PROGRAM PROGRAMME
EXCELLENCE
RED SEAL · SCEAU ROUGE

Red Seal Occupational Standard

Plumber

2016

INTERPROVINCIAL STANDARD
CANADA
NORME INTERPROVINCIALE

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Employment and Social Development Canada
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Canada

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PLUMBER

RED SEAL OCCUPATIONAL STANDARD

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PDF

Cat. No.: Em15-3/6-2016E-PDF

ISBN: 978-0-660-06053-8

ESDC

Cat. No. : LM-428-08-16E

FOREWORD

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this Red Seal Occupational Standard (RSOS) as the Red Seal standard for the Plumber trade.

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. Employment and Social Development Canada (ESDC) sponsors the Red Seal Program, which, under the guidance of the CCDA, develops a national occupational standard for each of the Red Seal trades.

Standards have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and assessment tools for apprenticeship and certification authorities;
- to develop common tools for apprenticeship on-the-job and technical training in Canada;
- to facilitate the mobility of apprentices and skilled workers in Canada;
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

Any questions, comments, or suggestions for changes, corrections, or revisions to this standard or any of its related products may be forwarded to:

Trades and Apprenticeship Division
Apprenticeship and Regulated Occupations Directorate
Employment and Social Development Canada
140 Promenade du Portage, Phase IV
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STRUCTURE OF THE OCCUPATIONAL STANDARD

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

Industry Expected Performance: description of the expectations regarding the level of performance of the tasks, including information related to specific codes, regulations and standards that must be observed

Language Requirements: description of the language requirements for working and studying in this trade in Canada

Pie Chart: a graph which depicts the national percentages of exam questions assigned to the major work activities

Task Matrix and Examination Weightings: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard and their respective exam weightings

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

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

Skills:

Performance Criteria: description of the activities that are done as the sub-task is performed

Evidence of Attainment: proof that the activities of the sub-task meet the expected performance of a tradesperson who has reached journeyperson level

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 performance criteria, evidence of attainment, 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

ACKNOWLEDGEMENTS

The CCDA and ESDC wish to express sincere appreciation for the contribution of the many tradespersons, industrial establishments, professional associations, labour organizations, provincial and territorial government departments and agencies, and all others who contributed to this publication.

Acknowledgement is extended by ESDC and the CCDA to the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry and the Mechanical Contractors Association of Canada for their contributions to the development of this standard.

Special thanks are offered to the following representatives who contributed greatly to the original draft of the standard and provided expert advice throughout its development:

Jarrod Brown	Nova Scotia
Adam Dodd	British Columbia
Scott Giesbrecht	Alberta
Michael Gordon	Ontario
Tim Groenendyk	Saskatchewan
Rick Guilbault	Manitoba
Tim Hayward	Newfoundland and Labrador
Blair Howes	Alberta
Mark MacAdam	Prince Edward Island
Justin MacDonald	New Brunswick
Andy O'Hearn	New Brunswick
Richard Player	Prince Edward Island
Renault Sage	Nunavut
Marco Silvestri	Manitoba
Ryan Skinner	Nova Scotia
Claudio Spanuolo	Ontario

This standard was prepared by the Apprenticeship and Regulated Occupations Directorate of ESDC. Its coordination, facilitation and processing was undertaken by employees of the standards development team of the Trades and Apprenticeship Division. The host jurisdiction of Alberta also participated in the development of this standard.

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 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. Computers 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.

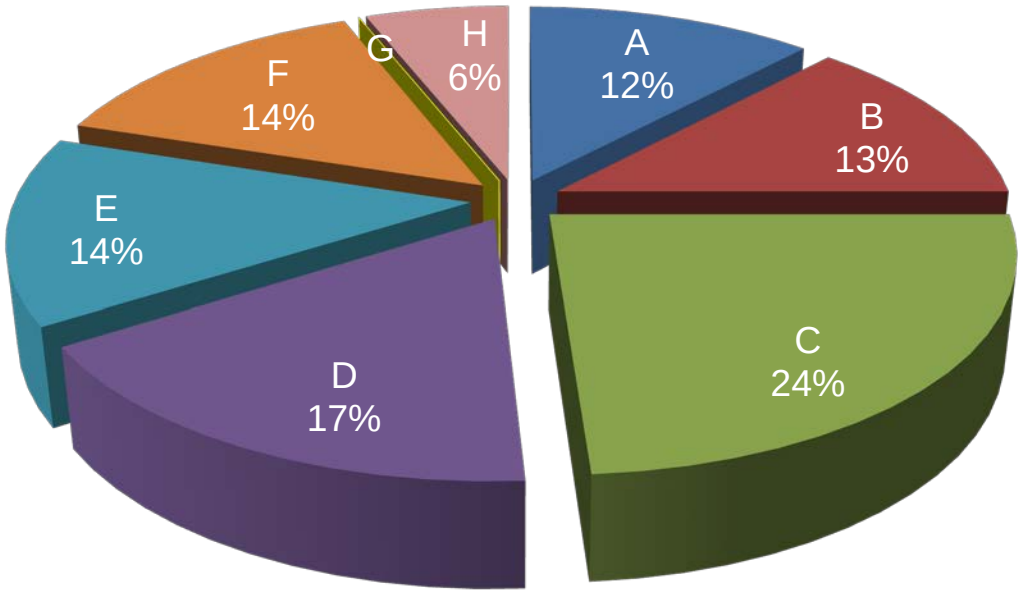
INDUSTRY EXPECTED PERFORMANCE

All tasks must be performed according to the applicable jurisdictional codes and standards. All health and safety standards must be respected and observed. Work should be done efficiently and at a high quality without material waste or environmental damage. All requirements of the manufacturer, client specifications, the NPC and AHJ must be met. At a journeyperson level of performance, all tasks must be done with minimal direction and supervision. As a journeyperson progresses in their career there is an expectation they continue to upgrade their skills and knowledge to keep pace with industry and promote continuous learning in their trade through mentoring of apprentices.

LANGUAGE REQUIREMENTS

It is expected that journeypersons are able to understand and communicate in either English or French, which are Canada’s official languages. English or French are the common languages of business as well as languages of instruction in apprenticeship programs.

PIE CHART
OF RED SEAL EXAMINATION WEIGHTINGS



MWA A	Performs Common Occupational Skills	12%
MWA B	Prepares and Assembles Pipe	13%
MWA C	Installs, Tests and Services Sewers, Sewage Treatment Systems and Drainage, Waste and Vent (DWV) Systems	24%
MWA D	Installs, Tests and Services Water Service and Distribution	17%
MWA E	Installs, Tests and Services Fixtures, Appliances and Water Treatment Systems	14%
MWA F	Installs, Tests and Services Low Pressure Steam and Hydronic Heating and Cooling Systems	14%
MWA G	Installs, Tests and Services Fire Protection Systems	NCC
MWA H	Installs, Tests and Services Specialized Plumbing Systems	6%

This pie chart represents a breakdown of the interprovincial Red Seal examination. Percentages are based on the collective input from workers from the trade from across Canada. The Task Matrix on the next pages indicates the breakdown of tasks and sub-tasks within each Major Work Activity, the percentage of questions assigned to the Tasks. The Interprovincial examination for this trade has 125 questions.

PLUMBER

TASK MATRIX CHART

A - PERFORMS COMMON OCCUPATIONAL SKILLS — 12%

Task A-1 **Performs safety-related functions** **20%**	**A-1.01 Maintains safe work environment**	**A-1.02 Uses personal protective equipment (PPE) and safety equipment**	**A-1.03 Performs lock-out and tag-out procedures**
Task A-2 **Uses and maintains tools and equipment** **27%**	**A-2.01 Uses common tools and equipment**	**A-2.02 Uses access equipment**	**A-2.03 Uses rigging, hoisting, lifting and positioning equipment**
	A-2.04 Rigs loads for cranes	**A-2.05 Uses welding equipment**	**A-2.06 Uses soldering and brazing equipment**
	A-2.07 Uses oxy-fuel equipment		
Task A-3 **Organizes work.** **18%**	**A-3.01 Organizes project tasks and procedures**	**A-3.02 Organizes materials and supplies**	
Task A-4 **Performs routine trade activities** **26%**	**A-4.01 Performs piping system layout**	**A-4.02 Calculates pipe, tube and tubing lengths**	**A-4.03 Calculates piping offsets**
	A-4.04 Installs piping supports	**A-4.05 Installs sleeves**	**A-4.06 Commissions systems**
	A-4.07 Protects piping systems, equipment and structure from damage	**A-4.08 Coordinates excavation and backfilling of trenches**	**A-4.09 Installs fire stopping devices and materials**
Task A-5 **Uses communication and mentoring techniques** **9%**	**A-5.01. Uses communication techniques**	**A-5.02 Uses mentoring techniques**	

B - PREPARES AND ASSEMBLES PIPE — 13%

Task B-6 **Prepares pipe** **41%**	**B-6.01 Inspects tube, tubing, pipe and fittings before installation**	**B-6.02 Cuts tube, tubing and pipe**	**B-6.03 Bends tube, tubing and pipe**
	B-6.04 Prepares tube, tubing and pipe connections		
Task B-7 **Joins tube, tubing and pipe** **59%**	**B-7.01 Joins copper tube, tubing and pipe**	**B-7.02 Joins plastic pipe and tubing.**	**B-7.03 Joins steel pipe**
	B-7.04 Joins cast iron pipe	**B-7.05 Joins specialized pipe**	

C - INSTALLS, TESTS AND SERVICES SEWERS, SEWAGE TREATMENT SYSTEMS AND DRAINAGE, WASTE AND VENT (DWV) SYSTEMS — 24%

Task C-8 **Installs, tests and services sewers** **19%**	**C-8.01 Sizes pipe for sewers**	**C-8.02 Installs manholes and catch basins**	**C-8.03 Installs piping for sewers**
	C-8.04 Tests manholes, catch basins and piping for sewers	**C-8.05 Services manholes, catch basins and piping for sewers**	
Task C-9 **Installs, tests and services sewage treatment systems** **14%**	**C-9.01 Plans installation of sewage treatment systems**	**C-9.02 Installs sewage treatment system components**	**C-9.03 Tests sewage treatment systems and components**
	C-9.04 Services sewage treatment systems and components		

Task C-10 **Installs, tests and services interior drainage, waste and vent (DWV) systems** **67%**	**C-10.01 Sizes pipe for interior drainage, waste and vent (DWV) systems**	**C-10.02 Installs underground piping and components for interior drainage, waste and vent (DWV) systems**	**C-10.03 Installs piping and components for interior drainage, waste and vent (DWV) systems above-ground**
	C-10.04 Tests interior drainage, waste and vent (DWV) systems	**C-10.05 Services piping and components for interior drainage, waste and vent (DWV) systems**	

D - INSTALLS, TESTS AND SERVICES WATER SERVICE AND DISTRIBUTION

17%

Task D-11 **Installs, tests and services water services** **24%**	**D-11.01 Sizes pipe for water services**	**D-11.02 Installs piping for water services**	**D-11.03 Installs water service equipment**
	D-11.04 Tests water service piping and components	**D-11.05 Services water services**	
Task D-12 **Installs, tests and services potable water distribution systems** **52%**	**D-12.01 Sizes piping and equipment for potable water distribution systems**	**D-12.02 Installs piping for potable water distribution systems**	**D-12.03 Installs potable water distribution equipment**
	D-12.04 Installs and uses cross-connection control devices and methods	**D-12.05 Tests potable water distribution systems**	**D-12.06 Services potable water distribution systems**
Task D-13 **Installs, tests and services pressure systems** **24%**	**D-13.01 Sizes pressure systems**	**D-13.02 Installs piping for pressure systems**	**D-13.03 Installs equipment and components for pressure systems**
	D-13.04 Tests pressure systems	**D-13.05 Services pressure systems**	

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

14%

Task E-14 **Installs, tests and services plumbing fixtures and appliances** **72%**	**E-14.01 Installs fixture supports**	**E-14.02 Installs plumbing fixtures and appliances**	**E-14.03 Tests plumbing fixtures and appliances**
	E-14.04 Services plumbing fixtures and appliances		
Task E-15 **Installs, tests and services water treatment equipment** **28%**	**E-15.01 Sizes water treatment equipment**	**E-15.02 Installs water treatment equipment**	**E-15.03 Tests water treatment equipment**
	E-15.04 Services water treatment equipment		

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

14%

Task F-16 **Installs, tests and services low pressure steam systems** **12%**	**F-16.01 Sizes piping and components for low pressure steam systems**	**F-16.02 Installs piping and components for low pressure steam systems**	**F-16.03 Tests piping and components for low pressure steam systems**
	F-16.04 Services piping and components for low pressure steam systems		
Task F-17 **Installs, tests and services hydronic heating and cooling piping systems** **33%**	**F-17.01 Sizes piping and components for hydronic systems**	**F-17.02 Installs piping and components for hydronic systems**	**F-17.03 Tests piping and components for hydronic systems**
	F-17.04 Services piping and components for hydronic systems		

Task F-18 **Installs, tests and services hydronic heating and cooling generating systems** **28%**	**F-18.01 Installs hydronic heating generating systems**	**F-18.02 Installs hydronic cooling generating systems**	**F-18.03 Tests hydronic heating and cooling generating systems**
	F-18.04 Services hydronic heating and cooling generating systems		
Task- F-19 **Installs, tests and services hydronic system controls and transfer units** **27%**	**F-19.01 Installs hydronic system controls**	**F-19.02 Installs hydronic transfer units**	**F-19.03 Tests hydronic system controls and transfer units**
	F-19.04 Services hydronic system controls and transfer units		

G – INSTALLS, TESTS AND SERVICES FIRE PROTECTION SYSTEMS NCC

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

H – INSTALLS, TESTS AND SERVICES SPECIALIZED PLUMBING SYSTEMS

6%

Task H-22 **Installs, tests and services specialized systems** **60%**	**H-22.01 Installs piping for specialized systems**	**H-22.02 Installs equipment and components for specialized systems**	**H-22.03 Tests specialized systems**
	H-22.04 Services specialized systems		
Task H-23 **Installs, tests and services process piping systems** **40%**	**H-23.01 Installs piping for process piping systems**	**H-23.02 Installs equipment and components for process piping systems**	**H-23.03 Tests process piping systems**
	H- 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

Essential Skills Oral Communication, Thinking, Document Use, Reading

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-1.01.01P	participate in tool box meetings	documentation of participation in meetings is signed off
A-1.01.02P	plan pre-hazard assessments before performing each task	pre-hazard assessment plan is in place and task is completed without incident
A-1.01.03P	reference ***safety regulations***	regulations are being followed by workers on site
A-1.01.04P	recognize, handle, store and document ***hazardous materials***	***hazardous materials*** are recognized, handled, stored and documented according to Workplace Hazardous Materials Information System (WHMIS) and controlled products regulations
A-1.01.05P	locate and interpret ***WHMIS materials***	directions on SDS are being followed (such as use of PPE and ventilation)
A-1.01.06P	recognize and report unsafe conditions and ***worksite hazards***	conditions are brought to the attention of safety advisors and documented

A-1.01.07P	address or correct the ***hazard*** by contacting the supervisor and Health and Safety representative immediately	***hazard*** is mitigated or eliminated and information is documented and communicated to personnel
A-1.01.08P	communicate ***hazards*** to co-workers using various ***methods***	co-workers are aware of ***hazards***
A-1.01.09P	keep workplace tidy and organized (housekeeping)	workplace is free of debris and clutter

RANGE OF VARIABLES

safety regulations include: lock-out and tag-out regulations, jurisdictional safety and health regulations, site-specific regulations

hazardous materials include: pipe dope, cutting oil, glycol, solvents, compressed gas cylinders

WHMIS materials are: SDS, labels

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

methods include: verbal, safety meetings, sirens, air horns, radios, warning lights, flagging off the area, putting up signage, digital

	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

Essential Skills Reading, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-1.02.01P	select ***PPE*** and ***safety equipment*** for task	***PPE*** and ***safety equipment*** selected meet application requirements including fit, specific work hazards and conditions
A-1.02.02P	maintain ***PPE*** and ***safety equipment*** by cleaning and ensuring it is in good condition	***PPE*** and ***safety equipment*** are in safe working condition
A-1.02.03P	identify and replace worn, damaged or defective ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are tagged and removed from service
A-1.02.04P	inspect for function, expiration date and fit of ***PPE*** and ***safety equipment***	all equipment deficiencies are identified, and defective equipment is tagged and removed from service
A-1.02.05P	store ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are organized and stored to prevent damage and theft
A-1.02.06P	complete ***training and certification*** for use of ***PPE*** and ***safety equipment***	certifications are achieved to meet jurisdictional and site-specific guidelines
A-1.02.07P	connect, tie or hook fall-protection and fall-arrest equipment	connection is performed in a manner that restricts user's free fall movement
A-1.02.08P	ensure fall-protection and fall-arrest equipment is re-certified	certification of equipment meets jurisdictional codes and regulations
A-1.02.09P	use ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** is being used in accordance with jurisdictional and manufacturers' guidelines

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

training and certification requirements include: first aid, confined space, fall-arrest, aerial work platform use

	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

Essential Skills Oral Communication, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-1.03.01P	determine lock-out and tag-out requirements for ***system components***	requirements for lock-out and tag-out are met according to local AHJ and site-specific guidelines
A-1.03.02P	obtain and install designated ***lock-out and tag-out equipment***	***lock-out and tag-out equipment*** is placed in correct location based on documentation from owner's representative
A-1.03.03P	complete required ***documentation*** for lock-out and tag-out	***documentation*** for lock-out and tag-out is signed off by involved personnel
A-1.03.04P	apply ***isolation methods*** to system being locked out	system is at a zero-energy state
A-1.03.05P	remove lock-out equipment	***procedures*** for lock-out removal are followed

