VOCATIONAL TRAINING PROGRAM

PLUMBING AND HEATING (DVS 5833)

Training Sector: Buildings and Public Works

Québec

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Training Sector : Buildings and Public Works

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Introduction to the Program

In vocational training, a program of study presents the competencies required to practise a given trade or occupation at entry level on the job market. The training provided allows students to acquire a degree of versatility that will be useful in their career and personal development.

A program is a coherent set of competencies to be developed. It outlines the knowledge and broad orientations to be favoured during training. The competencies correspond to the tasks of the trade or occupation or to activities related to work, vocational or personal life, depending on the case. Learning is acquired in a specific achievement context and targets the ability to act, succeed and evolve.

According to the *Education Act*,[1] "every program shall include compulsory objectives and contents and may include optional objectives and contents that shall be enriched or adapted according to the needs of students who receive the services." For behavioural competencies, the compulsory components include the statement of the competency, the elements of the competency, the achievement context and the performance criteria; for situational competencies, they include the corresponding components.

For information purposes, programs also provide a grid of competencies, educational aims, a summary of competency-related knowledge and know-how, and guidelines. They also specify the suggested duration of each competency. All optional components of a program may be enriched or adapted according to the needs of the students, the environment and the workplace.

Program Components

Program Goals

Program goals consist of the expected outcome at the end of training as well as a general description of a given trade or occupation. They also include the four general goals of vocational training.

Educational Aims

Educational aims are broad orientations to be favoured during training in order to help students acquire intellectual or motor skills, work habits or attitudes. Educational aims usually address important aspects of career and personal development that have not been explicitly included in the program goals or competencies. They serve to orient appropriate teaching strategies to contextualize students' learning, in keeping with the dimensions underlying the practice of a trade or occupation. They help guide educational institutions in implementing the program.

Competency

A competency is the ability to act, succeed and evolve in order to adequately perform tasks or activities related to one's working or personal life, based on an organized body of knowledge and skills from a variety of fields, perceptions, attitudes, etc.

A competency in vocational training can be defined in terms of a behaviour or a situation, and includes specific practical guidelines and requirements for learning.

1. Behavioural Competency

A behavioural competency describes the actions and the results expected of the student. It consists of the following features:

[1] *Education Act,* R.S.Q., c. I-13.3, s 461.

- The *statement of the competency* is the result of the job analysis, the orientations and general goals of vocational training and other determinants.
- The *elements of the competency* correspond to essential details that are necessary in order to understand the competency and are expressed in terms of specific behaviours. They refer to the major steps involved in performing a task or to the main components of the competency.
- The *achievement context* corresponds to the situation in which the competency is exercised at entry level on the job market. The achievement context attempts to re-create an actual work situation but does not describe a learning or evaluation situation.
- The *performance criteria* define the requirements to be respected. They may refer to elements of the competency or to the competency as a whole. When associated with a specific element, performance criteria are used to judge whether a competency has been acquired. When associated with the competency as a whole, the criteria describe the requirements for performing a task or activity and provide information on the expected level of performance or the overall quality of a product or service.

2. Situational Competency

A situational competency describes the situation in which students are placed to acquire learning, and allows for actions and results to vary from one student to another. It consists of the following features:

- The *statement of the competency* is the result of the job analysis, the orientations and general goals of vocational training and other determinants.
- The *elements of the competency* outline the essential aspects of the competency and ensure a better understanding of the competency with respect to the expected outcome. The elements of the competency are fundamental to the implementation of the learning situation.
- The *learning context* provides a broad outline of the learning situation designed to help the students develop the required competency. It is normally divided into three key phases of learning: information, participation and synthesis.
- The *instructional guidelines* provide reference points and means for teachers to ensure that learning takes place and that the context in which it occurs is always the same. These guidelines may include general principles or specific procedures.
- The *participation criteria* describe requirements that the students must meet when participating in learning activities. They focus on how the students take part in the activities rather than on the results obtained. Participation criteria *are* normally provided for each phase of the learning situation.

Competency-Related Knowledge and Know-How

Competency-related knowledge and know-how, together with related guidelines, are provided for information purposes. Competency-related knowledge and know-how define the essential and meaningful learning that students must acquire in order to apply and continue to develop the competency. They are in keeping with the job market and are accompanied by guidelines that provide information about the field of application, level of complexity and learning content. They generally encompass learning associated with knowledge, skills, strategies, attitudes, perceptions, etc.

Duration

The total duration of the program is compulsory and must be observed. It consists of teaching time, which includes time for the evaluation of learning and for enrichment or remedial activities, depending on the students' needs. The duration indicated for a given competency refers to the amount of time needed to develop the competency.

The amount of teaching time corresponds to the amount of time allotted to training, which is established during program development as the average amount of time needed to acquire a competency and evaluate learning. This duration is helpful in organizing training.

Credit

A credit is a unit used for expressing the quantitative value of each competency. One credit corresponds to 15 hours of training.

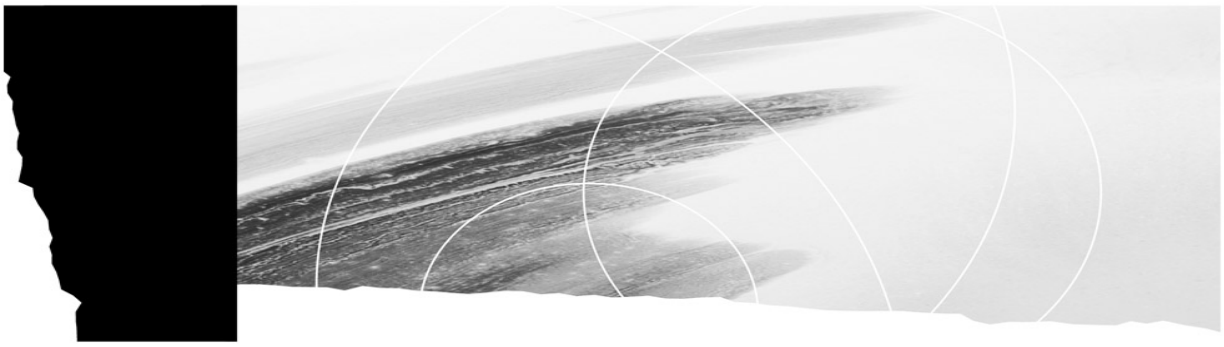
Aspects of Program Implementation

Program-Based Approach

The program-based approach is founded on a comprehensive view of a program of study and its components (e.g. goals, educational aims, competencies). It requires concerted action among all players involved, from the initial stages of program design and development, to program implementation and evaluation. It consists in ensuring that all of the actions and activities proposed are based on the same aims and take into account the same orientations. For students, the program-based approach makes training more meaningful as it presents learning as a coherent whole.

Competency-Based Approach

In vocational training, the competency-based approach uses a teaching philosophy that is designed to help students mobilize their own individual sets of resources in order to act, succeed and evolve in different contexts, according to established performance levels with all the required knowledge and know-how (e.g. skills, strategies, attitudes, perceptions). The competency-based approach is carried out in situations that are relevant to the students' working life and personal life.



5833	**Plumbing and Heating**

Year of approval: 2011

Certification:	Diploma of Vocational Studies
Number of credits:	112 credits
Number of competencies:	21 competencies
Total duration:	1 680 hours

To be eligible for admission to the *Plumbing and Heating* program, candidates must meet one of the following requirements:

Persons holding a Secondary School Diploma or its recognized equivalent.

OR

Persons who are at least 16 years of age on September 30 of the school year in which their training is to begin and have earned the Secondary IV credits in language of instruction, second language and mathematics in the programs of study established by the Minister, or have been granted recognition of equivalent learning.

OR

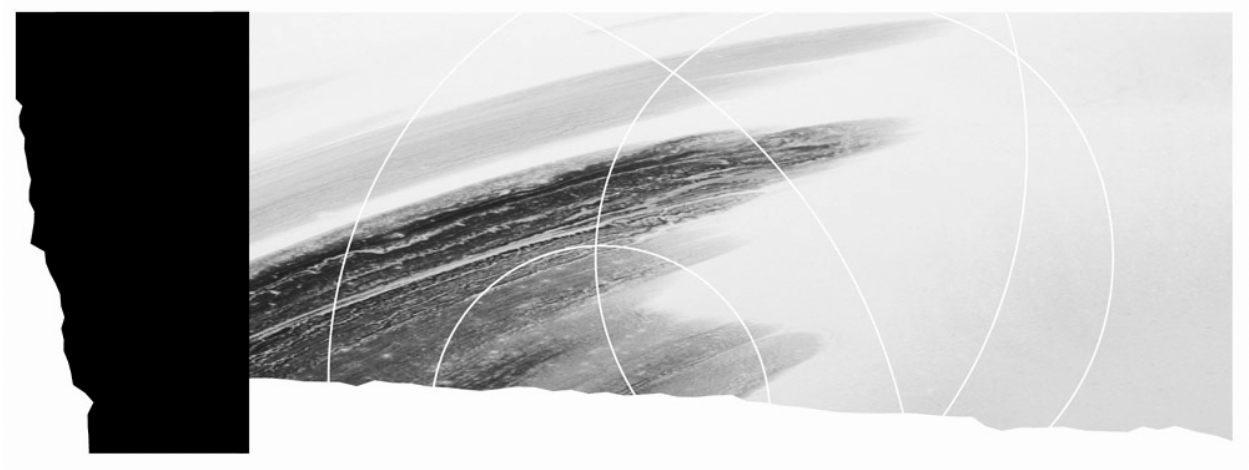
Persons who are at least 18 years of age upon entry into the program and have the following functional prerequisites: the successful completion of the general development test, English ENG 3101-1 and 3102-2 and mathematics MTH 1101-3, or recognition of equivalent learning.

OR

Persons having earned Secondary III credits in language of instruction, second language and mathematics in the programs of study established by the Minister and who will continue their general education courses concurrently with their vocational training in order to obtain the credits they are missing among the following: Secondary IV language of instruction, second language and mathematics in the programs of study established by the Minister.

The duration of the program is 1 680 hours, which includes 1 050 hours spent on the specific competencies required to practise the trade or occupation and 630 hours on general, work-related competencies. The program of study is divided into 21 competencies which vary in length from 15 to 120 hours. The total hours allocated to the program include time devoted to teaching, evaluation of learning and enrichment or remedial activities.

Competency	Code	Number	Hours	Credits
The Trade, the Training Process and Communication in the Workplace	807402	1	30	2
Health and Safety on Construction Sites	754992	2	30	2
Handling Equipment, Materials and Products	807414	3	60	4
Mechanical Piping Systems	807428	4	120	8
Installing Electrical Components	807435	5	75	5
Interpreting Plans and Specifications	807443	6	45	3
Installing Drainage Systems	807458	7	120	8
Installing Ventilation Systems	807468	8	120	8
Electrical and Electronic Control Systems	807478	9	120	8
Basic Welding-Brazing	807485	10	75	5
Installing Hot and Cold Water Distribution Systems, Plumbing Fixtures and Accessories	807498	11	120	8
Maintaining and Repairing Pipes, Plumbing Fixtures and Accessories	807505	12	75	5
Energy and Heating	807513	13	45	3
Installing, Maintaining and Repairing Oil-Burning Appliances	807528	14	120	8
Installing and Repairing Direct and Reverse Heating Systems	807538	15	120	8
Installing and Repairing Perimeter Heating Systems	807544	16	60	4
Installing Gas-Burning Systems	807558	17	120	8
Installing and Repairing Radiant Heating Systems	807565	18	75	5
Install and Repair Low-Pressure Steam Heating Systems	807578	19	120	8
Organizations Involved in the Construction Industry	754991	20	15	1
Job Search Techniques	807581	21	15	1



Part I

Program Goals

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Program Goals

The *Plumbing and Heating* program prepares students to practise the trade of pipe fitter.

This trade is part of the building services sector and includes two specialties: plumbing and heating. Generally speaking, pipe fitters install, modify, repair and maintain plumbing and heating systems. More specifically, they work on pipes in water supply and drainage systems. They also work on pipes and other components of hydronic, steam, forced air, oil, radiant, natural gas and propane heating systems. They are interested in new technologies, in particular renewable energy (e.g. geothermic, solar).

Provided they meet the necessary requirements, pipe fitters can work in the construction sector and in other sectors, in particular in the residential, commercial and institutional subsectors. They may also work in the industrial sector in areas other than construction.

