

**ONTARIO COLLEGE OF TRADES**

**ORDRE DES MÉTIERS DE L'ONTARIO**

Apprenticeship  
Curriculum Standard

Plumber

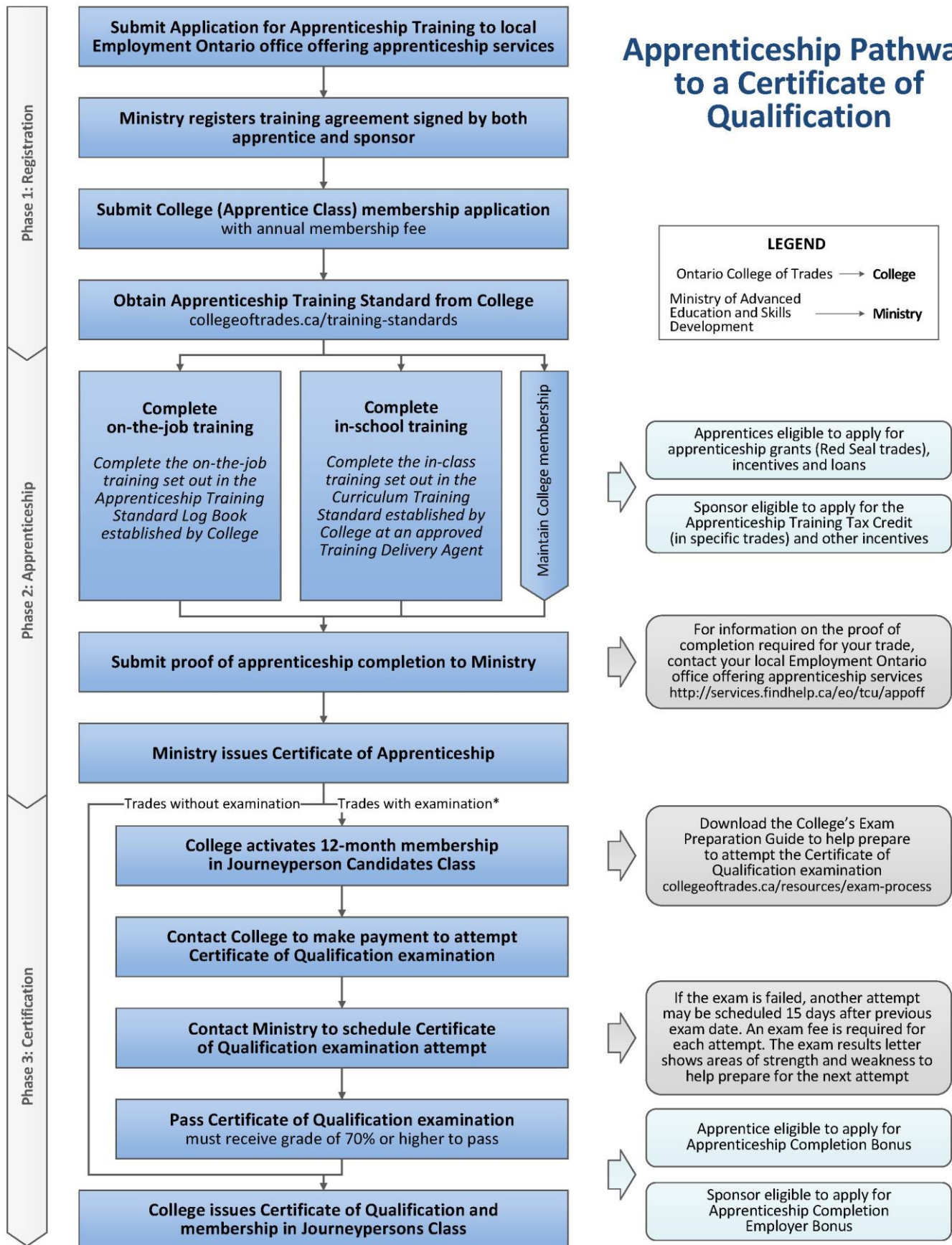
Levels 1, 2 & 3

306A

2018



# Apprenticeship Pathway to a Certificate of Qualification



\* For a list of trades subject to a certification examination, visit: [collegeoftrades.ca/resources/exam-process](http://collegeoftrades.ca/resources/exam-process)

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## **Introduction**

This new curriculum standard for the Plumber trade is designed from the learning outcomes, which were developed from the industry-approved training standard.

The curriculum is organized into **3 levels** of training, each including reportable subjects containing learning outcomes to reflect the units of the training standard. The hours charts indicate how the curriculum can be delivered in the current block release format and summarizes the hours of training for each reportable by level. Since the reportable subjects are all divisible by three they can be adapted to accommodate a more flexible training delivery other than block release.

The reportable subjects are Cross Referenced to the training standard for ease of comparison.

Each reportable subject and learning outcome identifies a recommended number of training hours. This hour allotment is broken into hours for instruction in theory and practical application. The division of the curriculum into reportable subjects follows a natural progression of learning through the training program. This structure will allow training centres and apprentices' flexibility in program delivery while still observing the importance of sequencing learning in a logical progression.

The curriculum is framed by and includes specific references to terminal performance objectives in the Apprenticeship Training Standards for Plumber. However, the curriculum identifies only the learning that takes place off the job, in a training environment. The in-school program focuses primarily on the theoretical knowledge required to master the performance objectives of the Training Standards. Employers are expected to extend the apprentice's knowledge and skills through appropriate practical training on the work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to assure that all apprentices have achieved the learning outcomes identified in the curriculum standard. The balance between theoretical and practical evaluation is identified for each unit of learning outcomes.

## **Pre-requisites**

In order to advance to Level 2 of the apprenticeship program, an individual must have completed all of the units outlined in Level 1. Similarly, in order to advance to Level 3 of the program, an individual must have completed all of the units outlined in Level 1 and 2.

## **Hours Disclaimer** (if applicable)

It is agreed that Training Delivery Agents (TDAs) may need to make slight adjustments (with cause) according to particular apprentice needs and may deviate from the unit sequencing and the prescribed Practical: and theoretical hours shown within the standard. However, all TDAs will comply with the hours at the reportable subject level.

### **Suggested Equipment for Training Delivery Agencies**

The listing of tools on page 92 does not list minimum quantities based on the understanding that the delivering TDA is in the best position to determine the need based on its delivery methodology.

Personal and Safety Equipment: Personal protective equipment is at the discretion of the TDA who must conform to Ontario Provincial Health and Safety Regulations.

**\*Please note that all practices described in this standard must be performed according to industry best practice.\***

## **Stakeholders Information**

A consortium of four Colleges of Applied Arts and Technology, working in collaboration with two unionized Training Delivery Agents and the Ontario College of Trades (OCOT), participated in the development of this document. A Project Steering Committee (PSC) was struck to guide the project development process of the Plumber documents. The format that is used in this document has been approved by the OCOT.

The Ontario College of Trades would like to acknowledge the following trade representatives for their contributions to the development of this document:

**Greg Van Bakel – Fanshawe College**

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**Jeff Willsie – Conestoga College**

**Don McMullen – Algonquin College**

**Michael Gordon – UA Local 46**

**Ian Harper – UA Local 67**

**Program Summary of Reportable Subjects**

<b>Number</b>	<b>Reportable Subjects</b>	<b>Hours Total</b>	<b>Hours Theory</b>	<b>Hours Practical</b>
S00021	Workplace Safety, Rigging and Hoisting – Level 1	24	21	3
S00022	Plumbing Systems – Level 1	96	96	0
S00023	Tools and Piping Methods – Level 1	48	0	48
S00024	Trade Calculations – Level 1	24	24	0
S00025	Trade Documentation – Level 1	24	12	12
S00026	Welding – Level 1	24	3	21
	<b>Total</b>	<b>240</b>	<b>156</b>	<b>84</b>

**Program Summary by Level & Evaluation & Testing**

Number: S00021

**Title: Workplace Safety, Rigging and Hoisting**

Duration: 24 Total Hours

Theory: 21 Hours

Practical: 3 Hours

Prerequisites: None

Co-requisites: S00021, S00023, S00024, S00026

**Evaluation Structure:**

Theory Testing 90%

Final Assessment 10%

Number: S00021.1

**Title: Demonstrate Effective Interpersonal Relations**

Duration: Total hours: 1

Theory: 1

Practical: 0

Prerequisites: None

Co-requisites: S00021, S00022, S00023, S00024, S00025, S00026

Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to demonstrate effective interpersonal relations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Use effective listening techniques.
- 1.2 Use language appropriate for the workplace.
- 1.3 Use of common trade terms and definitions correctly.
- 1.4 Explain the typical chain of command on a work site.
- 1.5 Explain trade-related problems, using verbal and non-verbal communications.
- 1.6 Identify and explain alternative solutions.
- 1.7 Seek and obtain approvals from appropriate personnel.
- 1.8 Verbally explain maintenance and warranty programs.

Number:	S00021.2	
Title:	<b>Receive and React to Instructions</b>	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00022, S00023, S00024, S00025, S00026	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464	

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to react to and carry out instructions.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 Listen to the instructions given.
- 2.2 Identify the key points given in the instructions.
- 2.3 Ask for clarification about any points which are not understood.
- 2.4 Repeat the instructions accurately.
- 2.5 Determine the feasibility and safety of the instructions and task assigned.
- 2.6 Identify the key tasks required by the instructions, including:
  - gathering the materials required
  - gathering the tools required
  - performing the required work
- 2.7 Communicate with others to ensure the task is completed in a timely manner and in conformity with company and/or customer standards, specifications, and codes.
- 2.8 Seek clarification, if and when required.



**Reportable Subject**

Number: S00021.3

**Title: Codes, Acts and Regulations**

Duration: Total hours: 2

Theory: 2

Practical: 0

Prerequisites: None

Co-requisites: None

Cross Reference to Training Standards: U5455

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate safe working habits and procedures in accordance with applicable safety standards and regulations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

3.1 Identify applicable acts, code, and regulations:

- identify the Occupational Health and Safety Act (OHSA) and Regulation
- explain the difference between the “Act” and the “Regulations”
- identify the sections of OHSA which deal with the construction industry

3.2 Interpret applicable acts, codes, and regulations:

- identify the group responsible for enforcement of the construction safety and health found in the OHSA
- state the responsibilities of the employer, worker, and an inspector
- explain when a worker may refuse work
- define a supervisor and a competent worker
- explain when a supervisor and safety officer/committee must be appointed

3.3 Apply sections of applicable acts, codes, and regulations dealing with:

- personal protective clothing
- hand and power tools
- flammable substances
- housekeeping practices

3.4 State the cause of most construction accidents.

Number:	S00021.4	
<b>Title:</b>	<b>Personal Protective Equipment and Personal Hygiene</b>	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards:	U5455	

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to protect self and others through the use of appropriate work dress, personal protective equipment, and personal hygiene.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.1 Identify and interpret sections of the OSHA, Infrastructure Health and Safety Association (IHSA) guidelines, and company/customer standards related to personal protection.
- 4.2 Determine the requirements for acceptable work dress and personal protective equipment, including:
  - protective head wear, foot wear, and eyewear
  - hearing protection and face mask
- 4.3 Select, adjust, wear and maintain work dress and personal protective equipment for maximum protection and suitable to the given task, including:
  - protective work clothing, headwear, footwear, and eyewear
- 4.4 Identify appropriate personal standards and list any hygiene and/or appearance requirements.
- 4.5 Determine hygiene and personal appearance standards from set requirements.
- 4.6 Comply with requirements of client or company, including:
  - wearing company uniform
  - keeping uniform in a neat and clean condition

Number:	S00021.5	
Title:	Recognize and Assess Hazardous Conditions	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards: U5455.0		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize and assess hazards, hazardous conditions, and potential damage and/or injury with equipment and/or materials that are not in compliance with the OHSA, WHMIS, and company/employer standards, as well as applicable codes and regulations.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 5.1 Identify codes, standards, and regulations that may be violated, including:
  - OHSA and client and/or company safety regulations
- 5.2 Identify conditions, material, or equipment that may be a safety hazard, including:
  - personal protective equipment
  - hand and power tools
  - rigging equipment
  - wire and fibre rope
  - scaffolds, guardrails, ladders, and lifts
  - trenching and shoring
  - unprotected openings and torches
- 5.3 Assess the hazardous condition, material, or equipment.
- 5.4 Note violation of codes and regulations by:
  - determining possible consequences
  - identifying causes and responsibility
  - determining how quickly action must be taken
- 5.5 Identify the potential damage and/or personal injury that may occur including:
  - falls causing cuts, bruises, abrasions, and burns to eyes, back, hands, knees, feet, and hearing
  - damaged hand and power tools, equipment, and fixtures
  - damages to the work site and injury of co-workers

Number:	S00021.6	
Title:	<b>Control Hazards</b>	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards: U5455.0		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to describe how to control hazardous conditions, equipment, and material in compliance with the OHSA, WHMIS, and company/employer standards, as well as applicable codes and regulations.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 6.1 Identify appropriate actions to correct and make safe the hazardous condition, material or equipment.
- 6.2 Identify relevant safety acts or company/customer standards.
- 6.3 Identify steps to take to prevent further hazards.
- 6.4 Report hazards to appropriate personnel.

Number:	S00021.7		
Title:	Work Platforms		
Duration:	Total hours:		1
	Theory:		1
	Practical:		0
Prerequisites:	None		
Co-requisites:	S00021		
Cross Reference to Training Standards: U5455			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to safely plan the erection, use, and dismantling of platforms and scaffolding.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 7.1 Identify and/or select approved scaffold parts.
- 7.2 Determine safe condition of scaffolding prior to use.
- 7.3 Describe safety procedures to follow to ensure safe use of platforms, scaffolds, and fall arrest systems.
- 7.4 Explain the procedure to follow to erect and to dismantle scaffolds
- 7.5 Identify any structural deficiencies.
- 7.6 Recommend replacement of damaged, unsafe, or worn scaffold components.
- 7.7 Identify how to secure all scaffold attachments to ensure the protection of self and others.
- 7.8 Identify personnel lifting devices, swing stages, and bosun's chairs.
- 7.9 Identify various approved power lifts and hoists.

Number:	S00021.8	
Title:	Lock Out and Tagging Procedures	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards: U5455		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to lock out and tag mechanical and electrical equipment according to applicable codes and company/customer standards.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 8.1 Determine which conditions would cause mechanical and electrical equipment to be tagged and locked out.
- 8.2 Describe how to lock out mechanical and electrical equipment according to all applicable codes and customer/company standards.
- 8.3 Describe tagging procedures of defective mechanical and electrical equipment according to all applicable codes and customer/company standards.
- 8.4 Describe how to remove locked-out mechanical and electrical equipment according to all applicable codes and customer/company standards.

Number:	S00021.9	
Title:	Operate and Maintain Tools	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards: U5455		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to use, inspect, and maintain tools and equipment to ensure safe operation in accordance with CSA standards and manufacturers' operating instructions. Operation of material handling equipment rated over 10 horsepower requires additional training as per *Occupational Health and Safety Act, R.S.O. 1990, c. O.1*

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 9.1 Recognize various hand and power tools.
- 9.2 Recognize the applications of various tools and material handling equipment.
- 9.3 Select the appropriate tools and/or material handling equipment for a given job.
- 9.4 Operate the various tools and/or material handling equipment according to CSA, manufacturer, and client /customer standards.
- 9.5 Determine the inspection points of hand and power tools and equipment according to the manufacturers' operating instructions.
- 9.6 Determine the frequency of inspections required for hand and power tools, and equipment according to the manufacturers' operating instructions.
- 9.7 Identify routine maintenance schedules.
- 9.8 Perform routine maintenance according to the manufacturer and/or client/company schedules.
- 9.9 Ensure hand and power tools, and equipment are free from defects and in proper working condition before using.
- 9.10 Remove hand tools, power tools, and equipment from service, if found to be defective.

Number:	S00021.10	
Title:	Perform Housekeeping Duties	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards: U5455		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to maintain a clean and safe work area.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 10.1 Identify and comply with all applicable codes and company/customer standards.
- 10.2 Identify the location of first aid equipment and supplies.
- 10.3 Identify the location of fire extinguishers.
- 10.4 Identify job conditions that require heating, ventilation, and lighting.
- 10.5 Store material and equipment in designated areas.
- 10.6 Erect protective barriers as required.
- 10.7 Remove debris to designated locations at intervals that will keep the work area clean and safe.
- 10.8 Recycle materials as required and where possible.



Number:	S00021.11	
Title:	Read and Interpret Specifications and Shop Drawings	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to determine the weight, size, and any special rigging requirements needed to rig and hoist material and equipment in compliance with the OHSA and company/customer safety precautions.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 11.1 Recognize and use common rigging terms and abbreviations.
- 11.2 Demonstrate the use of standard weight tables to determine the weight of a given load.
- 11.3 Identify the weight, size, and centre of gravity of a given object.
- 11.4 Determine whether there are any special rigging and/or hoisting requirements for given materials or pieces of equipment.

Number:	S00021.12	
Title:	Inspect the Job Site	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to plan how to assess a site to determine if rigging and hoisting operations may be carried out in accordance with the OHSA and company/customer safety procedures.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 12.1 Identify conditions which should be assessed before hoisting and rigging operations begin, including:
  - soil conditions
  - power lines
  - overhead clearance
  - underground services
  - special conditions
  - space requirements
- 12.2 Identify what steps must be taken if rigging conditions do not meet all safety requirements.

Number:	S00021.13	
Title:	Determine the Required Equipment	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021, S00024	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to determine the capacity of the hoisting equipment required in accordance with the OHSA and company/customer procedures.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 13.1 Estimate the weight of the load to be lifted by using:
  - bills of lading
  - technical drawings and data
  - estimation tables
- 13.2 Assist in the selection of the lifting or hoisting equipment by:
  - calculating the load radius of the equipment used to hoist the load
  - determining the boom angle of the hoist equipment
  - determining the lift height of the equipment hoisting the load

Number:	S00021.14		
Title:	Schedule the Lift		
Duration:	Total hours:		1
	Theory:		1
	Practical:		0
Prerequisites:	None		
Co-requisites:	S00021		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recommend a process of hoisting and off-loading tasks in compliance with the OHSA, and company/customer policy.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 14.1 Plan a schedule for the arrival of material and equipment to be hoisted.
- 14.2 Prepare a schedule for hoisting equipment.
- 14.3 Plan to assign duties to the hoisting crews.
- 14.4 Plan to monitor hoisting crews.

Number:	S00021.15		
Title:	Inspect the Rigging		
Duration:	Total hours:	1	
	Theory:	0	
	Practical:	1	
Prerequisites:	None		
Co-requisites:	S00021, S00024		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to inspect rigging and hoisting equipment to ensure it complies with OHSA, and company/customer safety procedures.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 15.1 Identify the rigging and hoisting equipment that requires inspection.
- 15.2 Describe the inspection procedures for rigging and hoisting equipment.
- 15.3 Perform inspection procedures for a variety of rigging and hoisting equipment.
- 15.4 Calculate the working load limit (WLL) and breaking strength for fibre rope.
- 15.5 Calculate the working load limit (WLL) and breaking strength for wire rope.

Number:	S00021.16	
Title:	Connect the Equipment to the Rigging	
Duration:	Total hours:	1
	Theory:	0
	Practical:	1
Prerequisites:	None	
Co-requisites:	S00021, S00024	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to describe required rigging operations as they conform to Canadian Standards Association (CSA) standards, OHSA, and company/customer safety procedures.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 16.1 Describe the use and purpose of rigging hardware.
- 16.2 Explain the use and purpose of rigging tools and devices.
- 16.3 Explain the use and purpose of standard types of fibre rope used when rigging.
- 16.4 Identify the use and purpose of standard types of wire rope used when rigging.
- 16.5 Estimate the working load limit (WLL) of slings at different sling angles.
- 16.6 Demonstrate a number of knots and hitches.

Number:	S00021.17	
Title:	Secure the Hoisting Area	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to plan how to secure an area where rigging and hoisting operations are to take place.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 17.1 Plan to secure the area(s) where rigging and hoisting operations will or may take place.
- 17.2 Explain how to coordinate with other trades when preparing for a hoisting and rigging operation to take place.
- 17.3 State how to barricade an area where rigging and hoisting activities will be taking place.

Number:	S00021.18	
Title:	Plan To Perform the Lift	
Duration:	Total hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to plan to perform the lift conforming to CSA standards, OHSA, and company/client safety procedures.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 18.1 Plan to secure the area where the lift will be performed.
- 18.2 Plan how to connect the rigging equipment to the load.
- 18.3 Explain how and where to connect a tag line.
- 18.4 Plan the landing area.

Number:	S00021.19		
Title:	Position, Secure and Disconnect the Load		
Duration:	Total hours:	2	
	Theory:	2	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00021		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to describe a process for releasing hoisting equipment from the load and to plan the removal and storage of lifting devices, in compliance with the OHSA, and company/customer safety procedures.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 19.1 Plan to position the load in the landing area.
- 19.2 Plan to secure the load in a safe manner.
- 19.3 Plan to release the hoisting equipment used.
- 19.4 Describe how to remove the lifting devices from the load.



Number:	S00021.20	
Title:	Communicate Throughout the Lift	
Duration:	Total hours:	1
	Theory:	0
	Practical:	1
Prerequisites:	None	
Co-requisites:	S00021	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to use signals in compliance with the OSHA, and company/ customer safety procedures.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 20.1 Determine when a signaler is required.
- 20.2 Demonstrate the use of International Hand Signals.
- 20.3 Identify situations when voice communications are to be used.

Number:	S00021.21	
Title:	Remove and Store the Rigging Equipment	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00021	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to plan the removal and storage of lifting devices to comply with company/customer standards.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 21.1 Identify a designated storage area for the rigging and hoisting equipment.
- 21.2 Explain how and where to store the rigging and hoisting equipment.

Number:	S00022
<b>Title:</b>	<b>Plumbing Systems – Level 1</b>
Duration:	96 Total Hours
	Theory: 96 Hours
	Practical: 0 Hours
Prerequisites:	None
Co-requisites:	S00022, S00023, S00024, S00025
<b>Evaluation Structure:</b>	
Theory Testing	90%
Practical Exercises	
Final Assessment	10%

## Pipe and Fitting Materials, Pipe Supports and Hangers

Number:	S00022.1
<b>Title:</b>	<b>Steel Pipe and Fittings</b>
Duration:	Total hours: 2
	Theory: 2
	Practical: 0
Prerequisites:	None
Co-requisites:	S00021, S00023
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465	

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify steel pipe and fittings composition, design, manufacture, terminology, available lengths and diameters, as well as previous and current approved uses.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 1.1 Name different grades and types of steel pipe
- 1.2 Explain how steel pipe diameters are measured through various diameters.
- 1.3 Identify different weights of steel pipe using the traditional designations.
- 1.4 State the letter designations for standard, strong, extra strong, and double extra strong steel pipe.
- 1.5 State the schedule number for standard wall thickness from 10 to 160.
- 1.6 Identify different types of fabrication used for steel pipe.
- 1.7 Identify the abbreviations OD and ID.
- 1.8 Explain the term, “nominal”.

- 1.9 State the dimension used to identify iron/steel pipe up to 12 inches in diameter.
- 1.10 Explain how different wall thicknesses will determine the cross sectional area of a pipe.
- 1.11 Identify the size range of iron/steel pipe from 1/8 inch to 12 inches to over 12 inches.
- 1.12 Identify the advantages and disadvantages of iron/steel and galvanized iron/steel pipe and fittings.
- 1.13 Explain the difference between a “pressure fitting” and a “drainage fitting” and where each fitting may be used.
- 1.14 Identify fittings from a given sample including elbows, tees, unions, couplings, bushings, and nipples.
- 1.15 State the common joining methods used for iron/steel pipe and fittings.
- 1.16 Identify the systems where iron/steel pipe and fittings have been installed.
- 1.17 Identify the uses for iron/steel pipe and fittings, as outlined in the OBC, and the restrictions placed on them; then state the required approvals for steel pipe and fittings.
- 1.18 List the support requirements for iron/steel pipe installation of various sizes.
- 1.19 List factors to be considered when selecting steel pipe including:
  - cost of material
  - installation time
  - availability
  - flame and smoke ratings
  - corrosion
  - OBC limitations

Number:	S00022.2	
Title:	Cast Iron Soil Pipe and Fittings	
Duration:	Total hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify cast iron soil pipe and fittings, terminology, available lengths and diameters, as well as previous and current approved uses.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 State the size range of cast iron soil pipe and fittings.
- 2.2 Identify the four common types of joining methods used to join cast iron pipe and fittings together.
- 2.3 State the two different types of caulked joints that may be used for cast iron pipe and fittings.
- 2.4 State the types and available size range of mechanical joint couplings.
- 2.5 Identify and state the available size range for a bi-seal gasket.
- 2.6 Identify the function of oakum in a caulked joint.
- 2.7 Identify the abbreviation PC4.
- 2.8 Explain the purpose of lead or PC4 in a caulked joint.
- 2.9 State the minimum depth of lead or PC4 required for a caulked joint.
- 2.10 Explain the common ways of cutting cast iron pipe.
- 2.11 Explain how to determine if a section of piping is cracked.
- 2.12 State the approved uses for cast iron soil pipe and fittings.
- 2.13 State the approved installation locations for cast iron pipe and fittings.
- 2.14 State the support requirements for cast iron pipe and fittings.
- 2.15 List factors to be considered when selecting cast iron pipe including:
  - cost of material
  - installation time
  - availability
  - flame and smoke ratings
  - corrosion
  - OBC limitations

Number:	S00022.3		
Title:	ABS Plastic Pipe and Fittings		
Duration:	Total hours:	1	
	Theory:	1	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00023		
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461 U5465			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify different plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods, and support requirements.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Identify the full name for the common abbreviation for ABS pipe.
- 3.2 Identify the joining methods of ABS pipe and fittings.
- 3.3 Identify the joining methods of ABS pipe and fittings to other plastics.
- 3.4 Identify the joining method of ABS pipe and fittings to non-plastic pipe and fittings.
- 3.5 State the standard colour for ABS pipe and fittings.
- 3.6 State what approvals are required for ABS pipe and fittings.
- 3.7 State the support requirements for ABS pipe and fittings.
- 3.8 Identify the standard pipe diameters for ABS pipe and fittings.
- 3.9 Identify the standard wall thickness for ABS pipe and fittings.
- 3.10 Explain how ABS pipe is ordered.
- 3.11 State the standard length for ABS pipe.
- 3.12 Identify and list the approved piping systems used for ABS pipe and fittings.
- 3.13 Explain the restrictions that are placed on ABS pipe and fittings.
- 3.14 Explain the differences between solid core and cellular core ABS pipe.

