PROGRAM PROGRAMME
EXCELLENCE
RED SEAL · SCEAU ROUGE

CURRICULUM OUTLINE

Plumber

2016

INTERPROVINCIAL STANDARD
CANADA
NORME INTERPROVINCIALE

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Employment and Social Development Canada
Emploi et Développement social Canada

Canada

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STRUCTURE OF THE CURRICULUM OUTLINE

To facilitate understanding of the occupation, this standard contains the following sections:

Description of the Plumber trade: an overview of the trade's duties, work environment, job requirements, similar occupations and career progression

Essential Skills Summary: an overview of how each of the 9 essential skills is applied in this trade

Trends in the Plumber trade: some of the trends identified by industry as being the most important for workers in this trade

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard

Elements of harmonization of apprenticeship training: includes number of levels of apprenticeship, total training hour and recommended apprenticeship levels

Sequencing of apprenticeship training topics and related subtasks: a chart which outlines the model for apprenticeship training sequencing and a cross-reference of the sub-tasks covered by each topic

Major Work Activity (MWA): the largest division within the standard that is comprised of a distinct set of trade activities

Task: distinct actions that describe the activities within a major work activity

Task Descriptor: a general description of the task

Sub-task: distinct actions that describe the activities within a task

Recommended apprenticeship level: as part of the interprovincial discussions on harmonization, this is the recommended level of apprenticeship technical training where this sub-task would be trained

Essential Skills: the most relevant essential skills for this sub-task

Knowledge:

Learning Outcomes: describes what should be learned relating to a sub-task while participating in technical or in-school training

Learning Objectives: topics to be covered during technical or in-school training in order to meet the learning outcomes for the sub-task

Range Variables: elements that provide a more in-depth description of a term used in the learning outcomes or learning objectives

Appendix A – Acronyms: a list of acronyms used in the standard with their full name

Appendix B – Tools and Equipment: a non-exhaustive list of tools and equipment used in this trade

Appendix C – Glossary: definitions or explanations of selected technical terms used in the standard

A complete version of the occupational standard, which provides additional detail for the trade activities, skills and knowledge can be found at www.red-seal.ca

DESCRIPTION OF THE PLUMBER TRADE

"Plumber" is this trade's official Red Seal occupational title approved by the CCDA. This standard covers tasks performed by plumbers whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Pipefitter – Plumber Specialty					■								
Plumber	■	■	■	■		■	■	■	■	■	■	■	■

Plumbers install, repair and maintain plumbing fixtures and systems such as water, hydronic, drain, waste and vent (DWV), low pressure steam, residential fire, chemical and irrigation. They also install specialized systems such as medical gas, process piping, compressed air, water conditioners, fuel piping, sewage and water treatment, and storage and flow equipment. Plumbers interpret drawings, refer to layouts of existing services, and review applicable codes and specifications to determine work details and procedures. They locate and mark positions for fixtures, pipe connections and sleeves, and cut openings to accommodate pipe and fittings.

Plumbers may be employed by plumbing/mechanical contractors, service companies, and maintenance departments of manufacturing, commercial, health care and educational facilities. They may also be self-employed. Plumbers install piping and equipment in residential, commercial, institutional and industrial buildings and sites.

Plumbers use a variety of tools and equipment such as hand and power tools, welding and soldering/brazing equipment, and hoisting and lifting equipment to perform the tasks in their trade. To perform some tasks or use some equipment, specific certification may be required. Plumbers work with a variety of piping materials such as copper, steel, plastic, glass, cast iron, cement, fibreglass and specialty materials. Before assembling and fitting pipe sections, tubing and fittings, the pipes must be measured, cut and bent as required. Joining pipe may be done by various means, such as threading, using mechanical joints, welding, soldering/brazing and using fastening materials and compounds. Plumbers test and commission systems to ensure proper operation. They perform scheduled, unscheduled and emergency maintenance and repair.

Safety awareness is essential for plumbers. They may work indoors or outdoors and working conditions vary from one job to another. The work of plumbers can be physically demanding. Plumbers often need to lift and carry heavy materials and equipment. While performing their duties, plumbers are also required to do considerable standing, climbing and kneeling. They may work at heights and in confined spaces. Special precautions may have to be taken when working with fluids, gases, steam and hazardous elements. Plumbers need to assess the systems and the environment to identify possible dangers.

Key attributes for people entering this trade are good mechanical, mathematical and spatial visualization skills. Plumbers also need good communication skills to communicate with co-workers and clients. Analytical/problem solving skills are required to interpret building plans, inspect piping systems and diagnose system faults and/or malfunctions.

This standard recognizes some similarities or overlaps with the work of gasfitters, steamfitters/pipefitters, refrigeration and air conditioning mechanics and sprinkler system installers.

With experience, plumbers act as mentors and trainers to apprentices in the trade. They may also move into other positions such as instructors, inspectors, estimators and project managers.

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml

The application of these skills may be described throughout this document within the skills and knowledge which support each sub-task of the trade. The most important essential skills for each sub-task have also been identified. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

READING

Plumbers require strong reading skills to consult installation procedures, reference manuals, Safety Data Sheets (SDS), the National Plumbing Code (NPC) and industry standards and safety requirements when installing, repairing and maintaining plumbing fixtures and systems. They also refer to project specifications and work orders when planning a job.

DOCUMENT USE

Document use is important in the work of plumbers. Plumbers interpret diagrams in the NPC to ensure compliance with regulatory standards. They interpret schematics and working drawings when planning the installation of piping systems. Plumbers read assembly drawings to install fixtures and appliances. They prepare sketches and drawings to plan a job.

WRITING

Writing skills are used by plumbers to perform tasks such as writing lists of materials required for a job, completing order forms to request materials, and keeping daily logs to track work status and reminders. When required, they must write incident or accident reports. They may be required to communicate in writing to other trade professionals such as engineers and architects.

ORAL COMMUNICATION

Plumbers require good oral communication skills to interact with colleagues, apprentices, supervisors, suppliers, inspectors, clients and other tradespersons when co-ordinating work, resolving problems and ensuring safety.

NUMERACY

Plumbers work in both imperial and metric systems of measurement. They locate and mark positions for pipe connections. They perform a variety of calculations such as offsets, drain line fall, hydraulic load, and temperature and pressure calculations depending on the type of piping system being installed. Plumbers estimate materials and supplies needed to complete a project. They may estimate labour requirements and prepare quotations and invoices.

THINKING

Plumbers diagnose and solve problems. They decide on work priorities and plan and organize their work accordingly. Plumbers may determine the most cost effective way to use materials and supplies when installing plumbing and heating systems.

WORKING WITH OTHERS

During the course of a work day, plumbers must interact with others such as co-workers, suppliers, clients and other trades.

DIGITAL TECHNOLOGY

Plumbers use computers and other digital devices more commonly as sources of resource information, communication and cost reporting. They are also used as a tool for design, layout, research, system diagnosis and estimating.

CONTINUOUS LEARNING

Changes to the NPC periodically modify procedures and methods for the design and installation of piping systems. Advances in technology are also changing the design, applications and materials of systems. There is an increased emphasis on worker health and safety. All these changes mean that related training and certification is often mandatory for both apprentices and journeypersons.

TRENDS IN THE PLUMBER TRADE

TECHNOLOGY

With advances in plumbing and related systems, plumbers are increasingly required to upgrade their skills to stay current or specialize in different aspects of the trade. Updates to the NPC are resulting in an increased emphasis on health and safety, environmental protection, and efficient plumbing systems.

Technological advances are influencing the design for water supply, DWV, gas fitting, and hydronic heating/cooling systems. New technologies are affecting the design of piping systems and creating opportunities for the use of integrated plumbing systems in construction. Various digital technologies and software applications are now being used as a more relevant source for communication and resource information such as estimating, cost reporting, design, layout, system diagnosis and documentation. The use of embedment scanners, recording media devices and global positioning system (GPS) devices are becoming more common.

ENVIRONMENT

Industry has become conscious of energy usage and efficiency of equipment and systems, resulting in a higher expectation from building owners and clients to meet the standards of programs such as Leadership in Energy and Environmental Design (LEED) and Energy Star. Plumbers must be more aware of the impact the trade has on the environment, the emerging requirements of these programs and the specific site requirements that are critical to projects. Many buildings are being built to standards that require new products and systems. This may include systems such as rainwater harvesting, grey water, solar thermal, geothermal, heat recovery and biomass.

PLUMBER TASK MATRIX CHART

A - PERFORMS COMMON OCCUPATIONAL SKILLS

A-1 Performs safety-related functions	1.01 Maintains safe work environment 1	1.02 Uses personal protective equipment (PPE) and safety equipment. 1	1.03 Performs lock-out and tag-out procedures 1		
A-2 Uses and maintains tools and equipment	2.01 Uses common tools and equipment 1	2.02 Uses access equipment 1	2.03 Uses rigging, hoisting, lifting and positioning equipment 1	2.04 Rigs loads for cranes 1	2.05 Uses welding equipment 1
	2.06 Uses soldering and brazing equipment 1	2.07 Uses oxy-fuel equipment 1			
A-3 Organizes work	3.01 Organizes project tasks and procedures In context	3.02 Organizes materials and supplies In context			
A-4 Performs routine trade activities	4.01 Performs piping system layout 1,2	4.02 Calculates pipe, tube and tubing lengths 1,2	4.03 Calculates piping offsets 1,2	4.04 Installs piping supports 1,2	4.05 Installs sleeves 1,2
	4.06 Commissions systems 1,2	4.07 Protects piping systems, equipment and structure from damage 1,2	4.08 Coordinates excavation and backfilling of trenches 1,2	4.09 Installs fire stopping devices and materials 1,2	
A-5 Uses communication and mentoring techniques	5.01 Uses communication techniques 1	5.02 Uses mentoring techniques 4			

B – PREPARES AND ASSEMBLES PIPE

B-6 Prepares pipe	**6.01 Inspects tube, tubing, pipe and fittings before installation** 1	**6.02 Cuts tube, tubing and pipe** 1	**6.03 Bends tube, tubing and pipe** 1	**6.04 Prepares tube, tubing and pipe connections** 1	
B-7 Joins tube, tubing and pipe	**7.01 Joins copper tube, tubing and pipe** 1	**7.02 Joins plastic pipe and tubing** 1	**7.03 Joins steel pipe** 1	**7.04 Joins cast iron pipe** 1	**7.05 Joins specialized pipe** 1

C – INSTALLS, TESTS AND SERVICES SEWERS, SEWAGE TREATMENT SYSTEMS AND DRAINAGE, WASTE AND VENT (DWV) SYSTEMS

C-8 Installs, tests and services sewers	**8.01 Sizes pipe for sewers** 3	**8.02 Installs manholes and catch basins** 3	**8.03 Installs piping for sewers** 3	**8.04 Tests manholes, catch basins and piping for sewers** 3	**8.05 Services manholes, catch basins and piping for sewers** 3
C-9 Installs, tests and services sewage treatment systems	**9.01 Plans installation of sewage treatment systems** 4	**9.02 Installs sewage treatment system components** 4	**9.03 Tests sewage treatment systems and components** 4	**9.04 Services sewage treatment systems and components** 4	
C-10 Installs, tests and services interior drainage, waste and vent (DWV) systems	**10.01 Sizes pipe for interior drainage, waste and vent (DWV) systems** 1,2,3	**10.02 Installs underground piping and components for interior drainage, waste and vent (DWV) systems** 1,2,3	**10.03 Installs piping and components for interior drainage, waste and vent (DWV) systems above-ground** 1,2,3	**10.04 Tests interior drainage, waste and vent (DWV) systems** 1,2,3	**10.05 Services piping and components for interior drainage, waste and vent (DWV) systems** 1,2,3

D – INSTALLS, TESTS AND SERVICES WATER SERVICE AND DISTRIBUTION

D-11 Installs, tests and services water services	**11.01 Sizes pipe for water services** 3	**11.02 Installs piping for water services** 3	**11.03 Installs water service equipment** 3	**11.04 Tests water service piping and components** 3	**11.05 Services water services** 3
D-12 Installs, tests and services potable water distribution systems	**12.01 Sizes piping and equipment for potable water distribution systems** 3	**12.02 Installs piping for potable water distribution systems** 3	**12.03 Installs potable water distribution equipment** 3	**12.04 Installs and uses cross-connection control devices and methods** 3	**12.05 Tests potable water distribution systems** 3
	12.06 Services potable water distribution systems 3				
D-13 Installs, tests and services pressure systems	**13.01 Sizes pressure systems** 4	**13.02 Installs piping for pressure systems** 4	**13.03 Installs equipment and components for pressure systems** 4	**13.04 Tests pressure systems** 4	**13.05 Services pressure systems** 4

E – INSTALLS, TESTS AND SERVICES FIXTURES, APPLIANCES AND WATER TREATMENT SYSTEMS

E-14 Installs, tests and services plumbing fixtures and appliances	**14.01 Installs fixture supports** 2	**14.02 Installs plumbing fixtures and appliances** 2	**14.03 Tests plumbing fixtures and appliances** 2	**14.04 Services plumbing fixtures and appliances** 2
E-15 Installs, tests and services water treatment equipment	**15.01 Sizes water treatment equipment** 4	**15.02 Installs water treatment equipment** 4	**15.03 Tests water treatment equipment** 4	**15.04 Services water treatment equipment** 4

F – INSTALLS, TESTS AND SERVICES LOW PRESSURE STEAM AND HYDRONIC HEATING AND COOLING SYSTEMS

F-16 Installs, tests and services low pressure steam systems	**16.01 Sizes piping and components for low pressure steam systems** 4	**16.02 Installs piping and components for low pressure steam systems** 4	**16.03 Tests piping and components for low pressure steam systems** 4	**16.04 Services piping and components for low pressure steam systems** 4
F-17 Installs, tests and services hydronic heating and cooling piping systems	**17.01 Sizes piping and components for hydronic systems** 2,3	**17.02 Installs piping and components for hydronic systems** 2,3	**17.03 Tests piping and components for hydronic systems** 2,3	**17.04 Services piping and components for hydronic systems** 2,3
F-18 Installs, tests and services hydronic heating and cooling generating systems	**18.01 Installs hydronic heating generating systems** 2,3	**18.02 Installs hydronic cooling generating systems** 2,3	**18.03 Tests hydronic heating and cooling generating systems** 2,3	**18.04 Services hydronic heating and cooling generating systems** 2,3
F-19 Installs, tests and services hydronic system controls and transfer units	**19.01 Installs hydronic system controls** 2,3	**19.02 Installs hydronic transfer units** 2,3	**19.03 Tests hydronic system controls and transfer units** 2,3	**19.04 Services hydronic system controls and transfer units** 2,3

G – INSTALLS, TESTS AND SERVICES FIRE PROTECTION SYSTEMS (NCC)

G-20 Installs, tests and services flow-through fire protection systems (Not Common Core)	**20.01 Installs flow-through fire protection systems (Not Common Core)**	**20.02 Tests flow-through fire protection systems (Not Common Core)**	**20.03 Services flow-through fire protection systems (Not Common Core)**
G-21 Installs, tests and services standpipe systems (Not Common Core)	**21.01 Installs piping and equipment for standpipe systems (Not Common Core)**	**21.02. Tests standpipe systems (Not Common Core)**	**21.03. Services standpipe systems (Not Common Core)**

H – INSTALLS, TESTS AND SERVICES SPECIALIZED SYSTEMS

H-22 Installs, tests and services specialized systems	**22.01 Installs piping for specialized systems** 3,4	**22.02 Installs equipment and components for specialized systems** 3,4	**22.03 Tests specialized systems** 3,4	**22.04 Services specialized systems** 3,4
H-23 Installs, tests and services process piping systems	**23.01 Installs piping for process piping systems** 4	**23.02 Installs equipment and components for process piping systems** 4	**23.03 Tests process piping systems** 4	**23.04 Services process piping systems** 4

ELEMENTS OF HARMONIZATION OF APPRENTICESHIP TRAINING

1. Trade name

The official Red Seal name for this trade is Plumber.

2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for this trade is 4.

3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for this trade is 7200.

SEQUENCING OF APPRENTICESHIP TRAINING TOPICS AND RELATED SUBTASKS

These Topic Titles are accompanied by the subtasks and their reference number contained in this Curriculum Outline. The topics in the shaded cells represent those that are covered “in context” with other training.