RANGE OF VARIABLES

system components include: pumps, valves, electrical panels

lock-out and tag-out equipment includes: lock and key, chains and tags, lock-out scissor clamps, lock-box

lock-out documentation includes: lock-out and tag-out permits, tool box meeting reports, sign-in and sign-out sheets

isolation methods include: double-block-and-bleed, blinding, breaker locks, opening low point valves, checking gauges and switches, inspecting sight glasses

procedures include: tag-in and tag-out, sign-in and sign-out, company-specific policies

	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

Essential Skills Thinking, Document Use, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**

A-2.01.01P	clean, lubricate and sharpen ***tools and equipment***	***tools and equipment*** are in safe working condition
A-2.01.02P	perform visual inspection before using ***tools and equipment***	***deficiencies or defects*** are identified
A-2.01.03P	identify and replace worn, damaged or defective ***tools and equipment***	defective ***tools and equipment*** are tagged using ***identification markings*** and removed from service
A-2.01.04P	inspect and store ***tools and equipment***	***tools and equipment*** are organized and stored to prevent damage
A-2.01.05P	follow scheduled maintenance procedures for ***tools and equipment***	documentation is completed for maintenance 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)

deficiencies or defects include: worn, bent, broken, damaged and inoperable tools

identification markings include: tape, colour codes, markings, tags

	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

Essential Skills	Working with Others, Document Use, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.02.01P	select ***ladders***	***ladder*** selected meets application requirements
A-2.02.02P	select ***aerial work platforms***	***aerial work platform*** selected meets application requirements
A-2.02.03P	perform visual inspection of ladders and aerial work platforms prior to and during use	safety documentation is completed with required signatures
A-2.02.04P	secure ladders and aerial work platforms	ladders and aerial work platforms are secured according to safety codes, jurisdictional guidelines and site-specific requirements
A-2.02.05P	identify, tag and replace worn, damaged or defective ladders and aerial work platforms	ladders and aerial work platforms are tagged and removed from service
A-2.02.06P	store ladders and aerial work platforms	ladders and aerial work platforms are organized and stored to prevent damage
A-2.02.07P	check certification dates for aerial work platforms	documentation confirms that any aerial work platforms' certifications are current
A-2.02.08P	obtain ***motorized aerial work platform*** training	training meets company policy and jurisdictional requirements

RANGE OF VARIABLES

ladders include: step ladders, extension ladders, platform ladders
aerial work platforms include: scaffolds, motorized work platforms
motorized aerial work platforms include: scissor lift, articulated boom, personnel basket

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

Essential Skills Thinking, Numeracy, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.03.01P	plans lift	lift plan and ***communication strategy*** is implemented according to job requirements and site conditions
A-2.03.02P	identify new and existing ***hazards***	***hazards*** are identified and recorded and hazard assessment forms are completed
A-2.03.03P	determine the equipment used is suitable for ***load requirements***	***rigging, hoisting, lifting and positioning equipment*** is verified to meet working load limit (WLL) requirements
A-2.03.04P	detect rigging, hoisting, lifting and positioning ***equipment faults***	equipment is inspected physically and visually, and is determined to be in good condition
A-2.03.05P	assess, report and, tag and remove damaged equipment from service	damaged equipment is tagged and removed from service

A-2.03.06P	inspect line for knots, hitches and bends	lines are de-rated when ***knots, hitches and bends*** are faulty and lines are removed from service
A-2.03.07P	communicate lift plan to others	personnel, clients and authorities are advised of lift plan
A-2.03.08P	identify potential obstructions and ***hazards*** for ***rigging, hoisting, lifting and positioning equipment***	***rigging, hoisting, lifting and positioning equipment*** is positioned to clear obstructions and ***hazards***
A-2.03.09P	restrict access to lift area and path of travel using barrier tape, barricades and signage	barrier tape, barricades and signage are erected to restrict personnel traffic to lift area
A-2.03.10P	select ***rigging, hoisting, lifting and positioning equipment*** and attach to load to ensure a safe lift	***rigging, hoisting, lifting and positioning equipment*** is visually and physically inspected according to safe work practices
A-2.03.11P	tie ***knots, hitches and bends***	***knots, hitches and bends*** are visually inspected
A-2.03.12P	place (land) load and secure in location using various ***methods***	***methods*** for securing load without damage to personnel and property are used
A-2.03.13P	clean and lubricate equipment	equipment is cleaned, lubricated and maintained according to manufacturers' specifications

RANGE OF VARIABLES

communication strategy includes: using hand signals, radio communication and a signaler

hazards include: blind spots, overhead piping, live equipment, site-specific hazards

load requirements include: WLL, final location of load

rigging, hoisting, lifting and positioning equipment include: block and tackle, chain blocks, come-alongs, snatch blocks, pallet jacks, tugger (power), winches, fork lifts, grip hoists, wire ropes, shackles, nylon slings, softeners, rope

equipment faults include: rips, tears, cracks, bird-caging, frayed wire rope, frayed synthetic slings, worn shackles, hydraulic oil leaks, missing rating tags, non-CSA approved equipment

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

methods for securing load include: bolting, lashing, site-specific methods

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

Essential Skills	Thinking, Numeracy, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.04.01P	plans lift	lift plan and ***communication strategy*** is implemented according to job requirements
A-2.04.02P	identify new and existing ***hazards*** and ***elements***	***hazards*** and ***elements*** are recorded on hazard assessment form
A-2.04.03P	assist to determine ***load requirements*** and WLL	***rigging, hoisting, lifting and positioning equipment*** is verified to ensure for safe WLL
A-2.04.04P	detect rigging, hoisting, lifting and positioning ***equipment faults***	equipment is inspected physically and visually, and is determined to be in good condition
A-2.04.05P	inspect line for ***knots, hitches and bends***	lines are de-rated when ***knots, hitches and bends*** are faulty and lines are removed from service
A-2.04.06P	communicate lift plan to others	personnel, clients and authorities are advised of lift plan
A-2.04.07P	identify swing radius and potential obstructions and ***hazards***	***equipment*** is positioned to clear obstructions and ***hazards***
A-2.04.08P	restrict access to lift area and path of travel using barrier tape, barricades and signage	barrier tape, barricades and signage are erected to restrict vehicular and pedestrian traffic to lift area
A-2.04.09P	assists in the inspection of ***rigging, hoisting, lifting and positioning equipment*** to ensure a safe lift	***rigging, hoisting, lifting and positioning equipment*** is visually and physically inspected according to safe work practices
A-2.04.10P	tie ***knots***, ***hitches and bends***	***knots, hitches and bends*** are tied and visually inspected
A-2.04.11P	use tag line to orientate and stabilize the lift	tag line is secured to load and load is under control at all times
A-2.04.12P	transfer load to other rigging equipment for final placement of load as required	***method*** of securing the load to transfer without damage to material, equipment or personnel is used
A-2.04.13P	place (land) load and secure in location using various ***methods***	load placement has met job requirements

RANGE OF VARIABLES

communication strategy includes: using hand signals, radio communication and a signaler

hazards include: blind spots, power lines, overhead piping, live equipment, site-specific hazards

elements include: weather, temperature

load requirements include: WLL, final location of load

rigging, hoisting, lifting and positioning equipment includes: wire rope, shackles, nylon slings, softeners, tag line

equipment faults include: rips, tears, cracks, bird-caging, frayed wire rope, frayed synthetic slings, worn shackles, hydraulic oil leaks, missing rating tags

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

equipment includes: boom truck, mobile crane, telescopic forklift, tower crane

method of securing load includes: bolting, lashing, site-specific methods

	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

Essential Skills Reading, Oral Communication, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
no	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.05.01P	assist in the selection of ***welding equipment***	***welding equipment*** is appropriate for application and materials
A-2.05.02P	handle ***welding consumables***	handling of ***welding consumables*** is performed according to quality control requirements
A-2.05.03P	assist in matching alloys to specific components to be welded	alloy selected matches specifications
A-2.05.04P	assist in setting up ***welding equipment***	***welding equipment*** is set up according to application
A-2.05.05P	protect surrounding equipment and flammable materials while welding	flammable materials are protected or removed from vicinity of welding work, and equipment is protected
A-2.05.06P	assist in performing tack welding	tack welds are performed within jurisdictional limitations
A-2.05.07P	assist in performing visual inspections in order to maintain welding equipment	all defects in welding equipment are identified
A-2.05.08P	assist in identifying, tagging and replacing worn, damaged or defective welding equipment	welding equipment is in safe and operable condition

RANGE OF VARIABLES

welding equipment includes: Shielded Metal Arc Welding (SMAW) equipment, Gas Tungsten Arc Welding (GTAW) equipment, Gas Metal Arc Welding (GMAW) equipment, heat fusion welding equipment, plasma welding equipment

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

	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

Essential Skills Oral Communication, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-2.06.01P	select ***soldering and brazing equipment***	***soldering and brazing equipment*** is appropriate for application and materials
A-2.06.02P	set up soldering and brazing equipment	setup is performed according to application
A-2.06.03P	match alloys to specific components to be soldered or brazed	alloy selected matches quality control requirements
A-2.06.04P	select flux and solder according to application	flux and solder selected meets requirements of weld procedures and quality control requirements
A-2.06.05P	join piping fittings and components	standards for brazed or soldered materials are met through inspection by quality assurance and local AHJ

A-2.06.06P	purge and flush piping and tubing	piping and tubing are purged and flushed ensuring system remains a closed system to prevent contamination
A-2.06.07P	protect equipment and flammable materials while soldering and brazing	flammable materials are protected or removed from vicinity of soldering and brazing work, and equipment is protected
A-2.06.08P	maintain ***soldering and brazing equipment***	***soldering and brazing equipment*** is in safe and operable condition
A-2.06.09P	identify, tag and replace worn, damaged or defective ***soldering and brazing equipment***	defects in ***soldering and brazing equipment*** are identified, tagged and replaced
A-2.06.10P	store ***soldering and brazing equipment*** and ***consumables***	***soldering and brazing equipment*** and ***consumables*** are organized and stored to prevent damage and according to specifications
A-2.06.11P	disarm the work area location within the ***fire monitoring system***	fire monitoring system procedures are followed according to building policy

RANGE OF VARIABLES

soldering and brazing equipment include: oxy-fuel and air-fuel torches, attachments (strikers, methylacetylene-propadiene propane [MAPP] gas cylinders, torch heads)

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

fire monitoring system is a system that assists locating fire hazard in a building and alerting first responders

	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

Essential Skills Oral Communication, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.07.01P	select ***oxy-fuel equipment***	***oxy-fuel equipment*** is appropriate for application and materials
A-2.07.02P	set up oxy-fuel gauges and torches	setup is performed according to safe work practices
A-2.07.03P	select tips	tips selected match thickness of material and fuel used
A-2.07.04P	protect equipment and flammable materials while operating ***oxy-fuel equipment***	flammable materials are protected or removed from vicinity of work and equipment is protected
A-2.07.05P	identify, tag and replace worn, damaged or defective ***oxy-fuel equipment***	defects in ***oxy-fuel equipment*** are identified and defective equipment is removed from service
A-2.07.06P	store ***oxy-fuel equipment*** and ***consumables***	***oxy-fuel equipment*** and ***consumables*** are stored in ventilated storage unit in an upright position

RANGE OF VARIABLES

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

consumables include: gases (oxygen, acetylene, MAPP, propane)

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

Essential Skills	Reading, Document Use, Numeracy, Digital Technology

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-3.01.01P	identify task and sequence of tasks	task planning is done by completing construction sequence and schedule
A-3.01.02P	identify tools, piping, equipment and materials required for task	required tools, piping, equipment and materials are identified
A-3.01.03P	estimate time and labour requirements to complete tasks	productivity and progress reports reflect estimates
A-3.01.04P	coordinate schedule and work with other trades	work practices are tracked in progress reports and work schedule

A-3.01.05P	verify that required permits are in place before commencing work	required documentation is filed according to site requirements
A-3.01.06P	adapt to changing ***environmental conditions***	work schedule includes a back-up plan to accommodate for unexpected ***environmental conditions***
A-3.01.07P	organize ***work area requirements***	work practices are tracked in productivity reports and work schedule
A-3.01.08P	perform ***hazard*** assessments	***hazard*** assessments are completed
A-3.01.09P	expedite tools, piping, equipment, materials and spool pieces to installation location	required tools, piping, equipment, materials and spool pieces are at installation location and documentation is complete

RANGE OF VARIABLES

environmental conditions include: site specific, inclement weather, air quality, asbestos abatement, flooding

work area requirements include: installing temporary shelters, platforms, heaters, waste disposal, lunch rooms, specific site safety requirements

hazards include: asbestos, trip hazards, overhead hazards, other trade activity, electrical hazards, silica dust

	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

Essential Skills Thinking, Document Use, Digital Technology

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-3.02.01P	estimate material and supplies required	materials and supplies are in place to prevent cost overruns and to enable smooth operation of project
A-3.02.02P	select and order material and equipment for task	material and equipment for task meets site requirements and specifications
A-3.02.03P	schedule the use of material and supplies throughout the project	sufficient materials and supplies are available through to successful completion of the project
A-3.02.04P	arrange for secure and organized storage of materials and supplies	materials and supplies are organized and stored to prevent theft and damage, and to ensure availability

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

Essential Skills Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-4.01.01P	lay out final position of ***fixtures, appliances***, pipe and ***pipe fittings***	final positions of ***fixtures, appliances***, pipe and ***pipe fittings*** match drawings, AHJ, ***specifications***, NPC and site conditions
A-4.01.02P	select and use ***layout tools and equipment***	required ***layout tools and equipment*** are selected according to type of ***piping material*** and used according to ***specifications***
A-4.01.03P	coordinate layout with other trades to avoid interferences with other ***systems***	final piping layout does not interfere with other ***systems***

RANGE OF VARIABLES

fixtures include: water closets, sinks, tubs, showers

appliances include: water heaters, dishwashers, water treatment equipment

pipe fittings include: Tees, 90^0 elbows, valves, devices

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

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

piping material includes: plastic, copper, steel, cast iron

systems include: ventilation, electrical, sprinkler

	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 length

Essential Skills Numeracy, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-4.02.01P	select and use ***tools***	pipe, tube and tubing length calculations are made using ***tools*** for the application
A-4.02.02P	calculate ***cut length*** of pipe, tube and tubing	***cut length*** of pipe, tube and tubing is calculated using fitting allowances, gaps, measurements and expansion rates

RANGE OF VARIABLES

tools include: tape measures, scale rulers, calculators

cut length includes: end-to-end, centre-to-centre, centre-to-end

	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

Essential Skills Numeracy, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-4.03.01P	select and use ***tools and equipment*** for calculating piping offsets	piping offset calculations are made using ***tools and equipment*** for the application
A-4.03.02P	obtain measurements to determine the cut length of pipe	measurements are obtained based on ***conditions***
A-4.03.03P	apply appropriate mathematical formula to calculate piping offsets	piping offsets are determined using formulas

RANGE OF VARIABLES

tools and equipment include: tape measures, calculators, squares, levels

conditions include: rise and run of pipes, spacing of pipes, required angles

	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

Essential Skills Numeracy, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-4.04.01P	select hangers based on pipe size, contents and pipe material	selected hangers ensure adequate support and prevent damage to piping and ***structural members***
A-4.04.02P	select adequate supports for seismic restraint	supports for seismic restraints are selected according to jurisdictional requirements and ***specifications***
A-4.04.03P	place supports and hanger systems	placement of supports and hanger systems meet NPC and ***specifications***
A-4.04.04P	assemble supports and hangers	support and hanger assemblies meet ***specifications***
A-4.04.05P	attach supports and hangers to ***structural members***	supports and hangers are attached according to ***specifications***
A-4.04.06P	select and use ***tools and equipment*** for installing hangers and supports	***tools and equipment*** are selected according to applications
A-4.04.07P	install ***support components***	***support components*** are installed according to ***specifications***

RANGE OF VARIABLES

structural members include: concrete, wood and steel beams, joist systems

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

tools and equipment include: powder-actuated tools, hammer drills, chop saws

support components include: anchors, guides

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

Essential Skills Document Use, Reading, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-4.05.01P	lay out sleeves	sleeve is laid out according to measurements taken from drawings
A-4.05.02P	select sleeves	sleeves meet ***specifications*** and pipe size to provide adequate space for insulation and fire stopping
A-4.05.03P	fabricate sleeves	sleeves are fabricated from ***material*** required for the application and according to ***specifications***
A-4.05.04P	select and use ***tools and equipment*** for installing sleeves	***tools and equipment*** appropriate for installation are used
A-4.05.05P	cut hole to receive sleeve	hole is cut to accommodate sleeve size using ***sleeve cutting methods***
A-4.05.06P	fasten sleeves to ***structures***	sleeves are aligned and securely fastened to ***structures***
A-4.05.07P	protect sleeves during the concrete pour	sleeves are protected from blockage and misalignment

RANGE OF VARIABLES

specifications include: engineered drawings, manufacturers' requirements, job specifications, shop drawings
material includes: pipe, sheet metal
tools and equipment include: coring drills, tin snips, grinders, hole saws
sleeve cutting methods include: coring, drilling, cutting
structures include: metal decking, formwork, block wall