Number:	S00022.4	
Title:	PVC Plastic Pipe and Fittings	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify different plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods, and support requirements.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.1 Identify the full name for the common abbreviation for PVC pipe.
- 4.2 Identify the joining methods of PVC pipe and fittings.
- 4.3 Identify the joining methods of PVC pipe and fittings to other plastics.
- 4.4 Identify the joining methods of PVC pipe and fittings to non-plastic pipe and fittings.
- 4.5 State what approvals PVC pipe and fittings require.
- 4.6 State the support requirements for PVC pipe and fittings.
- 4.7 Identify the standard pipe diameters for PVC pipe and fittings.
- 4.8 Identify the different wall thicknesses available for PVC pipe and fittings.
- 4.9 Explain how PVC pipe is ordered.
- 4.10 State the standard lengths of PVC pipe.
- 4.11 Identify and list the approved piping systems used for PVC pipe and fittings.
- 4.12 Explain the restrictions that are placed on PVC pipe and fittings.
- 4.13 Identify the different types and uses of PVC pipe, fittings and associated solvents.

Number:	S00022.5	
Title:	CPVC Plastic Pipe and Fittings	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify different plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods, and support requirements.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 5.1 Identify the full name for the common abbreviation for CPVC pipe.
- 5.2 Identify the joining methods of CPVC pipe and fittings.
- 5.3 Identify the joining methods of CPVC pipe and fittings to other plastics.
- 5.4 Identify the joining method of CPVC pipe and fittings to non-plastic pipe & fittings.
- 5.5 State what approvals CPVC pipe and fittings require.
- 5.6 State the support requirements for CPVC pipe and fittings.
- 5.7 Identify the standard pipe diameters for CPVC pipe and fittings.
- 5.8 Explain how CPVC pipe is ordered.
- 5.9 State the standard length for CPVC pipe.
- 5.10 Identify and list the approved piping systems used for CPVC pipe and fittings.
- 5.11 Explain the restrictions that are placed on CPVC pipe and fittings.
- 5.12 Identify the different types and uses of PVC pipe, fittings and associated solvents.

Number:	S00022.6
Title:	<b>Polyethylene Plastic Pipe and Fittings</b>
Duration:	Total hours: 1
	Theory: 1
	Practical: 0
Prerequisites:	None
Co-requisites:	S00022, S00023
Cross Reference to Training Standards:	U5455, U5457, U5458, U5460, U5461, U5465

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify different plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods, and support requirements.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 6.1 Identify the full names and common abbreviations of PE pipe.
- 6.2 Identify the joining methods of various types of PE pipe and fittings.
- 6.3 Identify the joining methods of polyethylene pipe and fittings to other plastics.
- 6.4 Identify the joining method of polyethylene pipe and fittings to non-plastic pipe and fittings.
- 6.5 State the standard colours for polyethylene pipe and fittings
- 6.6 State what approvals polyethylene pipe and fittings require.
- 6.7 Identify the minimum pressure requirements for polyethylene pipe.
- 6.8 State the support requirements for polyethylene pipe and fittings.
- 6.9 Identify the standard pipe diameters for polyethylene pipe and fittings.
- 6.10 Identify the standard wall thickness for polyethylene pipe and fittings.
- 6.11 Explain how polyethylene pipe is ordered.
- 6.12 State the standard lengths of polyethylene pipe.
- 6.13 Identify and list the approved piping systems used for polyethylene pipe and fittings.
- 6.14 Explain the restrictions that are placed on polyethylene pipe and fittings.



Number:	S00022.7		
Title:	<b>Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX/AL/PEX) Plastic Pipe, Cross-linked Polyethylene (PEX) Plastic Pipe, Polyolefin Plastic Pipe, and Fittings</b>		
Duration:	Total hours:	1	
	Theory:	1	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00023		
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify different plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods, and support requirements.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 7.1 Identify the full name for the common abbreviation for PEX/AL/PEX, PEX, and Polyolefin.
- 7.2 Identify the joining methods of PEX/AL/PEX, PEX, and Polyolefin pipe and fittings.
- 7.3 Identify the joining methods of PEX/AL/PEX, PEX, and Polyolefin pipe and fittings to other plastics.
- 7.4 Identify the joining method of PEX/AL/PEX, PEX, and Polyolefin pipe and fittings to non-plastic pipe and fittings.
- 7.5 State the standard colours for PEX/AL/PEX, PEX, and Polyolefin pipe and fittings.
- 7.6 State what approvals PEX/AL/PEX, PEX, and Polyolefin pipe and fittings require
- 7.7 State the support requirements for PEX/AL/PEX, PEX, and Polyolefin pipe and fittings.
- 7.8 Identify the standard pipe diameters of PEX/AL/PEX, PEX, and Polyolefin pipe and fittings.
- 7.9 Explain how PEX/AL/PEX, PEX, and Polyolefin pipe is sold.
- 7.10 State the standard lengths of PEX/AL/PEX, PEX, and Polyolefin pipe.
- 7.11 Identify and list the approved piping system used for PEX/AL/PEX, PEX, and Polyolefin pipe and fittings.
- 7.12 Explain the restrictions that are placed on PEX/AL/PEX, PEX, and Polyolefin pipe and fittings.
- 7.13 Identify various manufacturing methods.

Number:	S00022.8	
Title:	Polyethylene/Aluminum/Polyethylene (PE/AL/PE) Composite Pipe and Polypropylene Pipe and Fittings (PP-R)	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023	
Cross Reference to Training Standards:	U5455, U5457, U5458, U5460, U5461, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify different plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods, and support requirements.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 8.1 Identify the full name for the common abbreviation for PE/AL/PE and PP-R pipe.
- 8.2 Identify the joining methods of PE/AL/PE and PP-R pipe and fittings.
- 8.3 Identify the joining methods of PE/AL/PE and PP-R pipe and fittings to other plastics.
- 8.4 Identify the joining method of PE/AL/PE and PP-R pipe and fittings to non-plastic pipe and fittings.
- 8.5 Identify the fitting used with PE/AL/PE and PP-R pipe.
- 8.6 State the standard colour for PE/AL/PE and PP-R pipe and fittings.
- 8.7 State what approvals PE/AL/PE and PP-R pipe require.
- 8.8 State the support requirements for PE/AL/PE and PP-R pipe.
- 8.9 Identify the standard pipe diameters for PE/AL/PE and PP-R pipe.
- 8.10 State how PE/AL/PE and PP-R pipe is ordered.
- 8.11 State the standard lengths for PE/AL/PE and PP-R pipe.
- 8.12 Identify and list the approved piping system used for PE/AL/PE and PP-R pipe.
- 8.13 Explain the restrictions that are placed on PE/AL/PE and PP-R pipe.

Number:	S00022.9	
Title:	Copper Pipe and Fittings	
Duration:	Total hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify the distinguishing characteristics of copper pipe and fittings, including wall thicknesses, selection factors, applications, joining methods, and support requirements.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 9.1 Identify the four standard wall thicknesses for copper pipe.
- 9.2 Identify and explain the term, “degreased copper”.
- 9.3 Identify the colour designation assigned to each wall thickness.
- 9.4 Identify the advantages and disadvantages of copper pipe and fittings.
- 9.5 State the standard diameters for copper pipe and fittings.
- 9.6 State the standard lengths for hard drawn and coiled copper pipe.
- 9.7 Identify which wall thickness may be purchased as hard drawn lengths, coils, or both.
- 9.8 State where soft copper pipe may be installed.
- 9.9 Explain why restrictions are placed on soft copper coils.
- 9.10 State where hard drawn copper pipe may be installed.

- 9.11 Explain why restrictions are placed on hard drawn lengths.
- 9.12 State the common joining methods for copper pipe and tubing.
- 9.13 Identify the approval agency for copper pipe.
- 9.14 Explain the difference between “drainage” and “pressure” copper fitting.
- 9.15 State the support requirements for various diameters of copper pipe installations.
- 9.16 Identify the precaution that must be taken if supports for copper pipe and fittings are not copper.
- 9.17 Identify and explain the purpose of a dielectric coupling and/or alternative methods of joining dissimilar material.
- 9.18 Explain where dielectric couplings need to be installed.
- 9.19 List factors to be considered when selecting copper pipe including:
  - type of system
  - corrosion/erosion
  - cost of material
  - installation time
  - availability
  - flame and smoke ratings

Number:	S00022.10	
Title:	Glass Pipe and Fittings	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify the distinguishing characteristics of glass pipe and fittings, including selection factors, applications, joining methods, and support requirements.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 10.1 State the purpose of glass pipe and fittings.
- 10.2 State the available size range of glass pipe and fittings.
- 10.3 Explain the procedures used to cut glass pipe.
- 10.4 State the joining methods used to connect glass pipe and fittings.
- 10.5 Identify the approval agency for glass pipe and fittings.
- 10.6 State the approved uses for glass pipe and fittings.
- 10.7 State the approved installation locations for glass pipe and fittings.
- 10.8 List factors to be considered when selecting glass pipe including:
  - type of system
  - corrosion
  - cost of material
  - installation time
  - availability
  - flame and smoke ratings
- 10.9 State the support requirements for glass pipe and fittings.

Number:	S00022.11	
Title:	Pipe Supports, Anchors, and Hangers	
Duration	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify different pipe supports and hangers, as well as selection and installation factors.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 11.1 Explain the purpose of pipe supports, hangers, and anchors.
- 11.2 State the maximum vertical distances between supports.
- 11.3 Identify the largest size of pipe that may be supported by solid or perforated metal straphangers.
- 11.4 Identify the smallest threaded rod that may be installed to support the hanger.
- 11.5 State the minimum pipe size that must be supported by metal rods.
- 11.6 Explain the type of fastener that may be used when attaching hangers to concrete or masonry.
- 11.7 List the factors to be considered when selecting a hanger or support.
- 11.8 List the factors to be considered when using anchors and guides to support an expansion joint.
- 11.9 List the factors to be considered to support underground piping systems.
- 11.10 Identify types of hangers and supports and describe how they are installed, including:
  - strap hangers, ring hangers, clevis hangers, spring hangers, trapeze hangers, MJ pipe hangers, and roller hangers.
  - beam clamps, riser clamps, pipe clamps, and U bolts
  - threaded rod and threaded rod couplings
  - pipe clips, pipe racks, concrete inserts, wall pipe supports, expansion plugs, support anchors, and threaded studs

11.11 List factors to be considered when selecting pipe supports, including:

- type of system
- installation time
- cost of material
- availability
- capacity

Number:	S00022.12	
Title:	Drilling and Notching	
Duration:	Total Hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023,	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize floor joists, wall studs, and roof trusses and identify which structural and non- structural members may be drilled and/or notched to a given size and in given locations.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

12.1 Identify common structural members, such as:

- floor joists
- wall studs
- floor and roof trusses
- top plates
- bottom plates

12.2 State which structural and non-structural members may not be drilled or notched.

Number:	S00022.13	
Title:	Joining Dissimilar Pipe Materials	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify methods of joining together dissimilar materials.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 13.1 Describe the common approved methods of adapting cast iron, plastic, copper, aluminum, asbestos cement, and glass pipe to each other incorporating:
  - adaptors
  - female adaptors
  - caulking ferrules
  - mechanical joint couplings
  - slip joint adaptors
  - connectite adaptors
  - bushings
  - dielectric couplings
  - field cut couplings
- 13.2 Explain the restrictions placed upon slip joint adaptors, bushings, and mechanical joint couplings.



## Drainage Systems

Number:	S00022.14	
Title:	Drainage Terms and Definitions	
Duration:	Total hours:	4
	Theory:	4
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify and apply drainage terms and definitions.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 14.1 Identify the code that lists the common drainage terms and definitions.
- 14.2 State the section of the OBC that contains drainage terms, definitions, and abbreviations of proper names.
- 14.3 Define the following terms identifying minimum pipe size, installation or system location, and other distinguishing characteristics, including:
  - accessible
  - back vent
  - backwater valve
  - basement
  - branch
  - branch vent
  - building drain
  - building sewer
  - cleanout
  - continuous vent
  - developed length
  - drainage system
  - fixture
  - fixture drain
  - fixture outlet pipe
  - fixture unit
  - flood level rim
  - horizontal branch
  - nominally horizontal/vertical

- plumbing appliance
- plumbing
- sanitary building drain
- sanitary building sewer
- sanitary drainage pipe/system
- sanitary unit
- soil pipe
- soil stack
- stack vent
- storm building drain/sewer
- storm drainage pipe
- storm drainage system
- trap
- trap arm
- vent pipe
- vent stack
- venting system
- vertical leg
- waste pipe
- waste stack

14.4 Identify and list some of the common drainage terms and definitions by examining a drain plan and stack elevation drawing.

Number:	S00022.15	
Title:	Cleanouts and Locations	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023, S00025	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify, select, and install cleanout fittings and manholes.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 15.1 Identify the major causes of pipe blockages.
- 15.2 Explain the purpose of a cleanout fitting.
- 15.3 Identify the different types of cleanouts including:
  - Malcolm
  - Barrett
  - Westmount
  - in-line cleanouts
  - end cleanouts
  - fitting cleanouts
  - tube-end
- 15.4 Describe the term, “accessible”.
- 15.5 Explain why the screws, nuts, and bolts (used to hold cleanout covers) must be brass or other corrosion-resistant material.
- 15.6 State the minimum size of cleanouts for drainage piping of various sizes.
- 15.7 Explain why a cleanout must be both gastight and watertight at all times.
- 15.8 State the spacing requirements for cleanouts installed on:
  - sink wastes
  - horizontal storm and sanitary drainage piping smaller and larger than 4 inches

- 15.9 Identify cleanout requirements for storm and sanitary building drains as they leave the building.
- 15.10 State the cleanout requirements for soil stacks, waste stacks, and rainwater leaders.
- 15.11 Explain where a cleanout must be installed on kitchen sink drainage piping.
- 15.12 Identify which fixtures require a removable style p-trap or must be equipped with a bottom plug cleanout p-trap.
- 15.13 Explain the cleanout requirements for running trap installations.
- 15.14 State the cleanout requirements for sanitary and storm building drains that change direction more than 45 degrees.
- 15.15 Identify where cleanouts must be installed for interceptor installations and to serve wall-hung urinals.
- 15.16 State where cleanout fittings must be installed on an indirect waste system.
- 15.17 Explain where manholes must be installed both inside and outside a building and state their minimum dimension, listing installation requirements inside a building.

Number:	S00022.16	
Title:	Prohibited Fittings and Connections	
Duration:	Total hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023, S00025	
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify the problems caused by and reasons for prohibited fittings and connections.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 16.1 Define the terms vertical and horizontal as they are applied to plumbing installations.
- 16.2 Identify standard drainage fittings including elbows, branched fittings, adaptors, and reducing fittings.
- 16.3 Identify the pipe fittings that may not be installed in the horizontal plane in drainage applications.
- 16.4 Explain the possible problems that occur if pipe fittings are installed in unapproved positions.
- 16.5 State the minimum barrel and branch size for a double TY to be installed in drainage piping.
- 16.6 Identify the conditions where copper pipe may be drilled or tapped.
- 16.7 Identify the conditions where drainage pipe may be drilled or tapped.
- 16.8 Identify the location and the conditions that must be met to allow the installation of a saddle hub.
- 16.9 Identify the pipe materials that may be installed above ground, inside a building.
- 16.10 Identify the correct and incorrect fitting installations.
- 16.11 Explain why some drainage materials are restricted to above ground installation only.

Number:	S00022.17	
Title:	Purpose of a Drain Plan	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify the items that are shown on a drain plan, its approval process, and its uses after the construction is complete.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 17.1 Identify the items normally shown on a drain plan including:
  - sanitary and storm building drains
  - foundation drain connections
  - down spout/leader connections
  - floor drain connections
  - trap seal primers
  - cleanouts
  - any other required sanitary and storm drainage piping
- 17.2 Explain the main uses of a drain plan.
- 17.3 State the regulations to which a drain plan must conform for approval.
- 17.4 State the uses of a drain plan after the building is complete and occupied.
- 17.5 Identify errors in a drain plan.

Number:	S00022.18	
Title:	How to Draw a Drain Plan	
Duration:	Total hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to draw drain plans.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 18.1 Explain in which form or view the horizontal drainage system for a building is normally shown.
- 18.2 State the drawing instruments required to draw a drain plan.
- 18.3 Explain how colour codes are used to illustrate sanitary drainage, storm drainage, and vent piping.
- 18.4 Explain how to illustrate single-line piping drawings.
- 18.5 Explain why the correct fittings must be illustrated on a drain plan.

18.6 Identify the common abbreviations used in conjunction with drain plan including but not limited to:

- BD
- BS
- FAI
- BWV
- CO
- DS
- FD
- SS
- WS
- TSP
- LT
- WC

18.7 Explain how drainage piping installed at different elevations is illustrated.

18.8 State why storm and sanitary drainage pipe should be located in the same trench.

18.9 Explain how traps serving floor drains, showers, or other floor-mounted fixtures are illustrated on a drain plan.

18.10 State how trap seal primer connections are indicated on a drain plan.



Number:	S00022.19		
Title:	Foundation Drains		
Duration:	Total hours:	2	
	Theory:	2	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify the connection points, locate cleanouts, explain how to protect from back flooding, and illustrate foundation drains.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 19.1 Define the term, “foundation drain/sub-soil drainage pipe”
- 19.2 Identify where foundation drains are installed.
- 19.3 Explain the purpose of a foundation drain.
- 19.4 State the type of discharge that flows through foundation drains.
- 19.5 State the possible consequences of not installing foundation drains.
- 19.6 Identify where foundation drains may discharge and foundation sump requirements.
- 19.7 Explain why a foundation drain should not connect to a septic tank, holding tank, or any type of private sewage disposal system.
- 19.8 State the minimum number of foundation drains required.
- 19.9 Identify where cleanout fittings must be installed in foundation drain piping.
- 19.10 Define the term, “backwater valve”.
- 19.11 Explain the purpose of a backwater valve.
- 19.12 State why some municipalities require the installation of backwater valves.
- 19.13 Identify where a backwater valve should be installed, if required.
- 19.14 State why down spout and foundation drains should not be connected together.
- 19.15 Draw a number of drain plans, incorporating the foundation drain, down spout and rainwater leader piping connections.

Number:	S00022.20
<b>Title:</b>	<b>Floor Drains</b>
Duration:	Total hours: 3
	Theory: 3
	Practical: 0
Prerequisites:	None
Co-requisites:	S00022, S00025
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define a floor drain, identify floor drains, state the allowable discharge locations, illustrate the piping connections, as well as size, and illustrate the required trap seal primer piping.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 20.1 State what code sections outline the installation requirements for floor drains.
- 20.2 Define a floor drain.
- 20.3 State the minimum drainage pipe size required for a floor drain.
- 20.4 Determine the minimum size of floor drain, based on potential flow rates.
- 20.5 Determine minimum trap seal depth, including static pressure.
- 20.6 Identify where floor drains must be installed.
- 20.7 Explain where the discharge from a floor drain may discharge according to applicable codes.
- 20.8 Explain when the discharge from a floor drain may discharge to the storm drainage systems.
- 20.9 Identify a floor drain grate and explain its purpose.
- 20.10 State the type of construction where floor drain grates are normally installed.
- 20.11 Identify a manufactured floor drain body and explain its purpose.
- 20.12 State the type of construction where a floor drain body is normally installed.
- 20.13 Identify some common options that may be ordered with a floor drain body.
- 20.14 State when the waste pipe serving a floor drain does and does not require a vent connection.
- 20.15 State the common causes of trap seal loss for floor drains.
- 20.16 Explain how the trap seals in floor drain traps are maintained.
- 20.17 Define the trade term, "gang trapping".
- 20.18 State when floor drains may be gang trapped.
- 20.19 Identify the trade term "emergency floor drain".

Number:	S00022.21		
Title:	Hub Drains and Funnel Floor Drains		
Duration:	Total hours:	1	
	Theory:	1	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00025		
Cross Reference to Training Standards:U5457, U5458, U5459, U5460, U5461, U5462, U5465			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define, identify, and describe the installation requirements for hub drain and funnel floor installations.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 21.1 Define the terms “hub drain”.
- 21.2 Define the trade term “funnel floor drain”.
- 21.3 Explain the purpose of a hub drain and a funnel floor drain.
- 21.4 Explain why the flood-level rim of a hub drain must be installed above the floor drain.
- 21.5 Explain the difference between a hub drain and a funnel floor drain.
- 21.6 State the minimum size of a hub drain or a funnel floor drain.
- 21.7 Explain how to size a hub drain or funnel floor drain.
- 21.8 Identify to which drainage system a hub drain or funnel floor drain must be connected.
- 21.9 Describe the trap seal primer requirements of a hub drain or a funnel floor drain.
- 21.10 State the installation locations of a hub drain or funnel floor drain.
- 21.11 Explain where a hub drain or funnel floor drain cannot be installed.

Number:	S00022.22	
Title:	Trap Seal Primers	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5465, U5466, U5468	

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to explain the purpose of a trap seal primer and its installation requirements, as well as install a trap seal primer.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 22.1 Define the trade term, “trap seal primer” and explain its purpose.
- 22.2 Identify different types of trap seal primers and trap seal loss prevention devices including:
  - manufactured trap seal primers
  - drinking fountain wastes
  - residential laundry tub faucets
  - connections to flush valves flush tubes
  - water-using equipment
  - urinal flush tanks
  - trap seal anti-evaporation devices
- 22.3 Explain the principle of operation of manufactured trap seal primers and anti-evaporation devices.
- 22.4 Describe the piping arrangement for a manufactured trap seal primer, when used to prime floor drains, and state the minimum pipe size that may be used.

- 22.5 Describe the drainage piping arrangement of a drinking fountain when used to prime a floor drain.
- 22.6 Describe the piping arrangement when installed to prime floor drains for:
- a urinal flush tank
  - flush tubes from flushometers
- 22.7 Explain the conditions that must be met when using equipment to prime floor drains.
- 22.8 Explain whether the water used to prime floor drains must be potable.
- 22.9 State what steps must be taken if the water used to prime floor drains is not potable.
- 22.10 Define the terms air gap and, in relationship to a floor drain, flood-level rim.
- 22.11 Describe how a cross-connection may be created when installing a trap seal primer.
- 22.12 Explain how an air gap or a backflow prevention device may be incorporated into the trap seal primer installation to prevent a possible backflow condition.

Number:	S00022.23	
Title:	Drainage System Design	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465, U5466, U5468		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize and design drainage systems, incorporating different drainage system designs.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 23.1 Define the terms:
  - municipal sanitary sewer
  - municipal storm sewer
  - combined building sewer
  - combined building drain
  - semi-combined building sewer
  - semi-combined building drain
  - running trap
- 23.2 Review the definitions of separate building sewer and separate building drain.
- 23.3 Explain the terms, “combined and semi-combined drain systems”.
- 23.4 Identify the components of a running trap.
- 23.5 State where the cleanout must be installed with a running trap.
- 23.6 State where a running trap must be installed in combined and semi-combined systems.

- 23.7 Identify the connection of a fountain drain and how a down spout connection is made to:
- separate drainage system
  - combined drainage system
  - semi-combined drainage system
- 23.8 State where combined and semi-combined drainage systems may be found in service.
- 23.9 State where a separate system may be installed.
- 23.10 Identify the three drain designs that have been installed in Ontario.
- 23.11 Identify the most common drain design system currently installed.
- 23.12 Explain why combined drainage systems have been prohibited.
- 23.13 Describe the steps required to convert a semi-combined system into a separate drainage system.
- 23.14 Identify the importance of mandatory locating of underground services in relation to the sanitary or storm drainage systems.

Number:	S00022.24	
Title:	Sanitary Building Traps	
Duration:	Total hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5465, U5466, U5468	

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize a building trap, the purpose of the installation, the piping arrangement, and the disadvantages of the installation.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 24.1 Define the term, "building trap".
- 24.2 Describe the component parts of a building trap installation.
- 24.3 State the minimum size of a building trap.
- 24.4 Describe the purpose of a building trap.
- 24.5 Identify the types of neighborhoods where building traps may have been installed.
- 24.6 Identify the possible installation locations of a building trap.
- 24.7 Define the term, "fresh air inlet".
- 24.8 Describe the purpose of a fresh air inlet.
- 24.9 Identify the installation requirements of a fresh air inlet such as minimum size and height.
- 24.10 Describe the circulation of air through the drain, waste, and vent system with the installation of a building trap.
- 24.11 Explain why building traps are generally no longer installed on sanitary systems.



Number:	S00022.25	
Title:	Purpose of a Stack Elevation	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify the items that are shown on a stack elevation, its approval process, and its uses after the construction is complete.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

25.1 Identify the items normally shown on a stack elevation including but not limited to:

- sanitary and storm building drains
- foundation drain connections
- down spout/leader connections
- floor drain connections
- trap seal primers
- cleanouts
- building traps
- fixture traps
- backwater valves
- drainage systems
- venting systems
- vent terminal information
- any other required sanitary and storm drainage piping

25.2 Explain the main uses of a stack elevation.

25.3 State the regulations to which a stack elevation must conform for approval.

25.4 State the uses of a stack elevation after the building is complete and occupied.

25.5 Identify errors in a stack elevation.

Number:	S00022.26	
Title:	How to Draw a Stack Elevation	
Duration:	Total hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465, U5466, U5468		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to draw stack elevations.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 26.1 Explain the purpose of a stack elevation.
- 26.2 Explain which form or view of the vertical drainage system for a building is normally shown.
- 26.3 State the drawing instruments required to draw a stack elevation.
- 26.4 Identify the colour code used to illustrate sanitary drainage, storm drainage, and vent piping.
- 26.5 Explain why the correct fittings must be illustrated on stack elevations.
- 26.6 Explain how the traps for laundry tubs, kitchen sinks, and lavatories should be shown on a stack elevation.
- 26.7 Explain how the fixture traps for fixtures (other than laundry tubs, kitchen sinks, and lavatories) should be shown on a drain plan.
- 26.8 Explain how vent connections are shown on a stack elevation.
- 26.9 Illustrate the connections of fixtures and devices on a stack elevation.
- 26.10 State the information that should be shown at stack terminals.
- 26.11 Size all piping shown on the stack elevation.
- 26.12 Identify where cleanouts should be shown.
- 26.13 Explain the type of line that should be used to illustrate the stack vent.