Level 1	Level 2	Level 3	Level 4
Organizes Work 3.01 Organizes project tasks and procedures 3.02 Organizes tools and supplies	**Organizes Work** 3.01 Organizes project tasks and procedures 3.02 Organizes tools and supplies	**Organizes Work** 3.01 Organizes project tasks and procedures. 3.02 Organizes tools and supplies.	**Organizes Work** 3.01 Organizes project tasks and procedures. 3.02 Organizes tools and supplies.
		Plumbing Fixtures and Appliances	**Plumbing Fixtures and Appliances**
	Tools and Equipment	**Tools and Equipment**	**Tools and Equipment**
		Routine Trade Activities	**Routine Trade Activities**
			Interior Drainage, Waste and Vent (DWV) Systems
	Pipe Preparation	**Pipe Preparation**	**Pipe Preparation**
	Tube, Tubing, Pipe (Join)	**Tube, Tubing, Pipe (Join)**	**Tube, Tubing, Pipe (Join)**
			Water Services
			Potable Water Distribution
			Hydronic Systems

Level 1	Level 2	Level 3	Level 4
Safety-Related Functions 1.01 Maintains safe work environment 1.02 Uses personal protective equipment (PPE) and safety equipment 1.03 Performs lock-out and tag-out procedures			
Tools and Equipment 2.01 Uses common tools and equipment 2.02 Uses access equipment 2.03 Uses rigging, hoisting, lifting and positioning equipment 2.04 Rigs loads for cranes 2.05 Uses welding equipment 2.06 Uses soldering and brazing equipment 2.07 Uses oxy-fuel equipment			
Routine Trade Activities 4.01 Performs piping system layout 4.02 Calculates pipe, tube and tubing lengths 4.03 Calculates piping offsets 4.04 Installs piping supports 4.05 Installs sleeves 4.06 Commissions systems 4.07 Protects piping systems, equipment and structure from damage 4.08 Coordinates excavation and backfilling of trenches 4.09 Installs fire stopping devices and materials	**Routine Trade Activities** 4.01 Performs piping system layout 4.02 Calculates pipe, tube and tubing lengths 4.03 Calculates piping offsets 4.04 Installs piping supports 4.05 Installs sleeves 4.06 Commissions systems 4.07 Protects piping systems, equipment and structure from damage 4.08 Coordinates excavation and backfilling of trenches 4.09 Installs fire stopping devices and materials		
Communication Techniques 5.01 Uses communication techniques			**Communication Techniques** 5.02 Uses mentoring techniques
Pipe Preparation 6.01 Inspects tube, tubing, pipe and fittings before installation 6.02 Cuts tube, tubing and pipe 6.03 Bends tube, tubing and pipe 6.04 Prepares tube, tubing and pipe connections	**Plumbing Fixtures and Appliances** 14.01 Installs fixture supports 14.02 Installs plumbing fixtures and appliances 14.03 Tests plumbing fixtures and appliances 14.04 Services plumbing fixtures and appliances		

Level 1	Level 2	Level 3	Level 4
Tube, Tubing and Pipe (Join) 7.01 Joins copper tube, tubing and pipe 7.02 Joins plastic pipe and tubing 7.03 Joins steel pipe 7.04 Joins cast iron pipe 7.05 Joins specialized pipe		**Sewers** 8.01 Sizes pipe for sewers 8.02 Installs manholes and catch basins 8.03 Installs piping for sewers 8.04 Tests manholes, catch basins and piping for sewers 8.05 Services manholes catch basins and piping for sewers	**Sewer Treatment Systems** 9.01 Plans installation of sewage treatment systems 9.02 Installs sewage treatment system components 9.03 Tests sewage treatment systems and components 9.04 Services sewage treatment systems and components
Interior Drainage, Waste and Vent (DWV) Systems (Introduction) 10.01 Sizes pipe for interior drainage waste and vent (DWV) systems 10.02 Installs underground piping and components for interior drainage, waste and vent (DWV) systems 10.03 Installs piping and components for interior drainage, waste and vent (DWV) systems above-ground 10.04 Tests interior drainage, waste and vent (DWV) systems 10.05 Services piping and components for interior drainage waste and vent (DWV) systems	**Interior Drainage, Waste and Vent (DWV) Systems** 10.01 Sizes pipe for interior drainage waste and vent (DWV) systems 10.02 Installs underground piping and components for interior drainage, waste and vent (DWV) systems 10.03 Installs piping and components for interior drainage, waste and vent (DWV) systems above-ground 10.04 Tests interior drainage, waste and vent (DWV) systems 10.05 Services piping and components for interior drainage waste and vent (DWV) systems	**Interior Drainage, Waste and Vent (DWV) Systems** 10.01 Sizes pipe for interior drainage waste and vent (DWV) systems 10.02 Installs underground piping and components for interior drainage, waste and vent (DWV) systems 10.03 Installs piping and components for interior drainage, waste and vent (DWV) systems above-ground 10.04 Tests interior drainage, waste and vent (DWV) systems 10.05 Services piping and components for interior drainage waste and vent (DWV) systems	
		Water Services 11.01 Sizes pipe for water services 11.02 Installs piping for water services 11.03 Installs water service equipment 11.04 Tests water service piping and components 11.05 Services water services	
		Potable Water Distribution 12.01 Sizes piping and equipment for potable water distribution systems 12.02 Installs piping for potable water distribution systems 12.03 Installs potable water distribution equipment 12.04 Installs cross-connection control devices and methods 12.05 Tests potable water distribution systems 12.06 Services potable water distribution systems	

Level 1	Level 2	Level 3	Level 4
			Pressure Systems 13.01 Sizes pressure systems 13.02 Installs piping fore pressure systems 13.03 Installs equipment and components for pressure systems 13.04 Tests pressure systems 13.05 Services pressure systems
			(Low Pressure) Steam Systems 16.01 Sizes piping and components for low pressure steam systems 16.02 Installs piping and components for low pressure steam systems 16.03 Tests piping and components for low pressure steam systems 16.04 Services piping and components for low pressure steam systems
			Water Treatment Equipment 15.01 Sizes water treatment equipment 15.02 Installs water treatment equipment 15.03 Tests water treatment equipment 15.04 Services water treatment equipment

Level 1	Level 2	Level 3	Level 4
	Hydronic Systems 17.01 Sizes piping and components for hydronic systems 17.02 Installs piping and components for hydronic systems 17.03 Tests piping and components for hydronic systems 17.04 Services piping and components for hydronic systems 18.01 Installs hydronic heating generating systems 18.02 Installs hydronic cooling generating systems 18.03 Tests hydronic heating and cooling generating systems 19.01 Installs hydronic system controls 19.02 Installs hydronic transfer units 19.03 Tests hydronic system controls and transfer units 19.04 Services hydronic system controls and transfer units	**Hydronic Systems** 17.01 Sizes piping and components for hydronic systems 17.02 Installs piping and components for hydronic systems 17.03 Tests piping and components for hydronic systems 17.04 Services piping and components for hydronic systems 18.01 Installs hydronic heating generating systems 18.02 Installs hydronic cooling generating systems 18.03 Tests hydronic heating and cooling generating systems 19.01 Installs hydronic system controls 19.02 Installs hydronic transfer units 19.03 Tests hydronic system controls and transfer units 19.04 Services hydronic system controls and transfer units	
		Specialized Systems 22.01 Installs piping for specialized systems 22.02 Installs equipment and components for specialized systems 22.03 Tests specialized systems 22.04 Services specialized systems	**Specialized Systems** 22.01 Installs piping for specialized systems 22.02 Installs equipment and components for specialized systems 22.03 Tests specialized systems 22.04 Services specialized systems
			Process Piping 23.01 Installs piping for process piping systems 23.02 Installs equipment and components for process piping systems 23.03 Tests process piping systems 23.04 Services process piping systems

MAJOR WORK ACTIVITY A
PERFORMS COMMON OCCUPATIONAL SKILLS

TASK A-1 Performs safety-related functions

TASK DESCRIPTOR

Safety is integral to any and every aspect of the plumber trade. Plumbers maintain a safe work environment in order to prevent and correct any potential or immediate hazard, address an incident or accident, and follow up to ensure the safety and wellness of every person on the work site. Additional site specific safety may be required. The use and maintenance of Personal Protective Equipment (PPE) and safety equipment are essential to every job. It is also very important to be proficient in the use of safety documentation. Lock-out of equipment and piping is important before working on systems to prevent spills, property damage, personal injury and fatalities. Each plumber is responsible for their own lock-out and tag-out equipment.

A-1.01 Maintains safe work environment

Apprenticeship Level	1
Essential Skills	Oral Communication, Thinking, Document Use, Reading

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-1.01.01L	demonstrate knowledge of safe work practices	identify ***work site hazards*** and describe safe work practices
		describe components of ***professional conduct***
A-1.01.02L	demonstrate knowledge of regulatory requirements pertaining to workplace safety	describe federal, jurisdictional and local ***safety and health laws and requirements***
		describe company or jurisdictional procedures for emergency response
		identify responsibilities regarding site specific safety policies and procedures

RANGE OF VARIABLES

work site hazards include: poor housekeeping, overhead hazards, tripping hazards, trenching and shoring hazards, electrical hazards, confined space hazards, hot work hazards, silica and asbestos, noise hazards, environmental hazards, vibration hazards, air quality hazards, falling hazards

professional conduct includes: no horseplay or rough housing, no drug and alcohol use (either at work or prior to coming to work), no harassment, appropriate work attire

safety and health laws and requirements include: WHMIS, Transportation of Dangerous Goods (TDG)

A-1.02 Uses personal protective equipment (PPE) and safety equipment

Apprenticeship Level	1
Essential Skills	Reading, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-1.02.01L	demonstrate knowledge of ***PPE*** and ***safety equipment***, its applications, maintenance and procedures for use	identify types of ***PPE*** and ***safety equipment*** and describe their applications, limitations and procedures for use
		describe procedures used to care for, maintain and store ***PPE*** and ***safety equipment***
A-1.02.02L	demonstrate knowledge of regulatory requirements pertaining to ***PPE*** and ***safety equipment***	identify training required by jurisdictional codes and regulations, and site-specific regulations
		identify regulations and safety documentation pertaining to the use of ***PPE*** and ***safety equipment***

RANGE OF VARIABLES

PPE includes: fall-arrest systems, respirators, steel toed boots, hardhats, safety glasses, hearing protection, gloves, face shields, protective wristlets, fire-retardant clothing, high-visibility clothing

safety equipment includes: fire extinguishers, first aid kits, smoke and fume extractors

A-1.03 Performs lock-out and tag-out procedures

Apprenticeship Level	1
Essential Skills	Oral Communication, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-1.03.01L	demonstrate knowledge of regulations, applications and ***procedures for locking out*** equipment	identify situations and ***system components*** that require lock-out
		identify ***lock-out equipment***
		describe ***procedures*** for locking out equipment and piping
		identify safety regulations pertaining to locking out electrical equipment, piping equipment and piping

RANGE OF VARIABLES

system components include: pumps, valves, electrical panels
lock-out equipment includes: lock and key, chains and tags, lock-out scissor clamps, lock-box
procedures for locking out include: tag-in and tag-out, sign-in and sign-out, company policies

TASK A-2 Uses and maintains tools and equipment

TASK DESCRIPTOR

Tools and equipment must be used, maintained and stored in a safe manner to complete all tasks of the trade. Ladders and work platforms are often required to access job locations. Plumbers frequently perform rigging and hoisting operations, working with cranes, equipment and materials. Plumbers use various tools and equipment to assemble piping systems.

A-2.01 Uses common tools and equipment

Apprenticeship Level	1
Essential Skills	Thinking, Document Use, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.01.01L	demonstrate knowledge of ***tools and equipment***, their applications, maintenance and procedures for use	identify hazards and describe safe work practices pertaining to the use of tools and equipment
		identify training and certification required by AHJ related to the use of tools and equipment
		identify types of ***hand tools*** and describe their applications and procedures for use
		identify types of ***power tools*** and describe their applications and procedures for use
		identify types of ***measuring tools*** and equipment and describe their applications and procedures for use
		identify types of powder-actuated tools and describe their applications
		describe the procedures used to inspect, maintain and store tools and equipment
		identify types of pipe cutting and joining equipment and describe their applications and procedures for use
		demonstrate proper use of tools and equipment

RANGE OF VARIABLES

tools and equipment (for a list of Hand Tools, Power Tools and Equipment, Pipe Cutting and Joining Equipment, and Testing, Measuring and Communication Equipment see appendix B)

hand tools include: pipe wrenches, combination wrenches, spacers, wedges, squares, levels

power tools include: electrical, pneumatic, hydraulic

measuring tools include: measuring tape, ruler, manometer, digital measuring devices

A-2.02 Uses access equipment

Apprenticeship Level	1
Essential Skills	Working with Others, Document Use, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.02.01L	demonstrate knowledge of ***ladders*** and ***aerial work platforms***, their applications, limitations and procedures for use	identify hazards and describe safe work practices pertaining to ***ladders*** and ***aerial work platforms***
		identify ***jurisdictional regulations and site specific requirements*** pertaining to ***ladders*** and ***aerial work platforms***
		identify types of ***ladders*** and describe their characteristics and applications
		identify types of ***aerial work platforms*** and describe their characteristics and applications
		identify types of ***motorized aerial work platforms*** and describe their characteristics and applications
		describe the procedures used to erect and dismantle ***ladders*** and ***aerial work platforms***

RANGE OF VARIABLES

ladders include: step ladders, extension ladders, platform ladders

aerial work platforms include: scaffolds, motorized work platforms

jurisdictional regulations and site specific requirements include: personnel training/certification, equipment certification requirements, proper use and limitations of equipment

motorized aerial work platforms include: scissor lift, articulated boom, personnel basket

A-2.03 Uses rigging, hoisting, lifting and positioning equipment

Apprenticeship Level	1
Essential Skills	Thinking, Numeracy, Working with Others

KNOWLEDGE

	Learning Outcomes	Learning Objectives
A-2.03.01L	demonstrate knowledge of ***rigging, hoisting, lifting and positioning equipment***, their applications, limitations and procedures for use	define terminology associated with rigging, hoisting, lifting and positioning
		identify types of ***rigging, hoisting, lifting and positioning equipment*** and accessories and describe their applications and load capacity
		identify ***hazards*** and describe safe work practices pertaining to hoisting, lifting, rigging and positioning
		describe the ***procedures used to ensure the work area is safe*** for rigging, hoisting, lifting and positioning
		describe ***procedures used to communicate*** during rigging, hoisting, lifting and positioning operations
		identify types of equipment used to secure the lift area
		describe the procedures used to rig material/equipment for lifting, hoisting and positioning
		identify types of ***knots, hitches and bends*** and describe their applications and the procedures used to tie them
		describe the procedures used for attaching rigging equipment to the load
A-2.03.02L	demonstrate knowledge of calculations required when performing hoisting and lifting and positioning operations	explain how to calculate load weight
		explain ***sling angle*** when preparing for hoisting and lifting operation
		explain correlation of ***sling angles*** to sling capacities
		identify the ***factors*** to consider when selecting rigging, hoisting, lifting and positioning equipment
		calculate equipment de-rating criteria according to specifications

A-2.03.03L	demonstrate knowledge of inspection for ***rigging, hoisting, lifting and positioning equipment***	identify hazards and describe safe work practices pertaining to rigging, hoisting, lifting and positioning
		describe the procedures used to inspect, maintain and store ***rigging, hoisting, lifting and positioning equipment***
		identify types of ***knots, hitches and bends*** describe their applications and the procedures for inspecting them

RANGE OF VARIABLES

rigging equipment includes: lugs, chain falls, come-alongs, shackles, slings, tuggers

hoisting, lifting and positioning equipment includes: forklifts, rollers, chain falls, jacks, cable grip hoists (Tirfor™)

hazards include: shock loading, equipment fatigue, floor openings

procedures used to ensure a safe work area include: supervision of lift, securing work area, communication

procedures used to communicate include: electronic communications, audio/visual

knots, hitches and bends include: bowline, cat's paw, clove hitch, half hitch

sling angle includes: 45°, 60°

factors include: load characteristics, rigging inspection, environment, safety factors, sling angles

A-2.04 Rigs loads for cranes

Apprenticeship Level	1
Essential Skills	Thinking, Numeracy, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.04.01L	demonstrate knowledge of ***rigging, hoisting, lifting and positioning equipment***, their applications, limitations and procedures for use	define terminology associated with rigging, hoisting, lifting and positioning
		identify jurisdictional regulations and site requirements pertaining to rigging for cranes
		identify types of ***rigging, hoisting, lifting and positioning equipment*** and accessories and describe their applications and procedures for use
		identify ***hazards*** and describe safe work practices pertaining to rigging, hoisting, lifting and positioning
		describe the ***procedures used to ensure a safe work area*** for rigging, hoisting, lifting and positioning

	describe ***procedures used to communicate*** during rigging, hoisting, lifting and positioning operations
	identify types of ***knots, hitches and bends*** and describe their applications and the procedures used to tie them
	describe ***procedures used to communicate*** during set up operations
	describe the methods used for attaching ***rigging equipment*** to the load

RANGE OF VARIABLES

rigging equipment includes: wire rope, shackles, nylon slings, softeners, tag lines, spreader bars, slings, chokers

hoisting, lifting and positioning equipment includes: boom trucks, overhead cranes, telescopic forklifts, mobile cranes, tower cranes

hazards include: weather, shock loading

procedures used to ensure a safe work area include: supervision of lift, securing work area, communication

knots, ***bends and hitches*** include: bowline, cat's paw, clove hitch, half hitch

procedures used to communicate include: hand signals, electronic communications, audio/visual

A-2.05 Uses welding equipment

Apprenticeship Level	1
Essential Skills	Reading, Oral Communication, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.05.01L	demonstrate knowledge of ***welding equipment***, applications and procedures for not-pressure and non-structural welds	identify types of ***welding equipment***
		identify hazards and safety practices pertaining to welding
		identify different ***welding processes*** and applications
		identify ***welding consumables***
		demonstrate use of welding equipment according to industry standards for non-pressure and non-structural welds
		describe the procedures used to inspect, maintain and store welding equipment and consumables

RANGE OF VARIABLES

welding equipment includes: SMAW equipment, GTAW equipment, GMAW equipment, heat fusion welding equipment, plasma welding equipment

welding processes include: SMAW, GTAW, GMAW

welding consumables include: welding rods, flux, grinding discs, shielding gases

A-2.06 Uses soldering and brazing equipment

Apprenticeship Level	1
Essential Skills	Oral Communication, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.06.01L	demonstrate knowledge of ***soldering and brazing equipment***, applications and procedures	identify types of ***soldering and brazing equipment***
		identify hazards and safety procedures pertaining to soldering and brazing
		identify different soldering and brazing processes and applications
		identify ***flush and purge procedures*** required for soldering and brazing
		identify ***soldering and brazing consumables***
		perform soldering and brazing procedures according to industry standards
		describe the procedures used to inspect, maintain and store soldering and brazing equipment
A-2.06.02L	demonstrate knowledge of disarming the work area location within the fire monitoring system	explain the procedure on how to isolate specific area of the fire monitoring system

RANGE OF VARIABLES

soldering and brazing equipment includes: oxy-fuel and air-fuel torches, attachments (strikers, MAPP, gas cylinders, torch heads)

flush and purge procedures include: valve isolation, monitoring pressures, monitoring flow rates

soldering and brazing consumables include: silver solder, flux, soft solder, brazing rod, sand cloth, gases (nitrogen, carbon dioxide, oxygen, acetylene, MAPP, propane, argon)

A-2.07 Uses oxy-fuel equipment

Apprenticeship Level	1
Essential Skills	Oral Communication, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.07.01L	demonstrate knowledge of ***oxy-fuel equipment***, applications and procedures	identify ***oxy-fuel equipment***
		identify hazards and describe safe work practices pertaining to oxy-fuel brazing and cutting
		perform oxy-fuel brazing and cutting procedures according to industry standards
		describe the procedures used to inspect, maintain, store and shut down ***oxy-fuel equipment***

RANGE OF VARIABLES

oxy-fuel equipment includes: flashback arrestors, regulators, hoses

TASK A-3 Organizes work

TASK DESCRIPTOR

Plumbers participate in organizing jobs, planning the work, generating material lists and managing their time to meet project deadlines. They ensure the systems are assembled correctly by following regulations and specifications, and participating in quality control practices. Plumbers use drawings and specifications to determine scope of work, and materials and methods to be used for specific installations. Drawings are also used to communicate detailed construction information such as dimensions, materials used, joining methods and templates, which are used in the layout and fabrication of fittings and piping systems.

