of the total mechanical system in a building. The sanitary drainage system is a circuit of piping designed to remove waterborne waste from the plumbing fixtures in a building and drain them safely, reliably, and efficiently. A sanitary drainage system typically consists of fixture drains, branches, and stacks conveying liquid waste to a building drain that, in turn, becomes a building sewer outside the building. The wastewater is then delivered to either a municipal sewer system at the street or to an on-site private sewage disposal system. A recent development in the handling of building waste is to have the drainage from sinks, showers, and dishwashers (known as grey water) drain to a tank, where it is treated and reused for toilet flushing and irrigation purposes.

Along with all the drain and waste pipes, there is a system of vent pipes integrated into the DWV system that is critical for plumbing fixtures to function correctly (Figure 1). These vent pipes provide a free flow of air to maintain equalized pressure throughout the DWV systems and allow sewer gas to be vented out above the building, where it can quickly mix with the ambient air and dissipate. The vent piping allows the admission or emission of air into the system, limiting the pressure differential on the trap seals to not more than 1 in. water column (WC) (250 Pa).

This pressure limitation prevents back pressure or siphonage from removing the water trap seals that serve the fixture.

Parts of a DWV System

The main components to a DWV system include:

- Fixture outlet pipe
- P-trap
- Trap arm
- Fixture drain
- Branch
- Stack
- Sanitary building drain
- Sanitary building sewer
- Cleanouts
- Vents

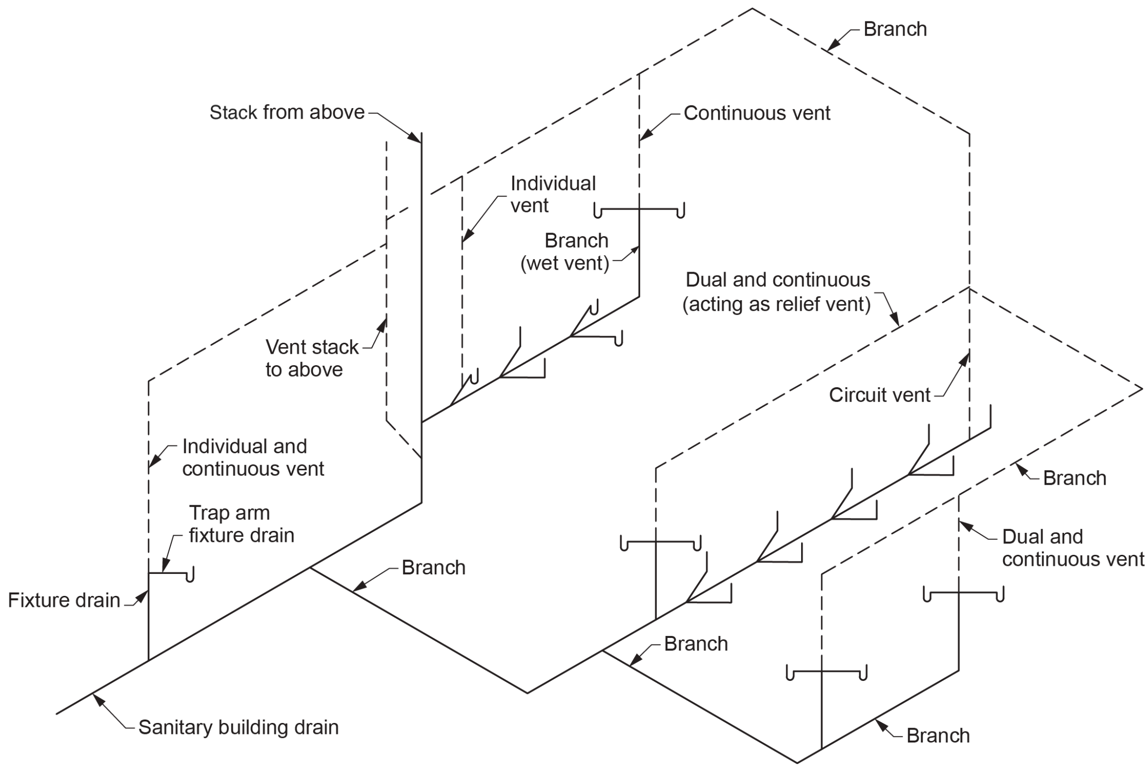

Figure 1 *DWV system component. (Skilled Trades BC, 2021) Used with permission.*

Fixture Outlet Pipe

The fixture outlet pipe is the section of drain pipe between the drain outlet of a fixture and the trap serving it. Fixture outlet pipes are typically sized by the tailpiece outlet of the fixture, with some exceptions, such as a three-compartment commercial kitchen sink served by a single trap (Figure 2). The portion of the fixture outlet pipe serving all three sinks is increased by one size. Some fixture outlet pipes may also be reduced from the size of the outlet of the fixture. For example, a shower base is usually supplied with a 50 mm (2 in.) outlet but only requires a 38 mm ($1\frac{1}{2}$ in.) fixture outlet pipe if there is only one showerhead installed.

The maximum length of a fixture outlet pipe is limited to 1,200 mm (4 ft) to prevent the velocity of the water draining through it from siphoning the trap; this is known as “self-siphonage.” However, this length does create the ability to place a trap for a fixture under the floor and is useful for some installations.

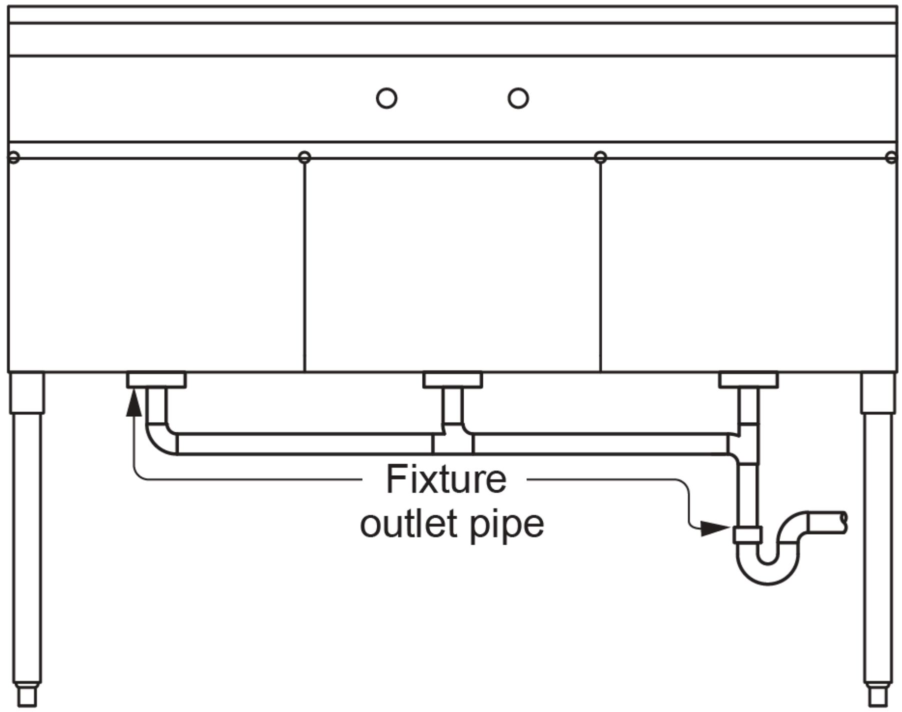

Figure 2 *Fixture outlet pipe serving a three-compartment commercial sink. (Skilled Trades BC, 2021) Used with permission.*

P-Trap

A trap is a non-mechanical device that prevents odours, animals, and drafts from entering the building through it while not affecting the flow from the fixture when it drains. It is important to recognize the other two functions of a trap seal. The velocity of water moving through a trap is important to its function. This is why there are limits to how far below the fixture the trap can be placed. If the liquid has too much velocity when it reaches the trap, it could self-siphon, which would remove the trap seal. The pipe (trap arm) exiting the trap has to be nominally horizontal so that the water does not rush through and siphon the trap. Most traps are installed external to the fixture, but a few fixtures — such as toilets and some urinals — have built-in traps known as "integral traps."

Trap Arm

A trap arm is the pipe between the trap weir and vent pipe serving the fixture. The National Plumbing Code regulates its minimum and maximum lengths. The minimum trap arm length shall be not less than two pipe diameters. For example, a 38 mm ($1\frac{1}{2}$ in.) trap arm shall not be less than 75 mm (3 in.) in length. The maximum length also depends on its size. The total fall in a trap arm due to its slope shall not exceed one pipe diameter. In other words, the vent pipe connection to a fixture drain cannot be below the weir of the trap.

To determine the maximum length of the trap arm, divide the pipe diameter by the required slope. The answer is the total feet of developed length of the trap arm from the trap weir to the vent connection. For example, a $1\frac{1}{2}$ in. trap arm graded at $\frac{1}{4}$ in./ft (1:50 or 2%) could run 1.8 m (6 ft) before being vented ($1\frac{1}{2}$ in. $\div$ $\frac{1}{4}$ in. $= 6$ ft or 1.8 m). For a 2 in. pipe, the maximum run can be 2.4 m (8 ft), and so on.

Fixture Drain

A fixture drain is the section of drainage pipe between the outlet of a single fixture trap and another section of the drainage system, such as another fixture drain, a branch, or a stack. In Figure 3, the trap arm section is called a "trap arm fixture drain" because it falls under both definitions.

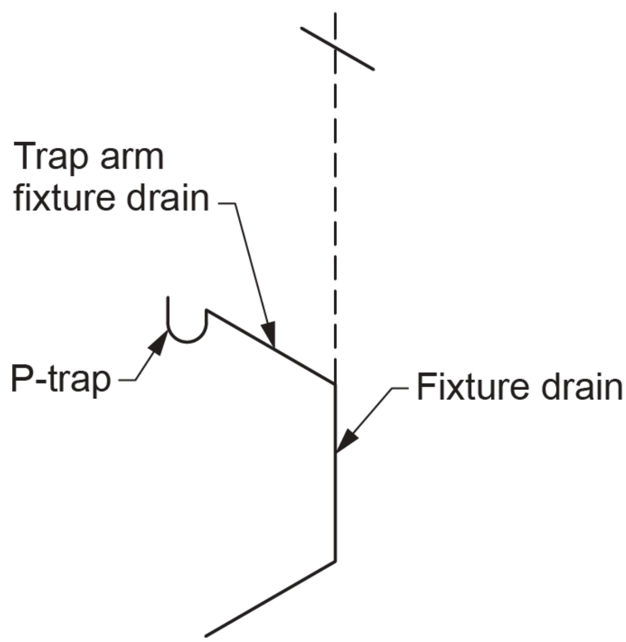

Figure 3 *Drainage pipe terminology serving a single fixture. (Skilled Trades BC, 2021) Used with permission.*

Branch

A branch in a drainage system is a sanitary drainage pipe that serves at least two fixtures located on a single storey and will connect at its downstream end to a stack, building drain, another branch, or possibly a sewage sump (Figure 4). The upstream end of a branch will connect two trap arms or fixture drains. A branch could also connect a stack to a building drain in the case where multiple stacks are installed in a building.

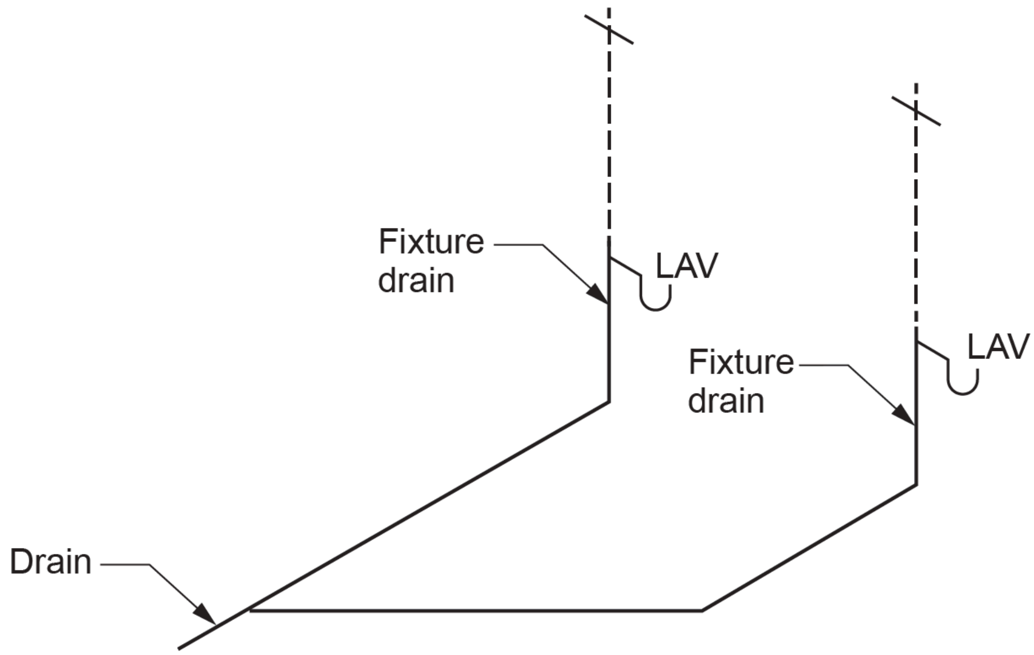

Figure 4 *Branch. (Skilled Trades BC, 2021) Used with permission.*

Stack

If a fixture drain or a branch carries waste through at least one storey, it is re-labeled as a stack. At its base, it will drain into either a branch or sanitary building drain, and it must have a cleanout near its lowest vertical point. The NPC also states that it must have a vent connected to the top of it, called a stack vent.

Wastewater flows through vertical pipes much differently than it does through nominally horizontal pipes. In order to understand the code requirements for piping connections at or near the base of stacks, a plumber must be aware of the pneumatic and hydraulic forces present in stacks.

Flow from a branch or fixture drain empties into the vertical stack using a wye and 45° fitting combination or a short-turn sanitary tee. When a high inflow rate is present, a slug of water is produced as the flow moves from horizontal to vertical (Figure 5). As the amount of inflow from the branch determines the size of the slug, there are limitations to the amount of flow entering the stack from any one floor level. This ensures discharge from the branch does not cause excessive interference with the sheet of liquid that may be flowing down the stack from above.

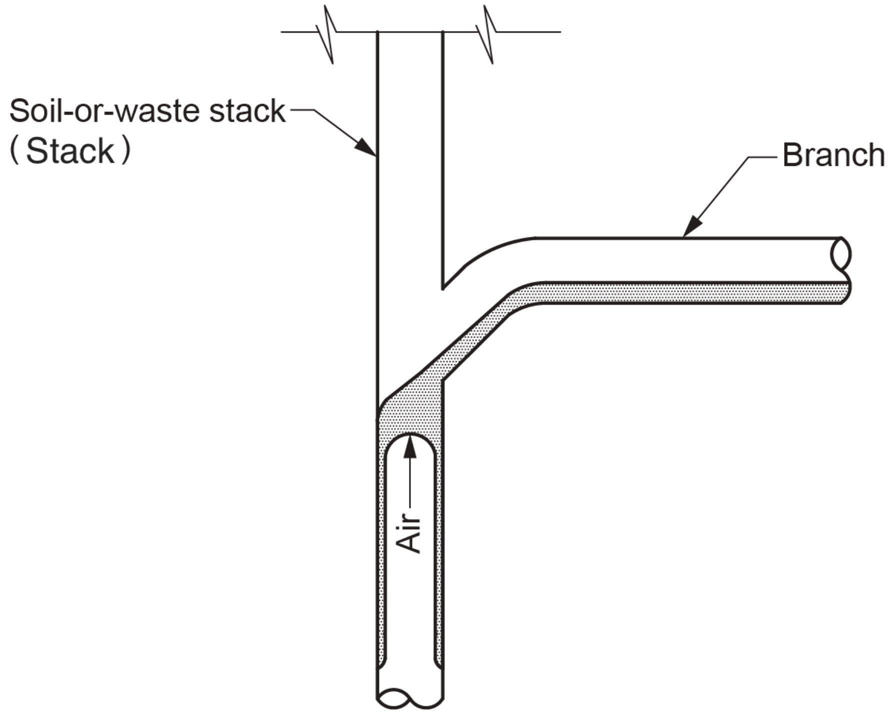

Figure 5 *Stack. (Skilled Trades BC, 2021) Used with permission.*

This slug is immediately accelerated at the rate of 9.8 m/sec/sec (32.2 ft/sec/sec) by the force of gravity. In a very short distance, air in the stack forces its way through this slug, sending the flow to the inner walls of the stack. This sheet of water — with a core of air in the centre — continues to accelerate until the frictional force exerted by the pipe wall on the falling sheet of water equals the gravitational force. The sheet of water will fall at a velocity that remains constant, provided that no additional flow enters the stack. This constant vertical velocity is called "terminal velocity," and the distance within which this maximum velocity is achieved is called the "terminal length." Field measurements have shown that a terminal velocity of 3–4.5 m/s (10–15 fps) is achieved within approximately 3–4.5 m (10–15 ft) from the point of entry to the stack. This constant velocity fact abolishes the myth that water falling from a great height will destroy the fittings at the base of a stack. In reality, the velocity at the base of an 80-storey stack is only slightly and insignificantly greater than the velocity at the base of a four-storey stack.

As the liquid falls down the stack, it exerts a frictional drag on the centre air core, dragging air with it. The air dragged downward is replenished by the stack vent to ensure negative pressures do not develop in the stack. The air being dragged down the stack can also cause positive pressure to build at the base of the stack. Therefore, the NPC requires that a vent stack be installed to serve any stack that conveys sewage through more than four storeys. The vent stack acts as a relief point for the air pressure created by the flow conditions at the base of the stack.

At the base of the vertical stack, flow enters the horizontal branch or building drain at stack terminal velocity. The velocity of the water flowing in the horizontal drain slowly decreases with a corresponding increase in the depth. This increase in depth is often great enough to completely fill the cross-sectional area of the pipe. This phenomenon of sudden rise in depth causes turbulence at the base of the stack and is called "hydraulic jump" (Figure 6).

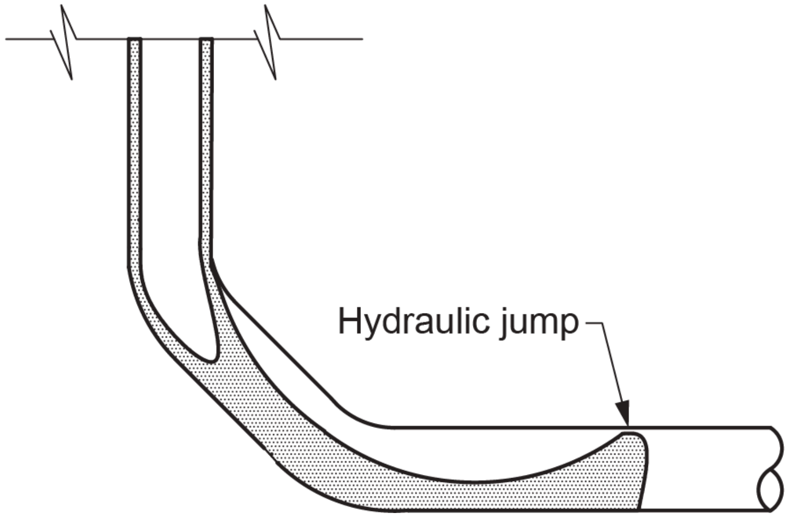

Figure 6 *Vertical to horizontal flow. (Skilled Trades BC, 2021) Used with permission.*

The turbulence resulting from hydraulic jump increases the static pressure, which can cause loss of trap seals in the downstream piping if the traps are installed too close to the base of the stack (Figure 7). The code requires that, in certain circumstances, fixture drains or branches be prohibited from connecting to a branch or sanitary building drain within 1.5 m (5 ft) of the bottom of the stack.

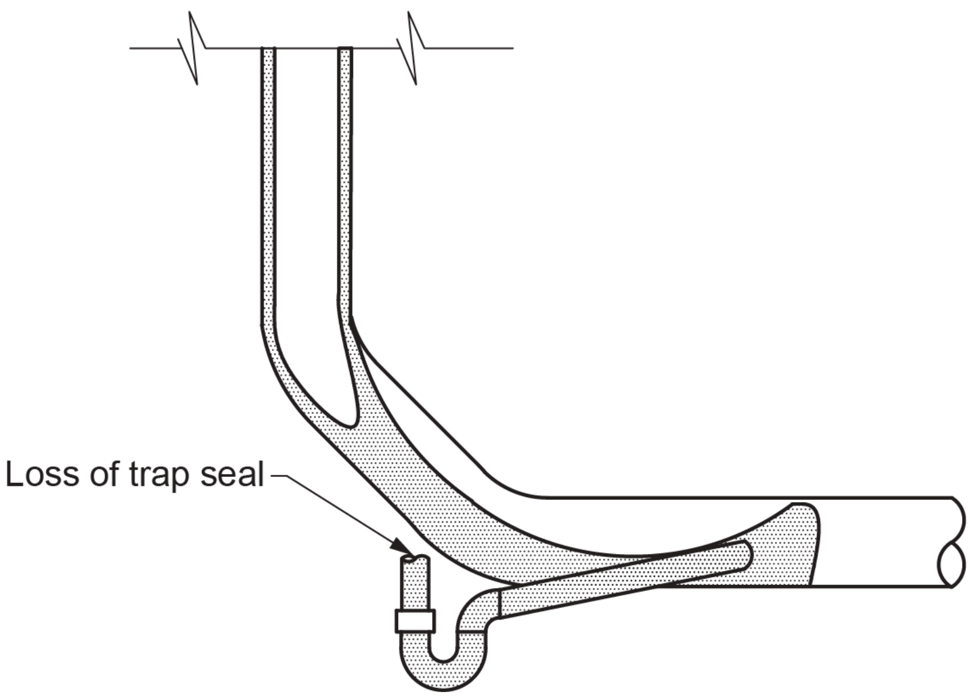

Figure 7 *Loss of trap seal. (Skilled Trades BC, 2021) Used with permission.*

Sanitary Building Drain

A sanitary building drain is always connected to a sanitary building sewer at its downstream end. Its path takes it to the most upstream stack, branch, or fixture drain that has a toilet draining through it. It becomes the main horizontal sanitary collection pipe within the building.

A cleanout must be installed on the sanitary building drain to serve the sanitary building sewer. The cleanout should always be installed as close as possible to where the building drain leaves the building — either inside or outside — and be accessible for sewer cleaning equipment. Some municipalities require backwater valves to be installed on the sanitary building drain to isolate the entire building in the event of sewer backup.

Sanitary Building Sewer

The sanitary building sewer is the part of the drainage system that extends from the end of the building drain (1 m/39 in. outside the building) and conveys its discharge to a public sewer, private sewer, on-site wastewater disposal system, or other points of disposal. Building sewers often have additional cleanouts between the building wall and the main sewer. The cleanout is usually a minimum size of 100 mm (4 in.) in diameter with a water- and gas-tight cap.

Building sewers are commonly constructed using sewer-grade thin wall piping, although DWV grade is also acceptable. The pipes in a sewer are installed over a compacted bed of sand that supports them, preventing them from settling and losing their grade. Typically, plumbers lay the sewer from the foundation wall to the property line, and the municipal sewer crew is in charge of the installation from the property line to the sewer main.

Sewage Sump Basins

A sewage sump basin is used when plumbing fixtures are installed at a lower elevation than the gravity building drain. Although not defined in the plumbing code, this type of arrangement is known in the industry as a "sub-drainage system." When used, the sewage is lifted into the building's gravity drainage system by automatic pump equipment.

A sewage sump basin must be airtight to prevent the escape of gases generated by sanitary waste from the sub-drainage system. Since it is airtight, a vent is required to relieve the air in the basin as wastes discharge into it and also to supply air to the basin while the contents are being pumped to the sanitary gravity drainage system.

The NPC requires that the minimum size of the vent pipe for a sewage sump shall be one size smaller than the size of the largest branch or fixture drain draining to the sump. This required vent shall be not less than 2 in. (50 mm) and not greater than 4 in. (100 mm).

As with all mechanical devices, equipment failure can occur, resulting in flooding at the pumping basin. Commercial installations reduce this risk by installing two pumps (duplex) in a duty/standby configuration, with each pump capable of handling peak flow. If pumping station capacity is based on two pumps operating in parallel, a third pump (triplex) is usually provided as a standby. Residential or other private pumping stations may be equipped with a single pump (simplex) (Figure 8), since the incoming sewage flow can easily be controlled by restricting the usage of facilities.

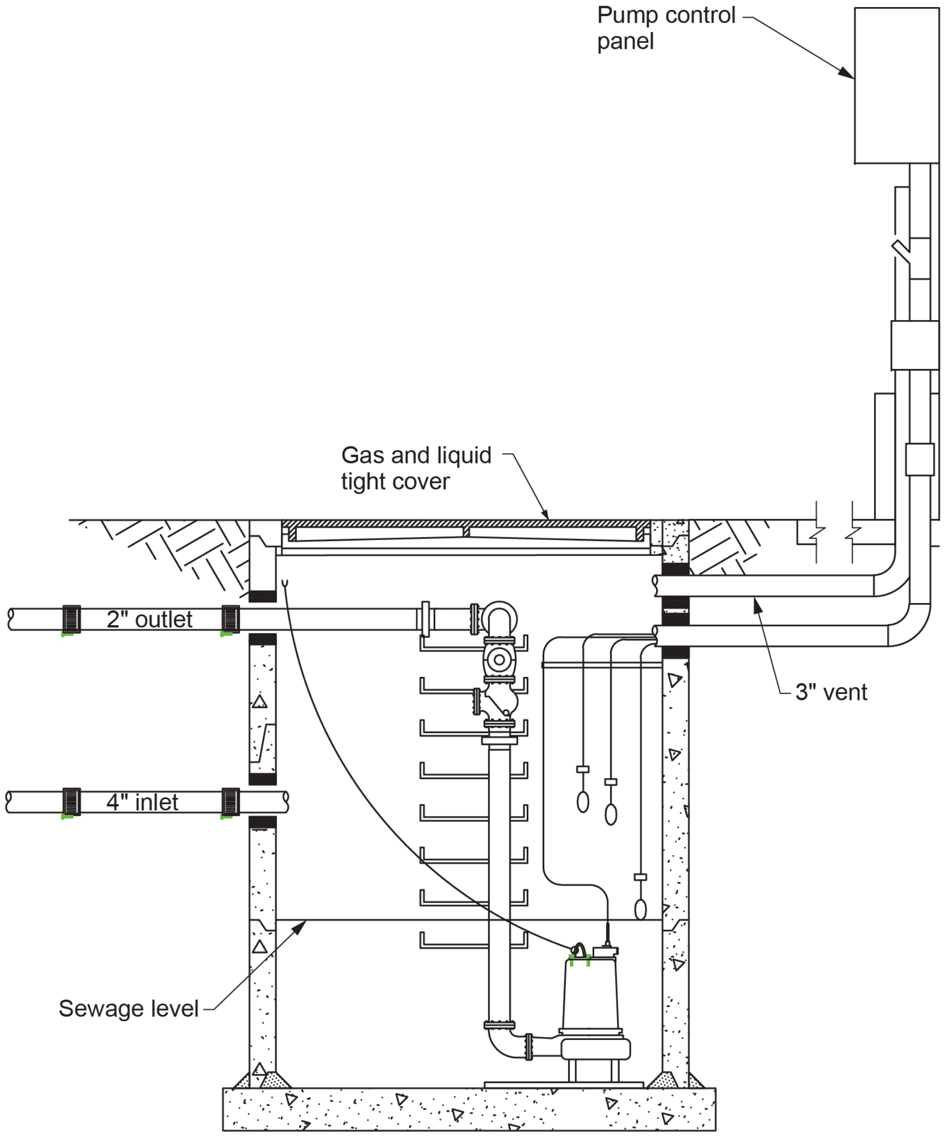

***Figure 8** Sewage sump basin with simplex pump. (Skilled Trades BC, 2021) Used with permission.*

Cleanouts

Cleanouts provide access to all parts of the drainage system so that obstructions can be removed. They should be located at intervals that conform to Table 2.4.7.2 of the NPC. The term "rodding" is an old term referring to the use of short pieces or "rods" of bamboo or similar material. These were coupled end-to-end and pushed into the drain to clear blockages. Because they did not bend easily around corners, there had to be many cleanouts installed, especially if the piping changed direction. Today's modern drain "snakes" are made from coils of spring steel and are capable of long lengths and tight turns, so distances between cleanouts are much greater than were previously allowed.

Cleanouts range from removable plugs in wyes installed in horizontal drainage piping to manhole covers in building sewers. One-way rodding means using a wye as a cleanout, while two-way rodding would be using a line cleanout or a manhole as the opening in the piping. If line cleanouts or manholes are used, the allowable distance between cleanouts doubles over what could be achieved when using wyes.

Manholes (Figure 9) are used as a cleanout for underground piping that is 200 mm (8 in.) or larger in diameter. They are constructed with metal covers of sufficient weight and strength for traffic and loading conditions. To direct flow through the manhole from the inlet pipe to the outlet pipe, a poured concrete channel — sometimes called "benching" — is used. It is shaped like a half-pipe. This channel is left open on top to allow access to the sanitary piping when required. To meet the applicable codes, manholes must be vented to open air if installed inside a building.

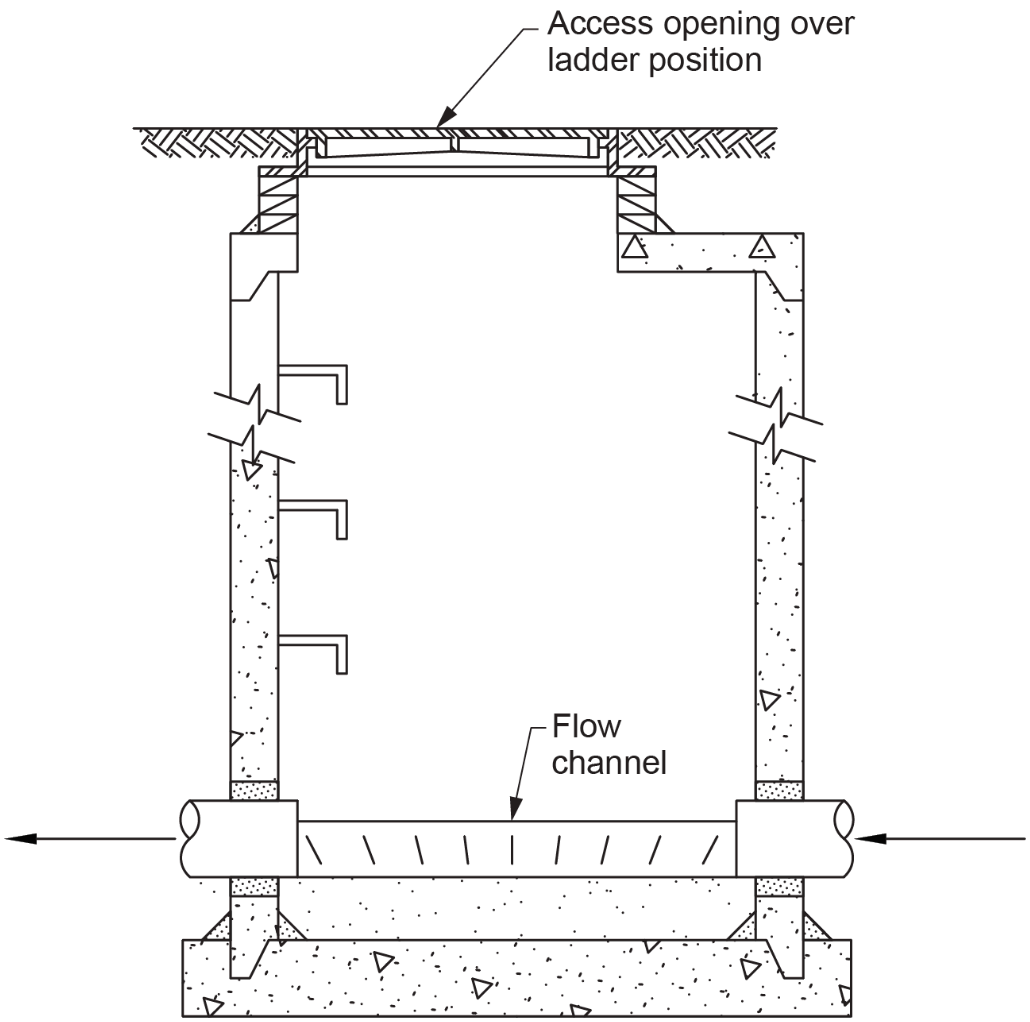

Figure 9 *Manhole used as a cleanout in large-diameter sanitary piping. (Skilled Trades BC, 2021) Used with permission.*

Vents

Vent piping allows the admission or emission of air into the system, limiting the pressure differential on the trap seals to not more than 1 in. WC (250 Pa). Venting lessens the likelihood of the removal of the water trap seals that serve the fixtures.

There are a variety of vents used in different applications. Common vents used include:

- Individual vents
- Dual vents

- Continuous vents
- Circuit vents
- Relief vents
- Additional circuit vents
- Offset relief vents
- Sump vents
- Branch vents
- Stack vents
- Vent stacks
- Vent headers

Individual Vents

An individual vent is a vent that serves one fixture only and is connected to its horizontal trap arm (Figure 10). The vent must be installed into the trap arm in a nominally vertical orientation. Individual vents may extend from the fixture being served to the outside air without joining another part of the venting system, or they may connect into another vent that will eventually extend to the open air.

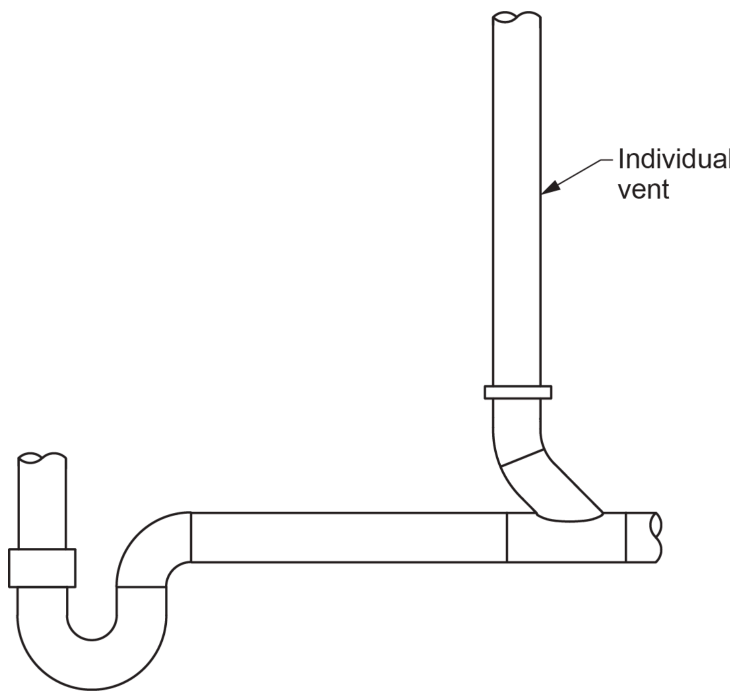

Figure 10 *Individual vent serving a fixture connected to the horizontal trap arm. (Skilled Trades BC, 2021) Used with permission.*

Dual Vents

Dual vents are similar in many ways to individual vents but with one main difference: dual vents serve two fixtures as opposed to one. When connecting the two fixtures to the branch, a double symmetrical fitting must be used (Figure 11).

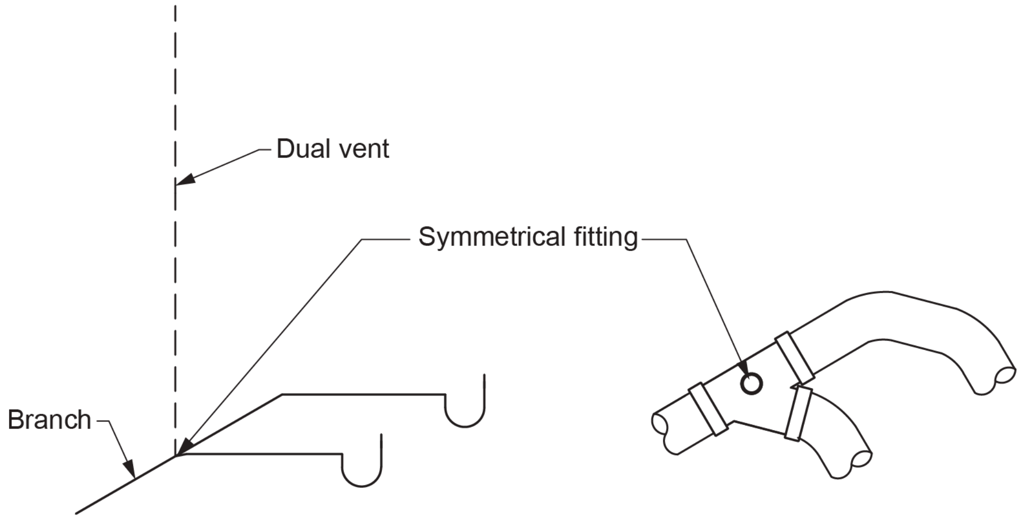

Figure 11 *Dual vent. (Skilled Trades BC, 2021) Used with permission.*

Continuous Vents

A continuous vent is a vent that extends from a vertical sanitary drainage pipe and can serve one or multiple fixtures located on the same storey. The most common application of continuous vents is to serve wet-vented branches (Figure 12). It may be important to remember that a continuous vent that is not also either an individual or dual vent will always be connected to either a fixture drain/wet vent or a branch/wet vent.

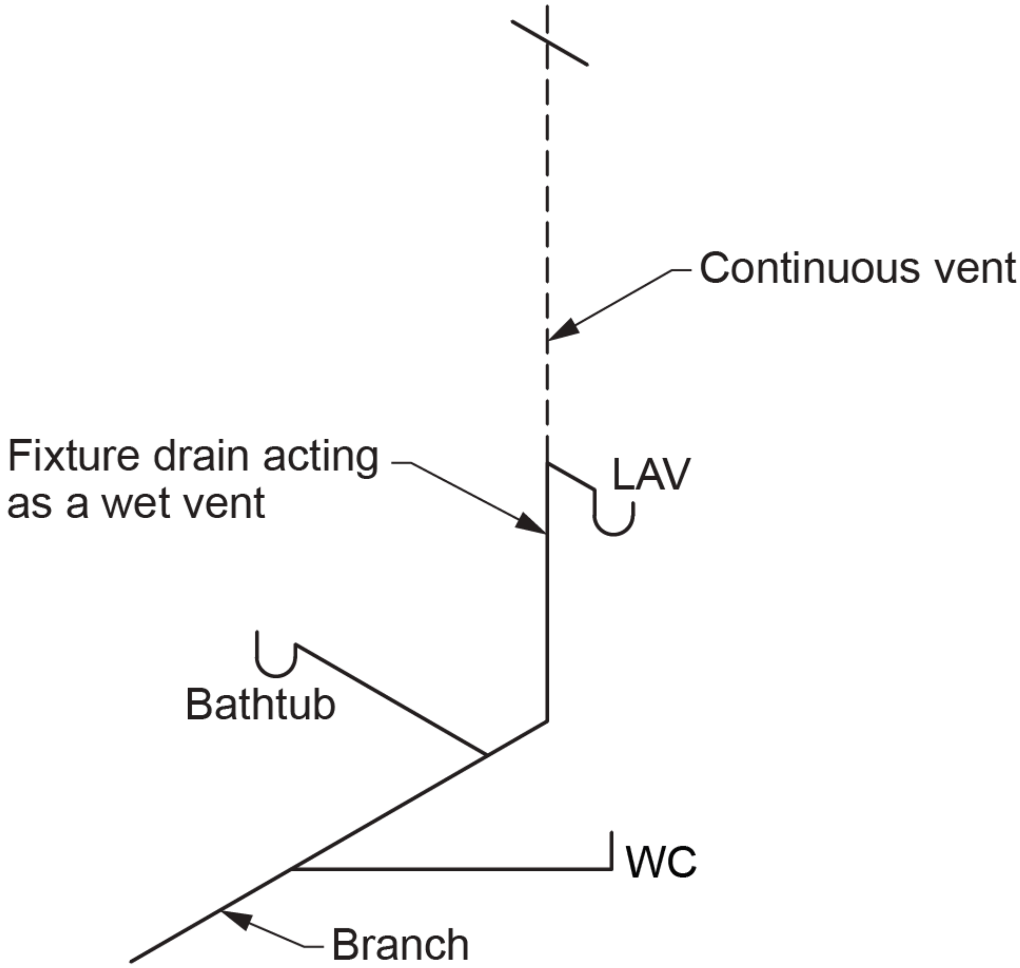

Figure 12 *Continuous vent serving a wet-vented bathroom group. (Skilled Trades BC, 2021) Used with permission.*

The naming of continuous vents overlaps with individual vents and dual vents if they are connected to a vertical sanitary drainage pipe, but the sizing requirements are different.

Individual and continuous vents (Figure 13) serve a single fixture connected to a vertical sanitary drainage pipe using a single sanitary tee.

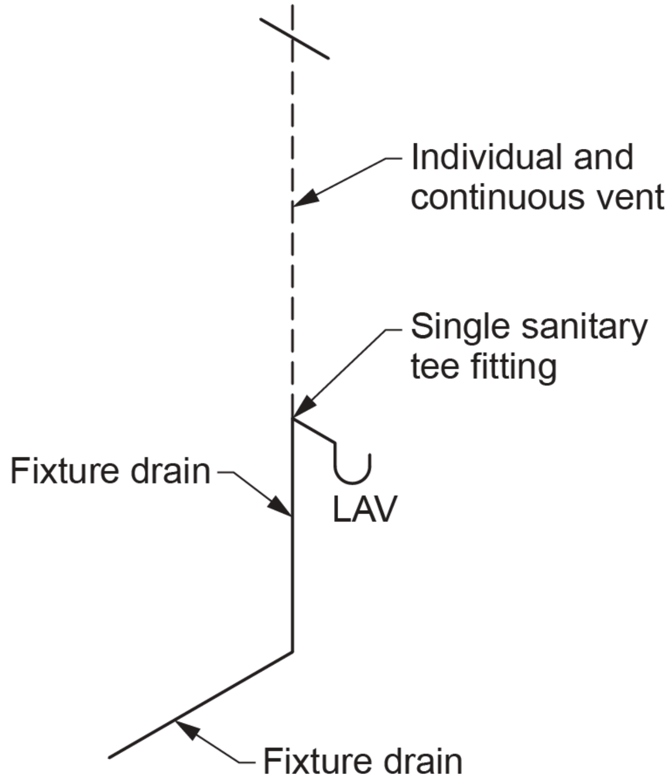

Figure 13 *Individual and continuous vent serving a single lavatory*

Dual and continuous vents (Figure 14) serve two fixtures connected to a vertical sanitary drainage pipe at the same level using a double sanitary tee.

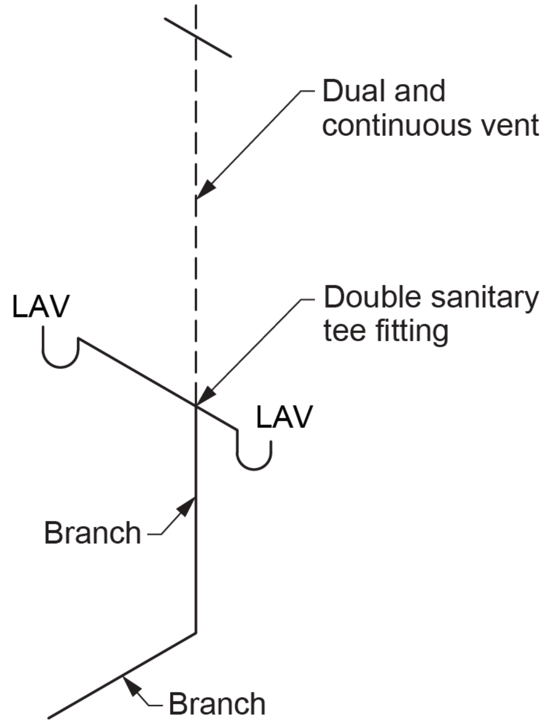

Figure 14 *Dual and continuous vent serving two lavatory basins. (Skilled Trades BC, 2021) Used with permission.*

Circuit Vents

Circuit venting is a method of commonly venting multiples of floor-outlet fixtures, most notably toilets. Circuit vents are typically used when serving a battery of fixtures with traps of 50 mm (2 in.) or larger in size (Figure 15). This configuration can also be used with 32–38 mm ($1\frac{1}{4}$–$1\frac{1}{2}$ in.) traps, but it must comply with certain code requirements related to circuit venting these small traps. Circuit vents are connected to the trap arm of the most upstream fixture of the battery. Once connected, the circuit vent is extended upward to the open air or tied into another vent that extends to open air.

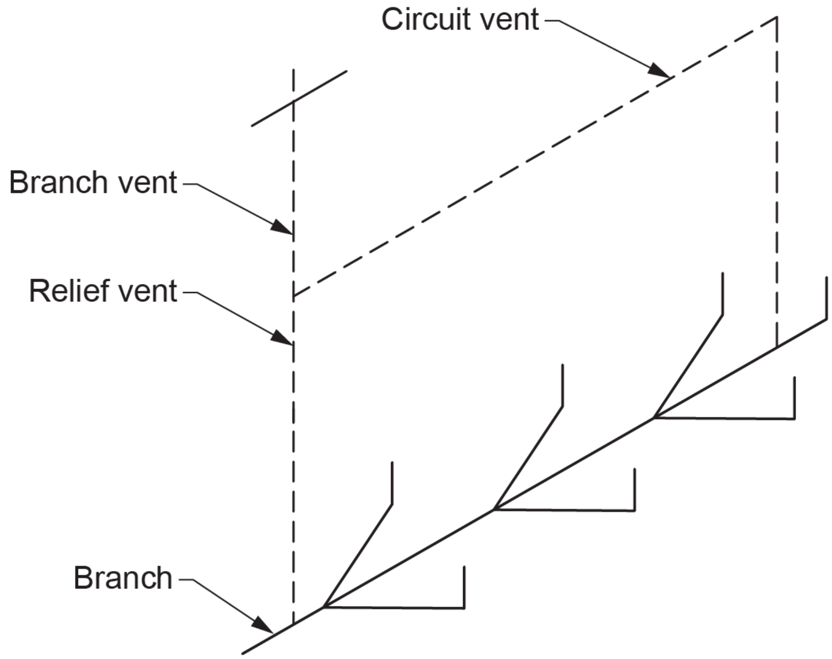

Figure 15 *Circuit vent serving a battery of WCs. (Skilled Trades BC, 2021) Used with permission.*

Relief Vents

Relief vents are required for circuit-vented branches to assist with air circulation and relieve pressure fluctuations caused by fluid flow in the branch (Figure 16). A relief vent may also be a fixture drain, a branch, or even a stack. When these drainage pipes are used as a relief vent, they are limited in the number of fixture units that can be drained into them.

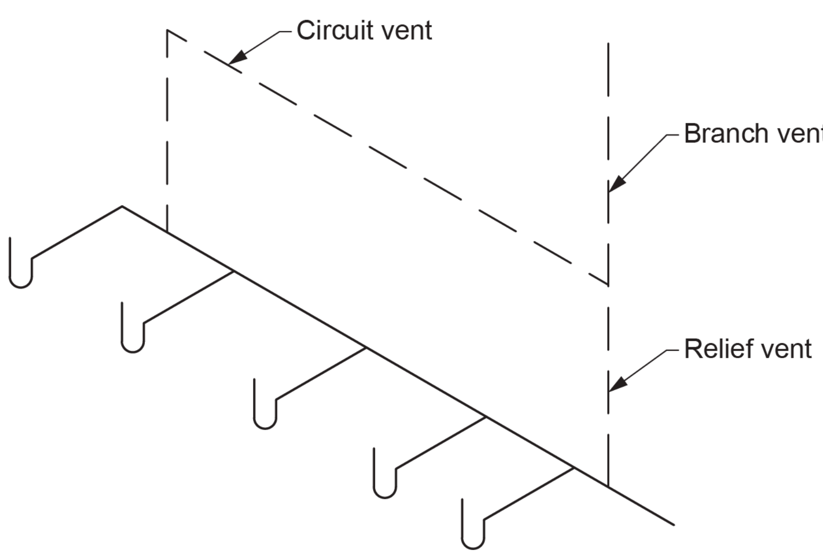

Figure 16 *Relief vent serving a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

Additional Circuit Vents

Additional circuit vents (Figure 17) are required on circuit-vented branches when there are more than eight fixtures connected between vent pipes or there is a cumulative change in direction of more than 45° between the circuit vent and relief vent.

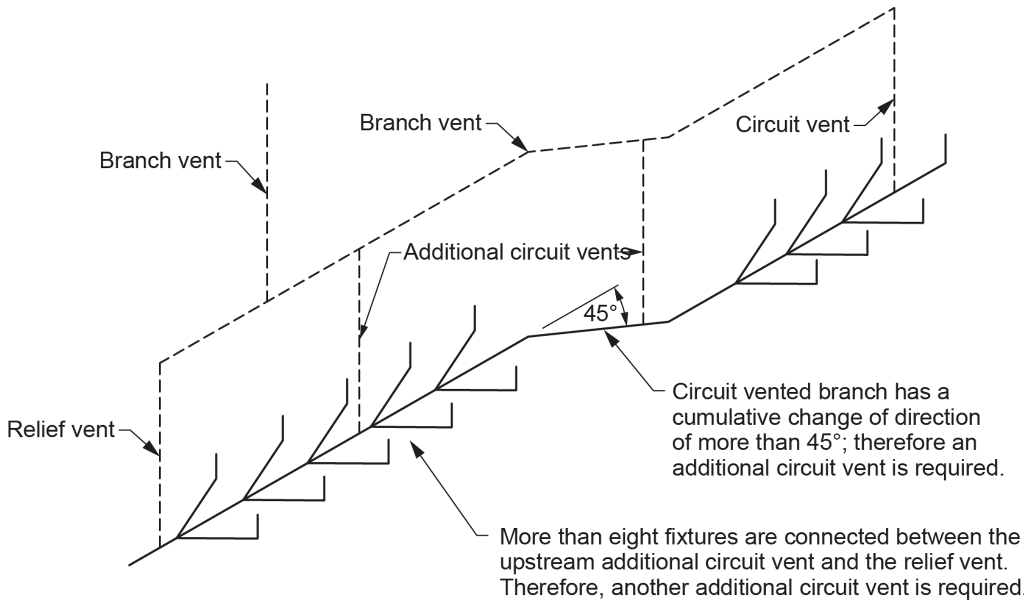

Figure 17 *Circuit-vented branch showing the requirements for additional circuit vents. (Skilled Trades BC, 2021) Used with permission.*

Offset Relief Vents

Offset relief vents provide additional air circulation to a stack with a nominally horizontal offset (Figure 18). An offset relief vent is required at A and B or A and C.

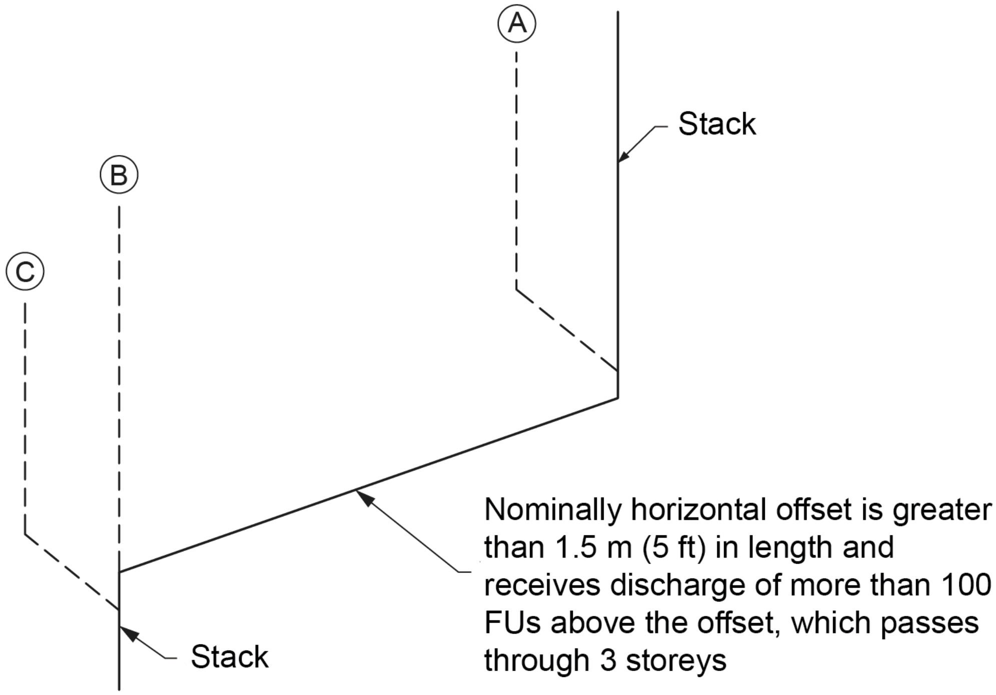

Figure 18 *Offset relief vents serving a nominally horizontal offset in a stack. (Skilled Trades BC, 2021) Used with permission.*

These vents are required if the offset is more than 1.5 m (60 in.) long and the upper portion of the stack passes through three or more storeys and has more than 100 fixture units on it. The offset relief vent connects at the lowest end of the upper stack after the last sanitary drainage pipe connection and at the upper end of the lower stack at a point higher than any drain connections.

Sump Vents

A sump vent (Figure 19) serves the sewage sump basin only to ensure that the basin operates at atmospheric pressure. It is not associated with venting the fixtures draining into the basin, which are vented normally even though they are connected to a sub-drainage system.

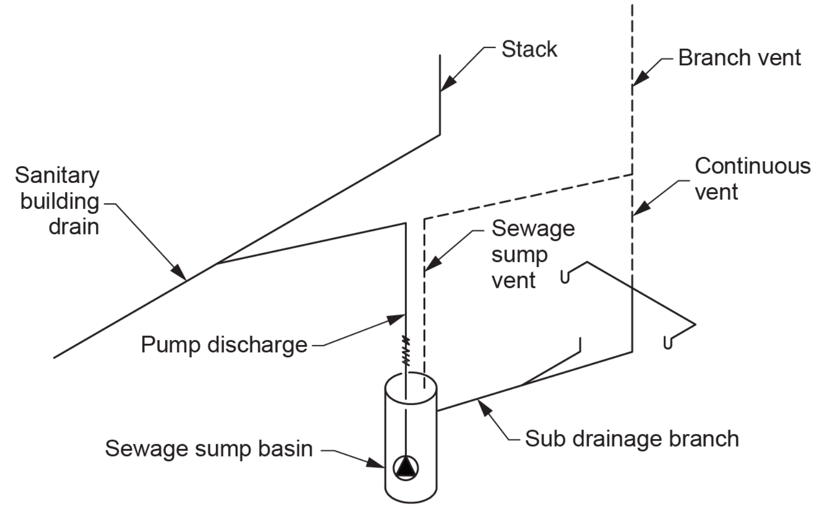

Figure 19 *Sewage sump vent. (Skilled Trades BC, 2021) Used with permission.*

Branch Vents

A branch vent is formed by combining two or more vent pipes that are not stack vents or vent stacks (Figure 20). Due to the hierarchy when naming vents, only some types of vents will become branch vents when tied into other vents.

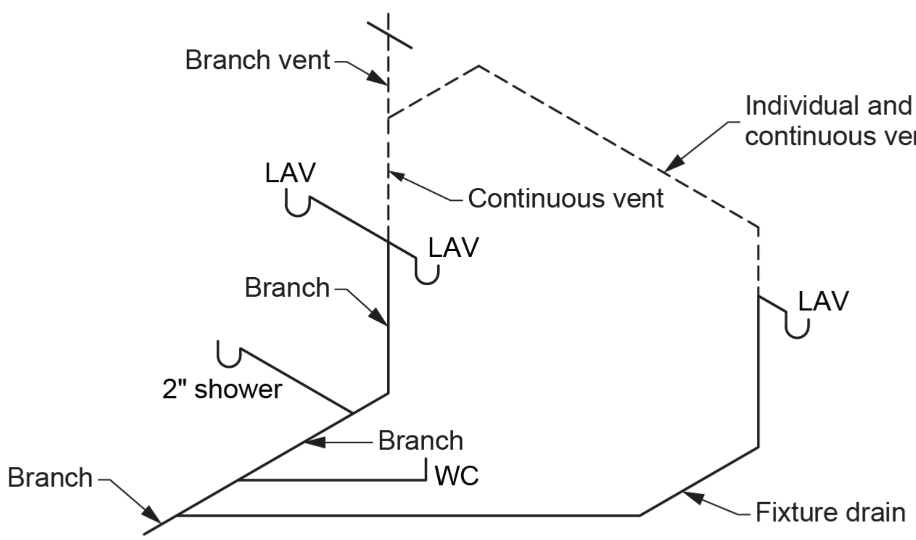

Figure 20 *Branch vent. (Skilled Trades BC, 2021) Used with permission.*

Stack Vents

A stack vent is the main vent for the stack. It begins at the highest fixture connection to the stack and typically extends through the roof. It may also connect to a vent stack or another stack vent, which would form a vent header. It reaches open air either independently or through the vent header. The stack vent must be adequately sized to accommodate the necessary air flow created by the potential total liquid flow into the stack.

Vent Stacks

A vent stack protects the base of the stack by relieving the positive air pressures that accumulate from the air being dragged down the stack. The most effective connection point for the vent stack is at or immediately below the lowest vertical drainage connection to the stack. It is at this location that the pressure in the stack is at its maximum. Vent stacks are required when the stack has fixtures draining into it from more than four storeys. As with the stack vent, it must be adequately sized to accommodate the potential maximum flow at the base of the stack. Wet-vented stacks are exempt from this requirement as the increased wet vent size negates any positive pressure accumulation at the stack base.

Vent Headers

The vent header is the “king of the castle” in a venting system and always leads to outside air. Although a vent header is really not much different from a stack vent, it is named so that it can be sized by different rules. A vent header is the name of the pipe that results from two or more stack vents or vent stacks or any combination of these being joined (Figure 21). Once a vent pipe is named a vent header, connecting anything else to it will not change the name:

- stack vent + stack vent = vent header
- vent stack + vent stack = vent header
- stack vent + vent stack = vent header

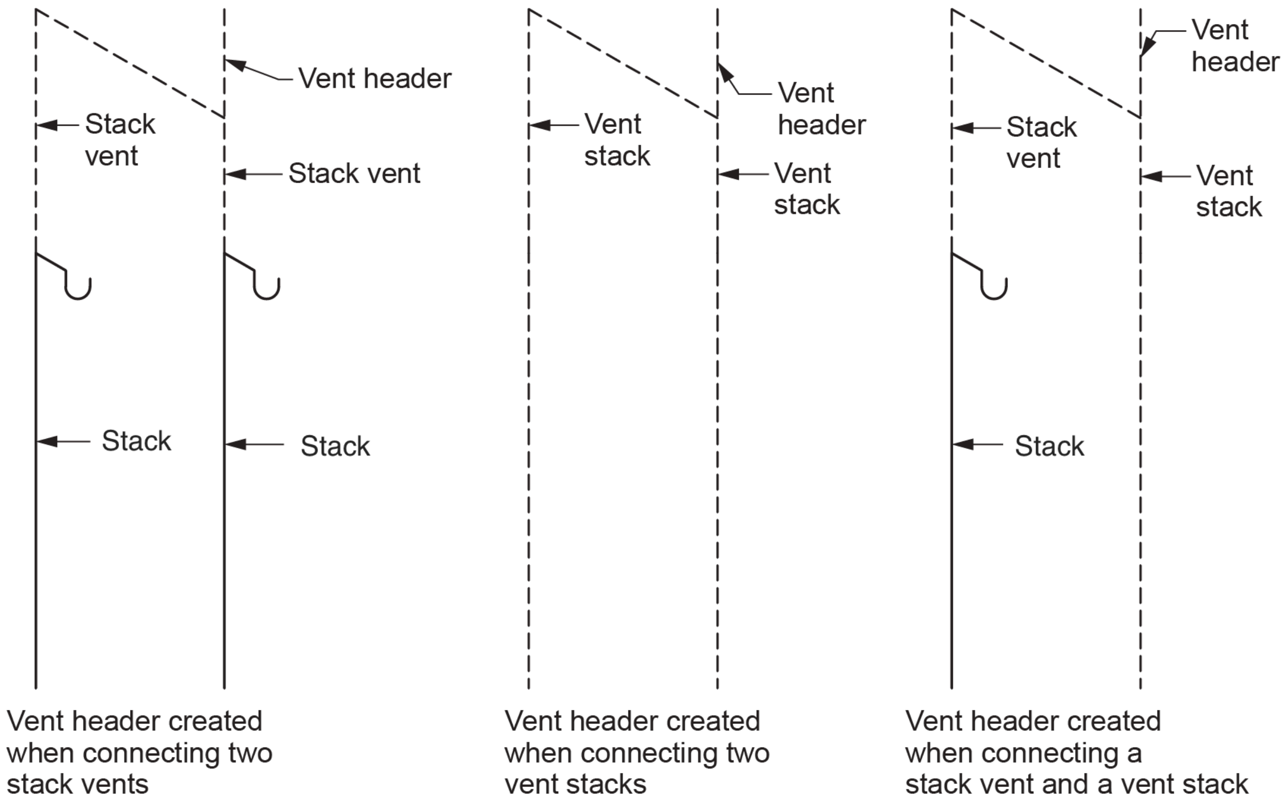

Figure 21 *Vent header combinations. (Skilled Trades BC, 2021) Used with permission.*

Vent Hierarchy

As stated earlier, there is a hierarchy when naming plumbing vents. The importance of a vent's role in the DWV system will determine not only its name but also when that name changes when connected to another vent type. It is very important to be able to identify the vents used in order to properly size them to code requirements. For example, if two individual vents are connected together, the resulting pipe becomes a branch vent. That single vent would be called a branch vent until it is connected to a higher class of vent — such as a vent stack, stack vent, or vent header — or until it terminates in open air. The first step is to understand that vents can be grouped into four categories, depending on their importance to the total system, as shown in Table 1. Note that Category 1 is the least important and Category 4 is the most important.

Table 1: Vent Hierarchy

Category 1	Category 2	Category 3	Category 4
Individual vent Dual vent Continuous vent Individual and continuous vent Dual and continuous vent Circuit vent Relief vent Additional circuit vent Sewage sump vent	Branch vent	Stack vent Vent stack	Vent header

Once a vent has been categorized, its name will follow the hierarchy rules for venting. Refer to the vent pyramid in Figure 22 to help you understand how to identify the vent names.

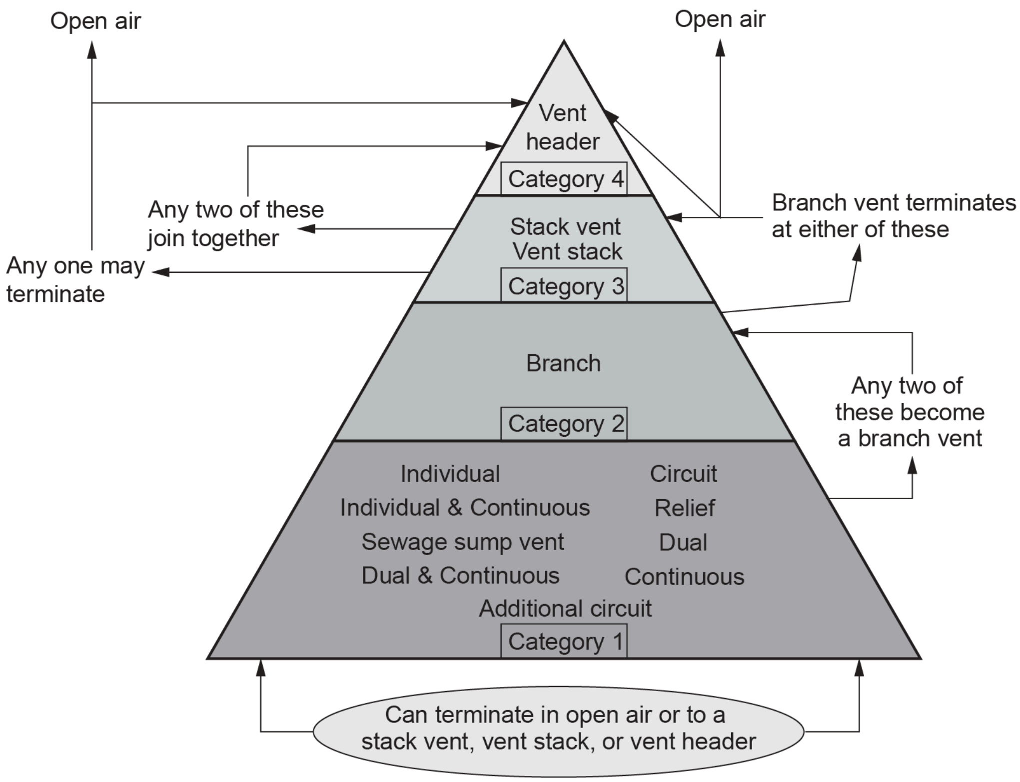

Figure 22 *Vent hierarchy pyramid. (Skilled Trades BC, 2021) Used with permission.*

Vent header (Category 4): created by connecting at least two Category 3 vents together (stack vents or vent stacks). Although a vent header is similar to a Category 3 vent, it is named differently so that it can be sized by a different code table.

Stack vent (Category 3): the vent at the top of a stack. It will remain a stack vent to open air unless it is connected to another stack vent or vent stack to form a vent header.

Vent stack (Category 3): a vertical vent pipe installed parallel to the stack and connected at its base. It will remain a vent stack to open air unless it is connected to another stack vent or vent stack to form a vent header.

Branch vent (Category 2): formed by joining two Category 1 vent pipes together. It will stay a branch vent until it is connected to a higher class of vent — such as a vent stack, stack vent or vent header — or it is terminated in open air.

Individual vent (Category 1): a vent that serves only one fixture and is connected at its lower end to the horizontal trap arm. The upper end may connect to a Category 2, 3, or 4 vent or terminate in open air.

Dual vent (Category 1): a vent that serves two fixtures. It connects with a double fitting where the horizontal trap arms meet to become a branch. The upper end may connect to a Category 2, 3, or 4 vent or terminate in open air.

Continuous vent (Category 1): a vent that extends from a vertical branch/wet vent or fixture drain/wet vent and can serve multiple fixtures located on the same storey. The upper end may connect to a Category 2, 3, or 4 vent or terminate in open air.

Individual and continuous vent (Category 1): a vent that serves only one fixture and is connected at its lower end to the junction of a vertical fixture drain and a horizontal trap arm. The upper end may connect to a Category 2, 3, or 4 vent or terminate in open air. The naming of this vent combines two of its attributes. Because it is an extension of a vertical fixture drain, it is a continuous vent, and because it serves only one fixture, it is an individual vent.

Dual and continuous vent (Category 1): a vent that serves two fixtures and is connected at its lower end to the junction of a vertical branch and two symmetrically connected trap arms. The upper end may connect to a Category 2, 3, or 4 vent or terminate in open air. Similar to the individual and continuous vent, the naming of this vent combines two code definitions. Because it is an extension of a vertical branch, it is a continuous vent, and because it serves two fixtures connected at the junction of the trap arms, it is a dual vent.

Circuit vent (Category 1): A vent that serves multiple fixtures on a horizontal branch installed on the same storey. Its lower end is connected to the trap arm of the most upstream circuit vented fixture on the branch. The upper end may connect to a Category 2, 3, or 4 vent or terminate in open air. Circuit vents must always be paired with a relief vent located downstream of the most downstream circuit vented fixture and may also require an additional circuit vent.

Relief vent (Category 1): required for circuit vented branches to assist with air circulation in the branch. The lower end of the relief vent is connected to the circuit vented branch downstream of the most downstream circuit vented fixture. The upper end of the relief vent may connect to a Category 2, 3, or 4 vent or terminate in open air.

Additional circuit vent (Category 1): required on circuit vented branches if there are more than eight trap arms or a cumulative change in direction of more than 45° between the circuit and relief vent. The lower end of the additional circuit vent is connected to the circuit vented branch in the offset piping or between fixtures to limit the number of circuit vented fixtures between any two vent pipes to eight. The upper end of an additional circuit vent may connect to a Category 2, 3, or 4 vent or terminate in open air.

Sump vent (Category 1): The NPC requires that sewage sumps be watertight, airtight, and vented. The vent allows sewer gas to travel to open air, where it dissipates. Another purpose of the vent is to allow air to enter the sump when the liquid level drops during pump operation. The lower end of the vent attaches to the sump cover, while the upper end may connect to a Category 2, 3, or 4 vent or terminate in open air.

Self-Test D-1.3 Functions of Different Pipes in a DWV System

Complete Self-Test D-1.3 and check your answers.

If you are using a printed copy, please find Self-Test D-1.3 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=41#h5p-16 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=41#h5p-16)

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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-1: Install sanitary drain, water and vent systems. In: *Plumber Apprenticeship Program: Level 2*. Industry Training Authority, BC.

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D-1.4 Acceptable Pipe Material Application

The **Plumbing Code** is a part of the Building Code and provides minimum requirements for plumbing installations in buildings to protect health and prevent water or sewer damage. The plumbing code specifies that all materials, systems, and equipment installed must be free of defects and possess the necessary characteristics to perform their intended functions when installed. Plumbers need to stay abreast of new regulations that may govern the types of pipes and fixtures acceptable to local inspectors. The purpose of this chapter is to help you correctly interpret plumbing code requirements for types of piping materials that may be used in DWV systems.

Identifying Piping

Every length of pipe and every **fitting** must have cast, stamped, or indelibly marked on it the maker's name or mark and the weight, class, or quality of the product, or be marked in accordance with the relevant standard. To help ensure the proper application of the different pipe materials, the code requires that these materials' identification markings must be visible after installation.

Piping Types

The acceptable piping materials for sanitary drainage systems are clearly listed in three tables in the Plumbing Code: Tables A-2.2.5., A-2.2.6., and A-2.2.7. The tables identify the acceptable material by reference to the appropriate ASTM or CSA standard and whether or not they are permitted above ground inside a building or below ground under a building in drainage and venting systems. The standard must properly address all technical matters in regulating a given material for use in a plumbing drainage and vent system.

One of the concerns with installing DWV systems is the impact the piping material has on the fire-protection aspects of a building. The building code requirements for pipe penetrations distinguish between **combustible piping** materials, such as ABS and PVC, and **non-combustible piping** materials, such as cast-iron soil pipe and copper tubing.

Another concern is the ability of DWV piping to withstand service pressures. This is usually not an issue with gravity systems, but when working with a pressure sewer "**forcemain**," it has some code restrictions. These systems are necessary when gravity flow is not sufficient to move sewage through a gravity line. Forcemains move wastewater under pressure using pumps or compressors located in lift stations. They convey wastewater from a lower to higher elevation or where construction of a gravity line would result in excessive excavation depths and prohibitive sewer line costs. The code requires that piping, fittings, and joints used in pressure sewer, forcemain, or sump pump discharge applications be capable of withstanding at least one and a half times the maximum potential pressure.

The following is a comprehensive list of piping materials used in DWV systems and the code requirements governing their use. The lists indicate:

- **Permitted application** with the letter **P**
- **Non-permitted application** with the letter **N**.

Fibrocement DWV Pipe

The material used to fabricate **fibrocement pipe** must conform to CAN/CSA-B127.3. This standard covers fibrocement Type 1 (Class 3000) and Type 2 (Class 4000) pipe and pipe fittings for installation in gravity-flow systems inside and outside of buildings, above and below grade

The pipe is formed under pressure and heat-cured in an **autoclave**. Using fibres rather than reinforcing steel provides adequate strength with lower weight. The standard was introduced in 2018 to replace the pipes that used asbestos as their reinforcing fibres.

DWV Application

Table 1: Fibrocement DWV Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P	P	P	P	P

Polyethylene Plastic Pipe

Polyethylene plastic (PE) piping is considered “flexible” pipe and can withstand large amounts of deflection without damage. For practical purposes, however, PE pipes are limited to 7.5% deflection or less, depending on the **standard dimension ratio (SDR)** and application. Using polyethylene pipe for drainage systems resulted from the fairly recent practice of “pulling” a new building sewer into the space occupied by an old sewer without digging a trench to do so.

DWV Application

Table 2: Polyethylene Plastic Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
N	P	P	N	P

Plastic Sewer Pipe

These applications include both single-wall and co-extruded dual-wall pipe with a smooth interior.

DWV Application

Table 3: Plastic Sewer Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
N	P	P	N	N

ABS (Acrylonitrile-Butadiene-Styrene) Pipe

Due to its combustible property, **ABS** is primarily used in non-rated combustible construction, such as single-family dwellings. It is available in solid-wall and cellular-core construction in Schedule 40 dimensions. When used in non-combustible construction, it must meet the requirements of the building code, which requires that all combustible piping in buildings be of non-combustible construction and have a **flame-spread rating (FSR)** of not more than 25.

Combustible piping used in a high-rise building is also required to have a smoke developed classification (SDC) of not more than 50. Plastic piping not meeting the required FSR or SDC is only allowed if it is concealed in a wall or concrete floor slab and does not project outside of the concrete, even if concealed behind other components. ABS piping has an FSR exceeding 25; therefore, it cannot be used in buildings required to be non-combustible.

Solid-Wall Application

Table 4: ABS Pipe Solid-Wall Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P (combustible construction)	P	P	P (combustible construction)	P

Cellular-Core Application

Table 5: ABS Pipe Cellular-Core Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P (combustible construction)	P	P	P (combustible construction)	N

PVC (Polyvinyl Chloride) DWV Pipe

PVC DWV piping may have an FSR of less than 25, but its SDC may exceed 50; therefore, it may be used in buildings required to be non-combustible but not in high-rise buildings. Several commercially available combustible pipes meet the required FSR.

Solid-Wall Application

Table 6: PVC DWV Pipe Solid-Wall Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P (combustible construction)	P	P	P (combustible construction)	P

Cellular-Core Application

Table 7: PVC DWV Pipe Cellular-Core Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P (residential, combustible construction)	P	N	P (residential, combustible construction)	P

PVC (Polyvinyl Chloride) Sewer Pipe (All Classes) Application

Table 8: PVC Sewer Pipe (All Classes) Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
N	P	P	N	P

Profile Polyethylene Sewer Pipe

Profile wall pipe gains its strength through the geometry of the pipe wall. The pipe has a smooth interior wall with exteriors that may be ribbed or corrugated.

Application

Table 9: Profile Polyethylene Sewer Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
N	P	P	N	P

Polyolefin Laboratory Drainage Systems

Polyolefin pipe is used in a wide range of medical and laboratory applications that require non-corrosive material. The two most common classes are polyethylene (PE) and polypropylene (PP).

Application

Table 10: Polyolefin Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P (combustible construction)	P	P	P (combustible construction)	P

Cast-Iron Pipe

Cast-iron soil pipe is used primarily in non-combustible building construction for sanitary, storm drain, waste, and vent piping applications. Because cast-iron pipe that penetrates fire separations will not allow the passage of flames from one compartment to another, fire retardants and cut-off devices are not required.

Application

Table 11: Cast-Iron Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P	P	P	P	P

Copper Tubing

Copper tubing is available in both hard and soft tempers. Only hard copper tubing may be used for DWV systems. Copper tube must not be used for the fixture drain or the portion of the vent pipe below the flood level rim of a urinal.

Type K and L copper joints installed underground shall be made with either flared or compression fittings or be brazed using a brazing alloy within the American Welding Society's AWS-BCuP range. Compression fittings are not allowed underground under a building because the joint cannot withstand building settlement.

Type K and L Hard Temper Application

Table 12: Copper Tube Type K and L Temper Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
N	P	P	P	P

Type M Hard Temper Application

Table 13: Copper Tube Type M Hard Temper Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P	N	N	P	N

DWV Types Application

Table 14: Copper Tube DWV Types Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P	N	N	P	N

Welded Seamless Steel Galvanized Pipe

Galvanized pipe is a variety of steel piping coated in a layer of zinc. While the layer of zinc over the steel was originally intended to help avoid corrosion, it has since been discovered that zinc has a tendency to react with the minerals in the water it carries, producing scale.

Application

Table 15: Welded Seamless Steel Galvanized Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P	N	N	P	N

Copper and Brass Pipe

These requirements refer to pipe that conforms to the same wall thickness standards as schedule steel pipe materials. If copper or brass pipes are used in drainage systems, they must use drainage fittings not threaded water fittings.

Copper and brass are two very similar-looking metals, but there are many occasions when it is useful to be able to differentiate between brass and copper pipes. Copper is a naturally occurring metal, while brass is an artificial alloy of copper and zinc mixed together.

Application

Table 16: Copper and Brass Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P	P	P	P	P

Lead Waste Pipe

Lead piping has not been commonly used since the 1950s, but it still has approved applications in the Plumbing Code. The code requires that when there is a change in size of a lead closet bend, the change shall be in the vertical section of the bend or made in a manner that prevents the retention of liquid in the bend.

Application

Table 17: Lead Waste Pipe Application

Drainage Systems			Venting Systems	
Above Ground Inside Building	**Underground Under Building**	**Building Sewer**	**Above Ground**	**Underground**
P (combustible construction)	P	N	P (combustible construction)	P

Self-Test D-1.4: Acceptable Pipe Material Application

Complete Self-Test D-1.4 and check your answers.

If you are using a printed copy, please find Self-Test D-1.4 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=43#h5p-14 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=43#h5p-14)

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-1: Install sanitary drain, water and vent systems. In: *Plumber Apprenticeship Program: Level* 2. Industry Training Authority, BC.

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D-1.5 Sizing Sanitary Drainage Pipes

Trap arms, fixture drains, branches, stacks, sanitary building drains, sanitary building sewers, and sewage sumps are all part of the sanitary drainage system. Wet vents are part of the drainage and venting systems. Sizing wet vents will be covered in later chapters.

To begin, we must understand that the load that a fixture imposes on the drainage system is measured in fixture units (FU). Each plumbing fixture has an FU rating that is calculated using the rate of discharge, the frequency of use, and the time between each use of a plumbing fixture. The fixture unit rating represents the **hydraulic load** placed on the sanitary drainage system by that fixture.

Sizing pipe for a drainage system is a relatively straightforward process once you are familiar with the tables provided in the Plumbing Code book. These tables provide the minimum size of all drainage pipes based on the maximum **fixture unit load** it can carry for any particular size.

Because there are different tables for sizing each drainage pipe designation, you must be able to properly identify the different sections of the drainage system and their function.

Sizing Traps and Fixture Outlet Pipes

The individual fixtures are the place to start whenever you are sizing a drainage system. Table 2.4.9.3 provides two very important pieces of information:

1. The fixture unit load imposed on the drainage system based on the type of fixture
2. The minimum size of the fixture outlet pipe, which would also determine the minimum size of the trap and fixture drain serving the fixture

Table 2.4.9.3

Table 1 is an excerpt from Table 2.4.9.3 in the National Plumbing Code (NPC) of Canada (2020; Division B 2-31) and provides a list of common plumbing fixtures found in domestic and commercial drainage installations.

Table 1: (From NPC Table 2.4.9.3) Minimum Permitted Size of Fixture Outlet Pipe and Hydraulic Loads for Fixtures

Fixture	Minimum size of fixture outlet pipe (in.)	Hydraulic load (FUs)
Autopsy table	1.50	2
Bathroom group with flush tank	N/A	6
Bathroom group with direct flush valve	N/A	8
Bathtub (with or without shower)	1.50	1.50
Bath: foot, sitz, or slab	N/A	1.50
Beer cabinet	N/A	1.50
Bidet	N/A	1
Domestic clothes washer	N/A	2 with 2 in. trap
Commercial clothes washer	N/A	2 with 2 in. trap
Dental unit or cuspidor	N/A	1
Domestic dishwasher	N/A	1.50, no load when connected to garbage grinder or domestic sink
Commercial dishwasher	N/A	3
Drinking fountain	N/A	0.50
Floor drain	N/A	2 with 2 in. trap 3 with 3 in. trap

Hydraulic Load for Floor Drains

Some clarification is needed regarding the hydraulic load assigned to a floor drain. Floor drains can be classified under two general headings:

1. Non-emergency floor drains
2. Emergency floor drains

Non-Emergency Floor Drains

Non-emergency floor drains are installed in the floor of a structure and are mainly designed to remove any nearby standing water. When installed, the hydraulic load imposed on the drainage system would equal the values listed in Table 2.4.9.3., as shown above. Some floor drains are installed near a wall and are usually equipped with a funnel attached to the strainer. These are also not considered emergency floor drains.

Emergency Floor Drains

Unlike the non-emergency variety, **emergency floor drains**, by code definition, are in place for overflow protection and do not receive regular discharge. The code also requires — in Division B, Notes to Part 2, A-Table 2.4.9.3. — that any floor drain installed in a washroom be considered an emergency floor drain. When a floor drain is designated as an emergency floor drain, there shall be no hydraulic load assigned to it. This provision allows the 0 FUs emergency floor drain to be connected to the drainage system without imposing additional fixture unit loading that might require an increase in drain pipe size.

If you require sizing information for a fixture that is not listed in Table 2.4.9.3., you must refer to Table 2.4.10.2. The fixture unit loads listed in this table are based on the trap size the fixture employs and not on the type of fixture. If this is the case, you would find the trap size by physically measuring the fixture outlet pipe on site or by referring to the manufacturer's information. This table would also be used if you were sizing a trap that may be used to serve drains from unspecified equipment on site. In Table 2, you can see that the fixture unit loads are, in most cases, larger than those in Table 2.4.9.3.

Example

A 3 in. non-emergency floor drain from Table 2.4.9.3. has a hydraulic load of 3 FUs, while the hydraulic load for a 3 in. trap from Table 2.4.10.2 (NPC, 2020, B 2-33) is 5 FUs.

Table 2: (From NPC Table 2.4.10.2) Permitted Hydraulic Load From a Fixture Based on Size of Trap

Trap Size (in.)	Hydraulic Load (FUs)
1.25	1
1.50	2
2	3
3	5
4	6

The reason for this inflated value is that the 3 in. trap serving as a floor drain will impose a load on the drainage system associated with the floor drain's function (3 FUs) (Figure 1). The 3 in. trap, on the other hand, could have an unknown flow rate; therefore, a larger FU load is assigned to it.

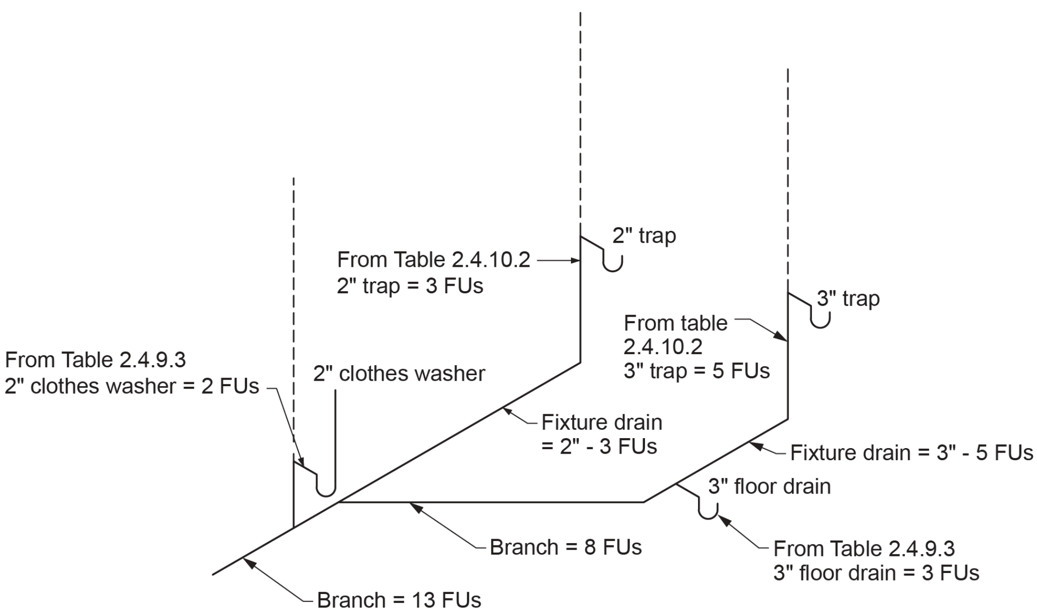

Figure 1 *Drainage system showing different fixture unit ratings for unknown traps and fixture designations. (Skilled Trades BC, 2021) Used with permission.*

Hydraulic Load from Fixtures with a Semi-Continuous Flow

Sometimes we need to size a drain receiving flow in litres/second (L/s) from a pump or other piece of equipment. The code is vague regarding a definition difference between continuous and **semi-continuous flow** and what produces it. When a pump operates and sends discharge to a drainage system, it is assumed that it will not be pumping forever and that it will cycle on and off. For that reason, both continuous and semi-continuous flows are treated the same.

In such cases, we need two pieces of information:

1. NPC Sentence 2.4.10.3.(1) is used to convert the pump flow rate (L/s) into fixture unit imposed on the sanitary system by the pump discharge.
2. If a trap is required to serve an indirect connection, the trap used to serve the pump discharge is sized using Table 2.4.10.12. (Table 3) in the NPC (2020, B 2-47).

Table 3: (From NPC Table 2.4.10.12) Maximum Permitted Hydraulic Load From Fixtures With a Semi-continuous Flow

Trap Size (in.)	Flow (L/s)	Hydraulic Load (FUs)
1.50	0.00–0.090	3
2	0.091–0.190	6
3	0.1910–0.850	27
4	0.85–5.700	180

Example

A pump discharges a continuous flow of 0.5 L/s into a sanitary drainage system.