## Waste Pipe Systems

Number:	S00022.27		
Title:	Traps and Types		
Duration:	Total hours:	3	
	Theory:	3	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465			

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize different types of traps, identify the distinguishing characteristics of a trap, the purpose of a trap, and the installation of a trap.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 27.1 Define the terms, “trap”, “trap seal”, and “running trap”.
- 27.2 State the purpose of a trap.
- 27.3 List the qualities of a well-designed trap.
- 27.4 Identify the dip, weir, and crown of different traps.
- 27.5 Describe how to measure the trap seal in a trap.
- 27.6 State the liquid level when the trap is at rest, the minimum trap seal for a trap, and the minimum trap seal for traps installed in an acid-waste system.
- 27.7 Identify the requirements for traps installed with laundry tubs, sinks, and lavatories.
- 27.8 Identify the most common trap currently installed.
- 27.9 Identify an S-trap, bell trap, drum trap, and a bottle trap.
- 27.10 Identify the dip, weir, and crown in an S-trap, P-trap, bell trap, drum trap, and a bottle trap.
- 27.11 Explain where an S-trap, bell trap, drum trap, and a bottle trap may be installed in a drainage system.
- 27.12 Explain the term integral trap.
- 27.13 Identify the fixtures that operate with an integral trap.
- 27.14 State where a running trap may be installed in a drain, waste, and vent system.
- 27.15 Identify where a cleanout fitting must be installed with a running trap.
- 27.16 State the dip weir and crown for an S-trap, P-trap, bell trap, drum trap, and a bottle trap.

Number:	S00022.28		
Title:	Trap Sizing		
Duration:	Total hours:	2	
	Theory:	2	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to determine trap sizes.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 28.1 Explain the terms, “fixture outlet pipe” and “vertical leg”.
- 28.2 Identify where a fixture outlet pipe is installed in relation to a plumbing fixture and its trap.
- 28.3 State the maximum length of a fixture outlet pipe.
- 28.4 Identify where a vertical leg is found in a drainage system.
- 28.5 State the maximum length of a vertical leg.
- 28.6 Explain how to determine the fixture outlet pipe size and the trap size for a selection of plumbing fixtures and appliances.
- 28.7 List the trap size for a selection of plumbing fixtures and appliances.
- 28.8 List the trap sizes for fixtures, appliances, and devices not listed in the OBC.

Number:	S00022.29
<b>Title:</b>	<b>Trap Seal Loss</b>
Duration:	Total hours: 3
	Theory: 3
	Practical: 0
Prerequisites:	None
Co-requisites:	S00022
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to describe trap seal loss and to install traps to prevent trap seal loss.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 29.1 Define the terms “trap seal loss”, “self-siphonage”, “indirect siphonage”, “oscillation”, “capillary action”, “back pressure”, momentum and “leakage”.
- 29.2 Define how much loss of a trap seal constitutes trap seal loss.
- 29.3 Explain how self-siphonage and indirect siphonage of a trap seal takes place.
- 29.4 State what measures must be taken to prevent self-siphonage and indirect siphonage.
- 29.5 Explain how oscillation, capillary action, and backpressure takes place and how it affects a trap seal.
- 29.6 State what measures may be taken to help control oscillation of a trap seal.
- 29.7 State what measures may be taken to help control trap seal loss due to capillary action and backpressure.
- 29.8 Explain how a leak will affect a trap seal.
- 29.9 State what measures are taken to identify and repair leaks.

Number:	S00022.30	
Title:	Trap Arm Requirements	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to install waste pipes that meet OBC requirements.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 30.1 Define the terms, “fixture drain” and “trap arm”.
- 30.2 Identify a fixture drain/trap arm in a drain, waste, and vent system from a given drain plan and/or stack elevation
- 30.3 Describe the function of a fixture drain/trap arm.
- 30.4 State the minimum size of a given fixture drain/trap arm.
- 30.5 State the minimum and maximum length of a fixture drain/trap arm.
- 30.6 Explain why fixture drains/trap arms have a limited minimum and maximum length.
- 30.7 Explain the term, “developed length”.
- 30.8 State the maximum change of direction in a fixture drain/trap arm serving a siphonic fixture and a P-trap fixture.
- 30.9 Explain why fixture drains/ trap arms are limited in total change of direction.
- 30.10 State the total fall allowed on a fixture drain/trap arm.
- 30.11 Explain why fixture drains/trap arms have a limited minimum and maximum fall.
- 30.12 State the minimum fall allowed on a fixture drain/trap arm of a given size.

Number:	S00022.31	
Title:	Sanitary Drainage System Sizing	
Duration:	Total hours:	6
	Theory:	6
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00024, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to size all sections of the sanitary drainage system on drain plans, stack elevations, and practical assignments.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 31.1 Define the terms “fixture unit”, “litre per minute flow”, “hydraulic load”, “maximum hydraulic load”, and “horizontal branch”, used in conjunction with drainage systems.
- 31.2 Describe the purpose for which the fixture unit is developed.
- 31.3 Identify and use tables to:
  - calculate fixture unit loading
  - size 1¼”, 1½” and 2” horizontal drainage piping
  - size 1¼”, 1½” and 2” vertical drainage piping
  - size 3” and larger horizontal drainage piping
  - size 3” and larger vertical drainage piping
  - convert fixture units to litres per minute flow
- 31.4 Identify the restrictions when connecting water closets to 3” drainage piping.
- 31.5 State the minimum allowable fall on drainage piping.
- 31.6 Explain how grade affects the capacity of a given horizontal drainage pipe.
- 31.7 Complete a number of elevations and drain plans sizing all the drainage piping.

Number:	S00022.32	
Title:	Grading Waste Pipes	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00024, S00025	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465	

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, define, and grade waste pipes.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 32.1 State the purpose of having fall or grade on drainage piping.
- 32.2 Explain how velocity of flow in drainage piping is controlled.
- 32.3 Describe the conditions that may develop if there is too little or too much fall on a drainage pipe.
- 32.4 Identify and list the name and diameters of horizontal drainage piping that may be usually installed with a minimum grade of 1:50 (2%).
- 32.5 Identify and list the name and diameters of horizontal drainage piping that may be installed with a minimum grade of 1:100 (1%).
- 32.6 Identify and describe the three methods used to grade horizontal drainage pipe.
- 32.7 Calculate the total fall on a horizontal drainage pipe in metric and imperial.
- 32.8 Calculate the length of a horizontal drainage pipe in metric and imperial.
- 32.9 Calculate the grade/slope of a horizontal drainage pipe in metric and imperial.



## Venting Systems

Number:	S00022.33		
Title:	Purpose of Venting		
Duration:	Total hours:	2	
	Theory:	2	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462			

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to explain the purpose of venting.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 33.1 Define the terms, “venting system” and “atmospheric pressure”
- 33.2 Describe the primary purpose of a vent in the drainage system.
- 33.3 Explain the secondary benefits of venting the drainage system.
- 33.4 Describe the movement of air within the venting.
- 33.5 Describe the principles of a siphon as it relates to venting.

Number:	S00022.34		
Title:	Types of Individual Vents		
Duration:	Total hours:		1
	Theory:		1
	Practical:		0
Prerequisites:	None		
Co-requisites:	S00022, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, and incorporate different types of individual vents.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 34.1 Define the trade terms “individual vent”, “back vent”, “flood level rim”, and “continuous waste and vent”.
- 34.2 Explain how a back vent must be installed in relation to the fixture drain.
- 34.3 Explain the term, “hydraulic gradient”.
- 34.4 Explain why a back vent will back flood.
- 34.5 Identify how high a back vent may back flood from a given stack elevation.
- 34.6 Explain why a continuous waste and vent will not back flood as high as a back vent installation.
- 34.7 Explain why the total length of an individual vent installed below the flood level rim must be kept to a minimum.
- 34.8 Identify and explain the minimum level or height to which individual vents must rise before they may be connected together.
- 34.9 Explain the outcome if a vent is installed with a dip, sag, or depression.
- 34.10 State the maximum length of an individual vent.

Number:	S00022.35		
Title:	Sizing Individual Vents		
Duration:	Total hours:	1	
	Theory:	1	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00024, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to size individual vents.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 35.1 Identify the tables used when determining individual vent pipe size.
- 35.2 Use the tables to determine individual vent pipe size.
- 35.3 State the individual vent size for a given trap size.

Number:	S00022.36	
Title:	Branch Vents	
Duration:	Total hours:	6
	Theory:	6
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, size, and install branch vents.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 36.1 Define the term, "branch vent".
- 36.2 State the purpose of a branch vent.
- 36.3 List the factors used to determine branch vent sizing.
- 36.4 Identify the tables used to size branch vents.
- 36.5 Explain the minimum branch vent size required to serve a given combination of fixtures.
- 36.6 Identify the specific locations on a branch vent where an increase in pipe size would be required.

Number:	S00022.37		
Title:	Dual Venting		
Duration:	Total hours:		1
	Theory:		1
	Practical:		0
Prerequisites:	None		
Co-requisites:	S00022, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, size, and install dual vents.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 37.1 Explain the term “dual venting”.
- 37.2 Explain the purpose of dual venting.
- 37.3 Identify both the acceptable and unacceptable fittings for dual venting installations.
- 37.4 Identify where the trap arms must connect when dual venting.
- 37.5 Explain the problems that could occur if an unacceptable drainage fitting were to be installed in a dual-vented installation.
- 37.6 State the maximum total fall permitted on each trap arm in a dual-vented group.
- 37.7 State the maximum distance permitted between a fixture trap and its dual vent.
- 37.8 Identify and list the group of fixtures that would be well suited for a dual-venting installation.

Number:	S00022.38		
Title:	Wet Venting		
Duration:	Total hours:	10	
	Theory:	10	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, size, and install wet-vented installations.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 38.1 Describe the term, “wet vent”.
- 38.2 State the purpose of wet venting and its advantages.
- 38.3 List the number of fixtures that may be installed in a wet-vented group.
- 38.4 Define a wet-venting fixture and a wet-vented fixture.
- 38.5 List the types of fixtures which may be wet-venting and which may be wet-vented.
- 38.6 Identify where a wet vent must connect to a fixture waste pipe when wet venting a siphonic fixture and a p-trap fixture.
- 38.7 List the wet vent pipe sizes for wet-vented traps.
- 38.8 Explain where a continuous vent must be installed in a wet-vented installation.
- 38.9 State the reason for the installation of a continuous vent in a wet-vented group installation.
- 38.10 List the requirements for multi-storey wet venting.

Number:	S00022.39		
Title:	Roof Flashings		
Duration:	Total hours:	1	
	Theory:	1	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, size, and install roof flashings.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 39.1 Define the trade term “roof flashing”.
- 39.2 Explain the purpose of a roof flashing.
- 39.3 State the common materials that may be used to construct a roof flashing.
- 39.4 State the minimum size of a manufactured roof flashing.
- 39.5 Explain how a roof flashing may reduce the diameter of a vent terminal.
- 39.6 State why it is prohibited for a roof flashing to reduce the diameter of a vent terminal.
- 39.7 Identify a sleeve flashing.
- 39.8 Explain sleeve-flashing requirements.
- 39.9 Describe the position of a roof flashing on a pitched roof in relation to the shingles.

Number:	S00022.40		
Title:	Vent Terminals		
Duration:	Total hours:	2	
	Theory:	2	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, size, locate, and install stack terminals.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 40.1 Define the trade term “vent terminal”.
- 40.2 Explain the purpose of a vent terminal.
- 40.3 State the minimum diameter of a vent terminal.
- 40.4 Explain why the locations of vent terminals are regulated.
- 40.5 Identify the air inlets that regulate the installation locations of vent terminals.
- 40.6 State the minimum distances vent terminals must be located from air inlets.
- 40.7 State the minimum height of a vent terminal installed on a pitched roof.
- 40.8 State the minimum height of a vent terminal installed on a flat roof designed to pond storm water.
- 40.9 State the minimum height of a vent terminal installed on a flat roof designed for human occupancy.
- 40.10 State the minimum height of a vent terminal that must be made stable and secure.

## Codes, Regulations and Standards

Number:	S00022.41	
Title:	Codes, Regulations and Standards	
Duration:	Total hours:	5
	Theory:	5
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023, S00025	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and use the Ontario Building Code (OBC).

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 41.1 Describe the primary purpose of the OBC and Act.
- 41.2 Identify the sections of the OBC that deals with code administration, terms, definitions, abbreviations, symbols, and the installation of plumbing systems.
- 41.3 Identify and list the sections of Part 7 and identify the numbering systems including Part, Section, Subsection, Article, Sentence, Clause, and Sub- clause.
- 41.4 Identify the official system of measurement in the OBC.
- 41.5 Explain the purpose of italicizing a word or words used in the code.
- 41.6 Identify the code on which Part 7 of the OBC is based.
- 41.7 Identify the location and purpose of the index for Part 7 and location of Appendix A.
- 41.8 Explain the primary purpose of the appendix found in Part 7.
- 41.9 Explain why illustrations shown in the appendix cannot be an official part of Part 7.
- 41.10 Identify the people responsible for the enforcement of Part 7.
- 41.11 Identify the people who must comply with Part 7.
- 41.12 Identify municipal by-laws and regulations.
- 41.13 Identify certification and standards agencies (CSA, ULC, ASTM, etc.)
- 41.14 Identify manufacturers' specifications.



Number:	S00023
<b>Title:</b>	<b>Tools and Piping Methods</b>
Duration:	48 Total Hours
	Theory: 0 hours                      Practical: 48 hours
Prerequisites:	None
Co-requisites:	S00021, S00022, S00023, S00024, S00026
<b>Evaluation Structure:</b>	
Oral/Written Testing	10%
Practical Exercises	70%
Final Assessment	20%

Number:	S00023.1
<b>Title:</b>	<b>Measuring Tools and Instruments</b>
Duration:	Total hours:                      1
	Theory:                              0
	Practical:                          1
Prerequisites:	None
Co-requisites:	S00021, S00023, S00024, S00026
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464	

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, select, and use various measuring tools and instruments.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Identify and use a variety of measuring tools and instruments including but not limited to:
  - tapes and measures
  - spirit levels
  - straight edges
  - squares
  - protractors
  - chalk lines
  - builders level and laser instruments
  - gauges
- 1.2 Identify various applications of measuring tools and instruments.
- 1.3 Select measuring tools and instrument based on:
  - application
  - instrument limitations
- 1.4 Adjust measuring instrument for zero error if applicable.
- 1.5 Set up and use different measuring instruments.
- 1.6 Interpret instrument readings by giving the correct value and unit of measurements.
- 1.7 Maintain and store measuring instrument.

Number:	S00023.2	
Title:	Identify and Use Various Hand Tools	
Duration:	Total hours:	1
	Theory:	0
	Practical:	1
Prerequisites:	None	
Co-requisites:	S00021, S00023, S00026	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, select, and use various hand tools.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

#### **2.1 Identify and use the following hand tools including but not limited to:**

- screwdrivers
- Allen keys
- chisels
- snips
- saws
- files
- reamers
- clamps
- pliers
- pipe cutters
- hand threaders
- vises
- flaring tools
- swaging tools
- bending tools
- drifts and punches
- taps and dies
- wrenches, including: pipe, adjustable, torque, socket and combination box, and open wrenches
- stud and bolt extractors
- gear pullers
- drill bits including: wood, metal, and masonry

- 2.2 Identify the types of hand tools according to:
- size and design including number and symbol classification
  - application to specific materials
  - capacity
  - operation
- 2.3 Identify the methods of assembly and adjustments for various hand tools.
- 2.4 Assemble, adjust, and maintain various hand tools in safe working order.
- 2.5 Determine, demonstrate, practice, and maintain the methods of using hand tools for safe, restricted, and efficient operation.

Number:	S00023.3		
Title:	Identify and Use Various Power Tools		
Duration:	Total hours:	2	
	Theory:	0	
	Practical:	2	
Prerequisites:	None		
Co-requisites:	S00021, S00023, S00026		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, select, and use various power tools.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Identify, select and use the following types of power tools including not limited to:
- electric drills
  - power saws
  - grinders
  - pipe cutters
  - threading machines
  - drill press
  - grooving machines
  - hydraulic press
  - chop saws
  - crimpers
  - pneumatic tools & compressors
- 3.2 Identify the required power tools base on:
- types and sizes
  - operating range
  - application

- 3.3 Select power tool accessories based on the specified types, applications and tolerances, and materials to be worked on.
- 3.4 Identify power tools, equipment, and accessories by model number and/or symbol.
- 3.5 Determine the power requirements of the tools by checking the voltage, amperage, and grounding requirements.
- 3.6 Identify and list the common hazards related to the use of power tools, equipment, and accessories.
- 3.7 Operate, adjust, maintain, and store the power tools, equipment, and accessories in accordance with the manufacturers' instructions.
- 3.8 Determine and demonstrate the safe operation of power tools, equipment, and accessories.

Number:	S00023.4	
Title:	Steel Pipe Joining Methods	
Duration:	Total hours:	3
	Theory:	0
	Practical:	3
Prerequisites:	None	
Co-requisites:	S00022, S00023, S00024	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, select, and assemble steel pipe, using various joining methods.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.1 Name the types of pipe materials that may be joined using a threaded connection.
- 4.2 State the advantages of standardizing pipe threads.
- 4.3 Identify the terms used in conjunction with an American Standard Pipe Thread.
- 4.4 State the number of threads per inch for pipe sizes ranging from 1/8 to 3 inch.
- 4.5 Explain the terms, "thread engagement" and "pipe engagement".

- 4.6 List the pipe diameters that may be threaded with the same die chasers.
- 4.7 Explain the importance of having the correct thread engagement on a threaded connection.
- 4.8 Describe and demonstrate threaded, grooved, flanged, and welded joining methods.
- 4.9 Cut to length, ream and thread, then test a number of pipe threads for pipe sizes ranging from ½" to 3" pipe.
- 4.10 Fabricate various sizes of nipple chucks.
- 4.11 Describe the method of preparing a pipe end for a grooved joint.
- 4.12 Cut to length, roll groove and cut groove, then test a number of pipe ends for pipe sizes ranging from 2" to 4".
- 4.13 Cut, bevel, and square up a welded pipe joint.
- 4.14 Describe the methods used to prepare a flanged connection, including gasketing, sequencing, and torquing.

Number:	S00023.5						
Title:	Cast Iron Pipe Joining Methods						
Duration:	Total hours:	2					
	Theory:	0					
	Practical:	2					
Prerequisites:	None						
Co-requisites:	S00022, S00023						
Cross Reference to Training Standards: U5457 U5458 U5459 U5460 U5461 U5463 U5464							

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify, select, and assemble cast iron soil pipe, using a variety of joining methods.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 5.1 Identify cast iron soil pipe and fittings.
- 5.2 Check for defective cast iron soil pipe and fittings.
- 5.3 Cut to length a variety of cast iron soil pipe sizes, using different cutting methods.
- 5.4 Fabricate and test various hub and spigot caulked joints.
- 5.5 Identify and name the two types of compression joints used with cast iron soil pipe and fittings.
- 5.6 Fabricate and test mechanical joint couplings and bi-seal joints for a number of cast iron soil pipe sizes.

Number:	S00023.6		
Title:	Copper Pipe Joining Methods		
Duration:	Total hours:	3	
	Theory:		
	Practical:	3	
Prerequisites:	None		
Co-requisites:	S00022, S00023		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, select, and assemble copper pipe and fitting, using a variety of joining methods.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 6.1 Describe different soldering processes and name two solder groups.
- 6.2 State the deciding factor in the selection of the solder to be used.
- 6.3 Describe the conditions that effect piping systems that should be considered when selecting a solder.
- 6.4 Explain how solder is drawn into a copper pipe joint and demonstrate capillary action between the pipe, fitting, and solder.
- 6.5 Identify the common soft solders, including:
  - 95-5
  - 50-50
  - 40-60
  - lead-free
- 6.6 Identify the applications for common soft solders.
- 6.7 Identify the content mentioned first in a tin-lead solder.
- 6.8 State the type of solder and the maximum allowable lead content for solders that must be used on potable water systems.
- 6.9 Identify the common hard solders including:
  - silver solder
  - sil-fos
  - brazing
- 6.10 Identify the applications for common hard solders.
- 6.11 Explain when hard soldering would be used instead of soft soldering.
- 6.12 Name the dissimilar metals that may be joined by both hard and soft soldering.
- 6.13 Explain the purpose of a solder flux.

- 6.14 State the effects of heat on flux.
- 6.15 State the factors to be considered when selecting a flux.
- 6.16 Describe the surface preparation for the surface of the pipe and fitting before applying a flux.
- 6.17 Identify the two basic types of flux, two active fluxes, and two non-active fluxes.
- 6.18 Describe what should be done to a solder joint after using a corrosive flux.
- 6.19 Cut to length, ream, clean, flux, soft solder, then test copper pipe-fittings ranging in size from ½" to 3".
- 6.20 Cut to length, ream, clean, flux, hard solder, then test copper pipe-fittings ranging in size from ¼" to 1".
- 6.21 Identify the type of copper pipe that may be roll grooved.
- 6.22 Explain the preparation required when roll grooving copper pipe.
- 6.23 Cut to length, roll groove, assemble, and test copper pipe-fittings.
- 6.24 Identify various mechanical joint methods.

Number:	S00023.7		
Title:	Build Piping Projects Incorporating Different Offsets		
Duration:	Total hours:	36	
	Theory:	0	
	Practical:	36	
Prerequisites:	None		
Co-requisites:	S00022, S00023, S00024		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, calculate, and assemble a variety of piping projects incorporating different materials and offsets.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 7.1 Define the terms, "pipe offset", "parallel offset", and "rolling offset".
- 7.2 Identify 22½°, 30°, 45°, and 60° piping offsets.
- 7.3 Calculate 22½°, 30°, 45°, and 60° piping offsets.
- 7.4 Calculate the end to end measurements, cut, prepare, assemble, test, and dismantle a number of piping projects (using steel, cast iron soil copper, and plastic piping), including:
  - single 45° pipe offset
  - parallel 45° pipe offset
  - rolling 45° single pipe offset
  - rolling 45° double pipe offset

- 7.5 Incorporate into the pipe offset assignments including the connections, but not limited to:
- threaded
  - soft soldered
  - hard soldered
  - solvent cement
  - grooved
  - flanged
  - flared
  - mechanical
  - crimp
  - compression bending

**All projects shall be constructed and evaluated to code standards, pressure tests, and dimensional tolerances.**



Number:	S00024
<b>Title:</b>	<b>Trade Calculations – Level 1</b>
Duration:	24 Total Hours
	Theory: 24 hours
	Practical: 0 hours
Prerequisites:	None
Co-requisites:	S00022, S00023, S00024, S00025, S00026

**Evaluation Structure:**

Theory Testing	70%
Practical Exercises	20%
Final Assessment	10%

Number:	S00024.1
<b>Title:</b>	<b>Basic Math</b>
Duration:	Total hours: 6
	Theory: 6
	Practical: 0
Prerequisites:	None
Co-requisites:	S00022, S00023, S00024, S00025, S00026
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate ability in basic arithmetic functions with whole numbers.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Identify whole numbers, fractions, and decimals.
- 1.2 Multiply, divide, add, and subtract whole numbers, fractions, and decimals manually.

Number:	S00024.2								
Title:	Conversions of SI to Imperial and US Values								
Duration:	Total hours:	5							
	Theory:	5							
	Practical:	0							
Prerequisites:	None								
Co-requisites:	S00022, S00023, S00024, S00025								
Cross Reference to Training Standards:		U5457	U5458	U5459	U5460	U5461	U5463	U5464	U5465

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to convert SI to Imperial measurements and Imperial to SI measurements.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 Identify the standard units used in the SI system.
- 2.2 Identify the standard units used in the Imperial system.
- 2.3 Convert linear measures from SI to Imperial and Imperial to SI.
- 2.4 Convert volume measurements from SI to Imperial and Imperial to SI.
- 2.5 Convert area measurements from SI to Imperial and Imperial to SI.
- 2.6 Calculate, given a Celsius reading, the equivalent reading on the Fahrenheit scale.
- 2.7 Calculate, given a Fahrenheit reading, the equivalent reading on the Celsius scale.

Number:	S00024.3	
Title:	<b>Linear Measurement</b>	
Duration:	Total hours:	4
	Theory:	4
	Practical:	0
Prerequisites:	None	
Co-requisites:	S00022, S00023, S00024, S00025, S00026	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465	

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, define, and use linear measurements in piping systems.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Explain the standard dimensioning used for pipe diagrams.
- 3.2 State the terms and abbreviations used for measuring pipe and fittings.
- 3.3 Define the terms:
  - linear measurement
  - fitting allowance
  - pipe engagement
  - face to face
  - end to end
  - center to center
  - face of fitting
  - back of fitting
- 3.4 Define any combination of the above piping terms.
- 3.5 Calculate and list the fitting allowances for various piping materials and sizes.
- 3.6 Calculate the end-to-end length of pipe necessary to fit pipe and fittings to the required end to center, center to center and end to back measurements, and the total length of piping required from a piping diagram.

Number:	S00024.4	
Title:	Pythagorean Theorem and Square Roots	
Duration:	Total hours:	2
	Theory	2
	Practical	0
Prerequisites:	None	
Co-requisites:	S00022, S00023, S00024, S00025, S00026	
Cross Reference to Training Standards: U5458, U5459, U5461, U5463, U5464, U5465		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to use Pythagorean Theorem and solve problems involving calculation of square roots.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.1 Define the terms, “Pythagorean Theorem” and “square root”.
- 4.2 Explain the use of calculating square roots in the plumbing industry.
- 4.3 Describe the methods of finding the square root of a number.
- 4.4 Calculate the square root for a selection of given numbers.
- 4.5 Explain Pythagorean Theorem and its use in the plumbing industry.
- 4.6 Perform various calculations using Pythagorean Theorem.

