PROGRAM PROGRAMME
EXCELLENCE
RED SEAL · SCEAU ROUGE

Red Seal Occupational Standard

Gasfitter - Class B

INTERPROVINCIAL STANDARD
CANADA
NORME INTERPROVINCIALE

red-seal.ca
sceau-rouge.ca

Employment and Social Development Canada
Emploi et Développement social Canada

Canada

PROGRAM PROGRAMME
EXCELLENCE
RED SEAL · SCEAU ROUGE

Red Seal Occupational Standard

Gasfitter – Class B

INTERPROVINCIAL STANDARD
CANADA
NORME INTERPROVINCIALE

Title: Gasfitter - Class B

This publication is available for download at canada.ca/publicentre-ESDC. It is also available upon request in multiple formats (large print, Braille, MP3, audio CD, e-text CD, DAISY, or Accessible PDF), by contacting 1 800 O-Canada (1-800-622-6232). By teletypewriter (TTY), call 1-800-926-9105.

PDF
Cat. No.: Em15-3/4-2024E-PDF
ISBN/ISSN: 978-0-660-72769-1

Foreword

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this Red Seal Occupational Standard (RSOS) as the Red Seal standard for the Gasfitter - Class B 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) funds 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 occupational standards.

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 Sectoral Initiatives Directorate
Employment and Social Development Canada
140 Promenade du Portage, Phase IV
Gatineau, Quebec K1A 0J9

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.

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:

Mike Beamish	New Brunswick
Greg Berry	Nova Scotia
Eric Bradbury	British Columbia
Sean Diakow	Alberta
Kyle Harvey	Ontario
Craig MacDonald	Ontario
Chad MacLean	New Brunswick
Hendrik Mills	Manitoba
Bob Park	Ontario
Chris Pengelly	Manitoba
Michael Pizzolato	British Columbia
Chris Snow	New Brunswick
Brian Sweet	British Columbia
Rick Touet	Saskatchewan
Jeff Tracy	Alberta
Russell Unrau	Manitoba
Rick Vanier	British Columbia
Dakota Wruck	Saskatchewan

This standard was prepared by the Apprenticeship and Sectoral Initiatives Directorate of ESDC. The coordinating, facilitating and processing of this standard were undertaken by employees of the standards development team of the Trades and Apprenticeship Division and of Alberta, the host jurisdiction for this trade.

Structure of the Occupational Standard

This standard contains the following sections:

Methodology: an overview of the process for development, review, validation and weighting of the standard

Description of the Gasfitter – Class B Trade: an overview of the trade's duties, work environment, job requirements, similar occupations and career progression

Trends in the Gasfitter – Class B Trade: some of the trends identified by industry as being the most important for workers in this trade

Skills for Success Summary: an overview of how each of the skills for success (formerly called essential skills) is applied in this trade

Roles and Opportunities for Skilled Trades in a Sustainable Future: an overarching description of how in the context of climate change, skilled trades play a large role in implementing solutions and adjusting to changes in the world. In addition to highlighting the importance of this awareness, the standard may also contain more details on activities, skills and knowledge elements that are specific to the 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 of Red Seal Examination Weightings: a graph which depicts the national percentages of exam questions assigned to the major work activities

Task Matrix and Weightings: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard and the national percentages of exam questions assigned to the major work activities and tasks

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

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

Range of Variables: elements and examples (not all inclusive) that provide a more in-depth description of a term used in the performance criteria and evidence of attainment

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 to meet the learning outcomes for the sub-task

Range of Variables: elements and examples (not all inclusive) that provide a more in-depth description of a term used in the learning outcomes and learning objectives

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

Appendix B – Tools and Equipment / Outils et équipement: a bilingual non-exhaustive list of tools and equipment used in this trade

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

Methodology

Development of the Standard

A draft standard is developed by a broad group of trade representatives, including tradespeople, instructors and employers at a National Workshop led by a team of facilitators. This draft standard breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

Online Survey

Stakeholders are asked to review and validate the activities described in the new standard via an online survey. These stakeholders are invited to participate in this consultation through apprenticeship authorities, as well as national stakeholder groups.

Draft Review

The RSOS development team forwards a copy of the standard to provincial and territorial authorities who consult with industry representatives to review it. Their recommendations are assessed and incorporated into the standard.

Validation and Weighting

Participating provinces and territories also consult with industry to validate and weight the document for the purpose of planning the makeup of the Red Seal Interprovincial Examination for the trade. They validate and weight the major work activities (MWA), tasks and sub-tasks, of the standard as follows:

MWA	Each jurisdiction assigns a percentage of questions to each MWA for an examination that would cover the entire trade.
Tasks	Each jurisdiction assigns a percentage of exam questions to each task within a MWA.
Sub-tasks	Each jurisdiction indicates, with a “yes” or “no”, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the RSOS development team who then analyzes the data and incorporates it into the document. The RSOS provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for MWA and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

The validation of the RSOS is used to identify common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions’ industry performs a sub-task, it shall be considered common core. Interprovincial Red Seal Examination questions are limited to the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

yes	sub-task performed by qualified workers in the occupation in that province or territory
no	sub-task not performed by qualified workers in the occupation in that province or territory
NV	standard Not Validated by that province or territory
ND	trade Not Designated in a province or territory
Not Common Core (NCC)	sub-task, task or MWA performed less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
National Average %	average percentage of questions assigned to each MWA and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

Description of the Gasfitter – Class B Trade

Gasfitters – Class B design, install, test, adjust, maintain, and repair fuel piping systems, venting, air supply systems, appliances, equipment and accessories in various sectors.

Gasfitters – Class B may work in residential, institutional and commercial building and restaurants on fuel-fired appliances that do not exceed 400 000 British Thermal Units per hour (Btuhs) or 120 kilowatts (kW). These appliances are typically designed and certified for space heating, cooking, domestic hot water heating and decorative installations, and include furnaces, boilers, hot water tanks and tankless heaters, fireplaces, fire pits and residential and commercial cooking equipment, that usually operate on natural gas or propane.

Depending on regional and jurisdictional regulations and limitations, fuels may include natural gas, manufactured gas, oil, liquefied petroleum gas, digester gas, landfill gas, biogas, hydrogen or a mixture or dilution of any of these gases.

They may be employed to repair and extend gas lines, and install, repair and service pipes and fittings between mains and buildings. For mechanical and service companies, they may install, service and maintain propane and natural gas piping systems and appliances.

For health and safety reasons, the gas fitting trade is regulated across Canada.

In some jurisdictions, to perform tasks such as welding, rigging and hoisting, gasfitters - class B may need to acquire additional certification.

It is essential that gasfitters – class B have strong mechanical aptitudes, problem-solving skills and a good understanding of electrical/electronic control systems, combustion theory and flame safeguard systems, and their regulatory requirements. There is a requirement for strong mathematical, spatial visualization and communication skills. Gasfitters – Class B must be able to interpret drawings and technical manuals.

Conditions may be stressful as the work environment for gasfitters – class B is varied and may involve working in extreme or adverse conditions both indoors and outdoors. They may work in confined spaces, at heights, and around heavy equipment and piping systems and may be required to respond to hazardous emergencies at any time. There are hazards involved in working with electricity, flammable and toxic gases, and power tools.

Gasfitters – Class B require manual dexterity and upper and lower limb coordination. Good physical condition is important because the work often requires considerable standing, lifting and moving of heavy items. They are also required to crouch, bend, kneel, crawl and twist when moving around equipment and piping systems.

This standard recognizes similarities or overlaps with the work of other trades such as gasfitters – class A, plumbers, steamfitters/pipefitters, oil heat system technicians, welders, refrigeration and air conditioning mechanics, electricians, sheet metal workers, and instrumentation and control technicians. Experienced gasfitters – class B often act as mentors and coaches to apprentices in the trade. Career advancement opportunities may include gasfitter - class A, supervisory positions such as supervisor, maintenance manager or service manager, starting their own contracting business, working for provincial/territorial regulators or becoming trainers.

Trends in the Gasfitter – Class B Trade

Technology and Environmental

Gasfitters need to be aware of the several initiatives being developed and implemented to reduce greenhouse gas emissions both federally and through provincial/territorial mandates and policies. These strategies recommend actions that focus on renewable natural gas (RNG) produced by landfill, digester, and biogas facilities, and on hydrogen production and utilization.

Landfill, digester and biogas facilities capture and utilize methane gas produced from the anaerobic digestion of organic waste materials that would otherwise pollute the environment through uncontrolled methane production while decomposing (methane gas has 20 to 30 times the heat-trapping capabilities of carbon dioxide). RNG produced from biogas, landfill gas and digester gas at these facilities can be used to supplement existing natural gas utility pipeline infrastructure, decreasing the amount of fossil fuel extraction needed to produce energy. This fuel can be used by fuel-burning appliances at the facility, or it can be compressed and dispensed to vehicles as CNG.

Landfill, digester and biogas facilities range in size from small-scale systems designed for animal waste or food waste, to large industrial systems designed to treat municipal wastewater, industrial wastewater, municipal solid waste and agricultural waste.

Hydrogen can be used for producing low-carbon synthetic fuels to reduce emissions in transportation and industry. When burned in appliances or used in a fuel cell, hydrogen produces no carbon emissions. Hydrogen can be dispensed to vehicle storage tanks for fuel cells and hydrogen/diesel combustion engines, and stationary power systems, especially important for industrial sites and remote communities currently powered by diesel. When blended into the natural gas grid, hydrogen can displace fossil fuels to heat and power homes and buildings.

Health and Safety

Due to increased health and safety concerns and regulations, air quality is a priority when installing and servicing systems. As well, governing agencies have an increasing enforcement causing gasfitters to be much more aware of compliance requirements such as working with fuel burning equipment, direct-vent or sealed combustion equipment.

In some jurisdictions, building codes now require the installation of residential carbon monoxide systems. Commercial full emission detection systems allow many more elements of detection to be monitored such as hazardous gases.

Occupational health and safety training such as Workplace Hazardous Materials Information System (WHMIS), first aid, fall arrest, aerial platform and confined space are necessary in today's working environment.

Tools and Equipment

There are new tools and equipment for installing piping. Battery-powered tools such as powered threaders and press connect fitting tools assist in installing piping in a safer and more efficient manner.

There is an increased functionality of tools such as Bluetooth enabled combustion analyzers, manometers and temperature sensors that allow better logging and tracking of results.

Products

The mandates for carbon reduction have had an impact on improving appliance efficiencies and more sophisticated burner and building management systems. Equipment across the trade that is used for heating, ventilation and air conditioning (HVAC) are becoming more energy efficient, integrate with home automation systems and incorporate sophisticated electronic control systems and monitoring circuits.

With the increased use of Wi-Fi enabled communication and tracking systems, gasfitters can remotely check equipment at the customer's location. This also enables gasfitters to verify technical information on the internet. With no/low carbon technology, hydrogen and hydrogen blend appliances and technology is increasing and has the potential of becoming the future of the trade.

These new appliances and systems have increased the training and knowledge requirements for gasfitters in electrical, electronics and control systems.

Gasfitters must be aware of the procedures and jurisdictional regulations for recycling products and materials that are removed from service as new recycling facilities emerge.

Skills for Success Summary

Skills for Success are needed in a quickly changing world for work, learning and life. They are foundational for building other skills and important for effective social interaction. Everyone benefits from having these skills as they help individuals get a job, progress at their current job and change jobs. They also help individuals become active members of their community and succeed in learning.

Through extensive research and consultations, the Government of Canada launched the new Skills for Success model renewing the previous Essential Skills framework to better reflect the needs of the current and future labour market.

The summary presented here is based on existing Essential Skills profiles and will be updated to align with the new Skills for Success model over time.

Reading

Gasfitters read descriptions and explanations on work orders and memos from supervisors and customers on details of the work tasks and activities that need to be done. They read warnings and instructions on labels, signs, tags and placards to make decisions about special precautions or procedures that are needed for a particular job. They must interpret and apply manufacturers' specifications, codes, and regulatory requirements when installing, maintaining, servicing, and decommissioning equipment or systems.

Document Use

Gasfitters use manufacturers' specification sheets, equipment manuals and code books to locate technical information and operation settings to complete installation, maintenance and repair procedures. They refer to drawings, pictures and diagrams in equipment manuals to troubleshoot equipment problems and complete repair and replacement procedures. Gasfitters use and read schematic drawings to understand various systems such as equipment, control, electrical, gas supply and energy distribution systems.

Writing

Gasfitters write detailed notes in logbooks, notebooks, layout drawings and inspection checklists to keep records of equipment installation, changes and deficiencies. They provide descriptive texts on work orders to provide description of work performed, equipment deficiencies and required remedial actions. Gasfitters create as-built diagrams and sketches. Gasfitters may complete sections of incident or accident reports.

Oral Communication

Gasfitters communicate with customers, managers, supervisors, coworkers and other trades to discuss equipment problems and outline job requirements, legal implications and negotiate repair processes. They also follow up with customers after jobs are completed to explain equipment operation and answer questions. Gasfitters may also communicate with a range of officials, such as provincial/territorial regulators and engineers.

Numeracy

Gasfitters calculate materials needed and determine estimates for installation or service jobs. Gasfitters convert length and volume measurement from metric to imperial units and vice versa. They also perform calculations for venting, combustion air and gas pipe sizing requirements. They take measurements such as distance, volume, temperature and pressure. Gasfitters must be able to convert different units of energy. These calculations and measurements are used for such things as sizing combustion air, energy distribution and exhaust gas analysis.

Thinking

Gasfitters problem solve when facing unexpected installation, service and removal problems. They may decide to not enter homes or buildings where personal health and safety may be at risk. Based on their sensory inspections, their knowledge of instrumentation, controls and equipment performance and the urgency to restart systems, gasfitters determine how to troubleshoot, maintain or replace equipment or components. They may also decide how and where to install system components to meet manufacturers' specifications, code requirements and maintain efficiency. Gasfitters evaluate efficiency of fuel-fired systems. They also plan and organize their daily tasks.

Working with Others

Gasfitters may work alone or with a team depending on the task requirements. When working with others, they may coordinate with other trades and contractors. They mentor and train apprentices and coworkers on the job.

Digital Technology

Gasfitters use computer programs and instrumentation to create installation layouts or to troubleshoot system or equipment problems. They use computers to interface with equipment and programming, changing parameters and maintaining control systems. They use electronic communication to communicate with customers, coworkers, suppliers or subcontractors.

Continuous Learning

Gasfitters often have in-house training or attend seminars to update their required site-specific and safety certifications such as WHMIS, fall arrest training, first aid and many others. Gasfitters must become proficient with new equipment, technology, regulations, codes and procedures by attending training sessions and seminars, reading manuals and through on-the-job experience.

Roles and Opportunities for Skilled Trades in a Sustainable Future

Climate change affects all of us. Trades play a large role in implementing solutions and adjusting to changes in the world.

Throughout this standard, there may be specific references to tasks, skills and knowledge that clearly show this trade's role in a more sustainable future. Each trade has different roles to play and contributions to make in their own way.

For example:

- Construction tradespeople need to consider the materials they are using, building methods, and improvements to mechanical and electrical installations. There are important changes to codes and standards to help meet the climate change goals and commitments set for 2030 and 2050. Retrofits and new construction of low-energy buildings provide enormous opportunities for workers in this sector. Concepts, such as energy efficiency and regarding buildings as systems are foundational.

- Automotive and mechanical trades are seeing a shift towards the electrification of vehicles and equipment. As a result, new skills and knowledge will be required for tradespeople working in this sector. There are mandates for sales of new light-duty zero-emission vehicles (ZEV) in Canada, with the goal of achieving 100% ZEV sales by 2035. Due to this mandate, the demand for these vehicles is growing quickly among consumers and fleets. With this escalating demand, the need for skilled workers to maintain and repair these vehicles is also increasing.

- In industrial and resource sectors, there is pressure to move towards increased electrification of industrial processes. Many industrial and commercial facilities are also being upgraded to improve energy efficiency in areas such as lighting systems, and new production processes and technologies. There are also opportunities in carbon capture, utilization and storage (CCUS), as well as the production and export of low-carbon hydrogen.

- Trades in the service sector may also need to be aware of responsible sourcing, as well as efficient use of products and materials. New ways of working better are always a part of the job.

There are fast-moving changes in guidelines, codes, regulations and specifications. Many are being implemented for the purpose of energy efficiency and climate change. Those that affect specific trades may be mentioned within the standard. Examples of these guidelines and legislation include:

- the National Energy Code of Canada for Buildings (NECB).

- the Canadian Net-Zero Emissions Accountability Act (CNZEAA).

- programs that encourage sustainable building design and construction such as Leadership in Energy and Environmental Design (LEED) and the Zero Carbon Building (ZCB) standards.

- the Montreal Protocol for phasing out R22 refrigerants.

- energy efficiency programs such as ENERGY STAR.

- principles of the United Nations Declaration for the Rights of Indigenous Peoples pertaining to energy sector development.

Apprentices and tradespeople need to increase their climate literacy and reinforce their own understanding of energy issues and environmental practices. It is important for them to understand why these changes are happening and their effect on trades' work. While individual tradespeople and apprentices may not be able to choose certain elements like; the architectural design of buildings, building material selection, regulatory requirements, use of electric vehicles and technologies, they must understand the impact of using these elements in their work. Impacts include using environmentally friendly products and following requirements related to the disposal and recycling of materials.

In apprenticeship, as well as in ongoing professional development, employers and instructors should encourage learning about these concepts, why they are important, how they are implemented, and the overarching targets they are aiming to achieve.

All in all, it's about doing the work better and building a better world.

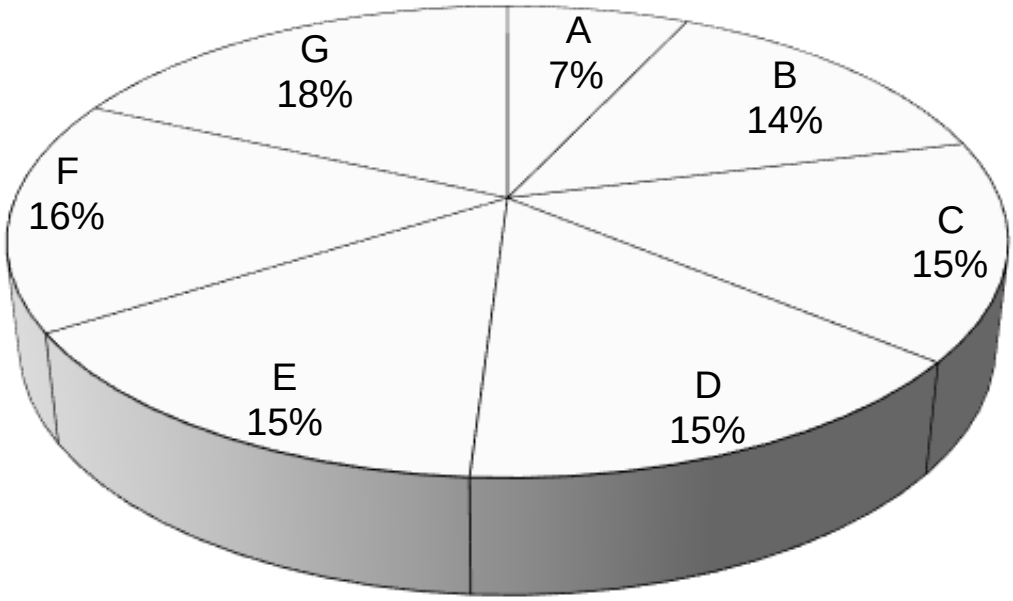
Industry Expected Performance

All tasks must be performed according to the applicable jurisdictional codes, standards and regulations. All health and safety standards must be respected and observed. Work should be performed efficiently and to a high quality without material waste or environmental damage. All requirements of employers, engineers, designers, manufacturers, provincial/territorial regulators, customers, and quality assurance and control policies 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 maintain 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, codes, regulations and standards as well as languages of instruction in apprenticeship programs.

Pie Chart of Red Seal Examination and Weightings



MWA A	Performs common occupational skills	7%
MWA B	Installs fuel piping and tubing systems	14%
MWA C	Installs venting and air supply systems	15%
MWA D	Installs controls and electrical systems	15%
MWA E	Installs and converts fuel systems, appliances and ancillary equipment	15%
MWA F	Tests and commissions fuel systems, appliances and ancillary equipment	16%
MWA G	Services fuel systems, appliances and ancillary equipment	18%

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 and the breakdown of questions assigned to the Tasks. The Interprovincial examination for this trade has 100 questions.

Gasfitter – Class B
Task Matrix and Weightings

A – Performs common occupational skills — 7%

Task A-1 Performs safety-related functions 21%	**A-1.01** Maintains safe work environment	**A-1.02** Uses personal protective equipment (PPE) and safety equipment	
Task A-2 Uses tools and equipment 40%	**A-2.01** Uses hand and power tools	**A-2.02** Uses technical instruments and testers	**A-2.03** Uses access equipment
	A-2.04 Operates lifting, rigging and hoisting equipment		
Task A-3 Organizes work 34%	**A-3.01** Interprets documents	**A-3.02** Selects systems, equipment and components	**A-3.03** Plans for installation, service and maintenance
Task A-4 Uses communication and mentoring techniques 5%	**A-4.01** Uses communication techniques	**A-4.02** Uses mentoring techniques	

B – Installs fuel piping and tubing systems — 14%

Task B-5 Selects and installs piping for fuel systems 53%	**B-5.01** Selects piping for fuel systems	**B-5.02** Prepares piping for fuel systems	**B-5.03** Installs piping for fuel systems
Task B-6 Selects and installs tubing for fuel systems 47%	**B-6.01** Selects tubing for fuel systems	**B-6.02** Prepares tubing for fuel systems	**B-6.03** Installs tubing for fuel systems

C – Installs venting and air supply systems — 15%

Task C-7 Selects and installs venting systems 40%	C-7.01 Selects materials for venting systems	C-7.02 Prepares materials for venting systems	C-7.03 Installs venting systems
Task C-8 Selects and installs air supply systems 36%	C-8.01 Selects materials for air supply systems	C-8.02 Prepares materials for air supply systems	C-8.03 Installs air supply systems
Task C-9 Selects and installs draft control systems 24%	C-9.01 Selects components for draft control systems	C-9.02 Installs components for draft control systems	

D – Installs controls and electrical systems — 15%

Task D-10 Selects and installs combustion control systems 22%	D-10.01 Selects combustion control components	D-10.02 Installs combustion control components
Task D-11 Selects and installs flame safeguard systems 24%	D-11.01 Selects flame safeguard components	D-11.02 Installs flame safeguard components
Task D-12 Selects and installs operating control systems 26%	D-12.01 Selects operating control components	D-12.02 Installs operating control components
Task D-13 Selects and installs electrical systems 19%	D-13.01 Selects electrical components	D-13.02 Installs electrical components
Task D-14 Selects and installs automation and instrumentation control systems 9%	D-14.01 Selects automation and instrumentation control components	D-14.02 Installs automation and instrumentation control components

E – Installs and converts fuel systems, appliances and ancillary equipment — 15%

Task E-15 Selects, installs and converts fuel systems, appliances and ancillary equipment 53%	**E-15.01** Selects appliances and ancillary equipment	**E-15.02** Installs appliances and ancillary equipment	**E-15.03** Installs fuel conversion components
Task E-16 Selects and installs propane and natural gas storage, handling and dispensing systems 34%	**E-16.01** Selects propane and natural gas storage, handling and dispensing systems	**E-16.02** Installs propane and natural gas storage, handling and dispensing systems	
Task E-17 Selects and installs other fuel storage, handling and dispensing systems 13%	**E-17.01** Selects other fuel storage, handling and dispensing systems	**E-17.02** Installs other fuel storage, handling and dispensing systems	

F – Tests and commissions fuel systems, appliances and ancillary equipment — 16%

Task F-18 Tests fuel delivery systems 45%	**F-18.01** Selects testing equipment and procedures	**F-18.02** Tests fuel piping and tubing systems	
Task F-19 Commissions fuel systems, appliances and ancillary equipment 55%	**F-19.01** Performs start-up procedures	**F-19.02** Performs testing, adjusting and balancing procedures	**F-19.03** Completes commissioning report and handover

G – Services fuel systems, appliances and ancillary equipment 18%

Task G-20 **Maintains fuel systems, appliances and ancillary equipment** 44%	**G-20.01** **Inspects system components and operation**	**G-20.02** **Performs maintenance activities**	
Task G-21 **Repairs fuel systems, appliances and ancillary equipment** 43%	**G-21.01** **Diagnoses system components and operation**	**G-21.02** **Replaces components**	**G-21.03** **Verifies operation**
Task G-22 **Decommissions fuel systems, appliances and ancillary equipment** 13%	**G-22.01** **Disconnects appliances and ancillary equipment**	**G-22.02** **Removes appliances and ancillary equipment**	

Major Work Activity A
Performs common occupational skills

Task A-1 Performs safety-related functions

Task Descriptor

Gasfitters must be able to recognize hazards and protect themselves, others, property and the environment when working with gas systems and equipment. They must wear personal protective equipment (PPE), use safety equipment, and follow manufacturers' specifications when performing certain tasks. They must follow codes, standards and regulations related to workplace safety.