What is:

1. The fixture unit load imposed on the system by the pump?
2. The trap and fixture drain size to accommodate the pump discharge?

Solution

1. First, we must covert the L/s discharge flow rate to drainage FUs. Clause 2.4.10.3 in the NPC gives us the conversion needed. It requires the load on a sanitary drainage system to be 31.7 FUs per L/s of flow. Using the equation below, we can determine that the hydraulic load on the system is 15.85 FUs
   ($0.5\ \mathrm{L/s} \times 31.7 = 15.85\ \mathrm{FUs}$).
2. With a drainage load of 15.85 FUs, we need to determine the trap size used for this installation. For that component, we use Table 2.4.10.12. For our example with a flow rate of 0.5 L/s, we would look down the centre column until we find a flow rate range that encompasses our flow rate. We can see that the third row with a flow rate ranging from 0.191–0.850 L/s is the proper choice. From this row, we can determine the trap size, which is 3 in.

Note that the table offers a third column, which gives a hydraulic load figure for all of the flow rate ranges. This hydraulic load is based on the maximum flow rate in all of the ranges. If you multiply the maximum flow rate in all of the ranges by 31.7, the product equals the hydraulic load given.

In our example with a flow rate of 0.5 L/s, our hydraulic load is 15.85 FUs and not 27 FUs, which is based on 0.85 L/s

(Figure 2). This is the maximum load that can be drained to a 3 in. trap from semi or continuous flow. While the discharge is within the sanitary system, it is considered to be 15.85 FUs and not 0.5 L/s.

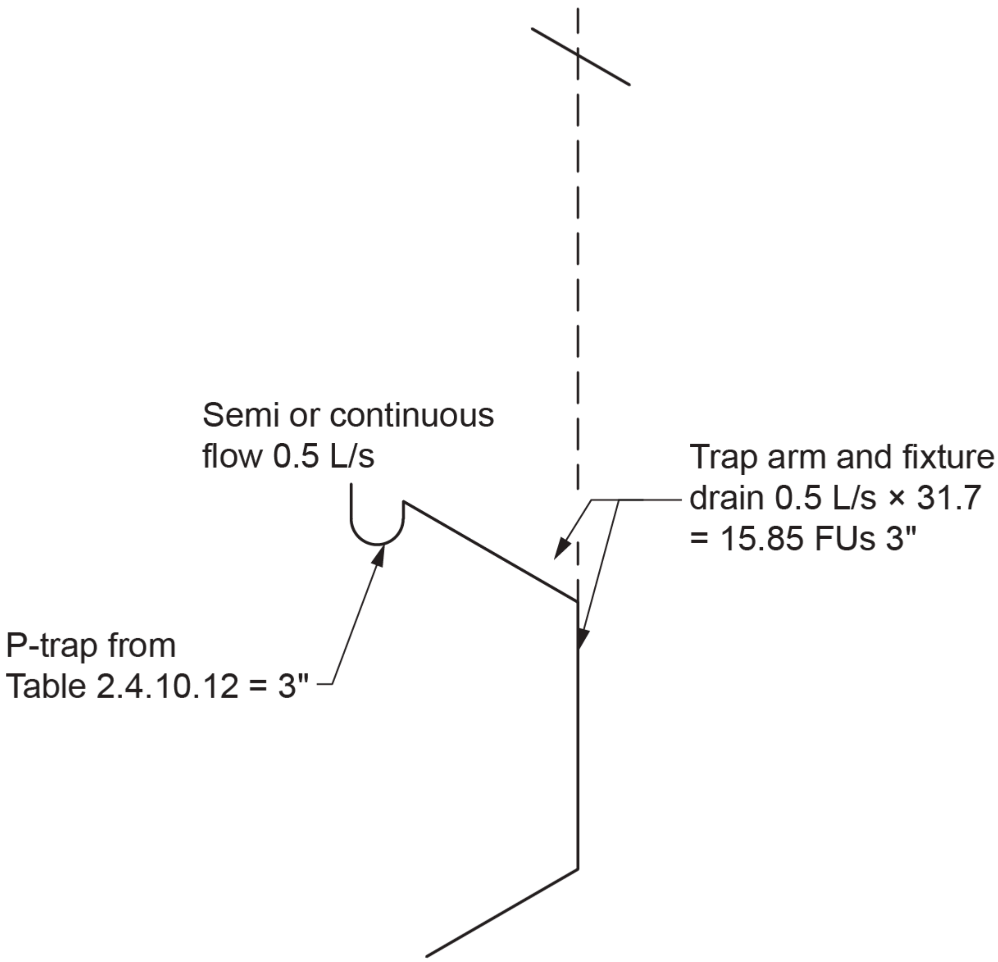

Figure 2 *Trap and fixture drain sizing based on semi or continuous flow. (Skilled Trades BC, 2021) Used with permission.*

Sizing Branches

A branch serves two or more fixtures or stack within a storey and may connect to another branch, building drain, sewage sump, or stack (Figure 3). When sizing a branch, use Table 2.4.10.6.-B to size each portion of the branch as the fixture load is applied, as shown in Table 4.

Table 4: (Table 2.4.10.6.-B) Maximum Permitted Hydraulic Load Drained to a Branch

Branch Size (in.)	Maximum Hydraulic Load (FUs)
1.25	2
1.50	3
2	6
3	27
4	180
5	390
6	700
8	1,600
10	2,500
12	3,900

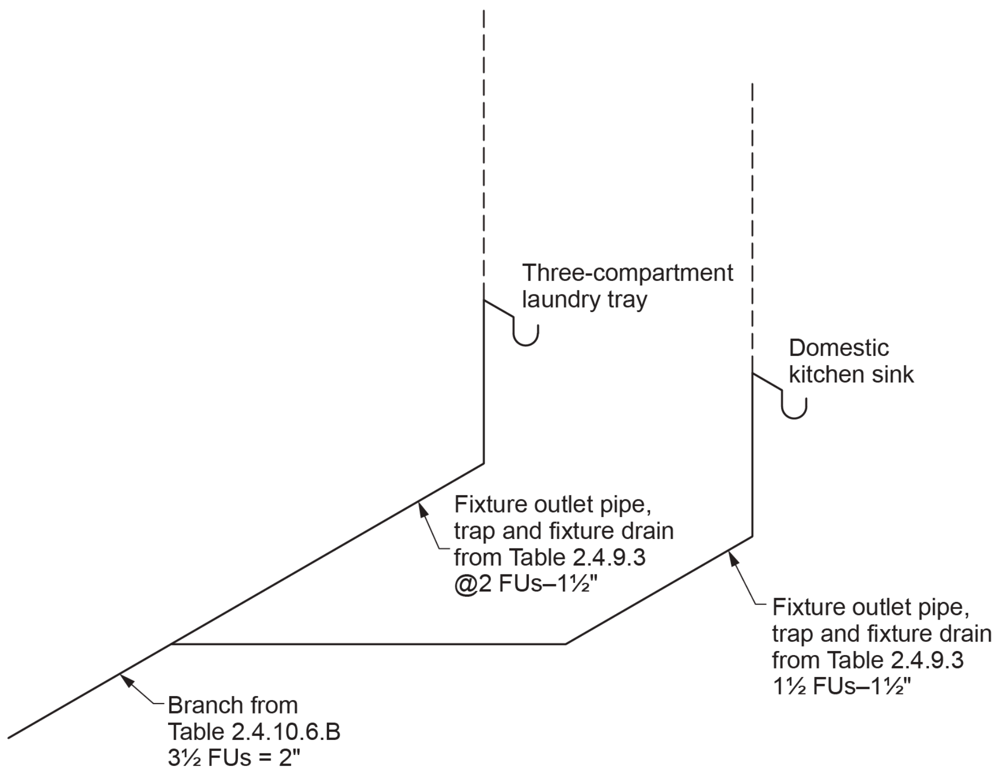

Figure 3 *Branch created by joining two fixture drains and sized from NPC Table 2.4.10.6.-B. (Skilled Trades BC, 2021) Used with permission.*

Sizing Stacks

A stack (also known as a soil-or-waste stack or SOWS) is a drainage pipe that passes through at least one storey as a drain pipe; this also includes any nominally horizontal offsets. A stack will typically receive waste from multiple fixtures connected to it. These may be located on a single floor or multiple storeys.

When sizing a stack, you would use Table 2.4.10.6.-A (Table 5). Notice that it states not only the maximum load that the stack can carry for any given size but also the maximum number of fixture units drained to it from any one storey for any given size.

Table 5: (Table 2.4.10.6.-A) Maximum Permitted Hydraulic Load Drained to a Stack

Stack Size (in.)	Maximum Hydraulic Load (FUs)	Maximum FUs Drained From Any One Storey
1.25	2	2
1.50	8	2
2	24	6
3	102	18
4	540	100
5	1,400	250
6	2,900	500
8	7,600	830
10	15,000	2,700
12	26,000	4,680
15	50,000	9,000

Example

A 3 in. stack can have a maximum load of 102 FUs in total. If the 3 in. stack receives a 20-FU load from any one storey, then the size of the stack would have to be 4 in. from that floor's connection point downward because, according to the third column of Table 2.4.10.6.-A, the maximum load from any one storey draining to a 3 in. stack is 18 FUs (Figure 4).

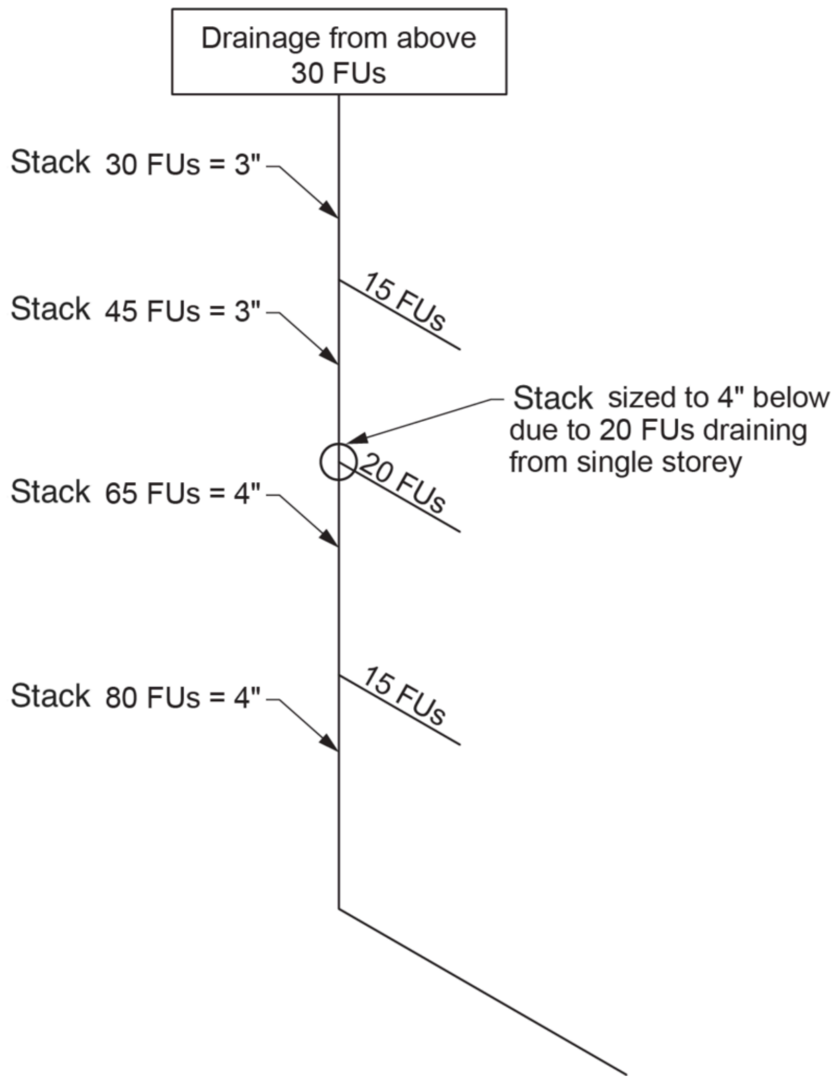

Figure 4 *Stack must be increased in size due to 20 FUs draining to it from any one storey. (Skilled Trades BC, 2021) Used with permission.*

Sizing a Sanitary Building Drain or Sewer

The sanitary building drain conducts sewage from the furthest upstream fixture drain, branch, or stack serving a water closet and terminates 1 meter (39 inches) outside the foundation. At this point, the sanitary building sewer is established and conducts the flow to the municipal disposal system or private disposal system.

To determine the size of any portion of the sanitary building drain or building sewer, you must know the drainage load and the pipe grade. Notice that for any pipe size, the load-carrying capacity of the pipe increases as the grade increases.

Table 6: (Table 2.4.10.6.-C) Maximum Permitted Hydraulic Load Drained to a Sanitary Building Drain or Sewer

Size of Drain or Sewer (in.)	Maximum Hydraulic Load (FUs)					
	Slope					
	1 in 400	1 in 200	1 in 133	1 in 100	1 in 50	1 in 25
3	N/A	N/A	N/A	N/A	27	36
4	N/A	N/A	N/A	180	240	300
5	N/A	N/A	380	390	480	670
6	N/A	N/A	600	700	840	1,300
8	N/A	1,400	1,500	1,600	2,250	3,370
10	N/A	2,500	2,700	3,000	4,500	6,500
12	2,240	3,900	4,500	5,400	8,300	13,000
15	4,800	7,000	9,300	10,400	16,300	22,500

Sizing the System

Now that the different tables have been explored, it is time to use them to size the entire sanitary system.

Sizing fixture drains:

- Fixture drains serve one fixture only and may run vertically or horizontally.
- The size of every fixture drain that serves a water closet must be at least 3 in., except for a macerating toilet, which must be at least $\frac{3}{4}$ in.
- Fixture drains begin at the trap weir and end at the connection point to a branch, stack, or sanitary building drain.
- The minimum size of a fixture drain is equal to the fixture outlet pipe and trap found in NPC Table 2.4.9.3. and 2.4.10.2.
- A fixture drain, fixture outlet pipe, and trap serving a semi or continuous flow fixture is sized from NPC Table 2.4.10.12.
- The portion of the fixture outlet pipe, trap arm, and fixture drain serving three or more compartments of a sink shall be increased one size larger than the largest fixture outlet pipe located upstream.
- The size of the fixture drain must not be smaller than the size of the individual vent connected to it.
- As long as proper grade and cleanout spacing are provided, there is no restriction to the length of a fixture drain.

Sizing branches:

- The size of a branch is found in Table 2.4.10.6.-B.
- The size of the branch shall not be smaller than the size of any vent connected to it.
- The load to consider on any section of a branch is the sum of the loads actually connected to — or future connections to — the branch upstream of the section being sized.
- A branch may never be smaller than any upstream drainage pipe connecting to the branch.
- Branches downstream of where a third water closet is connected must be 100 mm (4 in.) (Figure 5).
- As long as proper grade and cleanout spacing are provided, there is no restriction to the length of a branch

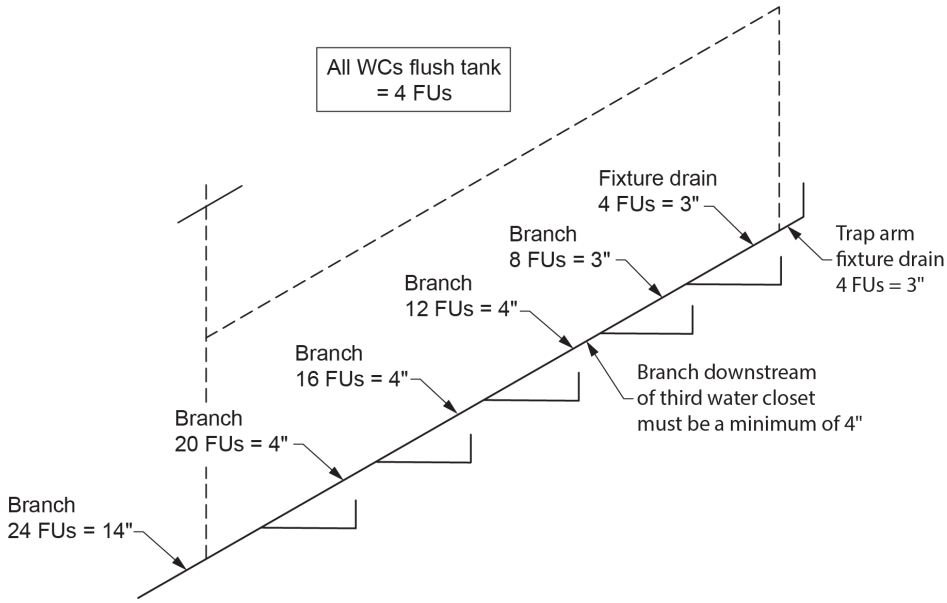

Figure 5 *Branch increasing to 4 in. in size due to the connection of a third water closet. (Skilled Trades BC, 2021) Used with permission.*

Fixture Unit Loads on Branches Serving Bathroom Groups

The NPC (Table 2.4.9.3.) requires that the drainage load imposed on the drainage system by bathroom groups are as follows:

- With flush tank water closet = 6 FUs
- With flush valve water closet = 8 FUs

These listed drainage fixture unit values reflect the load of entire bathroom groups on the sanitary drainage system. A closer look at these values shows that they are slightly lower than the total of all fixture unit loads of the fixtures that make up the bathroom group. The reason for this difference is that a diversity factor is placed on a bathroom group. In other words, the probability of all fixtures in the group discharging at once is extremely low, so the load imposed on the system can be reduced.

For example, suppose we have a standard bathroom group consisting of:

- A flush tank water closet (WC)
- An $1\frac{1}{4}$ in. lavatory basin
- A bathtub

The drainage fixture unit load total of all of the individual fixtures listed above would equal:

Table 7: Bathroom Group Drainage Load Example

Fixture	Drain Load (FUs)
WC with flush tank	4
1.25 in. lavatory basin	1
Bathtub	1.50
Total	**6.50**

In this case, by designating the fixtures as a bathroom group, the load is reduced by 0.50 FUs.

Whenever the opportunity presents itself, you should always use the reduced bathroom group values, as doing so will lower the total load on the DWV system. When you are sizing your drainage drawings, a good practice to employ is to identify all bathroom groups on your drawings with a circle or a cloud, as shown in Figure 6. This will help to indicate where load reduction may be utilized.

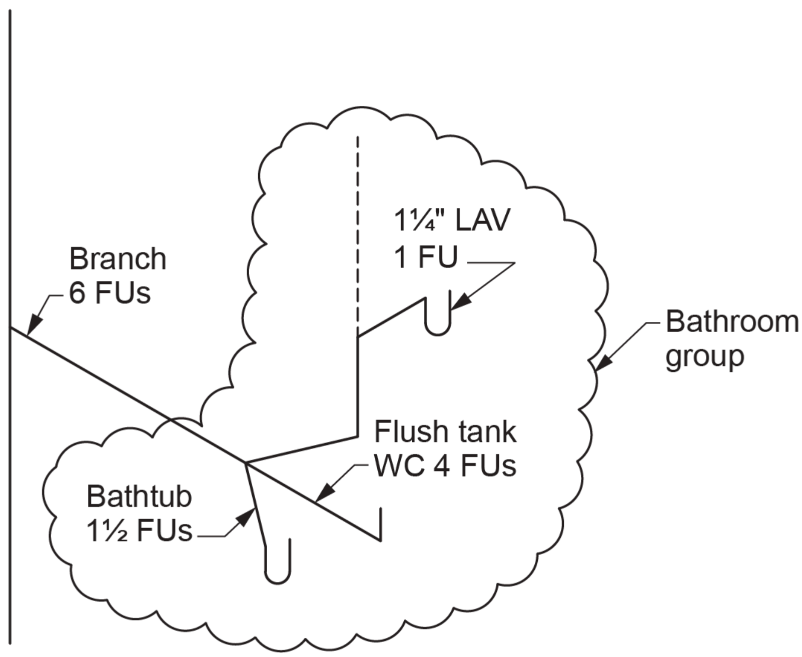

Figure 6 *Branch serving a bathroom group with a subsequent reduction in load on the system. (Skilled Trades BC, 2021) Used with permission.*

Fixture Unit Loads on Branches Serving Bathroom Groups with Additional Fixtures

The branch for a four- or five-piece bathroom has an additional fixture(s) that fall outside the NPC definition of a bathroom group. In order to gain the benefit of load reduction, you simply indicate the original bathroom group and add the fixture unit value of the additional fixture(s). The load on the branch serving the group is often referred to as a "bathroom group plus 1 in." or a "bathroom group plus 1.50 in." (Figures 7 and 8).

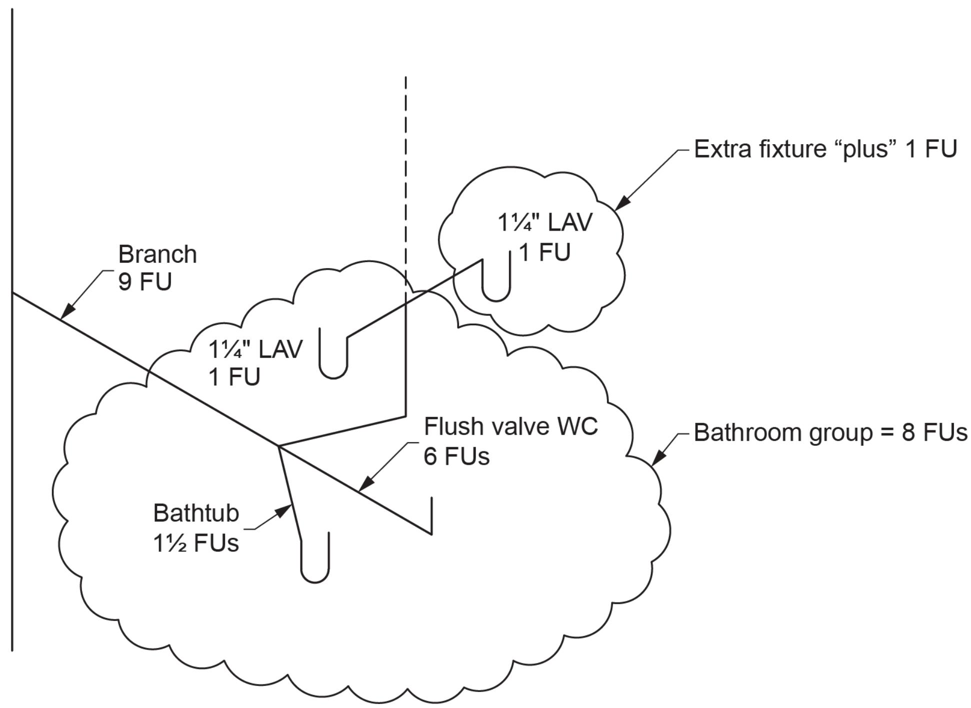

Figure 7 *Flush valve bathroom group with an additional lavatory basin. (Skilled Trades BC, 2021) Used with permission.*

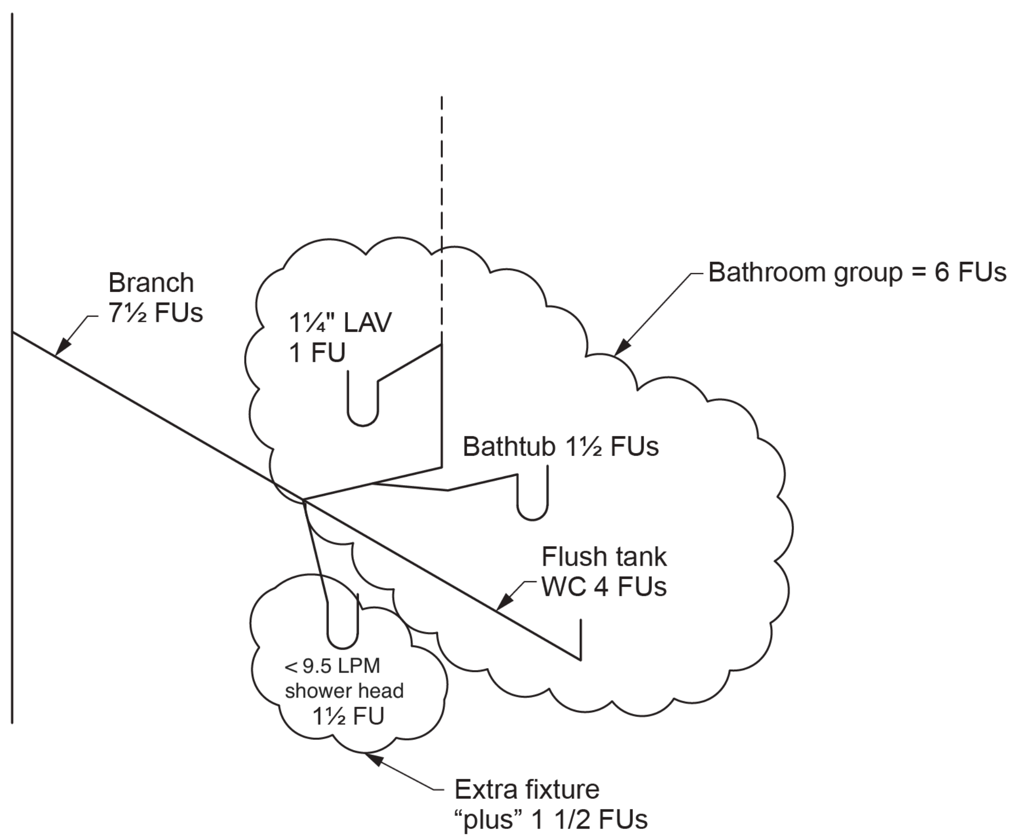

Figure 8 *Flush tank bathroom group with an additional single-headed shower. (Skilled Trades BC, 2021) Used with permission.*

Sizing stacks:

- The size of any section of a stack is found in Table 2.4.10.6.-A (NPC, 2020, B 2-34).
- A stack may never be smaller than any upstream drainage pipe connecting to the stack.
- The size of the stack shall not be smaller than the size of the stack vent connected to it.
- The size of any section of a stack is limited to a maximum number of fixture units draining to the stack from any one storey, as found in the third column of Table 2.4.10.6.-A.
- The load to consider on any section of a stack is the sum of the loads draining to the stack section from above.
- When a nominally horizontal offset in a stack is 1.5 m (5 ft) or more in length (Figure 9), the offset shall be sized as a branch using Table 2.4.10.6.-B (NPC, 2020, B 2-35) or a building drain using Table 2.4.10.6.-C (NPC, 2020, B 2-35). If the size of the offset in the two tables differs, the language states to go with “whichever is less restrictive”. This is meant to be taken in a legal context, which translates to “whichever is larger.” In the case of Figure 9, the offset would need to be increased to 4 in. due to both the table loads as well as the fact it is treated as a branch serving more than two water closets. If the offset increases in size, the larger stack size must be maintained due to the no reduction in drainage pipe size rule.
- A stack serving more than six water closets must be a minimum of 100 mm (4 in.).

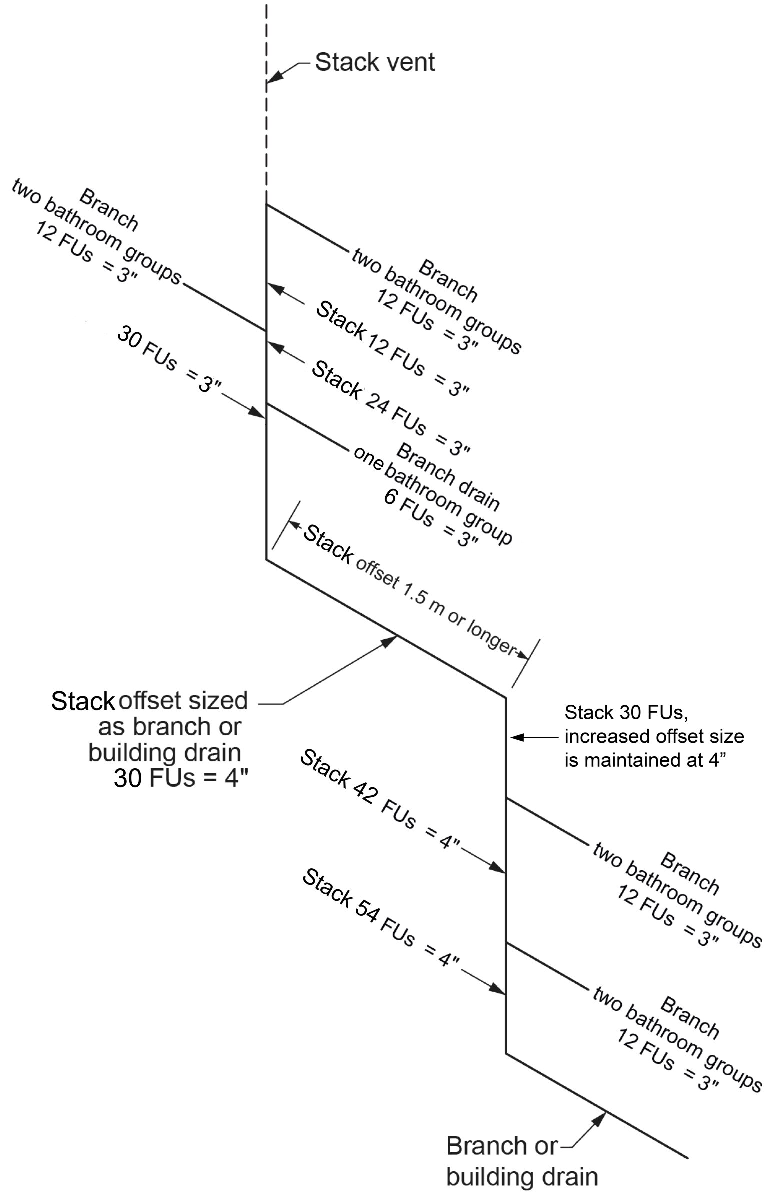

Figure 9 *Stack serving multiple bathroom groups with a nominally horizontal offset of 1.5 m or longer. (Skilled Trades BC, 2021) Used with permission.*

Sizing a sanitary building drain or sewer:

- The size of any section of a sanitary building drain or sewer is found in Table 2.4.10.6.-C using the hydraulic load draining to the section and the grade on the building drain or sewer.
- A sanitary building drain or sewer downstream of a main building cleanout fitting must be 100 mm (4 in.) in size.
- A sanitary building drain or sewer downstream of the third water close connected must be 100 mm (4 in.).
- A sanitary building drain or sewer may never be smaller than any upstream drainage pipe connecting to it.
- The load to consider on any section of the sanitary building drain or sewer is the sum of the loads actually connected to — or future connections to — the sanitary building drain or sewer upstream of the section being sized.
- If the building drain or sewer receives discharge from a sewage sump basin (Figure 10), the load to consider would be based on the load imposed by the sewage ejector pump not the FU load of the fixtures draining to the sump basin. For this example, the calculated load of the 2 in. discharge pipe would be:

$$0.75 \text{ L/s} \times 31.7 = 23.78 \text{ FUs (24 FUs)}$$

- As long as proper grade and cleanouts are provided, there is no restriction to the length of a sanitary building drain or sewer.

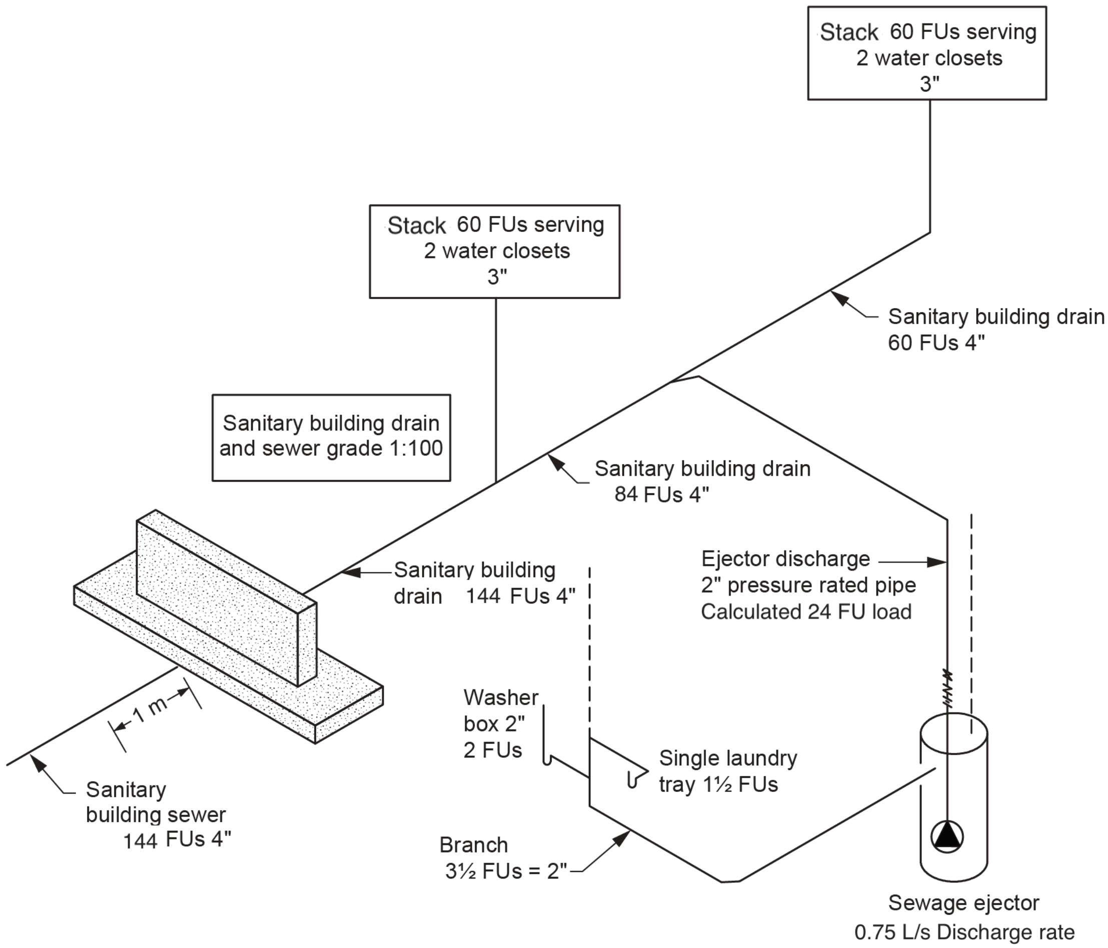

Figure 10 *Sanitary building drain sizing when receiving gravity and pumped discharge. (Skilled Trades BC, 2021) Used with permission.*

Self-Test D-1.5: Sizing Sanitary Drainage Pipes

Complete Self-Test D-1.5 and check your answers.

If you are using a printed copy, please find Self-Test D-1.5 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=45#h5p-17 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=45#h5p-17)

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D-1.6 Sizing Single-Storey Vents

The purpose of the venting system is to supply a free flow of air to maintain near-atmospheric-pressure conditions in the drainage system so fixtures can operate correctly.

Sizing a pipe for a venting system requires you to be familiar with both tables and clauses provided in the code book.

National Plumbing Code (NPC) Tables Used for Vents Serving Single Storey Fixtures

The NPC tables provide the minimum size of all vent pipes based on criteria, such as trap size, maximum fixture unit load it can carry, and the developed length of the vent.

The following are the tables you will need to refer to when sizing vents serving fixtures located on a single storey.

Table 2.5.7.1. — Minimum Permitted Size of Vent Pipe Based on Size of Trap Served

The NPC requires that the size of every vent pipe shall conform to Table 2.5.7.1. (NPC, 2020, B 2-43; refer to our Table 1), which takes precedence over all other venting tables. This is the only venting table that has an influence on the size of every vent pipe in the system, regardless of its name.

Table 1: (From NPC Table 2.5.7.1.) Minimum Permitted Size of Vent Pipe Based on Size of Trap Served

Trap Size Served (in.)	Minimum Vent Pipe Size (in.)
1.25	1.25
1.5	1.25
2	1.5
3	1.5
4	1.5
5	2
6	2

Table 2.5.8.1. — Maximum Permitted Hydraulic Loads Drained to a Wet Vent

A wet vent is simply a sanitary drainage pipe that serves as both a drain and a vent. Nearly every DWV system uses wet vents for material savings and space considerations. Because a wet vent must be able to drain the wastewater while providing air to protect the traps, it will be sized larger to accommodate the dual function.

Earlier in this section you were asked to identify certain DWV pipes by their function in the system. Whenever a sanitary drainage pipe serves both a drain and a vent pipe, it is said to be “acting as a wet vent.” During your exercise, some of the piping that matched this description were:

- Fixture drain acting as a wet vet
- Branch acting as a wet vet
- Stack acting as a wet vent

Whenever a pipe is “acting as a wet vent,” you must use Table 2.5.8.1. (NPC, 2020, B 2-44; refer to our Table 2) to check it for minimum size as a wet vent against any other factors such as being a fixture drain, branch or a stack.

This table states the total fixture units that may discharge into a wet vent above the most downstream wet-vented fixture or two symmetrically connected wet-vented fixtures. The fixture unit load from the lowest connecting fixture or fixtures in a wet-vented group, whether a water closet or not, are not counted when determining the load on the wet vent. In the table below, the second column is for sizing wet vents that do not serve water closets, and the third column is for wet vents that do serve water closets. Of special note is that the minimum size of a wet vent not serving water closets is $1\frac{1}{2}$ in. and, the minimum size of a wet vent serving a water closet is 2 in.

Table 2: (From NPC Table 2.5.8.1.) Maximum Permitted Hydraulic Loads Drained to a Wet Vent

Size of Wet Vent (in.)	Maximum Hydraulic Load (FUs)	
	Not Serving Watering Closets	Fixtures Other Than Water Closets That Serve Not More Than Two Water Closets
1.5	2	–
2	4	3
3	12	8
4	36	14
5	–	18
6	–	23

Table 2.5.8.3. — Sizing of Branch Vents, Vent Headers, Circuit Vents and Continuous Vents

Table 2.5.8.3. (NPC, 2020, B 2-45; refer to our Table 3) provides the minimum size for four different vent types used in DWV systems and is based on the following information:

- Maximum fixture unit load it can carry
- The developed length of the vent
    - This component is the major difference between sizing drainage pipe and vent pipe. The length of the vent is important because when air flows in a pipe there is a pressure loss due to the friction between the air and the pipe wall. The maximum length of vent piping for any particular size will limit the pressure drop within the venting system to 1 in. of water column, which is not substantial enough to cause a trap seal loss.

Example

To size a branch vent with a hydraulic load of 47 FUs and a developed length of 13 m (42 ft 7 in.), you would follow these steps:

1. Find a hydraulic load in the left-hand column that is equal to or greater than the load in the example. In this case you have a load of 47 FUs, so the choice you would make is 60 FUs.
2. Move to the right until you find a developed length that is greater than or equal to the length in the example of 13 m. The table entry of 15 m is the correct choice.
3. Move vertically up the table to find the size of the vent = 2 in.

Table 3: (From NPC Table 2.5.8.3.) Sizing of Branch Vents, Vent Headers, Circuit Vents, and Continuous Vents

Total Hydraulic Load Served by Vent Pipe (FUs)	Size of Vent Pipe (in.)							
	1.25	1.5	2	3	4	5	6	8
	Maximum Length of Vent Pipe (m)							
2	9	NL	NL	NL	NL	NL	NL	NL
8	9	30	61	NL	NL	NL	NL	NL
20	7.5	15	46	NL	NL	NL	NL	NL
24	4.5	9	30	NL	NL	NL	NL	NL
42	NP	9	30	NL	NL	NL	NL	NL
60	NP	4.5	15	120	NL	NL	NL	NL
100	NP	NP	11	79	305	NL	NL	NL
200	NP	NP	9	76	275	NL	NL	NL
500	NP	NP	6	55	215	NL	NL	NL
1,100	NP	NP	NP	15	61	215	NL	NL
1,900	NP	NP	NP	6	21	61	215	NL
2,200	NP	NP	NP	NP	9	27	105	335
3,600	NP	NP	NP	NP	7.5	18	76	245
5,600	NP	NP	NP	NP	NP	7.5	18	76

Sizing Individual Vents

An individual vent is installed in the nominally vertical position until it is above the flood level rim of the fixture that it is serving, protecting the individual fixture trap. The individual vent usually connects to the trap arm through a **sanitary tee** fitting.

There are two types of individual vents used in a venting system:

- Individual
- Individual and continuous

Both types of individual vents are sized by Code Clause 2.5.8.2., which directs you to refer to Table 2.5.7.1. The only consideration when sizing an individual vent is the size of trap served by the vent (Figure 1). To find the size of the trap, you would refer to Table 2.4.9.3. The size of the trap is the same as the fixture outlet pipe, which is given in the second column. The hydraulic load of the fixture and the length of the individual vent are considered non-applicable (N/A), as noted in Clause 2.5.8.2.(2).

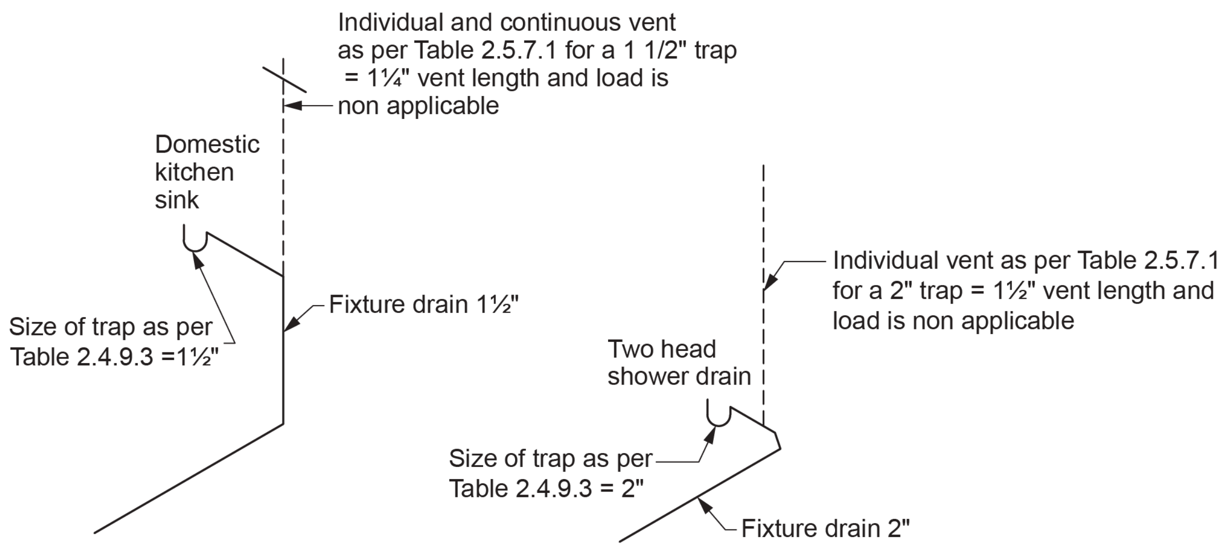

***Figure 1** Individual vent sizes based on trap size. (Skilled Trades BC, 2021) Used with permission.*

Sizing Dual Vents

Somewhat similar to individual vents, dual vents serve two fixtures, connected with a double fitting to a branch.

There are also two types of dual vents used in a venting system:

- dual
- dual and continuous

Like individual vents, dual vents are also sized by code Clause 2.5.8.2., which directs you to refer to Table 2.5.7.1 (NPC, 2020, B 2-43-44). The only difference is that the size of vent is dependent on the larger of the two traps served by the vent (Figure 2). To find the size of either trap, you would refer to Table 2.4.9.3. (NPC, 2020, B 2-31-32)., as before. The hydraulic load of the fixture and the length of the dual vent are considered non-applicable (N/A), as noted in Clause 2.5.8.2.(2).

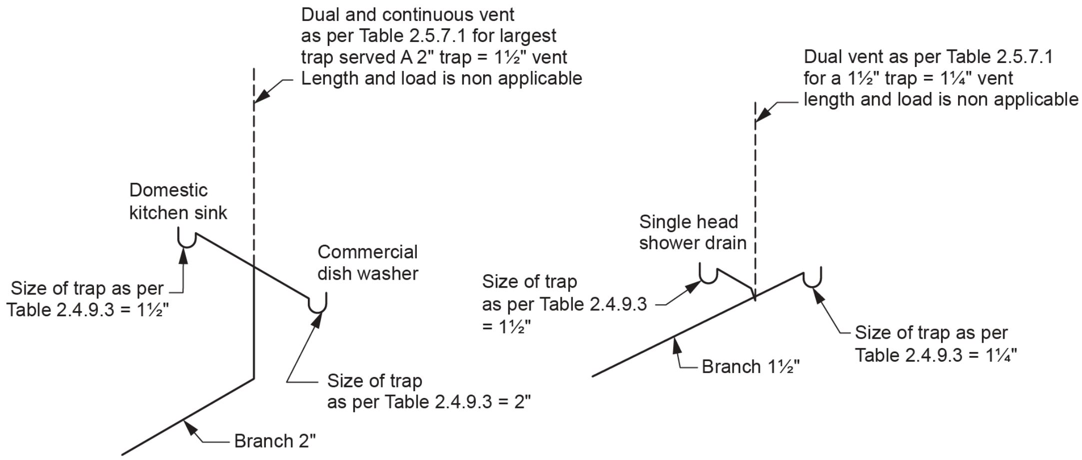

Figure 2 *Dual vents size based on largest trap size. (Skilled Trades BC, 2021) Used with permission.*

Vents for Floor Drains

As stated in the drainage section, floor drains can be categorized as either non-emergency or emergency, and this designation determines whether or not the drain is given a hydraulic load. When it comes to venting floor drains, the NPC Clause 2.5.1.1.(3) states that if a trap serves as a floor drain, it need not be protected by a vent if the following conditions are present (NPC, 2020, B 2-37):

- The size of the trap is not less than 75 mm (3 in.).
- The length of the fixture drain is not less than 450 mm (17.7 in.).
- The fall on the fixture drain does not exceed its size.

In general terms, a floor drain could have a venting load, drainage load, both drainage and venting loads, or no load at all, depending on its size and designation. To make things easier to understand, Table 4 summarizes the different combinations created by the various rules governing floor drains.

Table 4: Floor Drain Load Summary

Floor Drain Designation	Drain Load (FUs)	Venting Load (FUs)
2 in. non-emergency	2	2
2 in. emergency	0	2
3 in. non-emergency	3	0
3 in. emergency	0	0

The above summary table was laid out in the 1992 version of the BC Plumbing Code but has since escaped inclusion in subsequent editions of either the BCPC or NPC. Accordingly, most if not all jurisdictions still rely on this method of establishing loads on floor drains.

Sizing Wet Vents

Wet venting is a form of group venting based on the simple principle that wastewater clings to the side of a vertical waste pipe, leaving the centre core of the pipe open. This means a properly sized wet vent can have an open centre core of air to serve as a vent for fixtures downstream.

Plumbing code requirements for wet venting can be difficult to fully comprehend at first glance. With practice, the procedures presented here will become increasingly familiar. This skill will be advantageous to those performing plumbing layout work in the industry

Because wet vents can serve a group of fixtures on one or many levels, two categories of wet vents have been established by industry:

1. Single-storey wet vents (fixture drain/wet vents and branch/wet vents)
2. Multi-storey wet vents (stack wet vents)

The terms “single-storey wet vents” and “multi-storey wet vents” are not referenced in the code book as such. These terms are sometimes used as a learning tool or descriptor by educators to help learners visualize the concepts being explained. This textbook explores each category separately, keeping in mind that most of the following code requirements pertain to both types.

Sizing Single-Storey Wet Vents

The first step in sizing a wet vent is to become familiar with the code requirements stated in Section 2.5.2 of the NPC. (The remainder of this topic is quoted from this section of the NPC. Figures 3–9 illustrate bulleted points from this section.)

- The hydraulic load that drains to a wet vent shall conform to Table 2.5.8.1. This is the only table used to size the wet-vented portion of a drainage system.
- One or two water closets may connect to the wet vent, but they must be located furthest downstream, and if there are two water closets, they must be connected through a symmetrical fitting. This would be a double wye (if on a horizontal wet vent) or a sanitary cross (if on a vertical wet vent).

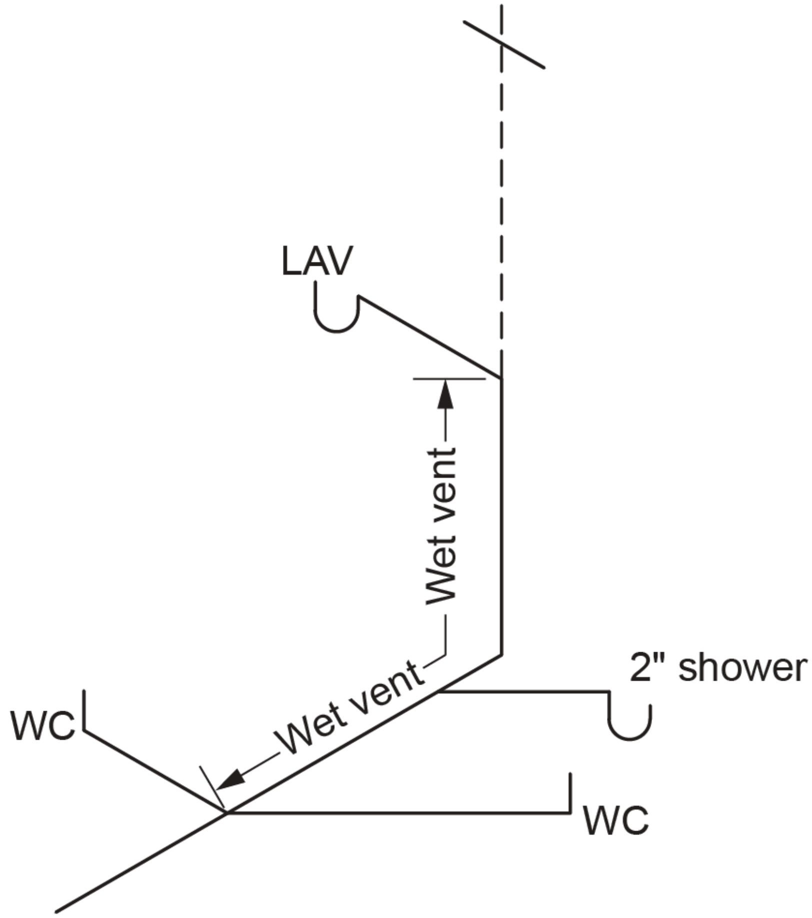

__Figure 3__ Maximum of two water closets connected to a wet vent. (Skilled Trades BC, 2021) Used with permission.

- Trap arms and fixture drains connected to the wet vent do not exceed 50 mm (2 in.) in size, except for connections from emergency floor drains (Figure 4).

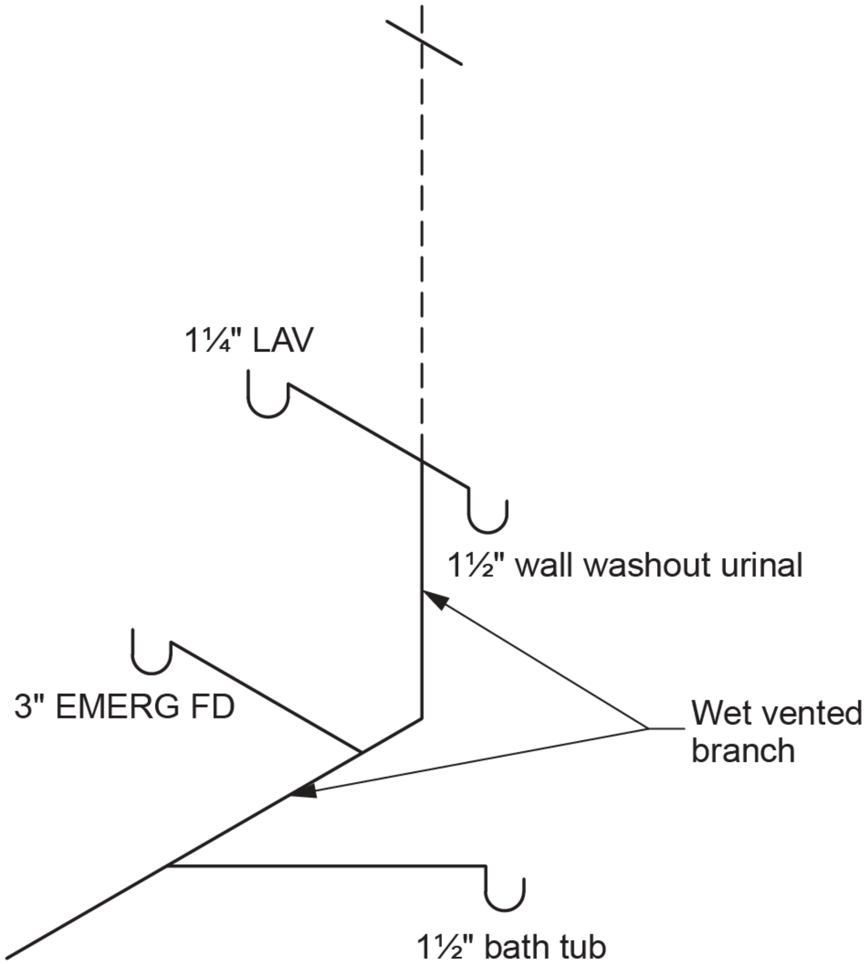

***Figure 4** A 3 in. emergency floor drain connected to a wet-vented branch. (Skilled Trades BC, 2021) Used with permission.*

- When determining the size of a wet vent, the hydraulic load to consider is the sum of all fixtures connected to the wet vent except for the most downstream fixture or symmetrically connected fixtures (Figure 5). Their load is not included when using Table 2.5.8.1. because the pipe below the lowest connection to the wet vent is only a drain and does not have to vent any fixtures through it. However, the lowest fixtures on the wet vent have to be included in the load of the drainage pipe, such as a branch, downstream of the wet vent.

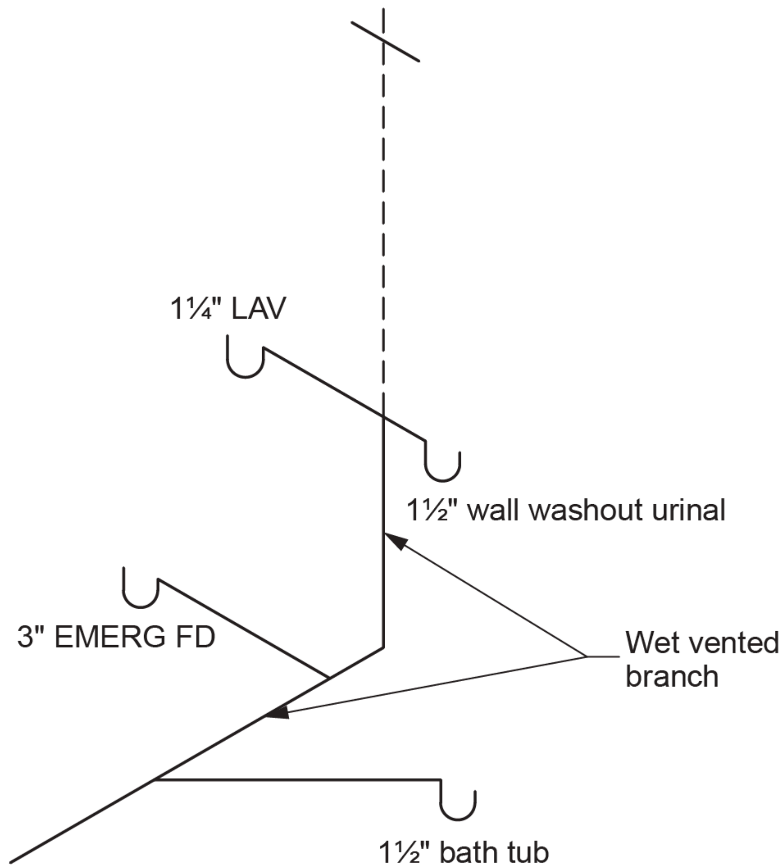

Figure 5 *Hydraulic load on a wet vent for the purpose of NPC Table 2.5.8.1. (Skilled Trades BC, 2021) Used with permission.*

- Other separately vented fixtures — located in the same storey and having a total hydraulic load not greater than 2 FUs — are allowed to tie into a wet vent or a wet-vented water closet trap arm (Figures 6 and 7). When this is done, their fixture unit load will be added to the wet vent load.
    - Figure 6:

        A. Fixture drain acting as a wet vent. 4 FUs serving water closets from Table 2.5.8.1. = 3 in. pipe (NPC, 2020, B 2-44). Furthest downstream fixture (WC) not included.
        B. Branch acting as a wet vent. 4 FUs serving water closets from Table 2.5.8.1. = 3 in. pipe. Furthest downstream fixture (WC) not included.
        C. Separately vented fixture connected to wet vent. The load of the kitchen sink must be added to the wet vent load.

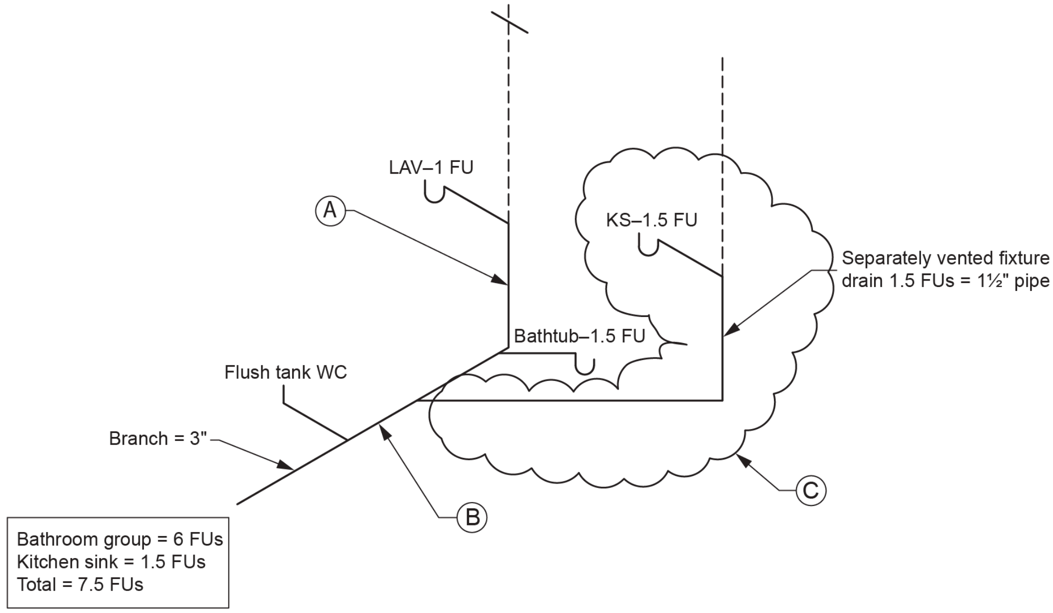

Figure 6 *The hydraulic load when a separately vented fixture is connected to a wet vent. (Skilled Trades BC, 2021) Used with permission.*

- Figure 7:
   A. Fixture drain acting as a wet vent. 4 FUs serving water closets from Table 2.5.8.1. = 3 in. pipe. Furthest downstream fixture (WC) not included.
   B. Branch acting as a wet vent. 4 FUs serving water closets from Table 2.5.8.1. = 3 in. pipe. Furthest downstream fixture (WC) not included.
   C. Separately vented fixture connected to wet vent. The load of the kitchen sink must be added to the wet vent load.

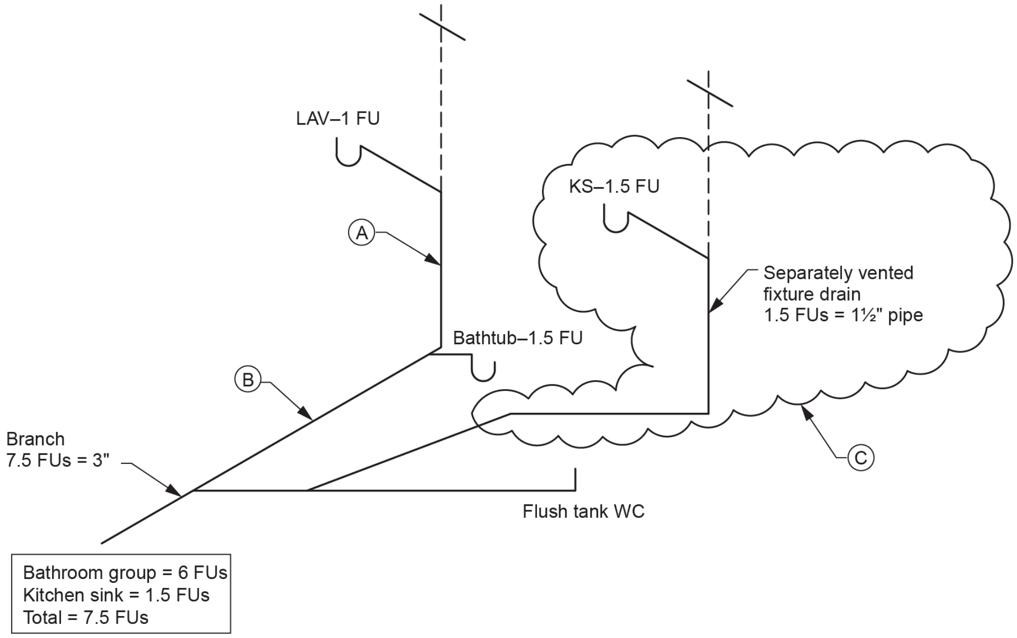

Figure 7 *The hydraulic load when a separately vented fixture is connected to the trap arm of a wet-vented water closet. (Skilled Trades BC, 2021) Used with permission.*

- The size of a wet vent will not reduce except for the portion upstream of the emergency floor drain (Figure 8).

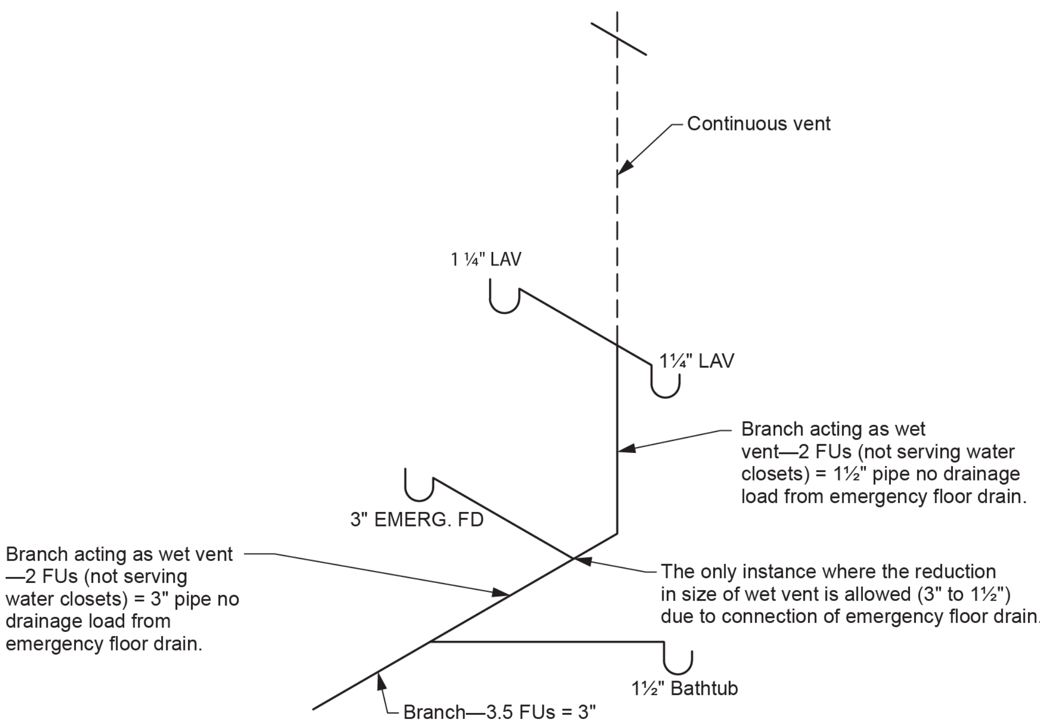

Figure 8 *A wet vent being reduced in size due to the connection of a 3 in. emergency floor drain. (Skilled Trades BC, 2021) Used with permission.*

- The length of a wet vent is not limited. Wet vents are sized by fixture unit load not by length (Figure 9).

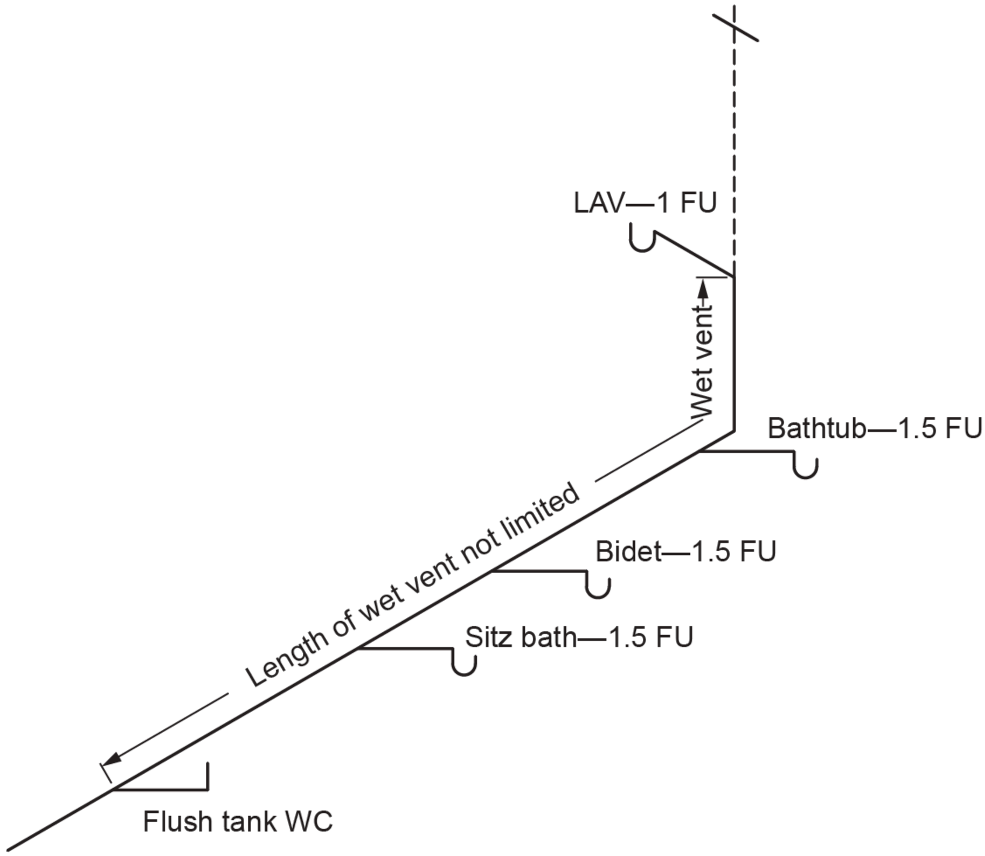

Figure 9 *The length of a wet vent is not limited. (Skilled Trades BC, 2021) Used with permission.*

Sizing Continuous Vents Serving Single-Storey Wet Vents

The most common applications of continuous vents are when serving single-storey wet-vented fixture drains and branches. The continuous vent connects to the vertical pipe where the most upstream wet-vented fixture is connected. Sizing of the continuous vent is found on Table 2.5.8.3. in the NPC.

Note: As with any vent, the continuous vent can never be smaller than permitted by Table 2.5.7.1. For example, if the continuous vent serves a water closet, Table 2.5.8.3 may permit a $1\frac{1}{4}$ in. vent. Table 2.5.7.1. overrides this value, as a $1\frac{1}{4}$ in. vent can only serve $1\frac{1}{4}$ in. and $1\frac{1}{2}$ in. traps.

You need the following information when using Table 2.5.8.3.:

1. The hydraulic load served by the continuous vent:
    - The hydraulic load to consider is the total number of wet-vented fixtures, including the most downstream connected fixture(s). The hydraulic load is most often identical to the drainage branch downstream of the wet vent portion. The one exception to this situation is explained below:

- The hydraulic load of separately vented fixtures draining into the wet vent is not included when sizing the continuous vent serving the wet vent (Figure 10).

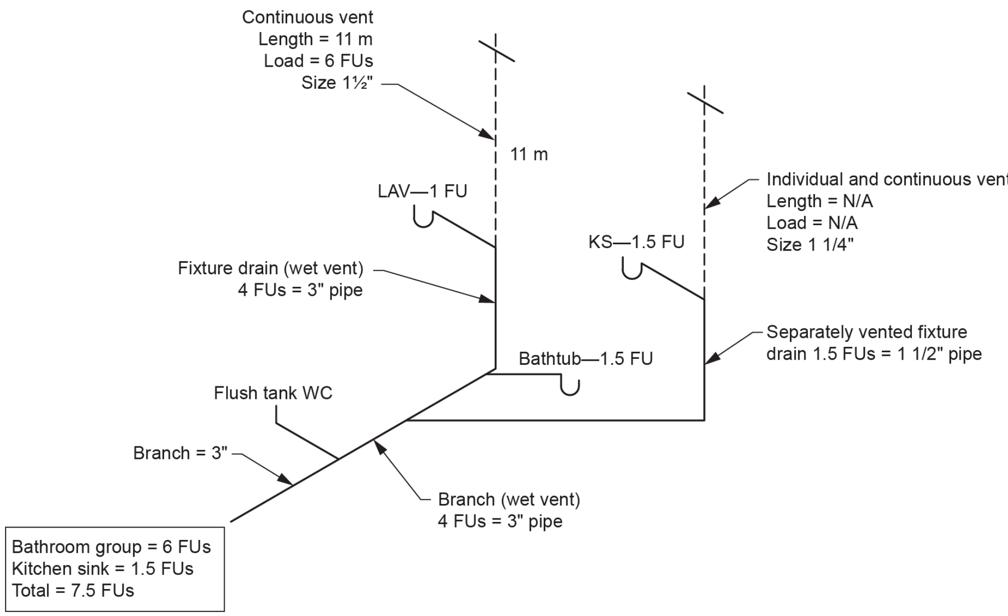

Figure 10 *Drainage load of separately connected fixtures draining into the wet vent. (Skilled Trades BC, 2021) Used with permission.*

2. The developed length of the vent measured from the vertical sanitary drainage pipe connection to where it joins a vent stack, stack vent, header (Category 3 or 4 vent) or measured through to open air (Figures 11 and 12).

The length and hydraulic load must be considered when sizing a continuous vent serving a single-storey wet-vented branch.

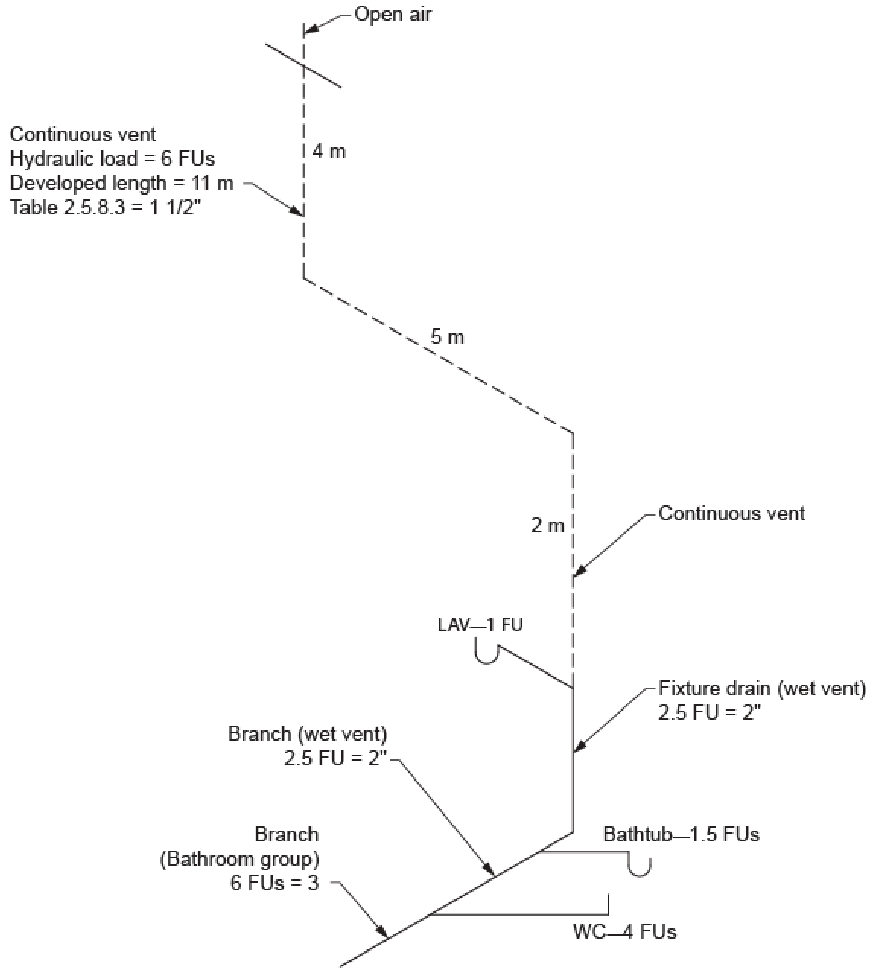

Figure 11 *Developed length and load of the vent. (Skilled Trades BC, 2021) Used with permission.*

For the example in Figure 12, Table 2.5.8.3. states the continuous vent size is $1\frac{1}{4}$ in. However, Table 2.5.7.1. states the minimum size of all vent pipes for 2 in. and 3 in. traps must be at least $1\frac{1}{2}$ in.

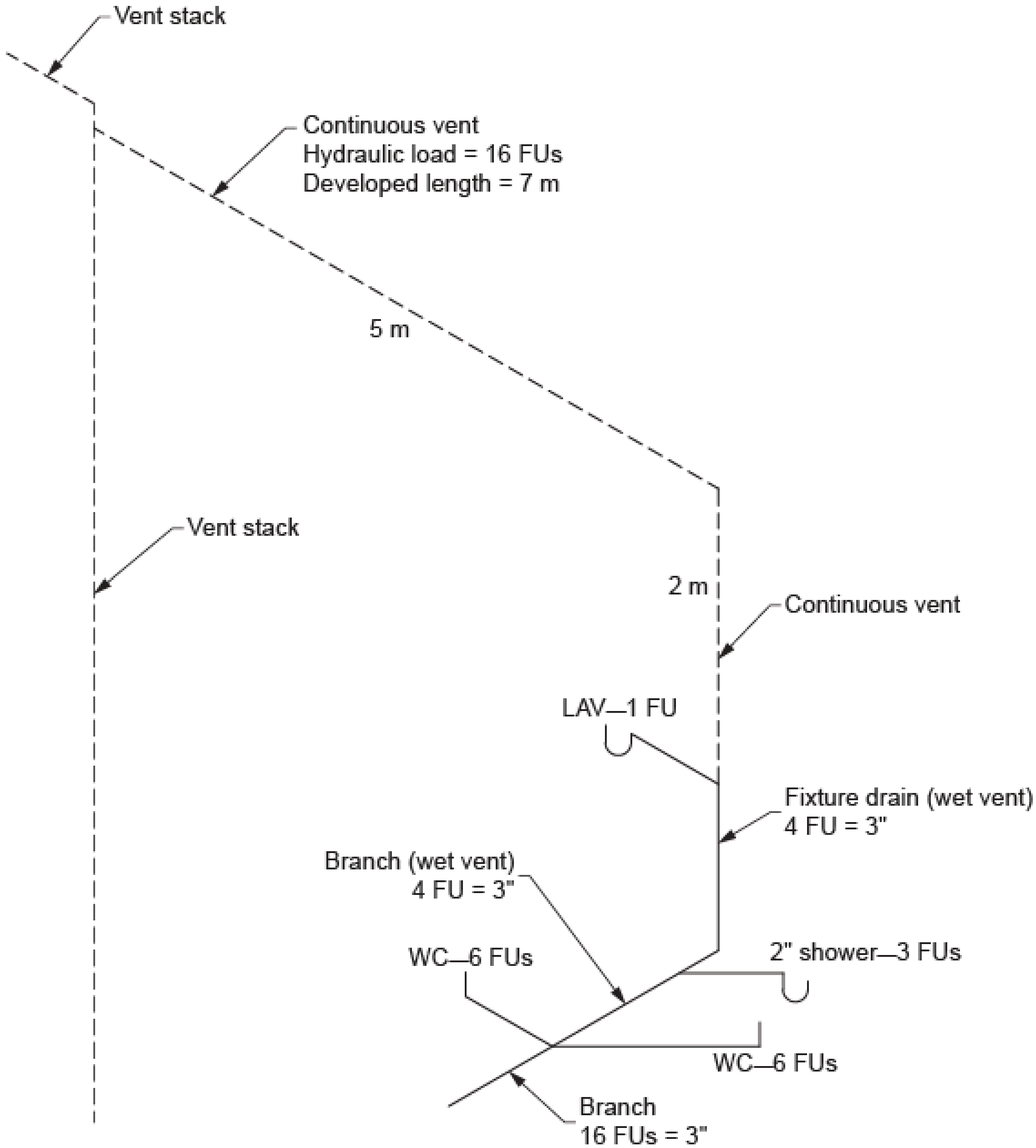

Figure 12 *Continuous vent sizing overridden by Table 2.5.7.1. (Skilled Trades BC, 2021) Used with permission.*

Self-Test D-1.6: Sizing Single-Storey Vents

Complete Self-Test D-1.6 and check your answers.

If you are using a printed copy, please find Self-Test D-1.6 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=47#h5p-18 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=47#h5p-18)

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National Research Council of Canada. (2020). *National plumbing code of Canada* 2020. Canadian Commission on Building and Fire Codes. https://nrc-publications.canada.ca/eng/view/ft/?id=6e7cabf5-d83e-4efd-9a1c-6515fc7cdc71 (https://nrc-publications.canada.ca/eng/view/ft/?id=6e7cabf5-d83e-4efd-9a1c-6515fc7cdc71)

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Trades Training BC. (2021). D-1: Install sanitary drain, water and vent systems. In: *Plumber Apprenticeship Program: Level* 2. Industry Training Authority, BC.

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D-1.7 Multi-Storey Wet Vents

Multi-storey wet vents have certain code regulations in common with the single-storey variety, including the following:

- The hydraulic load that drains to any wet vent shall conform to Table 2.5.8.1. Even though the drainage pipe is in fact a stack, it is "acting as a wet vent." Because of this, the wet-vented portion must be sized using Table 2.5.8.1. (See NPC and Section D-1.6 (#chapter-d-1-6-sizing-single-storey-vents))
- Two water closets may connect to a stack (wet vent) as long as they are installed at the same point with a double fitting. The fitting may be a **double sanitary tee** or **double wye and 45° combination** for multi-storey wet venting, as the connections to the wet vent are in the vertical plane.
- If a stack (wet vent) serves a water closet, it must be installed as the most downstream wet-vented fixture (Figure 1).

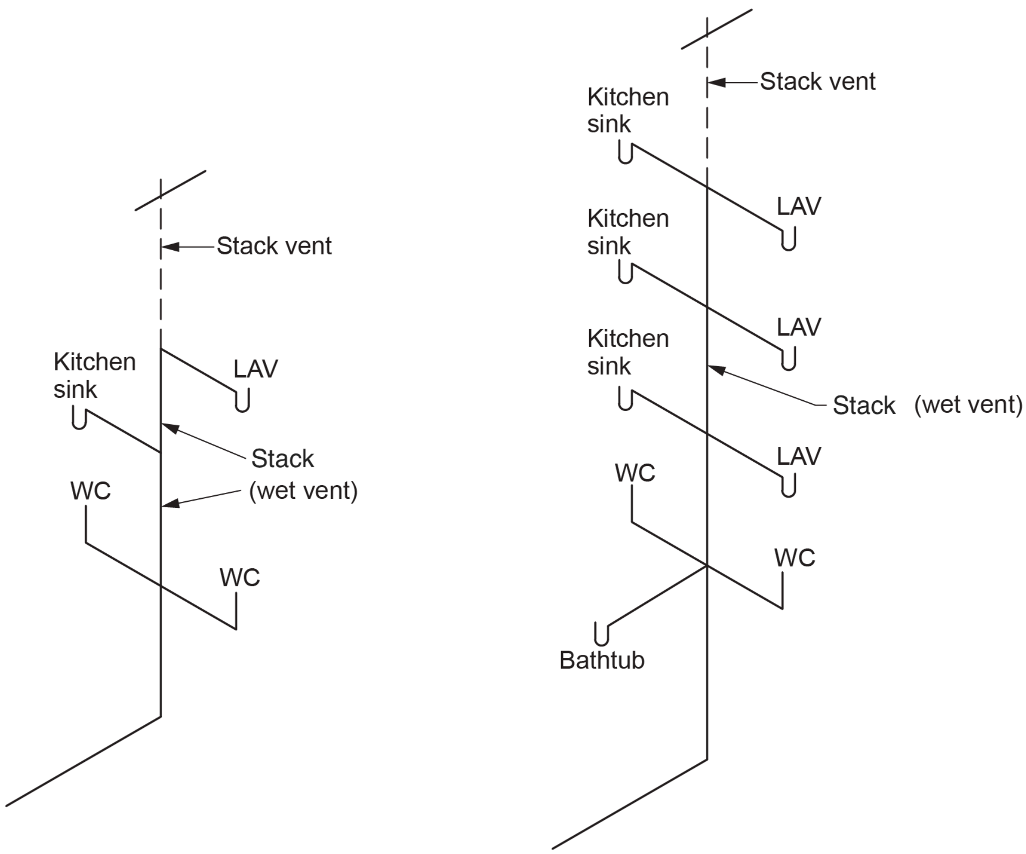

Figure 1 *Water closets connected to a multi-storey wet vent. (Skilled Trades BC, 2021) Used with permission.*

- Trap arms and fixture drains connected to the stack (wet vent) cannot exceed 50 mm (2 in.) in size, except for connections from emergency floor drains.
- The size of a stack (wet vent) will not reduce except for the portion upstream of an emergency floor drain.
- Other separately vented fixtures with a total hydraulic load not greater than 2 FUs are allowed to tie into a stack (wet vent), and their hydraulic load will be added to the stack (wet vent) load (Figure 2).
- The length of a stack (wet vent) is not limited.

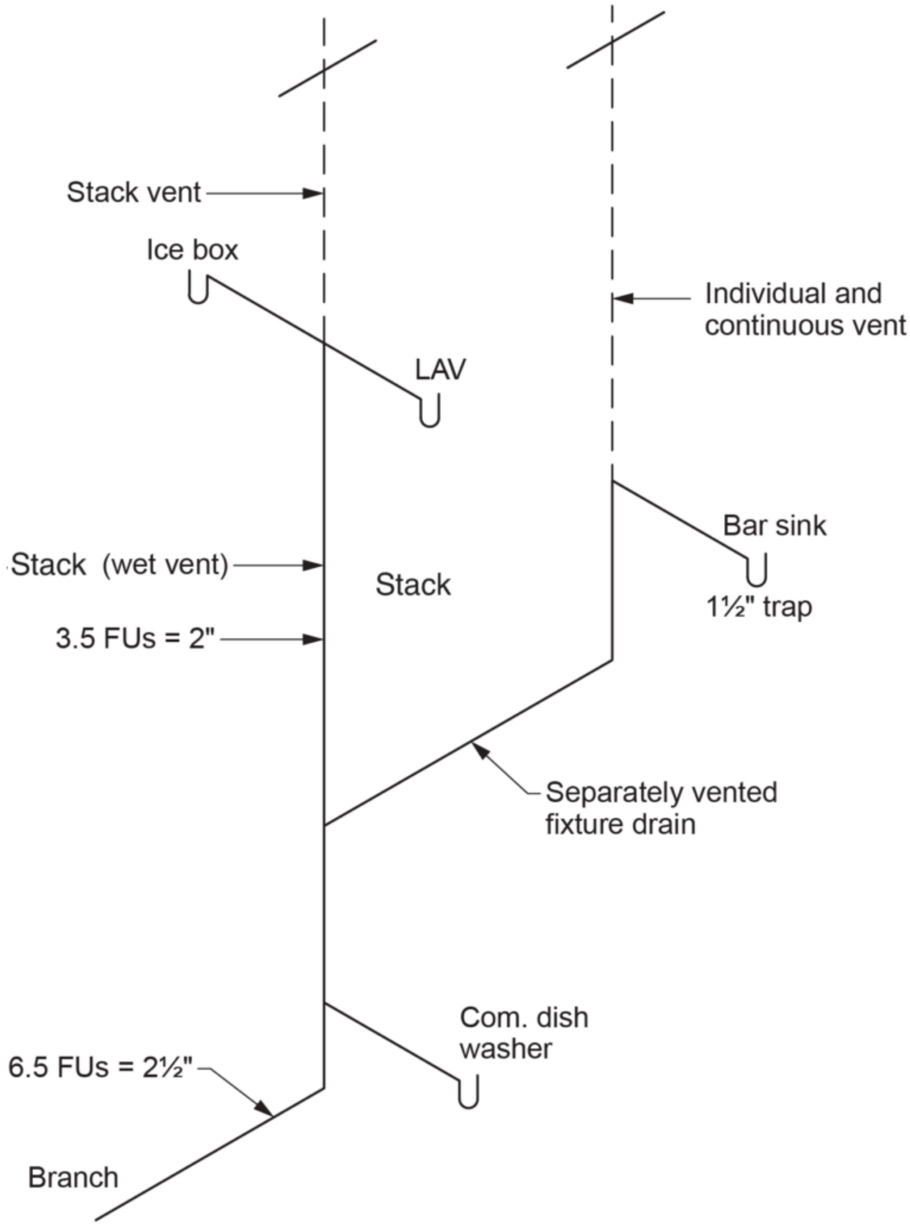

Figure 2 *Separately vented fixture draining to a multi-storey wet vent. (Skilled Trades BC, 2021) Used with permission.*

Code Requirements Exclusive to Multi-Storey Wet Vents

In addition to the unlimited length of a stack (wet vent), there are code regulations that do not apply to single-storey installations:

- A stack (wet vent) is limited to the number of fixture units that can be drained into the stack (wet vent) from the floors above the first storey.
- The total discharge from any one storey above the first storey is limited to 4 FUs as per Code Clause 2.5.2.1.(h).