It is very important for plumbers to develop a strong understanding of labour costs, material costs, and efficiencies in their work. Being able to keep "the big picture" and the final product in mind, while paying close attention to detail and maintaining a commitment to safe work practices is important for task organization. To maintain productivity, lifelong learning is crucial in this trade.

Plumbers must develop the ability to continuously do preliminary quality control checks to ensure compliance with specifications and AHJ requirements.

A-3.01 Organizes project tasks and procedures

Apprenticeship Level	In context
Essential Skills	Reading, Document Use, Numeracy, Digital Technology

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-3.01.01L	demonstrate knowledge of the procedures used to plan and organize work	identify ***sources of information*** relevant to work planning
		describe the ***considerations*** for determining job requirements
		describe the ***procedures used to plan work***
		describe the procedures used to organize and maintain inventory
A-3.01.02L	demonstrate knowledge of project costs and efficient trade practices	calculate labour and time costs
		calculate material costs and wastage
		identify work methods and planning to maximize practices that are most efficient while maintaining commitment to safety
A-3.01.03L	demonstrate knowledge of job specific technology	identify digital devices to plan and organize tasks and schedules
		describe the procedures for using digital devices to plan and organize tasks and schedules

RANGE OF VARIABLES

sources of information include: documentation, drawings, related professionals, clients, Internet
considerations include: safety, site layout, crane requirements, excavation, access
planning procedures include: scheduling, estimating, job costing

A-3.02 Organizes materials and supplies

Apprenticeship Level	In context
Essential Skills	Thinking, Document Use, Digital Technology

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-3.02.01L	demonstrate knowledge of procedures used to organize and maintain materials and supplies	identify sources of information relevant to organizing materials and supplies
		describe ***considerations*** for determining material and supply requirements
		describe procedures to organize and maintain inventory

RANGE OF VARIABLES

considerations include: plans, specifications, drawings, environment, NPC, AHJ

TASK A-4 Performs routine trade activities

TASK DESCRIPTOR

Routine trade activities are performed on a regular basis. These activities include performing piping system layout and related calculations, installing piping supports and sleeves, protecting piping systems, coordinating excavation and commissioning systems. Additional training and/or certification may be required, for example testing of cross-connection devices.

A-4.01 Performs piping system layout

Apprenticeship Level	1, 2
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.01.01L	demonstrate knowledge of various ***piping*** and ***equipment*** layouts and applications	interpret blueprints, specification documentation and job site instructions
		describe ***equipment*** used for various ***piping*** systems
		describe requirements of various piping systems and applications
A-4.01.02L	demonstrate knowledge of ***layout tools and equipment***	describe types of ***layout tools and equipment*** and their procedures for use

RANGE OF VARIABLES

piping includes: pipe and pipe fittings

equipment includes: appliances, fixtures, control devices

layout tools and equipment include: levels, builders' levels, tape measures, lasers, marking tools, wraparounds

A-4.02 Calculates pipe, tube and tubing lengths

Apprenticeship Level	1, 2
Essential Skills	Numeracy, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.02.01L	demonstrate knowledge of the procedures to calculate pipe, tube and tubing length	interpret linear expansion and contraction tables in NPC and ***specifications***
		describe the types of ***fitting allowances*** and their applications
		describe procedures to calculate cut length

RANGE OF VARIABLES

specifications include: engineered drawings, manufacturers' requirements, job specifications, shop drawings

fitting allowances include: end-to-end, centre-to-centre, centre-to-end

A-4.03 Calculates piping offsets

Apprenticeship Level	1, 2
Essential Skills	Numeracy, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.03.01L	demonstrate knowledge of mathematical calculations of piping ***offsets***	describe and apply trigonometry used in determining piping ***offsets***
		calculate ***offset*** using both imperial and metric units for spread offsets
		calculate ***offsets*** in piping for various changes in direction

RANGE OF VARIABLES

offsets include: rolling, jumper, equal spread

A-4.04 Installs piping supports

Apprenticeship Level	1, 2
Essential Skills	Numeracy, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.04.01L	demonstrate knowledge of piping supports and hangers and their installation	identify piping supports and hangers for various ***types*** and sizes of pipe
		describe procedures used to install piping supports and hangers
		identify NPC requirements and ***specifications*** for piping supports and hangers

RANGE OF VARIABLES

types of pipe include: steel, copper, plastic, cast iron, glass, asbestos-cement piping

specifications include: engineered drawings, manufacturers' requirements, job specifications, shop drawings

A-4.05 Installs sleeves

Apprenticeship Level	1, 2
Essential Skills	Document Use, Reading, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.05.01L	demonstrate knowledge of piping sleeves and their installation	identify types of materials used for piping sleeves
		identify piping sleeves for various sizes of pipe
		determine proper location of sleeves
		describe procedures used to install piping sleeves
		identify ***specifications*** for piping sleeves and clearances

RANGE OF VARIABLES

specifications include: engineered drawings, manufacturers' requirements, job specifications, shop drawings

A-4.06 Commissions systems

Apprenticeship Level	1, 2
Essential Skills	Document Use, Writing, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.06.01L	demonstrate knowledge of commissioning and its associated procedures	identify hazards and describe safe work practices pertaining to commissioning
		describe ***sources of information*** pertaining to commissioning
		identify ***tools and equipment*** related to commissioning and describe their applications and procedures for use
		identify systems and equipment that require commissioning
		describe the ***procedures*** used to commission systems

RANGE OF VARIABLES

sources of information include: specifications, codes and regulations, operation and maintenance manuals, quality assurance and quality control documentation, as-built drawings, approved shop drawings

tools and equipment include: pumps, glycol meters, gauges

procedures include: marking and labelling system components (valves, equipment, pipes), providing turnover instructions, coordinating system start-up

A-4.07 Protects piping systems, equipment and structure from damage

Apprenticeship Level	1, 2
Essential Skills	Document Use, Working with Others, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.07.01L	demonstrate knowledge of methods used to protect piping systems, equipment and structure from damage	identify types of potential damage
		describe ***components*** and applications used to protect against vibration and movement
		describe dielectric fittings and applications used to prevent corrosion

	describe heat trace and insulation, and applications used to prevent freezing of pipe contents
	describe expansion tanks and applications used to accommodate thermal expansion
	describe water hammer arrestors and applications used to prevent water hammer
	describe backwater valves and applications used to prevent backflow in drainage system

RANGE OF VARIABLES

components include: spring hangers, isolators, flex connectors, seismic restraints

A-4.08 Coordinates excavation and backfilling of trenches

Apprenticeship Level	1, 2
Essential Skills	Working with Others, Oral Communication, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.08.01L	demonstrate knowledge of procedures used and considerations to excavate and backfill, and compact trenches	identify hazards and describe safe work practices pertaining to excavating and backfilling trenches
		interpret codes, regulations, standards and drawings pertaining to excavating and backfilling trenches
		identify type of backfill materials and their applications
		describe the procedures used to excavate, backfill and compact trenches
		calculate the amount of grade and elevation required using fractions, ratios and percentages

A-4.09 Installs fire stopping devices and materials

Apprenticeship Level	1, 2
Essential Skills	Reading, Document Use, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.09.01L	demonstrate knowledge of the procedures to install ***fire stopping devices and materials***	identify ***systems requiring fire stopping***
		identify ***fire stopping devices and materials*** and describe their purpose and application
		interpret codes and regulations pertaining to fire stopping
		describe the procedures to install ***fire stopping devices and materials***

RANGE OF VARIABLES

fire stopping devices and materials include: collars, straps, caulking, insulating materials

systems requiring fire stopping include: sanitary drainage systems, venting systems, storm drainage systems, potable water distribution systems, hot water heating systems, specialty systems

TASK A-5 Uses communication and mentoring techniques

TASK DESCRIPTOR

Learning in the trades is done primarily in the workplace with tradespeople passing on their skills and knowledge to apprentices, as well as sharing knowledge among themselves. Apprenticeship is, and always has been about mentoring – learning workplace skills and passing them on. Because of the importance of this to the trade, this task covers the activities related to communication in the workplace and mentoring skills.

A-5.01 Uses communication techniques

Apprenticeship Level	1
Essential Skills	Oral communication, Working with Others, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-5.01.01L	demonstrate knowledge of trade terminology	define terminology used in the trade
A-5.01.02L	demonstrate knowledge of effective communication practices	describe the importance of using effective verbal and ***non-verbal communication*** with ***people in the workplace***
		identify ***sources of information*** to effectively communicate
		identify communication and ***learning styles***
		identify ***personal responsibilities and attitudes*** that contribute to on-the-job success
		identify communication that constitutes ***harassment*** and ***discrimination***

RANGE OF VARIABLES

non-verbal communication includes: body language, signals

people in the workplace include: other tradespeople, colleagues, apprentices, supervisors, clients, AHJ, manufacturers, suppliers

sources of information include: regulations, codes, occupational health and safety requirements, AHJ requirements, prints, drawings, specifications, company and client documentation

learning styles include: seeing it, hearing it, trying it

personal responsibilities and attitudes include: asking questions, working safely, accepting constructive feedback, time management and punctuality, respect for authority, good stewardship of materials, tools and property, efficient work practices

harassment includes: objectionable conduct, comment or display made either on a one-time or continuous basis that demeans, belittles, or causes personal humiliation or embarrassment to the recipient

discrimination is prohibited based on race, national or ethnic origin, colour, religion, age, sex, sexual orientation, marital status, family status, disability, conviction for which a pardon has been granted

A-5.02 Uses mentoring techniques

Apprenticeship Level	4
Essential Skills	Oral Communication, Working with Others, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-5.02.01L	identify, explain and demonstrate strategies for learning skills in the workplace	describe the importance of individual experience
		describe the shared responsibilities for workplace learning
		determine one's own learning preferences and explain how these relate to learning new skills
		describe the importance of different types of skills in the workplace
		describe the importance of ***essential skills*** in the workplace
		identify different ways of learning
		identify different ***learning needs*** and strategies to meet learning needs
		identify ***strategies*** to assist in learning a skill
A-5.02.02L	identify, explain and demonstrate ***steps*** for teaching workplace skills	identify different roles played by a workplace mentor
		describe the ***steps*** involved in teaching skills
		explain the importance of identifying the point of a lesson
		identify how to choose a good time to present a lesson
		explain the importance of linking the lessons
		identify the components of the skill (the context)
		describe considerations in setting up opportunities for skill practice
		explain the importance of providing feedback
		identify techniques for giving effective feedback
		describe methods of assessing progress

RANGE OF VARIABLES

essential skills are: reading, writing, document use, oral communication, numeracy, thinking skills, working with others, digital technology, continuous learning

learning needs include: learning disabilities, learning preferences, language proficiency

strategies include: understanding the basic principles of instruction, developing coaching skills, being mature and patient, providing feedback

steps include: identifying the point of the lesson, linking the lesson, demonstrating the skill, providing practice, giving feedback, assessing skills and progress

MAJOR WORK ACTIVITY B
PREPARES AND ASSEMBLES PIPE

TASK B-6 Prepares pipe

TASK DESCRIPTOR

Plumbers prepare tube, tubing and pipe for proper installation and trouble-free operation of the plumbing system. Preparation of tube, tubing and pipe includes many different techniques such as inspection, measuring, cutting, reaming, threading, grooving and bending. Pipe and tube are measured by nominal inside diameter (ID) and type, while some types of tubing are measured by outside diameter (OD) and wall thickness. Plumbers are responsible for the preparation of pipe for applications such as DWV, water distribution, pressure systems and other product conveyance such as chemicals.

B-6.01 Inspects tube, tubing, pipe and fittings before installation

Apprenticeship Level	1
Essential Skills	Document Use, Thinking, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-6.01.01L	demonstrate knowledge of tube, tubing, piping, fittings and accessories	define terminology associated with tube, tubing, piping, fittings and accessories
		identify hazards and describe safe work practices pertaining to tube, tubing, piping, fittings and accessories
		interpret codes and regulations pertaining to tube, tubing, piping, fittings and accessories
		interpret information pertaining to tube, tubing, piping, fittings and accessories found on drawings and specifications
		describe the identification systems and methods for tube, tubing, piping, fittings and accessories
		identify tools and equipment relating to tube, tubing, piping, fittings and accessories and describe their applications and procedures for use
		identify ***types of, tube, tubing and piping*** and describe their properties and characteristics
		identify fittings used with tube, tubing and piping and describe their purpose and applications

		identify ***tube, tubing and piping accessories*** and describe their purpose and applications
B-6.01.02L	demonstrate knowledge of the procedures used to measure tube, tubing and piping, and fitting allowance	explain the ***systems of measurement*** for tube, tubing and piping, and fitting allowance
		describe the procedures used to measure tube, tubing and piping
		perform ***calculations*** to determine tube, tubing and piping measurements
		describe the procedures used to inspect tube, tubing and piping

RANGE OF VARIABLES

types of tube, tubing and piping include: steel, copper, plastic, cast iron, asbestos-cement
tube, tubing and piping accessories include: supports, hangers, sleeves
systems of measurement include: dimension, length, wall thickness/schedule
calculations include: fitting allowances, center-to-center, end-to-end, offsets

B-6.02 Cuts tube, tubing and pipe

Apprenticeship Level	1
Essential Skills	Numeracy, Thinking, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-6.02.01L	demonstrate knowledge of tube, tubing, piping, fittings and accessories	define terminology associated with tube, tubing and piping
		identify hazards and describe safe work practices pertaining to tube, tubing and piping
		interpret codes and regulations pertaining to tube, tubing and piping
		identify tools and equipment relating to cutting tube, tubing and piping and their procedures for use
B-6.02.02L	demonstrate knowledge of the procedures used to measure and cut tube, tubing and pipe	explain the ***systems of measurement*** for tube, tubing and pipe
		describe the procedures used to measure tube, tubing and pipe
		perform calculations to determine ***tube, tubing and pipe measurements***

		describe the procedures used to inspect tube, tubing and pipe
		describe the process used to cut tube, tubing and pipe

RANGE OF VARIABLES

systems of measurement include: dimension, length, wall thickness (schedule), grades
tube, tubing and pipe measurements include: fitting allowances, center-to-center, end-to-end, offsets

B-6.03 Bends tube, tubing and pipe

Apprenticeship Level	1
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-6.03.01L	demonstrate knowledge of tube, tubing and pipe	define terminology associated with tube, tubing and piping
		identify ***tools and equipment*** used to bend tube, tubing and pipe
		identify hazards and describe safe work practices pertaining to bending tube, tubing and piping
		interpret codes and regulations pertaining to bending tube, tubing and piping
		interpret information pertaining to bending tube, tubing and piping found on drawings and specifications
B-6.03.02L	demonstrate knowledge of the procedures used to bend tube, tubing and pipe	describe the procedures used to bend tube, tubing and pipe

RANGE OF VARIABLES

tools and equipment include: pneumatic, hydraulic, manual benders

B-6.04 Prepares tube, tubing and pipe connections

Apprenticeship Level	1
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-6.04.01L	demonstrate knowledge of tube, tubing, piping, fittings and ***accessories***	define terminology associated with tube, tubing, piping, fittings and ***accessories***
		identify hazards and describe safe work practices pertaining to preparing pipe connections
		interpret codes, standards and regulations pertaining to preparing pipe connections
		interpret information pertaining to tube, tubing and pipe connections found in specifications
		describe the identification systems and methods for tube, tubing and pipe connections
		identify ***tools and equipment*** relating to tube, tubing and pipe connections and describe their applications and procedures for use
		identify fittings used to prepare tube, tubing and pipe connections and describe their purpose and applications
B-6.04.02L	demonstrate knowledge of the ***techniques*** for preparing tube, tubing and pipe connections	identify ***techniques*** for preparing tube, tubing and pipe connections and describe the applications and procedure for use
B-6.04.03L	demonstrate knowledge of the procedures used to measure tube, tubing and pipe	explain the ***systems of measurement*** for tube, tubing and pipe
		describe the procedures used to measure tube, tubing and pipe connections
		perform calculations to determine tube, tubing and pipe connections
		describe the procedures used to inspect tube, tubing and pipe connections

RANGE OF VARIABLES

accessories include: lubricants, sealants, cleaners, primers
tools and equipment include: threading, grooving, bevelling, cutting tools
techniques include: reaming, bevelling, filing, grinding, cleaning, sanding, priming, flaring, grooving
systems of measurement include: dimension, length, wall thickness (schedule), grades

TASK B-7 Joins tube, tubing and pipe

TASK DESCRIPTOR

Plumbers join tube, tubing and pipe to ensure trouble-free operation of systems. They use materials such as copper, plastic, steel, cast iron as well as specialized materials such as glass and stainless.

Copper may be used for potable water systems, DWV and specialized systems.

Steel is one of the most widely used piping materials installed by plumbers in heating and process applications. Some examples of systems using steel pipe are hydronic heating, fuel piping and food processing.

Plastic provides an alternative to other types of pipe. Fibreglass is also included in this task.

Cast iron has proven qualities that continue to make it a reliable material for drainage of sanitary and storm waste. Ductile iron is widely used for water service and process piping.

Glass is commonly used in laboratories, hospitals and chemical plants for corrosive waste. Small bore glass pipe is commonly used for such items as sight glasses.