	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

Essential Skills Document Use, Writing, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-4.06.01P	flush and degrease lines and remove start-up strainers prior to commissioning system to remove foreign matter	***foreign matter*** is removed so that plumbing system is ready for commissioning
A-4.06.02P	purge air and fill system to operating levels and pressure	air is purged from system and operating levels and pressure are set according to ***specifications***
A-4.06.03P	add ***chemicals*** for prevention of freezing and deterioration	***chemicals*** are added according to ***specifications***
A-4.06.04P	start system to verify operation	system operates safely according to ***specifications*** and system requirements
A-4.06.05P	adjust ***components*** to ensure operation of system	components are adjusted according to ***specifications***, and system and safety requirements
A-4.06.06P	clean, flush and sanitize potable water systems	potable water systems are sanitized according to ***specifications*** and prior to occupancy
A-4.06.07P	record and forward ***commissioning information***	***commission documents*** are complete and provided to ***building authority*** and according to AHJ

RANGE OF VARIABLES

foreign matter includes: debris, scale

specifications include: engineered drawings, manufacturers' requirements, job specifications, as-built drawings, approved shop drawings

chemicals include: glycol, inhibitors

components include: sensors, flushometers, mechanical and electrical controls

commissioning information includes: chemicals added, date of commissioning, pressure readings

commission documents include: manufacturers' instructions, engineering specifications

building authority includes: building owner/occupant, engineer, architect, maintenance staff

	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

Essential Skills Document Use, Working with Others, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-4.07.01P	make penetrations through the building envelope	penetrations through building envelope are secured and watertight using the ***materials*** according to ***specifications***

A-4.07.02P	install dielectric protection where dissimilar metals come into contact	dielectric protection is installed according to NPC to prevent electrolysis where required
A-4.07.03P	install heat tracing and insulation	heat tracing and insulation materials are installed according to ***specifications*** to prevent freezing of piping contents
A-4.07.04P	install ***components*** that protect against vibration and movement	piping and equipment is protected from damage from vibration or other movement
A-4.07.05P	install expansion joints in piping systems	expansion joints are installed according to ***specifications*** to allow for thermal expansion and settling of structures
A-4.07.06P	lay out housekeeping pads for pumps and equipment	housekeeping pads are placed according to ***specifications***
A-4.07.07P	install water hammer arrestors	water hammer arrestors are installed according to ***specifications*** to protect systems from water hammer
A-4.07.08P	protect embedded components	embedded components are protected as required according to AHJ, ***specifications*** and site requirements
A-4.07.09P	install backwater valves	backwater valves are installed according to NPC, AHJ and ***specifications*** to protect structure from backflow

RANGE OF VARIABLES

materials include: flashings, vent terminations, caulking, guards

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

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

	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

Essential Skills Working with Others, Oral Communication, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-4.08.01P	obtain permits	permits required by AHJ are obtained according to ***specifications***
A-4.08.02P	lay out and mark excavation route	excavation route is marked according to ***specifications***
A-4.08.03P	coordinate with utility companies to locate underground utilities	all utilities are located and marked to avoid ***consequences***
A-4.08.04P	determine ***excavation requirements*** and document	***excavation requirements*** are determined according to ***specifications*** and site conditions and are documented
A-4.08.05P	schedule ***equipment*** to ensure it is available for excavation	required ***equipment*** is available for excavation
A-4.08.06P	verify backfill material	backfill materials meet requirements set by NPC, AHJ, ***specifications*** and site conditions
A-4.08.07P	supervise backfilling and compaction	backfilling and compaction procedures meet requirements set by AHJ, ***specifications***, site conditions and site requirements

RANGE OF VARIABLES

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

consequences include: damage to utilities, injuries to personnel

excavation requirements include: depth, grade, bedding

equipment includes: backhoes, jackhammers, tampers, shovels

	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

Essential Skills Reading, Document Use, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-4.09.01P	identify locations where ***fire stopping devices and materials*** are required to prevent potential spread of fire and smoke	locations are identified according to ***specifications***
A-4.09.02P	select ***fire stopping devices and materials***	***fire stopping devices and materials*** meet requirements of ***specifications***
A-4.09.03P	select and use ***tools and equipment***	***tools and equipment*** are selected according to applications
A-4.09.04P	anchor ***fire stopping devices*** to building structure with approved ***methods***	***fire stopping devices*** are firmly attached to building structure
A-4.09.05P	apply ***fire stopping material*** to fill gaps and cavities around penetrations in walls and floors	all gaps and cavities around penetrations are filled
A-4.09.06P	secure ***fire stopping material*** to pipe	***fire stopping material*** is secured to pipe according to ***specifications***

RANGE OF VARIABLES

fire stopping devices and materials include: collars, straps, caulking, insulating materials
specifications include: manufacturer specifications, engineered listings, building code requirements
tools and equipment include: screw guns, caulking guns, hammer drills
methods include: screwing, wrapping, pinning

	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

Essential Skills Oral communication, Working with Others, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**

A-5.01.01P	demonstrates two-way communication practices	instructions and messages are understood by both parties involved in communication
A-5.01.02P	listens using ***active listening*** practices	steps of ***active listening*** are used
A-5.01.03P	receives and responds to feedback on work	response to feedback indicates understanding and corrective measures are taken
A-5.01.04P	uses questioning to improve communication	questions used enhance understanding, on-the-job training and goal setting
A-5.01.05P	participates in safety and information meetings	meetings have been attended and information has been understood and applied

RANGE OF VARIABLES

active listening includes: hearing, interpreting, reflecting, responding, paraphrasing

	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

Essential Skills	Oral Communication, Working with Others, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
A-5.02.01P	identify and communicate learning objective and point of lesson	apprentice or learner can explain the objective and point of the lesson
A-5.02.02P	link lesson to other lessons and the job	lesson order and unplanned learning opportunities have been defined
A-5.02.03P	demonstrates performance of a skill to an apprentice or learner	***steps required to demonstrate a skill*** have been performed
A-5.02.04P	set up conditions required for an apprentice or learner to practice a skill	***practice conditions*** have been set up so that the skill can be practiced safely by the apprentice or learner
A-5.02.05P	assess apprentice or learner's ability to perform tasks with increasing independence	performance of apprentice or learner has improved with practice to a point where skill can be done with little supervision
A-5.02.06P	give supportive and corrective feedback	apprentice or learner has adopted best practice after having been given supportive or corrective feedback
A-5.02.07P	support apprentices in pursuing technical training opportunities	technical training is completed within timeframe prescribed by apprenticeship authority
A-5.02.08P	support equity group learners and apprentices	workplace is harassment and discrimination-free
A-5.02.09P	implement probationary period for learners to assess their suitability to the trade	commitment has been demonstrated by the learner and more suitable career options are provided to others

RANGE OF VARIABLES

steps required to demonstrate a skill include: 5 Ws (who, what, where, when, why), explaining, showing, giving encouragement, following up to ensure skill is performed correctly

practice conditions are: guided, inspection for quality assurance, limited independence, fully independent

	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

Essential Skills	Document Use, Thinking, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
B-6.01.01P	perform sensory inspection	sensory inspection is performed to detect ***faults***
B-6.01.02P	confirm certification	required certifications are confirmed to meet codes, AHJ, specifications and site requirements and approval markings are recorded
B-6.01.03P	perform ***manual test***	***manual test*** is performed

RANGE OF VARIABLES

faults include: damage, cracks, debris

manual test includes: sounding cast iron pipe, checking threads, confirming groove depth

	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

Essential Skills	Numeracy, Thinking, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
B-6.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
B-6.02.02P	select tube, tubing and pipe	tube, tubing and pipe are selected according to NPC, AHJ, specifications and site requirements
B-6.02.03P	inspect tube, tubing and pipe for damage	tube, tubing and pipe are inspected for damage after each cut using visual and ***audio techniques***
B-6.02.04P	measure tube, tubing and pipe	tube, tubing and pipe are measured to determine length and location of cut
B-6.02.05P	use cutting ***guides***	cutting ***guides*** are used to make a straight cut
B-6.02.06P	support and secure tube, tubing and pipe	tube, tubing and pipe are supported and secured for cutting

RANGE OF VARIABLES

tools and equipment include: pipe and tubing cutters, saws, reamers, grinders
audio techniques include: sounding cast iron pipe
guides are contour wraparounds

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

Essential Skills Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
B-6.03.01P	identify types of ***tube, tubing and pipe***	***tube***, ***tubing and pipe*** are identified according to NPC, AHJ, specifications and site requirements
B-6.03.02P	select and use tube, tubing and pipe bender	tube, tubing and pipe bender is selected according to type and size
B-6.03.03P	determine location and angle of required offsets or bends	location and angle of required offsets or bends are determined according to site requirements
B-6.03.04P	measure and calculate distances	distances between offsets and bends are measured and calculated
B-6.03.05P	determine increments on bending tool	increments on bending tools are determined to achieve required angle
B-6.03.06P	inspect tube, tubing and pipe	tube, tubing and pipe are inspected after bending for ***distortions***

RANGE OF VARIABLES

tube, tubing and pipe include: soft, semi-soft (partially annealed), rigid
distortions include: kinks, ripples

	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

Essential Skills Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
B-6.04.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to application and material
B-6.04.02P	ream and thread pipe	pipe is reamed and threaded according to pipe specifications and standards
B-6.04.03P	flare tube, tubing and pipe	tube, tubing and pipe is flared according to specifications and application
B-6.04.04P	sand and clean tube, tubing and pipe	tube, tubing and pipe is sanded and cleaned according to code requirements and specifications
B-6.04.05P	bevel or groove pipe	pipe is grooved or bevelled according to pipe specification and application
B-6.04.06P	inspect tube, tubing and pipe for damage	tube, tubing and pipe are inspected for damage prior to connection

RANGE OF VARIABLES

tools and equipment include: threading, grooving, bevelling, cutting tools

	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

Essential Skills Reading, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
B-7.01.01P	determine types of fittings and ***joining methods*** and materials to be used	types of fittings, ***joining methods*** and materials are determined according to NPC, AHJ, standards, specifications and site requirements
B-7.01.02P	select and use ***tools and equipment*** for copper tube, tubing and pipe	***tools and equipment*** are selected and used according to fittings and joining methods
B-7.01.03P	connect flared tube and tubing ends	flared tube and tubing ends are connected and tightened according to specifications to ensure proper seal on fitting
B-7.01.04P	connect swaged pipe ends	swaged pipe ends are connected according to specifications
B-7.01.05P	connect grooved pipe ends	grooved pipe ends are connected according to specifications
B-7.01.06P	clean and lubricate grooved mechanical joints	grooved mechanical joints are cleaned and lubricated to avoid pinching and to allow for proper tightening to specifications
B-7.01.07P	select soldering and brazing materials	soldering and brazing materials are selected according to application

B-7.01.08P	purge pipe	brazed piping systems are purged with inert gas during brazing process to prevent oxidization of interior of pipe according to procedure
B-7.01.09P	solder assembly	adequate temperature is provided to soldered and brazed joints to achieve required flow and capillary action of filler metal
B-7.01.10P	assemble and install corporation, compression or push-fit fittings	corporation, compression or push-fit fittings are assembled and installed according to required depth and to specifications

RANGE OF VARIABLES

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

tools and equipment include: pipe and tubing cutters, flaring tools, grooving tools, soldering and brazing equipment, swaging tools, press-fit

	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

Essential Skills Reading, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
B-7.02.01P	determine types of fittings and ***joining methods*** and materials to be used	types of fittings, ***joining methods*** and materials are determined according to NPC, AHJ, standards, specifications and site requirements
B-7.02.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to application
B-7.02.03P	select solvents and primers	solvents and primers are selected according to specifications
B-7.02.04P	solvent weld plastic pipe and tubing joints	plastic pipe and tubing joints are solvent welded according to type of pipe and specifications
B-7.02.05P	groove plastic pipe	plastic pipes are grooved to depth according to specifications
B-7.02.06P	clean and lubricate grooved mechanical joints	grooved mechanical joints are cleaned and lubricated as required to avoid pinching and to allow for tightening to specifications
B-7.02.07P	connect and tighten mechanical joints	mechanical joints are connected and tightened to required rating
B-7.02.08P	perform ***plastic welding techniques***	***plastic welding techniques*** are performed according to type of pipe and specifications

B-7.02.09P	crimp or expand cross-linked polyethylene (PEX) pipe and tubing	PEX pipe and tubing are crimped or expanded to create a joint according to specifications
B-7.02.10P	prepare hub and spigot joints	hub and spigot joints are prepared by chamfering pipe ends and applying lubricant on pipe and gasket according to specifications
B-7.02.11P	assemble hub and spigot joints	hub and spigot joints are assembled for pressure water and drainage systems according to specifications
B-7.02.12P	assemble and install compression and push-fit fittings	compression and push-fit fittings are assembled and installed according to required depth and to specifications
B-7.02.13P	select appropriate pipe for threading	pipe for threading is selected according to specifications
B-7.02.14P	assemble components for flanged connections	components for flanged connections are assembled according to specifications

RANGE OF VARIABLES

joining methods include: welded, threaded, flanged, cut-grooved, crimped, expanded, push-fit, compression, mechanical, gasket, transition

tools and equipment include: crimping tools, expanders, heat plates and timer, cutters, hot-air tools, threading machines, chamfer tools, reaming tools, cut groovers, torque ratchets, electrofusion machines

plastic welding techniques include: solvent welding, hot-air welding, socket fusion, butt fusion

	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

Essential Skills Reading, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
B-7.03.01P	determine types of fittings and, ***joining methods*** and materials to be used	types of fittings, ***joining methods*** and materials are determined according to NPC, AHJ, standards, specifications and site requirements
B-7.03.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to type of materials, fittings and joining methods
B-7.03.03P	support and align pipe and fittings	pipe and fittings are supported and aligned prior to connection
B-7.03.04P	thread steel pipe	steel pipe is threaded using lubricants as required, ensuring proper taper and length of threads
B-7.03.05P	groove steel pipe	steel pipe is grooved to depth according to specifications

B-7.03.06P	clean and lubricate grooved mechanical joints	grooved mechanical joints are cleaned and lubricated as required to avoid pinching and to allow for tightening to specifications
B-7.03.07P	connect and tighten mechanical joints	mechanical joints are connected and tightened to required specifications
B-7.03.08P	fabricate gaskets	gaskets are fabricated for flanged joints
B-7.03.09P	install gaskets and tighten bolts	gasket and bolt tightening pattern is used for flanged joints according to specifications

RANGE OF VARIABLES

tools and equipment include: grinders, threaders, press-fit tools, cutters, cut-groovers, roll-groovers, wrenches

joining methods include: welded, threaded, flanged, cut-grooved, roll-grooved, press-fit, mechanical

	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

Essential Skills Reading, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
B-7.04.01P	determine types of ***joints*** and fittings, method of joining and materials to be used	types of ***joints*** and fittings, method of joining and materials are determined according to NPC, AHJ, standards, specifications and site requirements
B-7.04.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to fittings and joining methods
B-7.04.03P	align pipe and fittings	pipe and fittings are aligned and assembled using ***joints*** according to specifications
B-7.04.04P	identify locations	locations are identified where mechanical restraints are required
B-7.04.05P	install ***mechanical restraints***	***mechanical restraints*** are installed for cast iron pipe
B-7.04.06P	torque mechanical coupling	mechanical coupling is torqued to specifications
B-7.04.07P	join hub and spigot connections	hub and spigot connections are joined according to specifications and NPC

RANGE OF VARIABLES

joints include: mechanical joint clamps, oakum and cold caulking compound, lead and oakum, gasket joints
tools and equipment include: snap cutters, nut drivers, come-alongs, ratchets, sockets
mechanical restraints include: riser clamps, thrust blocks

	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

Essential Skills Continuous Learning, Reading, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
B-7.05.01P	determine types of ***joints*** and fittings, method of joining and materials to be used	types of ***joints*** and fittings, method of joining and materials are determined according to NPC, AHJ, standards, specifications and site requirements
B-7.05.02P	select and use tools and equipment required	tools and equipment are selected and used according to fittings and joining methods
B-7.05.03P	position system fittings and pipe	system fittings and pipe are selected and installed according to NPC, AHJ, standards and specifications
B-7.05.04P	select and install transition fittings	transition fittings are selected and installed to connect different materials according to NPC, AHJ, standards and specifications
B-7.05.05P	align and assemble pipe and fittings	pipe and fittings are aligned and assembled using ***joints*** according to NPC, AHJ, standards and specifications

RANGE OF VARIABLES

joints include: compression joints, mechanical joint clamps, welded, threaded, flanged, cut-grooved, roll-grooved, press-fit, heat fusion welding, solvent welding, gasket, crimped and expansion, push-fit, transition, brazing, soldering, flaring, swaged, corporation

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

Essential Skills Document Use, Numeracy, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
C-8.01.01P	identify ***fixtures and equipment***	***fixtures and equipment*** are identified for hydraulic load using blueprints
C-8.01.02P	identify roofs and paved surfaces	roofs and paved surfaces are identified for hydraulic load
C-8.01.03P	calculate total hydraulic load of building	calculations of hydraulic load correspond to appropriate tables contained in the NPC
C-8.01.04P	refer to sewer sizing tables in the NPC	sewer sizing tables in the NPC are referred to in order to obtain size of sewer pipe

RANGE OF VARIABLES

fixtures and equipment include: condensate drains, sump pumps, sinks, water closets, lavatories

	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

Essential Skills Document Use, Working with Others, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**