Figure 3 shows a hydraulic load in excess of 4 FUs draining to a multi-storey wet vent above the first storey.

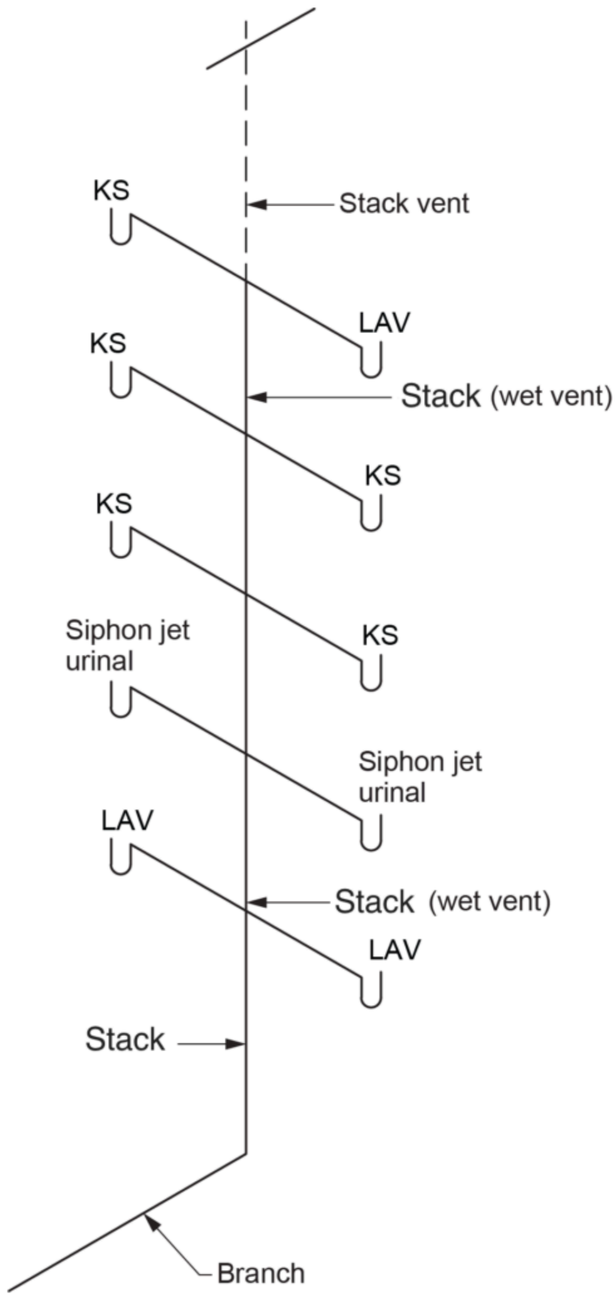

Figure 3 *Unapproved installation. (Skilled Trades BC, 2021) Used with permission.*

- A single offset may be installed in a stack (wet vent), but its length is limited depending on the size of the stack (wet vent) (Figure 4). When a single offset is installed, the length shall not exceed:
  - 1.2 m (47 in.) for stack (wet vent) 2 in. in size or less
  - 2.5 m ($90\frac{1}{2}$ in.) for stack (wet vent) larger than 2 in.

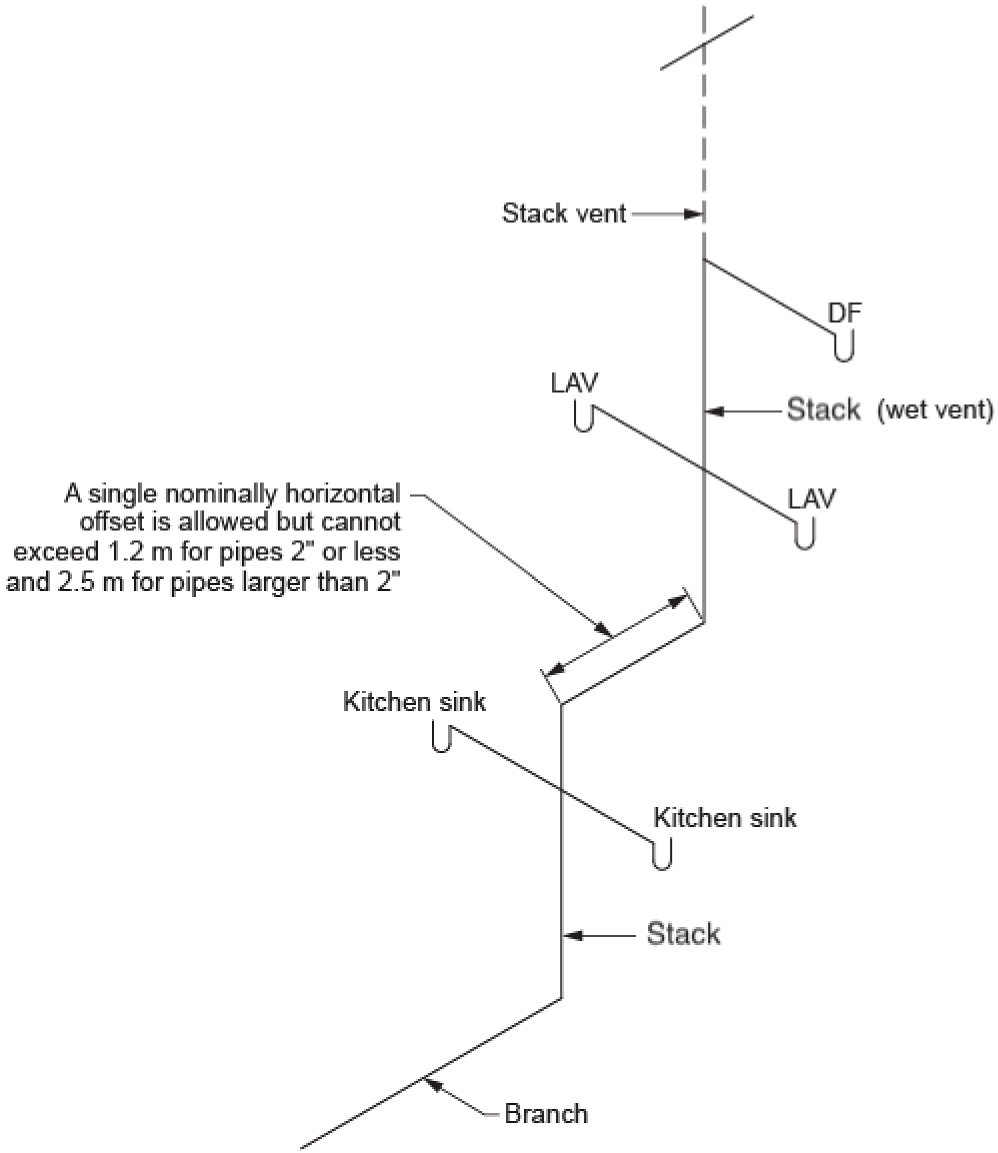

Figure 4 *Length limits of a nominally horizontal offset in a stack (wet vent). (Skilled Trades BC, 2021) Used with permission.*

Sizing Stack Vents Serving Multi-Storey Wet Vents

A stack (wet vent), like any other stack, must have a stack vent connecting to it where the most upstream wet-vented fixture connects. Stack vents are sized using Table 2.5.8.4.

Additionally, the code requires that:

- The stack vent never be smaller than permitted by Table 2.5.7.1.
- The minimum size be one-half the size of the stack at its base
- If the wet vent stack it serves is over four storeys, the stack vent must be the full size of the wet vent to open air

Table 2.5.8.4. — Size and Developed Length of Stack Vents and Vent Stacks

Table 2.5.8.4. (Table 1) is used for sizing stack vents and vent stacks only. You need three pieces of information to navigate through this table:

1. **The first column asks for the size of the stack**: the size of the stack at the base of the stack served by the stack vent or vent stack. Do not use the size of the stack at the top where the stack vent connects.
2. **The second column asks for the hydraulic load being vented**: the FU load at the base of the stack served by the stack vent or vent stack as well as any fixture unit vent loads being carried through the portion of the vent stack or stack vent being sized that were not drained to the base of the stack.
3. **The developed length of the stack vent or vent stack**: measured from the vent's lower end through to open air even if a vent header is installed.

Table 1: (Table 2.5.8.4.) Size and Developed Length of Stack Vents and Vent Stacks

Size of Stack (in.)	Total Hydraulic Load Being Vented (FUs)	Size of Stack Vent or Vent Stack (in.)									
		1.25	1.5	2	3	4	5	6	8	10	12
		Maximum Length of Stack Vent or Vent Stack (m)									
1.25	22	9	NL	NL	NL	NL	NL	NL	NL	NL	NL
1.5	8	15	46	NL	NL	NL	NL	NL	NL	NL	NL
2	12	9	23	61	NL	NL	NL	NL	NL	NL	NL
2	24	8	15	46	NL	NL	NL	NL	NL	NL	NL
3	10	NP	13	46	317	NL	NL	NL	NL	NL	NL
3	21	NP	10	33.5	247	NL	NL	NL	NL	NL	NL
3	53	NP	8	28.5	207	NL	NL	NL	NL	NL	NL
3	102	NP	7.5	26	189	NL	NL	NL	NL	NL	NL
4	43	NP	NP	10.5	76	299	NL	NL	NL	NL	NL
4	140	NP	NP	8	61	229	NL	NL	NL	NL	NL
4	320	NP	NP	7	52	177	NL	NL	NL	NL	NL
4	540	NP	NP	6.5	46	97.5	NL	NL	NL	NL	NL

Sizing a Stack Vent

If the stack (wet vent) measures four storeys or less in height (Figure 5), then Table 2.5.8.4. in the NPC (2020) code book is used (B 2-46). The information needed when using this table is:

- The size of the stack (wet vent) at its base
- The FU load of all fixtures draining into the stack (wet vent)
- The developed length of the stack vent measured from its lower end (the top of the wet vent portion) through to open air

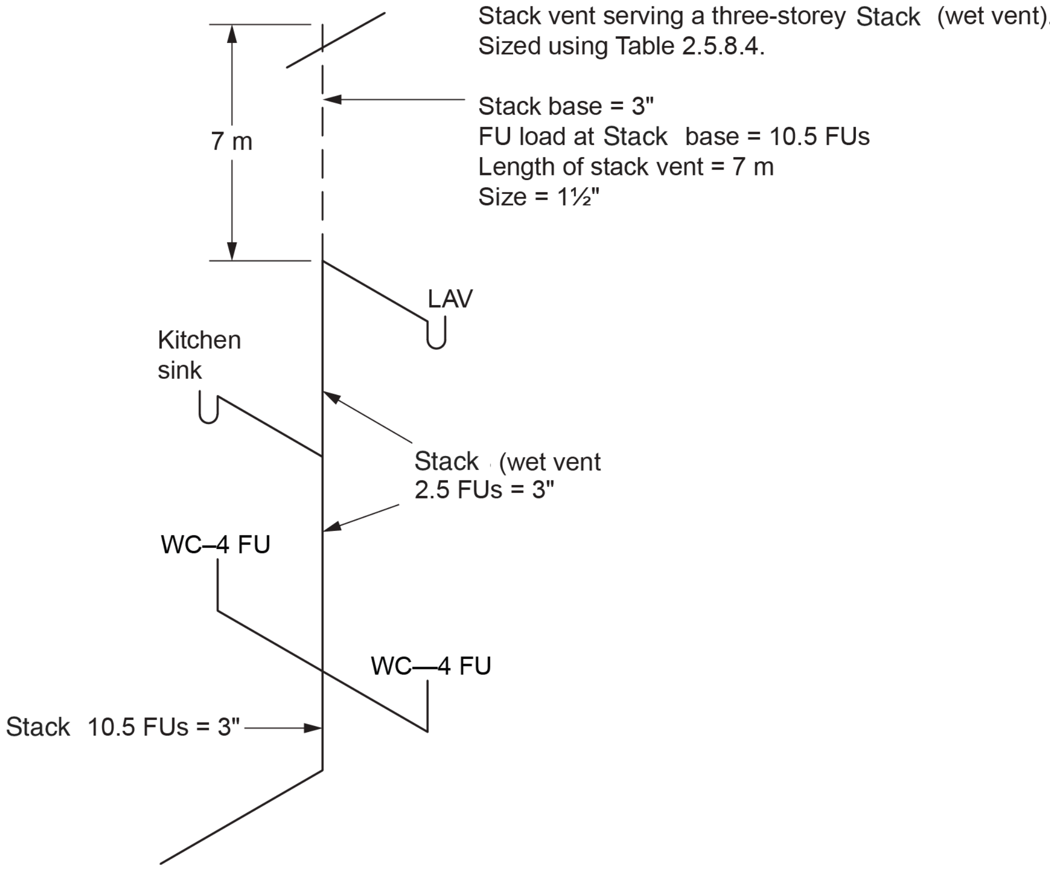

Figure 5 *Stack vent sizing when serving a stack (wet vent) measuring four storeys or less. (Skilled Trades BC, 2021) Used with permission.*

If the stack (wet vent) measures more than four storeys (Figure 6), then the stack vent must be the same size as the stack (wet vent) through to open air.

It is worth noting that although vent stacks are required to relieve air pressures when the stack has fixtures draining into it from more than four storeys, wet-vented stacks are exempt from this requirement, as they are sized as a wet vent and, therefore, are large enough to convey the air needed to protect the base of the stack.

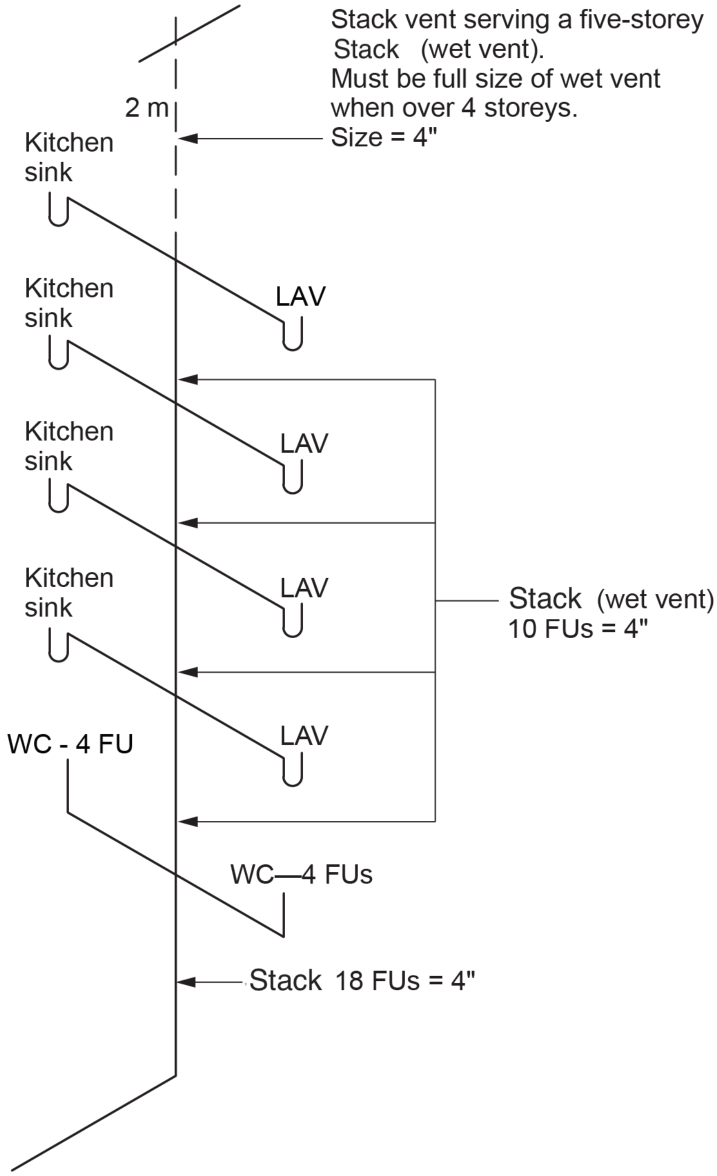

Figure 6 *Stack vent sizing when serving a stack. (Skilled Trades BC, 2021) Used with permission.*

Self-Test D-1.7: Multi-Storey Wet Vents

Complete Self-Test D-1.7 and check your answers.

If you are using a printed copy, please find Self-Test D-1.7 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.

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D-1.8 Sizing Branch and Circuit Vents

Although branch and **circuit vent**s are very different types of vents, they share some common sizing characteristics and have, therefore, been grouped together in this chapter.

Branch Vents

A branch vent is sized according to Table 2.5.8.3 (NPC, 2020, B 2-45). When using this table, you need to know the developed length of the branch vent and the hydraulic load (FUs) it serves at any given point.

The length to consider when sizing a branch vent is from the most distant sanitary drainage pipe connection to the point where it ties into a stack vent, vent stack, or vent header or where it continues as a branch vent to outside air (Figure 1).

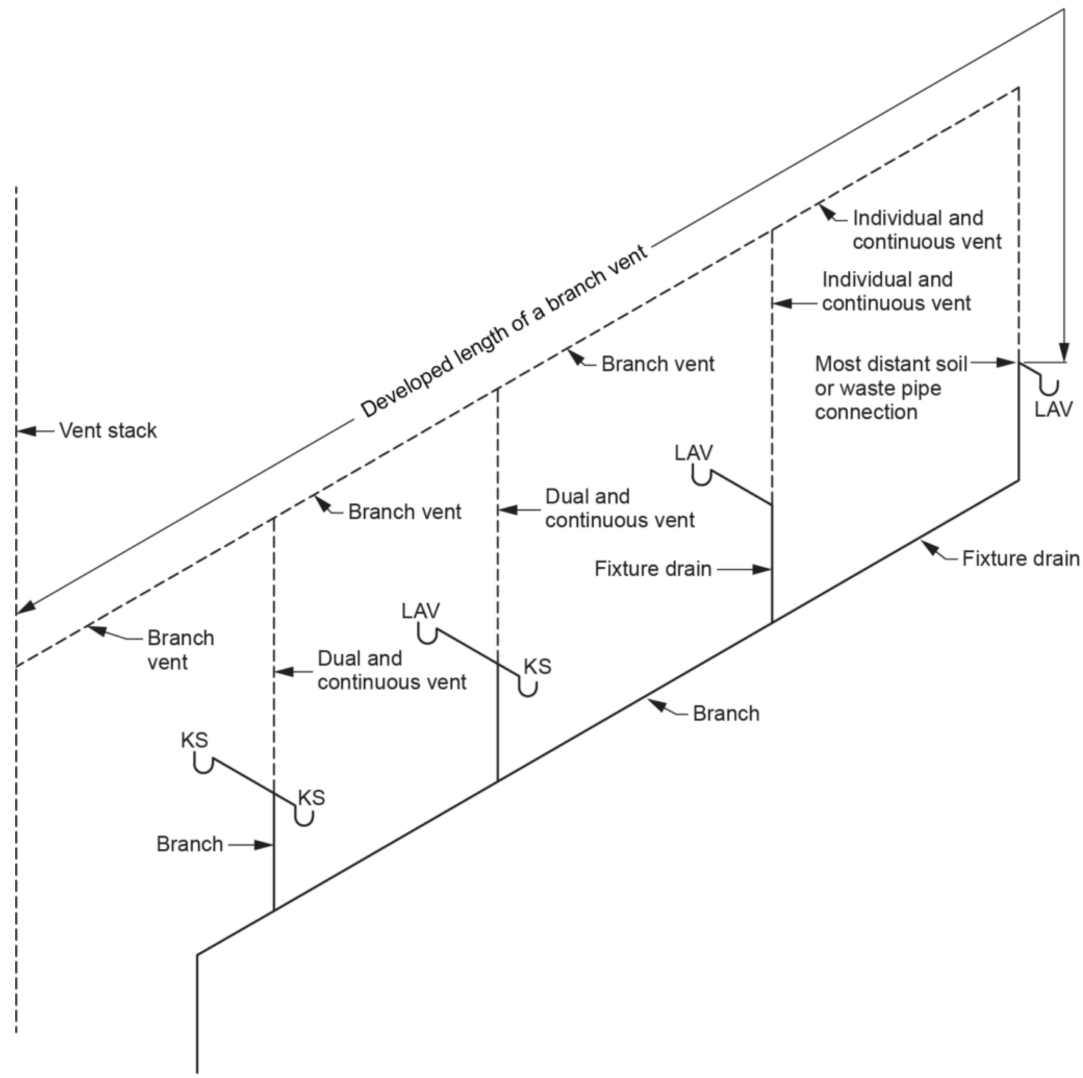

Figure 1 *Developed length of a branch vent. (Skilled Trades BC, 2021) Used with permission.*

The load to consider when sizing a branch vent is the sum of the FU loads for the fixtures it serves — in other words, the number of fixture units on the sanitary drainage pipes that it provides air for. As the fixtures are added to a branch vent, the load increases (Figure 2).

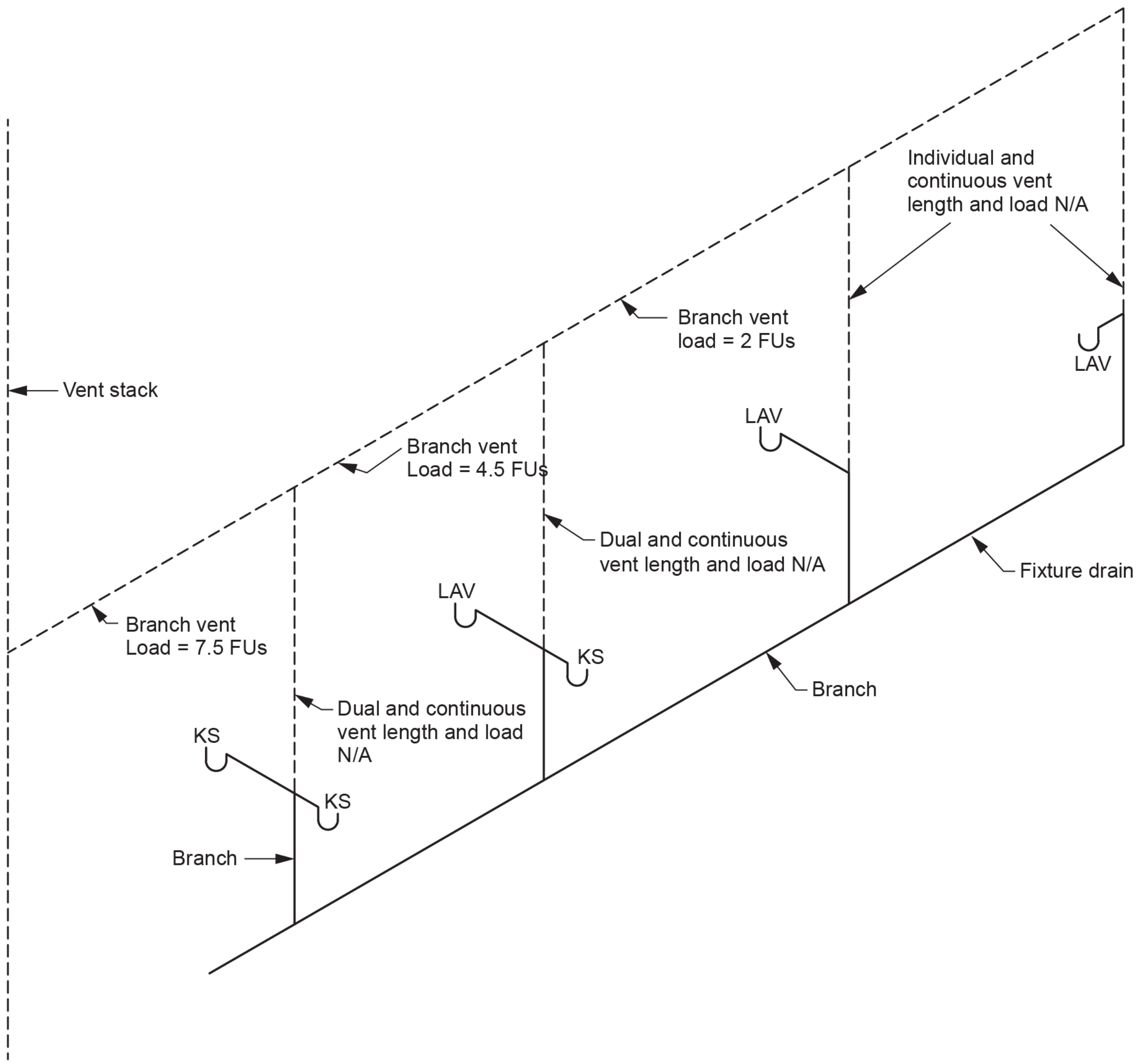

Figure 2 *Hydraulic load on certain branch vent sections. (Skilled Trades BC, 2021) Used with permission.*

Branch vents will increase in size as more vents are connected to them (provided Table 2.5.8.3. dictates) but will never be smaller than permitted by Table 2.5.7.1. and any vent connected to it.

The following example shows how the developed length of the branch vents remains the same (from the most distant sanitary drainage pipe connection) but the loads are additive as the other Category 1 vents join the branch vent (Figure 3 and Table 1).

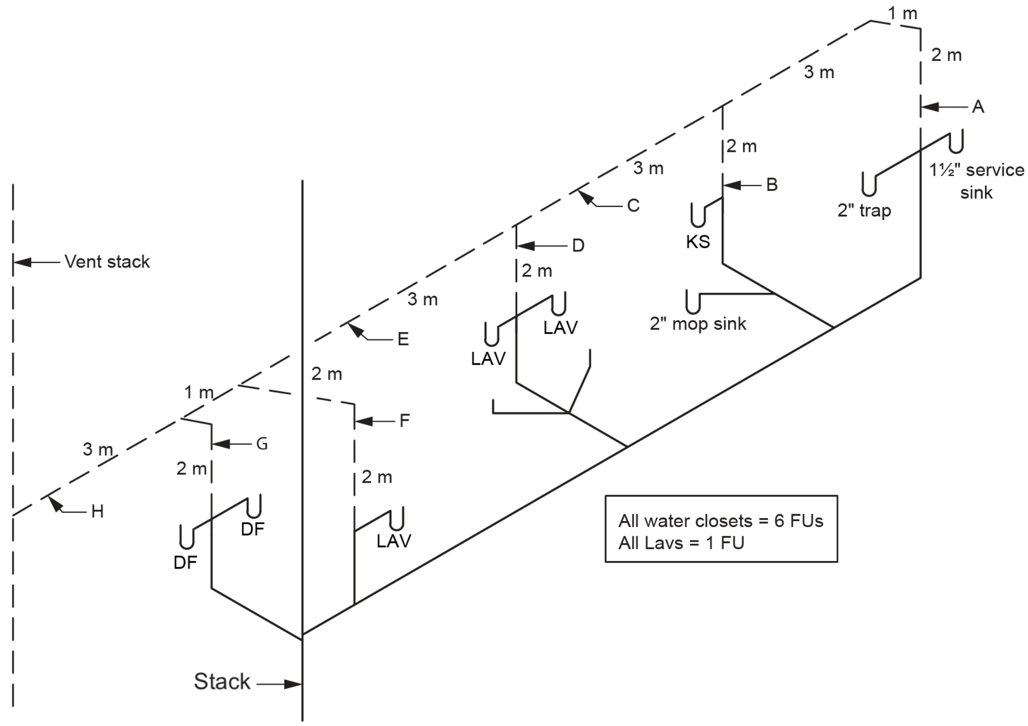

***Figure 3** Branch vent additive loads serving Category 1 vents. (Skilled Trades BC, 2021) Used with permission.*

Table 1: Figure 3 Components

Label	Name	Length (m)	Load (FU)	Size (in.)	Notes
A	Dual and continuous vent	N/A	N/A	1.5	Length and load N/A. Vent size from Table 2.5.7.1. using largest trap served
B	Continuous vent	12	3.5	1.5	Vent size from Table 2.5.8.3. Length from the connection of KS to the vent stack. Load is total of KS and mop sink
C	Branch vent	16	8	1.5	Vent size from Table 2.5.8.3. Length from the furthest sanitary drainage pipe connection to the vent stack. Load is total of fixtures served at that point
D	Continuous vent	9	14	1.5	Vent size from Table 2.5.8.3. Length from the connection of lavs to the vent stack. Load is total of lavs and WCs
E	Branch vent	16	22	2	Vent size from Table 2.5.8.3. Length from the furthest sanitary drainage pipe connection to the vent stack. Load is total of fixtures served at that point
F	Individual and continuous vent	N/A	N/A	1.25	Length and load N/A. Vent size from Table 2.5.7.1. using trap size served
G	Dual and continuous vent	N/A	N/A	1.25	Length and load N/A. Vent size from Table 2.5.7.1. using largest trap served
H	Branch vent	16	24	2	Vent size from Table 2.5.8.3. Length from the furthest sanitary drainage pipe connection to the vent stack. Load is total of fixtures served at that point

Circuit Vents

Circuit venting is a form of group venting sometimes confused with wet venting. Instead of using the core of air in a vertical pipe, circuit venting uses the top of a horizontal drainage pipe to vent the fixtures connecting to the horizontal branch. The drainage section is not sized as a wet vent but as a branch from Table 2.4.10.6.-B (NPC, 2020, B 2-35).

To size the circuit vent, you must use Table 2.5.8.3. in the NPC 2020 code book.

Note: As with any vent, the circuit vent can never be smaller than permitted by Table 2.5.7.1. For example, if the circuit vent serves a water closet, Table 2.5.8.3. may permit a 1.25 in. vent. Table 2.5.7.1. overrides this value, as a 1.25 in. vent can only serve 1.25 in. and 1.5 in. traps.

Using Table 2.5.8.3. requires the following information:

- **The hydraulic load served by the circuit vent** — The hydraulic load to consider is the total number of circuit-vented fixtures, not including the load of any fixtures that may be connected to the required relief vent. The hydraulic load is most often identical to the branch immediately upstream of the relief vent connection.
- **The developed length of the circuit vent** — The length to consider is from its lower end — where it connects to the trap arm of the furthest upstream circuit-vented fixture — to its upper end — where it joins a vent stack, stack vent, or header (Category 3 or 4 vent) — or measure through to open air.

To fully understand the circuit vent sizing procedures, a plumber must be well-versed in the Plumbing Code regulations for circuit vents.

The code requires that a section of a horizontal branch may be circuit-vented provided that:

- A circuit vent is connected to it.
- All fixtures served by the circuit vent are located in the same storey.
- No stack is connected to it upstream of a circuit-vented fixture (Figure 4).

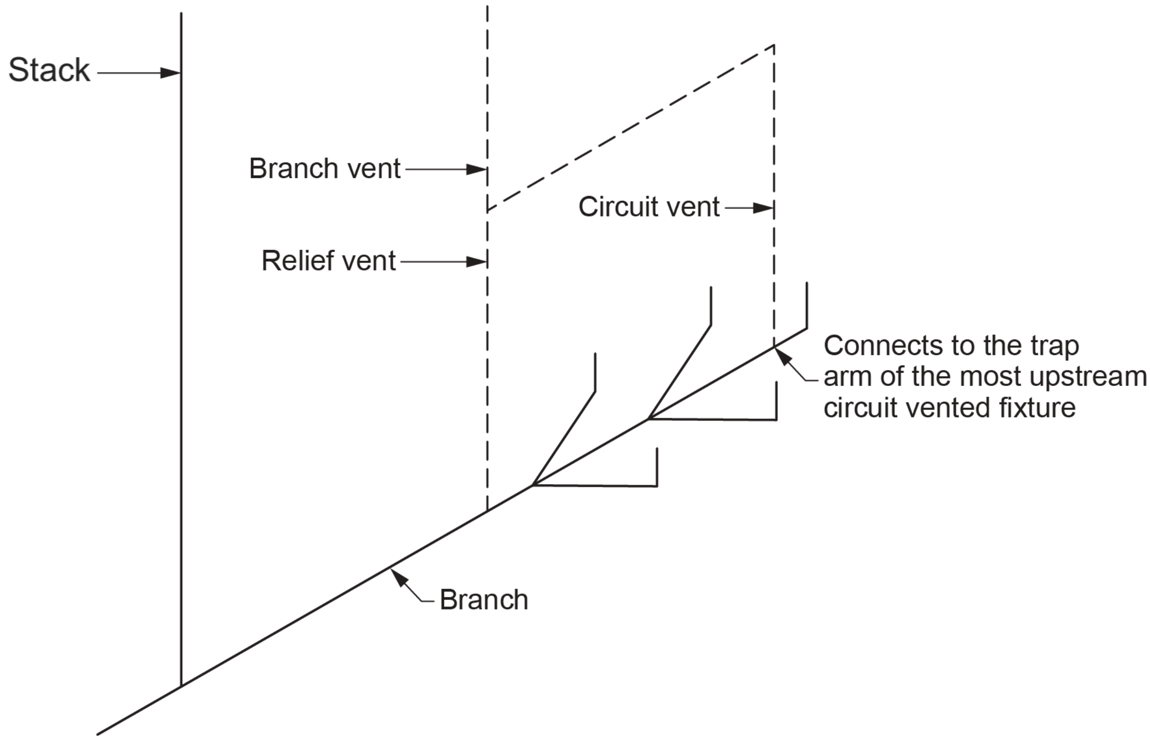

Figure 4 *Example of a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

Fixtures with fixture outlet pipes less than 50 mm (2 in.) in size must be separately vented or separately circuit-vented (Figure 6) as per Clause 2.5.3.1.(2).

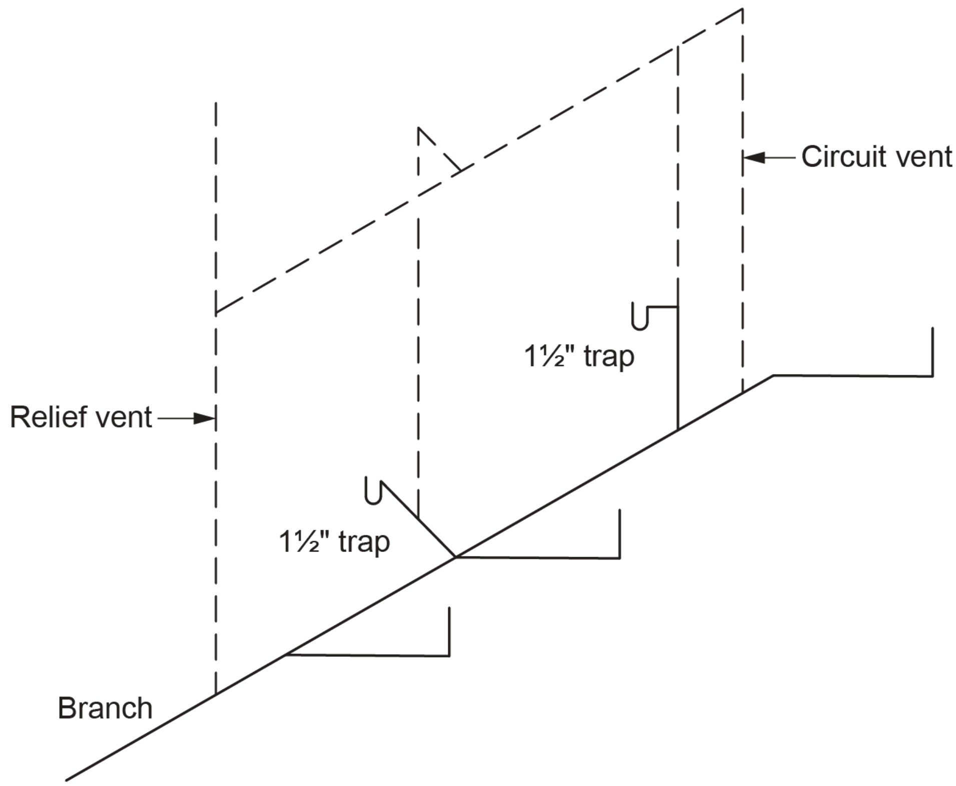

Figure 5 *Separately vented trap arm connected to a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

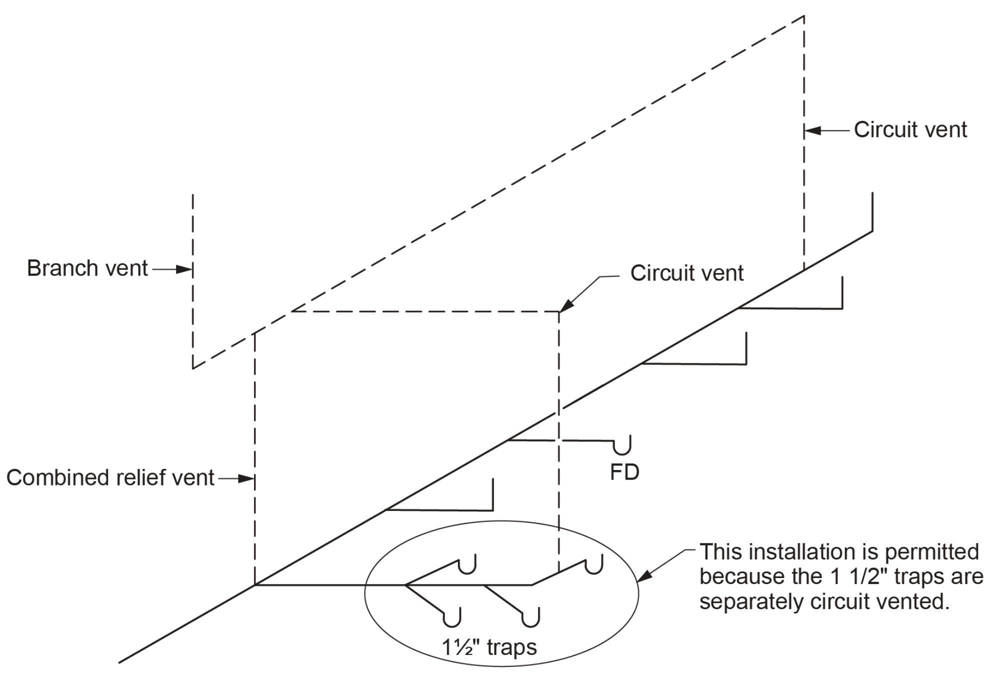

Figure 6 *The 1.5 in. traps are being separately circuit-vented when connecting to a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

A relief vent must be connected to the branch that forms part of a circuit-vented system, downstream of the connection of the most downstream circuit-vented fixture. This relief vent may be a dry vent (Figures 7 and 8).

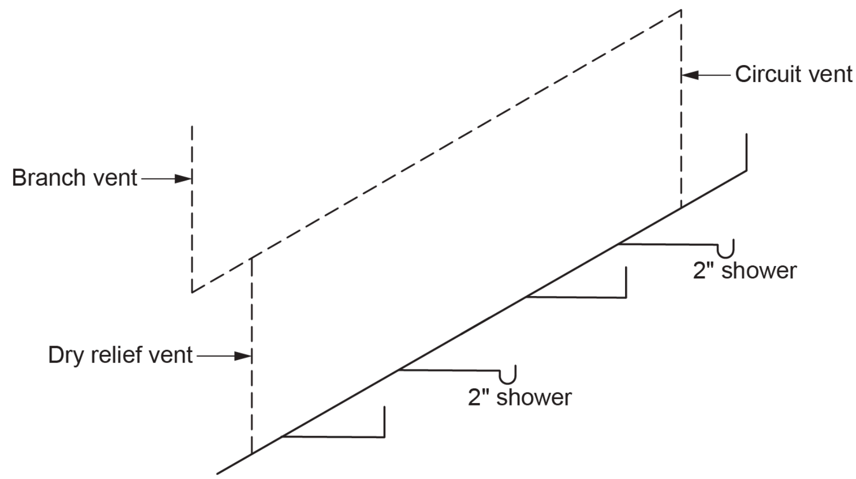

Figure 7 *A dry vent acting as a relief vent for a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

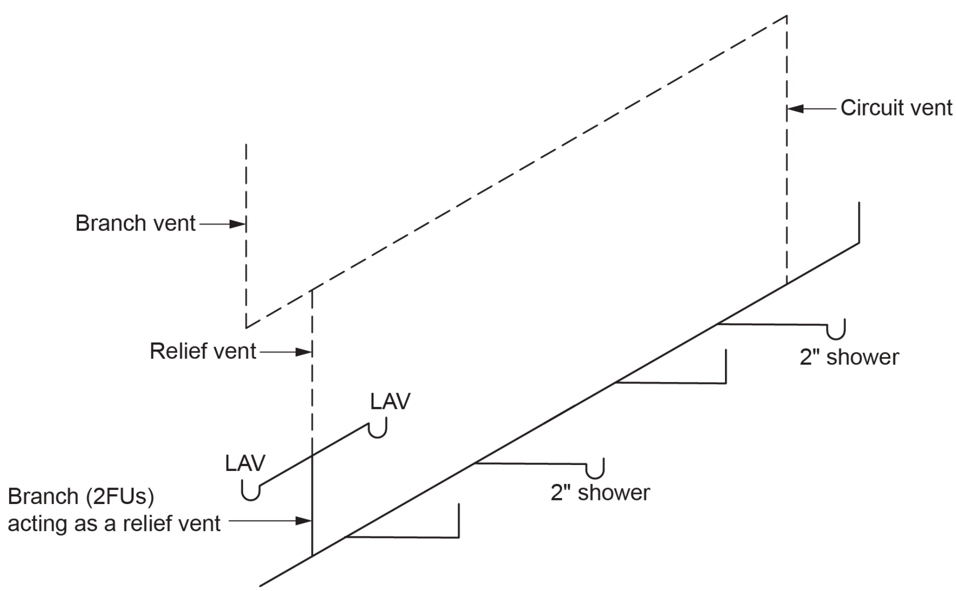

Figure 8 *A vertical branch acting as a relief vent for a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

A sanitary drainage pipe cannot have a hydraulic load of more than 6 FUs when acting as a relief vent. If the sanitary drainage pipe is acting as a relief vent, it may be installed either horizontally or vertically (Figures 9 and 10).

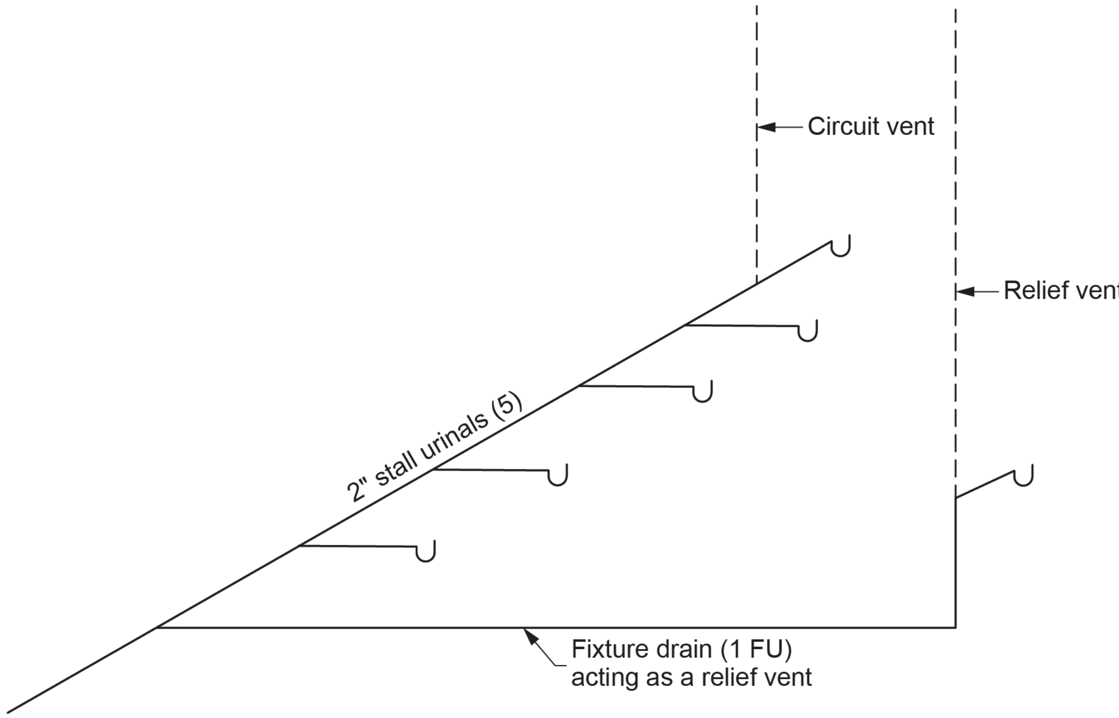

Figure 9 *A horizontal fixture drain acting as a relief vent for a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

A stack may act as a relief vent for a circuit-vented branch. If there are more than 6 FUs on the sanitary drainage pipe (stack), a relief vent must be added.

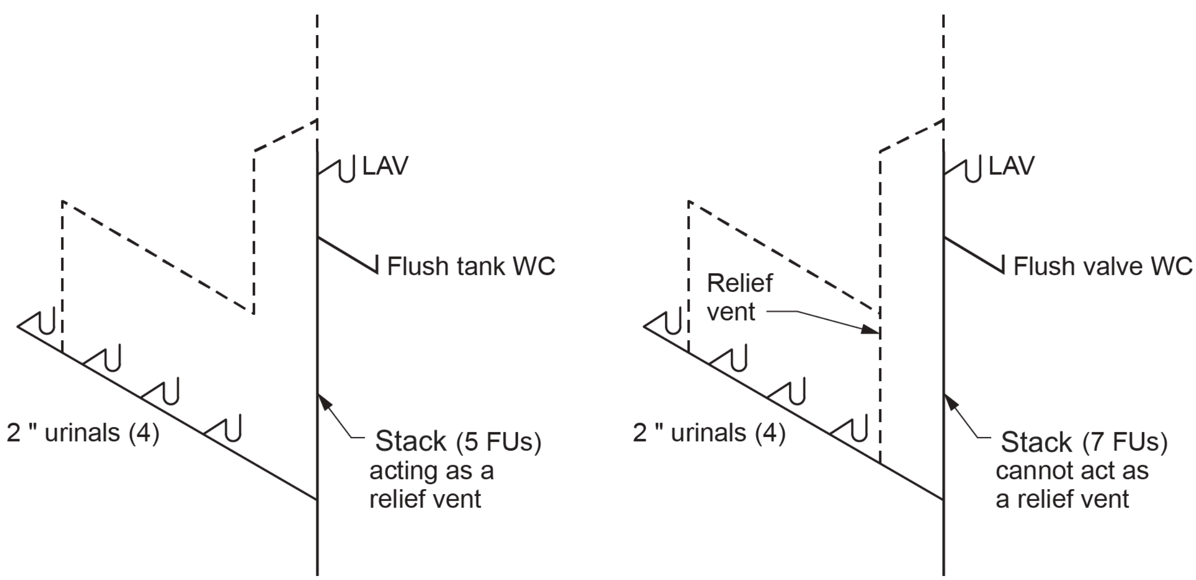

Figure 10 *Two examples of relief vents for a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

A symmetrically connected relief vent can serve as a combined relief vent for a maximum of two circuit-vented branches, provided there are not more than eight circuit-vented fixtures connected between the combined relief vent and each circuit vent (Figure 11).

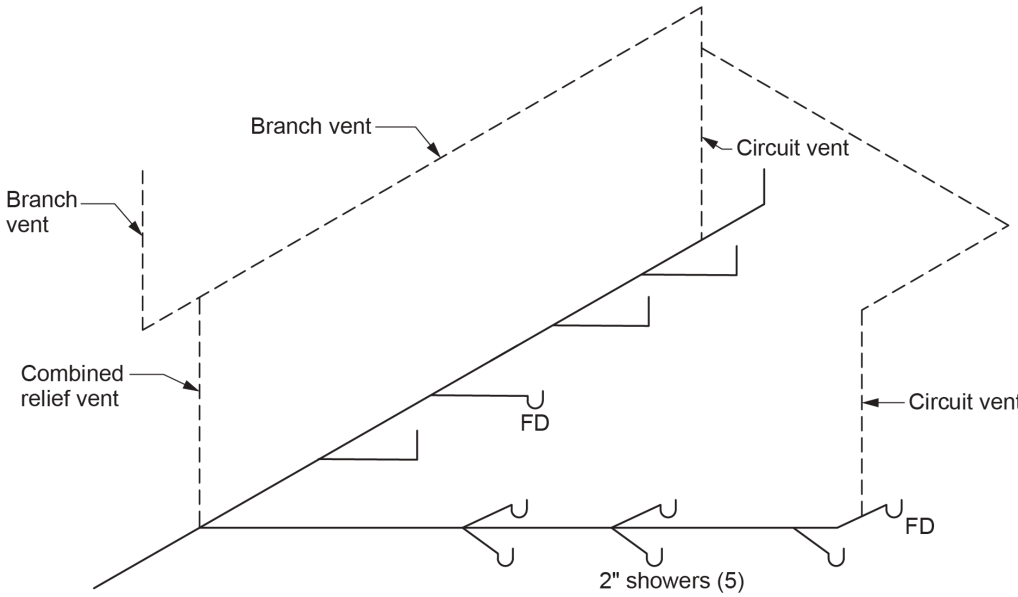

Figure 11 *A symmetrical connection used to join a combined relief vent when serving two circuit-vented branches. (Skilled Trades BC, 2021) Used with permission.*

Additional circuit vents are required where:

- Each cumulative horizontal change in direction of a branch served by a circuit vent exceeds 45° between vent pipe connections.
- More than eight circuit-vented fixtures are connected to a branch between vent pipe connections.

Figure 12 shows additional circuit vents serving a circuit-vented branch, thus allowing more than eight fixtures and the cumulative change of direction between vent pipes.

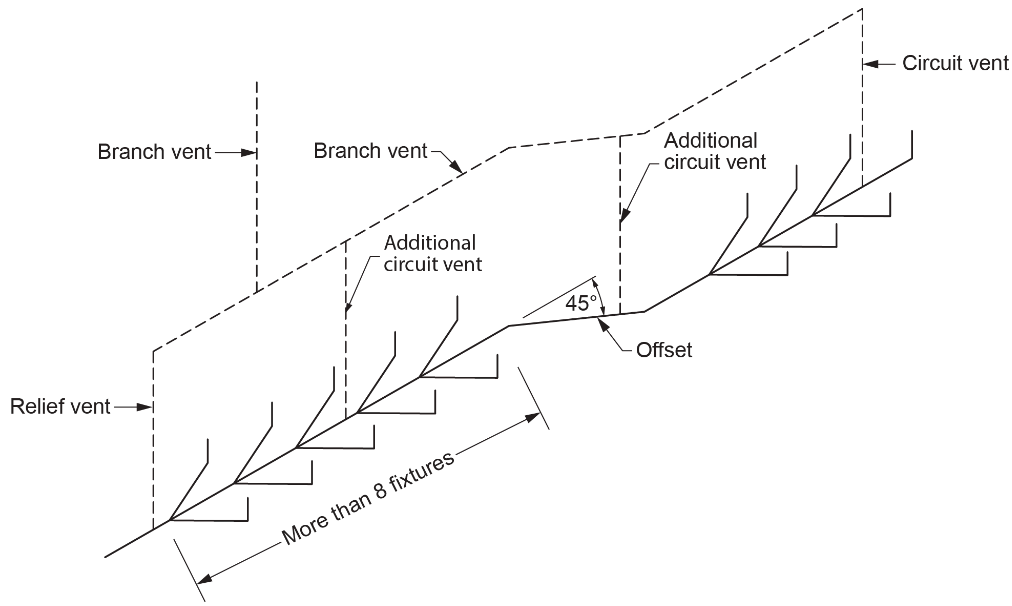

Figure 12 *Additional circuit vents added to meet Clause 2.5.3.1., with labeled branch vents, additional circuit vents, relief vent, and more than 5 fixtures connected with a 45-degree offset. (Skilled Trades BC, 2021) Used with permission.*

A sanitary drainage pipe can serve as an additional circuit vent provided:

- The sanitary drainage pipe is sized as a wet vent and is not less than 50 mm (2 in.) in size (Figure 13).

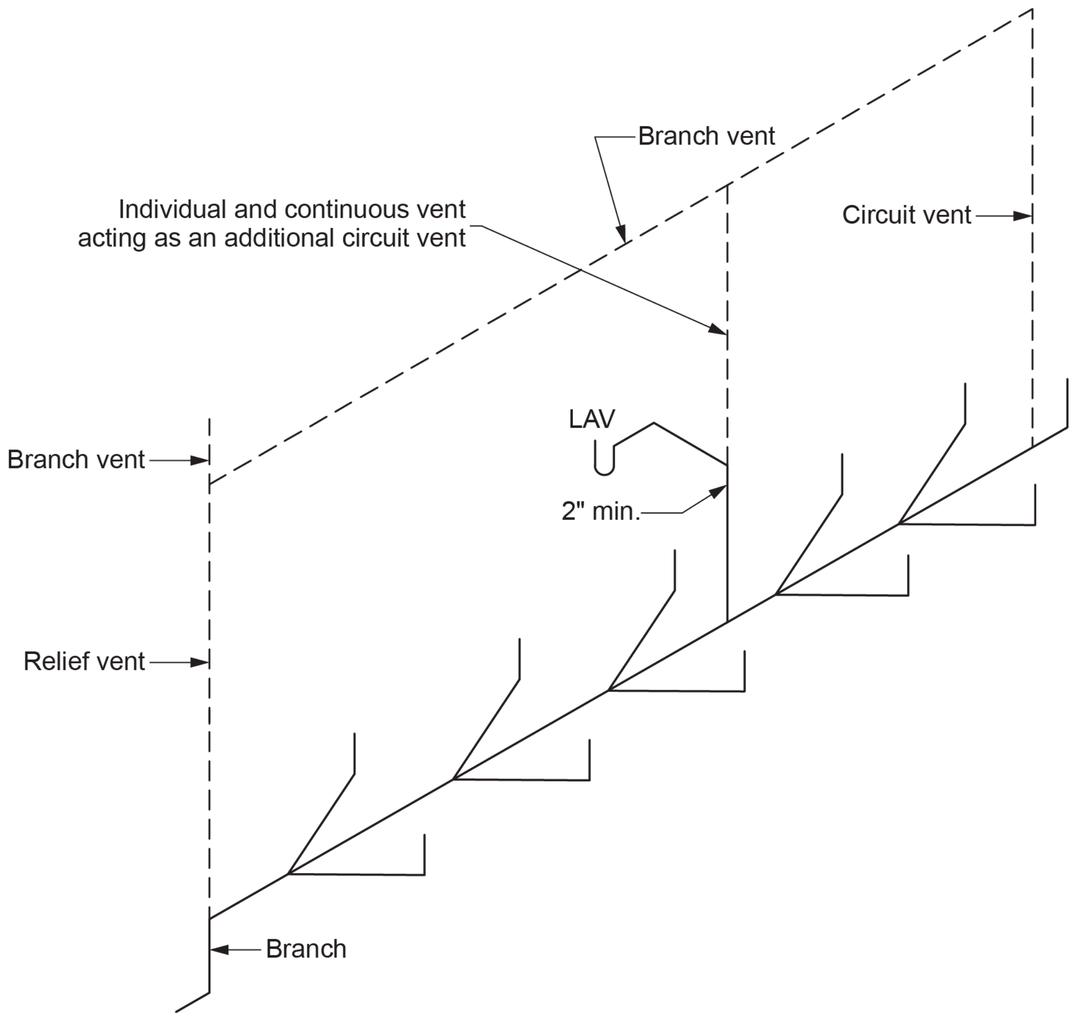

Figure 13 *Sanitary drainage pipe acting as an additional circuit vent. (Skilled Trades BC, 2021) Used with permission.*

- The maximum number of fixtures does not exceed two.
- The fixture(s) connected to the vent has a maximum hydraulic load of 1.5 FUs each.
- When two fixtures connect to the vent pipe, the connection is made using a double sanitary tee fitting.

Figure 14 shows a sanitary drainage pipe acting as an additional circuit vent. The branch is sized as a wet vent with a minimum diameter of 2 in.

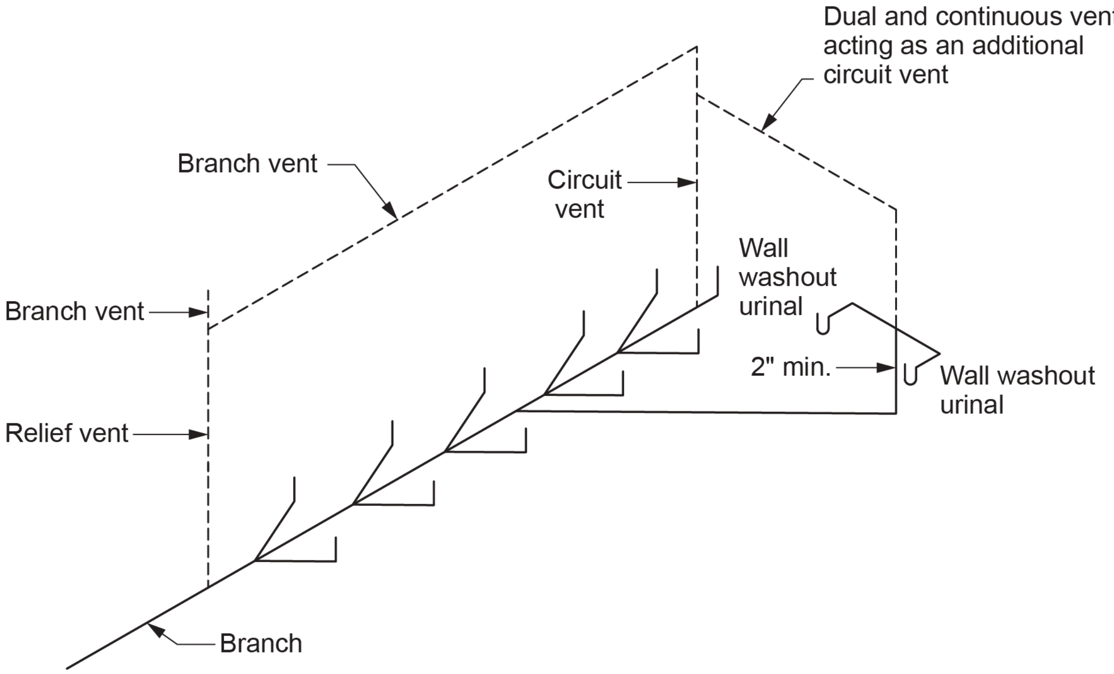

Figure 14 *Two maximum 1.5 FUs fixtures connected to the additional circuit vent by the use of a double sanitary tee fitting. (Skilled Trades BC, 2021) Used with permission.*

A trap arm(s) may be connected to a circuit vent (Figure 15), provided that:

- The branch or fixture drain is sized as a wet vent and is not less than 50 mm (2 in.) in size.
- The maximum number of fixtures does not exceed two.
- The fixture(s) connected to the circuit vent has a maximum hydraulic load of 1.5 FUs each.
- When two fixtures are connected to the vent pipe, the connection is made using a double sanitary tee fitting, as stated in Clause 2.5.4.5.(1).

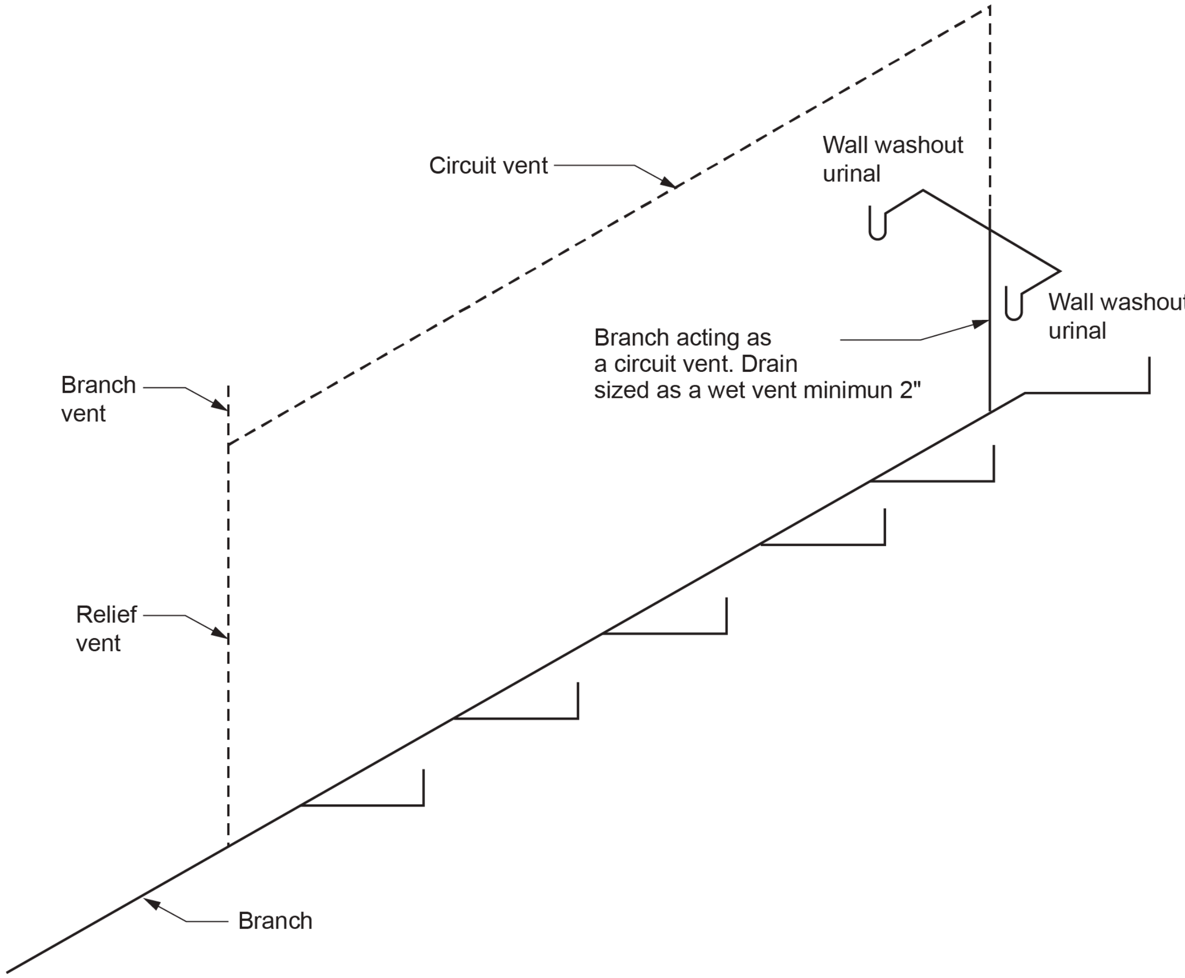

Figure 15 *Two maximum 1.5 FUs fixtures connected to the circuit vent by a double sanitary tee fitting. (Skilled Trades BC, 2021) Used with permission.*

Circuit-vented branches, including the fixture drain downstream of the circuit vent connection, shall be sized as a branch from Table 2.4.10.6.-B (NPC, 2020, B 2-35; refer to Figures 16–18 below), except that it shall be not less than:

- 50 mm (2 in.), where traps less than 50 mm in size are circuit-vented.
- 75 mm (3 in.), where traps 50 mm in size or larger are circuit-vented.

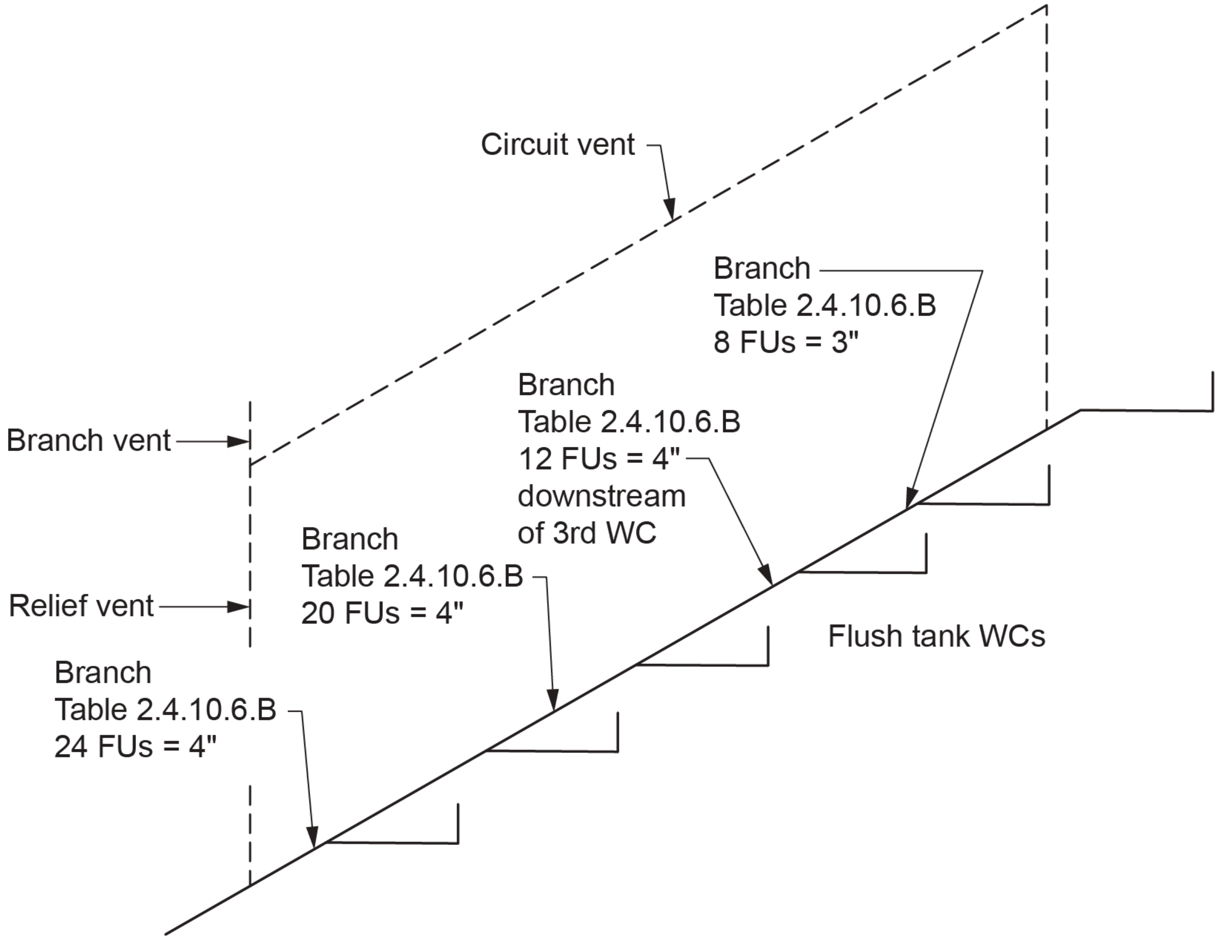

Figure 16 *Circuit-vented branch serving water closets sized as a branch from Table 2.4.10.6.-B. (Skilled Trades BC, 2021) Used with permission.*

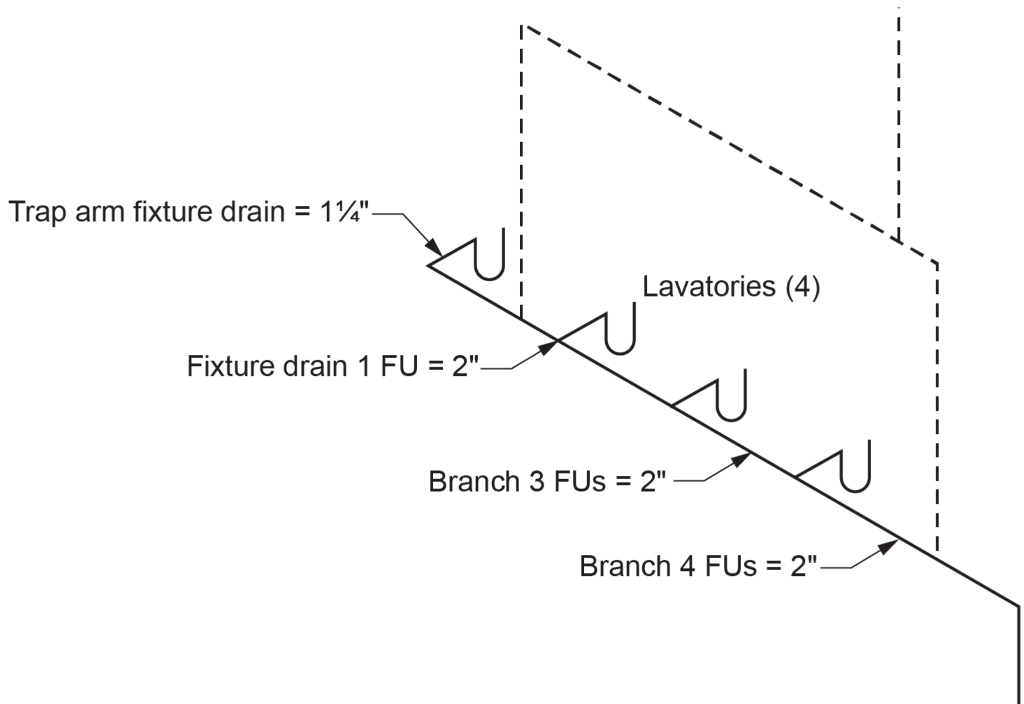

Figure 17 *Circuit-vented branch serving 1.25 in. lavatories increased to 2 in. fixture drain downstream of the circuit vent connection. (Skilled Trades BC, 2021) Used with permission.*

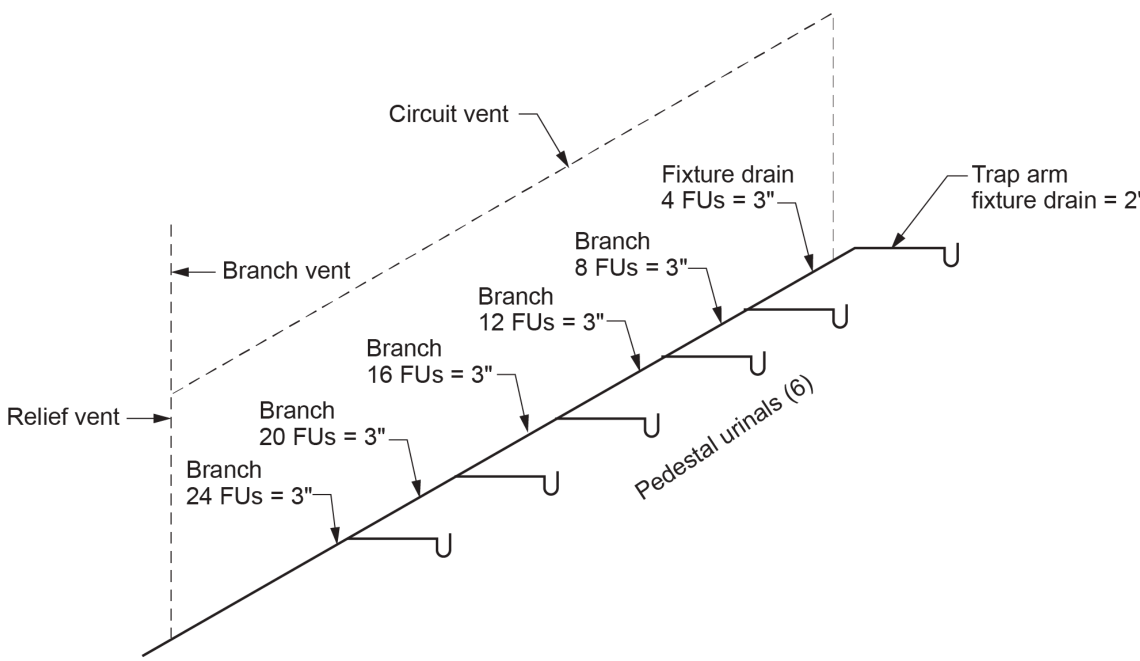

Figure 18 *Circuit-vented branch serving 2 in. urinals increased to 3 in. fixture drain downstream of the circuit vent connection. (Skilled Trades BC, 2021) Used with permission.*

The minimum size of an additional circuit vent or relief vent serving a circuit-vented branch need only be one size smaller than the size of the circuit vent, provided it conforms to the minimum vent requirements set out in Table 2.5.7.1., based on the size of the circuit-vented traps (Figures 19–21). If these requirements are met, the vents need not be larger than 50 mm (2 in.).

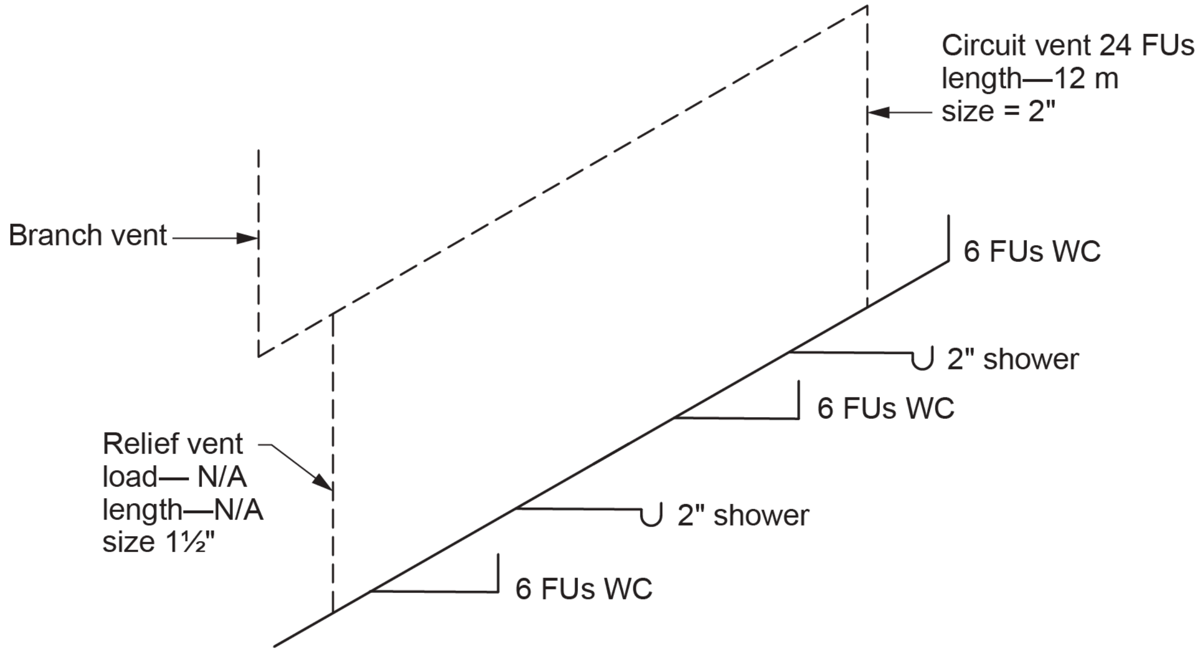

Figure 19 *Relief vent serving a circuit-vented branch one size smaller than circuit vent and in compliance with Table 2.5.7.1. (Skilled Trades BC, 2021) Used with permission.*

Figure 20 shows a relief vent and additional circuit vents serving a circuit-vented branch. The vents are sized one size smaller than the circuit vent and are in compliance with Table 2.5.7.1 (NPC, 2020, B 2-43).

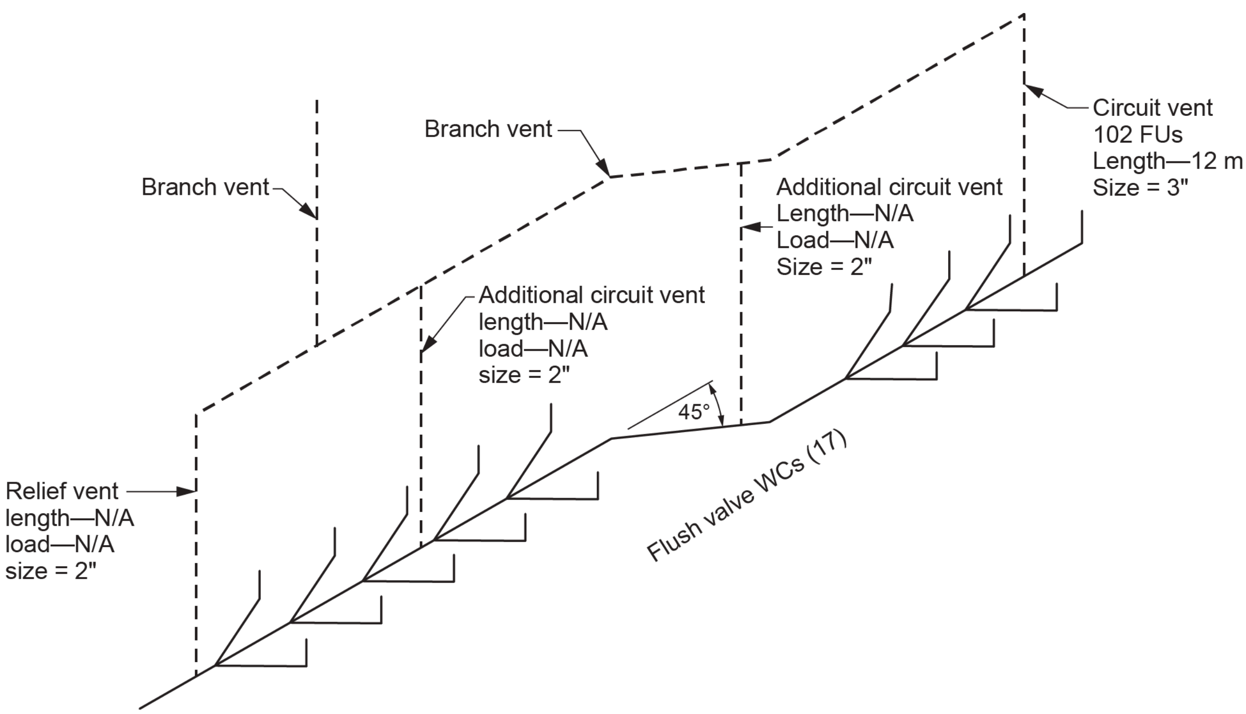

Figure 20 *Relief vent and additional circuit vents serving a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

Figure 21 shows a relief vent serving a circuit-vented branch. The relief vent is sized equal to the circuit vent in order to comply with Table 2.5.7.1.

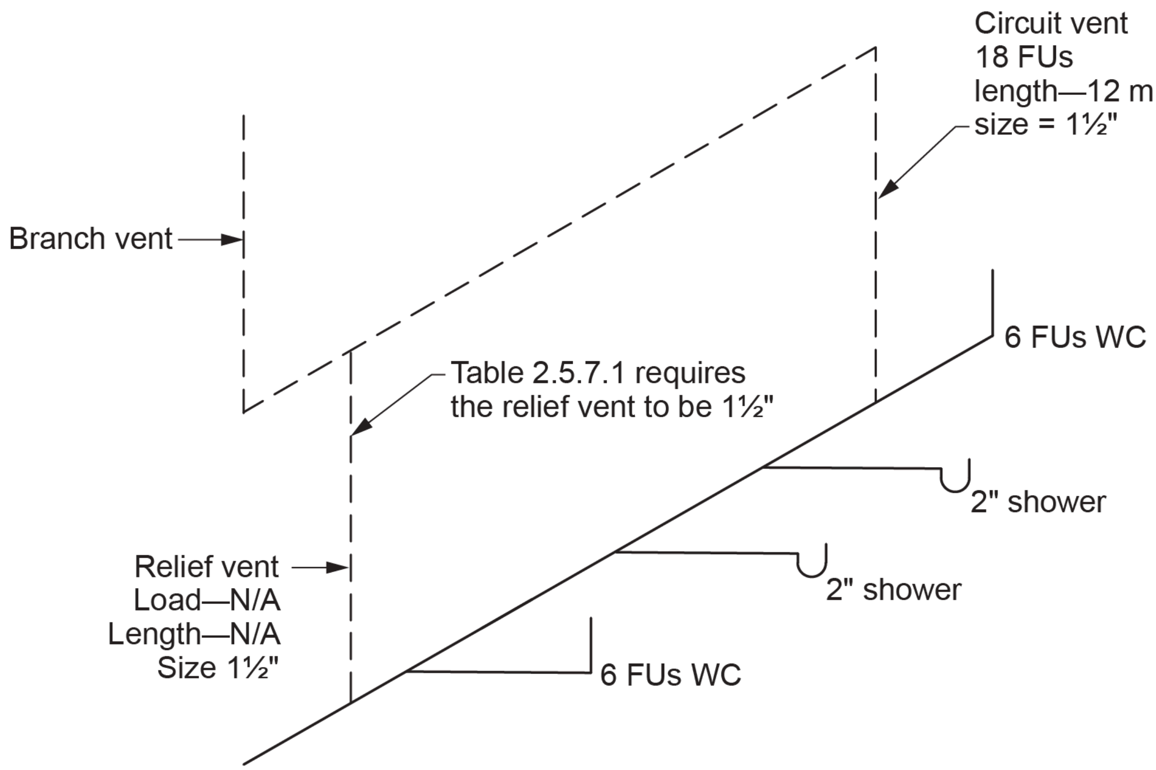

Figure 21 *Relief vent serving a circuit-vented branch. (Skilled Trades BC, 2021) Used with permission.*

The hydraulic load on a circuit vent must include the hydraulic load from fixtures connected to the branch served by the circuit vent but must not include the hydraulic load connected to the sanitary drainage pipe acting as the relief vent (Figures 22–25).