B-7.01 Joins copper tube, tubing and pipe

Apprenticeship Level	1
Essential Skills	Reading, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-7.01.01L	demonstrate knowledge of copper tube, tubing and pipe, and associated fittings and accessories	define terminology associated with copper tube, tubing and pipe
		identify hazards and describe safe work practices pertaining to copper tube, tubing and pipe
		interpret codes, regulations and standards pertaining to copper tube, tubing and pipe
		interpret information pertaining to copper tube, tubing and pipe found on drawings and specifications
		describe the identification systems and methods for copper tube, tubing and pipe
		identify tools and equipment relating to copper tube, tubing and pipe and describe their applications and procedures for use
		identify types of copper tube, tubing and pipe and describe their properties and characteristics
		identify fittings used with copper tube, tubing and pipe and describe their purpose and applications
		identify ***pipe and tubing accessories*** and describe their purpose and applications

B-7.01.02L	demonstrate knowledge of the procedures used to join copper tube, tubing and pipe	identify the ***methods*** used to join copper tube, tubing and pipe and describe their associated procedures
		describe the procedures used to install fittings and accessories for copper tube, tubing and pipe
		identify ***adaptors*** required to join dissimilar materials to prevent galvanic action

RANGE OF VARIABLES

pipe and tubing accessories include: supports, expansion joints, hangers and sleeves

methods include: press-fit, soldered, brazed, grooved, flanged, flared, compression, swaged, corporation, push-fit

adaptors are dielectric unions

B-7.02 Joins plastic pipe and tubing

Apprenticeship Level	1
Essential Skills	Reading, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-7.02.01L	demonstrate knowledge of plastic pipe and tubing, and associated fittings and accessories	define terminology associated with plastic pipe and tubing
		identify hazards and describe safe work practices pertaining to plastic pipe and tubing
		interpret codes and regulations pertaining to plastic pipe and tubing
		interpret information pertaining to plastic pipe and tubing found on drawings and specifications
		describe the identification systems and methods for plastic pipe and tubing
		identify tools and equipment relating to plastic pipe and tubing and describe their applications and procedures for use
		identify plastic pipe and tubing system applications and describe their characteristics and requirements
		identify ***types of plastic pipe and tubing*** and describe their properties and characteristics

		identify fittings used with plastic pipe and tubing and describe their purpose and applications
		identify ***plastic pipe and tubing accessories*** and describe their purpose and applications
B-7.02.02L	demonstrate knowledge of the procedures used to join plastic pipe and tubing	identify the ***methods*** used to join plastic pipe and tubing and describe their associated procedures
		describe the procedures used to install fittings and accessories for plastic pipe and tubing
		identify ***adaptors*** required for transitions

RANGE OF VARIABLES

types of plastic pipe and tubing include: PVC, chlorinated polyvinyl chloride (CPVC), acrylonitrile-Butadiene-Styrene (ABS), high-density polyethylene (HDPE), PEX, PEX-Aluminum-PEX (PEX-AL-PEX), Polyethylene (PE)

plastic pipe and tubing accessories include: supports, expansion joints, hangers, sleeves

methods include: heat fusion welding, threading, tapping, solvent welding, compression fittings and mechanical joints, gaskets, flanged, crimped and expansion, cut-grooved, push-fit

adaptors include: male, female, mechanical joints

B-7.03 Joins steel pipe

Apprenticeship Level	1
Essential Skills	Reading, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-7.03.01L	demonstrate knowledge of steel piping and associated fittings and accessories	define terminology associated with steel piping
		identify hazards and describe safe work practices pertaining to steel piping
		interpret codes and regulations pertaining to steel piping
		interpret information pertaining to steel piping found on drawings and specifications
		describe the identification systems and methods used for steel piping
		identify tools and equipment related to steel piping and describe their applications and procedures for use
		identify steel piping systems and describe their characteristics and applications

		identify ***types of steel piping*** and describe their properties and characteristics
		identify fittings used with steel piping and describe their purpose and applications
		identify ***steel piping accessories*** and describe their purpose and applications
B-7.03.02L	demonstrate knowledge of the procedures used to join steel piping	identify the ***methods*** used to join steel piping and describe their associated procedures
		describe the procedures used to install fittings and accessories for steel piping

RANGE OF VARIABLES

types of steel piping include: carbon steel, galvanized, stainless steel
steel piping accessories include: supports, hangers, sleeves
methods include: threading, grooving, welding, flanged, gasket, mechanical joints

B-7.04 Joins cast iron pipe

Apprenticeship Level	1
Essential Skills	Reading, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-7.04.01L	demonstrate knowledge of cast iron piping, and associated fittings and accessories	define terminology associated with cast iron piping
		identify hazards and describe safe work practices pertaining to cast iron piping
		interpret codes and regulations pertaining to cast iron piping
		interpret information pertaining to cast iron piping found on drawings and specifications
		describe the identification systems and methods for cast iron piping
		identify tools and equipment relating to cast iron piping and describe their applications and procedures for use
		identify ***types of cast iron piping*** and describe their properties and characteristics
		identify fittings used with cast iron piping and describe their purpose and applications

		identify ***cast iron piping accessories*** and describe their purpose and applications
B-7.04.02L	demonstrate knowledge of the procedures used to join cast iron piping	identify the ***methods*** used to join cast iron piping and describe their associated procedures
		describe the procedures used to install fittings and accessories for cast iron piping

RANGE OF VARIABLES

types of cast iron piping include: soil, duriron, ductile iron

cast iron piping accessories include: supports, hangers and sleeves, flanges, thrust blocks, pipe restraints

methods include: mechanical joints, hub and spigot, oakum and cold caulking compound, lead and oakum

B-7.05 Joins specialized pipe

Apprenticeship Level	1, 2, 3, 4
Essential Skills	Continuous Learning, Reading, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-7.05.01L	demonstrate knowledge of specialized piping, fittings and accessories	define terminology associated with specialized piping
		identify hazards and describe safe work practices pertaining to specialized piping
		interpret codes, standards and regulations pertaining to specialized piping
		interpret information pertaining to specialized piping found on drawings and specifications
		describe the identification systems and methods for specialized piping
		identify specialized piping systems and describe their characteristics and applications
		identify ***types of specialized piping*** and describe their properties and characteristics
		identify fittings used with specialized piping and describe their purpose and applications
		identify specialized piping and describe their purpose and applications

	identify the methods used to join specialized piping and describe their associated procedures
	describe the procedures used to install fittings and ***accessories*** for specialized piping

RANGE OF VARIABLES

types of specialized piping include: glass, asbestos-cement, lead, concrete, historical piping, fibreglass
accessories include: supports, hangers, sleeves

MAJOR WORK ACTIVITY C

INSTALLS, TESTS AND SERVICES SEWERS, SEWAGE TREATMENT SYSTEMS AND DRAINAGE, WASTE AND VENTS (DWV) SYSTEMS

TASK C-8 Installs, tests and services sewers

TASK DESCRIPTOR

Plumbers install both sanitary and storm sewers. They may be responsible for the sizing of the sewer as well as installing manholes, catch basins and piping. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

C-8.01 Sizes pipe for sewers

Apprenticeship Level	3
Essential Skills	Document Use, Numeracy, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-8.01.01L	demonstrate knowledge of sanitary drainage, storm and combination drainage systems, their components, applications and operation	interpret codes and regulations pertaining to sanitary drainage systems
		interpret codes and regulations pertaining to storm and combination drainage systems
		interpret information pertaining to sanitary drainage, storm and combination drainage systems found on drawings and specifications
		identify ***sanitary drainage system components*** and describe their purpose and applications
		identify ***storm and combination drainage system components*** and describe their purpose and applications

		identify the ***factors*** to consider when sizing sanitary drainage, storm and combination drainage system components
C-8.01.02L	demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements for sanitary drainage systems	identify the ***procedures*** used to determine hydraulic load on sanitary drainage, storm and combination drainage systems

RANGE OF VARIABLES

sanitary drainage system components include: piping, fixtures, drains, traps, cleanouts, joints and connections, backwater valves, fire stopping, sewage sumps, macerating toilet systems, expansion joints

storm and combination drainage system components include: piping, roof drains, area drains, fire stopping, expansion joints, storm water management devices

factors include: hydraulic load, code requirements, grade

procedures include: conversion factors, code requirements

C-8.02 Installs manholes and catch basins

Apprenticeship Level	3
Essential Skills	Document Use, Working with Others, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-8.02.01L	demonstrate knowledge of manholes and catch basins, their components, applications and operation	identify ***hazards*** and describe safe work practices pertaining to manholes and catch basins
		interpret codes and regulations pertaining to manholes and catch basins
		interpret information pertaining to manholes and catch basins found on drawings and specifications
		identify tools and equipment relating to manholes and catch basins and describe their applications and procedures for use
		identify the types of manholes and catch basins and describe their characteristics and applications
C-8.02.02L	demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements for manholes and catch basins	identify tools and equipment to determine the grade and elevation

C-8.02.03L	demonstrate knowledge of the procedures used to lay out and install manholes and catch basins	describe the ***procedures used to install*** manholes and catch basins
		describe the ***procedures used to protect*** manholes and catch basins according to mechanical specifications

RANGE OF VARIABLES

hazards include: trenching, confined spaces, pinch points, hoists, oxygen quality
procedures used to install include: locating, identifying, backfilling
procedures used to protect include: insulating, supporting, backfilling

C-8.03 Installs piping for sewers

Apprenticeship Level	3
Essential Skills	Document Use, Thinking, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-8.03.01L	demonstrate knowledge of sewers, their components, applications and operation	identify ***hazards*** and describe safe work practices pertaining to the installation of sewers
		interpret codes and regulations pertaining to sewers
		interpret information pertaining to sewers found on drawings and specifications
		identify tools and equipment relating to the installation of sewers and describe their applications and procedures for use
		identify the ***types of sewers*** and describe their characteristics and applications
		identify piping for sewers and describe their purpose and applications
C-8.03.02L	demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements for sewers	describe the procedures used to grade piping for sewers
		calculate elevations and inverts for sewers
C-8.03.03L	demonstrate knowledge of the procedures used to lay out and install piping for sewers	describe the procedures used to rough-in piping for sewers

	describe the ***procedures used to install*** piping for sewers
	describe the ***procedures used to protect*** piping for sewers according to mechanical specifications

RANGE OF VARIABLES

hazards include: trenching, confined spaces, pinch points, hoists, oxygen quality
types of sewers include: storm, waste
procedures used to install include: safety considerations (trenching, confined space, points of access), support, protection
procedures used to protect include: insulating, supporting, backfilling, identifying

C-8.04 Tests manholes, catch basins and piping for sewers

Apprenticeship Level	3
Essential Skills	Thinking, Reading, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-8.04.01L	demonstrate knowledge of manholes, catch basins and piping for sewers and their application	identify types of manholes, catch basins and piping for sewers and describe their characteristics and applications
C-8.04.02L	demonstrate knowledge of procedures used for testing manholes, catch basins and piping for sewers	describe the procedures used to test and troubleshoot manholes, catch basins and piping for sewers
		identify ***testing equipment*** for manholes, catch basins and piping for sewers
		identify potential problems and ***faults*** with manholes, catch basins and piping for sewers

RANGE OF VARIABLES

testing equipment include: balloons, inflatable test balls, test plugs, mandrel
faults include: cracks, corrosion, inadequate flow

C-8.05 Services manholes, catch basins and piping for sewers

Apprenticeship Level	3
Essential Skills	Writing, Document Use, Reading

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-8.05.01L	demonstrate knowledge of manholes, catch basins and piping for sewers, their components, applications and operation	identify hazards and describe ***safe work practices*** pertaining manholes, catch basins and piping for sewers
		interpret codes and regulations pertaining to manholes, catch basins and piping for sewers
		interpret information pertaining to manholes, catch basins and piping for sewers found on drawings and specifications
		identify tools and equipment relating to servicing manholes, catch basins and piping for sewers and describe their applications and procedures for use
		identify the types of manholes, catch basins and piping for sewers, and their components and describe their characteristics and applications
		identify the ***factors*** to consider when servicing manholes, catch basins and piping for sewers
C-8.05.02L	demonstrate knowledge of the procedures used to repair and troubleshoot manholes, catch basins and piping for sewers	describe the procedures used to replace manholes, catch basins and piping for sewers
		describe the procedures used to protect manholes, catch basins and piping for sewers
		describe the procedures used to maintain and repair manholes, catch basins and piping for sewers
		describe the procedures used to troubleshoot manholes, catch basins and piping for sewers

RANGE OF VARIABLES

safe work practices include: confined space, point of access, shoring
factors include: manufacturers' specifications, condition of manholes, catch basins and piping for sewers

TASK C-9 Installs, tests and services sewage treatment systems

TASK DESCRIPTOR

Sewage treatment systems may encompass holding and septic tanks, absorption fields and sewage treatment plants. Regulations concerning the installation of sewage treatment systems may vary by jurisdiction. Additional certification may be required in some jurisdictions to allow plumbers to plan and install these systems. Plumbers may be required to maintain and repair these systems and must have basic knowledge of how they are planned, installed and operated. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

C-9.01 Plans installation of sewage treatment systems

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Oral Communication

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-9.01.01L	demonstrate knowledge of private sewage treatment systems, their components, applications and operation	identify ***hazards*** and describe safe work practices pertaining to private sewage treatment systems
		interpret codes and regulations pertaining to private sewage treatment systems
		interpret information pertaining to private sewage treatment systems found on drawings and specifications
		identify tools and equipment relating to private sewage treatment systems and describe their applications and procedures for use
		identify ***types of private sewage treatment systems*** and describe their characteristics and applications
		identify ***private sewage treatment system components*** and describe their purpose and applications
		identify the ***factors*** to consider when planning private sewage treatment systems
		identify the factors to consider when sizing private sewage treatment system components
		describe the procedures used to size private sewage treatment system components
C-9.01.02L	demonstrate knowledge of public sewage treatment systems, their components, applications and operation	describe the types and operation of ***public sewage treatment facilities***

	identify hazards and describe safe work practices pertaining to public sewage treatment systems
	interpret codes and regulations pertaining to public sewage treatment systems
	interpret information pertaining to public sewage treatment systems found on drawings and specifications
	identify tools and equipment relating to public sewage treatment systems and describe their applications and procedures for use

RANGE OF VARIABLES

hazards include: health hazards, environmental hazards

types of private sewage treatment systems include: raised, slope and sand, pumped

private sewage treatment system components include: leaching chambers, distribution box, septic tank, holding tanks, effluent filter

factors include: location (system position, clearances, relation to water table, sensitive areas), soil conditions/properties (percolation test, soil test)

public sewage treatment facilities include: lagoon, plant

C-9.02 Installs sewage treatment system components

Apprenticeship Level	4
Essential Skills	Document Use, Thinking, Working with Others, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-9.02.01L	demonstrate knowledge of sewage treatment systems, their components, applications and operation	identify ***hazards*** and describe safe work practices pertaining to sewage treatment systems
		interpret codes and regulations pertaining to sewage treatment systems
		interpret information pertaining to sewage treatment systems found on drawings and specifications
		identify tools and equipment relating to sewage treatment systems and describe their applications and procedures for use
		identify types of sewage treatment systems and describe their characteristics and applications
		identify ***private sewage treatment system components*** and describe their purpose and applications

		identify ***public sewage treatment system components*** and describe their purpose and applications
		identify the ***factors*** to consider when planning and installing sewage treatment systems
C-9.02.02L	demonstrate knowledge of the procedures used to install sewage treatment systems	describe the procedures used to install sewage treatment systems
		describe the procedures used to protect sewage treatment systems
		describe the procedures used to determine grade and elevation for piping and components

RANGE OF VARIABLES

hazards include: health hazards, environmental hazards

private sewage treatment system components include: leaching chambers, distribution box, septic tank, holding tanks, effluent filter

public sewage treatment system components include: pumps, strainers, lift stations

factors include: location (system position, clearances, relation to water table, sensitive areas), soil conditions/properties (percolation test, soil test)

C-9.03 Tests sewage treatment systems and components

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Reading

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-9.03.01L	demonstrate knowledge of sewage treatment systems and their application	identify types of sewage treatment systems and describe their characteristics and applications
		identify hazards and describe safe work practices pertaining to sewage treatment systems
C-9.03.02L	demonstrate knowledge of ***testing equipment*** and procedures used for testing sewage treatment systems	describe the procedures used to test sewage treatment systems
		identify sewage treatment system testing equipment

RANGE OF VARIABLES

testing equipment includes: balloons, inflatable test balls, test plugs, mandrels

C-9.04 Services sewage treatment systems and components

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Writing

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-9.04.01L	demonstrate knowledge of sewage treatment system, their ***components***, applications and operation	identify ***hazards*** and describe safe work practices pertaining sewage treatment system
		interpret codes and regulations pertaining to sewage treatment system
		interpret information pertaining to sewage treatment system found on drawings and specifications
		identify tools and equipment related to servicing sewage treatment system and describe their applications and procedures for use
		identify types of sewage treatment system, and their ***components*** and describe their characteristics and applications
		identify the ***factors*** to consider when servicing sewage treatment system
C-9.04.02L	demonstrate knowledge of the procedures used to maintain, repair and troubleshoot sewage treatment system	describe the procedures used to replace sewage treatment system and components
		describe the procedures used to protect sewage treatment system
		describe the procedures used to maintain and repair sewage treatment system and components
		describe the procedures used to troubleshoot sewage treatment system and components
		describe the importance of filling out service documentation related to maintenance and repair

RANGE OF VARIABLES

components include: backwater values, leak seals, covers, grates
hazards include: health hazards, environmental hazards, access, confined space
factors include: manufacturers' specifications, condition of sewage treatment system

TASK C-10 Installs, tests and services interior drainage, waste and vent (DWV) systems

TASK DESCRIPTOR

Plumbers install both underground and above-ground piping and components for DWV systems. Underground systems are defined as piping systems in direct contact with the earth. Embedded components are encased in concrete or other materials. For the purpose of this standard service includes maintain, troubleshoot and repair.