C-8.02.01P	locate and size manholes and catch basins	manholes and catch basins are located and sized according to drawings, NPC, AHJ and specifications
C-8.02.02P	select and use ***tools and equipment***	***tools and equipment*** are used to ensure base is level and stable
C-8.02.03P	channel bottom of manhole	bottom of manhole is channeled to direct waste
C-8.02.04P	select, lubricate and place gaskets	gaskets are selected, lubricated and placed to ensure manholes and catch basins are watertight and to avoid damage or reaction between lubricant and gaskets
C-8.02.05P	modify manholes and catch basins for new laterals	manholes and catch basins are modified for new laterals by making additional penetrations while maintaining structural integrity
C-8.02.06P	seal penetration points	penetration points are sealed to ensure water tightness

RANGE OF VARIABLES

tools and equipment include: rigging, hoisting and lifting equipment, levels, compactors

	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

Essential Skills Document Use, Thinking, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-8.03.01P	select piping material	piping material is selected according to NPC, AHJ, specifications and site requirements
C-8.03.02P	identify benchmark	benchmark is identified to set grade or offset for piping
C-8.03.03P	lay out piping	piping is laid out according to NPC, drawings, AHJ, specifications, and site requirements and conditions
C-8.03.04P	grade pipe	pipe is graded according to NPC and AHJ
C-8.03.05P	verify pipe grade	pipe grade is verified using ***tools and equipment***
C-8.03.06P	select and install cleanouts	cleanouts are selected and installed according to NPC, AHJ, specifications and site requirements
C-8.03.07P	verify no cross-connection is present	absence of cross-connection is verified between storm and sanitary sewers using various ***methods***
C-8.03.08P	compact soil	soil is compacted using backfill material to ensure stable base and to prevent damage to piping according to NPC, AHJ and specifications

RANGE OF VARIABLES

tools and equipment include: laser and builder's levels
methods include: dye tests, visual inspections

	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

Essential Skills Thinking, Reading, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-8.04.01P	use ***testing equipment***	***testing equipment*** is used to detect ***faults*** and to confirm operation meets design specifications
C-8.04.02P	perform ***sensory inspection***	sensory inspection is performed to detect plumbing system problems
C-8.04.03P	perform pressure test	pressure test is performed according to NPC and AHJ
C-8.04.04P	perform test on manholes and catch basins	manholes and catch basins are tested using ***methods*** to ensure watertight seal according to AHJ and specifications

RANGE OF VARIABLES

testing equipment includes: balloons, inflatable test balls, test plugs, mandrel
faults include: cracks, corrosion, inadequate flow
sensory inspection includes: auditory, visual
methods include: hydrostatic, smoke and air testing, mandrel test

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

Essential Skills Writing, Document Use, Reading

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-8.05.01P	select and use tools and equipment	tools and equipment are selected and used according to applications
C-8.05.02P	perform scheduled maintenance of systems	scheduled maintenance of system is performed according to type of design and AHJ
C-8.05.03P	verify operation of manholes, catch basins and piping for sewers	operation of manholes, catch basins and piping for sewers is verified according to AHJ
C-8.05.04P	inspect manholes, catch basins and piping for sewers	manholes, catch basins and piping for sewers are inspected for ***conditions requiring maintenance***
C-8.05.05P	determine whether ***components*** require replacement or repair	***components*** are determined to be in need of repair or replacement according to industry standard
C-8.05.06P	determine required isolation of system	isolation of system is determined according to required maintenance
C-8.05.07P	notify system owner of need to isolate and execute isolation	owner is notified and isolation is executed
C-8.05.08P	clean ***components***	***components*** are cleaned to prolong life of system and adequate flow
C-8.05.09P	replace ***components***	***components*** are replaced according to manufacturers' specifications
C-8.05.10P	repair ***components***	***components*** are repaired according to manufacturers' specifications
C-8.05.11P	complete required ***documentation***	***documentation*** is completed according to AHJ and company policies
C-8.05.12P	return system to service and verify system operation	system is returned to service and system operation is verified to meet design specifications

RANGE OF VARIABLES

conditions requiring maintenance includes: wear, noise, leaks, corrosion
components include: backwater values, leak seals, covers, grates
documentation includes: service reports, maintenance reports

	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

Essential Skills Thinking, Document Use, Oral Communication

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	no	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-9.01.01P	determine type of system required	type of system is determined by performing percolation tests and by identifying ***factors***
C-9.01.02P	prepare and submit a site plan to AHJ	site plan is prepared and submitted to AHJ in order to obtain permits
C-9.01.03P	select and size ***sewage treatment system components***	***sewage treatment system components*** are selected and sized according to AHJ
C-9.01.04P	determine proper depth of piping and components	proper depth of piping and components are determined according to AHJ
C-9.01.05P	confirm that adequate bedding material is present	presence of adequate bedding material is confirmed according to type of system and AHJ

RANGE OF VARIABLES

factors include: soil conditions, available space for system, expected daily volume of sewage
sewage treatment system components include: pumps, septic tanks, absorption fields

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

Essential Skills Document Use, Thinking, Working with Others, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	no	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-9.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected according to applications
C-9.02.02P	determine elevation and position of piping and components	elevation and position of ***piping and components*** is determined according to site conditions
C-9.02.03P	install and secure tanks	tanks are installed and secured according to AHJ, specifications and ***site conditions***
C-9.02.04P	lubricate and place ***gaskets***	***gaskets*** are lubricated and placed to ensure tanks and components are watertight
C-9.02.05P	assemble, place and install pipe and components	pipe and components are assembled, placed and installed to specified grade in NPC and AHJ

RANGE OF VARIABLES

tools and equipment include: rigging, hoisting and lifting, excavation
piping and components include: pumps and siphons, filters, ejectors, tanks, controls
site conditions include: high water table, limiting layer
gaskets include: rubber O-rings and butyl rubber seals

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

Essential Skills Thinking, Document Use, Reading

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	no	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-9.03.01P	use ***testing equipment***	testing equipment is used to detect ***faults***
C-9.03.02P	perform systems check	systems check is performed to analyze performance according to design specifications
C-9.03.03P	perform pressure test	pressure test is performed according to NPC and AHJ
C-9.03.04P	perform sensory inspection	sensory inspection is performed to detect sewage treatment system problems

RANGE OF VARIABLES

testing equipment includes: balloons, inflatable test balls, test plugs, mandrels
faults include: leaks, inadequate grade, corrosion

	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

Essential Skills Thinking, Document Use, Writing

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	no	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
C-9.04.01P	inspect equipment	equipment is inspected for ***conditions that require repair***
C-9.04.02P	interpret client's information	client's information is interpreted to assist in the diagnostic process
C-9.04.03P	perform sensory inspection	sensory inspection is performed to detect sewage treatment system for conditions requiring service
C-9.04.04P	select and use tools and equipment	tools and equipment are selected and used according to applications
C-9.04.05P	perform scheduled servicing of systems	scheduled servicing of system is performed according to system specifications and AHJ
C-9.04.06P	verify operation of sewage treatment system	operation of sewage treatment system is verified according to system design

C-9.04.07P	determine whether components require replacement or repair	components are determined to be in need of repair or replacement according to industry standard
C-9.04.08P	determine required isolation of system	isolation of system is determined according to service required
C-9.04.09P	notify system owner of need to isolate and execute isolation	owner is notified and isolation is executed
C-9.04.10P	clean components	components are cleaned to prolong life of system and adequate flow
C-9.04.11P	replace components	components are replaced according to manufacturers' specifications
C-9.04.12P	repair components	components are repaired according to manufacturers' specifications
C-9.04.13P	complete required ***documentation***	***documentation*** is completed according to AHJ and company policies
C-9.04.14P	return system to service and verify system operation	system is returned to service and system operation is verified according to system design

RANGE OF VARIABLES

conditions requiring repair include: wear, noise, leaks, corrosion
documentation includes: service reports, maintenance reports

	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

Essential Skills	Numeracy, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-10.01.01P	identify ***fixtures and equipment***	***fixtures and equipment*** are identified for hydraulic load using blueprint
C-10.01.02P	identify roofs and paved surfaces	roofs and paved surfaces are identified for hydraulic load
C-10.01.03P	calculate total hydraulic load of building	calculations of hydraulic load correspond to tables contained in the NPC

C-10.01.04P	size sanitary drainage system and associated vent piping	sanitary drainage system and associated vent piping are sized by calculating total hydraulic load according to NPC and AHJ
C-10.01.05P	size storm drainage system and associated vent piping	storm system and associated vent piping is sized by calculating total hydraulic load according to NPC and AHJ

RANGE OF VARIABLES

fixtures and equipment include: condensate drains, sump pumps, sinks, water closets, lavatories

	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

Essential Skills Document Use, Numeracy, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-10.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
C-10.02.02P	select piping material	piping material is selected according to NPC, AHJ, specifications and site requirements
C-10.02.03P	identify benchmark	benchmark is identified to set grade or offset for piping
C-10.02.04P	lay out piping and components	piping and components are laid out according to NPC, drawings, AHJ, specifications and site requirements and conditions
C-10.02.05P	calculate required grade of piping	required grade of piping is calculated according to NPC and AHJ
C-10.02.06P	ensure excavation and compaction of trench	excavation and compaction of trench is ensured to prevent settling of piping and components
C-10.02.07P	install required pipe and components to proper grade	required pipe and components are installed to proper grade according to NPC and AHJ
C-10.02.08P	determine elevation and set ***embedded components***	elevation of ***embedded components*** are determined and set in relation to finished floor
C-10.02.09P	protect and prepare pipe and components	pipe and components are protected and prepared for backfill
C-10.02.10P	backfill trench	trench is backfilled once testing is complete using appropriate material and ensuring adequate protection of piping according to NPC and AHJ

RANGE OF VARIABLES

tools and equipment include: tampers, jackhammers, levels, excavation equipment
embedded components include: drains, sumps, trap seal primer (TSP), cleanouts, pipes, interceptors

	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

Essential Skills Document Use, Thinking, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-10.03.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
C-10.03.02P	select piping material	piping material is selected according to NPC, AHJ, specifications and site requirements
C-10.03.03P	lay out piping and components	piping and components are laid out according to NPC, drawings, AHJ, specifications and site requirements and conditions
C-10.03.04P	calculate required grade of piping	required grade of piping is calculated according to NPC
C-10.03.05P	install supports and hangers	supports and hangers are installed according to NPC and specifications
C-10.03.06P	install required pipe and components	required pipe and components are installed to grade according to NPC and specifications
C-10.03.07P	prepare and protect pipe and components	pipe and components are prepared for testing and protected from site conditions and thermal expansion

RANGE OF VARIABLES

tools and equipment include: torches, tubing cutters, hand and power saws

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

Essential Skills Document Use, Thinking, Oral Communication

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
C-10.04.01P	use ***testing equipment***	***testing equipment*** is used to detect ***faults*** and verify operation
C-10.04.02P	perform systems check	systems check is performed to analyze performance according to system design and AHJ
C-10.04.03P	perform pressure test	pressure test is performed according to NPC and AHJ
C-10.04.04P	perform sensory inspection	sensory inspection is performed to detect DWV system problems
C-10.04.05P	perform ***final test***	***final test*** is performed using required testing equipment

RANGE OF VARIABLES

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

faults include: leaks, inadequate grade

final tests include: smoke test, ball test, hydrostatic test, pneumatic test

	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

Essential Skills Continuous Learning, Thinking, Oral Communication

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
C-10.05.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
C-10.05.02P	inspect piping and ***components***	piping and ***components*** are inspected for ***conditions that require service***
C-10.05.03P	perform sensory inspection	sensory inspection is performed to detect ***conditions requiring service***
C-10.05.04P	select and use tools and equipment	tools and equipment are selected and used to service DWV systems
C-10.05.05P	perform scheduled servicing of systems	scheduled servicing of system is performed according to system design and AHJ

C-10.05.06P	verify operation of DWV system	operation of DWV system is verified according to system design
C-10.05.07P	determine whether pipes or components require replacement or repair	pipes or components are determined to be in need of repair or replacement according to industry standard
C-10.05.08P	determine required isolation of system	isolation of system is determined according to service requirements
C-10.05.09P	notify system owner of need to isolate and execute isolation	owner is notified and isolation is executed
C-10.05.10P	clean pipe and components	pipe and components are cleaned to prolong life of system and ensure adequate flow
C-10.05.11P	replace pipe and components	pipe and components are replaced according to manufacturers' specifications
C-10.05.12P	repair pipe and components	pipe and components are repaired according to manufacturers' specifications
C-10.05.13P	complete required ***documentation***	***documentation*** is completed according to AHJ and company policies
C-10.05.14P	return system to service and verify system operation	system is returned to service and system operation is verified according to system design

RANGE OF VARIABLES

components include: fittings, pipe, valves, sewage sumps, sewage lift, interceptors, specialty traps, expansion joints, wall plates, fire stopping, insulation

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

documentation includes: service reports, maintenance reports

	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

Essential Skills Numeracy, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
D-11.01.01P	identify demand flow requirements	demand flow requirements are identified according to NPC, AHJ and calculations
D-11.01.02P	calculate required peak demand flow for water service	peak demand flow is calculated considering fire protection requirements for residential/commercial/industrial applications and system demand according to AHJ and specifications
D-11.01.03P	refer to water service tables in NPC	water service tables in NPC are referenced to obtain size of water service pipe
D-11.01.04P	determine pipe size	pipe size is determined according to ***factors*** to consider for sizing piping, AHJ and specifications

RANGE OF VARIABLES

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

	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

Essential Skills Document Use, Thinking, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
D-11.02.01P	select piping materials, fittings and ***components*** for water service installation	piping materials, fittings and ***components*** are selected according to NPC, AHJ, specifications and site requirements
D-11.02.02P	select and use ***tools and equipment***	***tools and equipment*** are selected according to applications
D-11.02.03P	lay out location and elevation of water service	location and elevation is laid out according to AHJ, drawings, specifications and site requirements
D-11.02.04P	verify pipe depth	pipe depth is verified according to NPC, AHJ, specifications and site requirements
D-11.02.05P	select and coordinate placement of bedding and backfilling material	bedding and backfill material are selected and placed according to NPC and AHJ

D-11.02.06P	align piping and fittings	piping and fittings are aligned to facilitate joint assembly
D-11.02.07P	install fittings	fittings are installed according to NPC, AHJ and specifications
D-11.02.08P	install ***restraints and supports***	***restraints and supports*** are installed according to AHJ
D-11.02.09P	install heat tracing and insulation	heat tracing and insulation are installed according to NPC, AHJ, drawings, specifications and site requirements

RANGE OF VARIABLES

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

tools and equipment include: wrenches, saws, pipe cutters, excavation equipment, brazing equipment, levels

restraints and supports include: thrust blocks, mechanical restraints, anchors, rods, tie rods

	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

Essential Skills Document Use, Thinking, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-11.03.01P	select and assemble ***components***	***components*** are selected and assembled according to NPC, AHJ, specifications and site requirements
D-11.03.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
D-11.03.03P	connect equipment and ***components***	equipment and ***components*** are connected to water service according to NPC, AHJ, specifications and site requirements

RANGE OF VARIABLES

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

tools and equipment include: ratchets, brazing equipment, wrenches, levels, measuring tape, cutters

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

Essential Skills Thinking, Document Use, Digital Technology

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-11.04.01P	perform hydrostatic test	hydrostatic test is performed to determine leaks and operation according to NPC and AHJ
D-11.04.02P	perform sensory inspection	sensory inspection is performed to detect water service leaks
D-11.04.03P	document test results	test results are documented using digital equipment or by written report according to AHJ requirements

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

Essential Skills Document Use, Thinking, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-11.05.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
D-11.05.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
D-11.05.03P	inspect water service equipment	water service equipment is inspected for ***conditions requiring service***
D-11.05.04P	perform sensory inspection	sensory inspection is performed to detect ***conditions requiring service***
D-11.05.05P	determine whether ***components*** require replacement or repair	***components*** are determined to be in need of repair or replacement according to industry standard
D-11.05.06P	complete checklist	checklist documents status of water service and follow-up actions required
D-11.05.07P	clean components	components are ***cleaned*** to prolong life of system and to ensure adequate flow
D-11.05.08P	replace components	components are replaced according to NPC, AHJ and manufacturers' specifications
D-11.05.09P	repair components	components are repaired according to manufacturers' specifications
D-11.05.10P	complete required ***documentation***	***documentation*** is completed according to AHJ and company policies
D-11.05.11P	return system to service and verify operation	system is returned to service and operation is verified according to AHJ

RANGE OF VARIABLES

tools and equipment include: wrenches, saws, pipe cutters, excavation equipment, brazing equipment
conditions requiring service include: wear, leaks, corrosion, damage
components include: fittings, valves, meters, switches
cleaned includes: chlorination, flushing, swabbing
documentation includes: service reports, maintenance reports

	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

Essential Skills Document Use, Numeracy, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-12.01.01P	identify peak demand flow requirements	peak demand flow requirements are identified according to NPC and AHJ
D-12.01.02P	calculate required peak demand flow for potable water distribution system	peak demand flow is calculated considering fire protection requirements for residential/commercial/industrial applications, and fixtures, ***equipment*** and system demand according to NPC, AHJ and specifications
D-12.01.03P	refer to potable water distribution tables in NPC	potable water distribution tables in NPC are referenced to obtain size of water distribution piping
D-12.01.04P	determine pipe size	pipe size is determined according to ***factors*** to consider for sizing piping, NPC, AHJ and specifications

RANGE OF VARIABLES

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

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

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

Essential Skills Document Use, Thinking, Reading

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-12.02.01P	select piping materials and fittings for potable water distribution system	piping materials are selected according to NPC, AHJ, specifications and site requirements
D-12.02.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
D-12.02.03P	design layout and routing	layout and routing is designed ensuring structural integrity
D-12.02.04P	drill, cut or sleeve adequately sized holes for piping	holes for piping are drilled, cut or sleeved according to design requirements
D-12.02.05P	install ***piping components***	***piping components*** are installed according to NPC, AHJ and specifications
D-12.02.06P	install ***supports***	***supports*** are installed according to NPC and AHJ
D-12.02.07P	insulate distribution system	distribution system is insulated according to AHJ, drawings, specifications and site requirements
D-12.02.08P	label and stencil pipe	pipe is labelled and stenciled for pipe identification according to AHJ and site requirements