Number:	S00024.5
<b>Title:</b>	<b>Calculations of Various Offsets</b>
Duration:	Total hours: 7
	Theory: 7
	Practical: 0
Prerequisites:	None
Co-requisites:	S00022, S00023, S00024, S00025
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify, define, and calculate various pipe offsets used in the piping industry.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 5.1 Identify various pipe offsets including 22½°, 30°, 45°, and 60° fittings.
- 5.2 Define the term, “rolling offset”.
- 5.3 State why and explain where these various offsets are installed in plumbing systems.
- 5.4 Calculate the length of travel of a 22½° offset from a given measurement, using the factors of 2.61, 1.08, and 0.20.
- 5.5 Calculate the length of travel of a 30° offset from a given measurement, using the factor of 2.00”.
- 5.6 Calculate the length of travel of a 45° offset from a given measurement, using the factor of 1.414.
- 5.7 Calculate the length of travel of a 60° offset from a given measurement, using the factors of 2.0, 1.16, and 0.58.
- 5.8 Calculate the length of travel for a rolled offset using 45° fittings when the length of the vertical rise and horizontal spread are given.
- 5.9 Calculate the length of travel for a 45° rolled offset and the length of run on each end of the offset.

Number:	S00025
<b>Title:</b>	<b>Trade Documentation – Level 1</b>
Duration:	24 Total Hours
	Theory: 12 hours                      Practical: 12 hours
Prerequisites:	None
Co-requisites:	S00021, S00022, S00023, S00024, S00025, S00026
<b>Evaluation Structure:</b>	
Theory Testing	40%
Practical Exercises	50%
Final Assessment	10%

Number:	S00025.1		
Title:	Identify and Use Various Drafting Instruments		
Duration:	Total hours:	6	
	Theory:	3	
	Practical:	3	
Prerequisites:	None		
Co-resquisites:	S00024, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify and use various drafting instruments.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Identify and use the following basic drafting instruments, including:
  - architect's and engineer's scale in both SI and Imperial units
  - set squares
  - T-squares
  - pencils
  - erasers & eraser shields
- 1.2 Print legible numbers and letters and upper case letters.

Number:	S00025.2	
Title:	Identify and Draw Various Projection Drawings	
Duration:	Total hours:	12
	Theory:	3
	Practical:	9
Prerequisites:	None	
Co-requisites:	S00022, S00023, S00025	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify and draw various isometric and orthographic projection drawings.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 Define the terms, “orthographic projection” and “isometric drawing”.
- 2.2 Identify three principle views in an orthographic projection.
- 2.3 Draw single pipe line drawings to scale in orthographic projection fully dimensioned.
- 2.4 Explain why isometric drawings and sketches are used in the plumbing industry.
- 2.5 Define isometric drawing principles.
- 2.6 Produce an isometric drawing of a single pipe line drawing given the corresponding three views by hand.

Number:	S00025.3		
Title:	Identify and Interpret Construction Drawings		
Duration:	Total hours:	2	
	Theory:	2	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00022, S00023, S00025		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify and interpret construction drawings.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Identify the standard types of construction trade drawings and prints.
- 3.2 Identify the individual drawings produced for the following trades, including:
  - architectural
  - structural
  - mechanical
  - electrical
- 3.3 List the trades that use each of the following drawings:
  - architectural
  - structural
  - mechanical
  - electrical
- 3.4 Identify and apply the basic symbols used in each of the drawings for a planned plumbing installation:
  - architectural
  - structural
  - mechanical
  - electrical



- 3.5 Define the term, “shop drawing”.
- 3.6 List four purposes of shop drawings.
- 3.7 Identify the purpose of title blocks on drawings, containing the following information:
  - drawing number
  - drawing date
  - name of company or firm
  - signatures and approvals
  - scales
  - revisions
- 3.8 Identify and draw the types of lines used in single and multi-view drawings to indicate:
  - objects lines
  - center lines
  - extension lines
  - dimension lines
  - hidden lines
  - cutting plane lines
  - break lines
  - projection lines
  - sections lines

Number	S00025.4
<b>Title:</b>	<b>Sleeving</b>
Duration:	Total Hours: 4
	Theory: 4
	Practical: 0
Prerequisites:	None
Co-requisites:	S00022, S00023, S00025
Cross Reference to Training Standards: U5455, U5457, U5458, U5460, U5461, U5465	

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify different types of sleeves, construction, materials, applications, installation, and sealing procedures.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 4.1 State the purpose of sleeving.
- 4.2 List the different materials used for sleeves.
- 4.3 Identify the types of sleeves that must be filled prior to a concrete pour.
- 4.4 Define the term Building Information Modelling (BIM).
- 4.5 Identify various technologies used for sleeving and their applications.

Number:	S00026		
Title:	Welding – Level 1		
Duration:	24 Total Hours		
	Theory: 3 hours	Practical: 21 hours	
Prerequisites:	None		
Co-requisites:	S00021, S00026		
Evaluation Structure:			
Theory Testing	10%		
Practical Exercises	80%		
Final Assessment	10%		

Number:	S00026.1	
Title:	Oxy-Acetylene Cutting and Welding Equipment and Accessories	
Duration:	Total hours:	3
	Theory:	0
	Practical:	3
Prerequisites:	None	
Co-requisites:	S00021, S00026	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify oxy-acetylene cutting and welding equipment and accessories, including the construction, operation, assembly, and disassembly.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 1.1 Describe the construction and operation of:
  - oxygen cylinders
  - acetylene cylinders
  - welding torches
  - cutting torches
  - regulators
  - hoses and fittings
- 1.2 Safely assemble and disassemble oxy-acetylene cutting and welding equipment.
- 1.3 Check equipment for safe operating condition.

Number:	S00026.2	
Title:	Oxy-Acetylene Cutting Theory, Cutting and Welding Safety Requirements	
Duration:	Total hours:	3
	Theory:	0
	Practical:	3
Prerequisites:	None	
Co-requisites:	S00021, S00026	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, describe and demonstrate the theory of oxy-acetylene cutting.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 Safely set up equipment for oxy-acetylene cutting.
- 2.2 Select from a list the proper tip size, acetylene pressure, and oxygen pressure to cut a given metal thickness.
- 2.3 Safely turn on, light, adjust to a neutral flame, and shut down the oxy- acetylene cutting equipment.
- 2.4 Make 90<sup>0</sup> cuts on mild steel and restart a cut.
- 2.5 Cut a hole in mild steel.
- 2.6 List and sketch five methods of edge preparation for welded joints.
- 2.7 Prepare plate edges for butt-welding.
- 2.8 Prepare pipe by hand torch-cutting for a butt-weld joint.

Number:	S00026.3		
Title:	Oxy-Acetylene Welding Principles		
Duration:	Total hours:	3	
	Theory:	3	
	Practical:	0	
Prerequisites:	None		
Co-requisites:	S00021, S00026		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize weld faults and control distortion.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Name five factors that determine weld quality.
- 3.2 List five properties of a good weld.
- 3.3 Identify and sketch three types of oxy-acetylene welding flames.
- 3.4 Name two factors that determine tip selection in oxy-acetylene welding.
- 3.5 State the purpose of filler rod in oxy-acetylene welding.
- 3.6 List two factors that determine filler rod selection.
- 3.7 State the cause and control of oxy-acetylene welding faults.
- 3.8 State the cause and control of distortion.

Number:	S00026.4		
Title:	Lay Down Beads, Prepare, Tack & Weld a Butt Joint		
Duration:	Total hours:	15	
	Theory:	0	
	Practical:	15	
Prerequisites:	None		
Co-requisites:	S00021, S00026		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to lay beads, tack, and weld butt joints with filler rod in the flat position.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.1 Safely set up equipment for oxy-acetylene welding.
- 4.2 Select from a list the proper tip size, acetylene pressure, and oxygen pressure for a given metal thickness.
- 4.3 Safely turn on, light, adjust to a neutral flame, and turn off the oxy-acetylene welding equipment.
- 4.4 Lay beads on mild steel plate with filler rod.
- 4.5 Prepare butt joints to specifications for welding.
- 4.6 Tack weld butt joints to maintain alignment.
- 4.7 Weld butt joints with filler rod in the flat position.

**Summary of Equipment Recommended for Levels 1, 2 & 3**

Hand Tools
adjustable wrench
ball-peen hammer
basin wrench
bolt cutter
broom
caulking gun
chalk line
chisel
cistern pump (hand operated-diaphragm)
claw hammer
combination wrench
diaphragm pump (hand operated)
drywall saw
faucet seat wrench
file
flashlight
hacksaw
hand groover
hand saw
hand threader
hex keys (set)
hole saws
knife
level
locking pliers
pick
pipe wrenches
pliers (lineman, needle nose, water pump, groove lock)
plumb bob
pry bars
punch
ratchet
reamer
rubber mallet
scratch awl
screwdrivers (complete set)
shovel
sledgehammer
socket set (imperial and metric)
spud wrench
square

strap wrench
striker
stud finder
stud punch
swage
T square
tap and die sets
tin snips (set)
torque wrench
transfer pump (hand-operated)
tri square
utility brushes
wire brushes

Power Tools
air compressor and accessories
band saw
bench grinder
booster pump
chop saw
circular saw
concrete cutter
coring machines
cryogenic equipment
die grinder
drain cleaning equipment
drill press
drills
generator
heat gun
heat lamp
impact wrench
inspection cameras
mini grinder
portable band saw (hack saw)
powder-actuated tools
power hole saw
reciprocating saw
rotary hammer
steamer
task lighting equipment
transfer pump (electric and pneumatic)

Hoisting, Rigging and Access Tools and Equipment
beam trolleys
block and tackles
boom truck
bridles
chain block hoist (endless chain)
come-along and grip hoist
crane
dolly
fork lift
ladders
lifting eyes
man/material lift (manual and power)
pallet jack
rope/cable
scaffolding
scissor lifts
shackles (varying sizes)
skid steer loader
slings and chokers
snatch blocks
spreader bar
stair cart
telescopic forklift
tuggers (power)
winches
wire rope or nylon (synthetic)

Personal Protective and Safety Equipment
air quality tester
arc flash protection
barricades and caution tape
confined space equipment
eye wash kit
face shield
fire blanket
fire extinguisher
fire resistant clothing
first aid kit
gloves (industrial, rubber)
ground fault circuit interrupter
hard hat
hearing protection



kneepads
lock-out/tag out devices
reflective vests
respiratory mask
rubber boots (CSA)
safety boots (CSA)
safety glasses/goggles (CSA)
safety harness, lanyard and life line (CSA)
tripod

Pipe Cutting and Joining Equipment
copper tube cutter
crimpers
files (set)
flaring tools
fusion tools
gas cylinders, and soldering and brazing equipment
gas powered cut-off
grooving machine
hand-operated oiler
hot air gun (welder)
hot tap equipment
hydraulic pipe cutter
mechanical crimper
PEX crimper
PEX pipe expander (manual and power)
pipe cutter
pipe groover
pipe reamer
pipe roller
pipe stand
pipe threader
pipe vise
plastic tube cutters (set)
power vise
propane torch
ratchet cutter
snap cutter
specialized assembly tools and equipment
T-extracting tool
tube bender
tube cutter
welding equipment

Testing, Measuring and Communication Equipment
builder's level
calculator
calliper
communication devices
computer
crimp gauge
differential pressure gauge and sight tube
drafting equipment
electronic leak detector
gauges
GPS
groove depth tape
hand pump and accessories (bicycle pump)
hydrostatic pump and gauge (manual and power)
infrared thermometer
laser layout tools
manometer
markers
measuring tape
micrometer
multimeter
refractometer
scale rule
scanning equipment
test strips and kits
thermal imager
thermometer
two way radios

## **LEVEL 2**

**Program Summary of Reportable Subjects**

<b>Number</b>	<b>Reportable Subjects</b>	<b>Hours Total</b>	<b>Hours Theory</b>	<b>Hours Practical</b>
S00027	Plumbing Systems – Level 2	120	113	7
S00028	DWV Piping Systems	48	0	48
S00029	Trade Calculations – Level 2	24	24	0
S00030	Trade Documentation – Level 2	24	10	14
S00031	Welding – Level 2	24	3	21
	<b>Total</b>	<b>240</b>	<b>150</b>	<b>90</b>

Number:	S00027.0
<b>Title:</b>	<b>PLUMBING SYSTEMS – LEVEL 2</b>
Duration:	120 Total Hours
	Theory: 111                      Practical: 9
Prerequisites:	S00021, S00022, S00024, S00025
Co-requisites:	S00027, S00028, S00029, S00030

**Evaluation Structure**

Theory Testing	80%
Application Exercises	10%
Final Assessment	10%

**Instructional and Delivery Strategies**

Complete a number of elevation drawings and drain plans incorporating the learning outcomes and content of Level 2.

**Drainage Systems**

Number:	S00027.1
<b>Title:</b>	<b>Drainage Terms and Definitions</b>
Duration:	Total Hours: 3
	Theory: 3
	Practical: 0
Prerequisites:	S00022
Co-requisites:	S00027, S00028, S00030
Cross Reference to Training Standards: U5457 U5458 U5459 U5460 U5461 U5462 U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify and apply drainage terms and definitions.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Identify the code that lists the common drainage terms and definitions.
- 1.2 State the section of the Ontario Building Code (OBC) that contains drainage terms, definitions, and abbreviations of proper names.
- 1.3 Define the following terms, identifying minimum pipe size, installation or system location, and other distinguishing characteristics:
  - “accessible”
  - “backflooding prevention”
  - “developed length”

- “fixture standards”
- “fixture unit”
- “horizontal branch”
- “interceptor”
- “plumbing appliance”
- “rainwater leader”
- “sanitary unit”
- “storm drainage system”
- “trap”
- “trap arm”
- “venting system”

- 1.4 Identify and list some of the common drainage terms and definitions by examining a drain plan and stack elevation drawing.

Number:	S00027.2				
Title:	Sanitary and Storm System Design				
Duration:	Total Hours:	3			
	Theory:	3			
	Practical:	0			
Prerequisites:	S00022				
Co-requisites:	S00027, S00028, S00030				
Cross Reference to Training Standards: U5457 U5458 U5459; U5460 U5461 U5462U5465 U5466 U5468					

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize and design drainage systems, incorporating different drainage system designs.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 2.1 Explain and apply terms:
- “municipal sanitary sewer”
  - “municipal storm sewer”
  - “combined building sewer”
  - “combined building drain”
  - “semi-combined building sewer”
  - “semi-combined building drain”
  - “running hand hole trap”

- 2.2 Review the definitions of separate building sewer and separate building drain.
- 2.3 Explain the terms, “combined and semi-combined drain system”.
- 2.4 Identify the components of a running hand-hole trap.
- 2.5 State where the cleanout must be installed with a running hand-hole trap.
- 2.6 State where a running trap must be installed in semi-combined and combined systems.
- 2.7 Identify the connection of a foundation drain and how a down spout connection is made to separate drainage system
  - semi-combined drainage system
  - combined drainage system
- 2.8 State where combined and semi-combined drainage systems may be found in service.
- 2.9 State where a separate system may be installed.
- 2.10 Identify the three drain designs that have been installed in Ontario.
- 2.11 Identify the most common drain design system currently installed.
- 2.12 Explain why combined drainage systems have been prohibited.
- 2.13 Describe the steps required to convert a semi-combined system into a separate drainage system.

Number:	S00027.3		
Title:	Back Flooding		
Duration:	Total hours:	1	
	Theory:	1	
	Practical:	0	
Prerequisites:	S00022, S00024, S00025		
Co-requisites:	S00027, S00029 S00030		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5463, U5465, U5466			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain back flooding and describe the methods of controlling it.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Define the meaning of the following terms:
  - “municipal combined sewers”
  - “storm building sewer”
  - “storm building drain”
  - “foundation drains”
  - “normally open and normally closed back water valves”
  - “combined and semi-combined drainage system”
- 3.2 Define the trade term, “back flooding”.
- 3.3 Identify the conditions that may contribute to the possibility of back flooding.
- 3.4 State the section in Part 7 of the OBC that outlines the steps to control the effects of back flooding.
- 3.5 Explain the difference between a normally open and normally closed backwater valve.
- 3.6 Identify the type of backwater valve listed in Part 7 of the OBC.
- 3.7 Explain where a normally closed backwater valve may be installed in a drainage system.
- 3.8 State the type of devices that may be installed in a drainage system to control back flooding.
- 3.9 Identify the sections of the drainage system that may have devices installed to control back flooding and where a normally open backwater valve may be installed.



Number:	S00027.4	
Title:	Datum Line and Instrument Readings	
Duration:	Total Hours:	6
	Theory:	3
	Practical:	3
Prerequisites:	S00021, S00024	
Co-requisites:	S00028, S00029, S00030	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464 U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, define, and apply datum line and instrument principles in practical applications.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.1 Define the following terms:
  - “zero datum”
  - “leveling”
  - “elevation”
  - “bench mark”
  - “assumed level”
  - “backsight”
  - “foresight”
  - “turning points”
  - “builders level”
  - “transit level”
  - “meter rod”
  - “total station”
- 4.2 Identify elevation readings from a plot plan.
- 4.3 Convert instrument readings (given in feet and decimals of a foot) to feet, inches, and sixteenths of an inch.
- 4.4 Convert measurements (given in feet, inches, and fractions of an inch) to feet and tenths of a foot.
- 4.5 Calculate the total fall on a drain when given two points from an instrument reading.
- 4.6 Calculate the length of a drainage pipe when the total fall and grade are given on an elevation or plan view drawing.
- 4.7 Calculate the grade of a drainage pipe when the total fall and length are given on an elevation or plan view drawing.
- 4.8 Calculate the depth of a drain using both metric measurement (meters and millimeters) and imperial measurement (feet, inches, and fractions of an inch) from a given datum on a plan.
- 4.9 Demonstrate the ability to set-up and operate measuring equipment to obtain and record backsight, foresight, turning point, benchmark, and elevation data.

## Waste Pipe Systems

Number:	S00027.5	
Title:	Commercial Sanitary Drain System Sizing	
Duration:	Total Hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to size all sections of the sanitary drainage system on drain plans, stack elevations, and practical assignments for multi-dwelling and commercial structures.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 5.1 Identify and use tables to:
  - calculate fixture unit loading
  - size horizontal and vertical drainage piping
  - convert fixture units to litres per minute flow
  - convert litres per minute to fixture units
- 5.2 Identify the restrictions when connecting water closets to drainage piping.
- 5.3 State the minimum allowable slope on drainage piping.
- 5.4 Explain how grade affects the capacity of a given horizontal drainage pipe.
- 5.5 Explain the effect of flow rates and velocity on the efficiency of the drainage system.

Number:	S00027.6	
Title:	Grease Interceptors	
Duration:	Total Hours:	5
	Theory:	5
	Practical:	0
Prerequisites:	S00022, S00024	
Co-requisites:	S00027, S00029, S00030	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to define, identify size, and describe the installation requirements for grease interceptors.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 6.1 Define the term, "interceptor".
- 6.2 State the purpose of a grease interceptor.
- 6.3 State the principle that enables grease to be separated from water.
- 6.4 List the conditions that are eliminated when a grease interceptor is installed.
- 6.5 Identify and list the different locations a grease interceptor shall be installed.
- 6.6 Identify and apply the sizing requirements for a grease interceptor.
- 6.7 Explain why a grease interceptor may no longer act as a fixture trap.
- 6.8 Identify the fixtures that may discharge into a grease interceptor.
- 6.9 Identify the fixtures that may not discharge into a grease interceptor.
- 6.10 State the installation requirements for grease interceptors.
- 6.11 Define an electronic grease interceptor.
- 6.12 Explain the difference between an electronic and a standard grease interceptor.
- 6.13 Identify the locations for cleanouts on a grease interceptor installation.
- 6.14 State the purpose of the vent piping that must be installed in a grease interceptor installation.
- 6.15 Specify the vents required for a manufactured grease interceptor.
- 6.16 Explain the purpose and location of both the flow control fitting and the secondary flow control fitting serving grease interceptors.

Number:	S00027.7	
Title:	Indirect and Special Waste Systems	
Duration:	Total hours:	5
	Theory:	5
	Practical:	0
Prerequisites:	S00022,	
Co-requisites:	S00027	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define, identify and describe the installation requirements for indirect and special waste installations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 7.1 Define the term, “indirectly connected” and “hub drain”.
- 7.2 Explain the purpose of indirectly connecting a fixture.
- 7.3 Describe how an indirectly connected fixture is protected.
- 7.4 Identify the fixtures that must be indirectly connected.
- 7.5 Explain the purpose of a trap on an indirect waste pipe.
- 7.6 Specify the minimum pipe size of an indirect waste pipe serving one fixture.
- 7.7 Specify where cleanouts are required on an indirect waste pipe.
- 7.8 Identify the location where a receiving trap for an indirect waste pipe should be installed.
- 7.9 Define the term, “air break”, state its purpose, and its minimum size.
- 7.10 Define the term, “air gap”, state its purpose, and its minimum size.
- 7.11 State the size of a receiving trap for an indirect waste pipe serving one fixture.
- 7.12 Determine the size of a receiving trap for an indirect waste pipe serving more than one fixture.
- 7.13 Locate the termination of the vent extending from an indirectly connected stack in a multi-storey building.
- 7.14 Specify the minimum pipe size of an indirect waste pipe serving more than one fixture.
- 7.15 Describe the installation requirements for a floor drain installed in a walk-in cooler.
- 7.16 Identify the type of fixture drains that may be combined.
- 7.17 State the installation requirements for a group of combined fixture drains.
- 7.18 Size all the piping required for a receiving trap installation including the drainage piping, trap and vent pipe sizes.

Number:	S00027.8		
Title:	Commercial Kitchen Equipment and Water Using Devices		
Duration:	Total hours:	1	
	Theory:	1	
	Practical:	0	
Prerequisites:	S00022		
Co-requisites:	S00027, S00028		
Cross Reference to Training Standards:	U5457, U5458, U5459, U5461, U5462, U5463, U5464		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain the installation of commercial and institutional equipment.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 8.1 Describe the purpose and the requirements of the following commercial and institutional equipment including:
  - commercial dishwashers
  - commercial clothes washers
  - garbage grinders
  - vegetable peelers
  - coffee urns
  - refrigeration units
  - water dispensers and coolers
  - steam tables
  - hospital and lab service sinks
  - flushing rim sinks
  - laboratory tables
  - autopsy tables
  - bed-pan washers
  - sterilizers
  - exhaust hoods
  - food scrap interceptors
- 8.2 Identify the fixtures, appliances and water using devices that should be indirectly connected.
- 8.3 Identify the fixtures, appliances and water using devices that should and should not discharge through a grease interceptor.

Number:	S00027.9	
Title:	Oil Interceptors	
Duration:	Total Hours:	5
	Theory:	5
	Practical:	0
Prerequisites:	S00021, S00022	
Co-requisites:	S00027	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define, identify, and describe the installation requirements for an oil interceptor.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 9.1 State the purpose of an oil interceptor.
- 9.2 State the principle that enables oil to be separated from water.
- 9.3 State the installation requirements for oil interceptors.
- 9.4 List hazardous conditions that are eliminated when an oil interceptor is installed.
- 9.5 List locations that require the installation of an oil interceptor.
- 9.6 Identify two approved types of oil interceptors.
- 9.7 State the installation requirements for built-in place oil interceptors.
- 9.8 State the purpose of the vent piping that must be connected to oil interceptors.
- 9.9 Specify the vents required for a manufactured oil interceptor.
- 9.10 Specify the location of the vent terminals required for oil interceptor vent pipes.

- 9.11 State the minimum vent terminal heights required for an oil interceptor vent piping.
- 9.12 Identify the locations for cleanout installations.
- 9.13 Explain the purpose of the flow control fitting on the inlet of an oil interceptor.
- 9.14 Explain the operating principle of an internal gravity draw-off fitting.
- 9.15 State the proper setting for an adjustable gravity draw-off fitting.
- 9.16 Define an electronic oil interceptor.
- 9.17 Define the term, "oil holding tank / secondary receiver".
- 9.18 Explain the difference between an electronic and a standard oil interceptor.
- 9.19 Explain how an oil holding tank is installed in conjunction with an oil interceptor, and the function of the primary and secondary chambers found in built-in place oil interceptors.
- 9.20 State the installation location of an oil interceptor in relation to floor and trench drains.
- 9.21 Identify the requirements for gang trapping fixtures discharging into an oil interceptor.

Number:	S00027.10	
Title:	Sediment Interceptors	
Duration:	Total Hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define, identify, and describe the installation requirements for various sediment interceptors, including sand and grit, plaster, hair, fish scale, food scrap, and precious metal interceptors.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 10.1 State the purpose of a sediment interceptor, and the principle that enables sediment to be separated from water.
- 10.2 List the conditions that are eliminated when a sediment interceptor is installed.
- 10.3 List locations and buildings that may require the installation of sediment interceptors.
- 10.4 Identify the different locations where sediment interceptors may be installed.
- 10.5 Explain when a sediment interceptor may or may not act as a fixture trap.
- 10.6 Identify the fixtures that should discharge into a sediment interceptor.
- 10.7 State the installation requirements for sediment interceptors.
- 10.8 Identify the locations for cleanouts on a sediment interceptor installation.



Number:	S00027.11	
Title:	Blow Down and Blow Off Tanks	
Duration:	Total Hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define, identify, and describe the installation requirements for blow down tank installations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 11.1 Define the trade term “blow down,” and “blow off tank”.
- 11.2 State the purpose of a blow down and blow off tanks.
- 11.3 State the materials used in the construction of a blow down and blow off tanks.
- 11.4 State the working pressures for steel and cast iron blow down and blow off tanks.
- 11.5 List the connections a plumber may be responsible for when installing blow down and blow off tanks.
- 11.6 Describe the acceptable methods used to supply cold water to blow down and blow off tanks.
- 11.7 Explain the purpose of an anti-siphon pipe when installed for blow down and blow off tanks.
- 11.8 Explain the vent terminal requirements for blow down tank installation.
- 11.9 Explain the vapour vent requirements for blow off tank installation.