C-10.01 Sizes pipe for interior drainage, waste and vent (DWV) systems

Apprenticeship Level	1, 2, 3
Essential Skills	Numeracy, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-10.01.01L	demonstrate knowledge of DWV systems, their components, applications and operation	identify hazards and describe safe work practices pertaining to DWV systems
		interpret codes and regulations pertaining to DWV systems
		interpret information pertaining to DWV systems found on drawings and specifications
		explain the purpose of DWV systems
		identify the types of DWV systems and describe their characteristics and applications
		identify ***storm system components*** and describe their purpose and applications
C-10.01.02L	demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements for DWV systems	describe the ***procedures used to determine hydraulic load*** on sanitary DWV systems
		describe the ***procedures*** used to determine hydraulic load on storm systems
		describe the procedures used to grade piping for DWV systems

RANGE OF VARIABLES

storm system components include: piping, roof drains, area drains, fire stopping, expansion joints
procedures include: conversion factors, code requirements

C-10.02 Installs underground piping and components for interior drainage, waste and vent (DWV) systems

Apprenticeship Level	1, 2, 3
Essential Skills	Document Use, Numeracy, Thinking

KNOWLEDGE

	Learning Outcomes	Learning Objectives
C-10.02.01L	demonstrate knowledge of DWV systems, applications and operation	identify hazards and describe safe work practices pertaining to DWV systems
		interpret codes and regulations pertaining to DWV systems
		interpret information pertaining to DWV systems found on drawings and specifications
		explain the purpose and functionality of DWV systems
		identify the ***methods of backflow protection*** used in DWV systems
		identify the types of DWV systems and describe their characteristics and applications
C-10.02.02L	demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements for DWV systems	determine and transfer grade and elevation for piping in DWV systems
		describe the ***procedures used to install*** DWV systems in trenches
		describe the procedures used to grade piping for DWV systems
C-10.02.03L	demonstrate knowledge of the procedures used to layout and install DWV systems	describe the procedures used to install DWV systems
		identify the ***factors*** to consider when installing DWV system components
		describe the procedures used to protect DWV systems

RANGE OF VARIABLES

methods of backflow protection include: backwater valves and gate valves
procedures used to install include: safety considerations, support, protection
factors include: hydraulic load, code requirements

C-10.03 Installs piping and components for interior drainage, waste and vent (DWV) systems above-ground

Apprenticeship Level	1, 2, 3
Essential Skills	Document Use, Thinking, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-10.03.01L	demonstrate knowledge of DWV systems, applications and operation	identify hazards and describe safe work practices pertaining to DWV systems
		interpret codes and regulations pertaining to DWV systems
		interpret information pertaining to DWV systems found on drawings and specifications
		identify tools and equipment relating to DWV systems and describe their applications and procedures for use
		explain the purpose and functionality of DWV systems
		identify the ***methods of backflow protection*** used in DWV systems
		identify the types of DWV systems and describe their characteristics and applications
C-10.03.02L	demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements for DWV systems	identify the ***factors*** to consider when installing DWV systems components
		determine and transfer grade and elevation for piping in DWV systems
		describe the procedures used to grade piping for DWV systems
C-10.03.03L	demonstrate knowledge of the procedures used to layout and install DWV systems	identify types of hangers and supports used to install DWV systems
		describe the procedures used to install DWV systems and hangers and supports
		describe the procedures used to protect DWV systems

RANGE OF VARIABLES

methods of backflow protection include: backwater valves, gate valves
factors include: hydraulic load, code requirements

C-10.04 Tests interior drainage, waste and vent (DWV) systems

Apprenticeship Level	1, 2, 3
Essential Skills	Document Use, Thinking, Oral Communication

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-10.04.01L	demonstrate knowledge of interior DWV systems and their application	identify types of interior DWV systems and describe their characteristics and applications
		identify hazards and describe safe work practices pertaining to DWV systems
C-10.04.02L	demonstrate knowledge of ***testing equipment*** and procedures used for testing interior DWV systems	describe the procedures used to test interior DWV systems
		identify interior DWV system ***testing equipment***

RANGE OF VARIABLES

testing equipment includes: inflatable test balls, mechanical test plugs, gauge, smoke generating machine

C-10.05 Services piping and components for interior drainage, waste and vent (DWV) systems

Apprenticeship Level	1, 2, 3
Essential Skills	Continuous Learning, Thinking, Oral Communication

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-10.05.01L	demonstrate knowledge of interior DWV system ***equipment and components***, their applications and operation	identify types of interior DWV systems and describe their characteristics and applications
		identify tools and equipment relating to interior DWV systems and describe their applications and procedures for use
		identify interior DWV system ***equipment and components*** and describe their purpose, operation and applications
D-10.05.02L	demonstrate knowledge of the procedures used to service interior DWV systems	interpret codes and regulations pertaining to interior DWV systems

	describe the procedures used to service interior DWV system components
	describe the procedures and ***components used to protect*** interior DWV systems and buildings

RANGE OF VARIABLES

equipment and components include: sewage sumps, sewage lift, interceptors, specialty traps
components used to protect include: expansion joints, wall plates, fire stopping, insulation

MAJOR WORK ACTIVITY D

INSTALLS, TESTS AND SERVICES WATER SERVICE AND DISTRIBUTION

TASK D-11 Installs, tests and services water services

TASK DESCRIPTOR

By connecting piping from the municipal or private water supply to the water distribution system, plumbers make water available for use. Plumbers determine water demand in order to be able to size and install piping and equipment. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repair.

D-11.01 Sizes pipe for water services

Apprenticeship Level	3
Essential Skills	Numeracy, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-11.01.01L	demonstrate knowledge of water service piping, components, their applications and operation	identify ***types of water service*** and describe their characteristics and applications
		identify the ***factors*** to consider in sizing piping for water service
		interpret codes and regulations pertaining to sizing pipe for water service
		interpret information pertaining to water service found on drawings and specifications
		calculate piping size requirements for water service based on peak flow demand
D-11.01.02L	demonstrate knowledge of procedures used to determine elevation, friction loss, velocity and required pressure for water service	describe procedures used to determine elevation, friction loss, velocity and required pressure for water service

RANGE OF VARIABLES

types of water service include: rural, residential, commercial, industrial

factors include: total number of fixture units, developed length of pipe, most remote outlet, difference in elevation, available system pressure, flow velocity

D-11.02 Installs piping for water services

Apprenticeship Level	3
Essential Skills	Document Use, Thinking, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-11.02.01L	demonstrate knowledge of water service piping their applications and operation	identify types of water service piping and describe their applications
		identify tools and equipment relating to water service systems and describe their applications and procedures for use
D-11.02.02L	demonstrate knowledge of the procedures used to install water service ***components***	identify water service piping and ***components*** and describe their purpose, operation and applications
		identify the factors to consider in determining depth for water service piping
D-11.02.03L	demonstrate knowledge of the procedures used to install water service	interpret codes and regulations pertaining to water service in residential and industrial/commercial/institutional (ICI) applications
		describe the procedures used to lay out and install water service piping in trenches
		describe the procedures used to install water service piping and their associated supports and restraints
		describe the ***procedures used to protect*** piping for water service

RANGE OF VARIABLES

components include: corporation main stop, expansion loop, curb stop, meters, main shut-off, cathodic protection devices

procedures used to protect include: insulating, supporting, backfilling, identification, heat tracing, cathodic protection

D-11.03 Installs water service equipment

Apprenticeship Level	3
Essential Skills	Document Use, Thinking, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-11.03.01L	demonstrate knowledge of water service ***equipment***, their applications and operation	identify types of water service equipment and describe their characteristics and applications
		identify tools and equipment relating to water service systems and describe their applications and procedures for use
		identify water service equipment and describe their purpose, operation and applications
D-11.03.02L	demonstrate knowledge of the procedures used to install water service equipment	interpret codes and regulations pertaining to water service in residential and ICI applications
		describe the procedures used to install water service equipment
		describe the ***procedures used to protect*** water service equipment

RANGE OF VARIABLES

equipment includes: water meters, isolation valves, cross-connection control devices, check valves, expansion devices, pumps

procedures used to protect include: frost box installation, backfilling, heat tracing, insulating

D-11.04 Tests water service piping and components

Apprenticeship Level	3
Essential Skills	Thinking, Document Use, Digital Technology

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-11.04.01L	demonstrate knowledge of water service piping and ***components*** and their application	identify types of water service piping and ***components*** and describe their application
D-11.04.02L	demonstrate knowledge of procedures used for testing water service piping and ***components***	describe the procedures used to test water service piping and ***components***

RANGE OF VARIABLES

components include: water meters, isolation valves, cross-connection control devices, check valves, expansion devices, pumps, post-indicator valves, fire hydrants

D-11.05 Services water services

Apprenticeship Level	3
Essential Skills	Document Use, Thinking, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-11.05.01L	demonstrate knowledge of water service ***equipment and components***, their applications and operation	identify types of water service and describe their characteristics and applications
		identify ***hazards*** and describe safe work practices pertaining to water service servicing
		identify tools and equipment relating to water service systems and describe their applications and procedures for use
		identify water service ***equipment and components*** and describe their purpose, operation and applications
D-11.05.02L	demonstrate knowledge of the procedures used to maintain water service	interpret codes and regulations pertaining to water service in residential and commercial/institutional buildings
		describe the procedures used to maintain water service components
		describe the ***procedures used to protect*** equipment and components for water services

RANGE OF VARIABLES

equipment and components include: water meters, isolation valves, cross-connection control devices, check valves, expansion devices, pumps, fittings

hazards include: cave-ins, confined spaces

procedures used to protect include: frost box installation, backfilling, shoring, heat tracing, insulating

TASK D-12 Installs, tests and services potable water distribution systems

TASK DESCRIPTOR

Plumbers install potable water distribution systems by connecting the piping from the water service to equipment and fixtures. Plumbers must select the appropriate materials and properly size the system to deliver adequate water supply. By installing cross-connection devices, the water supply is protected from contamination. In some jurisdictions plumbers may be required to attain additional training to install and certify cross-connection devices. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

D-12.01 Sizes piping and equipment for potable water distribution systems

Apprenticeship Level	3
Essential Skills	Document Use, Numeracy, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-12.01.01L	demonstrate knowledge of potable water distribution equipment and components, their applications and operation	interpret codes and regulations pertaining to sizing of potable water distribution
		describe the procedures used to size potable water distribution system components and equipment
		identify ***types of potable water distribution systems*** and describe their characteristics and applications
		identify the ***factors*** *to consider in sizing* piping and ***equipment*** for potable water distribution system
		interpret information pertaining to potable water distribution systems found on drawings and specifications
D-12.01.02L	demonstrate knowledge of procedures used to determine elevation, friction loss and required pressure for potable water distribution systems	describe procedures used to determine elevation, friction loss and required pressure for potable water distribution systems

RANGE OF VARIABLES

types of potable water distribution systems include: public, private, residential, ICI

factors include: total number of fixture units, developed length of pipe, most remote outlet, difference in elevation, available system pressure, friction loss

equipment includes: pumps, pressure reducing valves, hot water tanks, tempering valves, cross-connection devices, pressure tanks, water treatment equipment

D-12.02 Installs piping for potable water distribution systems

Apprenticeship Level	3
Essential Skills	Document Use, Thinking, Reading

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-12.02.01L	demonstrate knowledge of potable water distribution system and ***components***, their applications and operation	identify potable water distribution ***components*** and describe their characteristics and applications
		identify tools and equipment relating to potable water distribution and describe their applications and procedures for use
D-12.02.02L	demonstrate knowledge of the procedures used to install piping and ***components*** for potable water distribution systems	interpret information pertaining to piping for potable water distribution found on drawings and specifications
		interpret codes and regulations pertaining to piping for potable water distribution
		describe the procedures used to rough-in and lay out potable water distribution
		describe the procedures used to install potable water distribution ***components***
		identify locations for potable water distribution ***components***
		describe the ***procedures used to protect*** potable water distribution ***components***

RANGE OF VARIABLES

components includes: pumps, pressure reducing valves, hot water tanks, tempering valves, cross-connection devices, pressure tanks, water treatment equipment

procedures used to protect include: installing water hammer arrestors and expansion joints, insulating

D-12.03 Installs potable water distribution equipment

Apprenticeship Level	3
Essential Skills	Document Use, Thinking, Reading

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-12.03.01L	demonstrate knowledge of potable water distribution equipment and ***components***, their applications and operation	identify potable water distribution ***components*** and describe their characteristics and applications
		identify ***tools*** relating to potable water distribution ***equipment*** and describe their applications and procedures for use
		explain water hammer, its causes and methods of prevention or control
D-12.03.02L	demonstrate knowledge of the procedures used to install potable water distribution ***equipment***	interpret information pertaining to potable water distribution equipment found on drawings and specifications
		interpret codes and regulations pertaining to potable water distribution ***equipment***
D-12.03.03L	demonstrate knowledge of volumetric expansion calculations	perform volumetric calculations

RANGE OF VARIABLES

components include: isolation valves, supply connectors, check valves, couplings, unions, flanges, water hammer arrestors, expansion joints (bellows)

tools include: pipe wrenches, adjustable wrenches, soldering and brazing equipment

equipment includes: pumps, expansion tanks, water treatment equipment

D-12.04 Installs and uses cross-connection control devices and methods

Apprenticeship Level	3
Essential Skills	Reading, Numeracy, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-12.04.01L	demonstrate knowledge of cross-connection control devices and methods, their applications and operation	identify ***types of cross-connection control devices and methods*** and describe their characteristics, operation and applications
		identify ***levels of hazard*** related to cross-connection control devices and methods

		identify tools and equipment relating to cross-connection control devices and describe their applications and procedures for use
		explain back siphonage and back pressure and their causes
D-12.04.02L	demonstrate knowledge of information pertaining to cross-connection control devices and methods	interpret information pertaining to cross-connection control devices and methods found on drawings, specifications and AHJ
		interpret ***codes*** and regulations pertaining to cross-connection control
D-12.04.03L	demonstrate knowledge of the procedures used to install cross-connection control devices	describe the procedures used to install cross-connection control devices

RANGE OF VARIABLES

types of cross-connection control devices and methods include: RPBP, double check valve assembly, dual check valve, air break, air gap

levels of hazard are: low (minor), moderate, severe

codes are: NPC, CSA B64

D-12.05 Tests potable water distribution systems

Apprenticeship Level	3
Essential Skills	Document Use, Numeracy, Writing

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-12.05.01L	demonstrate knowledge of the procedures used to test potable water distribution systems	describe the procedures used to test potable water distribution systems
		identify ***components*** of potable water distribution systems that require testing
		identify ***testing equipment*** for potable water distribution systems and their procedures for use
		identify codes and regulations pertaining to testing potable water distribution systems
		identify ***faults*** in potable water distribution systems

RANGE OF VARIABLES

components include: cross-connection controls, pressure reducing valves, relief devices, water treatment equipment, pumps

testing equipment includes: gauges, pumps, air compressors

faults include: ruptures, leaks, manufacturers' imperfections

D-12.06 Services potable water distribution systems

Apprenticeship Level	3
Essential Skills	Thinking, Document Use, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-12.06.01L	demonstrate knowledge of potable water distribution systems, ***components***, their applications and operation	identify types of potable water distribution systems and describe their characteristics and applications
		identify ***conditions requiring service***
		identify ***tools and equipment*** relating to potable water distribution systems and describe their applications and procedures for use
		identify potable water distribution system ***components*** and describe their purpose, operation and applications
		identify ***water conditions*** of potable water distribution systems that require service
D-12.06.02L	demonstrate knowledge of the procedures used to service potable water distribution systems	interpret codes and regulations pertaining to potable water distribution systems in residential and ICI applications
		describe the procedures used to service potable water distribution system components
		describe the ***procedures used to protect*** potable water distribution systems
D-12.06.03L	demonstrate knowledge of procedures used to service cross-connection control devices	describe the procedures used to service cross-connection control devices

RANGE OF VARIABLES

components include: piping, fittings, valves, shock arrestors, recirculating lines and pumps, fire stopping, cross-connection control devices, expansion tanks, pressure reducing valves

conditions requiring service include: leaks, wear, cleanliness

tools and equipment include: wrenches, freeze packs, pipe cutters, torches

water conditions include: pH, iron content, bacterial content, H_2S, TDS

procedures used to protect include: installing recirculation pump, installing frost box, heat tracing, insulation

TASK D-13 Installs, tests and services pressure systems

TASK DESCRIPTOR

Plumbers install water systems that maintain pressure within distribution systems. The pressure system installation requires sizing and installing piping, equipment and other components that reduce or increase pressure as required. Additional certification may be required in some jurisdictions to allow plumbers to design and install these systems. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

D-13.01 Sizes pressure systems

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.01.01L	demonstrate knowledge of ***types of pressure systems***, related ***equipment and components***, their applications and operation	identify ***types of pressure systems***, related ***equipment and components***
		describe pressure system applications and operation
		identify the ***water source factors*** to consider for sizing pressure system ***equipment and components***
		describe the procedures used to size pressure system ***equipment and components***
		interpret codes and regulations pertaining to pressure systems
		interpret information pertaining to pressure systems found on drawings and specifications

RANGE OF VARIABLES

types of pressure systems include: shallow well, deep well, boosted system
equipment and components include: pumps, pressure tanks, controls
water source factors include: drawdown, yield, depth

D-13.02 Installs piping for pressure systems

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.02.01L	demonstrate knowledge of ***types of pressure systems***, related equipment and ***components***, their applications and operation	identify types of pressure systems, related equipment and ***components***
		describe pressure system applications and operation
		identify ***tools*** and equipment relating to pressure systems and describe their applications and procedures for use
		interpret codes and regulations pertaining to pressure systems
		interpret information pertaining to pressure systems found on drawings and specifications
		perform calculations using ***formulas***
D-13.02.02L	demonstrate knowledge of the procedures used to install piping for pressure systems	describe procedures used to install piping for pressure systems
		describe ***procedures used to protect*** piping for pressure systems

RANGE OF VARIABLES

types of pressure systems include: deep well, shallow well, submersible, jet, boosted
components include: foot valves, clamps, pumps, pressure tanks, controls, relief valves, shut-off valves, air volume controls, drain valves, pitless adapters, torque arrestors, cable guards, pressure switches
tools include: wrenches, soldering and brazing equipment, nut drivers, cutters
formulas include: Boyle's Law, Bernoulli's Principle, volume
procedures used to protect include: backfilling, insulating, sleeving, heat tracing