The program goals of the *Plumbing and Heating* program are based on the general goals of vocational training. These goals are as follows:

- To help students develop effectiveness in the practice of a trade, that is:
  - to teach students to perform roles, functions, tasks and activities associated with the trade upon entry into the job market
  - to enable students to acquire the competencies they need to obtain a Competency Certificate–Apprentice (CCA) and those that will allow them, after the necessary apprenticeship periods, to obtain a Competency Certificate–Journeyman (CCJ) in order to work in the construction industry
  - to prepare students to progress satisfactorily on the job (which implies having the technical and technological knowledge and skills in such areas as communication, problem solving, decision making, ethics and health and safety
- To help students integrate into the work force, that is:
  - to familiarize students with the specific context of the trade of pipe fitter
  - to familiarize students with their rights and responsibilities as workers
- To foster students' personal development and acquisition of occupational knowledge, skills, perceptions and attitudes, that is:
  - to help students develop their autonomy and ability to learn, and acquire effective work methods
  - to help students understand the principles underlying the techniques and the technology used in the trade
  - to help students develop self-expression, creativity, initiative and entrepreneurial spirit
  - to help students adopt the attitudes required to successfully practise the trade, and instill in them a sense of responsibility and a concern for excellence
- To promote job mobility, that is:
  - to help students develop positive attitudes toward change
  - to help students develop the means to manage their careers by familiarizing them with entrepreneurship

Educational Aims

The aim of the *Plumbing and Heating* program is to help students develop attitudes and behaviours that representatives from education and the field deem essential to the practice of the trade:

1. Autonomy
2. The ability to evaluate their achievements
3. An understanding of the impact of the quality of their work on customer satisfaction
4. The ability to keep up to date with new trends and technologies in the field of plumbing and heating
5. A concern for engaging in lifelong learning in order to keep their competencies up to date

Statements of the Competencies

List of Competencies

- Determine their suitability for the trade and the training process and their ability to communicate in the workplace.
- Safeguard health, safety and physical well-being on construction sites.
- Handle equipment, materials and products.
- Assemble mechanical piping systems.
- Install electrical components.
- Interpret plans and specifications.
- Install drainage systems.
- Install ventilation systems.
- Work on electrical and electronic control systems.
- Do welding and brazing work.
- Install hot and cold water distribution systems, plumbing fixtures and accessories.
- Maintain and repair pipes, plumbing fixtures and accessories.
- Present information about energy and heating.
- Install, maintain and repair oil-burning appliances.
- Install and repair direct and reverse heating systems.
- Install and repair perimeter heating systems.
- Install natural gas- and propane-burning systems.
- Install and repair radiant heating systems.
- Install and repair low-pressure steam heating systems.
- Become familiar with the organizations involved in the construction industry.
- Use job search techniques.

Grid of Competencies

The grid of competencies shows the relationship between general competencies, which correspond to work-related activities, and specific competencies, which are required to practise the particular trade or occupation.

The general competencies appear on the horizontal axis and the specific competencies, on the vertical axis. The symbol (○) indicates a correlation between a general and a specific competency. Shaded symbols indicate that these relationships have been taken into account in the acquisition of specific competencies. The logic used in constructing the grid influences the course sequence. Generally speaking, this sequence follows a logical progression in terms of the complexity of the learning involved and the development of the students' autonomy. The vertical axis presents the specific competencies in the order in which they should be acquired and serves as a point of departure for determining how all of the competencies will be taught.

GRID OF COMPETENCIES

PLUMBING AND HEATING				**GENERAL COMPETENCIES**										
SPECIFIC COMPETENCIES	**Competency number**	**Type of competency**	**Duration (in hours)**	Determine their suitability for the trade and the training process and their ability to communicate in the workplace	Safeguard health, safety and physical well-being on construction sites	Handle equipment, materials and products	Assemble mechanical piping systems	Install electrical components	Interpret plans and specifications	Work on electrical and electronic control systems	Do welding and brazing work	Present information about energy and heating	Become familiar with the organizations involved in the construction industry	Use job search techniques
Competency Number				1	2	3	4	5	6	9	10	13	20	21
Type of Competency				S	S	C	C	C	C	C	C	C	S	S
Duration (in hours)				30	30	60	120	75	45	120	75	45	15	15
Install drainage systems	7	C	120	○	●	●	●	●	●	○			○	○
Install ventilation systems	8	C	120	○	●	●	●		●	○			○	○
Install hot and cold water distribution systems, plumbing fixtures and accessories	11	C	120	○	●	●	●	●	●	●	●		○	○
Maintain and repair pipes, plumbing fixtures and accessories	12	C	75	○	●	●	●	●	●	●			○	○
Install, maintain and repair oil-burning appliances	14	C	120	○	●	●	●	●	●	●	○	●	○	○
Install and repair direct and reverse heating systems	15	C	120	○	●	●	●	●	●	●	●	●	○	○
Install and repair perimeter heating systems	16	C	60	○	●	●	●	●	●	●	○	●	○	○
Install natural gas- and propane-burning systems	17	C	120	○	●	●	●	●	●	●	○	●	○	○
Install and repair radiant heating systems	18	C	75	○	●	●	●	●	●	●	○	●	○	○
Install and repair low-pressure steam heating systems	19	C	120	○	●	●	●	●	●	●	●	●	○	○

Harmonization

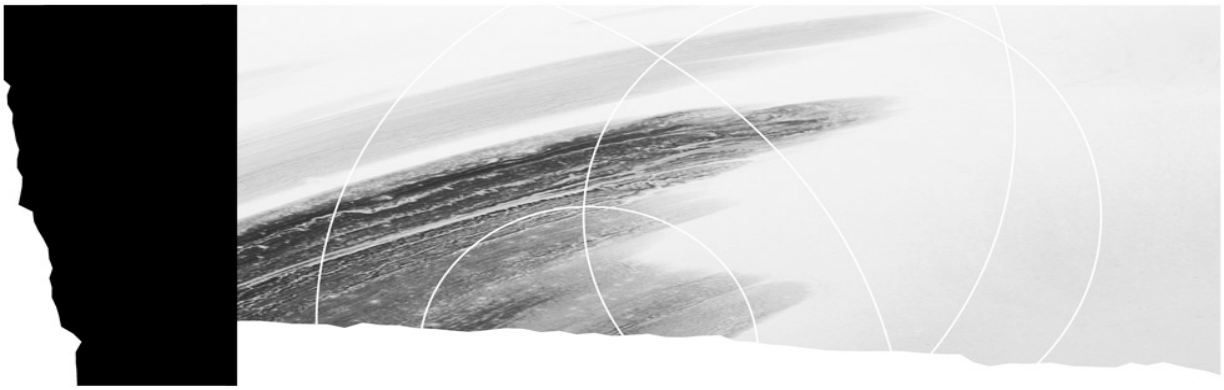
The Ministère de l'Éducation, du Loisir et du Sport harmonizes its vocational and technical programs by establishing similarities and continuity between secondary- and college-level programs within a particular sector or between sectors in order to avoid overlap in program offerings, to recognize prior learning and to optimize the students' progress.

Harmonization establishes consistency between training programs and is especially important in ensuring that the tasks of a trade or occupation are clearly identified and described. Harmonization makes it possible to identify tasks requiring competencies that are common to more than one program. Even if there are no common competencies, training programs are still harmonized.

Harmonization is said to be "inter-level" when it focuses on training programs at different levels, "intra-level" when it focuses on programs within the same educational level, and "inter-sector" when carried out between programs in various sectors.

An important aspect of harmonization is that it allows the common features of competencies to be identified and updated as needed. Common competencies are those that are shared by more than one program; once acquired in one program, they can be recognized as having been acquired in another. Competencies with exactly the same statement and elements are said to be identical. Common competencies that are not identical but have enough similarities to be of equal value are said to be equivalent.

The *Plumbing and Heating* program does not share any competencies with other programs at this time.



Part II

Program Competencies

The Trade, the Training Process and Communication in the Workplace	Code: 807402

Competency 1 Duration 30 hours Credits 2

Situational Competency

Statement of the Competency

Determine their suitability for the trade and the training process and their ability to communicate in the workplace.

Elements of the Competency

- Be familiar with the nature of the trade.
- Recognize the behaviours and attitudes needed to provide quality customer service.
- Communicate verbally and in writing in the workplace.
- Communicate verbally and in writing with customers.
- Understand the training program.
- Confirm their career choice.

Learning Context

Information Phase

- Learning about the job market in plumbing and heating.
- Recognizing the specific characteristics of the different sectors of activity that employ pipe fitters: construction and other sectors, and the residential, commercial, institutional and industrial subsectors.
- Learning about the nature and requirements of the job.
- Becoming familiar with the general regulations governing the trade.
- Learning about job prospects in the sector.
- Learning about the attitudes, behaviours and skills needed to exercise the trade, especially as concerns customer service.
- Learning about the attitudes and behaviours needed to work well in a team, as well as with their employer, competitors and other tradespeople.
- Learning about the tools used to communicate in the workplace and with customers.
- Learning about the program of study and the training process.

Participation Phase

- Discussing their perception of the trade:
  - advantages and disadvantages
  - employers' requirements
  - requirements for effective communication in the workplace
  - requirements with respect to customer service
- Discussing ways of keeping up with new developments.
- Discussing information gathered during visits to a company or conversations with trade specialists.
- Sharing their impressions about the program of study and the training process.

Synthesis Phase

- Assessing their career choice by comparing the requirements of the trade with their own aptitudes, interests, strengths and limitations.
- Assessing their verbal, nonverbal and written communication skills and identifying ways of making up for weaknesses, if any.
- Presenting the results of their assessment.

Instructional Guidelines

- Create a climate favourable to mutual respect.
- Be open to comments from all students.
- Encourage students to participate in the suggested activities.
- Provide students with the means to assess their career choice honestly and objectively.
- Organize activities representative of the situation in the workplace.
- Make available pertinent documentation.

Participation Criteria

Information Phase

- Gather information on the topics covered.

Participation Phase

- Express their views of the trade and the program of study in a group meeting.
- Participate in the suggested activities.

Synthesis Phase

- Produce a report in which they describe their preferences, interests, strengths and limitations with respect to the trade.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each phase of the learning context, along with their attendant guidelines.

Information Phase

• Identify the main sources of information. • Determine means of taking notes and presenting data. • Demonstrate a desire to learn.	Job analysis report and other pertinent documents.
• Determine the aspects to be considered in their exploration of the trade. • Show concern for exercising the trade responsibly.	Tasks, working conditions, workplaces, advantages and disadvantages, rights and responsibilities of workers, etc.

• Identify the main codes and regulations governing the trade.	National Building Code, Québec Construction Code, National Plumbing Code of Canada, Canadian Electrical Code, Natural Gas and Propane Code (CSA standard), Installation Code for Oil-Burning Equipment (CSA standard), Boiler, Pressure Vessel and Pressure Piping Code (CSA standard), municipal regulations, etc.
• Recognize the aspects that promote or hinder verbal and nonverbal communication.	Strong or poor interpersonal skills; attitudes that foster harmonious relationships; verbal and nonverbal communication techniques; approach adapted to particular people and situations; different customer profiles.
• Identify the behaviours and attitudes needed to provide quality customer service.	Cleanliness, proper grooming; observance of dress code; clean materials, equipment and service vehicle; politeness and courtesy; respect for the environment and customers' privacy; no drug or alcohol use at work, etc.
• Identify the behaviours and attitudes needed to work with their employer, competitors and other tradespeople.	Rules of politeness and courtesy for dealing with employers, colleagues and other staff members.
• Identify different tools used to communicate in the workplace.	Cell phone, pager, work orders, forms, accident and incident reports, complaints (grievances), etc.

Participation Phase

• Recognize the main rules for group discussion. • Demonstrate a desire to share their perception of the trade. • Respect others' opinions. • Learn about the requirements for successful learning.	Characteristics conducive to communication: active listening, self-confidence, openness to others, ability to adapt, courtesy, language level, etiquette, etc.

Synthesis Phase

• Learn about the importance of practising a trade that meets their hopes and expectations.	Impact on their career choice.
• Recognize their skills and aptitudes.	Technical, personal, communication skills; ability to adapt, exercise critical judgment, solve problems, etc.