A-1.01 Maintains safe work environment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-1.01.01P	identify and address ***hazards***	***hazards*** are identified and addressed according to ***codes, standards and regulations***
A-1.01.02P	report and follow up on ***hazards*** to customers, management, coworkers, other trades or Authority Having Jurisdiction (AHJ)	***hazards*** are reported and followed up to customers, management, coworkers, other trades or AHJ
A-1.01.03P	handle and store ***hazardous materials***	***hazardous materials*** are handled and stored according to Workplace Hazardous Materials Information System (WHMIS) and Transportation of Dangerous Goods (TDG) procedures
A-1.01.04P	remove, recycle and dispose of ***hazardous materials***	***hazardous materials*** are removed, recycled and disposed of according to WHMIS and TDG procedures
A-1.01.05P	install ***safety protection***	***safety protection*** is installed according to site specifications, ***safety regulations*** and company policies
A-1.01.06P	identify and implement ventilation in workspace	ventilation in workspace is identified and implemented according to Occupational Health and Safety (OHS), company policies and site specifications

A-1.01.07P	follow ***confined space procedures***	***confined space procedures*** are followed according to OHS, company policies and site specifications
A-1.01.08P	keep cables and straps safe	cables and straps are kept safe by preventing them from being a hazard whether in use or being stored
A-1.01.09P	follow lock-out and tag-out procedures to isolate ***energy sources***	lock-out and tag-out procedures are followed according to OHS, company policies and site specifications to isolate ***energy sources***
A-1.01.10P	follow elevated height procedures and requirements	elevated height procedures and requirements are followed according to B149.1, OHS, company policies and site specifications
A-1.01.11P	perform air analysis and identify ***dangerous air substances***	air analysis is performed to ensure air quality and ***dangerous air substances*** are identified according to B149.1, ***safety regulations***, company policies and site specifications
A-1.01.12P	protect surrounding area when using torches or open flame	surrounding area is protected when using torches or open flame
A-1.01.13P	maintain clean and tidy work site	clean and tidy work site is maintained to avoid injuries to self and others
A-1.01.14P	coordinate tasks with other workers	tasks with other workers are coordinated to avoid injury to self and others
A-1.01.15P	participate in safety meetings and discussions	safety meetings and discussions are held to ensure that information is recorded and distributed to all ***team members***
A-1.01.16P	identify location of WHMIS manuals and Safety Data Sheets (SDS)	location of WHMIS manuals and SDS are identified
A-1.01.17P	clear path for access to and egress from confined spaces	path for access to and egress from confined spaces is cleared according to site safety specifications

Range of Variables

hazards include: poor housekeeping that could cause personal injury, equipment or environmental damage, presence of dangerous substances (asbestos, silica)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: Canadian Standards Association (CSA) (Natural Gas and Propane Installation Code [B149.1]; Propane Storage and Handling Code [B149.2]; Code for the Field Approval of Fuel-Related Components on Appliances and Equipment [B149.3]; Installation Code for Propane Fuel Systems and Containers on Motor Vehicles [B149.5]; Code for Digester Gas, Landfill Gas, and Biogas Generation and Utilization [B149.6]; Natural Gas Refuelling Stations Installation Code [B108], Boiler, Pressure Vessel, and Pressure Piping Code [B51]), Canadian Hydrogen Installation Code (CAN/BNQ 1784), Canadian Electrical Code (CEC), National Building Code (NBC), AHJ, National Fire Protection Association (NFPA), American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME), TDG, OHS, WHMIS, Environmental Emergencies Regulations, provincial/territorial standards

hazardous materials include: threading oil, solvents, fuels, pipe thread compounds

safety protection includes: signage, barrier tape, barricades

safety regulations include: OHS, WHMIS

confined space procedures include: ensuring clear path of access to and egress, testing air quality of confined spaces on a continuous basis using calibrated handheld devices

energy sources include: electrical, hydronic, pneumatic, mechanical, centrifugal, kinetic

dangerous air substances include: CO, H_2S, Lower Explosive Level/Upper Explosive Level (LEL/UEL)

team members include: other tradespersons, customers, employers

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-1.01.01L	demonstrate knowledge of safe work practices	describe safe work practices to maintain healthy and safe work environment
		identify ***hazards*** and associated mitigating procedures
		describe procedures to handle, store, remove, recycle and dispose of ***hazardous materials***
		identify ***safety protection*** and describe its uses
		describe ***confined space procedures***
		describe procedures to lock out and tag out hazardous energies
		describe workers' rights and responsibilities
		describe components of safety meetings and discussions
		describe ***emergency procedures***
		describe hot work permit procedures
		describe characteristics of stored energy potential (pneumatic, electrical, mechanical, chemical, hydronic, centrifugal)

A-1.01.02L	demonstrate knowledge of ***training and certification requirements*** pertaining to workplace safety	identify ***training and certification requirements*** pertaining to workplace safety
A-1.01.03L	demonstrate knowledge of regulatory requirements pertaining to safety	identify and describe jurisdictional ***safety regulations*** to maintain a safe work environment
		identify ***components of WHMIS***
		identify and describe jurisdictional requirements for handling, storing, recycling and disposing of ***hazardous materials***
		describe jurisdictional environmental protection procedures

Range of Variables

hazards include: poor housekeeping that could cause personal injury, equipment or environmental damage, presence of dangerous substances (asbestos, silica)

hazardous materials include: threading oil, solvents, fuels, pipe thread compounds

safety protection includes: signage, barrier tape, barricades

confined space procedures include: ensuring clear path of access to and egress, testing air quality of confined spaces on a continuous basis using calibrated handheld devices

emergency procedures include: what to do in case of alarms, closest hospital, fire safety (chemical, muster points), identify location of on-site first aid stations and equipment, evacuation procedures

training and certification requirements include: WHMIS, fall protection, confined space entry, site-specific training requirements

safety regulations include: OHS, WHMIS

components of WHMIS include: SDS, labels, training

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

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-1.02.01P	select and use ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are selected and used according to task
A-1.02.02P	inspect ***PPE*** and ***safety equipment*** before each use	***PPE*** and ***safety equipment*** are inspected before each use
A-1.02.03P	identify unsafe, outdated, damaged or defective ***PPE*** and ***safety equipment***, and remove from service	unsafe, outdated, damaged or defective ***PPE*** and ***safety equipment*** are identified and removed from service according to company policies and manufacturers' specifications

A-1.02.04P	ensure proper fit of ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are properly fitted according to manufacturers' specifications
A-1.02.05P	organize ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are organized according to OHS regulations and company policies
A-1.02.06P	clean and store ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are cleaned and stored according to manufacturers' specifications
A-1.02.07P	obtain mandatory safety certifications for ***PPE*** and ***safety equipment***	mandatory safety certifications for ***PPE*** and ***safety equipment*** are obtained according to OHS, company policies and manufacturers' specifications

Range of Variables

PPE includes: detection devices (carbon monoxide, combustible gas), safety glasses, gloves, face shields, hearing protection, respiratory equipment, safety footwear, hard hats, fire retardants
safety equipment includes: fall arrest devices, first-aid kits, eye wash stations

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-1.02.01L	demonstrate knowledge of ***PPE*** and ***safety equipment***, their characteristics, applications and limitations	identify ***PPE*** and ***safety equipment***, and describe their characteristics, applications and limitations
		describe operating principles of ***PPE*** and ***safety equipment***
A-1.02.02L	demonstrate knowledge of procedures to use and maintain ***PPE*** and ***safety equipment***	identify ***hazards*** and describe safe work practices to use and maintain ***PPE*** and ***safety equipment***
		describe procedures to select and use ***PPE*** and ***safety equipment***
		describe procedures to ensure proper fit of ***PPE*** and ***safety equipment***
		describe procedures to inspect, identify and remove damaged, worn or unsafe ***PPE*** and ***safety equipment*** from service
		describe procedures to maintain and store ***PPE*** and ***safety equipment***
A-1.02.03L	demonstrate knowledge of training and certification requirements to use ***PPE*** and ***safety equipment***	identify training and certification requirements to use ***PPE*** and ***safety equipment***
A-1.02.04L	demonstrate knowledge of standards and regulations pertaining to ***PPE*** and ***safety equipment***	identify standards and regulations pertaining to ***PPE*** and ***safety equipment***

Range of Variables

PPE includes: detection devices (carbon monoxide, combustible gas), safety glasses, gloves, face shields, hearing protection, respiratory equipment, safety footwear, hard hats, fire retardants
safety equipment includes: fall arrest devices, first-aid kits, eye wash stations
hazards include: damaged, worn and outdated equipment, improper use

Task A-2 Uses tools and equipment

Task Descriptor

Gasfitters use tools and equipment to perform daily tasks in their trade in a safe and efficient manner. They maintain these tools and equipment to ensure longevity and safe operation.

A-2.01 Uses hand and power tools

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-2.01.01P	select and use hand and power tools	hand and power tools are selected and used according to task, and manufacturers' recommendations and specifications
A-2.01.02P	inspect hand and power tools before each use	hand and power tools are inspected before each use
A-2.01.03P	identify unsafe, damaged or defective hand and power tools, and remove from service	unsafe, damaged or defective hand and power tools are identified and removed from service according to company policies and manufacturers' instructions
A-2.01.04P	clean and lubricate hand and power tools	hand and power tools are cleaned and lubricated according to manufacturers' recommendations
A-2.01.05P	store hand and power tools	hand and power tools are stored according to manufacturers' recommendations

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-2.01.01L	demonstrate knowledge of hand and power tools, their characteristics and applications	identify hand and power tools, and describe their characteristics and applications
		interpret information pertaining to hand and power tools found in manufacturers' information
A-2.01.02L	demonstrate knowledge of procedures to use hand and power tools	identify ***hazards*** and describe safe work practices to use hand and power tools
		describe procedures to inspect hand and power tools
		describe procedures to use hand and power tools
		describe procedures to identify and remove unsafe, worn, damaged or defective hand and power tools from service
		describe procedures to store and maintain hand and power tools
A-2.01.03L	demonstrate knowledge of training and certification requirements to use power tools	identify training and certification requirements to use power tools
A-2.01.04L	demonstrate knowledge of regulatory requirements pertaining to hand and power tools	identify codes and regulations pertaining to hand and power tools

Range of Variables

hazards include: damaged, worn and outdated equipment, improper use, electrical hazards (e.g., faulty switches, damaged extension cords)

A-2.02 Uses technical instruments and testers

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-2.02.01P	select and use ***technical instruments and testers***	***technical instruments and testers*** are selected and used according to task and manufacturers' specifications
A-2.02.02P	inspect ***technical instruments and testers*** before each use	***technical instruments and testers*** are inspected before each use to check accuracy and safety

A-2.02.03P	identify unsafe, outdated, damaged or defective ***technical instruments and testers***, and remove from service	unsafe, outdated, damaged or defective ***technical instruments and testers*** are identified, and removed from service according to company policies and manufacturers' instructions
A-2.02.04P	interpret results provided by ***technical instruments and testers***	results provided by ***technical instruments and testers*** are interpreted
A-2.02.05P	calibrate ***technical instruments and testers***	***technical instruments and testers*** are calibrated according to manufacturers' specifications
A-2.02.06P	perform ***tests and analysis***	***tests and analysis*** are performed according to test conditions, manufacturers' specifications and code requirements
A-2.02.07P	store ***technical instruments and testers***	***technical instruments and testers*** are stored according to manufacturers' specifications

Range of Variables

technical instruments and testers include: multimeters, megohmmeters, pressure gauges, ground resistance testers, thermocouple testers, combustion analyzers, signal generators, digital and incline manometers, thermometers, pyrometers, combustible gas and carbon monoxide detectors

tests and analysis include: circuit voltage, current and resistance tests; pressure tests; indoor air quality tests; leak tests; gas analysis; combustion analysis

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-2.02.01L	demonstrate knowledge of ***technical instruments and testers***, their characteristics and applications	identify ***technical instruments and testers***, and describe their characteristics and applications
		interpret information pertaining to ***technical instruments and testers*** found in manufacturers' specifications
		describe ***gas properties*** and their associated tests
A-2.02.02L	demonstrate knowledge of procedures to use ***technical instruments and testers***	identify ***hazards*** and describe safe work practices to use ***technical instruments and testers***
		describe procedures to inspect, identify and remove damaged, worn or unsafe ***technical instruments and testers*** from service
		describe procedures to calibrate ***technical instruments and testers***
		describe procedures to use ***technical instruments and testers***

		identify types of ***tests and analysis*** performed with ***technical instruments and testers***
		describe procedures to store ***technical instruments and testers***
A-2.02.03L	demonstrate knowledge of procedures, principles and concepts to interpret results provided by ***technical instruments and testers***	interpret results provided by ***technical instruments and testers***
		describe principles and concepts of chemistry and physics
		apply combustion formulas
		describe emissions and flue gas composition
		describe environmental emissions requirements
		describe appliance thermal efficiencies
		describe draft velocity and vent pressures
		describe flue gas recirculation and effects on combustion
		describe indoor air quality requirements
		describe external static pressure (ESP) testing requirements
		describe appliance temperature rise testing requirements
		describe principles and concepts of electronics and electricity
		interpret electrical readings
A-2.02.04L	demonstrate knowledge of training requirements to use ***technical instruments and testers***	identify training requirements to use ***technical instruments and testers***
A-2.02.05L	demonstrate knowledge of regulatory requirements pertaining to ***technical instruments and testers***	identify codes and regulations pertaining to results from ***technical instruments and testers***

Range of Variables

technical instruments and testers include: multimeters, megohmmeters, pressure gauges, ground resistance testers, thermocouple testers, combustion analyzers, signal generators, digital and incline manometers, thermometers, pyrometers, combustible gas and carbon monoxide detectors

gas properties include: limits of flammability, flame speed, ignition temperature, specific gravity, calorific value

hazards include: damaged, worn and outdated equipment; improper use; electrical; environmental condition

tests and analysis include: circuit voltage, current and resistance tests; pressure tests; indoor air quality tests; leak tests; gas analysis; combustion analysis

A-2.03 Uses access equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-2.03.01P	select ***access equipment***	***access equipment*** is selected taking into consideration ***unstable conditions***, and according to task and manufacturers' specifications
A-2.03.02P	inspect ***access equipment*** before each use	***access equipment*** is inspected before each use according to operating instructions and OHS
A-2.03.03P	identify unsafe, outdated, damaged or defective ***access equipment***, and remove from service	unsafe, outdated, damaged or defective ***access equipment*** is identified and removed from service according to company policies and manufacturers' specifications
A-2.03.04P	set up and operate ***access equipment***	***access equipment*** is set up and operated according to OHS regulations, company policies and manufacturers' specifications
A-2.03.05P	clean and maintain ***access equipment***	***access equipment*** is cleaned and maintained according to manufacturers' specifications
A-2.03.06P	dismantle and store ***access equipment***	***access equipment*** is dismantled and stored according to manufacturers' specifications

Range of Variables

access equipment includes: ladders, mobile elevated work platforms (MEWP), scaffolding
unstable conditions include: soft and uneven ground, wind, hard-to-reach locations

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-2.03.01L	demonstrate knowledge of ***access equipment***, their characteristics and applications	identify ***access equipment***, and describe their characteristics and applications
		interpret information pertaining to ***access equipment*** found in manufacturers' specifications
A-2.03.02L	demonstrate knowledge of procedures to use and operate ***access equipment***	identify ***hazards*** and describe safe work practices to use and operate ***access equipment***

		describe procedures to inspect, identify and remove damaged or worn ***access equipment*** from service
		describe procedures to use and operate ***access equipment***
		describe procedures to clean and maintain ***access equipment***
		describe procedures to set up, dismantle and store ***access equipment***
A-2.03.03L	demonstrate knowledge of training and certification requirements to use and operate ***access equipment***	identify training and certification requirements to use and operate ***access equipment***
A-2.03.04L	demonstrate knowledge of regulatory requirements pertaining to ***access equipment***	identify codes and regulations pertaining to ***access equipment***

Range of Variables

access equipment includes: ladders, mobile elevated work platforms (MEWP), scaffolding

hazards include: damaged, worn and outdated equipment; improper use; electrical; environmental conditions

A-2.04 Operates lifting, rigging and hoisting equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-2.04.01P	select and tie knots	knots are selected and tied according to load and application
A-2.04.02P	select and use ***lifting, rigging and hoisting equipment***	***lifting, rigging and hoisting equipment*** is selected and used according to OHS regulations, company policies, and engineers' and manufacturers' specifications
A-2.04.03P	inspect ***lifting, rigging and hoisting equipment*** before each use	***lifting, rigging and hoisting equipment*** is inspected before each use
A-2.04.04P	identify unsafe, outdated, damaged or defective ***lifting, rigging and hoisting equipment***, and tag and remove from service	unsafe, outdated, damaged or defective ***lifting, rigging and hoisting equipment*** are identified, tagged and removed from service according to OHS regulations, company policies and manufacturers' specifications

A-2.04.05P	set up load	load is set up to enable access for lifting chains and slings according to OHS regulations, company policies and manufacturers' specifications
A-2.04.06P	locate lifting points	lifting points are located to ensure proper sling angle and to balance and secure load
A-2.04.07P	secure load	load is secured using ***rigging methods*** according to company policies, engineer's and manufacturers' specifications, and safety procedures
A-2.04.08P	guide and control load	load is guided and controlled using rigging and tag lines
A-2.04.09P	communicate with equipment operators	equipment operators are communicated with using approved ***communication methods***
A-2.04.10P	maintain and store ***lifting, rigging and hoisting equipment***	***lifting, rigging and hoisting equipment*** is maintained and stored in designated area according to company policies and manufacturers' specifications

Range of Variables

lifting, rigging and hoisting equipment includes: spreader beams, slings, chokers

rigging methods include: choking, slinging and securing hooks

communication methods include: standard crane and hoist hand signals, two-way radios, video, radio, mobile phones

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-2.04.01L	demonstrate knowledge of ***lifting, rigging and hoisting equipment***, their characteristics and applications	identify ***lifting, rigging and hoisting equipment***, and describe their characteristics and applications
		interpret information pertaining to ***lifting, rigging and hoisting equipment*** found in manufacturers' specifications
		identify types of knots and hitches used for lifting, rigging and hoisting
A-2.04.02L	demonstrate knowledge of procedures to operate ***lifting, rigging and hoisting equipment***	identify ***hazards*** and describe safe work practices to operate ***lifting, rigging and hoisting equipment***
		describe procedures to inspect ***lifting, rigging and hoisting equipment***
		describe procedures to identify and remove damaged, worn, or unsafe ***lifting, rigging and hoisting equipment*** from service
		describe procedures to operate ***lifting, rigging and hoisting equipment***

		identify ***communication methods*** used for lifting, rigging and hoisting
		identify ***rigging and hoisting practices***
		identify ***rigging methods***
A-2.04.03L	demonstrate knowledge of training and certification requirements to use and operate ***lifting, rigging and hoisting equipment***	identify training and certification requirements to use and operate ***lifting, rigging and hoisting equipment***
A-2.04.04L	demonstrate knowledge of regulatory requirements pertaining to ***lifting, rigging and hoisting equipment***	identify codes and regulations pertaining to ***lifting, rigging and hoisting equipment***

Range of Variables

lifting, rigging and hoisting equipment includes: spreader beams, slings, chokers
hazards include: damaged, worn and outdated equipment; improper use; electrical; environmental condition
communication methods include: standard crane and hoist hand signals, two-way radios, video, radio, mobile phones
rigging and hoisting practices include: load weight calculations, working load limits, sling angles
rigging methods include: choking, slinging and securing hooks

Task A-3 Organizes work

Task Descriptor

Gasfitters plan and prepare for installation, service and maintenance by using and interpreting drawings, specifications and codes. They may also prepare drawings and provide specifications for installation. They select systems and their components according to the job requirements. In organizing their work, gasfitters lay out fuel-fired equipment and systems, and check for the availability of equipment and personnel. They also ensure that all documentation is in order. Gasfitters work with other trades to ensure timely and safe completion of site work.

A-3.01 Interprets documents

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-3.01.01P	select ***documents***	***documents*** are selected according to job requirements
A-3.01.02P	review ***documents***	***documents*** are reviewed for inconsistencies and accuracy

A-3.01.03P	obtain permits	permits are obtained prior to starting job according to jurisdictional regulations
A-3.01.04P	select and use technical instruments to prepare plan	technical instruments are selected and used to prepare plan according to task
A-3.01.05P	measure lengths and dimensions of equipment and pipe	lengths and dimensions of equipment and pipe are measured to ensure consistency with job installation
A-3.01.06P	calculate ***material requirements***	***material requirements*** are calculated according to ***documents***
A-3.01.07P	identify orientation of equipment and pipes	orientation of equipment and pipes are identified to determine installation location and to avoid conflicts with other objects according to ***codes***
A-3.01.08P	create isometric drawings	isometric drawings are created using plans and drawings to assist in determining material requirements and layout
A-3.01.09P	use ***codes*** to determine minimum amount and type of material	***codes*** are used to determine minimum amount and type of material according to ***drawings*** and specifications
A-3.01.10P	use ***codes*** to confirm and calculate minimum service clearances, access requirements and allowances	***codes*** are used to confirm and calculate minimum service clearances, access requirements and allowances
A-3.01.11P	prepare schematic diagrams from plans and drawings	schematic diagrams are prepared from plans and drawings using standard formats, symbols and reference systems
A-3.01.12P	trace electrical processes through schematics and block diagrams	electrical processes are traced through schematics and block diagrams to determine control device requirements using specifications and ***codes***
A-3.01.13P	cross-reference all ***documents***	***documents*** are cross-referenced to each other for accuracy
A-3.01.14P	develop as-built drawings	as-built drawings are developed according to completed installation

Range of Variables

documents include: drawings, specifications, codes, permits, manufacturers' instructions, quality assurance (QA)/quality control (QC) manuals, QA/QC registrations, provincial/territorial regulatory notices

material requirements include: fittings, hangers, supports, piping

codes include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CEC, NBC, AHJ, NFPA, ANSI/ASME, TDG

drawings include: schematics, isometrics, wiring diagrams, layouts, interconnections, elevations, block and single lines, mechanical, process flow diagrams, piping and instrumentation drawings (P&ID)

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-3.01.01L	demonstrate knowledge of ***documents***, their characteristics and applications	identify types of ***documents*** and describe their characteristics and applications
		identify and describe ***codes*** and regulatory requirements pertaining to task
		identify ***information found on drawings***
		confirm ***drawing*** information as related to ***code*** requirements
		identify conventionally accepted symbols, abbreviations, National Electrical Manufacturers Association (NEMA) numbers
		identify and describe electrical terminology
A-3.01.02L	demonstrate knowledge of procedures to create installation plan	identify technical instruments used to perform measurements and calculations, and describe their procedures for use
		interpret ***documents*** to create plan
		identify ***views used on drawings***
		calculate material requirements
		describe procedures to prepare schematic diagrams, isometric and as-built drawings

Range of Variables

documents include: drawings, specifications, codes, permits, manufacturers' instructions, quality assurance (QA)/quality control (QC) manuals, QA/QC registrations, provincial/territorial regulatory notices

codes include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CEC, NBC, AHJ, NFPA, ANSI/ASME, TDG

information found on drawings includes: lines, legend, symbols and abbreviations, title block, notes and specifications, schedules, units of measurement (metric/imperial), seismic

drawings include: schematics, isometrics, wiring diagrams, layouts, interconnections, elevations, block and single lines, mechanical, process flow diagrams, piping and instrumentation drawings (P&ID)

views used on drawings include: elevation, plan, section, detail, 3-D

A-3.02 Selects systems, equipment and components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-3.02.01P	identify and choose ***systems***, ***equipment*** and component requirements	***systems***, ***equipment*** and component requirements are identified and chosen according to manufacturers' specifications, system capacity, site conditions, ***codes, standards and regulations***
A-3.02.02P	interpret and apply heat loss calculations for job requirements	heat loss calculations for job requirements are interpreted and applied
A-3.02.03P	size ***systems***	***systems*** are sized taking into consideration ***factors*** according to appliance input, job and manufacturers' specifications, ***codes, standards and regulations***
A-3.02.04P	determine on-site availability and capacity of drainage, ***fuel***, electrical and control compatibility	on-site availability and capacity of drainage, ***fuel***, electrical and control compatibility are determined to compare with ***equipment*** requirements and manufacturers' specifications
A-3.02.05P	submit QA/QC manual	QA/QC manual is submitted according to AHJ and company policies

Range of Variables

systems include: fuel-fired appliances, fuel-gas piping, dispensing, venting, air supply, controls

equipment includes: boilers, cooking equipment, forced warm-air equipment, water heaters, decorative appliances, process ovens and furnaces, atmosphere generators

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME, TDG

factors include: electrical, environment requirements, customer requirements, location, future growth

fuels include: natural gas, manufactured gas, liquefied petroleum gas, digester gas, landfill gas, biogas, hydrogen, propane gas and air, hydrogen-natural gas, propane, propylene, butanes (normal butane or isobutane), butylene, combination of fuels

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-3.02.01L	demonstrate knowledge of ***systems*** and ***equipment***, their components, characteristics, applications and operation	identify types of ***systems***, ***equipment*** and their components, and describe their characteristics and applications
		describe operating principles of ***systems***, ***equipment*** and their components
		interpret information pertaining to ***systems***, ***equipment*** and their components found on drawings and specifications
		describe principles and concepts of electronics and electricity
		describe principles and concepts of gas utilization
		identify ***gas properties***, and describe their characteristics and applications
		identify gas system pressure requirements
		identify and describe venting system combinations and category of appliances I, II, III and IV
		identify altitude elevation rated equipment and describe their characteristics and applications
		identify components and their symbols on valve trains (main and pilot)
		describe regulator applications, clearances, sizing and their accessories
		identify types of fans, auxiliary fans, and dampers and interlocks for equipment and describe their characteristics and applications
		interpret sizing charts and identify calculations needed to size ***systems***
		identify ***factors*** to consider when selecting and locating ***equipment***
		identify elements of QA/QC manual, and describe their characteristics and applications
A-3.02.02L	demonstrate knowledge of procedures to select ***systems***, ***equipment*** and their components	describe procedures to select ***systems***, ***equipment*** and their components
		identify ***hazards*** to consider when selecting ***systems***, ***equipment*** and their components

		describe procedures to size ***systems***, ***equipment*** and their components
A-3.02.03L	demonstrate knowledge of manufacturers' training and certification requirements for selecting and sizing ***systems***, ***equipment*** and their components	identify training and certification requirements for selecting and sizing ***systems***, ***equipment*** and their components
A-3.02.04L	demonstrate knowledge of regulatory requirements pertaining to ***systems***, ***equipment*** and their components	identify ***codes, standards and regulations*** pertaining to ***systems***, ***equipment*** and their components

Range of Variables

systems include: fuel-fired appliances, fuel-gas piping, dispensing, venting, air supply, controls

equipment includes: boilers, cooking equipment, forced warm-air equipment, water heaters, decorative appliances, process ovens and furnaces, atmosphere generators

gas properties include: limits of flammability, flame speed, ignition temperature, specific gravity, calorific value

factors include: electrical, environment requirements, customer requirements, location, future growth

hazards include: uncertified equipment, incorrect fuel, electrical hazards (e.g., faulty switches, damaged extension cords)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME, TDG

A-3.03 Plans for installation, service and maintenance

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-3.03.01P	determine labour requirements	labour requirements are determined according to job requirements
A-3.03.02P	acquire permits	permits are acquired according to job, site and AHJ requirements
A-3.03.03P	select tools and equipment and confirm availability	tools and equipment are selected, and availability is confirmed according to job requirements
A-3.03.04P	coordinate work schedules with other trades, customers and inspectors	work schedules with other trades, customers and inspectors are coordinated according to job requirements
A-3.03.05P	acquire and distribute ***documentation***	***documentation*** is acquired and distributed according to job requirements
A-3.03.06P	coordinate logistics of transportation and placement of equipment, material and labour to job site	logistics of transportation and placement of equipment, material and labour to job site are coordinated

A-3.03.07P	create bill of material	bill of material is created according to job requirements
A-3.03.08P	order and acquire materials	materials are ordered and acquired according to bill of material
A-3.03.09P	coordinate ***job site documentation***	***job site documentation*** is coordinated according to job site requirements

Range of Variables

documentation includes: plans, drawings, equipment specifications, safety procedures, permits
job site documentation includes: daily logs, time sheets, as-built final drawings, work orders

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-3.03.01L	demonstrate knowledge of installation, maintenance and service plans	identify ***documentation*** and ***job site documentation*** relevant to job planning and execution, and describe their characteristics and applications
		identify safety codes and regulations pertaining to installation, service and maintenance
A-3.03.02L	demonstrate knowledge of procedures to plan for installation, maintenance and service	describe procedures to plan for installation, maintenance and service of systems and equipment
		describe procedures to create bill of materials
		describe procedures to obtain permits
		describe procedures used to coordinate job tasks and procedures
		describe procedures used to estimate work requirements

Range of Variables

documentation includes: plans, drawings, equipment specifications, safety procedures, permits
job site documentation includes: daily logs, time sheets, as-built final drawings, work orders

Task A-4 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-4.01 Uses communication techniques

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-4.01.01P	demonstrate communication practices with individuals or in a group	instructions and messages are interpreted by all parties involved in communication
A-4.01.02P	listen using ***active listening*** practices	***active listening*** practices are utilized
A-4.01.03P	speak clearly using correct industry terminology to ensure understanding	understanding of message is confirmed by both parties
A-4.01.04P	receive and respond to instructions	response to instructions indicates understanding
A-4.01.05P	receive and respond to feedback on work completed or performed	response to feedback indicates understanding and corrective measures are taken
A-4.01.06P	provide and explain feedback	explanation and feedback are provided, and task is carried out as directed
A-4.01.07P	communicate understanding and comfort level in performing trade tasks	opportunities for practice and gradual exposure to new tasks is offered and understanding is confirmed
A-4.01.08P	use questions to improve communication	questions enhance understanding, on-the-job training and goal setting
A-4.01.09P	participate in safety and information meetings	meetings are attended, information is relayed to workforce, and is applied
A-4.01.10P	send and receive ***electronic messages***	***electronic messages*** are sent and received using professionalism, plain language and clear expressions according to company policies