D-13.03 Installs equipment and components for pressure systems

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.03.01L	demonstrate knowledge of the procedures used to install pressure system ***equipment and components***	describe the procedures used to install pressure system ***equipment and components***
		identify ***tools*** for the installation of pressure system ***equipment and components***
D-13.03.02L	demonstrate knowledge of pumps and their application and operation	identify ***types of pumps*** and describe their components, applications and operation
D-13.03.03L	demonstrate knowledge of the basic concepts of electricity	interpret electrical related information found on drawings and specifications
		describe the characteristics and applications of electricity related to pumps and controls
		identify ***tools and equipment*** used to test electrical circuits and describe their applications and procedures for use
		explain ***basic electrical principles***
D-13.03.04L	demonstrate knowledge of pumps for pressure systems and their application and operation	identify ***types of pumps*** and describe their components, applications and operation
D-13.03.05L	demonstrate knowledge of installing pumps for pressure systems and their application and operation	describe procedures used to install pumps for pressures systems

RANGE OF VARIABLES

equipment and components include: pumps, pressure tanks, pressure reducing valves, pressure relief valves

tools include: wrenches, torches, cutters, nut drivers, levels

types of pumps include: deep well, shallow well, submersible, jet, booster

tools and equipment include: multimeters, circuit meters, ohmmeters

basic electrical principles include: Ohm's Law, bonding and grounding

D-13.04 Tests pressure systems

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.04.01L	demonstrate knowledge of ***types of pressure systems***, related ***equipment and components***, their applications and operation	identify ***types of pressure systems***, related ***equipment and components***
D-13.04.02L	demonstrate knowledge of testing pressure systems, their procedures and equipment	identify ***testing equipment*** used for pressure systems
		describe the procedures used to test pressure systems components and equipment

RANGE OF VARIABLES

types of pressure systems include: shallow well, deep well, boosted system
equipment and components include: pumps, pressure tanks, controls
testing equipment includes: pressure gauges, multimeters

D-13.05 Services pressure systems

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.05.01L	demonstrate knowledge of pressure system ***equipment and components***, their applications and operation	describe the procedures used to service pressure system ***equipment and components***
		identify types of pressure systems and describe their characteristics and applications
		identify tools and equipment relating to pressure systems and describe their applications and procedures for use
		identify pressure system ***equipment and components*** and describe their purpose, operation and applications
D-13.05.02L	demonstrate knowledge of the procedures used to service pressure systems	interpret codes and regulations pertaining to pressure systems in residential and commercial/institutional buildings

	interpret ***performance data*** and manufacturers' specifications pertaining to servicing pressure systems
	describe the procedures used to service pressure system components

RANGE OF VARIABLES

equipment and components include: flanges, unions, couplings, joints, water treatment equipment, pressure switches, air volume control, pressure tanks (bladder, diaphragm)

performance data includes: documentation, pump curves, power requirements, rating plates

MAJOR WORK ACTIVITY E

INSTALLS, TESTS AND SERVICES FIXTURES, APPLIANCES AND WATER TREATMENT SYSTEMS

TASK E-14 Installs, tests and services plumbing fixtures and appliances

TASK DESCRIPTOR

Plumbers install fixtures and appliances in a variety of buildings. Plumbers must take care in the installation of fixtures and appliances since this is an important stage of the plumbing installation process.

Plumbing fixtures and appliances are connected to the water and/or drainage and/or electrical or fuel systems.

For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

E-14.01 Installs fixture supports

Apprenticeship Level	2
Essential Skills	Document Use, Numeracy, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
E-14.01.01L	demonstrate knowledge of plumbing fixtures, supports and accessories, their applications and operation	identify types of plumbing fixtures and supports, and describe their characteristics and applications
		identify plumbing accessories and describe their characteristics and applications
		interpret information pertaining to plumbing fixtures, supports, and accessories found on drawings and specifications
		interpret codes and regulations pertaining to plumbing fixtures, supports and accessories
		identify tools and equipment relating to plumbing fixtures, supports and accessories and describe their applications and procedures for use

E-14.01.02L	demonstrate knowledge of the procedures used to install plumbing fixtures, supports and accessories	describe the procedures used to install plumbing fixtures, supports and accessories
		identify tools and equipment required to install plumbing fixtures, supports and accessories
		describe hazards and safe work practices relating to installation of plumbing fixtures, supports and accessories

E-14.02 Installs plumbing fixtures and appliances

Apprenticeship Level	2
Essential Skills	Document Use, Thinking, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
E-14.02.01L	demonstrate knowledge of plumbing fixtures, appliances and accessories, their applications and operation	identify ***types of plumbing fixtures***, ***plumbing appliances*** and supports, and describe their characteristics and applications
		identify fixture and appliance accessories and describe their characteristics and applications
		interpret information pertaining to plumbing fixtures, appliances and accessories found on drawings and specifications
		interpret codes and regulations pertaining to plumbing fixtures, appliances and accessories
		identify tools and equipment relating to plumbing fixtures, appliances and accessories and describe their applications and procedures for use
E-14.02.02L	demonstrate knowledge of the procedures used to install plumbing fixtures, appliances and accessories	describe the procedures used to install plumbing fixtures, appliances supports and accessories
		identify tools and equipment required to install plumbing fixtures, appliances supports and accessories
		describe hazards and safe work practices relating to installation of plumbing fixtures, supports and accessories

RANGE OF VARIABLES

types of plumbing fixtures include: showers, water closets, lavatories, urinals, sinks
types of plumbing appliances include: water heaters, coffee machines, ice makers, dishwasher

E-14.03 Tests plumbing fixtures and appliances

Apprenticeship Level	2
Essential Skills	Continuous Learning, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-14.03.01L	demonstrate knowledge of plumbing fixtures and appliances and their application	identify types of plumbing fixtures and appliances and describe their characteristics and applications
		identify fixtures approved by AHJ, NPC, NBC and specifications
		identify hazards and describe safe work practices pertaining to plumbing fixtures and appliances
C-14.03.02L	demonstrate knowledge of procedures used for testing plumbing fixtures and appliances	describe the procedures used to test plumbing fixtures and appliances
		identify plumbing fixtures and appliances ***testing tools and equipment***

RANGE OF VARIABLES

testing tools and equipment include: thermometers, voltmeters, pressure meters

E-14.04 Services plumbing fixtures and appliances

Apprenticeship Level	2
Essential Skills	Thinking, Document Use, Oral Communication

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
E-14.04.01L	demonstrate knowledge of plumbing fixtures and appliances, their applications and operation	identify types of plumbing fixtures and appliances and describe their characteristics and applications
		identify trim and accessories for plumbing fixtures and appliances and describe their characteristics and applications
		interpret codes and regulations pertaining to plumbing fixtures and appliances

E-14.04.02L	demonstrate knowledge of the procedures used to maintain plumbing fixtures and appliances	describe the procedures used to troubleshoot and diagnose problems with plumbing fixtures and appliances
		describe the procedures used to maintain plumbing fixtures and appliances
		describe the procedures used to repair and replace plumbing fixtures and appliances

TASK E-15 Installs, tests and services water treatment equipment

TASK DESCRIPTOR

Water treatment systems are used in residential, commercial and institutional buildings to improve the quality of water. Plumbers may be responsible for sizing and installing these systems. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

E-15.01 Sizes water treatment equipment

Apprenticeship Level	4
Essential Skills	Document Use, Numeracy, Thinking, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
E-15.01.01L	demonstrate knowledge of water treatment systems, their components, applications and operation	interpret information pertaining to water treatment systems found on drawings and specifications
		identify tools and equipment relating to water treatment systems and describe their applications and procedures for use
		identify ***types of water quality problems*** and describe their characteristics and causes
		identify ***methods of water treatment*** and describe their characteristics and applications
		identify water treatment components and describe their applications and operation
E-15.01.02L	demonstrate knowledge of the procedures used to size water treatment systems	interpret information pertaining to water quality test results
		describe the procedures used to size water treatment systems and components

RANGE OF VARIABLES

types of water quality problems include: hardness, minerals, contamination/pollution, pH, taste/odour, turbidity

methods of water treatment include: filtering, softening, purifying, chemical feeding, sterilizing, reverse osmosis, de-ionizing, neutralizing, distilling

E-15.02 Installs water treatment equipment

Apprenticeship Level	4
Essential Skills	Document Use, Continuous Learning, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
E-15.02.01L	demonstrate knowledge of water treatment systems, their components, applications and operation	interpret information pertaining to water treatment systems found on drawings and specifications
		identify tools and equipment relating to water treatment systems and describe their applications and procedures for use
		identify ***types of water quality problems*** and describe their characteristics and causes
		identify ***methods of water treatment*** and describe their characteristics and applications
		identify water treatment components and describe their applications and operation
		describe the equipment used (backflow prevention equipment) to protect the potable water system from water treatment equipment
E-15.02.02L	demonstrate knowledge of the procedures used to install water treatment systems	describe the procedures used to install water treatment systems and ***components***
		describe sequence of installation of multiple water treatment systems and its importance
		describe the procedures used to protect water treatment systems and components

RANGE OF VARIABLES

types of water quality problems include: hardness, minerals, contamination/pollution, pH, taste/odour, turbidity

methods of water treatment include: filtering, softening, purifying, chemical feeding, sterilizing, reverse osmosis, de-ionizing, neutralizing, distilling

components include: brine tanks, cylinders, UV treatment bulbs

E-15.03 Tests water treatment equipment

Apprenticeship Level	4
Essential Skills	Document Use, Thinking, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
E-15.03.01L	demonstrate knowledge of water treatment equipment and their application	identify types of water treatment equipment and describe their characteristics and applications
		interpret information pertaining to water treatment systems found on drawings and specifications
		identify hazards and describe safe work practices pertaining to water treatment equipment
		interpret codes and regulations pertaining to water treatment equipment
E-15.03.02L	demonstrate knowledge of testing water treatment systems	identify testing equipment for water treatment systems
		describe the procedures used to test water treatment systems and components
		interpret results of water tests to determine water treatment requirements

E-15.04 Services water treatment equipment

Apprenticeship Level	4
Essential Skills	Digital Technology, Continuous Learning, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
E-15.04.01L	demonstrate knowledge of water treatment systems, their components, applications and operation	interpret information pertaining to water treatment systems found on drawings and specifications
		identify tools and equipment relating to water treatment systems and describe their applications and procedures for use
		identify ***types of water quality problems*** and describe their characteristics and causes
		identify ***methods of water treatment*** and describe their characteristics and applications

		identify water treatment components and describe their applications and operation
E-15.04.02L	demonstrate knowledge of the procedures used to service water treatment systems	describe the procedures used to troubleshoot, maintain and repair water treatment systems and components
		describe the procedures used to protect water treatment systems and components

RANGE OF VARIABLES

types of water quality problems include: hardness, minerals, contamination/pollution, pH, taste/odour, turbidity

methods of water treatment include: filtering, softening, purifying, chemical feeding, sterilizing, reverse osmosis, de-ionizing, neutralizing, distilling

MAJOR WORK ACTIVITY F

INSTALLS, TESTS AND SERVICES LOW PRESSURE STEAM AND HYDRONIC HEATING AND COOLING SYSTEMS

TASK F-16 Installs, tests and services low pressure steam systems

TASK DESCRIPTOR

Low pressure steam systems are used for processes such as sterilization, humidification, heat exchange and direct heating. This task includes the sizing and installation of piping and components. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

F-16.01 Sizes piping and components for low pressure steam systems

Apprenticeship Level	4
Essential Skills	Numeracy, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-16.01.01L	demonstrate knowledge of sizing pipe and components for low pressure steam systems	interpret drawings and specifications
		interpret codes and regulations related to low pressure steam systems
		perform heat transfer calculations to determine ***loads***
		identify the type of pipe and ***components*** required
		determine where provisions for ***expansion*** are required

RANGE OF VARIABLES

loads include: domestic water heating, space heating, cooling
components include: traps, strainers, drip legs and valves
expansion includes: bellows, pistons, loops, swing joints and offsets

F-16.02 Installs piping and components for low pressure steam systems

Apprenticeship Level	4
Essential Skills	Numeracy, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-16.02.01L	demonstrate knowledge of installing pipe and components for low pressure steam systems	identify the pipe and joining methods for low pressure steam systems
		interpret drawings and determine the path for piping providing allowance for ***interferences***, grade, insulation and fire stopping
		perform linear expansion calculations
		describe the purpose and procedure for documenting pipe heat numbers according to AHJ and quality control procedures
F-16.02.02L	demonstrate knowledge of the principles of low pressure steam system operation	identify why steam traps, drip legs and condensate pumps are required

RANGE OF VARIABLES

interferences include: duct, structural, electrical, other piping

F-16.03 Tests piping and components for low pressure steam systems

Apprenticeship Level	4
Essential Skills	Thinking, Continuous Learning, Oral Communication

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-16.03.01L	demonstrate knowledge of testing piping and components for low pressure steam systems	identify types of piping and ***components*** and describe their characteristics and applications
		identify inspection requirements for low pressure steam piping and ***components*** in order to meet design specifications
F-16.03.02L	demonstrate knowledge of the principles of low pressure steam system operation	identify procedure for monitoring the system for performance deficiencies
F-16.03.03L	demonstrate knowledge of procedures used for testing piping and ***components*** for low pressure steam systems	describe the procedures used to test piping and ***components***

	identify testing equipment for piping and ***components***
	identify potential ***problems*** and ***faults*** with piping and ***components***

RANGE OF VARIABLES

components include: traps, strainers, drip legs and valves
problems include: water hammer, inadequate flow
faults include: cracks, corrosion

F-16.04 Services piping and components for low pressure steam systems

Apprenticeship Level	4
Essential Skills	Thinking, Writing, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-16.04.01L	demonstrate knowledge of low pressure steam system operation	identify system ***conditions requiring service***
		identify strategy for isolation
F-16.04.02L	demonstrate knowledge of servicing piping and ***components*** for low pressure steam systems	describe procedures used to diagnose problems with piping and ***components***
		interpret drawings, specifications and equipment manuals required for system service
		identify the tools and equipment used to service the system
		describe procedures for lock-out and tag-out of low pressure steam systems
		describe procedures for disassembly of the problem area of the system, for repair or replacement of the faulty ***components*** and for reassembly of the system
		describe procedures for reinstating system to operating condition and verifying repair
F-16.04.03L	demonstrate knowledge of documenting the service for the low pressure steam system	describe program of scheduled service
		identify required ***documentation*** pertaining to servicing low pressure steam systems

RANGE OF VARIABLES

conditions requiring service include: wear, noise, leaks, corrosion
components include: traps, strainers, drip legs and valves
documentation includes: service reports, maintenance reports, building logbook

TASK F-17 Installs, tests and services hydronic heating and cooling piping systems

TASK DESCRIPTOR

While the temperatures of the contents of these systems are different, the piping principles used in a variety of hydronic systems (conventional hydronic, solar, geothermal/ground source heating and cooling) are similar. High and low temperature systems use various or multiple heat sources, generators and exchangers. Cooling systems use methods such as heat exchangers, heat pumps, solar panels, cooling towers and chillers. Additional certification may be required in some jurisdictions to allow Plumbers to design and install these systems. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

F-17.01 Sizes piping and components for hydronic systems

Apprenticeship Level	2, 3
Essential Skills	Numeracy, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-17.01.01L	demonstrate knowledge of fluid fundamentals	explain volumetric coefficient differences between various fluids
		calculate linear and volumetric expansion
		describe the effects of viscosity for various ***fluids*** through temperature range
		describe the difference between laminar and turbulent flow
		describe how velocity affects flow characteristics
F-17.01.02L	demonstrate knowledge of factors that impact the design	identify zoning strategies and how they impact piping
		explain the point of no pressure change and the importance of its location within the piping system
		identify how piping design strategies affect pipe sizing
F-17.01.03L	demonstrate knowledge of sizing pipe and components for hydronic systems	define terminology associated with hydronic systems
		interpret codes and regulations pertaining to hydronic systems

	interpret information found on drawings and specifications
	perform heat loss calculations
	describe procedures for sizing ***heat transfer units***
	describe procedures for selecting and sizing ***auxiliary equipment***
	identify ***heat transfer units*** and describe their characteristics and operation
	identify ***fluids*** used in hydronic systems and describe their characteristics and applications
	identify ***additives*** used in hydronic systems and describe their purpose and applications

RANGE OF VARIABLES

fluids include: water and brine solutions
heat transfer units includes: fan coil units, radiators, radiant panels, unit heaters
auxiliary equipment includes: indirect fired hot water tank, heat exchangers, make-up tanks
additives include: treatment chemicals, rust inhibitors, glycol

F-17.02 Installs piping and components for hydronic systems

Apprenticeship Level	2, 3
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-17.02.01L	demonstrate knowledge of installing piping and components for hydronic systems	define terminology associated with hydronic systems
		interpret codes and regulations pertaining to hydronic systems
		interpret information pertaining to hydronic systems found on drawings and specifications
		describe the effects of trapped air in hydronic systems
		identify control strategies for hydronic systems
		identify tools and equipment relating to hydronic systems and describe their applications and procedures for use

	identify types of hydronic systems and describe their characteristics and operation
	identify hydronic system ***components*** and describe their purpose and operation
	identify types of ***heat transfer units*** and describe their characteristics and operation
	describe procedure to add ***fluids*** used in hydronic systems
	describe procedure to add ***additives*** used in hydronic systems
	describe the procedures used to install piping and ***components*** for hydronic systems
	describe the procedures used to protect hydronic system piping and ***components***
	describe the types of ***auxiliary equipment*** used with hydronic systems

RANGE OF VARIABLES

components include: valves, air removal devices, circulators, gauges and thermometers, heat transfer units, dirt elimination devices

heat transfer units includes: fan coil units, radiators, radiant panels, unit heaters, termination heat pumps

fluids include: water, chemical, air and brine solutions

additives include: treatment chemicals, rust inhibitors, glycol

auxiliary equipment includes: indirect fired hot water tanks, heat exchangers, make-up tanks

F-17.03 Tests piping and components for hydronic systems

Apprenticeship Level	2, 3
Essential Skills	Thinking, Numeracy, Document Use, Writing

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-17.03.01L	demonstrate knowledge of testing piping and components for hydronic systems	identify types of piping and components and describe their characteristics and applications
		inspect types of piping and components and verify their operation according to their design
F-17.03.02L	demonstrate knowledge of the principles of hydronic system operation	monitor the system for performance deficiencies

		explain the effect of elevation and temperature on pressure when testing hydronic systems
		explain the effects trapped air in a hydronic systems will have on testing and describe the procedures to prevent or correct it
F-17.03.03L	demonstrate knowledge of procedures used for testing piping and components for hydronic systems	describe the procedures used to test piping, components and ***auxiliary equipment***
		identify testing equipment for piping, components and ***auxiliary equipment***
		identify potential problems and ***faults*** with piping, components and ***auxiliary equipment***
		identify method of filling, adding, draining or purging ***fluids*** or ***additives***
		describe procedures for start-up of ***components***

RANGE OF VARIABLES

auxiliary equipment includes: indirect fired hot water tanks, heat exchangers, make-up tanks

faults include: cracks, corrosion, inadequate flow, air lock

fluids include: water, air and brine solutions

additives include: treatment chemicals

components include: valves, air removal devices, circulators, gauges and thermometers, heat transfer units, dirt elimination devices

F-17.04 Services piping and components for hydronic systems

Apprenticeship Level	2, 3
Essential Skills	Thinking, Numeracy, Document Use, Oral Communication

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-17.04.01L	demonstrate knowledge of the principles of hydronic system operation	identify system ***conditions requiring service***
		identify strategy for isolation
		identify ***hazards*** pertaining to hydronic system operation
F-17.04.02L	demonstrate knowledge of servicing piping and ***components*** for hydronic systems	describe procedures used to diagnose problems with piping and ***components*** for hydronic systems
		interpret drawings, specifications and equipment manuals required for system service

		identify the tools and equipment used to service the system
		describe procedures for lock-out and tag-out of hydronic systems
		describe procedures for disassembly of the problem area of the system, for repair or replacement of the faulty ***components*** and for reassembly of the system
		describe procedures for reinstating system to operating condition and verifying repair
F-17.04.03L	demonstrate knowledge of documenting the service for hydronic systems	describe program of scheduled service
		identify required ***documentation*** pertaining to servicing hydronic systems

RANGE OF VARIABLES

conditions requiring service include: wear, noise, leaks, corrosion

hazards include: high temperature, high pressure, cross-contamination, electrical, spillage

components include: valves, air removal devices, circulators, gauges and thermometers, heat transfer units, dirt elimination devices

documentation includes: service reports, maintenance reports, building logbooks

TASK F-18 Installs, tests and services hydronic heating and cooling generating systems

TASK DESCRIPTOR

Hydronic heat generating systems keep heat transfer fluid at an elevated temperature for purposes such as perimeter heating, fan-coils, in-floor heating and domestic hot water.