Health and Safety on Construction Sites	Code: 754992

Competency 2 Duration 30 hours Credits 2

Situational Competency

Statement of the Competency

Safeguard health, safety and physical well-being on construction sites.

Elements of the Competency

- Develop a responsible attitude toward health and safety risks.
- Be aware of the importance of respecting occupational health and safety standards and regulations.
- Recognize hazardous situations or behaviours and the applicable preventive measures.

Learning Context

Information Phase

- Learning about the risks inherent in construction sites.
- Learning about health and safety standards and regulations applicable on construction sites.
- Learning about emergency measures.
- Thinking about the importance of acquiring occupational health and safety skills.

Participation Phase

- Experiencing situations in which they must prevent risks and eliminate hazards related to the environment, facilities, equipment, machinery, materials, tools, energy sources, etc.
- Participating in activities in which they can learn to recognize the risks related to the transportation of loads and restrictive work postures.
- Participating in activities in which they can learn to recognize signs and symbols related to risk prevention (hazardous products, roadwork, transportation of hazardous materials, etc.).
- Comparing risky behaviours observed on construction sites and identifying the main principles underlying safe behaviour.

Synthesis Phase

- Presenting a report containing:
  - a summary of their newly acquired knowledge and skills
  - an assessment of their attitude toward occupational health and safety
  - their goals and means of improving their performance

Instructional Guidelines

- Make available the necessary sources of information.
- If applicable, invite occupational health and safety specialists to meet with students.
- Make optimal use of audio-visual materials.
- Rely on learning situations representative of the reality of construction sites.
- Do not allow students to do anything dangerous during simulations.
- Encourage the participation of all students in discussions.
- Guide the students' evaluation process by providing them with tools (e.g. a questionnaire) to analyze their experience and establish their goals.

Participation Criteria

Information Phase

- Consult the sources of information made available to them.
- Describe the advantages of observing health and safety standards and regulations and adhere to them.

Participation Phase

- Participate seriously in the suggested activities.
- State the principles underlying safe behaviour.
- Make a list of the risks inherent in construction sites and the applicable preventive measures.

Synthesis Phase

- Present a report containing:
  - a summary of their newly acquired knowledge and skills
  - an assessment of their attitude toward occupational health and safety
  - their goals and means of protecting their health, safety and physical well-being, as well as those of others, on construction sites

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each phase of the learning context, along with their attendant guidelines.

Information Phase

• Be receptive to information about health and safety on construction sites.	
• Recognize the most common risks to health, safety and physical well-being on construction sites.	
• Recognize sources of information about health and safety on construction sites and find information in them.	Roles and responsibilities with respect to health and safety on construction sites; regulatory framework for health and safety.
• Identify the advantages of observing health and safety standards and regulations and adhere to them.	Prevention of accidents and diseases.

Participation Phase

• Associate the risks inherent in construction sites and the trade of pipe fitter with the applicable preventive measures.	Risks inherent in the site itself and in the exercise of the trade; appropriate preventive measures for different risks; systems for identifying hazardous materials.

Handling Equipment, Materials and Products	Code: 807414

Competency 3 Duration 60 hours Credits 4

Behavioural Competency

Statement of the Competency

Handle equipment, materials and products.

Achievement Context

- Given verbal or written instructions.
- Given:
  - manufacturers' manuals in English and French
  - the current regulations
  - the necessary safety accessories (e.g. glasses, hearing protectors, safety harness, air quality detectors, oxygen mask and filter, gloves, masks, coveralls)
  - the necessary hand and power tools
  - plumbing and heating products and materials
  - standard scaffolding, ladders, stepladders, winches, hoists, hydraulic scaffolding, etc.

Elements of the Competency	Performance Criteria
1. Plan the work based on: – the height at which the work is to take place – the necessary tools – the types of anchors needed – the types of loads to be lifted or moved	• Accurate interpretation of instructions. • Production of a complete list of the necessary materials, tools, equipment, scaffolding, etc. • Establishment of a safety perimeter.
2. Set up scaffolding and manoeuvre a motorized mobile platform.	• Accurate evaluation of the stability of the ground surface. • Rigorous application of safety measures. • Stability of scaffolding. • Safe use of ladders. • Proper use of the motorized mobile platform.
3. Fasten equipment and heavy objects.	• Consideration of manufacturers' data sheets or, if necessary, visual assessment of the loads to be lifted. • Determination of chains, slings, cables and knots to use. • Verification that the load is firmly fastened.
4. Lift and move materials, equipment or heavy objects: – horizontally – vertically	• Determination of the type of lifting appliance, truck or handcart to use depending on the weight and shape of the load. • Proper use of lifting appliance. • Proper use of crane operators' hand signals.

5. Determine the particular characteristics of work carried out in confined spaces.	• Accurate evaluation of risk level. • Recognition of the necessary safety equipment. • Recognition of the process for communicating with the person supervising the situation outside the confined space.
6. Apply procedures for disposing of contaminated products.	• Observance of: – WHMIS data sheets – health and safety standards – environmental policies, etc.
7. Maintain handling and lifting tools and equipment.	• Visual inspection after each use to identify anomalies. • Methodical disassembly and storage of lifting equipment, scaffolding and safety equipment for working in confined spaces. • Cleaning and tidying of work area.
	For the competency as a whole: • Application of individual and group safety measures. • Communication adapted to the situation. • Use of appropriate terminology. • Adoption of ergonomic postures. • Observance of manufacturers' recommendations.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

1. Plan the work based on:
   – the height at which the work is to take place
   – the types of anchors needed
   – the types of loads to be lifted or moved

• Identify the different types of anchors based on the materials they are made of and the types of structures they are used on.	Lead, plastic, steel anchors, etc.; wooden, concrete, steel, plaster structures, etc.
• Identify the types of lifting and pulling equipment needed depending on the job to be done.	Winches, hoists, etc.
• Identify the types of ladders and stepladders needed depending on the job to be done.	Wooden, fibreglass, aluminum ladders and stepladders, etc.

• Identify the different types of cables and fasteners needed depending on the job to be done.	Fibre, nylon, steel cables, etc.
• Identify the different types of slings needed depending on the job to be done.	Capacity of nylon slings, nameplate, etc.; slings and fasteners (e.g. links, hooks, shackles).

2. Set up scaffolding and manoeuvre a motorized mobile platform.

• Recognize different ways of installing scaffolding.	Mobile or fixed.

3. Fasten equipment and heavy objects.

• Make knots commonly used in the trade.	Bowline, anchor, thief, chimney hitch, stopper knots, etc.

5. Determine the particular characteristics of work carried out in confined spaces.

• Recognize the main contaminants encountered in the trade.	Asbestos, ammonia, oil, methane, etc.
• Use special equipment for working in confined spaces.	Fall protection lifeline, ventilator.

7. Maintain handling and lifting tools and equipment.

• Do a visual and physical inspection of the ladders and stepladders. • Do a visual and physical inspection of the slings, cables and fasteners.	Rungs, side rails, slides, vertical deflection, elongation, weakness of cables and slings, etc.

Mechanical Piping Systems	Code: 807428

Competency 4 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Assemble mechanical piping systems.

Achievement Context

- Working in the residential, commercial and institutional subsectors.
- Given verbal or written instructions.
- Given:
  - the National Building Code (NBC)
  - the Québec Construction Code
  - the National Plumbing Code of Canada (NPC)
  - municipal regulations
  - drafting tools
  - various hand and power tools
  - individual and group safety measures and accessories
  - print and electronic versions of technical documentation and manufacturers' manuals in English and French
  - equipment, materials and products

Elements of the Competency	Performance Criteria
1. Produce and interpret drawings, sketches and diagrams.	• Identification of the data needed to produce sketches and drawings. • Observance of the rules and conventions for producing sketches and diagrams.
2. Take measurements and do calculations.	• Appropriate use of different measuring instruments. • Accurate conversion of data from the metric to the imperial system of measurement and vice versa. • Calculation of volumes, areas, capacities, angles, etc. • Appropriate use of mathematical formulas for establishing dimensions.

3. Associate the current regulations with various piping installation tasks.	• Identification of the applicable sections in the various codes and municipal regulations. • Identification of prescribed materials, classifications and uses.
4. Install different types of hangers.	• Choice of the hangers and tools needed for the building's piping system and structures. • Application of techniques for installing and fastening hangers.
5. Assemble steel pipes.	• Accurate interpretation or production of the sketches needed to produce pipe assemblies. • Choice of the materials and tools needed to produce pipe assemblies. • Application of the appropriate cutting, threading, reaming and fitting techniques. • Application of the appropriate cutting, grooving and fitting techniques.
6. Assemble plastic pipes.	• Accurate interpretation or production of the sketches needed to produce pipe assemblies. • Choice of the materials and tools needed to produce pipe assemblies. • Application of the appropriate cutting, cleaning, gluing and fitting techniques.
7. Assemble copper pipes.	• Interpretation or production of pipe assembly sketches. • Choice of the materials and tools needed to produce pipe assemblies. • Appropriate choice of filler metals and connections. • Application of the appropriate cutting, reaming, fitting and soldering techniques. • Application of the appropriate flaring and bending techniques.

8. Assemble cast iron hubless pipes.	• Production of assembly sketches. • Choice of the materials and tools needed to produce pipe assemblies. • Application of the appropriate cutting and fitting techniques. *For the competency as a whole:* • Application of individual and group safety measures. • Determination of the equipment, tools and accessories required based on the type of pipes to be fitted. • Application of the relevant regulations. • Establishment of the sequence of operations. • Use of the appropriate terminology. • Quality control.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

1. Produce and interpret drawings, sketches and diagrams.

• Recognize different views.	Plan, front, side views.
• Produce drawings with orthogonal and isometric projections.	
• Recognize different symbols and pictograms.	

2. Take measurements and do calculations.

• Use the rule of three.	
• Use trigonometry.	Calculation of the different offsets (simple and multiple).

5. Assemble steel pipes.

• Classify different types of pipes, fittings and accessories based on their properties and uses.	Steel pipe schedules 20, 40, 80,160; different types of packing, flanges, bolts.
• Thread pipes.	
• Recognize different types of sealants and their uses.	Joint compounds, teflon, etc.

6. Assemble plastic pipes.	
• Classify different types of pipes, fittings and accessories based on their properties and uses.	Types of plastic pipe schedules: BNQ, ABS, PVC, CPVC, etc.
• Recognize different types of solvents and glues and their uses.	Types of adhesives and solvents.
7. Assemble copper pipes.	
• Classify different types of pipes, fittings and accessories based on their properties and uses.	Types of copper, filler metals, primers, adhesives, etc.
8. Assemble cast iron hubless pipes.	
• Classify different types of pipes, fittings and accessories based on their properties and uses.	Classes of cast iron, mechanical collars, MJ, etc.

Installing Electrical Components	Code: 807435

Competency 5 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Install electrical components.

Achievement Context

- On equipment such as water heaters and pumping, sump pump and well systems.
- Working in the residential, commercial and institutional subsectors.
- Given a work order or verbal instructions.
- Given:
  - the Canadian Electrical Code
  - sketches, circuit and wiring diagrams
  - a multimeter
  - various hand and power tools
  - individual and group safety measures and accessories
  - print and electronic versions of technical documentation and manufacturers' manuals in English and French
  - electrical components, equipment and materials

Elements of the Competency	Performance Criteria
1. Locate various electrical components found in plumbing and heating systems.	• Accurate identification of the different electrical components. • Recognition of their respective uses and operating principles.
2. Interpret circuit and wiring diagrams.	• Accurate location of components on the diagrams. • Accurate interpretation of symbols. • Accurate identification of the data needed for the installation.
3. Associate the provisions of the Canadian Electrical Code with plumbing and heating systems.	• Identification of standards for the connection of plumbing and heating equipment. • Consideration of the jurisdiction of the different trades involved.
4. Assemble electrical circuits: – series – parallel – series-parallel	• Accurate interpretation or production of the assembly sketches or diagrams. • Circuit assembly in accordance with recognized work methods. • Appropriate use of measuring instruments. • Methodical verification of the circuits' operation.