Number:	S00027.12		
Title:	Ejectors and Sumps		
Duration:	Total Hours:	4	
	Theory:	4	
	Practical:	0	
Prerequisites:	S00021, S00022		
Co-requisites:	S00027, S00028, S00030		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define, identify, and describe the installation requirements for sewage ejectors and storm sump installations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 12.1 Define the terms, “sewage ejector” and “storm sump”.
- 12.2 Identify the installation requirements for sewage ejectors and storm sumps.
- 12.3 List the main requirements of equipment selection.
- 12.4 Explain the purpose of and position where a union, check, and shut-off valve must be installed in an ejector and sump discharge pipe.
- 12.5 State where a sewage ejector discharge pipe may connect to the sanitary system.
- 12.6 State where a storm sump discharge pipe may connect to the storm system.
- 12.7 Describe the method of sizing a building drainage system when a sewage ejector is installed.
- 12.8 Explain the meaning of the term, “high water alarm”.
- 12.9 State the different ways the operation of a sewage ejector and storm sump may be controlled.
- 12.10 State the requirements for a sewage ejector vent.
- 12.11 Discuss the requirements for venting sealed storm sumps.
- 12.12 Describe the difference between a sewage pump and storm water pump.
- 12.13 State the installation requirements of a sewage ejector pit and pump installation.
- 12.14 State the installation requirements of a storm water pit and pump installation.

## Venting Systems

Number:	S00027.13	
Title:	Branch Vents	
Duration:	Total Hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to apply branch venting in multi-dwelling and commercial structures.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 13.1 Identify and apply the tables used to size branch vents in multi-dwelling and commercial structures.

Number:	S00027.14	
Title:	Wet Venting	
Duration:	Total Hours:	6
	Theory:	6
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to apply wet venting in multi-dwelling and commercial structures.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 14.1 Identify and apply the codes and tables used to size wet vents in multi-dwelling and commercial structures.

Number:	S00027.15		
Title:	Vent Stacks		
Duration:	Total Hours:	3	
	Theory:	3	
	Practical:	0	
Prerequisites:	S00022		
Co-requisites:	S00027, S00028, S00030		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, size, and install drain waste and vent installations that utilize a vent stack.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 15.1 Define the term, “vent stack”.
- 15.2 Explain the difference between the terms, “vent stack” and “stack vent”.
- 15.3 Explain the purpose of a vent stack.
- 15.4 State where the installation of a vent stack is required.
- 15.5 Determine the minimum size of a vent stack.
- 15.6 Explain the different initial connection points of a vent stack.
- 15.7 Identify and use the tables used to determine vent stack size.
- 15.8 Indicate how to size a vent stack using developed length and hydraulic load.
- 15.9 Identify the type and number and location of fixtures that may connect to a vent stack.
- 15.10 Identify the lowest point on a vent stack where other vents may connect.

Number:	S00027.16	
Title:	Circuit Venting	
Duration:	Total Hours:	9
	Theory:	9
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, size, and install drain waste and vent installations that utilize circuit venting.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 16.1 Define the term, “circuit vent”, “relief vent” and “additional circuit vent”.
- 16.2 State the principle used in circuit venting.
- 16.3 Explain the primary purpose of circuit venting.
- 16.4 Identify the types of buildings where circuit vents are commonly installed.
- 16.5 Specify the trap arm requirements of circuit vented fixtures.
- 16.6 Describe the effect of excessive fall in a circuit vented fixture drain serving a p-trap fixture.
- 16.7 Specify the location of the circuit vent and additional circuit vents required, given the number of fixtures connected to a horizontal branch.
- 16.8 State the minimum size of a circuit vented horizontal branch.
- 16.9 Describe how to size a circuit vent and additional circuit vent.
- 16.10 State the purpose of a relief vent.
- 16.11 Explain the installation location and minimum size of a relief vent.
- 16.12 State the purpose of a combined relief vent and explain where it may be installed.
- 16.13 State the number and type of fixtures that may connect to circuit vent and additional circuit vent.
- 16.14 State the number and type of fixtures that may connect to a relief vent.

Number:	S00027.17						
Title:	Yoke Vents, Auxiliary Stacks, and Offset Relief Vents						
Duration:	Total Hours:	3					
	Theory:	3					
	Practical:	0					
Prerequisites:	S00022						
Co-requisites:	S00027, S00028, S00030						
Cross Reference to Training Standards:		U5457	U5458	U5459	U5460	U5461	U5462

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, describe, size and install drain waste and vent installations that utilize yoke venting.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 17.1 Define the term, “yoke vent”, and state the purpose of yoke venting.
- 17.2 Identify the type of buildings in which yoke venting would be installed.
- 17.3 State the number of floor levels that comprise a section for the purpose of yoke venting.
- 17.4 Explain the difference in the definitions of “storey” listed in Part 1 of the OBC and Part 7 of the OBC.
- 17.5 Identify the point at which a yoke vent may connect to a soil or waste stack.
- 17.6 Identify the point where a yoke vent must connect to a vent stack.
- 17.7 Determine the number of yoke vents required for an installation given the number of storeys.
- 17.8 Define the trade term, “auxiliary stacks”.
- 17.9 State the application of an auxiliary stack.
- 17.10 State the reason why plumbing should not connect to the lower section of high stacks.
- 17.11 Explain the spacing of yoke vents.
- 17.12 Determine the minimum size of a yoke vent.
- 17.13 State the number and type of fixtures that may connect to a yoke vent.
- 17.14 Define a “stack offset” and “double offset”.
- 17.15 Determine the size of a given stack offset.
- 17.16 Determine the location of fixture connections to a stack offset.
- 17.17 Explain the difference between a nominally horizontal and a nominally vertical stack offset.
- 17.18 Describe the installation requirements that eliminate the requirement for yoke vents.
- 17.19 Define the term, “offset relief vent”.
- 17.20 State the application of an offset relief vents.
- 17.21 Determine the minimum size of an offset relief vent.

## Water Distribution Systems

Number:	S00027.18		
Title:	Types of Valves		
Duration:	Total Hours:	4	
	Theory:	4	
	Practical:	0	
Prerequisites:	S00022		
Co-requisites:	S00027, S00028, S00030		
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize various valves.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 18.1 State the primary purpose of a valve.
- 18.2 Describe the different ways a valve may control flow.
- 18.3 Describe the principle valve types.
- 18.4 Identify the materials used for valve manufacture and which may be installed in a plumbing system.
- 18.5 Identify and list the major component parts of the following valves, including but not limited to:
  - gate valves
  - plug valves
  - ball valves
  - globe valves
  - check valves
  - butterfly valves
- 18.6 Identify the common types of gate valves and list their uses, including but not limited to:
  - solid wedge disc
  - split wedge disc
  - double disc
  - plug disc
  - resilient seated gate valve

18.7 Identify the common type of globe valves and list their uses, including but not limited to:

- conventional disc
- composition disc
- plug disc
- needle valves

18.8 Identify the common types of ball valves and list their uses, including but not limited to:

- end- port, or blow out proof ball valves
- top port
- in-line
- full port
- standard port ball valves

18.9 Identify the common types of check valves and list their uses, including but not limited to:

- swing check valves
- lift check valves
- non-slam check valves
- spring loaded check valves

18.10 Identify the common uses of butterfly valves.

18.11 Identify the common uses of plug valves in a plumbing system.

18.12 Describe the stem operations of:

- rising stem with inside screw
- rising stem with outside screw
- non-rising stem with inside screw
- outside stem and yoke

18.13 Describe the design and function of:

- screwed bonnet assembly
- union bonnet assembly
- bolted bonnet assembly
- clamp-type bonnet assembly

18.14 Describe the function and design of:

- packing nut with gland
- bolted gland
- lantern type gland



- 18.15 Identify the different methods of controlling valves, including:
- handles
  - levers
  - lever handles
  - timers
  - limit torque arresters
  - solenoid switches
  - chains on wheels
  - spring loaded activators
  - electronic sensors
  - motorized actuators
- 18.16 Describe the recommended installation locations and procedures for all types of valves.
- 18.17 Identify valve abbreviations, including:
- SS
  - FM
  - UL
  - IBBM
  - RS
  - NRS
  - WOG
  - WSP
  - CSA
  - AWWA
  - CGA
  - AGA
- 18.18 Explain basic valve service requirements for:
- gate valves
  - globe valves
  - check valves
  - ball valves
- 18.19 List the factors to be considered when selecting a valve for a specific purpose.
- 18.20 Explain the meaning of pressure ratings and lettering found on valve bodies.
- 18.21 List the common end connections found on valve bodies.
- 18.22 Identify other types of valves and their uses such as three-way valves and four way valves.
- 18.23 Identify the difference between a mixing valve and a thermostatic tempering valve.
- 18.24 Identify the difference between a mixing valve and a diverting valve.
- 18.25 Identify the purpose of labelling on three-way valves including “A, B, and AB”.

Number:	S00027.19		
Title:	Location of Valves		
Duration:	Total Hours:	3	
	Theory:	3	
	Practical:	0	
Prerequisites:	S00022		
Co-requisites:	S00027, S00028, S00030		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the installation location of control valves in potable water distribution systems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 19.1 Identify the type of valve installed on the water service pipe outside the building.
- 19.2 Identify the location of the control valve, installed on the water service pipe outside the building, and state its minimum size.
- 19.3 Define the term, "building control valve".
- 19.4 Identify the requirements for and the type of building control valves commonly installed on water services  $\frac{3}{4}$ " and 1" in diameter.
- 19.5 State the building control valve and drain valve requirements for water services larger than 1" in diameter.
- 19.6 Explain why a check valve must be installed at the end of a plastic water service that may be damaged by hot water and discuss the resulting effects of thermal expansion.
- 19.7 Identify where a shut-off valve must be installed in a hot water tank installation.
- 19.8 Explain the types of valves that may be installed to supply water to the exterior of a building.
- 19.9 State the types of shut-off valves that must be installed to isolate the supply water to the exterior of a building.
- 19.10 Identify the fixtures, appliances, tanks, and devices that must be equipped with a shut-off valve.
- 19.11 Identify where shut-off valves must be installed to supply a riser in a non-residential building.
- 19.12 Identify where shut-off valves must be installed to control the flow of water to suites in a building.
- 19.13 Identify where shut-off valves must be installed to control the flow of water to fixtures installed in public washrooms.
- 19.14 Identify the type and installation sequence of the valves required on the discharge piping from a sewage ejector.
- 19.15 Identify the type of valves that must be sold, assembled, and shipped with backflow prevention devices.
- 19.16 Identify the types of valves associated with flushometers.

Number:	S00027.20	
Title:	<b>Water Distribution Terms and Definitions</b>	
Duration:	Total Hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify and explain water distribution terms and definition.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 20.1 Identify and state the code section of the OBC that lists water distribution terms and definitions and contains abbreviations of proper names.
- 20.2 Define the following terms, identifying minimum pipe size, installation, or system location, as well as other distinguishing characteristics:
  - “water purveyor”
  - “water distribution system”
  - “water service pipe”
  - “water system”
  - “distribution pipe”
  - “fire service main”
  - “potable”
  - “risers”
  - “mains”
  - “recirculation”

Number:	S00027.21	
Title:	Hot Water Tanks	
Duration:	Total Hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain domestic hot water tank installations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 21.1 Define the term, “domestic”, when applied to hot water tanks.
- 21.2 State four uses for domestic hot water heaters.
- 21.3 State the working and test pressures for a domestic hot water storage tanks.
- 21.4 State two reasons for installing a shut-off valve on the cold water supply to a tank.
- 21.5 Explain why the cold-water inlet must be located near the bottom of the tank or must be delivered to the bottom of the tank using a “dip tube”.
- 21.6 Name the materials that are commonly used as a protective coating on the inside of the tank wall.
- 21.7 Define the term, “sacrificial anode”.
- 21.8 Explain control of “legiononella bacteria”.
- 21.9 Identify the sources of heat commonly used on domestic hot water tanks.
- 21.10 State the advantages and disadvantages of electric, gas-fired, oil-fired, and solar hot water tanks.
- 21.11 Identify the installation requirements pertaining to domestic hot water tanks.
- 21.12 Complete a detailed drawing of a domestic hot water tank installation showing up to 15 correctly located items.
- 21.13 State the requirements of heat traps for a hot water tank.

Number:	S00027.22	
Title:	Hot Water Thermostatic Mixing Valves	
Duration:	Total Hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the installation requirements of thermostatic mixing valves.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 22.1 State the purpose of a thermostatic mixing valve.
- 22.2 Identify different types of thermostatic mixing valves.
- 22.3 State the discharge temperature for a master thermostatic mixing valve installed on a domestic hot water system as per OBC.
- 22.4 Identify the maximum water discharge temperature for fixture supplies.
- 22.5 Describe the locations for the different types of thermostatic mixing valves.
- 22.6 Identify the working parts of a thermostatic mixing valve.

Number:	S00027.23	
Title:	Relief Valves	
Duration:	Total Hours:	2
	Theory:	2
	Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the installation requirements of temperature and pressure relief valves.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 23.1 State the purpose of a temperature relief valve and pressure relief valve.
- 23.2 Explain the possible results of a hot water tank malfunctioning without a temperature and pressure relief valve installed.
- 23.3 State the discharge temperature and pressure settings for a temperature and pressure relief valve installed for a domestic hot water tank.
- 23.4 Identify how temperature relief valves and pressure relief valves are rated.
- 23.5 Describe the location of the sensing element for a temperature and pressure relief valve.
- 23.6 State the location a temperature and pressure relief valve may be installed.
- 23.7 State the location where a temperature and pressure relief valve drain may discharge.
- 23.8 State the diameter and the acceptable materials of the discharge pipe of a temperature and pressure relief valve.
- 23.9 Identify the working parts of a temperature and pressure relief valves and their maintenance requirements.
- 23.10 State the boiling point of water at atmospheric pressure.
- 23.11 State the boiling point of water under a pressure of 50 and 100 PSIG.
- 23.12 Explain the meaning of thermal heat lag in relation to the boiling point of water.
- 23.13 Determine water temperature when a temperature and pressure relief valve is installed at a given height above a hot water tank with a given pipe diameter.

Number:	S00027.24	
Title:	<b>Water Meters</b>	
Duration:	Total Hours:	5
	Theory:	3
	Practical:	2
Prerequisites:	S00022	
Co-requisites:	S00021, S00022, S00024	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain water meter and water meter by-pass installations and operations of all sizes.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 24.1 Describe the various functions of a water meter.
- 24.2 Describe the operation of a water meter.
- 24.3 Identify alternate applications of water meters.
- 24.4 Identify the unit of measure used to measure water consumption.
- 24.5 Identify when authorities govern the installation of water meters.
- 24.6 Name the three standard types of water meters.
- 24.7 Explain how water meters are protected when installed in areas that may be subject to freezing conditions.
- 24.8 Identify the water meters installed to register and record small, large, and both small and large water flows.
- 24.9 Identify the registers used on water meters.
- 24.10 Explain how remote registers operate and how they are read.
- 24.11 Explain the purpose of a meter by-pass.
- 24.12 Describe the two basic by-pass designs.
- 24.13 State the number of shut-off valves installed for a by-pass installation.
- 24.14 Identify the types of valves that may be installed in a water meter by-pass.
- 24.15 Explain the characteristics of valves installed in a water meter by-pass.
- 24.16 Draw single-line isometric sketches illustrating the design and installation of water meters and water meter by-passes.

## Plumbing Fixtures, Appliances and Equipment

Number:	S00027.25	
Title:	Plumbing Fixtures	
Duration:	Total Hours:	10
	Theory:	8
	Practical:	2
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, explain, and install a number of plumbing fixtures.

### Learning Outcomes

Upon successful completion the apprentice is able to:

#### WATER CLOSETS:

- 25.1 Describe the operation and list the materials used in the manufacture of a water closet.
- 25.2 Identify the association that must approve both the water closet bowl and the components installed in the water closet tank.
- 25.3 Discuss the features of a well-designed water closet.
- 25.4 Identify various water closet installations.
- 25.5 Identify the type of bowl design from a given cross-sectional diagram:
  - blowout type bowl
  - reverse trap bowl
  - siphon jet bowl
  - wash-down bowl
  - macerating toilet
- 25.6 Identify the type of bowl and seat that must be installed in a washroom intended for public use.
- 25.7 Explain the term, “barrier-free”, when used in conjunction with plumbing fixtures.
- 25.8 Explain the difference between a barrier-free and a regular water closet bowl.



**URINALS:**

- 25.9 Describe the operation of a urinal and list the materials used in the manufacture of urinals.
- 25.10 Identify the type of urinals from a given cross-sectional diagram, including:
- stall urinal
  - wall-hung urinal with (a) integral trap (b) integral siphonic trap (c) separate trap
- 25.11 Explain the effects of waterless urinals.

**BIDET:**

- 25.12 Describe the operation of a bidet, and list the materials used in the manufacture of a bidet.
- 25.13 Identify the type of bidet from a given cross-sectional diagram, including:
- submerged supply
  - deck-mounted faucet
- 25.14 Explain the type of cross-connection created with the installation of a bidet equipped with a submerged supply.
- 25.15 Identify the type of backflow prevention device that must be supplied with submerged head bidets.

**BATHTUBS:**

- 25.16 Describe the operation of a bathtub, and list the materials used in their manufacture.
- 25.17 Explain the difference between a left-hand bathtub and a right-hand bathtub.
- 25.18 Describe the principle of operation of a whirlpool bathtub and a hydro-massage tub.

**SHOWERS:**

- 25.19 Describe the operation of a shower and list the materials used in their manufacture.
- 25.20 Identify the different types of showers that may be installed, including:
- public shower area
  - spa shower
  - built-on-site shower
  - built-on-site shower installed with a manufactured shower base
  - manufactured shower cabinet/enclosures
  - manufactured neo-corner shower base with installed glass enclosures
- 25.21 Define the terms, “shower pan liner” or “shower safe”, and explain the purpose of its installation and the type of shower drain assembly that must be installed.
- 25.22 State the number of shower valves that may be served by a single shower drain.
- 25.23 Explain how and why the floor must be sloped in a group shower installation.
- 25.24 State the minimum horizontal distance allowed between showerheads.
- 25.25 State the minimum trap size that may be installed to serve a showerhead.
- 25.26 Explain the construction and installation requirements of a barrier-free shower installation.

**LAVATORIES:**

- 25.27 Describe the operation of a lavatory and identify the materials used in the manufacture of lavatories.
- 25.28 Identify the basic lavatory types, including:
  - wall-hung
  - pedestal-mounted
  - vanity top
- 25.29 Identify the different faucet spacing options available for lavatories.
- 25.30 Describe the type of waste fitting that must be installed when a lavatory is not equipped with an overflow.
- 25.31 Explain the construction and installation requirements of a barrier-free lavatory installation.

**SINKS:**

- 25.32 Describe the operation of a kitchen sink and identify the materials used in their manufacture.
- 25.33 Identify the options available for kitchen sinks, including:
  - number of compartments
  - ledge back
  - number of openings in the ledge back
  - under-counter installation
  - corner installation
- 25.34 List and identify sink requirements as they apply to all food premises.
- 25.35 Explain why a food preparation or a dishwashing sink may not be equipped with a concealed overflow.
- 25.36 Describe the operation of a service sink and list the materials used in their manufacture.
- 25.37 Identify various types of service sinks, including wall-hung, floor-mounted and recessed.
- 25.38 Explain what measures are taken to prevent a possible backflow condition at a service sink.
- 25.39 Explain the difference between a P-trap standard and an S-trap standard used in conjunction with a wall-hung service sink installation.

**DRINKING FOUNTAINS:**

- 25.40 Describe the operation of drinking fountains and identify the materials that are used in their manufacture.
- 25.41 Explain why the bubbler of a drinking fountain must be shielded and why the water from it must be directed up, at approximately 45 degrees.
- 25.42 Explain the purpose of the installation of a refrigeration unit in a drinking fountain.
- 25.43 Identify, from a number of illustrations, common types of drinking fountains, including:
  - free-standing refrigerated drinking fountains
  - wall-mounted drinking fountains
  - barrier-free drinking fountains

Number:	S00027.26		
Title:	Faucets and Shower Control Valves		
Duration:	Total Hours:	3	
	Theory:	3	
	Out of Class Practical:	0	
Prerequisites:	S00022		
Co-requisites:	S00027, S00028, S00030		
Cross Reference to Training Standards: U5457, U5458, U5459, U5461, U5462			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, explain, assemble, and install a number of faucets.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 26.1 Describe the operation of faucets, and identify materials used in their manufacture.
- 26.2 State the association that must approve all supply fittings.
- 26.3 Identify the following faucets and control valves including:
  - tub
  - shower
  - lavatory
  - residential sink
  - commercial sink
  - electronic
  - laundry tub
  - service sink
- 26.4 State the type of control valves that must be installed for showers.
- 26.5 Describe the difference between a pressure balanced and a thermostatic mixing control valve.
- 26.6 State the maximum allowable length of a flexible supply tube.
- 26.7 State the maximum allowable flow rates from various faucets and control valves.
- 26.8 Identify which side of a faucet and control valves must control the hot water supply and which side must control the cold water supply.

Number:	S00027.27							
Title:	Water Closets, Urinals, Flush Tanks, and Flushometers							
Duration:	Total Hours:	4						
	Theory:	4						
	Practical:	0						
Prerequisites:	S00022							
Co-requisites:	S00027, S00028							
Cross Reference to Training Standards:U5457 U5458 U5459 U5460 U5461 U5462 U5463 U5464								
U5465								

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, explain, install, and perform routine service on water closet and urinal flushometers.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 27.1 Describe the function of a water closet flush tank and urinal flush tank.
- 27.2 Identify the different types of flush tanks.
- 27.3 State the capacities of water closet tanks.
- 27.4 Explain the operation of a water closet flush valve.
- 27.5 Identify the major components of a water closet flush tank.
- 27.6 Explain how to adjust the water level and refill time of a water closet flush tank.
- 27.7 Explain the purpose of a urinal flush tank and alternate uses of urinal flush tanks.
- 27.8 Explain the operation of a urinal flush valve.
- 27.9 State the volume of a urinal flush tank.
- 27.10 Identify the major components of urinal flush tanks.
- 27.11 Explain how to adjust the water level and adjust the refill time of a urinal flush tank.
- 27.12 Explain the requirements that control unnecessary flush cycles of urinal flush tanks during building-down time.
- 27.13 Describe the function of a diaphragm-type flushometer valve.

- 27.14 Explain the difference between diaphragm-type flushometers and piston slip seal-type flush valves.
- 27.15 Explain the differences between a water closet and a urinal flushometer.
- 27.16 Describe the function and installation location of the vacuum breaker supplied with water closet and urinal flushometers.
- 27.17 State the maximum number of litres a water closet and urinal flushometer may discharge.
- 27.18 Explain why a control valve is installed with both water closet and urinal flushometers.
- 27.19 Explain the operation of various manufacturers' flushometers.
- 27.20 Describe how to adjust the flush cycle of a flushometer.
- 27.21 State where an electronic flushometer may be installed.
- 27.22 Describe the alterations that were made to standard flushometers to have them operate electronically.
- 27.23 Explain the principle of operation of an electronic flushometer valve.
- 27.24 Explain the different types of power supplies that may be used to operate electronic flushometer valves.
- 27.25 Describe the adjustments that may be made to electronic flushometer valves.
- 27.26 Identify the cause and explain the solution of flushometer operating problems.

## Codes

Number:	S00027.28									
Title:	Testing Requirements									
Duration:	Total Hours:	4								
	Theory:	4								
	Practical:	0								
Prerequisites:	S00022									
Co-requisites:	S00027, S00028									
Cross Reference to Training Standards:		U5457	U5458	U5459	U5460	U5461	U5462	U5463	U5464	U5465

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, perform, and comply with testing requirements.

### Learning Outcomes

Upon successful completion the apprentice is able to:

#### **DRAINAGE:**

- 28.1 Explain the purpose of testing plumbing systems.
- 28.2 Identify the code sections, listed in Part 7, that deal with testing of the drainage system, venting system, and storm systems.
- 28.3 Identify the tests that the sanitary and storm drainage system must be capable of withstanding without leakage, including:
  - water tests
  - air tests
  - ball tests
  - final tests
- 28.4 Identify the tests that the venting system must be capable of withstanding without leakage, including:
  - water tests
  - air tests
  - final tests
- 28.5 State the purpose of water testing the DWV and storm drainage system, and explain how to prepare them for a water test.
- 28.6 Identify the tools and equipment required to perform a water test on the DWV and/or storm drainage system.
- 28.7 Explain how a water test may be applied to the entire DWV and/or storm drainage system or to sections of the DWV and/or storm drainage system.

- 28.8 Identify the minimum height a water test may be applied to a DWV and/or storm drainage system.
- 28.9 Explain the purpose of the installation of a test fitting(s) in the DWV and/or storm drainage system.
- 28.10 Identify where test fittings are installed in a DWV and/or storm drainage system.
- 28.11 State the maximum recommended height of a water test when the drainage system has been constructed, using mechanical joint couplings and cast iron soil pipe and fittings.
- 28.12 State the minimum time a water test must be maintained on a DWV and/or storm drainage system.
- 28.13 State the purpose of air testing the DWV and/or storm drainage system, and explain why an air test would be performed instead of a water test.
- 28.14 Identify the tools and equipment required to perform an air test on a DWV and/or storm drainage system, and explain how to prepare them for the test.
- 28.15 Explain how an air test may be applied to the entire DWV and/or storm drainage system or sections of the DWV and/or storm drainage system.
- 28.16 Identify the minimum section height of the DWV and/or storm drainage system to which an air test may be applied.
- 28.17 State the minimum allowable air pressure for an air test when testing the DWV and/or storm drainage system.
- 28.18 State the minimum time an air test must be sustained when testing the DWV and/or storm drainage system.
- 28.19 Explain the different methods that may be used to find a leak in a DWV and/or storm drainage system when testing with air.
- 28.20 Define the term, "ball test", and explain its purpose.
- 28.21 Identify the sections of the DWV and/or storm drainage system where a ball test shall be performed.
- 28.22 State the specific gravity and diameter of the ball used in a ball test, and explain how to perform a ball test.
- 28.23 Define the term, "final test/smoke test", and explain the purpose of conducting this test.
- 28.24 Identify the municipal official who determines if a final test is required.