Range of Variables

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

electronic messages include: email, text messages

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-4.01.01L	demonstrate knowledge of trade terminology	define terminology used in trade
A-4.01.02L	demonstrate knowledge of effective communication practices	describe importance of using effective verbal and non-verbal communication with ***people in the workplace***
		describe importance of teamwork
		identify ***sources of information*** to effectively communicate
		identify communication and ***learning styles***
		describe effective listening and speaking skills
		describe how to receive and give instructions effectively
		identify ***personal responsibilities and attitudes*** that contribute to on-the-job success
		identify value of equity, diversity and inclusion in workplace
		identify communication that constitutes bullying, ***harassment*** and ***discrimination***
		identify communication styles appropriate to different systems and applications of ***electronic messages***

Range of Variables

people in the workplace include: other tradespeople, colleagues, apprentices, supervisors, customers, jurisdictional representatives, manufacturers, office administrators

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

learning styles include: visual, auditory, kinesthetic

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 practice

harassment: as defined by the Canadian and jurisdictional Human Rights Commissions

discrimination: as defined by the Canadian Human Rights Act and jurisdictional human rights laws

electronic messages include: email, text messages

A-4.02 Uses mentoring techniques

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-4.02.01P	identify and communicate learning objective and point of lesson	apprentice or learner can explain objective and point of lesson
A-4.02.02P	link lesson to other lessons and project	lesson order and unplanned learning opportunities are defined
A-4.02.03P	demonstrate performance of a skill to an apprentice or learner	***steps required to demonstrate a skill*** are performed
A-4.02.04P	set up conditions required for apprentice or learner to practice a skill	***practice conditions*** are set up so that skill can be practiced safely by apprentice or learner
A-4.02.05P	set up conditions where apprentice or learner feels comfortable communicating and asking questions	conditions are such that apprentice or learner feels comfortable communicating and asking questions
A-4.02.06P	recognize and discuss multiple possible techniques for performing trade tasks and options that may be best for apprentice or learner	multiple possible techniques for performing trade tasks and options that may be best for apprentice or learner are recognized and discussed
A-4.02.07P	assess apprentice or learner's ability to perform tasks with increasing independence	performance of apprentice or learner improves with practice to a point where task can be done with little supervision
A-4.02.08P	give supportive and corrective feedback	apprentice or learner adopts best practice after having been given supportive or corrective feedback
A-4.02.09P	support apprentices or learners in pursuing technical training opportunities	technical training is completed within timeframe prescribed by apprenticeship authority
A-4.02.10P	support anti-***harassment*** and anti-***discrimination*** practices in workplace	workplace is ***harassment*** and ***discrimination***-free
A-4.02.11P	support accommodations and alternate work practices that are appropriate for apprentice or learner	accommodations and alternate work practices that are appropriate for apprentice or learner are supported
A-4.02.12P	assess apprentice or learner suitability to trade during probationary period	apprentice or learner is given constructive feedback that helps them identify their own strengths and weaknesses and suitability for trade

Range of Variables

steps required to demonstrate a skill include: understanding who, what, where, when, why, and how, explaining, showing, giving encouragement, following up to ensure skill is performed correctly
practice conditions mean: guided, limited independence, full independence
harassment: as defined by the Canadian and jurisdictional Human Rights Commissions
discrimination: as defined by the *Canadian Human Rights Act* and jurisdictional human rights laws

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-4.02.01L	demonstrate knowledge of strategies for learning skills in workplace	describe importance of individual experience
		describe shared responsibilities for workplace learning
		determine one's own learning preferences and explain how these relate to learning new skills
		describe importance of different types of skills in workplace
		describe importance of ***skills for success (essential skills)*** in workplace
		identify different ***learning styles***
		identify different ***learning needs*** and strategies to meet them
		identify ***strategies to assist in learning a skill***
A-4.02.02L	demonstrate knowledge of strategies for ***teaching*** workplace ***skills***	identify different roles played by workplace mentor
		describe ***teaching skills***
		explain importance of identifying point of lesson
		identify how to choose a good time to present lesson
		explain importance of linking lessons
		identify context for learning skills
		describe considerations in setting up opportunities for skill practice
		explain importance of providing feedback
		identify techniques for giving effective feedback
		describe a skills assessment
		identify methods of assessing progress
		explain how to adjust lesson to different situations

Range of Variables

skills for success (essential skills) are: adaptability, collaboration, communication, creativity and innovation, digital, numeracy, problem solving, reading, writing

discrimination: as defined by the *Canadian Human Rights Act* and jurisdictional human rights laws

learning styles include: visual, auditory, kinesthetic

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

strategies to assist in learning a skill include: understanding basic principles of instruction, developing coaching skills, being mature and patient, providing feedback

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

Major Work Activity B
Installs fuel piping and tubing systems

Task B-5 Selects and installs piping for fuel systems

Task Descriptor

Gasfitters select, prepare and install a variety of piping for fuel systems. Preparation and installation of piping includes cutting, joining, supporting, identifying and protecting according to codes, standards, regulations and manufacturers' specifications.

B-5.01 Selects piping for fuel systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-5.01.01P	select ***piping for fuel systems***	***piping for fuel systems*** is selected according to job specifications, ***codes, standards and regulations***
B-5.01.02P	inspect ***piping for fuel systems***	***piping for fuel systems*** is inspected to identify ***deficiencies***
B-5.01.03P	select ***support materials***	***support materials*** are selected according to job and manufacturers' specifications
B-5.01.04P	select ***fasteners***	***fasteners*** are selected according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

piping for fuel systems include: plastic, steel, stainless steel, non-ferrous, hoses, connectors
codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS
deficiencies include: impurities, dents, cracks
support materials include: hangers, brackets, braces, clips, strapping, clamps, rods
fasteners include: screws, nails, nuts and bolts, anchors

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-5.01.01L	demonstrate knowledge of ***piping for fuel systems***, their ***characteristics***, applications and operation	identify types of ***piping for fuel systems***, and describe their ***characteristics*** and applications
		describe ***operating principles of piping for fuel systems***
		interpret information pertaining to ***piping for fuel systems*** found on drawings, job specifications, ***codes, standards and regulations***
B-5.01.02L	demonstrate knowledge of procedures to select ***piping for fuel systems***	describe procedures to select ***piping for fuel systems***
		describe procedures to inspect ***piping for fuel systems***
		identify restrictions on use of ***piping for fuel systems***
B-5.01.03L	demonstrate knowledge of training and certification requirements to select ***piping for fuel systems***	identify training and certification requirements to select ***piping for fuel systems***
B-5.01.04L	demonstrate knowledge of regulatory requirements pertaining to ***piping for fuel systems***	identify ***codes, standards and regulations*** pertaining to ***piping for fuel systems***

Range of Variables

piping for fuel systems include: plastic, steel, stainless steel, non-ferrous, hoses, connectors

characteristics include: grades, composition, sizes, wall thickness

operating principles of piping for fuel systems include: maximum allowable pressure, system pressure drop, flow rates

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS

B-5.02 Prepares piping for fuel systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-5.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
B-5.02.02P	calculate ***piping for fuel systems*** length and fitting allowances	***piping for fuel systems*** length and fitting allowances are calculated
B-5.02.03P	calculate offset and rolling offset dimensions	offset and rolling offset dimensions are calculated according to spool sheets, drawings and site conditions
B-5.02.04P	calculate dimensions	dimensions are calculated according to spool sheets, drawings and site conditions
B-5.02.05P	measure and mark ***piping for fuel systems*** to length	***piping for fuel systems*** is measured and marked to length according to spool sheets, drawings and site conditions considering fitting allowances
B-5.02.06P	cut ***piping for fuel systems*** to length	***piping for fuel systems*** is cut to length according to job specifications
B-5.02.07P	ream ***piping for fuel systems*** to remove burrs and scales from ends	***piping for fuel systems*** is reamed to remove burrs and scales from ends
B-5.02.08P	chamfer ends	ends are chamfered according to size and manufacturers' specifications of ***piping for fuel systems***
B-5.02.09P	bevel, square and clean ***piping for fuel systems*** end for joining	***piping for fuel systems*** end is bevelled, squared and cleaned for joining according to manufacturers' specifications, ***codes, standards and regulations***
B-5.02.10P	seal ends using ***materials*** until ***piping for fuel systems*** is installed	ends are sealed using ***materials*** until ***piping for fuel systems*** is installed to prevent contamination

Range of Variables

tools and equipment include: pipe cutters, reamers, chamfering tools, grinders, files, marking devices, chop saws, threaders

piping for fuel systems include: plastic, steel, stainless steel, non-ferrous, hoses, connectors

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS

materials include: caps, plugs

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-5.02.01L	demonstrate knowledge of ***piping for fuel systems***, their ***characteristics***, applications and operation	identify types of ***piping for fuel systems*** and describe their ***characteristics*** and applications
		describe ***operating principles of piping for fuel systems***
		interpret information pertaining to ***piping for fuel systems*** found on drawings and job specifications
		describe thermal coefficient of expansion of ***piping for fuel systems***
		identify restrictions on use of ***piping for fuel systems***
B-5.02.02L	demonstrate knowledge of ***procedures to prepare piping for fuel systems***	identify ***tools and equipment*** used to prepare ***piping for fuel systems***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to prepare ***piping for fuel systems***
		describe ***procedures to prepare piping for fuel systems***
		identify ***deficiencies*** found while inspecting ***piping for fuel systems***
		describe ***procedures to measure piping for fuel systems***
		explain ***trade math concepts***
		explain metric and imperial systems of measurement and conversions
B-5.02.03L	demonstrate knowledge of training and certification requirements to prepare ***piping for fuel systems***	identify training and certification requirements to prepare ***piping for fuel systems***
B-5.02.04L	demonstrate knowledge of regulatory requirements pertaining to ***piping for fuel systems***	identify ***codes, standards and regulations*** pertaining to ***piping for fuel systems***

Range of Variables

piping for fuel systems include: plastic, steel, stainless steel, non-ferrous, hoses, connectors

characteristics include: grades, composition, sizes, schedule

operating principles of piping for fuel systems include: maximum allowable pressure, system pressure drop, flow rates

procedures to prepare piping for fuel systems include: calculating offset and rolling offset dimensions; measuring, marking, cutting, bevelling, squaring and cleaning piping; sealing ends of piping

tools and equipment include: pipe cutters, reamers, chamfering tools, grinders, files, marking devices, chop saws, threaders

hazards include: dust, exposed fibres, burrs, sparks, fumes, sharp edges, burns

deficiencies include: impurities, dents, cracks, burrs, scales

procedures to measure piping for fuel systems include: centre-to-centre, end-to-centre, end-to-end, gain or loss, measuring of angles

trade math concepts include: Pythagorean theorem, algebra, trigonometry, area and capacity, converting units of energy

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS

B-5.03 Installs piping for fuel systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-5.03.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to manufacturers' specifications
B-5.03.02P	identify style of joint and approved ***fittings***	style of joint and approved ***fittings*** are identified according to manufacturers' specifications, ***codes, standards and regulations***
B-5.03.03P	select ***fittings***	***fittings*** are selected according to site conditions
B-5.03.04P	clean ***piping for fuel systems*** and ***fittings***	***piping for fuel systems*** and ***fittings*** are cleaned to remove ***impurities*** according to ***joining method***
B-5.03.05P	select ***joining compound***	***joining compound*** is selected according to manufacturers' specifications, ***codes, standards and regulations***
B-5.03.06P	join ***piping for fuel systems***	***piping for fuel systems*** is joined using ***joining methods***

B-5.03.07P	follow sequence of bolt tensioning and torquing	sequence of bolt tensioning and torquing are followed according to manufacturers' specifications
B-5.03.08P	position and fasten ***support materials***	***support materials*** are positioned and fastened using ***fasteners*** according to manufacturers' specifications, ***codes, standards and regulations***
B-5.03.09P	***protect*** and support ***piping for fuel systems***	***piping for fuel systems*** is ***protected*** and supported according to site conditions, job and manufacturers' specifications, ***codes, standards and regulations***
B-5.03.10P	label section of ***piping for fuel systems***	section of ***piping for fuel systems*** is labelled according to job specifications, ***codes, standards and regulations***

Range of Variables

tools and equipment include: heat fusion machines, electrofusion machines, hand tools, power tools, power dies

fittings include: risers, tees, couplings, bends, valves, unions, caps, plugs, adapters, flanges

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS

piping for fuel systems include: plastic, steel, stainless steel, non-ferrous, hoses, connectors

impurities include: dirt, oil, moisture, filings, scale

joining methods include: threaded, welded, flanged, pressed, fused

joining compounds include: pipe dope, thread sealant tape, primers, glues

support materials include: hangers, brackets, braces, clips, strapping, clamps, rods

fasteners include: screws, nails, nuts and bolts, anchors

protection includes: wood, bollards, paint, sleeves, cathodic

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-5.03.01L	demonstrate knowledge of ***fittings, joining compounds***, and hangers and supports for joints, their characteristics and applications	identify types of ***fittings, joining compounds***, and hangers and supports for joints, and describe their characteristics and applications
		interpret information pertaining to ***fittings, joining compounds***, and hangers and supports for joints found in manufacturers' specifications, ***codes, standards and regulations***
B-5.03.02L	demonstrate knowledge of ***procedures to install piping for fuel systems***	identify ***tools and equipment*** used to install ***piping for fuel systems***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install ***piping for fuel systems***

		describe ***procedures to install piping for fuel systems***
		identify ***joining methods***
		identify ***impurities*** removed while cleaning ***piping for fuel systems***
		describe methods of preventing electrolysis
		describe methods of pipe tracing
		describe thermal coefficient of expansion
		explain piping identification and describe its purpose
B-5.03.03L	demonstrate knowledge of training and certification requirements to install ***piping for fuel systems***	identify training and certification requirements to install ***piping for fuel systems***
B-5.03.04L	demonstrate knowledge of regulatory requirements pertaining to ***piping for fuel systems***	identify ***codes, standards and regulations*** pertaining to ***piping for fuel systems***

Range of Variables

fittings include: risers, tees, couplings, bends, valves, unions, caps, plugs, adapters, flanges

joining compounds include: pipe dope, thread sealant tape, primers, glues

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS

procedures to install piping for fuel systems include: identifying style of joint, selecting fittings, cleaning piping and fittings, selecting joining compounds, joining piping, following sequence of bolt tensioning and torquing, positioning and fastening support materials, protecting and supporting piping, labelling section of piping

tools and equipment include: heat fusion machines, electrofusion machines, hand tools, power tools, power dies

piping for fuel systems include: plastic, steel, stainless steel, non-ferrous, hoses, connectors

hazards include: working at heights, repetitive movements, dust, exposed fibres, burrs, sparks, fumes, sharp edges, welder's flash, heavy lifting

joining methods include: threaded, welded, flanged, pressed, fused

impurities include: dirt, oil, moisture, filings, scale

Task B-6 Selects and installs tubing for fuel systems

Task Descriptor

Gasfitters select, prepare and install a variety of tubing for fuel systems. Preparation and installation of tubing includes cutting, bending, joining, supporting and protecting according to codes, standards, regulations and manufacturers' specifications.

B-6.01 Selects tubing for fuel systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-6.01.01P	select ***tubing for fuel systems***	***tubing for fuel systems*** is selected according to job specifications, ***codes, standards and regulations***
B-6.01.02P	inspect ***tubing for fuel systems***	***tubing for fuel systems*** is inspected to identify ***deficiencies***
B-6.01.03P	select ***support materials***	***support materials*** are selected according to job and manufacturers' specifications
B-6.01.04P	select ***fasteners***	***fasteners*** are selected according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

tubing for fuel systems include: seamless copper corrugated stainless steel tubing (CSST), seamless steel

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME, UNS

deficiencies include: impurities, dents, cracks, kinks

support materials include: hangers, brackets, braces, clips, strapping, clamps, rods

fasteners include: screws, nails, nuts and bolts, anchors

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-6.01.01L	demonstrate knowledge of ***tubing for fuel systems***, their ***characteristics***, applications and operation	identify types of ***tubing for fuel systems***, and describe their ***characteristics*** and applications
		describe ***operating principles of tubing for fuel systems***
		interpret information pertaining to ***tubing for fuel systems*** found on drawings and specifications
B-6.01.02L	demonstrate knowledge of procedures to select ***tubing for fuel systems***	describe procedures to select ***tubing for fuel systems***
		describe procedures to inspect ***tubing for fuel systems***
		identify restrictions on use of ***tubing for fuel systems***
		identify ***deficiencies*** found while inspecting ***tubing for fuel systems***
B-6.01.03L	demonstrate knowledge of training and certification requirements to select ***tubing for fuel systems***	identify training and certification requirements to select ***tubing for fuel systems***
B-6.01.04L	demonstrate knowledge of regulatory requirements pertaining to ***tubing for fuel systems***	identify ***codes, standards and regulations*** pertaining to ***tubing for fuel systems***

Range of Variables

tubing for fuel systems include: seamless copper corrugated stainless steel tubing (CSST), seamless steel

characteristics include: coating, sizes, wall thickness

operating principles of tubing for fuel systems include: maximum allowable pressure, system pressure drop, flow rates

deficiencies include: impurities, dents, cracks, kinks

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME, UNS

B-6.02 Prepares tubing for fuel systems

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	NV	yes	yes	ND	yes	ND	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 manufacturers' specifications
B-6.02.02P	calculate offset and rolling offset dimensions	offset and rolling offset dimensions are calculated according to spool sheets, drawings and site conditions
B-6.02.03P	measure ***tubing for fuel systems*** to dimensions	***tubing for fuel systems*** is measured to dimensions according to spool sheets, drawings and site conditions, considering fitting, bend and flare allowances
B-6.02.04P	mark ***tubing for fuel systems***	***tubing for fuel systems*** is marked
B-6.02.05P	cut ***tubing for fuel systems*** to length	***tubing for fuel systems*** is cut to length according to job specifications
B-6.02.06P	ream and chamfer ***tubing for fuel systems*** to remove burrs from ends	***tubing for fuel systems*** is reamed and chamfered to remove burrs from ends
B-6.02.07P	measure and mark bend points	bend points are measured and marked according to spool sheets, drawings and site conditions
B-6.02.08P	bend ***tubing for fuel systems***	***tubing for fuel systems*** is bent to match determined dimensions and angles
B-6.02.09P	seal ends until ***tubing for fuel systems*** is installed	ends are sealed using ***materials*** until tubing is installed to prevent contamination

Range of Variables

tool and equipment include: tubing cutters, reamers, chamfering tools, marking devices, flaring tools, benders, torches

tubing for fuel systems include: seamless copper, CSST, seamless steel

materials include: caps, plugs, couplings, reducers, elbows, tees

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-6.02.01L	demonstrate knowledge of ***tubing for fuel systems***, their ***characteristics***, applications and operation	identify types of ***tubing for fuel systems***, and describe their ***characteristics*** and applications
		describe ***operating principles of tubing for fuel systems***
		interpret information pertaining to ***tubing for fuel systems*** found on drawings and job specifications
B-6.02.02L	demonstrate knowledge of ***procedures to prepare tubing for fuel systems***	identify ***tools and equipment*** used to prepare ***tubing for fuel systems***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to prepare tubing for fitting
		describe ***procedures to prepare tubing for fuel systems***
		describe ***procedures to measure tubing***
		explain ***trade math concepts***
		explain metric and imperial systems of measurement and conversions
B-6.02.03L	demonstrate knowledge of training and certification requirements to prepare ***tubing for fuel systems***	identify training and certification requirements to prepare ***tubing for fuel systems***
B-6.02.04L	demonstrate knowledge of regulatory requirements pertaining to ***tubing for fuel systems***	identify ***codes, standards and regulations*** pertaining to ***tubing for fuel systems***

Range of Variables

tubing for fuel systems include: seamless copper, CSST, seamless steel

characteristics include: coating, sizes, wall thickness

operating principles of tubing for fuel systems include: maximum allowable pressure, system pressure drop, flow rates

procedures to prepare tubing for fuel systems include: calculating offset and rolling offset dimensions; measuring, marking, bending, cutting, reaming, chamfering and sealing tubing for fuel systems

tool and equipment include: tubing cutters, reamers, chamfering tools, marking devices, flaring tools, benders, torches

hazards include: dust, exposed fibres, burrs, sparks, fumes, sharp edges, burns

procedures to measure tubing include: centre-to-centre, end-to-centre, end-to-end, gain or loss, measuring of angles

trade math concepts include: Pythagorean theorem, algebra, trigonometry, area and capacity, converting units of energy

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS

B-6.03 Installs tubing for fuel systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-6.03.01P	select and use ***tools and equipment***, and ***materials***	***tools and equipment***, and ***materials*** are selected and used according to material and joining practice, manufacturers' specifications, ***codes, standards and regulations***
B-6.03.02P	identify ***style of joint***	***style of joint*** is identified according to manufacturers' specifications, ***codes, standards and regulations***
B-6.03.03P	select ***fittings***	***fittings*** are selected according to material and joining practice, ***codes, standards and regulations***
B-6.03.04P	clean ***tubing for fuel systems*** and ***fittings***	***tubing for fuel systems*** and ***fittings*** are cleaned to remove ***impurities***
B-6.03.05P	assemble ***fittings*** on ***tubing for fuel systems***	***fittings*** on ***tubing for fuel systems*** are assembled according to manufacturers' specifications
B-6.03.06P	join ***tubing for fuel systems***	***tubing for fuel systems*** is joined using ***joining methods***
B-6.03.07P	position and fasten ***support materials***	***support materials*** are positioned and fastened using ***fasteners*** according to manufacturers' specifications, ***codes, standards and regulations***
B-6.03.08P	***protect*** and support ***tubing for fuel systems***	***tubing for fuel systems*** is ***protected*** and supported according to site conditions, job and manufacturers' specifications, ***codes, standards and regulations***
B-6.03.09P	label section of ***tubing for fuel systems***	section of ***tubing for fuel systems*** is labelled according to job specifications, ***codes, standards and regulations***

Range of Variables

tool and equipment include: tubing cutters, reamers, chamfering tools, marking devices, flaring tools, benders, torches

materials include: fluxes, brazing rods, lubricants

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS

styles of joints include: brazed, flared, press connect, mechanical fitting other than ball sleeve compression

fittings include: risers, tees, couplings, bends, valves, unions, caps, plugs, adapters, flanges, flare nuts, press connect, mechanical fitting other than ball sleeve compression

tubing for fuel systems include: seamless copper, CSST, seamless steel

impurities include: dirt, oil, moisture, filings, scale

joining methods include: brazing, flaring, using press connect, using mechanical fitting other than ball sleeve compression

support materials include: hangers, brackets, braces, clips, strapping, clamps, rods

fasteners include: screws, nails, nuts and bolts, anchors

protection includes: wood, bollards, sleeves, cathodic

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-6.03.01L	demonstrate knowledge of ***materials, fittings, support materials, fasteners*** and ***protection*** used to install ***tubing for fuel systems***	identify types of ***materials, fittings, support materials, fasteners*** and ***protection*** used to install ***tubing for fuel systems***
		interpret information pertaining to ***materials, fittings, support materials, fasteners*** and ***protection*** found in manufacturers' specifications
B-6.03.02L	demonstrate knowledge of ***procedures to install tubing for fuel systems***	identify ***tools and equipment*** used to install ***tubing for fuel systems***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install ***tubing for fuel systems***
		describe ***procedures to install tubing for fuel systems***
		identify ***impurities*** found while cleaning ***tubing for fuel systems*** and ***fittings***
		identify ***styles of joints***
		describe methods of preventing electrolysis
		describe thermal coefficient of expansion
		explain tubing identification and describe its purpose

B-6.03.03L	demonstrate knowledge of training and certification requirements to install ***tubing for fuel systems***	identify training and certification requirements to install ***tubing for fuel systems***
B-6.03.04L	demonstrate knowledge of regulatory requirements pertaining to ***tubing for fuel systems***	identify ***codes, standards and regulations*** pertaining to ***tubing for fuel systems***

Range of Variables

materials include: fluxes, brazing rods, lubricants

fittings include: risers, tees, couplings, bends, valves, unions, caps, plugs, adapters, flanges, flare nuts, press connect, mechanical fitting other than ball sleeve compression

support materials include: hangers, brackets, braces, clips, strapping, clamps, rods

fasteners include: screws, nails, nuts and bolts, anchors

protection includes: wood, bollards, sleeves, cathodic

tubing for fuel systems include: seamless copper, CSST, seamless steel

procedures to install tubing for fuel systems include: identifying style of joint, selecting fittings, cleaning tubing and fittings, assembling fittings, joining tubing, positioning and fastening support materials, protecting and supporting tubing, labelling section of tubing

tool and equipment include: tubing cutters, reamers, chamfering tools, marking devices, flaring tools, benders, torches

hazards include: dust, exposed fibres, burrs, sparks, fumes, sharp edges, burns

impurities include: dirt, oil, moisture, filings, scale

styles of joints include: brazed, flared, press connect, mechanical fitting other than ball sleeve compression

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, NBC, AHJ, NFPA, ANSI/ASME, UNS

Major Work Activity C
Installs venting and air supply systems

Task C-7 Selects and installs venting systems

Task Descriptor

Gasfitters install venting systems to convey potential hazardous gases to a safe location.