5. Install and connect electrical components found in: – water heaters – sump pumps – artesian well pumps – surface well pumps	• Establishment of a logical sequence of operations. • Installation of electrical components in conformity with the Canadian Electrical Code. • Appropriate use of measuring instruments. • Methodical verification of the operation of the different components. *For the competency as a whole:* • Application of individual and group safety measures. • Use of the appropriate terminology. • Quality control. • Consideration of the established jurisdictions.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

1 Locate various electrical components found in plumbing and heating systems.

• Recognize the different means of producing electricity.	Hydroelectric, coal-burning, nuclear power plants, etc.
• Recognize the different forms of electricity.	Magnetism, electromagnetism, static.
• Recognize the operating principles of electricity.	Ohm's law, alternating current, direct current, etc.
• Recognize the dangers inherent in electricity.	
• Recognize the operating principles of temperature control devices.	Thermostats, aquastats, etc.
• Recognize the operating principles of pressure control devices.	Mechanical, hydraulic, pneumatic pressure control devices.

2. Interpret circuit and wiring diagrams.

• Associate the pictograms with the different electrical components.	Diagrams, symbols, etc.

Interpreting Plans and Specifications	Code: 807443

Competency 6 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency

Interpret plans and specifications.

Achievement Context

- Given plans of residential, commercial and institutional buildings.
- Given:
  - specifications
  - the Québec Construction Code
  - the National Building Code (NBC)
  - the National Plumbing Code of Canada (NPC)
  - software for estimating the cost of plumbing materials and duration of labour

Elements of the Competency	Performance Criteria
1. Interpret general information in a plan.	• Distinction between the different types of plans. • Identification of the different sections of a plan. • Accurate interpretation of the information in the title block. • Interpretation of symbols. • Proper handling of plans. • Distinction between the different sections, elevations, details, etc.
2. Identify and locate plumbing systems and appliances.	• Identification of the different rooms in the plan. • Identification and calculation of the different plumbing fixtures. • Calculation of lengths of pipes, fittings and hangers based on their diameter. • Verification of the information in the plans with respect to the current regulations. • Production of a freehand or dimensioned sketch of part of the plan.
3. Identify and locate heating systems and appliances.	• Identification and calculation on the plan of the different heating system accessories. • Calculation of lengths of pipes, fittings and hangers based on their diameter. • Verification of the information in the plans with respect to the current regulations. • Production of a freehand or dimensioned sketch of part of the plan.

4. Identify equipment and accessories in the specifications.	• Accurate interpretation of technical data. • Calculation of equipment and accessories. • Verification of the information contained in the specifications with respect to the current regulations. • Consideration of the customer's or architect's requirements. • Estimate of the time and materials needed.
	For the competency as a whole:
	• Accurate identification of information. • Careful handling of plans and specifications. • Use of the appropriate terminology.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

1. Interpret general information in a plan.

• Recognize different types of plans.	Architectural, layout, structural, demolition drawings, etc.
• Use the metric and imperial systems of measurement.	
• Use dimensions.	
• Interpret the information in the tables of specifications.	
• Interpret the alphanumeric axes.	

2. Identify and locate plumbing systems and appliances.

• Associate the pictograms with the different plumbing fixtures.	Diagrams, symbols, etc.

3. Identify and locate heating systems and appliances.

• Associate the pictograms with the different heating appliances.	
• Recognize the different heating systems.	Hydronic, steam heating systems, etc.
• Distinguish between the different heating appliances.	Boiler, unit heater, circulating pump, etc.

Installing Drainage Systems	Code: 807458

Competency 7 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Install drainage systems.

Achievement Context

- For sanitary and storm drainage systems, and combined building drains and sewers.
- Given a work order or instructions.
- Given:
  - drainage diagrams, sketches and drawings
  - the National Building Code (NBC)
  - the National Plumbing Code of Canada (NPC)
  - the Canadian Electrical Code
  - municipal regulations, if applicable
  - print and electronic versions of technical documentation and manufacturers' manuals in English and French
  - the necessary equipment, materials, products and tools
  - scaffolding, if applicable
  - the necessary safety equipment

Elements of the Competency	Performance Criteria
1. Associate the current regulations with piping and equipment installation tasks.	• Identification of the applicable sections in the different codes and municipal regulations. • Identification of prescribed materials, classifications and uses.

2. Plan the work: – underground installation – aboveground installation	• Accurate interpretation of instructions or the drainage diagram, sketch or drawing. • Accurate identification of the location of the installation. • Appropriate planning based on constraints and needs: – type of building and rooms – environmental conditions – type of occupation – the necessary equipment, materials, tools, etc. • Establishment of the sequence of operations. • Consideration of manufacturers' data sheets and recommendations concerning the plumbing fixtures and drainage pumps to be installed. • Determination of the type of soil, flooring, walls or roofing. • Recognition of the operating principles of an individual installation and ways of setting it up.
3. Determine the path of the piping.	• Production of a diagram of all the plumbing to be done. • Determination of the necessary assembly techniques and work methods. • Consideration of possible obstacles. • Determination of constraints with respect to the openings needed. • Accurate calculation of lengths of pipes and offsets needed.
4. Install an underground drainage system.	• Drainage trench in conformity with codes and current regulations. • Proper installation of: – cast iron or plastic piping – grease and oil traps, etc. – the sump and sump pump • Proper joints for the type of material used. • Trench properly filled in and levelled.

5. Install an aboveground drainage system.	• Installation of different types of anchors depending on the building structures. • Installation of different types of hangers depending on the type of pipes used. • Holes drilled in walls, ceilings and floors with the necessary tools in accordance with the structures in place. • Appropriate joints (glued, soldered, mechanical collars) for the type of material used. • Proper installation of the necessary firestop spacers. • Identification of pipes in accordance with current standards. • Methodical leakproof testing.
6. Install a sump, a lift pump and a drainage pump.	• Excavation of a hole for the catchment basin. • Installation level and at the proper height for the pipes. • Installation of pump in conformity with instructions. • Electrical connection of the pump to the junction box. • Appropriate adjustment of electrical and mechanical components. • Appropriate installation of sump piping for the type of ditch (catchment or drainage).
7. Remove existing installations.	• Methodical disassembly of aboveground piping. • Integrity of anchors and hangers. • Disassembly of underground piping. • Hole filled in and levelled. • Storage or recycling of pipes. • Cleaning and tidying of work area.

For the competency as a whole:

- Observance of health and safety rules.
- Observance of manufacturers' recommendations.
- Safe handling of materials and equipment.
- Adoption of ergonomic work postures.
- Installation in conformity with current regulations.
- Use of the appropriate terminology.
- Use of techniques in accordance with desired results.
- Quality control.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work:
   – underground installation
   – aboveground installation

• Recognize the configuration of a drainage system.	Diagram of a drainage system.
• Recognize the different types of collectors and sewers.	Storm drains, building drains, sanitary drains; separate, storm, combined sewers.
• Determine the diameter of the pipes needed.	
• Recognize different types of piping assemblies.	

5. Install an above-ground drainage system.

• Use manual and power tools in accordance with the materials in question.	Wood, concrete, steel.
• Recognize different types of firestop spacers.	
• Distinguish between the different leakproof tests.	Water, air, smoke.

6. Install a sump, a lift pump and a drainage pump.

• Compact the soil and make sure the equipment is level.	Ditches, sumps and interceptors.
• Recognize the operating principles of different types of pumps and how to install them and do the appropriate calculations.	Drainage, well, pressurization pumps; manufacturers' alignment charts and charts.

Installing Ventilation Systems	Code: 807468

Competency 8 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Install ventilation systems.

Achievement Context

- Including soil and vent stacks, and wet, dual, relief, stack, yoke, continuous, loop and circuit vents.
- Including branch vents and headers.
- Given a work order or verbal instructions.
- Given:
  - drainage diagrams, sketches and drawings
  - the National Building Code (NBC)
  - the National Plumbing Code of Canada (NPC)
  - municipal regulations, if applicable
  - the necessary equipment, materials, products and tools
  - scaffolding, if applicable
  - the necessary safety equipment

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of pipes and equipment.	• Identification of the applicable sections in the various codes and municipal regulations. • Identification of prescribed materials, classifications and uses.

2. Plan the work.	• Accurate interpretation of instructions or the drainage diagram, sketch or drawing. • Accurate identification of the location of the installation. • Appropriate planning based on constraints and needs: – type of building and rooms – environmental conditions – type of occupation – the necessary materials, tools and equipment, etc. • Establishment of a logical sequence of operations. • Consideration of manufacturers' data sheets and recommendations concerning plumbing fixtures and drainage pumps to be installed. • Determination of the type of soil, flooring, walls or roofing.
3. Determine the path of the piping.	• Production of a diagram of all the plumbing to be done. • Determination of the appropriate assembly techniques and work methods. • Consideration of possible obstacles. • Determination of constraints with respect to the openings needed. • Accurate calculation of lengths of pipes and offsets needed.
4. Install the vent pipes to the drainage system.	• Proper installation of cast iron, copper or plastic pipes. • Proper joints for the type of material used. • Trench completely filled in and level, if applicable. • Proper installation of: – different types of anchors depending on the building structures – different types of hangers depending on the types of piping used • Holes drilled in walls, ceilings and floors with the appropriate tools, taking the existing structures into account. • Appropriate joints (glued, soldered or using mechanical collars) depending on the type of material used. • Proper installation of the necessary firestop spacers. • Identification of pipes in accordance with current standards. • Methodical leakproof testing.

5. Install the vent pipes on a sump or drainage basin.	• Proper installation of: – different types of anchors depending on the building structures – different types of hangers depending on the types of piping used • Holes drilled in walls, ceilings and floors with the appropriate tools, taking the existing structures into account. • Appropriate joints (glued, soldered or using mechanical collars) depending on the type of material used. • Proper installation of the required firestop spacers. • Identification of pipes in accordance with current standards. • Methodical leakproof testing.
6. Remove existing installations.	• Methodical disassembly of aboveground piping. • Integrity of anchors and hangers. • Disassembly of underground piping. • Hole filled in and levelled. • Storage or recycling of pipes. • Cleaning and tidying of work area.
	For the competency as a whole: • Observance of health and safety rules. • Handling of materials and equipment in accordance with manufacturers' recommendations and observation of safety measures. • Adoption of ergonomic work postures. • Installation in conformity with current regulations. • Use of techniques in accordance with desired results. • Observance of manufacturers' recommendations. • Use of the appropriate terminology. • Quality control.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work.

• Recognize the configuration of a ventilation system.	Production of a diagram of a ventilation system.
• Recognize the different types of vent piping systems.	Headers, stack vents, vent stacks, ventilation system and vent pipes.
• Determine the diameter of the pipes needed.	

4. Install vent pipes on the drainage system.

• Recognize different types of vents.	Fresh air inlets, loop vents, etc.

Electrical and Electronic Control Systems	Code: 807478

Competency 9 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Work on electrical and electronic control systems.

Achievement Context

- When installing and repairing control systems for hydronic, radiant, hot air and steam heating systems.
- When installing and repairing control systems for natural gas, propane and oil heating systems.
- Working in the residential, commercial and institutional subsectors.
- Given a work order or verbal instructions.
- Given:
  - circuit and wiring diagrams, sketches and installation drawings
  - print and electronic versions of technical documents and manufacturers' manuals in English and French and data sheets (Internet)
  - the Canadian Electrical Code
  - the Natural Gas and Propane Installation Code (CSA standard)
  - the Installation Code for Oil-Burning Equipment (CSA standard)
  - the necessary components, tools and measuring instruments
  - a programmable controller for heating systems

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of electrical control systems.	• Identification of the applicable sections of the different codes. • Identification of the prescribed wiring, calibration and uses.
2. Plan the work.	• Accurate interpretation of instructions, diagram, sketch or installation drawing. • Establishment of a logical sequence of operations. • Determination of the components and tools needed for the control systems to be installed and their location. • Determination of the conductors and connections needed. • Consideration of the data sheets for the components to be installed.

3. Fasten and connect the control systems for natural gas, propane and oil heating appliances in different heating systems: – hot air – hydronic – steam	• Electrical connections done in accordance with trade jurisdictions. • Methodical verification of the operation of the control systems. • Consideration of the type of heating system. • Optimization of the heating system using a programmable controller. • Solid and clean connection.
4. Diagnose malfunctions.	• Relevant information gathered from customer. • Visual inspection of the area. • Collection of auditory and olfactory data. • Methodical testing of system. • Observance of troubleshooting procedure. • Determination of the cause of the malfunction.
5. Replace control systems.	• Safe disconnection of system. • Replacement of components in accordance with manufacturers' installation standards. • Methodical verification of operation of system.
6. Finish the work.	• Accurate information recorded in the installation reports. • Customer provided with relevant information about the work done. • Formulation of recommendations concerning the operation of the system, troubleshooting and maintenance procedures, and monitoring, if applicable. • Final visual inspection of system. • Careful storage of materials and tools, and cleaning and tidying of work area. • Complete log sheet, with customer's signature and satisfaction rating.
	For the competency as a whole: • Observance of health and safety rules. • Installation in conformity with current regulations. • Use of techniques in accordance with desired results. • Observance of manufacturers' recommendations. • Use of the appropriate terminology. • Quality control.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work.