RANGE OF VARIABLES

tools and equipment include: soldering and brazing equipment, crimping tools, solvents, cutters, expansion tools, compression tools

piping components include: piping, fittings, valves, shock arrestors, recirculating lines, fire stopping, cross-connection devices, expansion tanks

supports include: riser clamps, hangers

	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 system equipment

Essential Skills Document Use, Thinking, Reading

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
D-12.03.01P	select potable water distribution ***equipment***	***equipment*** is selected according to NPC, AHJ, specifications and site requirements

D-12.03.02P	select and use ***tools***	***tools*** are selected and used for installing distribution equipment
D-12.03.03P	connect ***equipment*** using ***components***	***equipment*** is connected according to NPC, AHJ, specifications and site requirements
D-12.03.04P	select and install isolation valves	isolation valves are selected and installed according to NPC, plans and specifications

RANGE OF VARIABLES

equipment includes: pumps, expansion tanks, water treatment equipment

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

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

	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

Essential Skills Reading, Numeracy, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-12.04.01P	determine ***level of hazard*** and select devices and methods	***level of hazard*** is determined and devices and methods are selected for the hazard according to NPC and AHJ
D-12.04.02P	determine location of device and method	location of device and method is determined to allow for accessibility for servicing and testing, and according to ***level of hazard***, NPC and AHJ
D-12.04.03P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
D-12.04.04P	connect ***cross-connection control devices and methods*** to piping	***cross-connection control devices and methods*** are connected to piping according to NPC, AHJ and specifications

RANGE OF VARIABLES

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

tools and equipment include: wrenches, soldering and brazing equipment, unions, rigging and hoisting equipment

cross-connection control devices and methods include: reduced pressure backflow preventer (RPBP), double check valve assembly, dual check valve, air break, air gap

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

Essential Skills Document Use, Numeracy, Writing

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-12.05.01P	use ***testing equipment***	***testing equipment*** is used to detect ***faults***
D-12.05.02P	perform sensory inspection	sensory inspection is performed to detect potable water distribution system ***faults***
D-12.05.03P	perform systems check	systems check is performed to analyze system performance
D-12.05.04P	check, set and adjust pressures	pressures are checked to detect system problems and, set and adjusted to correct operating pressures
D-12.05.05P	test or arrange for testing of ***cross-connection control devices***	testing of ***cross-connection control devices*** is performed or arranged for according to AHJ

RANGE OF VARIABLES

testing equipment includes: gauges, pumps, air compressors

faults include: ruptures, leaks, manufacturers' imperfections

cross-connection control devices include: RPBP, double check valve assembly, dual check valve

	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

Essential Skills Thinking, Document Use, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
D-12.06.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
D-12.06.02P	inspect potable water distribution system and equipment	potable water distribution system and equipment is inspected for ***conditions requiring service***
D-12.06.03P	select and use ***tools and equipment*** required for repairs	***tools and equipment*** are selected and used according to applications
D-12.06.04P	perform sensory inspection	sensory inspection is performed to detect ***conditions requiring service***
D-12.06.05P	lubricate pumps and bearings	pumps and bearings are lubricated to prevent wear of components

D-12.06.06P	clean and change filters and strainers	filters and strainers are cleaned and changed to maintain water quality, prolong the life of the system and maintain adequate flow
D-12.06.07P	adjust ***components***	***components*** are adjusted according to specifications
D-12.06.08P	determine required isolation of system	isolation of system is determined according to service required
D-12.06.09P	notify system owner of need to isolate and execute isolation	owner is notified and isolation is completed
D-12.06.10P	replace and repair components	components are replaced and repaired
D-12.06.11P	check and adjust pressures	pressures are checked and adjusted to maintain system performance and to detect system problems
D-12.06.12P	check potable ***water conditions***	potable ***water conditions*** are checked according to AHJ
D-12.06.13P	complete checklist	checklist documents status of current system and follow-up actions required
D-12.06.14P	verify operation of temperature and pressure relief valves	operation of temperature and pressure relief valves is verified to ensure operation
D-12.06.15P	perform scheduled maintenance of system	scheduled maintenance of system is performed according to manufacturers' specifications
D-12.06.16P	return system to service and verify system operation	system is returned to service and system operation is verified according to manufacturers' specifications
D-12.06.17P	complete required documentation	documentation is completed according to specifications, AHJ and company policies

RANGE OF VARIABLES

conditions requiring service include: leaks, wear, cleanliness, water quality

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

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

water conditions include: pH, iron content, bacterial content, H_2S, total dissolved solids (TDS)

	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

Essential Skills Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
D-13.01.01P	calculate required peak flow demand	peak flow demand is calculated according to NPC, AHJ, specifications and site requirements
D-13.01.02P	calculate elevations and distances	elevations and distances are calculated to determine size of piping, ***components and equipment***
D-13.01.03P	select components and equipment	***components and equipment*** are selected according to elevation and distance calculations
D-13.01.04P	determine sizing of pressure system	sizing of pressure system is determined based on ***water source factors***

RANGE OF VARIABLES

components and equipment include: pressure tanks, pumps, controls
water source factors include: drawdown, yield, depth

	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

Essential Skills Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-13.02.01P	determine piping design for installing piping for pressure system	piping design is determined based on ***factors***
D-13.02.02P	determine required piping materials	required piping materials are determined according to NPC, AHJ, specifications and site requirements
D-13.02.03P	select and use ***tools***	***tools*** are selected and used according to application
D-13.02.04P	connect piping to ***components***	piping is connected to ***components*** according to application

RANGE OF VARIABLES

factors include: environmental, site conditions

tools include: wrenches, soldering and brazing equipment, nut drivers, cutters

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

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

Essential Skills Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-13.03.01P	determine ***installation equipment and components*** required for pressure system	***installation equipment and components*** are determined according to application
D-13.03.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
D-13.03.03P	assemble equipment and components	equipment and components are assembled according to specifications
D-13.03.04P	attach cables	cables are attached to equipment and components to facilitate removal, service and repair
D-13.03.05P	determine and coordinate power and control connection requirements	power and control connection requirements are determined and coordinated according to electrical code

RANGE OF VARIABLES

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

tools and equipment include: wrenches, soldering and brazing equipment, cutters, nut drivers

	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

Essential Skills	Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-13.04.01P	charge system and inspect for ***faults***	system is charged and inspected for ***faults***
D-13.04.02P	perform sensory inspection	sensory inspection is performed to detect plumbing ***system problems***
D-13.04.03P	perform systems check	systems check is performed to analyze performance
D-13.04.04P	check and adjust pressures	pressures are checked and adjusted to detect ***system problems***

RANGE OF VARIABLES

faults includes: debris, leaks, cracks, manufacturers' defects
system problems include: pressure differentials, air lock, cavitation, electrical faults

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

Essential Skills Thinking, Document Use, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
D-13.05.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
D-13.05.02P	inspect equipment	equipment is inspected for ***conditions requiring service***
D-13.05.03P	perform sensory inspection	sensory inspection is performed to detect conditions requiring service in pressure systems
D-13.05.04P	lubricate pumps and bearings	pumps and bearings are lubricated using ***materials*** to prevent wear of components
D-13.05.05P	clean and change filters and strainers	filters and strainers are cleaned and changed to maintain water quality, prolong the life of the system and maintain adequate flow
D-13.05.06P	adjust ***equipment and components***	***equipment and components*** are adjusted to manufacturers' specifications
D-13.05.07P	check and adjust pressures	pressures are checked and adjusted as required to maintain system performance and to detect system problems
D-13.05.08P	select and use tools and equipment	tools and equipment are selected and used according to applications
D-13.05.09P	determine required isolation of system	isolation of system is determined according to service requirements
D-13.05.10P	notify system owner of need to isolate and execute isolation	owner is notified and isolation is executed
D-13.05.11P	determine whether ***equipment and components*** require replacement or repair	replacement or repair of ***equipment and components*** is determined
D-13.05.12P	replace and repair ***equipment and components***	***equipment and components*** are replaced or repaired as required
D-13.05.13P	complete checklist	checklist documents status of current system and follow-up actions required
D-13.05.14P	perform scheduled service of systems	scheduled service of systems is performed according to manufacturers' specifications

D-13.05.15P	return system to service and verify system operation	system is returned to service and operation is verified according to system design
D-13.05.16P	complete required documentation	documentation is completed according to specifications and company policies

RANGE OF VARIABLES

conditions requiring service includes: wear, noise, leaks, corrosion, electrical faults

materials include: graphite, grease, oil

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

	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

Essential Skills	Document Use, Numeracy, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
E-14.01.01P	lay out fixture location	fixture location is laid out according to drawings, specifications, NPC and AHJ
E-14.01.02P	determine and mark location of required backing	location of required backing is determined and marked according to specifications
E-14.01.03P	install backing	backing is installed to ensure stability of fixture
E-14.01.04P	assemble ***fixture supports***	***fixture supports*** are assembled according to specifications
E-14.01.05P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
E-14.01.06P	mount supports to floor and walls	supports are mounted to floor and walls using fasteners
E-14.01.07P	level and plumb ***fixture supports***	***fixture supports*** are leveled and plumb

E-14.01.08P	set up a grouping of ***fixture supports***	grouping of ***fixture supports*** is set up to ensure grade, spacing and alignment
E-14.01.09P	install ***fixture supports***	installation of ***fixture supports*** is completed in coordination with other trades

RANGE OF VARIABLES

fixture supports include: brackets, carriers, wood backing
tools and equipment include: hammer drills, cordless drills, torpedo levels, chop saws, wrenches

	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

Essential Skills Document Use, Thinking, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
E-14.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used to install plumbing ***fixtures*** and ***appliances***
E-14.02.02P	verify rough-ins of carriers, plumbing connections and fixture and appliance dimensions	rough-ins of carriers and plumbing connections are verified to be in appropriate locations, fixture and appliance dimensions are matched according to manufacturers' specifications, NPC and AHJ
E-14.02.03P	complete assembly and adjustment of fixture and appliance supports	fixture and appliance supports are assembled and adjusted to ensure proper installation (off-site and on-site)
E-14.02.04P	select ***fixture*** and ***appliance***, and ***trim***	***fixture*** and ***appliance***, and ***trim*** are selected for specific application according to drawings, NPC, AHJ and specifications
E-14.02.05P	install ***fixture*** and ***appliance***	***fixture*** and ***appliance*** are installed plumb and level and are secured according to specifications and AHJ
E-14.02.06P	verify proper operation of ***fixture*** and ***appliance***	operation of ***fixture*** and ***appliance*** is verified

RANGE OF VARIABLES

tools and equipment include: strap, spud, basin wrenches
fixtures include: showers, water closets, lavatories, urinals, sinks
appliances include: water heaters, coffee machines, ice makers, dishwashers
trim include: chrome traps, shower heads, grab bars

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

Essential Skills Continuous Learning, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
E-14.03.01P	select and use testing equipment	testing equipment is selected and used to detect ***faults***
E-14.03.02P	perform sensory inspection	sensory inspection is performed to detect plumbing fixture and appliance problems
E-14.03.03P	perform systems check	systems check is performed to analyze operation and performance according to NPC, AHJ and specifications
E-14.03.04P	adjust plumbing fixtures and appliances	plumbing fixtures and appliances are adjusted for operation according to specifications and AHJ

RANGE OF VARIABLES

faults include: leaks, inadequate operation, cracks

	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

Essential Skills Thinking, Document Use, Oral Communication

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
E-14.04.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
E-14.04.02P	inspect plumbing fixtures and appliances	fixtures and appliances are inspected for ***conditions that require repair***
E-14.04.03P	perform sensory inspection	sensory inspection is performed to detect plumbing fixtures and appliances for conditions requiring service
E-14.04.04P	select and use tools and equipment	tools and equipment are selected and used according to applications
E-14.04.05P	perform scheduled servicing of plumbing fixtures and appliances	servicing of plumbing fixtures and appliances is performed according to service requirements

E-14.04.06P	verify operation of plumbing fixtures and appliances	operation of plumbing fixtures and appliances is verified according to manufacturers' specifications
E-14.04.07P	determine whether components require replacement or repair	components are determined to be in need of repair or replacement according to industry standard
E-14.04.08P	determine required isolation of plumbing fixtures and appliances	isolation of plumbing fixtures and appliances is determined according to service requirements and NPC
E-14.04.09P	notify owner of need to isolate and execute isolation	owner is notified and isolation is executed
E-14.04.10P	clean components	components are cleaned to prolong life of system and maintain adequate flow
E-14.04.11P	replace components	components are replaced according to manufacturers' specifications
E-14.04.12P	repair components	components are repaired according to manufacturers' specifications
E-14.04.13P	complete required ***documentation***	***documentation*** is completed according to company policies and AHJ
E-14.04.14P	return plumbing fixtures and appliances to service and verify system operation	plumbing fixtures and appliances are returned to service and system operation is verified

RANGE OF VARIABLES

conditions requiring repair include: wear, noise, leaks, corrosion
documentation includes: service reports, maintenance reports

	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

Essential Skills	Document Use, Numeracy, Thinking, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
E-15.01.01P	collect water sample	water sample is collected according to AHJ procedures
E-15.01.02P	test and analyze sample	sample is tested and analyzed to determine water quality and ***characteristics***
E-15.01.03P	obtain results and interpret data	results are obtained and data is interpreted to determine type of equipment for water treatment requirements
E-15.01.04P	calculate water demand	water demand is calculated to determine size of equipment and according to specifications
E-15.01.05P	select and size system	system is selected and sized according to various ***factors***

RANGE OF VARIABLES

characteristics include: hardness, pH, and chemical, physical and biological composition
factors include: test results, demand, specifications, service/regeneration intervals, space constraints

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

Essential Skills Document Use, Continuous Learning, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
E-15.02.01P	verify water treatment equipment	water treatment equipment is verified to match determined demand, site requirements and conditions
E-15.02.02P	determine location of installation	location of installation is determined according to specifications and service requirements
E-15.02.03P	determine installation sequence	installation sequence is determined according to specifications to ensure optimum operation
E-15.02.04P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
E-15.02.05P	assemble water treatment equipment	water treatment equipment is assembled according to AHJ, NPC and specifications
E-15.02.06P	plumb and level water treatment equipment	water treatment equipment is plumb and levelled
E-15.02.07P	secure water treatment equipment	water treatment equipment is secured according to manufacturers' specifications and site conditions

E-15.02.08P	connect water and drainage	water and drainage are connected to ensure watertight installation
E-15.02.09P	verify operation of equipment	operation of equipment is verified
E-15.02.10P	collect and analyze sample	water sample is collected and analyzed to ensure equipment is operating

RANGE OF VARIABLES

tools and equipment include: wrenches, tubing cutters, soldering and brazing equipment

	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

Essential Skills Document Use, Thinking, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
E-15.03.01P	select and use ***testing equipment***	***testing equipment*** is selected and used to detect ***faults*** and verify operation
E-15.03.02P	perform sensory inspection	sensory inspection is performed to detect water treatment equipment problems
E-15.03.03P	perform systems check	systems check is performed to analyze operation and performance according to AHJ and specifications
E-15.03.04P	adjust water treatment equipment	water treatment equipment is adjusted for optimal operation according to specifications

RANGE OF VARIABLES

testing equipment includes: pH kits, mineral kits
faults include: leaks, inadequate operation, cracks

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

Essential Skills	Digital Technology, Continuous Learning, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
E-15.04.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
E-15.04.02P	inspect water treatment equipment	equipment is inspected for ***conditions that require repair***
E-15.04.03P	perform sensory inspection	sensory inspection is performed to detect conditions requiring service of water treatment equipment
E-15.04.04P	select and use tools and equipment	tools and equipment are selected and used according to applications
E-15.04.05P	perform scheduled servicing of water treatment equipment	scheduled servicing of water treatment equipment is performed according to service requirements
E-15.04.06P	verify operation of water treatment equipment	operation of water treatment equipment is verified according to system design and manufacturers' specifications
E-15.04.07P	determine whether components require replacement or repair	components are determined to be in need of repair or replacement according to industry standard and specifications
E-15.04.08P	determine required isolation of water treatment equipment	isolation of water treatment equipment is determined according to system design
E-15.04.09P	notify owner of need to isolate and execute isolation	owner is notified and isolation is executed
E-15.04.10P	clean components	components are cleaned to prolong life of system and maintain adequate flow
E-15.04.11P	replace components	components are replaced according to manufacturers' specifications
E-15.04.12P	repair components	components are repaired according to manufacturers' specifications
E-15.04.13P	complete required ***documentation***	***documentation*** is completed according to company policies
E-15.04.14P	return water treatment equipment to service and verify system operation	water treatment equipment is returned to service and system operation is verified

RANGE OF VARIABLES

conditions requiring repair include: wear, noise, leaks, corrosion, contamination, blockage, loss of pressure

documentation includes: service reports, maintenance reports

	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

Essential Skills Numeracy, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	no	no	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
F-16.01.01P	identify load requirements	load requirements are identified according to system being used, heat transfer calculations, drawings and specifications
F-16.01.02P	select required steam generator	required steam generator is selected for load according to AHJ
F-16.01.03P	determine pipe size according to ***load*** and distribution requirements	pipe size is determined according to load and distribution requirements
F-16.01.04P	select and position ***components***	components are selected and positioned according to system requirements, specifications and AHJ
F-16.01.05P	select and position ***expansion joints***	***expansion joints*** are selected and positioned according to system requirements, specifications and AHJ