Hydronic cooling generating systems are used to keep the heat transfer fluid at a constant temperature for cooling. Additional certification may be required in some jurisdictions to allow plumbers to install, test and service these systems. For the purpose of this standard service includes troubleshooting, diagnosing, maintenance and repairs.

F-18.01 Installs hydronic heating generating systems

Apprenticeship Level	2, 3
Essential Skills	Thinking, Document Use, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-18.01.01L	demonstrate knowledge of hydronic heat sources and their operation	define terminology associated with hydronic heat sources
		identify hazards and describe safe work practices pertaining to hydronic heat sources
		identify and interpret codes, manufacturers' specifications, drawings and regulations pertaining to hydronic heat sources
		identify tools and equipment relating to hydronic heat sources and describe their applications and procedures for use
		explain the ***principles of heat transfer***
		identify ***sources of energy*** used by hydronic heat sources
		identify types of ***heat sources*** and describe their characteristics and operation
		identify hydronic heat source ***components*** and describe their purpose and operation
		explain ***variables*** that impact on pipe and tubing in hydronic systems and their associated calculations

	identify ***fluids*** used in ***hydronic systems*** and describe their characteristics and applications
	identify additives used in ***hydronic systems*** and describe their purpose and applications

RANGE OF VARIABLES

principles of heat transfer include: radiation, conduction, convection

sources of energy include: oil, gas, solid fuel, geothermal, solar

heat sources include: high and low mass boilers, heat pumps, solar thermal panels, bio-mass boilers

components include: boiler trim, heat pumps, expansion tanks, heat exchangers, circulating pumps, mixing components, valves

variables include: thermal expansion, thermal contraction, weight, friction loss, turbulence, galvanic action

fluids include: water, glycol and methyl hydrate

hydronic systems include: high pressure, low pressure

F-18.02 Installs hydronic cooling generating systems

Apprenticeship Level	2, 3
Essential Skills	Thinking, Documentation, Continuous Learning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-18.02.01L	demonstrate knowledge of ***principles of heat transfer***	explain the principles of how heat is transferred
		explain the difference between latent and sensible heat removal in cooling systems
F-18.02.02L	demonstrate knowledge of hydronic cooling sources and their operation	define terminology associated with hydronic cooling sources
		identify hazards and describe safe work practices pertaining to hydronic cooling sources
		identify and interpret codes, manufacturers' specifications, drawings and regulations pertaining to hydronic cooling sources
		identify tools and equipment relating to hydronic cooling sources and describe their applications and procedures for use
		identify sources of energy used by hydronic cooling sources
		identify types of ***cooling sources*** and describe their characteristics and operation

	identify hydronic cooling source ***components*** and describe their purpose and operation
	explain ***variables*** that impact on pipe and tubing in hydronic systems and their associated calculations
	identify ***fluids*** used in cooling systems and describe their characteristics and applications
	identify ***additives*** used in cooling systems and describe their purpose and applications

RANGE OF VARIABLES

principles of heat transfer include: radiation, conduction, convection
cooling sources include: heat pumps, cooling towers, fluid coolers, chillers
components include: expansion tanks, heat exchangers, circulating pumps, mixing components, valves
variables include: thermal expansion, thermal contraction, weight, friction loss, turbulence, galvanic action
fluids include: water and brine solutions
additives include: methyl hydrate and glycol

F-18.03 Tests hydronic heating and cooling generating systems

Apprenticeship Level	2, 3
Essential Skills	Thinking, Documentation Use, Writing

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-18.03.01L	demonstrate knowledge of testing hydronic heating and cooling sources and their operation	define terminology associated with hydronic heating and cooling sources
		identify ***tools and equipment*** used for testing
		describe function of ***safeties***
		describe the operation of ***controls***
F-18.03.02L	demonstrate knowledge of interpreting manufacturers' data	interpret manufacturers' data

RANGE OF VARIABLES

tools and equipment include: multimeter with thermal attachments, manometer, thermal scanner, combustion analysis equipment
safeties include: electronic, mechanical
controls include: electronic, mechanical

F-18.04 Services hydronic heating and cooling generating systems

Apprenticeship Level	2, 3
Essential Skills	Thinking, Continuous Learning, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-18.04.01L	demonstrate knowledge of the principles of hydronic heating and cooling generating systems operation	identify system ***conditions requiring service***
		identify hazards pertaining to hydronic heating and cooling generating systems
		identify strategy for isolation
F-18.04.02L	demonstrate knowledge of servicing for hydronic heating and cooling generating systems	describe procedures used to diagnose problems with hydronic heating and cooling ***generating equipment*** and associated piping and components
		interpret drawings, specifications and equipment manuals required for system service
		identify the tools and equipment used to service the system
		describe procedures for lock-out and tag-out of hydronic heating and cooling generating systems
		describe procedures for disassembly of the problem area of the system, for repair or replacement of the faulty ***components*** and for reassembly of the system
		describe procedures for reinstating system to operating condition and verifying repair
F-18.04.03L	demonstrate knowledge of documenting the service for hydronic heating and cooling generating systems and associated piping and ***components***	describe program of scheduled service
		identify required ***documentation*** pertaining to servicing hydronic systems

RANGE OF VARIABLES

conditions requiring service include: wear, noise, leaks, corrosion, no heat, no cooling, adverse effects of low return temperature

generating equipment include: boilers, cooling towers, heat pumps, chillers, fluid coolers, solar thermal panels

components include: expansion tanks, heat exchangers, circulating pumps, mixing components, valves

documentation includes: service reports, maintenance reports, building logbooks

TASK F-19 Installs, tests and services hydronic system controls and transfer units

TASK DESCRIPTOR

Hydronic system controls are used to monitor and/or control conditions such as water temperatures, circulator speeds and outdoor air temperatures. They may be installed by plumbers and controlled from different areas, either on-site or in remote locations.

Transfer units are used to move heat from one space to another. Examples of transfer units are fan units, radiant panels, cast iron radiators and terminal heat pumps. This is done to maintain a comfortable temperature. Additional certification may be required in some jurisdictions to allow plumbers to install, test and service these systems.

For the purposes of this standard service refers to maintenance, repair and diagnosis of the system.

F-19.01 Installs hydronic system controls

Apprenticeship Level	2, 3
Essential Skills	Digital Technology, Thinking, Document Use

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-19.01.01L	demonstrate knowledge of hydronic system control ***components and accessories***, their applications and operation	identify hydronic system control ***components and accessories*** and describe their purpose and operation
		identify types of ***hydronic system controls*** and describe their characteristics, applications and operation
		identify hazards and describe safe work practices pertaining to hydronic system control
		interpret codes and regulations pertaining to hydronic system controls
		interpret information pertaining to hydronic system controls found on drawings and specifications
		identify ***tools and equipment*** relating to hydronic system controls and describe their applications and procedures for use
F-19.01.02L	demonstrate knowledge of the procedures used to install hydronic system controls	describe the procedures used to install hydronic system control components
		describe the procedures used to set and adjust hydronic system control components
		describe the procedures used to protect hydronic system control components

RANGE OF VARIABLES

components and accessories include: control modules, thermostats, supply sensors, circulator sensors, outdoor temperature sensors, safety devices
hydronic system controls include: operating and temperature controls
tools and equipment include: wrenches, thermometers, multimeters

F-19.02 Installs hydronic transfer units

Apprenticeship Level	2, 3
Essential Skills	Thinking, Document Use, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-19.02.01L	demonstrate knowledge of ***hydronic transfer units***, their applications and operation	identify **types of *hydronic transfer units*** and describe their characteristics, applications and operation
		identify ***hazards*** and describe safe work practices pertaining to hydronic transfer units
		interpret codes and regulations pertaining to hydronic transfer units
		interpret information pertaining to hydronic transfer units found on drawings and specifications
		identify ***tools and equipment*** relating to hydronic transfer units and describe their applications and procedures for use
		identify hydronic transfer unit components and describe their purpose and operation
F-19.02.02L	demonstrate knowledge of the procedures used to install *hydronic transfer units*	***describe the procedures used to install*** hydronic transfer units
		describe the procedures used to set and adjust hydronic transfer unit
		describe the ***procedures used to protect*** hydronic transfer unit
		describe the ***procedures used to join*** hydronic transfer unit to system

RANGE OF VARIABLES

types of hydronic transfer units include: terminal heat pumps, fan coils, radiant panels
hazards include: working at height, confined space
tools and equipment include: drills, levels, measuring tapes
procedures used to protect include: vibration isolation, insulating, installation of cover plates
procedures used to join include: threading, soldering, grooving, welding

F-19.03 Tests hydronic system controls and transfer units

Apprenticeship Level	2, 3
Essential Skills	Thinking, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-19.03.01L	demonstrate knowledge of types of hydronic system controls and transfer units, related equipment and components, their applications and operation	identify types of hydronic system controls and transfer units, and related equipment and components
F-19.03.02L	demonstrate knowledge of testing hydronic system controls and transfer units, their procedures and equipment	identify ***testing equipment*** used for hydronic system controls and transfer units
		describe the procedures used to test hydronic system controls and transfer units

RANGE OF VARIABLES

testing equipment includes: control modules, digital technology (scanners, scopes), multimeters (including thermal accessories), gauges

F-19.04 Services hydronic system controls and transfer units

Apprenticeship Level	2, 3
Essential Skills	Thinking, Document Use, Digital Technology, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
F-19.04.01L	demonstrate knowledge of hydronic system controls and ***transfer unit equipment*** and ***components***, their applications and operation	describe the procedures used to service hydronic system controls and ***transfer unit equipment*** and ***components***
		identify types of hydronic system controls and transfer units, and describe their characteristics and applications
		identify tools and equipment relating to hydronic system controls and transfer unit and describe their applications and procedures for use
		identify hydronic system controls and ***transfer unit equipment*** and ***components*** and describe their purpose, operation and applications

F-19.04.02L	demonstrate knowledge of the procedures used to service hydronic system controls and transfer units	interpret ***performance data*** and specifications pertaining to servicing hydronic system controls and ***transfer unit equipment*** and ***components***
		describe the procedures used to service hydronic system controls and ***transfer unit equipment*** and ***components***

RANGE OF VARIABLES

transfer unit equipment includes: terminal heat pumps, fan coils, radiant panels
components include: flanges, unions, couplings, joints
performance data includes: documentation, system requirements

MAJOR WORK ACTIVITY G

INSTALLS, TESTS AND SERVICES FIRE PROTECTION SYSTEMS (NOT COMMON CORE)

TASK G-20 Installs, tests and services flow-through fire protection systems (Not Common Core)

TASK DESCRIPTOR

Fire protection systems help save lives and ensure minimal fire damage to structures. Jurisdictional regulations determine the scope of the work that plumbers can perform in installing fire protection systems. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

G-20.01 Installs flow-through fire protection systems (Not Common Core)

Apprenticeship Level	Not Common Core
Essential Skills	Document Use, Reading, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
G-20.01.01L	demonstrate knowledge of flow-through fire protection systems and components, their applications and operation	define terminology associated with flow-through fire protection systems according to specifications
		identify hazards and describe safe work practices pertaining to flow-through fire protection systems
		identify types of flow-through fire protection systems and describe their characteristics and applications
		interpret codes and regulations pertaining to flow-through fire protection systems
		interpret information pertaining to flow-through fire protection systems found on drawings and specifications
		identify tools and equipment relating to flow-through fire protection systems and describe their applications and procedures for use

		describe method for determining size of pipe required for flow-through fire protection system according to AHJ
		identify flow-through fire protection system components and describe their purpose and operation
G-20.01.02L	demonstrate knowledge of the procedures used to install flow-through fire protection systems	describe the procedures used to install flow-through fire protection systems

G-20.02 Tests flow-through fire protection systems (Not Common Core)

Apprenticeship Level	Not Common Core
Essential Skills	Reading, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
G-20.02.01L	demonstrate knowledge of flow-through fire protection systems, their components, applications and operation	describe the ***procedures used to test*** fire protection systems and components
		define terminology associated with flow-through fire protection systems
		identify hazards and describe safe work practices pertaining to flow-through fire protection systems
		identify types of flow-through protection systems and describe their characteristics and applications
		interpret codes and regulations pertaining to flow-through fire protection systems
		interpret information pertaining to flow-through fire protection systems found on drawings and specifications
		identify tools and equipment relating to flow-through fire protection systems and describe their applications and procedures for use
		identify flow-through fire protection systems components and describe their purpose and operation
G-20.02.02L	demonstrate knowledge of the procedures used to test flow-through fire protection systems	describe the ***procedures used to test*** flow-through fire protection systems

RANGE OF VARIABLES

procedures used to test include: pneumatic, hydrostatic

G-20.03 Services flow-through fire protection systems (Not Common Core)

Apprenticeship Level	Not Common Core
Essential Skills	Reading, Document Use, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
G-20.03.01L	demonstrate knowledge of flow-through fire protection systems and components, their applications and operation	define terminology associated with flow-through fire protection systems
		identify hazards and describe safe work practices pertaining to flow-through fire protection systems
		identify types of flow-through fire protection systems and describe their characteristics and applications
		interpret codes and regulations pertaining to flow-through fire protection systems
		interpret information pertaining to flow-through fire protection systems found on drawings and specifications
		identify tools and equipment relating to flow-through fire protection systems and describe their applications and procedures for use
		identify flow-through fire protection systems components and describe their purpose and operation
G-20.03.02L	demonstrate knowledge of the procedures used to maintain flow-through fire protection systems	identify procedures used to maintain flow-through fire protection systems
G-20.03.03L	demonstrate knowledge of the procedures used to repair flow-through fire protection systems	describe the procedures used to repair flow-through fire protection systems

TASK G-21 Installs, tests and services standpipe systems (Not Common Core)

TASK DESCRIPTOR

Standpipe systems help save lives and ensure minimal fire damage to structures. Jurisdictional regulations determine the scope of the work that plumbers can perform in installing standpipe systems. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

G-21.01 Installs piping and equipment for standpipe systems (Not Common Core)

Apprenticeship Level	Not Common Core
Essential Skills	Document Use, Reading, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
G-21.01.01L	demonstrate knowledge of standpipe systems and ***components***, their applications and operation	define terminology associated with standpipe systems
		identify ***hazards*** and describe safe work practices pertaining to standpipe systems
		identify types of standpipe systems and describe their characteristics and applications
		interpret codes and regulations pertaining to standpipe systems
		interpret information pertaining to standpipe systems found on drawings and specifications
		identify tools and equipment relating to standpipe systems and describe their applications and procedures for use
		identify standpipe systems ***components*** and describe their purpose and operation
G-21.01.02L	demonstrate knowledge of the procedures used to install standpipe systems	describe the procedures used to install standpipe systems

RANGE OF VARIABLES

components include: fire pumps, jockey pumps, siamese connections, supervisory valves, fire hose cabinets, flow switches

hazards include: electrical, contamination, flooding

G-21.02 Tests standpipe systems (Not Common Core)

Apprenticeship Level	Not Common Core
Essential Skills	Document Use, Reading, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
G-21.02.01L	demonstrate knowledge of standpipe systems and ***components***, their applications and operation	describe the procedures used to test standpipe systems and ***components***
		define terminology associated with standpipe systems and ***components***
		identify ***hazards*** and describe safe work practices pertaining to standpipe systems
		identify types of standpipe systems and describe their characteristics and applications
		interpret codes and regulations pertaining to standpipe systems
		interpret information pertaining to standpipe systems found on drawings and specifications
		identify tools and equipment relating to standpipe systems and describe their applications and procedures for use
		identify standpipe systems ***components*** and describe their purpose and operation

RANGE OF VARIABLES

components include: fire pumps, jockey pumps, siamese connections, supervisory valves, fire hose cabinets, flow switches

hazards include: electrical, contamination, flooding

G-21.03 Services standpipe systems (Not Common Core)

Apprenticeship Level	Not Common Core
Essential Skills	Document Use, Reading, Writing

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
G-21.03.01L	demonstrate knowledge of standpipe systems and components, their applications and operation	define terminology associated with standpipe systems
		identify ***hazards*** and describe safe work practices pertaining to standpipe systems
		identify types of standpipe systems and describe their characteristics and applications
		interpret codes and regulations pertaining to standpipe systems
		interpret information pertaining to standpipe systems found on drawings and ***specifications***
		identify tools and equipment relating to standpipe systems and describe their applications and procedures for use
		identify standpipe systems ***components*** and describe their purpose and operation
G-21.03.02L	demonstrate knowledge of the procedures used to maintain standpipe systems	describe the procedures used to maintain standpipe systems
G-21.03.03L	demonstrate knowledge of the procedures used to repair standpipe systems	describe the procedures used to repair standpipe systems

RANGE OF VARIABLES

hazards include: electrical, contamination, flooding

specifications include: NFPA, NPC, AHJ, manufacturers' literature, shop drawings, engineers' drawings

components include: fire pumps, jockey pumps, siamese connections, supervisory valves, fire hose cabinets, flow switches

MAJOR WORK ACTIVITY H
INSTALLS, TESTS AND SERVICES SPECIALIZED PLUMBING SYSTEMS

TASK H-22 Installs, tests and services specialized systems

TASK DESCRIPTOR

There are a number of specialized systems that, depending on the provincial jurisdictional regulations, may be worked on in the plumbing trade. Additional certification may be required in some jurisdictions to allow plumbers to work on these systems.