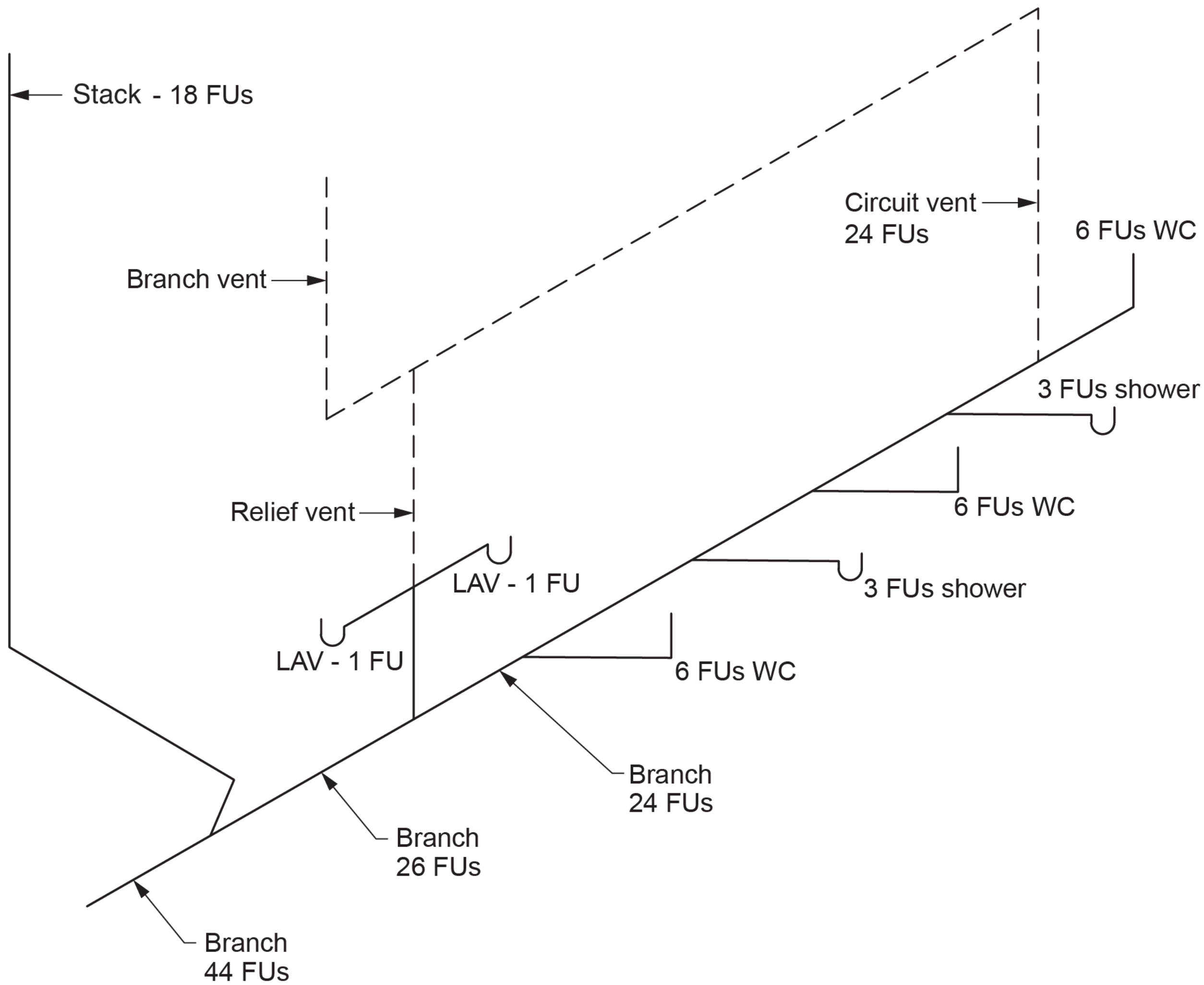

Figure 22 *The hydraulic load on a circuit vent is the connected load to the circuit-vented branch, not including the fixtures connected to the relief vent. (Skilled Trades BC, 2021) Used with permission.*

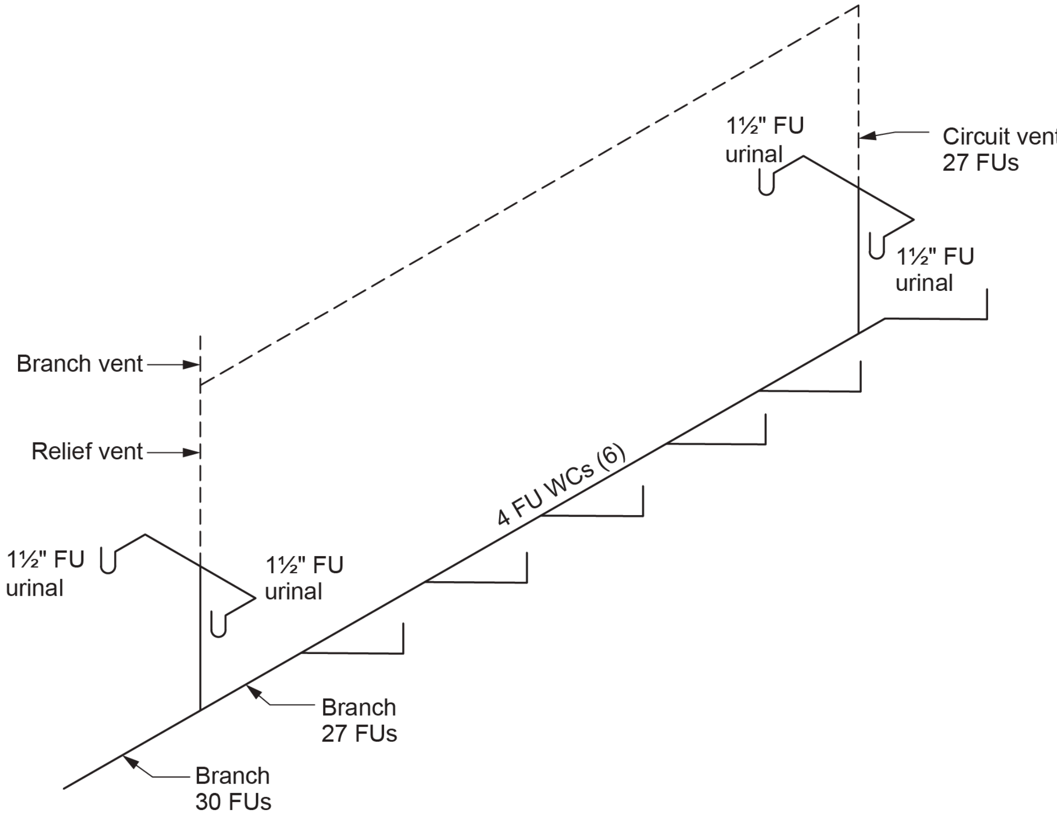

Figure 23 *The hydraulic load on a circuit vent is the connected load to the circuit-vented branch, including fixtures connected to the circuit vent. The load does not include the fixtures connected to the relief vent. (Skilled Trades BC, 2021) Used with permission.*

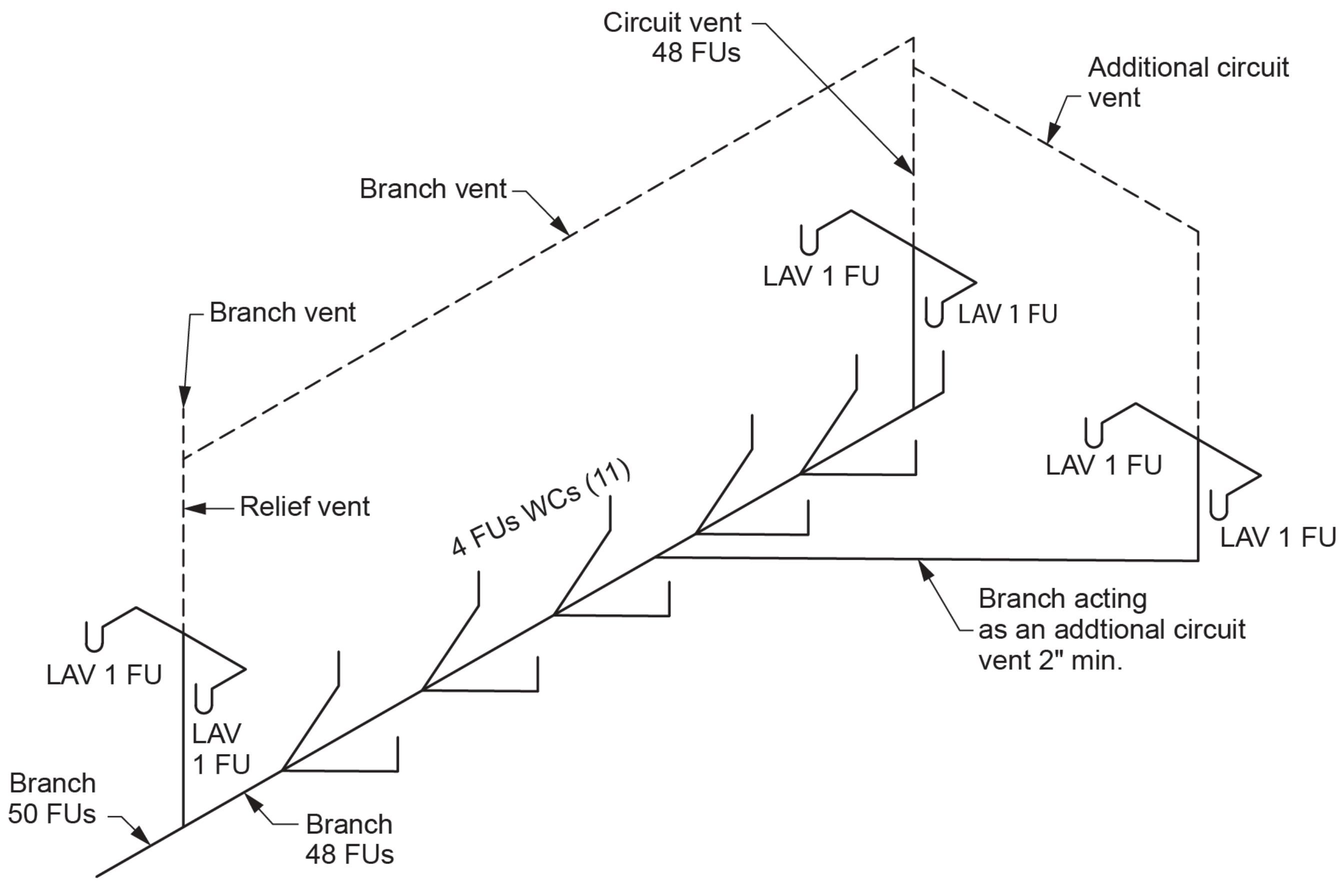

Figure 24 *The hydraulic load on a circuit vent is the connected load to the circuit-vented branch, including fixtures connected to the circuit vent and additional circuit vents. The load does not include the fixtures connected to the relief vent. (Skilled Trades BC, 2021) Used with permission.*

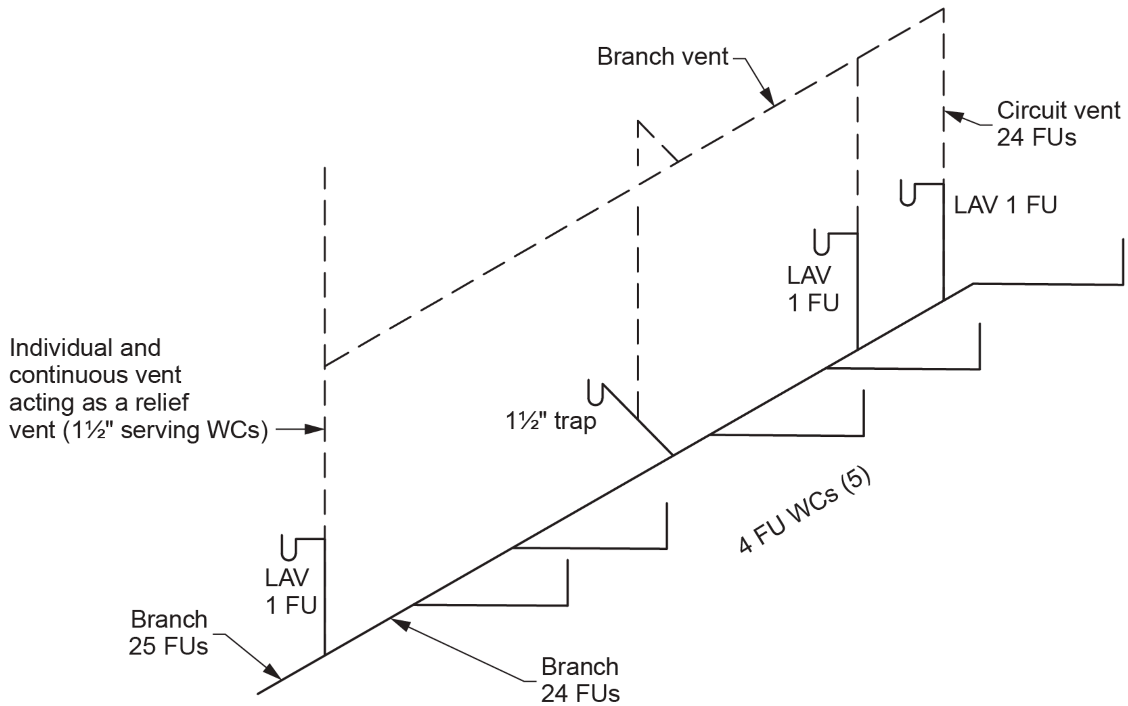

Figure 25 *The hydraulic load on a circuit vent is the connected load to the circuit-vented branch, including individually vented fixtures connected to the circuit vent. The load does not include the fixtures connected to the relief vent. (Skilled Trades BC, 2021) Used with permission.*

Self-Test D-1.8: Sizing Branch and Circuit Vents

Complete Self-Test D-1.8 and check your answers.

If you are using a printed copy, please find Self-Test D-1.8 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=52#h5p-21 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=52#h5p-21)

References

National Research Council of Canada. (2020). *National plumbing code of Canada* 2020. Canadian Commission on Building and Fire Codes. https://nrc-publications.canada.ca/eng/view/ft/?id=6e7cabf5-d83e-4efd-9a1c-6515fc7cdc71 (https://nrc-publications.canada.ca/eng/view/ft/?id=6e7cabf5-d83e-4efd-9a1c-6515fc7cdc71)

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-1: Install sanitary drain, water and vent systems. In: *Plumber Apprenticeship Program: Level* 2. Industry Training Authority, BC.

Media Attributions

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D-1.9 Sizing Stack Vents, Vent Stacks, and Headers

The upper end of every **stack** becomes a stack vent above the highest fixture connection. The stack vent can extend individually to open air or connect into another stack vent or vent stack, becoming a vent header, and then extend to open air. It is important to note that the stack below the stack vent connection cannot be smaller than the size of the stack vent.

Sizing Stack Vents

Stack vents are sized using Table 2.5.8.4. in the NPC (2020, B 2-46; refer to Figure 1 below). When using this table to obtain the size of the stack vent, there are three things to consider:

1. The size of the stack served by the stack vent. Because a stack may become larger as the loads from floors are drained to it, the size at the base of the stack is the size to consider. Do not use the size of the stack at the top where the stack vent connects.
2. The hydraulic load (FU load) at the base of the stack served by the stack vent.
3. The developed length of the stack vent. This is measured from the lower end of the stack vent through to open air, even if a vent header is installed.

The NPC (2020) requires that the minimum size of a stack vent not be smaller than one-half the size of the stack at its base and never be smaller than permitted by Table 2.5.7.1.

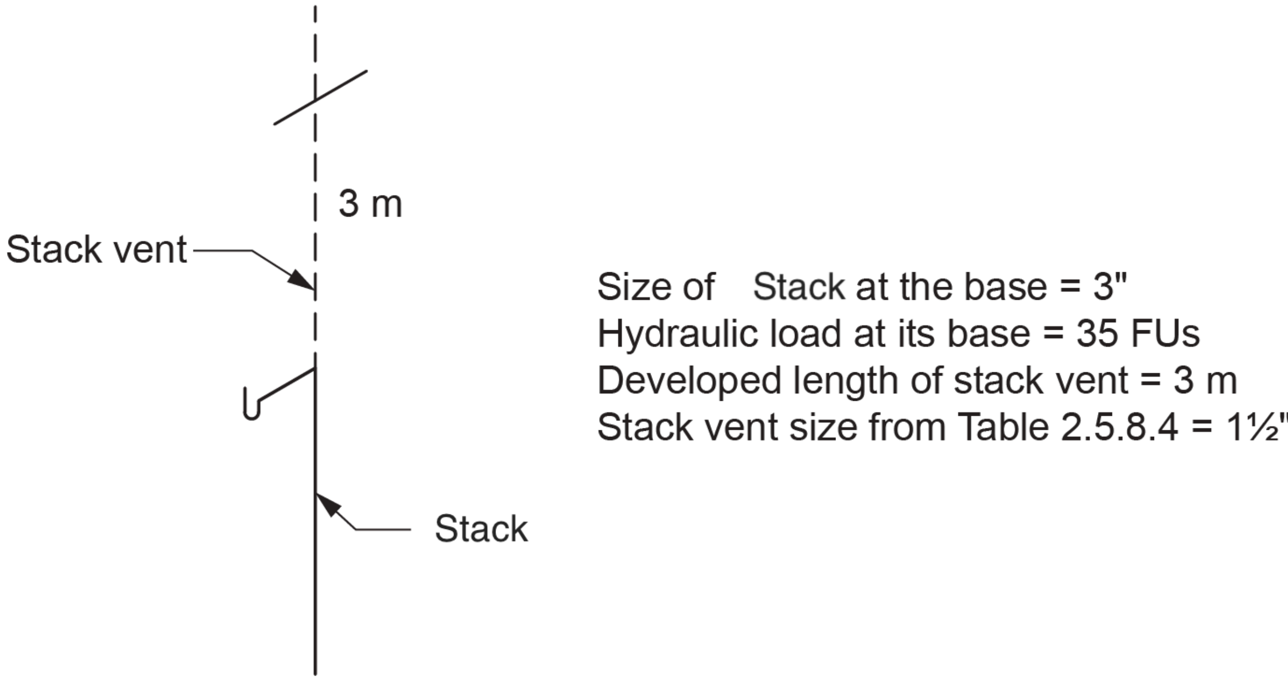

Figure 1 *Sizing of a stack vent using Table 2.5.8.4. (Skilled Trades BC, 2021) Used with permission.*

Clause 2.5.8.4.(5) states that "Every building drain shall be provided with at least one vent that is not less than 3 in. in size." This requirement would overrule Table 2.5.8.4. if there is only one 3 in. stack in a building, such as in a single-family dwelling. If a building has more than one 3 or 4 in. stack, then at least one of the stack vents must be at least 3 in. through to open air (Figure 2).

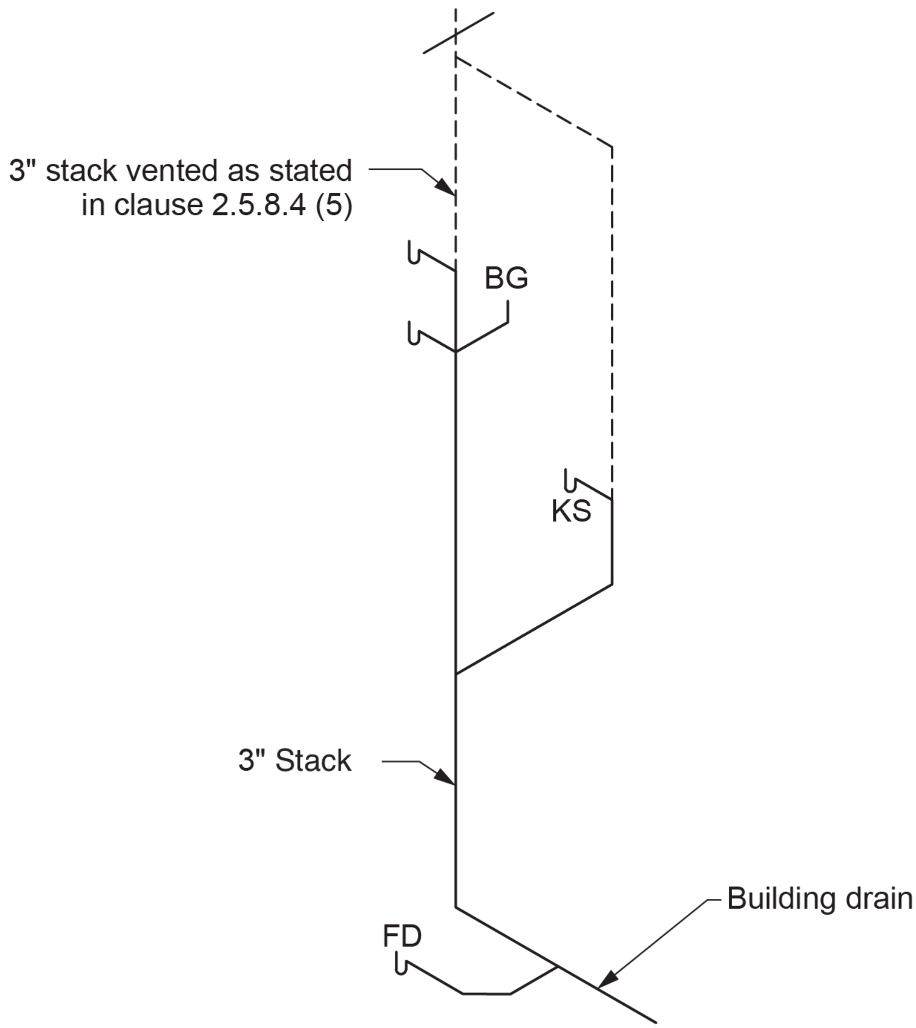

Figure 2 *Sizing of a stack vent in accordance with Clause 2.5.8.4.(5). (Skilled Trades BC, 2021) Used with permission.*

Sizing Vent Stacks

A vent stack is a vent installed in conjunction with a stack used to limit the pressure differential created between the drainage and venting systems. The NPC states that any stack that receives discharge from more than four storeys requires a vent stack. However, this rule does not apply to multi-storey wet vents sized to provide ample air circulation within the wet-vented stack.

Vent stacks are also sized using Table 2.5.8.4. in the NPC (2020, B 2-46). When using this table to obtain the size of the vent stack (Figure 3), there are three things to consider:

1. The size of the stack at the base served by the vent stack. This would be the location where the vent stack connects to the stack below the lowest fixture connection to the stack.
2. The hydraulic load (FU load) at the base of the stack served by the vent stack plus any additional vent loads connected to the vent stack.
3. The developed length of the vent stack. This is measured from the lower end of the vent stack through to open air,

even if a vent header is installed.

The NPC requires that the minimum size of a vent stack not be smaller than one-half the size of the stack at its base and never be smaller than permitted by Table 2.5.7.1.

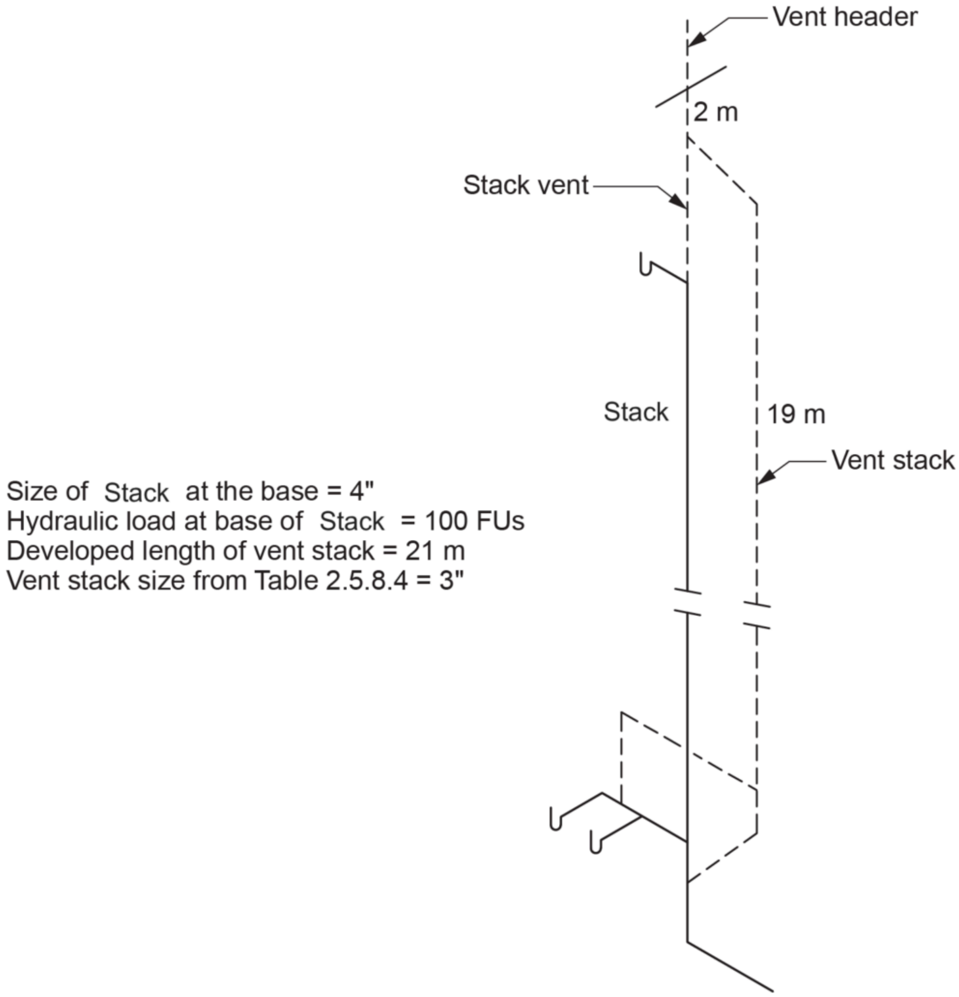

Figure 3 *Sizing of a vent stack using Table 2.5.8.4. (Skilled Trades BC, 2021) Used with permission.*

There are often instances when fixtures do not drain to a stack served by a vent stack, but the vents from these fixtures do connect to the vent stack. In such cases, the hydraulic load on the vent stack will increase from that point of connection as the additional venting loads are introduced to the vent stack (Figure 4).

Venting from similar scenarios, where additional fixtures vent loads may tie into a stack vent, are dealt with in the same manner.

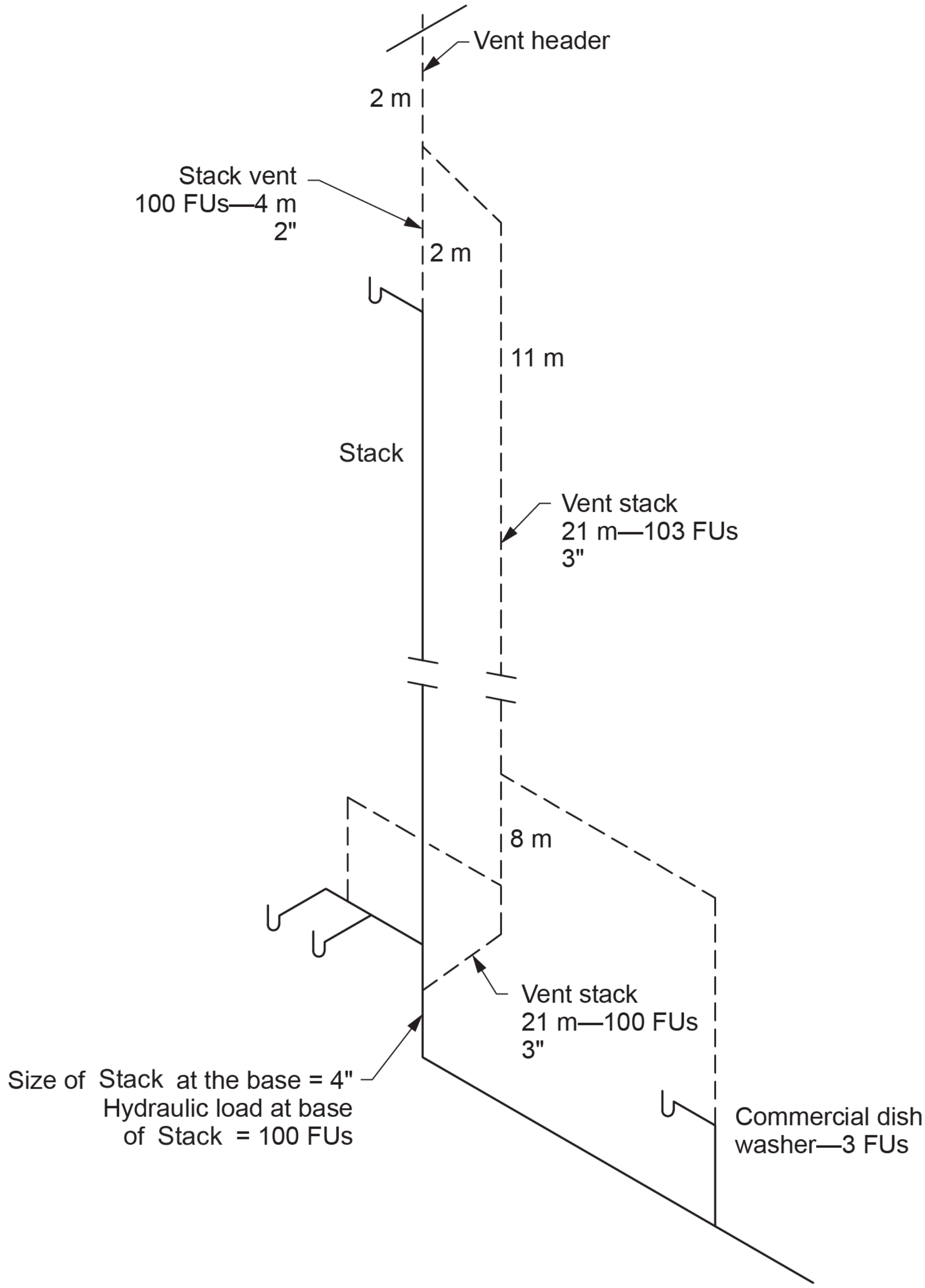

Figure 4 *Vent stack hydraulic load determination. (Skilled Trades BC, 2021) Used with permission.*

Fixtures Connecting to the Base of Vent Stacks

Clause 2.5.4.2.(4) of the NPC allows fixtures to connect to a vent stack (Figure 5), provided that the following conditions are met:

- The total hydraulic load of the connected fixtures does not exceed 8 FUs.
- At least one fixture is connected to a vertical portion of the vent stack and is upstream of any other fixtures.
- No other fixture is connected downstream of a water closet.
- All fixtures are located in the lowest storey served by the vent stack.
- The section of the vent pipe that acts as a wet vent conforms to the requirements regarding wet vents.
- The wet-vented portion described above cannot be smaller than the size of the vent stack above the wet vent.

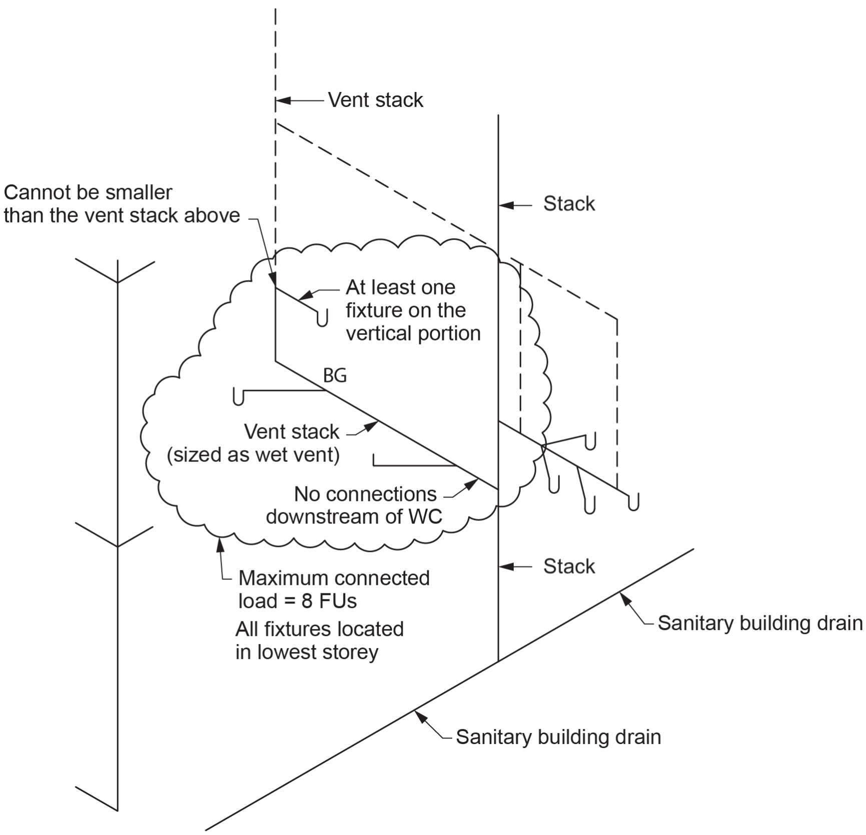

Figure 5 *Rules surrounding fixtures connecting to the base of vent stacks. (Skilled Trades BC, 2021) Used with permission.*

Size Vent Header

Vent headers are sized using Table 2.5.8.3. in the NPC (Figure 6). When using this table, you must consider two things:

1. The total number of fixture units being vented by the vent header
2. The total developed length of the vent header, which is measured from the furthest vented fixture through to open air

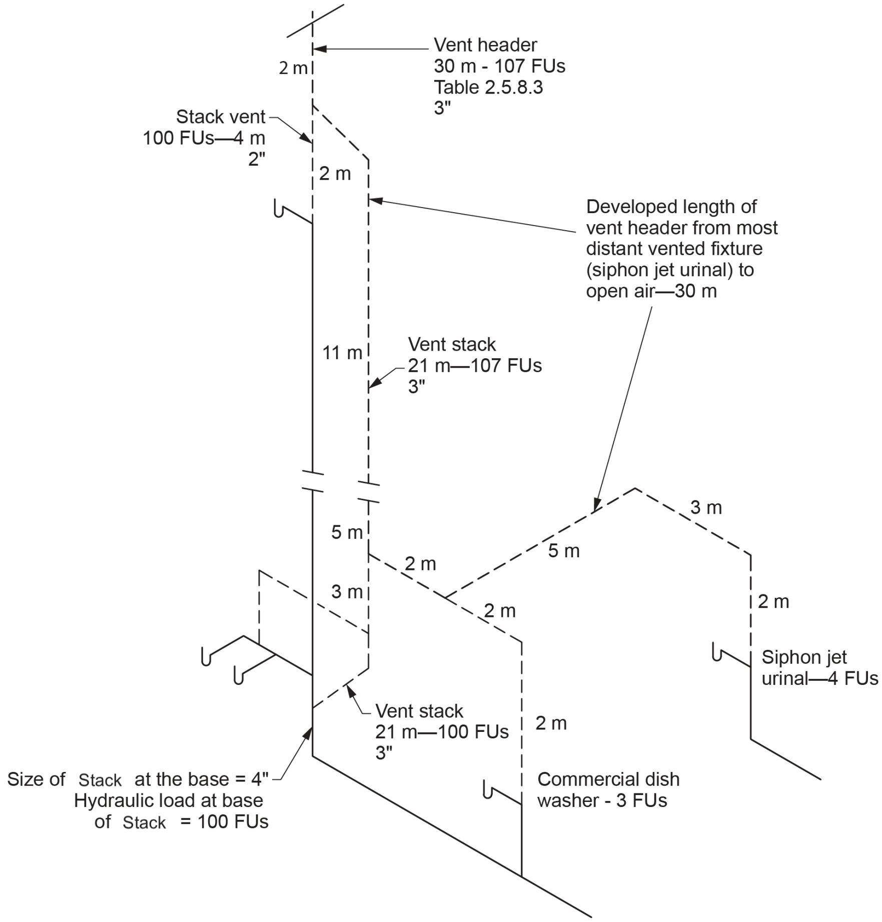

Figure 6 *Sizing a vent header using Table 2.5.8.3. (Skilled Trades BC, 2021) Used with permission.*

Sizing Miscellaneous Vent Pipes

A number of other miscellaneous special vents do not have an additional hydraulic venting load but may be required to provide proper air circulation within the DWV systems. These can include:

- Sump vents
- Yoke vents
- Offset relief vents

Sanitary Sewage Sumps

Every sump or tank that receives sanitary sewage shall be provided with a vent pipe connected to the top of the sump or tank. The lower end of the vent serving a **sanitary sewage sump** or tank connects to the lid or the upper interior side extending upward to any other part of the venting system. The size of the vent is found in Clause 2.5.7.7.:

> The minimum size of the vent pipe for a sanitary sewage sump or tank or a dilution tank shall be one size smaller

than the size of the largest branch or fixture drain draining to the sump or tank. The size shall be not less than 50 mm (2 in.) and need not be greater than 100 mm (4 in.).

In other words, a 2 in. vent is the minimum size for a sump vent if it receives waste from a 3 in. drain, a 3 in. vent is the minimum size if it receives waste from a 4 in. drain, and so on.

Unlike fixtures that drain to the sump, the sump vent does not have a hydraulic load associated with it. When it connects to a branch vent or vent stack, it does not increase the load at the connection point. The branch vent or vent stack may have to be increased in size above the connection point because Clause 2.5.7.2.(1) requires that the size of a branch vent or vent stack be not less than the size of the vent pipe to which it is connected (Figure 7).

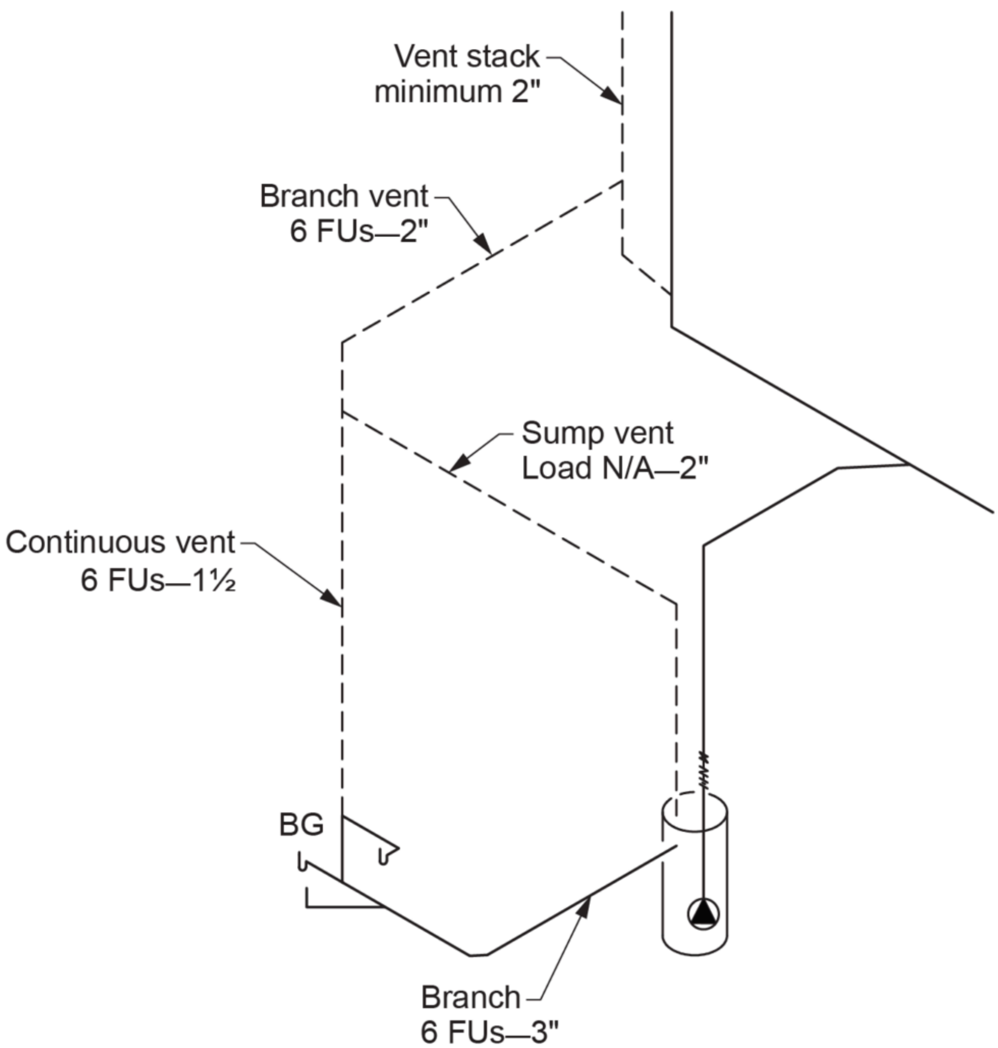

Figure 7 *Sump vent implications using Clause 2.5.7.2.(1). (Skilled Trades BC, 2021) Used with permission.*

Macerating Toilet Systems

The size of every vent pipe for a **macerating toilet system** with a sump or tank shall be not less than 38 mm ($1\frac{1}{2}$ in.).

Yoke Vents

Additional vents are sometimes required on buildings more than 11 storeys tall to minimize the effect of pressure changes in the DWV system. The need for these vents can be eliminated by interconnecting the stack with the vent stack in each storey where the fixtures are located. This can be done using a vent pipe equal in size to the branch or fixture drain or 50 mm (2 in.) in size, whichever is smaller.

- When required, yoke vents are installed on every fifth storey (counting from the top down) and immediately above each offset or double offset.
- The lower end is connected to the stack by a drainage fitting at or immediately below the last connected fixture on the lower floor of the five-storey section.
- Yoke vents are sized by the pipes to which they are connected and are allowed to be one pipe size smaller than the smallest pipe to which they are connected (Figure 8).

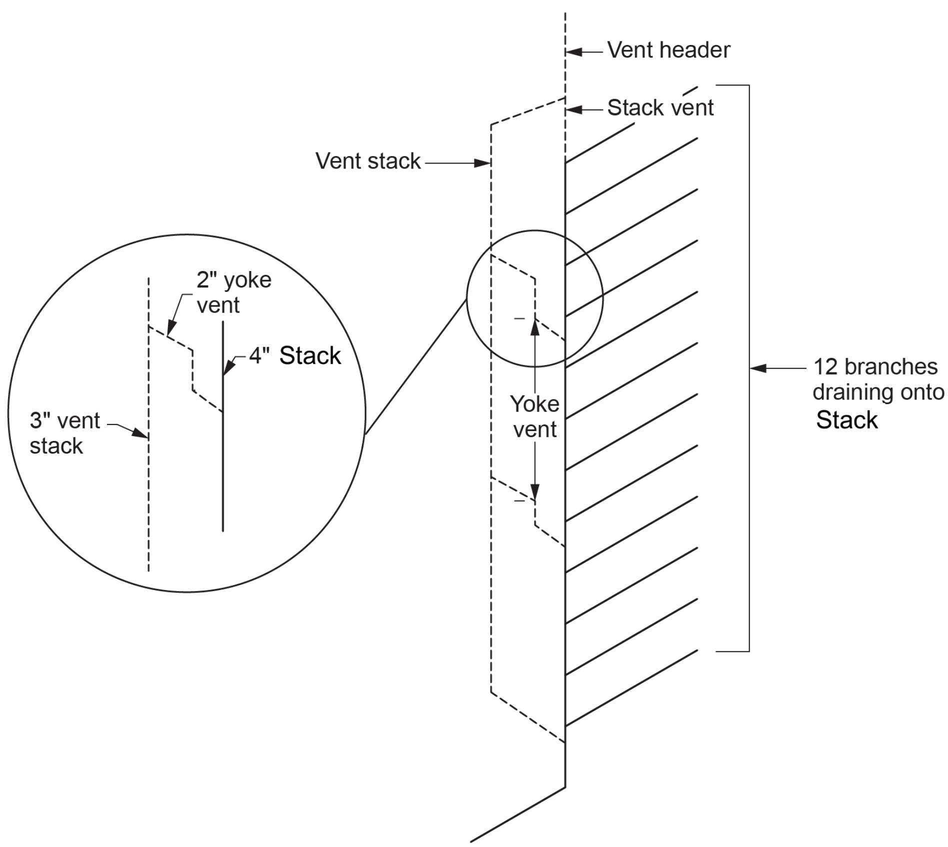

Figure 8 *NPC requirements for yoke vent connections. (Skilled Trades BC, 2021) Used with permission.*

Offset Relief Vents

An offset relief vent provides additional air circulation to a stack with a nominally horizontal offset of more than 1.5 m (60 in.) long and where the upper portion of the stack passes through three or more storeys and has more than 100 fixture units on it.

- The connection of the offset relief vent is made at the lowest end of the upper stack, after the last sanitary drainage pipe connection, and the upper end of the lower stack higher than any drain connections.
- The minimum size of an offset relief vent is permitted to be one size smaller than the size of the stack vent serving the stack (Figure 9).

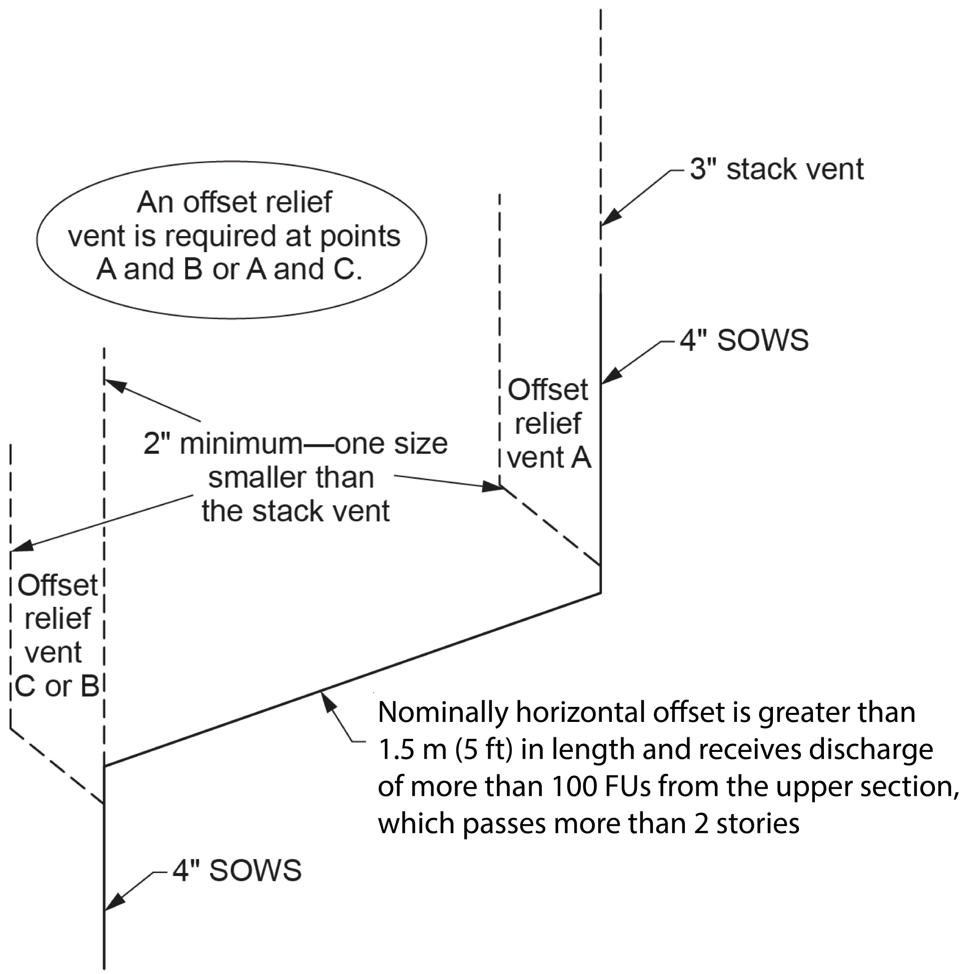

Figure 9 *NPC requirements for offset relief vent connections. (Skilled Trades BC, 2021) Used with permission.*

Putting it All Together

In the previous sections, you were asked to identify and determine hydraulic loads and size individual sections of a DWV system. In the following self-test, you will be asked to use these skills to size "whole building" DWV systems. The ability to design and size a total DWV system to minimum code standards is essential to eliminate on-site code violations as an apprentice or journeyperson.

At first glance, the following drawings may look complicated, but in reality, they are just groups of fixtures and connected piping that you are familiar with. By following a simple procedure and practice, you will find that the sizing exercises become easier. Here are some hints to help you establish a sizing procedure:

- If a group of fixtures falls under the definition of a "bathroom group," the hydraulic load will either be 6 or 8 FUs, depending on the flushing mechanism of the water closet. Look for bathroom groups, circle them, and jot down the FU load.
- If an existing bathroom group has additional fixtures, such as an additional lavatory, then the hydraulic load for the total group will be a bathroom group plus the load of the additional fixture(s).
- When determining the hydraulic load on any part of the drainage section of the DWV system, it is best to start at the highest fixture and work your way down the drawing toward the building sewer. Because the drainage load is additive, it will be easier to determine the hydraulic load on any section.
- When determining the hydraulic load on any part of the venting section of the DWV system, it is best to start at the lowest fixture and work your way up the drawing to open air. As with the drainage section, the venting load is also additive. This will lessen the possibility of errors and omissions.
- Ensure that the proper sizing table is being utilized for the piping based on the definition of the pipe in question.
- Focus on the location of water closets, remembering that the minimum size of drainage piping downstream will be 3 in. and the minimum size of any venting from one will be 1.5 in.

Self-Test D-1.9: Sizing Stack Vents, Vent Stacks, and Headers

Complete Self-Test D-1.9 and check your answers.

If you are using a printed copy, please find Self-Test D-1.9 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=54#h5p-22 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?p=54#h5p-22)

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D-1.10 Requirements and Prohibitions for DWV Systems

This chapter summarizes some of the overriding requirements identified in various parts of the National Plumbing Code (NPC) of Canada 2020.

Slope

Drainage and waste systems rely on gravity to move solid and liquid wastes, so these piping systems must be installed at a **slope** downward in the direction of flow. In the plumbing industry, this slope is called grade and can be expressed as a ratio (1:50, 1:100, etc.), percentage (2%, 1%, etc.), or fraction of an inch fall for every foot of run ($\frac{1}{4}$ in./ft, $\frac{1}{8}$ in./ft, etc.).

Typically, plumbers select the grades according to the applicable plumbing code. Choosing the proper grade is very important to allow the liquid waste to flow at the right velocity (speed) to scour the inside of the pipe and carry away the solids. If the grade is too shallow, the liquid waste will not flow fast enough to scour the pipe and remove the solid wastes. If the grade is too steep, the liquid waste may flow too fast, leaving the solids behind. In either case, the pipe will soon become blocked with solid wastes. Vent piping should be free of sags and be graded to drain back by gravity to the fixture(s) it serves.

The NPC requires that every drainage pipe that has a size of 75 mm (3 in.) or less shall have a downward slope in the direction of flow of at least 1 in 50 ($\frac{1}{4}$ in./ft or 2%). As stated in Tables 2.4.10.6.-C and 2.5.6.3., a 100 mm (4 in.) trap arm, building drain, or sewer is permitted to be sloped at 1:100 ($\frac{1}{8}$ in./ft).

Building drain and building sewer grade allowances are provided in Table 2.4.10.6.-C (NPC, 2020, B 2-35; refer to Table 1 below). This table shows that when the size of a building drain or building sewer increases, the grade can be reduced accordingly.

Table 1: (From NPC Table 2.4.10.6.-C) Maximum Permitted Hydraulic Load Drained to a Sanitary Building Drain or Sewer

Size of Drain or Sewer (in.)	Maximum Hydraulic Load (FUs)					
	Slope					
	1 in 400	1 in 200	1 in 133	1 in 100	1 in 50	1 in 25
3	N/A	N/A	N/A	N/A	27	36
4	N/A	N/A	N/A	180	240	300
5	N/A	N/A	380	390	480	670
6	N/A	N/A	600	700	840	1,300
8	N/A	1,400	1,500	1,600	2,250	3,370
10	N/A	2,500	2,700	3,000	4,500	6,500
12	2,240	3,900	4,500	5,400	8,300	13,000
15	4,800	7,000	9,300	10,400	16,300	22,500

Drainage Fittings

Whenever a fitting is chosen to change flow direction, two primary DWV piping practices should be followed:

1. Install fittings so they provide a gradual curve in the direction of flow.
2. Install fittings to maintain the minimum slope.

The NPC has certain restrictions pertaining to the use and orientation of DWV fittings installed in a system. The use of the wrong fitting in the wrong place could cause the DWV system to be unreliable or stop working.

Tee and Cross Fittings

These fittings are not the sanitary tee fittings you are probably familiar with. These fittings do not have a radius throat on the fitting branch to change flow direction from horizontal to vertical (Figure 1).

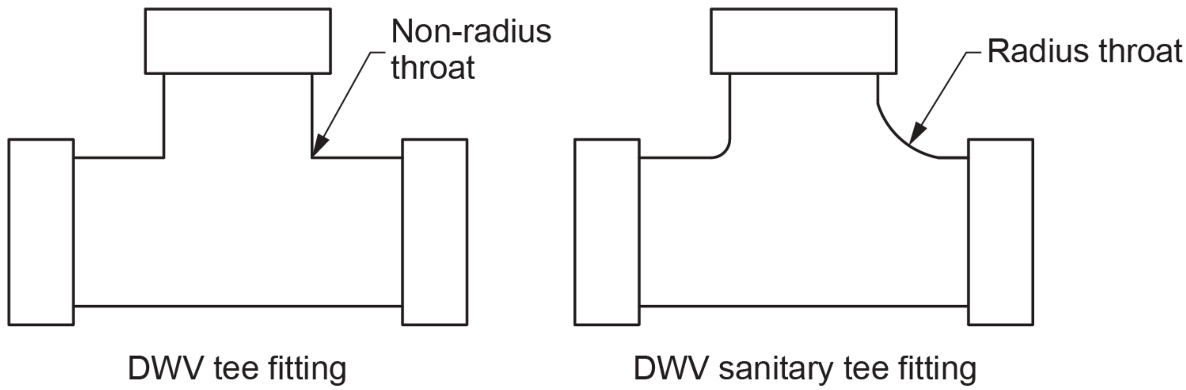

Figure 1 *The difference between a tee fitting and a sanitary tee fitting. (Skilled Trades BC, 2021) Used with permission.*

The NPC requires the following:

- A tee fitting shall not be used in a drainage system, except to connect a vent pipe (Figure 2).

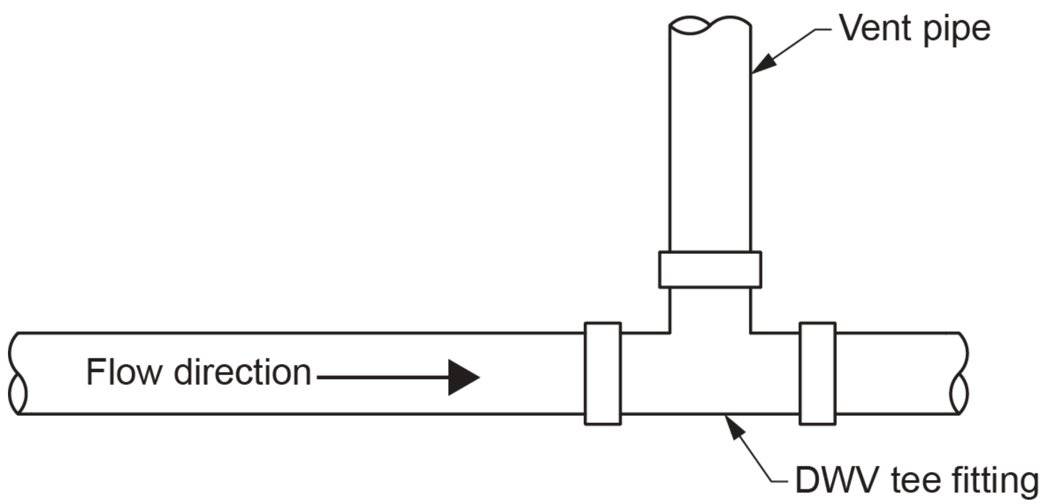

Figure 2 *Allowed installation for a DWV tee fitting. (Skilled Trades BC, 2021) Used with permission.*

- A cross fitting shall not be used in a drainage system (Figure 3).

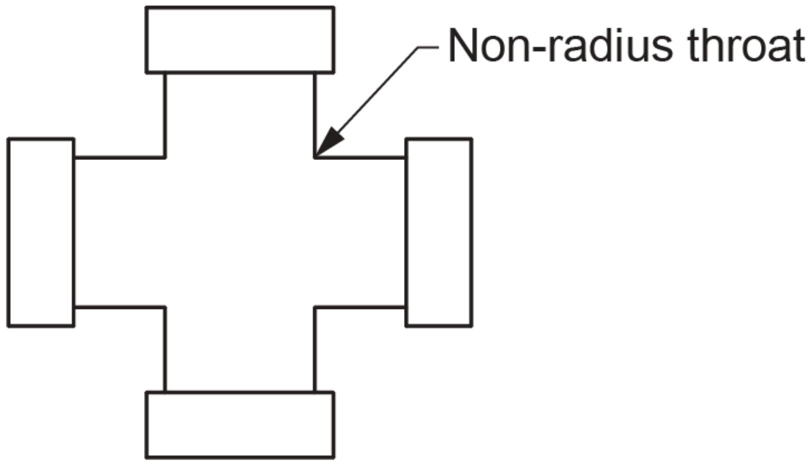

Figure 3 *Cross fitting is prohibited in a drainage system due to lack of throat radius. (Skilled Trades BC, 2021) Used with permission.*

Sanitary Tee Fittings

This fitting is often misused in a DWV system. Its proper use is to connect a horizontal branch or fixture drain to a nominally vertical branch or stack. The only time this fitting can be used in a horizontal drain pipe is to connect a nominally vertical dry vent to the system. Using a sanitary tee to change flow direction through its branch inlet from vertical to horizontal or to connect drainage pipes in the horizontal plane is never allowed.

The NPC requires that:

- A single or double sanitary tee fitting shall not be used in a nominally horizontal sanitary drainage pipe, except that a single sanitary tee fitting may be used to connect a vent pipe (Figure 4).

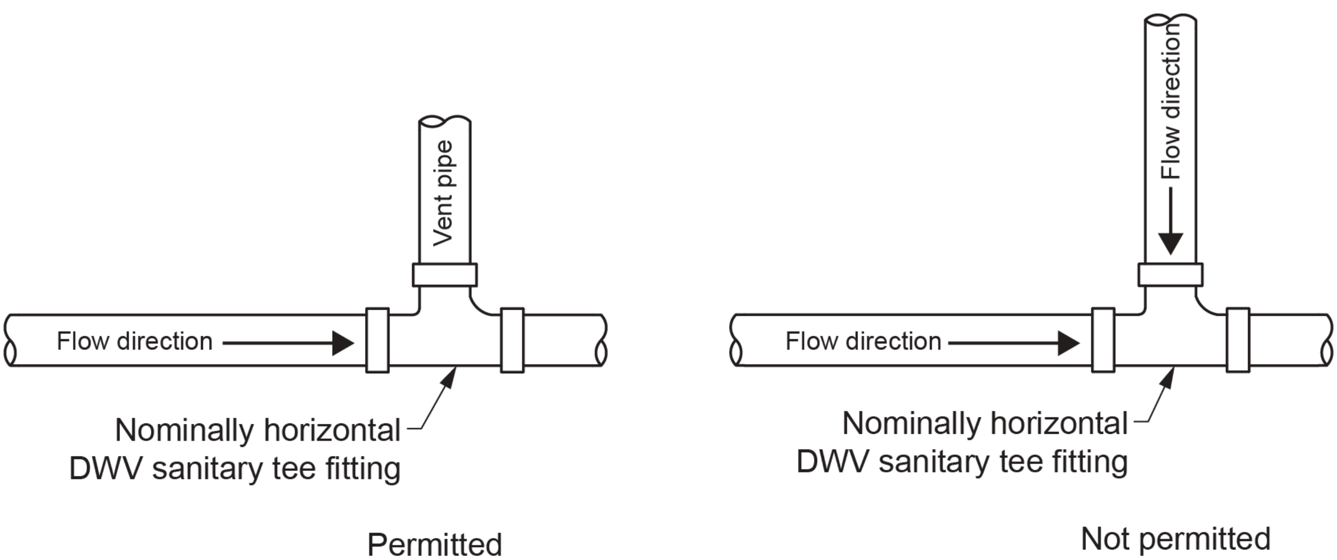

Figure 4 *NPC restrictions for single sanitary tee fittings. (Skilled Trades BC, 2021) Used with permission.*

- A double sanitary tee fitting cannot be used to connect the trap arms of back outlet water closets installed back-to-back (Figure 5) or two urinals with no cleanout fitting provided above the connection (Figure 6). Using a double wye fitting and 45° elbow combination is acceptable.

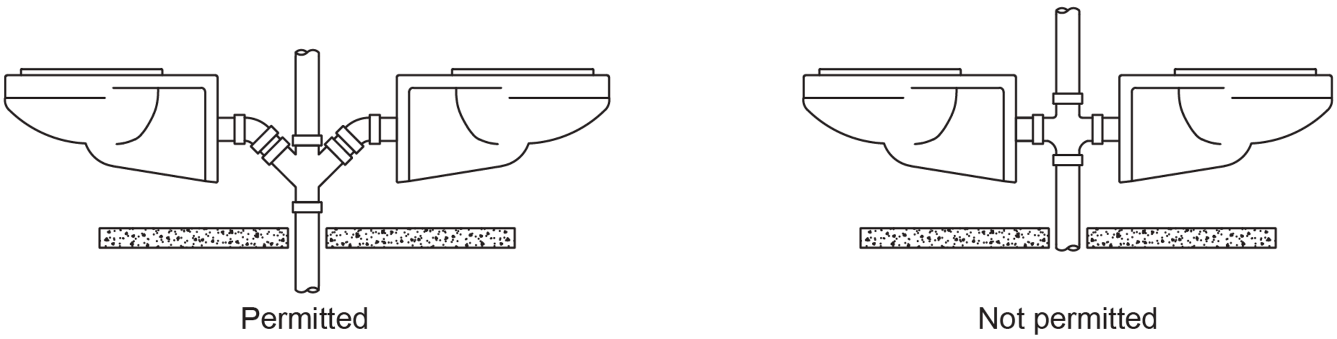

Figure 5 *NPC restrictions for double sanitary tee fittings serving back-to-back back outlet water closets. (Skilled Trades BC, 2021) Used with permission.*

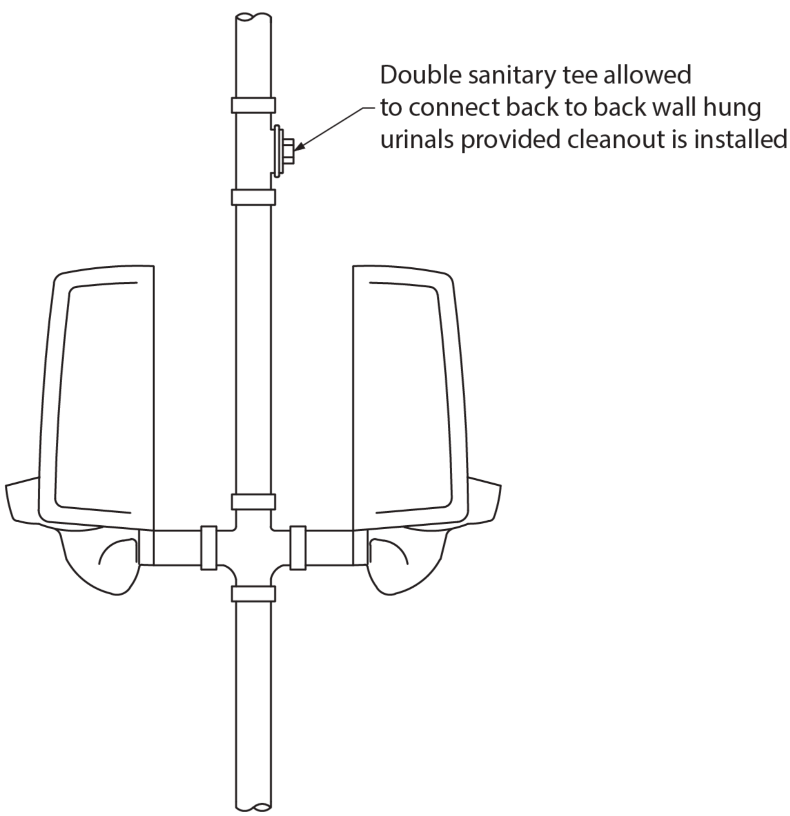

Figure 6 *NPC restrictions for double sanitary tee fittings serving wall hung urinals. (Skilled Trades BC, 2021) Used with permission.*

90° Elbows

These fittings are also called bends, which helps distinguish these DWV fittings from other **90° elbow**s that may be used in a pressurized system. Bends are described by the fraction of a circle that they sweep. A $\frac{1}{4}$ bend changes direction 90° ($\frac{1}{4}$ of 360°), a $\frac{1}{8}$ bend changes direction 45°, and so on. Bends may change flow in any direction, except for $\frac{1}{4}$ bends, which have some restrictions.

90° elbows (quarter bends) come in regular (short-radius) and long-radius styles. A long-radius bend is one whose centreline radius is at least equal to the diameter of the bend. Using long-radius bends to join two sanitary drainage pipes is unrestricted.

Short-radius bends used in systems of 100 mm (4 in.) in size or less are only permitted to do the following:

- Change flow direction from horizontal to vertical in the direction of flow or where a trap arm enters a wall (Figure 7)
- Connect trap arms — such as trap arms of water closets — s-trap standards, or any other fixture that also discharges vertically and depends on siphonic action to function properly

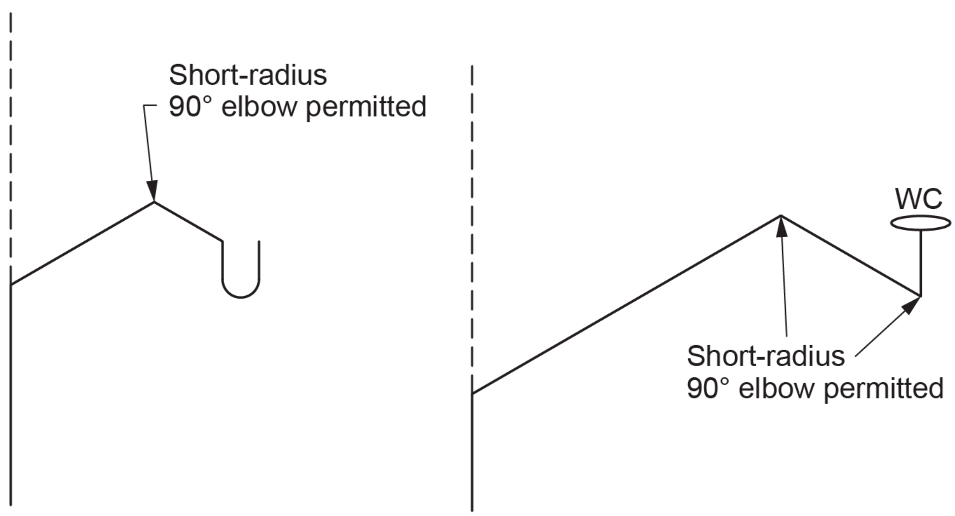

Figure 7 *NPC restriction for short-radius 90° elbows used in systems 100 mm (4 in.) in size or less. (Skilled Trades BC, 2021) Used with permission.*

Installing Fixtures and Associated Equipment

All plumbing fixtures shall not be installed in a room without lighting and ventilation. Every fixture, appliance, interceptor, cleanout, valve, device, or piece of equipment shall be located so that it is readily accessible for use, cleaning, and maintenance.

Additionally, there are a number of requirements specific to the type of fixture.

Showers

- Every shower receptor shall be constructed and arranged so that water cannot leak through the walls or floor.
- A single shower drain shall serve not more than six showerheads.
- Where a shower drain serves two or more showerheads, the floor shall be sloped and the drain located so that water from one head cannot flow over the area that serves another head.
- Except for column showers, when a battery of showerheads is installed, the horizontal distance between two adjacent showerheads shall be not less than 750 mm (30 in.).

Water Closets

- When a water closet is installed in a washroom for public use, it shall be of the elongated type and be provided with a seat of the open front type.
- When installing a water closet, the NPC requires that every screw, bolt, nut, and washer shall be of corrosion-resistant materials when used to:
    - Connect a water closet to a water closet flange
    - Anchor the water closet flange to the floor
    - Anchor the water closet to the floor

Clothes Washer

- Where clothes washers do not drain to a laundry tray, the trap inlet shall be fitted with a vertical standpipe not less than 600 mm (24 in.) long (measured from the trap weir) that terminates above the flood level rim of the clothes washer (Figure 8).

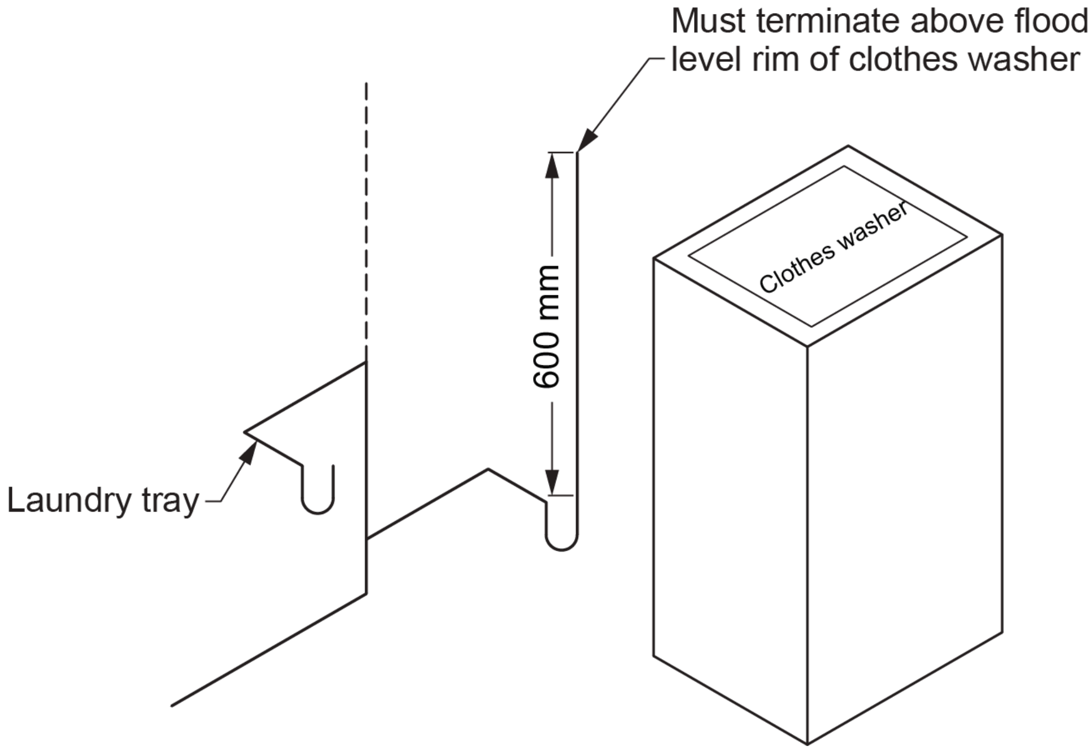

Figure 8 *NPC requirement for the installation of clothes washers. (Skilled Trades BC, 2021) Used with permission.*

Sumps or Tanks

- Piping that is too low to drain into a building sewer by gravity shall be drained to a **sump** or receiving tank.
- Where the sump or tank receives sewage, it shall be watertight, airtight, and vented.
- Equipment such as a pump or ejector that can lift the contents of the sump or tank and discharge it into the building drain or building sewer shall be installed.
- Where the equipment does not operate automatically, the capacity of the sump shall be sufficient to hold at least a 24-hour accumulation of liquid.
- Where there is a building trap, the discharge pipe from the equipment shall be connected to the building drain downstream of the trap.
- The discharge pipe from every pumped sump shall be equipped with a union, a check valve, and a shutoff valve installed, in that sequence, in the direction of discharge.
- The discharge piping from a pump or ejector shall be sized for optimum flow velocities at pump design conditions.

Manholes

- A manhole, including the cover, shall be designed to support all loads imposed upon it.
- A manhole shall be provided with the following (Figure 9):
    - A cover that provides an airtight seal, if located within a building
    - A rigid ladder of a corrosion-resistant material where the depth exceeds 1 m (39 in.)
    - A vent to the exterior, if located within a building

- A manhole shall have a minimum horizontal dimension of 1 m (39 in.), except that the top 1.5 m (60 in.) may be tapered from 1 m down to a minimum of 600 mm (24 in.).
- A manhole in a sanitary drainage system shall be channeled to direct the flow of effluent.

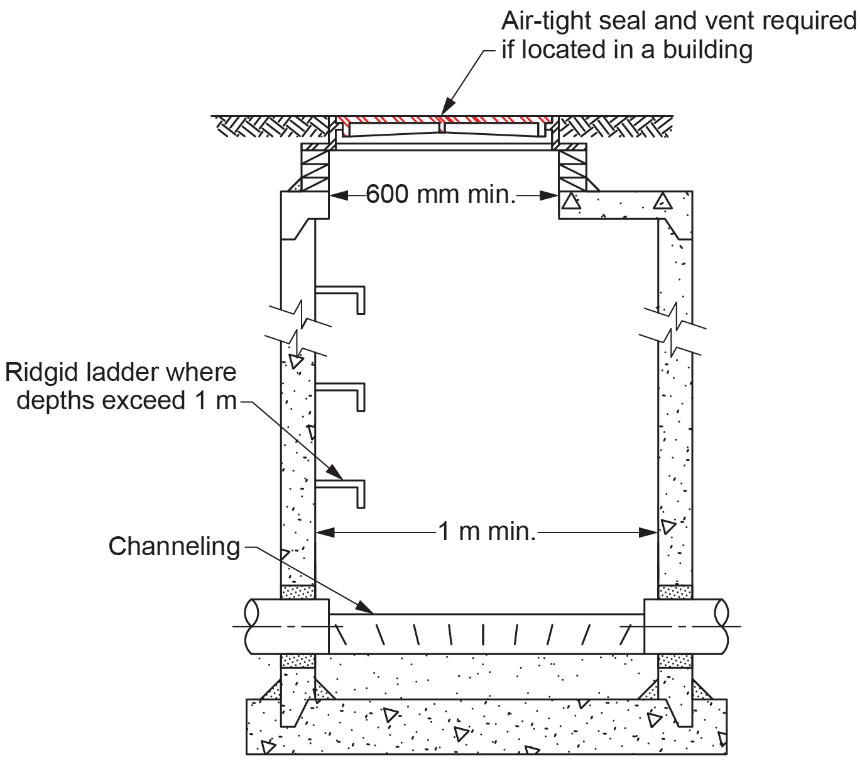

Figure 9 *NPC requirement for the installation of manholes. (Skilled Trades BC, 2021) Used with permission.*

Mobile Home Sewer Service

A building sewer intended to serve a mobile home shall be not less than 100 mm (4 in.) in size, terminated above ground, and provided with the following:

- A tamperproof terminal connection capable of being repeatedly connected, disconnected, and sealed
- A protective concrete pad
- A means to protect it from frost heave

Protection from Backflow in Drainage Systems

The NPC allows a **backwater valve** to be installed in a building drain provided that it is of a "normally open" design and does not serve more than one dwelling unit. As an alternative, where a building drain or a branch may be subject to backflow, a gate valve or backwater valve shall be installed on every fixture drain connected to it when the fixture is located below the level of the adjoining street. If more than one fixture is located on a storey and all are connected to the same branch, the gate valve or backwater valve may be installed on the branch. If the alternative method is used and the fixture is a floor drain, a removable screw cap may be installed on the upstream side of the trap.

A subsoil drainage pipe that drains into a sanitary drainage system subject to surcharge shall be connected in such a manner that sewage cannot back up into the subsoil drainage pipe.

Prohibitions

Fixtures

- A dishwashing sink and a food preparation sink shall not have concealed overflows.

Connection to Public Services

- Piping in any building connected to public services shall be connected separately from the piping of any other building, except that an ancillary building on the same property may be served by the same service.

Restrictions

Fixture Locations

- Urinals shall not be installed adjacent to wall and floor surfaces that are pervious to water.
- **Indirect connections** or any trap that may overflow shall not be located in a crawl space or any other unfrequented area.
- Except for an organic solids interceptor, equipment discharging waste with organic solids shall not be located upstream of a **grease interceptor**.
- A floor drain or other fixture located in an oil transformer vault, a high-voltage room, or any room where flammable, dangerous, or toxic chemicals are stored or handled shall not be connected to a drainage system.
- A macerating toilet system shall only be installed where no connection to a gravity sanitary drainage system is available.
- Where a drain is provided in an elevator pit, it shall be connected directly to a sump located outside the elevator pit, and the drain pipe that connects the sump to the drainage system shall have a backwater valve.

Connections to the Drainage System

- A saddle hub or fitting shall not be installed in a DWV system.
- The NPC does not allow a fixture to be connected to a lead bend or stub serving a water closet.
- The connection of a sanitary drainage pipe to a nominally horizontal sanitary drainage pipe or a nominally horizontal offset in a stack shall be not less than 1.5 m (60 in.) measured horizontally from the bottom of a stack or the bottom of the upper vertical section of the stack that:
    - Receives a discharge from 30 or more fixture units
    - Receives a discharge from fixtures located on two or more storeys (Figure 10)

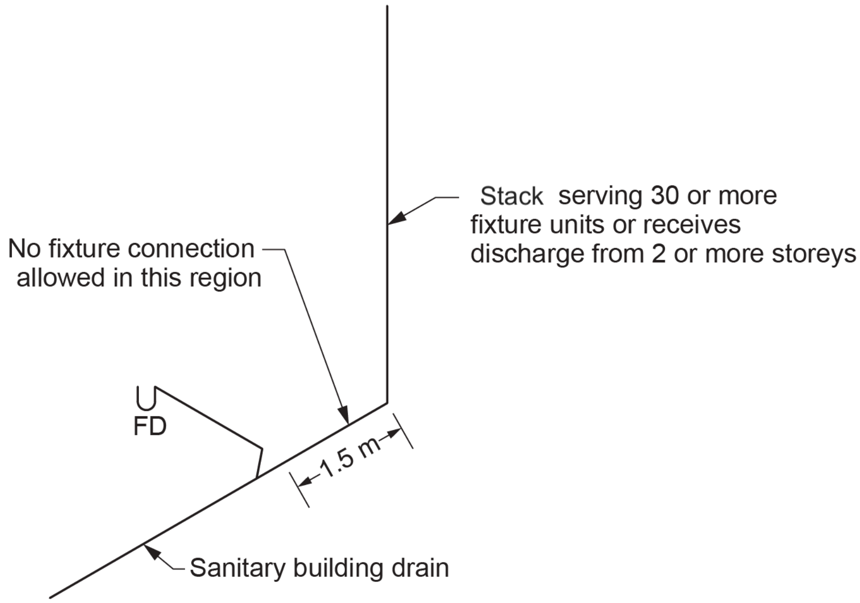

Figure 10 *NPC restrictions when connecting to a nominally horizontal sanitary drainage pipe serving a stack. (Skilled Trades BC, 2021) Used with permission.*

- Fixtures shall be directly connected to a sanitary drainage system, with the exception of a drinking fountain, which may be indirectly connected to a drainage system.

The following devices must be indirectly connected to a drainage system:

A. Device for displaying, storing, preparing, or processing food or drink
B. Sterilizer
C. Device that uses water as a cooling or heating medium
D. Water-operated device
E. Water treatment device
F. Drain or overflow from a water system or a heating system

For the fixtures listed above, the following methods of directly connecting to a shared drain pipe may also be used, as they will give the same level of protection as an indirect individual fixture connection.

- In reference to all of the above fixtures, two or more fixture outlet pipes that serve outlets from a single fixture may be directly connected to a branch that:
  - Has a size of not less than 32 mm (1.25 in.)
  - Is terminated above the flood level rim of a directly connected fixture to form an air break
- The above fixtures listed in A and B may be directly connected to a pipe that:
  - Is terminated to form an air break above the flood level rim of a fixture directly connected to a sanitary drainage system
  - Is extended through the roof when fixtures on three or more storeys are connected to it
- The above-fixtures listed in Items C through E may be directly connected to a pipe that:
  - Is terminated to form an air break above the flood level rim of a fixture directly connected to a storm drainage system
  - Is extended through the roof when fixtures on three or more storeys are connected to it

Suds Pressure Zones

Detergents that produce high volumes of suds in clothes washers have created a serious problem called suds pressure in all residential occupancy buildings and more notably in high-rise buildings. Whenever a sanitary drainage pipe receives waste from two or more clothes washers, the drainage and vent piping below the clothes washer connections must be arranged to avoid connecting to any zone where suds pressure exists.

High suds pressure zones occur at every change in direction — vertically or horizontally — greater than 45°. Because liquid discharge is heavier than suds, it easily flows through the suds-loaded drainage piping without carrying the suds along with it, leaving the most of the suds behind. The air and liquid flowing in the drainage pipe compresses the suds and forces them to move through any available path of relief, such as the building drain, any branches connected to the building drain, the vent stack, branch vents, individual vents, or combinations of these. Excessively high suds pressures are capable of blowing out the seals of traps, with suds also appearing in fixtures.

The NPC restricts the connection of sanitary drainage pipes to suds pressure zones within certain distances, as listed below:

- 40 times the size of the sanitary drainage pipe or 2.44 m (96 in.) maximum vertical, whichever is less, before changing direction (Figure 11)
- 10 times the size of the nominally horizontal sanitary drainage pipe after changing direction
- Where a vent pipe is connected into the suds pressure zone, no other vent pipe shall be connected to that vent pipe within the height of the suds pressure zone.

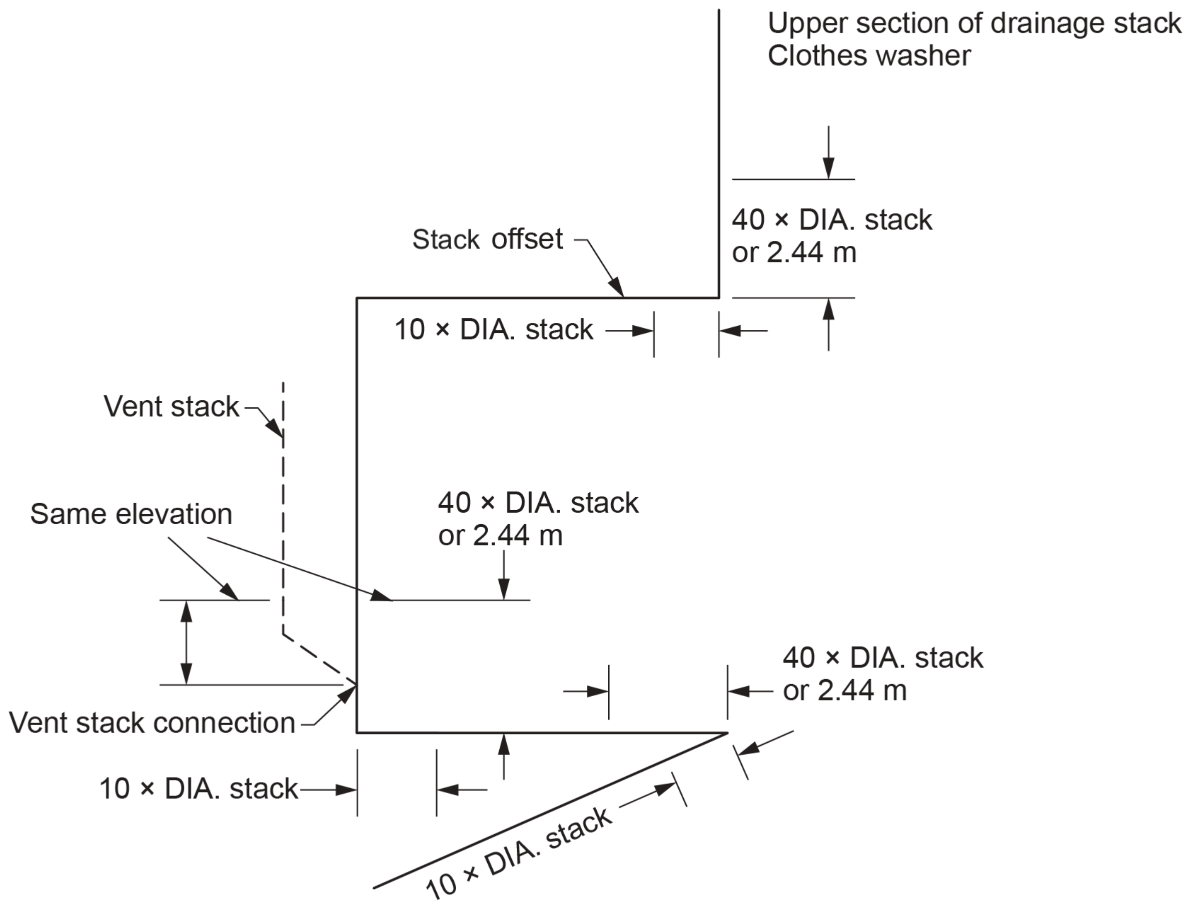

***Figure 11** NPC restrictions when connecting to a sanitary drainage pipe that serves two or more clothes washers. (Skilled Trades BC, 2021) Used with permission.*

High-Temperature Wastes

High-temperature wastes (above 75°C/167°F) must never discharge directly into the drainage system. High temperatures can cause piping to expand and contract excessively, resulting in harmful effects. Joints may be pulled apart or loosened, and solidly bedded pipe may be broken. The discharges from boiler blow-offs, steam exhaust, condensate, and so on must be cooled down to at least 75°C before connecting to the drainage system. This may be accomplished by piping the high-temperature discharge to a water-supplied sump or a cooling tank.

Acidic or Corrosive Wastes

All acidic or corrosive waste requires neutralization before being permitted to be discharged into any public sewer for disposal. The primary procedures used most often are:

- Dilution
- Direct continuous contact with limestone chips in an acid-neutralizing basin
- Continuous or batch treatment in an automated neutralization system using chemical feed neutralizing

The connection of the neutralizing basin to the sanitary drainage system shall be indirect or through a trap.

Sanitary Drainage Pipes Locations

To prevent contamination of potable water or food sources in the event of a DWV system leak, the NPC requires that a sanitary drainage pipe not be located directly above the following:

- Non-pressure potable water storage tanks
- Manholes in pressure potable water storage tanks
- Food-handling or food-processing equipment

Traps and Interceptors

Traps

The NPC (2020) places restrictions on how a p-trap is used and manufactured. The following are some of those limitations, restrictions, and clarifications:

- Every trap shall have a trap seal depth of not less than 38 mm (1.5 in.). For fixtures draining to an acid waste system, the trap seal depth shall be a minimum of 50 mm (2 in.).
- Traps shall be manufactured with single walls so that a failure of the trap seal wall will cause exterior leakage.
- Traps shall have a non-mechanical water seal so that it does not depend on the action of moving parts to be effective.
- Every trap that serves a lavatory, sink, or laundry tray shall be provided with a cleanout plug located at the lowest point of the trap. The cleanout plug shall be of the same material as the trap. The one exception to this requirement concerns a cast-iron trap, which must have a brass cleanout plug to facilitate removal. If a cleanout plug is not provided, then the trap shall be designed so that part or all of the trap can be removed for cleaning purposes.
- A drum trap shall not be used as a fixture trap unless required to serve as an interceptor and access for servicing is provided.
- A tubular trap shall be used only in accessible locations. A tubular trap is made of thin-walled material and is not of the thickness of DWV; therefore, it cannot be concealed.

Prohibited Traps

As mentioned, the NPC (2020) places restrictions on how a p-trap is used and manufactured. The following are some of those limitations, restrictions, and clarifications:

- **Bell trap:** were sometimes used in floor drains installed many years ago (Figure 12). Their installation is prohibited by the NPC.
- **S-trap:** was very common years ago when most plumbing drains came up through the floor instead of out from a

wall, but they are subject to losing their trap seal through self-siphoning. Except for an s-trap standard, the s-trap shown in Figure 12 is prohibited by Clause 2.5.6.3.(1)(b), which limits the maximum fall on a trap arm fixture drain to not more than the inside diameter of the pipe.

- **Crown vented trap:** has a vent rising from the top of the trap and is prohibited by Clause 2.5.6.3.(1)(a), which requires that the distance from the trap weir to the vent be not less than twice the size of the fixture drain.