RANGE OF VARIABLES

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

	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

Essential Skills	Numeracy, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	no	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
F-16.02.01P	fit piping, components and accessories together	piping, components and accessories are fitted according to drawings, codes, AHJ and specifications
F-16.02.02P	determine routing	routing is determined according to drawings, specifications, site conditions, and equipment and component location
F-16.02.03P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
F-16.02.04P	assist in setting up welding equipment	welding equipment is set up according to AHJ

F-16.02.05P	install piping	piping is installed plumb, level, straight or graded according to system design
F-16.02.06P	locate and install drip legs	drip legs are located and installed according to system design
F-16.02.07P	determine when a condensate pump is required	condensate pump is installed according to drawings and specifications
F-16.02.08P	select and install steam traps	steam traps are selected and installed to ensure optimum operation of steam system and according to drawings and specifications
F-16.02.09P	install anchors, guides and expansion joints	anchors, guides and expansion joints are installed to control movement of pipe
F-16.02.10P	label and stencil pipe	pipe is labelled and stenciled for pipe identification
F-16.02.11P	verify operation of system	system operation is verified according to system design
F-16.02.12P	record and transfer heat numbers	heat numbers labelled on the pipe are recorded and transferred

RANGE OF VARIABLES

tools and equipment include: threading equipment, cutters, oxy-fuel torches, welding equipment

	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

Essential Skills	Thinking, Continuous Learning, Oral Communication

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	no	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-16.03.01P	use ***testing equipment***	***testing equipment*** is used to detect ***faults*** and to confirm operation
F-16.03.02P	perform ***sensory inspection***	***sensory inspection*** is performed to detect ***problems***
F-16.03.03P	perform pressure test	pressure test is performed according to AHJ
F-16.03.04P	perform test on piping and components for low pressure steam systems	piping and components are tested according to specifications and AHJ

RANGE OF VARIABLES

testing equipment includes: infrared thermometer, pneumatic compressor, multimeter (including thermal accessories)

faults include: cracks, corrosion

sensory inspection includes: visual, auditory and tactile testing

problems include: water hammer, inadequate flow, leaks

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

Essential Skills Thinking, Writing, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	no	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-16.04.01P	select and use tools and equipment	tools and equipment are selected and used according to applications
F-16.04.02P	perform scheduled maintenance of systems	scheduled maintenance of system is performed according to manufacturers' specifications
F-16.04.03P	verify operation of piping and components	operation of piping and components is verified according to system design
F-16.04.04P	inspect piping and components	piping and components are inspected for ***conditions requiring service***
F-16.04.05P	determine whether components require replacement or repair	components are determined to be in need of repair or replacement according to industry standard
F-16.04.06P	notify system owner of need to isolate	owner is notified and isolation is executed
F-16.04.07P	clean ***components***	***components*** are cleaned to prolong life of system and maintain adequate flow
F-16.04.08P	replace ***components***	***components*** are replaced according to manufacturers' specifications
F-16.04.09P	repair ***components***	***components*** are repaired according to manufacturers' specifications
F-16.04.10P	inspect water quality	water is treated according to system requirements
F-16.04.11P	complete required ***documentation***	***documentation*** is completed according to AHJ and company policies
F-16.04.12P	return system to service and verify system operation	system is returned to service and system operation is verified according to system design

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

	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

Essential Skills Numeracy, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-17.01.01P	perform room-by-room heat loss and gain calculation	heat loss and gain calculations are performed as required by AHJ and system design
F-17.01.02P	identify load requirements	load requirements are identified according to ***designs***, drawings, building requirements and specifications
F-17.01.03P	determine pipe type and size	pipe type and size are determined according to friction loss, load and distribution requirements
F-17.01.04P	determine circulators required	circulators required are determined according to drawings, design and specifications
F-17.01.05P	calculate provision for expansion and apply to selection and sizing of ***expansion device***	***expansion device*** is selected and sized with consideration for expansion calculations
F-17.01.06P	calculate requirements for circuit balancing valves	circuit balancing valves meet system requirements and calculations
F-17.01.07P	ensure piping design allows compatibility between multiple heating and cooling generating systems	piping design allows compatibility between multiple heating and cooling generating systems

RANGE OF VARIABLES

designs include: one pipe, two pipe, three pipe, four pipe, reverse return, direct return, primary/secondary, injection

expansion devices include: bladder, diaphragm, conventional air cushion, open tank

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

Essential Skills Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-17.02.01P	determine routing of hydronic system piping and components	routing is determined by drawings, specifications, site conditions and equipment location
F-17.02.02P	determine high points and low points for hydronic piping and components	high points and low points are identified
F-17.02.03P	select and use tools and equipment	tools and equipment are selected and used according to applications
F-17.02.04P	install system piping and components	piping and components are installed plumb, level, straight or graded
F-17.02.05P	assemble and install piping and ***components***	piping and ***components*** are assembled and installed using joining methods and in a manner to allow for insulation of piping including sleeving and proper spacing
F-17.02.06P	install provisions for expansion, contraction and vibration	expansion, contraction and vibration provisions are installed according to specifications
F-17.02.07P	install heat transfer units with relevant trim	heat transfer units are installed according to drawings, manufacturers' specifications and system requirements
F-17.02.08P	install ***air removal devices***	***air removal devices*** are installed according to system requirements
F-17.02.09P	label and stencil pipe for pipe identification	pipes are identified for the purpose and content
F-17.02.10P	ensure ***requirements for isolation*** and removal of ***components*** are installed	***requirements for isolation*** and removal of ***components*** are provided to facilitate servicing according to AHJ
F-17.02.11P	install provisions for draining of the system	provisions are installed so that system can be drained for service

RANGE OF VARIABLES

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

air removal devices include: manual vents, automatic vents, scoops, separators, scrubbers

requirements for isolation include: unions, flanges, valves, blanks

	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

Essential Skills Thinking, Numeracy, Document Use, Writing

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-17.03.01P	perform a visual pre-inspection check	visual pre-inspection check is completed to confirm state of components and that they are installed
F-17.03.02P	determine type of test and appropriate equipment required	type of test and the test parameters are determined to match system application and requirements according to engineered specifications
F-17.03.03P	perform ***sensory inspection***	***sensory inspection*** is performed to detect problems
F-17.03.04P	install isolation components or remove ***sensitive equipment***	isolation components are installed or ***sensitive equipment*** is removed from test pressures
F-17.03.05P	perform test on piping and components	piping and components are tested according to specifications and AHJ
F-17.03.06P	verify operation of components	components operate according to manufacturers' specification and system design

RANGE OF VARIABLES

sensory inspection includes: visual, auditory and tactile testing
sensitive equipment includes: safety valves, air vents, gauges

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

Essential Skills Thinking, Numeracy, Document Use, Oral Communication

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-17.04.01P	select and use tools and equipment	tools and equipment are selected and used according to applications
F-17.04.02P	perform scheduled maintenance of systems	scheduled maintenance of system is performed
F-17.04.03P	verify operation of piping and components	operation of piping and components is verified according to system design and manufacturers' specifications
F-17.04.04P	inspect piping and components	piping and components are inspected for ***conditions requiring service***
F-17.04.05P	determine whether components require replacement or repair	components are determined to be in need of repair or replacement according to industry standard

F-17.04.06P	notify system owner of need to isolate and execute isolation	owner is notified and isolation is executed
F-17.04.07P	clean ***components***	***components*** are cleaned to prolong life of system and maintain adequate flow
F-17.04.08P	replace ***components***	***components*** are replaced according to manufacturers' specifications
F-17.04.09P	repair ***components***	***components*** are repaired according to manufacturers' specifications
F-17.04.10P	inspect ***fluid*** quality	***fluid*** is treated according to system requirements
F-17.04.11P	complete required ***documentation***	***documentation*** is completed according to AHJ and company policies
F-17.04.12P	return system to service and verify system operation	system is returned to service and system operation is verified according to system design

RANGE OF VARIABLES

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

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

fluid includes: water, air and brine solutions

documentation includes: service reports, maintenance reports, building logbooks

	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

Essential Skills	Thinking, Document Use, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-18.01.01P	coordinate and set up installation of heat source	heat sources are selected and assembled according to building requirements, manufacturers' specifications, drawings and AHJ
F-18.01.02P	determine location and placement of heat source	location and placement of heat source is determined according to drawings, specifications, site conditions and AHJ
F-18.01.03P	determine the need for housekeeping pad	need for housekeeping pad for protection of heat source is determined according to drawings, specification, site conditions and AHJ

F-18.01.04P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
F-18.01.05P	install vibration isolation for heat source	vibration isolation is installed where required according to drawings, site conditions and specifications
F-18.01.06P	level and secure equipment	heat source is installed respecting required clearances and limitations, is aligned/orientated, leveled and anchored
F-18.01.07P	assemble near heat source piping and ***trim***	heat source piping and ***trim*** is assembled according to drawings, specification, site conditions and AHJ
F-18.01.08P	install connections for flue gas condensate	connections for flue gas condensate are installed according to AHJ
F-18.01.09P	select and install treatment equipment for corrosive condensate	treatment for corrosive condensate is selected and installed according to manufacturers' specifications and AHJ

RANGE OF VARIABLES

tools and equipment include: come-alongs, chain falls, forklifts and pallet jacks, slings, cranes
trim includes: low water cutoffs, safety relief devices, flow switches, operating controls

	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

Essential Skills Thinking, Document Use, Continuous Learning

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-18.02.01P	coordinate and set up installation of cooling source	cooling sources are selected and assembled according to building requirements, manufacturers' specifications, drawings and AHJ
F-18.02.02P	determine location and placement of cooling source	location and placement of cooling source is determined according to drawings, specifications, site conditions and AHJ
F-18.02.03P	determine housekeeping pad	housekeeping pad for protection of cooling source is determined according to drawings, specification, site conditions and AHJ
F-18.02.04P	select and use ***tools and equipment***	tools and equipment are selected and used according to applications
F-18.02.05P	install vibration isolation for cooling source	vibration isolation is installed where required according to drawings, site conditions and specifications
F-18.02.06P	level and secure equipment	cooling source is installed respecting required clearances and limitations, is aligned/orientated, leveled and anchored

F-18.02.07P	assemble near cooling source piping and ***trim***	cooling source piping and ***trim*** is assembled according to drawings, specification, site conditions and AHJ
F-18.02.08P	install connections for condensate	connections for condensate are installed according to AHJ

RANGE OF VARIABLES

tools and equipment include: come-alongs, chain falls, forklifts and pallet jacks, slings, cranes
trim includes: feed water controls, flow switches, operating controls

	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

Essential Skills Thinking, Document Use, Writing

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-18.03.01P	conduct a ***pressure test***	***pressure test*** is performed to specifications and AHJ
F-18.03.02P	verify the sequence of operations	sequence of operation is verified according to manufacturers' specifications
F-18.03.03P	test safeties and controls	safeties and controls are tested to insure operation according to manufacturers' specifications
F-18.03.04P	verify flow rate	flow rate is compared to manufacturers' specifications and operating design
F-18.03.05P	complete a ***fuel*** combustion analysis	***fuel*** combustion analysis is conducted to meet manufacturers' specifications
F-18.03.06P	set manifold pressures	manifold pressures are adjusted to manufacturers' specifications
F-18.03.07P	conduct a ***fluid test***	***fluid test*** is conducted according to engineer and manufacturers' specifications
F-18.03.08P	submit a commission report	commission report is submitted to required authority

RANGE OF VARIABLES

pressure test includes: hydrostatic, pneumatic
fuel includes: oil, gas, biomass, coal
fluid test includes: pH, TDS, glycol strength, return temperature

	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

Essential Skills Thinking, Continuous Learning, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
F-18.04.01P	select and use tools and equipment	tools and equipment are selected and used according to applications
F-18.04.02P	perform scheduled maintenance of generating systems	scheduled maintenance of generating system is performed according to system design
F-18.04.03P	verify operation of ***generating equipment*** and associated piping and ***components***	operation of ***generating equipment***, piping and ***components*** is verified according to system design
F-18.04.04P	inspect generating equipment, piping and ***components***	generating equipment, piping and ***components*** are inspected for ***conditions requiring service***
F-18.04.05P	determine whether ***components*** require replacement or repair	***components*** are determined to be in need of repair or replacement according to industry standard
F-18.04.06P	notify system owner of need to isolate and execute isolation	owner is notified and isolation is executed
F-18.04.07P	perform lock-out and tag-out procedures	lock-out and tag-out procedures are performed according to AHJ

F-18.04.08P	clean generating equipment and associated components	generating equipment and associated components are cleaned to prolong life of system and maintain design flow
F-18.04.09P	replace generating equipment and associated components	generating equipment and associated components are replaced according to manufacturers' specifications
F-18.04.10P	repair generating equipment and associated components	generating equipment and associated components are repaired according to manufacturers' specifications
F-18.04.11P	inspect heat transfer fluid quality	heat transfer fluid is treated as required
F-18.04.12P	complete required ***documentation***	***documentation*** is completed according to AHJ and company policies
F-18.04.13P	return system to service and verify system operation	system is returned to service and system operation is verified according to system design

RANGE OF VARIABLES

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

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

conditions requiring service include: wear, noise, leaks, corrosion, no heat, no cooling

documentation includes: service reports, maintenance reports, building logbooks

	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

Essential Skills	Digital Technology, Thinking, Document Use

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-19.01.01P	confirm system requirements for ***components and accessories***	***components and accessories*** meet system requirements and design
F-19.01.02P	confirm the location of components and accessories	components and accessories are located according to plans and specifications

F-19.01.03P	use ***tools and equipment***	***tools and equipment*** are selected and used according to application
F-19.01.04P	assemble and install components and accessories	components and accessories are installed according to plans and specifications
F-19.01.05P	program, calibrate and adjust mechanical and electrical controls/modules and components	mechanical and electrical controls/modules and components are set to points to optimize system performance

RANGE OF VARIABLES

components and accessories include: control modules, thermostats, supply sensors, circulator sensors, outdoor temperature sensors, safety devices

tools and equipment include: hand tools, thermometers, multimeters

	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

Essential Skills	Thinking, Document Use, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-19.02.01P	confirm location and ***type of hydronic transfer units***	location and ***type of hydronic transfer units*** are confirmed according to drawings and specifications
F-19.02.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
F-19.02.03P	level and secure hydronic transfer units	hydronic transfer units are level and secure
F-19.02.04P	install trim	trim is installed according to type and style of hydronic transfer unit
F-19.02.05P	install vibration isolation on hydronic transfer units	vibration isolation on hydronic transfer units is installed according to specifications
F-19.02.06P	position and connect hydronic transfer unit to piping	hydronic transfer unit is positioned and connected to piping using ***joining methods***

RANGE OF VARIABLES

type hydronic transfer units includes: terminal heat pumps, fan coils, radiant panels
tools and equipment include: drills, levels, measuring tapes
joining methods include: threading, soldering, grooving, welding

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

Essential Skills	Thinking, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
F-19.03.01P	pressurize system and inspect for ***faults***	system is pressurized and inspected for ***faults***
F-19.03.02P	activate automated controls and inspect	automated controls are activated and inspected for designed operation
F-19.03.03P	perform sensory inspection of system controls and transfer unit	sensory inspection is performed to detect non-automated controls and transfer unit problems
F-19.03.04P	perform systems check	systems check is performed to analyze performance of controls and accessories
F-19.03.05P	check and adjust pressures	pressures are checked and adjusted according to system design

RANGE OF VARIABLES

faults include: leaks, cracks, manufacturers' defects, blockage

	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

Essential Skills Thinking, Document Use, Digital Technology, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
F-19.04.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
F-19.04.02P	inspect equipment	equipment is inspected for ***conditions requiring service***
F-19.04.03P	perform sensory inspection	sensory inspection is performed to detect conditions requiring service
F-19.04.04P	clean and change filters and strainers	filters and strainers are cleaned and changed to prolong the life of the system and maintain adequate flow
F-19.04.05P	adjust ***components***	***components*** are adjusted according to manufacturers' specifications
F-19.04.06P	check and adjust pressures	pressures are checked and adjusted to maintain system performance and to detect system problems
F-19.04.07P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
F-19.04.08P	determine required isolation of system	isolation of system is determined according to required service

F-19.04.09P	notify system owner of need to isolate and execute isolation	owner is notified and isolation is executed
F-19.04.10P	determine whether components require replacement or repair	components are determined to require replacement or repair based on factors
F-19.04.11P	replace and repair components	components are replaced or repaired as required
F-19.04.12P	complete checklist	checklist documents status of current system and follow-up actions required
F-19.04.13P	perform scheduled service of system	scheduled service of system is performed according to manufacturers' specifications, system design and AHJ
F-19.04.14P	return system to service and verify system operation	system is returned to service and operation is verified according to system design
F-19.04.15P	complete required documentation	documentation is completed according to specifications and company policies

RANGE OF VARIABLES

conditions requiring service include: wear, noise, leaks, no flow, air lock

components include: flanges, unions, couplings, joints

tools and equipment include: wrenches, thermometers, multimeters (including thermal accessories), thermal imagers

	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)