C-7.01 Selects materials for venting systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-7.01.01P	determine location of venting lines, terminations and condensation drain traps	location of venting lines, terminations and condensation drain traps are determined according to ***factors*** while considering structure without impacting its integrity
C-7.01.02P	select ***support materials***	***support materials*** are selected according to job and manufacturers' specifications, ***codes, standards and regulations***
C-7.01.03P	select ***protection materials***	***protection materials*** are selected according to job and manufacturers' specifications, ***codes, standards and regulations***
C-7.01.04P	select ***venting materials***	***venting materials*** are selected according to manufacturers' specifications, ***codes, standards and regulations***
C-7.01.05P	select ***fasteners***	***fasteners*** are selected according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

factors include: drawings, manufacturers' specifications, best practices, codes, standards and regulations

support materials include: hangers, brackets, braces, strapping

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

protection materials include: wood, drywall, insulating millboard, metal, fire stops

venting materials include: fittings, flashings, pipes, sleeves, liners, connectors, fire stops, sealants, chimneys, terminations, adapters, glues, primers, gaskets, lubricants

fasteners include: bolts, anchors, straps, screws, clamps

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-7.01.01L	demonstrate knowledge of venting systems, their ***characteristics***, applications and operation	identify types of venting systems and describe their ***characteristics*** and applications
		describe ***operating principles of venting systems***
		interpret information pertaining to venting systems found on drawings and manufacturers' specifications
		describe draft and how it is created and controlled
		describe venting system combinations and category of appliances I, II, III and IV
C-7.01.02L	demonstrate knowledge of ***support materials***, ***protection materials*** and ***venting materials***, and ***fasteners***, their characteristics, applications and operation	identify types of ***support materials*** and describe their characteristics and applications
		identify types of ***protection materials*** and describe their characteristics and applications
		identify types of ***venting materials*** and describe their classifications, ***characteristics*** and applications
		identify types of ***fasteners*** and describe their characteristics and applications
		interpret information pertaining to ***support materials, protection materials***, ***venting materials*** and ***fasteners***, found on drawings, manufacturers' specifications, ***codes, standards and regulations***
C-7.01.03L	demonstrate knowledge of ***procedures to select venting systems***	describe ***procedures to select venting systems***
		identify ***hazards*** and describe safe work practices to select venting systems

C-7.01.04L	demonstrate knowledge of training and certification requirements to select venting systems	identify training and certification requirements to select venting systems
C-7.01.05L	demonstrate knowledge of regulatory requirements pertaining to venting systems	identify ***codes, standards and regulations*** pertaining to venting systems

Range of Variables

characteristics (of venting materials) include: gauge, size, composition (plastic, stainless steel, copper, aluminum, galvanized steel, masonry)

operating principles of venting systems include: draft velocity, pressure, temperature, condensate collection and neutralizers

support materials include: hangers, brackets, braces, strapping

protection materials include: wood, drywall, insulating millboard, metal, fire stops

venting materials include: fittings, flashings, pipes, sleeves, liners, connectors, fire stops, sealants, chimneys, terminations, adapters, glues, primers, gaskets, lubricants

fasteners include: bolts, anchors, straps, screws, clamps

procedures to select venting systems include: determining location of venting lines, terminations and condensation drain traps; selecting support, venting, protection materials and fasteners

hazards include: dust, exposed fibres, burrs, sparks, fumes, sharp edges, burns

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

C-7.02 Prepares materials for venting systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-7.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task and manufacturers' specifications
C-7.02.02P	calculate ***venting material*** length and fitting allowances	***venting material*** length and fitting allowances are calculated according to system requirements, manufacturers' specifications, ***codes, standards and regulations***
C-7.02.03P	measure section length	section length is measured according to location of venting termination and appliance
C-7.02.04P	cut ***venting materials*** to length	***venting materials*** are cut to length according to calculations

C-7.02.05P	ream, chamfer or crimp ***venting materials***	***venting materials*** are reamed, chamfered or crimped according to manufacturers' specifications
C-7.02.06P	dry fit ***components*** and ***fittings***	***components*** and ***fittings*** are dry fit according to manufacturers' specifications, ***codes, standards and regulations***

tools and equipment include: hacksaws, chop saws, plastic pipe cutters, tin snips, reamers, chamfers, crimpers, mitre boxes

venting materials include: fittings, flashings, pipes, sleeves, fasteners, connectors, fire stops, sealants, adhesives, chimneys

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

components include: locking bands, mechanical connections, terminations

fittings include: tees, couplings, bends, caps, plugs, adapters

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-7.02.01L	demonstrate knowledge of ***venting materials***, their ***characteristics***, applications and operation	identify types of ***venting materials***, and describe their ***characteristics*** and applications
		describe operating principles of ***venting materials***
		interpret information pertaining to ***venting materials*** found on drawings and manufacturers' specifications
C-7.02.02L	demonstrate knowledge of venting systems, their characteristics, applications and operation	identify types of venting systems and describe their characteristics and applications
		describe ***operating principles of venting systems***
		interpret information pertaining to venting systems found on drawings and manufacturers' specifications
C-7.02.03L	demonstrate knowledge of ***procedures to prepare materials for venting systems***	identify ***tools and equipment*** used to prepare materials for venting systems, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to prepare materials for venting systems
		describe ***procedures to prepare materials for venting systems***
C-7.02.04L	demonstrate knowledge of regulatory requirements pertaining to venting systems	identify ***codes, standards and regulations*** pertaining to venting systems

Range of Variables

venting materials include: fittings, flashings, pipes, sleeves, fasteners, connectors, fire stops, sealants, adhesives, chimneys

characteristics (of venting materials) include: gauge, composition (plastic, stainless steel, copper, aluminum, galvanized steel, masonry)

operating principles of venting systems include: draft velocity, pressure, temperature, condensate collection and neutralizers

procedures to prepare materials for venting systems include: calculating venting material length and fitting allowances, measuring section length, cutting venting materials to length, reaming, chamfering or crimping venting materials, dry fitting components and fittings

tools and equipment include: hacksaws, chop saws, plastic pipe cutters, tin snips, reamers, chamfers, crimpers, mitre boxes

hazards include: repetitive movements, dust, exposed fibres, burrs, sparks, fumes, sharp edges, heavy lifting

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

C-7.03 Installs venting systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-7.03.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
C-7.03.02P	identify, measure and mark location of ***support materials*** for venting systems	location of ***support materials*** for venting systems are identified, measured and marked according to job and manufacturers' specifications, ***codes, standards and regulations***
C-7.03.03P	position ***support materials*** for venting systems	***support materials*** for venting systems are positioned according to job and manufacturers' specifications, ***codes, standards and regulations***
C-7.03.04P	fasten ***support materials*** to structure	***support materials*** are fastened to structure using ***fasteners***
C-7.03.05P	***prepare connectors*** for joining	***connectors are prepared*** for joining according to manufacturers' specifications
C-7.03.06P	mount venting systems on supports	venting systems are mounted on supports according to manufacturers' specifications, ***codes, standards and regulations***

C-7.03.07P	connect ***components*** and ***fittings***	***components*** and ***fittings*** are connected using ***connecting methods*** according to manufacturers' specifications, ***codes, standards and regulations***
C-7.03.08P	terminate venting systems	venting systems are terminated according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

tools and equipment include: hacksaws, chop saws, plastic pipe cutters, tin snips, reamers, chamfers, crimpers, mitre boxes, wrenches, fastening tools

support materials include: hangers, brackets, braces

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

fasteners include: bolts, anchors, straps, screws, clamps

preparing connectors includes: cleaning, priming, gluing, lubricating

components include: locking bands, mechanical connections, terminations

fittings include: tees, couplings, bends, caps and terminations, plugs, adapters

connecting methods include: solvent welding, brazing, welding, using clamps and mechanical fittings

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-7.03.01L	demonstrate knowledge of venting systems, their characteristics, applications and operation	identify types of venting systems, and describe their characteristics and applications
		describe ***operating principles of venting systems***
		interpret information pertaining to venting systems found on drawings and manufacturers' specifications
C-7.03.02L	demonstrate knowledge of ***procedures to install venting systems***	identify ***tools and equipment*** used to install venting systems, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install venting systems
		describe ***procedures to install venting systems***
		identify ***venting considerations***
		describe ***procedures to measure for support materials***
		describe stack, draft and chimney effects
		explain metric and imperial systems of measurement and conversions

C-7.03.03L	demonstrate knowledge of training and certification requirements to install venting systems	identify training and certification requirements to install venting systems
C-7.03.04L	demonstrate knowledge of regulatory requirements pertaining to venting systems	identify ***codes, standards and regulations*** pertaining to venting systems

Range of Variables

operating principles of venting systems include: draft velocity, pressure, temperature, condensate collection and neutralizers

procedures to install venting systems include: identifying, measuring and marking location of support materials; positioning and fastening support materials; preparing connectors for joining; mounting venting on supports; connecting components and fittings; terminating venting systems

tools and equipment include: hacksaws, chop saws, plastic pipe cutters, tin snips, reamers, chamfers, crimpers, mitre boxes, wrenches, fastening tools

hazards include: repetitive movements, dust, exposed fibres, burrs, sparks, fumes, sharp edges, heavy lifting

venting considerations include: condensation, draining, grade, flue gas velocity, combustion analyzer test points, material clearances for natural and mechanical draft

procedures to measure for support materials include: centre-to-centre, end-to-centre, end-to-end

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

Task C-8 Selects and installs air supply systems

Task Descriptor

Gasfitters install air supply systems to maintain safe and efficient operation of gas appliances. They must be thoroughly familiar with prevailing construction methods, air infiltration, exhaust equipment, and consider the building as a system. In this task, air supply systems include combustion, excess, dilution and ventilation air for appliances located in a building or a structure.

C-8.01 Selects materials for air supply systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-8.01.01P	determine location of air supply systems, intakes and terminations	location of air supply systems, intakes and terminations are determined according to ***factors*** while considering structure without impacting its integrity
C-8.01.02P	calculate ***air supply material*** length, size, fitting allowances and round duct equivalence	***air supply material*** length, fitting allowances and round duct equivalence are calculated according to system requirements, manufacturers' specifications, ***codes, standards and regulations***
C-8.01.03P	select ***air supply materials***	***air supply materials*** are selected according to manufacturers' specifications, ***codes, standards and regulations***
C-8.01.04P	select ***support materials***	***support materials*** are selected according to job and manufacturers' specifications, and ***codes, standards and regulations***
C-8.01.05P	select ***protection materials***	***protection materials*** are selected according to job and manufacturers' specifications, and ***codes, standards and regulations***
C-8.01.06P	select ***fasteners***	***fasteners*** are selected according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

factors include: drawings, manufacturers' specifications, best practices, codes, standards and regulations

air supply materials include: fittings, pipes, fasteners, turning vanes, terminations, grilles, louvres

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

support materials include: hangers, brackets, braces, strapping

protection materials include: wood, drywall, insulating millboard, metal, fire stops

fasteners include: bolts, anchors, straps, screws

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-8.01.01L	demonstrate knowledge of air supply systems, their characteristics, applications and operation	identify ***types of air supply systems***, and describe their characteristics and applications
		describe ***operating principles of air supply systems***
		interpret information pertaining to air supply systems found on drawings and manufacturers' specifications
C-8.01.02L	demonstrate knowledge of ***support materials***, ***protection materials, air supply materials*** and ***fasteners***, their characteristics, applications and operation	identify types of ***support materials*** and describe their characteristics and applications
		identify types of ***protection materials*** and describe their characteristics and applications
		identify types of ***air supply materials*** and describe their ***characteristics*** and applications
		identify types of ***fasteners*** and describe their characteristics and applications
		interpret information pertaining to ***support materials***, ***protection materials, air supply materials*** and ***fasteners*** found on drawings and manufacturers' specifications
C-8.01.03L	demonstrate knowledge of ***procedures to select air supply systems***	describe ***procedures to select air supply systems***
C-8.01.04L	demonstrate knowledge of regulatory requirements pertaining to air supply systems	identify ***codes, standards and regulations*** pertaining to air supply systems

Range of Variables

types of air supply systems include: natural/passive, mechanical

operating principles of air supply systems include: sizing, duct free area, fitting resistance, thermal traps, stack effects, grille/louver efficiency, building depressurization

support materials include: hangers, brackets, braces, strapping

protection materials include: wood, drywall, insulating millboard, metal, fire stops

air supply materials include: fittings, pipes, fasteners, turning vanes, terminations, grilles, louvres

characteristics (of air supply materials) include: gauge, composition (wood, plastic, stainless steel, galvanized steel, specialty materials), fire ratings

fasteners include: bolts, anchors, straps, screws

procedures to select air supply systems include: determining location of air supply systems, intakes and terminations; calculating air supply material length, size, fitting allowances and round duct equivalence; selecting support, venting, protection materials and fasteners

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

C-8.02 Prepares materials for air supply systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-8.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
C-8.02.02P	measure section length	section length is measured according to location of air supply termination or appliance connection
C-8.02.03P	cut ***air supply materials*** to length	***air supply materials*** are cut to length according to calculations
C-8.02.04P	ream, chamfer or crimp ***air supply materials***	***air supply materials*** are reamed, chamfered or crimped according to manufacturers' specifications
C-8.02.05P	dry fit ***components*** and ***fittings***	***components*** and ***fittings*** are dry fit according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

tools and equipment include: hacksaws, chop saws, plastic pipe cutters, tin snips, reamers, chamfers, crimpers, mitre boxes, bar folders, measuring tapes, notchers, rippers, seamers, stretchers, power tools

air supply materials include: fittings, pipes, fasteners, turning vanes, terminations, grilles, louvres, ducting

components include: locking bands, mechanical connections, terminations

fittings include: tees, couplings, bends, caps, plugs, adapters

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-8.02.01L	demonstrate knowledge of ***air supply materials***, their characteristics, applications and operation	identify types of ***air supply materials*** and describe their ***characteristics*** and applications
		describe operating principles of ***air supply materials***
		interpret information pertaining to ***air supply materials*** found on drawings and manufacturers' specifications
C-8.02.02L	demonstrate knowledge of air supply systems, their characteristics, applications and operation	identify ***types of air supply systems***, and describe their characteristics and applications
		describe ***operating principles of air supply systems***
		interpret information pertaining to air supply systems found on drawings and manufacturers' specifications
C-8.02.03L	demonstrate knowledge of ***procedures to prepare materials for air supply systems***	identify ***tools and equipment*** used to prepare materials for air supply systems, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to prepare materials for air supply systems
		describe ***procedures to prepare materials for air supply systems***
C-8.02.04L	demonstrate knowledge of regulatory requirements pertaining to air supply systems	identify ***codes, standards and regulations*** pertaining to air supply systems

Range of Variables

air supply materials include: fittings, pipes, fasteners, turning vanes, terminations, grilles, louvres, ducting

characteristics (of air supply materials) include: gauge, composition (wood, plastic, stainless steel, galvanized steel, specialty materials), fire ratings

types of air supply systems include: natural/passive, mechanical

operating principles of air supply systems include: sizing, duct free area, fitting resistance, thermal traps, stack effects, grille/louver efficiency, building depressurization

procedures to prepare materials for air supply systems include: measuring section length; cutting air supply materials to length; reaming, chamfering or crimping air supply materials; dry fitting components and fittings

tools and equipment include: hacksaws, chop saws, plastic pipe cutters, tin snips, reamers, chamfers, crimpers, mitre boxes, bar folders, measuring tapes, notchers, rippers, seamers, stretchers, power tools

hazards include: repetitive movements, dust, exposed fibres, burrs, sparks, fumes, sharp edges, heavy lifting

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

C-8.03 Installs air supply systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-8.03.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
C-8.03.02P	identify, measure and mark location of ***support materials*** for air supply systems	location of ***support materials*** for air supply systems are identified, measured and marked according to job and manufacturers' specifications, and ***codes, standards and regulations***
C-8.03.03P	position ***support materials*** for air supply systems	***support materials*** for air supply systems are positioned according to job and manufacturers' specifications, and ***codes, standards and regulations***
C-8.03.04P	fasten ***support materials*** to structure	***support materials*** are fastened to structure using ***fasteners***
C-8.03.05P	***prepare connectors*** for joining	***connectors are prepared*** for joining according to manufacturers' specifications
C-8.03.06P	connect ***components*** and ***fittings***	***components*** and ***fittings*** are connected using ***connecting methods***

C-8.03.07P	mount and assemble air supply systems on supports	air supply systems are mounted and assembled on supports according to job and manufacturers' specifications, and ***codes, standards and regulations***
C-8.03.08P	seal joint connections using sealants or mechanical joints	joint connections are sealed using sealants or mechanical joints to prevent leakage according to manufacturers' specifications, ***codes, standards and regulations***
C-8.03.09P	terminate air supply systems	air supply systems are terminated according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

tools and equipment include: hacksaws, chop saws, plastic pipe cutters, tin snips, reamers, chamfers, crimpers, mitre boxes, bar folders, measuring tapes, notchers, rippers, seamers, stretchers, power tools, rigging equipment

support materials include: hangers, brackets, braces

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CEC, NBC, AHJ, NFPA, ANSI/ASME

fasteners include: bolts, anchors, straps, screws, clamps

preparing connectors includes: cleaning, priming, gluing, lubricating

components include: locking bands, mechanical connections, terminations

fittings include: tees, couplings, bends, caps, plugs, adapters

connecting methods include: cementing, brazing, welding

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-8.03.01L	demonstrate knowledge of air supply systems, their characteristics, applications and operation	identify ***types of air supply systems***, and describe their characteristics and applications
		describe ***operating principles of air supply systems***
		interpret information pertaining to air supply systems found on drawings and manufacturers' specifications
C-8.03.02L	demonstrate knowledge of concepts and fundamentals relating to air supply systems	describe concepts and fundamentals relating to combustion
		explain how air supply affects combustion
		define building as a system
		describe draft and how it is created
		describe combustion air supply methods

		describe combustion, excess, dilution, relief, secondary and primary ventilation requirements and applications
		describe sizing charts and calculations of combustion, excess, dilution, relief, secondary, primary and ventilation air
		describe grille and louver sizing allowances and restrictions
		explain calculations for ***conditions***
		describe ***characteristics of air***
		describe psychrometric characteristics and charts
		describe air supply requirements for various ***appliance categories***
C-8.03.03L	demonstrate knowledge of ***procedures to install air supply systems***	identify ***tools and equipment*** used to install air supply systems, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install air supply systems
		describe ***procedures to install air supply systems***
		describe ***procedures to measure for support materials***
C-8.03.04L	demonstrate knowledge of regulatory requirements pertaining to air supply systems	identify ***codes, standards and regulations*** pertaining to air supply systems

Range of Variables

types of air supply systems include: natural/passive, mechanical

operating principles of air supply systems include: sizing, duct free area, fitting resistance, thermal traps, stack effects, grille/louver efficiency, building depressurization

conditions include: free area, air volume

characteristics of air include: humidity, dewpoint, relative density, temperature, composition

appliance categories include: I, II, III and IV

procedures to install air supply systems include: identifying, measuring and marking location of support materials; positioning and fastening support materials; preparing connectors for joining; mounting air supply systems on supports; connecting components and fittings; terminating air supply systems

tools and equipment include: hacksaws, chop saws, plastic pipe cutters, tin snips, reamers, chamfers, crimpers, mitre boxes, bar folders, measuring tapes, notchers, rippers, seamers, stretchers, power tools, rigging equipment

hazards include: repetitive movements, dust, exposed fibres, burrs, sparks, fumes, sharp edges, heavy lifting

procedures to measure for support materials include: centre-to-centre, end-to-centre, end-to-end

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CEC, NBC, AHJ, NFPA, ANSI/ASME

Task C-9 Selects and installs draft control systems

Task Descriptor

Gasfitters install draft control systems to maintain safe and efficient operation of gas appliances. In this task, draft control systems include draft hoods and diverters, barometric dampers (single and double-acting) and mechanical forced and induced draft control devices.

C-9.01 Selects components for draft control systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-9.01.01P	determine location of draft control equipment and ***components***	location of draft control equipment and ***components*** is determined according to drawings, manufacturers' specifications, best practices, ***codes, standards and regulations***
C-9.01.02P	select ***support materials***	***support materials*** are selected according to job and manufacturers' specifications, and ***codes, standards and regulations***
C-9.01.03P	select draft control equipment and ***components***	draft control equipment and ***components*** are selected according to manufacturers' specifications, ***codes, standards and regulations***
C-9.01.04P	select ***fasteners***	***fasteners*** are selected according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

components include: fans, blowers, motors, controls, pressure switches, dampers, gauges, flow indicators, conductors

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

support materials include: hangers, brackets, braces, strapping

fasteners include: bolts, anchors, straps, screws, clamps

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-9.01.01L	demonstrate knowledge of draft control systems, their ***components***, characteristics, applications and operation	identify types of ***natural draft control systems*** and their ***components***, and describe their characteristics and applications
		identify types of ***mechanical draft control systems*** and their ***components***, and describe their characteristics and applications
		describe ***operating principles of draft control systems***
		interpret information pertaining to draft control systems found on drawings and manufacturers' specifications
		define building as a system
		describe draft and how it is created
		describe combustion draft control methods
C-9.01.02L	demonstrate knowledge of ***support materials*** and ***fasteners***, their characteristics, applications and operation	identify types of ***support materials*** and describe their characteristics and applications
		identify types of ***fasteners*** and describe their characteristics and applications
		interpret information pertaining to ***support materials*** and ***fasteners*** found on drawings and manufacturers' specifications
C-9.01.03L	demonstrate knowledge of ***procedures to select draft control systems***	describe ***procedures to select draft control systems***
C-9.01.04L	demonstrate knowledge of regulatory requirements pertaining to draft control systems	identify ***codes, standards and regulations*** pertaining to draft control systems

Range of Variables

components include: fans, blowers, motors, controls, pressure switches, dampers, gauges, flow indicators, conductors

natural draft control systems include: barometric dampers, draft hoods, draft diverters

mechanical draft control systems include: induced, forced, balanced

operating principles of draft control systems include: draft velocity, pressure, temperature

support materials include: hangers, brackets, braces, strapping

fasteners include: bolts, anchors, straps, screws, clamps

procedures to select draft control systems include: determining location of draft control system and components; selecting support materials, draft control equipment and components, and fasteners

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

C-9.02 Installs components for draft control systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-9.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
C-9.02.02P	identify, measure and mark location of ***support materials*** for draft control systems	location of ***support materials*** for draft control systems are identified, measured and marked according to job and manufacturers' specifications, and ***codes, standards and regulations***
C-9.02.03P	position ***support materials*** for draft control systems	***support materials*** for draft control systems are positioned according to job and manufacturers' specifications, and ***codes, standards and regulations***
C-9.02.04P	fasten ***support materials*** to structure	***support materials*** are fastened to structure using ***fasteners***
C-9.02.05P	mount draft control system ***components*** on supports	draft control system ***components*** are mounted on supports according to manufacturers' specifications, ***codes, standards and regulations***
C-9.02.06P	***prepare connectors*** for joining	***connectors are prepared*** for joining according to manufacturers' specifications
C-9.02.07P	connect ***components*** and ***fittings***	***components*** and ***fittings*** are connected using ***connecting methods***

Range of Variables

tools and equipment include: hand tools, power tools, lifting equipment, gauges

support materials include: hangers, brackets, braces

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

fasteners include: bolts, anchors, straps, screws, clamps

components include: fans, blowers, motors, controls, pressure switches, dampers, gauges, flow indicators, conductors

preparing connectors includes: crimping, folding, fastening, drilling

fittings include: tees, couplings, bends, caps, plugs, adapters

connecting methods include: cementing, brazing, welding

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-9.02.01L	demonstrate knowledge of draft control systems, their ***components***, characteristics, applications and operation	identify types of ***natural draft control systems*** and their ***components***, and describe their characteristics and applications
		identify types of ***mechanical draft control systems*** and their ***components***, and describe their characteristics and applications
		describe ***operating principles of draft control systems***
C-9.02.02L	demonstrate knowledge of ***procedures to install draft control systems and their components***	identify ***tools and equipment*** used to install draft control systems and their ***components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install draft control systems
		describe ***procedures to install draft control systems and their components***
		identify sizing calculations for draft control systems
		identify procedures to test draft control systems and their components
C-9.02.03L	demonstrate knowledge of regulatory requirements pertaining to draft control systems	identify ***codes, standards and regulations*** pertaining to draft control systems

Range of Variables

components include: fans, blowers, motors, controls, pressure switches, dampers, gauges, flow indicators, conductors

natural draft control systems include: barometric dampers, draft hoods, draft diverters

mechanical draft control systems include: induced, forced, balanced

operating principles of draft control systems include: draft velocity, pressure, temperature

procedures to install draft control systems and their components include: identifying, measuring and marking location of support materials; positioning and fastening support materials; mounting draft control systems on supports; preparing connectors for joining; connecting components and fittings

tools and equipment include: hand tools, power tools, lifting equipment, gauges

hazards include: repetitive movements, dust, exposed fibres, burrs, sparks, fumes, sharp edges, heavy lifting, electrocution

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), NBC, AHJ, NFPA, ANSI/ASME

Major Work Activity D
Installs controls and electrical systems

Task D-10 Selects and installs combustion control systems

Task Descriptor

Gasfitters assemble, place, secure and connect combustion control systems in residential, industrial, commercial and institutional (ICI) sectors.

The controls enable the systems to start, stop, monitor and modulate to obtain safe and energy efficient operation.

D-10.01 Selects combustion control components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-10.01.01P	verify original equipment specifications	original equipment specifications are verified
D-10.01.02P	select and verify ***components***	***components*** are selected and verified according to ***factors***
D-10.01.03P	select location and ***enclosures***	location and ***enclosures*** are selected according to job and manufacturers' specifications, certifying bodies, ***codes, standards and regulations***

Range of Variables

components include: pressure transmitters, servo motors, control modules, fuel air ratio controls, NOx controls, programmable logic controllers (PLC), variable frequency drives (VFD), supervisory systems, O_2, NOx and CO monitors

factors include: site requirements, type of equipment, manufacturers' specifications, certifying bodies, codes, standards and regulations

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-10.01.01L	demonstrate knowledge of combustion control systems, their ***components***, characteristics, applications and operation	identify combustion control systems and their ***components***, and describe their characteristics and applications
		describe operating principles of combustion control systems and their ***components***
		interpret information pertaining to combustion control systems and their ***components*** found on drawings and specifications
		describe combustion theory and formulas
		describe fuel-air ratios
D-10.01.02L	demonstrate knowledge of ***electrical systems*** and their ***components***, their characteristics, applications and operation	describe ***electricity principles***
		identify ***electrical systems*** and their ***components***, and describe their characteristics, applications and operation
		identify electrical symbols and wiring diagrams
		describe ***types of circuits***
		identify and describe conductors, semi-conductors and insulators
D-10.01.03L	demonstrate knowledge of regulatory requirements pertaining to combustion controls and their ***components***	identify ***codes, standards and regulations*** pertaining to combustion controls and their ***components***
		identify certifying bodies responsible for combustion controls and their ***components***

Range of Variables

components include: pressure transmitters, servo motors, control modules, fuel air ratio controls, NOx controls, programmable logic controllers (PLC), variable frequency drives (VFD), supervisory systems, O_2, NOx and CO monitors

electrical systems include: milli voltage, low voltage, line voltage (single [1] phase, three [3] phase), AC/DC, resistive

electrical system components include: starters, capacitors, temperature switches, relays, disconnects, transformers, flow switches, pressure switches, line voltage filters, overload and overcurrent protection, limit switches, pumps, interlocks, motors, actuators, speed drives

electricity principles include: Ohm's Law, Kirchhoff's Laws

types of circuits include: series, parallel, series/parallel

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

D-10.02 Installs combustion control components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-10.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
D-10.02.02P	install mounting points and brackets for ***combustion control components***	mounting points and brackets for ***combustion control components*** are installed according to manufacturers' specifications
D-10.02.03P	install certified ***enclosures***	certified ***enclosures*** are installed according to job and manufacturers' specifications, and ***codes, standards and regulations***
D-10.02.04P	mount and connect combustion control and ***components***	combustion control and ***components*** are mounted and connected according to manufacturers' specifications, ***codes, standards and regulations***
D-10.02.05P	program and configure control modules	control modules are programmed and configured according to job specifications, ***codes, standards and regulations***
D-10.02.06P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
D-10.02.07P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: hand tools, drills, multimeters, signal generators, wire strippers, wiring identification equipment, network cabling tools and testers

combustion control components include: pressure transmitters, servo motors, control modules, fuel air ratio controls, NOx controls, PLCs, VFDs, supervisory systems, O_2, NOx and CO monitors

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-10.02.01L	demonstrate knowledge of combustion control systems, their ***components***, characteristics, applications and operation	identify combustion control systems and their ***components***, and describe their characteristics and applications
		describe operating principles of combustion control systems and their ***components***
		interpret information pertaining to combustion control systems and their ***components*** found on drawings and specifications
		describe combustion theory and formulas
		describe fuel-air ratios
D-10.02.02L	demonstrate knowledge of ***electrical systems*** and their ***components***, their characteristics, applications and operation	describe ***electricity principles***
		identify ***electrical systems*** and their ***components***, and describe their characteristics, applications and operation
		identify electrical symbols and wiring diagrams
		describe ***types of circuits***
		identify and describe conductors, semi-conductors and insulators
D-10.02.03L	demonstrate knowledge of procedures to install combustion controls and their ***components***	identify ***tools and equipment*** used to install combustion controls and their ***components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install combustion controls and their ***components***
		describe ***procedures to install combustion controls and their components***
		identify ***site-specific and regional considerations*** for installation
D-10.02.04L	demonstrate knowledge of training and certification requirements to install combustion control systems	identify training and certification requirements to install combustion control systems
D-10.02.05L	demonstrate knowledge of regulatory requirements pertaining to combustion control systems and their ***components***	identify ***codes, standards and regulations*** pertaining to combustion control systems and their ***components***
		identify certifying bodies responsible for combustion controls and their ***components***

Range of Variables

combustion control components include: pressure transmitters, servo motors, control modules, fuel air ratio controls, NOx controls, PLCs, VFDs, supervisory systems, O_2, NOx and CO monitors

electrical systems include: milli voltage, low voltage, line voltage (single [1] phase, three [3] phase), AC/DC, resistive

electrical system components include: starters, capacitors, temperature switches, relays, disconnects, transformers, flow switches, pressure switches, line voltage filters, overload and overcurrent protection, limit switches, pumps, interlocks, motors, actuators, speed drives

electricity principles include: Ohm's Law, Kirchhoff's Laws

types of circuits include: series, parallel, series/parallel

tools and equipment include: hand tools, drills, multimeters, signal generators, wire strippers, wiring identification equipment, network cabling tools and testers

hazards include: energy sources, environmental, working at heights, confined spaces

procedures to install combustion controls and their components include: verifying original equipment specifications; selecting and verifying components; selecting location and enclosures; installing mounting points and brackets for components; installing certified enclosures; mounting and connecting combustion controls and components; programming and configuring control modules; verifying, setting up and confirming operation prior to commissioning; creating as-built final drawings

site-specific and regional considerations include: seismic restraints, climate, ambient temperature, altitude

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

Task D-11 Selects and installs flame safeguard systems

Task Descriptor

Gasfitters assemble, place, secure and connect flame safeguard systems in residential and ICI sectors. A flame safeguard system controls the safety aspects of establishing and maintaining a flame during the run period and monitoring during the off period.