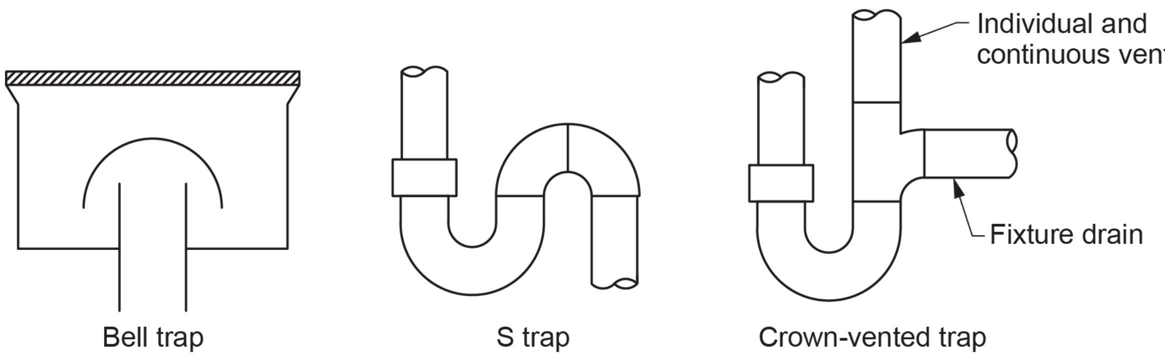

Figure 12 *Prohibited traps as defined in the NPC. (Skilled Trades BC, 2021) Used with permission.*

Sanitary Drainage System Traps

The NPC requires that every fixture shall be protected by a separate trap, with certain exceptions:

- One trap may protect all the trays or compartments of a two- or three-compartment sink, a two-compartment laundry tray, or two similar single-compartment fixtures located in the same room.
- One trap may serve a group of floor drains, shower drains, washing machines, or laboratory sinks if the fixtures are in the same room and not located where they can receive food or other organic matter.
- An indirectly connected fixture that can discharge only clear-water waste, other than a drinking fountain, need not be protected by a trap.
- Where a domestic dishwashing machine equipped with a drainage pump discharges through a direct connection into the fixture outlet pipe of an adjacent kitchen sink or disposal unit, the pump discharge line shall rise as high as possible to just under the counter and connect on the inlet side of the sink trap by means of a wye fitting or to the disposal unit.

Traps Used for Subsoil Drainage Pipes Connecting to a Sanitary Drainage System

The NPC requires that, when a subsoil drainage pipe is connected to a sanitary drainage system (Figure 13), a trap must be installed between the subsoil drainage pipe and the sanitary drainage system. The connection shall be made on the upstream side of the trap with a cleanout fitting. An alternative to this arrangement could be through the use of a trapped sump.

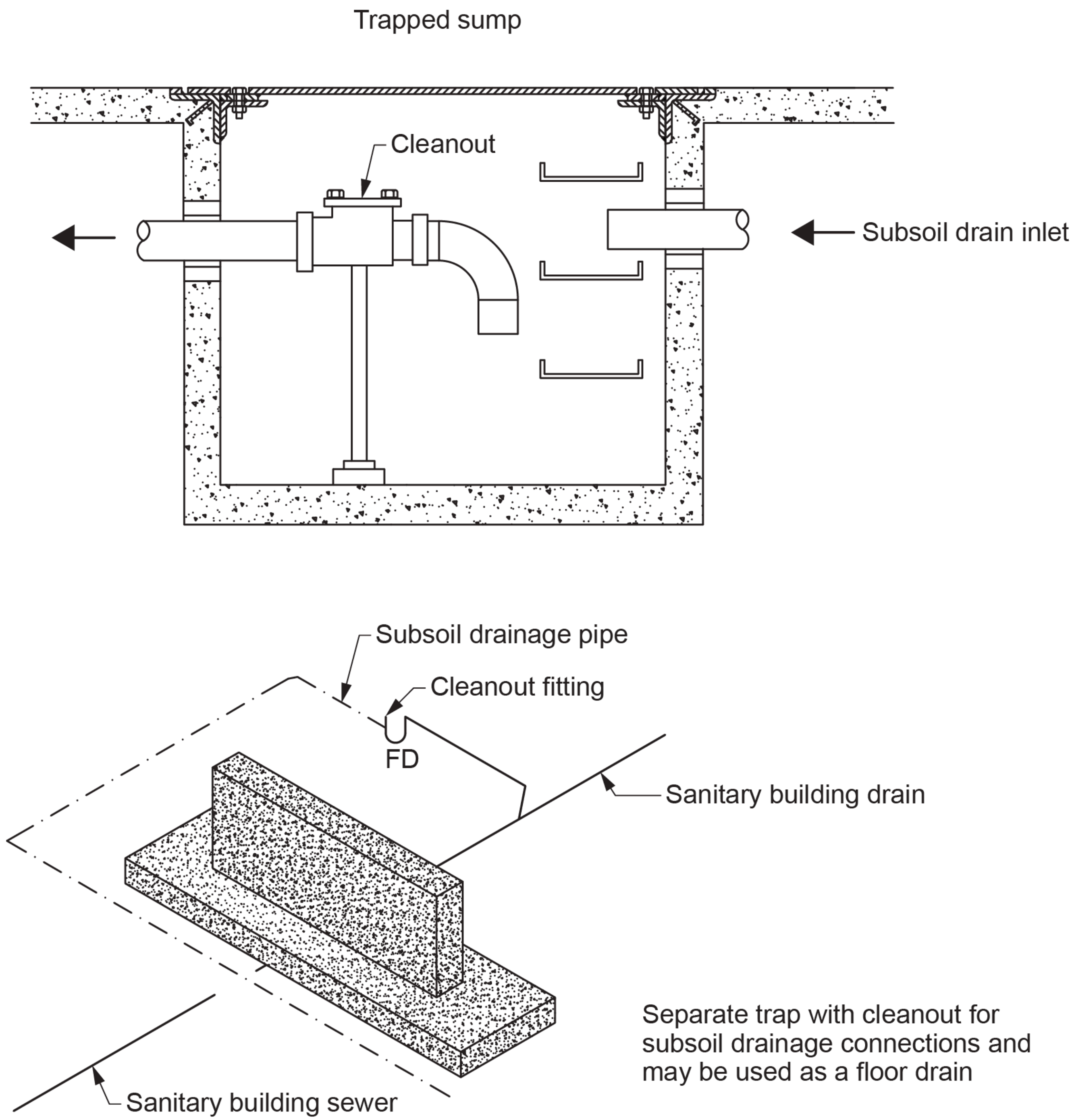

Figure 13 *Connecting subsoil drainage pipes to a sanitary drainage system. (Skilled Trades BC, 2021) Used with permission.*

Trap Seals

When a floor drain trap seal is lost, objectionable smells and gases may enter the building. Therefore, the water seal in floor drain traps must be maintained under all circumstances. The NPC requires that provision shall be made for maintaining the trap seal of a floor drain by using:

- A trap seal primer
- The drain as a receptacle for an indirectly connected drinking fountain
- Some other equally effective means

Interceptors

Interceptors are required when conditions provide an opportunity for harmful or unwanted materials to enter a sanitary drainage system. When oil, grease, sand, or other harmful substances are likely to enter a drainage system, an interceptor is required. The NPC has a number of regulations regarding interceptors used in drainage systems:

- An interceptor may serve as a trap, provided that it has an effective water seal of not less than 38 mm ($1\frac{1}{2}$ in.).
- Every interceptor shall be designed so that it can be readily cleaned.
- Every interceptor shall have sufficient capacity to perform the service for which it is provided.

Grease Interceptor

- Where a fixture discharges sewage that includes fats, oils, or grease and is located in a public kitchen, restaurant, or care or detention occupancy, it shall discharge through a grease interceptor.
- A grease interceptor shall be designed so that it does not become air bound (flow stoppage due to trapped air), and does not have a water jacket.

Oil Interceptor

- Where the discharge from a fixture may contain oil or gasoline, an **oil interceptor** shall be installed.

Solid Interceptor

- Where a fixture discharges sand, grit, or similar materials, an interceptor designed for the purpose of trapping such discharges shall be installed.

Cleanouts

Cleanouts are a means of accessing the interior of drainage pipes. They are needed so that blockages in drains may be cleared. Without cleanouts, it is much more difficult to clean the drain. The NPC has established minimums for the size of cleanouts and their placement in the drainage system.

Cleanouts for Drainage Systems

The NPC requires that:

- Every plug, cap, nut, or bolt intended to be removable from a ferrous fitting shall be of a non-ferrous material.
- A cleanout fitting that, as a result of normal maintenance operations, cannot withstand the physical stresses of removal and reinstallation or cannot ensure a gas-tight seal shall not be installed.
- Every sanitary drainage system shall be provided with cleanouts that will permit cleaning of the entire system through “one-way rodding” in the direction of flow or “two-way rodding” in either direction originating at the cleanout.
- Cleanouts and access covers shall be located so that their openings are readily accessible for drain cleaning purposes.
- A cleanout shall not be located in a floor assembly in a manner that may constitute a hazard or allow it to be used as a floor drain.
- Cleanouts that allow rodding in only one direction shall be installed to permit rodding in the direction of flow.
- There shall be no change of direction between a cleanout fitting and the trap that it serves.
- The piping between a cleanout fitting and the drainage piping or vent piping that it serves shall not change direction by more than 45°.
- Cleanouts shall be installed so that the cumulative change in direction is not more than 90° between cleanouts in a drip pipe from a food receptacle or in a fixture drain serving a kitchen sink.

Required Locations

- A cleanout fitting shall be provided on the upstream side and directly over every running trap.
- Where a running trap serves a building trap, it shall be provided with a cleanout fitting on the upstream side of and directly over the trap, be located upstream of the building cleanout, and be located inside the building as close as practical to the place where the building drain leaves the building or outside the building in a manhole.
- Every building drain shall be provided with a cleanout fitting located as close as practical to the place where the building drain leaves the building.
- Every stack shall be provided with a cleanout fitting at the bottom of the stack, not more than 3 m (9 ft 10 in.) upstream of the bottom of the stack, or on a wye fitting connecting the stack to the building drain or branch.
- A cleanout shall be provided to permit the cleaning of the piping downstream of an interceptor.
- Cleanouts serving fixtures in health care facilities, mortuaries, laboratories, and similar occupancies where contamination by body fluids is likely shall be located a minimum of 150 mm (6 in.) above the flood level rim of the fixture.

Minimum Size and Maximum Spacing

- Cleanouts are required to be the same size as the pipe they are serving unless the pipe is larger than 100 mm (4 in.). The maximum spacing between cleanouts depends on whether or not they provide one- or two-way rodding, as explained in Table 2.4.7.2. (NPC, 2020, B 2-29; refer to Table 2 below).
- Cleanouts for building drains shall be a minimum of 4 in. (100 mm) in size.

Table 2: (From NPC Table 2.4.7.2.) Permitted Sizes and Spacing of Cleanouts

Size of Drainage Pipe (m)	Minimum Size of Cleanout (in.)	Maximum Spacing — One-way Rodding (m)	Maximum Spacing — Two-way Rodding (m)
Less than 3	Same size as drainage pipe	7.5	15
3 and 4	3	15	30
Over 4	4	26	52

Regulations for Cleanouts Serving Building Sewers

- Where a cleanout is required on a building sewer 200 mm (8 in.) or larger in size, it shall be a manhole.
- A building sewer shall not change direction or slope between the building and public sewer or between cleanouts, except that pipes not more than 150 mm (6 in.) in size may change direction by not more than 5° every 3 m (9 ft 10 in.) or by using fittings with a cumulative change in direction of not more than 45°.
- Where a building sewer connects to another building sewer other than by a manhole, the developed length between the building and the building sewer to which it connects shall not exceed 30 m (98 ft 5 in.).
- The developed length of a building sewer between the building and the first manhole to which the building sewer connects shall not exceed 75 m (246 ft).
- The spacing between manholes serving a building sewer 600 mm (24 in.) or less in size shall not exceed 90 m (295 ft) and over 600 mm in size shall not exceed 150 m (490 ft).

Venting

Vent Pipe Drainage

When venting systems are installed, the vents should have a small amount of grade in the downstream direction to allow condensation to drain. Vents cannot be installed in a trapped position; this will fill the vent up with condensation and close it off. Unless it is impractical to do so, vents are required to be installed in a nominally vertical position, which will allow the condensation to flow to the drainage system and keep the venting system free-flowing.

The NPC requires that every vent pipe shall be installed without any depressions in which moisture can collect.

Vent Pipe Locations on Trap Arms

- Except for a wet vent, every vent pipe extends above the flood level rim of every fixture that it serves before turning nominally horizontal or being connected to another vent pipe.
- No vent pipe shall be connected in such a manner that a blockage in a sanitary drainage pipe would cause waste to drain through the vent pipe to the drainage system.
- When a vent pipe, other than a wet vent, is connected to a nominally horizontal sanitary drainage pipe, the connection shall be above the horizontal centreline of the sanitary drainage pipe.
- Except for water closets, s-trap standards, or any other fixture that depends on siphonic action to function

properly, a vent pipe that protects a fixture trap shall be located so that:

- The developed length of the trap arm is not less than twice the size of the fixture drain
- The total fall of the trap arm does not exceed its size
- The trap arm does not have a cumulative change in direction of more than 135° (Figure 14)

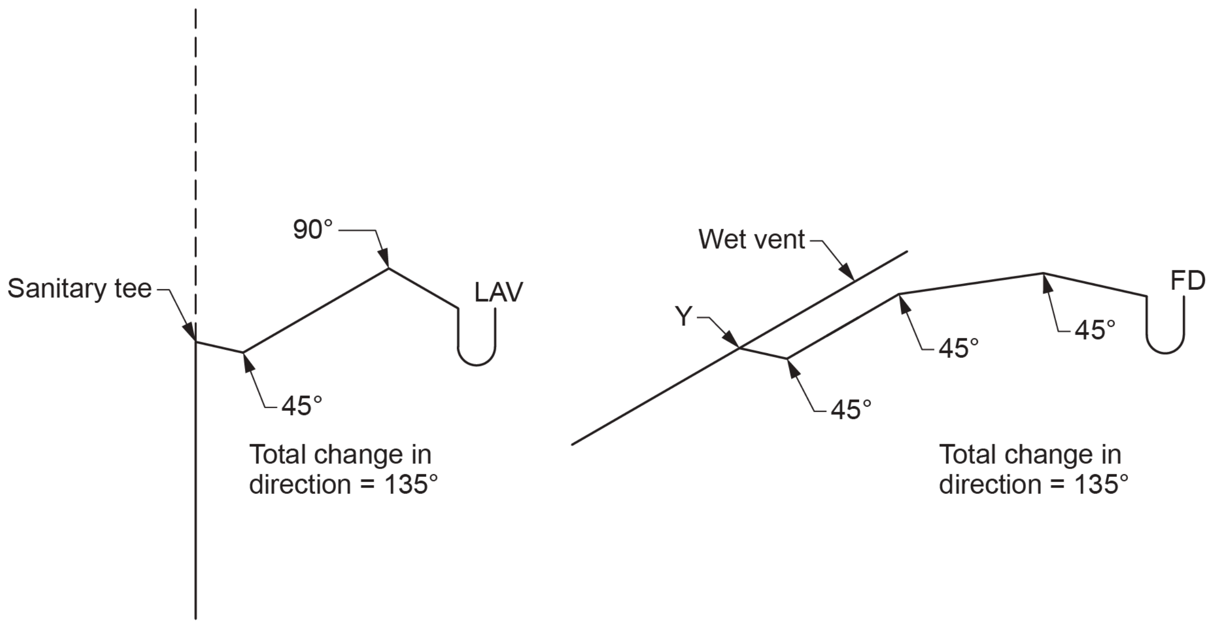

Figure 14 *NPC restriction on maximum change of direction of trap arms other than water closets. (Skilled Trades BC, 2021) Used with permission.*

The maximum length of a trap arm upstream of the vent connection shall not exceed the distances shown in Table 2.5.6.3. (Table 3) based on trap size:

Table 3: (From Table 2.5.6.3.) Trap Arm Length

Trap Size Served (in.)	Maximum Trap Arm Length (m)	Minimum Slope
1.25	1.5	$\frac{1}{50}$
1.50	1.8	$\frac{1}{50}$
2	2.4	$\frac{1}{50}$
3	3.6	$\frac{1}{50}$
4	9.8	$\frac{1}{100}$

Vent Pipe Locations on Trap Arms Serving Fixtures that Depend on Siphonic Action

The trap arm of water closets, s-trap standards, and any other fixture that also discharges vertically and depends on siphonic action to function properly shall not have a cumulative change in direction of more than 225° (Figure 15).

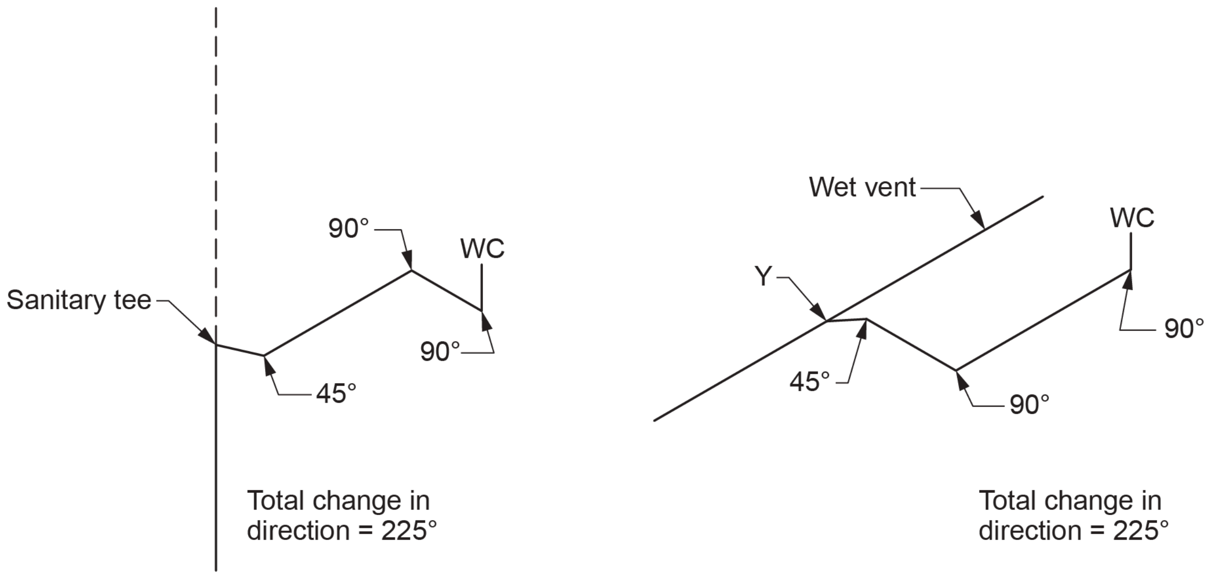

Figure 15 *Vent pipe location serving water closets. (Skilled Trades BC, 2021) Used with permission.*

A vent pipe that protects a water closet or any other fixture that also depends on siphonic action to function properly shall be located so that the distance between the connections of the fixture drain to the fixture and the vent pipe does not exceed:

- 1 m (39 in.) in the vertical plane
- 3 m (9 ft 10 in.) in the horizontal plane (Figure 16)

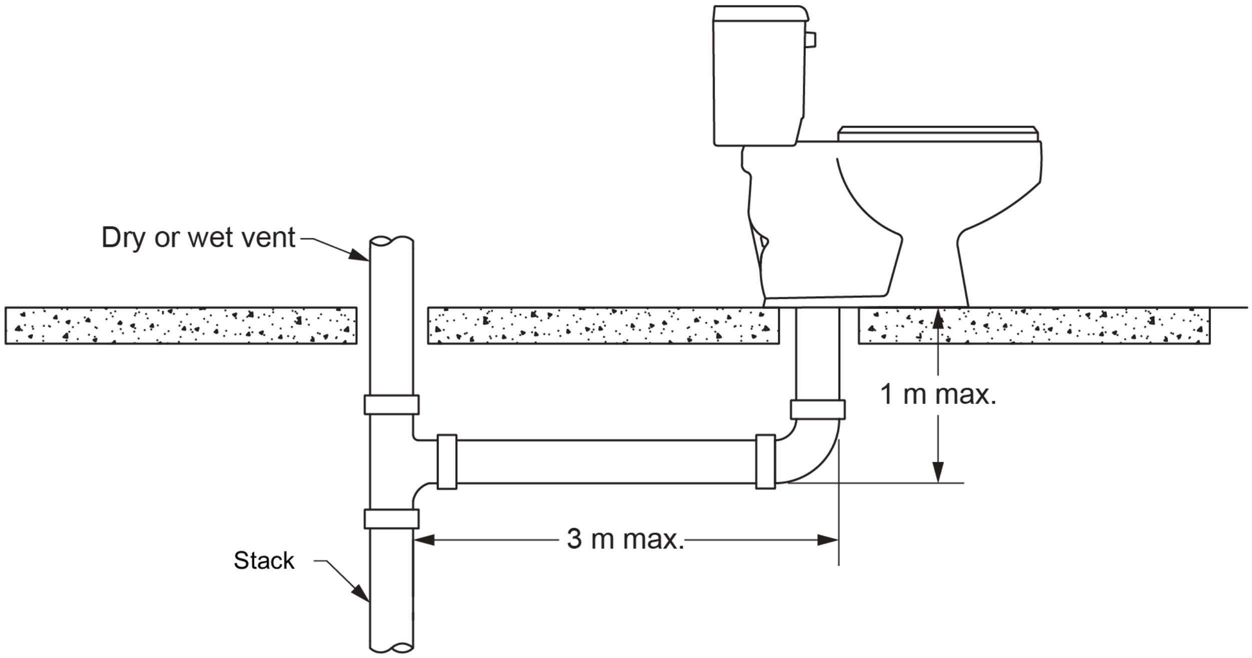

Figure 16 *Maximum length of WC trap arm. (Skilled Trades BC, 2021) Used with permission.*

Island Venting

With the acceptance of air admittance valves by the NPC, many island installations are being installed using this device. It is strongly suggested that this device only be used if the piping configurations shown in Figure 17 is not possible. Air admittance valves are a one-way check valve and, as such, do not allow free flow of air through the system. As well, they are a mechanical device that can and do fail, requiring replacement. Unfortunately, the NPC does not give much guidance to the installer with regard to this practice. In the "Notes to Part 2" section of the code, A.2.4.8.2.(1) illustrates two installations that limit the length of the fixture outlet pipe and the length of the trap arm in relation to the trap size (Figure 17).

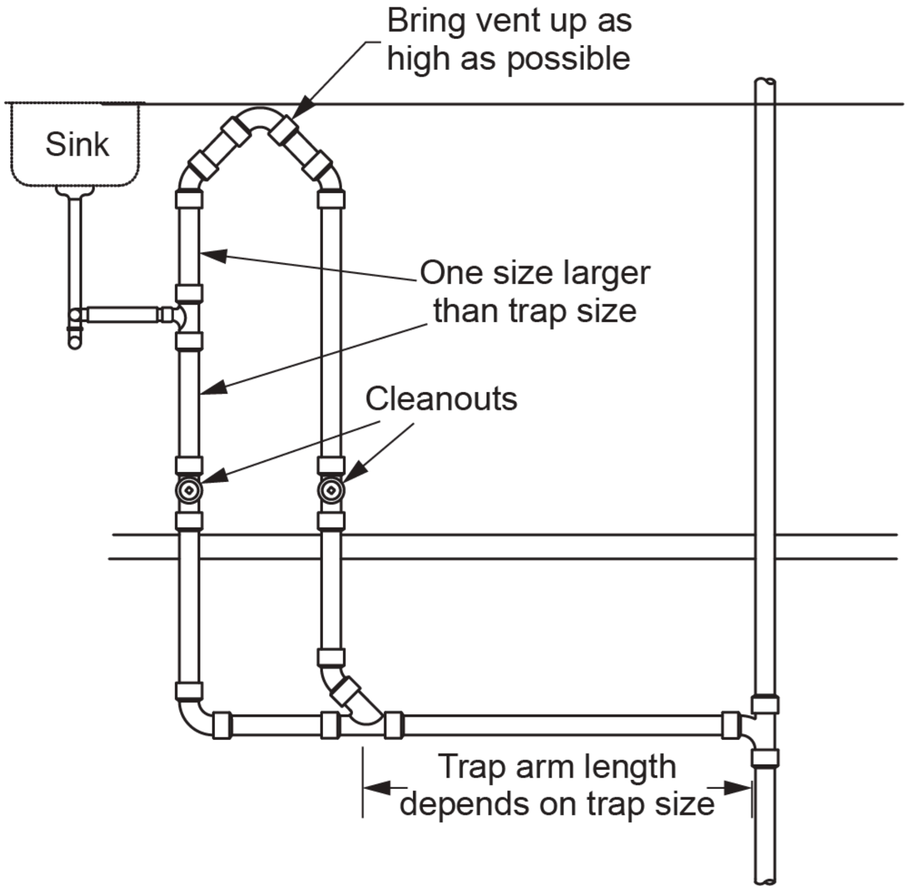

Figure 17 *Island venting method 1. (Skilled Trades BC, 2021) Used with permission.*

If the vent riser is further away from the fixture than permitted in Figure 17, some jurisdictions allow an alternative piping arrangement that uses a “foot vent” running below the floor, where there is no restriction to length (Figure 18).

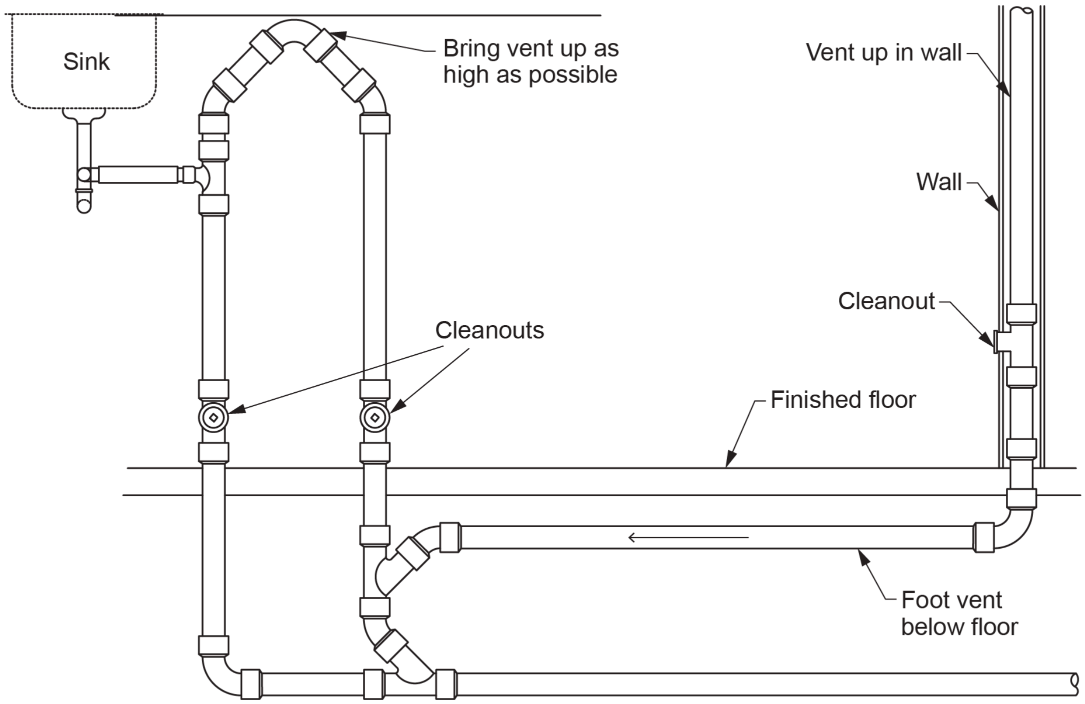

Figure 18 *Foot venting for island-vented sinks. (Skilled Trades BC, 2021) Used with permission.*

Always get approval from your local plumbing inspector before installing this type of vent.

Air Admittance Valves

Air admittance valves are not a replacement for the venting system but are only an added component of an existing sanitary system. This means that this type of valve is not intended to replace a vent extending to open air nor will it help circulate air as needed for relief vents or circuit vents. The valve will open only when a negative pressure or a pressure below atmospheric is present in the drainage system. It remains closed when subjected to a positive pressure.

Using air admittance valves is limited because the valve shall only be used under certain conditions and after the AHJ has determined it is warranted.

[Air admittance valves] shall only be used to vent:

- Fixtures located in island counters

- Fixtures that may be affected by frost closure of the vent due to local climatic conditions
- Fixtures in one- and two-family dwellings undergoing renovation
- Installations where connection to a vent may not be practical

[Air admittance valves] shall be located:

- Not less than 100 mm (4 in.) above the fixture drain served
- Within the maximum developed length permitted for the vent
- Not less than 150 mm (6 in.) above insulation materials

Installation Requirements

- Shall not be installed in supply or return air plenums or in locations where they may be exposed to freezing temperatures
- Shall be installed in accordance with the manufacturer's installation instructions
- Shall be rated for the size of vent pipe to which they are connected
- Shall be accessible and located in a space that allows air to enter the valve

Future Connections

- Where provision is made for a fixture to be installed in the future, the drainage system and venting system shall be sized accordingly, and provision shall be made for the necessary future connections.
- Except in a situation where a sewage sump is installed that requires a minimum 50 mm (2 in.) vent, every storey in which plumbing is or may be installed, including the basement of a single-family dwelling, shall have a vent pipe of at least 38 mm ($1\frac{1}{2}$ in.) in size extending into or passing through it for the provision of future connections.
- Unused vent pipes installed for future connections shall be permanently capped with an end cleanout or an adapter and plug.

Miscellaneous Vent Pipes

Venting Requirements for Corrosive Waste Piping or Dilution Tanks

Venting systems for drain piping or dilution tanks conveying corrosive waste shall extend independently and terminate in outside air.

The minimum size requirement for the vent pipe serving a dilution tank is identical to that serving a sewage sump. It is allowed to be one size smaller than the size of the largest branch or fixture drain draining to the tank but cannot be less than 50 mm (2 in.) nor does it need to be greater than 100 mm (4 in.).

Fresh Air Inlets Serving Building Traps

A fresh air inlet not less than 100 mm (4 in.) in size shall be connected upstream and within 1.2 m (47 in.) of the building trap and downstream of any other connection (Figure 19).

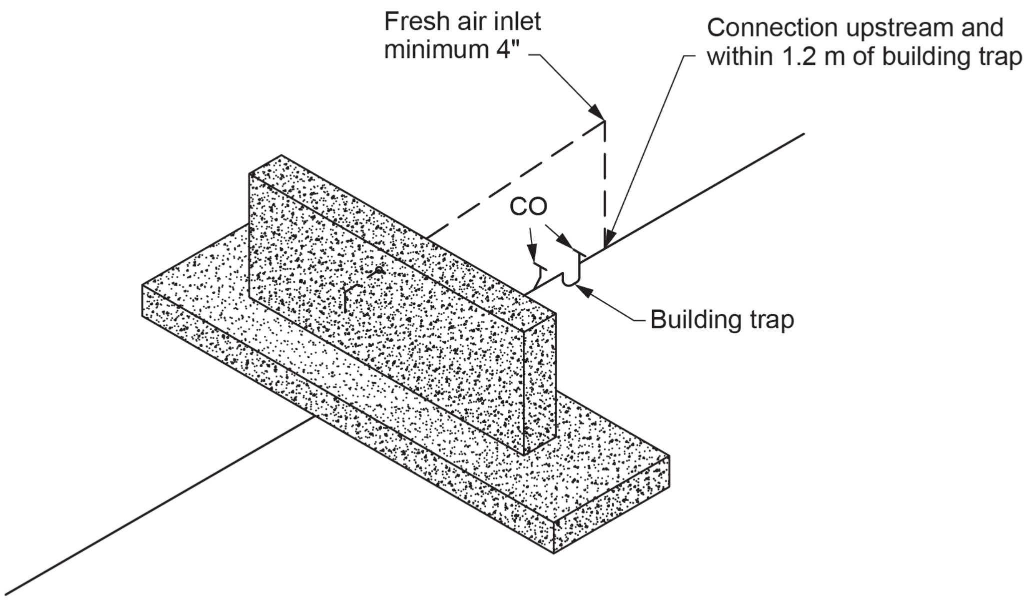

***Figure 19** NPC requirements for fresh air inlets. (Skilled Trades BC, 2021) Used with permission.*

Venting Requirements for Manholes Installed Inside a Building

The minimum size of a vent pipe that serves a manhole within a building shall be 50 mm (2 in.).

Venting Requirements for Oil and Grease Interceptors

In some instances, grease interceptors and, more often, oil interceptors are installed outside of the building structure. In this case, it is important to note that every vent pipe that serves an oil or grease interceptor located outside a building shall be not less than 75 mm (3 in.) in size in areas where it may be subject to frost closure.

An oil interceptor functions in the same way as a grease interceptor except that flammable fumes must be expelled using natural air currents. This is done by connecting the top area of adjacent compartments to allow air flow up through to individual “fume” vents that extend to open air. A vent is required on the outlet of the interceptors to prevent siphoning of the interceptor.

National Plumbing Code Requirements for Oil and Grease Interceptors

- Every oil interceptor shall be provided with two vent pipes that:
    - Connect to the interceptor at opposite ends
    - Do not connect to each other or any other vent pipe and extend independently to open air
    - Terminate not less than 2 m ($78\frac{3}{4}$ in.) above ground and at elevations differing by at least 300 mm (12 in.)
- The vent pipes are permitted to be one size smaller than the largest connected drainage pipe but not less than 32 mm (1.25 in.) in size or can be sized in accordance with the manufacturer's recommendations.
- Adjacent compartments within every oil interceptor shall be connected to each other by a vent opening (Figure 20).
- Where a secondary receiver for oil is installed in conjunction with an oil interceptor, it shall be vented in accordance with the manufacturer's recommendations, and the vent pipe shall:
    - In no case be less than 38 mm (1.25 in.) in size
    - Extend independently to outside air
    - Terminate not less than 2 m ($78\frac{3}{4}$ in.) above ground

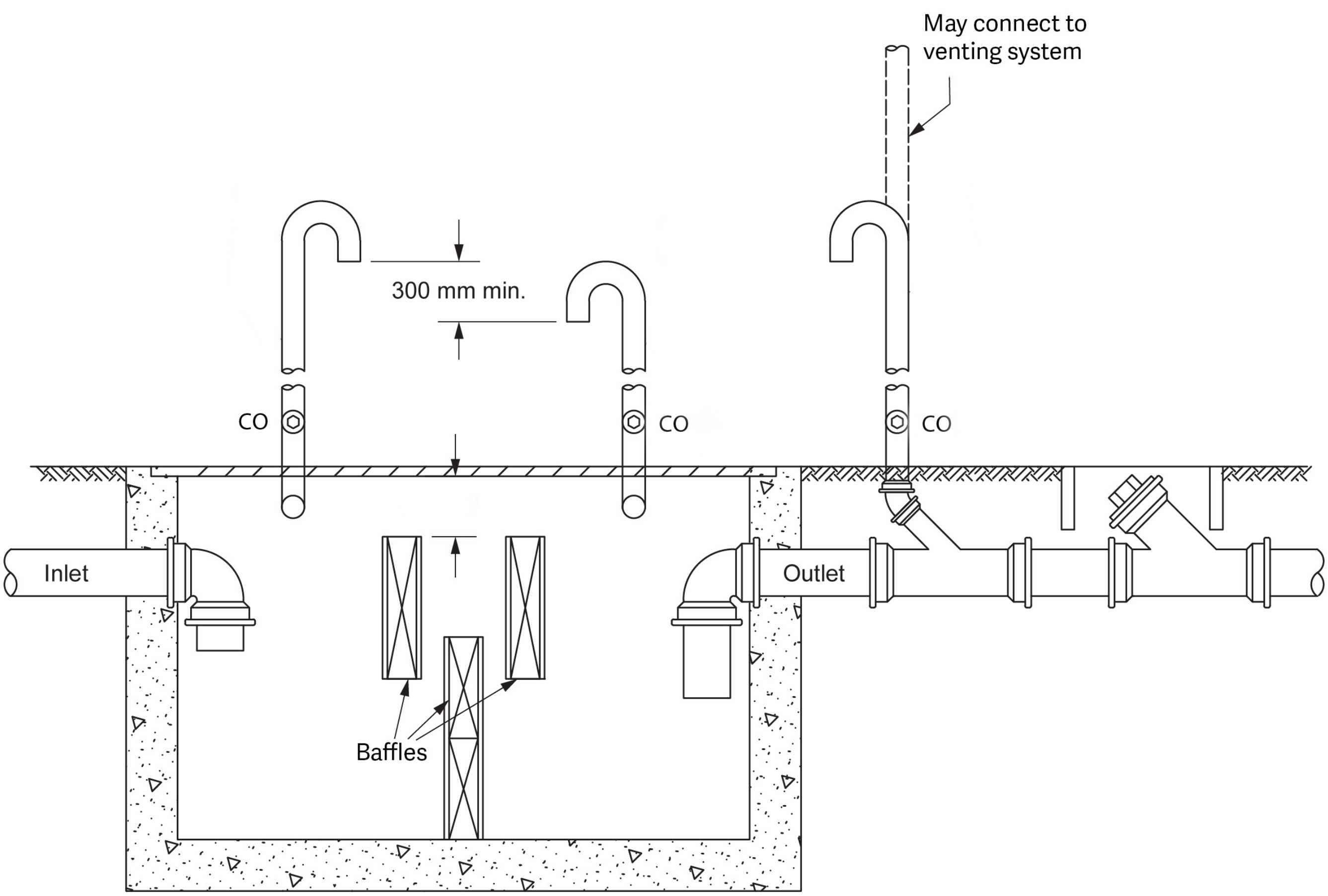

Figure 20 *NPC requirements for oil interceptor venting. (Skilled Trades BC, 2021) Used with permission.*

Vent Terminals

Vent terminals are fresh air inlets serving a building trap or vents serving an oil interceptor and must extend above the roof level. The proximity of the vent terminal location to windows, doors, or other ventilating openings must be considered.

National Plumbing Code Requirements for Vent Terminals

- The vent terminal should be located:
  - Not less than 1 m (39 in.) above or not less than 3.5 m (138 in.) in any other direction from every air inlet, openable window, or door
  - Not less than 2 m (47 in.) above or not less than 3.5 m in any other direction from a roof that supports an occupancy
  - Not less than 2 m above ground
  - Not less than 1.8 m (72 in.) from every properly line
- The vent terminal should be:
  - Terminated high enough to prevent the entry of roof drainage but not less than 150 mm (6 in.) above the roof or above the surface of storm water that could pond on the roof
  - Provided with flashing to prevent the entry of water between the vent pipe and the roof
  - Supported or braced if a vent pipe that may be subject to misalignment terminates above the surface of a roof
- The vent terminal shall be protected from frost closure by:
  - Increasing its diameter at least one size, but not less than 75 mm (3 in.) in size, immediately before it penetrates the roof
  - Insulating the pipe
  - Protecting it in some other manner
- Under certain conditions, a vent pipe is allowed to be installed outside a building, provided that the following conditions are met:
  - No single change in direction of the vent pipe exceeds 45°.
  - All parts of the vent pipe are nominally vertical.
  - In areas where the vent pipe may be subject to frost closure, it is increased to not less than 75 mm (3 in.) in size before penetrating a wall or roof.
  - Where the building is four storeys or less in height, the vent pipe terminates above the roof of the building.

Vent Pipe Flashing

Flashing fabricated on site for vent pipes shall be fabricated from one of the following:

- **Copper sheet:** not less than 0.33 mm (0.013 in.) thick
- **Aluminum sheet:** not less than 0.48 mm (0.0189 in.) thick
- **Alloyed zinc sheet:** not less than 0.35 mm (0.0138 in.) thick
- **Lead sheet:** not less than 1.73 mm (0.068 in.) thick
- **Galvanized steel sheet:** not less than 0.33 mm (0.013 in.) thick

- **Polychloroprene (neoprene):** not less than 2.89 mm (0.114 in.) thick

Hangers and Supports

The method of supporting pipes is regulated by the NPC. There are requirements for the type of materials you may use and how you may use them.

The hangers used to support pipe must be capable of supporting the pipe and its contents at all times. The hanger must be attached to the pipe and to the structural member holding the hanger in a satisfactory manner to maintain alignment. Where a hanger is attached to concrete or masonry, it shall be fastened by metal or expansion-type plugs inserted or built into the concrete or masonry.

Piping, fixtures, tanks, or devices shall be supported independently of each other, and every water-closet bowl shall be securely attached to the floor or wall by means of a flange and shall be stable. Wall-mounted fixtures shall be independently supported so that no strain is transmitted to the piping.

The hangers used must be compatible with the pipe they are supporting. You must use a hanger that will not have a detrimental effect on your piping. For example, you may not use a galvanized strap hanger to support copper pipe. As a rule of thumb, the hangers used to support a pipe should be made from the same material as the pipe being supported.

For example, copper pipe should be hung with copper hangers. This eliminates the risk of a corrosive action between two different types of materials. If you are using a plastic or plastic- coated hanger, you may use it with all types of pipe. The exception to this rule is for pipes carrying a liquid with a temperature that might affect or melt the plastic hanger.

Due to the flexibility and relatively soft wall composition of plastic pipe, the NPC has set out regulations regarding its support and requires that:

- When installing PVC, CPVC, or ABS plastic pipe:
  - The pipe shall be aligned without added strain on the piping.
  - The pipe shall not be bent or pulled into position after being welded.
  - Hangers shall not compress, cut, or abrade the pipe.
- Where PEX, PP-R, PE/AL/PE, or PEX/AL/PEX plastic pipe is installed, hangers shall not compress, cut, or abrade the pipe.
- Nominally horizontal piping inside a building shall be braced to prevent swaying and buckling and to control the effects of thrust.
- When supporting nominally horizontal piping, hangers with rods or metal strapping shall be:
  - If rods are used, they must be not less than:
    - 6 mm (0.25 in.) diameter to support piping 50 mm (2 in.) or less in size
    - 8 mm (0.315 in.) diameter to support piping 100 mm (4 in.) or less in size
    - 13 mm (0.50 in.) diameter to support piping over 100 mm in size
  - If solid or perforated metal straps are used, they must not be less than:
    - 0.6 mm (0.0236 in.) nominal thickness and 12 mm ($\frac{1}{2}$ or 0.50 in.) wide to support piping 50 mm or less in size
    - 0.8 mm (0.0315 in.) nominal thickness and 18 mm ($\frac{7}{10}$ or 0.70 in.) wide to support piping 100 mm or less in

size

Support Spacing

Depending upon the type of material being used and whether the pipe is installed horizontally or vertically, the spacing between hangers will vary. Both horizontal and vertical pipes require support. The regulations in the NPC apply to the maximum distance between hangers.

Vertical Piping Support Spacing

Vertical piping shall be supported at its base and at the floor level of alternate storeys by rests, each of which can bear the weight of the pipe between it and the rest above it. The maximum spacing of these supports shall be 7.5 m (24 ft 7.25 in.).

Horizontal Support Spacing

The maximum spacing of supports for nominally horizontal piping is dependent on the piping material, as shown in Table 2.3.4.5. (NPC, 2020, B 2-20; refer to Table 4 below).

Table 4: (From NPC Table 2.3.4.5.) Support for Nominally Horizontal Piping

Piping Material	Maximum Horizontal Spacing of Supports (m)	Additional Conditions
Galvanized iron or steel pipe: 150 mm (6 in.) NPS or larger	3.75	None
Galvanized iron or steel pipe: Less than 150 mm (6 in.) NPS	2.5	None
Lead Pipe	Throughout length of pipe	None
Cast-iron pipe	3.0	At or adjacent to each hub or joint
Cast iron pipe with mechanical joints measuring 300 mm (12 in.) or less between adjacent fittings	1.0	None
Stainless steel pipe or tube: 25 mm (1 in.) NPS or larger	3.0	None
Stainless steel pipe or tube: Less than 25 mm (1 in.)	2.5	None
ABS or PVC plastic pipe	1.2	At the end of branches or fixture drains and at changes in direction and elevation
ABS or PVC plastic trap arm or fixture drain pipe greater than 1 m (39 in.) long	N/A	As close as possible to the trap
CPVC pipe	1.0	None
Copper tube or copper and brass pipe, hard temper: Greater than 25 mm (1 in.) NPS	3.0	None
Copper tube or copper and brass pipe, hard temper: 25 mm (1 in.) NPS or less	2.5	None
Copper tube, soft temper	2.5	None
PE/AL/PE composite pipe	1.0	None
PEX/AL/PEX composite pipe	1.0	None
PEX plastic pipe	0.8	None
PE-RT tube	0.8	None
PP-R plastic pipe	1.0	At the end of branches and at changes in direction and elevation

Horizontal Underground Piping Support

- Nominally horizontal piping that is underground shall be supported on a base that is firm and continuous under the whole of the pipe.
- Nominally horizontal piping installed underground may be installed using hangers fixed to a foundation or structural slab, provided that the hangers are capable of keeping the pipe in alignment and supporting the weight of the pipe, its contents, and the fill over the pipe.

Protecting Piping

The NPC requires that the design and installation of every piping system shall include means to accommodate its expansion and contraction caused by temperature changes, movement of the soil, building shrinkage, or structural settlement.

Backfilling the Pipe Trench

Where piping is installed underground, the backfill shall be carefully placed and tamped to a height of 300 mm (12 in.) over the top of the pipe and be free of stones, boulders, cinders, and frozen earth.

Protecting Non-Metallic Pipe

Where asbestos-cement drainage pipe or vitrified clay is located less than 600 mm (24 in.) below a basement floor and the floor is constructed of other than 75 mm (3 in.) or more of concrete, the pipe shall be protected by a 75-mm layer of concrete installed above the pipe.

Isolation from Loads

Where piping passes through or under a wall, it shall be installed so that the wall does not bear on the pipe.

Protection from Frost

Where piping may be exposed to freezing conditions, it shall be protected from the effects of freezing.

Protection from Mechanical Damage

Plumbing, piping, and equipment exposed to mechanical damage shall be protected.

Seismic Restraint

British Columbia is a large and geographically diverse province. Seismic hazard varies across the province, covering the entire range from low to high risk. As a result, the building code has different **seismic restraint** requirements for mechanical system components in different regions of the province. Although the seismic restraints, including anchors to building structure, shall be specified by a registered professional structural engineer (P. Eng), you will be responsible for installing these components.

Because of this, good coordination with the design professionals involved with the building project is vital for the following reasons:

- The seismic restraints installed for a system can and will interfere with those of another system unless restraint locations are well-coordinated.
- Typically, piping systems are restrained with rigid braces that run upward at an angle from the pipe to the ceiling. The space required for the installed restraints can cause problems if non-structural walls need to be penetrated or other mechanical components are in the designed load path for the restraints.

Figure 21 shows different seismic restraint assemblies for piping systems.

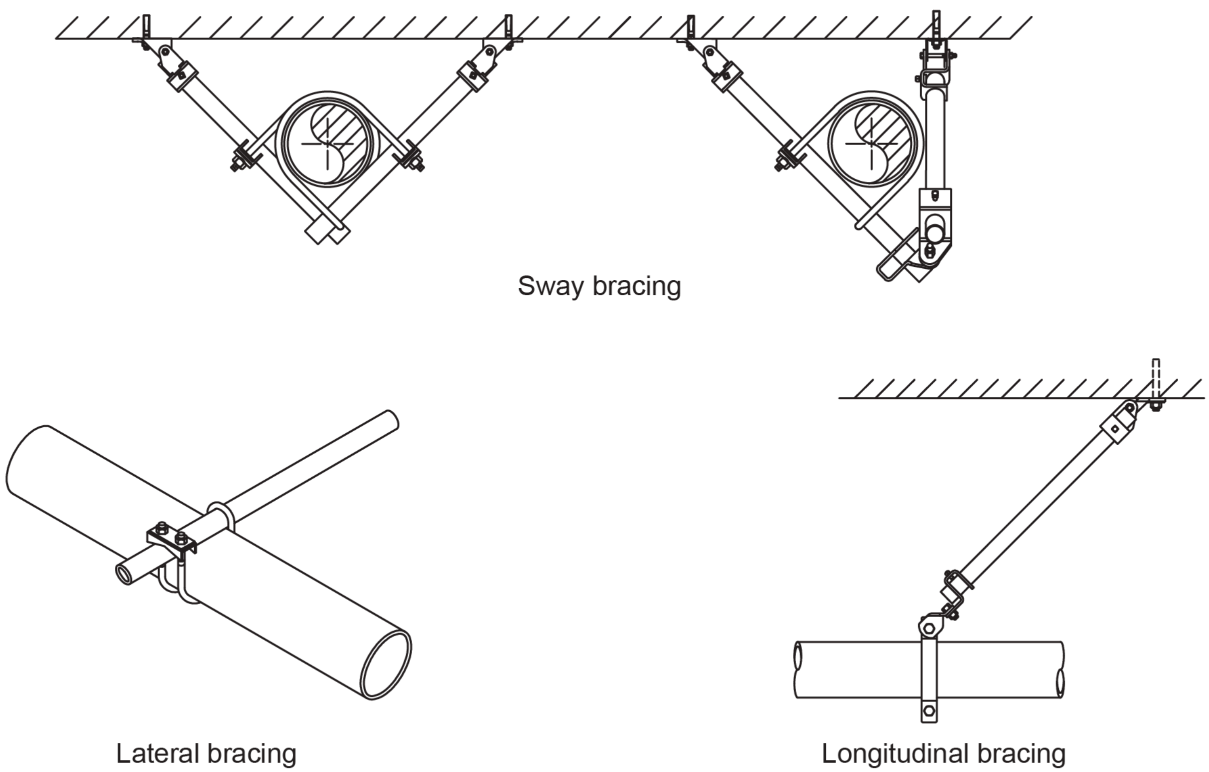

***Figure 21** Seismic restraint bracing assemblies. (Skilled Trades BC, 2021) Used with permission.*

Mechanical Component Anchorage

The purpose of a seismic restraint is to form a load path between the mechanical component and the building structure. It must be attached to a portion of the building structure capable of carrying the expected seismic loads.

Materials and Installation

Planning for the installation of seismic restraint components early in a project can greatly reduce the cost and complexity of the project. The P. Eng or manufacturer can provide comprehensive shop drawings and details to facilitate proper and cost-effective installation in accordance with existing standards and codes.

Installing seismic restraint hardware and seismic-rated vibration isolators requires the consideration of four aspects of the system:

1. **Attachment of the equipment to the restraint:** the equipment must be securely attached to the restraint, and this attachment must demonstrate sufficient strength to withstand the imposed forces and to allow for transfer of seismic forces into the restraint.
2. **Restraint design:** the strength of the seismic restraint must be sufficient to withstand the equipment-imposed forces.
3. **Attachment of restraint to the building structure:** this attachment is typically via bolts, welds, or concrete anchors. Typically this attachment is the "weakest link" of the overall system, especially when post-installed concrete anchors are used.
4. **Equipment fragility:** the ability of the equipment to continue to operate after being subjected to seismic force. This information must be obtained from the equipment manufacturer.

Joining Practices

Joints and connections in a DWV system must be water- and gas-tight at the required pressure for testing and their intended use. Many different material and joining practices may be used in a DWV system, and specific code requirements apply for each.

Plastic Pipe Transition

- Transition solvent cement shall only be used for joining an ABS drainage system to a PVC drainage system.

Caulked Lead Drainage Joints

- Caulked lead drainage joints shall not be used except for cast-iron pipe in a drainage system or venting system or between such pipe and:
  - Other ferrous pipe
  - Brass and copper pipe
  - A caulking ferrule
  - A trap standard
- Every caulked lead drainage joint shall be firmly packed with oakum and tightly caulked with lead to a depth of not less than 25 mm (1 in.).
- No paint, varnish, or other coating shall be applied on the lead until after the joint has been tested.
- A length of hub, spigot pipe, and pipe fillings in a drainage system shall be installed with the hub at the upstream end.

Wiped Joints (Lead Pipe)

- Wiped joints shall not be used except for sheet lead or lead pipe or between such pipe and copper pipe or a ferrule.
- Every wiped joint in straight pipe shall:
  - Be made of solder
  - Have an exposed surface on each side of the joint of at least 19 mm ($\frac{3}{4}$ in.) wide
  - Be not less than 10 mm (0.394 in.) thick at the thickest part
- Every wiped flanged joint shall be reinforced with a lead flange not less than 19 mm wide.

Screwed Joints

- When making a screwed joint, the ends of the pipe shall be reamed or filed out to the size of the bore, and all chips and cuttings shall be removed.
- No pipe-joint cement or paint shall be applied to the internal threads.

Flared Joints

- When making a flared joint, the pipe shall be expanded with a proper flaring tool and not be used for hard (drawn) copper tube.

Mechanical Joints (MJ and Victaulic)

- Mechanical joints shall be made with compounded elastomeric rings held in compression by stainless-steel or cast-iron clamps or groove and shoulder-type mechanical couplings.

Cold-Caulked Joints (Cement and Fibre Compound)

- **Cold-caulked joint**s shall not be used except for bell and spigot pipe in a water system, a drainage system, or a venting system.
- Caulking compound used in cold-caulked joints shall be applied according to the manufacturer's directions.
- Every cold-caulked joint in a drainage system shall be firmly packed with oakum and tightly caulked with cold-caulking compound to a depth of not less than 25 mm (1 in.).

Stainless Steel Welded Joints

- Stainless steel **welded joints** shall conform to ASME B31.9, "Building Services Piping."
- Butt weld pipe fittings shall be at least as thick as the wall of the pipe used.

Drilled and Tapped Joints

- Drilled and tapped joints shall not be made in a sanitary drainage pipe or vent pipe and fittings unless suitable provision has been made for drilling and tapping.

Welded Joint Restrictions

- Galvanized steel pipe and fittings as well as cast-iron soil pipe and fittings shall not be welded.

Unions and Slip Joints

- Running thread and packing nut connections and unions with a gasket seal shall not be used downstream of a trap weir in a drainage system or in a venting system.
- A slip joint shall not be used in a venting system or drainage system, except to connect a fixture trap to a fixture drain in an accessible location.

Increasing or Reducing Size

- Every connection between two pipes of different size shall be made with an increaser or a reducer fitting installed so that it will permit the system to be completely drained.

Joining Dissimilar Metals

- Adaptors, connectors, or mechanical joints used to join dissimilar materials shall be designed to accommodate the required transition.

Connection of Floor Outlet Fixtures

- Every pedestal urinal, floor-mounted water closet, or s-trap standard shall be connected to a fixture drain by a floor flange, except a cast-iron trap standard which may be caulked to a cast-iron pipe.
- Every floor flange shall be brass, except that where cast-iron or plastic pipe is used, a floor flange of the same material may be used.
- Every floor flange shall be securely set on a firm base and fastened to the floor or trap flange of the fixture.
- Water-closet bowls shall be securely attached to the floor flange, floor, or wall carrier.
- Every joint in a floor flange shall be sealed with a resilient watertight and gas-tight seal.
- Where a lead water-closet stub is used, the length of the stub below the floor flange shall be not less than 75 mm (3 in.).

Indirect Connections

- Where a fixture or device is indirectly connected, the connections shall be made by terminating the fixture drain above the flood level rim of a directly connected fixture to form an air break.
- The size of the air break shall at least equal the size of the fixture drain, branch, or pipe that terminates above the directly connected fixture, and it shall be not less than 25 mm (1 in.).

Self-Test D-1.10: Requirements and Prohibitions for DWV Systems

Complete Self-Test D-1.10 and check your answers.

If you are using a printed copy, please find Self-Test D-1.10 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.

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D-1.11 Trade Waste Systems

Provincial and federal plumbing codes have been developed with a focus primarily on the conveyance of liquid waste generated by domestic plumbing fixtures, such as toilets, basins, bathtubs/showers, kitchen sinks, and laundries. When used in a residential settings, these fixtures normally have a discharge with little fats, oils, grease ("FOGs"), and other constituents that may have a negative impact on the private or municipal sewage system to which they are connected. As such, they are routinely drained directly into such systems without needing any pre-treatment.

Establishments other than residential occupancies may be required to install special piping arrangements and pre-treatment systems, known as **trade waste system**s, when deemed necessary by the authority having jurisdiction (AHJ). Trade waste is sewage that may be of significantly increased organic strength compared to domestic sewage and may also contain other substances, such as high levels of fats and grease, heavy metals, organic solvents, and chlorinated organic substances. These pollutants can harm people, the environment, and the wastewater system; they are removed by installing some form of interceptor. As well, some commercial and industrial processes may wish to reclaim valuable constituents, such as silver in photo finishing labs, that may otherwise be lost through the drainage system.

An **interceptor** is defined in the National and BC Plumbing Codes as "a receptacle that is installed to prevent oil, grease, sand or other materials from passing into a drainage system." Interceptors come in a variety of types and sizes and are typically a manufactured item; however, they can also be constructed on-site, such as a concrete sump or catch basin for stormwater systems (covered in this textbook's section on storm drainage systems).

Many plumbing professionals of an "older vintage" may remember what trade waste systems are and why they may be necessary, but definitions for trade waste systems are no longer included within current versions of either the National Plumbing Code of Canada or the BC Plumbing Code. One would have to look back to the 2007 version of the BC Plumbing Code to find the last regulatory definition for a trade waste system, which is as follows:

> *Trade waste system means a system of drainage pipes from floor drains and hub drains located in food display areas that are intercepted by a trade waste sump and backwater valve before entering the sanitary building drain.*

Another definition for trade waste can found in a reference from a current regulation in Auckland, New Zealand, which reads:

> *Liquid trade waste is any discharge to a sewerage system other than domestic waste from a hand wash basin, shower, bath or toilet.*

Yet another reference is found within a current publication from the locality of Victoria, Australia:

> *Trade waste is any water that goes down the drain that has been used in a commercial environment for food preparation, cooking, cleaning dishes or cleaning the kitchen area.*

Regardless of the origin or jurisdiction of the definition, the intent seems clear: any discharge into a sewage system from fixtures or appurtenances other than those found in a residential setting may be referred to as "trade waste" and may therefore require special consideration by the AHJ and the installer.

Cities and municipalities are empowered under the provincial Environmental Management Act to regulate the discharge of waste into their sewers. As well, although not specifically mentioned in our federal and provincial plumbing codes, the requirement for a trade waste system can be interpreted from those codes in Clause 2.4.4.1.(1) "Sewage Treatment," which states:

> *Where a fixture or equipment discharges sewage or waste that may damage or impair the sanitary drainage system*

or the functioning of a public or private sewage disposal system, provision shall be made for treatment of the sewage or waste before it is discharged to the sanitary drainage system.

This means that the undesirable component(s) within the discharge must be either removed or rendered harmless to the system downstream. This would involve using some type of interceptor.

Grease Interceptors

There is some confusion in the field over the use of the terms "grease trap" and "grease interceptor." In the United States, their two main model codes have, in the past, determined that the use of the two terms was dependent upon the flow rates or maximum capacities involved. In Canada, we make no such distinctions, and the terms are synonymous, meaning that they both refer to the same piece of equipment. A grease interceptor cannot be used as a trap for the fixture feeding it unless it can be proven that the interceptor can provide a minimum 38 mm ($1\frac{1}{2}$ in.) trap seal. In most cases, this is difficult to prove, so any fixture draining into the grease interceptor will need its own trap. As well, if the interceptor qualifies as a trap, then it will have to be placed within 1,200 mm (4 ft) of the furthest outlet on the sink that feeds it, in order to comply with Clause 2.4.8.2.(1) in the code (NPC, 2020, B 2-30).

The most common type of trade waste system found in the field is a "passive" or "hydromechanical" grease interceptor serving a commercial pot sink or similar type of fixture. These systems are commonly required in any commercial kitchens that cook food on site, such as restaurants and fast food outlets. Only the grease-handling fixtures will be piped into the grease interceptor. This allows for more accurate sizing and cost effectiveness.

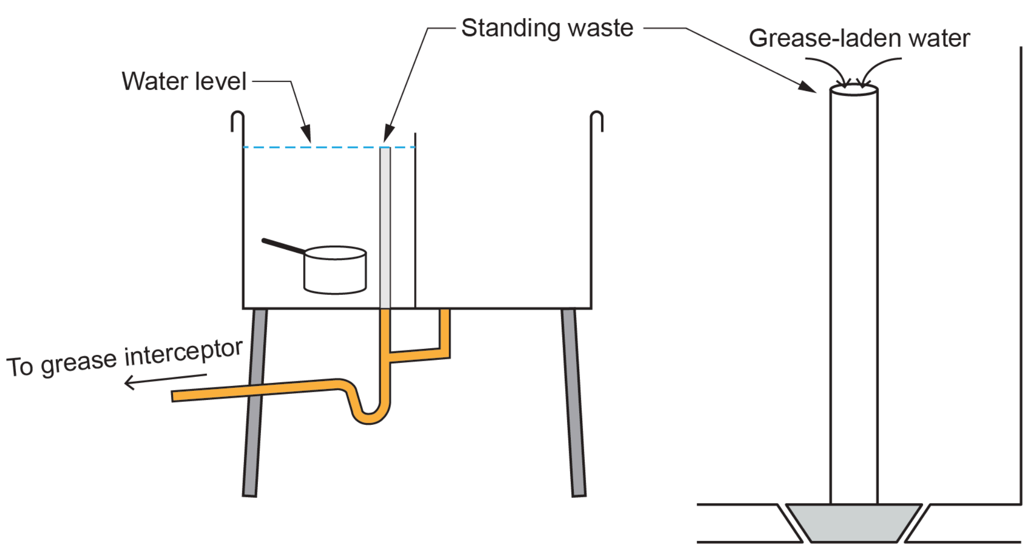

Figure 1 *Commercial pot sink with standing waste. (Skilled Trades BC, 2021) Used with permission.*

In a commercial kitchen, greasy pots and pans are submerged in a compartment of a pot sink that has a standing waste inserted into its drain opening. A slow supply of hot water is allowed to constantly run into the sink compartment. The resulting grease-laden water spills into the top of the standing waste and is directed via the sink's outlet piping to a grease interceptor.

Grease Interceptor Operation

It is a popular misconception that grease interceptors work best if the grease-laden discharge entering the interceptor is as cool as possible. This only serves to plug the inlet piping with grease that has come out of solution too soon. Rather, interceptors function best if the incoming fluid is kept as hot as possible. This allows the grease to separate, cool, and solidify inside the interceptor, where it can be stored until manually removed by hand or, more commonly, cleaned out on a regular interval by companies that use **"jet vac" trucks.** Also, keeping the interceptor as close as possible to the fixture feeding it ensures the water stays as hot as possible. A flow control fitting installed on the inlet piping or within the interceptor at its inlet ensures that the flow rate through the interceptor is kept to design limits and turbulence within the interceptor is kept to a minimum, which enhances its operation.

Most plumbing codes require a cleanout be installed immediately downstream of any grease interceptor, due to the probability that some grease will make its way through the unit and, over time, clog the piping.

Operationally, it is suggested to use as little detergent as possible. Soaps and detergents act to break down the **fats, oils, and greases (FOGs)** into much smaller particles that tend to move through the interceptor rather than rise and be trapped within it. This is problematic for all downstream piping as well as the treatment facility at the end of the system.

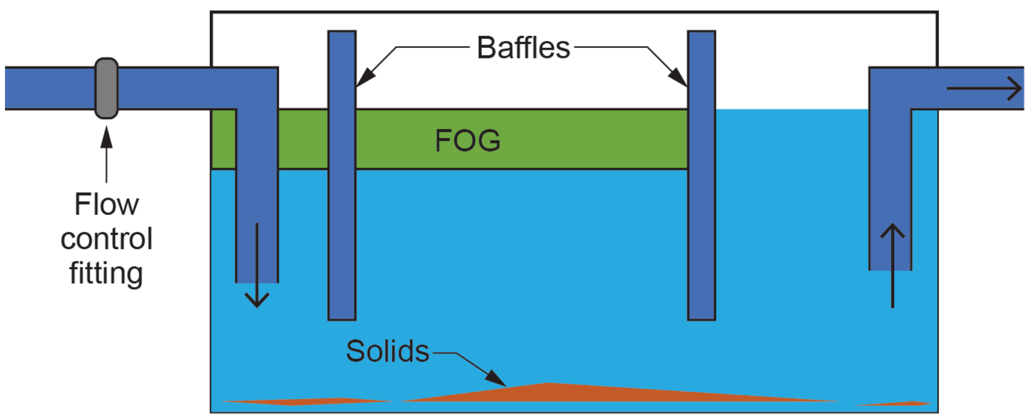

Figure 2 *Grease interceptor. (Skilled Trades BC, 2021) Used with permission.*

Grease interceptors are boxes constructed of stainless steel, plastic, or epoxy-coated steel. Wastewater or effluent enters the interceptor and fills the tank. A system of baffles may be used to slow down water and allow FOGs to cool and effectively separate. Solids settle or sink and either accumulate at the bottom or, if small and light enough, are carried off through the outlet and usually do not pose problems downstream. Some models may have a strainer to catch solids, reducing the quantity settling in the bottom of the interceptor. FOGs, having a specific gravity less than water, float and accumulate at the top. Effluent siphons out the outlet to the downstream drainage system piping.

FOGs and solids sit in the interceptor until emptied (a task advised when the box is approximately 25% full). The stagnant waste can often lead to bad smells, an increased risk of pest infestation, and less-than-sanitary kitchens. Be aware that if passive grease interceptors are neglected, they will become ineffective as the tank fills with FOGs, and the drainage rate slows or stops.

Automatic Grease Interceptors

Automatic grease interceptors are often considered a more sophisticated grease removal system than the passive variety, with solids and grease being separated from grey water into collection containers ready for daily disposal.

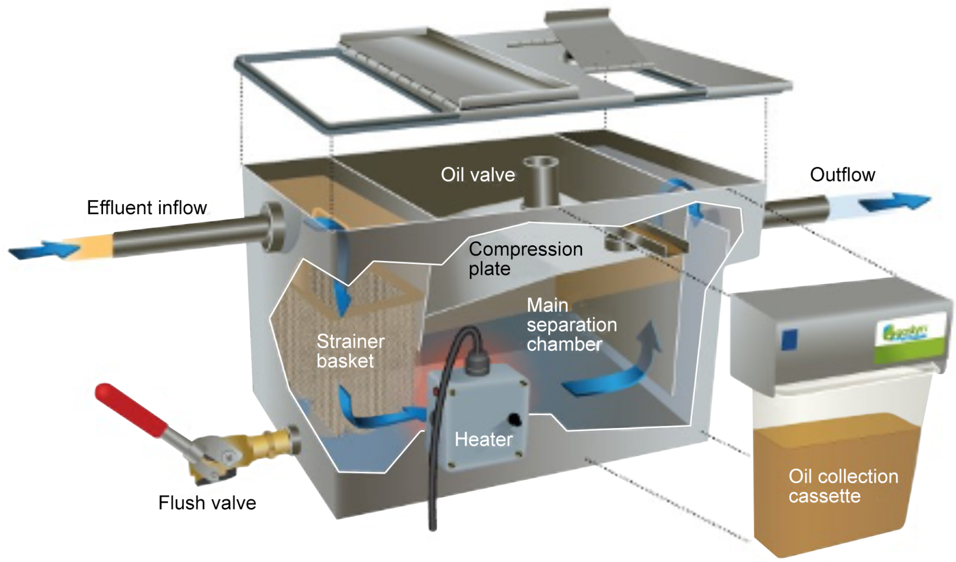

Figure 3 *Automatic grease interceptor (Image courtesy ACO, Inc.). All rights reserved.*

In an automatic grease interceptor, wastewater enters the grease trap and passes through a filter that collects solids. Water mixed with FOGs flows through to the main chamber. Non-mechanical grease recovery units employ a small heater that prevents FOGs from cooling and solidifying, using hydrostatic pressure to force FOGs out into an external oil container.

Automatic mechanical models allow FOGs to cool and separate to the surface (as with passive); however, they regularly skim the top layer into a separate collection container.

In either case, water continues the journey into the sewer via the outlet, unaccompanied by any unwanted additions. FOGs and solids are effectively separated into independent containers that can be easily disposed of by staff members without needing to shut the kitchen down and force down time. A major benefit of automatic grease separators is that they continuously remove FOGs to maintain the ongoing efficiency of the trap.

The addition of grease-busting enzymes to the waste entering interceptors is discouraged, as the now-minute particles of grease and fats move through the interceptor into the system downstream and become a problem there rather than being contained and removed within the interceptor.

Interceptors can be installed fully exposed on the floor, fully or semi-recessed into a floor, or located completely underground. The key point remains that they will need to be accessible for cleaning and servicing.

Sizing Grease Interceptors

Grease interceptors are sized according to the rate of incoming flow in US gallons per minute (USGPM). Associated with the incoming flow rate is an interceptor's storage capacity. The rated capacity, in pounds (lb), is listed at twice the flow rate, in GPM. For example, a 10 GPM interceptor has a rated capacity of 20 lb of grease.

Example:

Suppose that a two-compartment commercial pot sink has compartments that measure 18 in. in length by 18 in. in width by 16 in. in depth. The two compartments will, therefore, have a capacity of $18 \times 18 \times 16 \times 2 = 0\,368 \text{ in.}^3$. One US gallon (the typical unit of measure) is 231 in.^{3}, which translates to a capacity of $10\,368 \div 231 = 44.88 \text{ USG}$.

A common assumption in grease interceptor sizing methods is that a full sink in use will have roughly 25% of its volume taken up by pots, pans, and other items being washed, so $44.88 \times 0.75 = 33.66$ US gallons of grease-laden water to process. Industry-standard drain down time is expected to be one minute, so the correct interceptor to choose should have a flow rate of at least 33.66 GPM and will, therefore, have a storage capacity of approximately 67.3 lb of grease.

One would then consult manufacturers' charts to select an appropriate model and size. When the desired flow rate falls between two model sizes, always defer to the larger size.

Interceptors are the intended terminus of unwanted materials being carried through any trade waste system, and there are many types to choose from. The following is an example list of interceptors that Watts Industries manufacture:

- **Art rooms, dental labs, metal recovery:** SI-742, SI-742-L, SI-762
- **Commercial laundry, washing machines:** LI-800
- **Cooking, prep sinks, dishwasher:** WD Series, GI-K Series
- **Elevator pits & oil spill areas:** OI Series, OI-K Series
- **Hair wash sinks:** SI-750, SI-750-TO
- **Pot, pan, scullery sinks:** WD Series, GI-K Series
- **Sand and sediment:** SA Series, See Also FD-410
- **Catch basin vehicle and maintenance areas:** OI Series, OI-K Series

Other Trade Waste Systems

Pot sinks draining into grease interceptors is an example of only one type of trade waste system. Figure 4 is an example of a trade waste system that might be found in a food processing plant. In essence, it is a type of circuit-vented system that is allowed to have flat dry vents as long as there are appropriately placed cleanouts installed.

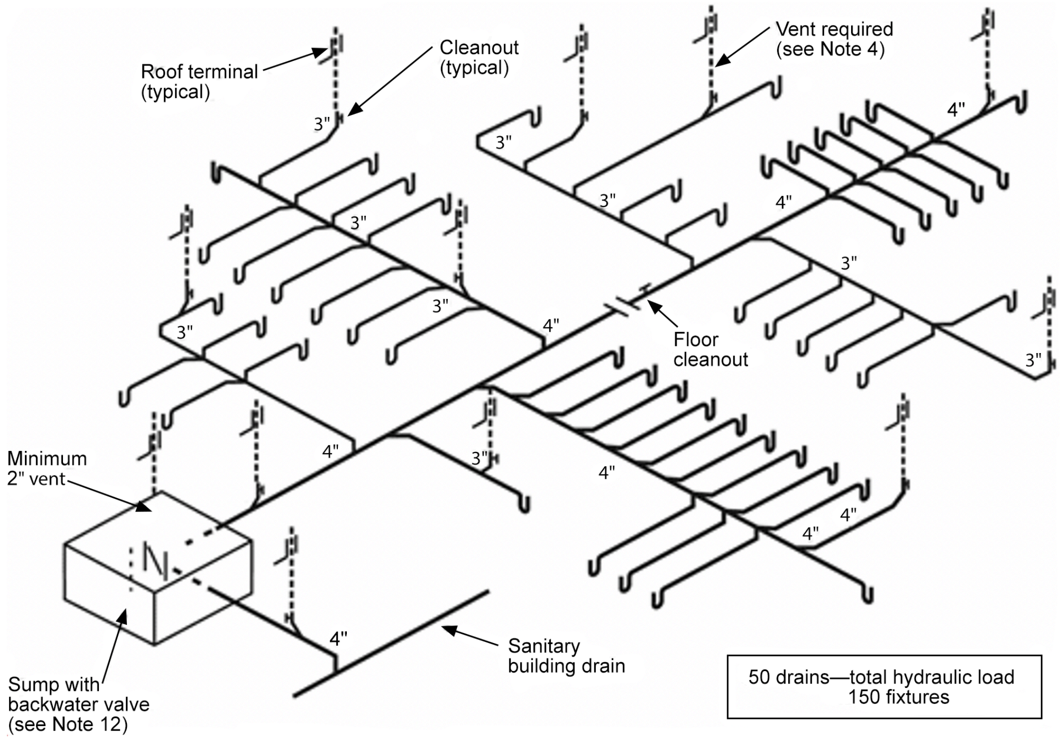

Figure 4 *Sump with backwater valve. (Skilled Trades, BC, 2007)*

The diagram above appeared in A-7.4.2.1.(5) of the appendix in the 2007 edition of the BC Plumbing Code but has not been published in the plumbing codes since. However, most plumbing officials are aware of its previous existence and intent and may refer to it when specifying to customers the mandated use of a trade waste system.

The following are the referenced clauses that accompanied the diagram in the appendix:

- This system is restricted to discharge only from product display cases, ice machines, cooler condensate, and emergency discharge from a heat reclaim pump.
- Hydraulic load for traps in trade waste systems should be:
  - 3 FUs for a 3 in. trap
  - 4 FUs for a 4 in. trap
- All drainage branches should be sloped at a minimum of a 1 in 50 slope for pipes up to 3 in. in diameter and 1 in 100 for 4 in. in diameter and over.
- Trap arms should have a downward slope in the direction of flow with a minimum of a 1 in 50 slope and shall not exceed the pipe diameter.
- Fixture outlet pipes should have a developed length not greater than 900 mm.
- A reduction of pipe size on a horizontal branch should leave a vent at the point of reduction.
- All vents should be not less than 1.5 in. in diameter
- Any dry vent should roll off the top of a horizontal waste pipe where possible.
- Heat reclaim trenches should be provided with an emergency pumped drain and an alarm system.
- Trade waste system sumps should be a minimum 24 in. square and up to 48 in. in depth. Larger sumps are required for greater depths. Sumps should have an 18 in. liquid depth and should be provided with a backwater valve at the outlet.
- Trade waste systems should be restricted to a single floor level.

As well, the two clauses below were included in the code reference above.

> **A-7.4.3.3.(1)** Waste with Organic Solids. Equipment such as garbage grinders and potato peelers produce waste with organic solids. These devices reduce most waste into small- sized particles that will flow easily through the drainage system. However, if they are located upstream of the interceptor, the particles could block the interceptor.

The above clause still exists in both the BC and national codes, in 2.4.3.3 (1) and (2), but is a bit more definitive in that it prohibits any equipment discharging waste that contains organic solids from being installed upstream of a grease interceptor unless an organic solids interceptor is installed in between them.

> **A-7.4.4.3.(1)** Grease Interceptors. Grease interceptors may be required when it is considered that the discharge of fats, oil or grease may impair the drainage system. Information on the design and sizing of grease interceptors can be found in ASPE Data Book, Volume 4, Chapter 8, Grease Interceptors.

The above clause has been replaced and expanded upon in the current codes. Clauses 2.4.4.3.(1), (2), (3), and (4) identify the code requirements for instances where a grease interceptor, oil interceptor, or interceptors for sand, grit, and other such materials must be installed. Any other locations or situations are left to the discretion of the authority having jurisdiction.

As well, Clauses 2.4.4.4.(1) and (2) of the current code editions spell out the requirements for the installation of neutralizing and dilution tanks for acid waste. These would also be considered a specific type of interceptor.

Oil Interceptors

Oil interceptors are designed for use in drain lines from areas where oils, sediment, and other liquids are found. These areas may be parking garages, machine shops, service stations, aircraft hangars, industrial and manufacturing facilities, etc., and all need an environmentally sensible way to be drained.

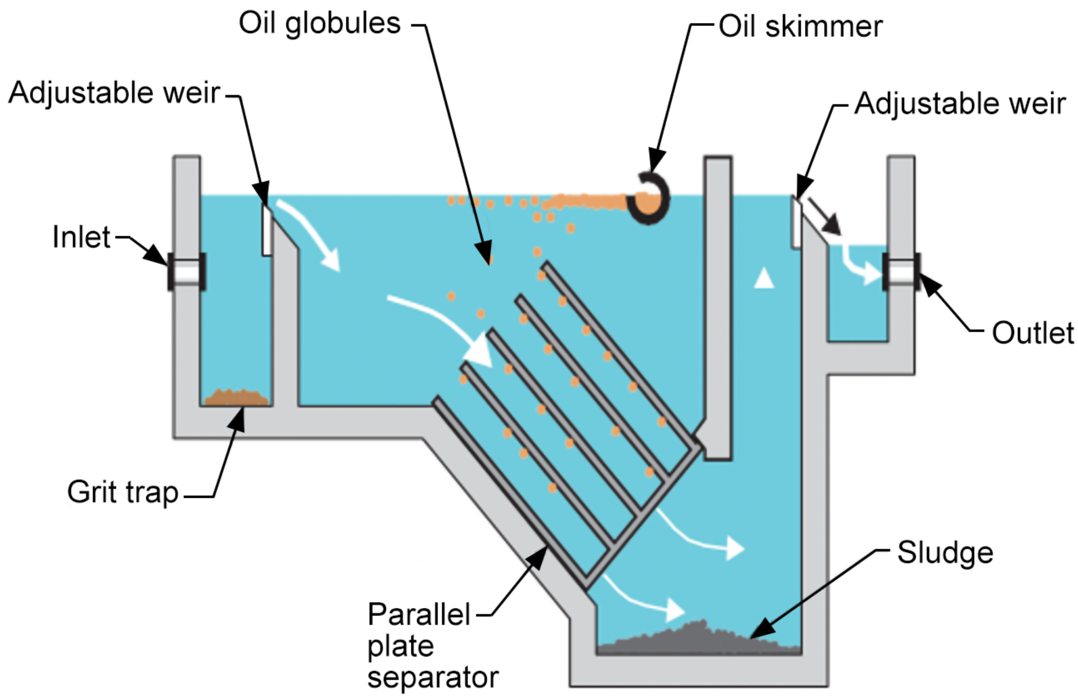

Figure 5 *Oil interceptor. (Skilled Trades BC, 2021) Used with permission.*

Operating an oil interceptor is very similar to that of a passive grease interceptor. The solid baffle plate opposite the inlet to the oil interceptor diffuses the flow into the interceptor and lessens the turbulence of the oil-laden water as it enters the intercepting chamber. Solids and sludge carried in the water are stopped by the baffle and collected in the solids retaining bucket between the inlet and the flow-retarding baffle. Such accumulation can then be removed. The resulting quiet, even flow of water through the interceptor permits the oils and other light density substances to rise to the surface by the "flotation" principle of separation. Oils are less dense than water; therefore, gravity causes the oil to float to the surface of the water. Maximum separation and interception is proportional to the elimination of turbulence of wastewater within the interceptor. The unique baffle/bucket design permits almost 90% of the interior of the interceptor to be used for oil separation.

Like in grease interceptors, oil interceptors are constructed of 100% epoxy-coated steel for long-lasting performance and durability.

Some models have an oil draw-off assembly that allows the separated oils and other similar light-density substances automatically drain out through a properly adjusted internal stand pipe. A pipe connection from the internal adjustable standpipe is connected to an oil drain line leading from the oil interceptor to an oil storage tank, which may be a component of the interceptor (Figure 7), or may be separate from the interceptor.

A standpipe sleeve (brass tube) within the oil containment compartment must be adjusted so the opening is $\frac{1}{8}$ in. above the top of the normal water flow level in the interceptor chamber. The oil that floats to the surface will drain off by gravity flow as waste water flows through the interceptor. When the adjustable sleeve in the standpipe is correctly set, no water will drain off with the oil, and there is no need to manually skim the oil.

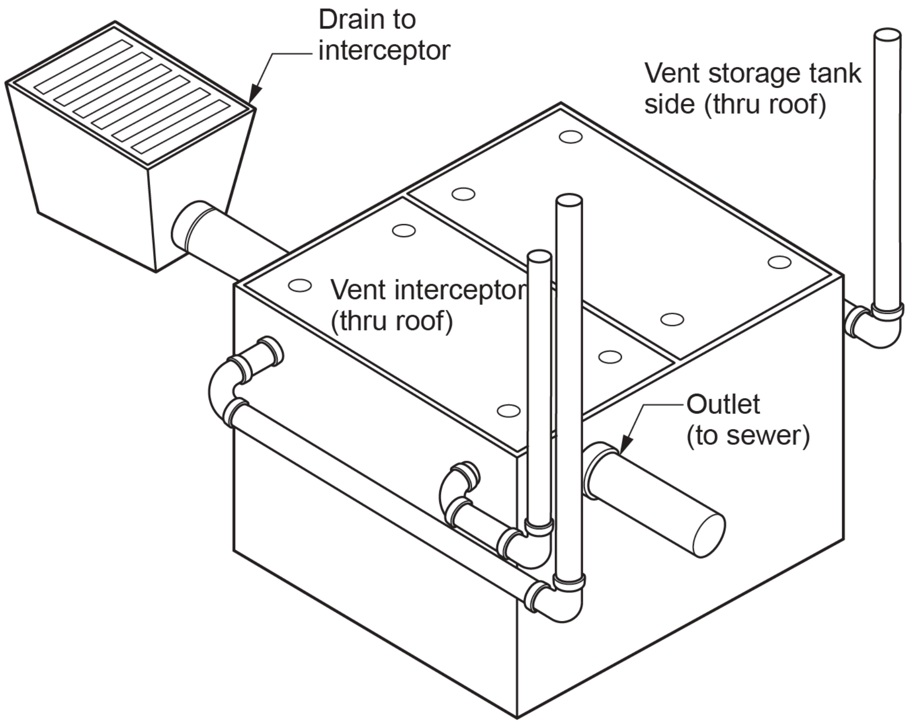

Figure 6 *Combination oil interceptor/oil storage tank. (Skilled Trades BC, 2021) Used with permission.*

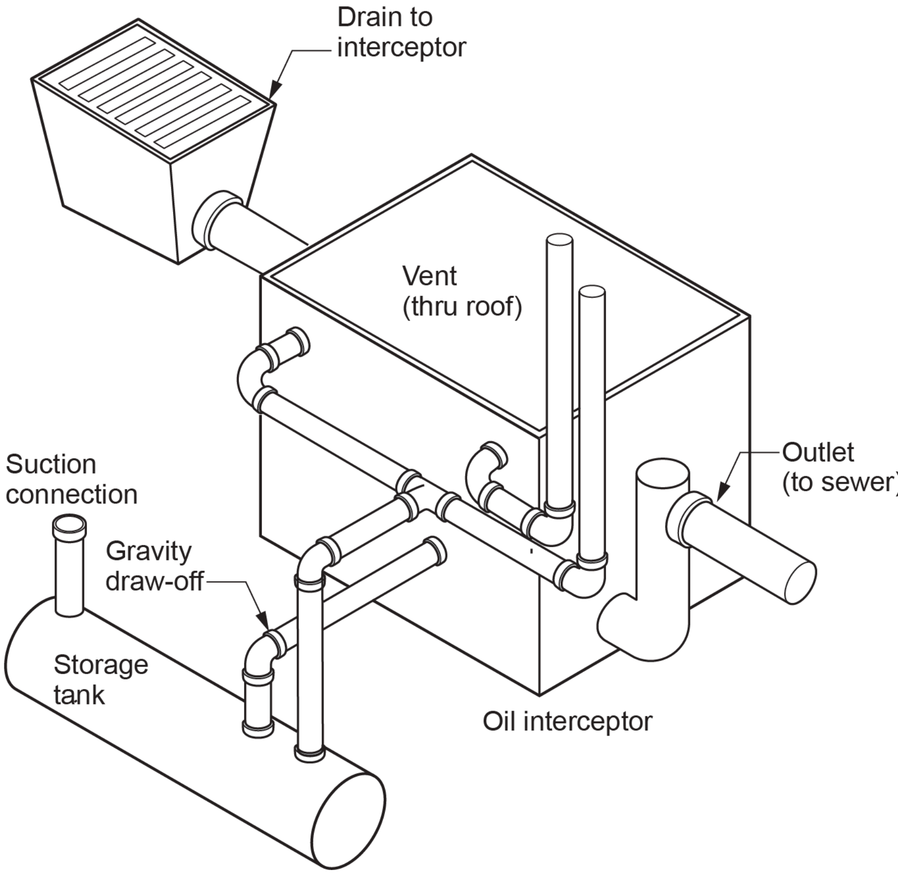

Figure 7 *Oil interceptor with separate storage tank. (Skilled Trades BC, 2021) Used with permission.*

Dilution and Neutralization Tanks

pH is a measure of the hydrogen ion (H^+) concentration in a liquid and classifies liquids as being acidic or caustic. pH values range from 0 to 14 and indicate the degree of acidity or alkalinity of a liquid. A liquid with a pH value below 7 is acidic, and a liquid with a pH value above 7 is alkaline. A pH of 7 indicates that a liquid is neutral.

Liquid discharges that are either too acidic or too caustic may cause corrosion damage to downstream piping systems and may also adversely affect the environment or create problematic conditions for **waste water treatment** plants. It should be noted that acidic and caustic liquids can be equally harmful; hence they should be treated with equal attention. Chemical effluent should be treated to ensure that the pH level is as close to 7 as possible or to other values dictated by the authority having jurisdiction.

Generally, effluent with a pH range of 5.5 to 8.5 can be disposed of without treatment, but local requirements may vary and must be adhered to. However, even mild caustics and acids within this range can cause severe damage to piping systems, depending on the piping material. Therefore, it is recommended that the composition of piping materials is checked against both the predicted pH discharge level and the individual chemicals being discharged to ensure compatibility.