Essential Skills	Document Use, Reading, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
no	no	yes	yes	NV	yes	yes	yes	yes	no	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
G-20.01.01P	confirm type, location and installation sequence of equipment	type, location and installation sequence of equipment are confirmed according to ***specifications*** and site conditions
G-20.01.02P	confirm ***components*** are suitable for potable water systems	***components*** are confirmed according to drawings, NPC, AHJ, specifications and site conditions
G-20.01.03P	use ***tools and equipment***	***tools and equipment*** are used according to applications
G-20.01.04P	size pipe of flow-through fire protection systems	pipe size meets specifications
G-20.01.05P	place, level, plumb and secure equipment and components	equipment and components are level, plumb and secure according to NPC and AHJ

G-20.01.06P	connect pipe, equipment and accessories	connections are made to ensure water remains potable
G-20.01.07P	compensate for expansion and contraction of system	compensation for expansion and contraction has been provided to prevent damage to piping and structure

RANGE OF VARIABLES

specifications include: NFPA, NPC, AHJ, manufacturers' literature, shop drawings, engineers' drawings
components include: supervisory valves, sprinkler heads
tools and equipment include: cutters, crimpers, expansion tools

	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)

Essential Skills	Reading, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
no	no	yes	yes	NV	yes	yes	yes	yes	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
G-20.02.01P	use ***testing equipment***	***testing equipment*** is used to detect faults and to confirm operation of flow-through fire protection system
G-20.02.02P	perform sensory inspection	sensory inspection is performed to detect flow-through fire protection system and sprinkler head coverage according to specifications
G-20.02.03P	perform diagnostic inspection	diagnostic inspection is performed to analyse operation and performance according to ***specifications***
G-20.02.04P	perform pressure test	pressure test is performed according to ***specifications***

RANGE OF VARIABLES

testing equipment includes: compressors, hydrostatic pumps, gauges
specifications include: NFPA, NPC, AHJ, manufacturers' literature, shop drawings, engineers' drawings

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)

Essential Skills	Reading, Document Use, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
no	no	yes	yes	NV	yes	yes	yes	yes	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
G-20.03.01P	check and adjust pressures	pressures are checked and adjusted to maintain system performance and to detect system problems
G-20.03.02P	complete checklist	checklist documents location and accessibility of sprinkler heads of current system and follow-up actions required
G-20.03.03P	perform scheduled maintenance of systems	scheduled maintenance of system is performed and documented
G-20.03.04P	determine whether components require replacement or repair	components are replaced or repaired considering ***factors*** for replacement or repair
G-20.03.05P	use tools and equipment required for repairs	tools and equipment are selected and used according to applications
G-20.03.06P	return system to service and verify correct system operation	system is returned to service and correct operation is verified
G-20.03.07P	complete required documentation	documentation is completed according to AHJ and specifications

RANGE OF VARIABLES

factors include: leaks, damaged sprinkler heads

	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)

Essential Skills	Document Use, Reading, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
no	no	no	no	NV	no	no	yes	yes	no	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
G-21.01.01P	confirm materials required to install piping and equipment	materials required to install piping and equipment are confirmed according to drawings, AHJ and specifications
G-21.01.02P	confirm type, location and installation sequence of equipment and ***components***	type, location and installation sequence of equipment and ***components*** are confirmed according to drawings, AHJ, specifications and site requirements
G-21.01.03P	confirm routing of piping	routing is confirmed according to drawings, specifications, site requirements and equipment location
G-21.01.04P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
G-21.01.05P	identify pipe using ***methods***	pipes are labelled and tagged according to AHJ, specifications and site requirements
G-21.01.06P	position and assemble pipe and required equipment and ***components***	pipe and required equipment and ***components*** are positioned, assembled and connected according to drawings, AHJ, operational requirements and specifications
G-21.01.07P	install drain valves as required	drain valves are installed for complete drainage of the system
G-21.01.08P	compensate for movement and vibration of equipment	equipment does not move or vibrate
G-21.01.09P	connect standpipe system to pipe, equipment and accessories	pipe, equipment and accessories are connected to standpipe system according to drawings, AHJ, operational requirements and specifications

RANGE OF VARIABLES

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

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

methods include: painting, labelling, tagging

	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)

Essential Skills Document Use, Reading, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
no	no	no	no	NV	no	no	yes	yes	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
G-21.02.01P	select and use testing equipment	testing equipment is selected and used to detect faults and to confirm proper operation of standpipe
G-21.02.02P	perform flow test	flow test is performed to ensure adequate flow of water according to ***specifications***
G-21.02.03P	perform sensory inspection	sensory inspection is performed to detect standpipe system meets ***specifications***
G-21.02.04P	perform systems check	systems check is performed to analyse operation and performance according to ***specifications***
G-21.02.05P	perform pressure test	pressure test is performed according to ***specifications***
G-21.02.06P	test backflow preventer	test reports verify operation of backflow preventer meets ***specifications***

RANGE OF VARIABLES

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

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)

Essential Skills Document Use, Reading, Writing

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
no	no	no	no	NV	no	no	yes	yes	no	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
G-21.03.01P	inspect equipment	equipment is inspected for ***conditions requiring service***
G-21.03.02P	lubricate pumps and bearings	pumps and bearings are lubricated using approved materials to prevent wear of ***components***
G-21.03.03P	adjust and tighten ***components***	***components*** are adjusted and tightened
G-21.03.04P	check and adjust pressures	pressures are checked and adjusted to maintain system performance and to detect system problems
G-21.03.05P	complete checklist	checklist documents status of current system and follow-up actions required
G-21.03.06P	perform scheduled maintenance of systems	scheduled maintenance of system is performed according to specifications
G-21.03.07P	determine required isolation of system	isolation of system is determined using a visually indicating valve
G-21.03.08P	notify AHJ and system owner of need to isolate and execute isolation	AHJ and owner are notified of need to isolate system and isolation is executed
G-21.03.09P	select and use tools and equipment required for repairs	tools and equipment are selected and used according to applications
G-21.03.10P	determine whether ***components*** require repair or replacement	***components*** are replaced or repaired considering ***factors*** for repair or replacement
G-21.03.11P	test backflow preventer	test reports verify operation of backflow preventer meets ***specifications***

G-21.03.12P	return system to service and verify system operation	system is returned to service and system operation is verified
G-21.03.13P	complete required documentation	documentation is completed according to AHJ and ***specifications***

RANGE OF VARIABLES

conditions requiring service include: noise, vibration, faulty wiring, pressure loss

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

factors include: seized pumps, leaking valves, pin hole leaks

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

	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

Essential Skills Reading, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
H-22.01.01P	confirm materials required to install piping	materials required to install piping are confirmed according to ***codes***, AHJ and ***specifications***
H-22.01.02P	confirm routing	routing is confirmed according to ***specifications***, site conditions and equipment location
H-22.01.03P	lay out and assemble pipe	pipe is laid out and assembled according to ***codes***, AHJ, ***specifications***, site conditions and equipment location
H-22.01.04P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
H-22.01.05P	plumb and level or grade pipe	pipe is plumb and level or graded according to ***codes*** and AHJ
H-22.01.06P	install approved ***piping components***	approved ***piping components*** are installed according to ***codes***, AHJ and ***specifications***

RANGE OF VARIABLES

codes include: NPC, CSA B149, American Society of Mechanical Engineers (ASME)

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

piping components include: drip leg, swing joints, flexible connectors

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

Essential Skills Document Use, Reading, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
H-22.02.01P	confirm materials required to install ***equipment and components***	materials required to install ***equipment and components*** are confirmed according to ***codes***, AHJ and ***specifications***
H-22.02.02P	confirm location and installation sequence of ***equipment and components***	location and installation sequence of ***equipment and components*** are confirmed according to ***codes***, AHJ and ***specifications***
H-22.02.03P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
H-22.02.04P	place and secure ***equipment and components***	***equipment and components*** are placed and secured according to ***codes***, AHJ and ***specifications***
H-22.02.05P	install ***materials*** to compensate for movement and vibration	***equipment and components*** do not move or vibrate
H-22.02.06P	verify type of liquid or gas and supply pressure/vacuum	type of liquid or gas being used is verified and pressure/vacuum is supplied according to ***codes***, AHJ and ***specifications***
H-22.02.07P	connect piping to ***equipment and components***	***equipment and components*** are connected to piping according to ***codes***, AHJ and ***specifications***

RANGE OF VARIABLES

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

codes include: NPC, CSA B149, ASME

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

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

materials include: housekeeping pads, spring isolators, flexible connections, anchor points, expansion joints

	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

Essential Skills	Document Use, Thinking, Writing, Reading

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
H-22.03.01P	use ***testing equipment***	***testing equipment*** is used to detect ***faults*** and to confirm operation
H-22.03.02P	perform ***sensory inspection***	***sensory inspection*** is performed to detect ***specialized system*** problems
H-22.03.03P	perform ***tests*** according to ***specialized system***	tests are performed according to ***codes***, AHJ and ***specifications***
H-22.03.04P	verify integrity of piping, ***equipment and components*** of ***specialized systems***	integrity of piping, ***equipment and components*** is tested according to ***codes***, AHJ and ***specifications***
H-22.03.05P	***isolate*** piping, ***equipment and components*** not required in advance of test to prevent damage	sensitive ***equipment and components*** are ***isolated***
H-22.03.06P	record test results upon completion	test results are verified and recorded based on ***codes***, AHJ and ***specifications***

RANGE OF VARIABLES

testing equipment includes: inflatable test balls, test plugs, mandrels, compressors, hydrostatic pumps

faults include: cracks, corrosion, inadequate flow, poor workmanship

sensory inspection includes: audio, visual, smell, touch

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

tests include: hydrostatic, smoke, dye testing, nitrogen, air testing, pin index safety system, disc index safety system

codes include: NPC, CSA B149, ASME

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

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

isolation includes: tag-out/lock-out, valves in closed position, caps, plugs, blanks

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

Essential Skills Thinking, Document Use, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
H-22.04.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
H-22.04.02P	inspect piping, equipment, components and operation of ***specialized systems***	piping, equipment, components and operation of ***specialized systems*** is inspected to determine ***conditions requiring service***
H-22.04.03P	clean, lubricate, repair or replace ***equipment and components***	***equipment and components*** are cleaned, lubricated, repaired or replaced according to ***codes***, AHJ and ***specifications***
H-22.04.04P	calibrate ***equipment and components***	***equipment and components*** are calibrated according to ***codes***, AHJ and ***specifications***
H-22.04.05P	check and adjust levels and conditions of ***media***	levels and conditions of ***media*** are adjusted according to ***codes***, AHJ and ***specifications***
H-22.04.06P	check and adjust pressures	pressures are checked and adjusted according to ***codes***, AHJ and ***specifications*** to maintain system performance
H-22.04.07P	complete service and maintenance records	service and maintenance records are completed according to company policy, ***codes***, AHJ and ***specifications*** to indicate status of current system and follow-up actions required

H-22.04.08P	verify operation of safety devices	operation of safety devices is verified according to ***codes***, AHJ and ***specifications***
H-22.04.09P	select and use tools and equipment	tools and equipment are selected and used according to applications
H-22.04.10P	perform scheduled maintenance of system	maintenance of system is performed according to schedule and ***codes***, AHJ and ***specifications***
H-22.04.11P	notify building occupants and isolate system	building occupants are notified and system is isolated according to the application ***codes***, AHJ and ***specifications***
H-22.04.12P	return system to service and verify system operation	system is returned to service and operation is verified

RANGE OF VARIABLES

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

conditions requiring service includes: wear, noise, leaks, corrosion, failure

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

codes include: NPC, CSA B149, ASME

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

media includes: glycol, medical gas, natural gas

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

Essential Skills Reading, Document Use, Numeracy

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
H-23.01.01P	confirm materials required to install piping	materials required to install piping are confirmed according to ***codes***, AHJ and ***specifications***
H-23.01.02P	confirm routing	routing is confirmed according to ***codes***, AHJ, ***specifications***, site conditions and equipment location
H-23.01.03P	lay out and assemble pipe	pipe is laid out and assembled according to ***codes***, AHJ and ***specifications***, site conditions and equipment location
H-23.01.04P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
H-23.01.05P	plumb and level or grade pipe	pipe is plumb and level or graded according to ***codes***, AHJ and ***specifications***
H-23.01.06P	install, label and identify approved ***piping components***	approved ***piping components*** are installed, labelled and identified according to ***codes***, AHJ and ***specifications***

RANGE OF VARIABLES

codes include: NPC, CSA, Canadian Food and Drugs Act (CFDA), ASME

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

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

piping components include: flexible connectors, vibration isolators, expansion joints

	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

Essential Skills	Document Use, Reading, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
H-23.02.01P	confirm materials required to install ***equipment and components***	materials required to install ***equipment and components*** are confirmed according to ***codes***, AHJ and ***specifications***
H-23.02.02P	confirm location and installation sequence of ***equipment and components***	location and installation sequence of ***equipment and components*** are confirmed according to ***codes***, AHJ and ***specifications***

H-23.02.03P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
H-23.02.04P	place and secure ***equipment and components***	***equipment and components*** are placed according to ***codes***, AHJ and ***specifications*** and are secured
H-23.02.05P	install ***materials*** to compensate for movement and vibration	***equipment and components*** do not move or vibrate
H-23.02.06P	connect piping to ***equipment and components***	***equipment and components*** are connected to piping according to ***codes***, AHJ and ***specifications***

RANGE OF VARIABLES

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

codes include: NPC, CSA, CFDA, ASME

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

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

materials include: housekeeping pads, spring isolators, flexible connections

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

Essential Skills Document Use, Writing, Thinking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

SKILLS

	Performance Criteria	Evidence of Attainment
H-23.03.01P	use ***testing equipment***	***testing equipment*** is used to detect ***faults*** and to confirm operation
H-23.03.02P	perform ***sensory inspection***	***sensory inspection*** is performed to detect problems
H-23.03.03P	perform ***tests***	***tests*** are performed according to the ***codes***, AHJ and ***specifications***
H-23.03.04P	verify integrity of piping, ***equipment and components***	integrity of piping, ***equipment and components*** is tested according to ***codes***, AHJ and ***specifications***
H-23.03.05P	***isolate*** piping, ***equipment and components*** not required in advance of test to prevent damage	sensitive ***equipment and components*** are ***isolated***
H-23.03.06P	record test results upon completion	test results are verified and recorded based on ***codes***, AHJ and ***specifications***

RANGE OF VARIABLES

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

faults include: cracks, corrosion, inadequate flow, poor workmanship

sensory inspection includes: audio, visual, smell, touch

tests include: hydrostatic, smoke, bending test, dye testing, nitrogen and air testing

codes include: NPC, CSA, CFDA, ASME

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

isolation includes: tag-out/lock-out, valves in closed position, caps, plugs, blanks

	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

Essential Skills Thinking, Document Use, Working with Others

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	NV	yes	yes	yes	yes	yes	NV	NV	NV

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
H-23.04.01P	interpret client's information	client's information is interpreted to assist in the diagnostic process
H-23.04.02P	inspect piping, equipment, components and the operation of ***process piping systems***	piping, equipment, components and the operation of ***process piping systems*** is inspected to determine ***conditions requiring service***
H-23.04.03P	clean, lubricate, repair or replace ***equipment and components***	***equipment and components*** are cleaned, lubricated, repaired or replaced according to ***codes,*** AHJ and ***specifications***
H-23.04.04P	adjust ***equipment and components***	***equipment and components*** are adjusted according to ***codes***, AHJ and ***specifications***
H-23.04.05P	check and adjust levels and conditions of ***media***	levels and conditions of ***media*** are adjusted according to ***codes***, AHJ and ***specifications***

H-23.04.06P	check and adjust pressures	pressures are checked and adjusted according to ***codes***, AHJ and ***specifications*** to maintain system performance
H-23.04.07P	complete service and maintenance records	service and maintenance records are completed according to company policy, ***codes***, AHJ and ***specifications*** to indicate status of current system and follow-up actions required
H-23.04.08P	verify operation of safety devices	operation of safety devices is verified according to ***codes***, AHJ and ***specifications***
H-23.04.09P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to applications
H-23.04.10P	perform scheduled maintenance of system	maintenance of system is performed according to schedule and ***codes***, AHJ and ***specifications***
H-23.04.11P	notify building occupants and isolate system	building occupants are notified and system is isolated according to the application ***codes***, AHJ and ***specifications***
H-23.04.12P	return system to service and verify correct system operation	system is returned to service and correct operation is verified

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)

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

codes include: NPC, CSA, CFDA, ASME

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

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

media includes: glycol, pulp, chemicals, food and beverage

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

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	testeurs de qualité de l’air
arc flash protection	protecteurs contre les éclairs d’arcs électriques
barricades and caution tape	barrières et ruban d’avertissement
confined space equipment	équipement pour les espaces clos
eye wash kit	douches oculaires
face shield	écrans faciaux
fire blanket	couvertures ignifuges
fire extinguisher	extincteurs
fire resistant clothing	vêtements résistants au feu
first aid kit	trousses de premiers soins
gloves (industrial, rubber)	gants (industriels, en caoutchouc)
ground fault circuit interrupter	disjoncteurs de fuite de terre
hard hat	casques de sécurité
health care and infectious control equipment	équipement de soins de santé et de contrôle des infections
hearing protection	protecteurs auditifs
kneepads	genouillères
lock-out/tag out devices	dispositifs de cadenassage et d’étiquetage
reflective vests	gilets réflecteurs
respiratory mask	masques respiratoires
rubber boots (CSA)	bottes en caoutchouc de sécurité (CSA)
safety boots (CSA)	bottes de sécurité (CSA)
safety glasses/goggles (CSA)	lunettes de sécurité (CSA)
safety harness, lanyard and life line (CSA)	harnais et cordage de sécurité (CSA)
tripod	trépieds