D-11.01 Selects flame safeguard components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-11.01.01P	verify original equipment specifications	original equipment specifications are verified
D-11.01.02P	select and verify ***components***	***components*** are selected and verified according to ***factors***
D-11.01.03P	select location and ***enclosures***	location and ***enclosures*** are selected according to job and manufacturers' specifications, certifying bodies, ***codes, standards and regulations***

Range of Variables

components include: flame rods or scanners (ultraviolet [UV], infrared [IR], self-checking), wiring base, chassis, display, purge timer, flame amplifier, hot surface ignition (HSI), direct spark ignitor (DSI), pilots

factors include: site requirements, certifying bodies, type of equipment, manufacturers' specifications, codes, standards and regulations

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-11.01.01L	demonstrate knowledge of ***flame safeguards***, their ***components***, characteristics, applications and operation	identify types of ***flame safeguards*** and their ***components***, and describe their characteristics and applications
		describe types and operation of ignition systems
		describe operating principles of ***flame safeguards*** and their ***components***

		describe sequence of operation of flame safeguards
		interpret information pertaining to ***flame safeguards*** and their ***components*** found on drawings and specifications
D-11.01.02L	demonstrate knowledge of regulatory requirements pertaining to ***flame safeguards*** and their ***components***	identify ***codes, standards and regulations*** pertaining to ***flame safeguards*** and their ***components***
		identify certifying bodies responsible for ***flame safeguards*** and their ***components***

Range of Variables

flame safeguards include: solid state, microprocessor, programmable, non-programmable

components include: flame rods or scanners (ultraviolet [UV], infrared [IR], self-checking), wiring base, chassis, display, purge timer, flame amplifier, hot surface ignition (HSI), direct spark ignitor (DSI), pilots

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

D-11.02 Installs flame safeguard components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-11.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
D-11.02.02P	install mounting points and brackets for ***components***	mounting points and brackets for ***components*** are installed according to manufacturers' specifications
D-11.02.03P	install certified ***enclosures***	certified ***enclosures*** are installed according to job and manufacturers' specifications, and ***codes, standards and regulations***
D-11.02.04P	mount and connect ***flame safeguards*** and ***components***	***flame safeguards*** and ***components*** are mounted and connected according to manufacturers' installation procedures
D-11.02.05P	configure ***flame safeguard***	***flame safeguard*** is configured according to ***job specifications***
D-11.02.06P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
D-11.02.07P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: hand tools, drills, multimeters, signal generators, wire strippers, wiring identification equipment, network cabling tools and testers

components include: flame rods or scanners (UV, IR, self-checking), wiring bases, chassis, displays, purge timers, flame amplifiers, HSI, DSI, pilots

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

flame safeguards include: solid state, microprocessor, programmable, non-programmable

job specifications include: purge times, flame amplifiers

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-11.02.01L	demonstrate knowledge of ***flame safeguards***, their ***components***, characteristics, applications and operation	identify types of ***flame safeguards*** and their ***components***, and describe their characteristics and applications
		describe types and operation of ignition systems
		describe operating principles of ***flame safeguards*** and their ***components***
		describe sequence of operation of ***flame safeguards***
		identify component and system compatibility when performing upgrading/conversions
		interpret information pertaining to ***flame safeguards*** and their ***components*** found on drawings and specifications
D-11.02.02L	demonstrate knowledge of ***procedures to install flame safeguards and their components***	identify ***tools and equipment*** used to install ***flame safeguards*** and their ***components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install ***flame safeguards*** and their ***components***
		describe ***procedures to install flame safeguards and their components***
		identify ***site-specific and regional considerations*** for installation
D-11.02.03L	demonstrate knowledge of regulatory requirements pertaining to ***flame safeguards*** and their ***components***	identify ***codes, standards and regulations*** pertaining to ***flame safeguards*** and their ***components***
		identify certifying bodies responsible for ***flame safeguards*** and their ***components***

Range of Variables

flame safeguards include: solid state, microprocessor, programmable, non-programmable

components include: flame rods or scanners (UV, IR, self-checking), wiring bases, chassis, displays, purge timers, flame amplifiers, HSI, DSI, pilots

procedures to install flame safeguards and their components include: verifying original equipment specifications; selecting and verifying components; selecting location and enclosures; installing mounting points and brackets for components; installing certified enclosures; mounting and connecting flame safeguards and components; configuring flame safeguard; verifying, setting up and confirming operation of flame safeguard prior to commissioning; creating as-built final drawings

tools and equipment include: hand tools, drills, multimeters, signal generators, wire strippers, wiring identification equipment, network cabling tools and testers

hazards include: energy sources, environmental, working at heights, confined spaces, static discharge

site-specific and regional considerations include: climate, ambient temperature

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

Task D-12 Selects and installs operating control systems

Task Descriptor

Gasfitters assemble, place, secure and connect limits and operating control systems in residential, and ICI sectors.

The operating control system's function is to start, stop, monitor and modulate the appliance's operation to ensure its safe and efficient operation.

D-12.01 Selects operating control components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-12.01.01P	verify original equipment specifications	original equipment specifications are verified
D-12.01.02P	select and verify ***components***	***components*** are selected and verified according to ***factors***
D-12.01.03P	select location and ***enclosures***	location and ***enclosures*** are selected according to job and manufacturers' specifications, certifying bodies, ***codes, standards and regulations***

Range of Variables

components include: on-off operators, low and high gas pressure switches, combustion air proving switches, high limit controls, gas valves, temperature controls, liquid level controls, alternate fuel controls (e.g., digester gas, fuel selector switches, flame arrestors, oil valves, return oil systems), waste fuel system components (fuel oil preheat systems), interlocks, control point instrumentation (e.g., resistance temperature detectors [RTD], pressure transducers, thermocouples, flow meters), PLCs, programmable thermostats

factors include: site requirements, certifying bodies, type of equipment, manufacturers' specifications, codes, standards and regulations

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-12.01.01L	demonstrate knowledge of operating controls, their ***components***, characteristics, applications and operation	identify types of operating controls and their ***components***, and describe their characteristics and applications
		describe operating principles of operating controls and their ***components***
		describe sequence of operation of operating and limit controls
		interpret information pertaining to operating controls and their ***components*** found on drawings and specifications
		describe operation of computer interfaces and programs
		describe types of ***control signals and protocols***
		describe integration of different types of controls
D-12.01.02L	demonstrate knowledge of regulatory requirements pertaining to operating controls and their ***components***	identify ***codes, standards and regulations*** pertaining to operating controls and their ***components***
		identify certifying bodies responsible for operating controls and their ***components***

Range of Variables

components include: on-off operators, low and high gas pressure switches, combustion air proving switches, high limit controls, gas valves, temperature controls, liquid level controls, alternate fuel controls (e.g., digester gas, fuel selector switches, flame arrestors, oil valves, return oil systems), waste fuel system components (fuel oil preheat systems), interlocks, control point instrumentation (e.g., resistance temperature detectors [RTD], pressure transducers, thermocouples, flow meters), PLCs, programmable thermostats

control signals and protocols include: 4 to 20 milliamps (mA), 0-10 DC volts, Modbus, BACnet, Hypertext Transfer Protocol (HTTP), Address Resolution Protocol (ARP), Wheatstone bridge

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

D-12.02 Installs operating control components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-12.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
D-12.02.02P	install mounting points and brackets for operating control ***components***	mounting points and brackets for operating control ***components*** are installed according to manufacturers' specifications
D-12.02.03P	install certified ***enclosures***	certified ***enclosures*** are installed according to job and manufacturers' specifications, ***codes, standards and regulations***
D-12.02.04P	mount and connect operating control ***components***	operating control ***components*** are mounted and connected according to manufacturers' installation procedures and venting requirements
D-12.02.05P	configure operating controls	operating controls are configured according to ***job specifications***
D-12.02.06P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
D-12.02.07P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: hand tools, drills, multimeters, signal generators, wiring identification equipment, network cabling tools and testers

components include: on-off operators, low and high gas pressure switches, combustion air proving switches, high limit controls, gas valves, temperature controls, liquid level controls, alternate fuel controls (e.g., digester gas, fuel selector switches, flame arrestors, oil valves, return oil systems), waste fuel system components (fuel oil preheat system), interlocks, control point instrumentation (e.g., RTDs, pressure transducers, thermocouples, flow meters), PLCs, programmable thermostats

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

job specifications include: set points, high limits, minimum/maximum gas pressures

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-12.02.01L	demonstrate knowledge of operating controls, their ***components***, characteristics, applications and operation	identify types of operating controls and their ***components***, and describe their characteristics and applications
		describe operating principles of operating controls and their ***components***
		describe sequence of operation of operating and limit controls
		interpret information pertaining to operating controls and their ***components*** found on drawings and specifications
		describe operation of computer interfaces and programs
		describe types of ***control signals and protocols***
		describe integration of different types of controls
D-12.02.02L	demonstrate knowledge of ***procedures to install operating controls and their components***	identify ***tools and equipment*** used to install operating controls and their ***components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install operating controls and their ***components***
		describe ***procedures to install operating controls and their components***
		identify ***site-specific and regional considerations*** for installation

D-12.02.03L	demonstrate knowledge of regulatory requirements pertaining to operating controls and their ***components***	identify ***codes, standards and regulations*** pertaining to operating controls and their ***components***
		identify certifying bodies responsible for operating controls and their ***components***

Range of Variables

components include: on-off operators, low and high gas pressure switches, combustion air proving switches, high limit controls, gas valves, temperature controls, liquid level controls, alternate fuel controls (e.g., digester gas, fuel selector switches, flame arrestors, oil valves, return oil systems), waste fuel system components (fuel oil preheat system), interlocks, control point instrumentation (e.g., RTDs, pressure transducers, thermocouples, flow meters), PLCs, programmable thermostats

control signals and protocols include: 4 to 20 mA, 0-10 DC volts, Modbus, BACnet, HTTP, ARP, Wheatstone bridge

procedures to install operating controls and their components include: verifying original equipment specifications; selecting and verifying components; selecting location and enclosures; installing mounting points and brackets; installing certified enclosures; mounting and connecting components; configuring operating controls; verifying, setting up and confirming operation prior to commissioning; creating as-built final drawings

tools and equipment include: hand tools, drills, multimeters, signal generators, wiring identification equipment, network cabling tools and testers

hazards include: energy sources, environmental, working at heights, confined spaces, hazardous materials (e.g., mercury, silica, asbestos, ceramic fibre insulation, lead)

site-specific and regional considerations include: seismic restraints, climate, ambient temperature, altitude

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA

Task D-13 Selects and installs electrical systems

Task Descriptor

Gasfitters assemble, place, secure and connect electrical components (from the disconnect to the appliance) in residential and ICI sectors. In some provinces and territories, gasfitters may be restricted in electrical work they can perform and must coordinate work as needed with appropriate trades.

Electrical components enable system operation by providing power to sub-systems such as electronic controls, pumps and motors to obtain the designed condition and maintain safe operation.

D-13.01 Selects electrical components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-13.01.01P	verify ***original equipment specifications***	***original equipment specifications*** are verified
D-13.01.02P	select and verify ***electrical components***	***electrical components*** are selected and verified according to ***factors***
D-13.01.03P	select and size conductors for application	conductors for application are selected and sized according to ***codes, standards and regulations***
D-13.01.04P	select location and ***enclosures***	location and ***enclosures*** are selected according to job and manufacturers' specifications, certifying bodies, ***codes, standards and regulations***

Range of Variables

original equipment specifications include: voltage, current, phase, resistance, revolutions per minute (RPM)

electrical components include: transformers, relays (solid-state relays [SSR], electromechanical relays), motor starters, motors, capacitors, power supplies, protective devices (overload, overcurrent), resistors, actuators, silicon-controlled rectifiers (SCR), DC motor controls and electronically commutated motors (ECM), VFDs, line voltage filters, line voltage reactors, switches and limits, disconnects and motor control centre (MCC) panels, power factor correction devices, uninterrupted power supply (UPS)

factors include: site requirements, type of equipment, manufacturers' specifications, certifying bodies, codes, standards and regulations

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ1784, CEC, NBC, AHJ, NFPA

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-13.01.01L	demonstrate knowledge of ***electrical components***, their characteristics, applications and operation	identify types of ***electrical components*** and describe their characteristics and applications
		describe operating principles of ***electrical components***
		interpret information pertaining to ***electrical components*** found on drawings and specifications
D-13.01.02L	demonstrate knowledge of ***electrical systems***, their characteristics, applications and operation	describe ***electricity principles***
		identify ***electrical systems***, and describe their characteristics, applications and operation
		identify electrical symbols and wiring diagrams
		describe ***types of circuits***
		identify and describe conductors, semi-conductors and insulators
D-13.01.03L	demonstrate knowledge of regulatory requirements pertaining to ***electrical components***	identify ***codes, standards and regulations*** pertaining to ***electrical components***
		identify certifying bodies responsible for electrical systems and their ***components***

Range of Variables

electrical components include: transformers, relays (solid-state relays [SSR], electromechanical relays), motor starters, motors, capacitors, power supplies, protective devices (overload, overcurrent), resistors, actuators, silicon-controlled rectifiers (SCR), DC motor controls and electronically commutated motors (ECM), VFDs, line voltage filters, line voltage reactors, switches and limits, disconnects and motor control centre (MCC) panels, power factor correction devices, uninterrupted power supply (UPS)

electrical systems include: milli voltage, low voltage, line voltage (single [1] phase, three [3] phase), AC/DC, resistive

electricity principles include: Ohm's Law, Kirchhoff's Laws

types of circuits include: series, parallel, series/parallel

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ1784, CEC, NBC, AHJ, NFPA

D-13.02 Installs electrical components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-13.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
D-13.02.02P	install mounting points and brackets for ***electrical components***	mounting points and brackets for ***electrical components*** are installed according to manufacturers' specifications
D-13.02.03P	install certified ***enclosures***	certified ***enclosures*** are installed according to job and manufacturers' specifications, ***codes, standards and regulations***
D-13.02.04P	mount and connect ***electrical components***	***electrical components*** are mounted and connected according to manufacturers' specifications, ***codes, standards and regulations***
D-13.02.05P	perform wiring of ***electrical components***	wiring of ***electrical components*** is performed according to ***best practices***, ***codes, standards and regulations***
D-13.02.06P	configure VFDs and ECMs	VFDs and ECMs are configured according to ***job specifications***
D-13.02.07P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
D-13.02.08P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: hand tools, drills, multimeters, signal generators, wiring identification equipment, network cabling tools and testers

electrical components include: transformers, relays (SSR, electromechanical), motor starters, motors, capacitors, power supplies, protective devices (overload, overcurrent), resistors, actuators, SCRs, motor controls, DC motor controls and ECMs, VFDs, line voltage filters, line voltage reactors, switches and limits, disconnects and MCC panels, power factor correction devices, UPS

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

best practices include: grouped and well-organized wire runs; end wire labelling and identification; approved connection techniques; isolation of control lines, communication lines and line voltage; create and update representative as-built drawings

job specifications include: efficiency, performance

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-13.02.01L	demonstrate knowledge of ***electrical components***, their characteristics, applications and operation	identify types of ***electrical components***, and describe their characteristics and applications
		describe operating principles of ***electrical components***
		interpret information pertaining to ***electrical components*** found on drawings and specifications
D-13.02.02L	demonstrate knowledge of ***electrical systems***, their characteristics, applications and operation	describe ***electricity principles***
		identify ***electrical systems***, and describe their characteristics, applications and operation
		identify electrical symbols and wiring diagrams
		describe ***types of circuits***
		identify and describe conductors, semi-conductors and insulators
D-13.02.03L	demonstrate knowledge of ***procedures to install electrical components***	identify ***tools and equipment*** used to install ***electrical components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install ***electrical components***
		describe ***procedures to install electrical components***
D-13.02.04L	demonstrate knowledge of regulatory requirements pertaining to ***electrical components*** and their ***components***	identify ***codes, standards and regulations*** pertaining to ***electrical components*** and their ***components***
		identify certifying bodies responsible for electrical systems and their ***components***

Range of Variables

electrical components include: transformers, relays (SSR, electromechanical), motor starters, motors, capacitors, power supplies, protective devices (overload, overcurrent), resistors, actuators, SCRs, motor controls, DC motor controls and ECMs, VFDs, line voltage filters, line voltage reactors, switches and limits, disconnects and MCC panels, power factor correction devices, UPS

electrical systems include: milli voltage, low voltage, line voltage (single [1] phase, three [3] phase), AC/DC, resistive

electricity principles include: Ohm's Law, Kirchhoff's Laws

types of circuits include: series, parallel, series/parallel

procedures to install electrical components include: verifying original equipment specifications; selecting and verifying electrical components; selecting and sizing conductors for application; selecting location and enclosures; installing mounting points and brackets; installing certified enclosures; mounting and connecting electrical components; performing wiring of electrical components; configuring VFDs and ECMs; verifying, setting up and confirming operation prior to commissioning; creating as-built final drawings

tools and equipment include: hand tools, drills, multimeters, signal generators, wiring identification equipment, network cabling tools and testers

hazards include: energy sources, environmental, working at heights, confined spaces, hazardous materials (e.g., mercury, silica, asbestos, ceramic fibre insulation, lead)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

Task D-14 Selects and installs automation and instrumentation control systems

Task Descriptor

Gasfitters assemble, place, secure and connect automation and instrumentation control systems in residential and ICI sectors.

Automation control systems are used to control single units such as boilers as well as multiple heating applications for buildings.

Instrumentation control systems are used to control the flow of mediums such as liquid, steam and air.

Automation and instrumentation control systems provide monitoring, management, scheduling, load shedding, energy conservation, and enabling/disabling of equipment and processes to achieve efficiencies and precise parameter control.

D-14.01 Selects automation and instrumentation control components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-14.01.01P	verify ***original equipment specifications***	***original equipment specifications*** are verified
D-14.01.02P	select and verify ***components***	***components*** are selected and verified according to ***factors***
D-14.01.03P	select ***communication protocols***	***communication protocols*** are selected according to existing building automation system (BAS) and ***component*** specifications
D-14.01.04P	select location and ***enclosures***	location and ***enclosures*** are selected according to job and manufacturers' specifications, certifying bodies, ***codes, standards and regulations***

Range of Variables

original equipment specifications include: voltage, network protocols

components include: control point instrumentation (RTDs, transducers, O_2 and CO sensors, flow meters, proportional, integral and derivative [PID] components), set point instrumentation (BAS, process, stand-alone controllers)

factors include: site requirements, certifying bodies, type of equipment, manufacturers' specifications, codes, standards and regulations

communication protocols include: baud rates, network communication protocols (Modbus, BACnet [MSTP, IP], HTTP, ARP, HART, local operation network [LON]), serial port protocols (e.g., RS-232, RS-485, RS-422), communication speeds, wireless networks (e.g., Wi-Fi, ZigBee, Z-Wave)

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.3, B149.5), CEC, NBC, AHJ

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-14.01.01L	demonstrate knowledge of automation and instrumentation control systems, their ***components***, characteristics, applications and operation	identify types of automation and instrumentation control systems and their ***components***, and describe their characteristics and applications
		describe operating principles of automation and instrumentation control systems and their ***components***
		interpret information pertaining to automation and instrumentation control systems and their ***components*** found on drawings and specifications
D-14.01.02L	demonstrate knowledge of ***communication protocols***, their characteristics and applications	identify ***communication protocols***, and describe their characteristics and applications
D-14.01.03L	demonstrate knowledge of ***electrical systems***, their characteristics, applications and operation	describe ***electricity principles***
		identify ***electrical systems*** and describe their characteristics, applications and operation
		identify electrical symbols and wiring diagrams
		describe ***types of circuits***
		identify and describe conductors, semi-conductors and insulators

D-14.01.04L	demonstrate knowledge of regulatory requirements pertaining to automation and instrumentation control systems and their ***components***	identify ***codes, standards and regulations*** pertaining to automation and instrumentation control systems and their ***components***
		identify certifying bodies responsible for automation and instrumentation control systems and their ***components***

Range of Variables

components include: control point instrumentation (RTDs, transducers, O_2 and CO sensors, flow meters, proportional, integral and derivative [PID] components), set point instrumentation (BAS, process, stand-alone controllers)

communication protocols include: baud rates, network communication protocols (Modbus, BACnet [MSTP, IP], HTTP, ARP, HART, local operation network [LON]), serial port protocols (e.g., RS-232, RS-485, RS-422), communication speeds, wireless networks (e.g., Wi-Fi, ZigBee, Z-Wave)

electrical systems include: milli voltage, low voltage, line voltage (single [1] phase, three [3] phase), AC/DC, resistive

electricity principles include: Ohm's Law, Kirchhoff's Laws

types of circuits include: series, parallel, series/parallel

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.3, B149.5), CEC, NBC, AHJ

D-14.02 Installs automation and instrumentation control components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
D-14.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
D-14.02.02P	install mounting points and brackets for ***components*** and cabling	mounting points and brackets for ***components*** and cabling are installed according to manufacturers' specifications
D-14.02.03P	install ***enclosures***	***enclosures*** are installed according to job and manufacturers' specifications, ***codes, standards and regulations***
D-14.02.04P	mount and connect automation and instrumentation control systems, and their ***components***	automation and instrumentation control systems, and their ***components*** are mounted and connected according to manufacturers' specifications
D-14.02.05P	perform wiring of automation and instrumentation control systems	wiring of automation and instrumentation control systems is performed according to ***best practices***, ***codes, standards and regulations***

D-14.02.06P	program and configure controllers	controllers are programmed and configured according to job specifications such as control sequence requirements
D-14.02.07P	check control configurations	control configurations are checked to ensure they are set according to manufacturers' installation requirements and job specifications
D-14.02.08P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
D-14.02.09P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: hand tools, wiring identification equipment, network cabling tools and testers

components include: control point instrumentation (RTDs, transducers, O_2 and CO sensors, flow meters, PID components), set point instrumentation (BAS, process, stand-alone controllers)

enclosures include: structures, existing or new panels (e.g., control, electrical, junction), junction boxes, switch boxes

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.3, B149.5), CEC, NBC, AHJ

best practices include: grouped and well-organized wire runs; end wire labelling and identification; approved connection techniques; isolation of control lines, communication lines and line voltage; create and update representative as-built drawings

	Knowledge	
	Learning Outcomes	**Learning Objectives**
D-14.02.01L	demonstrate knowledge of automation and instrumentation control systems, their ***components***, characteristics, applications and operation	identify types of automation and instrumentation control systems and their ***components***, and describe their characteristics and applications
		describe operating principles of automation and instrumentation control systems, and their ***components***
		interpret information pertaining to automation and instrumentation control systems, and their ***components*** found on drawings and specifications
D-14.02.02L	demonstrate knowledge of ***communication protocols***, their characteristics and applications	identify ***communication protocols***, and describe their characteristics and applications
D-14.02.03L	demonstrate knowledge of ***electrical systems***, their characteristics, applications and operation	describe ***electricity principles***
		identify ***electrical systems***, and describe their characteristics, applications and operation

		identify electrical symbols and wiring diagrams
		describe ***types of circuits***
		identify and describe conductors, semi-conductors and insulators
D-14.02.04L	demonstrate knowledge of ***procedures to install automation and instrumentation control systems and their components***	identify ***tools and equipment*** used to install automation and instrumentation control systems, and their ***components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install automation and instrumentation control systems, and their ***components***
		describe ***procedures to install automation and instrumentation control systems, and their components***
D-14.02.05L	demonstrate knowledge of regulatory requirements automation and instrumentation control systems, and their ***components***	identify ***codes, standards and regulations*** pertaining to automation and instrumentation control systems, and their ***components***
		identify certifying bodies responsible for automation and instrumentation control systems, and their ***components***

Range of Variables

components include: control point instrumentation (RTDs, transducers, O_2 and CO sensors, flow meters, PID components), set point instrumentation (BAS, process, stand-alone controllers)

communication protocols include: baud rates, network communication protocols (Modbus, BACnet [MSTP, IP], HTTP, ARP, HART, local operation network [LON]), serial port protocols (e.g., RS-232, RS-485, RS-422), communication speeds, wireless networks (e.g., Wi-Fi, ZigBee, Z-Wave)

electrical systems include: milli voltage, low voltage, line voltage (single [1] phase, three [3] phase), AC/DC, resistive

electricity principles include: Ohm's Law, Kirchhoff's Laws

types of circuits include: series, parallel, series/parallel

procedures to install automation and instrumentation control systems, and their components include: selecting and verifying components; selecting communication protocols; selecting location and enclosures; installing mounting points and brackets for components and cabling; installing enclosures; mounting and connecting automation and instrumentation control systems and their components; performing wiring of systems; programming and configuring controllers; checking control configurations; verifying, setting up and confirming operation prior to commissioning; creating as-built final drawings

tools and equipment include: hand tools, wiring identification equipment, network cabling tools and testers

hazards include: energy sources, environmental, working at heights, confined spaces, hazardous materials (e.g., mercury, silica, asbestos, ceramic fibre insulation, lead)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.3, B149.5), CEC, NBC, AHJ

Major Work Activity E
Installs and converts fuel systems, appliances and ancillary equipment

Task E-15 Selects, installs and converts fuel systems, appliances and ancillary equipment

Task Descriptor

Gasfitters install and connect appliances to gas piping systems and energy distribution systems. They also install components that convert appliances and systems from one energy source to another.