Neutralization

Neutralization is a chemical reaction resulting from the physical mixing or extended contact of a base and an acid to form a neutral solution of water and salt. This neutral solution is suitable for discharge into sanitary sewer systems. Neutralization is accomplished by one of three methods:

1. Dilution
2. Limestone chips (calcium carbonate)
3. Chemical dosing

Dilution

Dilution involves physical mixing the chemical waste with water to stabilize (dilute) the waste. Initial dilution can be as simple as flushing the chemical with water at the sink and discharging the mixture through a p-trap and the associated drainage piping. Alternatively, dilution can be accomplished via a large dilution trap (dilution tank) located under the bench at each sink. In either case, the waste piping should discharge into a central neutralization system for further treatment prior to discharging into the sewer system.

Limestone Chip Neutralization

In a typical system, acidic waste is drained into a plastic tank filled with high purity limestone chips that are 1–3 in. in diameter with a calcium carbonate ($CaCO_3$) content of at least 90%. After a designed dwell time in the tank, the chemical is neutralized and subsequently discharged by gravity flow into the sewer. The chemical reaction creates an off-gassing, and therefore, these tanks should be vented. The limestone is used up in the process and must be replaced periodically. Dilution and neutralization using limestone chips is most commonly used as a small-scale point-of-use treatment.

Note that an alkaline solution can be as corrosive and problematic to systems and piping as an acidic solution. An alkaline solution with a pH of more than 7 would require an acid to neutralize it and bring its pH level down to near 7.

Chemical-Dosing Neutralization Systems

Instead of using limestone chips for neutralization, chemicals can be injected into the waste stream to achieve the same result. Sophisticated controls monitor the process and introduce a solution of acid, base (alkali), or both into the chemical waste holding tank via metering pumps, controls, and mixers. The resulting liquid mixture chemically reacts to form a salt and water composition, which is then discharged by gravity flow into the sewer. These systems are usually installed in large buildings that contain laboratories and similar operations. The tanks can sometimes be as large in volume as a classroom.

Solid Interceptors

Solids interceptors are perhaps the least sophisticated variety of interceptor. They are designed to recover all types of solids from precious metal particles to food waste, plaster, clay, or similar materials. This is accomplished through the principle of gravity separation. Particles of various sizes and weights are trapped in a bucket. Some varieties of solids interceptors have a replaceable filter bag (similar to a vacuum cleaner) for ease of disposal.

The wastewater flows from the inlet piping into the removable bucket or filter bag, passes through a screen into the main body chamber, and then exits the interceptor to the sanitary drainage system. An example of a solids interceptor would be a hair trap installed on the fixture outlet piping from a beauty parlour sink.

Figure 8 *Hair trap. (Skilled Trades BC, 2021) Used with permission.*

Interceptor Venting

The venting of interceptors should conform to the manufacturers' specifications but must also satisfy the requirements of the plumbing code. A-2.5.5.2 in the "Notes to Part 2" of the BC and National Plumbing Codes shows a graphic of suggested venting for an oil interceptor. The following are some examples of code requirements for venting sewage sumps, oil interceptors, and dilution tanks.

If a sewage sump is used as an interceptor, Clause 2.5.5.5.(1) states that it must be provided with a vent pipe connected to the top of the sump, and Article 2.5.7.7 states that it shall be a minimum size of one size smaller than the size of the largest branch or fixture drain connected to the sump and be at least 2 in. but need not be larger than 4 in.

Oil interceptors have many venting requirements found in Article 2.5.5.2, the most significant being that any vents from oil interceptors cannot be interconnected with other vents. They must extend independently to outside air and differ in elevations where they terminate.

Dilution tank venting requirements are found in Article 2.5.5.3 and 2.5.5.7 and are similar to those for venting sewage sumps.

Consult the applicable plumbing codes for the full scope of venting requirements for interceptors.

Self-Test D-1.11: Trade Waste Systems

Complete Self-Test D-1.11 and check your answers.

If you are using a printed copy, please find Self-Test D-1.11 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.

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- **Figure 3** Automatic grease interceptor (https://goslyn.com/product/4-gpm-grd-gos20/) [Goslyn diagram] is from ACO, Inc., and is used with permission. All rights reserved. [Note, this image is no longer on the original website.]
- **Figure 4** Sump with backwater valve is from Skilled Trades BC (2021). The original image (https://free.bcpublications.ca/civix/document/id/public/vbbl2007/building_B_appA_P7) is Figure A-7.4.2.1.(5). from the British Columbia Building Code 2007, also from Skilled Trades BC (2007).
- **Figure 5** Oil interceptor was modified by Skilled Trades BC (2021). The original image was from Mbeychok (https://en.wikipedia.org/wiki/User:Mbeychok) at English Wikipedia (https://en.wikipedia.org/wiki/), licensed under the CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0/deed.en) license.

Self-Test D-1.1 Codes and Standards

Complete Self-Test D-1.1 and check your answers.

1. Which governing body is responsible for issuing plumbing permits?
    a. Municipal
    b. Provincial
    c. Federal
    d. Technical safety branch

2. In the province of BC, which document provides the minimum requirements for building plumbing systems?
    a. BC Building Code
    b. National Plumbing Code
    c. BC Plumbing Code
    d. CSA Gas Code

3. Which document may be adopted by provincial and territorial governments to regulate the design and installation of plumbing systems with or without adaption to local needs?
    a. BC Building Code
    b. National Plumbing Code
    c. BC Plumbing Code
    d. Sewage System Regulation

4. Which of the following organizations maintains records of onsite sewage systems installed in BC?
    a. Ministry of Health
    b. AHJ or local municipal government
    c. BCWWA
    d. Ministry of Development

5. How does the National Plumbing Code identify any technical changes or additions found in the latest edition of the code?
    a. Bulletins
    b. Highlighted sections
    c. Vertical line in margin
    d. Italics

6. Which of the following processes would require a plumbing permit?
    a. Installing new piping
    b. Adding additional fixtures
    c. Opening a wall to replace piping
    d. All of the above

7. What does a municipal government use to require a plumber apply for a permit for work?
    a. Bylaws
    b. Decrees
    c. Amendments
    d. Regulations

8. What term describes a product that has been tested and certified by an accredited certification organization?
    a. Listed
    b. Applicable
    c. Standardized
    d. Harmonized

9. A typical standard used in the construction industry will outline the minimum acceptable performance of a material used in building.
    a. True
    b. False

10. A standard may outline procedural standards to detail how products are to be installed to be safe and reliable for the intended purpose.
    a. True
    b. False

Answer Key: Self-Test D-1.1 (#chapter-answer-key-self-test-d-1-1) is on the next page.

Answer Key: Self-Test D-1.1

1. a. Municipal
2. c. BC Plumbing Code
3. b. National Plumbing Code
4. a. Ministry of Health
5. c. Vertical line in margin
6. d. All of the above
7. a. Bylaws
8. a. Listed
9. a. True
10. a. True

Self-Test D-1.2 DWV Terminology

Complete Self-Test D-1.2 and check your answers.

1. According to the BC Plumbing Code, a bathroom group consists of which components installed in the same room?
    a. One domestic lavatory, one WC, and one bathtub
    b. One domestic lavatory, one WC, and one bathtub with a single showerhead
    c. One domestic lavatory, one WC, and one single showerhead
    d. All of the above

2. What is the name given to a vent connected at its lower end to the junction of two or more vent pipes and at its upper end to a stack vent, vent stack, vent header, or open air?
    a. Circuit vent
    b. Branch vent
    c. Wet vent
    d. Continuous vent

3. What is the name given to a vent that serves two fixtures and connects at the junction of the trap arms?
    a. Circuit vent
    b. Branch vent
    c. Dual vent
    d. Relief vent

4. What is the name given to the length along the centreline of a pipe and fittings for the purpose of sizing?
    a. Centreline length
    b. Equivalent length
    c. Developed length
    d. Combined length

5. What is the name given to a fixture designed for overflow protection that does not receive regular discharge from other fixtures?
    a. Emergency floor drain
    b. Emergency fixture
    c. Emergency scupper
    d. Emergency drain pan

6. A pipe installed at 47° to the horizontal is said to be in what plane?
    a. Nominally horizontal
    b. Nominally vertical
    c. Horizontal
    d. Vertical

7. A fresh-air inlet is a vent pipe installed in conjunction with which component in a sanitary drainage system?
    a. Manhole
    b. Sewage sump basin
    c. Building trap
    d. Oil interceptor

8. What is the name given to a drainage pipe that extends from the trap of a fixture to a point of connection with another part of the drainage system?
    a. Branch
    b. Fixture drain
    c. Individual drain
    d. Trap drain

9. The top edge of a fixture or receptacle from which water can overflow is given what designation in the NPC?
    a. Concealed overflow
    b. Waste and overflow
    c. Standing waste
    d. Flood-level rim

10. When a drainage pipe is physically connected in such a way that water or gas cannot escape from the connection, it is said to be connected in which way?
    a. Air break
    b. Air gap
    c. Indirectly
    d. Directly

11. What is the name given to the portion of a fixture drain between the trap weir and the vent pipe fitting?
    a. Fixture outlet pipe
    b. Waste and overflow
    c. Trap arm
    d. Continuous waste

12. Identify the trap dip in Figure 1.
13. Identify the traps seal in Figure 1.
14. Identify the trap weir in Figure 1.

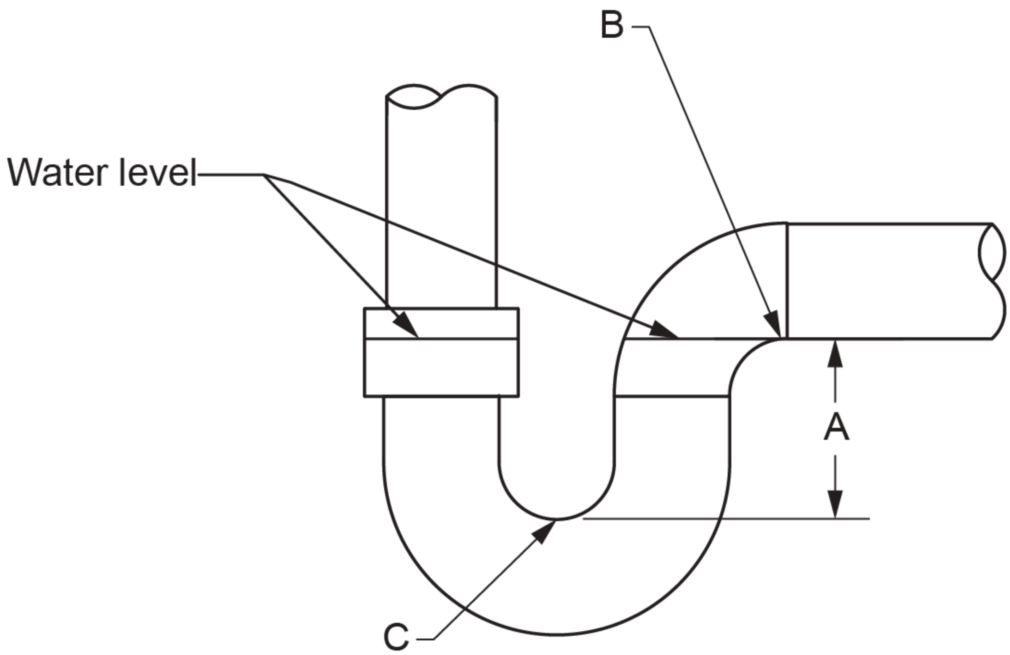

Figure 1

15. What is defined as a combination of elbows or bends that brings one section of pipe out of line but into a line parallel with the original section of pipe?
    a. Offset
    b. Barber's loop
    c. Jumper configuration
    d. Running trap

16. What is the name of a vertical main sanitary drainage pipe that passes through one or more storeys?
    a. Stack
    b. Vent stack
    c. Stack vent
    d. Riser

17. Which of the following terms best describes a vent that is the extension of a vertical branch or fixture drain?
    a. Individual vent
    b. Continuous vent
    c. Dual vent
    d. Branch vent

18. According to the National Plumbing Code, what name is given to the unobstructed vertical distance between the lowest point of an indirect drainage system and the flood-level rim of the fixture into which it discharges?
    a. Air gap
    b. Air break
    c. Critical level

d. Developed length

19. Which of the following terms best describes water with impurity levels that will not be harmful to health and may include HVAC condensate but does not include stormwater?
    a. Clear-water waste
    b. Sewage
    c. Effluent
    d. Potable water

20. What is the name given to a one-way valve that allows air to enter a plumbing drainage system when negative pressures develop in the piping?
    a. Backwater valve
    b. Check valve
    c. Pressure-reducing valve
    d. Air-admittance valve

21. Which of the following terms best describes a vent pipe that serves a number of fixtures and connects to the fixture drain of the most upstream fixture?
    a. Dual vent
    b. Vent stack
    c. Circuit vent
    d. Relief vent

22. What trade term is used to describe a trap for a fixture that is also used as the main support for the fixture?
    a. Drum trap
    b. Trap standard
    c. Crown-vented trap
    d. Bell trap

23. How far does a building drain continue outside the building wall before it can be considered a building sewer?
    a. 0.5 m
    b. 1 m
    c. 1.5 m
    d. 2 m

24. What is the main purpose of a venting system?
    a. Allows sewer gas to be taken to the roof terminal
    b. Protects the fixture traps
    c. Limits the fluid velocities in the stack
    d. Allows overflow to reach the building drain in the event of a blockage in the drainage line

25. What is the name given to a device installed in a building drain to prevent air from circulating between the drainage system and the public sewer?
    a. Backwater valve
    b. Air admittance valve
    c. Building trap
    d. Vacuum breaker

Answer Key: Self-Test D-1.2 (#chapter-answer-key-self-test-d-1-2) is on the next page.

Answer Key: Self-Test D-1.2

1. d. All of the above
2. b. Branch vent
3. c. Dual vent
4. c. Developed length
5. a. eEmergency floor drain
6. b. Nominally vertical
7. c. Building trap
8. b. Fixture drain
9. d. Flood level rim
10. d. Directly
11. c. Trap arm
12. c. Trap dip
13. a. Trap seal
14. b. Trap weir
15. a. Offset
16. a. Stack
17. b. Continuous vent
18. b. Air break
19. a. Clear-water waste
20. d. Air admittance valve
21. c. Circuit vent
22. b. Trap standard
23. b. 1 m
24. b. Protects the fixture traps
25. c. Build trap

Self-Test D-1.3 Functions of Different Pipes in a DWV System

Complete Self-Test D-1.3 and check your answers.

1. Using Figure 2P-1, fill in Table 1 by identifying the drains indicated by the numbers and the vents indicated by the letters.

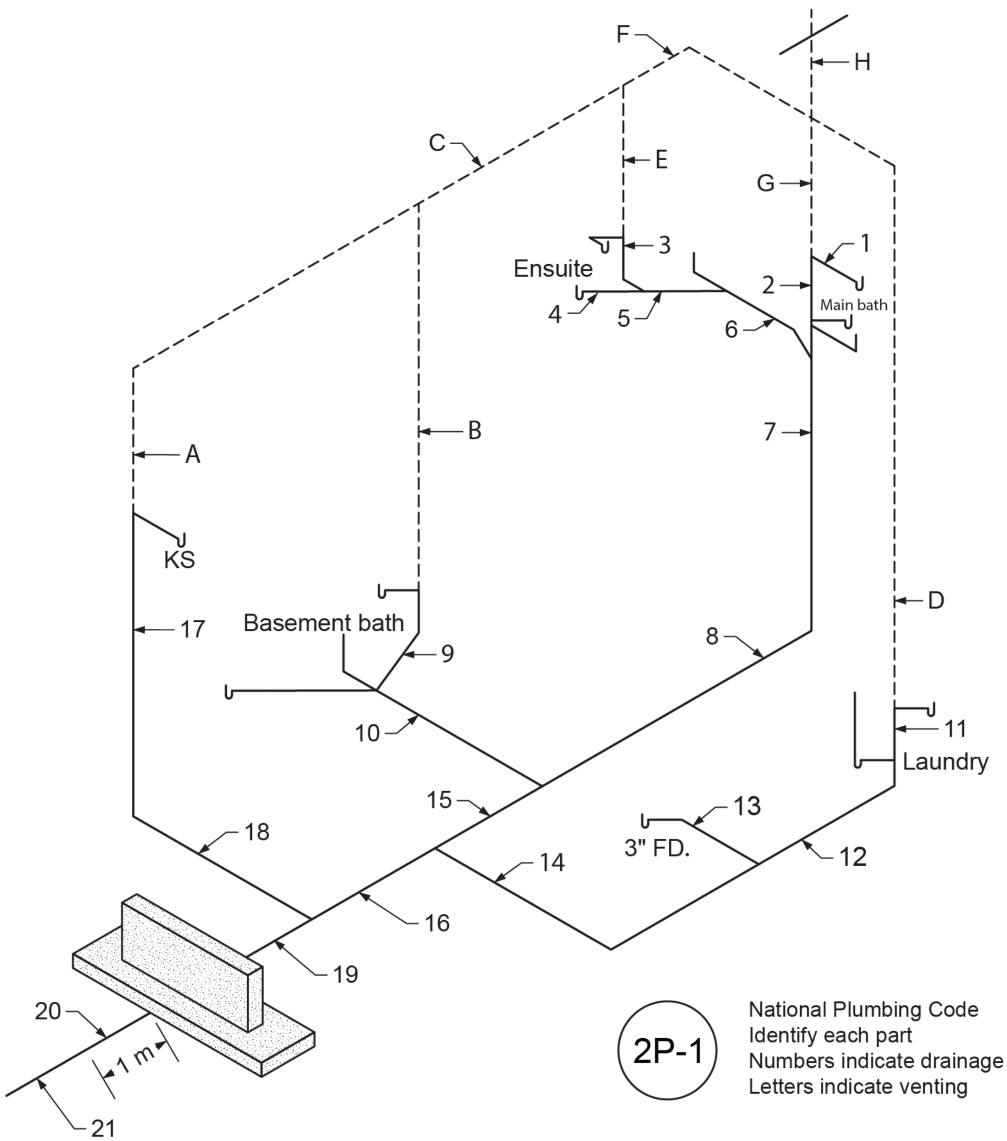

Figure 2P-1

Table 1

Drains	Name	Vents	Name
1		A	
2		B	
3		C	
4		D	
5		E	
6		F	
7		G	
8		H	
9			
10			
11			
12			
13			
14			
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17			
18			
19			
20			
21			

2. Using Figure 2P-2, fill in Table 2 by identifying the drains indicated by the numbers and the vents indicated.

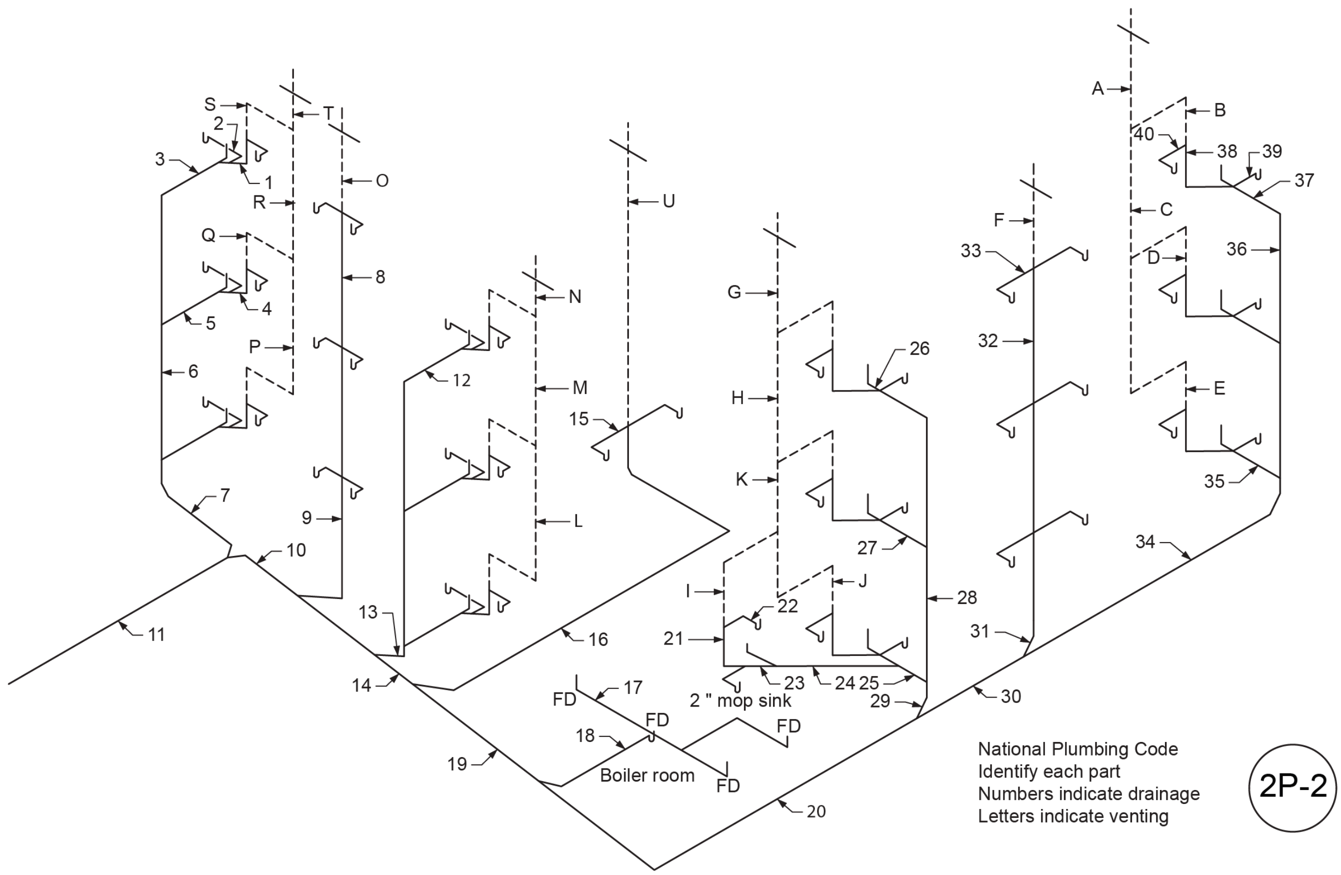
S
2
3
1
T
O
R
Q
4
8
5
P
6
7
9
10
11
N
12
M
L
13
14
16
U
15
G
26
H
K
27
I
22
J
21
23
24
25
28
29
2 " mop sink
FD
17
FD
18
Boiler room
FD
FD
19
20
A
B
40
38
39
37
F
C
33
D
36
32
E
35
34
31
30
National Plumbing Code
Identify each part
Numbers indicate drainage
Letters indicate venting
2P-2

Figure 2P-2

Table 2

Drains	Name	Vents	Name
1		A	
2		B	
3		C	
4		D	
5		E	
6		F	
7		G	
8		H	
9		I	
10		J	
11		K	
12		L	
13		M	
14		N	
15		O	
16		P	
17		Q	
18		R	
19		S	
20		T	
21		U	
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
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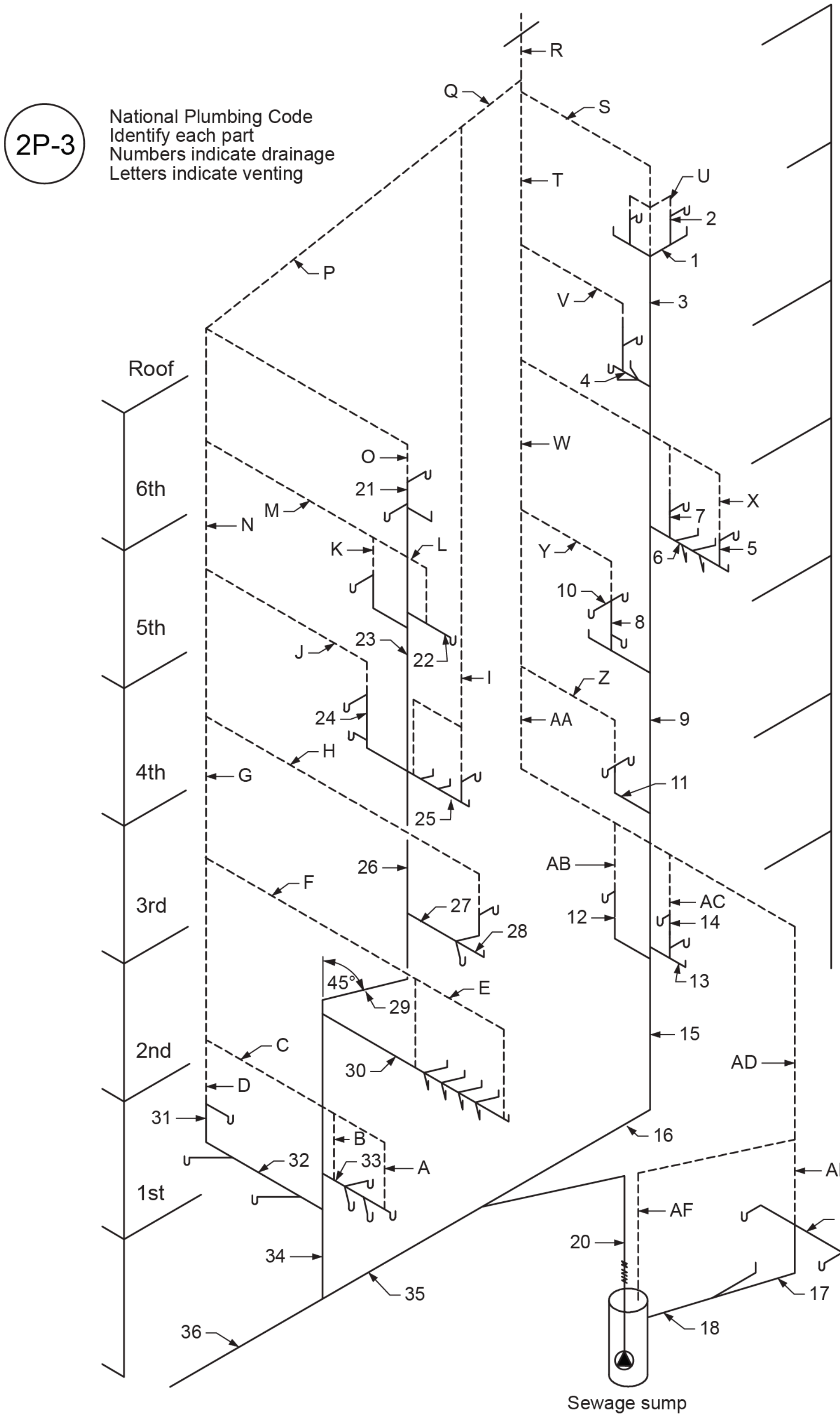
36			
37			
38			

39			
40			

3. Using Figure 2P-3, fill in Table 3 by identifying the drains indicated by the numbers and the vents indicated.


2P-3
National Plumbing Code
Identify each part
Numbers indicate drainage
Letters indicate venting
Roof
6th
5th
4th
3rd
2nd
1st
45°
Sewage sump
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z
AA
AB
AC
AD
AE
AF
1
2
3
4
5
6
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22
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24
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26
27
28
29
30
31
32
33
34
35
36

Figure 2P-3

Table 3

Drains	Name	Vents	Name
1		A	
2		B	
3		C	
4		D	
5		E	
6		F	
7		G	
8		H	
9		I	
10		J	
11		K	
12		L	
13		M	
14		N	
15		O	
16		P	
17		Q	
18		R	
19		S	
20		T	
21		U	
22		V	
23		W	
24		X	
25		Y	
26		Z	
27		AA	
28		AB	
29		AC	
30		AD	
31		AE	
32		AF	
33			
34			
35			
36			

Answer Key: Self-Test D-1.3 (#chapter-answer-key-self-test-d-1-3) is on the next page.

Answer Key: Self-Test D-1.3

1. Figure 2P-1

Table 1 Answers

Drains	Name	Vents	Name
1	Trap arm — Fixture drain	A	Stack vent
2	Stack acting as a wet vent	B	Continuous vent
3	Fixture drain acting as a wet vent	C	Stack vent
4	Trap arm — Fixture drain	D	Continuous vent
5	Branch acting as wet vent	E	Continuous vent
6	Branch	F	Stack vent
7	Stack	G	Stack vent
8	Sanitary building drain	H	Vent header
9	Fixture drain acting as a wet vent		
10	Branch		
11	Fixture drain acting as a wet vent		
12	Branch		
13	Trap arm — Fixture drain		
14	Branch		
15	Sanitary building drain		
16	Sanitary building drain		
17	Stack		
18	Branch		
19	Sanitary building drain		
20	Sanitary building drain		
21	Sanitary building sewer		

2. Figure 2P-2

Table 2 Answers

Drains	Name	Vents	Name
1	Stack acting as a wet vent	A	Stack vent
2	Trap arm — Fixture drain	B	Stack vent
3	Stack	C	Branch vent
4	Fixture drain acting as a wet vent	D	Continuous vent
5	Branch	E	Continuous vent
6	Stack	F	Stack vent
7	Branch	G	Stack vent
8	Stack acting as a wet vent	H	Branch vent
9	Stack	I	Continuous vent
10	Sanitary building drain	J	Continuous vent
11	Sanitary building drain	K	Branch vent
12	Stack	L	Continuous vent
13	Branch	M	Branch vent
14	Sanitary building drain	N	Stack vent
15	Trap arm — Fixture drain	O	Stack vent
16	Branch	P	Continuous vent
17	Fixture outlet pipe	Q	Continuous vent
18	Trap arm — Fixture drain	R	Branch vent
19	Sanitary building drain	S	Stack vent
20	Sanitary building drain	T	Stack vent
21	Fixture drain acting as a wet vent	U	Dual and continuous vent
22	Trap arm — Fixture drain		
23	Branch acting as a wet vent		
24	Branch		
25	Branch		
26	Trap arm — Fixture drain		
27	Branch		
28	Stack		
29	Branch		
30	Sanitary building drain		
31	Branch		
32	Stack acting as a wet vent		
33	Trap arm — Fixture drain		
34	Sanitary building drain		
35	Branch		
36	Stack		
37	Stack		
38	Stack acting as a wet vent		

39	Trap arm — Fixture drain	
40	Trap arm — Fixture drain	

3. Figure 2P-3

Table 3 Answers

Drains	Name	Vents	Name
1	Branch	A	Circuit vent
2	Fixture drain acting as a wet vent	B	Relief vent
3	Stack	C	Branch vent
4	Branch acting as a wet vent	D	Vent stack
5	Fixture drain acting as a circuit vent and a wet vent	E	Circuit vent
6	Branch	F	Branch vent
7	Fixture drain acting as a relief vent	G	Vent stack
8	Branch acting as a wet vent	H	Continuous vent
9	Stack	I	Branch vent
10	Trap arm — Fixture drain	J	Continuous vent
11	Branch	K	Individual and continuous vent
12	Fixture drain acting as a vent stack and a wet vent	L	Individual vent
13	Trap arm — Fixture drain	M	Branch vent
14	Fixture drain acting as a wet vent	N	Vent stack
15	Stack	O	Stack vent
16	Sanitary building drain	P	Vent header
17	Branch acting as a wet vent	Q	Vent header
18	Branch	R	Vent header
19	Trap arm — Fixture drain	S	Stack vent
20	Sump discharge	T	Vent stack
21	Stack acting as a wet vent	U	Continuous vent
22	Trap arm — Fixture drain	V	Continuous vent
23	Stack	W	Vent stack
24	Fixture drain acting as a wet vent	X	Circuit vent
25	Branch	Y	Continuous vent
26	Stack	Z	Dual and continuous vent
27	Branch	AA	Vent stack
28	Trap arm — Fixture drain	AB	Vent stack
29	Stack	AC	Continuous vent
30	Branch	AD	Branch vent
31	Fixture drain acting as a vent stack and a wet vent	AE	Continuous vent
32	Branch acting as a vent stack and a wet vent	AF	Sewage sump vent
33	Branch		
34	Stack		
35	Sanitary building drain		
36	Sanitary building drain		

Self-Test D-1.4 Acceptable Pipe Material Application

Complete Self-Test D-1.4 and check your answers.

For each question, select all answers that apply.

1. According to the NPC, in what applications are copper and brass pipes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

2. According to the NPC, in what applications are Type K and L hard temper copper tubes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

3. According to the NPC, in what applications are polyolefin laboratory drainage pipes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

4. According to the NPC, in what applications are lead waste pipes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

5. According to the NPC, in what applications are cast iron drainage pipes permitted?

a. Above-ground drainage inside building, any type of construction
b. Above-ground drainage inside building, combustible construction only
c. Underground drainage under building
d. Building sewer
e. Above-ground venting inside building, any type of construction
f. Above-ground venting inside building, combustible construction only
g. Underground venting under building

6. According to the NPC, in what applications are PVC DWV pipes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

7. According to the NPC, in what applications are Type M hard temper copper tubes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

8. According to the NPC, in what applications are ABS DWV pipes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

9. According to the NPC, in what applications are PVC sewer pipes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

10. According to the NPC, in what applications are seamless galvanized steel pipes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

11. According to the NPC, in what applications are plastic sewer pipes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

12. According to the NPC, in what applications are DWV copper tubes permitted?
    a. Above-ground drainage inside building, any type of construction
    b. Above-ground drainage inside building, combustible construction only
    c. Underground drainage under building
    d. Building sewer
    e. Above-ground venting inside building, any type of construction
    f. Above-ground venting inside building, combustible construction only
    g. Underground venting under building

Answer Key: Self-Test D-1.4 (#chapter-answer-key-self-test-d-1-4) is on the next page.

Answer Key: Self-Test D-1.4

1. a, b, c, d, e, f, g
2. a, b, c, d, e, f, g
3. b, c, d, f, g
4. b, c, d, f, g
5. a, b, c, d, e, f, g
6. b, c, d, f, g
7. a, e
8. b, c, d, f, g
9. c, d, g
10. a, e
11. c, d
12. a, e

Self-Test D-1.5 Sizing Sanitary Drainage Pipes

Complete Self-Test D-1.5 and check your answers.

1. Using Figure 2P-4, fill in Table 1 by sizing the drainage piping indicated by the numbers.

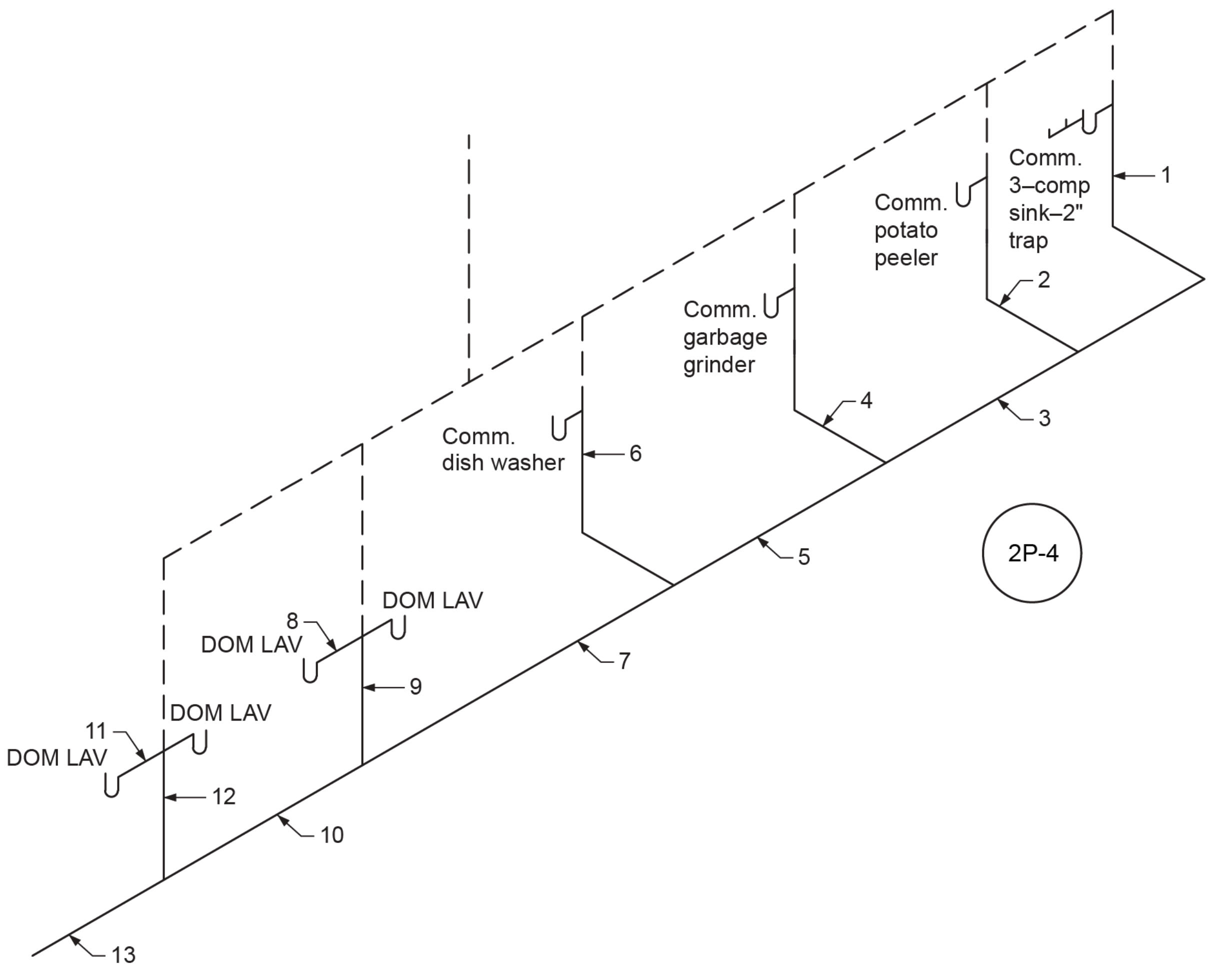


Figure 2P-4

Table 1

Number	Name	Fixture Units	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

2. Using Figure 2P-5, fill in Table 2 by sizing the drainage piping indicated by the numbers.

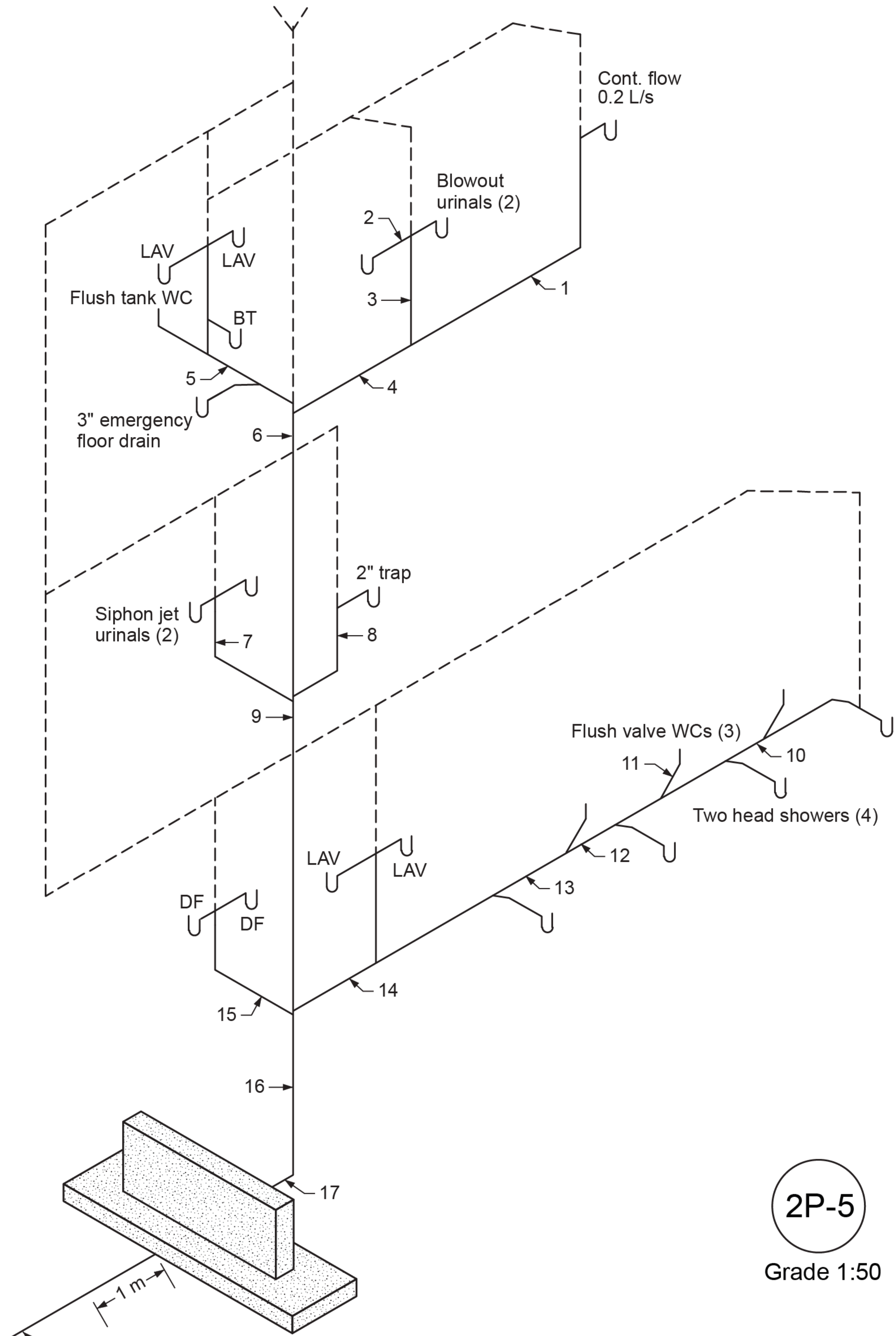

Cont. flow
0.2 L/s
Blowout
urinals (2)
2
LAV
LAV
Flush tank WC
BT
3
1
5
4
3" emergency
floor drain
6
2" trap
Siphon jet
urinals (2)
7
8
9
Flush valve WCs (3)
11
10
Two head showers (4)
12
LAV
LAV
13
DF
DF
14
15
16
17
1 m
18
2P-5
Grade 1:50

Figure 2P-5

Table 2

Number	Name	Fixture Units	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

3. Using Figure 2P-6, fill in Table 3 by sizing the drainage piping indicated by the numbers.

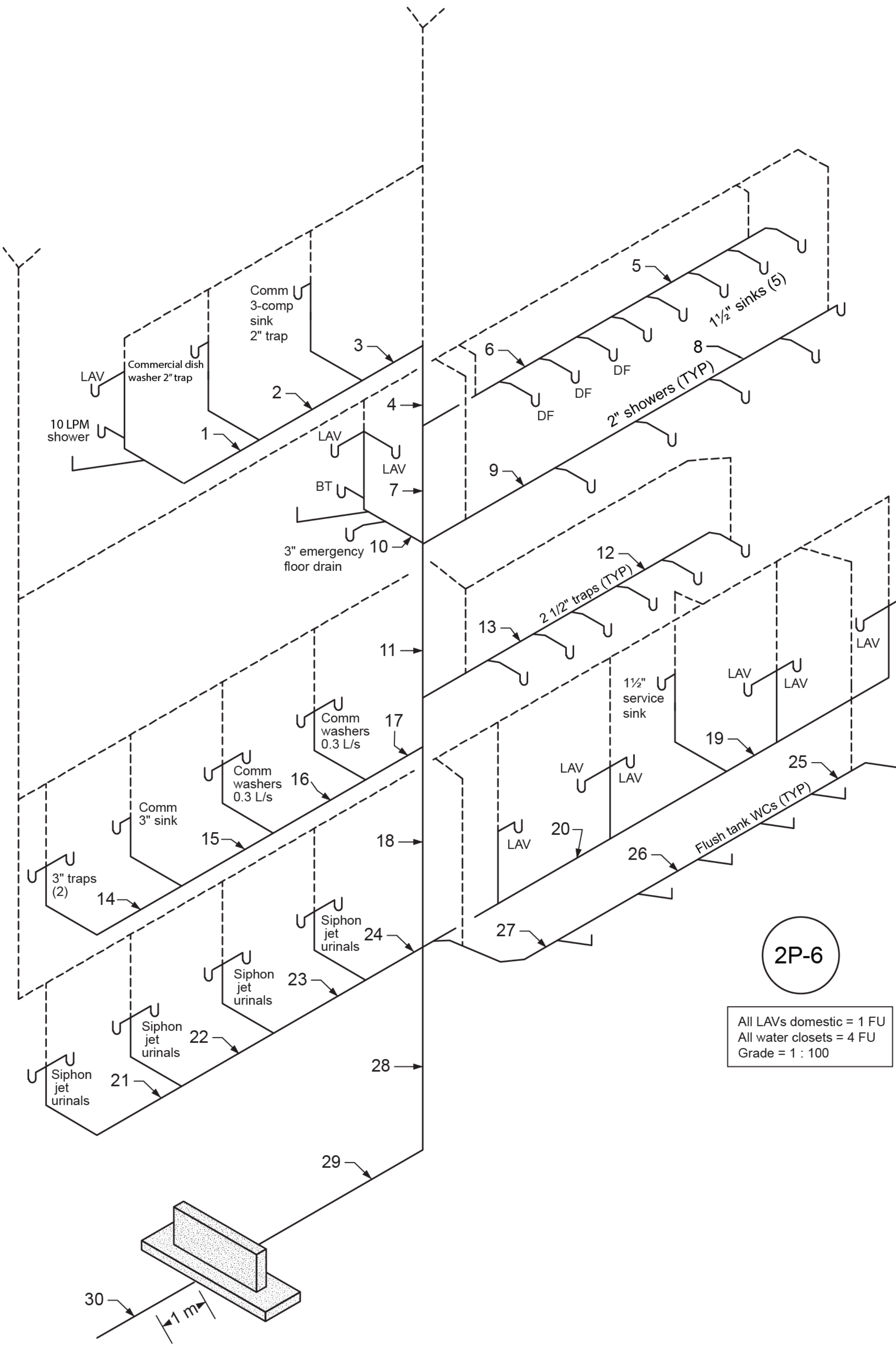

Comm
3-comp
sink
2" trap
LAV
Commercial dish
washer 2" trap
10 LPM
shower
1
2
3
4
5
6
1½" sinks (5)
8
DF
DF
DF
DF
2" showers (TYP)
LAV
LAV
BT
7
9
3" emergency
floor drain
10
12
2 1/2" traps (TYP)
13
11
LAV
LAV
1½"
service
sink
LAV
LAV
Comm
washers
0.3 L/s
17
Comm
washers
0.3 L/s
16
19
25
Comm
3" sink
15
LAV
LAV
LAV
20
Flush tank WCs (TYP)
26
18
3" traps
(2)
14
Siphon
jet
urinals
24
27
Siphon
jet
urinals
23
Siphon
jet
urinals
22
Siphon
jet
urinals
21
28
29
30
1 m
2P-6
All LAVs domestic = 1 FU
All water closets = 4 FU
Grade = 1 : 100

Figure 2P-6

Table 3

Number	Name	Fixture Units	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Answer Key: Self-Test D-1.5 (#chapter-answer-key-self-test-d-1-5) is on the next page.

Answer Key: Self-Test D-1.5

1. Figure 2P-4

Table 1 Answers

Number	Name	Fixture Units	Size
1	Fixture drain	2	2 in.
2	Fixture drain	3	2 in.
3	Branch	5	2 in.
4	Fixture drain	3	2 in.
5	Branch	8	3 in.
6	Fixture drain	3	2 in.
7	Branch	11	3 in.
8	Trap arm — Fixture drain	1	1.25 in.
9	Branch	2	1.25 in.
10	Branch	13	3 in.
11	Trap arm — Fixture drain	1	1.25 in.
12	Branch	2	1.25 in.
13	Branch	15	3 in.

2. Figure 2P-5

Table 2 Answers

Number	Name	Fixture Units	Size
1	Fixture drain	6.34	3 in.
2	Trap arm — Fixture drain	4	2 in.
3	Branch	8	3 in.
4	Branch	14.34	3 in.
5	Branch	7	3 in.
6	Stack	21.34	4 in.
7	Branch	8	3 in.
8	Fixture drain	3	2 in.
9	Stack	32.34	4 in.
10	Branch	9	3 in.
11	Trap arm — Fixture drain	6	3 in.
12	Branch	21	3 in.
13	Branch	27	4 in.
14	Branch	32	4 in.
15	Branch	1	1.25 in.
16	Stack	65.34	4 in.
17	Sanitary building drain	65.34	4 in.
18	Sanitary building sewer	65.34	4 in.

3. Figure 2P-6

Table 3 Answers

Number	Name	Fixture Units	Size
1	Branch	8	3 in.
2	Branch	11	3 in.
3	Branch	13	3 in.
4	Stack	13	3 in.
5	Branch	4.5	2 in.
6	Branch	8.5	3 in.
7	Stack	22	3 in.
8	Branch	6	2 in.
9	Branch	15	3 in.
10	Branch	7	3 in.
11	Stack	44	4 in.
12	Branch	8	3 in.
13	Branch	20	3 in.
14	Branch	10	3 in.
15	Branch	13	3 in.
16	Branch	32.02	4 in.
17	Branch	51.04	4 in.
18	Stack	119.04	4 in.
19	Branch	4	2 in.
20	Branch	7.5	3 in.
21	Branch	8	3 in.
22	Branch	16	3 in.
23	Branch	24	3 in.
24	Branch	32	4 in.
25	Fixture drain	4	3 in.
26	Branch	16	4 in.
27	Branch	24	4 in.
28	Stack	183.54	4 in.
29	Sanitary building drain	183.54	4 in.
30	Sanitary building sewer	183.54	4 in.

Self-Test D-1.6 Sizing Single-Storey Vents

Complete Self-Test D-1.6 and check your answers.

1. Using Figure 2P-7, fill in Table 1 by identifying and sizing the wet vent installation as per the NPC.

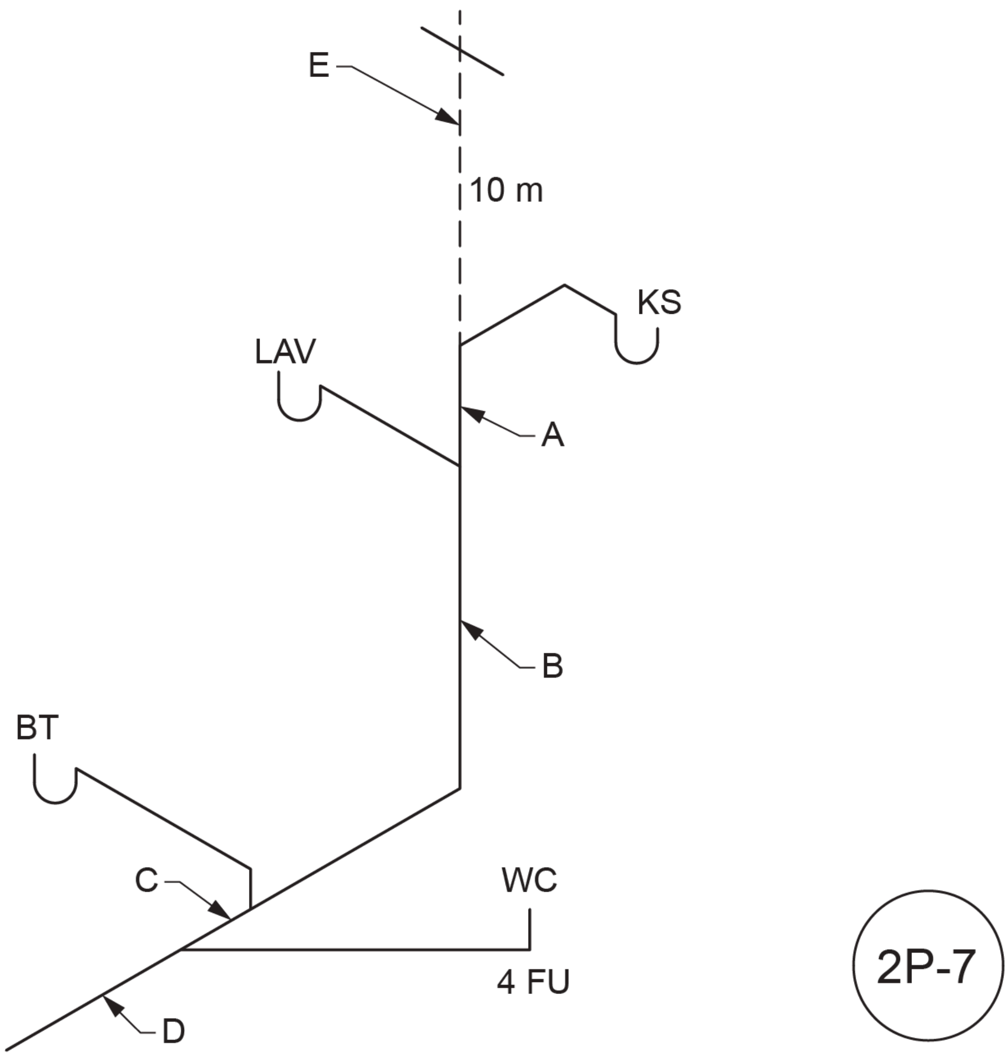


***Figure* 2P-7**

Table 1

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				

2. Using Figure 2P-8, fill in Table 2 by identifying and sizing the wet vent installation as per the NPC.

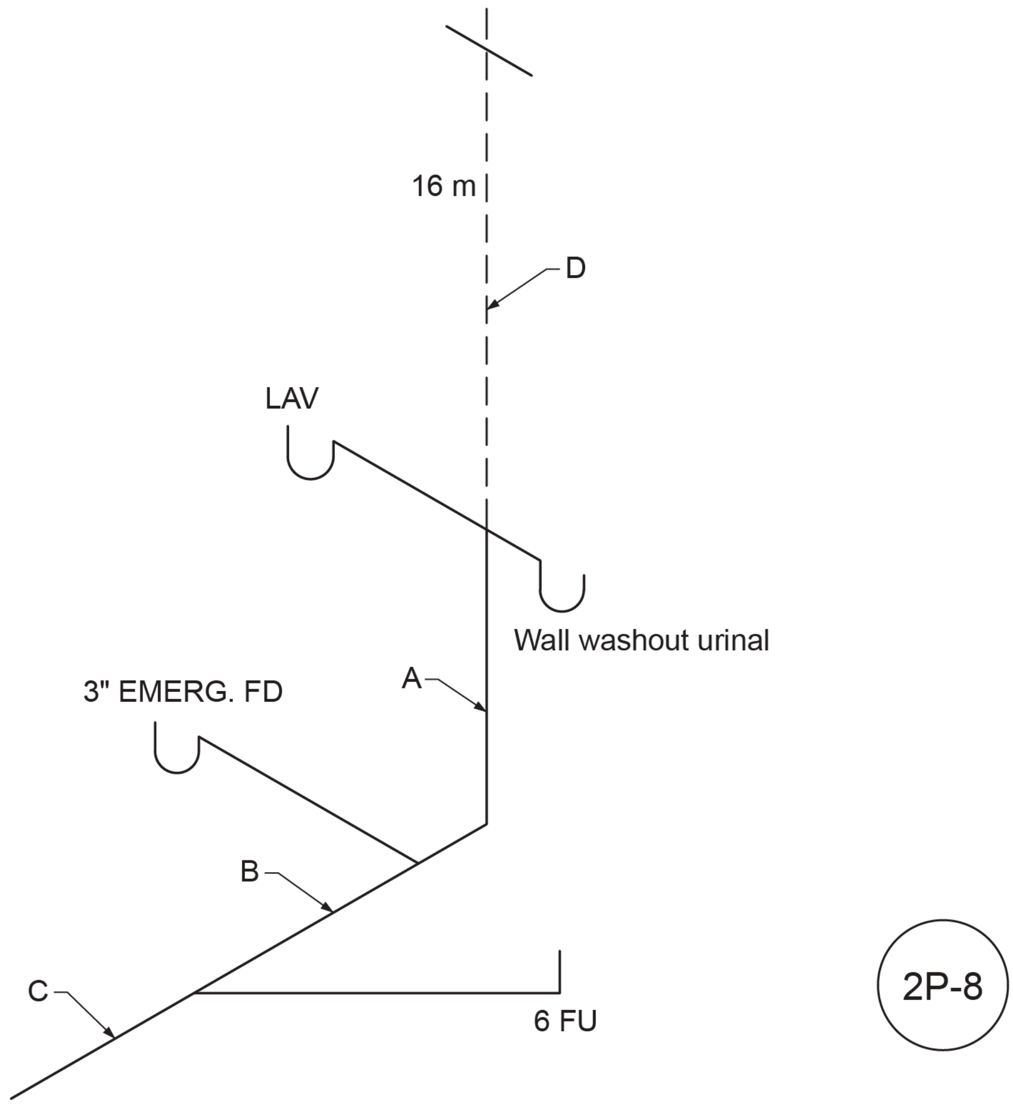


Figure 2P-8

Table 2

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				

3. Using Figure 2P-9, fill in Table 3 by identifying and sizing the wet vent installation as per the NPC.

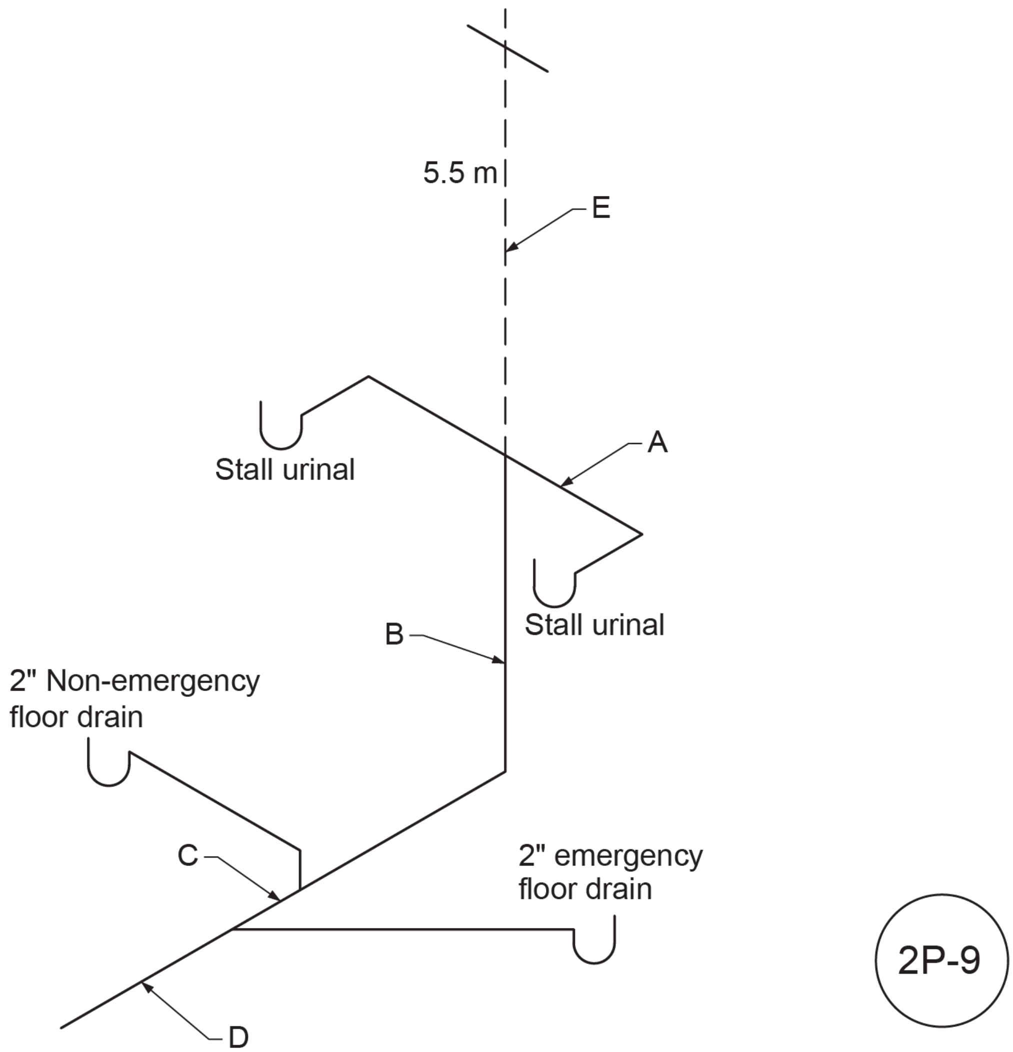


Figure 2P-9

Table 3

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				

4. Using Figure 4, fill in Table 4 by identifying and sizing the wet vent installation as per the NPC.

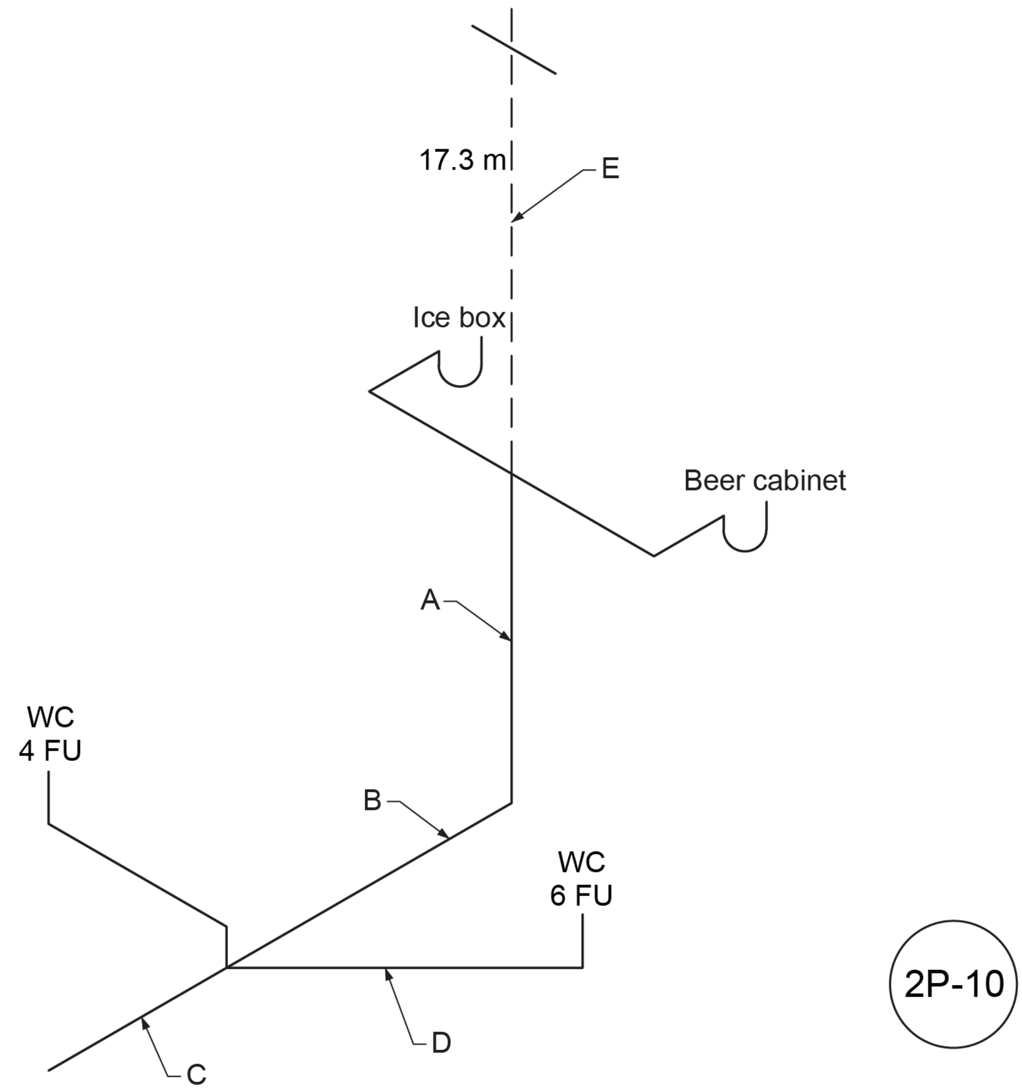


Figure 2P-10

Table 4

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				‘

5. Using Figure 2P-11, fill in Table 5 by identifying and sizing the wet vent installation as per the NPC.

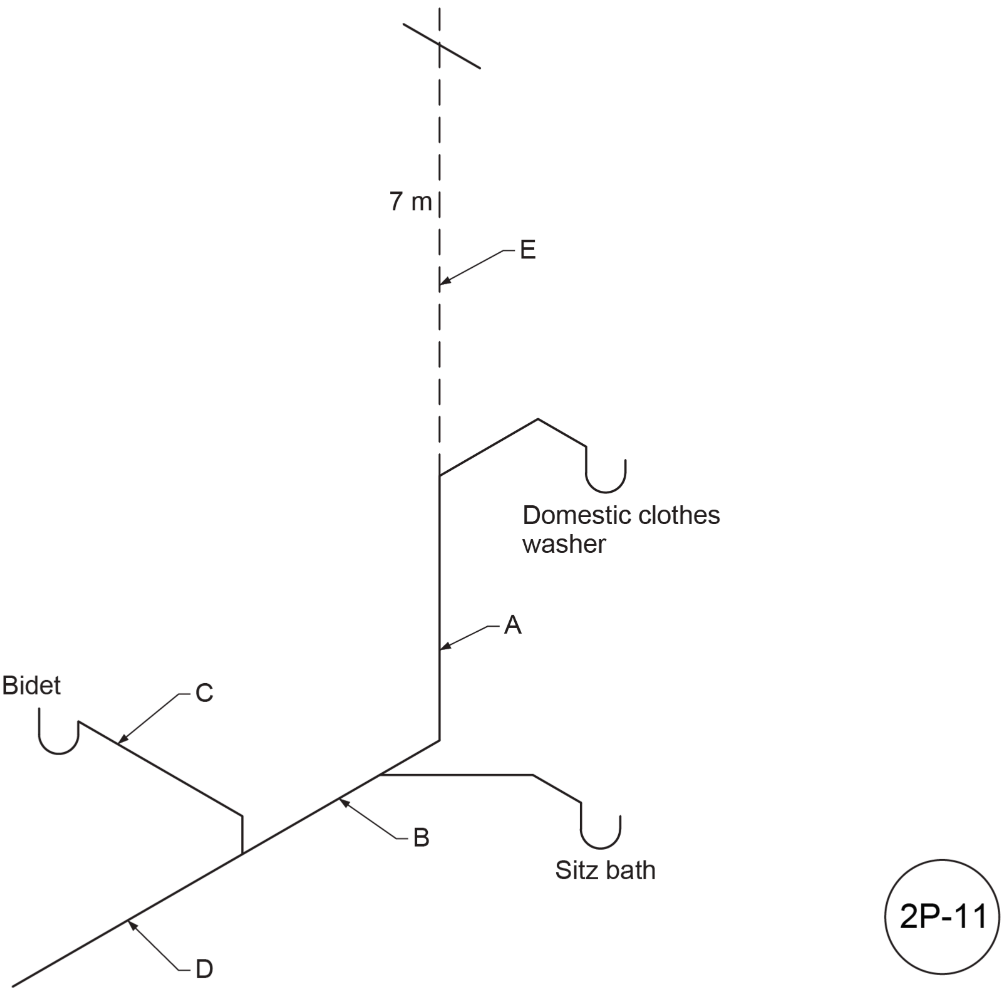


Figure 2P-11

Table 5

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				

6. Using Figure 2P-12, fill in Table 6 by identifying and sizing the wet vent installation as per the NPC.

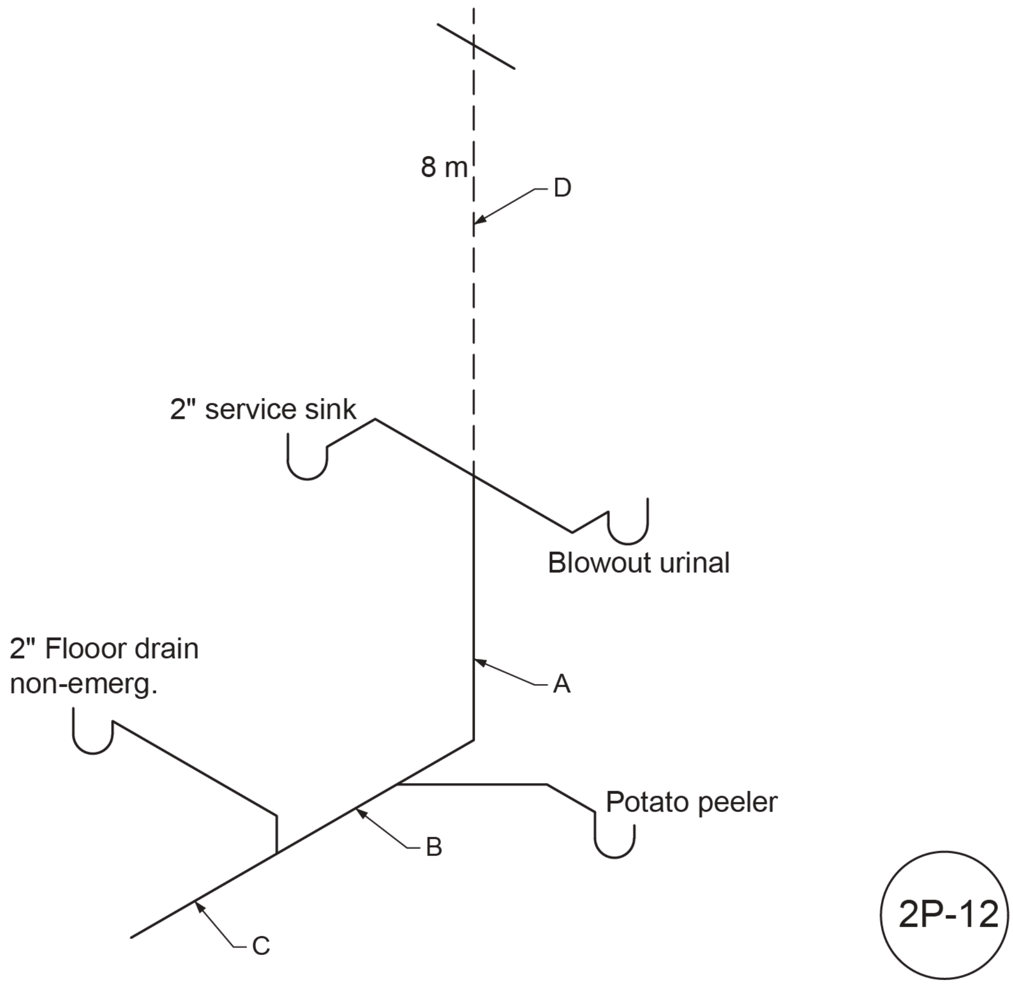


Figure 2P-12

Table 6

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				

7. Using Figure 2P-13, fill in Table 7 by identifying and sizing the wet vent installation as per the NPC.

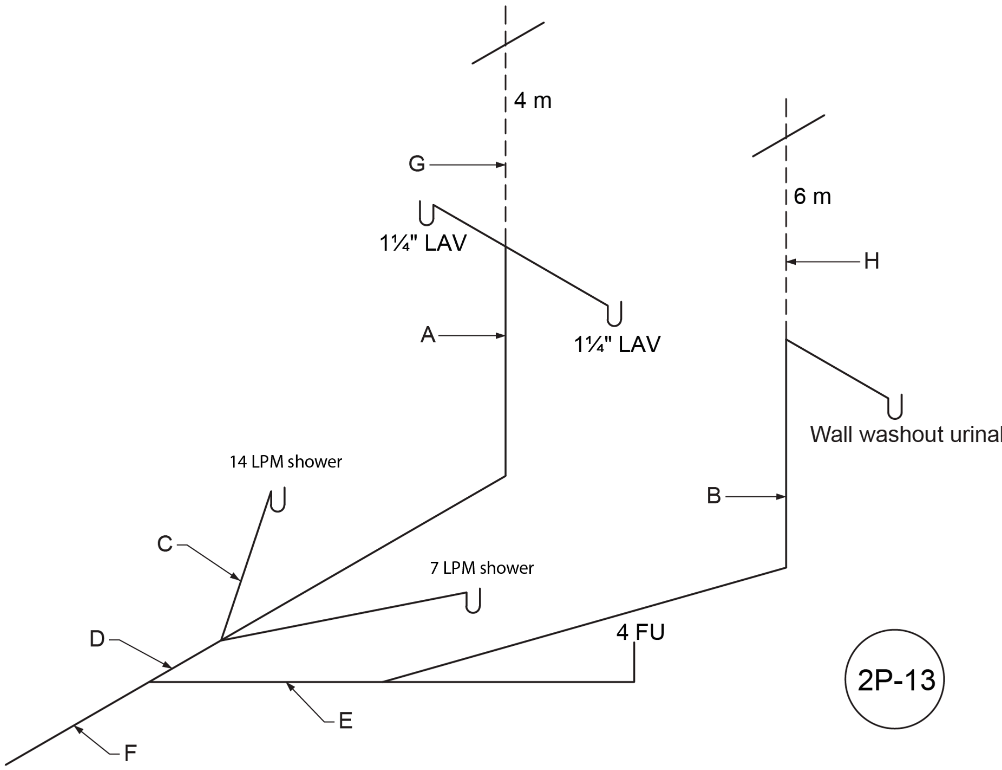


Figure 2P-13

Table 7

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				

8. Using Figure 2P-14, fill in Table 8 by identifying and sizing the wet vent installation as per the NPC.

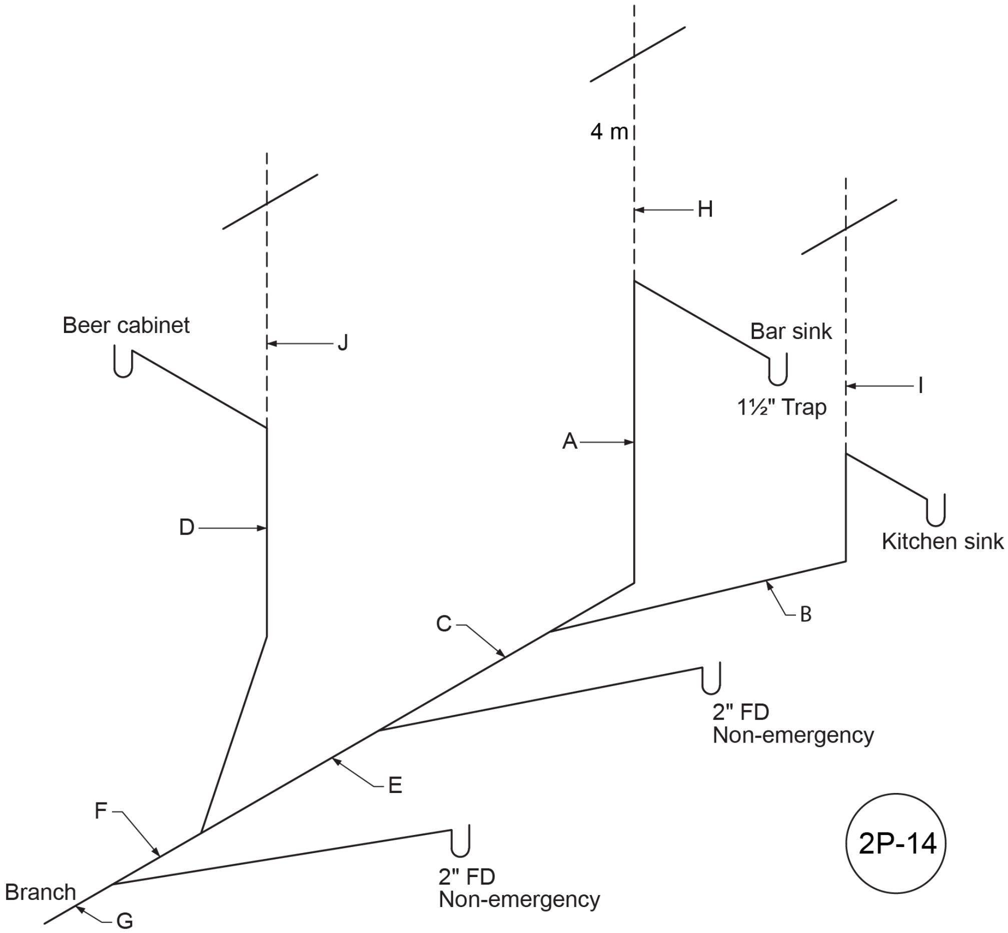


Figure 2P-14

Table 8

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				

9. Using Figure 2P-15, fill in Table 9 by identifying and sizing the wet vent installation as per the NPC.

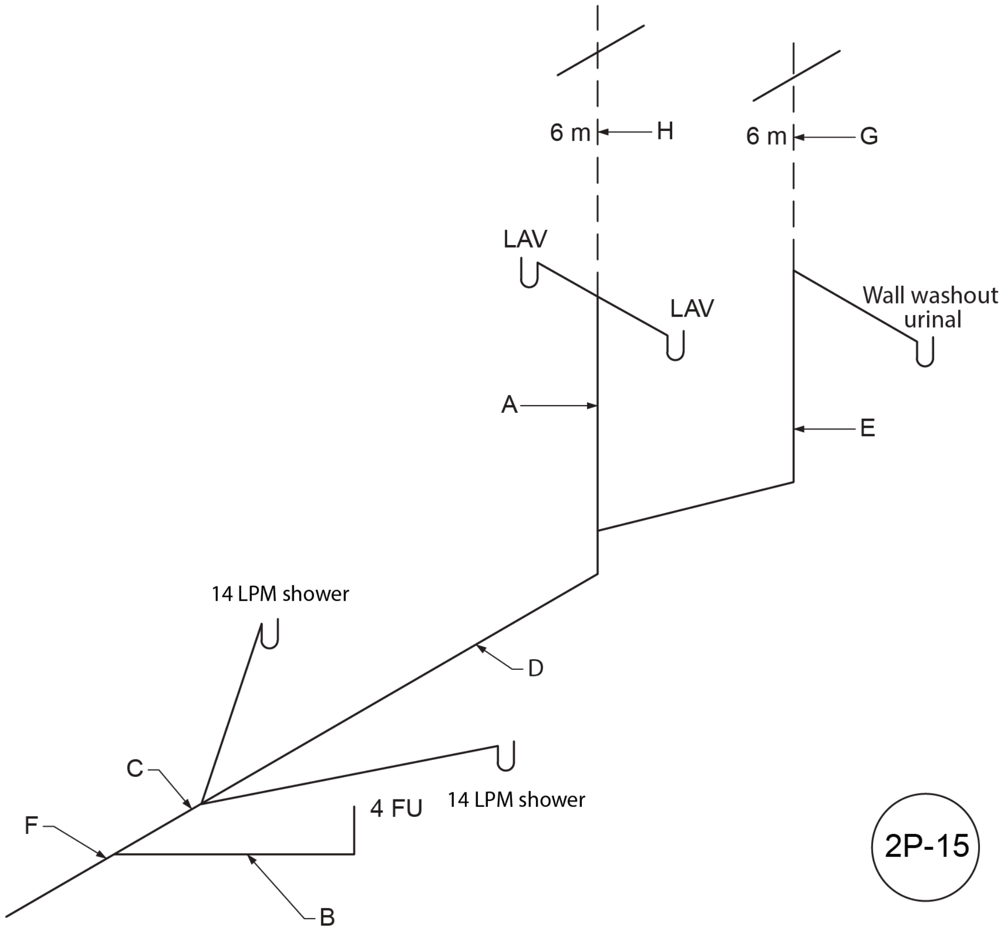


Figure 2P-15

Table 9

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				

10. Using Figure 2P-16, fill in Table 10 by identifying and sizing the wet vent installation as per the NPC.

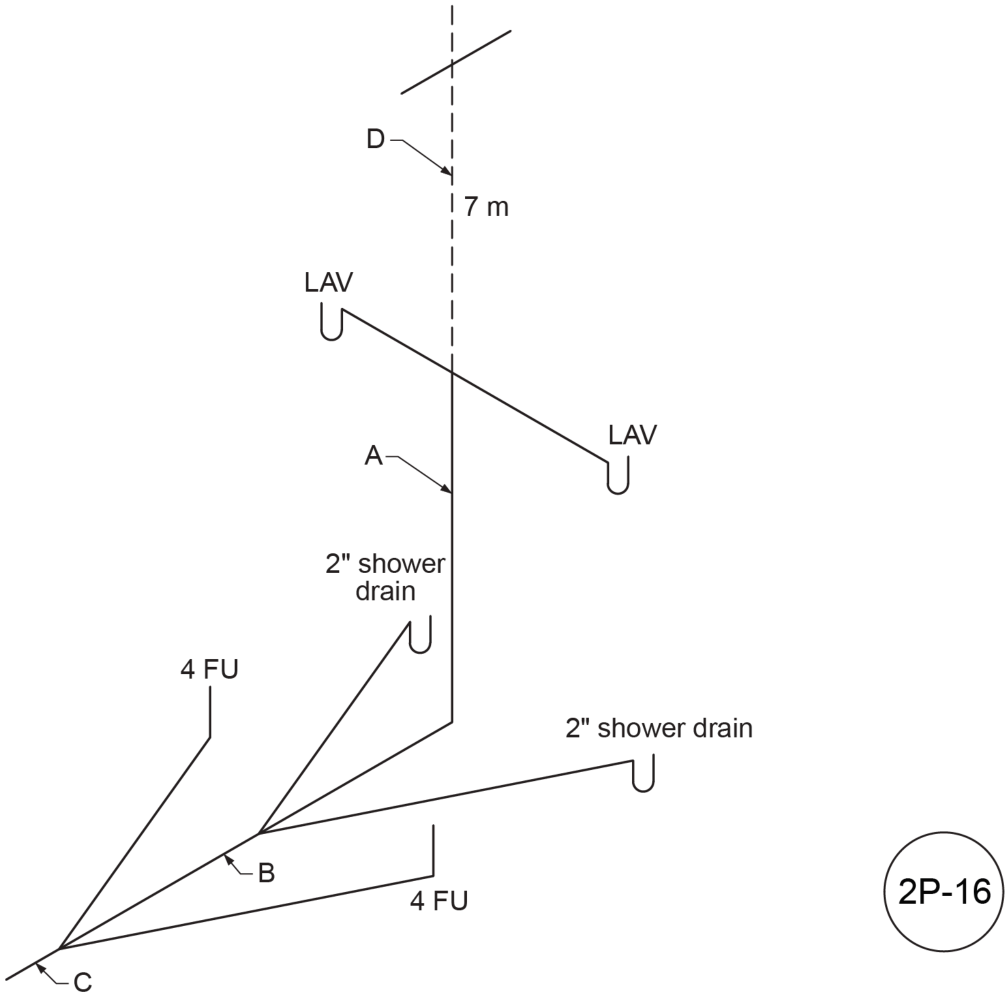


Figure 2P-16

Table 10

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				

11. Using Figure 2P-17, fill in Table 11 by identifying and sizing the wet vent installation as per the NPC.

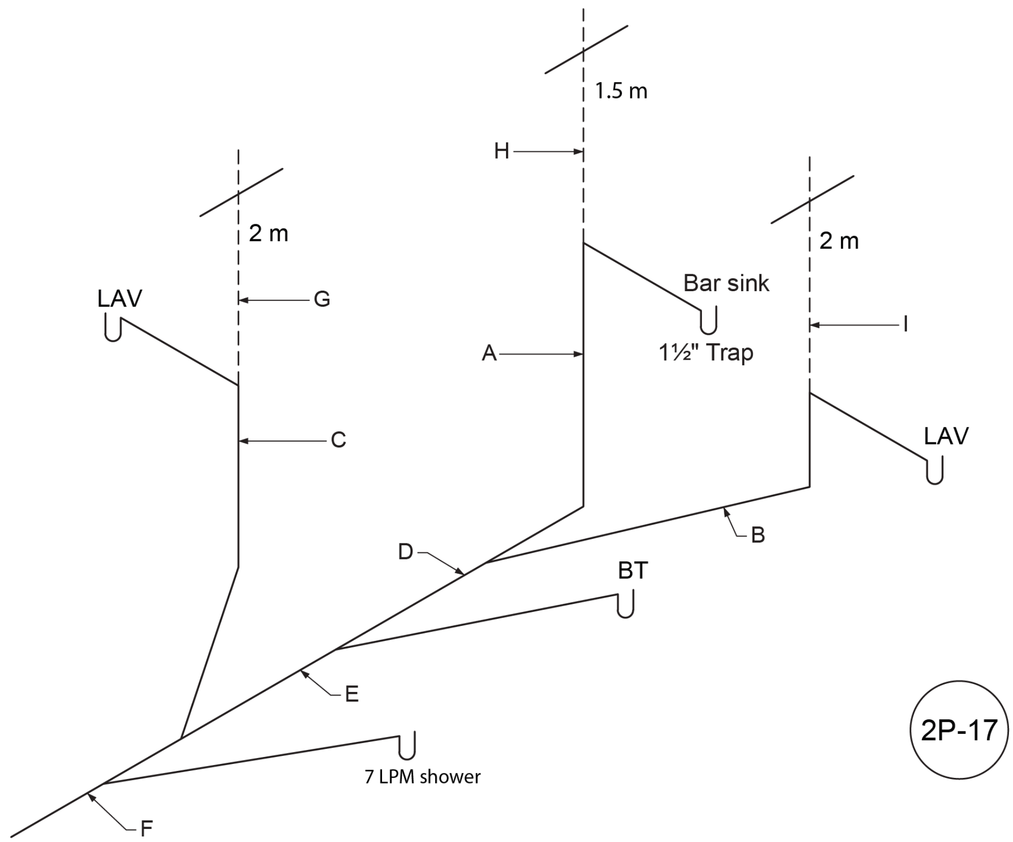


Figure 2P-17

Table 11

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				

Answer Key: Self-Test D-1.6 (#chapter-answer-key-self-test-d-1-6) is on the next page.