Hand Tools

adjustable wrench	clés réglables
ball-peen hammer	marteaux à panne ronde
basin wrench	clés à robinet de montée
bolt cutter	coupe-boulons
broom	balais
caulking gun	pistolets à calfeutrer
chalk line	cordeaux à tracer
chisel	ciseaux
cistern pump (hand operated-diaphragm)	pompes à citerne (manuelles – à membrane)
claw hammer	marteaux à panne fendue

combination wrench	clés mixtes
diaphragm pump (hand operated)	pompes à membrane (manuelles)
drywall saw	scies pour cloisons sèches
faucet seat wrench	clés à siège de robinet
file	limes
flashlight	lampes de poche
hacksaw	scies à métaux
hand groover	fraises manuelles à rainer
hand saw	scies à main
hand threader	filières à main
hex keys (set)	clés hexagonales (jeu)
hole saws	scies emporte-pièce
knife	couteaux
level	niveaux
locking pliers	pince étaux
pick	pioches
pipe wrenches	clés à tuyaux
pliers (lineman, needle nose, water pump, groove lock)	pinces (de monteur, à bec effilé, pour pompe à eau, multiprises)
plumb bob	fils à plomb
pry bars	leviers
punch	poinçons
ratchet	rochets
reamer	alésoirs
rubber mallet	maillets en caoutchouc
scratch awl	pointes à tracer
screwdrivers (complete set)	tournevis (jeu complet)
shovel	pelles
sledgehammer	masses
socket set (imperial and metric)	jeux de douilles (systèmes impérial et métrique)
spud wrench	clés à mâchoires
square	équerres
strap wrench	clés à sangle
striker	percuteurs
stud finder	localisateurs de montants
stud punch	chasse-goujons
swage	outils à emboîture
t square	équerres en t
tap and die sets	jeux de tarauds et filières
tin snips (set)	cisailles de ferblantier (jeu)
torque wrench	clés dynamométriques
transfer pump (hand-operated)	pompes de transfert (à main)
tri square	équerres à coulisse

utility brushes	brosses à usages multiples
wire brushes	brosses métalliques

Power Tools and Equipment

air compressor and accessories	compresseurs d’air et accessoires
band saw	scies à ruban
bench grinder	meuleuses d’établi
booster pump	pompes de surpression
chain saw	scie à chaîne
chop saw	scies à tronçonner
circular saw	scies circulaires
compaction equipment	matériel de compactage
concrete cutter	coupe-béton
coring machines	carotteuses
cryogenic equipment	équipement cryogénique
die grinder	meules à rectifier les matrices
drain cleaning equipment	matériel de débouchage
drill press	perceuses à colonne
drills	perceuses
generator	générateurs
heat gun	pistolets thermiques
heat lamp	lampes infrarouges
impact wrench	clés à chocs
inspection cameras	caméras d’inspection
mini-grinder	mini-meuleuses
mini-excavator	mini-excavateur
portable band saw (hack saw)	scies à ruban portatives (scies à métaux)
powder-actuated tools	outils à charge explosive
power hole saw	mèches emporte-pièce utilisées sur une perceuse
reciprocating saw	scies alternatives
rotary hammer	perceuses à percussion
steamer	vaporisateurs
task lighting equipment	matériel d’éclairage des aires de travail
telescopic boom	flèche télescopique
transfer pump (electric and pneumatic)	pompes de transfert (électriques et pneumatiques)

Pipe Cutting and Joining Equipment

copper tube cutter	outils de coupe pour les tubes en cuivre
crimpers	pinces à sertir
files (set)	limes (jeu)
flaring tools	outils à évaser
fusion tools	outils de fusion
gas cylinders, and soldering and brazing	bouteilles à gaz et matériel de brasage

equipment	
gas powered cut-off	tronçonneuses à essence
grooving machine	rainureuses
hand-operated oiler	graisseurs manuels
hot air gun (welder)	pistolets à air chaud (soudage)
hot tap equipment	équipement de piquage sur conduite en charge
hydraulic pipe cutter	coupe-tuyaux hydrauliques
mechanical crimper	sertisseuses mécaniques
PEX crimper	sertisseuses en polyéthylène réticulé
PEX pipe expander (manual and power)	évaseurs de tuyaux en polyéthylène réticulé (manuels et mécaniques)
pipe cutter	coupe-tuyaux
pipe groover	rainureuses à tuyaux
pipe reamer	alésoirs à tuyaux
pipe roller	supports à rouleau pour tuyaux
pipe stand	supports de tuyaux
pipe threader	filières à tuyaux
pipe vise	étaux à tuyaux
plastic tube cutters (set)	outils de coupe pour les tubes en plastique (jeu)
power vise	étaux électriques
ratchet cutter	chalumeaux
snap cutter	coupe-tuyaux à rochet
specialized assembly tools and equipment	coupe-tuyaux à chaîne
T-extracting tool	outils et matériel d’assemblage spéciaux
torch	extracteurs en T
tube bender	cintreuses
tube cutter	coupe-tubes
welding equipment	équipement de soudage

Testing, Measuring and Communication Equipment

builder’s level	niveaux de bâtisseur
calculator	calculatrices
calliper	compas d’épaisseur
communication devices	dispositifs de communication
computer	ordinateurs
crimp gauge	jauges à sertissures
differential pressure gauge and sight tube	manomètres différentiels et visiverres
drafting equipment	matériel de traçage
electronic leak detector	détecteurs de fuites électroniques
gauges	jauges
GPS	GPS
groove depth tape	ruban à profondeur de rainure
hand pump and accessories (bicycle pump)	pompes à main et accessoires (pompes à

	bicyclettes)
hydrostatic pump and gauge (manual and power)	pompes hydrostatiques et manomètres (à main ou mécaniques)
infrared thermometer	thermomètres à infrarouges
laser layout tools	outils de traçage à laser
manometer	manomètres
markers	marqueurs
measuring tape	ruban à mesurer
micrometer	micromètres
multimeter	multimètres
pipe locator	localisateur de conduits
refractometer	réfractomètres
scale rule	règles graduées
scanning equipment	équipement de balayage
test strips and kits	bandes et trousses d’essai
thermal imager	imageurs thermiques
thermometer	thermomètres
two way radios	radios émetteurs-récepteurs

Hoisting, Rigging and Access Tools and Equipment

beam trolleys	chariots à poutres
block and tackles	palans
boom truck	camions à flèche
bridles	guide-câbles
chain block hoist (endless chain)	palans à chaîne (chaîne sans fin)
come-along and grip hoist	palans à levier et palans à levier à course illimitée du câble
crane	grues
dolly	socles roulants
equalizer beam	balancier
fork lift	chariots élévateurs à fourche
ladders	échelles
lifting eyes	anneaux de levage
man/material lift (manual and power)	monte-personnes/monte-charges (manuels et électriques)
pallet jack	transpalettes à main
rope/cable	cordes et câbles
scaffolding	échafaudages
scissor lifts	plateformes élévatrices à ciseaux
shackles (varying sizes)	manilles de diverses grandeurs
skid steer loader	chargeurs à direction à glissement
slings and chokers	élingues et étrangleurs
snatch blocks	poulies à chape ouvrante
spreader bar	barres d'écartement

stair cart	chariots pour escaliers
telescopic forklift	chariots élévateurs à fourche télescopique
tuggers (power)	chariots tracteurs
winches	treuils
wire rope or nylon (synthetic)	cordes métalliques ou de nylon (synthétique)

APPENDIX C
GLOSSARY

appliance	piece of equipment which may require connection to a plumbing system	**appareil**	pièce d'équipement qui peut demander un branchement à une installation de plomberie
backflow	flowing back or reversal of the normal direction of the flow	**refoulement**	inversion du sens normal d'écoulement de l'eau
backflow preventer	a device used to prevent backflow due to back pressure or back siphonage	**dispositif antirefoulement**	dispositif utilisé pour empêcher le refoulement causé par la contrepression ou la rentrée d'eau
backing	a layer of material that forms, protects and strengthens the supports for plumbing fixtures and equipment	**pièce de renfort**	couche de matériau qui façonne, protège et renforce le support des appareils et de l'équipement sanitaires
backwater valve	check valve designed for use in a gravity drainage system	**clapet antiretour**	clapet de retenue conçu pour un réseau d'évacuation par gravité
benchmark	predetermined elevation used as a reference point	**repère**	élévation préétablie utilisée comme point de référence
check valve	valve that permits flow in only one direction	**clapet de retenue**	dispositif ne permettant l'écoulement que dans un sens
cleanout	access provided in drainage and venting systems to provide for cleaning and inspection services	**regard de nettoyage**	accès prévu dans un réseau d'évacuation ou de ventilation pour en permettre le nettoyage et l'inspection
cross-connection	a connection between a potable water source to a non-potable water source	**raccordement croisé**	raccordement entre une source d'eau potable et une source d'eau non potable
developed length	length along the centre line of the pipe and fitting	**longueur développée**	longueur d'un tuyau mesurée le long de l'axe du tuyau et de ses raccords
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	**raccord de sécurité à diamètres correspondants**	système utilisé pour les gaz médicaux qui définit les propriétés des points d'accès (diamètre et configuration) et permet seulement de brancher les dispositifs de raccordement spécifiques au point d'accès au gaz qui convient
dielectric protection	a method isolating dissimilar metals to prevent electrolysis (ion transfer)	**protection diélectrique**	méthode visant à isoler les métaux dissemblables afin d'empêcher l'électrolyse (transfert d'ions)
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	**réseau d'évacuation**	ensemble de tuyaux, de raccords, d'appareils sanitaires, de siphons et d'accessoires utilisés pour l'acheminement des eaux usées, des eaux nettes ou des eaux pluviales à un égout public ou à une installation individuelle d'assainissement, à l'exclusion des tuyaux de drainage souterrains
embedded	components of a plumbing system	**composants enfouis**	composants d'une tuyauterie

components	that are encased in concrete or other materials		enfermés dans du béton ou d'autres matériaux
expansion tank	device used to accept expansion of water in a closed system	**réservoir d'expansion**	dispositif conçu pour recueillir l'augmentation du volume d'eau dans un système fermé
fire monitoring system	a system that assists locating fire hazard in a building and alerting first responders	**système de surveillance des incendies**	système qui permet de localiser les risques d'incendie dans un bâtiment et d'alerter les premiers intervenants
fire separation / fire stopping	construction assembly that acts as a barrier against the spread of fire and smoke	**séparation coupe-feu/dispositif coupe-feu**	construction destinée à retarder la propagation du feu et de la fumée
fixture	receptacle, appliance, apparatus or other device that discharges sewage or clear-water waste, includes a floor drain	**appareil sanitaire**	réceptacle, appareil ou dispositif, y compris un avaloir de sol, qui évacue des eaux usées ou des eaux nettes
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	**facteur d'évacuation (en parlant d'un réseau d'évacuation)**	unité de mesure fondée sur le débit d'écoulement, le temps de fonctionnement et la fréquence d'utilisation d'un appareil sanitaire, et qui exprime la charge hydraulique imposée au réseau d'évacuation par cet appareil
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	**facteur d'alimentation (en parlant d'un réseau de distribution d'eau)**	unité de mesure fondée sur le débit d'alimentation, le temps de fonctionnement et la fréquence d'utilisation d'un appareil sanitaire ou d'un point de sortie, et qui exprime la charge hydraulique imposée au réseau de distribution d'eau par cet appareil ou ce point de sortie
flashing	component made of rubber, sheet metal or lead used to seal around exterior pipe penetrations	**solin**	composant fait de caoutchouc, de tôle métallique ou de plomb, utilisé pour empêcher l'infiltration d'eau aux pénétrations de tuyaux extérieurs
flex connector	device used to isolate vibration and allow for expansion and movement of appliances, equipment and piping	**connecteur souple**	dispositif utilisé pour protéger des vibrations et pour permettre la dilatation et le mouvement d'un appareil, de matériel ou de la tuyauterie
flow-through fire protection systems	any fire protection system connected to potable water piping	**systèmes de protection contre les incendies à circulation continue**	tout système de protection contre les incendies raccordé aux tuyauteries d'eau potable
heat tracing	an electrical resistance cable, hydronic or steam piping that prevents the freezing of systems	**dispositif de réchauffage de tuyaux**	tuyauterie à câble à résistance électrique, à eau chaude ou à vapeur qui empêche le gel des tuyaux
offset	a piping that connects the ends of two pipes that are parallel or perpendicular	**déviation**	tuyauterie reliant les extrémités de deux tuyaux parallèles ou perpendiculaires
pitless adaptor	fitting that allows the connection and removal of a pump without the use of tools or entering a confined space	**coulisseau de raccordement**	dispositif qui permet de raccorder et de retirer une pompe sans devoir utiliser d'outils ou pénétrer dans un espace clos
plumbing	drainage system, a venting system	**installation de**	réseau d'évacuation, réseau de

system	and a water system or parts thereof	**plomberie**	ventilation, réseau d’alimentation en eau ou toute partie de ceux-ci
potable	safe for human consumption	**eau potable**	eau propre à la consommation humaine
private sewage treatment system	privately owned plant for the treatment and disposal of sewage (such as a septic tank with an absorption field)	**installation individuelle d’assainissement**	installation individuelle de traitement et d’évacuation des eaux usées (par exemple, une fosse septique avec champ d’épuration)
private water supply system	assembly of pipes, fittings, valves, equipment and appurtenances that supplies water from a private source to a water distribution system	**installation individuelle d’alimentation en eau**	ensemble de tuyaux, de raccords, d’appareils de robinetterie, d’équipement et d’accessoires utilisés pour acheminer l’eau d’une source individuelle à un réseau de distribution d’eau
purge	to pass inert gas inside of pipe to displace oxygen and prevent oxidation during brazing and welding operations	**purger**	action de faire passer du gaz inerte à l’intérieur d’un tuyau afin de déplacer de l’oxygène et empêcher l’oxydation pendant les opérations de brasage et de soudage
roof drain	fitting or device that is installed in the roof to permit storm water to discharge into a leader	**avaloir de toit**	raccord ou dispositif installé sur le toit pour diriger les eaux pluviales vers une descente pluviale
rough-in	placement of pipes in order to allow for final installation of fixtures and equipment	**plomberie brute**	positionnement de tuyaux pour permettre l’installation finale d’appareils sanitaires et de matériel
sanitary sewer	sewer that conducts sewage	**égout sanitaire**	égout acheminant des eaux usées
sensory inspection	inspection using one or more of the following: sight, taste, touch, smell, auditory	**inspection sensorielle**	inspection faite à partir d’un ou plusieurs des cinq sens, c’est-à-dire la vue, le goût, le toucher, l’odorat ou l’ouïe
sewage	any liquid water other than clear-water waste or storm water	**eaux usées**	eau de rejet autre que les eaux nettes (eaux de rejet dont la teneur en impuretés n’est pas dangereuse pour la santé) et les eaux pluviales
sleeve	a component used to create a penetration through walls, floors and ceilings prior to the installation of piping	**manchon**	composant destiné à créer une voie de pénétration dans des murs, des planchers ou des plafonds avant l’installation de tuyauterie
soil-or-waste pipe	pipe in a sanitary drainage system	**tuyau d’évacuation d’eaux usées**	tuyau faisant partie d’un réseau sanitaire d’évacuation
sounding	a method of detecting cracks in cast iron pipe and fitting	**sondage**	méthode utilisée pour détecter des fissures dans des tuyaux ou des raccords en fonte
storm sewer	sewer that conveys storm water	**égout pluvial**	égout acheminant des eaux pluviales
swing joint	piping arrangement to allow for movement without putting strain on piping	**joint articulé**	disposition de la tuyauterie permettant le mouvement sans imposer de tension à la tuyauterie
thrust blocks	a formed concrete block used to prevent movement of a fitting at a change of direction in a buried piping system	**massif d’ancrage**	bloc de béton moulé utilisé pour empêcher le mouvement d’un raccord où une tuyauterie enfouie change de direction
torque arrestor	device installed on a pipe in a well	**cale anticouple**	dispositif installé sur un tuyau placé

	casing which prevents the pipe from spinning		dans un tubage de puits pour empêcher le tuyau de tourner
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	**siphon**	dispositif obturateur hydraulique empêchant le passage des gaz sans gêner l'écoulement des liquides
tube	measured by inside diameter	**tube**	tuyau mesuré selon son diamètre intérieur
tubing	measured by OD and wall thickness	**tubulure**	tuyau mesuré selon son diamètre extérieur et l'épaisseur de la paroi
vent piping	pipe that is part of a venting system	**tuyauterie de ventilation**	tuyau faisant partie d'un réseau de ventilation
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	**réseau de ventilation**	ensemble de tuyaux et de raccords mettant un réseau d'évacuation en communication avec l'air extérieur et assurant la circulation d'air et le maintien des gardes d'eau dans ce réseau
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	**réseau de distribution d'eau**	ensemble de tuyaux, de raccords, d'appareils de robinetterie et d'accessoires acheminant l'eau d'un branchement d'eau général ou d'une installation individuelle d'alimentation en eau aux sorties d'eau, aux appareils sanitaires, aux appareils et aux autres dispositifs
water heater	device for heating water for plumbing services	**chauffe-eau**	dispositif servant à chauffer l'eau circulant dans les installations de plomberie
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	**branchement d'eau général**	tuyau acheminant l'eau d'une canalisation publique d'alimentation principale en eau ou d'une source d'eau individuelle vers l'intérieur d'un bâtiment, jusqu'au robinet d'isolement principal inclusivement
water system	private water supply system, a water service pipe, a water distribution system or parts thereof	**réseau d'alimentation en eau**	installation individuelle d'alimentation en eau, branchement d'eau général, réseau de distribution d'eau ou toute partie de ceux-ci