- Recognize the operating principles of electrical, electronic and pneumatic control systems.

  Relay, controllers, thermostats, limit controls, transformers, flame safeguard controls and ultraviolet, infrared and cadmium sulfide flame detectors, high and low water level controls, circulation controls, internal and external compensating controls, electronic boards, etc.

- Recognize the principles governing dual-energy systems.

3. Fasten and connect the control systems for natural gas, propane and oil heating appliances in different heating systems:

– hot air
– hydronic
– steam

- Recognize how a programmable controller works.

- Interpret programmable controller graphs.

4. Diagnose malfunctions.

- Recognize the precautions to be taken when diagnosing a malfunction.

  Risk of electric shock, burns, etc.

- Use a systematic and recurrent troubleshooting procedure.

6. Finish the work.

- Recognize the information to be recorded in an installation report and in a log.

  Personal information, invoicing address, list of materials used, duration of labour, costs, taxes, totals, warranty information, etc.

Basic Welding-Brazing	Code: 807485

Competency 10 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Do welding and brazing work.

Achievement Context

- Given verbal or written instructions.
- Working on different types of materials.
- Given:
  - diagrams and sketches
  - an oxyacetylene welding setup
  - a stationary gas welding setup
  - a stationary arc welding setup
  - acetylene, propane or natural gas cylinders
  - filler rods
  - various hand and power tools
  - individual and group safety measures and accessories
  - print and electronic versions of technical documents and manufacturers' manuals in English and French

Elements of the Competency	Performance Criteria
1. Install a mobile oxyacetylene cutting setup.	• Consideration of manufacturers' data sheets and recommendations. • Safe setup in accordance with requirements.
2. Apply oxyacetylene cutting techniques.	• Preparation of the necessary materials. • Marking of pipes using the necessary tools and in accordance with the diagrams and sketches. • Determination of the necessary torch and tips. • Appropriate adjustments to gas pressure. • Bevelling, production of hangers, drilling and cutting of steel (soft). • Appropriate cleaning of materials using different tools.
3. Use electric arc welding techniques.	• Preparation of the necessary materials (e.g. cutting, cleaning, bevel). • Determination of type of electrode. • Determination of amperage needed. • Formation of adequate beads and solid assembly of different plates, corner plates, hangers, etc. • Appropriate cleaning of materials using different tools.

4. Use brazing techniques.	• Preparation of the necessary materials. • Marking of pipes using the appropriate tools. • Satisfactory adjustment of gases, appropriate choice of filler rods. • Safe use of oxygen and acetylene torch. • Satisfactory brazing and leakproof copper piping. • Satisfactory brazing and solid assembly of steel plates. • Appropriate cleaning of materials using different tools.
5. Heat and bend metals.	• Preparation of the necessary materials. • Determination of the necessary torch and tips. • Adjustment of gas pressure as needed. • Satisfactory production of pipe hangers with angle iron and U-bolts. • Appropriate cleaning of materials using different tools.
6. Assemble steel pipes and fittings.	• Establishment of a logical sequence of operations. • Cutting of parts and production of bevels in conformity with sketches, diagrams and instructions. • Appropriate preparation and cleaning of materials for welding. • Precise tacking and assembly of flanges and fittings on pipes by tacking with an electric welding machine.
7. Recover components from existing installations.	• Methodical disassembly of joints and fittings on existing installations. • Precise grinding of fittings and flanges for storage. • Appropriate cleaning of work area and storage of equipment, accessories and products.
	For the competency as a whole: • Interpretation or production of sketches or diagrams. • Observance of individual and group health and safety standards. • Adoption of ergonomic work postures. • Consideration of manufacturers' data sheets and recommendations. • Work in conformity with sketches, diagrams and instructions. • Use of the appropriate terminology. • Quality control and solid assembly.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

1. Install a mobile oxyacetylene cutting setup.

• Determine the sequence of operations for installing a welding setup.	Purging of cylinders, assembly of regulators, attachment of torches, mixing chamber and tip, connection of torch to hose, etc.
• Recognize health and safety risks and hazards.	Respiratory problems, eye injuries, irritations, burns, exposure to radiation, magnetic fields (cardiac problems); risk of fire, explosion, electrocution, etc.
• Recognize the advantages and disadvantages of the different welding techniques.	Brazing, electric arc welding, use of filler rods, etc.

2. Apply oxyacetylene cutting techniques.

• Recognize the principal characteristics of the gases used in oxyacetylene welding. • Interpret gas pressure charts based on the tips used and the thickness of the metal.	Fuels, oxidizers, inert gases.
• Recognize oxyacetylene cutting flaws.	Irregularities in the cut, slag, etc.

3. Use electric arc welding techniques.

• Distinguish between the different types of electric arc welding machines. • Choose the electrode, the intensity, the angle, the angle of attack, the feed speed and the length of the arc. • Use different types of filler rods.	Alternating current, direct current.

4. Use brazing techniques.

• Prepare the surfaces to be welded. • Recognize by colour the appropriate level of heat of the parts to be welded. • Use filler rods of bronze, steel or silver alloy.	Cleaning of surface with sandpaper or steel wool or by burring.

6. Assemble steel pipes and fittings.

• Prepare the surfaces.	Grinder, file, steel wire brush, etc.

Installing Hot and Cold Water Distribution Systems, Plumbing Fixtures and Accessories	Code: 807498

Competency 11 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Install hot and cold water distribution systems, plumbing fixtures and accessories.

Achievement Context

- Working on public water supply systems.
- Working on private water supply systems (surface or artesian wells).
- Working with regular or adapted plumbing fixtures and accessories.
- Given a work order or verbal instructions.
- Given:
  - hot and cold water distribution system diagrams, sketches and drawings
  - the National Building Code (NBC)
  - the National Plumbing Code of Canada (NPC)
  - the Canadian Electrical Code
  - municipal regulations, if applicable
  - print and electronic versions of technical documentation and manufacturers' manuals in English and French
  - the necessary equipment, materials, products and tools
  - the necessary safety equipment

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of pipes and equipment.	• Identification of the applicable sections in the various codes and municipal regulations. • Identification of prescribed materials, classifications and uses.

2. Plan the work: – underground installation – aboveground installation	• Accurate interpretation of instructions, diagram, sketch or drawing of the distribution of hot and cold water and the installation of plumbing fixtures. • Methodical planning of installation based on constraints and needs: – type of building and rooms – environmental conditions – type of occupation – the necessary materials, tools, equipment, etc. • Establishment of a logical sequence of operations. • Consideration of manufacturers' data sheets and recommendations concerning the connection of plumbing fixtures, well pumps, electric hot water heaters, filtering systems, etc. • Determination of the type of soil, flooring, walls or roofing involved.
3. Determine the path of the piping.	• Production of a diagram of all the plumbing to be done. • Determination of the appropriate assembly techniques and work methods. • Consideration of possible obstacles. • Determination of constraints with respect to the openings needed. • Accurate calculation of pipe lengths and offsets. • Precise marking of the path of the piping.
4. Install an underground hot and cold water distribution system.	• Excavation of a trench in conformity with current codes. • Appropriate installation of copper or plastic pipes, etc. • Soldering of copper piping, as needed. • Type of joints in accordance with type of material. • Trench properly filled in and levelled.

5. Install an aboveground hot and cold water distribution system.	• Proper installation of: – different types of anchors depending on the structures in place – different types of hangers depending on the types of piping used • Holes drilled in walls, ceilings and floors with the appropriate tools depending on the structures in place. • Joints glued, soldered, etc., depending on the type of material used. • Appropriate installation of a domestic hot water recirculation system. • Installation of the necessary firestop spacers. • Identification of pipes in accordance with current standards. • Careful cleaning of pipes. • Methodical leakproof testing.
6. Install a water treatment system.	• Proper installation using the appropriate tools. • Start-up in accordance with manufacturer's recommendations. • Methodical verification of the operation of the system. • Adjustment of components, if applicable.
7. Install a pumping system.	• Level installation. • Installation of the pump, its components and its control systems. • Proper installation of: – electrical components – pipes
8. Install an electric water heater.	• Appropriate installation of the tank and its components. • Connection of different types of pipes to the tank. • Types of joints in accordance with the types of materials. • Consideration of data sheets. • Connection of electrical components and verification of their operation. • Adjustment of temperatures. • Careful cleaning of equipment.
9. Install plumbing fixtures and accessories: – for a standard residential kitchen – for a comfort station – for a public restroom	• Consideration of data sheets. • Holes drilled and hangers installed for the fixtures. • Connection of fixtures. • Careful cleaning of fixtures. • Methodical verification of the operation of the fixtures.

10. Remove existing installations.	• Methodical disassembly of all the aboveground piping. • Disassembly and cleaning of all plumbing fixtures for storage. • Removal of anchors and hangers. • Disassembly of underground piping. • Storage or recycling of pipes. • Filling in and levelling of ground.
11. Finish the work.	• Accurate information recorded in the installation reports. • Careful storage of materials and tools, cleaning and tidying of work area. • Transmission of relevant information to the customer about the work done and any warranties. • Formulation of recommendations concerning the operation of the system and fixtures and troubleshooting and maintenance procedures. • Final visual inspection of the installation. • Production of an accurate invoice and customer's satisfaction rating.
	For the competency as a whole: • Observance of health and safety rules. • Handling of materials and equipment in conformity with manufacturers' recommendations and the necessary precautions. • Adoption of ergonomic work postures. • Installation in conformity with current regulations. • Use of techniques and tools in accordance with the desired results. • Observance of manufacturers' recommendations. • Use of the appropriate terminology. • Quality control.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work:
   – underground installation
   – aboveground installation

• Recognize the configuration of a water supply system.	Production of a diagram of a water supply system.

• Recognize the different types of water supply and distribution systems.	Service connection.
• Determine the diameter of the pipes needed.	

5. Install an aboveground hot and cold water distribution system.

• Protect existing structures when soldering.	Frost, metal plates, nonflammable insulation, etc.
• Install a bronze circulating pump.	
• Recognize the operation of a self-regulating heating system.	

6. Install a water treatment system.

• Recognize the operating principles of different water treatment systems based on the quality of the water.	Qualitative properties of water (containing iron, sulphur, etc.); different treatment systems: chlorine, charcoal filters, salt, tanks with zeolites, etc.

7. Install a pumping system.

• Recognize different types of pumps and their components.	Well pumps, booster pumps, etc.
• Recognize the operating principle of pumps.	
• Select the appropriate pump based on the manufacturers' charts.	

8. Install an electric water heater.

• Recognize the operating principles of different types of water heaters.	Electric, oil-burning, gas-burning, indirect, instant, etc.
• Differentiate between different methods of connecting multiple water heaters.	In parallel, series, etc.

9. Install plumbing fixtures and accessories.

• Recognize different types of plumbing fixtures.	In the residential, institutional and commercial subsectors.
• Drill holes in different materials.	Melamine, ceramic, fibreglass, plastic, etc.
• Recognize plumbing fixtures and emergency accessories.	Eyewash station, emergency shower, etc.
• Recognize the parameters for installing plumbing fixtures below the main building drain.	Grinder toilet, ejector pumps, etc.
• Install automatic valves.	Infrared, motion detector, energy sensor, etc.

• Install flush valves.	
• Install valve accessories for people with disabilities.	Wing-tip faucet handles, higher sink to accommodate wheelchairs, supports, etc.
10. Remove existing installations.	
• Recognize the precautions to be taken when disassembling porcelain fixtures.	Risk of accident due to breakage and shattering of porcelain, etc.
• Recognize the information that must be included on an invoice.	Personal information, invoicing address, list of materials used, duration of labour, cost, taxes, warranty information, totals, etc.

Maintaining and Repairing Pipes, Plumbing Fixtures and Accessories	Code: 807505

Competency 12 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Maintain and repair pipes, plumbing fixtures and accessories.