Answer Key: Self-Test D-1.6

1. Figure 2P-7

Table 1 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Fixture drain acting as a wet vent	4	N/A	3 in.
B	Branch — Wet vent	4	N/A	3 in.
C	Branch — Wet vent	4	N/A	3 in.
D	Branch	7.5	N/A	3 in.
E	Continuous vent	7.5	10 m	1.5 in.

2. Figure 2P-8

Table 2 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch — Wet vent	2.5	N/A	2 in.
B	Branch — Wet vent	2.5	N/A	3 in.
C	Branch	8.5	N/A	3 in.
D	Continuous vent	8.5	16 m	2 in.

3. Figure 2P-9

Table 3 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Trap arm — Fixture drain	2	N/A	2 in.
B	Branch — Wet vent	6	N/A	3 in.
C	Branch — Wet vent	6	N/A	3 in.
D	Branch	6	N/A	3 in.
E	Continuous vent	8	5.5 m	1.5 in.

4. Figure 2P-10

Table 4 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch — Wet vent	2.5	N/A	2 in.
B	Branch — Wet vent	2.5	N/A	2 in.
C	Branch	12.5	N/A	3 in.
D	Trap arm — Fixture drain	6	N/A	3 in.
E	Continuous vent	12.5	17.3 m	2 in.

5. Figure 2P-11

Table 5 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Fixture drain acting as a wet vent	3.5	N/A	2 in.
B	Branch — Wet vent	3.5	N/A	2 in.
C	Trap arm — Fixture drain	1	N/A	1.25 in.
D	Branch	4.5	N/A	2 in.
E	Continuous vent	4.5	7 m	1.5 in.

6. Figure 2P-12

Table 6 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch — Wet vent	9	N/A	3 in.
B	Branch — Wet vent	9	N/A	3 in.
C	Branch	11	N/A	3 in.
D	Continuous vent	11	8 m	1.5 in.

7. Figure 2P-13

Table 7 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch — Wet vent	8	N/A	3 in.
B	Fixture drain	1.5	N/A	1.5 in.
C	Trap arm — Fixture drain	3	N/A	2 in.
D	Branch — Wet vent	8	N/A	3 in.
E	Branch	5.5	N/A	3 in.
F	Branch	11.5	N/A	3 in.
G	Continuous vent	10	4 m	1.5 in.
H	Individual and continuous vent	N/A	N/A	1.25 in.

8. Figure 2P-14

Table 8 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Fixture drain acting as a wet vent	6.5	N/A	3 in.
B	Fixture drain	1.5	N/A	1.5 in.
C	Branch — Wet vent	6.5	N/A	3 in.
D	Fixture drain	1.5	N/A	1.5 in.
E	Branch — Wet vent	6.5	N/A	3 in.
F	Branch — Wet vent	6.5	N/A	3 in.
G	Branch	8.5	N/A	3 in.
H	Continuous vent	5.5	4 m	1.5 in.
I	Individual and continuous vent	N/A	N/A	1.25 in.
J	Individual and continuous vent	N/A	N/A	1.25 in.

9. Figure 2P-15

Table 9 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch — Wet vent	9.5	N/A	4 in.
B	Trap arm — Fixture drain	4	N/A	3 in.
C	Branch — Wet vent	9.5	N/A	4 in.
D	Branch — Wet vent	9.5	N/A	4 in.
E	Fixture drain	1.5	N/A	1.5 in.
F	Branch	13.5	N/A	4 in.
G	Individual and continuous vent	N/A	N/A	1.5 in.
H	Continuous vent	12	6 m	1.5 in.

10. Figure 2P-16

Table 10 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch — Wet vent	8	N/A	3 in.
B	Branch — Wet vent	8	N/A	3 in.
C	Branch	16	N/A	3 in.
D	Continuous vent	16	7 m	1.5 in.

11. Figure 2P-17

Table 11 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Fixture drain acting as a wet vent	5	N/A	3 in.
B	Fixture drain	1	N/A	1.25 in.
C	Fixture drain	1	N/A	1.25 in.
D	Branch — Wet vent	5	N/A	3 in.
E	Branch — Wet vent	5	N/A	3 in.
F	Branch	6.5	N/A	3 in.
G	Individual and continuous vent	N/A	N/A	1.25 in.
H	Continuous vent	4.5	1.5 m	1.25 in.
I	Individual and continuous vent	N/A	N/A	1.25 in.

Self-Test D-1.7 Multi-Storey Wet Vents

Complete Self-Test D-1.7 and check your answers.

1. Using Figure 2P-18, fill in Table 1 by identifying and sizing the multi-storey wet vent installation as per the NPC.

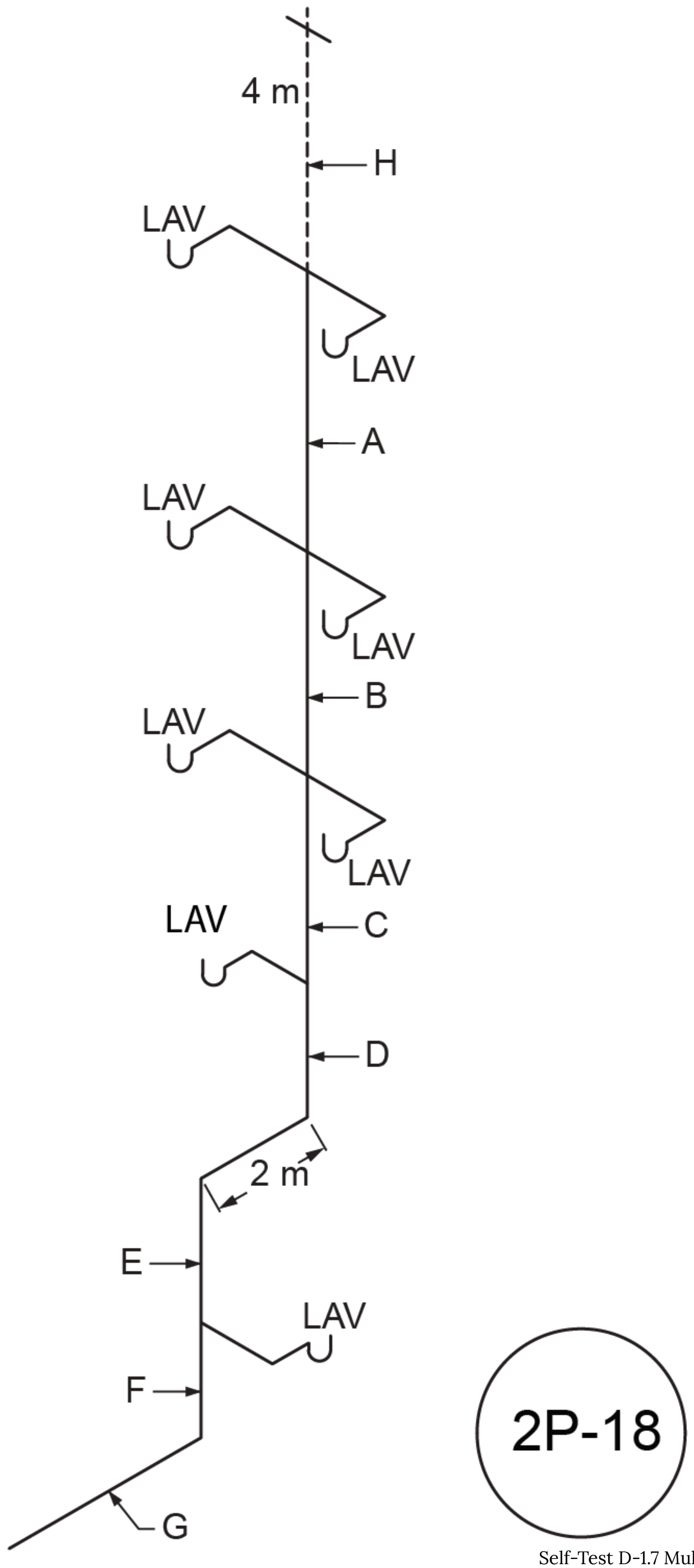

4 m
H
LAV
LAV
A
LAV
LAV
B
LAV
LAV
LAV
C
D
2 m
E
LAV
F
G
2P-18

Figure 2P-18

Table 1

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				

2. Using Figure 2P-19, fill in Table 2 by identifying and sizing the multi-storey wet vent installation as per the NPC.

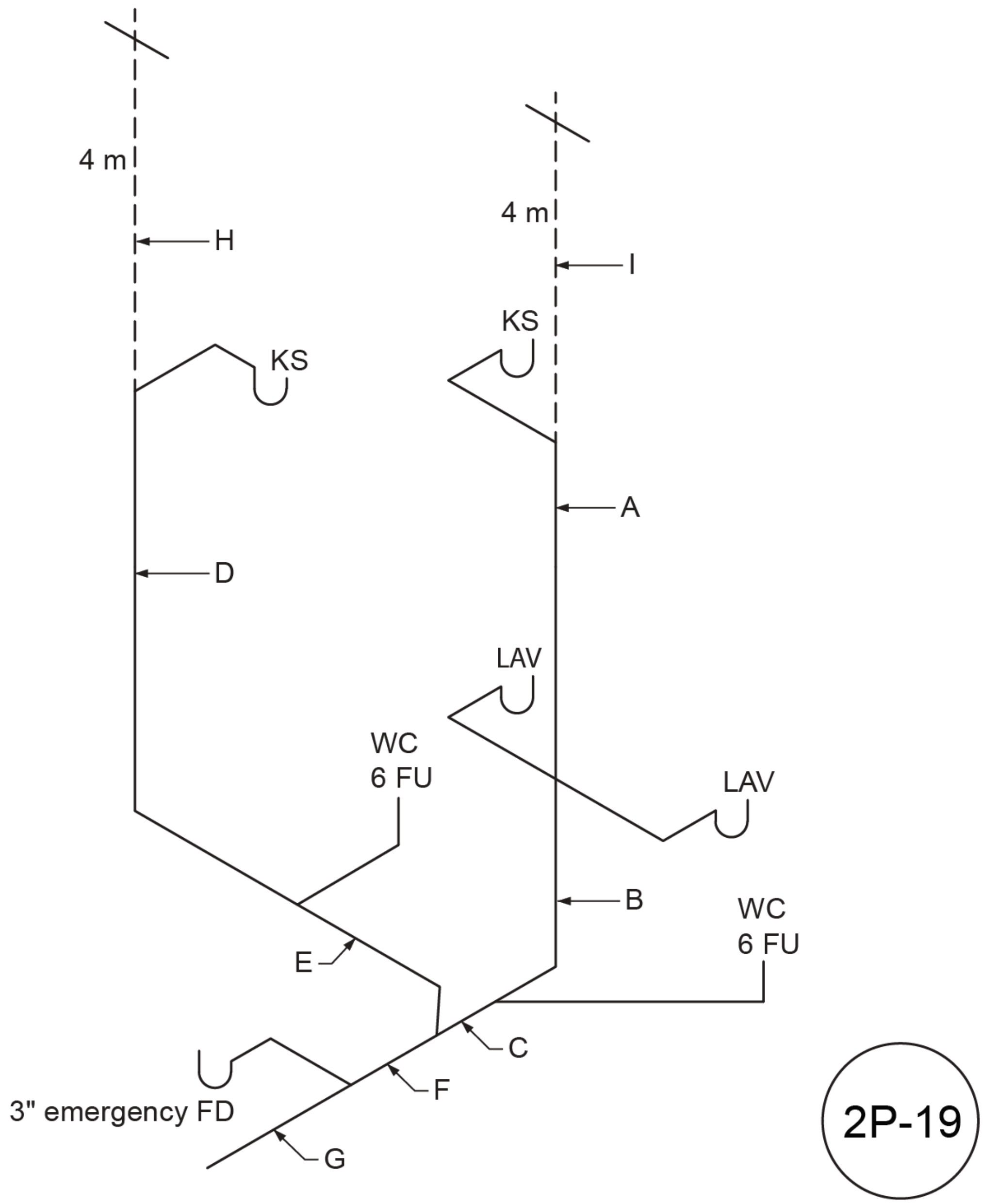


Figure 2P-19

Table 2

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				

3. Using Figure 2P-20, fill in Table 3 by identifying and sizing the multi-storey wet vent installation as per the NPC.

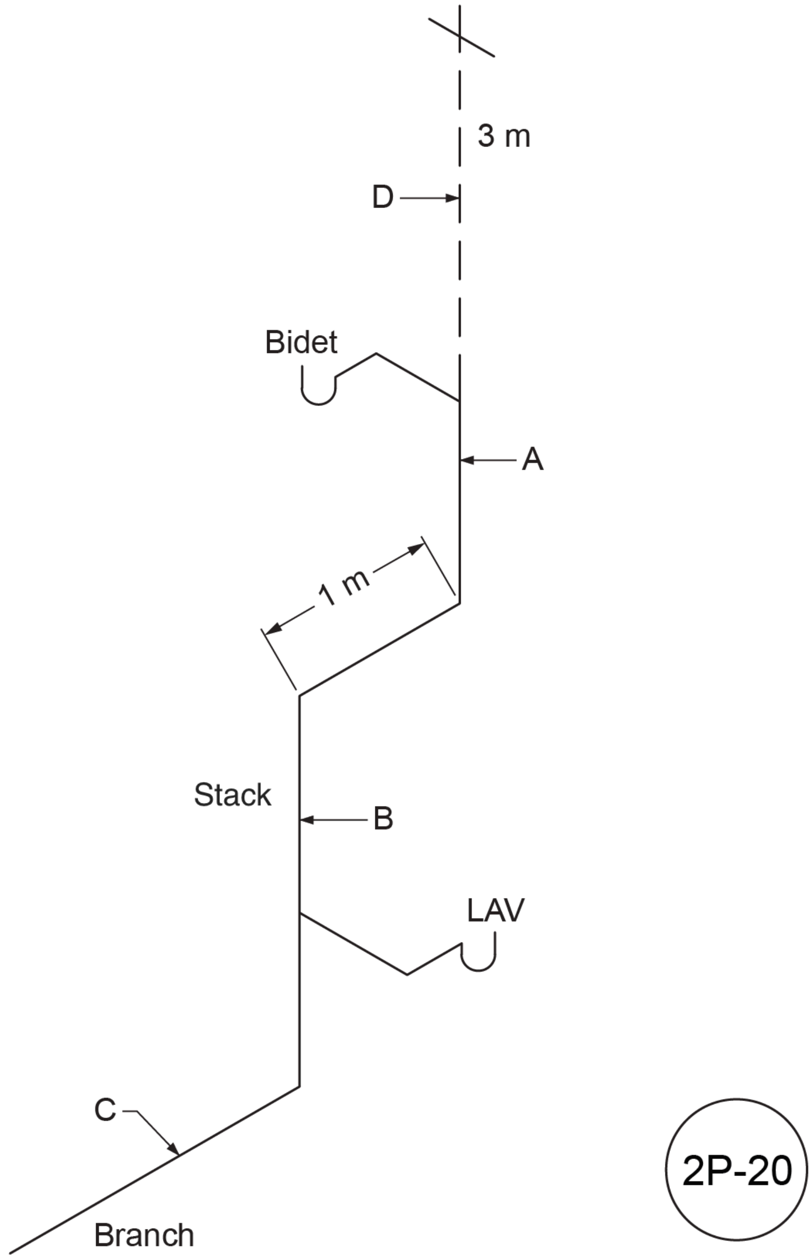


Figure 2P-20

Table 3

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				

4. Using Figure 2P-21, fill in Table 4 by identifying and sizing the multi-storey wet vent installation as per the NPC.

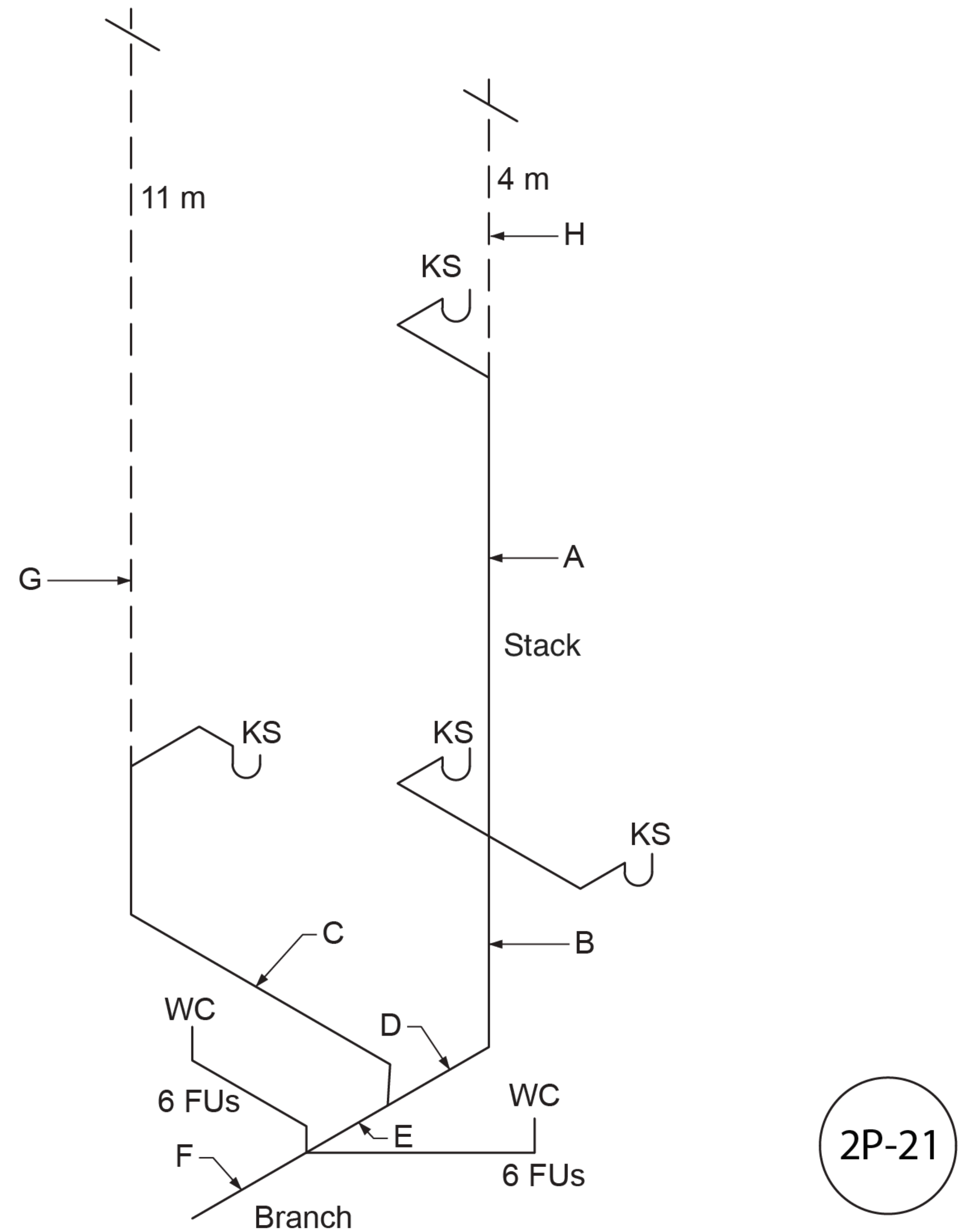


Figure 2P-21

Table 4

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				

5. Using Figure 2P-22, fill in Table 5 by identifying and sizing the multi-storey wet vent installation as per the NPC.

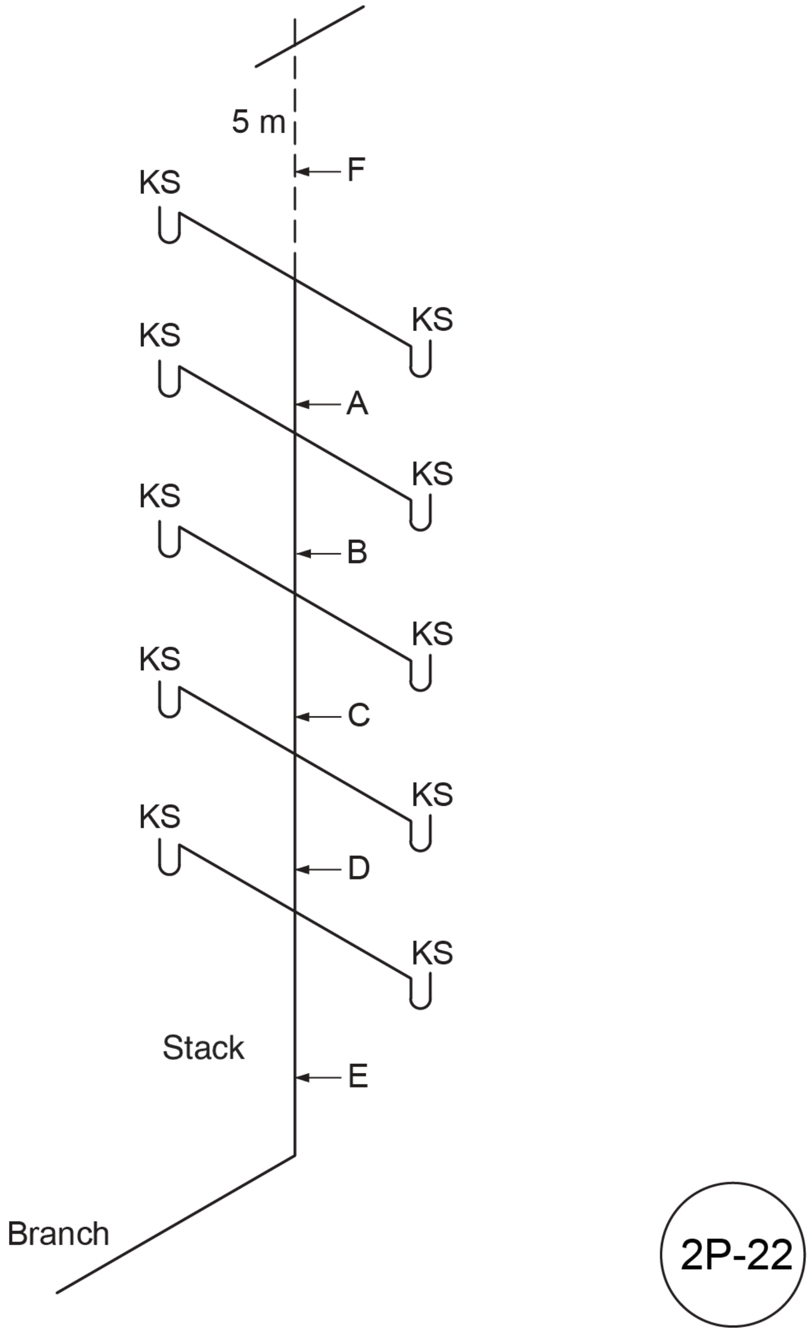


Figure 2P-22

Table 5

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				

6. Using Figure 2P-23, fill in Table 6 by identifying and sizing the multi-storey wet vent installation as per the NPC.

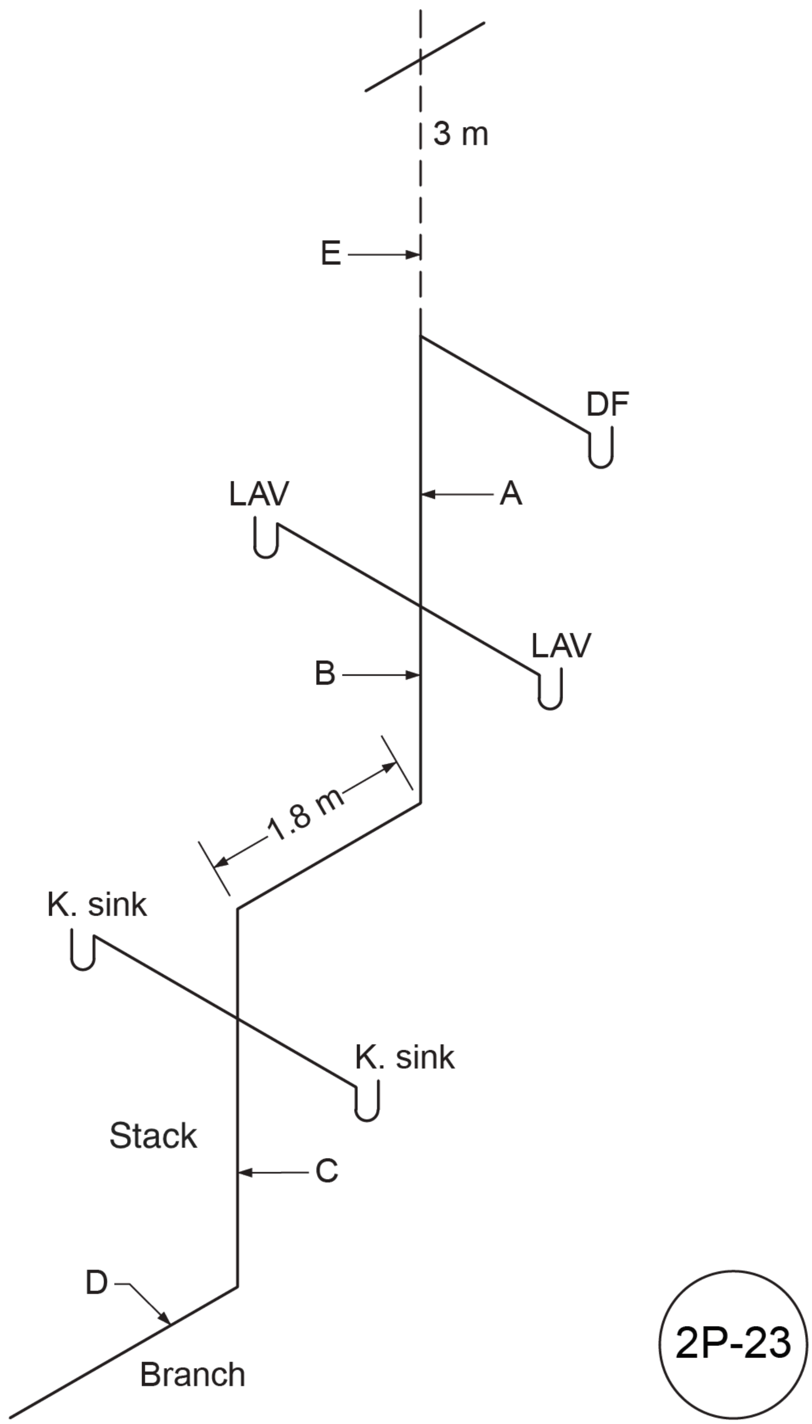


Figure 2P-23

Table 6

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				

7. Using Figure 2P-24, fill in Table 1 by identifying and sizing the multi-storey wet vent installation as per the NPC.

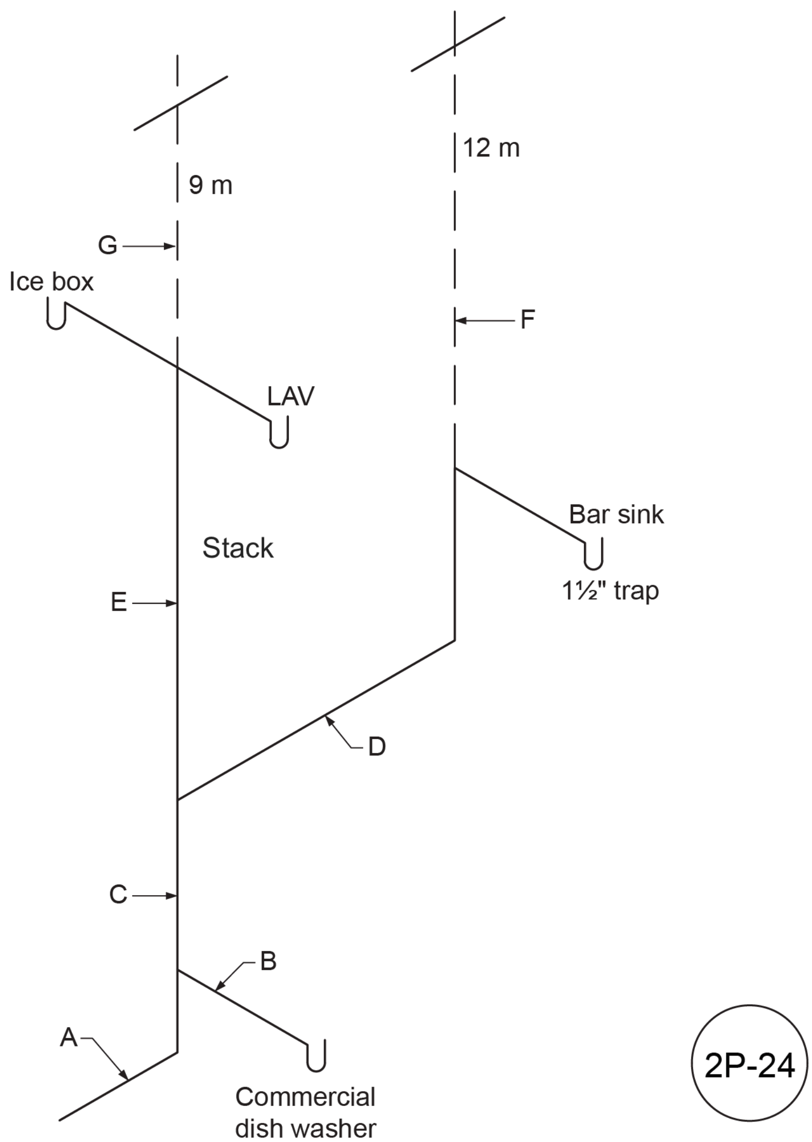


Figure 2P-24

Table 7

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				‘

8. Using Figure 2P-25, fill in Table 8 by identifying and sizing the multi-storey wet vent installation as per the NPC.

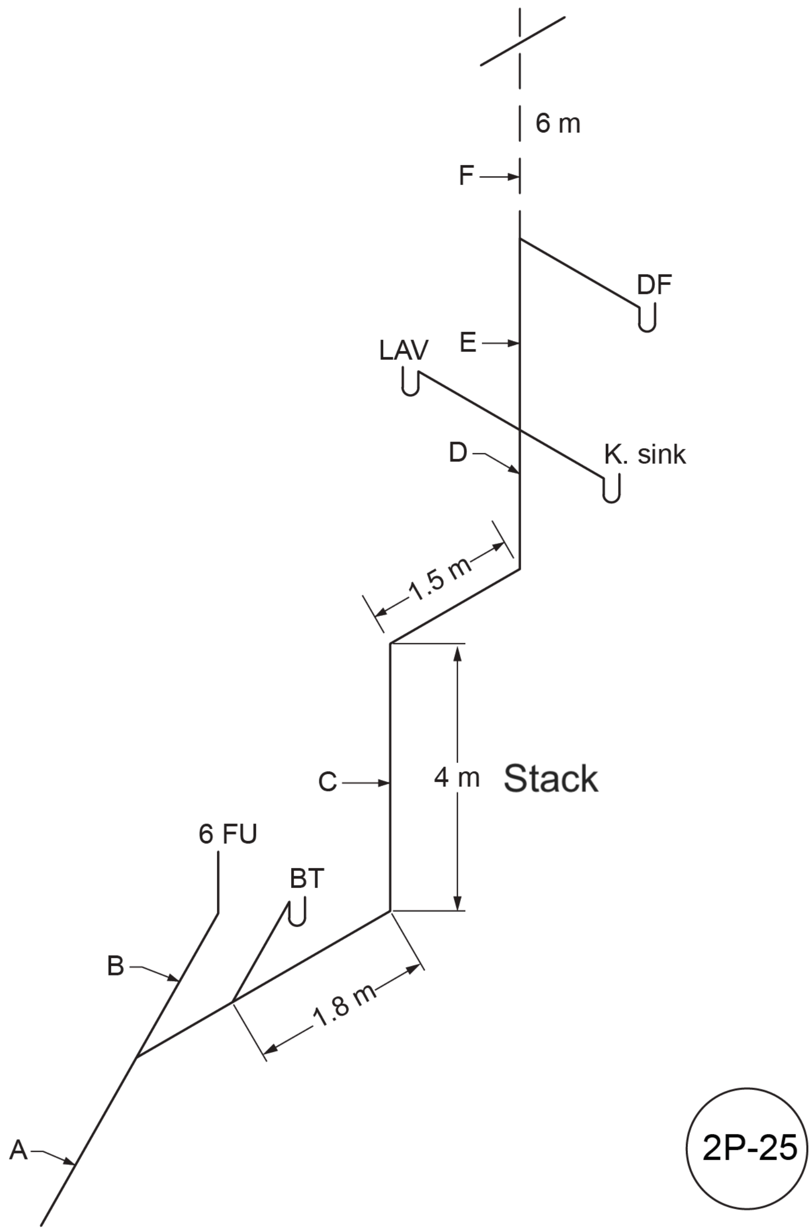


Figure 2P-25

Table 8

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				

9. Using Figure 2P-26, fill in Table 9 by identifying and sizing the multi-storey wet vent installation as per the NPC.

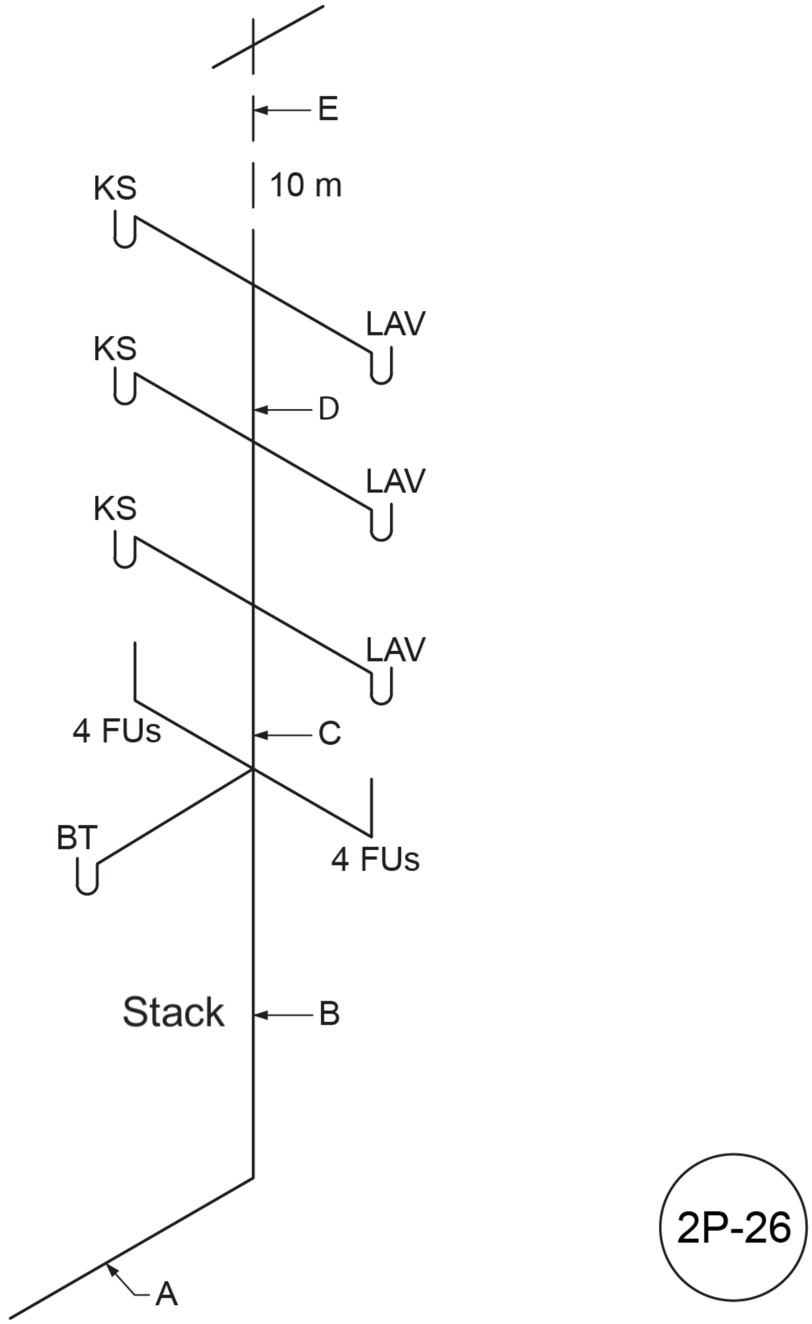


Figure 2P-26

Table 9

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				

10. Using Figure 2P-27, fill in Table 10 by identifying and sizing the multi-storey wet vent installation as per the NPC.

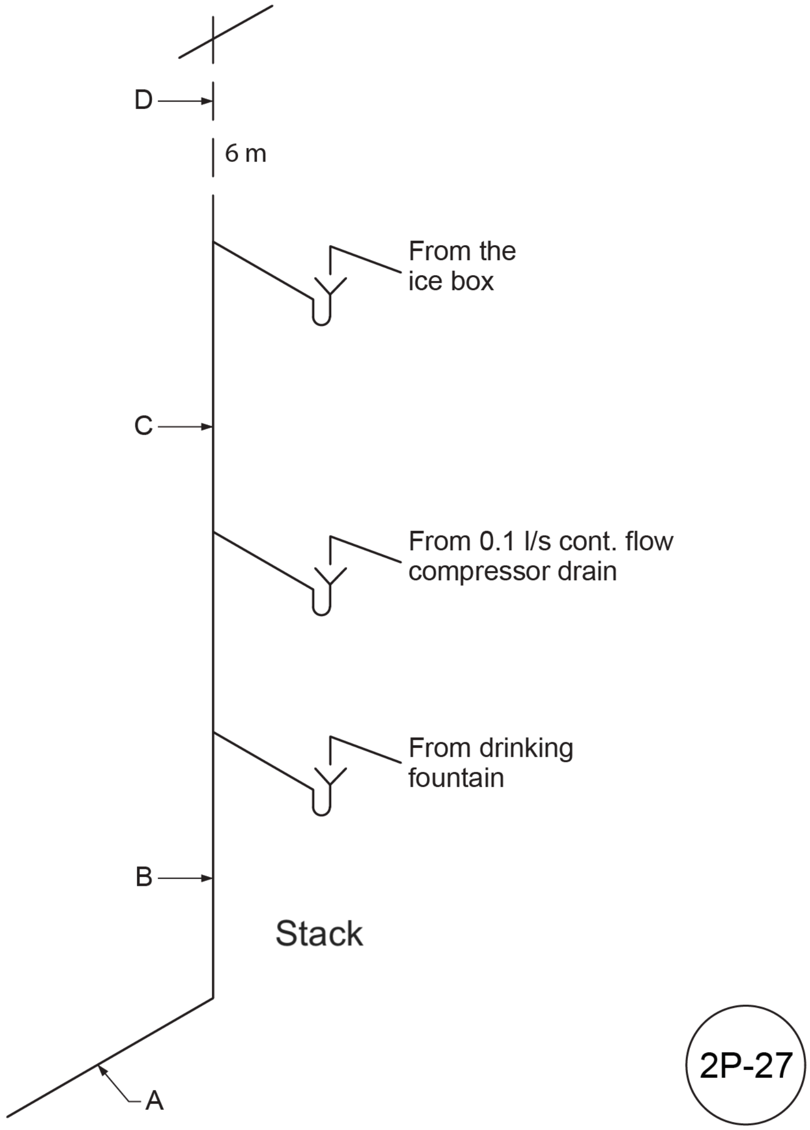


Figure 2P-27

Table 10

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				

Answer Key: Self-Test D-1.7 (#chapter-answer-key-self-test-d-1-7-2) is on the next page.

Answer Key: Self-Test D-1.7

1. Figure 2P-18

Table 1 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	7	N/A	3 in.
B	Stack acting as a wet vent	7	N/A	3 in.
C	Stack acting as a wet vent	7	N/A	3 in.
D	Stack acting as a wet vent	7	N/A	3 in.
E	Stack acting as a wet vent	7	N/A	3 in.
F	Stack	8	N/A	3 in.
G	Branch	8	N/A	3 in.
H	Stack vent	8	4 m	3 in.

2. Figure 2P-19

Table 2 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	3.5	N/A	3 in.
B	Stack acting as a wet vent	3.5	N/A	3 in.
C	Branch	9.5	N/A	3 in.
D	Stack acting as a wet vent	1.5	N/A	2 in.
E	Branch	7.5	N/A	3 in.
F	Branch	17	N/A	3 in.
G	Branch	17	N/A	3 in.
H	Stack vent	7.5	4 m	1.5 in.
I	Stack vent	9.5	4 m	1.5 in.

3. Figure 2P-20

Table 3 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	1	N/A	1.5 in.
B	Stack acting as a wet vent	1	N/A	1.5 in.
C	Branch	2	N/A	1.5 in.
D	Stack vent	2	3 m	1.25 in.

4. Figure 2P-21

Table 4 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	6	N/A	3 in.
B	Stack acting as a wet vent	6	N/A	3 in.
C	Fixture drain	1.5	N/A	1.5 in.
D	Branch – Wet vent	6	N/A	3 in.
E	Branch – Wet vent	6	N/A	3 in.
F	Branch	18	N/A	3 in.
G	Individual and continuous vent	N/A	N/A	1.25 in.
H	Stack vent	16.5	4 m	1.5 in.

5. Figure 2P-22

Table 5 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	12	N/A	3 in.
B	Stack acting as a wet vent	12	N/A	3 in.
C	Stack acting as a wet vent	12	N/A	3 in.
D	Stack acting as a wet vent	12	N/A	3 in.
E	Stack	15	N/A	3 in.
F	Stack vent	15	5 m	3 in.

6. Figure 2P-23

Table 6 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	2.5	N/A	3 in.
B	Stack acting as a wet vent	2.5	N/A	3 in.
C	Stack	5.5	N/A	3 in.
D	Branch	5.5	N/A	3 in.
E	Stack vent	5.5	3 m	1.5 in.

7. Figure 2P-24

Table 7 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	6.5	N/A	2.5 in.
B	Trap arm — Fixture drain	3	N/A	2 in.
C	Stack acting as a wet vent	3.5	N/A	2 in.
D	Fixture drain	1.5	N/A	1.5 in.
E	Stack acting as a wet vent	3.5	N/A	2 in.
F	Individual and continuous vent	N/A	N/A	1.25 in.
G	Stack vent	5	9 m	1.5 in.

8. Figure 2P-25

Table 8 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	10.5	N/A	3 in.
B	Trap arm — Fixture drain	6	N/A	3 in.
C	Stack acting as a wet vent	4.5	N/A	3 in.
D	Stack acting as a wet vent	4.5	N/A	3 in.
E	Stack acting as a wet vent	4.5	N/A	3 in.
F	Stack vent	10.5	6 m	1.5 in.

9. Figure 2P-26

Table 9 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	17	N/A	3 in.
B	Stack	17	N/A	3 in.
C	Stack acting as a wet vent	7.5	N/A	3 in.
D	Stack acting as a wet vent	7.5	N/A	3 in.
E	Stack vent	17	10 m	1.5 in.

10. Figure 2P-27

Table 10 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	4.67	N/A	3 in.
B	Stack	4.67	N/A	3 in.
C	Stack acting as a wet vent	4.17	N/A	3 in.
D	Stack vent	4.67	6 m	1.5 in.

Answer Key: Self-Test D-1.7 is on the next page.

Answer Key: Self-Test D-1.7

1. Figure 2P-18

Table 1 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	7	N/A	3 in.
B	Stack acting as a wet vent	7	N/A	3 in.
C	Stack acting as a wet vent	7	N/A	3 in.
D	Stack acting as a wet vent	7	N/A	3 in.
E	Stack acting as a wet vent	7	N/A	3 in.
F	Stack	8	N/A	3 in.
G	Branch	8	N/A	3 in.
H	Stack vent	8	4 m	3 in.

2. Figure 2P-19

Table 2 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	3.5	N/A	3 in.
B	Stack acting as a wet vent	3.5	N/A	3 in.
C	Branch	9.5	N/A	3 in.
D	Stack acting as a wet vent	1.5	N/A	2 in.
E	Branch	7.5	N/A	3 in.
F	Branch	17	N/A	3 in.
G	Branch	17	N/A	3 in.
H	Stack vent	7.5	4 m	1.5 in.
I	Stack vent	9.5	4 m	1.5 in.

3. Figure 2P-20

Table 3 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	1	N/A	1.5 in.
B	Stack acting as a wet vent	1	N/A	1.5 in.
C	Branch	2	N/A	1.5 in.
D	Stack vent	2	3 m	1.25 in.

4. Figure 2P-21

Table 4 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	6	N/A	3 in.
B	Stack acting as a wet vent	6	N/A	3 in.
C	Fixture drain	1.5	N/A	1.5 in.
D	Branch – Wet vent	6	N/A	3 in.
E	Branch – Wet vent	6	N/A	3 in.
F	Branch	18	N/A	3 in.
G	Individual and continuous vent	N/A	N/A	1.25 in.
H	Stack vent	16.5	4 m	1.5 in.

5. Figure 2P-22

Table 5 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	12	N/A	3 in.
B	Stack acting as a wet vent	12	N/A	3 in.
C	Stack acting as a wet vent	12	N/A	3 in.
D	Stack acting as a wet vent	12	N/A	3 in.
E	Stack	15	N/A	3 in.
F	Stack vent	15	5 m	3 in.

6. Figure 2P-23

Table 6 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Stack acting as a wet vent	2.5	N/A	3 in.
B	Stack acting as a wet vent	2.5	N/A	3 in.
C	Stack	5.5	N/A	3 in.
D	Branch	5.5	N/A	3 in.
E	Stack vent	5.5	3 m	1.5 in.

7. Figure 2P-24

Table 7 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	6.5	N/A	2.5 in.
B	Trap arm — Fixture drain	3	N/A	2 in.
C	Stack acting as a wet vent	3.5	N/A	2 in.
D	Fixture drain	1.5	N/A	1.5 in.
E	Stack acting as a wet vent	3.5	N/A	2 in.
F	Individual and continuous vent	N/A	N/A	1.25 in.
G	Stack vent	5	9 m	1.5 in.

8. Figure 2P-25

Table 8 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	10.5	N/A	3 in.
B	Trap arm — Fixture drain	6	N/A	3 in.
C	Stack acting as a wet vent	4.5	N/A	3 in.
D	Stack acting as a wet vent	4.5	N/A	3 in.
E	Stack acting as a wet vent	4.5	N/A	3 in.
F	Stack vent	10.5	6 m	1.5 in.

9. Figure 2P-26

Table 9 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	17	N/A	3 in.
B	Stack	17	N/A	3 in.
C	Stack acting as a wet vent	7.5	N/A	3 in.
D	Stack acting as a wet vent	7.5	N/A	3 in.
E	Stack vent	17	10 m	1.5 in.

10. Figure 2P-27

Table 10 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	4.67	N/A	3 in.
B	Stack	4.67	N/A	3 in.
C	Stack acting as a wet vent	4.17	N/A	3 in.
D	Stack vent	4.67	6 m	1.5 in.

Self-Test D-1.8 Sizing Branch and Circuit Vents

Complete Self-Test D-1.8 and check your answers.

1. Using Figure 2P-28, fill in Table 1 by identifying and sizing the circuit vent installation as per the NPC.

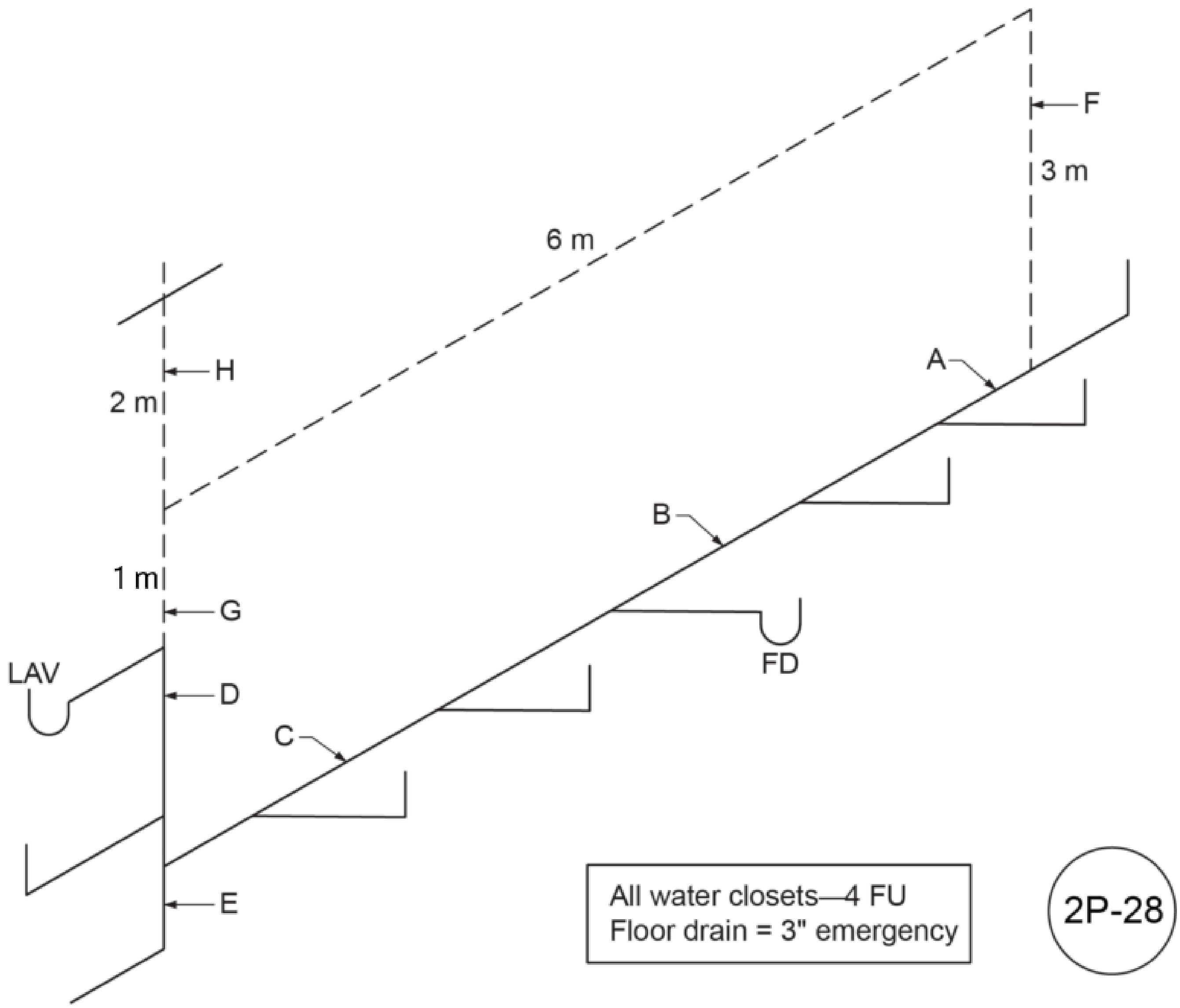


Figure 2P-28

Table 1

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				

1. Using Figure 2P-29, fill in Table 2 by identifying and sizing the circuit vent installation as per the NPC.

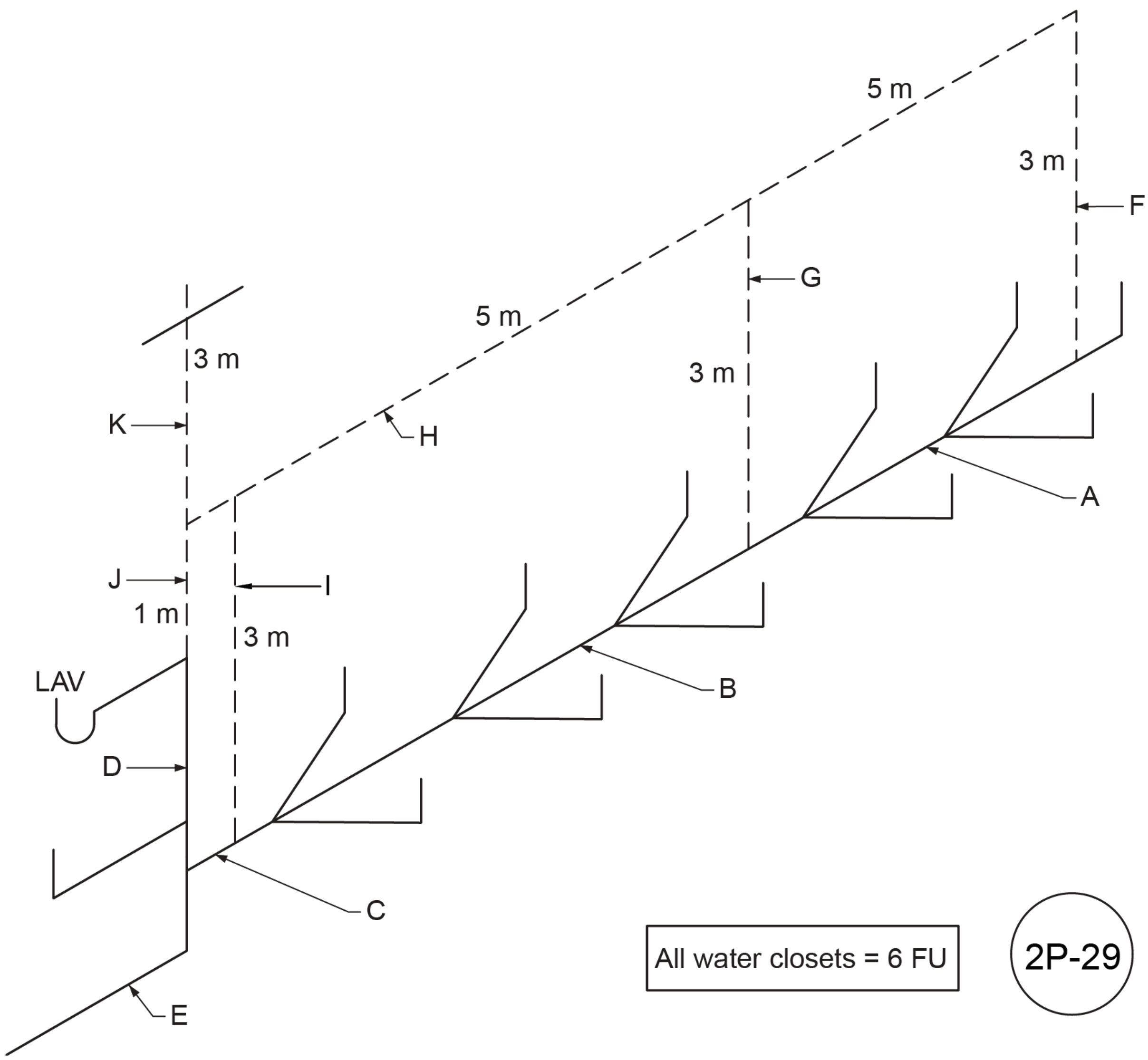


Figure 2P-29

Table 2

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				

1. Using Figure 2P-30, fill in Table 3 by identifying and sizing the circuit vent installation as per the NPC.

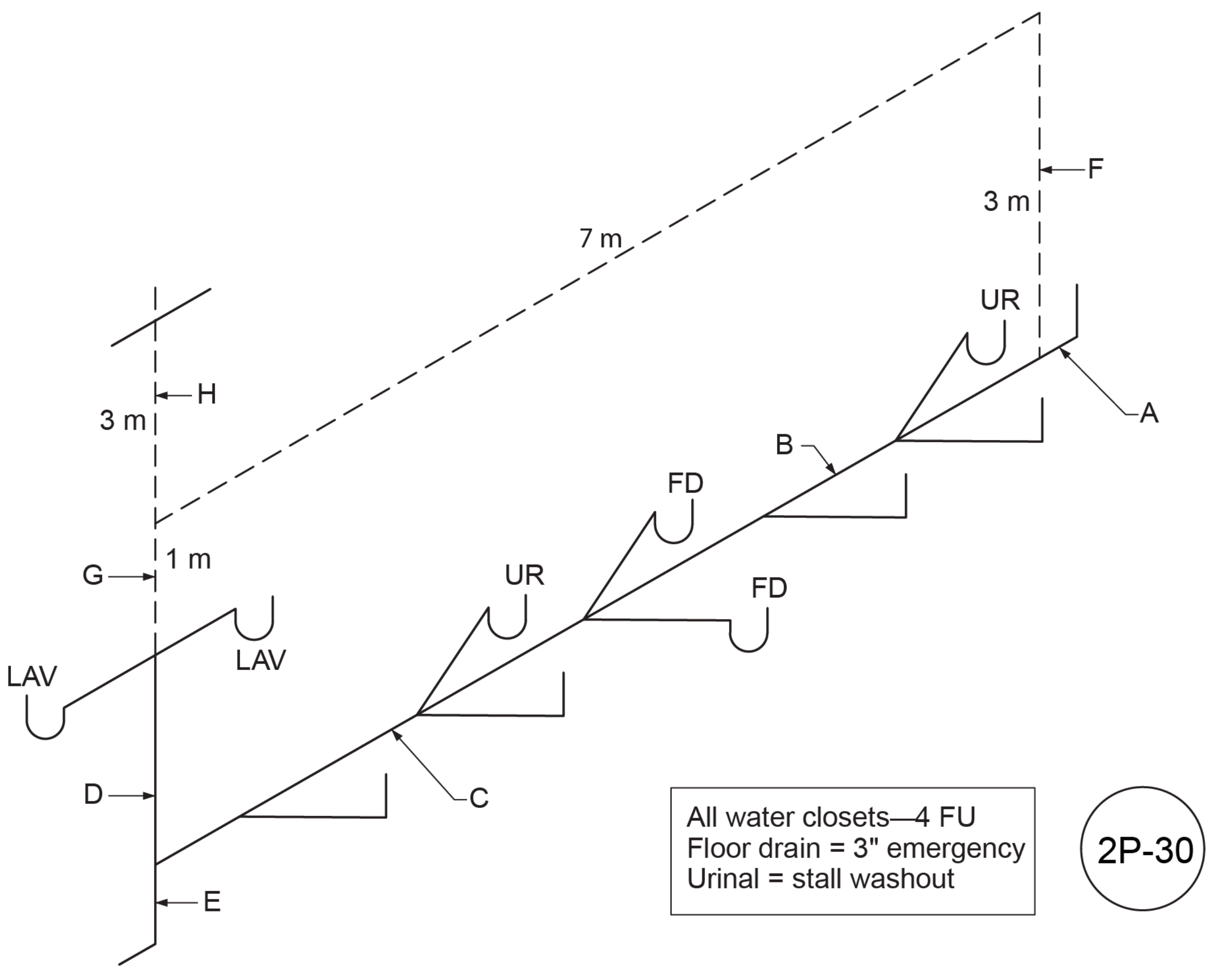


Figure 2P-30

Table 3

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				

1. Using Figure 2P-31, fill in Table 4 by identifying and sizing the circuit vent installation as per the NPC.

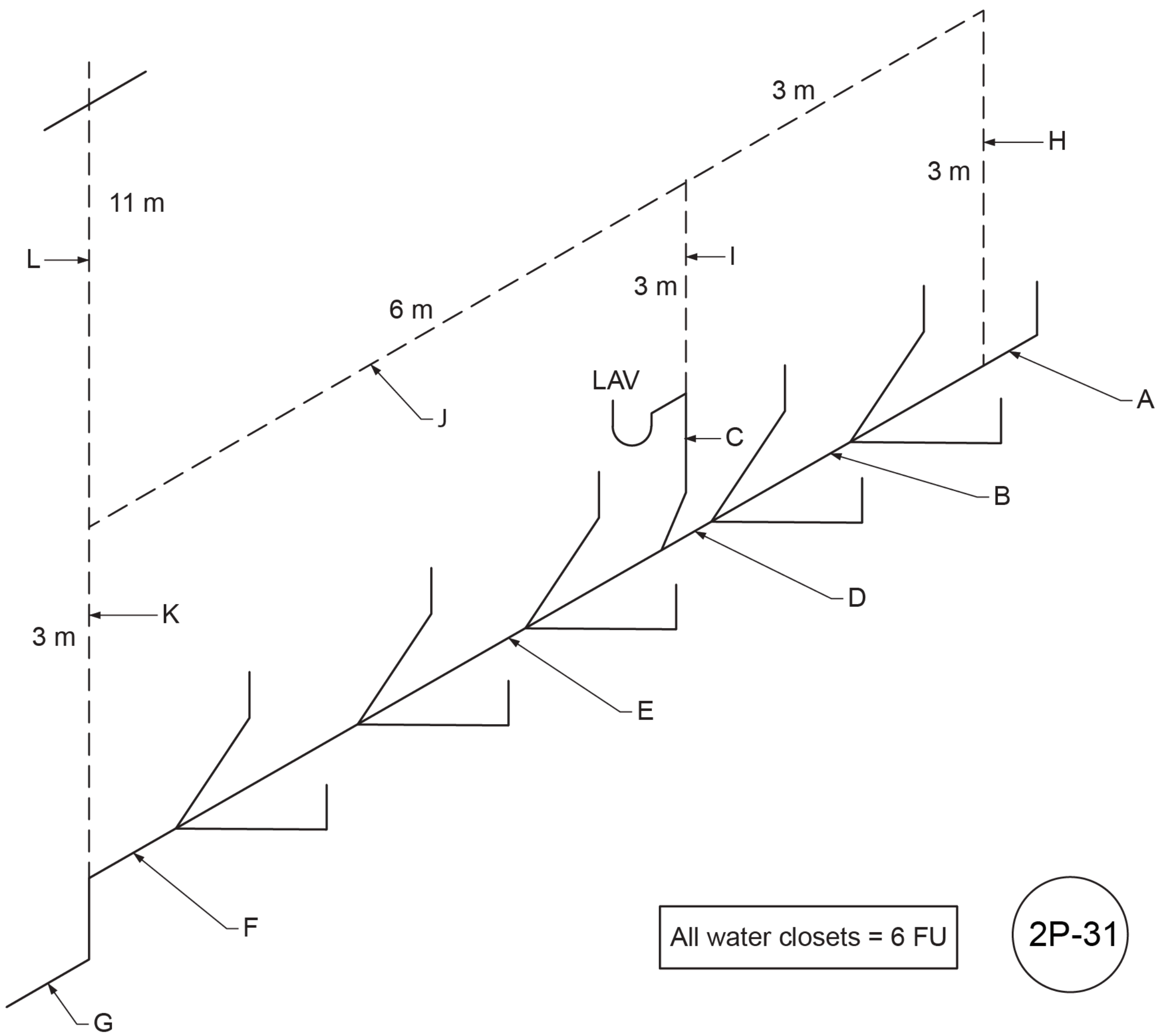


Figure 2P-31

Table 4

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				

1. Using Figure 2P-32, fill in Table 5 by identifying and sizing the circuit vent installation as per the NPC.

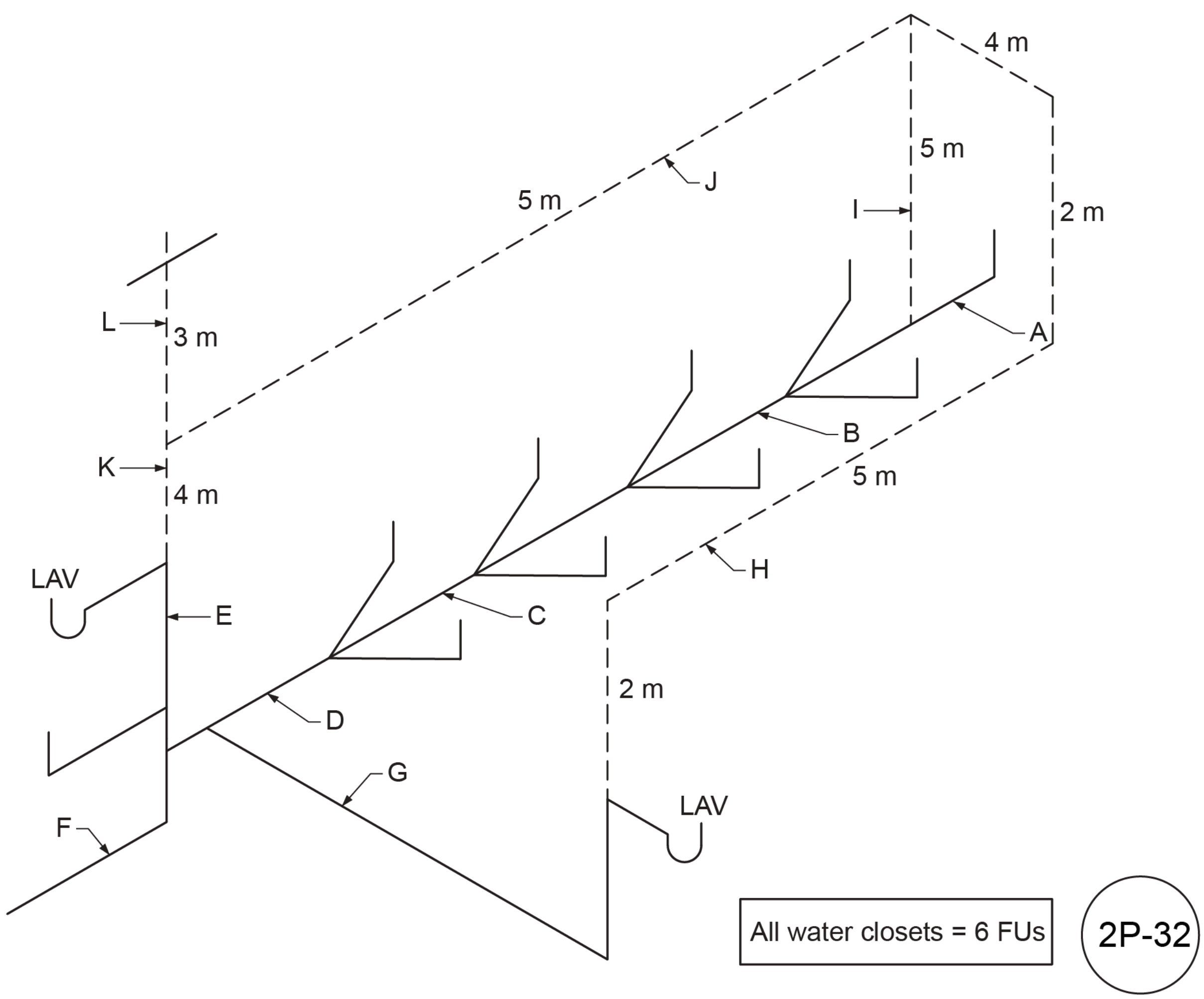


Figure 2P-32

Table 5

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				

1. Using Figure 2P-33, fill in Table 6 by identifying and sizing the circuit vent installation as per the NPC.

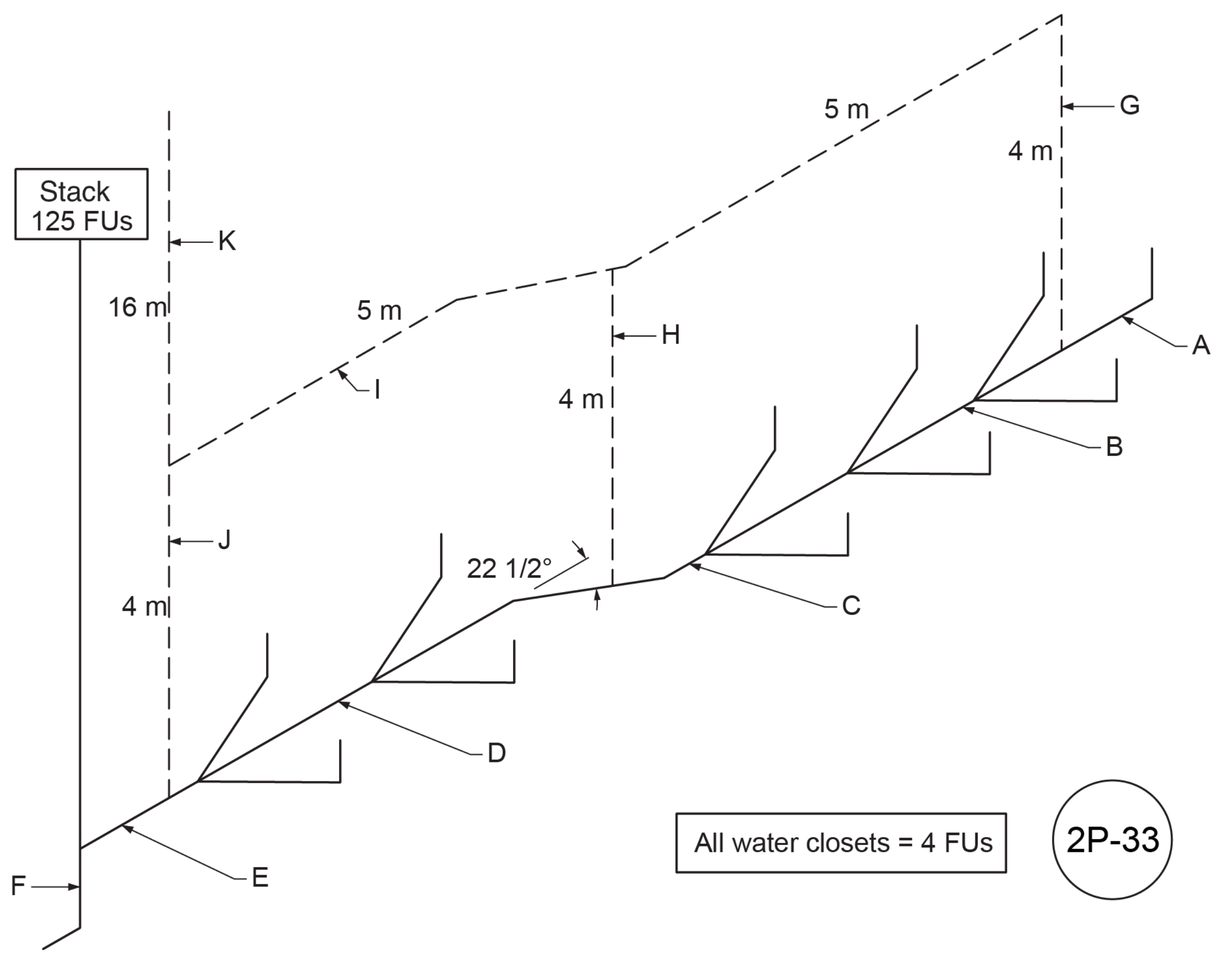


Figure 2P-33

Table 6

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				

1. Using Figure 2P-34, fill in Table 7 by identifying and sizing the circuit vent installation as per the NPC.

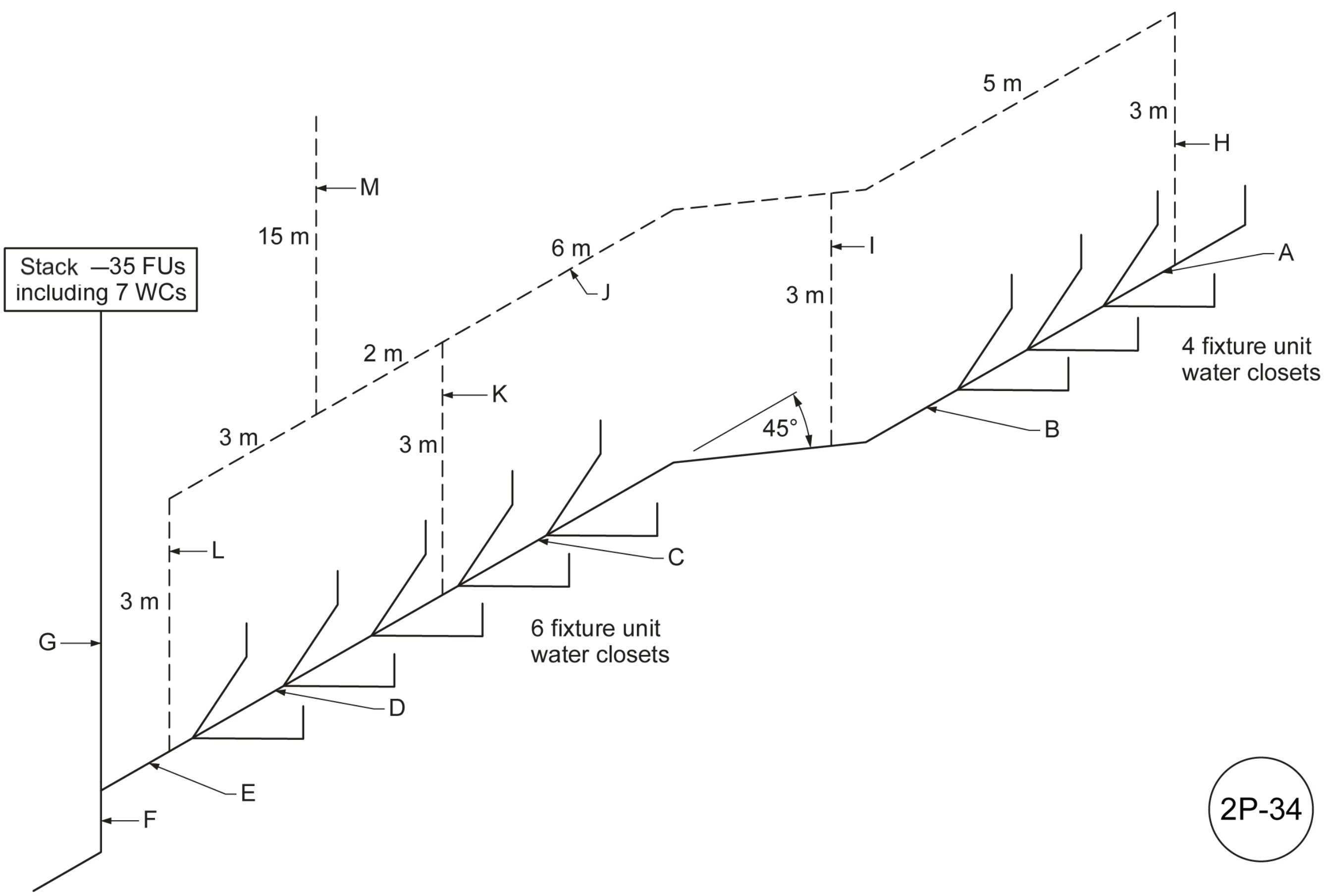


Figure 2P-34

Table 7

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				

1. Using Figure 2P-35, fill in Table 8 by identifying and sizing the circuit vent installation as per the NPC.

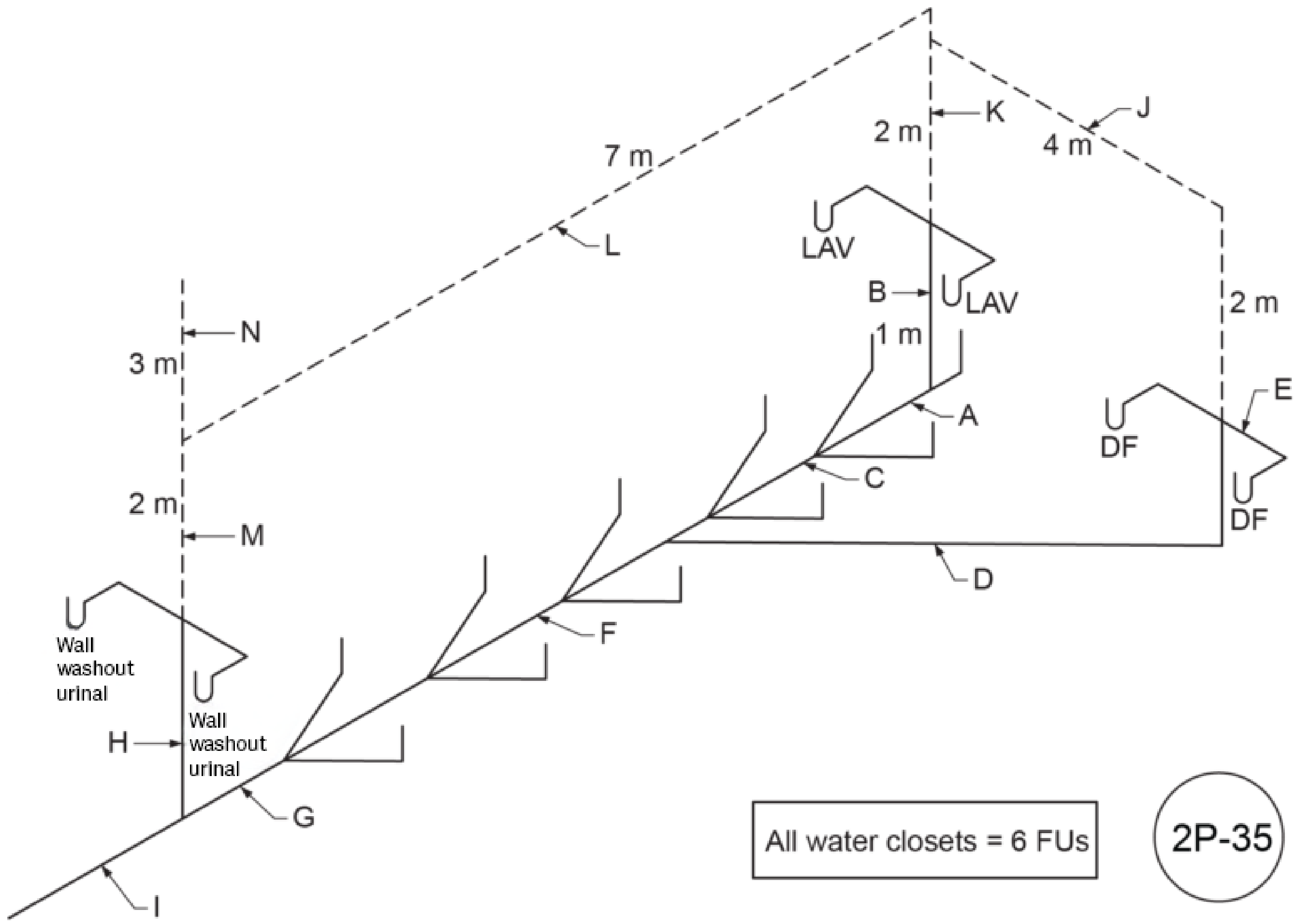


Figure 2P-35

Table 8

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				

1. Using Figure 2P-36, fill in Table 9 by identifying and sizing the circuit vent installation as per the NPC.

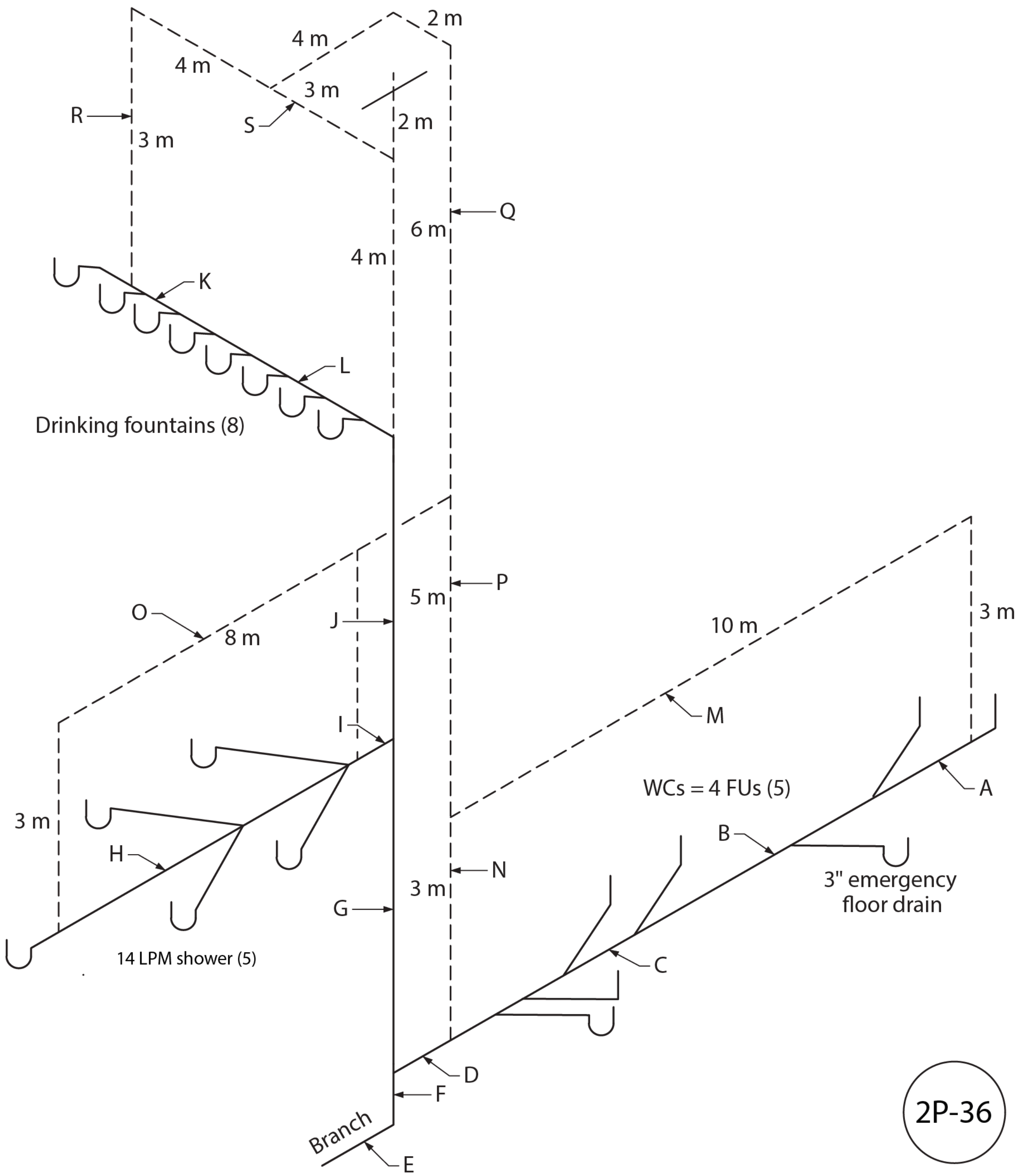


Figure 2P-36

Table 9

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				

1. Using Figure 2P-37, fill in Table 10 by identifying and sizing the circuit vent installation as per the NPC.

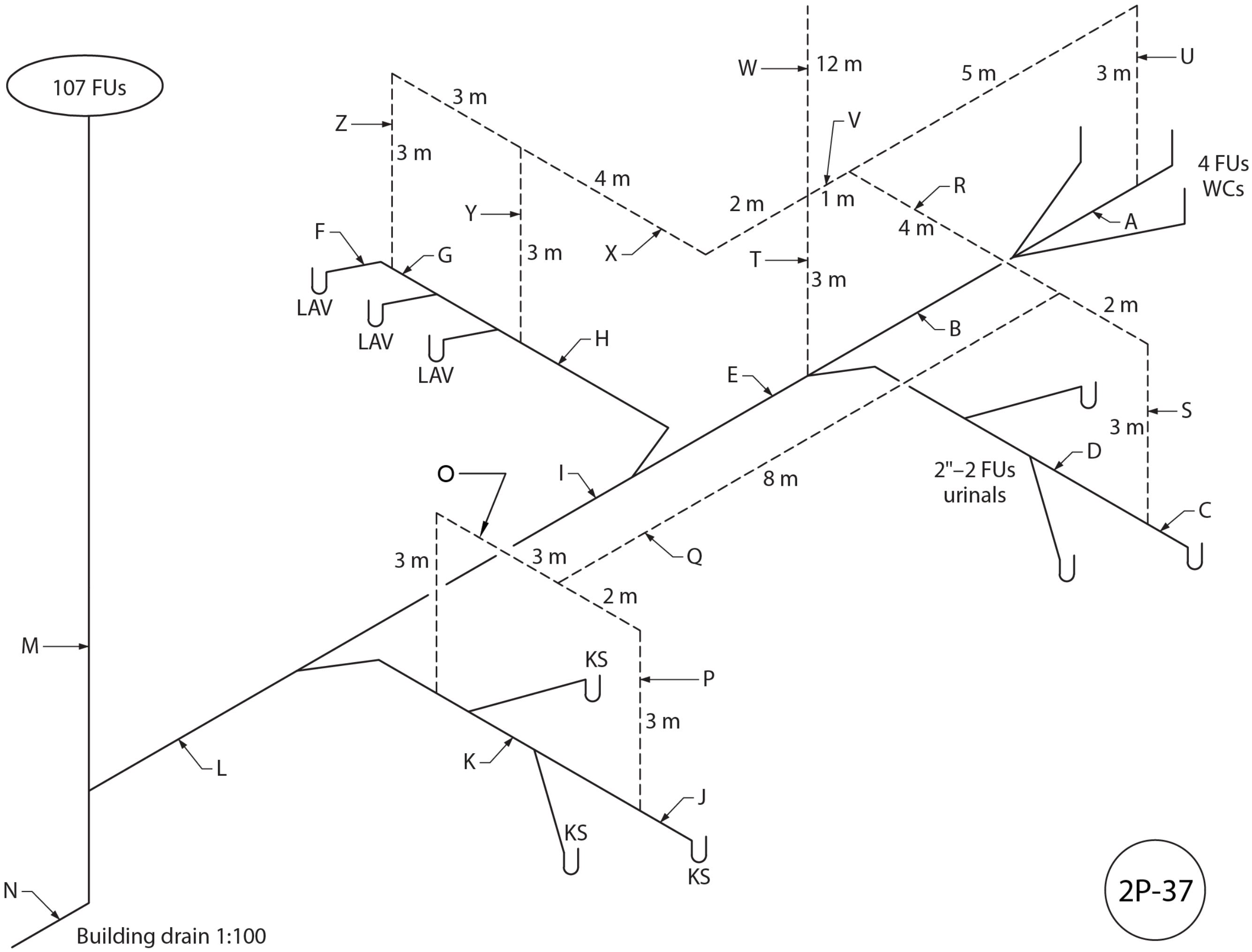

107 FUs
Z
3 m
3 m
4 m
Y
3 m
X
F
G
LAV
LAV
LAV
H
W
12 m
V
2 m
1 m
T
3 m
5 m
3 m
U
R
4 m
4 FUs
WCs
A
B
2 m
E
S
3 m
D
2"–2 FUs
urinals
C
8 m
I
O
3 m
3 m
Q
2 m
M
KS
P
3 m
L
K
J
KS
KS
N
Building drain 1:100
2P-37
Figure 2P-37

Table 10

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				
T				
U				
V				
W				
X				
Y				
Z				

Answer Key: Self-Test D-1.8 (https://d-drainagesystems-bcplumbingapprl2.pressbooks.tru.ca/?post_type=chapter&p=1828&preview=true) is on the next page.