- 28.25 Identify the tools and equipment required to perform a final test.
- 28.26 Explain how to prepare the DWV system for a final test.
- 28.27 State the air pressure that must be maintained when performing a final test on the DWV system.
- 28.28 State the minimum time a final test must be sustained on the DWV system.
- 28.29 Define the term, “cross-connection test /dye test”, and explain the purpose of conducting it.

**POTABLE:**

- 28.30 Identify the tests that the potable water system must be capable of withstanding, without leakage, including:
  - water tests
  - air tests
- 28.31 State the purpose of water or air testing the potable water system.
- 28.32 Identify the tools and equipment required to perform a water or air test on the potable water system.
- 28.33 Explain how to prepare the potable water system for a water or air test.
- 28.34 State the minimum water pressure and time that must be sustained when performing a water test on the potable water system.
- 28.35 Explain when the potable water system must be tested, as a complete system or in sections.
- 28.36 State the type of water that must be used when water testing a potable water system.
- 28.37 State the minimum allowable air pressure and time that must be sustained when performing an air test on the potable water system.



Number:	S00027.29	
Title:	Required Inspections	
Duration:	Total Hours:	1
	Theory:	1
	Out of Class Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and arrange all required inspections.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 29.1 Explain the purpose of a plumbing inspection.
- 29.2 Identify the information required by a municipal inspector when requesting an inspection.
- 29.3 Identify who may conduct inspections, including:
  - municipal building officials
  - fire department officials
  - inspectors representing the owner of a building
  - health inspectors
- 29.4 Identify sections of documents that outline the required inspections for various piping systems, including but not limited to:
  - job specifications
  - CAN/CSA-B149.1-05
  - CSA medical gas installation standard
  - NFPA Standard
  - Ontario Building Code (OBC)
  - National Building Code (NBC)
- 29.5 Identify when the DWV system requires inspections.
- 29.6 Explain the inspection process if a piping system is prefabricated off the building site.
- 29.7 Explain when the potable water system requires inspections.
- 29.8 Explain when the plumbing system requires a final test and/or inspection.
- 29.9 Identify the key points to be examined during inspections of a DWV, storm piping systems, and potable water systems.
- 29.10 Explain what steps an inspector must take when a system(s) or component does not conform to the OBC.
- 29.11 Explain what steps a plumber must take to comply with an inspector's orders.

Number:	S00027.30	
Title:	Fire Stopping	
Duration:	Total hours:	3
	Theory:	3
	Out of Class Practical:	0
Prerequisites:	S00021, S00022, S00025	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and select fire stopping.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 30.1 Define the trade term, “fire stopping”, and explain the purpose of fire stopping.
- 30.2 State the sections of the job specification and OBC that regulates the selection and installation of fire stopping.
- 30.3 Define the terms, “flame spread rating” and “smoke development rating”.
- 30.4 Identify the materials installed in plumbing systems that may require the installation of fire stopping.
- 30.5 Identify and list the factors involved in the selection and installation of fire stopping.
- 30.6 Identify different type of fire stopping devices approved for installation.
- 30.7 Describe the installation requirements of common fire stopping devices.
- 30.8 Identify the installation location of fire stopping from a given construction drawing.
- 30.9 Identify the inspectors who are responsible for inspection of fire stopping.
- 30.10 Explain when a fire stopping installation would require inspection.
- 30.11 Identify the key examination points when fire stopping is being inspected.

## Properties of Water and Heat Transfer

Number:	S00027.31
Title:	Properties of Water
Duration:	Total Hours: 2
	Theory: 2
	Practical: 0
Prerequisites:	S00022
Co-requisites:	S00027
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to identify, define, and explain the properties of water.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 31.1 Explain the term, "potable water".
- 31.2 State the chemical composition of water, and list and explain its chemical symbol, H<sub>2</sub>O.
- 31.3 Describe the characteristics of pure water.
- 31.4 Identify the different states of water.
- 31.5 Define water in a solid state and a gaseous state.
- 31.6 State the density of water.
- 31.7 State the formula used to find the specific gravity of a substance.
- 31.8 State the specific gravity of liquids compared to water such as but not limited to:
  - oils
  - ice
  - steam
  - mercury
  - lead
- 31.9 State the approximate expansion of water when converted to steam at 212° Fahrenheit or 100° Celsius.
- 31.10 State the approximate expansion of water when converted to ice at 32° Fahrenheit or 0° Celsius.
- 31.11 Calculate the boiling point of water in Fahrenheit at 50, 100, and 150 PSIG.
- 31.12 Calculate the boiling point of water in Fahrenheit when it is confined in a vacuum.
- 31.13 State the boiling point and freezing point of water on the Celsius and Fahrenheit scales.
- 31.14 State the terms used at 0°, 4°, and 100° on the Celsius scale.
- 31.15 State the terms used at 32°, 39.2°, and 212° on the Fahrenheit scale.

Number:	S00027.32					
Title:	Heat Transfer					
Duration:	Total Hours:	2				
	Theory:	2				
	Practical:	0				
Prerequisites:	S00022					
Co-requisites:	S00027					
Cross Reference to Training Standards: U5457 U5458 U5459 U5460 U5461 U5463 U5464 U5465						

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, define, and state the practical applications of heat transfer.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 32.1 Define the term, “heat transfer”.
- 32.2 Identify the three main methods of heat transfer.
- 32.3 Explain the following heat transfer processes, including:
  - conduction
  - convection
  - radiation
- 32.4 Identify good conductors of heat.
- 32.5 Identify poor conductors of heat.
- 32.6 Explain thermal conductivity.
- 32.7 Identify factors that may affect the speed that an iron bar will conduct heat.
- 32.8 Identify and list examples of forced convection.
- 32.9 Identify the type of materials that will readily absorb radiant heat.
- 32.10 State the approximate percentage of radiated heat emitted by a radiator.

Number:	S00027.33	
Title:	Latent and Sensible Heat	
Duration:	Total Hours:	2
	Theory:	2
	Out of Class Practical:	0
Prerequisites:	S00022	
Co-requisites:	S00027	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify and interpret the definitions and principles of latent heat.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 33.1 Define the terms:
  - “heat”
  - “latent heat”
  - “sensible heat”
  - “heat intensity”
  - “heat quantity”
- 33.2 Explain the difference between heat intensity and heat quantity.
- 33.3 Explain what happens when the temperature of a substance decreases.
- 33.4 Describe the type of unit used to measure latent heat.
- 33.5 Explain why latent heat is often described as “hidden heat”.
- 33.6 Explain the purpose of calculating latent heat.
- 33.7 State the value of the latent heat of fusion for water.
- 33.8 Describe the method of measuring latent and sensible heat.
- 33.9 State the value of the latent heat of vaporization.
- 33.10 Describe the method of measuring the latent heat of vaporization for water at atmospheric pressure.
- 33.11 Complete a number of assignments that require the calculation of the latent heat of fusion and the latent heat of vaporization.

Number:	S00027.34		
Title:	British Thermal Units		
Duration:	Total Hours:	4	
	Theory:	4	
	Practical:	0	
Prerequisites:	S00022		
Co-requisites:	S00027		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5463, U5464, U5465			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, define, and perform calculations involving British Thermal Units.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 34.1 Define the term, "British Thermal Unit", and the abbreviation, "MBTU"
- 34.2 Explain when MBTU would be used.
- 34.3 Define the term, "specific heat".
- 34.4 State the formula used to calculate the specific heat of a substance when the heat quantity, mass, and temperature change is known.
- 34.5 State the specific heat of:
  - water
  - ice
  - air
  - steam
  - lead
- 34.6 State the formula for calculating heat quantity when mass, temperature change, and the specific heat of a substance are known.
- 34.7 Explain the law of heat exchange.
- 34.8 Calculate the quantity of heat gained or lost when the mass, temperature change, and specific heat of a substance are known.
- 34.9 Calculate the quantity of heat gained or lost by a substance undergoing a change of state when mass, temperature change, specific heat, and the latent heat are known.

Number: S00028.0  
**Title: DWV PIPING SYSTEMS**  
Duration: 48 Total Hours  
Theory: 0 Practical: 48  
Prerequisites: S00021, S00022  
Co-requisites: S00027, S00028, S00030

**Evaluation Structure**

Theory Testing	20%
Application Exercises	70%
Final Assessment	10%

Number: S00028.1  
**Title: Design, Draw, Install, and Test Various Drain, Waste, Vent, Storm, and Fixture Installations**  
Duration: Total Hours: 42  
Theory: 0  
Practical: 42  
Prerequisites: S00022  
Co-requisites: S00027, S00028, S00030  
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to plan, design, draw, install, test, and commission a commercial installation including a grease/oil interceptors.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Plan the layout of a commercial washroom group.
- 1.2 Plan for the use and installation of:
  - plastic pipe
  - copper pipe
  - cast iron pipe
- 1.3 Design the DWV and potable water system for the installation of a washroom group.
- 1.4 Prepare a set of working drawings, including:
  - plan view
  - stack elevation
  - complete material list
  - isometric DWV drawings
  - isometric water pipe drawing

- 1.5 Prepare a set of shop drawings for the fixtures, faucets, and components to be installed.
- 1.6 Submit drawing package and shop drawings for review, alterations, and approval.
- 1.7 Install the DWV and the hot and cold potable water pipe systems.
- 1.8 Water or air test the DWV piping.
- 1.9 Test the potable water system.
- 1.10 Assemble and install the fixtures and fixture trim, including at least one wall- mounted fixture.
- 1.11 Set up and perform a final air test on the completed installation.

Number:	S00028.2	
Title:	Perform Various Service, Maintenance, and Repair Assignments	
Duration:	Total Hours:	6
	Theory:	0
	Practical:	6
Prerequisites:	S00021, S00022	
Co-requisites:	S00027, S00028	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464	

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to perform various service operations suited to particular geographical locations.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 2.1 Troubleshoot, shutdown, dismantle, rebuild, reassemble, and reactivate a variety of water closet and urinal flushometers.
- 2.2 Troubleshoot, shutdown, dismantle, rebuild, reassemble, reactivate, and set-up a variety of electronic lavatory faucets, water closet, and urinal flushometers.
- 2.3 Perform a series of tests to determine if a domestic electric hot water is performing correctly.
- 2.4 Troubleshoot, shutdown, remove, disassemble, rebuild, reinstall, and set-up a simplex and/or duplex storm/sewage pump installation.



Number: S00029.0  
Title: **TRADE CALCULATIONS – LEVEL 2**

Duration: 24 Total Hours

Theory: 24                      Practical: 0  
Prerequisites: S00024

Co-requisites: S00027, S00028, S00029, S00030

**Evaluation Structure**

Theory Testing	80%
Application Exercises	0%
Final Assessment	20%

Number: S00029.1  
Title: **Area Calculations**

Duration: Total Hours: 6

Theory: 6  
Practical: 0

Prerequisites: S00024

Co-requisites: S00027, S00028, S00029, S00030

Cross Reference to Training Standards: U5458, U5459, U5461, U5463, U5464, U5465

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to calculate the area of geometric shapes including squares, rectangles, circles, and triangles.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Define the term, “area calculation”.
- 1.2 State the units of measurements used in area calculations.
- 1.3 State the formula used to calculate the area of a:
  - square and rectangle
  - circle
  - triangle
- 1.4 State the area of a square, rectangle, circle, trapezoid, and a triangle in both Imperial and SI units.

Number:	S00029.2	
Title:	Surface Area Calculations	
Duration:	Total Hours:	6
	Theory:	6
	Practical:	0
Prerequisites:	S00024	
Co-requisites:	S00027, S00028, S00029, S00030	
Cross Reference to Training Standards:	U5458, U5459, U5461, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to calculate the surface areas of tanks and cylinders in both Imperial and SI units.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 Define the term, “surface area calculation”.
- 2.2 State the unit of measurements used in surface area calculations.
- 2.3 State the formulas used for finding the surface area of the following shaped tanks:
  - square, rectangular, and spherical
  - cylindrical with flat ends and spherical ends
  - hemispherical
  - segments of a circle
- 2.4 Calculate the total surface area in Imperial and SI units of square tanks with closed and open tops.
- 2.5 Calculate the total surface area of a rectangular tank with closed and open tops, a coned-shaped tank with a closed and open bottom, a cylindrical tank with flat and spherical ends, and a hemispherical tank in imperial and SI units.

Number:	S00029.3	
Title:	Volume Calculations	
Duration:	Total Hours:	6
	Theory:	6
	Practical:	0
Prerequisites:	S00024	
Co-requisites:	S00027, S00028, S00029, S00030	
Cross Reference to Training Standards: U5458, U5459, U5461, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to calculate the volumes of tanks and cylinders in both Imperial and SI units.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Define the term, “volume calculation”.
- 3.2 State the units of measurements used in volume calculations.
- 3.3 State the formulas used for volume calculations of the following shaped tanks:
  - square or rectangular tanks
  - spherical tanks
  - cylindrical tanks with flat ends
  - cylindrical tanks with spherical ends
  - hemispherical tanks
  - segments of a tank and of a pipe
- 3.4 Calculate, in both Imperial and SI units, the volume of square and rectangular tanks, coned-shaped tanks, cylindrical tanks with flat and spherical ends, spherical tanks, and hemispherical tanks.
- 3.5 Calculate, in both Imperial and SI units, the weight of the water contained in various shaped tanks with given dimensions.
- 3.6 Calculate, in both Imperial and SI units, the combined weight of both the water and the material used to construct various shaped tanks with given dimensions.

Number:	S00029.4	
Title:	Percentages and Ratios	
Duration:	Total Hours:	6
	Theory:	6
	Practical:	0
Prerequisites:	S00024	
Co-requisites:	S00027, S00028, S00029, S00030	
Cross Reference to Training Standards: U5458, U5459, U5461, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to calculate percentages and to solve ratio and proportion problems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.1 Define the terms:
  - “percentage”
  - “ratio”
  - “proportion”
  - “direct ratio”
  - “inverse ratio”
- 4.2 Explain how these terms and definitions are used in the plumbing industry.
- 4.3 Perform the following mathematical operations:
  - express a common fraction as a percentage
  - express a percentage as a common fraction
  - express a decimal as a percentage
  - express a percentage as a decimal
- 4.4 Solve a number of problems incorporating the operations listed above.
- 4.5 Solve a number of problems, involving:
  - ratio
  - proportion
  - direct proportion
  - inverse proportion

Number: S00030.0  
**Title: Trade Documentation – Level 2**  
 Duration: 24 Total Hours  
 Theory: 10 Practical: 14  
 Prerequisites: S00021, S00022, S00023, S00025  
 Co-requisites: S00027, S00028, S00030

**Evaluation Structure**

Theory Testing	10%
Application Exercises	80%
Final Assessment	10%

Number: S00030.1  
**Title: Read and Apply Information from Construction Drawings**  
 Duration: Total Hours: 6  
 Theory: 6  
 Practical: 0  
 Prerequisites: S00022, S00023, S00025  
 Co-requisites: S00027, S00028, S00030  
 Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to read and apply information from construction drawings.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Apply the information shown on architectural drawings, structural drawings, mechanical drawings, and electrical drawings for a commercial or industrial building in order to plan the installation of a plumbing system and consider factors, such as:
  - definitions
  - symbols
  - legends
  - site and grade drawings
  - floor and roof drawings
  - elevation drawings
  - details and notes
  - schedules
  - “as-built” drawings
  - plumbing drawings
  - piping drawings
  - interference drawings

Number:	S00030.2	
Title:	Read and Interpret Job Specifications	
Duration:	Total Hours:	4
	Theory:	4
	Practical:	0
Prerequisites:	S00021, S00022, S00025	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to read and interpret a job specification.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 Define a “specification”.
- 2.2 Explain the purpose of a specification.
- 2.3 Identify the sections of a specification.
- 2.4 Explain the numbering system used in a construction specification.
- 2.5 Identify the number and section of the specification that relates to the plumbing system installation.
- 2.6 Identify the other sections of the specification that may relate to the section dealing with the plumbing system installation.
- 2.7 Identify the other sections of the specifications for which a plumber may be responsible.
- 2.8 Identify the key points included in the section of the specification relating to the plumbing system installation.

Number:	S00030.3		
Title:	Produce Various Plumbing Drawings		
Duration:	Total Hours:	8	
	Theory:	2	
	Practical:	6	
Prerequisites:	S00022, S00025		
Co-requisites:	S00027, S00028, S00030		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464			

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to create a number of plumbing drawings of various complexities.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Produce a number of isometric drawings, each of which is drawn to scale, fully sized, and fully dimensioned with both a title block and a legend. The drawings may illustrate:
  - a section of a domestic water pipe system
  - a section of a residential DWV system
  - a section of a stack illustrating a multi-fixture stack-vented group
  - a section of a horizontal branch illustrating multi-fixture circuit-vented group
  - a section of a domestic water pipe serving a multi-fixture washroom group
  - an elevator pit installation
  - an oil interceptor installation
  - a grease interceptor installation
  - an acid neutralizer installation
  - the DWV piping required for a commercial kitchen installation
- 3.2 Produce an interference drawing.
- 3.3 Produce a valve chart from a given drawing.
- 3.4 Identify how to tag pipe and valves and how to label pipe, valves, and equipment.
- 3.5 Produce a shop-drawing manual.
- 3.6 Review the components in a material list, including:
  - type of materials
  - quantity of materials
  - list price
  - net price
  - material mark up, overhead, and profit
- 3.7 Define the term, "labour estimate".
- 3.8 Explain how a labour estimate may be made.
- 3.9 Identify the different labour estimators available.
- 3.10 Describe the use of a labour estimator.
- 3.11 Produce a material take-off sheet for a given drawing, including:
  - a priced, extended, and totaled material/labour list
  - determine list cost, net cost, mark up, profit, and final selling price

Number:	S00030.4	
Title:	Write Job-Related Documents	
Duration:	Total Hours:	6
	Theory:	2
	Practical:	4
Prerequisites:	S00021, S00022	
Co-requisites:	S00027, S00028, S00030	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to write job-related documents, either manually or with a personal computer.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.3 Identify which tasks, events, or requests must be documented in a written format.
- 4.3 Review documents to determine what information is required for their completion.
- 4.3 Gather the information required to complete job documentation.
- 4.3 Organize the information, and complete job-related documentation to a required format.
- 4.3 Forward the completed documents to the appropriate personnel.



Number: S00031.0  
Title: **Welding – Level 2**

Duration: 24 Total Hours

Prerequisites: Theory: 3                      Practical: 21  
S00021, S00026  
Co-requisites: S00031

**Evaluation Structure**

Theory Testing	10%
Application Exercises	80%
Final Assessment	10%

Number: S00031.1  
Title: **Arc Welding Theory, Terminology, Equipment, Procedures, and Safety Precautions**

Duration:	Total Hours:	3
	Theory:	3
	Practical:	0

Prerequisites: S00021, S00026  
Co-requisites: S00031

Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain arc welding theory, terms, equipment, procedures, and safety precautions.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Describe the shielded metal arc welding process and equipment.
- 1.2 Define six given arc welding terms.
- 1.3 Name two different types of arc welding power sources and current, and describe the advantages and disadvantages of each.
- 1.4 Describe the operating adjustments found on arc welding machines.
- 1.5 Describe the special safety requirements for the operation of an electric arc to protect against electrical shock, arc flashes, and radiation.
- 1.6 List and describe all equipment required for the personal protection of the operator.
- 1.7 Identify the parts of the welding process.
- 1.8 Describe two methods of striking an arc.
- 1.9 State the correct range of lens shade numbers for arc welding.

- 1.10 Explain the difference between straight and reverse polarity and how to test for polarity.
- 1.11 Identify the meaning of the numbers in the AWS/CSA electrode code classification.
- 1.12 Name four types of electrodes commonly used in the welding industry.
- 1.13 State the purpose of the coating on electrodes.
- 1.14 List the factors to be considered when selecting an electrode for a specific job application.
- 1.15 Describe the storage procedures for electrodes.
- 1.16 Read and comprehend welding symbols.
- 1.17 Identify common arc welding faults, and describe the methods used to control them.
- 1.18 State five reasons for a poor weld.
- 1.19 Explain two reasons for removing slag from a weld.
- 1.20 Explain three reasons for fusing one bead in with another.
- 1.21 List four factors that determine weld quality.
- 1.22 Explain four reasons for polarity changes.

Number:	S00031.2	
Title:	Arc Welding Procedures	
Duration:	Total Hours:	21
	Theory:	0
	Practical:	21
Prerequisites:	S00026	
Co-requisites:	S00031	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to perform arc welding procedures.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 Select the correct electrode for the intended weld.
- 2.2 Safely set up and adjust the welding machine prior to welding.
- 2.3 Check the condition of the welding equipment for correct and safe operation.
- 2.4 Strike and maintain an arc.
- 2.5 Lay beads on mild steel plate.
- 2.6 Prepare, tack, and butt weld mild steel plate in flat, horizontal, and overhead positions.

## **LEVEL 3**

**Program Summary of Reportable Subjects**

<b>Number</b>	<b>Reportable Subjects</b>	<b>Hours Total</b>	<b>Hours Theory</b>	<b>Hours Practical</b>
S00032	Plumbing Systems – Level 3	144	134	10
S00033	Process Piping Systems	48	-	48
S00034	Trade Documentation – Level 3	48	36	12
	<b>Total</b>	<b>240</b>	<b>170</b>	<b>70</b>

Number:	S00032.0
Title:	<b>Plumbing Systems – Level 3</b>
Duration:	144 Total Hours
	Theory: 134                      Practical: 10
Prerequisites:	S00021, S00022, S00024, S00025, S00027, S00029, S00030,
Co-requisites:	S00032, S00033, S00034

**Evaluation Structure**

Theory Testing	80%
Application Exercises	10%
Final Assessment	10%

## Waste Pipe Systems

Number:	S00032.1
Title:	<b>Acid Neutralizers</b>
Duration:	Total hours: 3
	Theory: 3
	Practical: 0
Prerequisites:	S00022, S00027
Co-requisites:	S00032
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define, identify and describe the installation requirements for an acid neutralizer.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Define the trade term, “acid neutralizers”.
- 1.2 State the purpose of an acid neutralizer and the principle that enables acid to be neutralized based on the PH scale.
- 1.3 List the conditions that are eliminated when an acid neutralizer is installed.
- 1.4 List locations and/or buildings that may require the installation of an acid neutralizer.
- 1.5 Explain when an acid neutralizer may and may not act as a fixture trap.
- 1.6 Identify the fixtures, appliances and devices that may discharge into an acid neutralizer.

- 1.7 State the installation and material requirements for acid neutralizers.
- 1.8 State the purpose of the vent piping that must be connected to an acid neutralizer.
- 1.9 Specify the vents required for an acid neutralizer.
- 1.10 Explain how to size the vent required for an acid neutralizer installation.
- 1.11 Identify the connection location for a vent serving an acid neutralizer.
- 1.12 Describe a water make-up connection to an acid neutralizer.
- 1.13 Identify by-laws controlling acid concentrations and removal.

## Water Distribution System

Number:	S00032.2		
Title:	Water Mains		
Duration:	Total hours:	1	
	Theory:	1	
	Practical:	0	
Prerequisites:	S00022, S00027		
Co-requisites:	S00032, S00034		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465			

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain water main installations on private property.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 2.1 Define the following trade terms: “water main”, “thrust block”, and “restraints”.
- 2.2 State the approved materials that may be installed for water mains.
- 2.3 State the approved sources of supply for a water distribution system.
- 2.4 State the type of projects that require the installation of a private water main.
- 2.5 Explain the installation procedures for each of the acceptable materials.
- 2.6 Explain the purpose of a thrust block.

- 2.7 State the material used in the construction of a thrust block.
- 2.8 Identify installation locations of thrust blocks.
- 2.9 Explain the sizing procedure for thrust blocks and restraints.
- 2.10 Explain the installation of cathodic protection for buried water mains.
- 2.11 State the minimum depth of burial of water mains in different localities throughout Ontario.

Number:	S00032.3	
Title:	Water Services	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	S00022, S00027	
Co-requisites:	S00032, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain water service pipe installations on private property.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 3.1 Define the term, “water service pipe”, “corporation stop” and “curb stop”.
- 3.2 State the installation locations of a water service pipe.
- 3.3 State the approved materials and methods that may be used for the installation of a water service pipe.
- 3.4 State the approved materials that may be installed in a water distribution system.
- 3.5 State the minimum size of a water service pipe.
- 3.6 Describe the spatial separation requirements for water service pipe.
- 3.7 State the thrust restraint requirements for water service pipes.
- 3.8 State the purpose of a tracer wire.
- 3.9 State when a tracer wire would and would not be required when installing a water service pipe or a fire service main.
- 3.10 State the type and gauge of wire to be used as a tracer wire.
- 3.11 State the type of water service pipe that must have a check valve installed at the building end of the water service.
- 3.12 Describe the purpose of the check valve installed at the building end of a water service pipe.

Number:	S00032.4	
Title:	Municipal Water Supplies	
Duration:	Total hours:	6
	Theory:	6
	Practical	0:
Prerequisites:	S00022, S00025, S00027, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain municipal water treatment.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 4.1 State the estimated water consumption per capita for the average family in Ontario.
- 4.2 Describe how the degree and type of water treatments are determined.
- 4.3 Identify what all surface water contains.
- 4.4 Identify the term applied to the finely divided suspended and colloidal material that is too light to settle out of water.
- 4.5 State the cause of colour in the water.
- 4.6 Explain why bacteria must be removed from a potable water supply.
- 4.7 Explain the objective of water treatment.
- 4.8 Identify a number of pieces of equipment typically used in a water treatment plant.
- 4.9 Explain each of the following steps involved in a water treatment process, including:
  - low lift pumping stations
  - flocculation
  - filtration
  - sedimentation
  - ultra-violet
  - reverse osmosis
  - distillation
  - chlorination
- 4.10 Review the latest technology used in municipal water treatment systems.
- 4.11 Complete a flow chart indicating the steps involved in water filtration for a typical water treatment plant.