Achievement Context

- Given a work order or verbal instructions.
- Given:
  - sketches and wiring diagrams
  - print and electronic versions of technical documentation and manufacturers' manuals in English and French
  - the necessary components, accessories, equipment and products
  - the necessary devices, measuring instruments and tools
  - the necessary safety equipment

Elements of the Competency	Performance Criteria
1. Diagnose malfunctions in pipes, plumbing fixtures, domestic hot water heaters and accessories.	• Gathering of additional information from the customer. • Visual, auditory, olfactory and tactile inspection. • Application of safety measures, if applicable. • Satisfactory use of a multimeter. • Accurate interpretation of the manufacturer's data sheets. • Accurate pinpointing of leaks, verification of connections and the condition of the components, depending on the situation. • Determination of possible problems by deduction.

Maintaining and Repairing Pipes, Plumbing Fixtures and Accessories	Code: 807505
2. Maintain and repair plumbing fixture components and accessories and functional domestic hot water heaters.	• Application of diagnostic procedure. • Establishment of possible problems. • Satisfactory disassembly and reassembly or replacement of different plumbing fixture components or accessories. • Methodical testing and verification of operation.
3. Maintain and repair a drainage system.	• Application of diagnostic procedure. • Establishment of possible problems. • Use of the necessary tools or devices to unblock the components of the drainage system. • Appropriate disassembly and reassembly or replacement of the different components or accessories of underground and aboveground drainage systems. • Methodical testing, verification of leakproof system and proper functioning of system.
4. Maintain and repair a water supply system on a functional system.	• Application of diagnostic procedure. • Establishment of possible problems. • Appropriate disassembly and reassembly or replacement of different components or accessories of the water supply system. • Methodical testing, verification of leakproof system and proper functioning of system.
5. Maintain functional pumping systems and repair malfunctions.	• Application of diagnostic procedure. • Establishment of possible problems. • Appropriate disassembly and reassembly or replacement of different components and devices on pumping systems. • Methodical testing, verification of leakproof system and proper functioning of system.

6. Finish the work.	• Accurate information recorded on the work orders. • Careful storage of equipment, devices and tools. • Appropriate cleaning and tidying of work area. • Final visual inspection of the work. • Accurate production of the log and invoice with the customer's signature and satisfaction rating. • Transmission to the customer of relevant information about the work done. • Formulation of relevant recommendations concerning the operation of the systems and troubleshooting and monitoring procedures, if applicable.
	For the competency as a whole:
	• Observance of health and safety rules. • Handling of materials and equipment in conformity with manufacturers' recommendations and the necessary precautions. • Adoption of ergonomic work postures. • Consideration of the compatibility of replacement components. • Establishment of the sequence of operations. • Use of techniques in accordance with desired results. • Observance of manufacturers' recommendations. • Use of the appropriate terminology. • Quality control.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

1. Diagnose malfunctions in pipes, plumbing fixtures, domestic hot water heaters and accessories.

• Identify the consequences of the most common malfunction in: – plumbing fixtures and accessories – drainage systems – water supply systems – pumping systems	Mechanical problems, electrical problems, obstructions, distortion, etc.
• Use a diagnostic method.	Reception of call, observation, analysis, deduction, synthesis and proposed solution.

3. Maintain and repair a drainage system.

• Use different tools and devices to unblock pipes.	Manual or electric drain cleaner, drain camera, high-pressure water unblocker, etc.

- Use devices to test for leakproof system. Smoke generator

4. Maintain and repair a water supply system on a functional system.
   - Use an airflow tester to check for leaks.
5. Maintain functional pumping systems and repair malfunctions.
   - Recognize the mechanical components and operating principles of different types of pumps.

Energy and Heating	Code: 807513

Competency 13 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency

Present information about energy and heating.

Achievement Context

- In the context of heating systems in the residential, commercial and institutional subsectors.
- To different customers.
- Taking into account new energy-saving technologies.
- Given:
  - the National Building Code
  - the Québec Construction Code
  - the *Act respecting the conservation of energy in buildings*
  - regulations governing the conservation of energy in new buildings
  - the current standard *Determining the Required Capacity of Residential Space Heating and Cooling Appliances*
  - pipe-sizing alignment charts
  - print and electronic versions of technical documents and manufacturers' manuals in English and French

Elements of the Competency	Performance Criteria
1. Recognize different energy sources.	• Identification of different energy sources based on their: – origin – calorific value – advantages and disadvantages • Identification of renewable energies. • Relevant explanations of the connections between the different energy sources and their costs with respect to different heating systems.
2. Identify the source of energy losses and gains.	• Establishment of relevant connections between a building's frame and energy loss. • Evaluation of energy loss in a building using an empirical approach. • Determination of the components of a heating system aimed at compensating for energy loss.

3. Recognize the general operating principles of heating systems.	• Relevant explanations about the operation of boilers and furnaces. • Accurate identification of heating system accessories and their functions. • Relevant explanations about the principles of the balancing of heating systems to ensure maximum efficiency.
4. Present different ways of saving energy.	• Recognition of the importance of promoting energy-efficient appliances. • Correct identification of different ways of recovering energy.
	For the competency as a whole:
	• Consideration of manufacturers' data sheets and recommendations. • Consideration of current standards, codes, laws and regulations. • Accurate interpretation of information. • Demonstration of openness and curiosity with respect to new technologies. • Use of the appropriate terminology. • Clear information transmitted in a manner comprehensible to different types of customers.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

1. Recognize different energy sources.

• Identify technologies that use renewable energies.	Geothermal, solar, biomass energy, etc.
• Make connections between the cost of using different energy sources and their social, economic and environmental impact.	Energy sources: oil, propane, natural gas, electricity, wood, etc.

2. Identify the source of energy losses and gains.

• Size pipes, heating units and circulators.	Calculation and use of alignment charts.

3. Recognize the general operating principles of heating systems.

• Recognize the principles of heat transfer.	Convection, conduction and radiation.
• Recognize the general principles of heat distribution systems.	Systems using forced air, water, a mixture of water and glycol, steam, etc.

Installing, Maintaining and Repairing Oil-Burning Appliances	Code: 807528

Competency 14 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Install, maintain and repair oil-burning appliances.

Achievement Context

- Working with oil-burning forced air, hydronic and auxiliary (atmospheric) appliances, oil-burning hot water heaters, oil tanks, etc.
- On service calls and in emergency situations.
- Given:
  - forms, installation reports, technical documentation, circuit diagrams and the data sheet for the system
- Given:
  - the current Installation Code for Oil-Burning Equipment (CSA standard)
  - the necessary tools, materials, products and measuring instruments
  - a combustion analyzer
  - print and electronic versions of technical documentation and manufacturers' manuals in English and French
  - protective clothing and accessories

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of oil-burning heating appliances.	• Identification of the applicable sections of the different codes. • Identification of materials and components.
2. Plan the installation of an oil-burning appliance.	• Accurate interpretation of instructions, diagram, sketch or installation drawing. • Determination of the tools and equipment needed depending on the type of appliance and its location. • Establishment of a logical sequence of operations. • Identification of risk factors. • Sizing of exhaust duct and chimney piping depending on the capacity of the appliances. • Consideration of the necessary electrical connections. • Determination of fresh air supply, if necessary. • Identification of gas vent requirements. • Consideration of the data sheets for the appliances.

3. Install the appliances.	• Holes drilled in wall with the appropriate tools and in accordance with existing structures. • Satisfactory installation of: – oil tank and pipe fittings – different types of anchors depending on the structures in place – heating system • Appropriate connection of electrical components and control devices to the junction box. • Satisfactory installation of: – the burner and its components – the flues depending on the type of appliance • Methodical testing for leaks.
4. Start up the system.	• Start-up in accordance with established procedures. • Precise adjustment of pressures, temperatures, etc. • Methodical testing of the system's energy efficiency and safety.
5. Diagnose malfunctions.	• Gathering of relevant information about the problem from the customer. • Visual inspection of the area. • Collection of auditory and olfactory data. • Observance of troubleshooting procedure. • Use of the necessary devices and measuring instruments based on the original hypothesis. • Determination of the cause of the malfunction related to: – fuel supply – combustion – electricity – exhaust – other • Realistic cost estimate.
6. Repair, replace and maintain components of oil-burning appliances.	• Safe shutdown of electricity and oil supply. • Appropriate cleaning of heating surfaces and components. • Methodical verification of the operation of the draft regulator. • Appropriate removal of defective components. • Repair or replacement of components in accordance with standards. • Methodical verification of operation.

7. Remove existing installations.	• Methodical disassembly of pipes. • Integrity of anchors and hangers. • Careful storage or recycling of appliances and piping.
8. Finish the work.	• Accurate information recorded in the installation reports. • Careful storage of tools and equipment, appropriate cleaning and tidying of work area. • Transmission to the customer of relevant information about the work done. • Formulation of relevant recommendations concerning the operation of the system and troubleshooting and monitoring procedures, if applicable. • Final visual inspection of system. • Accurate production of log with customer's signature and satisfaction rating. • Safe handling of used components and hazardous materials, and disposal in accordance with environmental protection standards.
	For the competency as a whole: • Observance of sketches and diagrams. • Observance of health and safety rules. • Handling of equipment and materials in accordance with manufacturers' recommendations and the necessary precautions. • Adoption of ergonomic work postures. • Ability to solve problems. • Consideration of the compatibility of replacement components. • Use of work techniques in accordance with the desired results. • Observance of manufacturers' recommendations. • Use of the appropriate terminology. • Respect for the environment. • Quality control. • Respect for other people's property.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the installation of an oil-burning appliance.

• Distinguish between the different types of boilers.	Watertube, firetube, cast iron, coil tube boilers, etc.
• Recognize the operating principles of atmospheric heating.	
• Recognize the operating principles of the components needed to operate a burner.	Filters, spray tips, diffusers, electrodes, etc.
• Distinguish between the types of chimneys.	

3. Install the appliances.

• Recognize the health and safety risks and hazards.	Toxic fumes, burns, irritations, etc.
• Recognize the different procedures for connecting oil tanks.	Single-pipe, two-pipe connections

4. Start up the system.

• Recognize the principles of combustion.	Perfect, complete, incomplete combustion, etc.
• Recognize the operating principles of combustion chambers.	Rectangular, square, round, etc.
• Recognize the different types of oil pumps.	
• Use a smoke density analyzer.	
• Use a combustion analyzer.	
• Use a draft indicator.	
• Determine the type of spray tip required.	
• Adjust the tip holder (e.g. ignition electrodes, diffuser).	

6. Repair, replace and maintain components of oil-burning appliances.

• Recognize the cleaning techniques and accessories to be used.	Types of brushes, accessories, vacuum cleaner, etc.
• Identify different components to be maintained or replaced.	Filters, humidifiers, etc.

Installing and Repairing Direct and Reverse Heating Systems	Code: 807538

Competency 15 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Install and repair direct and reverse heating systems.

Achievement Context

- During installations, on service calls and in emergency situations.
- Given:
  - specifications and a drawing
  - a written quotation
- Given:
  - the National Building Code (NBC)
  - the Canadian Electrical Code
  - the Boiler, Pressure Vessel and Pressure Piping Code (B51)
  - the Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers (B64)
  - current regulations
  - print and electronic versions of technical documents and manufacturers' manuals in English and French, circuit diagrams, the data sheet for the system, manufacturers' data sheets, print and electronic versions of service reports
  - alignment charts
  - the necessary tools, equipment, products and measuring instruments
  - protective clothing and accessories

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of direct and reverse heating systems.	• Identification of the applicable sections of the different codes. • Identification of materials and components.

2. Plan the work.	• Accurate interpretation of instructions, drawing and specifications, if applicable. • Accurate interpretation or production of an installation sketch. • Accurate determination of the path of the piping. • Determination of the tools, equipment and accessories needed depending on the type of system and its location. • Identification of risks and application of safety measures. • Establishment of a logical sequence of operations. • Sizing of pipes and heating units in accordance with energy loss. • Consideration of the necessary electrical connections and control devices. • Consideration of manufacturers' data sheets and recommendations.
3. Install direct and reverse heating systems and their components.	• Satisfactory production and installation of: – different types of anchors depending on the existing structures – different types of hangers depending on the types of pipes used • Holes drilled in walls, ceilings and floors using the necessary tools and in accordance with the existing structures. • Satisfactory installation of: – the necessary firestop spacers – heating units – accessories on the boiler • Accurate zoning of heating system. • Methodical leakproof testing. • Identification of pipes in accordance with standards (commercial and institutional subsectors).