E-15.01 Selects appliances and ancillary equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
E-15.01.01P	identify location for ***appliances and ancillary equipment***, and their ***components***	location for ***appliances and ancillary equipment***, and their ***components*** is identified according to layout, site conditions, job specifications, ***codes, standards and regulations***
E-15.01.02P	measure placement of ***appliances and ancillary equipment***, and their ***components***	placement of ***appliances and ancillary equipment***, and their ***components*** is measured according to layout, site conditions, manufacturers' specifications, ***codes, standards and regulations***
E-15.01.03P	select ***appliances and ancillary equipment***, and their ***components***	***appliances and ancillary equipment***, and their ***components*** are selected according to manufacturers' specifications, site requirements, ***codes, standards and regulations***
E-15.01.04P	select ***valve train components***	***valve train components*** are selected according to manufacturers' specifications, site requirements, ***codes, standards and regulations***
E-15.01.05P	select ***joining methods***	***joining methods*** are selected according to manufacturers' specifications, ***codes, standards and regulations***

E-15.01.06P	select ***joining compounds***	***joining compounds*** are selected according to manufacturers' specifications, ***codes, standards and regulations***
E-15.01.07P	select ***fasteners***	***fasteners*** are selected according to manufacturers' specifications, ***codes, standards and regulations***
E-15.01.08P	select accessories	accessories are selected according to manufacturers' specifications, site requirements, ***codes, standards and regulations***

Range of Variables

appliances and ancillary equipment include: hydronic, steam, domestic hot water, hot air systems, humidification, kitchen and process equipment, ovens, kilns, decorative appliances

appliance and ancillary equipment components include: regulators, valves, overpressure protection, valve trains

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CEC, NBC, AHJ, NFPA, ANSI/ASME

valve train components include: solenoids, gas valves, gas valve actuators, regulators, low/high gas pressure switches, firing valves, gauges, burners, manual shutoff valves, thermocouple shutoff valves, dual combination control shutoffs, safety shutoffs with proof of closure, safety vents, input flow control valves, input flow control valves with mechanical stop and low fire stop switches, bypass pressure regulators, pressure test points, valve proving systems, fuel filtrations

joining methods include: flanged, flared, brazed, welded, press-connect, plastic fusion

joining compounds include: thread compounds, thread sealing tapes, gaskets, brazing alloys, welding alloys

fasteners include: rods, anchors, hangers, bolts, clamps, tie wires, zip ties, epoxies

	Knowledge	
	Learning Outcomes	**Learning Objectives**
E-15.01.01L	demonstrate knowledge of ***appliances and ancillary equipment***, their ***components***, characteristics, applications and operation	identify types of ***appliances and ancillary equipment***, and their ***components***, and describe their characteristics and applications
		identify types of ***valve train components***, and describe their characteristics and applications
		describe operating principles of ***appliances and ancillary equipment***, and their ***components***
		identify ***burner types***
		describe principles and concepts of gas utilization
		describe fuel types and characteristics
		describe principles of combustion

		describe input gas pressures, flow rates and British Thermal Units per hour (Btuh) inputs
		interpret information pertaining to ***appliances and ancillary equipment***, and their ***components***, found on drawings and specifications
E-15.01.02L	demonstrate knowledge of training and certification requirements to install ***appliances and ancillary equipment***, and their ***components***	identify training and certification requirements to install ***appliances and ancillary equipment***, and their ***components***
E-15.01.03L	demonstrate knowledge of regulatory requirements pertaining to ***appliances and ancillary equipment***, and their ***components***	identify ***codes, standards and regulations*** pertaining to ***appliances and ancillary equipment***, and their ***components***
		identify certifying bodies responsible for ***appliances and ancillary equipment***, and their ***components***

Range of Variables

appliances and ancillary equipment include: hydronic, steam, domestic hot water, hot air systems, humidification, kitchen and process equipment, ovens, kilns, decorative appliances

appliance and ancillary equipment components include: regulators, valves, overpressure protection, valve trains

valve train components include: solenoids, gas valves, gas valve actuators, regulators, low/high gas pressure switches, firing valves, gauges, burners, manual shutoff valves, thermocouple shutoff valves, dual combination control shutoffs, safety shutoffs with proof of closure, safety vents, input flow control valves, input flow control valves with mechanical stop and low fire stop switches, bypass pressure regulators, pressure test points, valve proving systems, fuel filtrations

burner types include: nozzle mix, pre-mix (zero-governor), diffusion, rectifier, raw gas, low NO_X, atmospheric, immersion, forced draft, induced draft, fan assist, infrared, radiant, dual fuel

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CEC, NBC, AHJ, NFPA, ANSI/ASME

E-15.02 Installs appliances and ancillary equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
E-15.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
E-15.02.02P	install hangers and supports	hangers and supports are installed according to site conditions, ***codes, standards and regulations***
E-15.02.03P	lift and move ***appliances and ancillary equipment***, and their ***components*** into place	***appliances and ancillary equipment***, and their ***components*** are lifted and moved into place according to site conditions, ***codes, standards and regulations***
E-15.02.04P	secure and place ***appliances and ancillary equipment***, and their ***components*** in supports	***appliances and ancillary equipment***, and their ***components*** are secured and placed in supports using ***fasteners*** according to drawings and manufacturers' specifications
E-15.02.05P	secure and align ***appliances and ancillary equipment***, and their ***components*** to housekeeping pads	***appliances and ancillary equipment***, and their ***components*** are secured and aligned to housekeeping pads using ***fasteners*** according to drawings and manufacturers' specifications
E-15.02.06P	assemble ***valve train components***	***valve train components*** are assembled according to manufacturers' specifications, ***codes, standards and regulations***
E-15.02.07P	fasten supports to valve train	supports are fastened to valve train to ensure valve train is supported according to manufacturers' specifications, ***codes, standards and regulations***
E-15.02.08P	fasten supports to accessories	supports are fastened to accessories according to manufacturers' specifications, ***codes, standards and regulations***
E-15.02.09P	assemble final connection points	final connection points are assembled using approved ***joining methods*** and ***joining compounds*** according to manufacturers' specifications, ***codes, standards and regulations***

E-15.02.10P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
E-15.02.11P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: dollies, hoisting and rigging equipment, pipefitting tools (hand and power tools)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA, ANSI/ASME

appliances and ancillary equipment include: hydronic, steam, domestic hot water, hot air systems, humidification, kitchen and process equipment, ovens, kilns, decorative appliances

appliance and ancillary equipment components include: regulators, valves, overpressure protection, valve trains

fasteners include: rods, anchors, hangers, bolts, clamps, tie wires, zip ties, epoxies

valve train components include: solenoids, gas valves, gas valve actuators, regulators, low/high gas pressure switches, firing valves, gauges, burners, manual shutoff valves, thermocouple shutoff valve, dual combination control shutoff, safety shutoff with proof of closure, safety vent, input flow control valve, input flow control valve with mechanical stop and low fire stop switch, bypass pressure regulator, pressure test points, valve proving system, fuel filtration

joining methods include: flanged, flared, brazed, welded, press-connect, plastic fusion

joining compounds include: thread compounds, thread sealing tapes, gaskets, brazing alloys, welding alloys

	Knowledge	
	Learning Outcomes	**Learning Objectives**
E-15.02.01L	demonstrate knowledge of ***appliances and ancillary equipment***, their ***components***, accessories, characteristics, applications and operation	identify types of ***appliances and ancillary equipment***, and their ***components*** and accessories, and describe their characteristics and applications
		describe operating principles of ***appliances and ancillary equipment***, and their ***components*** and accessories
		identify types of ***valve train components***, and describe their characteristics and applications
		identify ***burner types***
		describe principles and concepts of gas utilization
		describe fuel types and characteristics
		describe principles of combustion
		describe input gas pressures, flow rates and Btuh inputs

		interpret information pertaining to ***appliances, ancillary equipment***, and their ***components*** found on drawings and specifications
E-15.02.02L	demonstrate knowledge of ***procedures to install appliances and ancillary equipment, and their components***	identify ***tools and equipment*** used to install ***appliances and ancillary equipment***, and their ***components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install ***appliances and ancillary equipment***
		describe ***procedures to install appliances and ancillary equipment, and their components***
E-15.02.03L	demonstrate knowledge of ***procedures to install valve trains and their components***	identify ***tools and equipment*** used to install valve trains and their ***components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install valve trains and their ***components***
		describe ***procedures to install valve trains and their components***
E-15.02.04L	demonstrate knowledge of ***procedures to install appliance and ancillary equipment accessories***	identify ***tools and equipment*** used to install ***appliance and ancillary equipment*** accessories, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install ***appliance and ancillary equipment*** accessories
		describe ***procedures to install appliance and ancillary equipment accessories***
E-15.02.05L	demonstrate knowledge of regulatory requirements pertaining to ***appliances and ancillary equipment***, and their ***components*** and accessories	identify ***codes, standards and regulations*** pertaining to ***appliances and ancillary equipment***, and their ***components*** and accessories
		identify certifying bodies responsible for ***appliances and ancillary equipment***, and their ***components*** and accessories

Range of Variables

appliances and ancillary equipment include: hydronic, steam, domestic hot water, hot air systems, humidification, kitchen and process equipment, ovens, kilns, decorative appliances

appliance and ancillary equipment components include: regulators, valves, overpressure protection, valve trains

burner types include: nozzle mix, pre-mix (zero-governor), diffusion, rectifier, raw gas, low NO_X, atmospheric, immersion, forced draft, induced draft, fan assist, infrared, radiant, dual fuel

procedures to install appliances and ancillary equipment, and their components include: identifying location, measuring placement, installing hangers and supports, lifting and moving equipment into place, securing and placing equipment in supports, securing and aligning equipment to housekeeping pads

tools and equipment include: dollies, hoisting and rigging equipment, pipefitting tools (hand and power tools)

hazards include: energy sources, environmental, working at heights, confined spaces, hazardous materials (e.g., mercury, silica, asbestos, ceramic fibre insulation, lead)

procedures to install valve trains and their components include: selecting valve train components, joining compounds and fasteners, installing hangers and supports, assembling valve train components, fastening supports to valve train, assembling final connection points

procedures to install appliance and ancillary equipment accessories include: selecting accessories, joining compounds and fasteners; fastening support to accessories; assembling final connection points

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA, ANSI/ASME

fasteners include: rods, anchors, hangers, bolts, clamps, tie wires, zip ties, epoxies

valve train components include: solenoids, gas valves, gas valve actuators, regulators, low/high gas pressure switches, firing valves, gauges, burners, manual shutoff valves, thermocouple shutoff valve, dual combination control shutoff, safety shutoff with proof of closure, safety vent, input flow control valve, input flow control valve with mechanical stop and low fire stop switch, bypass pressure regulator, pressure test points, valve proving system, fuel filtration

joining methods include: flanged, flared, brazed, welded, press-connect, plastic fusion

joining compounds include: thread compounds, thread sealing tapes, gaskets, brazing alloys, welding alloys

E-15.03 Installs fuel conversion components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
E-15.03.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
E-15.03.02P	lift and move ***fuel conversion components*** into place	***fuel conversion components*** are lifted and moved into place according to site conditions, ***codes, standards and regulations***

E-15.03.03P	secure and place ***fuel conversion components*** in supports	***fuel conversion components*** are secured and placed in supports using ***fasteners*** according to drawings and manufacturers' specifications
E-15.03.04P	confirm existing equipment hangers and supports are adequate for conversion	existing equipment hangers and supports are adequate for conversion according to job requirements, manufacturers' specifications, ***codes, standards and regulations***
E-15.03.05P	confirm venting and electrical components are adequate for conversion	venting and electrical components are adequate for conversion according to job requirements, manufacturers' specifications, ***codes, standards and regulations***
E-15.03.06P	leave previous energy source in safe and environmentally stable condition	previous energy source is left in safe and environmentally stable condition by capping lines and terminating connections
E-15.03.07P	assemble ***fuel conversion components***	***fuel conversion components*** are assembled according to manufacturers' specifications, ***codes, standards and regulations***
E-15.03.08P	fasten supports for ***fuel conversion components***	supports are fastened for ***fuel conversion components*** according to manufacturers' specifications, ***codes, standards and regulations***
E-15.03.09P	assemble final connection points	final connection points are assembled using ***joining methods*** and ***joining compounds*** according to manufacturers' specifications, ***codes, standards and regulations***
E-15.03.10P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
E-15.03.11P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: dollies, hoisting and rigging equipment, pipefitting tools (hand and power tools)

fuel conversion components include: orifices, regulators, overpressure protection, piping, gauges, burners, flame rectification, flame safeguards, solenoids, gas valves, gas valve actuators, low/high gas pressure switches, firing valves, manual shutoff valves, thermocouple shutoff valves, dual combination control shutoffs, safety shutoffs with proof of closure, safety vents, input flow control valves, input flow control valves with mechanical stop and low fire stop switches, bypass pressure regulators, pressure test points, valve proving systems, fuel filtration

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA, ANSI/ASME

fasteners include: rods, anchors, hangers, bolts, clamps, tie wires, zip ties, epoxies

joining methods include: flanged, flared, brazed, welded, press-connect, plastic fusion

joining compounds include: thread compounds, thread sealing tapes, gaskets, brazing alloys, welding alloys

	Knowledge	
	Learning Outcomes	**Learning Objectives**
E-15.03.01L	demonstrate knowledge of ***fuel conversion components***, characteristics, applications and operation	identify types of ***fuel conversion components***, and describe their characteristics and applications
		identify ***burner types***
		describe operating principles of ***fuel conversion components***
		describe principles and concepts of gas utilization
		describe fuel types and characteristics
		describe principles of combustion
		describe input gas pressures, flow rates and Btuh inputs
		describe combustion chamber design and characteristics
		describe venting and air supply requirements
		interpret information pertaining to ***fuel conversion components*** found on drawings and specifications
E-15.03.02L	demonstrate knowledge of ***procedures to install fuel conversion components***	identify ***tools and equipment*** used to install ***fuel conversion components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install ***fuel conversion components***
		describe ***procedures to install fuel conversion components***

E-15.03.03L	demonstrate knowledge of training and certification requirements to install ***fuel conversion components***	identify training and certification requirements to install ***fuel conversion components***
E-15.03.04L	demonstrate knowledge of regulatory requirements pertaining to ***fuel conversion components***	identify ***codes, standards and regulations*** pertaining to ***fuel conversion components***
		identify certifying bodies responsible for ***fuel conversion components***

Range of Variables

fuel conversion components include: orifices, regulators, overpressure protection, piping, gauges, burners, flame rectification, flame safeguards, solenoids, gas valves, gas valve actuators, low/high gas pressure switches, firing valves, manual shutoff valves, thermocouple shutoff valves, dual combination control shutoffs, safety shutoffs with proof of closure, safety vents, input flow control valves, input flow control valves with mechanical stop and low fire stop switches, bypass pressure regulators, pressure test points, valve proving systems, fuel filtration

burner types include: nozzle mix, pre-mix (zero-governor), diffusion, rectifier, raw gas, low NO_X, atmospheric, immersion, forced draft, induced draft, fan assist, infrared, radiant, dual fuel

procedures to install fuel conversion components include: identifying location, measuring placement, installing hangers and supports, lifting and moving equipment into place, securing and placing equipment in supports

tools and equipment include: dollies, hoisting and rigging equipment, pipefitting tools (hand and power tools)

hazards include: energy sources, environmental, working at heights, confined spaces, hazardous materials (e.g., mercury, silica, asbestos, ceramic fibre insulation, lead)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6), CEC, NBC, AHJ, NFPA, ANSI/ASME

Task E-16 Selects and installs propane and natural gas storage, handling and dispensing systems

Task Descriptor

Gasfitters install propane and natural gas storage tanks and cylinders, dispensers, safety devices and vaporizers for distribution and use. Depending on the jurisdiction, gasfitters – class B work on liquid propane and liquid natural gas systems and their components may be limited.

E-16.01 Selects propane and natural gas storage, handling and dispensing systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
E-16.01.01P	identify location for propane and natural gas storage, handling and dispensing systems, and their ***components***	location for propane and natural gas storage, handling and dispensing systems, and their ***components*** is identified according to layout, site conditions, job specifications, ***codes, standards and regulations***
E-16.01.02P	measure placement of propane and natural gas storage, handling and dispensing systems, and their ***components***	placement of propane and natural gas storage, handling and dispensing systems, and their ***components*** is measured according to layout, site conditions, job specifications, ***codes, standards and regulations***
E-16.01.03P	select propane and natural gas storage, handling and dispensing systems, and their ***components***	propane and natural gas storage, handling and dispensing systems, and their ***components*** are selected according to ***criteria***
E-16.01.04P	select components for cryogenic applications	components for cryogenic applications are selected according to manufacturers' specifications, ***codes, standards and regulations***
E-16.01.05P	select ***joining compounds***	***joining compounds*** are selected according to manufacturers' specifications, ***codes, standards and regulations***
E-16.01.06P	select ***fasteners***	***fasteners*** are selected according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

components (note that certain components may not be worked on by gasfitters in some provinces and territories) include: tanks, cylinders, dispensers, vaporizers, gauges, emergency shut-off devices, heaters, over-pressure protection, excessive flow protection, internal safety control valves, pumps, breakaway fittings, cathodic protection (anodes, impressed current), metering devices

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B139, B149.1, B149.2, B149.5, B108, B51), CEC, NBC, AHJ, NFPA, ANSI/ASME

criteria include: individual tank capacity, total storage capacity does not exceed restrictions based on facility type and location, system load, design ambient temperature, certification, distance to adjoining properties and buildings, tank location (above or below ground), liquid or gas storage (liquefied petroleum gas [LPG], liquefied natural gas [LNG], compressed natural gas [CNG]), pressure, bulk, fleet or public dispensing, cylinder or vehicle refuelling, horizontal or vertical tank

joining compounds include: thread compounds, thread sealing tapes, gaskets, brazing alloys, welding alloys

fasteners include: rods, anchors, hangers, bolts, clamps, tie wires, zip ties, epoxies

	Knowledge	
	Learning Outcomes	**Learning Objectives**
E-16.01.01L	demonstrate knowledge of propane and natural gas storage, handling and dispensing systems, their ***components*** characteristics, applications and operation	identify propane and natural gas storage, handling and dispensing systems, and their ***components***, and describe their characteristics and applications
		describe operating principles of propane and natural gas storage, handling and dispensing systems, and their ***components***
		interpret information pertaining to propane and natural gas storage, handling and dispensing systems found on drawings and specifications
		describe procedures for sizing propane and natural gas storage, handling and dispensing systems
E-16.01.02L	demonstrate knowledge of training and certification requirements to install propane and natural gas storage, handling and dispensing systems, and their ***components***	identify training and certification requirements to install propane and natural gas storage, handling and dispensing systems, and their ***components***
E-16.01.03L	demonstrate knowledge of regulatory requirements pertaining to propane and natural gas storage, handling and dispensing systems, and their ***components***	identify ***codes, standards and regulations*** pertaining to propane and natural gas storage, handling and dispensing systems, and their ***components***
		identify certifying bodies responsible for propane and natural gas storage, handling and dispensing systems, and their ***components***

Range of Variables

components (note that certain components may not be worked on by gasfitters in some provinces and territories) include: tanks, cylinders, dispensers, vaporizers, gauges, emergency shut-off devices, heaters, over-pressure protection, excessive flow protection, internal safety control valves, pumps, breakaway fittings, cathodic protection (anodes, impressed current), metering devices

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B139, B149.1, B149.2, B149.5, B108, B51), CEC, NBC, AHJ, NFPA, ANSI/ASME

E-16.02 Installs propane and natural gas storage, handling and dispensing systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
E-16.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
E-16.02.02P	installs hangers and supports	hangers and supports are installed according to site conditions, ***codes, standards and regulations***
E-16.02.03P	assemble piping and ***components***	piping and ***components*** are assembled according to job specifications, site conditions, ***codes, standards and regulations***
E-16.02.04P	confirm placement of vehicle protection barricades in designated space	vehicle protection barricades are in place in designated space according to job specifications, site conditions, ***codes, standards and regulations***
E-16.02.05P	place tanks and cylinders on level, solid and non-combustible base, and secure to base	tanks and cylinders are placed on level, solid, non-combustible base and secured to base using fasteners according to manufacturers' specifications, ***codes, standards and regulations***
E-16.02.06P	bury tanks	tanks are buried according to job and manufacturers' specifications, site conditions, ***codes, standards and regulations***
E-16.02.07P	connect manifold and ***components*** to distribution system for vapour and liquid withdrawal	manifold and ***components*** are connected to distribution system for vapour and liquid withdrawal according to job and manufacturers' specifications, site conditions, ***codes, standards and regulations***

E-16.02.08P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
E-16.02.09P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: dollies, hoisting and rigging equipment, pipefitting tools (hand and power tools)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B139, B149.1, B149.2, B149.5, B108, B51), CEC, NBC, AHJ, NFPA, ANSI/ASME

components include: tanks, cylinders, dispensers, vaporizers, gauges, emergency shut-off devices, heaters, over-pressure protection, excessive flow protection, internal safety control valves, pumps, breakaway fittings, cathodic protection (anodes, impressed current), metering devices

	Knowledge	
	Learning Outcomes	**Learning Objectives**
E-16.02.01L	demonstrate knowledge of propane and natural gas storage, handling and dispensing systems, their ***components*** characteristics, applications and operation	identify propane and natural gas storage, handling and dispensing systems, and their ***components***, and describe their characteristics and applications
		describe operating principles of propane and natural gas storage, handling and dispensing systems, and their ***components***
		interpret information pertaining to propane and natural gas storage, handling and dispensing systems found on drawings and specifications
		describe procedures for sizing propane and natural gas storage, handling and dispensing systems
		describe intrinsically safe devices and equipment for hazardous environments and systems
E-16.02.02L	demonstrate knowledge of ***procedures to install propane and natural gas storage, handling and dispensing systems***	identify ***tools and equipment*** used to install propane and natural gas storage, handling and dispensing systems, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install propane and natural gas handling systems
		describe ***procedures to install propane and natural gas storage, handling and dispensing systems***
		describe input gas pressures, flow rates and system loads

		describe vapour and liquid withdrawal, flaring, and tank and cylinder purging and evacuation procedures
E-16.02.03L	demonstrate knowledge of training and certification requirements to install propane and natural gas storage, handling and dispensing systems, and their ***components***	identify training and certification requirements to install propane and natural gas storage, handling and dispensing systems, and their ***components***
E-16.02.04L	demonstrate knowledge of regulatory requirements pertaining to propane and natural gas storage, handling and dispensing systems, and their ***components***	identify ***codes, standards and regulations*** pertaining to propane and natural gas storage, handling and dispensing systems, and their ***components***
		identify certifying bodies responsible for propane and natural gas storage, handling and dispensing systems, and their ***components***

Range of Variables

components include: tanks, cylinders, dispensers, vaporizers, gauges, emergency shut-off devices, heaters, over-pressure protection, excessive flow protection, internal safety control valves, pumps, breakaway fittings, cathodic protection (anodes, impressed current), metering devices

procedures to install propane and natural gas storage, handling and dispensing systems include: identifying and preparing location for system; measuring placement of system and components; installing hangers and supports; assembling piping and components; placing tanks and cylinders; burying tanks; selecting piping, supports, fittings and vehicle protection barricades; performing pressure test on piping lines; verifying, setting up and confirming operation prior to commissioning; creating as-built final drawings

tools and equipment include: dollies, hoisting and rigging equipment, pipefitting tools (hand and power tools)

hazards include: energy sources, liquid burns, vapour pooling of fuel, environmental, working at heights, confined spaces, hazardous materials (e.g., mercury, silica, asbestos, ceramic fibre insulation, lead)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B139, B149.1, B149.2, B149.5, B108, B51), CEC, NBC, AHJ, NFPA, ANSI/ASME

Task E-17 Selects and installs other fuel storage, handling and dispensing systems

Task Descriptor

Gasfitters install other fuel storage tanks and cylinders, piping, safety devices, dispensers and vaporizers for distribution and use. These can include systems for fuels such as hydrogen, biogas, digester gas, landfill gas, oil, diesel, waste oil and manufactured gas. In some jurisdictions, gasfitters may have limitations or require additional certifications to perform work on systems utilizing some fuel gases and liquid fuels.