Answer Key: Self-Test D-1.8

1. Figure 2P-28

Table 1 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Fixture drain	4	N/A	3 in.
B	Branch	12	N/A	4 in.
C	Branch	16	N/A	4 in.
D	Fixture drain — Sized as a wet vent — Acting as a relief vent	1	N/A	2 in.
E	Branch	25	N/A	4 in.
F	Circuit vent	20	11 m	1.5 in.
G	Continuous vent — Acting as a relief vent	5	3 m	1.5 in.
H	Branch vent	25	11 m	2 in.

2. Figure 2P-29

Table 2 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	18	N/A	4 in.
B	Branch	42	N/A	4 in.
C	Branch	66	N/A	4 in.
D	Fixture drain — Acting as a wet vent	1	N/A	2 in.
E	Branch	73	N/A	4 in.
F	Circuit vent	66	16 m	3 in.
G	Additional circuit vent	N/A	N/A	2 in.
H	Branch vent	66	16 m	3 in.
I	Relief vent	N/A	N/A	2 in.
J	Continuous vent	7	4 m	1.5 in.
K	Branch vent	73	16 m	3 in.

3. Figure 2P-30

Table 3 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Trap arm — Fixture drain	4	N/A	3 in.
B	Branch	10	N/A	3 in.
C	Branch	20	N/A	4 in.
D	Branch — Acting as a relief vent	2	N/A	1.5 in.
E	Branch	26	N/A	4 in.
F	Circuit vent	24	13 m	2 in.
G	Dual and continuous vent — Acting as a relief vent	N/A	N/A	1.5 in.
H	Branch vent	26	13 m	2 in.

4. Figure 2P-31

Table 4 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Trap arm — Fixture drain	6	N/A	3 in.
B	Branch	18	N/A	4 in.
C	Fixture drain — Sized as a wet vent — Acting as an additional circuit vent	1	N/A	3 in.
D	Branch	30	N/A	4 in.
E	Branch	43	N/A	4 in.
F	Branch	67	N/A	4 in.
G	Branch	67	N/A	4 in.
H	Circuit vent	67	23 m	3 in.
I	Additional circuit vent	N/A	N/A	2 in.
J	Branch vent	67	23 m	3 in.
K	Relief vent	N/A	N/A	2 in.
L	Branch vent	67	23 m	3 in.

5. Figure 2P-32

Table 5 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Trap arm — Fixture drain	6	N/A	3 in.
B	Branch	18	N/A	4 in.
C	Branch	42	N/A	4 in.
D	Branch	54	N/A	4 in.
E	Fixture drain — Acting as a wet vent	1	N/A	2 in.
F	Branch	62	N/A	4 in.
G	Fixture drain — Acting as a relief vent	1	N/A	1.5 in.
H	Individual and continuous vent — Acting as a relief vent	N/A	N/A	1.5 in.
I	Circuit vent	54	13 m	2 in.
J	Branch vent	55	21 m	3 in.
K	Continuous vent	7	7 m	1.5 in.
L	Branch vent	62	21 m	3 in.

6. Figure 2P-33

Table 6 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Trap arm — Fixture drain	4	N/A	3 in.
B	Branch	12	N/A	4 in.
C	Branch	28	N/A	4 in.
D	Branch	36	N/A	4 in.
E	Branch	44	N/A	4 in.
F	Stack	169	N/A	4 in.
G	Circuit vent	44	30 m	3 in.
H	Additional circuit vent	N/A	N/A	2 in.
I	Branch vent	44	30 m	3 in.
J	Relief vent	N/A	N/A	2 in.
K	Branch vent	44	30 m	3 in.

7. Figure 2P-34

Table 7 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Fixture drain	4	N/A	3 in.
B	Branch	28	N/A	4 in.
C	Branch	40	N/A	4 in.
D	Branch	76	N/A	4 in.
E	Branch	88	N/A	4 in.
F	Stack	123	N/A	4 in.
G	Stack	35	N/A	4 in.
H	Circuit vent	88	31 m	3 in.
I	Additional circuit vent	N/A	N/A	2 in.
J	Branch vent	88	31 m	3 in.
K	Additional circuit vent	N/A	N/A	2 in.
L	Relief vent	N/A	N/A	2 in.
M	Branch vent	88	31 m	3 in.

8. Figure 2P-35

Table 8 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Branch	8	N/A	3 in.
B	Branch sized as a wet vent acting as a circuit vent	(2 – wv) 69	N/A	3 in.
C	Branch	20	N/A	4 in.
D	Branch sized as a wet vent acting as an additional relief vent	1	N/A	2 in.
E	Trap arm fixture drain	0.5	N/A	1.25 in.
F	Branch	45	N/A	4 in.
G	Branch	69	N/A	4 in.
H	Branch acting as a relief vent	3	N/A	2 in.
I	Branch	74	N/A	4 in.
J	Dual and continuous vent acting as an additional circuit vent	N/A	N/A	2 in.
K	Circuit vent	69	13 m	3 in.
L	Branch vent	69	16 m	3 in.
M	Dual and continuous vent acting as a relief vent	N/A	N/A	2 in.
N	Branch vent	77	16 m	3 in.

9. Figure 2P-36

Table 9 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Fixture drain	4	N/A	3 in.
B	Branch	8	N/A	3 in.
C	Branch	12	N/A	4 in.
D	Branch	20	N/A	4 in.
E	Branch	39	N/A	4 in.
F	Stack	39	N/A	4 in.
G	Stack	19	N/A	3 in.
H	Fixture drain	3	N/A	3 in.
I	Branch	15	N/A	3 in.
J	Stack	4	N/A	2 in.
K	Branch	1	N/A	2 in.
L	Branch	3	N/A	2 in.
M	Circuit vent	20	33 m	2 in.
N	Relief vent	N/A	N/A	1.5 in.
O	Circuit vent	15	26 mm	2 in.
P	Branch vent	20	33 m	2 in.
Q	Branch vent	35	33 m	3 in.
R	Circuit vent	4	10 m	1.5 in.
S	Branch vent	39	33 m	3 in.

10. Figure 2P-37

Table 10 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Fixture drain	4	N/A	3 in.
B	Branch	12	N/A	4 in.
C	Trap arm — Fixture drain	2	N/A	2 in.
D	Fixture drain	2	N/A	3 in.
E	Branch	18	N/A	4 in.
F	Trap arm — Fixture drain	1	N/A	1.25 in.
G	Fixture drain	1	N/A	2 in.
H	Branch	3	N/A	2 in.
I	Branch	21	N/A	4 in.
J	Trap arm — Fixture drain	1.5	N/A	1.5 in.
K	Branch	3	N/A	2 in.
L	Branch	25.5	N/A	4 in.
M	Stack	107	N/A	4 in.
N	Sanitary building drain	132.5	N/A	4 in.
O	Relief vent	N/A	N/A	1.25 in.
P	Circuit vent	4.5	30 m	1.5v
Q	Branch vent	4.5	31 m	2 in.
R	Branch vent	10.5	31 m	2 in.
S	Circuit vent	6	22 m	1.5 in.
T	Combined relief vent	N/A	N/A	1.5 in.
U	Circuit vent	12	21 m	2 in.
V	Branch bent	22.5	31 m	3 in.
W	Branch vent	25.5	31 m	3 in.
X	Branch vent	3	24 m	1.5 in.
Y	Relief vent	N/A	N/A	1.25 in.
Z	Circuit vent	3	24 m	1.5 in.

Self-Test D-1.9 Sizing Stack Vents, Vent Stacks, and Headers

Complete Self-Test D-1.9 and check your answers.

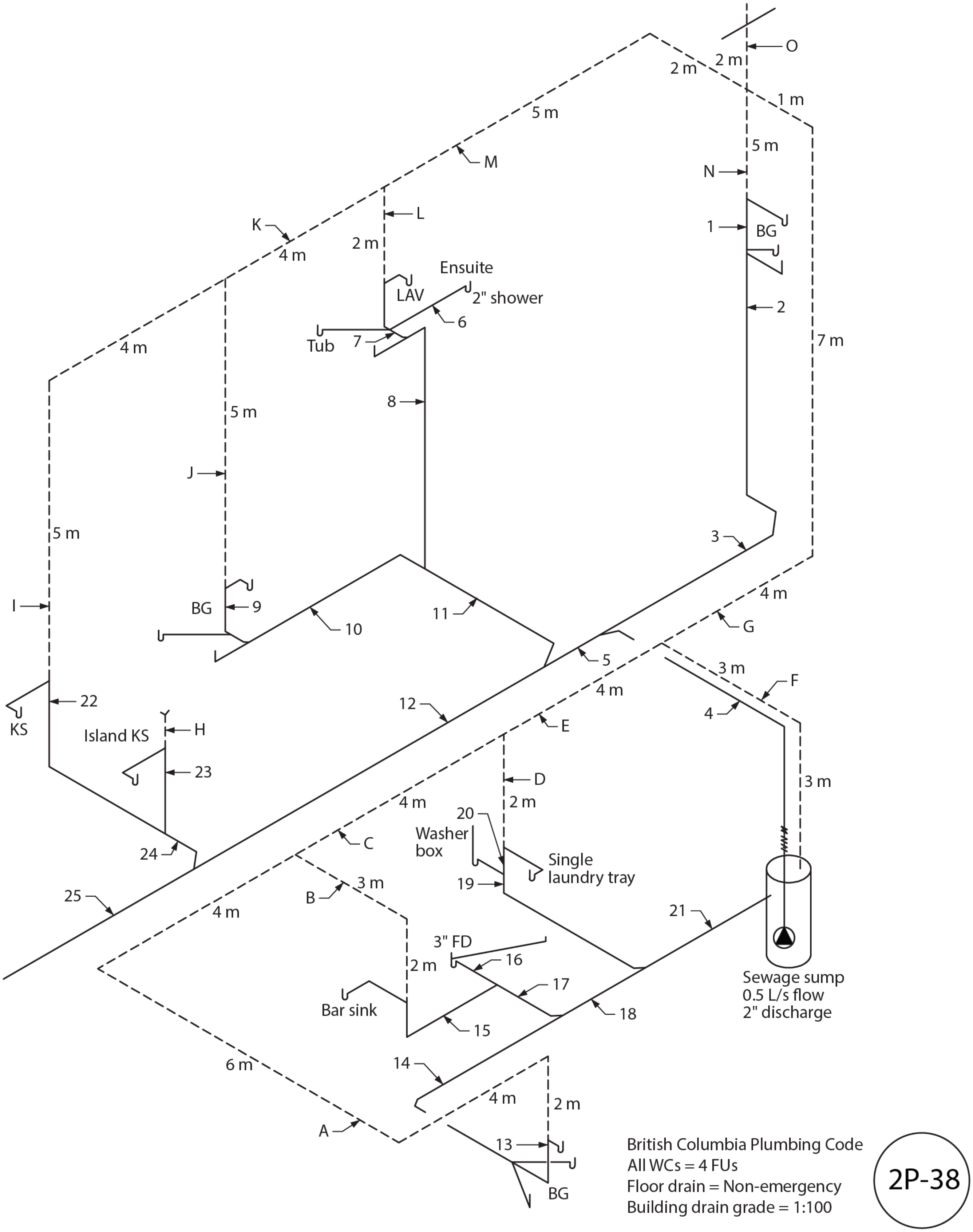

O
2 m
2 m
1 m
5 m
5 m
M
N
L
K
1
2 m
4 m
BG
Ensuite
LAV
2" shower
6
2
Tub
7
7 m
4 m
8
5 m
J
5 m
3
I
BG
9
10
11
4 m
G
5
3 m
F
12
4 m
22
KS
E
4
Island KS
H
23
D
3 m
4 m
2 m
20
Washer box
24
C
Single laundry tray
25
B
3 m
19
4 m
21
3" FD
16
2 m
17
Sewage sump
0.5 L/s flow
2" discharge
Bar sink
18
15
6 m
14
4 m
2 m
A
13
BG
British Columbia Plumbing Code
All WCs = 4 FUs
Floor drain = Non-emergency
Building drain grade = 1:100
2P-38

Figure 2P-38

1. Using Figure 2P-38, fill in Table 1 by identifying and sizing the DWV drainage installation indicated by the numbers.

Table 1

Number	Name	Hydraulic Load (FU)	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

2. Using Figure 2P-38, fill in Table 2 by identifying and sizing the DWV venting installation indicated by the letters.

Table 2

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				

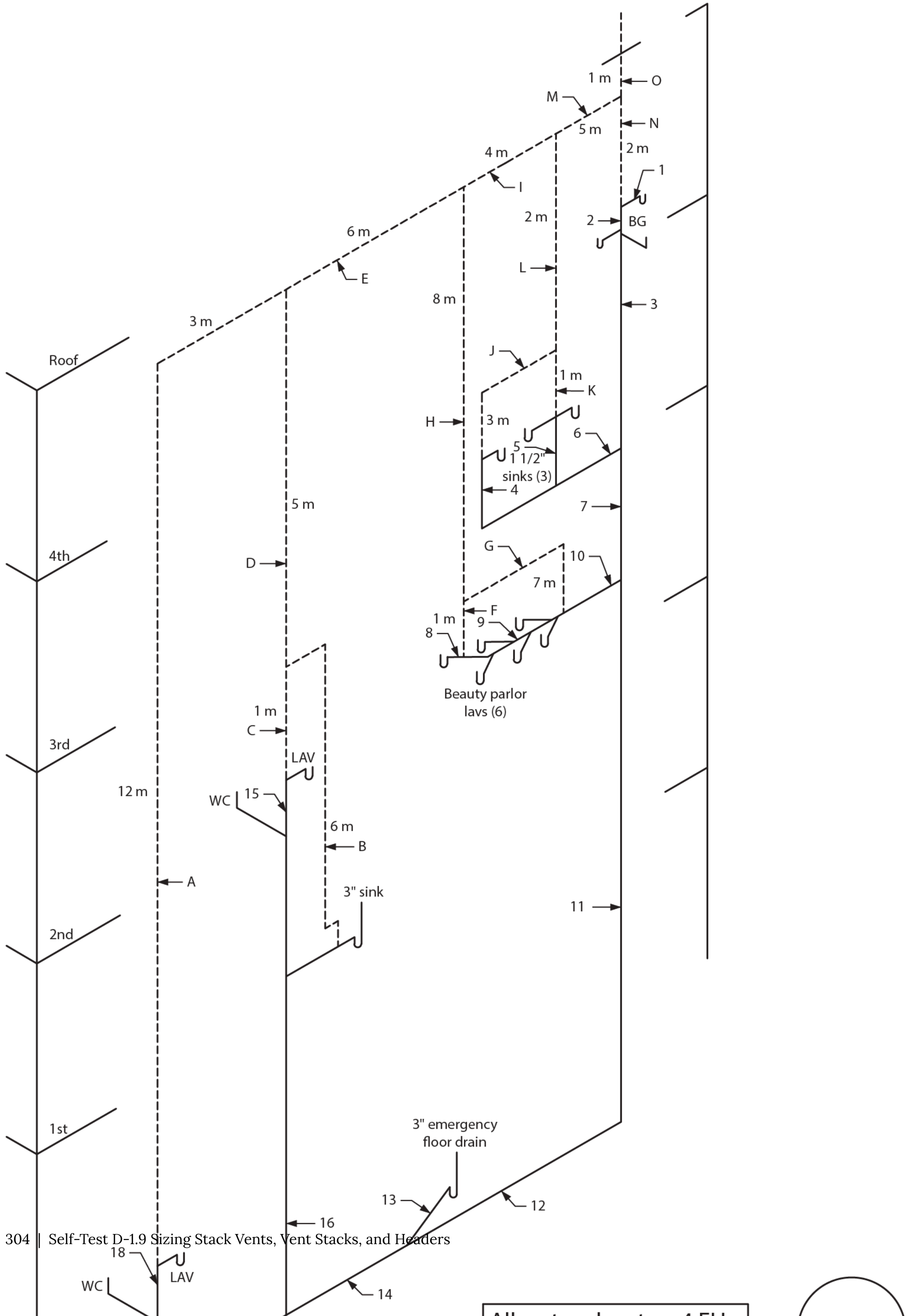

1 m
O
M
5 m
N
2 m
4 m
1
I
2 m
2
BG
6 m
E
L
3
8 m
3 m
Roof
J
1 m
K
H
3 m
6
5
1 1/2"
sinks (3)
4
5 m
7
4th
G
10
D
7 m
F
1 m
9
8
Beauty parlor
lavs (6)
1 m
3rd
C
LAV
12 m
WC
15
6 m
B
A
3" sink
11
2nd
1st
3" emergency
floor drain
13
12
16
18
LAV
WC
14

Figure 2P-39

3. Using Figure 2P-39, fill in Table 3 by identifying and sizing the DWV drainage installation indicated by the numbers.

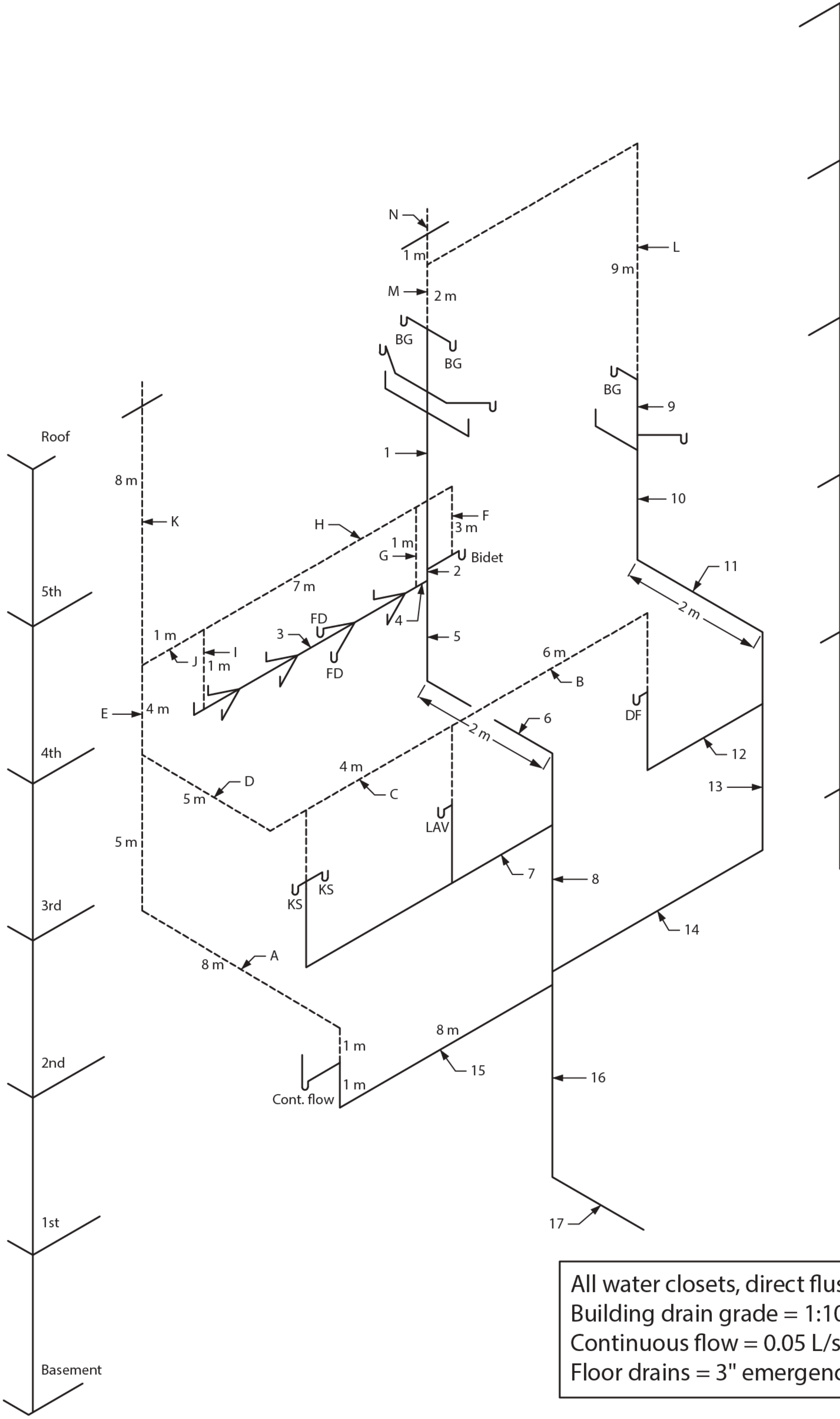
Table 3

Number	Name	Hydraulic Load (FU)	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

4. Using Figure 2P-39, fill in Table 4 by identifying and sizing the DWV venting installation indicated by the letters.

Table 4

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				



All water closets, direct flush valve
Building drain grade = 1:100
Continuous flow = 0.05 L/s
Floor drains = 3" emergency

2P-40

Figure 2P-40

5. Using Figure 2P-40, fill in Table 5 by identifying and sizing the DWV drainage installation indicated by the numbers.

Table 5

Number	Name	Hydraulic Load (FU)	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			

6. Using Figure 2P-40, fill in Table 6 by identifying and sizing the DWV venting installation indicated by the letters.

Table 6

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				

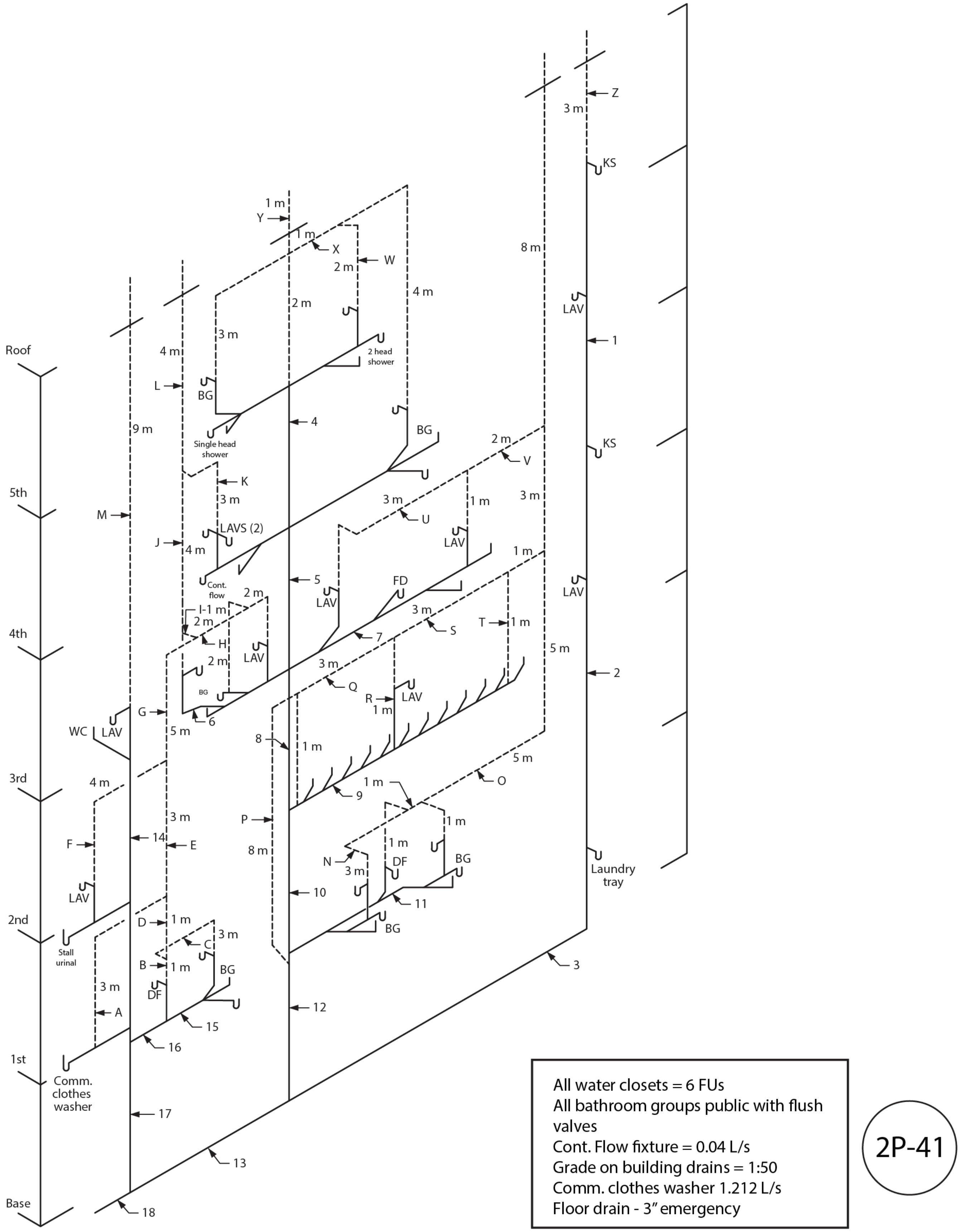

Roof
5th
4th
3rd
2nd
1st
Base
All water closets = 6 FUs
All bathroom groups public with flush valves
Cont. Flow fixture = 0.04 L/s
Grade on building drains = 1:50
Comm. clothes washer 1.212 L/s
Floor drain - 3″ emergency
2P-41
KS
LAV
Laundry tray
Comm. clothes washer
Stall urinal
WC
DF
BG
FD
Single head shower
2 head shower
LAVS (2)
Cont. flow

Figure 2P-41

7. Using Figure 2P-41, fill in Table 7 by identifying and sizing the DWV drainage installation indicated by the numbers.

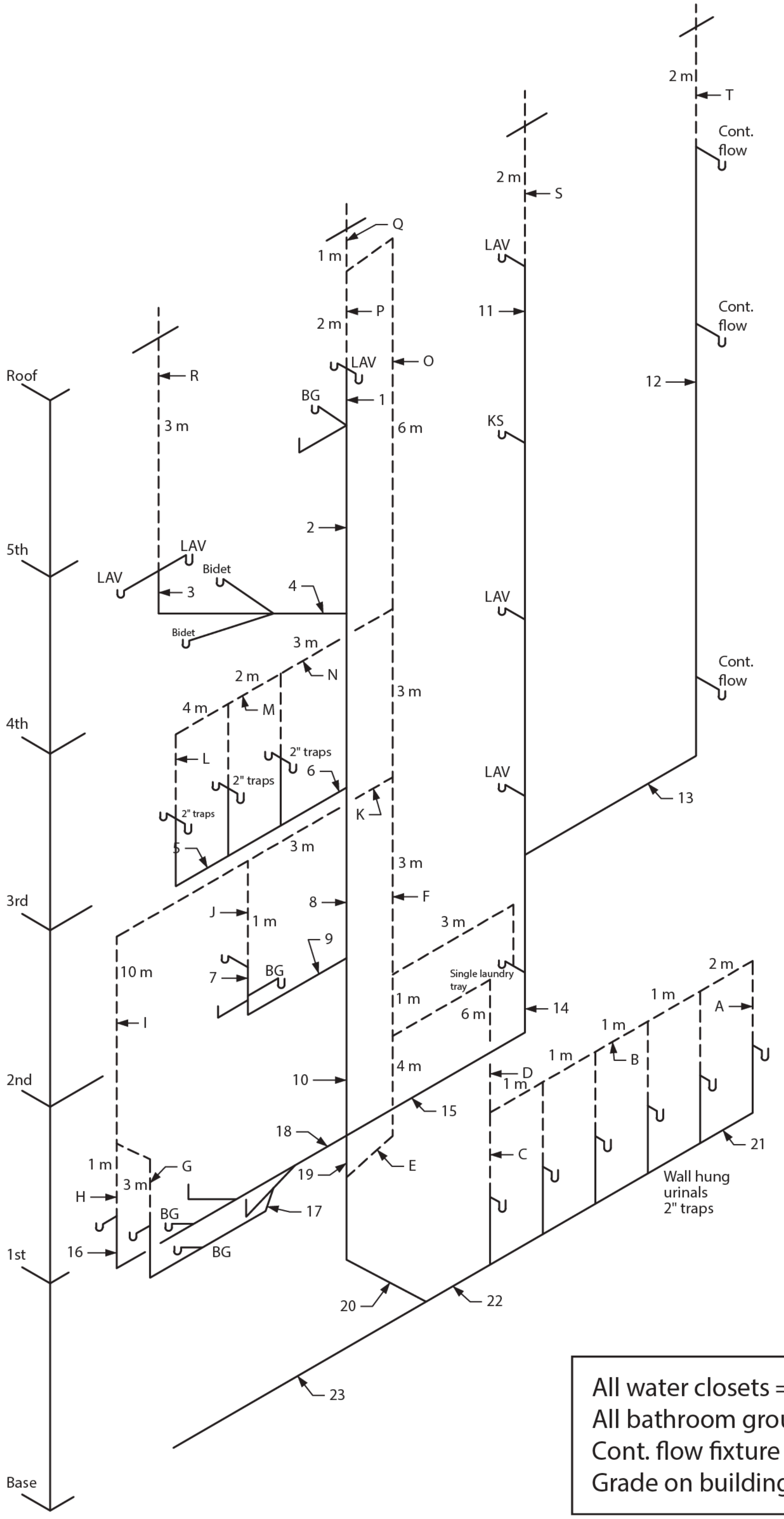
Table 7

Number	Name	Hydraulic Load (FU)	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

8. Using Figure 2P-41, fill in Table 8 by identifying and sizing the DWV venting installation indicated by the letters.

Table 8

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				
T				
U				
V				
W				
X				
Y				
Z				



All water closets = 6 FU
All bathroom groups public
Cont. flow fixture = 0.07 L/s
Grade on building drains = 1:50

2P-42

Figure 2P-42

9. Using Figure 2P-42, fill in Table 9 by identifying and sizing the DWV drainage installation indicated by the numbers.

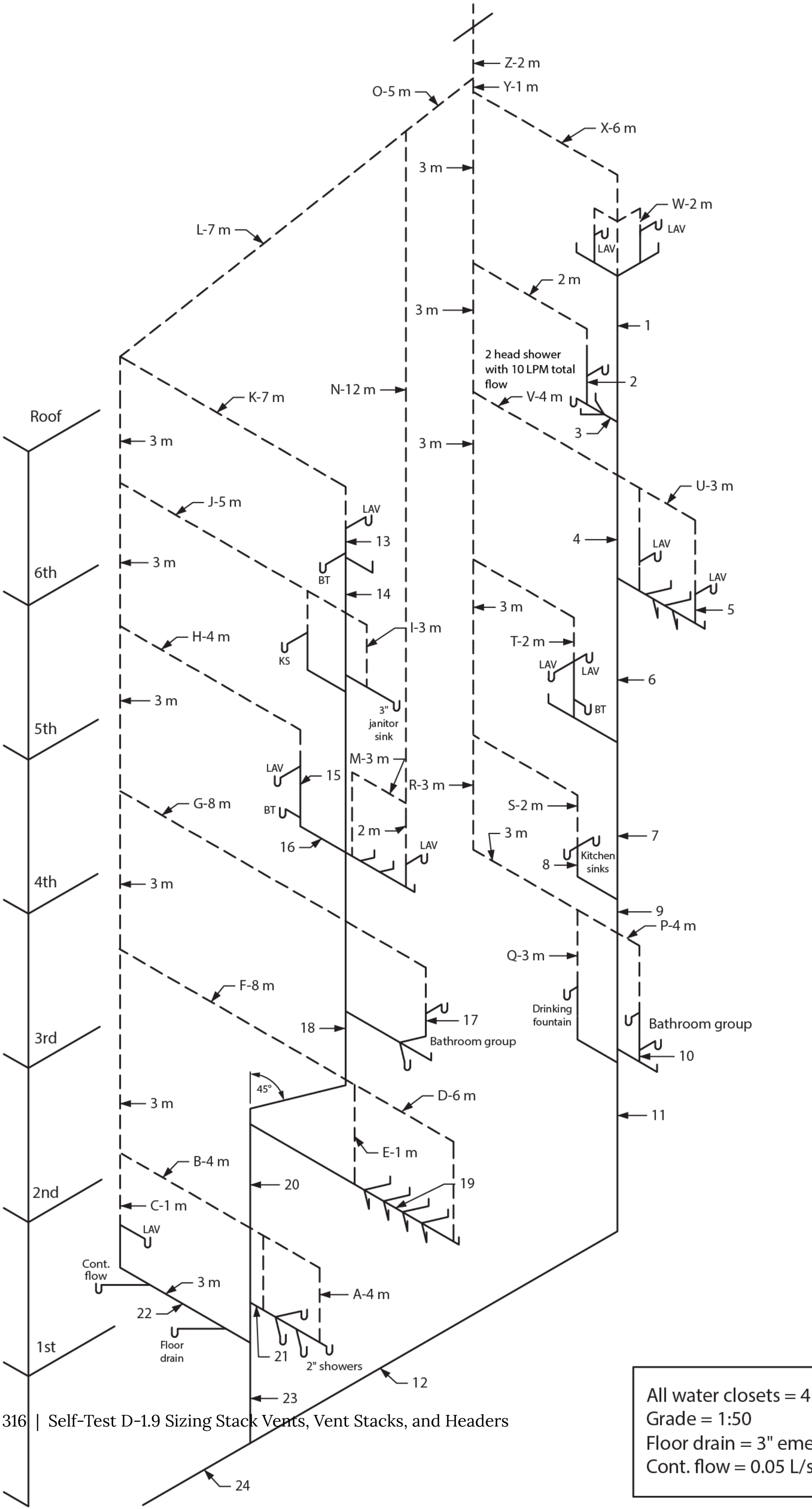
Table 9

Number	Name	Hydraulic Load (FU)	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			

10. Using Figure 2P-42, fill in Table 10 by identifying and sizing the DWV venting installation indicated by the letters.

Table 10

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				
T				



All water closets = 4 FUs
Grade = 1:50
Floor drain = 3" emergency
Cont. flow = 0.05 L/s

2P-43

Figure 2P-43

11. Using Figure 2P-43, fill in Table 11 by identifying and sizing the DWV drainage installation indicated by the numbers.

Table 11

Number	Name	Hydraulic Load (FU)	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

12. Using Figure 2P-43, fill in Table 12 by identifying and sizing the DWV venting installation indicated by the letters.

Table 12

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				
T				
U				
V				
W				
X				
Y				
Z				

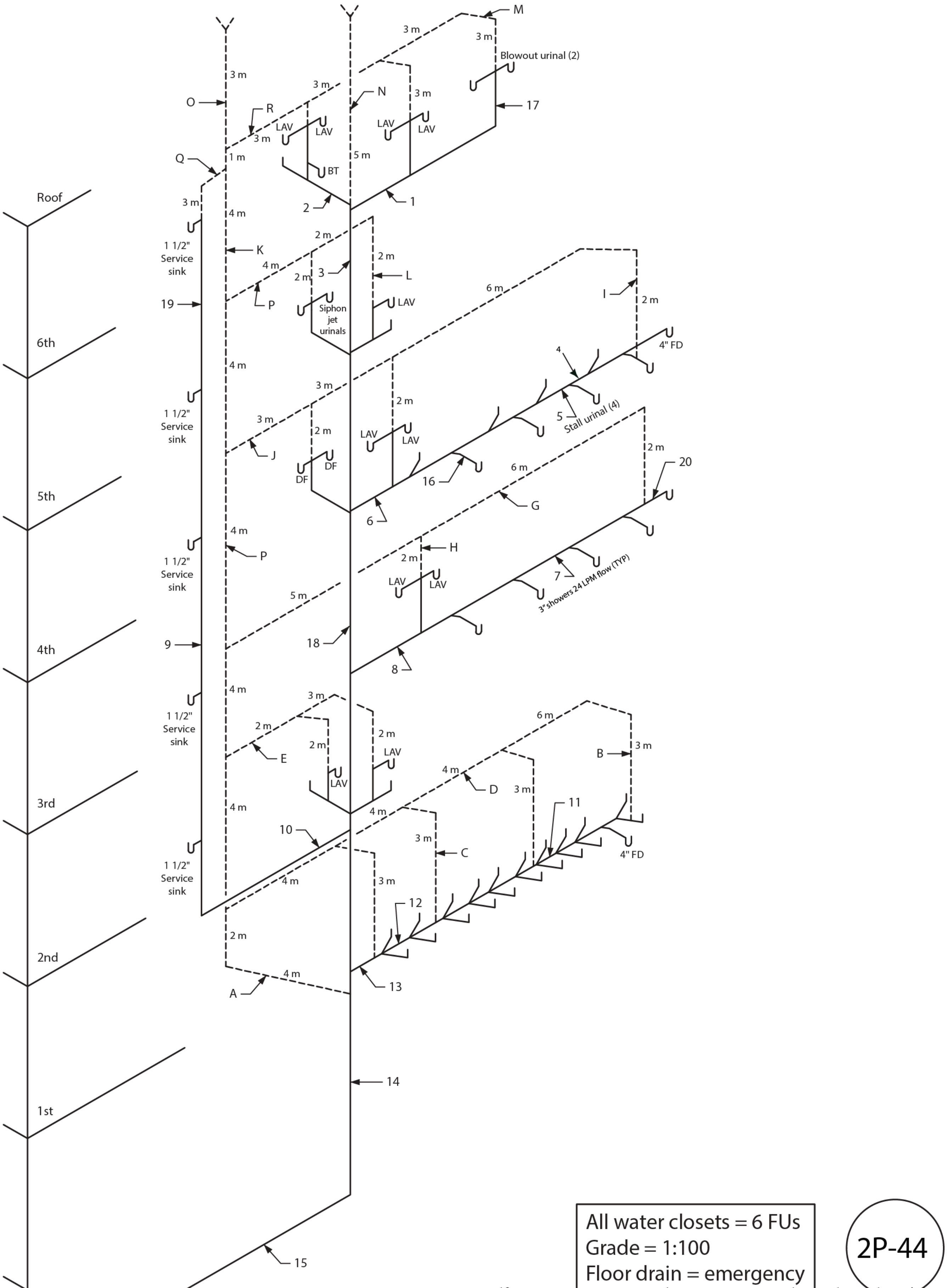

Roof
6th
5th
4th
3rd
2nd
1st
Blowout urinal (2)
LAV
BT
Siphon jet urinals
DF
1 1/2" Service sink
4" FD
Stall urinal (4)
3" showers 24 LPM flow (TYP)
3 m
5 m
1 m
4 m
2 m
6 m
A
B
C
D
E
G
H
I
J
K
L
M
N
O
P
Q
R
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
All water closets = 6 FUs
Grade = 1:100
Floor drain = emergency
2P-44

Figure 2P-44

13. Using Figure 2P-44, fill in Table 13 by identifying and sizing the DWV drainage installation indicated by the numbers.

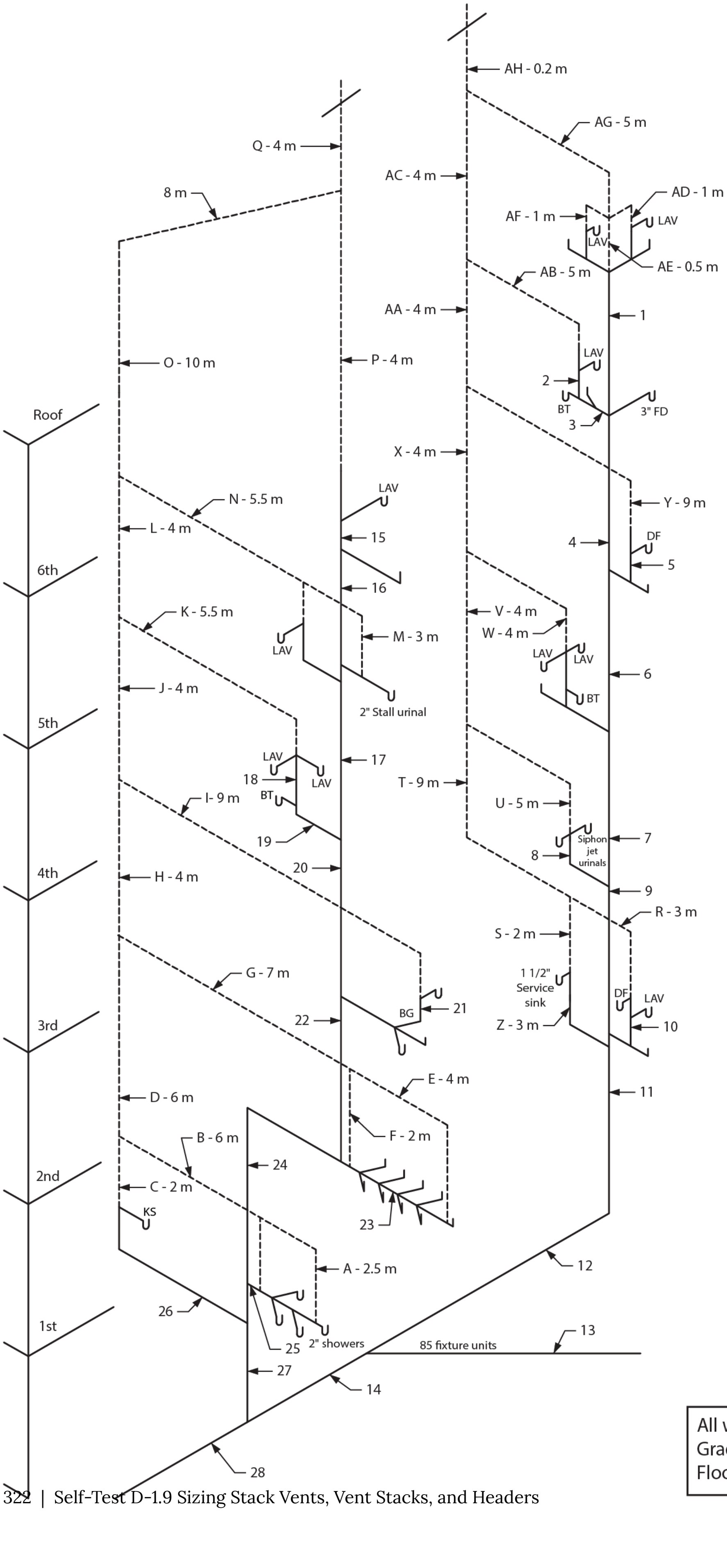
Table 13

Number	Name	Hydraulic Load (FU)	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

14. Using Figure 2P-44, fill in Table 14 by identifying and sizing the DWV venting installation indicated by the letters.

Table 14

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				



All water closets = 4 FUs
Grade 1:100
Floor drain = non-emergency

2P-45

Figure 2P-45

15. Using Figure 2P-45, fill in Table 15 by identifying and sizing the DWV drainage installation indicated by the numbers.

Table 15

Number	Name	Hydraulic Load (FU)	Size
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			

16. Using Figure 2P-45, fill in Table 16 by identifying and sizing the DWV venting installation indicated by the letters.

Table 16

Letter	Name	Hydraulic Load (FU)	Length	Size
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				
T				
U				
V				
W				
X				
Y				
Z				
AA				
AB				
AC				
AD				
AE				
AF				
AG				
AH				

Answer Key: Self-Test D-1.9 (#chapter-answer-key-self-test-d-1-9) is on the next page.

Answer Key: Self-Test D-1.9

1. Drawing 2P-38 — Drainage

Table 1 Answers

Number	Name	Hydraulic Load (FU)	Size
1	Stack acting as a wet vent	2.5	3 in.
2	Stack	6	3 in.
3	Sanitary building drain	6	4 in. (preferred)
4	Sump discharge	15.85	2 in.
5	Sanitary building drain	21.85	4 in. (preferred)
6	Trap arm — Fixture drain	3	2 in.
7	Stack acting as a wet vent	5.5	3 in.
8	Stack	9	3 in.
9	Fixture drain — Acting as a wet vent	2.5	2 in.
10	Branch	6	3 in.
11	Branch	15	3 in.
12	Sanitary building drain	36.85	4 in. (preferred)
13	Fixture drain — Acting as a wet vent	1	2 in.
14	Branch	6	3 in.
15	Fixture drain	1.5	1.5 in.
16	Trap arm — Fixture drain	3	3 in.
17	Branch	4.5	3 in.
18	Branch	10.5	3 in.
19	Branch	3.5	2 in.
20	Fixture drain — Acting as a wet vent	1.5	1.5 in.
21	Branch	14	3 in.
22	Fixture drain	1.5	1.5 in.
23	Fixture drain	1.5	1.5 in.
24	Branch	3	1.5 in.
25	Sanitary building drain	39.85	4 in. (preferred)

2. Drawing 2P-38 — Venting

Table 2 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Continuous vent	6	36 m	2 in.
B	Individual and continuous vent	N/A	N/A	1.25 in.
C	Branch vent	7.5	36 m	2 in.
D	Continuous vent	3.5	18 m	1.5 in.
E	Branch vent	11	36 m	2 in.
F	Sump vent	N/A	N/A	2 in.
G	Branch vent	27	36 m	3 in.
H	Island vent (air admittance valve)	1.5	N/A	1.25 in.
I	Individual and continuous vent	N/A	N/A	1.25 in.
J	Continuous vent	6	9 m	1.5 in.
K	Branch vent	7.5	13 m	1.5 in.
L	Stack vent	9	11 m	1.5 in.
M	Stack vent	16.5	11 m	2 in.
N	Stack vent (Clause 2.5.8.4 (5))	6	7 m	3 in.
O	Vent header	49.5	38 m	3 in.

3. Drawing 2P-39 — Drainage

Table 3 Answers

Number	Name	Hydraulic Load (FU)	Size
1	Trap arm — Fixture drain	1	1.25 in.
2	Stack acting as a wet vent	2.5	3 in.
3	Stack	6	3 in.
4	Fixture drain	1.5	1.5 in.
5	Branch	3	1.5 in.
6	Branch	4.5	2 in.
7	Stack	10.5	3 in.
8	Trap arm — Fixture drain	1.5	1.5 in.
9	Branch	4.5	2 in.
10	Branch	9	2.5 in.
11	Stack	19.5	3 in.
12	Sanitary building drain	19.5	4 in. Preferred
13	Trap arm — Fixture drain	N/A	3 in.
14	Sanitary building drain	19.5	4 in. Preferred
15	Stack acting as a wet vent	1	2 in.
16	Stack	8	3 in.
17	Sanitary building drain	27.5	4 in.
18	Fixture drain acting as a wet vent	1	2 in.
19	Branch	5	3 in.
20	Sanitary building drain	32.5	4 in.

4. Drawing 2P-39 — Venting

Table 4 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Continuous vent	5	15 m	1.5 in.
B	Individual vent	N/A	N/A	1.5 in.
C	Stack vent	8	22 m	2 in.
D	Stack vent	8	22 m	2 in.
E	Stack vent	13	22 m	2 in.
F	Circuit vent	9	9 m	1.5 in.
G	Relief vent	N/A	N/A	1.25 in.
H	Branch vent	9	15 m	1.5 in.
I	Stack vent	22	22 m	2 in.
J	Individual and continuous vent	N/A	N/A	1.25 in.
K	Dual and continuous vent	N/A	N/A	1.25 in.
L	Branch vent	4.5	5 m	1.25 in.
M	Stack vent	26.5	22 m	2 in.
N	Stack vent	19.5	3 m	3 in.
O	Vent header	32.5	31 m	3 in.

5. Drawing 2P-40 — Drainage

Table 5 Answers

Number	Name	Hydraulic Load (FU)	Size
1	Stack	16	3 in.
2	Stack	17	3 in.
3	Branch	30	4 in.
4	Branch	42	4 in.
5	Stack	59	4 in.
6	Stack (Offset)	59	4 in.
7	Branch	4	2 in.
8	Stack	63	4 in.
9	Stack acting as a wet vent	2.5	2 in.
10	Stack	8	3 in.
11	Stack (Offset)	8	3 in.
12	Fixture drain	0.5	1.25 in.
13	Stack	8.5	3 in.
14	Branch	8.5	3 in.
15	Vent stack acting as a fixture drain sized as a wet vent	1.59	3 in.
16	Stack	73.09	4 in.
17	Sanitary building drain	73.09	4 in.

6. Drawing 2P-40 — Venting

Table 6 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Vent stack	73.09	35 m	3 in.
B	Individual and continuous vent	N/A	N/A	1.25 in.
C	Branch vent	1.5	15 m	1.5 in.
D	Branch vent	4.5	15 m	1.5 in.
E	Vent stack	73.09	35 m	3 in.
F	Individual vent	N/A	N/A	1.25 in.
G	Relief vent	N/A	N/A	1.5 in.
H	Branch vent	43	11 m	2 in.
I	Circuit vent	42	2 m	1.5 in.
J	Branch vent	43	11 m	2 in.
K	Vent stack	73.09	35 m	3 in.
L	Stack vent	8.5	10 m	1.5 in.
M	Stack vent	73.09	3 m	2 in.
N	Vent header	73.09	10 m	2 in.

7. Drawing 2P-41 —Drainage

Table 7 Answers

Number	Name	Hydraulic Load (FU)	Size
1	Stack acting as a wet vent	5	3 in.
2	Stack acting as a wet vent	5	3 in.
3	Branch	6.5	3 in.
4	Stack	18	3 in.
5	Stack	35.27	3 in.
6	Fixture drain acting as a wet vent	1	2 in.
7	Branch	13	3 in.
8	Stack	58.27	4 in.
9	Branch	61	4 in.
10	Stack	131.27	4 in.
11	Branch	8	3 in.
12	Stack	147.77	4 in.
13	Sanitary building drain	154.27	4 in.
14	Stack	7	3 in.
15	Branch	8	3 in.
16	Branch	8.5	3 in.
17	Stack	56.92	4 in.
18	Sanitary building drain	211.19	4 in.

8. Drawing 2P-41 — Venting

Table 8 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Individual vent	N/A	N/A	1.5 in.
B	Individual and continuous vent	N/A	N/A	1.25 in.
C	Continuous vent	8	21 m	1.5 in.
D	Branch vent	8.5	21 m	2 in.
E	Branch vent	46.92	21 m	3 in.
F	Continuous vent	3	18 m	1.5 in.
G	Branch vent	49.92	21 m	3 in.
H	Branch vent	2.5	13 m	1.5 in.
I	Branch vent	52.42	21 m	3 in.
J	Branch vent	58.92	21 m	3 in.
K	Continuous vent	9.27	7 m	1.5 in.
L	Branch vent	68.19	21 m	3 in.
M	Stack vent	56.92	9 m	3 in.
N	Continuous vent	8	14 m	1.5 in.
O	Branch vent	16.5	14 m	1.5 in.
P	Vent stack	147.77	26 m	3 in.
Q	Vent stack	147.77	26 m	3 in.
R	Fixture drain acting as an additional circuit vent sized as a wet vent	N/A	N/A	2 in.
S	Vent stack	148.77	26 m	3 in.
T	Circuit vent	73	1 m	2 in.
U	Individual and continuous vent acting as a relief vent	N/A	N/A	1.5 in.
V	Branch vent	14	5 m	1.5 in.
W	Continuous vent	10	3 m	1.5 in.
X	Branch vent	18	5 m	1.5 in.
Y	Stack vent	147.77	3 m	2 in.
Z	Stack vent	6.5	3 m	3 in.

9. Drawing 2P-42 — Drainage

Table 9 Answers

Number	Name	Hydraulic Load (FU)	Size
1	Stack acting as a wet vent	2	3 in.
2	Stack	9	3 in.
3	Branch	2	1.5 in.
4	Branch	4	2 in.
5	Branch	6	2 in.
6	Branch	18	3 in.
7	Fixture drain acting as a wet vent	2.5	2 in.
8	Stack	31	3 in.
9	Branch	8	3 in.
10	Stack	39	3 in.
11	Stack acting as a wet vent	3.5	2 in.
12	Stack acting as a wet vent	4.44	3 in.
13	Branch	6.66	3 in.
14	Stack	12.66	3 in.
15	Branch	12.66	3 in.
16	Fixture drain acting as a wet vent	2.5	2 in.
17	Branch — Wet vent	2.5	2 in.
18	Branch	16	3 in.
19	Stack	67.66	3 in.
20	Sanitary building drain	67.66	4 in.
21	Fixture drain	3	2 in.
22	Branch	18	3 in.
23	Sanitary building drain	85.66	4 in.

10. Drawing 2P-42 — Venting

Table 10 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Individual and continuous vent	N/A	N/A	1.5 in.
B	Branch vent	9	12 m	1.5 in.
C	Individual and continuous vent	N/A	N/A	1.5 in.
D	Branch vent	18	12 m	1.5 in.
E	Vent stack	67.66	18 m	2 in.
F	Vent stack	85.66	18 m	2 in.
G	Continuous vent	8	16 m	1.5 in.
H	Continuous vent	8	14 m	1.5 in.
I	Branch vent	16	16 m	2 in.
J	Continuous vent	8	4 m	1.5 in.
K	Branch vent	24	16 m	2 in.
L	Dual and continuous vent	N/A	N/A	1.5 in.
M	Branch vent	12	9 m	1.5 in.
N	Branch vent	18	9 m	1.5 in.
O	Vent stack	85.66	18 m	2 in.
P	Stack vent	67.66	3 m	3 in.
Q	Vent header	85.66	26 m	3 in.
R	Continuous vent	4	3 m	1.25 in.
S	Stack vent	12.66	2 m	1.5 in.
T	Stack vent	6.66	2 m	1.5 in.

11. Drawing 2P-43 — Drainage

Table 11 Answers

Number	Name	Hydraulic Load (FU)	Size
1	Stack	10	3 in.
2	Fixture drain acting as a wet vent	4	3 in.
3	Branch	12	3 in.
4	Stack	22	3 in.
5	Fixture drain acting as a circuit vent sized as a wet vent	1	2 in.
6	Stack	44	4 in.
7	Stack	51	4 in.
8	Branch	3	1.5 in.
9	Stack	54	4 in.
10	Branch — Wet vent	2.5	2 in.
11	Stack	60.5	4 in.
12	Sanitary building drain	60.5	4 in.
13	Stack acting as a wet vent	2.5	3 in.
14	Stack	6	3 in.
15	Fixture drain acting as a wet vent	1	1.5 in.
16	Branch	2.5	1.5 in.
17	Fixture drain acting as a wet vent	1	2 in.
18	Stack	32	4 in.
19	Branch	20	4 in.
20	Stack	68	4 in.
21	Branch	12	3 in.
22	Vent stack acting as a branch sized as a wet vent	2.59	3 in.
23	Stack	82.59	4 in.
24	Sanitary building drain	143.09	4 in.

12. Drawing 2P-43 — Venting

Table 12 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Circuit vent	12	8 m	1.5 in.
B	Branch vent	12	8 m	1.5 in.
C	Vent stack	82.59	33 m	3 in.
D	Circuit vent	36	14 m	2 in.
E	Relief vent	N/A	N/A	1.5 in.
F	Branch vent	36	14 m	2 in.
G	Continuous vent	6	8 m	1.5 in.
H	Continuous vent	2.5	4 m	1.25 in.
I	Individual vent	N/A	N/A	1.5 in.
J	Branch vent	4.5	8 m	1.5 in.
K	Stack vent	82.59	21 m	3 in.
L	Vent header	82.59	40 m	3 in.
M	Relief vent	N/A	N/A	1.5 in.
N	Branch vent	13	14 m	1.5 in.
O	Vent header	82.59	40 m	3 in.
P	Continuous vent	6	4 m	1.5 in.
Q	Vent stack	60.5	24 m	3 in.
R	Vent stack	60.5	24 m	3 in.
S	Dual and continuous vent	N/A	N/A	1.25 in.
T	Continuous vent	7	2 m	1.5 in.
U	Circuit vent	21	7 m	1.5 in.
V	Branch vent	22	7 m	1.5 in.
W	Continuous vent	5	2 m	1.5 in.
X	Stack vent	60.5	9 m	3 in.
Y	Vent header	60.5	25 m	3 in.
Z	Vent header	143.09	40 m	3 in.

13. Drawing 2P-44 — Drainage

Table 13 Answers

Number	Name	Hydraulic Load (FU)	Size
1	Branch	10	2.5 in.
2	Branch	9	3 in.
3	Stack	19	4 in.
4	Branch	8	2.5 in.
5	Branch	10	4 in.
6	Branch	34	4 in.
7	Branch	18	3 in.
8	Branch	32	4 in.
9	Stack acting as a wet vent	6	3 in.
10	Branch	7.5	3 in.
11	Branch	36	4 in.
12	Branch	108	4 in.
13	Branch	120	4 in.
14	Stack	242.5	5 in.
15	Sanitary building drain	242.5	5 in.
16	Trap arm — Fixture drain	2	2 in.
17	Branch	8	2.5 in.
18	Stack	69	4 in.
19	Stack acting as a wet vent	6	3 in.
20	Trap arm — Fixture drain	6	3 in.

14. Drawing 2P-44 — Venting

Table 14 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Vent stack	242.5	30 m	4 in.
B	Circuit vent	120	21 m	3 in.
C	Additional circuit vent	N/A	N/A	2 in.
D	Branch vent	120	21 m	3 in.
E	Branch vent	14	7 m	1.5 in.
F	Vent stack	242.5	30 m	4 in.
G	Circuit vent	30	13 m	2 in.
H	Dual and continuous vent acting as a relief cent	N/A	N/A	1.5 in.
I	Circuit vent	32	14 m	2 in.
J	Branch vent	35	14 m	2 in.
K	Vent stack	242.5	30 m	4 in.
L	Continuous vent	7	8 m	1.5 in.
M	Dual and continuous vent	N/A	N/A	1.5 in.
N	Stack vent	242.5	5 m	3 in.
O	Vent header	242.5	45 m	4 in.
P	Branch vent	15	8 m	1.5 in.
Q	Stack vent	7.5	7 m	3 in.
R	Branch vent	19	12 m	1.5 in.

15. Drawing 2P-45 — Drainage

Table 15 Answers

Number	Name	Hydraulic Load (FU)	Size
1	Stack	10	3 in.
2	Fixture drain acting as a wet vent	2.5	2 in.
3	Branch	6	3 in.
4	Stack	19	3 in.
5	Fixture drain acting as a wet vent	0.5	2 in.
6	Stack	23.5	3 in.
7	Stack	30.5	3 in.
8	Branch	8	2.5 in.
9	Stack	38.5	3 in.
10	Branch — Wet vent	1.5	2 in.
11	Stack	45.5	3 in.
12	Sanitary building drain	45.5	4 in.
13	Branch	85	4 in.
14	Sanitary building drain	130.5	4 in.
15	Stack acting as a wet vent	1	2 in.
16	Stack	5	3 in.
17	Stack	8	3 in.
18	Branch — Wet vent	2	1.5 in.
19	Branch	3.5	2 in.
20	Stack	11.5	3 in.
21	Fixture drain acting as a wet vent	1	2 in.
22	Stack	17.5	3 in.
23	Branch	20	4 in.
24	Stack	53.5	4 in.
25	Branch	12	3 in.
26	Vent stack acting as a fixture drain sized as a wet vent	1.5	3 in.
27	Stack	67	4 in.
28	Sanitary building drain	197.5	5 in.

16. Drawing 2P-45 — Venting

Table 16 Answers

Letter	Name	Hydraulic Load (FU)	Length	Size
A	Circuit vent	12	8.5 m	1.5 in.
B	Branch vent	12	8.5 m	1.5 in.
C	Vent stack	67	42 m	3 in.
D	Vent stack	67	42 m	3 in.
E	Circuit vent	36	11 m	2 in.
F	Relief vent	N/A	N/A	1.5 in.
G	Branch vent	36	11 m	2 in.
H	Vent stack	67	42 m	3 in.
I	Continuous vent	6	9 m	1.5 in.
J	Vent stack	67	42 m	3 in.
K	Continuous vent	3.5	5.5 m	1.25 in.
L	Vent stack	67	42 m	3 in.
M	Individual vent	N/A	N/A	1.5 in.
N	Branch vent	3	8.5 m	1.5 in.
O	Vent stack	67	42 m	3 in.
P	Stack vent	67	8 m	2 in.
Q	Vent header	67	48.5 m	3 in.
R	Continuous vent	5.5	3 m	1.5 in.
S	Vent stack	45.5	30.2 m	3 in.
T	Vent stack	45.5	30.2 m	3 in.
U	Dual and continuous vent	N/A	N/A	1.5 in.
V	Vent stack	45.5	30.2 m	3 in.
W	Continuous vent	7	4 m	1.5 in.
X	Vent stack	45.5	30.2 m	3 in.
Y	Continuous vent	4.5	9 m	1.5 in.
Z	Vent stack acting as a fixture sized as a wet vent	1.5	30.2 m	3 in.
AA	Vent stack	45.5	30.2 m	3 in.
AB	Continuous vent	6	5 m	1.5 in.
AC	Vent stack	45.5	30.2 m	3 in.
AD	Continuous vent	5	1 m	1.5 in.
AE	Stack vent	45.5	5.7 m	1.5 in.
AF	Continuous vent	5	1 m	1.5 in.
AG	Stack vent	45.5	5.7 m	1.5 in.
AH	Vent header	45.5	28.2 m	3 in.

Self-Test D-1.10 Requirements and Prohibitions for DWV Systems

Complete Self-Test D-1.10 and check your answers.

1. Piping, fittings and joints used in a pressure sewer, forcemain, or sump pump discharge applications shall be capable of withstanding at least ______ times the potential pressure.
   a. 1.5
   b. 2
   c. 2.5
   d. 3

2. What is the maximum number of showerheads that can be served by a single shower drain?
   a. 3
   b. 4
   c. 5
   d. 6

3. Except for column showers, what is the minimum dimension between two adjacent showerheads?
   a. 730 mm
   b. 690 mm
   c. 750 mm
   d. 800 mm

4. What type of fixture shall not have a concealed overflow?
   a. Lavatory
   b. Shampoo sink
   c. Food prep sink
   d. Shower

5. Where must copper tube not be used when connecting a flush valve–operated urinal?
   a. Branch drain serving the fixture
   b. Vent above the flood level rim
   c. Fixture drain
   d. Both b and c

6. What type of material may the cleanout plug be made of if serving a 2 in. trap standard made of cast-iron?
   a. Cast iron
   b. Galvanized steel
   c. Brass

d. Both b and c

7. What is the minimum trap seal depth for a lab sink that drains to an acid waste system?
   a. 25 mm
   b. 33 mm
   c. 38 mm
   d. 50 mm

8. According to the NPC, which of the following types of traps are prohibited?
   a. Bell traps
   b. Crown-vented trap
   c. All of the above

9. Transition solvent cement permitted by the NPC is used to join which type of pipe?
   a. ABS drainage to PE subsoil drainage
   b. PVC pressure to CPVC pressure
   c. PVC drainage to PE subsoil drainage
   d. PVC drainage to ABS drainage

10. Fasteners used to secure WC flanges to a building structure must have what quality?
    a. Corrosion resistant
    b. Coarse thread
    c. Expansion type
    d. Non-removable

11. If an indirectly connected 1.5 in. pipe forms an air break above a directly connected fixture, what is the minimum dimension of the air break?
    a. 1.25 in.
    b. 1.5 in.
    c. 2 in.
    d. 3 in.

12. What is the maximum pipe support spacing for a vertical three-storey stack?
    a. 6.5 m
    b. 7.0 m
    c. 7.5 m
    d. 8.0 m

13. When installing a hub and spigot pipe, at which end of the pipe shall the hub be installed?
    a. Upstream
    b. Downstream

14. What is the minimum depth of lead in a cold-caulked lead drainage joint?
    a. 15 mm
    b. 25 mm
    c. 50 mm
    d. 75 mm

15. When installing a caulked lead drainage joint, when is it acceptable to paint the pipe and caulking material?
    a. Immediately after installation
    b. Before testing the joint
    c. After testing the joint
    d. Never paint a lead joint; it will turn toxic.

16. What is the maximum hanger spacing for horizontal cast-iron soil pipe?
    a. 1 m
    b. 2 m
    c. 3 m
    d. 4 m

17. What is the maximum hanger spacing for horizontal PVC pipe?
    a. 1 m
    b. 1.2 m
    c. 1.3 m
    d. 1.4 m

18. When installing copper tube underground, the joints shall be joined by what method?
    a. Soldered or compression
    b. Soldered or brazed
    c. Brazed or screwed
    d. Brazed or flared

19. Cold-caulked joints shall only be used in which of the following bell and spigot piping systems?
    a. Water systems
    b. Drainage systems
    c. Venting systems
    d. Any of the above

20. When installing a lead stub during the rough-in of a WC, what type of floor flange shall be used when the toilet is set in place?
    a. ABS
    b. Cast-iron

c. Lead
d. Brass

21. Which fixture does not have to be directly connected to a sanitary drainage system?
    a. Kitchen sink
    b. Toilet c/w flush valve
    c. Drinking fountain
    d. Bar sink

22. What is the maximum permitted hydraulic load drained to a 12 in. sanitary building drain with a slope of 1:200?
    a. 1,400 FU
    b. 2,500 FU
    c. 3,900 FU
    d. 4,500 FU

23. You are sent to an existing house to rough-in a basement bathroom group. The building drain that you want to tie into serves a stack with 35 FU draining to it. What is the minimum distance from the base of the stack to the tie-in point that must be maintained in this situation?
    a. 1 m
    b. 1.5 m
    c. 2 m
    d. No restriction

24. You are sent to a business that provides bottled water for its customers. You are to provide a drainage system for six reverse osmosis (RO) water filtration units. You have decided to connect the drains to a common branch and then indirectly connect the branch to the sanitary drainage system. What is the minimum size of the common branch in this situation?
    a. 0.75 in.
    b. 1 in.
    c. 1.25 in.
    d. Twice the size of the largest drain (air gap)

25. Urinals shall not be installed in which of the following areas?
    a. Residential occupancy buildings
    b. Where the wall and floor surfaces are pervious to water
    c. Where there is no emergency floor drain
    d. All of the above

26. You are installing a domestic dishwasher and are going to drain the machine to the fixture outlet pipe of an adjacent kitchen sink. What type of fitting would you use to make the connection at the fixture outlet pipe?
    a. Sanitary tee
    b. Sanitary tee and a 90° ell

c. Wye fitting
d. Any of the above

27. A cleanout fitting serving a building trap shall be installed in which location(s) listed below?
    a. Directly over the upstream side of the trap
    b. Directly over the downstream side of the trap
    c. As close as practicable to where the building drain leaves the building
    d. Any of the above

28. When a building trap is installed, where does the NPC allow it to be located?
    a. Upstream of the main building cleanout
    b. Outside the building in a manhole
    c. Inside the building as close as practicable to where the building drain leaves the building
    d. Any of the above

29. Is the drain from an indirectly connected drinking fountain considered an acceptable method of maintaining the trap seal for a floor drain?
    a. Yes
    b. No
    c. Yes, but only if the floor drain drains to a storm drainage system
    d. No, only a manufactured trap seal primer is acceptable for this situation

30. There are certain requirements for the order in which valves and fittings are installed on a sump pump discharge. Listing the items in the direction of flow, what is the proper order?
    a. Union, shut-off valve, check valve
    b. Shut off-valve, union, check valve
    c. Union, check valve, shut-off valve
    d. Check valve, union, shut-off valve

31. When installed in a single-family dwelling building drain, a backwater valve shall meet which of the following requirements?
    a. Normally closed
    b. Normally open
    c. Larger than 4 in. NPS
    d. Not allowed by code on a building drain or building sewer

32. A floor drain subject to backflow may be protected in which manner?
    a. Backwater valve only
    b. Backwater valve or gate valve only
    c. Backwater valve, gate valve, or removable screw cap on the upstream side of the trap
    d. A floor drain subject to backflow cannot be installed.

33. A building sewer that serves a mobile home shall meet which of the following requirements?
    a. Minimum 4 in. NPS in size
    b. Terminated below ground in a frost-free vault
    c. Be of flexible construction to accommodate connection
    d. All of the above

34. What is the minimum size of cleanout fittings installed for pipes with diameters of 4 in. or less?
    a. Half the size of the drainage pipe being served
    b. The size of the drainage pipe being served
    c. The same size of the drainage pipe being served
    d. 4 in.

35. When installing a cleanout for a 4 in. building sewer using a wye fitting 6 ft below grade, what is the maximum length of pipe you can install before the next cleanout is required?
    a. 7.5 m
    b. 15 m
    c. 26 m
    d. 30 m

36. Every building drain shall be provided with a cleanout fitting located at which of the following locations?
    a. Upstream of the building trap
    b. At the base of the stack
    c. As close as practicable to where the building drain leaves the building
    d. Any of the above

37. When a manhole more than 1 m in depth is located in a building, which of the following features must it be provided with?
    a. Vent
    b. Corrosion-resistant ladder
    c. Cover with an airtight seal
    d. All of the above

38. What is the minimum horizontal dimension of a manhole at the bottom of the enclosure?
    a. 500 mm
    b. 600 mm
    c. 1,000 mm
    d. 1,500 mm

39. What is the minimum horizontal dimension of a manhole at the top of the enclosure?
    a. 500 mm

b. 600 mm
c. 1,000 mm
d. 1,500 mm

40. When roughing in an autopsy table at your neighbourhood mortuary, what is the minimum dimension above the flood level rim of the autopsy table that the cleanout could be installed?
    a. 150 mm
    b. 200 mm
    c. 300 mm
    d. 350 mm

41. When installing a grease interceptor to serve as a fixture trap for a commercial kitchen sink, what is the maximum developed length of the fixture outlet pipe between the sink and the interceptor?
    a. 900 mm
    b. 1 m
    c. 1.2 m
    d. 1.5 m

42. You are installing a triple-compartment kitchen sink equipped with 1.5 in. tailpieces. You are told to drain all compartments to a common trap. What is the minimum size trap that will suit this installation?
    a. 1.5 in.
    b. 2 in.
    c. 3 in.
    d. 4 in.

43. When installing a washer box in a single-family dwelling laundry room, what is the minimum distance of the drain standpipe measured from the trap weir to the top of the standpipe?
    a. 400 mm
    b. 600 mm
    c. 800 mm
    d. 1 m

44. When installing a washer box in a single-family dwelling laundry room, at what height above the floor shall the drain opening of the box be?
    a. Below the flood level rim of the washing machine
    b. Level with the flood level rim of the washing machine
    c. Above the flood level rim of the washing machine
    d. Any of the above

45. You are installing a stack through a building. You have to offset the stack 2 m horizontally to accommodate a change in wall location. The offset and lower section of stack shall be sized as which of the following?
    a. Sanitary branch

b. Stack, but one size larger than it was prior to the offset
c. Sanitary building drain
d. Either a or c, whichever is less restrictive

46. What is the minimum size of a vent pipe that serves a manhole within a building?
    a. 1.5 in.
    b. 2 in.
    c. 3 in.
    d. 4 in.

47. What is the maximum length of a 3 in. wet vent?
    a. 1.5 m
    b. 2 m
    c. 3 m
    d. There is no limit to the length of a wet vent.

48. What is the minimum size of a vent pipe that serves a sewage sump?
    a. 1.25 in.
    b. 1.5 in.
    c. 2 in.
    d. 3 in.

49. What is the maximum change in direction that a basin trap arm may have before it is vented?
    a. 115°
    b. 125°
    c. 135°
    d. 225°

50. What is the minimum distance that a stack vent can terminate from an openable window or other air inlet?
    a. 3.0 m
    b. 3.5 m
    c. 4.0 m
    d. 4.5 m

51. If a sewage sump has a 6 in. pipe draining into it, what is the minimum size vent for the sump?
    a. 3 in.
    b. 4 in.
    c. 5 in.
    d. 6 in.

52. What is the minimum difference in elevation between the two vents serving an oil interceptor?

a. 150 mm
b. 200 mm
c. 250 mm
d. 300 mm

53. What is the minimum distance that a vent must terminate above the roof?
    a. 25 mm
    b. 50 mm
    c. 100 mm
    d. 150 mm

54. What is the maximum change in direction that a water closet trap arm may have before it is vented?
    a. 115°
    b. 125°
    c. 135°
    d. 225°

55. With regard to a multi-storey wet vent, what is the maximum load drained to the wet vent from any one storey above the first storey when the stack passes through more than one storey?
    a. 4
    b. 8
    c. 16
    d. No limit

56. What is the maximum number of fixture units that can be drained to the base of a vent stack?
    a. 6
    b. 8
    c. No drainage can discharge on a vent stack.
    d. No limit

57. A stack that serves as a multi-storey wet vent has restrictions regarding offsets. Choose the clause that best describes these restrictions for a wet-vented stack.
    a. Cannot have offsets
    b. May have one offset that does not exceed 2 m in length
    c. May have two offsets that do not exceed 2.5 m in length
    d. May have one offset that does not exceed 2.5 m in length

58. A wet-vented stack has fixtures draining into it from six storeys. The stack is serving two water closets located on the bottom floor. There are two kitchen sinks on each of the five floors above the bottom floor. What is the minimum size of the stack vent if it is 20 m in length?
    a. 3 in.
    b. 4 in.

c. 5 in.
d. 6 in.

59. What is the minimum size of a fresh air inlet?
  a. 1.5 in.
  b. 2 in.
  c. 4 in.
  d. 3 in.

60. Which of the following must a relief vent serving a circuit-vented branch be?
  a. A sanitary drainage pipe with at least 6 FU draining to it
  b. Connected downstream of the most downstream water closet
  c. Connected to the trap arm of the most upstream fixture
  d. Connected downstream of the most downstream circuit-vented fixture

61. A 12-storey building served by a 3 in. stack and a 2 in. vent stack may require a yoke vent. What would be the minimum size of the yoke vent in this situation?
  a. 1.5 in.
  b. 2 in.
  c. 3 in.
  d. 4 in.

62. A stack in a building has a nominally horizontal, 2-m long offset installed in it. The load above the offset is 143 FU draining from three floors. What is the additional venting requirement for this situation?
  a. No additional venting required
  b. One relief vent for the offset
  c. Two relief vents for the offset
  d. Three relief vents for the offset

63. If a combined relief vent is serving two circuit-vented branches, the combined relief vent must conform to which of the following requirements?
  a. 2 in. minimum size
  b. Sized as a wet vent
  c. Symmetrically connected
  d. Same size as the largest circuit vent

64. If an additional circuit vent is installed in conjunction with a circuit-vented branch and has a lavatory draining to it, the portion of the additional circuit vent that accepts the drainage shall conform to which of the following requirements?
  a. Same size as the circuit vent
  b. One size smaller than the circuit vent
  c. Sized as a wet vent, maximum 2 in.

d. Sized as a wet vent, minimum 2 in.

65. If you are hired to install an acid dilution tank at a hospital lab, does the NPC allow you to connect the dilution tank vent to the existing plumbing venting system?

a. Yes, if the existing venting is cast iron
b. Yes, to a vent stack only, not to a branch vent
c. No, use an island vent configuration
d. No, it must be independent to open air

66. Which of the following fixtures would be considered when determining the hydraulic load on a continuous vent that serves a wet-vented branch?

a. All fixtures draining to the wet vent, including the water closets
b. All fixtures except 2 in. emergency floor drains
c. All wet-vented fixtures, except the water closets
d. All wet-vented fixtures

67. When circuit venting three drinking fountains, what would be the size of the fixture drain immediately downstream of the circuit vent connection?

a. 1.25 in.
b. 1.5 in.
c. 2 in.
d. 3 in.

68. When circuit venting four 2 in. showers, what would be the size of the fixture drain immediately downstream of the circuit vent connection?

a. 2 in.
b. 2.5 in.
c. 3 in.
d. 4 in.

69. What is the hydraulic load to be considered when sizing a circuit vent that serves a circuit-vented branch?

a. All fixtures draining to the circuit-vented branch
b. All fixtures draining to the circuit-vented branch, except separately vented fixtures
c. All circuit-vented fixtures and the fixtures attached to the relief vent
d. All circuit-vented fixtures

70. When circuit venting four drinking fountains, what is the size of the fixture drain immediately upstream of the circuit vent connection?

a. 1.25 in.
b. 1.5 in.
c. 2 in.
d. 3 in.

71. What is the code restriction for connecting fixtures to a circuit vent or an additional circuit vent?

a. 1 fixture maximum; 2 in. trap size
b. 2 fixtures maximum; 2 FU each
c. 1 fixture maximum; 1.5 in. trap size
d. 2 fixtures maximum; 1.5 FU each

72. What are the venting requirements for a secondary receiver installed in conjunction with an oil interceptor?

a. 1.5 in. minimum size
b. 2 in. minimum size
c. 1 size smaller than the largest inlet
d. It does not require a vent.

73. You have been hired to install the rough DVW piping in a single-family dwelling. You decide to stub a future vent into the basement. Due to no sewage sump in the basement, what would be the minimum size vent allowed by code?

a. 1.25 in.
b. 1.5 in.
c. 2 in.
d. 3 in.

74. What is the maximum horizontal distance a 3 in. trap arm serving a water closet may run before a vent connection is provided?

a. 1.2 m
b. 1.5 m
c. 3 m
d. 3.6 m

75. In areas where vents are subject to frost closure, the code allows for the installation of air admittance valves. Could all of the vents serving a single-family dwelling be air admittance valves?

a. Yes, without any code restrictions
b. No
c. Yes, a maximum of four valves that must terminate where they will not freeze
d. Yes, only if all the fixtures are individually vented and the valves terminate in an area where they will not freeze

76. When terminating an air admittance valve in an area where insulation materials are present, what is the minimum distance above the insulation that the valve can be installed?

a. 100 mm
b. 150 mm
c. Cannot be installed in areas where insulation materials are present
d. Should be covered by insulation so it will not freeze shut

77. You are installing an island vented kitchen sink. You decide to use an air admittance valve for your vent. What is the minimum distance above the trap arm of the sink that the valve may be installed?

   a. 100 mm
   b. 150 mm
   c. Above the flood level rim of the sink
   d. No minimum distance above the trap arm

Answer Key: Self-Test D-1.10 is on the next page.

Answer Key: Self-Test D-1.10

1. a. 1.5
2. d. 6
3. c. 750 mm
4. c. Food prep sink
5. c. Fixture drain
6. c. Brass
7. d. 50 mm
8. c. All of the above
9. d. PVC drainage to ABS drainage
10. a. Corrosion resistant
11. b. 1.5 in.
12. c. 7.5 m
13. a. Upstream
14. b. 25 mm
15. c. After testing the joint
16. c. 3 m
17. b. 1.2 m
18. d. Brazed or flare
19. d. Any of the above
20. d. Brass
21. c. Drinking fountain
22. c. 3900 FU
23. b. 1.5 m
24. c. 1.25 in.
25. b. Where the wall and floor surfaces are pervious to water
26. c. Wye fitting
27. a. Directly over the upstream side of the trap
28. d. Any of the above
29. a. Yes
30. c. Union, check valve, shut-off valve
31. b. Normally open
32. c. Backwater valve, gate valve, or removable screw cap on the upstream side of the trap
33. a. Minimum 4 in. NPS in size
34. c. Same size of the drainage pipe being served
35. b. 15 m
36. c. As close as practicable to where the building drain leaves the building
37. d. All of the above
38. c. 1,000 mm
39. b. 600 mm
40. a. 150 mm
41. c. 1.2 m
42. b. 2 in.
43. b. 600 mm
44. c. Above the flood level rim of the washing machine

45. d. Either a or c, whichever is less restrictive
46. b. 2 in.
47. d. There is no limit to the length of a wet vent.
48. c. 2 in.
49. c. 135°
50. b. 3.5 m
51. b. 4 in.
52. d. 300 mm
53. d. 150 mm
54. d. 225°
55. a. 4
56. b. 8
57. d. May have one offset that does not exceed 2.5 m in length
58. c. 5 in.
59. c. 4v
60. d. Connected downstream of the most downstream circuit vented fixture.
61. a. 1.5 in.
62. c. Two relief vents for the offset
63. c. Symmetrically connected
64. d. Sized as a wet vent, minimum 2 in.
65. d. No, it must be independent to open air.
66. a. All fixtures draining to the wet vent, including the water closets
67. c. 2 in.
68. c. 3 in.
69. a. All fixtures draining to the circuit-vented branch
70. a. 1.25 in.
71. d. 2 fixtures maximum 1.5 FU each
72. a. 1.5 in. minimum size
73. b. 1.5 in.
74. c. 3 m
75. b. No
76. b. 150 mm
77. a. 100 mm

Self-Test D-1.11 Trade Waste Systems

Complete Self-Test D-1.11 and check your answers.

1. Which classification of fixtures would generally not need to be drained to a trade waste system?
   a. Residential
   b. Commercial
   c. Industrial
   d. Institutional

2. What type of trade waste system is most commonly seen in a commercial setting?
   a. Clothes washer draining into a lint trap
   b. Toilet draining into a septic system
   c. Pot sink draining into a grease interceptor
   d. Basin draining into a septic tank

3. Complete the following statement: "The discharge draining into a grease interceptor should ______."
   a. Be as cool as possible
   b. Be as soapy as possible
   c. Be as hot as possible
   d. Move as fast as possible

4. How often should a grease interceptor be emptied?
   a. Yearly
   b. Monthly
   c. Daily
   d. When approximately 25% full

5. Approximately how much space in a pot sink's compartments is assumed to be taken up by pots and pans when sizing a grease interceptor?
   a. 10%
   b. 25%
   c. 40%
   d. 50%

6. As referenced in the 2007 BC Plumbing Code clauses, a 3-in. trap used in a trade waste system is assumed to be how many fixture units?
   a. 3
   b. 5
   c. 7
   d. 10

7. What should be the minimum size of vent used in the trade waste system referenced in the diagram from the 2007 BC Plumbing Code?
    a. 1.25 in.
    b. 1.5 in.
    c. 2 in.
    d. 3 in.

8. What is the principle by which an oil interceptor separates oil from drainage water?
    a. Venturi
    b. Conductivity
    c. Capillary action
    d. Flotation

9. What item inside an oil interceptor, when adjusted properly, allows oil to be drained off by gravity to a collection tank?
    a. Standpipe sleeve
    b. Float
    c. Inverted bell
    d. Baffle

10. Which one of the following pH ranges would generally not need to be adjusted for drainage to be allowed directly into a sanitary drainage system?
    a. 8 to 11
    b. 3 to 6.5
    c. 5.5 to 8.5
    d. 7.5 to 10.5

11. What is the minimum percentage of calcium carbonate ($CaCO_3$) content for limestone chips used in an acid neutralizer?
    a. 100%
    b. 90%
    c. 80%
    d. 70%

12. What is the name of the device found in a commercial pot sink that allows hot water to continually flow into a sink compartment without allowing it to spill over the flood level rim of the sink?
    a. Continuous waste
    b. Waste and overflow
    c. Standing waste
    d. Standpipe

13. What is installed either on the piping entering a grease interceptor or inside the interceptor near its inlet that slows the flow rate and reduces turbulence so that grease more easily separates from the water?
    a. Vent
    b. Strainer
    c. Escutcheon
    d. Flow control fitting

14. What type of grease interceptor has a mechanism that regularly skims the top layer of FOG into a separate collection chamber so that it can be disposed of on a daily basis without opening up the interceptor?
    a. Passive
    b. Aggressive
    c. Automatic
    d. Automatic mechanical

15. A three-compartment pot sink drains to a grease interceptor. Each compartment measures 15 in. by 15 in. by 10 in. If the drain-down time is one minute and 25% of the volume of the compartments is taken up by pots and pans, what is the minimum flow rate in USGPM and grease storage capacity in pounds for the grease interceptor?
    a. 7.3 USGPM and 14.6 pounds capacity
    b. 14.6 USGPM and 29.2 pounds capacity
    c. 21.9 USGPM and 43.8 pounds capacity
    d. 29.2 USGPM and 58.4 pounds capacity

Answer Key: Self-Test D-1.11 (#chapter-answer-key-self-test-d-1-11) is on the next page.

Answer Key: Self-Test D-1.11

1. a. Residential
2. c. Pot sink draining into a grease interceptor
3. c. Be as hot as possible
4. d. When approximately 25% full
5. b. 25%
6. a. 3
7. a. 1.25 in.
8. d. Flotation
9. a. Standpipe sleeve
10. c. 5.5 to 8.5
11. b. 90
12. c. Standing waste
13. d. Flow control fitting
14. d. Automatic mechanical
15. c. 21.9 USGPM and 43.8 pounds capacity

$$\begin{aligned}
15 \times 15 \times 10 \times 3 \times 0.75 &= 5,062.5 \text{ in.}^3 \\
5062.5 \text{ in.}^3 \div 231 \text{ in.}^3/\text{USG} &= 21.9 \text{ USGPM flow rate} \\
21.9 \times 2 &= 43.8 \text{ pounds storage capacity}
\end{aligned}$$

Answer Key: Self-Test D-1.11

1. a. Residential
2. c. Pot sink draining into a grease interceptor
3. c. Be as hot as possible
4. d. When approximately 25% full
5. b. 25%
6. a. 3
7. a. 1.25 in.
8. d. Flotation
9. a. Standpipe sleeve
10. c. 5.5 to 8.5
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12. c. Standing waste
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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)