4. Start up the system.	• Methodical testing for leaks and adjustments, if necessary. • Elimination of all air from the system. • Accurate adjustment of pressures and temperatures. • Electrical connections done in accordance with trade jurisdictions. • Preliminary adjustments. • Methodical testing for leaks. • Final start-up of system.
5. Diagnose malfunctions.	• Gathering of relevant information about the nature of the problem from the customer. • Visual inspection of the area. • Collection of auditory and olfactory data. • Observance of troubleshooting procedure. • Determination of the cause of the malfunction with respect to: – flow – pressure – temperature, etc.
6. Repair or modify system components.	• Safe shutdown of: – power supply – water supply • Repair, replacement or modification of components in accordance with manufacturer's installation standards. • Verification of the operation of the system.
7. Remove existing installations.	• Methodical disassembly of pipes. • Integrity of anchors and hangers. • Careful storage or recycling of appliances and piping. • Safe handling of used components and hazardous materials, and disposal in accordance with environmental protection standards.
8. Finish the work.	• Accurate information recorded in the installation reports. • Transmission to customer of relevant information about the work done. • Formulation of relevant recommendations concerning the operating principle of the system and troubleshooting, maintenance and monitoring procedures, if applicable. • Final visual inspection of system. • Careful storage of tools and equipment, appropriate cleaning and tidying of work area. • Accurate production of log with customer's signature and satisfaction rating.

For the competency as a whole:

- Observance of sketches and diagrams.
- Observance of health and safety rules.
- Handling of equipment and materials in accordance with manufacturers' recommendations and the necessary precautions.
- Adoption of ergonomic work postures.
- Ability to solve problems.
- Consideration of the compatibility of replacement components.
- Use of techniques in accordance with desired results.
- Observance of manufacturers' recommendations.
- Use of the appropriate terminology.
- Respect for the environment.
- Quality control.
- Respect for other people's property.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work.
   - Recognize the operating principles of the systems and their accessories.

3. Install direct and reverse heating systems and their components.
   - Distinguish between the different types of heating units. — Baseboards, convectors, radiators, unit heaters, Convectair heaters, etc.
   - Install balancing valves.
   - Install and calibrate an expansion tank.
   - Install and calibrate water-reducing valves. — Two-way valves approved.
   - Make connections between the heating units, their location and the size of pipe needed.
   - Differentiate between different ways of zoning a heating system. — Water circulation, motorized valve, thermostatic valve, etc.

4. Start up the system.
   - Fill direct and reverse heating systems.

- Differentiate between different methods of bleeding.
- Use measuring instruments. Manometers, thermometers, etc.

6. Repair or modify system components.
   - Freeze and thaw piping. Appropriate techniques.

Installing and Repairing Perimeter Heating Systems	Code: 807544

Competency 16 Duration 60 hours Credits 4

Behavioural Competency

Statement of the Competency

Install and repair perimeter heating systems.

Achievement Context

- In the residential, commercial and institutional subsectors.
- During installations, on service calls and in emergency situations.
- Given a work order or verbal instructions.
- Given:
  - diagrams, sketches and installation drawings
  - technical documentation, print and electronic versions of manufacturers' manuals in English and French, circuit diagrams, the data sheet for the system, manufacturers' data sheets, print and electronic versions of service reports
  - alignment charts
  - the National Building Code (NBC)
  - the Canadian Electrical Code
  - the Boiler, Pressure Vessel and Pressure Piping Code (B51)
  - the Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers (B64)
  - other regulations, if applicable
  - the necessary equipment, materials, products and tools
  - scaffolding, if applicable
  - the necessary individual and group safety equipment
  - CO, CH_4 and CO_2 detectors

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of perimeter heating systems.	• Identification of the applicable sections of the different codes. • Identification of materials and components.

2. Plan the work.	• Accurate interpretation of instructions, drawing and specifications, if applicable. • Accurate interpretation or production of installation sketch. • Determination of the path of the piping. • Determination of the materials, tools and accessories needed depending on the type of system and its location. • Identification of risks and application of safety measures. • Establishment of a logical sequence of operations. • Sizing of pipes and heating units in accordance with energy loss. • Consideration of the necessary electrical connections. • Consideration of manufacturers' data sheets and recommendations.
3. Install a perimeter heating system.	• Satisfactory installation of: – different types of anchors depending on the existing structures – different types of hangers depending on the types of pipes used • Holes drilled in walls, ceilings and floors with the appropriate tools depending on the existing structures. • Appropriate installation of: – pipes – the necessary firestop spacers – heating units – accessories on the boiler • Methodical testing for leaks and adjustments, if necessary. • Identification of pipes in accordance with standards (commercial and institutional subsectors).

4. Start up the system.	• Elimination of all air in system. • Precise adjustment of pressures and temperatures. • Connection of electrical components and control devices in accordance with trades' jurisdictions. • Preliminary adjustments. • Final start-up of system.
5. Diagnose malfunctions.	• Gathering of relevant information about the problem from the customer. • Visual inspection of the area. • Collection of auditory and olfactory data. • Observance of troubleshooting procedure. • Determination of the cause of the malfunction with respect to: – flow – pressure – temperature, etc.
6. Repair or modify system components.	• Safe shutdown of: – power supply – water supply • Appropriate repair, maintenance or replacement of components in accordance with manufacturer's installation standards. • Verification of the operation of the system.
7. Remove existing installations.	• Methodical disassembly of pipes. • Integrity of anchors and hangers. • Careful storage or recycling of appliances and piping. • Safe handling of used components and hazardous materials, and disposal in accordance with environmental protection standards.
8. Finish the work.	• Accurate information recorded in the installation reports. • Transmission to customer of relevant information about the work done. • Formulation of relevant recommendations concerning the operation of the system and troubleshooting, maintenance and monitoring procedures, if applicable. • Final visual inspection of system. • Storage of tools and equipment, appropriate cleaning and tidying of work area. • Accurate production of log with customer's signature and satisfaction rating.

For the competency as a whole:

- Observance of sketches and diagrams.
- Observance of health and safety rules.
- Handling of equipment and materials in accordance with manufacturers' recommendations and the necessary precautions.
- Adoption of ergonomic work postures.
- Ability to solve problems.
- Consideration of the compatibility of replacement components.
- Use of techniques in accordance with desired results.
- Observance of manufacturers' recommendations.
- Use of the appropriate terminology.
- Respect for the environment.
- Quality control.
- Respect for other people's property.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work.
   - Recognize the operating principles of the systems and their accessories.
   - Recognize the operating principles of the venturi-T systems and monoflo-T systems.

3. Install a perimeter heating system.
   - Distinguish between the different boiler accessories.

Aquastat, thermostat, expansion tank, circulator, etc.

Installing Gas-Burning Systems	Code: 807558

Competency 17 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency	Achievement Context
Install natural gas- and propane-burning systems.	• In the residential, commercial and institutional subsectors. • Given a work order or verbal instructions. • Given: – diagrams, sketches and installation drawings – the National Building Code (NBC) – the Natural Gas & Propane Installation Code (CSA B149.1) – the Canadian Electrical Code – municipal regulations, if applicable – print and electronic versions of technical documentation and manufacturers' manuals in English and French – the necessary equipment, materials, products, tools and measuring instruments – scaffolding, if applicable – the necessary safety equipment – a combustion analyzer – carbon monoxide (CO) and methane (CH_4) detectors

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of natural gas- and propane-burning systems.	• Identification of the applicable sections of the different codes. • Identification of materials and components.

2. Plan the work.	• Accurate interpretation of instructions. • Accurate interpretation or production of a diagram or sketch. • Determination of the tools and equipment needed for the type of appliance and its location. • Identification of possible hazards. • Determination of the path of the piping. • Size of gas supply pipe based on the capacity of the appliances. • Size of gas vent and chimney pipe based on the capacity of the appliances. • Consideration of the necessary electrical connections. • Identification of requirements with respect to gas vents. • Establishment of a logical sequence of operations. • Consideration of the data sheets for the appliances and validation of their certification.
3. Place heating appliances for connection to the natural gas or propane supply.	• Identification of the characteristics of the appliances. • Consideration of the necessary connection to the meter and/or regulator. • Determination of the usefulness of installing an indoor regulator (based on the capacity and pressure of the appliances). • Determination of the location of the appliances, accessories and components based on the clearance required and the proximity of combustible materials.
4. Install and connect the pipes required for natural gas- and propane-burning appliances: – boiler, hot water heater, fireplace, stove, refrigerator, heating panel, etc.	• Installation of: – different types of anchors depending on the existing structures – different types of hangers depending on the type of pipes used in accordance with current codes – pipes and rigid and flexible tubing (steel, copper and plastic) • Satisfactory connection of electrical components and control devices to the junction box. • Application of standards respecting clearance for the installation of pressure regulator vents, if applicable. • Pressure testing of pipes, tubes and fittings. • Identification of pipes and colour codes in accordance with standards.

5. Determine the air supply volume needed.	• Recognition of different air supply systems. • Determination of air ducts in accordance with current standards.
6. Install exhaust ducts.	• Determination of the category of the appliance. • Installation of exhaust duct in accordance with current standards.
7. Do a final inspection.	• Inspection of the installation by a competent authority using a checklist. • Quality control.
8. Start up the system.	• Methodical testing for efficiency and combustion. • Adjustments, if necessary.
9. Finish the work.	• Accurate information recorded in the installation reports. • Transmission to the customer of relevant information about the work done. • Formulation of relevant recommendations concerning the operation of the system and maintenance and monitoring procedures, if applicable. • Final visual inspection of system. • Careful storage of tools and equipment, appropriate cleaning and tidying of work area. • Accurate production of log with customer's signature and satisfaction rating.
	For the competency as a whole: • Observance of sketches and diagrams. • Observance of health and safety rules. • Handling of equipment and materials in accordance with manufacturers' recommendations and the necessary precautions. • Adoption of ergonomic work postures. • Ability to solve problems. • Consideration of the compatibility of replacement components. • Use of techniques in accordance with desired results. • Observance of manufacturers' recommendations. • Use of the appropriate terminology. • Respect for the environment. • Quality control. • Respect for other people's property.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work.
   - Use the tables in the Code to size the piping.
   - Identify different types of chimney pipes.

4. Install and connect the pipes required for natural gas- and propane-burning appliances: boiler, hot water heater, fireplace, stove, refrigerator, heating panel, etc.
   - Recognize the different methods of connecting gas-burning appliances.
   - Do a pneumatic leakproof test. — To the ounce, pressure per pound (PSI, kPa).
   - Detect leaks. — Test using soapy water, etc.

5. Determine the air supply volume needed.
   - Calculate the size of the air ducts.

6. Install exhaust ducts.
   - Calculate the size of the exhaust ducts.

8. Start up the system.
   - Use different types of manometers.
   - Use an electronic combustion analyzer.

Installing and Repairing Radiant Heating Systems	Code: 807565

Competency 18 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Install and repair radiant heating systems.

Achievement Context

- In the residential, commercial and institutional subsectors.
- During installations, on service calls and in emergency situations.
- Given a work order or verbal instructions.
- Given:
  - diagrams, sketches and installation drawings
  - technical documentation, print and electronic versions of manufacturers' manuals in English and French, circuit diagrams, the data sheet for the system, print or electronic versions of service reports
  - alignment charts
  - the National Building Code (NBC)
  - the Canadian Electrical Code
  - the Boiler, Pressure Vessel and Pressure Piping Code (B51)
  - the Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers (B64)
  - other regulations, if applicable
  - the necessary equipment, materials, products and tools
  - the necessary individual and group safety equipment

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of radiant heating systems.	• Identification of the applicable sections of the different codes. • Identification of materials and components.