E-17.01 Selects other fuel storage, handling and dispensing systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
E-17.01.01P	identify location for ***other fuel*** storage, handling and dispensing systems, and their ***components***	location for ***other fuel*** storage, handling and dispensing systems, and their ***components*** is identified according to layout, site conditions, job specifications, ***codes, standards and regulations***
E-17.01.02P	measure placement of ***other fuel*** storage, handling and dispensing systems, and their ***components***	placement of ***other fuel*** storage, handling and dispensing systems, and their ***components*** is measured according to layout, site conditions, ***codes, standards and regulations***
E-17.01.03P	select ***other fuel*** storage, handling and dispensing systems, and their ***components***	***other fuel*** storage, handling and dispensing systems, and their ***components*** are selected according to ***criteria,*** job specifications, ***codes, standards and regulations***
E-17.01.04P	select ***joining compounds***	***joining compounds*** are selected according to manufacturers' specifications, ***codes, standards and regulations***
E-17.01.05P	select ***fasteners***	***fasteners*** are selected according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

other fuels (note that certain fuels may not be worked on by gasfitters in some provinces and territories) include: hydrogen, biogas, digester gas, landfill gas, oil, diesel, waste oil, manufactured gas

components include: tanks, cylinders, dispensers, compressors, drip/sediment traps, filters, flame arrestors, gauges, emergency shut-off devices, over-pressure protection, excessive flow protection, internal safety control valves, pumps, breakaway fittings, cathodic protection (anodes, impressed current), metering devices, electrolysers, flare stacks

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.3, B149.5, B149.6, B51), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

criteria include: storage capacity, load demand, certification, distance to adjoining properties and buildings, tank location (above or below ground), fuel type, pressure, bulk, fleet or public vehicle dispensing, horizontal or vertical tanks, internal use or supply to gas utility grid, design ambient temperature

joining compounds include: thread compounds, thread sealing tapes, gaskets, brazing alloys, welding alloys

fasteners include: rods, anchors, hangers, bolts, clamps, tie wires, zip ties, epoxies

	Knowledge	
	Learning Outcomes	**Learning Objectives**
E-17.01.01L	demonstrate knowledge of ***other fuel*** storage, handling and dispensing systems, their ***components***, characteristics, applications and operation	identify ***other fuel*** storage, handling and dispensing systems, and their ***components***, and describe their characteristics and applications
		describe operating principles of ***other fuel*** storage, handling and dispensing systems, and their ***components***
		interpret information pertaining to ***other fuel*** storage, handling and dispensing systems found on drawings and specifications
E-17.01.02L	demonstrate knowledge of training and certification requirements to select ***other fuel*** storage, handling and dispensing systems, and their ***components***	identify training and certification requirements to select ***other fuel*** storage, handling and dispensing systems, and their ***components***
E-17.01.03L	demonstrate knowledge of regulatory requirements pertaining to ***other fuel*** storage, handling and dispensing systems, and their ***components***	identify ***codes, standards and regulations*** pertaining to ***other fuel*** storage, handling and dispensing systems, and their ***components***
		identify certifying bodies responsible for ***other fuel*** storage, handling and dispensing systems, and their ***components***

Range of Variables

other fuels (note that certain fuels may not be worked on by gasfitters in some provinces and territories) include: hydrogen, biogas, digester gas, landfill gas, oil, diesel, waste oil, manufactured gas

components include: tanks, cylinders, dispensers, compressors, drip/sediment traps, filters, flame arrestors, gauges, emergency shut-off devices, over-pressure protection, excessive flow protection, internal safety control valves, pumps, breakaway fittings, cathodic protection (anodes, impressed current), metering devices, electrolysers, flare stacks

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.3, B149.5, B149.6, B51), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

E-17.02 Installs other fuel storage, handling and dispensing systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
E-17.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
E-17.02.02P	install hangers and supports	hangers and supports are installed according to site conditions, ***codes, standards and regulations***
E-17.02.03P	assemble piping and ***components***	piping and ***components*** are assembled according to job specifications, site conditions, ***codes, standards and regulations***
E-17.02.04P	confirm placement of vehicle protection barricades in designated space	vehicle protection barricades are in place in designated space according to ***codes, standards and regulations***
E-17.02.05P	place tanks on level, solid and non-combustible base, and secure to base	tanks are placed on level, solid, non-combustible base and secured to base using fasteners according to manufacturers' specifications, ***codes, standards and regulations***
E-17.02.06P	connect manifold and ***components*** to distribution system for vapour and liquid withdrawal	manifold and ***components*** are connected to distribution system for vapour and liquid withdrawal according to manufacturers' specifications, ***codes, standards and regulations***
E-17.02.07P	verify, set up and confirm operation prior to commissioning	operation is verified, set up and confirmed prior to commissioning
E-17.02.08P	update drawings to create as-built final drawings	drawings are updated to create as-built final drawings

Range of Variables

tools and equipment include: dollies, hoisting and rigging equipment, pipefitting tools (hand and power tools)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.3, B149.5, B149.6, B51), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

components include: tanks, cylinders, dispensers, compressors, drip/sediment traps, filters, flame arrestors, gauges, emergency shut-off devices, over-pressure protection, excessive flow protection, internal safety control valves, pumps, breakaway fittings, cathodic protection (anodes, impressed current), metering devices, electrolysers, flare stacks

	Knowledge	
	Learning Outcomes	**Learning Objectives**
E-17.02.01L	demonstrate knowledge of ***other fuel*** storage, handling and dispensing systems, their ***components***, characteristics, applications and operation	identify ***other fuel*** storage, handling and dispensing systems, and their ***components***, and describe their characteristics and applications
		describe operating principles of ***other fuel*** and natural gas storage, handling and dispensing systems, and their ***components***
		interpret information pertaining to ***other fuel*** storage, handling and dispensing systems found on drawings and specifications
		describe intrinsically safe devices and equipment for hazardous environments and systems
E-17.02.02L	demonstrate knowledge of ***procedures to install other fuel storage, handling and dispensing systems, and their components***	identify ***tools and equipment*** used to install ***other fuel*** storage, handling and dispensing systems, and their ***components***, and describe their procedures for use
		identify ***hazards*** and describe safe work practices to install ***other fuel*** storage, handling and dispensing systems, and their ***components***
		describe ***procedures to install other fuel storage, handling and dispensing systems, and their components***
		describe input gas pressures, flow rates and system loads
		describe vapour and liquid withdrawal, flaring, and tank purging and evacuation procedures
E-17.02.03L	demonstrate knowledge of training and certification requirements to install ***other fuel*** storage, handling and dispensing systems, and their ***components***	identify training and certification requirements to install ***other fuel*** storage, handling and dispensing systems, and their ***components***

E-17.02.04L	demonstrate knowledge of regulatory requirements pertaining to ***other fuel*** storage, handling and dispensing systems, and their ***components***	identify ***codes, standards and regulations*** pertaining to ***other fuel*** storage, handling and dispensing systems, and their ***components***
		identify certifying bodies responsible for ***other fuel*** storage, handling and dispensing systems, and their ***components***

Range of Variables

other fuels (note that certain fuels may not be worked on by gasfitters in some provinces and territories) include: hydrogen, biogas, digester gas, landfill gas, oil, diesel, waste oil, manufactured gas

components include: tanks, cylinders, dispensers, compressors, drip/sediment traps, filters, flame arrestors, gauges, emergency shut-off devices, over-pressure protection, excessive flow protection, internal safety control valves, pumps, breakaway fittings, cathodic protection (anodes, impressed current), metering devices, electrolysers, flare stacks

procedures to install other fuel storage, handling and dispensing systems, ***and their components*** include: identifying and preparing location for other fuel system; selecting piping, supporting, fittings and vehicle protection barricades; installing hangers and supports; assembling piping and components; placing tanks; connecting manifold and component to distribution system; performing pressure test on piping lines; verifying, setting up and confirming operation prior to commissioning; creating as-built final drawings

tools and equipment include: dollies, hoisting and rigging equipment, pipefitting tools (hand and power tools)

hazards include: energy sources, environmental, working at heights, confined spaces, hazardous materials (e.g., mercury, silica, asbestos, ceramic fibre insulation, lead), site-specific hazards

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.3, B149.5, B149.6, B51), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

Major Work Activity F
Tests and commissions fuel systems, appliances and ancillary equipment

Task F-18 Tests fuel delivery systems

Task Descriptor

Gasfitters test fuel delivery systems and components to ensure safety and efficiency. Testing of the system is done after installation to verify that the system meets the design parameters and criteria prior to commissioning the system.

F-18.01 Selects testing equipment and procedures

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
F-18.01.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
F-18.01.02P	select ***testing procedure***	***testing procedure*** is selected according to specifications, ***codes, standards and regulations***

Range of Variables

tools and equipment include: gauges, valves, manometers, electronic testers, leak detection devices, pressure sources, purge burners, flare stacks

testing procedures include: isolating system; installing testing equipment; performing system pressurization testing; recording and comparing test results to code requirements, manufacturers' specifications and AHJ; purging procedures; performing flaring off and gasifying; reconnecting after testing; painting and identifying piping; performing leak test

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108, B51), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

	Knowledge	
	Learning Outcomes	**Learning Objectives**
F-18.01.01L	demonstrate knowledge of fuel piping and tubing systems, their characteristics, applications and operation	identify fuel piping and tubing systems, and describe their characteristics and applications
		describe operating principles of fuel piping and tubing systems
		interpret information pertaining to testing of fuel piping and tubing systems found on drawings, specifications, ***codes, standards and regulations***
F-18.01.02L	demonstrate knowledge of ***testing procedures*** for fuel piping and tubing systems	identify ***hazards*** and describe safe work practices to test fuel piping and tubing systems
		identify ***tools and equipment*** used to test fuel piping and tubing systems, and describe their procedures for use
		describe ***testing procedures*** for fuel piping and tubing systems
		describe purge calculations
F-18.01.03L	demonstrate knowledge of regulatory and QA/QC manual requirements to test fuel piping and tubing systems	identify QA/QC manuals, ***codes, standards and regulations*** to test fuel piping and tubing systems
		identify ***jurisdictional testing requirements***

Range of Variables

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108, B51), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

testing procedures include: isolating system; installing testing equipment; performing system pressurization testing; recording and comparing test results to code requirements, manufacturers' specifications and AHJ; purging procedures; performing flaring off and gasifying; reconnecting after testing; painting and identifying piping; performing leak test

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injury, atmospheric (explosion)

tools and equipment include: gauges, valves, manometers, electronic testers, leak detection devices, pressure sources, purge burners, flare stacks

jurisdictional testing requirements include: witness sign-off, reporting and engineers' inspection, AHJ inspection

F-18.02 Tests fuel piping and tubing systems

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
F-18.02.01P	isolate ***fuel piping and tubing system*** for testing	***fuel piping and tubing system*** is isolated for testing according to ***codes, standards and regulations***
F-18.02.02P	install ***testing equipment***	***testing equipment*** is installed according to ***codes, standards and regulations***
F-18.02.03P	perform system pressurization	system pressurization is performed using ***testing medium***
F-18.02.04P	record and compare test results to QA/QC manuals, ***codes, standards and regulations***	test results are recorded and compared to QA/QC manuals, ***codes, standards and regulations***
F-18.02.05P	perform flaring off and purging procedures	flaring off and purging procedures are performed for safe gasification of piping and tubing
F-18.02.06P	reconnect after testing, and paint and identify (label) piping and tubing	piping and tubing is reconnected after testing, painted and identified (labelled) according to ***codes, standards and regulations***
F-18.02.07P	perform leak test	leak test is performed using ***methods***

Range of Variables

fuel piping and tubing systems include: gas meters, pressure-sensitive equipment

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108, B51), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

testing equipment includes: gauges, valves, manometers, electronic testers, leak detection devices, pressure sources

testing mediums include: air, nitrogen, CO_2

methods include: approved leak testing solution, electronic combustible gas leak detector

	Knowledge	
	Learning Outcomes	**Learning Objectives**
F-18.02.01L	demonstrate knowledge of ***fuel piping and tubing systems***, their characteristics, applications and operation	identify ***fuel piping and tubing systems***, and describe their characteristics and applications
		describe operating principles of ***fuel piping and tubing systems***

		interpret information pertaining to testing of ***fuel piping and tubing systems*** found on drawings and specifications
F-18.02.02L	demonstrate knowledge of ***procedures to test fuel piping and tubing systems***	identify ***hazards*** and describe safe work practices to test ***fuel piping and tubing systems***
		identify tools and equipment used to test ***fuel piping and tubing systems***, and describe their procedures for use
		describe ***procedures to test fuel piping and tubing systems***
F-18.02.03L	demonstrate knowledge of regulatory requirements to test ***fuel piping and tubing systems***	identify ***codes, standards and regulations*** to test ***fuel piping and tubing systems***

Range of Variables

fuel piping and tubing systems include: gas meters, pressure-sensitive equipment

procedures to test fuel piping and tubing systems include: isolating system, installing testing equipment, performing system pressurization testing, recording and comparing test results, performing flaring off and purging procedures, reconnecting after testing, painting and identifying piping, performing leak test

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injury, atmospheric (explosion), pneumatic test failure

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108, B51), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

Task F-19 Commissions fuel systems, appliances and ancillary equipment

Task Descriptor

Gasfitters verify the operation of the entire system after installation to ensure that it meets codes, standards and regulations, and attains optimum performance. Providing documentation and explanation to the end user is also a key responsibility when commissioning a system.

F-19.01 Performs start-up procedures

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
F-19.01.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
F-19.01.02P	perform ***installation checks***	***installation checks*** are performed according to installation specifications, ***codes, standards and regulations***
F-19.01.03P	check electrical configurations	electrical configurations are checked to ensure voltage and amperage are set to appliance requirements, including rotation checks
F-19.01.04P	perform series of dry runs	series of dry runs are performed to test electrical, electronic and control operation
F-19.01.05P	follow manufacturers' and AHJ start-up procedures	manufacturers' and AHJ start-up procedures, including permits and permissions are followed
F-19.01.06P	commission fuel systems	fuel systems are commissioned according to manufacturers' specifications, ***codes, standards and regulations***
F-19.01.07P	perform start-up of appliances and ancillary equipment	start-up of appliances and ancillary equipment is performed according to manufacturers' specifications, ***codes, standards and regulations***

Range of Variables

tools and equipment include: gauges, valves, manometers, electronic testers, multimeters
installation checks include: valve train components, linkages, safeties, type of fuel, electrical inputs
codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

	Knowledge	
	Learning Outcomes	**Learning Objectives**
F-19.01.01L	demonstrate knowledge of procedures to commission fuel systems and perform start-up of appliances and ancillary equipment	identify ***hazards*** and describe safe work practices to perform procedures to commission fuel systems and perform start-up of appliances and ancillary equipment
		identify ***tools and equipment*** used to perform start-up procedures, and describe their procedures for use
		describe ***start-up procedures***
F-19.01.02L	demonstrate knowledge of training and certification requirements to commission fuel systems and perform start-up of appliances and ancillary equipment	identify training and certification requirements to commission fuel systems and perform start-up of appliances and ancillary equipment
F-19.01.03L	demonstrate knowledge of regulatory requirements pertaining to commissioning of fuel systems and performing start-up procedures on appliances and ancillary equipment	identify ***codes, standards and regulations*** pertaining to commissioning of fuel systems and performing start-up procedures on appliances and ancillary equipment

Range of Variables

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injury, atmospheric (explosion), pneumatic test failure

tools and equipment include: gauges, valves, manometers, electronic testers, multimeters

start-up procedures include: performing installation checks, checking electrical configurations, performing series of dry runs, following manufacturers' and AHJ start-up procedures, commissioning fuel systems, performing start-up of appliances and ancillary equipment

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

F-19.02 Performs testing, adjusting and balancing procedures

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
F-19.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
F-19.02.02P	introduce fuel and adjust ***components***	fuel is introduced and ***components*** are adjusted based on readings to achieve mixtures required for complete and efficient combustion, and according to manufacturers' specifications
F-19.02.03P	verify ***conditions*** to match system requirements	***conditions*** are verified to match system requirements
F-19.02.04P	evaluate appliance and equipment performance	appliance and equipment performance are evaluated by verifying ***factors***
F-19.02.05P	verify ***system start-up procedures***	***system start-up procedures*** are verified according to manufacturers' specifications, ***codes, standards and regulations***
F-19.02.06P	adjust and calibrate controls	controls are adjusted and calibrated according to manufacturers' specifications, system demands, ***codes, standards and regulations***
F-19.02.07P	perform ***functional operation and safety checks***	***functional operation and safety checks*** are performed
F-19.02.08P	operate appliance and equipment through several cycles	appliance and equipment are operated through several cycles to ensure they meet manufacturers' specifications

Range of Variables

tools and equipment include: manometers, multimeters, combustion analyzers, thermometers

components include: valves, dampers, regulators, operating controls, fan speeds

conditions include: medium quality, flow rates, temperature, pressures, ESP

factors include: air gas mix; combustion air volume; stack temperature; combustion analysis; CO, CO_2 and O_2 levels

system start-up procedures include: boil-outs in hot water and steam systems, refractory and equipment curing

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

functional operation and safety checks include: flame safeguards, combustion controls, draft controls, permissives, limits and interlocks

	Knowledge	
	Learning Outcomes	**Learning Objectives**
F-19.02.01L	demonstrate knowledge of measurements, ratios, theories, formulas and calculations	describe combustion measurements, theories, formulas and calculations
		describe fuel-air measurements, ratios, theories, formulas and calculations
F-19.02.02L	demonstrate knowledge of ***fuel systems, appliances and ancillary equipment***, their ***components***, characteristics, applications and operation	identify types of ***fuel systems, appliances and ancillary equipment,*** and their ***components***, and describe their characteristics and applications
		describe operating principles of ***fuel systems, appliances and ancillary equipment***, and their ***components***
		interpret information pertaining to ***fuel systems, appliances and ancillary equipment***, and their ***components*** found on drawings and specifications
F-19.02.03L	demonstrate knowledge of ***procedures to test, adjust and balance fuel systems, appliances and ancillary equipment, and their components***	identify ***hazards*** and describe safe work practices to test, adjust and balance ***fuel systems, appliances and ancillary equipment***, and their ***components***
		identify ***tools and equipment*** used to test, adjust and balance ***fuel systems, appliances and ancillary equipment,*** and their ***components***, and describe their procedures for use
		describe ***procedures to test, adjust and balance fuel systems, appliances and ancillary equipment, and their components***
		describe calculations such as pre- and post-purge times based on volumes and number of air changes
		describe combustion system and allowable products of combustion
F-19.02.04L	demonstrate knowledge of regulatory requirements pertaining to testing, adjusting and balancing of ***fuel systems, appliances and ancillary equipment***, and their ***components***	identify ***codes, standards and regulations*** pertaining to testing, adjusting and balancing of ***fuel systems, appliances and ancillary equipment***, and their ***components***

Range of Variables

fuel systems, appliances and ancillary equipment include: storage, handling and dispensing systems; hydronic; steam; domestic hot water; hot air system; humidification; kitchen and process equipment; ovens; kilns

components include: valves, dampers, regulators, operating controls, fan speeds

procedures to test, adjust and balance fuel systems, appliances and ancillary equipment, and their components include: adjusting components, adjusting and calibrating controls, performing calculations, taking measurements, performing functional operation and safety checks, evaluating appliance and equipment performance, performing start-up procedures, operating appliance and equipment through several cycles

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injuries (e.g., burns), atmospheric (explosion), pneumatic test failure

tools and equipment include: manometers, multimeters, combustion analyzers, thermometers

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

F-19.03 Completes commissioning report and handover

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
F-19.03.01P	record ***testing results*** and compare to manufacturers' baseline information	***testing results*** are recorded and compared to manufacturers' baseline information
F-19.03.02P	prepare and submit documentation required by job site, AHJ, and engineering and manufacturers' specifications	documentation required by job site, AHJ, and engineering and manufacturers' specifications are prepared and submitted
F-19.03.03P	explain system operational procedures and specifications to end user	system operational procedures and specifications are explained to end user

Range of Variables

testing results include: voltages, pressures, efficiencies, temperatures, amperages, combustion analysis, flow rates

	Knowledge	
	Learning Outcomes	**Learning Objectives**
F-19.03.01L	demonstrate knowledge of documentation requirements for commissioning, their characteristics and applications	identify documentation requirements for commissioning, and describe their characteristics and applications
		interpret information pertaining to documentation requirements for commissioning found in specifications
F-19.03.02L	demonstrate knowledge of procedures to complete commissioning reports and handover	describe procedures to complete commissioning reports
		describe procedures to hand over systems to end users
F-19.03.03L	demonstrate knowledge of regulatory requirements pertaining to commissioning reports	identify ***codes, standards and regulations*** pertaining to commissioning reports

Range of Variables

testing results include: voltages, pressures, efficiencies, temperatures, amperages, combustion analysis, flow rates

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

Major Work Activity G
Services fuel systems, appliances and ancillary equipment

Task G-20 Maintains fuel systems, appliances and ancillary equipment

Task Descriptor

Maintaining fuel systems, appliances and ancillary equipment is important to ensure safe operation, optimal efficiency and reliable service.

G-20.01 Inspects system components and operation

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
G-20.01.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
G-20.01.02P	verify that installation conforms to manufacturers' specifications, ***codes, standards and regulations***	installation is verified that it conforms to manufacturers' specifications, ***codes, standards and regulations***
G-20.01.03P	inspect ***fuel delivery system components*** and verify operation	***fuel delivery system components*** are inspected, and operation is verified
G-20.01.04P	verify operation of ***controls***	***controls*** are verified to ensure they operate according to end-user requirements, manufacturers' specifications, ***codes, standards and regulations***
G-20.01.05P	inspect ***heat delivery systems***	***heat delivery systems*** are inspected to identify operation, wear, damage or deterioration
G-20.01.06P	inspect venting, chimneys and air supply	venting, chimneys and air supply are inspected to ensure operation according to ***codes, standards and regulations***

G-20.01.07P	inspect refractory components of combustion chamber and heat exchangers	refractory components of combustion chamber and heat exchangers are inspected to identify cracks and deterioration
G-20.01.08P	inspect ***mechanical components***	***mechanical components*** are inspected to identify operation, wear, damage and deterioration
G-20.01.09P	perform sensory inspection of ***safety components*** to check operation	sensory inspection of ***safety components*** is performed to check operation
G-20.01.10P	verify functional operation of flame safeguard systems	flame safeguard systems are verified as operational
G-20.01.11P	verify functional operation of combustion control systems	combustion control systems are verified as operational
G-20.01.12P	verify functional operation of draft control systems	draft control systems are verified as operational
G-20.01.13P	verify functional operation of fuel valve train	fuel valve train is verified as operational
G-20.01.14P	test ***safety limits*** and ***controls***	***safety limits*** and ***controls*** are tested to verify operation
G-20.01.15P	inspect burner performance	burner performance is inspected by confirming fuel consumption and using ***combustion data***
G-20.01.16P	inspect condensate lines	condensate lines are inspected to verify they are clean and clear of debris
G-20.01.17P	inspect fuel valves	fuel valves are inspected to ensure complete closure
G-20.01.18P	use computers to communicate with control systems and components to verify and adjust operation	control systems and components operation are verified and adjusted using computers

Range of Variables

tools and equipment include: manometers, pressure and temperature gauges, multimeters, combustion analyzers, leak detectors, computers, electronic devices

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

fuel delivery system components include: gas lines, burners, valve trains, regulators, meters

controls include: permissives, limits, interlocks

heat delivery systems include: radiators, heat exchangers, ducts, piping, pumps, blowers, valves

mechanical components include: switches, valves, dampers, fans, motors, linkages

safety components include: UV and infrared scanners, flame-monitoring systems, thermopiles, thermocouples

safety limits include: high limit, high and low water cut-offs, flow switches, high and low gas pressure switches

combustion data includes: verify air gas mix using a combustion analyzer; combustion air volume; stack temperature; CO, CO_2 and O_2 levels; draft data; NOx; SOx

	Knowledge	
	Learning Outcomes	**Learning Objectives**
G-20.01.01L	demonstrate knowledge of ***fuel systems, appliances and ancillary equipment***, their components, characteristics, applications and operation	identify types of ***fuel systems, appliances and ancillary equipment,*** and their components, and describe their characteristics and applications
		describe operating principles of ***fuel systems, appliances and ancillary equipment***, and their components
		interpret information pertaining to ***fuel systems, appliances and ancillary equipment***, and their components found on drawings and specifications
G-20.01.02L	demonstrate knowledge of concepts and fundamentals related to fuel	describe concepts and fundamentals related to fuel
G-20.01.03L	demonstrate knowledge of concepts and fundamentals related to electricity	describe concepts and fundamentals related to electricity
G-20.01.04L	demonstrate knowledge of concepts and fundamentals related to combustion	describe concepts and fundamentals related to combustion
G-20.01.05L	demonstrate knowledge of ***procedures to inspect system components and operation***	identify ***hazards*** and describe safe work practices to inspect system components and operation
		identify ***tools and equipment*** used to inspect system components and operation, and describe their procedures for use
		describe ***procedures to inspect system components and operation***
		describe sequence of operation to assist with inspection of systems
G-20.01.06L	demonstrate knowledge of regulatory requirements pertaining to inspection of system components and operation	identify AHJ, ***codes, standards and regulations*** pertaining to inspection of system components and operation

Range of Variables

fuel systems, appliances and ancillary equipment include: storage, handling and dispensing systems; hydronic; steam; domestic hot water; hot air system; humidification; kitchen and process equipment; ovens; kilns

procedures to inspect system components and operation include: verifying that installation of system conforms to manufacturers' specifications, codes, standards and regulations; performing system inspections; verifying operation of system and controls; verifying functional operation of system; using computers to communicate with control systems and components

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injuries, atmospheric (explosion), atmospheric contamination (CO), hazardous materials

tools and equipment include: manometers, pressure and temperature gauges, multimeters, combustion analyzers, leak detectors, computers, electronic devices

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

G-20.02 Performs maintenance activities

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
G-20.02.01P	select and use tools and equipment	tools and equipment are selected and used according to task
G-20.02.02P	replace ***components***	***components*** are replaced according to maintenance schedule
G-20.02.03P	clean ***components***	***components*** are cleaned according to manufacturers' specifications
G-20.02.04P	lubricate ***components***	***components*** are lubricated according to manufacturers' specifications to ensure smooth operation of system
G-20.02.05P	remove components	components are removed using hoisting equipment
G-20.02.06P	adjust burner	burner is adjusted to safe and functional operation and manufacturers' and AHJ requirements
G-20.02.07P	document repairs required for predictive ***component*** replacement	repairs required for predictive ***component*** replacement are documented according to maintenance schedule

Range of Variables

components (to be replaced) include: belts, flame rods, filters, gaskets

components (to be cleaned) include: combustion chambers, burners, flame rods, scanners, blowers, heat exchangers

components (to be lubricated) include: valves, linkages, motors, bearings, dampers

components include: belts, flame rods, filters, gaskets, combustion chambers, burners, scanners, blowers, heat exchangers, valves, linkages, motors, bearings, dampers

	Knowledge	
	Learning Outcomes	**Learning Objectives**
G-20.02.01L	demonstrate knowledge of ***fuel systems, appliances and ancillary equipment***, their ***components***, characteristics, applications and operation	identify types of ***fuel systems, appliances and ancillary equipment***, and their ***components***, and describe their characteristics and applications
		describe operating principles of ***fuel systems, appliances and ancillary equipment***, and their ***components***
		interpret information pertaining to ***fuel systems, appliances and ancillary equipment***, and their ***components*** found on drawings and specifications
G-20.02.02L	demonstrate knowledge of ***procedures to maintain fuel systems, appliances and ancillary equipment, and their components***	identify ***hazards*** and describe safe work practices to maintain ***fuel systems, appliances and ancillary equipment***, and their ***components***
		identify tools and equipment used to maintain ***fuel systems, appliances and ancillary equipment***, and their ***components***, and describe their procedures for use
		describe ***procedures to maintain fuel systems, appliances and ancillary equipment, and their components***
G-20.02.04L	demonstrate knowledge of regulatory requirements pertaining to maintenance of ***fuel systems, appliances and ancillary equipment***, and their ***components***	identify ***codes, standards and regulations*** pertaining to maintenance of ***fuel systems, appliances and ancillary equipment***, and their ***components***

Range of Variables

fuel systems, appliances and ancillary equipment include: storage, handling and dispensing systems; hydronic; steam; domestic hot water; hot air system; humidification; kitchen and process equipment; ovens; kilns

components include: belts, flame rods, filters, gaskets, combustion chambers, burners, scanners, blowers, heat exchangers, valves, linkages, motors, bearings, dampers

procedures to maintain fuel systems, appliances and ancillary equipment, ***and their components*** include: removing, replacing, cleaning, lubricating and adjusting components; documenting required repairs

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injuries, atmospheric (explosion)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

Task G-21 Repairs fuel systems, appliances and ancillary equipment

Task Descriptor

Gasfitters repair fuel systems, appliances and ancillary equipment by diagnosing problems and isolating problem areas. They replace faulty components to correct the issue. It is important to subsequently verify the operation of the repaired system and fully document the repair work.