Number:	S00032.5	
Title:	Pressure and Heads	
Duration:	Total hours:	9
	Theory:	9
	Practical:	0
Prerequisites:	S00024, S00029	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5458, U5459, U5461, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define and calculate pressure and heads.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 5.1 Define the terms, “weight of water”, “pressure of water”, “PSI,” “PSIG”, “PSIA” and “bar”.
- 5.2 State the unit of measurement used to express pressure in Imperial and SI.
- 5.3 Calculate the pressure in PSI and kPa from a given head in feet and meters.
- 5.4 Calculate the head in feet and inches from a given pressure.
- 5.5 Calculate the pressure, total force, and total weight for a number of given pipe, tank and combination tank and pipe problems.

Number:	S00032.6
Title:	Private Water Supplies
Duration:	Total hours: 3
	Theory: 3
	Practical: 0
Prerequisites:	S00022, S00027
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain common private water supplies.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 6.1 Identify the legislation governing the installation and servicing of water wells.
- 6.2 State the percentage of water in all living matter.
- 6.3 Explain the term, “hydrologic cycle”, including:
  - precipitation
  - infiltration
  - percolation
  - evaporation
  - transpiration
  - condensation
- 6.4 List conditions that could cause the water table to lower.
- 6.5 State the major requirements of a private water supply.
- 6.6 Explain why any surface water supply should be carefully checked prior to human use and consumption.

- 6.7 Identify different cistern types.
- 6.8 Explain the installation of cisterns.
- 6.9 Explain the connections of the cistern to the water system.
- 6.10 Name the four different types of wells.
- 6.11 Describe the types of “shallow wells” and state their average maximum depth.
- 6.12 Identify the types of wells installed when penetrating through hard consolidations and rock.
- 6.13 State the depth of installation for a drilled or tubular well.
- 6.14 Explain how and why a bored well must be curbed or lined.
- 6.15 Describe the conditions that often effect dug well water quality.
- 6.16 Identify the type of ground suitable for driven wells and where they are most practical.
- 6.17 Identify the type of well that uses the well casing as a delivery tube.
- 6.18 State where drilled wells should be installed.
- 6.19 Explain the advantages of a drilled well and the purpose of a well casing.
- 6.20 Identify the type of pipe used to case a drilled well.
- 6.21 State the sizes of casings used for drilled wells.
- 6.22 State the termination point of a well casing and how it is sealed.
- 6.23 Explain the different ways a well casing may be terminated, or capped off below or above finished grade.
- 6.24 Explain the advantages and disadvantages of each well type.
- 6.24 Explain the terms, “static water level” and “drawdown”.

Number:	S00032.7	
Title:	Types of Pumps	
Duration:	Total hours:	6
	Theory:	6
	Practical:	0
Prerequisites:	S00022, S00027	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain the basic operating principles of common pumps installed in plumbing systems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 7.1 Define the following terms: “pump,” “suction lift”, “discharge head”, and “total dynamic head”.
- 7.2 Explain how the capacity of a pump is expressed.
- 7.3 Identify the two basic types of pumps.
- 7.4 Identify the common types of pumps installed including:
  - centrifugal pumps
  - jet pumps
  - submersible pumps
  - piston pumps
- 7.5 Explain the operating principle of a positive displacement pump and centrifugal pump.

- 7.6 State the advantages and disadvantages of centrifugal pumps and positive displacement type pumps.
- 7.7 Explain the operating principle of a jet-venturi.
- 7.8 Explain the maximum theoretical lift of a shallow well jet pump.
- 7.9 Explain how the lifting capacity is increased in a deep well pump.
- 7.10 Define the following terms: “drive pipe”, “suction line”, and “foot valve”.
- 7.11 Explain the relationship of the water traveling through the drive pipe and suction line in a deep well jet pump installation.
- 7.12 Explain the function of a foot valve and identify its installation location.
- 7.13 Define the term, “submersible pump”.
- 7.14 Explain the operating principles of a submersible pump.
- 7.15 State the installation requirements (including electrical safety and grounding requirements) of a submersible pump including the installation of a:
  - pit-less adaptor
  - torque arrester
  - rope
  - pump control panel
- 7.16 State the selection factors used to determine if a submersible or a jet pump is to be installed for a given installation.
- 7.17 State the standard pressure control settings for a domestic hydro-pneumatic system.

Number:	S00032.8
Title:	Pressure Tanks
Duration:	Total hours: 4
	Theory: 2
	Practical: 2
Prerequisites:	S00021, S00024, S00027 S00029
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, size and explain the purpose and installation requirements of a pressure tank.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 8.1 Define the terms, “pressure tank” and “waterlogged”.
- 8.2 Explain the purpose of pressure tanks and identify their installation location.
- 8.3 Explain the condition created by a waterlogged pressure tank.
- 8.4 Explain the function of an air volume control valve.
- 8.5 Identify where air volume control valves are installed on pressure tanks.
- 8.6 Explain how the installation of an air volume control valve helps prevent a pressure tank from becoming waterlogged.
- 8.7 Explain the difference between a standard pressure tank and a captive air pressure tank and why a captive air tank does not become waterlogged.
- 8.8 Identify how to calculate the pre-charge pressure of a captive air tank.
- 8.9 Identify the materials used to construct standard and captive air pressure tanks.
- 8.10 Explain the purpose of the pressure relief valve installed in conjunction with a submersible water pump.
- 8.11 State the sizing method recommended to determine the capacity of a pressure tank.
- 8.12 Determine the amount of water that will be delivered from both a standard and a captive air tank of a given size, at a given operating pressure range.
- 8.13 Calculate, given the pressure tank size and control settings for a given hydro-pneumatic system installation the volume of air in the tank at a given pressure, the discharge of water in gallons/litres and the ratio of water discharged to total volume during the cycle.

Number:	S00032.9
Title:	Boyle's Law
Duration:	Total hours: 3
	Theory: 3
	Practical: 0
Prerequisites:	S00024, S00029
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards:	U5458, U5459, U5461, U5463, U5464, U5465

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to solve trade-related problems using Boyle's law.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 9.1 Define Boyle's Law.
- 9.2 State the formula for Boyle's Law.
- 9.3 Apply Boyle's Law to a number of trade-related problems, including the calculation of the volume of:
  - pressure tanks.
  - pre-charged pressure tanks.
  - air chambers

Number:	S00032.10	
Title:	Hydro-Pneumatic Systems	
Duration:	Total hours:	6
	Theory:	4
	Practical:	2
Prerequisites:	S00022, S00024, S00027, S00029	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, explain and size basic hydro-pneumatic water systems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 10.1 Explain the term, “hydro-pneumatic water systems”.
- 10.2 State the major components of a hydro-pneumatic water system.
- 10.3 List the primary factors used to select a pump.
- 10.4 Explain how to determine daily water requirements.
- 10.5 Identify the use of a performance curve chart in the selection of a water pump.
- 10.6 Explain the following terms:
  - “static water level”
  - “drawdown”
  - “friction loss”
  - “suction lift”
  - “discharge head”
  - “total dynamic head”
- 10.7 Determine the jet or submersible water pump required for a given installation by calculating:
  - friction loss
  - suction lift
  - discharge head
  - total dynamic head
- 10.8 Determine the available maximum and minimum water pressure at the highest faucet location considering:
  - head loss
  - friction loss
  - GPM/velocity
  - Voltage



Number:	S00032.11	
Title:	<b>Water Conditioning Equipment</b>	
Duration:	Total hours:	6
	Theory:	4
	Practical:	2
Prerequisites:	S00022, S00024, S00027, S00029	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain the operating principles of water conditioning equipment.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 11.1 Identify the common impurities and contaminants found in water.
- 11.2 Explain the difference between an impurity and a contaminate.
- 11.3 Explain how the amount of impurities is expressed.
- 11.4 Define the term, "hard water".
- 11.5 Explain the difficulties encountered when using hard water.
- 11.6 Identify the conditioning equipment used to condition hard water.
- 11.7 Describe three ways of measuring the degree of hardness in water.
- 11.8 Name the solution used to determine the amount of hardness in water.
- 11.9 Identify the types of hardness.
- 11.10 Explain how to convert parts per million (PPM) to grains per US gallon (GPG).
- 11.11 Explain how to convert parts per million (PPM) to grains per Imperial gallon (GPG).
- 11.12 Identify the material used in the exchange process of a water softener.
- 11.13 Identify the substance used to regenerate a water softener.
- 11.14 Identify the working components of a water softener.

- 11.15 Explain each operation cycle of a water softener.
- 11.16 Calculate the capacity of a water softener.
- 11.17 Identify to where the discharge pipe from a water softener should connect.
- 11.18 Identify the typical installation location for water softeners.
- 11.19 Describe the effects of iron in the water and high iron content in a water supply.
- 11.20 Identify the conditioning equipment installed to remove iron in a water supply.
- 11.21 Explain the operating principle of an iron filter.
- 11.22 Explain where an iron filter should be installed in relation to a water softener.
- 11.23 Explain the effects of high sulphur content in a water supply.
- 11.24 Identify the water conditioning equipment installed to remove excess sulphur in a water supply.
- 11.25 Explain the two types of filters installed for the removal of iron and sulphur.
- 11.26 Define the term, “reverse osmosis” (RO).
- 11.27 Describe the operating principle of a RO unit.
- 11.28 Explain the types of contaminants and impurities that may be removed with a RO unit.
- 11.29 Explain the term, “ultra-violet light (UV) unit”.
- 11.30 Explain the operating principle of an UV unit.
- 11.31 Explain the types of contaminants that may be treated with an UV unit.
- 11.32 Explain the operating principle of a chlorinator.
- 11.33 Explain the types of contaminants that may be treated with a chlorinator installation.
- 11.34 Explain the operation principle of a distilled water system.
- 11.35 Review the latest technology used in water treatment processes.

Number:	S00032.12
Title:	<b>Water Pipe Sizing</b>
Duration:	Total hours: 9
	Theory: 9
	Practical: 0
Prerequisites:	S00022, S00024, S00027, S00029
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to size water distribution systems based on the Ontario Building Code.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 12.1 Define the terms, “friction loss”, “velocity”, “derated pressure” and “water supply fixture unit”.
- 12.2 Determine optimum flow velocity in a water distribution system.
- 12.3 Identify how the four terms affect pipe size.
- 12.4 Calculate the pipe sizes based on velocity and demand.
- 12.5 Identify the tables used to size the potable water service and water distribution system.
- 12.6 Explain how to use the tables to size the potable water service and water distribution system.
- 12.7 Explain how to determine the supply pressure to a building.
- 12.8 Determine the total water supply fixture units for a given installation.
- 12.9 Determine the developed length of the distribution main for a given installation.
- 12.10 Determine the incoming water supply pressure.
- 12.11 Determine the total height of the water supply system.
- 12.12 Using the above information and the appropriate tables, size the branch lines and distribution main for both the domestic hot and cold water piping systems using:
  - Simplified method
  - Small commercial building method
  - Average pressure loss method

Number:	S00032.13					
Title:	Thermal Expansion and Contraction					
Duration:	Total hours:	3				
	Theory:	3				
	Practical:	0				
Prerequisites:	S00024, S00029					
Co-requisites:	S00032, S00033, S00034					
Cross Reference to Training Standards: U5458 U5459 U5461 U5463 U5464 U5465						

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to define, calculate, control the effects and incorporate methods to control thermal expansion.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 13.1 Define the following terms: “linear expansion”, “superficial expansion”, and “volumetric expansion”.
- 13.2 State the term used to describe the expansion of a given material.
- 13.3 Describe how most piping materials will expand or contract when heated or cooled.
- 13.4 Describe how fluids will expand or contract when heated or cooled.
- 13.5 State the coefficient of expansion for various piping materials including but not limited to:
  - copper
  - steel
  - cast iron
  - ABS
  - PVC
- 13.6 Identify the rate of expansion for a material over a given temperature change.
- 13.7 Calculate the increase in length of a material over a given temperature change using imperial and metric units.
- 13.8 Explain the effects on a piping system when provisions for linear expansion have not been taken.
- 13.9 Identify and explain the provisions that are taken when necessary to prevent, reduce and/or control the effects of linear expansion on a piping system installation.

Number:	S00032.14	
Title:	Commercial Hot Water Tanks	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022, S00025, S00027, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain commercial hot water tank installations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 14.1 Define the term, “commercial hot water tank”.
- 14.2 State the purpose of a commercial hot water tank installation.
- 14.3 Describe the different types of hot water storage systems.
- 14.4 Identify the regulatory agencies for certification and installation methods of commercial hot water tanks.
- 14.5 Explain the safety requirements for the different types of installation.
- 14.6 Explain why some storage tanks are elevated above their heating units.
- 14.7 Identify the preferred hot water and cold-water connection points to storage tanks and commercial hot water tanks.
- 14.8 Define the terms, “series”, “parallel” and “reverse return”, applied to the installation of hot water tanks.
- 14.9 Describe the operation of a “series”, “parallel” and “reverse return” hot water tank installation and the difference in their installation and operation.
- 14.10 Define the terms, “tempering valve” and “booster tank”, applied to commercial hot water tank installations and identify the type of installation that may use them in its hot water distribution system installation.
- 14.11 Explain the operation of a tempering/mixing valve and booster tank on a two-temperature hot water storage system.
- 14.12 Complete the drawing of single line elevation drawings of tank installations including: series, parallel and reverse return commercial hot water, tempering valve and booster tank installations featuring all required check, shut off, control, temperature and pressure relief and drain valves.

Number:	S00032.15	
Title:	Indirect Heaters	
Duration:	Total hours:	5
	Theory:	5
	Practical:	0
Prerequisites:	S00022, S00025, S00027, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain indirect heaters installations and operations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 15.1 Explain the term, “indirect”, applied to domestic hot water systems.
- 15.2 Explain the characteristics of a separate domestic water-heating boiler.
- 15.3 Explain the term, “combination hot water heating system”.
- 15.4 Explain the operation of a domestic combination hot water heating system.
- 15.5 Describe the installation and operation of a separate domestic water-heating boiler.
- 15.6 Describe the installation and operation of a combination hot water heating system.
- 15.7 Identify the controls required for the operation of convection and pump circulated domestic hot water heating boilers including but not limited to:
  - aquastats
  - high limit controls
  - flow switches

- 15.8 Define the trade term, “heat exchanger”.
- 15.9 Describe the installation and operation of a:
- heat exchanger
  - boiler immersion heat exchanger
  - tank immersion heat exchanger
  - separate immersion heat exchanger
- 15.10 Define the term, “converter”.
- 15.11 Define the term, “convector”.
- 15.12 Describe the installation and operation of a converter
- boiler immersion converter
  - separate converter
  - tank immersion converter
- 15.13 State some other common uses for heat exchangers and converters.
- 15.14 Draw a single line elevation drawing of a boiler immersion heat exchanger installation illustrating the boiler, storage tank, piping, valves, pump, pump by- pass, control wiring.
- 15.15 Draw a single line elevation drawing of a boiler immersion converter installation illustrating the boiler, storage tank, piping, valves, pump, pump by-pass, control basic wiring.
- 15.16 Draw a single line elevation drawing of a separate heat exchanger installation illustrating the boiler, storage tank, piping, valves, pump, pump by-pass, control wiring.
- 15.17 Draw a single line elevation drawing of a separate converter installation illustrating the boiler, storage tank, piping, valves, pump, pump by-pass, control wiring.
- 15.18 Draw a single line elevation drawing of a tank immersion heat exchanger installation illustrating the boiler, storage tank, piping, valves, pump, pump by- pass, control wiring.
- 15.19 Draw a single line elevation drawing of a tank immersion converter installation illustrating the boiler, storage tank, piping, valves, pump, pump by-pass, control wiring.

Number:	S00032.16	
Title:	Domestic Hot Water Circulation Lines and Pumps	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022, S00024, S00025, S00027, S00029, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain domestic hot water circulation systems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 16.1 Define the trade terms, “hot water circulation piping” and “hot water circulation pumps”.
- 16.2 Describe the purpose of a domestic hot water circulation system.
- 16.3 Describe the type of installations that may have a hot water circulation system installed.
- 16.4 Explain the principle of operation of a domestic hot water circulation system.
- 16.5 Describe the characteristics of domestic hot water circulation pumps including:
  - materials used for the impeller and impeller body construction
  - pressure ratings
  - control methods
- 16.6 Explain the purpose of a by-pass installed with a domestic hot water circulation pump.
- 16.7 Calculate the size of a circulating line.
- 16.8 Calculate the size of the circulating pump.
- 16.9 Describe the installation requirements of a by-pass installed with a domestic hot water circulation pump.
- 16.10 Identify the types and purpose of valves installed in a domestic hot water circulation system.
- 16.11 State the installation location of valves in a domestic hot water circulation system.
- 16.12 Draw a single line elevation drawing of a domestic hot water circulation pump and the by-pass installation.
- 16.13 Draw a single line elevation drawing of a domestic hot water circulation system of the convection circulated, pump assisted and pump operated type.



Number:	S00032.17
Title:	Pressure Reducing Valves
Duration:	Total hours: 1
	Theory: 1
	Practical: 0
Prerequisites:	S00022, S00025, S00027, S00030
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain pressure reducing valves and pressure reducing valve installations.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 17.1 Define the term, “pressure-reducing valve”.
- 17.2 Define the following terms used in PRV installations, including:
  - “no-flow pressure”
  - “reduced pressure fall off”
  - “reduced flow pressure”
  - “series P.R.V. installations”
  - “parallel P.R.V. installations”
- 17.3 Describe the operating principle of a PRV.
- 17.4 Explain how to adjust a PRV to increase and decrease the downstream pressure.
- 17.5 Define the term, “pilot operated PRV”.
- 17.6 Explain the difference between a pilot-operated P.R.V. and a standard PRV.
- 17.7 List the common uses for a PRV in a water distribution system installation.
- 17.8 Explain why a strainer assembly should be installed upstream of a PRV, and why a pressure relief valve must be installed downstream, or on the house side of a PRV when the PRV is installed to supply water to a hot water heating device.
- 17.8 Describe and explain the purpose of a series and a parallel PRV installation, the latter with PRV set at different operating pressures.
- 17.9 Draw a single line elevation drawing illustrating a series and a parallel PRV installation including all required valves, strainers and piping required.

Number:	S00032.18	
Title:	Water Supplies to High Rise Buildings	
Duration:	Total hours:	6
	Theory:	6
	Practical:	0
Prerequisites:	S00022, S00025, S00027, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain water supply systems to high-rise buildings.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 18.1 Define the term, “pressure booster system”.
- 18.2 Discuss the terms, “low-rise” and “high-rise”.
- 18.3 Identify the factors that determine if a booster system installation is required.
- 18.4 Identify and explain the operation of the common high rise distribution systems operating with, or without pressure booster pumps including:
  - up-feed systems
  - down-feed systems
  - combination up feed down-feed systems
  - mains pressure up feed, booster pump down-feed system
  - PRV down-feed system
  - combination up-feed down-feed PRV system

- 18.5 Describe the characteristics of domestic pressure booster pumps including:
- materials used for the impeller and impeller body construction
  - pressure ratings
- 18.6 Explain the purpose of and describe the installation requirements of a by-pass installed with a domestic pressure booster pump.
- 18.7 Identify and explain the operation of the common domestic pressure booster pump installations including:
- continuous running
  - continuous running with a pressure relief valve
  - continuous running with intermittent running booster pump
  - dual alternating
  - dual alternating with hydro-pneumatic pressure tank
- 18.8 Draw a single line elevation drawing illustrating:
- up-feed booster systems
  - down-feed booster systems
  - combination up feed down-feed booster system
  - mains pressure up feed, booster pump down-feed system
  - P.R.V. down-feed system
  - combination up-feed down-feed system, PRV booster system
- 18.9 Draw a single line elevation drawing including the booster pump, pump controls, bypasses and control valves illustrating:
- continuous running booster pump
  - continuous running booster pump installation with a pressure relief valve
  - continuous running booster pump with intermittent running booster pump
  - dual alternating booster pumps
  - dual alternating booster pumps with a hydro-pneumatic pressure tank

Number:	S00032.19
Title:	<b>Cross Connections and Backflow Prevention</b>
Duration:	Total hours: 8
	Theory: 6
	Practical: 2
Prerequisites:	S00021, S00022, S00024, S00027, S00029, S00030
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465

### **General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain cross connections and apply necessary backflow prevention.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

#### 19.1 Define the following terms:

- “backflow preventer”
- “cross connection”
- “backflow”
- “back siphonage backflow”
- “back-pressure backflow”
- “pollutant”
- “critical level”
- “contaminant”
- “minor hazard”
- “moderate hazard”
- “severe hazard”
- “individual isolation”
- “area or zone isolation”
- “premise isolation”

#### 19.2 Identify different ways to control backflow conditions, including but not limited to:

- barometric loops
- air gaps
- hose connection vacuum breakers
- laboratory faucet vacuum breakers
- atmospheric vacuum breakers
- pressure vacuum breakers
- spill resistant vacuum breakers
- dual check with intermediate port (vending machine backflow preventer)
- dual check with atmospheric port
- double check valve assembly
- reduced pressure assembly

- 19.3 Explain how to select a backflow prevention device.
- 19.4 Identify the type of building that requires premise isolation.
- 19.5 List cross-connections that constitute a minor hazard.
- 19.6 List cross-connections that constitute a moderate hazard.
- 19.7 List cross-connections that constitute a severe hazard.
- 19.8 Identify the minimum height of an air gap.
- 19.9 Explain the concern in the installation of air gaps in areas with toxic or hazardous atmospheres.
- 19.10 Describe the installation requirements for atmospheric vacuum breakers including the height above the critical level the device must be installed.
- 19.11 Describe the installation requirements for pressure vacuum breakers including the height above the critical level the device must be installed.
- 19.12 Explain why shut off valves must be supplied with all testable backflow prevention devices.
- 19.13 Identify and list the backflow preventers that cannot be operated under continuous pressure.
- 19.14 Identify and list the backflow prevention devices that may be used to isolate minor hazards only.
- 19.15 Identify and list the backflow prevention devices that may be used to isolate minor and moderate hazards.
- 19.16 Identify and list the backflow prevention devices that may be used to isolate minor, moderate and severe hazards.
- 19.17 Identify and list the backflow prevention devices that may be used to protect against back-siphonage backflow conditions only.
- 19.18 Identify and list the backflow prevention devices that may be used to protect against both back-siphonage and backpressure backflow conditions.
- 19.19 Explain the installation recommendations for backflow prevention devices.
- 19.20 Identify when backflow prevention devices must be tested.
- 19.21 Identify who may test backflow prevention devices in Ontario.

Number:	S00032.20	
Title:	Water Hammer	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022, S00027	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain and control the effects of a water hammer condition on a water distribution system.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 20.1 Define the term, “water hammer”, and state its primary cause.
- 20.2 Explain what happens in a water distribution system when water hammer occurs.
- 20.3 Explain how much pressure may be created in the water distribution piping when water hammer occurs.
- 20.4 Describe the relationship between system pressure and flow velocities and the resulting water hammer pressures and calculate the pressure created given the initial flow velocity and system pressure.
- 20.5 Identify types of valves that may cause a water hammer condition.
- 20.6 Explain why water hammer will eventually stop and describe its effects on a system.
- 20.7 Explain how an air chamber controls the effects of water hammer and its disadvantage.
- 20.8 Describe how to re-charge an air chamber.
- 20.9 Identify common types of water hammer arresters, explain their operating principles, how they are rated and explain how to select an arrester for a given installation.
- 20.10 Explain the selection and sizing of water hammer arresters to PDI standards.
- 20.11 Draw a number of single line elevation drawings sizing and installing water hammer arresters on the water distribution piping as required.

Number:	S00032.21	
Title:	Standpipe Systems	
Duration:	Total hours:	1
	Theory:	1
	Practical:	0
Prerequisites:	S00022, S00024, S00027, S00029	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain standpipe system installations.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 21.1 Define the term, “standpipe and hose system”.
- 21.2 Explain the effectiveness of standpipe and hose systems when compared to other types of fire protection systems.
- 21.3 List the three classes of service for standpipe and hose systems.
- 21.4 Describe the design and operation of the four basic types of standpipe and hose systems.
- 21.5 Describe a “combined system”.
- 21.6 Specify the minimum water supply for a combined system for a light-hazard high- rise building protected by sprinklers.
- 21.7 Describe and list the requirements pertaining to a fire department connection.
- 21.8 Specify the type of valves installed on the connections to each water supply and to be installed on risers that utilize a common water supply.
- 21.9 Describe the purpose, location and installation of indicator post valves.
- 21.10 Describe the recommended procedure to be followed when a system is to be out of service.
- 21.11 State the requirements pertaining to standpipe installations in buildings under construction.
- 21.12 State the requirements pertaining to the installation of fire department connections in a building under construction.
- 21.12 Identify the location of hose valves in buildings under construction.
- 21.13 Identify the location of the uppermost hose connection during construction and the requirements pertaining to this condition.
- 21.14 State the length of time a temporary standpipe must remain in service.
- 21.15 Identify the location of signs indicating the fire department connection.

Number:	S00032.22	
Title:	Sprinkler Systems	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022, S00027	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain the installation of sprinkler systems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 22.1 State the purpose of a sprinkler system.
- 22.2 Identify and describe the types of sprinkler systems.
- 22.3 Explain the operation of and why a “jockey / booster” pump is installed in a sprinkler system.
- 22.4 Describe the functions, possible hazards and applications of fire protection systems such as:
  - Anti-freeze
  - Foam
  - Halon
  - Carbon dioxide
- 22.5 Identify the different types of sprinkler heads.
- 22.6 Describe the function of a fusible link and frangible sprinkler head.
- 22.7 State the minimum pipe size installed for a standard sprinkler head.
- 22.8 State what must be done when a sprinkler head has discharged.
- 22.9 List the types of hazard areas.
- 22.10 State the number of square feet a sprinkler head will cover in each type of hazard area.
- 22.11 Define the term, “supervisory valve”.
- 22.12 Describe the function of a flow indicator in a sprinkler system installation.
- 22.13 Explain the meaning of “UL Approved” in conjunction with a residential sprinkler system installation.
- 22.14 Identify which NFPA standard is used for the installation of residential sprinkler systems.
- 22.15 State the minimum installation requirements for residential sprinkler systems.