2. Plan the work.	• Accurate interpretation of instructions, drawing and specifications, if applicable. • Accurate production of installation sketch. • Determination of the path of the piping. • Determination of the necessary tools, equipment and accessories depending on the type of system and its location. • Identification of risks and application of safety measures. • Sizing and balancing of piping in accordance with energy loss. • Establishment of a logical sequence of operations. • Consideration of the necessary electrical connections. • Consideration of manufacturers' data sheets and recommendations.
3. Install a radiant heating system: – in a ceiling – in a floor – under a floor	• Satisfactory installation of: – different types of anchors depending on the existing structures – different types of hangers depending on the types of pipes used • Holes drilled in walls, ceilings and floors using the appropriate tools given the existing structures. • Proper installation and zoning of pipes. • Satisfactory installation of accessories on the boiler. • Methodical testing for leaks and adjustments, if necessary.
4. Start up the system.	• Elimination of all air from the system. • Accurate adjustment of pressures and temperatures. • Accurate adjustment of balancing valves. • Connection of electrical components and control devices in accordance with trades' jurisdictions. • Preliminary adjustments. • Final start-up of system.
5. Diagnose malfunctions.	• Gathering of relevant information about the problem from the customer. • Visual inspection of the area. • Collection of auditory and olfactory data. • Observance of troubleshooting procedure. • Determination of the cause of the malfunction with respect to: – flow (balancing) – pressure – temperature, etc.

6. Repair or modify system components.	• Safe shutdown of: – power supply – water supply • Repair, maintenance, replacement or modification of components in accordance with manufacturer's installation standards. • Verification of the operation of the system. • Careful storage or recycling of appliances.
7. Finish the work.	• Accurate information recorded in the installation reports. • Transmission to the customer of relevant information about the work done. • Formulation of relevant recommendations concerning the operation of the system and troubleshooting and monitoring procedures, if applicable. • Final visual inspection of system. • Careful storage of tools and equipment, appropriate cleaning and tidying of work area. • Accurate production of log with customer's signature and satisfaction rating.
	For the competency as a whole:
	• Observance of sketches and diagrams. • Observance of health and safety rules. • Handling of equipment and materials in accordance with manufacturers' recommendations and the necessary precautions. • Adoption of ergonomic work postures. • Ability to solve problems. • Consideration of the compatibility of replacement components. • Use of techniques in accordance with desired results. • Observance of manufacturers' recommendations. • Use of the appropriate terminology. • Respect for the environment. • Quality control. • Respect for other people's property.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work.

• Recognize the operating principles of hydronic systems and glycol mixtures.	
• Recognize different types of installations based on heating needs and the existing structure and materials.	Type of foundation, wood, concrete, carpeting, etc.

4. Start up the system.

• Adjust the balancing valves and balance the zones.	Different types of zoning.

5. Diagnose malfunctions.

• Diagnose problems by zone.	Different problems related to radiant heating systems: channels in concrete slabs and walls, uncomfortable temperatures, etc.; use of different detection techniques and measuring instruments: infrared, laser, etc.

6. Repair or modify system components.

• Recognize different repair techniques.	Repair techniques related to radiant heating systems depending on the existing structure and materials.

Install and Repair Low-Pressure Steam Heating Systems	Code: 807578

Competency 19 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Install and repair low-pressure steam heating systems.

Achievement Context

- Given:
  - specifications and a drawing
  - a written quotation
  - service calls
- Given:
  - the National Building Code (NBC)
  - the Canadian Electrical Code
  - the Boiler, Pressure Vessel and Pressure Piping Code (B51)
  - the Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers (B64)
  - current regulations
  - technical documentation, print and electronic versions of manufacturers' manuals in English and French, circuit diagrams, the data sheet for the system, print or electronic versions of service reports
  - alignment charts
  - the necessary tools, equipment, products and measuring instruments
  - protective clothing and accessories

Elements of the Competency	Performance Criteria
1. Associate current regulations with the installation of low-pressure steam heating systems.	• Identification of the applicable sections of the different codes. • Identification of materials and components.

2. Plan the work.	• Accurate interpretation of instructions, drawing and specifications, if applicable. • Accurate interpretation or production of installation sketch. • Determination of the path of the piping. • Determination of the equipment, tools and accessories needed depending on the type of system and its location. • Identification of risks and application of safety measures. • Size of pipes according to their use. • Establishment of a logical sequence of operations. • Consideration of the necessary electrical connections. • Consideration of manufacturers' data sheets and recommendations.
3. Install a low-pressure steam heating system and its components.	• Satisfactory production and installation of: – different types of anchors depending on the existing structures – different types of hangers depending on the types of pipes used • Holes drilled in walls, ceilings and floors with the appropriate tools given the existing structure. • Satisfactory installation of: – pipes – the necessary firestop spacers – heating units, heat exchangers, humidifiers, etc. – boiler accessories – a water supply system (e.g. tank, supply water pump, water softener) • Methodical leakproof testing. • Identification of pipes in accordance with standards (commercial and institutional subsectors).
4. Start up the system.	• Adjustment of pressures. • Connection of electrical components and control devices in accordance with trades' jurisdictions. • Preliminary adjustment of system. • Final start-up of system.

5. Diagnose malfunctions.	• Gathering of relevant information about the problem from the customer. • Visual inspection of the area. • Collection of auditory and olfactory data. • Methodical testing for leaks. • Observance of troubleshooting procedure. • Verification of operation of steam traps. • Determination of the cause of the malfunction with respect to: – steam flow – pressure
6. Repair or modify system components.	• Safe shutdown of: – power supply – water supply • Repair, replacement or modification of components in accordance with manufacturer's installation standards. • Verification of the operation of the system.
7. Remove existing installations.	• Methodical disassembly of pipes. • Integrity of anchors and hangers. • Careful storage or recycling of appliances and piping.
8. Finish the work.	• Accurate information recorded in the installation reports. • Transmission to customer of relevant information about the work done. • Formulation of relevant recommendations concerning the operation of the system and troubleshooting, maintenance and monitoring procedures, if applicable. • Final visual inspection of system. • Careful storage of tools and equipment, appropriate cleaning and tidying of work area. • Accurate production of log with customer's signature and satisfaction rating.

For the competency as a whole:

- Observance of sketches and diagrams.
- Observance of health and safety rules.
- Handling of equipment and materials in accordance with manufacturers' recommendations and the necessary precautions.
- Adoption of ergonomic work postures.
- Ability to solve problems.
- Consideration of the compatibility of replacement components.
- Use of techniques in accordance with desired results.
- Observance of manufacturers' recommendations.
- Use of the appropriate terminology.
- Respect for the environment.
- Quality control.
- Respect for other people's property.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each element of the competency, along with their attendant guidelines.

2. Plan the work.

• Recognize the operating principles of low-pressure steam heating systems and their components.	
• Recognize the different types of steam traps.	Inverted bucket, thermostatic, float/thermostatic steam traps, etc.
• Recognize the different types of manometers.	Atmospheric, absolute, vacuum, etc.
• Differentiate between the types of heat associated with steam.	Sensible, latent, total heat.
• Differentiate between the types of expansion joints.	Swivels and offsets, U loops, etc.
• Calculate the quantity of steam condensate to determine the size of pipe needed.	

3. Install a low-pressure steam heating system and its components.

• Recognize the different types of unit heaters.	Vertical, horizontal.
• Distinguish between the different low-pressure steam heating system accessories.	Pressure gauges, safety valves, low level water cutoff controllers, pump controllers, etc.

• Distinguish between the different water supply system accessories.	Condensation tank, supply pumps, water softener, condensation supply tank, etc.
• Recognize the different appliances that can be added to a low-pressure steam heating system.	Humidifiers, sterilizers, heat exchangers, etc.

5. Diagnose malfunctions.

• Recognize different steam trap malfunctions.	Leaks, unusual noises, blockages, etc.

Organizations Involved in the Construction Industry	Code: 754991

Competency 20 Duration 15 hours Credits 1

Situational Competency

Statement of the Competency

Become familiar with the organizations involved in the construction industry.

Elements of the Competency

- Learn about the construction industry.
- Learn about the role and importance of the organizations involved in the industry.
- Form a realistic impression of labour relations in the industry.

Learning Context

Information Phase

- Learning about the construction industry.
- Learning about the roles and responsibilities of the organizations involved in the construction industry (e.g. management and union associations, CCQ, CSST).
- Learning about labour relations in the construction industry.

Participation Phase

- Participating in activities aimed at understanding:
  - the development and future of the construction industry
  - the interdependence of different trades and occupations
  - the effects of regulation on the labour system in the industry
- Exploring the possibility of continuing training for workers in the industry.

Synthesis Phase

- Presenting a report that contains a summary of the learning they acquired, as well as an assessment of its impact on their career path.

Instructional Guidelines

- Make available the necessary sources of information.
- Use learning situations representative of the situation in the construction industry.
- Encourage students to share their opinions and express themselves.
- Guide students by providing the necessary tools (e.g. a questionnaire).

Participation Criteria

Information Phase

- Consult the information sources made available to them.

Participation Phase

- Participate seriously and consistently in the suggested activities.

Synthesis Phase

- Present a report containing a summary of the learning they have acquired, as well as an assessment of its impact on their career path.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each phase of the learning context, along with their attendant guidelines.

Information Phase

• Identify the specific characteristics of the construction industry.	Characteristics and economic importance.
• Distinguish between the different management associations.	Roles and responsibilities: Association de la construction du Québec, Association des constructeurs de routes et grands travaux du Québec, Association des entrepreneurs en construction du Québec, Association provinciale des constructeurs d'habitations du Québec, Corporation des maîtres électriciens du Québec and Corporation des maîtres mécaniciens en tuyauterie du Québec.
• Distinguish between the different unions.	Roles and responsibilities: Fédération des travailleurs du Québec, Conseil provincial du Québec des métiers de la construction, Centrale des syndicats démocratiques, Confédération des syndicats nationaux and Syndicat québécois de la construction.
• Recognize the role and responsibilities of the Commission des relations de travail.	Structure, components, functions and powers in the construction industry.
• Recognize the role and responsibilities of the Régie du bâtiment du Québec.	Structure, components, functions and powers.
• Recognize the role and responsibilities of the Commission de la construction du Québec.	Structure, components, functions and powers.
• Recognize the role and responsibilities of occupational health and safety organizations.	CSST and Association sectorielle paritaire; structure, components, functions and powers.

Participation Phase

• Show concern for sharing their point of view with classmates.	Usefulness of sharing points of view, attitude with respect to different views and usefulness in the practice of the trade.
• Distinguish between trades and occupations.	Criteria for distinction and characteristics.
• Distinguish between the different sector-based collective agreements.	Residential, commercial, institutional, industrial, civil engineering and roadwork sectors.
• Recognize the law and regulations governing labour relations in the construction industry.	Purpose and impact on working conditions: *Act respecting labour relations, vocational training and workforce management in the construction industry* (R.S.Q., c. R-20), *Regulation respecting the vocational training of workforce in the construction industry, Regulation respecting complementary social benefit plans in the construction industry.*
• Recognize the benefits of training funds.	Construction industry workers training fund; training plan for residential sector workers.

Job Search Techniques	Code: 807581

Competency 21 Duration 15 hours Credits 1

Situational Competency

Statement of the Competency

Use job search techniques.

Elements of the Competency

- Consult information sources.
- Plan a job search.
- Prepare the necessary documents.

Learning Context

Information Phase

- Learning about the steps in the job search process.
- Learning about the available job search information sources.
- Learning what to include in a résumé and cover letter.

Participation Phase

- Writing a résumé and cover letter.
- Determining which workplaces correspond to their areas of interest.
- Taking the steps set out in the job search plan.
- Participating in simulated interviews.

Synthesis Phase

- Analyzing the effectiveness of their job search plan.
- Presenting a summary of their experience.

Instructional Guidelines

- Make all of the relevant documentation available to students.
- Moderate group discussions.
- Encourage students to express themselves.
- Encourage students to take the exercises seriously and to respect others.
- Encourage students to evaluate themselves.

Participation Criteria

Information Phase

- Consult the information sources made available to them.
- Participate in group discussions.

Participation Phase

- Produce a résumé and cover letter.
- Participate in the activities.

Synthesis Phase

- Present a summary of their experience.

Suggestions for Competency-Related Knowledge and Know-How

The following is a summary of the knowledge, skills, strategies, attitudes and perceptions related to each phase of the learning context, along with their attendant guidelines.

Information Phase

• Gather information about the topics to be addressed.	Model résumés and cover letters, searching for employment on the Internet, etc.
• Analyze job offers.	Requirements with respect to education and experience; comparison with their career goals.

Participation Phase

• Understand the importance of preparing for an interview.	Presentation, appropriate responses, behaviour, dress, etc.

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