G-21.01 Diagnoses system components and operation

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
G-21.01.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
G-21.01.02P	verify equipment performance	equipment performance is verified to identify faults or erratic operation
G-21.01.03P	apply trade knowledge to isolate problems	trade knowledge is applied to isolate problems
G-21.01.04P	check operation of ***electrical components***	operation of ***electrical components*** is checked to manufacturers' specifications
G-21.01.05P	check fuel pressures	fuel pressures are checked to ensure switches meet operational parameters

G-21.01.06P	inspect burner performance	burner performance is inspected using ***combustion data***
G-21.01.07P	set up diagnostic monitoring devices	diagnostic monitoring devices are set up to record and identify operating conditions and interpret fault codes

Range of Variables

tools and equipment include: manometers, draft gauges, combustion analyzers, multimeters

electrical components include: fuses, transformers, contacts, relays, limit switches, control devices, flame safeguard systems

combustion data includes: verify air gas mix using a combustion analyzer; combustion air volume; stack temperature; CO, CO_2 and O_2 levels; draft data; NOx; SOx

	Knowledge	
	Learning Outcomes	**Learning Objectives**
G-21.01.01L	demonstrate knowledge of ***fuel systems, appliances and ancillary equipment***, their components, characteristics, applications and operation	identify types of ***fuel systems, appliances and ancillary equipment,*** and their components, and describe their characteristics and applications
		describe operating principles of ***fuel systems, appliances and ancillary equipment***, and their components
		interpret information pertaining to ***fuel systems, appliances and ancillary equipment***, and their components found on drawings and specifications
G-21.01.02L	demonstrate knowledge of concepts and fundamentals related to fuel	describe concepts and fundamentals related to fuel
G-21.01.03L	demonstrate knowledge of concepts and fundamentals related to electricity	describe concepts and fundamentals related to electricity
G-21.01.04L	demonstrate knowledge of concepts and fundamentals related to combustion	describe concepts and fundamentals related to combustion
G-21.01.05L	demonstrate knowledge of ***procedures to diagnose fuel systems, appliances and ancillary equipment, and their components***	identify ***hazards*** and describe safe work practices to diagnose ***fuel systems, appliances and ancillary equipment***, and their components
		identify ***tools and equipment*** used to diagnose ***fuel systems, appliances and ancillary equipment***, and their components, and describe their procedures for use
		describe ***procedures to diagnose fuel systems, appliances and ancillary equipment, and their components***
G-21.01.06L	demonstrate knowledge of manufacturers' training to diagnose ***fuel systems, appliances and ancillary equipment***, and their components	identify manufacturers' training to diagnose ***fuel systems, appliances and ancillary equipment***, and their components

G-21.01.07L	demonstrate knowledge of regulatory requirements to diagnose ***fuel systems, appliances and ancillary equipment***, and their components	identify ***codes, standards and regulations*** to diagnose ***fuel systems, appliances and ancillary equipment***, and their components
		identify ***documentation***

Range of Variables

fuel systems, appliances and ancillary equipment include: storage, handling and dispensing systems; hydronic; steam; domestic hot water; hot air system; humidification; kitchen and process equipment; ovens; kilns

procedures to diagnose fuel systems, appliances and ancillary equipment, and their components include: verifying equipment performance to identify faults or erratic operation, applying trade knowledge to isolate problems, checking operation of electrical components and fuel pressures, inspecting burner performance, setting up diagnostic monitoring devices to record and identify operating conditions, interpreting fault codes

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injuries, atmospheric (explosion)

tools and equipment include: manometers, draft gauges, combustion analyzers, multimeters

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

documentation includes: service reports, check sheets, permits

G-21.02 Replaces components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
G-21.02.01P	identify appliance and equipment	appliance and equipment are identified by make, model number, serial number and manufacturers' code
G-21.02.02P	source out parts, availability of equipment and compatibility of replacement parts	parts, availability of equipment and compatibility of replacement parts are sourced out
G-21.02.03P	verify replacement parts are all included and operate	replacement parts are verified that they are all included and operate according to specifications
G-21.02.04P	select and use tools and equipment	tools and equipment are selected and used according to task
G-21.02.05P	perform lock-out and tag-out procedures on system to isolate energy sources	system is locked out and tagged out to isolate energy sources
G-21.02.06P	remove and reassemble ***components*** to access repair area	***components*** are removed and reassembled to access repair area

G-21.02.07P	disconnect and reconnect wiring and linkages	wiring and linkages are disconnected and reconnected
G-21.02.08P	***record*** configuration of components	configuration of components is ***recorded*** to facilitate reassembly
G-21.02.09P	remove defective components and install replacement components	defective components are removed, and replacement components are installed
G-21.02.10P	dispose of and recycle defective components	defective components are disposed of and recycled according to AHJ

Range of Variables

components include: protective covers, shields

record includes: making sketches, taking photographs, marking components, storing data

	Knowledge	
	Learning Outcomes	**Learning Objectives**
G-21.02.01L	demonstrate knowledge of ***fuel systems, appliances and ancillary equipment***, their components, characteristics, applications and operation	identify types of ***fuel systems, appliances and ancillary equipment***, and their components, and describe their characteristics and applications
		describe operating principles of ***fuel systems, appliances and ancillary equipment***, and their components
		interpret information pertaining to ***fuel systems, appliances and ancillary equipment***, and their components found on drawings and specifications
G-21.02.02L	demonstrate knowledge of ***procedures to replace components***	identify ***hazards*** and describe safe work practices to replace components
		identify tools and equipment used to replace components, and describe their procedures for use
		describe ***procedures to replace components***
G-21.02.03L	demonstrate knowledge of regulatory requirements pertaining to replacement of components	identify ***codes, standards and regulations*** pertaining to replacement of components

Range of Variables

fuel systems, appliances and ancillary equipment include: storage, handling and dispensing systems; hydronic; steam; domestic hot water; hot air system; humidification; kitchen and process equipment; ovens; kilns

procedures to replace components include: identifying appliance and equipment; sourcing out parts, availability of equipment and compatibility of replacement parts; verifying replacement parts are all included and operational; performing lock-out and tag-out procedures on system; removing and reassembling components to access repair area; disconnecting and reconnecting wiring and linkages; recording configuration of components; removing defective components; installing replacement components; disposing of and recycling defective components

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injuries, atmospheric (explosion)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME, TDG

G-21.03 Verifies operation

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
G-21.03.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task
G-21.03.02P	remove lock-out and tag-out and restore energy sources	lock-out and tag-out are removed and energy sources are restored
G-21.03.03P	check operation of system	system is checked that it operates according to manufacturers' specifications, ***codes, standards and regulations***
G-21.03.04P	perform ***tests***	***tests*** are performed to verify operation
G-21.03.05P	verify ***electrical components***	***electrical components*** are verified they have correct rotation and are at rated operating parameters
G-21.03.06P	verify ***mechanical components***	***mechanical components*** are verified they are operational
G-21.03.07P	check lighting and operation of burner	burner is checked to ensure safe lighting and operation

G-21.03.08P	operate system through several cycles and monitor performance throughout	system is operated through several cycles and performance is monitored throughout
G-21.03.09P	complete ***documentation***	***documentation*** is completed according to company policies, manufacturers' requirements, ***codes, standards and regulations***

Range of Variables

tools and equipment include: manometers, draft gauges, combustion analyzers, multimeters

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

tests include: combustion analysis; flame safeguard tests; functional operation of permissives, limits and interlocks

electrical components include: motors, blowers, capacitors, contactors, relays

mechanical components include: valves, regulators, switches, pumps, bearings, seals, linkages, dampers

documentation includes: service reports, check sheets, permits, warrantees

	Knowledge	
	Learning Outcomes	**Learning Objectives**
G-21.03.01L	demonstrate knowledge of ***fuel systems, appliances and ancillary equipment***, their components, characteristics, applications and operation	identify types of ***fuel systems, appliances and ancillary equipment***, and their components, and describe their characteristics and applications
		describe operating principles of ***fuel systems, appliances and ancillary equipment***, and their components
		interpret information pertaining to ***fuel systems, appliances and ancillary equipment***, and their components found on drawings and specifications
G-21.03.02L	demonstrate knowledge of ***procedures to verify operation of fuel systems, appliances and ancillary equipment, and their components***	identify ***hazards*** and describe safe work practices to verify operation of ***fuel systems, appliances and ancillary equipment***, and their components
		identify ***tools and equipment*** used to verify operation of ***fuel systems, appliances and ancillary equipment***, and their components, and describe their procedures for use

		describe ***procedures to verify operation of fuel systems, appliances and ancillary equipment, and their components***
G-21.03.03L	demonstrate knowledge of regulatory requirements to verify operation of ***fuel systems, appliances and ancillary equipment***, and their components	identify ***codes, standards and regulations*** to verify operation of ***fuel systems, appliances and ancillary equipment***, and their components

Range of Variables

fuel systems, appliances and ancillary equipment include: storage, handling and dispensing systems; hydronic; steam; domestic hot water; hot air system; humidification; kitchen and process equipment; ovens; kilns

procedures to verify operation of fuel systems, appliances and ancillary equipment, and their components include: removing lock-out and tag-out, checking operation of system, performing tests, verifying electrical and mechanical components, checking lighting and operation of burner, operating system through several cycles and monitoring performance throughout, completing documentation

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injuries, atmospheric (explosion)

tools and equipment include: manometers, draft gauges, combustion analyzers, multimeters

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

Task G-22 Decommissions fuel systems, appliances and ancillary equipment

Task Descriptor

Gasfitters decommission fuel systems, appliances and ancillary equipment for upgrading, retrofitting or demolition. Safety and isolation of energy sources is very important.

G-22.01 Disconnects appliances and ancillary equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
G-22.01.01P	select and use tools and equipment	tools and equipment are selected and used according to task
G-22.01.02P	perform lock-out and tag-out procedures for ***energy sources***	lock-out and tag-out procedures are performed for ***energy sources***

G-22.01.03P	isolate and terminate ***energy sources***	***energy sources*** are isolated and terminated according to site requirements, AHJ, ***codes, standards and regulations***
G-22.01.04P	rig and hoist heavy equipment and components	heavy equipment and components are rigged and hoisted for removal
G-22.01.05P	disconnect and terminate control wires and tubing	control wires and tubing are disconnected and terminated
G-22.01.06P	isolate, purge and cap gas supply	gas supply is isolated, purged and capped according to ***codes, standards and regulations***
G-22.01.07P	disconnect and cap venting system	venting system is disconnected and capped
G-22.01.08P	disconnect and cap ***distribution system***	***distribution system*** is disconnected and capped
G-22.01.09P	isolate ***accessories*** from system and remove ***energy sources***	***accessories*** are isolated from system and ***energy sources*** are removed to disable function
G-22.01.10P	disconnect ***accessories*** from appliance	***accessories*** are disconnected from appliance
G-22.01.11P	check for leaks	systems are checked for leaks to ensure they are safe according to safe work practices, ***codes, standards and regulations***

Range of Variables

energy sources include: electrical, hydronic, pneumatic, mechanical, centrifugal, kinetic

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

distribution systems include: piping for distribution system, ductwork

accessories include: heating and cooling coils, humidifiers, electronic air cleaners, filtration systems, pumps

	Knowledge	
	Learning Outcomes	**Learning Objectives**
G-22.01.01L	demonstrate knowledge of ***procedures to disconnect appliances and ancillary equipment***	identify ***hazards*** and describe safe work practices to disconnect appliances and ancillary equipment
		identify tools and equipment used to disconnect appliances and ancillary equipment, and describe their procedures for use
		describe ***procedures to disconnect appliances and ancillary equipment***
		describe building systems and impact of decommissioning fuel systems

G-22.01.02L	demonstrate knowledge of training and certification requirements to disconnect appliances and ancillary equipment	identify training and certification requirements to disconnect appliances and ancillary equipment
G-22.01.03L	demonstrate knowledge of regulatory requirements to disconnect appliances and ancillary equipment	identify ***codes, standards and regulations*** to disconnect appliances and ancillary equipment

Range of Variables

procedures to disconnect appliances and ancillary equipment include: performing lock-out and tag-out procedures; isolating and terminating energy sources; rigging and hoisting heavy equipment and components; disconnecting and terminating control wires and tubing; isolating, purging and capping gas supply; disconnecting and capping venting and distribution systems; isolating accessories from system and removing energy sources; disconnecting accessories from appliance; checking for leaks

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injuries, atmospheric (explosion)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME

G-22.02 Removes appliances and ancillary equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
G-22.02.01P	select and use tools and equipment	tools and equipment are selected and used according to task
G-22.02.02P	rig and hoist heavy appliances, ancillary equipment and components	heavy appliances, ancillary equipment and components are rigged and hoisted for removal
G-22.02.03P	coordinate with ***personnel*** to move appliances and ancillary equipment	***personnel*** to move appliances and ancillary equipment is coordinated
G-22.02.04P	remove appliances, accessories and ancillary equipment as required	appliances, accessories and ancillary equipment are removed as required
G-22.02.05P	store appliances and ancillary equipment	appliances and ancillary equipment are stored according to site requirements
G-22.02.06P	dispose of and recycle appliances, accessories and ancillary equipment	appliances, accessories and ancillary equipment are disposed of and recycled according to environmental acts, jurisdictional regulations and best practices

Range of Variables

personnel include: designates, other tradespersons, contractors

	Knowledge	
	Learning Outcomes	**Learning Objectives**
G-22.02.01L	demonstrate knowledge of ***procedures to remove appliances, ancillary equipment and their components***	identify ***hazards*** and describe safe work practices to remove appliances, ancillary equipment and their components
		identify tools and equipment used to remove appliances, ancillary equipment and their components, and describe their procedures for use
		describe ***procedures to remove appliances, ancillary equipment and their components***
G-22.02.02L	demonstrate knowledge of training and certification requirements to remove appliances, ancillary equipment and their components	identify training and certification requirements to remove appliances, ancillary equipment and their components
G-22.02.03L	demonstrate knowledge of regulatory requirements pertaining to removal and disposal of appliances, ancillary equipment and their components	identify ***codes, standards and regulations*** pertaining to removal and disposal of appliances, ancillary equipment and their components

Range of Variables

procedures to remove appliances, ancillary equipment and their components include: rigging and hoisting heavy appliances and ancillary equipment, and their components; coordinating with personnel to move appliances and ancillary equipment; removing appliances, accessories and ancillary equipment; storing appliances and ancillary equipment; disposing of and recycling appliances, accessories and ancillary equipment

hazards include: compressed gas, flammable gas, equipment failure, electrocution, alternate energy systems, physical injuries, atmospheric (explosion)

codes, standards and regulations (note that certain codes may not be adopted in some provinces and territories) include: CSA (B149.1, B149.2, B149.3, B149.5, B149.6, B108), CAN/BNQ 1784, CEC, NBC, AHJ, NFPA, ANSI/ASME, TDG

Appendix A
Acronyms

ARP	Address Resolution Protocol
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BAS	building automation system
Btuh	British thermal units per hour
CCUS	carbon capture, utilization and storage
CEC	Canadian Electrical Code
CNG	compressed natural gas
CNZEAA	Canadian Net-Zero Emissions Accountability Act
CSA	Canadian Standards Association
CSST	corrugated stainless steel tubing
DSI	direct spark ignitor
ECM	electronically commutated motors
ESP	external static pressure
HEPA	high-efficiency particulate air
HSI	hot surface ignition
HTTP	Hypertext Transfer Protocol
HVAC	heating, ventilation and air conditioning
ICI	industrial, commercial and institutional
IR	infrared
kW	kilowatts
LEED	Leadership in Energy and Environmental Design
LEL/UEL	Lower Explosive Level/Upper Explosive Level
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LON	local operation network
mA	milliamps
MCC	motor control centre
MEWP	mobile elevated work platforms
MIG	Metal Inert Gas
NBC	National Building Code
NECB	National Energy Code of Canada for Buildings
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OHS	Occupational Health and Safety

PID	proportional, integral and derivative
P&ID	piping and instrumentation drawings
PLC	programmable logic controller
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RNG	renewable natural gas
RPM	revolutions per minute
RTD	resistance temperature detector
SCBA	self-contained breathing apparatus
SCR	silicon-controlled rectifiers
SDS	Safety Data Sheets
SSR	solid-state relay
TDG	Transport of Dangerous Goods
TIG	Tungsten Inert Gas
UPS	uninterrupted power supply
UV	ultraviolet
VFD	variable frequency drive
WHMIS	Workplace Hazardous Materials Information System
ZCB	Zero Carbon Building
ZEV	zero-emission vehicle

Appendix B
Tools and Equipment/Outils et équipement

Personal Protective Equipment (PPE) and Safety Equipment/Équipement de protection individuelle (EPI) et de sécurité

air quality monitors	dispositifs de surveillance de la qualité de l'air
aprons	tabliers
arc flash protection	protecteurs contre les arcs électriques
barricades/guardrails/pylons	barrières, garde-corps, cônes
detection devices (carbon monoxide, combustible gas)	détecteurs (de monoxyde de carbone, de gaz combustible)
eye wash kits	trousses de rinçage oculaire
face shields	écrans faciaux
fall-arrest and restraint systems	dispositifs antichute et systèmes de retenue
fire blankets	couvertures antifeu
fire extinguishers	extincteurs
fire-retardant clothing	vêtements ignifuges
first-aid kits	trousses de premiers soins
gloves (industrial rubber [low/high voltage] and leather)	gants (en cuir et en caoutchouc industriel [hautes et basses tensions])
hard hats	casques de protection
hearing protection (plugs, muffs)	protecteurs d'oreilles (bouche-oreilles, casque antibruit)
high-visibility clothing	gilet de haute visibilité
leather chaps	jambières de cuir
lock-out devices and padlocks	dispositifs de verrouillage et cadenas
masks (dust, particle and filter)	masques (antipoussières, antiparticules et filtrants)
overalls (fire-rated)	salopettes (résistantes au feu)
rain suits	ensembles imperméables
respirators	appareils de protection respiratoire
respirator cartridges	cartouches filtrantes de l'appareil respiratoire
respiratory masks	masques respiratoires
rubber boots	bottes en caoutchouc
safety boots	bottes de sécurité
safety glasses/goggles	lunettes de sécurité et de protection
self-contained breathing apparatus (SCBA)	appareils respiratoires autonomes (ARA)
warning signs and caution tape	panneaux d'avertissement et rubans de mise en garde
welder visors	visières de soudage
welding screens	écrans de soudeur

Hand Tools/Outils à main

adjustable wrenches	clés réglables
angle finders	rapporteurs d'angles
bearing pullers	extracteurs de roulement
bolt cutters	coupe-boulons
bolt dies	filières à boulons
bolt taps	tarauds à boulons
brooms	balais

brushes (wire, paint, acid and fitting)	brosses (métalliques, brosses à peinturer, brosses pour application d'acide, de raccords)
callipers	pieds à coulisse
caulking guns	pistolets à calfeutrer
C-clamps	serre-joints en C
centre-point sets	ensembles de pointeaux centreurs
chalk lines	cordeaux traceurs
chisels	ciseaux
cloths (sand, emery, sandpaper)	toiles (abrasives, toiles d'émeri, papiers abrasifs)
cold-chisel sets	jeux de ciseaux à froid
combination wire strippers	pinces à dénuder combinées
combination wrench sets (imperial and metric)	jeux de douilles (métrique et impérial)
conduit benders	cintreuses de tuyaux
crimpers	sertisseurs
crowbars	leviers
differential pressure gauges	manomètres différentiels
dollies	plateaux roulants
draft gauges	indicateurs de tirage
drift-punch sets	ensembles de chasse-goupilles
extendable mirrors	miroirs extensibles
feeler gauges	jauges d'épaisseur
files	limes
fish tapes	rubans de tirage
flange alignment pins	chevilles de positionnement à collet
flange spreaders (jacks)	écarteurs de bride (crics)
flaring tools	outils à évaser
flashlights	lampes de poche
folding rules	règles pliantes
fuse pullers	arrache-fusibles
gas cylinders, and soldering and brazing equipment	bouteilles de gaz comprimé et matériel de brasage et de brasage tendre
gas leak detector solution	solution de détection de fuites de gaz
gasket cutters	coupeurs de joints
grease guns	pistolets graisseurs
hacksaws	scies à métaux
hammers (claw, ball peen, sledge, brass, chipping, soft-face)	marteaux (arrache-clous, à panne ronde, masses, en laiton, à piquer, massettes)
hand crimpers	sertisseurs à main
hand drills	perceuses à main
hand saws	scies à main
hex/torx keys (set)	ensembles de clés à six pans et torx
hole saws	scies-cloche
ignition tools (sparker, torch)	dispositifs d'allumage (allumeurs, chalumeaux)
keyhole saws	scies à guichet
knives	couteaux
knockout (k.o.) sets	ensembles de scies emporte-pièces
labelling machines	étiqueteuses
levels (line, laser and transit)	niveaux (de ligne, à laser et théodolites)
nut driver sets	ensembles de tourne-écrous
oiling cans	burettes à huile
orifice drills	perceuses d'orifice
pencils and pads	crayons et bloc-notes
PEX pipe expanders (manual)	outils à main pour agrandir les tuyaux en polyéthylène réticulé
picks	pics

pipe cutters (single-wheel, multi-wheel)	coupe-tuyaux (à roulette unique, à roulettes)
pipe stands (roller and V type)	supports à tuyaux (à tête de rouleau, à tête en V)
pipe taps	tarauds pour tuyauterie
pipe threaders	filières à tuyaux
pipe vises (chain and yokes, tri-stand and bench vise)	étaux à tuyaux (à chaine et à charnière, sur trépied et d'établi)
pipe wraparounds	bandes à tracer pour tuyaux
pipe wrenches	clés à tuyaux
pitot tubes (velometer)	tubes de Pitot (vélomètres)
plastic pipe cutters	coupes-tuyaux pour plastique
pullers	extracteurs
punches	poinçons
purging equipment	matériel de purge de gaz
rasps	râpes
ratchets	clés à rochet
reamers	alésoirs
scratch awls	pointes à tracer
screw extractors	extracteurs de vis
screwdrivers (complete set)	tournevis (ensemble complet)
shovels	pelles
socket sets (imperial and metric)	jeux de clés combinées (impérial et métrique)
spacing tools	outils d'espacement
spud wrenches	clés à mâchoires
squares	équerres
strikers	gâches
swaging tools	outils de sertissage
swedge (hand flaring tool)	outils de sertissage (outil à évaser à main)
T squares	équerres en T
tap and die sets	jeux de tarauds et de filières
tape measurers	rubans à mesurer
threading hand dies	filières à main
tin snips	cisailles de ferblantier
tip cleaners	nettoyeurs de buse
toolboxes	boîtes à outils
torches	chalumeaux
torque wrenches	clés dynamométriques
transfer pumps (hand-operated)	pompes de transfert (manuelles)
tri-squares	équerres de menuisier
tube benders	cintreuses de tuyaux rigides
tube cleaners	nettoie-tubes
tube cutters	coupe-tubes
utility brushes	brosses à usages multiples
wire strippers	pinces à dénuder
wood chisels	ciseaux à bois

Power Tools/Outils mécaniques

air compressors and accessories	compresseurs d'air et accessoires
air tools	outils pneumatiques
arc welders (electrical, fuel)	soudeuses à l'arc (électriques, essence)
band saws	scies à ruban
blowers	soufflantes
chop-saws	tronçonneuses à disque
circular saws	scies circulaires
compressed gas cylinders (purge, shield,	bouteilles de gaz comprimé (purge, écran,

cutting)	coupage)
cordless tools (drills, saws)	outils sans fil (perceuses et scies)
gas coring machine	carotteuse à essence
crimping tools	outils de sertissage
electric drills	perceuses électriques
exhaust fans	ventilateurs extracteurs
grinders (electric or pneumatic, angle, bench, die, pedestal)	meuleuses (électriques ou pneumatiques, d'angle, d'établi, à rectifier les matrices, sur socle)
hammer-drills	perceuses à percussion
heat guns	pistolets thermiques
impact drivers	visseuses à percussion
impact guns	pistolets à percussion
impact wrenches	clés à chocs
jigsaws	scies sauteuses
knockout cutters	outils à emporte-pièce
lighting equipment	appareillage d'éclairage
nibblers	grignoteuses
PEX pipe expanders (power)	outils mécaniques pour agrandir les tuyaux en polyéthylène réticulé
portable band saws (hacksaws)	scies à ruban portatives (scies à métaux)
powder-actuated tools	outils à charge explosive
power pipe threaders	filières à tuyaux mécaniques
power threading machines	machines à fileter mécaniques
propane tiger torches (preheating)	buses de lance-flammes au propane (préchauffage)
reciprocating saws	scies alternatives
rotary hammers	marteaux perforateurs rotatifs
soldering guns	pistolets à souder
tank lifters	chariots de bouteille de gaz
transfer pumps	pompes de transfert
vacuum cleaners (high-efficiency particulate air [HEPA])	aspirateurs à filtre HEPA
welding equipment (Metal Inert Gas [MIG], Tungsten Inert Gas [TIG])	matériel de soudage (MIG, TIG)

Technical Instruments and Testers/Instruments techniques et matériel d'essai

alignment tools	outils d'alignement
atmosphere testers	appareils de contrôle de la qualité de l'air
calculators	calculatrices
calipers	étriers
capacitor testers	capacimètres
clamp-on ammeters	pinces ampèremétriques
combustion analyzers	analyseurs de combustion
computers	ordinateurs
data recorders	enregistreurs de données
dial indicators	indicateurs à cadran
differential pressure gauges and sight tubes	manomètres différentiels et tubes de regard
digital recordings	enregistrements de données
digital tachometers	tachymètres numériques
draft gauges	indicateurs de tirage
drafting equipment	équipement de dessin
electronic leak detectors	détecteurs de fuites électroniques
ground resistance testers	pinces de contrôle de la résistance de terre
hand pumps and accessories	pompes manuelles et accessoires

hydrostatic pumps and gauges (manual and power)	pompes et jauges hydrostatiques (à main et mécaniques)
manometers	manomètres
manufacturer-specific diagnostic equipment	équipement de diagnostic propre au fabricant
megohmmeters	mégohmmètres
micrometers	micromètres
multimeters (voltage, amperage, resistance)	multimètres (tension, intensité, résistance)
ohmmeters	ohmmètres
rotameters	rotamètres
rulers	règles
scale rulers	règles graduées
squares (standard 24 in. combination, flange, straightedge)	équerres (normales de 24 pouces, combinées, à bride, de précision)
string lines	cordeaux
temperature testers	appareils d'essai de la température
thermocouple testers	testeurs de thermocouple
thermometers (infrared, electronic, mechanical)	thermomètres (à infrarouges, électroniques, mécaniques)
true RMS meters	multimètres à valeur efficace vraie (RMS)
velocity meters	compteurs de vitesse

Access Equipment/Équipement d'accès

ladders (combination, extension, step)	échelles (transformables, coulissantes, escabeaux)
mobile elevated work platforms (electrical, hydraulic, pneumatic, hand and power winch, one-person, platform, scissor lift, articulating boom)	plateformes de travail élévatrices mobiles (électriques, hydrauliques, pneumatiques, treuils à main, treuils à moteur, plateformes, nacelles, plateformes élévatrices à ciseaux, nacelles articulées)
scaffolding	échafaudages

Lifting, Rigging and Hoisting Equipment/Équipement de levage, de gréage et de hissage

chokers	attaches à étranglement
eye bolts	boulons à œil
portable wire rope winches	treuils portables à câble en acier
rigging tools (blocks, come-alongs, snatch block, handlines and pulleys)	outils de gréage (moufles, palans manuels, poulies à chape ouvrante, cordes de service, poulies)
ropes/cables (wire, nylon [synthetic])	cordes et câbles en acier ou en nylon (synthétique)
shackles (varying sizes)	manilles (tailles variées)
spreader beams	palonniers
slings	élingues

Appendix C
Glossary/Glossaire

Note: a list of definitions can be referred to in all CSA codes for clarification and meaning of terms and items used in the trade.

accessory	part capable of performing an independent function and contributing to the operation of the appliance or gas piping system that it serves	**accessoire**	pièce capable de remplir une fonction indépendante et de contribuer au fonctionnement de l'appareil ou de la tuyauterie de gaz qu'elle dessert
building as a system	building is made up of components that work together to form an integrated system	**bâtiment en tant que système**	bâtiment constitué de composants adaptés les uns aux autres pour former un système intégré
forced draft	a mechanical draft produced by a device upstream form the combustion zone of an appliance producing a positive combustion chamber pressure	**tirage forcé**	tirage mécanique produit par un dispositif en amont de la zone de combustion d'un appareil produisant une pression positive dans la chambre de combustion
induced draft	a mechanical draft produced by a device downstream form the combustion zone of an appliance producing a negative combustion chamber pressure	**tirage induit**	tirage mécanique produit par un dispositif en aval de la zone de combustion d'un appareil produisant une pression négative dans la chambre de combustion
spool sheet	pipe fabrication details	**schéma de raccordement**	plan détaillé de la fabrication de la tuyauterie