Natural gas, liquefied petroleum gas (LPG) and petroleum products are specialized piping installations. Plumbers install the piping from point of supply to the appliance isolation valve.

Plumbers install specialized piping and related equipment to provide medical gases in institutions such as hospitals, dental offices and clinics.

Residential irrigation systems provide water to lawns, gardens and flowerbeds. Commercial applications may include high volume installations for large areas such as farms, municipal parks and other public green spaces.

Ground source loops are essential components of a ground source heat pump system (geothermal). De-superheaters are components of the heat pump, used to provide heat supplementation to the domestic hot water supply.

Radon mitigation to systems is installed by plumbers to prevent the entry of harmful radon gas into buildings.

Solar thermal systems are used to transfer heat for potable water and space heating supplementation as well as pool heating. Industrial installations also apply and may include low and high temperature applications.

Drain pipe heat recovery systems reclaim otherwise lost heat content from drains such as showers, sinks and lavatory drains.

Compressed air systems provide filtered and dry compressed air for a variety of purposes.

Non-potable water systems would include green initiative items like grey water reuse and rainwater harvesting applications for irrigation and firefighting purposes. Plumbers would install collection and distribution piping and equipment for these systems. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repair.

Additional certification may be required in some jurisdictions to allow plumbers to install, test and service these systems.

H-22.01 Installs piping for specialized systems

Apprenticeship Level	3, 4
Essential Skills	Reading, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
H-22.01.01L	demonstrate knowledge of piping for ***specialized systems***, their applications and operation	identify types of piping for ***specialized systems*** and describe their ***properties, characteristics*** and applications
		interpret information pertaining to ***specialized systems*** found in ***specifications***
		interpret ***codes*** and regulations pertaining to piping for ***specialized systems***
H-22.01.02L	demonstrate knowledge of the procedures used to install piping for ***specialized systems***	identify the factors to consider for determining pipe sizing in ***specialized systems***
		identify ***tools and equipment*** for installing piping of ***specialized systems*** and describe their applications and procedures for use
		describe the procedures used to install piping for ***specialized systems***

RANGE OF VARIABLES

specialized systems include: compressed air, natural gas, propane, inert gas, medical gas, utility, process, radon

properties and characteristics include: physical characteristics, composition, toxicity, heating value, certification requirements

specifications include: engineered drawings, manufacturers' requirements, system requirements, job specifications, shop drawings

tools and equipment include: threading equipment, cutters, soldering and brazing equipment, flaring tools

codes include: NPC, CSA B149, ASME

H-22.02 Installs equipment and components for specialized systems

Apprenticeship Level	3, 4
Essential Skills	Document Use, Reading, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
H-22.02.01L	demonstrate knowledge of ***equipment and components*** for ***specialized systems*** and their applications and operation	define terminology associated with ***equipment and components*** for ***specialized systems***
		identify ***equipment and components*** of ***specialized systems*** and describe their purpose and operation
		identify hazards and describe safe work practices pertaining to ***equipment and components*** of ***specialized systems***
		identify handling, storage and transportation of ***equipment and components*** for ***specialized systems***
		interpret ***codes*** and regulations pertaining to ***equipment and components*** of ***specialized systems***
		interpret information found in specifications for ***equipment and components*** of ***specialized systems***
H-22.02.02L	demonstrate knowledge of the procedures used to install ***equipment and components*** of ***specialized systems***	identify ***tools and equipment*** used to install ***equipment and components*** of ***specialized systems*** and describe their applications and procedures for use
		describe the procedures used to install ***equipment and components*** of ***specialized systems***

RANGE OF VARIABLES

equipment and components include: tanks, pumps, valve boxes, zone valves, sprinkler heads, pressure gauges, backflow preventers, neutralizers, interceptors

specialized systems include: compressed air, natural gas, propane, inert gas, medical gas, utility, process, radon

codes include: NPC, CSA B149, ASME

tools and equipment include: wrenches, chain-falls, cutting equipment, come-alongs

H-22.03 Tests specialized systems

Apprenticeship Level	3, 4
Essential Skills	Document Use, Thinking, Writing, Reading

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
H-22.03.01L	demonstrate knowledge of procedures used to test ***specialized systems***	identify ***testing equipment*** for each ***specialized system*** and describe their applications and procedures for use
		identify potential problems and faults with each ***specialized system***
		describe the procedures used to test each ***specialized system***
		identify ***codes*** and regulations pertaining to ***specialized systems***

RANGE OF VARIABLES

testing equipment includes: inflatable test balls, test plugs, mandrels, compressors, hydrostatic pumps
specialized systems include: compressed air, natural gas, propane, inert gas, medical gas, utility, process, radon
codes include: NPC, CSA B149, ASME

H-22.04 Services specialized systems

Apprenticeship Level	3, 4
Essential Skills	Thinking, Document Use, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
H-22.04.01L	demonstrate knowledge of the procedures used to service ***specialized systems***	identify tools and equipment used to service ***specialized systems*** and describe their applications and procedures for use
		describe the procedures used to service ***specialized systems*** and their ***equipment and components***
		identify ***codes*** and regulations pertaining to servicing ***specialized systems***

RANGE OF VARIABLES

specialized systems include: compressed air, natural gas, propane, inert gas, medical gas, utility, process, radon

equipment and components include: tanks, pumps, valve boxes, zone valves, sprinkler heads, pressure gauges, backflow preventers

codes include: NPC, CSA B149, ASME

TASK H-23 Installs, tests and services process piping systems

TASK DESCRIPTOR

Process piping allows for a wide variety of applications. These piping systems may convey materials or fluids for applications such as manufacturing or treatment processes. These systems are installed in locations ranging from small businesses to large factories. For the purpose of this standard, service includes troubleshooting, diagnosing, maintenance and repairs.

H-23.01 Installs piping for process piping systems

Apprenticeship Level	4
Essential Skills	Reading, Document Use, Numeracy

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
H-23.01.01L	demonstrate knowledge of process piping systems, their applications and operation	identify ***types of process piping systems*** and describe their properties, characteristics and applications
		interpret information pertaining to process piping systems found in ***specifications***
		interpret ***codes*** and regulations pertaining to piping for process piping systems
H-23.01.02L	demonstrate knowledge of the procedures used to install piping for process piping systems	identify ***tools and equipment*** relating to process piping systems and describe their applications and procedures for use
		describe the procedures used to install piping for process piping systems
		describe the ***procedures used to protect*** piping for process piping systems

RANGE OF VARIABLES

types of process piping systems include: food processing (food grade, non-food grade), reverse-osmosis, high purity water, water treatment plant, waste water treatment plant, non-potable water (reclaim)

specifications include: engineered drawings, manufacturers' requirements, system requirements, job specifications, shop drawings, standards

codes include: NPC, CSA, CFDA, ASME

tools and equipment include: threading equipment, cutters, torches, grooving equipment, flaring tools, welding equipment

procedures used to protect include: installing guards, installing anchor points, installing expansion joints

H-23.02 Installs equipment and components for process piping systems

Apprenticeship Level	4
Essential Skills	Document Use, Reading, Thinking

KNOWLEDGE

	Learning Outcomes	Learning Objectives
H-23.02.01L	demonstrate knowledge of ***types of process piping systems***, ***equipment and components*** and their applications and operation	define terminology associated with process piping ***equipment and components***
		identify hazards and describe safe work practices pertaining to process piping ***equipment and components***
		identify proper handling, storage and transportation of process piping ***equipment and components***
		interpret ***codes***, ***specifications*** and regulations pertaining to process piping ***equipment and components***
		interpret information found in specifications for process piping ***equipment and components***
		identify process piping ***equipment and components*** and describe their purpose and operation
H-23.02.02L	demonstrate knowledge of the procedures used to install process piping ***equipment and components***	identify ***tools and equipment*** relating to process piping ***equipment and components*** and describe their applications and procedures for use
		describe the procedures used to install process piping ***equipment and components***

RANGE OF VARIABLES

types of process piping systems include: food processing (food grade, non-food grade), reverse-osmosis, high purity water, water treatment plant, waste water treatment plant, non-potable water (reclaim)

equipment and components include: tanks, pumps, valve boxes, zone valves, sprinkler heads, pressure gauges, backflow preventers

codes include: NPC, CSA, CFDA, ASME

tools and equipment include: threading equipment, cutters, torches, grooving equipment, flaring tools, welding equipment

specifications include: engineered drawings, manufacturers' requirements, system requirements, job specifications, shop drawings, standards

H-23.03 Tests process piping systems

Apprenticeship Level	4
Essential Skills	Document Use, Writing, Thinking

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
H-23.03.01L	demonstrate knowledge of the procedures used to test ***process piping systems***	identify ***testing equipment*** relating to ***process piping systems*** and describe their application
		identify potential problems and faults with each ***process piping system***
		describe the procedures used to test and troubleshoot ***process piping systems***
		identify ***codes***, ***specifications*** and regulations pertaining to process piping systems

RANGE OF VARIABLES

process piping systems include: food processing (food grade, non-food grade), reverse-osmosis, high purity water, water treatment plant, waste water treatment plant, non-potable water (reclaim)

testing equipment includes: inflatable test balls, test plugs, compressors

codes include: NPC, CSA, CFDA, ASME

specifications include: engineered drawings, manufacturers' requirements, system requirements, job specifications, shop drawings, standards

H-23.04 Services process piping systems

Apprenticeship Level	4
Essential Skills	Thinking, Document Use, Working with Others

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
H-23.04.01L	demonstrate knowledge of the procedures used to service ***process piping systems***	identify ***tools and equipment*** used to service ***process piping systems*** and describe their applications and procedures for use
		describe the procedures used to service ***process piping systems*** and their ***equipment and components***
		identify ***codes, specifications*** and regulations pertaining to servicing ***process piping systems***

RANGE OF VARIABLES

process piping systems include: food processing (food grade, non-food grade), reverse-osmosis, high purity water, water treatment plant, waste water treatment plant, non-potable water (reclaim)

tools and equipment include: threading equipment, cutters, torches, grooving equipment, flaring tools, welding equipment

equipment and components include: tanks, pumps, valve boxes, zone valves, specialty valves, pressure gauges, backflow preventers

codes include: NPC, CSA, CFDA, ASME

specifications include: engineered drawings, manufacturers' requirements, system requirements, job specifications, shop drawings, standards

APPENDIX A
ACRONYMS

ABS	acrylonitrile-Butadiene-Styrene
AHJ	Authority Having Jurisdiction
ASME	American Society of Mechanical Engineers
CFDA	Canadian Food and Drugs Act
CPVC	chlorinated polyvinyl chloride
CSA	Canadian Standards Association
DWV	drainage, waste and vent
GMAW	Gas Metal Arc Welding
GPS	global positioning system
GTAW	Gas Tungsten Arc Welding
HDPE,	high-density polyethylene
ICI	industrial/commercial/institutional
ID	inside diameter
LEED	Leadership in Energy and Environmental Design
LPG	liquefied petroleum gas
MAPP	methylacetylene-propadiene propane
NBC	National Building Code
NFPA	National Fire Protection Association
NPC	National Plumbing Code
OD	outside diameter
PE	Polyethylene
PEX	crosslinked polyethylene
PEX-AL-PEX	PEX-Aluminum-PEX
PPE	personal protective equipment
PVC	polyvinyl chloride
RPBP	reduced pressure backflow preventer
SDS	Safety Data Sheets
SMAW	Shielded Metal Arc Welding
TDG	Transportation of Dangerous Goods
TDS	total dissolved solids
TSP	trap seal primer
WHMIS	Workplace Hazardous Materials Information System
WLL	working load limit

APPENDIX B
TOOLS AND EQUIPMENT

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
health care and infectious control equipment
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

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
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)

knife
level
locking pliers
pick
pipe wrenches
torque wrench
transfer pump (hand-operated)
tri square
utility brushes
wire brushes

Power Tools and Equipment

air compressor and accessories
band saw
bench grinder
booster pump
chain saw
chop saw
circular saw
compaction equipment
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
mini-excavator
portable band saw (hack saw)
powder-actuated tools
power hole saw
reciprocating saw
rotary hammer
steamer
task lighting equipment
telescopic boom
transfer pump (electric and pneumatic)

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
ratchet cutter
snap cutter
specialized assembly tools and equipment
T-extracting tool
torch
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
pipe locator
refractometer
scale rule
scanning equipment
test strips and kits
thermal imager
thermometer
two way radios

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
equalizer beam
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)

APPENDIX C
GLOSSARY

appliance	piece of equipment which may require connection to a plumbing system
backflow	flowing back or reversal of the normal direction of the flow
backflow preventer	a device used to prevent backflow due to back pressure or back siphonage
backing	a layer of material that forms, protects and strengthens the supports for plumbing fixtures and equipment
backwater valve	check valve designed for use in a gravity drainage system
benchmark	predetermined elevation used as a reference point
check valve	valve that permits flow in only one direction
cleanout	access provided in drainage and venting systems to provide for cleaning and inspection services
cross-connection	a connection between a potable water source to a non-potable water source
developed length	length along the centre line of the pipe and fitting
Diameter Index Safety System (DISS)	index system used for medical gases which defines the properties of the access points (diameter and configuration) allowing only specific connection devices to connect to corresponding gas access point
dielectric protection	a method isolating dissimilar metals to prevent electrolysis (ion transfer)
drainage system	assembly of pipes, fittings, fixtures, traps and appurtenances that is used to convey sewage, clear-water waste or storm water to a public sewer or a private sewage disposal system, but does not include subsoil drainage pipes
embedded components	components of a plumbing system that are encased in concrete or other materials
expansion tank	device used to accept expansion of water in a closed system
fire monitoring system	a system that assists locating fire hazard in a building and alerting first responders
fire separation / fire stopping	construction assembly that acts as a barrier against the spread of fire and smoke
fixture	receptacle, appliance, apparatus or other device that discharges sewage or clear-water waste, includes a floor drain
fixture unit – drainage systems	unit of measure based on the rate of discharge, time of operation and frequency of use of a fixture that expresses the hydraulic load that is imposed by that fixture on the drainage system
fixture unit – water distribution systems	unit of measure based on the rate of supply, time of operation and frequency of use of a fixture or outlet that expresses the hydraulic load that is imposed by that fixture or outlet on the water supply system
flashing	component made of rubber, sheet metal or lead used to seal around exterior pipe penetrations
flex connector	device used to isolate vibration and allow for expansion and movement of appliances, equipment and piping
flow-through fire protection systems	any fire protection system connected to potable water piping
heat tracing	an electrical resistance cable, hydronic or steam piping that prevents the freezing of systems
offset	a piping that connects the ends of two pipes that are parallel or perpendicular

pitless adaptor	fitting that allows the connection and removal of a pump without the use of tools or entering a confined space
plumbing system	drainage system, a venting system and a water system or parts thereof
potable	safe for human consumption
private sewage treatment system	privately owned plant for the treatment and disposal of sewage (such as a septic tank with an absorption field)
private water supply system	assembly of pipes, fittings, valves, equipment and appurtenances that supplies water from a private source to a water distribution system
purge	to pass inert gas inside of pipe to displace oxygen and prevent oxidation during brazing and welding operations
roof drain	fitting or device that is installed in the roof to permit storm water to discharge into a leader
rough-in	placement of pipes in order to allow for final installation of fixtures and equipment
sanitary sewer	sewer that conducts sewage
sensory inspection	inspection using one or more of the following: sight, taste, touch, smell, auditory
sewage	any liquid water other than clear-water waste or storm water
sleeve	a component used to create a penetration through walls, floors and ceilings prior to the installation of piping
soil-or-waste pipe	pipe in a sanitary drainage system
sounding	a method of detecting cracks in cast iron pipe and fitting
storm sewer	sewer that conveys storm water
swing joint	piping arrangement to allow for movement without putting strain on piping
thrust blocks	a formed concrete block used to prevent movement of a fitting at a change of direction in a buried piping system
torque arrestor	device installed on a pipe in a well casing which prevents the pipe from spinning
trap	fitting or device that is designed to hold a liquid seal that will prevent the passage of gas but will not materially affect the flow of a liquid
tube	measured by inside diameter
tubing	measured by OD and wall thickness
vent piping	pipe that is part of a venting system
venting system	assembly of pipes and fittings that connects a drainage system with outside air for circulation of air and the protection of trap seals in the drainage system
water distribution system	assembly of pipes, fittings, valves and appurtenances that conveys water from the water service pipe or private water supply system to water supply outlets, fixtures, appliances and devices
water heater	device for heating water for plumbing services
water service pipe	pipe that conveys water from a public water main or private water source to the inside of a building up to and including the main isolation valve
water system	private water supply system, a water service pipe, a water distribution system or parts thereof