## Codes

Number:	S00032.23	
Title:	National Plumbing Code	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022, S00027	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5462, U5463, U5464, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain the use of the National Plumbing Code.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 23.1 Describe the purpose of the National Plumbing Code.
- 23.2 State the Provinces not under the jurisdiction of the National Plumbing Code.
- 23.3 Identify the examination based upon the National Plumbing Code.
- 23.4 Identify different locations where the National Plumbing Code may be available for study purposes.
- 23.5 State the differences between the Ontario Building Code and the National Plumbing Code.

## Storm Drainage Systems

Number:	S00032.24		
Title:	Open Flow and Metered Flow Roof Drain Systems		
Duration:	Total hours:	4	
	Theory:	4	
	Practical:	0	
Prerequisites:	S00022, S00024, S00025, S00027, S00029, S00030		
Co-requisites:	S00032, S00033, S00034		
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5463, U5465, U5466			

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify and explain roof drain, roof drain connections, conventional flow roof and metered flow roof drain systems and size the different piping systems.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 24.1 Define the terms, “roof drain” and “rain water leader”.
- 24.2 Explain why allowances for expansion and contraction must be allowed for when installing roof drains and rainwater leaders, and the consequences of non- allowance.
- 24.3 Explain how allowances are made in the storm drainage piping for expansion and contraction.
- 24.4 Describe the operation of a conventional flow roof drainage system.
- 24.5 Identify and apply all available rainfall tables.
- 24.6 State the recommended procedure for the location and spacing of roof drains.
- 24.7 Size a conventional and metered flow storm drainage system for a building.
- 24.8 Define the trade term, “metered flow roof drainage”, and explain the purpose of installing this system, identifying the types of fittings installed in the roof drains.
- 24.9 Explain the purpose of fittings installed in the roof drains of a metered flow roof drain system.
- 24.10 Describe the operation of a metered flow roof drainage system.
- 24.11 State the recommended procedure for the location and spacing of roof drains.

## Sewage Disposal Systems

Number:	S00032.25	
Title:	Private Sewage Disposal Systems	
Duration:	Total hours:	4
	Theory:	4
	Practical:	0
Prerequisites:	S00021, S00022, S00025, S00027, S00029	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5463, U5465, U5466	

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the installation and operation of a private sewage disposal system.

### Learning Outcomes

Upon successful completion the apprentice is able to:

- 25.1 Describe the purpose of a private sewage disposal system.
- 25.2 Identify who is responsible for the administration and regulation of private sewage disposal systems.
- 25.3 List different types of private sewage systems.
- 25.4 Identify and list the information required for a private sewage disposal system installation.
- 25.5 Explain where septic tanks systems are installed.
- 25.6 State the operating principle of a septic tank system.
- 25.7 Specify the acceptable minimum distances between a septic tank and:
  - a building
  - a property line
  - any source of water
- 25.8 Identify the type of bacteria that is necessary in a septic tank system.
- 25.9 State the materials used in the manufacture of septic tanks.
- 25.10 Identify the amount of ground cover required on top of a septic tank to prevent freezing.

- 25.11 Specify the minimum capacity of a septic tank for a given installation.
- 25.12 Describe the difference between the inlet and the outlet of a septic tank.
- 25.13 Explain the reasons for having two compartments in a septic tank.
- 25.14 Explain the reason for installing a siphon chamber and a pump chamber in a septic tank system.
- 25.15 Explain where storm water should be discharged when a septic tank is installed.
- 25.16 State if any plumbing fixtures are exempted from being connected to a septic tank.
- 25.17 Explain when a septic tank should be pumped.
- 25.18 State the purpose and location of a distribution box in a leaching bed system.
- 25.19 Define the term, “leaching bed”.
- 25.20 Explain the purpose of a leaching bed.
- 25.21 Identify the types of leaching beds.
- 25.22 Explain the construction of a leaching bed.
- 25.23 Describe what takes place in the leaching bed when it receives effluent from a septic tank.
- 25.24 Identify the factors to be considered when locating a leaching bed.
- 25.25 Specify the location of a leaching bed in relation to:
  - wells
  - buildings
  - property lines
  - lakes
  - rivers
  - streams
  - water courses
  - ponds
  - springs
  - reservoirs
- 25.26 State the materials that may be used for leaching bed piping.

- 25.27 Specify the minimum height a leaching bed must be installed above a rock or a rock formation.
- 25.28 Specify the maximum allowable length of a lateral installed in a leaching bed system.
- 25.29 Specify the minimum and maximum grade of a lateral installed in a leaching bed system.
- 25.30 State how the piping is installed in a leaching bed system.
- 25.31 State the type of materials that should be installed as a cover over the leaching bed piping.
- 25.32 Explain the purpose of covering the leaching bed piping.
- 25.33 State the minimum allowable distance between each leaching bed trench.
- 25.34 Specify the minimum height of invert of a leaching bed above the highest maximum water table.
- 25.35 Explain the purpose, size, location, and acceptable materials for a header.
- 25.36 Describe how a header shall be installed when used on a leaching bed system.
- 25.37 Explain the purpose of a raised bed filter media installation.
- 25.38 Specify the types of materials used in the installation of a raised bed installation.
- 25.39 Identify how the bed dimensions are determined.
- 25.40 Identify the equipment required to lift the effluent into a raised bed.
- 25.41 Describe the test used to determine water absorption into the soil.
- 25.42 State the factors used in a percolation test.
- 25.43 Describe the standard procedures for a percolation test.
- 25.44 Identify the items necessary to calculate the required length of a leaching bed.
- 25.45 Calculate the required size of a leaching bed for two examples using the leaching bed sizing table.

Number:	S00032.26	
Title:	Municipal Sewage Disposal Systems	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00022, S00025, S00027, S00030	
Co-requisites:	S00032, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5463, U5465, U5466		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the operation of a municipal sewage disposal system.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 26.1 Define the following terms and abbreviations, including but not limited to:
  - “BOD”
  - “sewage”
  - “biodegradable”
  - “PPM”
  - “activated sludge”
  - “bacteria”
  - “flocculation”
  - “mixed liquor”
- 26.2 Identify the purpose of mechanical screening.
- 26.3 Identify and explain the purpose and principle of operation of:
  - grit removal
  - primary settling
  - aeration tanks
  - secondary settling
  - digesters
  - vacuum filtration
  - chlorination
  - sedimentation ponds
- 26.4 Review the latest technology used in municipal sewage disposal systems.
- 26.5 Complete a flow chart indicating the steps involved in sewage treatment for a typical sewage treatment plant.
- 26.6 Complete a flow chart indicating the steps involved in sewage treatment for a typical sewage treatment plant.

## Piping Systems

Number:	S00032.27	
Title:	Hydronic Systems	
Duration:	Total hours:	18
	Theory:	16
	Practical:	2
Prerequisites:	S00021, S00022, S00024, S00025, S00027, S00029, S00030,	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465		

### General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the principle of operation of hydronic heating systems.

### Learning Outcomes

Upon successful completion the apprentice is able to:

27.1 Define the terms, “hydronic heating”, “hydronic cooling” and describe their purposes.

27.2 Describe the benefits of hydronic systems over forced air systems.

27.3 Identify applicable codes and standards that relate to hydronic systems.

27.4 Describe terms regarding hydronic systems, including but not limited to:

- Open/closed system
- Heat transfer fluid
- Emitter/heat transfer unit
- Limit
- Boiler trim
- DHW priority
- BTU metering
- Delta T
- Zone
- Staple up panel systems
- Sleeper panel systems
- “Wet”/”dry” panel systems
- High mass/low mass panel systems
- Snow and ice melt systems
- (HWS) hot water supply piping/(HWR) hot water return piping.
- (CHS) chilled water supply piping/(CHR) chilled water return piping
- (CS) condenser water supply piping/(CR) condenser water return piping
- Condensate systems

- 27.5 Identify the types of pipe and joining methods used for transmission piping in hydronic systems.
- 27.6 Describe the procedure used to determine hydronic equipment requirements.
- 27.7 Explain the operating characteristics of various steam and water boilers.
- 27.8 Identify conventional sources of BTUs used for heat sources for:
- Natural gas
  - Propane
  - Fuel oil
- 27.9 Explain how conventional heat source efficiencies may be rated.
- 27.10 Identify the safety devices used in hydronic systems.
- 27.11 Identify mixing strategies/methods for temperature control in hydronic systems such as, but not limited to:
- Two temperature systems
  - Boiler protection
- 27.12 Identify the minimum temperature requirements for the heat transfer fluid returning to a conventional boiler in contrast to a condensing boiler.
- 27.13 Identify various methods of piping multiple boilers.
- 27.14 Explain boiler redundancy and boiler staging and boiler turn down ratio.
- 27.15 Define the term 'boiler bypass' and explain the purpose of this near boiler piping arrangement.
- 27.16 Define the term 'system bypass' and explain the purpose of this near boiler piping arrangement.
- 27.17 Explain the general operating characteristics of alternate heat sources, including but not limited to:
- Heat pumps (ground source/water source)
  - Solar thermal
  - Biomass (wood/wood-fired/pellet-fired boilers)
- 27.18 Explain how a heat pump's efficiency may be rated.
- 27.19 Explain the function of a reversing valve in a heat pump.



- 27.20 Explain the operating characteristics of hydronic cooling system components.
- 27.21 Explain the operation of various methods of zone control.
- 27.22 Discuss low voltage wiring for hydronic system controls.
- 27.23 Explain the operation of various heat transfer units.
- 27.24 Identify auxiliary loads to a hydronic system, including but not limited to:
- Snow melting
  - Pool heating
  - DHW
- 27.25 Explain the operation of hydronic system components.
- 27.26 Identify the differences and explain the operation of various devices, including but not limited to:
- Open expansion tank
  - Air cushion tank
  - Bladder tank
  - Diaphragm tank
- 27.27 Explain the importance of an appropriate precharge to the air-side of a bladder or diaphragm device.
- 27.28 Explain the meaning of 'the point of no pressure change'.
- 27.29 Explain the relation between pipe diameter, flow rate and velocity.
- 27.30 Describe the steps involved in determining the pipe sizes required for a hydronic system.
- 27.31 Explain how velocity is related to turbulence, friction and pressure drop in a hydronic system.
- 27.32 Explain the importance of air removal devices, their location and the proper sizing of the piping in a hydronic system.
- 27.33 Identify where grading may have been required in a hydronic system.
- 27.34 Identify dirt separating devices, their purpose(s), and the importance of their maintenance.
- 27.35 Explain hydraulic separation, various strategies and the uses within a hydronic system.
- 27.36 Explain where a domestic cold water make-up should be connected to a hydronic system loop and how to properly assemble all components.

- 27.37 Identify why a minimum pressure must be maintained at the highest point in a hydronic system.
- 27.38 Explain when glycol is necessary in a hydronic system and discuss design factors which must be considered when sizing a glycol system.
- 27.39 Identify the various types of circulators and related technology utilized in hydronic systems.
- 27.40 Explain how cavitation of circulators in a hydronic system may occur and the importance of pumping away from the expansion device.
- 27.41 Explain the differences between safeties and controls.
- 27.42 Identify and explain various terms with regards to radiant panel installations.
- 27.43 Identify the purpose of an outdoor reset controller.
- 27.44 Explain the purpose(s) of BTU metering.
- 27.45 Illustrate various hydronic installations by means of a single line drawing,
- including but not limited to:
  - Heat source(s) and associated piping arrangements (including trim)
  - Various systems and components
  - Control wiring
- 27.46 Explain the principle of operation and the installation procedures and requirements of a radiant floor heating loop.
- 27.47 Identify how the mass of an in-floor panel affects operation with regards to recovery and response.
- 27.48 Explain how the spacing of the piping in a radiant panel will affect the amount of heat delivered over a given surface area.
- 27.49 Discuss the various temperatures of the water throughout hydronic systems.

Number:	S00032.28	
Title:	Hydronic System Calculations	
Duration:	Total hours:	10
	Theory:	10
	Practical:	0
Prerequisites:	S00022, S00024, S00025, S00027, S00029	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5458, U5459, U5461, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to calculate heat loss and pump sizes for hydronic systems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

**28.1 Define the terms:**

- heat loss
- heat gain
- building envelope
- Delta –T

**28.2 Define the following factors that affect heat loss and heat gain including but not limited to:**

- air change factor
- air infiltration/exfiltration
- ventilation
- outdoor design temperature
- indoor design temperature
- R-value
- U-factor
- mean soil temperature

**28.3 Calculate heat loss for the following:**

- slab on grade
- walls below grade
- walls above grade
- windows
- doors
- ceilings
- ice melt

- 28.4 Calculate the size of pressure vessels.
- 28.5 Perform a heat loss calculation, given a set of residential construction drawings.
- 28.6 Calculate the flow rate for:
- pumps
  - pipe sizes (and include friction loss)
  - expansion tanks
  - operating pressures
- 28.7 Identify and calculate operating temperatures for:
- heat source differential
  - supply and return differential
  - set points
- 28.8 Calculate mixed temperatures given combined source flow rates.

Number:	S00032.29	
Title:	Natural Gas Piping Systems	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00021, S00022, S00024, S00027, S00029	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards:	U5457, U458, U5459, U5460, U5461, U5463, U5464, U5465	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the principle of operation of natural gas piping systems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 29.1 Describe the chemical composition of propane and natural gas, and explain how natural gas is delivered.
- 29.2 State the pressures from the meter to the consumer's equipment, and describe the two purposes of a gas meter.
- 29.3 Define the abbreviations "CFH", "BTU", "MBTUH" and "THERM".
- 29.4 Identify the regulation that governs the installation of natural gas piping.
- 29.5 Identify and list the approved and prohibited piping materials and joining methods for gas piping use.
- 29.6 Identify and list prohibited installation locations for gas piping.
- 29.7 Describe how natural gas piping is connected to gas-fired equipment.
- 29.8 State the gas installer's responsibilities in the installation of gas equipment.
- 29.9 Explain the different certification steps for gas-fitting licences.
- 29.10 Define and explain the following gas terms:
  - "low pressure"
  - "high pressure"
  - "pressure loss"
  - "manifold pressure"
  - "water column" (wc)
- 29.11 Convert inches of water column to ounces per square inch pressure.
- 29.12 Explain how a manometer is used to measure gas pressure.
- 29.13 Explain the procedure used to test for and locate a leak in a gas piping installation.
- 29.14 State the required test requirements for a variety of gas pipe installations.
- 29.15 Describe how to purge a gas pipe system.
- 29.16 Explain when, where, and how gas-piping is installed.

Number:	S00032.30	
Title:	Medical Gas Piping Systems	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00021, S00022, S00027	
Co-requisites:	S00032, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the basic installation requirements for a medical gas piping system.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 30.1 Define the term, “medical gas piping system”.
- 30.2 Identify the type of buildings where medical gas piping is usually installed.
- 30.3 Identify the different types of medical gas piping systems.
- 30.4 Identify the test procedures used in medical gas piping systems:
  - purity
  - pressure
  - cross-connection
- 30.5 State the types of gases transported by medical gas piping systems.
- 30.6 Identify the standard used to regulate the installation of medical gas piping systems.
- 30.7 State the qualifications and certification required for the installation of medical gas piping systems.
- 30.8 Identify and list the type of piping materials, pipe fittings, and valves that may be installed in a medical gas piping system.
- 30.9 State the types of joining methods that may be used in a medical gas piping system.
- 30.10 State the support requirements for medical gas piping systems.
- 30.11 Describe the valve tagging and identification requirements for medical gas piping systems.
- 30.12 Explain any special procedures that must be taken when joining pipe and fittings together in medical gas piping systems.
- 30.13 Identify potential cross-connection hazards in medical gas piping systems.

Number:	S00032.31	
Title:	Industrial Process Piping Systems	
Duration:	Total hours:	3
	Theory:	3
	Practical:	0
Prerequisites:	S00021, S00022, S00027	
Co-requisites:	S00032, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to recognize, identify, and explain the general installation requirements for a selection of industrial process piping systems.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 31.1 Define a “process piping system”, and state its purpose.
- 31.2 Describe the difference between a process piping system and a plumbing system.
- 31.3 Identify industries where process-piping systems are installed.
- 31.4 Identify some common process piping systems, including:
  - compressed air
  - chemical supply piping
  - high purity water supply piping
  - food process piping
  - irrigation piping
  - brewery piping
  - oil refineries

- 31.5 Identify different acts, regulations, and specifications used to estimate, plan, install, inspect, and commission a variety of process piping systems.
- 31.6 Identify the authorities having jurisdiction for process piping systems, including:
- owners
  - owner representatives
  - engineers
  - health inspectors
  - municipal inspectors
  - pressure vessel inspectors
  - underwriters
- 31.7 Research, document, and report on a process piping system, including details such as:
- type
  - purpose
  - enforcing authority
  - any special training, certificates, or licenses required for installation
  - types of pipe, valves, fittings, and joining methods that may be used
  - support, testing, and commissioning requirements
  - specification, code, or act used



Number:	S00033.0
Title:	<b>PROCESS PIPING SYSTEMS</b>
Duration:	48 Total Hours
	Theory: 0                      Practical: 48
Prerequisites:	S00021, S00022, S00023, S00024, S00025, S00027, S00028, S00029, S00030
Co-requisites:	S00032, S00033, S00034

**Evaluation Structure**

Theory Testing	10%
Application Exercises	80%
Final Assessment	10%

Number:	S00033.1
Title:	<b>Perform Various Service, Maintenance, Repair, and Fabrication Assignments</b>
Duration:	48 Total Hours
	Theory: 0                      Practical: 48
Prerequisites:	S00021, S00022, S00023, S00024, S00025, S00027, S00028, S00029, S00030
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to perform various service, maintenance, repair, and fabrication assignments suited to particular geographical locations.

**Learning Outcomes**

Upon successful completion the apprentice is able to perform a minimum of four of the following assignments:

- 1.1 Troubleshoot, shutdown, dismantle, rebuild, reassemble, and reactivate a variety of water closet and urinal flushometers.
- 1.2 Troubleshoot, shutdown, dismantle, rebuild, reassemble, reactivate, and set up a variety of electronic lavatory faucets, as well as water closet and urinal flushometers.
- 1.3 Perform a series of tests to determine if a domestic electric hot water is performing correctly.

- 1.4 Troubleshoot, shutdown, remove, disassemble, rebuild, reinstall, and set-up a simplex and/or duplex storm/sewage pump installation.
- 1.5 Balance a section of hot water circulation piping by identifying and adjusting balancing valves to a given flow.
- 1.6 Troubleshoot, shutdown, remove, disassemble, rebuild, reinstall, and set up a water pump installation.
- 1.7 Troubleshoot, shutdown, disconnect, remove, re-install, connect, and set up a domestic hot water circulation pump and water conditioning equipment.
- 1.8 Test a number of backflow prevention devices.
- 1.9 Layout and set a roof drain.
- 1.10 Pipe in a combination boiler/domestic hot water tank (combo unit).
- 1.11 Pipe in a domestic hot water boiler.
- 1.12 Pipe in a packaged domestic heating boiler.
- 1.13 Design and fabricate a pipe bending assembly.
- 1.14 Design and fabricate a tee-drilled header assembly.
- 1.15 Design and fabricate a plastic mitre-cut welded fitting.
- 1.16 Design and fabricate a stainless steel assembly.

Number:	S00034.0
Title:	<b>Trade Documentation – Level 3</b>
Duration:	48 Total Hours
	Theory: 36                      Practical: 12
Prerequisites:	S00021, S00022, S00024, S00025, S00027, S00029, S00030
Co-requisites:	S00032, S00033, S00034
<b>Evaluation Structure</b>	
Theory Testing	10%
Application Exercises	80%
Final Assessment	10%

Number:	S00034.1
Title:	<b>Identify, Read, and Interpret Plumbing and Hydronic Piping Drawings</b>
Duration:	Total hours: 9
	Theory: 9
	Practical: 0
Prerequisites:	S00024, S00029
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to identify, read, and interpret plumbing and hydronic piping drawings.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 1.1 Define a “plumbing drawing” and a “hydronic piping drawing”.
- 1.2 Explain the purpose of a plumbing drawing.
- 1.3 Explain the purpose of a hydronic piping drawing.
- 1.4 List the components that may be shown on a plumbing drawing.
- 1.5 List the components that may be shown on a hydronic piping drawing.
- 1.6 Define an “interference drawing”.
- 1.7 Identify the drawings that must be read and interpreted to produce an interference drawing.
- 1.8 List the components that may be shown on an interference drawing.
- 1.9 Define a “spool drawing”.
- 1.10 Identify the drawings that must be read and interpreted to produce a spool drawing.
- 1.11 Define “CAD” and “BIM”.
- 1.12 Identify how CAD or BIM drawings are used in the plumbing industry and the advantages of their use.

Number:	S00034.2	
Title:	Read and Interpret Job Specifications for Industrial, Commercial, and Institutional (ICI) Sector	
Duration:	Total hours:	9
	Theory:	9
	Practical:	0
Prerequisites:	S00021, S00022, S00025, S00027, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5457, U5458, U5459, U5460, U5461, U5463, U5464		

Upon successful completion the apprentice is able to demonstrate the ability to read and interpret a job specification for the ICI sector.

### **Learning Outcomes**

Upon successful completion the apprentice is able to:

- 2.1 Define a “specification”.
- 2.2 Explain the purpose of a specification.
- 2.3 Identify the sections of a specification.
- 2.4 Explain the numbering system used in a construction specification.
- 2.5 Identify the number and section of the specification that relates to the plumbing system installation.
- 2.6 Identify the other sections of the specification that may relate to the section dealing with the plumbing system installation.
- 2.7 Identify the other sections of the specifications for which a plumber may be responsible.
- 2.8 Identify the key points included in the section of the specification relating to the installation of the plumbing system.
- 2.9 Interpret and apply information from job-site documents to ensure compliance and completion of tasks.

Number:	S00034.3	
Title:	Produce Various Plumbing Drawings	
Duration:	Total hours:	12
	Theory:	2
	Practical:	10
Prerequisites:	S00022, S00025, S00027, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to create a number of plumbing drawings of various complexities.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 3.1 Produce a number of isometric drawings that illustrate:
  - a section of a domestic water pipe system
  - a section of a residential DWV system
  - a section of a stack illustrating a multi-fixture wet vented group
  - a section of a horizontal branch illustrating a multi-fixture circuit vented group
  - a section of a domestic water pipe serving a multi-fixture washroom group
  - an elevator pit installation
  - an oil interceptor installation
  - a grease interceptor installation
  - an acid neutralizer installation
  - the DWV piping required for a commercial kitchen installation

Each drawing must:

  - be drawn to scale
  - include title block
  - include a legend
  - include a scale
  - be fully sized
  - be fully dimensioned
- 3.2 Produce an interference drawing.
- 3.3 Produce a spool drawing and an associated bill of materials.
- 3.4 Produce a valve chart from a given drawing.
- 3.5 Identify how to tag pipe and valves, and label pipe, valves, and equipment.
- 3.6 Define and produce a shop-drawing manual.

Number:	S00034.4	
Title:	Produce Hydronic Drawings	
Duration:	Total hours:	7
	Theory:	5
	Practical:	2
Prerequisites:	S00025, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards:	U5457, U5458, U5459, U5460, U5461, U5463, U5464	

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to create a number of hydronic drawings of various complexities.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

**4.1 Produce a number of isometric drawings that may illustrate:**

- water make-up
- multiple boiler setup
- pumps
- valves
- expansion tank
- air separator
- primary loop
- secondary loop
- controllers
- heat emitters
- heat panels
- perimeter heat
- fan coil units
- indirect heaters
- indoor/outdoor sensors
- fresh air intake
- breeching

Each drawing must:

- be drawn to scale
- include a title block
- include a legend
- include a scale
- be fully sized
- be fully dimensioned

**4.2 Produce a flow-schematic drawing.****4.3 Produce a spool drawing.****4.4 Define and produce a shop-drawing manual.**

Number:	S00034.5	
Title:	Bids and Contracts	
Duration:	Total hours:	9
	Theory:	9
	Practical:	0
Prerequisites:	S00024, S00025, S00029, S00030	
Co-requisites:	S00032, S00033, S00034	
Cross Reference to Training Standards: U5458, U5459, U5461, U5463, U5464, U5465		

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to read and interpret bids and contracts.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 5.1 Identify available estimating software.
- 5.2 Review bid documents to determine:
  - scope of work
  - responsibilities of contractor
  - scheduling
  - material types
  - terms of payment
  - liabilities
  - miscellaneous expenses
- 5.3 Define the following terms: “list price”, “net price”, “trade discount”, and “chain discount” or “compound discount”.
- 5.4 Calculate the net price of a trade-related item, given the list price and the discount.

- 5.5 Calculate the list price of a trade-related item, given the net price and the discount.
- 5.6 Calculate the discount of a trade-related item, given the net price and the list price.
- 5.7 Produce a material list to include the following components:
  - type of materials
  - quantity of materials
  - list price
  - net price
  - material mark up, overhead, and profit
- 5.8 Define the term, “labour estimate”.
- 5.9 Explain how a labour estimate may be made.
- 5.10 Identify the different labour estimators available.
- 5.11 Describe the use of a labour estimator.
- 5.12 Review and interpret contract types, including:
  - lump sum price
  - stipulated price
  - cost plus/time and material
  - turn key



Number:	S00034.6
Title:	<b>Simple and Compound Interest</b>
Duration:	Total hours: 2
	Theory: 2
	Practical: 0
Prerequisites:	S00024, S00029
Co-requisites:	S00032, S00033, S00034
Cross Reference to Training Standards:	U5458, U5459, U5461, U5463, U5464, U5465

**General Learning Outcomes**

Upon successful completion the apprentice is able to demonstrate the ability to solve trade-related problems involving simple and compound interest.

**Learning Outcomes**

Upon successful completion the apprentice is able to:

- 6.1 Define the terms, “simple interest” and “compound interest”.
- 6.2 Solve a number of trade-related problems involving both simple and compound interest.





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